INTERNATIONAL CIVIL AVIATION ORGANIZATION

FINAL REPORT

REPORT OF THE TWENTY FOURTH MEETING OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (APANPIRG/24)

Bangkok, Thailand, 24 to 26 June 2013

The views expressed in this Report should be taken as those of the APANPIRG and not of the Organization. This Report will be presented to the Air Navigation Commission/Council and any formal action taken will be published in due course as a supplement to the Report.

Approved by the Meeting
and published by the ICAO Asia and Pacific Office

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PART I — HISTORY OF THE MEETING

PART I - HISTORY OF THE MEETING

1.1 Introduction

1.1.1 The Twenty Fourth Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/24) was held at the Kotaite Wing of the ICAO Asia and Pacific Regional Office Bangkok, Thailand from 24 to 26 June 2013.

1.2 Attendance

1.2.1 The meeting was attended by 122 participants from 22 Member States, 2 Special Administrative Regions of China and 4 International Organizations (CANSO, IATA, IFALPA and SITA).

1.2.2 A list of participants is provided at **Attachment 1** to the Report.

1.3 Opening of the Meeting

Welcome address by Mr. Mokhtar A. Awan, Regional Director,
ICAO Asia/Pacific Office and Secretary of APANPIRG

1.3.1 Mr. Awan welcomed the participants from the Member States, International Organizations and delivered the welcome address. He highlighted the progress achieved on the regional activities by the APAC States since the last meeting.

Opening remarks by Mr. Norman Lo, Director General of Civil Aviation,
Civil Aviation Department, Hong Kong, China and Chairman of APANPIRG

1.3.2 Mr. Norman Lo, Director General of Civil Aviation, Department of Civil Aviation Hong Kong, China, and Chairman of APANPIRG welcomed the members and delivered the opening address.

1.4 Officers and Secretariat

1.4.1 Mr. Norman Lo, Director General of Civil Aviation, Civil Aviation Department, Hong Kong, China and Chairman of the APANPIRG, presided over the meeting.

1.4.2 Mr. Mokhtar A Awan, ICAO Regional Director, Asia/Pacific Office, was the Secretary of the meeting, assisted by Mr. N. C. Sekhar, Regional Officer/AGA.

1.4.3 The meeting was also assisted by Mr. H. V. Sudarshan, Regional Programme Officer, ICAO Headquarters, Mr. Yoshiki Imawaka, Deputy Director, Mr. Len Wicks and Mr. Shane Sumner, Regional Officers/ATM, Mr. Li Peng and Mr. Frédéric Lecat Regional Officer/CNS, and Mr. Peter Dunda, Regional Officer/MET.

1.5 Agenda of the Meeting

1.5.1 The meeting adopted the following agenda:

Agenda Item 1 Follow-up on the outcome of APANPIRG/23 Meeting

1.1 Review of the action taken by the ANC and the Council on the report of APANPIRG/23

1.2 Review Status of Implementation of APANPIRG/23 Conclusions and Decisions

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1.6 Working Arrangements, Language and Documentation

1.6.1 The working language of the meeting was English inclusive of all documentation and this Report. Information Papers (IP) and Working Papers (WP) considered by the meeting are listed in the **Attachment 2** to this Report.

1.7 Conclusions and Decisions - Definition

1.7.1 The APANPIRG records its actions in the form of Conclusions and Decisions with the following significance:

1) Conclusions deal with matters which, in accordance with the Group's Terms of Reference, require the attention of States or actions by ICAO in accordance with established procedures; and

2) Decisions deal with matters of concern only to the APANPIRG and its contributory bodies.

1.7.2 Lists of Conclusions and Decisions are given on pages i-5 to i-7.

1.8 Terms of Reference of APANPIRG

1.8.1 The Terms of Reference of APANPIRG was approved by the Council of ICAO (6th Meeting of its 171st Session on 27 February 2004) and revised consequent to the decision of the Council [C- DEC 183/9, March/April 2008 and C-WP/13558,C 190/4 on 25 May 2010]. The revised terms of reference are:

1. Membership

All ICAO Contracting States, who are service providers in an air navigation region and part of that region's ANP, should be included in the membership of that region's PIRG. Furthermore user States are entitled to participate in any other PIRG Meetings as a non member. International Organisations recognised by the Council may be invited as necessary to attend PIRG meetings as observers.

2. The Terms of Reference of the Group are:

a) to ensure continuous and coherent development of the Asia/Pacific Regional Air Navigation Plan and other relevant regional documentation in a manner that is harmonized with adjacent regions, consistent with ICAO SARPs and Global Air Navigation Plan for CNS/ATM Systems (DOC 9750) and reflecting global requirements;

b) to facilitate the implementation of air navigation systems and services as identified in the Asia/Pacific Regional Air Navigation Plan with due observance to the primacy of air safety, regularity and efficiency; and

c) to identify and address specific deficiencies in the air navigation field.

3. In order to meet the Terms of Reference, the Group shall:

a) review, and propose when necessary, the target dates for implementation of facilities, services and procedures to facilitate the coordinated development of the Air Navigation Systems in the Asia/Pacific Region;

b) assist the ICAO Asia/Pacific Regional Office in fostering the implementation of the Asia/Pacific Regional Air Navigation Plan;

c) in line with the Global Aviation Safety Plan (GASP), facilitate the conduct of any necessary systems performance monitoring, identify specific deficiencies in the air navigation field, especially in the context of safety, and propose corrective action;

d) facilitate the development and implementation of action plans by States to resolve identified deficiencies, where necessary;

e) develop amendment proposals to update the Asia/Pacific Regional Air Navigation Plan to reflect changes in the operational requirements;

f) monitor implementation of air navigation facilities and services and where necessary, ensure interregional harmonization, taking due account of organizational aspects, economic issues (including financial aspects, cost/benefit analyses and business case studies) and environmental matters;

g) examine human resource planning and training issues and propose where necessary human resource development capabilities in the region that are compatible with the Asia/Pacific Regional Air Navigation Plan;

h) review the Statement of Basic Operational Requirements and Planning Criteria and recommend to the Air Navigation Commission such changes as may be required in the light of new developments in the air navigation field;

i) request financial institutions, on a consultative basis as appropriate to provide advice in the planning process;

j) maintain close cooperation with relevant organizations and State grouping to optimize the use of available expertise and resources;

k) conduct the above activities in the most efficient manner possible with a minimum of formality and documentation and call meetings of the APANPIRG when deemed necessary to do so; and

l) coordinate with RASG APAC on safety issues.

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List of Conclusions

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PART II — REPORT ON AGENDA ITEMS

AGENDA ITEM 1:	**FOLLOW-UP ON THE OUTCOME OF APANPIRG/23 MEETING**
Agenda Item 1.1:	Review of the action taken by the ANC and the Council on the Report of APANPIRG/23
Agenda Item 1.2:	Review status of implementation of APANPIRG/23 Conclusions and Decisions
Agenda Item 1.3:	Review status of implementation of APANPIRG outstanding Conclusions and Decisions

Agenda Item 1: Follow-up on the Outcome of APANPIRG/23 Meeting

1.1 Review of the ANC Actions on the APANPIRG/23 Report

1.1.1 The Meeting noted that the Air Navigation Commission (ANC), on 25 March 2013, reviewed the Report of the APANPIRG/23 (Bangkok, 10 - 14 September 2012) Meeting. The **Appendix A to the Report on Agenda Item 1.2** presents the action taken by the ANC on the conclusions and decisions on the recommendations of the WG/SRP to the ANC. The ANC expressed its appreciation of the work completed by APANPIRG and its proactive approach to implementation and resolution of air navigation matters.

1.1.2 The ANC was interested in Conclusion 23/5 regarding the concept of operations mandates. The matter, related to concepts such as best equipped, best served, was highlighted at the recent 12th Air Navigation Conference and that the current APANPIRG work involved preparatory or interim ideas on a basic implementation pending the outcome of ICAO global deliberations.

1.1.3 In relation to Conclusion 23/11 the ANC considered the replication of 5LNC to be a significant issue that deserved global attention. The ANC will task a suitable expert group to address the matter. Several other initiatives undertaken by the APANPIRG were considered to be of global interest, including satellite communications (Conclusions 23/23 and 23/25 refer) and the establishment of a PBN/TF to support Block 0 implementation (Conclusion 23/27). Regarding Conclusion 23/33, the ANC was informed that the issue of broadcast of misleading ADS-B data was due to older airframes that had pioneering or early generation equipage, pre-global standardisation. The suggested solution was to order the aircraft not to use the transponders. The ANC suggested that use of the term 'Blacklist' be reconsidered.

~~1.1.4 As a result of new air navigation reporting structures, such as Regional Performance Dashboard and Global Air Navigation Report, to be in place by 2014, the Meeting was apprized that the ANC and Council will no longer review individual PIRG/RASG reports unless a specific action is called for.~~

1.1.4 The meeting thanked the ANC for their valuable guidance on various activities of the APANPIRG and that it would be taken into account in the development of on-going work programme of the region.

1.2 Review of Status of Implementation of APANPIRG/23 Conclusions and Decisions

1.2.1 The Meeting reviewed the progress made on the APANPIRG/23 Conclusions and Decisions.

1.2.2 The actions taken by States and the Secretariat on the above mentioned Conclusions and Decisions were reviewed and the updated list is provided in **Appendix A** to the Report on Agenda Item 1.2. This updated list is in the new format in line with the ICAO Business Planning and Performance based approach.

1.2.3 The Meeting noted that out of the 46 Conclusions and 7 Decisions action has been taken to close/complete 41 Conclusions and 7 Decisions. Action on the remaining 5 Conclusions is ongoing.

1.2.4 Hong Kong China expressed appreciation for ICAO having completed 90% of its task and also expressed concern that Conclusion 23/9 on AIS-AIM Transition Plans contains important task to carry forward to. The Meeting urged States who are yet to develop their basic plans that identified the target completion dates of transition elements in the AIS AIM Road Map to put in more efforts and resources.

1.2.5 Singapore referred to conclusion 23/11 and noted that 5 Letter Name Codes (5LNC) are essential for PBN implementation.

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APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/1	**Transition to NEW FPL Format**	That, States are urged to commence operational acceptance and processing of both PRESENT and NEW format FPL and ATS messages as early as possible, and in any event no later than 0000 UTC on 12 November 2012, in order to avoid the risks involved in direct transition from PRESENT to NEW processing.	ICAO APAC office	State Letter Ref. T3/10.0, T3/10.1.20-AP124/12 (ATM)	September 2012	Complete	To note
C 23/2	**FPL Guidance Material Version 5**	That, the Asia/Pacific Guidance Material for the Implementation of Amendment 1 to the 15th Edition of the Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM, Doc 4444) is updated as Version 5 in accordance with excerpts contained in **Appendix C** to the Report on Agenda Item 3.2.	ICAO APAC office	State Letter Ref. T3/10.0, T3/10.1.20-AP124/12 (ATM) Updated Guidance Material on ICAO ASIA/PAC Regional Office Website	September 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
D 23/3	**Dissolution of the Southeast Asia Route Review Task Force**	That, the South East Asia Route Review Task Force (SEARR/TF), be dissolved and any on-going tasks be delegated to existing bi-lateral or multilateral groups as identified in the South East Asia Implementation Plan.	ICAO APAC Office	Notify concerned States through State Letter Ref. T3/10.0-AP136/12 (ATM)	September 2012	Complete	To note
D 23/4	**Dissolution of the BOB-RHS/TF**	That, the Bay Of Bengal Reduced Horizontal Separation Task Force (BOB-RHS/TF) be dissolved and any outstanding tasks be delegated to South Asia/Indian Ocean ATM Coordination Group (SAIOACG).	ICAO APAC Office	Notify concerned States through State Letter Ref. T3/10.0-AP136/12 (ATM)	September 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/5	**Asia/Pacific Air Navigation Concept of Operations Mandates**	That, States intending to implement Performance-Based Navigation and Safety Nets may, after appropriate consultation with airspace users, designate portions of airspace within their area of responsibility: a) as providing priority for access to such airspace for aircraft with prescribed Performance-Based Navigation (PBN) specifications and supporting data-link equipage (ADS-C/CPDLC); and/or b) mandating the carriage and use of an operable Automatic Dependent Surveillance-Contract/ Controller Pilot Data-link Communications Systems (ADS-C/CPDLC) system, and mode A/C and/or mode S transponder.	ICAO APAC office	State letter Ref. T3/10.0, T3/8.30-AP134/12 (ATM)	October 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/6	**Basic Air Navigation Plan Amendment Procedure Template**	That, for ease of reference and reduction of submission errors, the ICAO Regional Office should provide the Doc 9673 Amendment Procedure appended as **Appendix E** to the Report on Agenda Item 3.2 on the Asia/Pacific website, including requirements to provide detailed and accurate information, an appropriate chart in the case of ATS route amendments, and information on prior consultation with any affected States.	ICAO APAC office	State Letter Posted on APAC Web site Ref. T3/10.0-AP138/12 (ATM)	September 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/7	**Asia/Pacific Region ATS Route Catalogue Update**	That, ICAO should update the Asia/Pacific Region ATS Route Catalogue as Version 11 by: a) amending the administrative details as required; b) incorporating any ANS Deficiency changes approved by APANPIRG; c) incorporating new airspace user proposals presented at the ATM/AIS/SAR/SG/22 meeting; d) undertaking a review of existing routes within the Route Catalogue, in collaboration with affected States and administrations in order to update this information; and e) developing a new document structure organized by geographical reference that allows easy review.	ICAO APAC office	State Letter Ref. T3/10.0-AP138/12 (ATM) Update ATS Route Catalogue Upload to the ICAO APAC web site.	October 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/8	**Annex 15 Promulgation Requirements Compliance**	That, States should be urged to recognize the importance of Annex 15 compliance in respect of aeronautical data affected by major projects, by: a) establishing formal coordination between change originators and Aeronautical Information Service (AIS) units to ensure appropriate planning and that promulgation requirements were taken into account; and b) creating a mechanism to allow AIS personnel to decline requests that did not comply with Annex 15, except for urgent corrections, emergencies, and matters of national security.	ICAO APAC office	State letter Ref. T3/10.0, T3/10.1.6-AP135/12 (ATM) Include in State Letter a request for States to report their actions to AAITF/8	October 2012	Complete	To note
C 23/9	**AIS-AIM Transition State Plans**	That, States should develop a basic plan that identified the target completion dates of Transition elements in the AIS-AIM Roadmap and submit these plans to the Asia/Pacific Regional Office by 1 January 2013.	ICAO APAC office	State letter Ref. T3/10.0, T3/10.1.6-AP135/12 (ATM) Attach to State Letter a Basic Plan template	October 2012	Complete	ANC requests the Secretariat to provide a (global) status report in the near future and at regular periods thereafter

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C23/10	**AIM Quality Assurance Seminar**	That, ICAO should conduct an AIM Quality Assurance Seminar in conjunction with the Aeronautical Information Services – Aeronautical Information Management Implementation Task Force (AAITF).	ICAO APAC office	Conducted seminar in conjunction with AAITF/8 SL Ref. T3/10.1.6-AP185/12 (ATM)	May 2013	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/11	**Duplication and Amendment of 5LNC**	Recognizing that with the increasing use of Five Letter Name Codes (5LNC), it was not practical to avoid any duplication of 5LNC worldwide, and that States often used discretion in managing both duplications and minor changes of waypoint position that may not strictly be in accordance with the provisions of Annex 11, Appendix 1; ICAO is requested to consider: a) reviewing and updating Annex 11 to ensure its provisions related to 5LNC are appropriate; and b) standards for Flight Management Systems (FMS) that ensure logic checks on duplicated waypoint entries are highlighted to pilots.	ICAO APAC office ICAO Headquarters ANB/ATM	IOM to ICAO HQ Ref. T3/5.2, T3/10.1-AP-ATM0325 Updating Annex 11 to ensure its provisions related to 5LNC are appropriate	September 2012 TBD	Complete	ANC should task a suitable expert group to address the matter

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
D 23/12	**Establishment of APSAR Task Force**	That, an Asia/Pacific Regional SAR Task Force (APSAR/TF) be established, reporting to the ATM Sub-Group of APANPIRG, in accordance with the Terms of Reference as shown in **Appendix I** to the Report on Agenda Item 3.2.	ICAO APAC office	Conduct APSAR/TF/1 meeting State Letter Ref. T3/10.0, T3/10.1.2-AP125/12 (ATM)	July 2013	Complete	To note
C 23/13	**Data-link Performance Monitoring Seminar**	That, recognizing the key role data-link performance had in supporting PBN implementation; ICAO should conduct a Data-Link Performance Monitoring Seminar in conjunction with a Future Air Navigation Systems Interoperability Team-Asia (FIT-Asia) meeting.	ICAO APAC office	Data-Link Performance Monitoring Seminar run in conjunction with FIT-Asia/2 State Letter Ref. T3/8.13.1, T3/10.1.17-AP133/12 (ATM)	March 2013	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/14	**Asia/Pacific Regional RVSM Monitoring Statement**	That, the Asia/Pacific Regional RVSM Monitoring Statement attached as **Appendix A** to the Report on Agenda Item 3.3 be endorsed.	ICAO APAC office	State Letter Ref. T3/10.0, T3/10.1.7-AP137/12 (ATM) Upload to the ICAO APAC website	September 2012	Complete	To note
C 23/15	**Long-Term Non-RVSM Approved Aircraft**	That, States are urged in a timely manner to: a) update Regional Monitoring Agency data on RVSM approved aircraft; and b) respond to, and take action regarding RMA queries on long-term data indicating that aircraft were not approved.	ICAO APAC office	State Letter Ref. T3/10.0, T3/10.1.7-AP137/12 (ATM) State Letter to include request that States report progress to RASMAG/18	October 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/16	**Safety Monitoring Data Provision**	That, recognizing the importance of data collection for safety monitoring purposes, States be urged to: a) provide data as requested by Regional and En-Route Monitoring Agencies (RMA/EMA) in accordance with the RMA Manual (Doc 9937) and EMA Manual (either through a formal agreement or an informal understanding as appropriate); and b) provide available ADS-B data for height-keeping monitoring to RMAs when requested.	ICAO APAC office	State Letter Ref. T3/10.0, T3/10.1.7-AP137/12 (ATM) State Letter to include request that States report progress to RASMAG/18	October 2012	Complete	To note
C 23/17	**Asia/Pacific IP SNDCF ICD**	That, the Asia/Pacific Internet Protocol (IP) Sub-Network Dependent Convergence Function (SNDCF) Interface Control Document (ICD) provided in **Appendix A** to the Report on agenda item 3.4 be adopted as regional guidance material.	ICAO APAC office	State Letter Ref. T 8/2.13:AP141/12 (CNS) States notified and the GM posted on the APAC website	October. 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/18	**More Efficient Functioning of AMC**	That, ICAO be requested to invite EUROCONTROL AMC to consider the provision of more efficient function to enable States to identify recent changes from the previous AIRAC Cycle and to develop means of automation for providing updated AMHS Address Information.	ICAO APAC office	IOM to Paris Office Ref.: T 8/3.13:AP-CNS0151/12 Eurocontrol AMC agreed to take action & action has been done	November. 2012	Complete	To note
C 23/19	**Sample TMC for ATN/AMHS Interconnection Trials**	That, the sample Technical Memorandum of Cooperation (TMC) for ATN/AMHS interconnection trial between States, provided in **Appendix B** to the Report on agenda item 3.4 be adopted as regional guidance material for reference by States.	ICAO APAC office	State Letter Ref. T 8/2.13: AP141/12 (CNS) TMC for ATN/AMHS posted on APAC website and States notified	October. 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/20	**Inter-regional APAC/NAT AIDC Task Force**	That, a) the Terms of Reference of the inter-regional APAC/NAT AIDC Task Force provided by NAT System Planning Group at **Appendix C** to the Report on agenda item 3.4 be endorsed; b) States in Asia/Pacific Regions with experience of AIDC implementation be encouraged to participate in the Task Force to contribute for finalization of inter-regional ICD for AIDC; c) the outcome of the task force should be coordinated with APANPIRG through the CNS Sub-group; and d) States be urged to share their AIDC implementation plan with the neighbouring States in order to implement AIDC in a timely manner.	ICAO APAC office	State letter Ref.: T 8/3.5:AP148/ 12 (CNS) States notified and TF established according to the TOR	November 2012 except for point c) on-going with target date in 2014	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/21	**IMS Operational Concept**	That, ICAO be invited to a) develop IMS Operational Concept and expedite finalization of IPv6 network configuration; and	ICAO HQ ANB/IIM	IMS operational concept of IMS and IPv6 network configuration developed	March. 2013	TBA	ANC should bring this to the attention of the ACP (perhaps as in the context of Job-card ACP001)
		b) conduct cost-benefit analyses for the implementation of an IPv6 network and IMS/SWIM at regional level.	APANPIRG/ ATNICG	CBA for IPv6 and IMS/SWIM implementation conducted	April 2013	Under development target date revised to April 2014	

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/22	**Support of AMSS in the new/replacement SATCOM System**	That, States, implementing new/replacement SATCOM data-link systems be invited to consider the following in their study for next generation systems in support of AMSS: a) the system to be compatible with one of the existing and/or future AMSS systems such as INMARSAT to support AMSS data link interoperability; b) to establish an operational environment which will enable seamless AMSS operation for AESs, and architecting AMSS systems with appropriate reliability both in space and ground segments; and c) to include function of SATVOICE for ATS services.	ICAO APAC office	State letter Ref. T8/4.13: AP144/12 (CNS) States concerned notified	October. 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/23	**FANS 1/A over Iridium (FOI) for ATS Communication**	That, considering that FANS 1/A over Iridium (FOI) is expected to be useable for CPDLC and ADS-C operations using Iridium Next beginning in 2015, FOI be accepted as one of the viable means for conducting ATS data-link communications in the ASIA/PAC Region.	ICAO APAC office	State letter Ref. T 8/4.13: AP183/12 (CNS) States informed by State letter & Regional Strategy of the Air-Ground Data Link amended to include FOI	November 2012	Complete	To note
C 23/24	**Workshop on RCP and RSP**	That, ICAO be invited to organize a workshop on RCP and RSP in the Asia/Pacific Region.	ICAO APAC office	Workshop on RCP and RSP conducted	Nov. 2013	Complete Workshop was conducted in May 2013	To note
C 23/25	**Adoption of 1st Edition of Satellite Voice (SATVOICE) Guidance Material (SVGM)**	That, the 1st Edition of the Satellite Voice (SATVOICE) Guidance Material (SVGM) provided in **Appendix D** to the Report on agenda item 3.4 be adopted.	ICAO APAC office	State letter Ref.: T 8/4.13: AP182/12 (CNS) States notified about the GM which has been posted on the APAC website	December. 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/26	**Asia/Pacific GLS Seminar**	That, ICAO plans an Asia/Pacific GNSS Landing System (GLS) Seminar to provide information on emerging GLS technology, airport and airline GLS planning, and the development of applicable standards.	ICAO APAC office	State concerned coordinated and GLS Seminar conducted Ref. T3/8.30-AP118/12 (ATM)	December 2012	Complete Conducted seminar from 6-7 December 2012, Sydney	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
D 23/27	**Revised PBN/TF Terms of Reference**	That, the following amendments are made to the PBN/TF Terms of Reference: 3) Identify other issues/action items arising from the work of ICAO or for consideration by ICAO in order to facilitate regional and global harmonization of existing as well as future applications, and where appropriate, provide responses and support to the ICAO ~~RNPSOR~~ PBNSG. 4) Assist States in the preparation and review of their PBN implementation documentation and provide feedback to ensure regional harmonization and for possible inclusion in ICAO-developed model documentation. 5) Monitor the progress of State PBN implementation, identify constraints to implementation and capture information on the effectiveness (tangible benefits) of State PBN applications. 7) Address other regional PBN implementation issues, including the development of staff resources and skills, as needed by safety management. Coordinate and consult with ICAO FPP, COSCAP, industry partners and volunteering administrations who are providing support to State PBN implementation.	ICAO APAC Office	PBNTF notified about the approval of revised TOR	December. 2012	Complete The Task Force has been informed.	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/28	**Sharing of Ionospheric Data**	That, the States which are not participating in the Ionospheric Studies Task Force be urged to share ionospheric data from their national sources with the Task Force to support development of regional ionospheric models for GBAS and SBAS.	ICAO APAC office	State letter Ref.: T 8/5.1 & T 8/5.15: AP142/12 (CNS) States requested to provide the required data for sharing with the Task Force	October. 2012	Complete	To note
C 23/29	**Navigation Strategy for the Asia/Pacific Region**	That, the revised navigation strategy provided in **Appendix E** to the Report on agenda item 3.4 be adopted for the Asia/Pacific Region.	ICAO APAC office	State letter Ref. T 8/2.11:AP169/ 12 (CNS) States notified and revised Navigation strategy posted on the website	November. 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
D 23/30	**Revised Terms of Reference and Subject/Tasks List of ADS-B Study and Implementation Task Force**	That, the revised Terms of Reference and updated Subject/Tasks List of ADS-B Study and Implementation Task Force provided in **Appendices F** and **Appendix G** to the Report on agenda item 3.4 be adopted.	ICAO APAC office	ADS-B SITF notified about approval of revised TOR and Task List	April 2013	Complete ADS-B SITF/12 held 16-18 April 13 was informed about the Decision.	To note
C 23/31	**Guidance Materials on ASTERIX Category 21 Messages & Advice to Military Authorities regarding Sharing of ADS-B Data**	That, the following ADS-B implementation guidance materials be adopted: a) generation, processing and sharing of ASTERIX Category 21 ADS-B Messages provided in **Appendix H** to the Report on agenda item 3.4; and b) advice to military authorities regarding sharing of ADS-B data provided in **Appendix I** to the Report on agenda item 3.4.	ICAO APAC office	State letter Ref.: T 8/10.21: AP184/12 (CNS) States notified about the regional GMs which have been posted on the APAC website	December 2012	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/32	**Amendment to ADS-B Implementation Guidance Document (AIGD)**	That, the AIGD be amended to include a sample template on harmonization framework for ADS-B implementation as provided in **Appendix J** to the Report on agenda item 3.4.	ICAO APAC office and States	State letter Ref.: T 8/10.21: AP184/12 (CNS) AIGD amended to include the template and posted on APAC Website.	April 2013	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/33	**Database of Blacklist Airframe broadcasting misleading ADS-B Data**	That, a) Australia be requested to establish and maintain a Database of Blacklist airframe broadcasting misleading ADS-B data for sharing with other Administrations in the Asia/Pacific Region; and b) States implementing ADS-B based surveillance service be encouraged to provide the identified occurrences of airframe broadcasting misleading data to Australia for entry into the ADS-B Blacklist Database.	ICAO APAC office and Australia ICAO APAC office	Individual letter Ref. T 8/10.21:AP-CNS0159/12 sent to Australia Database established at request of ICAO RO States requested to provide the required data for sharing	February 2013 March 2013	CLOSED The request was not considered acceptable. Accordingly, further follow-up Action b) was not taken.	To note Use of the term 'Blacklist' should be reconsidered
C 23/34	**Sharing of ADS-B data to support ATC operations and safety monitoring**	That, States be urged to provide ADS-B data for sharing to support ATC operations and safety monitoring.	ICAO APAC office	States requested to provide Data to regional airspace monitoring agencies	March 2013 General reminder letter was sent to States in April13. (Relation with Conl.23/16 - RASMAG)	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/35	**Surveillance Strategy for the Asia/Pacific Region**	That, the revised surveillance strategy for the Asia/Pacific Region provided in the **Appendix K** to the Report on agenda item 3.4 be adopted.	ICAO APAC office	State letter Ref. T 8/2.11:AP169/ 12 (CNS) States notified and the revised Strategy posted on APAC website	November 2012	Complete	To note
C 23/36	**Nomination of Contact Focal Point**	That, States be urged to nominate/reconfirm Contact Focal Points for WRC-15 and inform ICAO APAC Office about their contact details.	ICAO APAC office and States	State letter Ref. : T 8/8.10:AP017/ 13 (CNS) Focal Points for WRC-15 nominated or confirmed by States	February 2013	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/37	**Preparations for WRC-15**	That, a) States consider national and international requirements for aeronautical services identified in the WRC-15 Agenda and develop national positions in line with ICAO Position to ensure the availability and protection of this spectrum for aviation use; b) States actively participate and support WRC-15 aeronautical spectrum issues through national and international meetings including APT Preparatory Group for WRC-15, ITU-R Working Party 5B and JTG 4-5-6-7; and c) States be encouraged to establish consultative groups of aviation industry participants to assist in the preparations for WRC-15 as appropriate.	ICAO APAC Office States	State letter Ref. : T 8/8.10:AP017/ 13 (CNS) a) National position for WRC-15 developed in line with ICAO position by States; b)States actively participated various forum for WRC-15; c)ICAO state letter issued urging States to establish industry consultative group	September 2013 July 2013 December 2014 January 2013	SL issued on 31 Jan. 2013 On Going On Going Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/38	**A SIP Workshop on Radio Spectrum Management**	That, a Special Implementation Programme (SIP) Workshop on radio spectrum management including revision to the overall ICAO Spectrum Policy and relevant frequency assignment planning criteria be organized in the Asia/Pacific Region.	ICAO APAC office	SIP Workshop on radio spectrum management conducted	July 2014	Proposed SIP for 2014 to be approved	To note
C 23/39	**User readiness for transition from GRIB1 to GRIB2 code form WAFS Forecasts**	That, ICAO urges States/users of WAFS forecasts in the ASIA/PAC Region to accelerate preparations for transition from WMO GRIB1 to GRIB2 WAFS forecasts if not already done so.	ICAO APAC office	State Letter	September 2012 (Revised March 2013) Realigned target date with WAFSOPSG/7 C 7/11)	Completed State Letters: AP029/13 (22/02/13) and AN10/3.1-13/2 (23/01/13)	To note
C 23/40	**Update to the ASIA/PAC FASID Table MET 6**	That, the ASIA/PAC FASID Table MET 6 be amended to reflect the requirements provided by States for primary Internet-Based service for WAFS Forecasts as provided in **Appendix P** to the Report on agenda item 3.4.	ICAO APAC office	Amendment to ASIA/PAC FASID Table MET 6	November 2012 (Revised Jan/Feb 2013) Revised to combine with PfA required by WAFSOPSG/7 Conclusion 7/2)	Completed PfA APAC 13/3 circulated to States (18/02/13)	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/41	**VAAC Backup Procedures in the ASIA/PAC Region**	That, Australia, Japan and New Zealand considers the further development of: a) VAAC Backup Procedures in the Asia-Pacific Region, as given at **Appendix Q** to the Report on agenda item 3.4, in order to include Tokyo, Wellington and Darwin VAACs; and b) Procedures for VAAC Backup Tests between Tokyo, Wellington and Darwin VAACs for inclusion in the Asia/Pacific Regional SIGMET Guide.	a) Japan, New Zealand and Australia; b) ICAO APAC Office	a) VAAC Backup Procedures for Tokyo/Wellington/Darwin; and b) Appendix (VAAC Backup Test Procedures) in ASIA/PAC Regional SIGMET Guide	November 2012 (Revised March 2013) (Revised based on expected time-frame for Darwin/ Wellington procedures)	**In Progress** Darwin/Tokyo procedures in SIGMET Guide (Oct 2012); to be reviewed/updated (Aug 2013); Darwin/Wellington procedures to be developed and added to SIGMET Guide (Dec 2013).	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/42	**Improvement of OPMET Data Availability**	That, the ICAO Secretariat, with the assistance of the OPMET/M TF, be invited to: a) continue the efforts to improve the availability (IATA requires at least 95% for AOP and 90% for non-AOP aerodromes listed in the FASID), timeliness and regularity of OPMET data at the RODBs, SADIS and WIFS, through regular monitoring and testing; and b) remind States concerned to ensure not more than one TAF is valid at an aerodrome at any given time (in accordance with Annex 3 – Meteorological Service for International Air Navigation, 6.2.7), and transmitted internationally as per ICAO provisions for services in support of flight planning.	ICAO APAC office	State Letter	September 2012	Complete S/L (T 4/3.2.3: AP139/12) issued 8 Oct 2012	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/43	**Improvement of Timeliness, Regularity and Availability of OPMET**	That, ICAO urges the States in the ASIA/PAC Region to: a) note the proposed Amendment 76 Annex 3 provision (intended applicability in November 2013) that will require an aerodrome forecast in the TAF code form to be issued not earlier than one hour prior to the beginning of its validity period; b) note that IATA expressed its requirement for international exchange of aerodrome forecasts to be completed no later than 30 minutes before the commencement of the period of validity *; c) continue efforts for standardized procedures for the issuance of OPMET data; d) consider the details provided in the IATA monitoring for the ASIA/PAC Region; and e) improve the issuance of OPMET data with respect to timeliness, regularity and availability. * ICAO to consider the requirements expressed by IATA and amends the global provisions as necessary.	ICAO APAC office	State Letter	September 2012	Complete S/L (T 4/3.2.3: AP139/12) issued 8 Oct 2012	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/44	**Improvement of OPMET Data Format**	That, ICAO remind the States in the Asia Pacific Region of the: a) Standards and Recommended Practices in Annex 3 – Meteorological Service for International Air Navigation concerning provision of operational meteorological information; and b) Annex 3 provisions concerning the quality management of meteorological information to be supplied to users that includes verification and validation procedures to be applied for the exchange of meteorological information for operational purposes, such as OPMET information.	ICAO APAC office	State Letter	September 2012	Complete S/L (T 4/3.2.3: AP139/12) issued 8 Oct 2012	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/45	**Implementation of Quality Management Systems for Meteorological Service Provision**	That ICAO, in coordination with the World Meteorological Organization (WMO), considers urgent strategies to foster the implementation of quality management systems for meteorological service amongst States in the Asia/Pacific Region in light of the ICAO Annex 3 – Meteorological Service for International Air Navigation requirement applicable 15 November 2012.	ICAO APAC office	Strategy/plan	October 2012 (Revised June 2013)	**In Progress** States surveyed on QMS status; ICAO/WMO in discussion on plan for assistance.	To note
D 23/46	**Subjects and Task Lists for CNS and MET Sub-groups**	That, the list of Subjects/Tasks for CNS Sub-group provided in the **Appendix S** and list of Subjects/Tasks for MET Sub-group provided in the **Appendix T** to the Report on agenda item 3.4 be adopted.	ICAO APAC office	CNS and MET SGs notified of the approved Task List	May 2013	Completed Subjects/Tasks list reviewed and updated at MET SG/17 (16/05/13)	To note
C 23/47	**Benefits of using ICAO Procurement Services**	That, the States/Administrations in the ASIA/PAC Region be encouraged to consider utilizing ICAO's Civil Aviation Purchasing Service in their procurement of civil aviation equipment and services.	ICAO APAC office	State letter	January 2013	Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
D 23/48	**Aspect of Space Weather**	That, CNS and MET SGs review the impact of space weather in the CNS and MET area and report to APANPIRG.	ICAO APAC office	Working Papers (reviewed by CNS SG/17 & MET SG/17 and delivered to APANPIRG/24	16 April 2013, for CNS SG/17 & MET/SG 17 and 7 June 2013, for APANPIRG/24	**Completed** MET SG/17 WP/27, CNS SG/17 WP/08, APANPIRG/24 IP/10	To note
C 23/49	**Asia/Pacific Position Statement on ASBU**	That, the Asia/Pacific Position Statement containing the response to the Draft Aviation System Block Upgrade (ASBU) Document appended as **Appendix 2 to the Report on Agenda Item 3.5** be adopted for States to use as a reference in formulating their position for the 12th Air Navigation Conference .	ICAO APAC office	States notified by SL Ref. T3/10.1.21-AP143/12 (ATM)		Complete	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/50	**States' Action Plan on Environment**	The States a) continue to consider environmental issues in the planning and implementation of regional air navigation systems; b) bring to the attention of the ICAO specific areas where additional guidance on environmental benefits would be valuable; c) use of IFSET to estimate the fuel savings and corresponding environmental benefits from the implementation of operational improvements, as part of the development of States' action plans; d) note the availability of further assistance by ICAO in the preparation and submission of States' action plans; and e) attend the Assistance for Action – Aviation and Climate Change Seminar in Montreal from 23 to 24 October 2012.	ICAO APAC office	States notified by SL	December 2012	Complete SL dated 26 AP 152/12-19/10/12	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date	Status as of 31 May 2013	Action agreed by ANC
C 23/51	**ICAO Public Health Emergency related SARPs**	That, States/Administrations: a) should develop, update and test aviation public health emergency (PHE) preparedness plan in collaboration with public health authorities, in compliance with related ICAO SARPs and WHO IHR (2005), and prepare for the ICAO USOAP Continuous Monitoring Approach (CMA) audit which, from 2013, will include protocol questions concerning PHE related ICAO Standards and Recommended Practices; and b) consider become participating members of the ICAO CAPSCA Asia Pacific project, if not yet members, and accept PHE Preparedness Assistance Visits by the ICAO CAPSCA Asia Pacific Project, by sending a letter to the ICAO APAC Regional Office.	ICAO APAC office	States notified by SL	December 2012	Complete SL AN3/3 AP 172/12 dated 3 December 2012	To note

APANPIRG/23 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**	**Status as of 31 May 2013**	**Action agreed by ANC**
C 23/52	**Transition from five regional deficiency databases to single global database**	That States and International organization, a) note the approach to transfer five regional air navigation deficiency databases into a single centralized database on iSTARS platform by December 2012; b) test the centralized database on iSTARS platform using the guidance; c) Update the data as necessary in coordination with ICAO APAC Regional Office; and d) provide feedback to ICAO APAC Regional Office on the use of centralized database available in iSTARS, by 30 November 2012.	ICAO APAC office	State letter	October 2012	Complete SL AP159/12 dated 7 Nov 2012	To note
C 23/53	**Update of ATM/AIS/SAR Deficiency List**	That, the ATM/AIS/SAR, AOP, CNS and MET Deficiency List be amended as detailed in **Attachment** A to D to the Report on Agenda Item 4.	ICAO APAC office	Deficiency list updated	December 2012	Complete	To note

* NOTE: ICAO HAS ESTABLISHED THE FOLLOWING STRATEGIC OBJECTIVES FOR THE PERIOD 2011-2013: *STRATEGIC OBJECTIVE A: SAFETY — ENHANCE GLOBAL CIVIL AVIATION SAFETY; STRATEGIC OBJECTIVE B: SECURITY — ENHANCE GLOBAL CIVIL AVIATION SECURITY;* STRATEGIC OBJECTIVE C: *ENVIRONMENTAL PROTECTION AND SUSTAINABLE DEVELOPMENT OF AIR TRANSPORT — FOSTER HARMONIZED AND ECONOMICALLY VIABLE DEVELOPMENT OF INTERNATIONAL CIVIL AVIATION THAT DOES NOT UNDULY HARM THE ENVIRONMENT*

1.3 Review of Status of Implementation of APANPIRG Outstanding Conclusions and Decisions

1.3.1 The Meeting reviewed the progress made on the APANPIRG Outstanding Conclusions and Decisions up to its Twenty Second Meeting.

1.3.2 The actions taken by States and the Secretariat on the above mentioned Conclusions and Decisions were reviewed and the updated list is provided in **Appendix A** to the Report on Agenda Item 1.3.

1.3.3 The Meeting noted that out of the outstanding 14 Conclusions and 1 Decision, the follow-up actions on 7 Conclusions have been completed/closed. Actions on the remaining 7 Conclusions and 1 Decision are ongoing. The Meeting acknowledged that significant progress had been made in completing required action on the Outstanding APANPIRG Conclusions and Decisions.

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Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 19/43 **D**	**Training for the new WAFS gridded forecasts**	That, in order to facilitate the implementation by the States of the new WAFS gridded forecasts, a) WAFC Provider States, in coordination with ICAO and WMO, be invited to organize training on the use of the new WAFS gridded forecasts for icing, turbulence and cumulonimbus clouds; and	a) Organize training	ICAO HQ	conduct training programme	Revised target date-Dec 2013	In progress Revised target date Dec 2013 (updated twice, the last target date 2011) ANC action-Noted and invited the Secretary General to invite WAFC provider States in coordination with ICAO and WMO to organize the required training.
		b) WAFSOPSG be invited to consider, in addition to the planned regional training seminars, developing alternative methods for provision of training to the States on the new gridded forecasts for icing, turbulence and cumulonimbus clouds in order to ensure that a maximum number of WAFS users in the States will have access to the training in the most efficient way. *Note: The alternative training methods include computer based training products distributed to States and web-based training.*	b) Develop alternative methods for provision of training to the States on the new gridded forecasts for icing, turbulence and cumulonimbus clouds	ICAO HQ	Alternative training methods	Revised target date Sep 2012	Training organized on use of new WAFS gridded forecasts through placement of guidance on WAFSOPSG website (Sep 2012). Computer-based initial training material under review by WAFSOPSG (Apr 2013). Training seminars deferred (WAFSOPSG/6) ; but may be re-considered by WAFSOPSG/8 (Sep 2013).

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 20/68	**Expanded WV SIGMET Test Development**	That, a) Japan be invited to further develop an expanded WV SIGMET Test utilizing automated templates in consultation with the Darwin VAAC; and b) upon completion of a) above, Japan conducts the expanded WV SIGMET Test and produce an analysis to the OPMET/M TF/8 meeting for further review and subsequent reporting to the CNS/MET SG/14 meeting to determine the next phase of the test.	Develop WV expansion SIGMET test Conduct and report on trial test	Japan/ VAAC Darwin Japan	Updated WV expansion SIGMET Test Test results included in OPMET/M TF/8 and CNS/MET SG/14 reports	Revised target date March 2014	**IN PROGRESS** Efforts suspended due to earthquake/Tsunami and accidental release of radioactive material; Japan to resume work on developing an expanded SIGMET test for volcanic ash in the APAC Region; Australia to assist..
C 21/6	**Notification of State Transition Date to the New flight Plan Format**	That, in order to keep the ICAO Flight Plan Implementation Tracking System (FITS) website updated, States which have not yet provided data inform the Regional Office of the initial set of data required in the FITS website, such as scheduled date and contact person, by 22 October 2010, and subsequently update the data as required.	Update FITS	States	a) State letter b) FITS update	September 2010 22 October 2010	Completed

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 21/7	**Use of Global database for allocation of five-letter name codes in the Asia and Pacific Regions**	That, States which have not yet done so be urged to: a) nominate an ICARD authorized user in order to make use of the ICARD system and improve the process of allocation of Five-Letter Name-Codes (5LNCs); b) review the list of allocated 5LNCs with respect to each States, identify non-used, duplicate or non-ICAO 5LNCs and take actions to rectify the situations; and c) update the ICARD database by adding missing information, e.g. latitude and longitude coordinates, etc; and d) take necessary actions to implement the widespread use of the ICARD system.	a) nominate user b) review 5LNCs c) update ICARD d) implement ICARD	States	a) authorized user b) resolutions of duplication or non-ICAO 5LNC c) ICARD update	Ongoing Ongoing Ongoing	**COMPLETED** The recent ICARD Seminar (13 March 2012) resulted in an increase of users from 14 to 22 administrations. These administrations were Cambodia, India, Indonesia, Macao China, Philippines, Sri Lanka, Solomon Islands and Vietnam. It was reported to APANPIRG/23 that there were now 26 ICARD users, representing a significant portion of APAC administrations.

Appendix A to the Report on Agenda Item 1.3

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
D 21/9	**Develop Sub-Regional volcanic Ash Contingency Plan**	That, a) in view of the recent volcanic activity in Iceland, the CNS/MET Sub-Group be requested to develop sub-regional volcanic ash contingency plans; and	CNS/MET SG to develop volcanic ash contingency plans	ICAO APAC	Volcanic ash regional contingency plan	Revised date- March 2014	a) **IN PROGRESS** A framework for APAC regional contingency plans developed (Mar 2011); Ad-hoc group to consider input to ATM VACP.
		b) urge States to designate appropriate contact points to establish/maintain contacts in the interim period until the sub-regional volcanic ash contingency plans become available.	States to provide POC for volcanic ash events	ICAO APAC	Contingency contact list Assignment of duties – CNS/MET SG/14 D14/30 to METWARN/I TF and MET/ATM TF	Jan 2011	b)Completed

Appendix A to the Report on Agenda Item 1.3

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 21/13	**Coordination for the Transition to the NEW Flight Plan Format among States**	That, as the global and the regional harmonization is crucial in implementing the NEW flight plan format by 15 November 2012, States start close coordination soon with adjacent States/FIRs on transition about, but not limited to: i) difference of timing for transition between the States/FIRs; ii) operations in the mixed environment of PRESENT and NEW; iii) operational transition for AIDC; and iv) procedures when ATS messages are not processed properly.	Start coordination	ICAO APAC Office States ICAO HQ	State letter Coordination Global harmonization through monitoring of implementation status on ICAO FITS portal	March 2011 Nov 2012	COMPLETED (FPL 2012 SUCCESSFULLY IMPLEMENTED 15 NOV 2012)

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 21/46	**Improvements to WAFS Implementation**	That, the WAFSOPSG is invited to discuss and consider the following improvement measures in WAFS implementation:					
		a) the WAFC Provider States inform users in advance about forthcoming changes to the contents of the WAFS forecasts; and	Determine changes, if necessary, to the WAFS change bulletin notice	WAFSOPSG/ 6 (March 2011)	Update WAFS bulletin notice, if required	July 2011	a) **COMPLETED** WAFSOPSG/7 (Sep 2012) Conclusion 7/8.
		b) further guidance be provided regarding the specific actions to be taken by the MET service providers and all relevant end users of WAFS upon receiving the administrative message. *Note: Guidance should also include any requirement for a user State to generate its own administrative message for a product affected by a received administrative message.*	Determine further guidance, if necessary, for users of WAFS administrative messages	WAFSOPSG/ 6 (March 2011)	Update guidance on WAFS administrative messages, if required	Sept 2013	b) **IN PROGRESS** Secretariat to submit WP to WAFSOPSG/8 to consider further guidance regarding specific actions

Appendix A to the Report on Agenda Item 1.3

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 21/47	**Improvements to VA and TC advisories**	That, The IAVWOPSG consider including the file name of the graphical advisories, if issued, under “Remarks” of the corresponding textual advisories.	Determine if link between graphical and textual advisories is necessary	IAVWOPSG/6 (September 2011) Note: APANPIRG/21 report not reviewed by ANC until Feb 2012, therefore follow-up action deferred to IAVWOPSG/7 (March 2013	Update relevant standards (Am 76 to Annex 3) and/or guidance material if necessary	2013	**COMPLETED** IAVWOPSG considered that proposed digital format VA advisories (Am77 to Annex 3) will deem link between graphical and textual VA advisories unnecessary. In the interim IAVWOPSG noted that VAACs may choose to provide VA advisory information in CSV file on bilateral basis, which would also deem link between graphical and textual VA advisories unnecessary.

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 21/48	**Update of SADIS and ISCS User Guide**	That, the SADISOPSG and WAFSOPSG consider the need to update the SADIS and ISCS User Guides by aligning with regional Meteorological Watch Offices requirements (Regional FASID Tables) *Note: To achieve this, the following steps should be taken in time for the regional SIGMET advisory trial (1 April 2011)*					a) **COMPLETED** b) & c) **IN PROGRESS** (all regions submitted latest version table in excel format to HQ in Nov 2010, except for NAM) WAFSOPSG/6 noted development of database at HQ (but will not meet target date) Development of a global database of SIGMET requirements is underway in ICAO headquarters (along with the development of a database for all MET Tables contained in the air navigation plan).
		a) Regional amendment proposals on FASID Table MET 1B;	Amendment Proposals to Tables in the Regions, where necessary	ICAO APAC	Up-to-date FASID Tables MET 1B for all Regions	Dec 2010	
		b) Develop global database based on Regional requirements in a); and	HQ IT develop global database of FASID Table MET 1B	ICAO HQ	Global MWO database	Mar 2011	
		c) Consider global database on SIGMET requirements for use in SADIS and ISCS User Guides	Incorporate SIGMET requirements in SADIS Users Guide (as a link to the global database)	WAFSOPSG/ 6 (March 2011) SADISOPSG/ 15 (May 2011)	Provide link to global database for SIGMET requirements	Apr 2011	

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 21/53	**Elimination of ATM Air Navigation Deficiencies**	That, States concerned a) be urged to take urgent actions to correct the deficiencies in the ATM/AIS/SAR fields identified in Attachment A to the Report on Agenda Item 4 ; b) notify details of the problems/difficulties to the Regional Office; and c) designate a point of contact in each State to deal with deficiencies and provide details to the Regional Office by 22 October 2010.	a) take actions to correct deficiencies b) notify details of difficulty c) designate point of contact	States	less deficiencies remedial actions point of contact	Ongoing Ongoing 22 October 2010	Complete
C 22/36 **A**	**Amendment to Regional Supplementary Procedures on ADS-B**	That, the Regional Supplementary Procedure Doc7030 MID/ASIA Chapter 5 be amended in accordance with the established procedure to include regional requirements on ADS-B as provided in the **Appendix N** to the report on Agenda Item 3.4.	Prepare and process PfA to SUPP	ICAO APAC Office ICAO HQ/ ANB/ATM	Proposal for amendment (PfA) processed and submitted to HQ. Sharing of APANPIRG's PfA for DOC 7030 related to ADS-B with other regions.	March 2012/rev May 2012 Rev May 2013	On Going PfA slightly amended and processed in April 2013. Revised target date July 2013

Appendix A to the Report on Agenda Item 1.3

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 22/41 A &C	**Improvement of WAFS SIGMET availability**	That, the SADIS and ISCS States be invited to participate in regional SIGMET monitoring exercises and/or regional SIGMET tests in the APAC Region in an effort to improve the availability of SIGMET.	Request SADIS and ISCS States to conduct monitoring of Regional SIGMET and to conduct tests	ICAO APAC Office	State Letter to SADIS and ISCS States	January 2012 Revised date- June 2012	Completed SL (Ref:T4/7.5 AP127/12) 28 Sep 2012
C 22/42 **A &C**	**Improvement of WAFC SIGWX charts**	That, the WAFSOPSG be invited to request the WAFC Provider States to provide SIGWX chart verification results, if any, to illustrate the degree of accuracy of their SIGWX charts.	Invite WAFSOPSG to request WAFC provider States to improve SIGWX charts	ICAO APAC Office	Letter to Secretary WAFSOPG	February 2012	**IN PROGRESS** WAFSOPSG/7 (Sep 2012) formulated Conclusion 7/4 — Implementation of enhanced WAFS performance indicators, which will be reported at WAFSOPSG/8 (Sep 2013). MET SG/17 Decision 17/1 will request WAFSOPSG/8 to consider further follow-up concerning SIGWX chart verification results.

Status of Outstanding Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 22/44 C	**SIGMET template and example for no VA expected**	That, a) ICAO consider modifying the SIGMET template in Annex 3 to include an example to report a situation when no ash is expected in the forecast section of a SIGMET; and b) the Asia/Pacific SIGMET Guide be amended accordingly with an example of a SIGMET satisfying the condition in a).	ICAO to consider modification of Annex 3 provisions relating to SIGMET	ICAO HQ/ ANB/MET ICAO APAC Office	Amendment to relevant provision of Annex 3. Amendment to Asia/Pacific SIGMET guide.	March 2012	**COMPLETED** Am76 to Annex 3 adopted by Council 27 Feb 2013 (AN 10/1.1-13/39 refers) Applicability 14 Nov 2013 **IN PROGRESS** SIGMET Guide to be updated Sep 2013.
C 22/45 A &C	**Improvement of timeliness, regularity and availability of OPMET data on the SADIS and ISCS broadcast**	That ICAO be invited, a) to request States to implement the standardized procedures for the issuance of OPMET data as specified in - the ROBEX Handbook ; and b) to inform States of the details provided in the IATA monitoring for the ASIA/PAC region.	Request States to implement procedure specified in ROBEX Handbook for OPMET exchanges	ICAO APAC Office	State Letter	March 2012	Completed SL (Ref:T4/3.2.3: AP139/12) 8 Oct 2012

* **Note: 1)** ICAO has established the following Strategic Objectives for the period 2005-2010:
A: Safety - *Enhance global civil aviation safety*; **B: Security** - *Enhance global civil aviation security*; **C: Environmental Protection** - *Minimize the adverse effect of global civil aviation on the environment*; **D: Efficiency** - *Enhance the efficiency of aviation operations*; **E: Continuity** - *Maintain the continuity of aviation operations;* **F: Rule of Law** - *Strengthen law governing international civil aviation.*

Note: 2) ICAO has established the following Strategic Objectives for the period 2011 -13:
A: Safety - *Enhance global civil aviation safety*; **B: Security** - *Enhance global civil aviation security*; Strategic Objective C: Environmental Protection and Sustainable Development of Air Transport — Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment.

Agenda Item 2: Flight Safety and RASG APAC Activities

Global and Inter Regional Activities

2.1 REGIONAL PRIORITIES AND TARGETS FOR AIR NAVIGATION

2.1.1 To support a globally harmonized air navigation system, the Meeting noted that ICAO has developed the fourth edition of the Global Air Navigation Plan (GANP) that contains the Aviation System Block Upgrades (ASBUs) framework.

2.1.2 Although the GANP has a global perspective, all ASBU modules may not be applicable to all States or regions. Some of the modules are specialized packages that should be applied where specific operational requirements or corresponding benefits exist. Therefore, the Meeting agreed that implementation priorities for Air Traffic Management (ATM) enhancements will vary between regions as each has different operational environments, traffic volumes, etc. This prioritization exercise could be done by individual States and regionally by the APANPIRG. Guided by the GANP, the Meeting acknowledged that the regional planning process requires full involvement of States, service providers, airspace users and other stakeholders, thus ensuring commitment by all for implementation.

2.1.3 In this regard the Meeting was informed that a PIRGs and RASGs Global Coordination Meeting was held in Montreal on 19 March 2013 under the Chairmanship of the President of the ICAO Council. The outcome of this coordination meeting includes: establishing regional priorities and targets for air navigation by May 2014 consistent with the GANP/ASBU framework; the need to measure performance improvements to help demonstrate their positive impact on the environment; endorsement of the envisioned regional performance dashboard prototype; confirmation of the need for a coordination mechanism in each region between the RASG and PIRG to ensure consistency of action and avoid overlap; encouragement of the sharing of successful initiatives among one other; identification of the need for training on how to determine priorities for the ASBUs; and agreement on utilizing specific interface groups where required for addressing the harmonization of air navigation plans in adjacent areas of PIRGs. It was decided to convene the PIRG-RASG global coordination meeting in this format once every two years with the next one planned for March 2015. As a result of discussions, the Meeting adopted the following Decision:

Decision 24/1 — Regional Priorities and Targets for Air Navigation

That APANPIRG

a) establish, consistent with Recommendations 6/1 and 6/12 of the AN-Conf/12, priorities and targets for air navigation by May 2014;

b) utilize specific interface groups, where required, for addressing the harmonization of air navigation plans in adjacent areas of APANPIRG; and

c) coordinate with APAC-RASG to ensure consistency of action and avoid overlap.

2.1.4 The meeting noted that the PIRG RASG Global coordination meeting held on 19 March 2013 requested PIRGs to establish the regional priorities and set targets and report to ICAO by May 2014. The meeting also noted that Seamless ATM Plan spelt out the 6 regional ASBU priorities which are aligned to GANP (ASBU Modules) and adopted the following conclusion:

Conclusion 24/2 — Establishing Regional Priorities and Targets

That, following the PIRG- RASG Global Coordination meeting held in March 2013 APANPIRG/24 invited the Chairpersons of ATM, RASMAG, CNS, and MET sub groups to establish regional priorities and targets for the APAC Region in alignment with the GANP and APAC Seamless ATM Plan by December 2013 in order to facilitate submission to ICAO by May 2014.

2.2 REGIONAL AND GLOBAL AIR NAVIGATION REPORTING

2.2.1 The Meeting recalled that in 2009 the APANPIRG adopted a performance-based approach to air navigation planning and implementation. The next step calls for establishment of measurement and reporting strategy by States that comprises of data compilation, processing, storage and reporting for the identified regional performance metrics.

2.2.2 Consistent with this principle of transparency and sharing of information, the Meeting was informed that the ICAO is planning to introduce regional 'Performance Dashboard' homepages for every public website of the ICAO Regional Offices. These dashboards will illustrate the regional implementation status of air navigation systems. This new interactive online system will be in place for Africa in August 2013 and for the remaining regions in March 2014, and will be updated semi-annually.

2.2.3 Much like the existing annual Safety Report, the objective of the annual Global Air Navigation Report is to assist PIRGs and States in understanding which areas require special attention to effectively improve air navigation performance worldwide as well as to help propagate information on success stories. This first edition of this Report, slated for April 2014, will also provide an opportunity for the civil aviation community to evaluate progress across different ICAO regions. The outcomes reflected in the proposed Report could also help identify annual tactical adjustment priorities for regional work programmes, as well as informing longer-term policy adjustment.

2.2.4 The *Global* Air Navigation Report will consist of qualitative and quantitative information and cover key performance areas of air navigation systems. The report will cover among other things global air navigation challenges and implementation progress of selected ASBU Block 0 Modules. The metrics or initial dataset proposed are Performance Based Navigation (PBN), Continuous Descent Operation (CDO), Continuous Climb Operations (CCO), Aeronautical Information Management (AIM), Air Traffic Flow Management (ATFM) and estimated environmental benefits accrued from operational improvements based on ICAO Fuel Savings Estimation Tool (IFSET). This initial dataset for both *Regional* Performance Dashboard and the *Global* Air Navigation Report was recently agreed by the PIRG Chairs which will be proposed for regional adoption. In terms of carrying out the task of performance measurement within the APANPIRG mechanism, the Meeting agreed to assign it to the existing subgroups.

2.2.5 The Meeting supported the plan for an online Regional Performance Dashboard in March 2014 and annual Global Air Navigation Report in April 2014 and adopted the following Conclusion;

Conclusion 24/3 — Regional and Global Air Navigation Reporting

That States:

a. support the the plan for an online Regional Performance Dashboard in March 2014 and annual Global Air Navigation Report in April 2014

b. provide requisite information to the ICAO Regional Office, Bangkok to demonstrate operational improvements; and

c. establish, if not yet done so, a performance measurement strategy that comprises of data compilation, processing, storage and reporting for the identified regional performance metrics for the air navigation systems.

2.3 FOLLOW-UP TO RECOMMENDATIONS OF THE TWELFTH AIR NAVIGATION CONFERENCE (AN-Conf/12)

2.3.1 The Meeting noted that the Twelfth Air Navigation Conference (AN-Conf/12) held in Montréal from 19 to 30 November 2012 dealt with six Agenda Items. The Conference made fifty-six recommendations, often comprising a number of components, covering a variety of air navigation subjects. The Meeting noted that the Council on 1 March 2013 considered and approved the report of the AN- Conf/12. In taking action recommended by the Commission, the Council confirmed ICAO's role in the follow up, and called upon States, international organizations, PIRGs and stakeholders to initiate action on specific recommendations as necessary. The work associated with the recommendations, which will be undertaken by ANC panels and the Secretariat, could be considerable. Following acceptance by the Council of the recommendations of the Conference, the Meeting was apprized that the Commission and the Air Navigation Bureau will now assign, as necessary, the work to the expert groups.

2.3.2 The scope of the follow-up action by APANPIRG on the recommendations, in some cases, extends to States, International Organizations and other stakeholders. This distinction becomes clear when the required follow-up to the recommendations of AN-Conf/12 are examined in the **Appendix A to Report on Agenda Item 2.** It is considered that one of the first coordination efforts required by the APANPIRG will be to assign the task of developing an implementation plan for the relevant recommendations to its subgroups and that a report is submitted to APANPIRG/25 as appropriate.

2.3.3 On the basis of the analysis of the Appendix, the Meeting adopted the following Conclusion and Decision:

Conclusion 24/4 — Follow-up to AN-Conf/12 Recommendations by States and International Organizations

That, the States and International Organizations, on the basis of analysis contained in the Appendix A to Report on Agenda Item 2, takes follow-up action as appropriate on the applicable recommendations of the AN-Conf/12.

Decision 24/5 — Follow-up to AN-Conf/12 Recommendations by APANPIRG

That the subgroups of APANPIRG study the recommendations of the AN-Conf/12, initiate appropriate follow-up actions and submit a report on the outcomes of these actions to APANPIRG/25.

2.4 FUNDING OF AVIATION INFRASTRUCTURE, OVERSIGHT FUNCTIONS AND AVIATION SYSTEMS

2.4.1 The Meeting recalled that the AN-Conf/12 recommended that the Conference conclusions relating to the economic, financial and social aspects of ASBUs be referred to ATConf/6 with the aim of developing solutions that would support a safe and sustainable air navigation system. The ATConf/6 considered two sub-items, funding and financing and developed Recommendations that called upon ICAO to take follow–up action as detailed below.

2.4.2 ICAO, in cooperation with States, international organizations and the industry, will establish a multi-disciplinary working group to consider the challenges associated with the establishment of operational and economic incentives, such as service priority, to allow early benefits of new technologies and procedures, as described in the ASBUs. ICAO will undertake relevant measures to ensure widespread awareness and knowledge of its policies, guidance and other material related to funding infrastructure, and ensure that they remain relevant, current and responsive to the changing situation. With the objective of ensuring the sustainable funding of the oversight functions at the State and regional levels, ICAO will explore possibilities for the establishment of new mechanisms that are in line with Doc 9082 and will take into account the various situations encountered by different States.

2.5 A COMPREHENSIVE STRATEGY FOR AIR NAVIGATION REVISED GLOBAL AIR NAVIGATION PLAN

2.5.1 The Meeting noted that the AN-Conf/12, held in November 2012, reviewed the fourth edition of the GANP and recognized that it provides a global planning framework through the ASBU Modules. The AN-Conf/12 agreed that the associated technology roadmaps were an integral part of the GANP and it serves as a valuable tool kit for a successful global long-term air navigation planning and implementation. The revised GANP represents a rolling, fifteen–year strategic planning methodology which leverages existing technologies and anticipates future developments. The Meeting noted that the Council (C199/5) of ICAO has approved this fourth edition of the GANP on 29 May 2013. In noting the revised global plan, the Meeting called on States, service providers and airspace users to establish priorities and targets for air navigation consistent with GANP objectives.

2.5.2 In term of update process, the Meeting noted that the ICAO Air Navigation Commission will review the GANP as part of the triennial work programme, reporting to the Council one year in advance of each ICAO Assembly. The ANC report will provide a review of global progress made in achieving the GANP objectives and will consider lessons learned by States, industry and PIRGs. Prior to being presented to the Council, proposed updates will be circulated to Member States for consultation. Following approval by the Council, the updated GANP will then be submitted for endorsement by ICAO Member States at the following ICAO Assembly.

2.5.3 Australia submitted a proposal to integrate the GANP planning approach into the development of a revision of the Regional Air Navigation Plan, which included a harmonization of coordination between regions and consistent upward reporting, regional implementation priorities supported by a performance case, and consideration of trans-regional aspects.

2.5.4 The meeting requested ICAO to ensure a consistent approach to reporting required by the global dashboard approach and that suggested by the Implementation Guidance Material supporting the Asia/Pacific Seamless ATM Plan. Australia stressed the importance of minimizing reporting duplication.

2.5.5 The differences between the status of the Regional Air Navigation Plan (which contained commitments by States) and the Seamless ATM Plan (which was guidance material and thus non-binding) was recognized by APANPIRG.

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RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
Recommendation 1/1 – The draft Fourth Edition of the Global Air Navigation Plan (Doc 9750, GANP)			
That States: a) agree in-principle, with the replacement of the introduction by the high level policy principles as shown in the appendix and inclusion of other proposed improvements made at this Conference, into the updated draft Fourth Edition of the GANP;	a): Noted.	a) and c): Develop and review the new draft version of the GANP taking into account AN-Conf/12 recommendations.	a) Note
b) should have the opportunity to provide any final comments on the updated draft GANP to ICAO before it is considered by the ICAO Assembly in 2013;	b): Approved validation process of the new draft version of the GANP as proposed by the ANC.	b): Noted.	b) Note
That ICAO: c) include the key air navigation policy principles presented in the appendix under “Global Air Navigation Plan” into the Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP);	c): Approved as part of the GANP approval.	-	c) to g): Note
d) develop financial policies which support efficient acquisition and implementation of global air navigation services infrastructure and aircraft equipage;	d): Requested Secretary General to take appropriate action.	d): Contribute to the definition of financial policies.	
e) taking a total systems and performance-based approach, create a Standards and Recommended Practices development plan for the aviation system block upgrades including the establishment of	e) to g): Noted.	e) to g): Approved and include in the Air Navigation work programme.	

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
agreed global priorities between the different blocks and modules; f) define a stable and efficient process for endorsement by the 38th Session of the ICAO Assembly, for updating the GANP that ensures stability in module timelines for any future updates; and g) ensure that the nature and status of the planning information in the various documents pertaining to the GANP are consistent and complete and allow due account to be taken of the inputs from ATM research, development and deployment programmes.			
Recommendation 1/2 – Implementation That ICAO: a) through its regional offices, provide guidance and practical assistance to States and regions and subregions when they decide to implement individual blocks or modules of the aviation system block upgrades; b) establish a group and improved mechanism for interregional cooperation to ensure harmonization of air traffic management; and c) assist States and regions in training and capacity-building towards implementation of the relevant modules of the aviation system block upgrades.	a) to c): Noted.	a) to c): Consider including into the Air Navigation work programme and requested the Secretary General to take appropriate action.	a) to c): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
Recommendation 1/3 – Guidance on business cases That ICAO complete the development of guidance material on business case analysis, adopting such appropriate guidance material that may be already available or under development.	Approved and requested the Secretary General to take appropriate action.	Contribute to the definition of business cases and related guidance.	Note
Recommendation 1/4 – Architecture That ICAO: a) develop, for inclusion in the first update of the GANP after the 38th Session of the ICAO Assembly, a global ATM logical architecture representation in support of the GANP and planning work by States and regions; and b) develop a breakdown of the logical architecture of the ground system to the level needed to best address the global interoperability issues.	a) and b): Noted.	a) and b): Approved and include in the Air Navigation work programme.	a) and b): Note.
Recommendation 1/5 – Time reference accuracy That ICAO define the accuracy requirements for the future use of a time reference and to prepare the necessary amendments to Standards and Recommended Practices.	Noted.	Approved and include in the Air Navigation work programme	Note
Recommendation 1/6 – Data communications issues			

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
That ICAO: a) organize a multidisciplinary review of air traffic control communication requirements and issues; and b) review the operation, management and modernization of a regional digital network technical cooperation project and other similar regional experiences with the aim that this efficient practice can be adapted for use in other ICAO regions; That States: c) explore multi-modal solutions when appropriate to overcome transition issues; and d) anticipate and accelerate the migration of air traffic management communication systems towards more efficient technologies to timely service the aviation system block upgrade modules.	a) and b): Noted. c) and d): Noted.	a) and b): Approved and include in the Air Navigation work programme. c) and d): Approved and requested the Secretary General to bring to the attention of States.	a) and b): Note c) and d): States to take appropriate action
Recommendation 1/7 – Automatic dependent surveillance — broadcast That States: a) recognize the effective use of automatic dependent surveillance — broadcast (ADS-B) and associated communication technologies in bridging surveillance gaps and its role	a) to c): Noted.	a) to c): Noted and requested the Secretary General to bring to the attention of States.	a) to b): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	**AIR NAVIGATION COMMISSION (ANC)**	**PIRGs/States/International Organizations (IO)**
in supporting future trajectory-based air traffic management operating concepts, noting that the full potential of ADS-B has yet to be fully realized; and b) recognize that cooperation between States is key towards improving flight efficiency and enhancing safety involving the use of automatic dependent surveillance — broadcast technology; That ICAO: c) urge States to share automatic dependent surveillance — broadcast (ADS-B) data to enhance safety, increase efficiency and achieve seamless surveillance and to work closely together to harmonize their ADS-B plans to optimize benefits.			c) States to share ADS-B data to enhance safety, increase efficiency and achieve seamless surveillance and to work closely together
Recommendation 1/8 – Rationalization of radio systems That ICAO and other stakeholders to explore strategies for the decommissioning of some navigation aids and ground stations, and the rationalization of the on-board communications, navigation and surveillance systems while maintaining safety and coordinating the need for sufficient system redundancy.	Noted.	Approved and include in the Air Navigation work programme.	States and IOs explore strategies for the decommissioning of some navigation aids and ground stations, and the rationalization of the on-board CNS systems, while maintaining safety.
Recommendation 1/9 – Space-based			

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
automatic dependent surveillance — broadcast That ICAO: a) support the inclusion in the Global Air Navigation Plan, development and adoption of space-based automatic dependent surveillance — broadcast surveillance as a surveillance enabler; b) develop Standards and Recommended Practices and guidance material to support space-based automatic dependent surveillance — broadcast as appropriate; and c) facilitate needed interactions among stakeholders, if necessary, to support this technology.	a) to c): Noted.	a) to c): Approved and include in the Air Navigation work programme.	a) to c): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
Recommendation 1/10 – Automatic dependent surveillance — self-organizing wireless data networks That ICAO consider the use of self-organizing wireless data networks based on VDL Mode-4 technology taking into account: a) possible technical advantages; b) whether it satisfies any unmet operational need; and c) its impact of forward and retro-fit on the global air transport fleet.	a) to c): Noted.	a) to c): Approved and include in the Air Navigation work programme.	a) to c): Note.
Recommendation 1/11 – Automation roadmap That ICAO: a) develop a global roadmap for the evolution of ground air traffic management automation systems in line with aviation system block upgrade implementation; and b) develop performance-based system requirements for air traffic management automation systems so that: 1) where necessary these systems	a) and b): Noted.	a) and b): Approved and include in the Air Navigation work programme.	a) to b): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
are interoperable across States and regions; and 2) the function and operation of these systems will result in consistent and predictable air traffic management system performance across States and regions.			
Recommendation 1/12 – Development of the aeronautical frequency spectrum resource That States and stakeholders: a) recognize that a prerequisite for the deployment of systems and technologies is the availability of adequate and appropriate radio spectrum to support aeronautical safety services; b) work together to deliver efficient aeronautical frequency management and "best practices" to demonstrate the effectiveness and relevance of the industry in spectrum management; c) support ICAO activities relating to the aviation spectrum strategy and policy through relevant expert group meetings and regional planning	a) to d): Noted.	a) to d): Noted and requested the Secretary General to bring to the attention of States and Stakeholders.	a) to d): PIRGs, States and IO to take appropriate action

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
groups; and d) support Assembly Resolution A36-25 and the requirement for sufficient State representation of aviation interests at World Radiocommunication Conferences (WRCs) and relevant International Telecommunication Union WRC preparatory meetings; That ICAO:			
e) develop and implement a comprehensive aviation frequency spectrum strategy to be referenced to the Global Air Navigation Plan (GANP), which includes the following objectives: 1) timely availability and appropriate protection of adequate spectrum to create a sustainable environment for growth and technology development to support safety and operational effectiveness for current and future operational systems and allow for the transition between present and next generation technologies; 2) demonstrate efficient use of the	e) to i): Noted.	e) to i): Approve and include in the Air Navigation work programme.	e) to i): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	**FOLLOW-UP ACTION TAKEN**		**FOLLOW-UP ACTION TO BE INITIATED**
	COUNCIL	**AIR NAVIGATION COMMISSION (ANC)**	**PIRGs/States/International Organizations (IO)**
spectrum allocated through efficient frequency management and use of best practises; and 3) clearly state in the strategy the need for aeronautical systems to operate in spectrum allocated to an appropriate aeronautical safety service; f) establish timelines and methodologies to complement the GANP planning objectives with a frequency spectrum strategy; g) continue to allocate adequate resources with a far-sighted approach to its work programmes regarding aviation spectrum challenges; h) consider a methodology to enable ATM stakeholders to effectively share ICAO material on aviation frequency spectrum as a common guidance for securing the aviation position at World Radiocommunication Conferences; and i) consider structuring the *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation*			

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including Statement of Approved ICAO Policies (Doc 9718) by using a web-based platform as appropriate, to further support States in their implementation of the spectrum strategy.			
Recommendation 1/13 – Potential use of fixed satellite service spectrum allocations to support the safe operation of remotely piloted aircraft systems That ICAO support studies in the International Telecommunication Union Radio Communication Sector (ITU-R) to determine what ITU regulatory actions are required to enable use of frequency bands allocated to the fixed satellite service for remotely piloted aircraft system command and control (C2) links to ensure consistency with ICAO technical and regulatory requirements for a safety service.	Noted.	Approved and include in the Air Navigation work programme.	Note
Recommendation 1/14 – Long-term very small aperture terminal spectrum availability and protection That:			

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a) ICAO and Member States not support additional international mobile telecommunications spectrum allocations in the fixed satellite service C-band spectrum at the expense of the current or future aeronautical very small aperture terminal networks; and b) ICAO and Member States pursue this matter in the International Telecommunication Union Radio Communication Sector (ITU-R) and during the World Radiocommunication Conference (WRC-15), with a coordinated proposal to promote a solution where the international mobile telecommunications spectrum allocation does not compromise the availability of the aeronautical very small aperture terminal networks.	a) and b): Noted.	a) and b): Approved and include in the Air Navigation work programme and request the Secretary General to take appropriate action.	a) and b): States to take appropriate action for a long-term VSAT spectrum availability and protection.
Recommendation 1/15 – Performance monitoring and measurement of air navigation systems That ICAO: a) establish a set of common air	 a) to c): Noted.	 a) to c): Approved and include in	 a) and c): Note.

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navigation service performance metrics supported by guidance material, building on existing ICAO documentation (e.g. Manual on Global Performance of the Air Navigation System (Doc 9883) and the Manual on Air Navigation Services Economics (Doc 9161)); b) promote the development and use of "leading safety indicators" to complement existing "lagging safety indicators" as an integral and key component to drive improvement in performance and in the achieved management of risk; and c) encourage the early and close involvement of the regulator and oversight bodies in the development, proving of concepts and implementation of the aviation system block upgrades and regional programmes.		the Air Navigation work programme.	
Recommendation 1/16 – Access and equity considerations That States: a) ensure, as part of the aviation system block upgrade implementation, the principles of access and equity are included in all	a) and b): Noted.	a) and b): Noted and requested the Secretary General to take appropriate action and bring to the attention of States and	a) and b): States to ensure the principles of access and equity are included in all airspace modernization and redesign efforts and detail how they will

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airspace modernization and redesign efforts; and b) detail how they will monitor the service providers to ensure that they are providing fair, equitable, and efficient access to all aviation services including general aviation.		Stakeholders.	monitor the service providers to ensure that they are providing fair, equitable, and efficient access to all aviation services including general aviation.
Recommendation 2/1 – ICAO aviation system block upgrades relating to airport capacity That the Conference: a) endorse the aviation system block upgrade modules relating to airport capacity included in Block 1 and recommend that ICAO use them as the basis of its standards work programme on the subject; b) agree in principle to the aviation system block upgrade modules relating to airport capacity included in Blocks 2 and 3 as the strategic direction for this subject; c) recommend that the ICAO Council supports the implementation of the APEX in Safety Programme and asks the Secretary General to continue ICAO participation in	c): Noted .	c): Noted.	c) Note

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	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
safety reviews and sharing of relevant safety information, as provided for in the Memorandum of Cooperation between ACI and ICAO;			
That ICAO:			
d) include, following further development and editorial review, the aviation system block upgrade modules relating to airport capacity in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP);	d): Noted.	d): Approved and include in the Air Navigation work programme.	d) Note
e) States and service providers ensure that airport capacity, including relevant airport planning and operational issues, are addressed and accounted for when planning for air traffic management capacity and system performance;	e): Noted.	e): Approved and include in the Air Navigation work programme, and requested the Secretary General to take appropriate action.	e) States and service providers ensure that airport capacity issues are addressed and accounted for when planning for air traffic management capacity and system performance;
f) work with the Airports Council International (ACI) and other interested parties on guidance material to promote the globally-harmonized implementation of airport collaborative decision-making, including best practices and global technical standards; and	f): Noted.	f): Approved and include in the Air Navigation work programme.	f) Note

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That States: g) according to their operational needs, implement the aviation system block upgrade modules relating to airport capacity included in Block 0.	g): Noted.	g): Approved and requested the Secretary General to bring to the attention of States and Stakeholders.	g) Note
Recommendation 2/2 – Development of ICAO provisions for remotely operated air traffic services That ICAO provide: a) updates on additional guidelines for surveillance and air and ground communications systems; b) requirements for the use of sensors and display technologies to replace visual observation to air traffic in the provision of air traffic services; and c) requirements for air traffic services (ATS) personnel and flight crew training, ATS personnel licensing and related procedures for remotely operated air traffic services.	a) to c): Noted.	a) to c): Approved and include in the Air Navigation work programme.	a) to c): Note
Recommendation 2/3 – Security of air navigation systems That ICAO: a) seek the support of States and	a) and b): Approved	a) and b): Approved and include	a) to b): Note

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stakeholders to complete its work in developing a robust, secure aeronautical telecommunication network; and b) establish, as a matter of urgency, an appropriate mechanism including States and industry to evaluate the extent of the cyber security issues and develop a global air traffic management architecture taking care of cyber security issues.	and include in the Security work programme.	in the Air Navigation work programme.	
Recommendation 2/4 – Optimized management of wake turbulence That ICAO: a) accelerate the implementation of new ICAO wake turbulence categorization systems and to pursue development of dynamic wake turbulence separation provisions with supporting implementation guidance; b) support the continuation of the cooperative work on-going addressing the static pair wise separation, with a view to having revised global provisions in place in advance of Block 1 timescales; and c) develop the wake vortex flight	a) to c): Noted	a) to c): Approved and include in the Air Navigation work programme.	a) to c): Note

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safety system (WVSS) concept description along with a proposed system architecture with the possibility for WVSS to be included in the aviation system block upgrade Modules B1-70, B2-70, B1-85 and B2-85.			
Recommendation 2/5 – Performance-based navigation for terminal and approach operations implementation That States and stakeholders: a) urgently implement, where appropriate, performance-based navigation for terminal and approach operations in accordance with Assembly Resolution A37-11; b) urgently adopt efficient operations approval procedures and support the mutual recognition of other States' operational approvals; c) share their best practices including required navigation performance authorization required implementation initiatives as well as relevant flight operational safety assessment documentation with other States;	a) to g): Noted.	a) to g): Noted and requested the Secretary General to bring to the attention of States and Stakeholders.	a) States and IOs urgently implement, where appropriate, PBN for terminal and approach operations in accordance with Assembly Resolution A37-11; b) States and IOs urgently adopt efficient operations approval procedures and support the mutual recognition of other States' operational approvals; c) States and IOs share their best practices

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d) determine operational requirements in support of their airspace concept in accordance with the processes described in the *Performance-based Navigation (PBN) Manual* in order to select the appropriate PBN specification;			d) States and IOs determine operational requirements in support of their airspace concept in accordance with the processes described in the *PBN Manual*
e) including regulators, airport authorities, air navigation service providers, commercial operators, General Aviation and the military, work together at all levels and in close coordination to ensure successful performance-based navigation implementation;			e) States and IOs work together at all levels and in close coordination to ensure successful PBN implementation;
f) international organizations and industry continue to provide resources to support ICAO with the development of provisions, guidance and training material in support of performance-based navigation implementation; and			f) IOs provide resources to support ICAO with the development of provisions, guidance and training material in support of PBN implementation
g) States, when considering performance-based navigation routes arriving at and departing from airports, should ensure that air navigation service providers and aircraft operators involve airport operators from the outset so that			g) States, when considering PBN routes arriving at and departing from airports, should ensure that air navigation service providers and aircraft operators involve airport operators from the outset so that they may consult fully with local

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they may consult fully with local communities in order to avoid adverse noise impact on those communities.			communities in order to avoid adverse noise impact on those communities
Recommendation 2/6 – Development of ICAO provisions for performance-based navigation for en route terminal and approach operations That ICAO study and make appropriate additions where required to the ICAO provisions, including: a) required navigation performance authorization-required departure navigation specification; b) the application of performance-based navigation standard terminal arrival routes for en route independent simultaneous approaches; c) assessment of the need for ICAO provisions on the use of ground-based augmentation system to append standard instrument arrival and standard instrument departure procedures to approach and landing trajectory; d) development of separation minima to support all performance-based	a) to g): Noted.	a) to g): Approved and include in the Air Navigation work programme.	a) to g): Note.

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navigation specifications and which will also allow for operations where mixed performance requirements are in effect; e) advanced use of performance-based navigation to support aviation system block upgrade modules; f) continued development of provisions, guidance and training material in support of performance-based navigation implementation; and g) develop and make available the minimum qualification requirements for personnel to attend performance-based navigation procedure design training.			
Recommendation 3/1 – ICAO aviation system block upgrades relating to performance improvement through the application of system-wide information management That the Conference: a) endorse the aviation system block upgrade module relating to performance improvement through the application of system-wide			

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information management included in Block 1, and recommend that ICAO use it as the basis of its work programme on the subject; b) agree in principle with the aviation system block upgrade module relating to performance improvement through the application of system-wide information management included in Block 2, as the strategic direction for this subject; That ICAO: c) include, following further development and editorial review, the aviation system block upgrade modules relating to performance improvement through the application of system-wide information management for inclusion in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP).	c) Noted.	c) Approved and include in the Air Navigation work programme.	c) Note
Recommendation 3/2 – Development of a global system-wide information management concept That ICAO:			

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a) undertake further work to develop a global system-wide information management concept for air traffic management operations and related ICAO provisions that may be necessary; b) at the appropriate time coordinate information management principles and performance-based information management; c) perform additional work on the global implementation of those principles and framework for all air traffic management information through the development of appropriate information management/system-wide information management concepts to be ready in 2014 for subsequent system development work in Block 1 and to include in its work programme, specific activities tailored at coordinating system-wide information management deployment at a local, regional and global level; d) update the information management/system-wide information management	a) to d): Noted.	a) to d): Approved and include in the Air Navigation work programme.	a) to d): Note.

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(IM/SWIM) working arrangements; That States and stakeholders: e) work together to demonstrate how system-wide information management capabilities and functions will meet the needs of the future air traffic management system.	e): Noted.	e): Noted and requested the Secretary General to bring to the attention of States.	e) States and IOs work together to demonstrate how SWIM capabilities and functions will meet the needs of the future ATM

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Recommendation 3/3 – Development of ICAO provisions relating to system-wide information management That: a) under the leadership of ICAO, develop detailed technical specifications for system-wide information management in close collaboration with the aviation community; b) detailed technical specifications for system-wide information management should be open and rely on generic international standards to the extent possible; and c) ICAO undertake work to identify the security standards and bandwidth requirements for system-wide information management.	a) to c): Noted.	a) to c): Approved and include in the Air Navigation work programme.	a) to c): Note.
Recommendation 3/4 – State and industry and industry support of system-wide information management a) industry support the transition towards system-wide information management by providing appropriate systems supporting	a) and b): Note.	a) and b): Noted and requested the Secretary General to bring to the attention of States.	a) States and IOs support the transition towards SWIM

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automation and the exchange of all relevant air traffic management data in a globally standardized manner; and b) States and all relevant stakeholders contribute to further development and harmonization of performance-based information management.			b) States and IOs contribute to further development and harmonization of performance-based information management
Recommendation 3/5 – Operational performance through flight and flow – information for a collaborative environment That the Conference: a) endorse the aviation system block upgrade module relating to flight and flow – information for a collaborative environment included in Block 1, and recommend that ICAO use it as the basis of its work programme on the subject; b) agree in principle with the aviation system block upgrade module relating to flight and flow – information for a collaborative environment included in Blocks 2 and 3, as the strategic direction for this subject;			

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That ICAO:			
c) include, following further development and editorial review, the aviation system block upgrade modules relating to flight and flow – information for a collaborative environment for inclusion in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP);	c) and d): Noted.	c) and d): Approved and include in the Air Navigation work programme.	c) and d): Note
d) investigate, as part of the post-implementation review of the FPL2012, proposals for the implementation of all performance-based navigation codes and other capabilities into the flight plan, having regard to an impact assessment including cost benefit analysis and other factors;			
e) convene a symposium, as soon as possible, where interested partners would develop an end-to-end advanced system demonstrations of new air traffic management concepts to support a common understanding of concepts such as SWIM, FF-ICE trajectory-based operations and collaborative	e): To Review.	e): Noted.	e) : Noted. .

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decision-making; That States: f) and industry work through ICAO to mature the flight and flow – information for a collaborative environment concept; g) support the development of a flight information exchange model; h) according to their operational needs, implement the aviation system block upgrade modules relating to improved operational performance through flight and flow – information for a collaborative environment included in Block 0.	f) to h): Noted.	f) to h): Noted and requested the Secretary General to bring to the attention of States and Stakeholders.	f) States and IOs work through ICAO to mature the FF-ICE for a collaborative environment concept; g) States and IOs support the development of a flight information exchange model; h) States according to their operational needs, implement the ASBU modules relating to improved operational performance through FF-ICE
Recommendation 3/6 – ICAO aviation system block upgrades relating to service improvement through aeronautical information management as well as digital air traffic management information That the Conference: a) endorse the aviation system block upgrade module relating to service			

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improvement through the integration of digital air traffic management information included in Block 1 and recommend that ICAO use it as the basis of its work programme on the subject; That ICAO: b) include, following further development and editorial review, the aviation system block upgrade modules relating to service improvement through digital aeronautical information management as well as integration of digital air traffic management information in the draft in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); That States: c) according to their operational needs, implement the aviation system block upgrade module relating to service improvement through digital aeronautical information management included in Block 0.	b): Noted. c): Note.	b): Approved and include in the Air Navigation work programme. c): Noted and requested the Secretary General to bring to the attention of States.	b) Note c) States, according to their operational needs, implement the ASBU module relating to service improvement through digital AIM
Recommendation 3/7 – ICAO provisions relating to service improvement through aeronautical			

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	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
information management as well as digital air traffic management information That ICAO: a) expedite the development of relevant Standards facilitating the transition of aeronautical information service to aeronautical information management and the implementation of system-wide information management taking into account the work accomplished in State programmes; and b) as a matter of urgency, to translate and make available the necessary Standards and guidance material to facilitate the global transition from aeronautical information service to aeronautical information management.	a) and b): Noted.	a) and b): Approved and include in the Air Navigation work programme.	a)and b) :Note

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	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
Recommendation 3/8 – State actions relating to service improvement through aeronautical information management as well as digital air traffic management information That States: a) accelerate transition from aeronautical information service to aeronautical information management by implementing a fully automated digital aeronautical data chain; b) implement necessary processes to ensure the quality of aeronautical data and information from the origin to the end users; c) engage in intraregional and interregional cooperation for an expeditious transition from aeronautical information service (AIS) to aeronautical information management (AIM) in a harmonized manner and to using digital data exchange and consider regional or subregional AIS databases as an enabler for the transition from AIS to AIM; and d) review their NOTAM publication procedures, provide appropriate guidance to NOTAM originators and ensure adequate oversight of the NOTAM publication process is conducted.	a) to d): Noted.	a) to d): Noted and requested the Secretary General to bring to the attention of States and Stakeholders.	a) States accelerate transition from AIS to AIM by implementing a fully automated digital aeronautical data chain; b) States implement necessary processes to ensure the quality of aeronautical data and information from the origin to the end users; c) States /PIRGS engage in intraregional and interregional cooperation for an expeditious transition from AIS to aeronautical information management AIM in a harmonized manner and to using digital data exchange and consider regional or subregional AIS databases as an enabler for the transition from AIS to AIM; and d) States review their NOTAM publication procedures, provide appropriate guidance to NOTAM originators and ensure adequate oversight of the NOTAM publication process

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Recommendation 3/9 – Review of NOTAM system and development of options for replacement That ICAO initiate a review of the current NOTAM system, building further on the digital NOTAM activities, including the development of options for a replacement system that would enable web-based applications and compliant with the system-wide information management principles that are being developed for the air traffic management system.	Noted.	Approved and include in the Air Navigation work programme.	Note.
Recommendation 4/1 –Efficient management of airspace and improved flow performance through collaborative decision-making That the Conference: a) endorse the aviation system block upgrade modules relating to network operations included in Block 1 and recommend that ICAO use them as the basis of its work programme on the subject; b) agree in principle with the aviation system block upgrade modules relating to network operations included in Blocks 2 and 3 as the strategic direction for this subject;			

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That ICAO: c) include, following further development and editorial review, the aviation system block upgrade modules relating to network operations in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); d) include in its work programme the future standardization of all elements to support the collaborative decision-making process underlying the air traffic control (ATC)-air traffic flow management (ATFM) integration as well as of the technical exchanges between ATFM and ATC; e) develop and incorporate into the ICAO *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) implementation guidance on Airport-CDM and provisions on air traffic flow management data exchange format including trajectory information;	c) to g): Noted.	c) to g): Approved and include in the Air Navigation work programme.	c) to g): Note.

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f) develop and execute global communications, roll-out and training plan for the ICAO *Manual on Collaborative Air Traffic Flow Management* (Doc 9971); and g) develop further provisions and guidance on flexible use of airspace principles for future use and in preparation for future 4D trajectory-based airspace management. That States: h) accelerate the implementation of collaborative decision-making processes in the provision of services at the regional level, being guided by the principles set forth in the *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) and the *Manual on Flight and Flow – Information for a Collaborative Environment* (Doc 9965); i) according to their operational needs, implement the aviation system block upgrade modules relating to network operations included in Block 0.	h) and i): Noted.	h) and i): Noted and requested the Secretary General to bring to the attention of States.	h) States and PIRGs to accelerate the implementation of CDM i) States, according to their operational needs, implement the ASBU modules relating to network operations included in Block 0.
Recommendation 4/2 – ICAO aviation system block upgrades			

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relating to ground surveillance using automatic dependent surveillance – broadcast/multilateration, air traffic situational awareness, interval management and airborne separation. That the Conference: a) endorse the aviation system block upgrade modules relating to interval management included in Block 1 and recommend that ICAO use them as the basis of its work programme on the subject; b) agree in principle to the aviation system block upgrade modules relating to airborne separation included in Block 2 as the strategic direction for this subject; That ICAO:			
c) include, following further development and editorial review, the aviation system block upgrade modules relating to airborne separation in the Appendices to the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP);	c) to g): Noted.	c) to g): Approved and include in the Air Navigation work programme.	c) to g): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
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d) agree in principle to review the concepts and terminology of the "airborne separation" concepts involving controllers assigning tasks to flight crews, with controllers able to apply different, risk-based separation minima for properly equipped ADS-B IN aircraft;			
e) in the development of provisions, acknowledge the relationship between airborne separation and airborne collision avoidance system;			
f) modify aviation system block upgrade (ASBU) Module B2-85 to reflect d) and e), modify ASBU Module B2-101 to reflect f); and			
g) agree in principle to review the concepts and terminology supporting B2-85 "airborne separation" and amend the module accordingly.			
That States:			
h) according to their operational needs, to implement the aviation system block upgrade modules relating to ground surveillance, improved air traffic situational awareness and	h): Noted	h): Noted and requested the Secretary General to bring to the attention of States.	h): States, according to their operational needs, to implement the ASBU modules relating to ground surveillance, improved ATSA and improved access to optimum flight

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improved access to optimum flight levels included in Block 0.			levels included in Block 0.
Recommendation 4/3 – ICAO aviation system block upgrades relating to airborne collision avoidance systems and ground-based safety nets That the Conference: a) endorse the aviation system block upgrade module relating to ground-based safety nets included in Block 1 and recommend that ICAO use it as the basis of its work programme on the subject; b) agree in principle to the aviation system block upgrade module relating to airborne collision avoidance systems included in Block 2, as the basis of the strategic direction for this subject; That ICAO: c) include, following further development and editorial review, the aviation system block upgrade	c) to h): Noted.	c) to h): Approved and include in the Air Navigation work programme.	c) to h): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
modules relating to airborne collision avoidance systems and ground-based safety nets in the Appendices to the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); d) adopt a coordinated approach towards reviewing and developing as necessary Standards and Recommended Practices, Procedures for Air Navigation Services and guidance material for ground-based and airborne safety nets, taking into account careful evaluation and validations of the effects on safety and performance of downlinking airborne collision avoidance system (ACAS) Resolution Advisories (RAs) to controllers; e) when considering Standards and Recommended Practices for airborne collision avoidance system (ACAS) downlink, to emphasize the significant amount of training material already existing and the importance of increased pilot and air traffic controller training on the responsibilities and requirements to reacting correctly to ACAS RA			

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events and then communicating; f) develop an ICAO Manual for Ground-based Safety Nets, which includes provision for tools for validation and certification of these; g) incorporate the new generation of airborne collision avoidance system (ACAS X) into its work programme; h) encourage the Federal Aviation Administration to work with other States with the capacity and capability to do so, in the development of new generation of airborne collision avoidance system (ACAS X); That States:			
i) according to their operational needs, to implement the aviation system block upgrade modules relating to airborne collision avoidance systems and ground based safety nets included in Block 0.	i): Noted.	i): Noted and requested the Secretary General to bring to the attention of States.	i): States to implement the ASBU modules relating to ACAS and ground based safety nets included in Block 0.

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	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
Recommendation 4/4 – Positioning and tracking over oceanic and remote areas, and flight data triggered transmission That ICAO: a) continue the evaluation of the necessary changes in the field of transmission of flight data, bearing in mind the cost associated with any of these changes as well as the need to improve search and rescue operations; and b) develop suitable proposals for the amendment of ICAO documents, as necessary.	a) and b): Noted.	a) and b): Approved and include in the Air Navigation work programme.	a) and b): Note.
Recommendation 4/5 – Civil/military coordination/cooperation and sharing of airspace			

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
That States: a) planning and implementation regional groups, and ICAO to analyse the benefits that could be achieved through improved civil/military cooperation and sharing of the airspace serving international traffic flows and express the results of this analysis in terms of: 1) capacity increases and reduction in routine delays as measured by traffic volumes on major traffic flows; 2) document fuel savings and emission reductions through the use of the fuel savings estimation tools; and 3) other additional benefits;	a) to c): Noted.	a) to c): Noted and request the Secretary General to bring to the attention of States.	a): PIRGs to analyse the benefits that could be achieved through improved civil/military cooperation and sharing of the airspace serving international traffic flows and express the results of this analysis in terms of capacity increase, fuel savings and emissions reductions and other additional benefits.
b) based on the analysis made by States, planning and implementation regional groups, and ICAO, urge States to develop plans to implement improvements for the cooperative use of airspace related to the top areas of opportunity and establish concrete targets using tools already available for this purpose;			b): States to develop plans to implement improvements for the cooperative use of airspace on the basis of analysis made by States /PIRGs and ICAO.

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c) in relation to international traffic flows, for each ICAO region urge the planning and implementation regional groups and their associated States to identify the top areas of opportunity that could benefit the most from improvements in civil/military cooperation and sharing of the airspace and develop concrete targets for improvement; That ICAO: d) develop a set of criteria or metrics to enable objective measurement of progress in civil/military cooperation; and e) continue to develop guidance material for States on the flexible use of their airspace, airspace design, interoperability and integration of humanitarian assistance flights in crisis response scenarios in their airspaces to facilitate integrated use of the airspace.	d) and e): Noted.	d) and e): Approved and include in the Air Navigation work programme.	c): PIRGs and States to identify the top areas of opportunity that could benefit the most from improvements in civil/military cooperation and sharing of the airspace and develop concrete targets for improvement d) and e): Note.
Recommendation 4/6 – ICAO aviation system block upgrades relating to integration of remotely piloted aircraft into non-segregated airspace			

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
That the Conference: a) endorse the aviation system block upgrade module relating to remotely piloted aircraft included in Block 1 and recommend that ICAO use it as the basis of its work programme on the subject; b) agree in principle to the aviation system block upgrade modules relating to remotely piloted aircraft included in Blocks 2 and 3 as the strategic direction for this subject; That ICAO:			
c) as a matter of urgency, develop the necessary regulatory framework in its entirety to support the integration of remotely piloted aircraft into non-segregated airspace and at aerodromes including and clearly showing the scope of such regulation; d) investigate the need for and scope of oversight of datalinks related to command, control and air traffic control communications for remotely piloted aircraft systems;	c) to e): Noted.	c) to e): Approved and include in the Air Navigation work programme.	c) to e): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
e) include, following further development and editorial review, the aviation system block upgrade modules relating to the integration of remotely piloted aircraft into non segregated airspace in the Appendices to the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); That States: f) be cognizant of the recent amendments to Annexes 2 — *Rules of the Air* and 7 — *Aircraft Nationality and Registration Marks* related to remotely piloted aircraft systems and to support the continuation of this work at ICAO; g) work closely with ICAO and each other to ensure harmonization of provisions if they have an urgent need to accommodate remotely piloted aircraft system operations.	f) and g): Noted.	f) and g): Noted and requested the Secretary General to bring to the attention of States.	f):Note l) States to work closely with ICAO and each other to ensure harmonization of provisions if they have an urgent need to accommodate RPAS operations.
Recommendation 4/7 – ICAO aviation system block upgrades relating to meteorological			

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
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information That the Conference: a) endorse the aviation system block upgrade module relating to meteorological information included in Block 1, including the addition of the provision of information on space weather, and recommend that ICAO uses it as the basis of its work programme on the subject; b) agree in principle the aviation system block upgrade module relating to meteorological information included in Block 3 as the strategic direction for this subject; That ICAO:			
c) include, following further development and editorial review, the aviation system block upgrade modules relating to meteorological information in the draft Fourth edition of the *Global Air Navigation Plan* (Doc 9750, GANP); d) undertake the development of the air traffic management meteorological information integration plan and an	c) to f): Noted.	c) to f): Approved and include in the Air Navigation work programme.	c) to f): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
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associated roadmap by a cross-disciplinary group of experts; e) work on defining the meteorological information exchange model as an enabler for system-wide information management; f) invite the next Meteorology Divisional Meeting, held in coordination with the World Meteorological Organization, to develop initial provisions in Annex 3 — *Meteorological Service for International Air Navigation* relating to the aviation system block upgrade modules concerning meteorological information and f) above, and to develop a long-term strategy to support their further development and full implementation; That States:			
g) according to their operational needs, to implement the aviation system block upgrade module relating to meteorological information included in Block 0, including the addition of the provision of OPMET information;	g) and h): Noted.	g) and h): Noted and requested the Secretary General to bring to the attention of States.	g): States , according to their operational needs, to implement the ASBU module relating to meteorological information included in Block 0, including the addition of the provision of OPMET information;

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h) work together in the implementation of the aviation system block upgrades relating to meteorological information and to increase investment in education and training.			h) work together in the implementation of the ASBU relating to meteorological l information and to increase investment in education and training.
Recommendation 4/8 – Crisis coordination arrangements and contingency plans That ICAO: a) consider how crisis coordination arrangements for potentially disruptive events, similar to that used for volcanic eruptions, could be established on a regional basis; and b) and regional offices continue to support the development, promulgation, maintenance of contingency plans, including the holding of practical exercises, in preparedness for potentially disruptive events, including those events that may adversely impact aviation safety.	a) and b): Noted.	a) and b): Approved and include in the Air Navigation work programme.	a) and b): Note.
Recommendation 5/1 – Improved operations through enhanced airspace organization and routing			

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Considering that performance-based navigation (PBN) is one of ICAO's highest air navigation priorities and the potential benefits achievable through creation of additional capacity with PBN: That States:			
a) implement performance-based navigation in the en-route environment;	a) to d): Noted.	a) to d): Approved and include in the Air Navigation work programme.	a): States implement PBN in the enroute environment
b) fully assess the operational, safety, performance and cost implications of a harmonization of transition altitude and, if the benefits are proven to be appropriate, undertake further action on a national and (sub) regional basis a first step towards a globally harmonized transition altitude;			b) : States fully assess the operational, safety, performance and cost implications of a harmonization of transition altitude and, if the benefits are proven to be appropriate, undertake further action on a national and (sub) regional basis a first step towards a globally harmonized transition altitude;
c) take advantage of improved models for inter-regional coordination and collaboration to achieve seamless air traffic management and more optimum routes through the airspace;			c): States and PIRGs take advantage of improved models for inter-regional coordination and collaboration to achieve seamless air traffic management and more optimum routes through the airspace;
d) through the planning and implementation regional groups			d): States and PIRGs improve their

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improve their methods of coordination to increase implementation of en-route performance-based navigation in order to achieve more optimum routes through the airspace; That ICAO:			methods of coordination to increase implementation of en-route performance-based navigation in order to achieve more optimum routes through the airspace;
e) encourage the planning and implementation regional groups to support the early deployment of performance-based navigation in accordance with Assembly Resolution 37-11; f) support, through development of a framework that capitalizes, builds on, and promotes demonstration activities which confirm the benefits of performance-based navigation as an enabler of more efficient operations in the en-route phase of flight; and	e) and f): Noted.	e) and f): Noted and request the Secretary General to bring to the attention of States.	e) and f): Note.
g) that avionics incorporate fixed radius transition functionality to support closer spacing of performance-based navigation routes and improve airspace capacity.	g): Noted.	g): Noted and request the Secretary General to bring to the attention of relevant Industry Stakeholders.	g): Note
Recommendation 5/2 – ICAO aviation system block upgrades			

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	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
relating to trajectory based operations That the Conference: a) endorse the aviation system block upgrade module relating to trajectory-based operations included in Block 1 and ICAO use it as the basis of its work programme on the subject; b) agree in principle with the aviation system block upgrade module relating to 4D trajectory-based operations included in Block 3 as the strategic direction for this subject; That ICAO:			
c) include, following further development and editorial review, the aviation system block upgrade module relating to 4D trajectory-based operations in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); That States:	c): Noted.	c): Approved and include in the Air Navigation work programme.	c): Note.
d) support development by ICAO of	d) and e): Note.	d) and e): Note and request the	d): support development by ICAO of

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Standards and Recommended Practices and guidance material related to trajectory-based operations; and e) implement, according to their operational needs, the aviation system block upgrade module relating to trajectory-based operations included in Block 0.		Secretary General to bring to the attention of States.	SARPs and guidance material related to TBO e): States implement, according to their operational needs, the ASBU module relating to TBO included in Block 0.
Recommendation 5/3 – Increased flexibility and efficiency in descent and departure profiles That the Conference: a) endorse the aviation system block upgrade module relating to continuous descent operations included in Block 1; b) agree in principle to the aviation system block upgrade module relating to continuous descent operations included in Block 2; That ICAO: c) include, following further development and editorial review, the aviation system block upgrade	c) and d): Noted.	c) and d): Approved and include in the Air Navigation work programme.	c) and d): Note

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	COUNCIL	**AIR NAVIGATION COMMISSION (ANC)**	**PIRGs/States/International Organizations (IO)**
modules relating to continuous climb operations and continuous descent operations in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); d) incorporate the point merge technique as an interim continuous descent operations measure in Block B0-05;			
That States: e) as supported by their operational requirements and a positive business case, implement according to their operational needs as a matter of urgency, the aviation system block upgrade modules relating to continuous climb operations and continuous descent operations included in Blocks 0 and 1; and	e) and f): Noted.	e) and f): Noted and requested the Secretary General to bring to the attention of States	e):States, as supported by their operational requirements and a positive business case, implement according to their operational needs as a matter of urgency, the ASBU modules relating to CCO and CDO included in Blocks 0 and 1.
f) as supported by their operational requirements and a positive business case, use point merge technique as an application towards achieving full continuous descent operations, when developing performance-			f) States, as supported by their operational requirements and a positive business case, use point merge technique as an application towards achieving full continuous descent operations, when developing

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based navigation standard instrument arrivals (STARs).			PBN STARs,
Recommendation 6/1 – Regional performance framework – planning methodologies and tools That States and PIRGs: a) finalize the alignment of regional air navigation plans with the Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP) by May 2014; b) focus on implementing aviation system block upgrade Block 0 Modules according to their operational needs, recognizing that these modules are ready for deployment; c) use the electronic regional air navigation plans as the primary tool to assist in the implementation of the agreed regional planning framework for air navigation services and facilities; d) involve regulatory and industry personnel during all stages of planning and implementation of aviation system block upgrade modules;	a) to e): Approved.	a) to e): Noted and requested the Secretary General to bring to the attention of States and Stakeholders.	a): States and PIRGs finalize the alignment of regional air navigation plans with the Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP) by May 2014; b):States and PIRGs focus on implementing ASBU Block 0 Modules according to their operational needs. c): States, PIRGs, IOs, use the electronic regional air navigation plans as the primary tool to assist in the implementation of the agreed regional planning framework for air navigation services and facilities; d) States and PIRGs involve regulatory and industry personnel during all stages of planning and implementation of ASBU modules;

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e) develop action plans to address the identified impediments to air traffic management modernization as part of aviation system block upgrade planning and implementation activities;			e) States and PIRGs develop action plans to address the identified impediments to air traffic management modernization as part of aviation system block upgrade planning and implementation activities;
That ICAO:			
f) considers how the continuous monitoring approach to safety oversight maps to the evaluation of Member States' safety oversight capabilities concerning aviation system block upgrades	f) to l): Noted.	f) to l): Approved with the exception of j), include in the Air Navigation work programme and request the Secretary General take appropriate action.	f) to l): Note
g) review the current amendment process to the Regional Air Navigation Plans (ANPs) and recommend improvements to increase efficiencies related to the approval and maintenance of the data in the regional ANPs;			
h) develop guidance material, on the basis of best practices employed worldwide, for the regional/local deployment of new ATM technologies, required procedures,			

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operational approvals and continue to support States in the implementation of the aviation system block upgrades;			
i) identify the issues, funding, training and resource requirements necessary to support a safety framework that would lay the foundation for successful implementation the aviation system block upgrades;			
j) develop, together with industry and stakeholders, an engagement strategy to address the economic and institutional impediments to implementation of the aviation system block upgrades;	j): Approved and requested the Secretary General to address the economic and institutional impediments to GANP implementation.	j): Noted and consider contribution to be included in the Air Navigation work programme.	j): Note
k) develop a mechanism for sharing of best practices for the aviation system block upgrade implementation; and			
l) define a methodology to ensure interregional and global harmonization of air navigation services through ANRF reporting in an effective and timely manner, and consider the employment of interregional and multi-regional fora.			

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Recommendation 6/2 – Guidelines on service priority That: a) ICAO develop an appropriate set of operational and economic incentive principles to allow early benefits of new technologies and procedures, as described in the aviation system block upgrade modules, to support operational improvements, while maximizing safety, capacity and overall system efficiency; and b) States and international organizations contribute to this work.	a) and b): Noted.	a) and b): Approved, consider contribution to be included in the Air Navigation work programme and request the Secretary General to take appropriate action.	a) and b): Note

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Recommendation 6/3 – Assessment of economic, financial and social implications of air traffic management modernization and aviation system block upgrades deployment That ICAO:			
a) undertake work toward developing a network-wide operational improvement level assessment for global use, which should include the development of standard values and processes for economic evaluations; b) take the relevant conclusions from the AN-Conf/12, regarding economic, financial and social aspects of the aviation system block upgrades, to the Sixth Air Transport Conference with the aim of developing solutions which would support a safe and sustainable air navigation system; That States:	a) and b): Noted.	a) and b): Approved, consider contribution to be included in the Air Navigation work programme and request the Secretary General to take appropriate action.	a) and b): Note
c) conduct their economic, financial and social analyses in a closely coordinated manner with relevant ATM stakeholders in view of their diverse position of involvement in the implementation of aeronautical systems.	c): Note and request the Secretary General to bring to the attention of States.	c): Noted and the Secretary General to bring to the attention of States.	c): States conduct their economic, financial and social analyses in a closely coordinated manner with relevant ATM stakeholders in view of their diverse position of involvement in the implementation of aeronautical systems

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Recommendation 6/4 – Human performance That ICAO: a) integrate human performance as an essential element for the implementation of ASBU modules for considerations in the planning and design phase of new systems and technologies, as well as at the implementation phase, as part of a safety management approach. This includes a strategy for change management and the clarification of the roles, responsibilities and accountabilities of the aviation professionals involved; b) develop guidance principles, guidance material and provisions, including SARPs as necessary, on ATM personnel training and licensing including instructors and assessors, and on the use of synthetic training devices, with a view to promoting harmonization, and consider leading this effort with the support of States and industry; c) develop guidance material on using field experience and scientific knowledge in human performance	a) to f): Noted.	a) to f): Approved and include in the Air Navigation work programme.	a) to f): Note.

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	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
approaches through the identification of human-centred operational and regulatory processes to address both current safety priorities and the challenges of future systems and technologies; d) assess the impact of new technologies on competencies of existing aviation personnel, and prioritize and develop competency-based provisions for training and licensing to attain global harmonization; e) establish provisions for fatigue risk management for safety within air traffic services operations; f) develop guidance material on different categories of synthetic training devices and their respective usage;			
That States: g) provide human performance data, information and examples of operational and regulatory developments to ICAO for the benefit of the global aviation community;	g) to j): Note.	g) to j): Note and request the Secretary General to bring to the attention of States.	g): States provide human performance data, information and examples of operational and regulatory developments to ICAO.

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h) support all ICAO activities in the human performance field through the contribution of human performance expertise and resources; i) adopt airspace procedures, aircraft systems, and space-based/ground-based systems that take into account human capabilities and limitations and that identify when human intervention is required to maintain optimum safety and efficiency; and j) investigate methods to encourage adequate numbers of high quality aviation professionals of the future and ensure training programmes are in line with the skills and knowledge necessary to undertake their roles within a changing industry.			h) States support all ICAO activities in the human performance field through the contribution of human performance expertise and resources. i) States adopt airspace procedures, aircraft systems, and space-based/ground-based systems that take into account human capabilities and limitations and that identify when human intervention is required j) States investigate methods to encourage adequate numbers of high quality aviation professionals of the future and ensure training programmes are in line with the skills and knowledge necessary.
Recommendation 6/5 – ICAO work programme to support global navigation satellite system evolution That ICAO undertake a work programme to address: a) interoperability of existing and future global navigation satellite system constellations and augmentation systems, with particular regard to the technical and	a) to c): Noted.	a) to c): Approved and include in the Air Navigation work programme.	a) to c): Note

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	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
operational issues associated with the use of multiple constellations; b) identification of operational benefits to enable air navigation service providers and aircraft operators to quantify these benefits for their specific operational environment; and c) continued development of Standards and Recommended Practices and guidance material for existing and future global navigation satellite system elements and encouraging the development of industry standards for avionics.			
Recommendation 6/6 – Use of multiple constellations That States, when defining their air navigation strategic plans and introducing new operations: a) take advantage of the improved robustness and availability made possible by the existence of multiple global navigation satellite system constellations and associated augmentation systems;	a) to e): Noted.	a) to e): Noted and requested the Secretary General to bring to the attention of States and Stakeholders.	a): States take advantage of the improved robustness and availability made possible by the existence of multiple GNSS constellations and associated augmentation systems;

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b) publish information specifying the global navigation satellite system elements that are approved for use in their airspace;			b) States publish information specifying the GNSS elements that are approved for use in their airspace;
c) adopt a performance-based approach with regard to the use of global navigation satellite system (GNSS), and avoid prohibiting the use of GNSS elements that are compliant with applicable ICAO Standards and Recommended Practices;			c) States adopt a performance-based approach with regard to the use of GNSS, and avoid prohibiting the use of GNSS elements that are compliant with applicable ICAO SARPs
d) carefully consider and assess if mandates for equipage or use of any particular global navigation satellite system core constellation or augmentation system are necessary or appropriate;			d) States carefully consider and assess if mandates for equipage or use of any particular global navigation satellite system core constellation or augmentation system are necessary or appropriate;
That aircraft operators:			
e) consider equipage with GNSS receivers able to process more than one constellation in order to gain the benefits associated with the support of more demanding operations.			e) IOs consider equipage with GNSS receivers able to process more than one constellation in order to gain the benefits associated with the support of more demanding operations

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Recommendation 6/7 – Assistance to States in mitigating global navigation satellite system vulnerabilities That ICAO: a) continue technical evaluation of known threats to the global navigation satellite system, including space weather issues, and make the information available to States; b) compile and publish more detailed guidance for States to use in the assessment of global navigation satellite system vulnerabilities; c) develop a formal mechanism with the International Telecommunication Union and other appropriate UN bodies to address specific cases of harmful interference to the global navigation satellite system reported by States to ICAO; and d) assess the need for, and feasibility of, an alternative position, navigation and timing system.	a) to d): Noted.	a) to d): Approved and include in the Air Navigation work programme.	a) to d): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
Recommendation 6/8 – Planning for mitigation of global navigation satellite system vulnerabilities			
That States:			
a) assess the likelihood and effects of global navigation satellite system vulnerabilities in their airspace and apply, as necessary, recognized and available mitigation methods;	a) to f): Noted.	a) to f): Approved and requested the Secretary General to bring to the attention of States and Stakeholders.	a) States assess the likelihood and effects of GNSS vulnerabilities in their airspace and apply, as necessary, recognized and available mitigation methods.
b) provide effective spectrum management and protection of global navigation satellite system (GNSS) frequencies to reduce the likelihood of unintentional interference or degradation of GNSS performance;			b) States provide effective spectrum management and protection of GNSS frequencies to reduce the likelihood of unintentional interference or degradation of GNSS performance.
c) report to ICAO cases of harmful interference to global navigation satellite system that may have an impact on international civil aviation operations;			c) States report to ICAO cases of harmful interference to global navigation satellite system that may have an impact on international civil aviation operations.
d) develop and enforce a strong regulatory framework governing the use of global navigation satellite system repeaters, pseudolites, spoofers and jammers;			d) States develop and enforce a strong regulatory framework governing the use of global navigation satellite system repeaters, pseudolites, spoofers and jammers.
e) allow for realization of the full			e) States allow for realization of the full

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
advantages of on-board mitigation techniques, particularly inertial navigation systems; and f) where it is determined that terrestrial aids are needed as part of a mitigation strategy, give priority to retention of distance measuring equipment (DME) in support of inertial navigation system (INS)/DME or DME/DME area navigation, and of instrument landing system at selected runways.			advantages of on-board mitigation techniques, particularly inertial navigation systems. f) States where it is determined that terrestrial aids are needed as part of a mitigation strategy, give priority to retention of DME in support of inertial navigation system (INS)/DME or DME/DME area navigation, and of instrument landing system at selected runways
Recommendation 6/9 – Ionosphere and space weather information for future global navigation satellite system implementation That ICAO: a) coordinate regional and global activities on ionosphere characterization for global navigation satellite system implementation; b) continue its effort to address the global navigation satellite system (GNSS) vulnerability to space weather to assist States in GNSS implementation taking into account of long-term GNSS evolution as well as projected space weather	a) to c): Noted.	a) to c): Approved and include in the Air Navigation work programme.	a) to c): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
phenomena; c) study the optimum use of space weather information that is globally applicable from low to high magnetic latitude regions for enhanced global navigation satellite system performance at a global context; That States: d) consider a collaborative approach to resolve ionospheric issues including ionospheric characterization for cost-effective, harmonized and regionally suitable global navigation satellite system implementation.	d): Noted.	d): Noted and requested the Secretary General to bring to the attention of States.	d): States consider a collaborative approach to resolve ionospheric issues including ionospheric characterization for cost-effective, harmonized and regionally suitable global navigation satellite system implementation
Recommendation 6/10 – Rationalization of terrestrial navigation aids That, in planning for the implementation of performance-based navigation, States should: a) assess the opportunity for realizing economic benefits by reducing the number of navigation aids through the implementation of performance-based navigation; b) ensure that an adequate terrestrial	a) to c): Noted.	a) to c): Approved and requesedt the Secretary General to bring to the attention of States and Stakeholders.	a): States assess the opportunity for realizing economic benefits by reducing the number of navigation aids through the implementation of PBN; b) States ensure that an adequate

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
navigation and air traffic management infrastructure remains available to mitigate the potential loss of global navigation satellite system service in their airspace; and c) align performance-based navigation implementation plans with navigation aid replacement cycles, where feasible, to maximize cost savings by avoiding unnecessary infrastructure investment.			terrestrial navigation and air traffic management infrastructure remains available to mitigate the potential loss of global navigation satellite system service in their airspace; and c) States align performance-based navigation implementation plans with navigation aid replacement cycles, where feasible, to maximize cost savings by avoiding unnecessary infrastructure investment.
Recommendation 6/11 – Regional performance framework – alignment of air navigation plans and regional supplementary procedures That ICAO initiate a formal amendment process in accordance with normal procedures to align the areas of applicability of the air navigation plans and the regional supplementary procedures, observing the following principles: 1) there will be no change to the current accreditation of the ICAO regional offices to Contracting States; 2) there will be no change to the	Approved and requested the Secretary General to bring to the attention of States and Stakeholders.	Noted.	Note

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
obligation of individual States to provide services in accordance with ICAO Annex 11 — *Air Traffic Services*, 2.1; 3) there will be no change to the governance responsibilities of the ICAO Council, including approval of amendments to air navigation plans and regional supplementary procedures; 4) there will be no change to the current requirements for services and facilities and or to the current supplementary procedures for a given airspace as listed in current air navigation plans and regional supplementary procedures; 5) there will be no change to the principle that a planning and implementation regional group is composed of the Contracting States providing air navigation service in the air navigation region and that other Contracting States can participate in the activities with observer status; 6) there will be no change to ICAO's assistance to planning and implementation regional groups			

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
from the regional offices; 7) the responsibilities of the performance framework management for an air navigation region will now be integrated and will rest with the planning and implementation regional group established for the region; and 8) to the extent possible, the main traffic flows will be accommodated within homogeneous airspaces in order to minimize changes between different air navigation systems and different operational procedures during flight.			
Recommendation 6/12 – Prioritization and categorization of block upgrade modules That States and PIRGs: a) continue to take a coordinated approach among air traffic management stakeholders to encourage effective investment into airborne equipment and ground facilities; b) take a considerate approach when mandating avionics equipage in its own jurisdiction of air navigation	a) and b): Noted.	a) and b): Noted.	a): States, PIRGS and IOs continue to take a coordinated approach among air traffic management stakeholders to encourage effective investment into airborne equipment and ground facilities b) States , PIRGs and IOs, take a considerate approach when mandating avionics equipage in its own

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
service provision, taking into account of burdens on operators including foreign registry and the need for consequential regional/global harmonization; That ICAO:			jurisdiction of air navigation service provision, taking into account of burdens on operators including foreign registry and the need for consequential regional/global harmonization
c) continue to work on guidance material for the categorization of block upgrade modules for implementation priority and provide guidance as necessary to planning and implementation regional groups and States;	c): Noted.	c): Approved and include in the Air Navigation work programme.	c): Note
d) modify the block upgrade module naming and numbering system using, as a basis, the intuitive samples agreed by the Conference; and	d):Noted.	d): Approved and requested the Secretary General to take appropriate action.	d): Note
e) identify modules in Block 1 considered to be essential for implementation at a global level in terms of the minimum path to global interoperability and safety with due regard to regional diversity for further consideration by States.	e):Noted.	e): Approved and include in the Air Navigation work programme.	e): Note
Recommendation 6/13 – Development of Standards and Recommended Practices, procedures and guidance material			

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
That ICAO: a) improve its project management and coordination of contributing ICAO panels, study groups and other expert groups, including task forces and other specialized teams tasked with the development of ICAO provisions and related work, through: 1) consistent application of the *Directives for Panels of the Air Navigation Commission* (Doc 7984); 2) receiving regular reports from the expert groups against agreed terms of reference and work programmes; 3) mandating strong coordination between all expert groups developing ICAO provisions to ensure efficient management of issues and avoidance of duplication; 4) application of the principles of accountability, geographical representation, focus, efficiency, consistency, transparency and	a) to d): Noted.	a) to d): Approved and include in the Air Navigation work programme. d), 1): review and update the *Directives for Panels of the Air Navigation Commission* (Doc 7984) along principles stated by the Conference.	a) to d): Note

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
integrated planning to the operation of all the expert groups; 5) developing documented procedures for other expert groups, including task forces and other specialized teams as well; and 6) better use of today's communication media and internet to facilitate virtual meetings, thereby increasing participation and reducing costs to States and ICAO; b) continue to coordinate with the other recognized standards-making organizations (Assembly Resolution A37-15 refers) in order to make the best use of the capabilities of these other recognized standards-making organizations and to make reference to their material, where appropriate; c) initiate studies to improve the verification and validation process required within ICAO before material developed by recognized standards-making organizations can be referenced in ICAO documentation; and			

RECOMMENDATIONS ADOPTED BY AN-CONF/12	FOLLOW-UP ACTION TAKEN		FOLLOW-UP ACTION TO BE INITIATED
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)	PIRGs/States/International Organizations (IO)
d) consider a methodology by which ICAO can capture the regional implementation and challenges, and to reflect them in a standardized process to effectively support the aviation system block upgrade deployment.			
Recommendation 6/14 – Guidelines for conducting aeronautical studies to assess permissible penetration of obstacle limitation surfaces That ICAO develop comprehensive guidelines for States in the uniform application in conducting aeronautical studies to assess the permissible penetration of obstacle limitation surfaces (OLS).	Noted.	Approved and include in the Air Navigation work programme.	Note

Agenda Item 3: Performance Framework for Regional Air Navigation Planning and Implementation

3.1 Aerodrome Operations and Planning (AOP)

3.1.1 The First Meeting of the Aerodrome Operations and Planning Working Group (AOPWG/1) of Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) was held at the ICAO Asia and Pacific Regional Office, Bangkok, Thailand from 21 to 23 May 2013. The meeting was attended by 46 participants from 18 States, 2 Special Administrative Regions of China and 2 International Organization. Full report of the meeting is available at: http://www.bangkok.icao.int/cns/meeting.do?method=MeetingDetail&meeting_id=276

3.1.2 AOPWG/1 Considered 21 Working Papers and 9 Information Papers. The meeting formulated 6 Draft Conclusions and 1 Draft Decisions for consideration by APANPIRG/24.

APANPIRG/23 Outcomes

3.1.3 APANPIRG/24 noted that the ICAO Regional Office had forwarded the concern raised by India to ICAO HQ on non-applicability of frangibility design requirements for GP antenna mast and housing and for inclusion of a note under Para 9.9.3 for consideration by the Aerodromes Panel.

Relevant Action Items of the 49th DGCA Conference

3.1.4 APANPIRG noted that the working group had reviewed the outcomes of the 49th DGCA conference and identified 4 out of the 16 Action Items relating to the work of the AOPWG.

ICAO Regional Workshops on Airfield Pavement - Outcome

3.1.5 APANPIRG/24 noted that ICAO's Pavement Sub Group is working on the recommendations developed by the Pavement Design Workshop and decided to refer the matter to ICAO HQ as proposed by AOPWG/1. The meeting noted the recommendations developed by the workshop which are to be addressed by ICAO as below:

1) A need to define "unrestricted operations" in the ACN-PCN guidance material;

2) The need to clearly define the level of traffic for operation of an aircraft to be considered as "overload" or normal operations; and

3) These two items are clearly related and combining them into a single definition would provide valuable guidance to the airport operation's community.

3.1.6 APANPIRG adopted the following Conclusion:

Conclusion 24/6 – Airfield Pavement

That, ICAO be invited to provide the definition of 'unrestricted operations' in the ACN-PCN guidance material and the level of traffic for operation of an aircraft to be considered as overload or normal.

Updates on Runway Safety

3.1.7 APANPIRG/24 recognized the importance of establishing Runway Safety Teams as a means for improving runway safety and adopted the following Conclusion:

Conclusion 24/7 - Establishment of Runway Safety Team at Airports

That, States in APAC Region establish Runway Safety Teams comprising all the stakeholders at their airports and Runway Safety Programmes should address the mitigation measures in a timely manner taking into RASG activities and report the action taken to Regional Office.

3.1.8 APANPIRG expressed appreciation for the Department of Civil Aviation Malaysia's gesture to host the Second Regional Runway Safety Seminar from 18 to 20 November 2013 and urged the delegates to participate and request their administration to provide speakers

3.1.9 Australia supported the implementation of Runway Safety Teams and proposed cross coordination between the work of RASG and AOPWG.

Status of Implementation of Certification of Aerodrome Requirements in the APAC Region

3.1.10 APANPIRG recognized the importance of aerodrome certification and noted that 57% of the international aerodromes listed in ANP have been certified.

3.1.11 Considering that still 43% of International airports have still to be certified, APANPIRG urged States who have not implemented the requirements of aerodrome certification and SMS at certified airports to allocate high priority and adequate resources.

Regional and National Performance Framework

3.1.12 The meeting noted that AOPWG had reviewed APAC Metric 4 - *Average delays for departures at State's primary international airports for the busiest hour on weekly basis* and the difficulty expressed in obtaining data to support this metric until such time a regional approach to ATFM was in place.

3.1.13 The meeting took note that the 12^{th} Air Navigation Conference held in November 2012 had endorsed the ASBU methodology and performance reporting using the Air Navigation Report Form (ANRF). As ICAO would be migrating to the ASBU Framework, consequently the Performance Framework forms will be modified to the ANRF.

3.1.14 The meeting also noted that implementation of tasks under performance objective 16 and 17 were still in progress.

Amendment 11 to Annex 14, Volume I - *Aerodrome Design and Operations*

3.1.15 APANPIRG noted that Amendment 11 to Annex 14, Volume I will become effective from 15 July 2013 and applicable on 14 November 2013 (Amendment 11A) except for the element concerning new approach classification which will become applicable on 13 November 2014 (Amendment 11B). The meeting urged States to review the amendments published as attachments to ICAO State letter AN 4/1.2.24-13/20 dated 5 April 2013 on the ICAO NET (http://portal.icao.int) and

i) notify ICAO before 15 July 2013 if there is any part of the adopted Standards and Recommended Practices (SARPs) amendments in Amendment 11 [i.e. Amendments 11-A and 11-B] concerning which the States wishes to register disapproval;

ii) notify ICAO before 14 October 2013 any differences that will exist on 14 November 2013 between the national regulations or practices and the provisions of the whole of Annex 14, Volume I as amended by all amendments up to and including Amendment 11 and thereafter of any further differences that may arise; and

iii) to provide the date or dates by which their Administration will have complied with the provisions of the whole of Annex 14, Volume I, as amended by all amendments up to and including Amendment 11.

Amendment 5 to Annex 14, Volume II - Heliports

3.1.16 APANPIRG noted that Amendment 5 to Annex 14, Volume II will become effective from 15 July 2013 and applicable on 14 November 2013. The meeting urged States to review the amendments published as attachments to ICAO State letter AN 4/16.7-13/21 dated 28 March 2013 on the ICAO NET (http://portal.icao.int)) and

a) notify ICAO before 15 July 2013 if there is any part of the adopted Standards and Recommended Practices (SARPs) amendments in Amendment 5 concerning which the States wishes to register disapproval;

b) notify ICAO before 14 October 2013 any differences that will exist on 14 November 2013 between the national regulations or practices and the provisions of the whole of Annex 14, Volume II as amended by all amendments up to and including Amendment 5 and thereafter of any further differences that may arise; and

c) to provide the date or dates by which their Administration will have complied with the provisions of the whole of Annex 14, Volume II, as amended by all amendments up to and including Amendment 5.

Standards for seaplane bases (Water Aerodromes)

3.1.17 APANPIRG noted that Indonesia had adopted the standards for seaplane bases from FAA Advisory Circular 150/5395-1 Seaplane Bases. The meeting recognized the importance of developing seaplane bases (Water Aerodromes) which could be the best mode of transportation in geographical isolation in addition to providing recreational access and evacuation in emergencies.

3.1.18 India supported the development of SARPs for water aerodromes. ICAO suggested that the APAC region has a demand for water aerodromes and specifications for the water aerodromes should be seen from regional perspective. A regional workshop/seminar would assist to assess and justify the need for water aerodromes SARPs.

3.1.19 New Zealand, Hong Kong China, Pakistan, Polynesia supported the regional approach.

3.1.20 The meeting recognized that developing SARPs for water aerodromes is a major task for ICAO considering the resources available and invited ICAO to convene a workshop/seminar in which APAC States would share their experiences and provide statistics on sea plane operations. The AOPWG will report the progress to APANPIRG/25.

Provision of Minimum Vertical Clearances between an Aircraft and an Object

3.1.21 APANPIRG noted the challenges faced by airports to provide the necessary clearances on aircraft stands as stated in Annex 14, Volume I due to physical limitations of existing facilities. Airport operators had to impose operational restrictions to accommodate new larger aircraft based on aeronautical studies and that the restriction of space on apron stands created additional pressures in parking the ground support equipment required for facilitating the aircraft.

3.1.22 The meeting also noted that the AOPWG had reviewed the requirements and recognized that there was a need to provide additional guidance on this based on best practices. India supported the Conclusion. Recognizing the need for guidance the APANPIRG adopted the following Conclusion:

Conclusion 24/8 – Minimum Vertical Clearance between Aircraft and an Object on aircraft stands;

That ICAO be invited to:

i) carry out studies based on the best practices followed at airports worldwide and develop guidance for parking low height equipment in-between the aircraft stands; and

ii) carry out feasibility studies regarding the provision of guidance for minimum vertical clearances between an aircraft and an object on aircraft stands.

Proposal to Set Standards for Aeronautical Study

3.1.23 The meeting noted that Republic of Korea highlighted the importance of aeronautical study before granting permission to erect structures within the obstacle limitation surfaces and for granting exemptions. The meeting took note that there was a need to establish minimum guidelines to assess the permissible penetration of obstacle limitation surfaces and also noted that the 12th Air Navigation Conference held in 2012 adopted the recommendation 6/14 on Guidelines for conducting aeronautical studies to assess permissible penetration of OLS.

Proposal to Ease Regulations on OLS in the Area surrounding Airports

3.1.24 The meeting noted that Republic of Korea (ROK) highlighted that with the advancement of technology, aircraft and air navigation facilities have become state-of-the-art and there was a need to revisit the regulations for obstacle limitation surfaces. Bangladesh, Singapore, India, Hong Kong China, New Zealand, Vietnam and Pakistan supported the draft Conclusion. APANPIRG noted the importance of balancing safety and economic application and adopted the following Conclusion:

Conclusion 24/9 – Review of SARPS on Obstacle Limitation Surfaces (OLS)

That, recognizing the advancement of air navigation systems and the need for land use optimization around aerodromes, ICAO be invited to review the OLS requirements.

APANPIRG AOPWG Task List

3.1.25 APANPIRG noted the Subject and Task List developed for the AOP Working Group and adopted the following Decision.

Decision 24/10: AOPWG Task List

That the AOPWG Task List contained in **Appendix A** to the Report on Agenda Item 3.1 be adopted as the current work programme for the AOPWG of APANPIRG.

Aerodrome Workshops/Seminar

3.1.26 APANPIRG expressed appreciation for FAA to support the wildlife workshop with expert speakers and encouraged Administrations participation.

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SUBJECT/TASKS LIST IN THE AOP FIELD

The priorities assigned in the list have the following connotation:
A = Tasks of a high priority on which work should be expedited;
B = Tasks of medium priority on which work should be under taken as soon as possible but not to the detriment of Priority "A tasks; and
C = Tasks of medium priority on which work should be undertaken as time and resources permit but not to the detriment of priority "A" and "B" tasks.
TOR = Terms of Reference of the Sub-Group

No.	Ref.	Associated Strategic Objective & GPIs	Task	Priority	Action Proposed/ In Progress	Action by	Target Date
AOPWG/1/1	AOPWG/1	A & C GPI 13 and 14	Establish a base line on the APAC State's requirements through a preliminary survey. Review and monitor at each AOP/WG Meeting the status of progress.	A	Develop survey questionnaire, circulate to APAC States and receive completed questionnaire from APAC States.	AOPWG	2014
AOPWG/1/2	APANPIRG/18 Conclusion 18/1 APANPIRG Conclusion 21/2 RAN meeting – Asia/PAC/3, rec 4/6	A GPI-13 Aerodrome design and management GPI-14 Runway operations	<u>Bird Control Committee</u> Assist States to establish a national bird control committee to: a)study, analyze and adopt measures to prevent bird hazards in its aerodromes and their vicinity, and b) monitor the implementation of a bird control programme by the aerodrome operator, to evaluate its effectiveness and suggest measures for improvement <u>Wildlife hazard reduction</u> Assist States confronting problems of wild life/bird strike hazard to develop and implement an effective wildlife hazard management plan with procedures to control wildlife at or near airports	B	17 States + 1 SAR have reported bird strike committee established. Monitor the establishment of a bird strike committee by the remaining administrations. Monitor the development and implementation of wildlife hazard management plan.	AOPWG	2016
AOPWG/1/3	APANPIRG 18 Conclusion 18/62 APANPIRG 21 Conclusion 21/54	A,	<u>Air Navigation Deficiencies- AOP</u> Assist States to establish action plans with fixed target dates for resolution of safety related deficiencies	A	Assist States to develop Corrective action plan to resolve deficiencies. Monitor resolution of air navigation deficiencies	AOPWG	2015

No.	Ref.	Associated Strategic Objective & GPIs	Task	Priority	Action Proposed/ In Progress	Action by	Target Date
AOPWG/1/4	APANPIRG APAC ANP, Doc 9673, Volume I	A GPI 13 and 14	Review and monitor the implementation of the requirement for aerodrome certification (Annex 14, Vol. I)	A	Monitor implementation of aerodrome certification	AOPWG	2015
AOPWG/1/5	APANPIRG APAC ANP, Doc 9673, Volume I	A GPI 13 and 14	Review and monitor the implementation of the requirement for safety management system at aerodromes. (Annex 14, Vol. I)	A	Monitor implementation of SMS at certified aerodromes	AOPWG	2017
AOPWG/1/6	RAN ASIA/PAC/3 Rec 4/10	A GPI 13 and 14	Review and monitor the status of implementation of visual aids and of provision of resources for ensuring preventive maintenance, human factors and progress in technology development in order to achieve increased safety and capacity.	B		AOPWG	Continuous basis
AOPWG/1/7	APANPIRG/19 RAN – ASIA/PAC/3, Conc 4/4	A GPI 13 and 14	Review the provision of rescue and firefighting services and emergency planning at international aerodromes in the APAC Region.	A	Monitor provision of Rescue fire Fighting trucks, equipment, training and conduct of emergency exercise	AOPWG	2015
AOPWG/1/8	APANPIRG/20 RAN recommendation ASIA/PAC/3, rec 4/2	A GPI 13 and 14	Review and monitor the measurement and reporting by States of the surface condition and unevenness on movement areas at aerodromes in the APAC Region.	A	Monitor the availability of equipment for periodic measurements and reporting	AOPWG	Continuous basis
AOPWG/1/9	APANPIRG 22	A GPI 13 and 14	Review States efforts to allocate the necessary resources to ensure the establishment of preventive maintenance at their aerodromes in order to provide adequate maintenance of facilities, installations and services.	B	Monitor the availability of Aerodrome Maintenance plan	AOPWG	2015
AOPWG/1/10	TOR	A	Review, at each AOP/WG Meeting, the content of the Table AOP 1 and, where necessary, after coordination with users and operators~~,~~ and introduce the respective changes to the APAC ANP and FASID through the established ICAO procedures.	A		AOPWG	Continuous
AOP/WG/1/11	APANPIRG 23	A GPI 13 and 14	Review and monitor the status of implementation of the obstacle limitation surface	A	Monitor the status of implementation of OLS	AOPWG	2015

Agenda Item 3: Performance Framework for Regional Air Navigation Planning and Implementation

3.2: ATM

Report of the 1st Meeting of the ATM Sub-Group

3.2.1 The First Meeting of the APANPIRG Air Traffic Management Sub-Group (ATM/SG/1) was held at Bangkok, Thailand from 20 to 24 June 2013. The meeting was attended by 86 participants from 21 States, 2 Special Administrative Regions of China, and 2 International Organizations.

3.2.2 ATM/SG/1 formulated thirteen (13) Draft Conclusions and two (2) Draft Decisions for consideration by APANPIRG/24. A further six (6) Draft Conclusions and one (1) Draft Decision formulated by the First Meeting of the Aerodromes Operations and Planning Working Group (AOPWG/1) were endorsed by ATM/SG/1. The following discussion highlights the key outcomes.

Asia/Pacific Seamless ATM Planning Group (APSAPG) Outcomes

3.2.3 The ATM/SG had extensively discussed the draft Seamless ATM Plan with a view to providing advice to the APSAPG on matters within the ATM/SG's expertise. A number of papers had been presented by States and administrations that assisted this. In addition, the ATM/SG was informed of the discussion on specific areas of the draft Seamless ATM Plan that took place in the preceding week at the APANPIRG Communications, Navigation and Surveillance Sub-Group (CNS/SG) meeting. The discussion resulted in an update for APSAPG/4 that included the following major changes and additions:

- The ATM/SG agreed that a firm date (day) should be chosen as a target for the Phases; the USA strongly supported using the chart Aeronautical Information Regulation and Control (AIRAC) date.
- The ATM/SG endorsed the Automatic Dependent Surveillance – Broadcast (ADS-B) airspace Preferred Aerodrome/Airspace and Route Specifications (PARS).
- The CNS/SG and ATM/SG endorsed the Modes S Transponder and Airborne Collision Avoidance System/Terrain Avoidance Warning System (ACAS/TAWS) airspace PARS after amendment.
- The CNS/SG endorsed the Performance-Based Navigation (PBN) airspace and routes PARS without comment.
- The ATM/SG, after some wide ranging discussion, agreed to a Draft Conclusion regarding ATS Inter-facility Data Communication (AIDC), including five messages.
- The ATM/SG meeting noted Singapore's suggested text for the first two paragraphs of the Research and Development (R and D) portion in Section 8. Japan agreed with the Singapore submission.
- The ATM/SG discussed the need for the text related to encouraging the use of the minimum ATC separation standard to be as clear as possible; thus this was amended.
- The ATM/SG noted the submission by Pakistan on harmonization of Transition Altitudes as far as practicable, so an item of this nature was added to the research subjects in section 8 of the Plan.

Flight Plan 2012 Post Implementation Review

3.2.4 The ATM/SG/1 meeting had been informed of activities prior to, during and since the implementation of Amendment 1 to the 15th Edition of ICAO Doc. 4444 (PANS/ATM) on 15 November 2012. In their daily status reports during the transition period Japan included statistical analysis of the numbers of NEW format flight plans:

- 11 November: 17.3%;
- 12 November: 27.6%;
- 13 November: 47.4%;
- 14 November: 74.6%; and
- 15 November: 98.0%.

3.2.5 These figures and the relatively minor nature of the issues identified during the transition period demonstrated the value of the three day minimum period for acceptance of both NEW and Pre-Amendment 1 formats. The strategy ensured a progressive transition by airspace users, and avoided the significant challenges inherent in the concentration of issues in a short 'big bang' cutover scenario.

3.2.6 The operational deployment of Amendment 1 identified problems that included a number of pre-existing issues, and some new issues requiring further attention. The most significant were:

- the use of the letter 'J' to indicate SUPER wake turbulence category was not included in Amendment 1, and is currently only supported by State Letter AP080/08. This issue was being addressed by ICAO Headquarters;
- the indicator RVR/ in Item 18 of the FPL (not a new issue, and this indicator should be either accepted without processing or deleted without rejection by ATM systems);
- rejection of FPL if unexpected RMK/ information was included in Item 18 (the Asia/Pacific Guidance Material clearly specified that RMK is a free text field);
- limitations on the number of characters in the Item 18 indicator PBN/ (global guidance was provided); and
- inconsistent instructions in PANS/ATM on the use of Item 10 indicators for ADS-B capability (this matter was referred to ICAO HQ).

3.2.7 A significant proportion of administrations responding to the updated questionnaire circulated in May 2012 had indicated that they would be commissioning converter solutions to down-convert NEW format FPL and ATS messages into pre-Amendment 1 format, for subsequent processing by their ATM automation and associated peripheral or supporting systems. There may have been a larger proportion of non-respondent administrations that also used converters.

3.2.8 The use of converters could only be considered a short-term solution, pending modification of ATM systems to receive, process and send NEW format FPL and ATS messages. While ATM systems remained incapable of independently processing NEW format messages the benefits of the Amendment 1 changes could not be realized, particularly those relating to PBN based separation and provision of ADS-B services, including separation. The interoperability of AIDC messaging would remain restricted where converter solutions were in use.

3.2.9 Several States indicated that they would implement either a manual handling process to manage NEW format messages, or that no changes to the ATM system were required as it was effectively blind to the new format. For the same reasons as described above, the benefits of the Amendment 1 changes could not be realized under these circumstances. APANPIRG/24 adopted the following Conclusion:

Conclusion 24/11: Reliance on FPL and ATS Message Converters

That, considering the airspace capacity, efficiency and safety benefits intended by the full implementation of PANS/ATM Amendment 1changes, States are urged to:

a) report to the ICAO Asia/Pacific Regional Office the:

i. current status of ATM automation and conversion systems; and

ii. planned date of implementation of full capability to process NEW format FPL and ATS messages without conversion; and

b) where converters are utilized, upgrade ATM Automation and supporting systems to fully support Amendment 1 changes without using converters.

3.2.10 APANPIRG/24 also adopted the following Decision, dissolving the FPL&ATM Messages Task Force:

Decision 24/12: Dissolution of the FPL&AM Implementation Task Force

That, considering the successful implementation of Amendment 1 to the Fifteenth Edition of ICAO Doc 4444 (PANS/ATM), the Asia/Pacific Flight Plan and ATS Messages Implementation Task Force (FPL&AM/TF) be dissolved, and any on-going tasks be delegated to the ATM Sub-Group.

<u>Regional ATM Contingency Plan Task Force Outcomes</u>

3.2.11 The meeting was informed of the outcomes of the Second Meeting of the Regional ATM Contingency Plan Task Force (RACP/TF/2, Bangkok, Thailand, 12 – 15 March 2013).

3.2.12 A survey questionnaire developed to analyse Asia/Pacific Region's contingency readiness had received responses from 15 administrations. Each responding administration's overall contingency readiness was categorized as Robust, Marginal or Incomplete for both Level 1 (internal State) and Level 2 (bi-lateral or multi-lateral inter-State) plans, according to the following scale:

- Robust (80 - 100% implementation);
- Marginal (40 – 79%); and
- Incomplete (0 – 39%).

3.2.13 Due to the limited number of responses received further work would be required in gathering information from States for further analysis, and determining improvement priorities for the region. To develop harmonized Level 2 Plans the Task Force had made the following decision:

RACP/TF Decision 2/1: Small Working Groups

That, RACP/TF forms Small Working Groups to formulate contingency route structures and Flight Level Allocation Schemes (FLAS) for Level 2 Contingency Plans.

3.2.14 Overall Regional implementation of all four of the key areas examined was found to be Marginal. Of the 20 elements within the four key areas, one was Incomplete, 14 were Marginal and five were Robust. Four administrations had Robust Level 2 plans; five were Marginal and six were Incomplete.

3.2.15 **Figure 1** provides a representation of Asia/Pacific States' Level 1 contingency readiness.

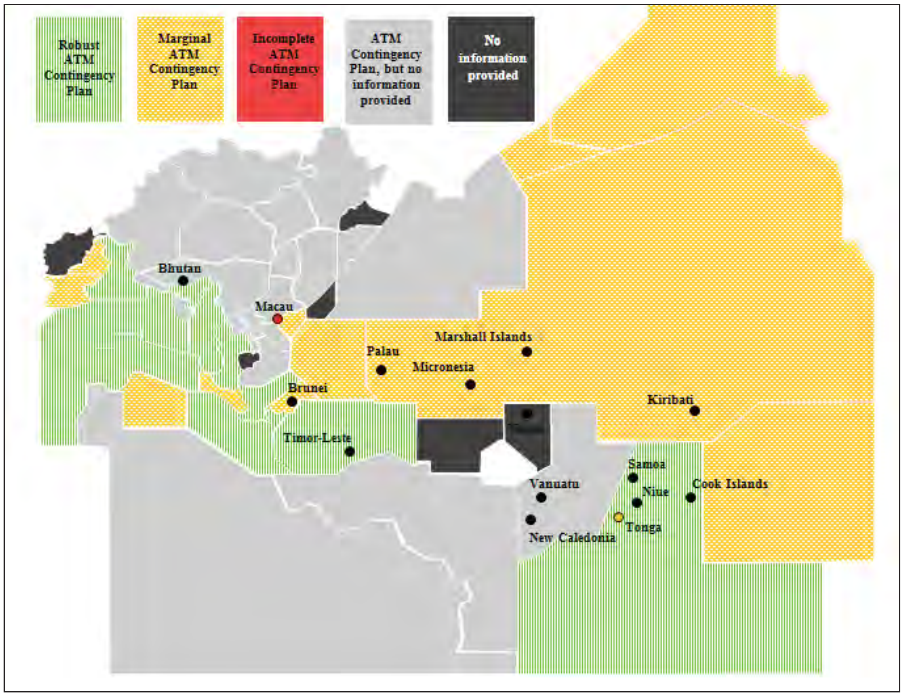


Figure 1: Level 1 Contingency Planning

3.2.16 **Table 1** summarizes the Regional Level 2 contingency readiness determined by State responses to the questionnaire, also expressed as a percentage of 'full' implementation.

Level 2 Plans – Summary of Overall Regional Readiness (%)	
Delegation of ATC Separation	33
Formal Inter-State Agreements (LoA or MoU)	47
Contingency Route Structure	47
Flight Level Allocation Scheme	47
Minimum Longitudinal Spacing	47
Frequency Transfer Arrangements	60
Delegation of FIS and SAR Alerting Services	60

Table 1: Level 2 Contingency Readiness

3.2.17 The Task Force meeting had considered a proposed template for contingency arrangements between States, and agreed that a re-drafted template would be prepared by the Secretariat for review and amendment by the Task Force Review Team. A proposed framework for the Regional ATM Contingency Plan and its Basic Plan Elements (BPE) were considered by the Task Force.

3.2.18 The meeting was informed of the ATM Volcanic Ash Contingency Plan Template (ATM VACP), which had been finalized by International Volcanic Ash Task Force (IVATF) and made available to all ICAO Regional Offices. The ATM VACP was available on the Asia/Pacific Regional Office internet website, and would be referenced in the Regional ATM Contingency Plan.

3.2.19 The Task Force considered a concept of a contingency routing system north of the Himalayas, known as the 'Silk Road' routes, joining Europe and East/Southeast Asia, in order to provide alternative regional routes in case in South Asia Major Traffic Flow (MTF-4) airspace was not available.

Regional Air Traffic Flow Management

3.2.20 IATA presented ATFM/SG/1 with its views on the focus of Air Traffic Flow Management (ATFM) in the Asia/Pacific Region. South East Asia in particular was characterized by relatively small FIRs with corresponding low 'flight transit times' (often a flight would transit an FIR in 10 -20 minutes flying time). This meant that the process applied in one FIR had a knock-on effect in multiple 'downstream' FIRs and procedures applied were therefore structured around the lowest capability of a particular route/flow. 'Flow Management' in the region had, until recently tended to be a rather blunt tool restricting volumes rather than taking a wider Network View that optimized available capacity on a sub-regional basis.

3.2.21 IATA had recognised that the ICAO Asia Pacific Seamless ATM Plan would assist and provide a blueprint for coordinated Regional development based on the ICAO Aviation System Block Upgrades (ASBU) roadmap. ATFM, taking a Network view, was a key element in ASBU Block Zero and was identified as 'critical' in the Seamless Plan. - *PIA 3/BO35 - Improved Flow Performance through planning based on a Network-wide view*.

3.2.22 IATA had noted that for the Asia/Pacific, a centralized ATFM Unit (ATFMU) approach was not practical at this time, and a more pragmatic approach would be to concentrate on and support sub-regional multi State programs.

3.2.23 The ATFM/SG/1 meeting noted the necessity to focus on sub-regional, rather than FIR-focused ATFM initiatives, and the need for a regional ATFM framework. It was also noted that the ATFM part of the ICAO Manual on Collaborative ATFM (Doc 9971) was in a late stage of finalisation based on comments from the 12th ICAO Air Navigation Conference (AN-Conf/12).

Development of a Sub-Regional CDM/ATFM Concept

3.2.24 Hong Kong China, Singapore and Thailand provided ATM/SG/1 with an update on their collaborative effort to develop a sub-regional ATFM concept with Collaborative Decision-Making (CDM). With the continued strong growth of air traffic in the Asia Pacific Region, there was a need to effectively manage the demand against capacity, especially at major international air hubs like Bangkok Suvarnabhumi International Airport, Hong Kong International Airport and Singapore Changi Airport.

3.2.25 While concepts such as a single ATFM entity to serve a region could work well in Europe or North America, they would not necessarily be the ideal solution for Asia Pacific region. There was a need to research and develop a CDM/ATFM concept that could be implemented at a regional or sub-regional level in Asia Pacific region. Recognizing this need, Hong Kong China, Singapore and Thailand had collaborated to develop a sub-regional ATFM concept, which would be comprised of independent virtual CDM/ATFM nodes supported by interconnected information sharing framework.

SAIOACG/3 and SEACG/20 Meeting Outcomes

3.2.26 The combined Third Meeting of the South Asia/Indian Ocean ATM Coordination Group (SAIOACG/3) and Twentieth Meeting of the South-East Asia ATM Coordination Group (SEACG/20) were held in Bangkok, Thailand from 18 to 22 February 2013.

3.2.27 IATA had advised ATM/SG/1 that the Surveillance Small Working Group (SWG-SUR) had compiled a comprehensive regional overview of the application of separations applied at Flight Information Region (FIR) transfer of control points. This had identified areas between states where overlapping surveillance and communication coverage existed, but the conservative procedural separation of 10 minutes or 80 NM continued to be used.

3.2.28 IATA stated that over recent decades regional infrastructure had improved significantly and with the majority of the region now being within surveillance and communication coverage, it was necessary to review the application of procedural separations. The ATM/SG Chair supported the proposal to apply surveillance-based separation within surveillance coverage, to improve efficiency and capacity.

3.2.29 ATM/SG/1had recognised that the SEACG SWGs were already addressing the identification and development of proposals for resolution of this issue.

3.2.30 As a result of the SAIOACG/SEACG ATFM Small Working Group (SWG) discussion, the following Conclusions were adopted by APANPIRG/24:

Conclusion 24/13: Air Traffic Flow Management Capacity Assessments

That States be urged to establish capacity assessment and adjustment mechanisms, and regular review for all aerodromes and ATC sectors where traffic demand is expected to reach capacity, or is experiencing traffic congestion, and to report the assessment outcomes to the Asia/Pacific Regional Office prior to 1 May 2014.

Conclusion 24/14: Air Traffic Flow Management Information Sharing

That States, where ATFM processes are in place, including within adjacent airspace, be urged to share information, which may include:

a) capacity assessment: including factors of interest affecting capacity, such as special use airspace status, runway closures and weather information;

b) traffic demand information: which may include flight schedules, flight plan, repetitive flight plan data as well as associated surveillance updates of flight status; and

c) ATFM Daily Plan.

Conclusion 24/15: Asia/Pacific ATFM Steering Group

That, States participate in, and support the Asia/Pacific ATFM Steering Group to develop a common Regional ATFM framework, which addresses ATFM implementation and ATFM operational issues in the Asia/Pacific region.

3.2.31 With regard to APANPIRG Decision 24/15, Hong Kong, China supported the reconvening of the ATFM Steering Group along with Japan, Thailand, India and Singapore, and announced that they were ready to host the ATFM/SG/2 meeting.

3.2.32 Following on from the outcomes of the SAIOACG/SEACG Communications (COM) SWG discussion, APANPIRG 24 adopted the following Conclusions:

Conclusion 24/16: South China Sea ATS Facilities

That the provision of surveillance and communications services in the South China Sea area, where radar, ADS-B and/or VHF voice communications are currently not provided, be reviewed by China, Hong Kong China, Malaysia, Philippines, Singapore and Viet Nam, to consider:

a) enhancement of current services;

b) delegation or amendment of airspace service volumes; and

c) cooperative agreements to exchange communications and surveillance capability.

Conclusion 24/17: AIDC Implementation

Recognizing that States implementing AIDC messaging may be doing so without previous knowledge or experience, and significant safety, ATC capacity and workload benefits arise from implementation of an appropriately selected initial suite of AIDC messages;

States should:

a) engage as soon as possible in AIDC trials to develop knowledge and address any related ATM or communications system issues;

b) implement operational AIDC messaging as a matter of priority, in accordance with APANPIRG Conclusion 19/19; and

c) implement as far as practicable, the AIDC messages Advanced Boundary Information (ABI), Coordinate Estimate (EST), Acceptance (ACP), Transfer of Control (TOC) and Assumption of Control (AOC).

3.2.33 Recommendations identified by the SAIOACG and SEACG Surveillance (SUR) SWGs were as follows:

a) States with overlapping surveillance coverage should implement direct speech circuit to allow tactical coordination between surveillance controllers, in addition to AIDC, instead of relaying the information.

b) States with overlapping surveillance coverage should consider introducing surveillance handoff procedures.

c) A reduction in spacing at the transfer of control point could be reviewed on a step by step basis, starting with a comfortable agreed spacing for a period of time before reducing the spacing further. This should be subject to the safety assessment of each individual State, which should consider radar handoff requirements.

d) ADS-B with VHF Communications should be considered in areas where there was a lack of infrastructure. Sharing of ADS-B data and VHF Communications between adjacent States should also be considered to improve safety and efficiency. .

3.2.34 The SAIOACG/SEACG meeting noted that in South Asia, traffic continued to be separated by 50NM or even 80NM at some identified transfer of control points within ATS surveillance coverage. Moreover, the meeting had noted that in the South China Sea 30NM to 40NM was applied within ATS surveillance capability. Given the fact that the traffic had more than doubled in the last ten years and the increasing delays, the meeting noted that attention should be focussed on infrastructure improvements.

3.2.35 The Secretariat presented draft Version 12 of the *Asia and Pacific Region ATS Route Catalogue* to the ATM/SG/1 for review and update. The ATS Route Catalogue contained an updated list of regional ATS routes supporting the Regional Air Navigation Plan, and a list of ATS route airspace and State requests. APANPIRG/24 adopted the following Conclusion:

Conclusion 24/18: ATS Route Catalogue Version 12

That Version 12 of the Asia and Pacific Region ATS Route Catalogue, appended as **Appendix A** to the Report on Agenda Item 3.2 replace Version 11 on the Asia/Pacific Regional Office's web site

AIS – AIM Implementation Task Force Outcomes

3.2.36 The Aeronautical Information Management (AIM) Quality Assurance Seminar and the Eighth Meeting of the Aeronautical Information Services – Aeronautical Information Management (AIS-AIM) Implementation Task Force (AAITF/8) were held in Ulaanbaatar, Mongolia, from 6 – 10 May 2013.

3.2.37 The ICAO Regional Office had conducted an analysis of the electronic Aeronautical Information Publication (eAIP) of the 23 States having previously reported eAIP availability. Of 23 States reporting eAIP availability, only 6 had internet-accessible eAIP which was fully compliant with Annex 15 requirements for an Integrated Aeronautical Information Package. Six provided an Annex 15-compliant AIP Book, AIP SUP and AIC, but not NOTAM. A further three States provided AIP Book, but not AIP Supplements (AIP SUP) and/or Aeronautical Information Circulars (AIC).

3.2.38 The meeting also discussed the ICAO Document 7383 requirements for distribution of copies of AIP, AIP SUP and AIC to ICAO Headquarters and Regional Offices. An updated AIS-AIM Transition Table recording the aforementioned 15 eAIP is provided at **Appendix B** to the Report on Agenda Item 3.2. India expressed concern about the security of public access to eAIP. The APANPIRG Chair noted the following Conclusion adopted by APANPIRG/24 would provide beneficial principles:

Conclusion 24/19: Electronic AIP

That, considering that Electronic AIP (eAIP) is part of Phase 2 of the AIS-AIM Transition Roadmap, due for completion by 14 November 2013 to coincide with the publication of Amendment 37 to Annex 15, and that few Asia/Pacific States' internet-accessible eAIP as reported to ICAO Regional Office comply with the Annex 15 requirements for Integrated Aeronautical Information Packages, States are urged to:

a) implement internet-accessible electronic AIP (eAIP) as soon as possible;

b) ensure the eAIP has the unconditional authority of the State, without disclaimers referring to a separately published paper product;

c) permit open access to the eAIP either without the need for registration or, if registration is required, access to eAIP is automatically and immediately available;

d) provide the facility to register for an update/amendment notification service;

e) ensure the eAIP complies with Annex 15 requirements for content and structure;

f) report eAIP implementation and its internet hyperlink to the ICAO Asia/Pacific Regional Office; and

g) having implemented internet-accessible eAIP, on receipt of advice from the ICAO Asia/Pacific Regional Office, discontinue the forwarding of paper or CD copies of AIP, AIP SUP, AIC and NOTAM Checklists to the Regional Office.

3.2.39 The only view of AIS – AIM transition progress available to States was the State AIS AIM Transition Table (available on the ICAO Regional Office website). While the reporting of individual Steps in terms of percentage-completion made it difficult to clearly assess, it was clear that clear that progress was different between States, and significantly different than the AIS-AIM Roadmap, in which Phase 1 was intended to be completed by November 2010 and Phase 2 by November 2013.

3.2.40 The AAITF meeting noted that many States would like to implement in accordance with the Roadmap, but there were no detailed criteria for each Step's completion, leading to difficulty for States in evaluating their own progress. Mongolia had agreed to host an informal website for the sharing of knowledge and information within the AIM community, and asked States to provide necessary information. The Secretariat had undertaken to examine what other opportunities or resources may be available for seminars or workshops to address the difficulty States were having in gaining knowledge of the AIM Transition Steps and determining how to implement them.

3.2.41 Recognizing the slow progress of implementation in many States, APANPIRG/23 had previously agreed to the following Conclusion:

Conclusion 23/9 – AIS-AIM Transition State Plans

That, States should develop a basic plan that identified the target completion dates of Transitional elements in the AIS-AIM Roadmap and submit these plans to the Asia/Pacific Regional Office by 1 January 2013.

3.2.42 17 Administrations responded to the subsequent State Letter (AP135-12) requesting basic plans. 10 States had completed Phase 1, which was intended to be completed by November 2010. No State planned to complete all 9 Phase 2 Steps by the scheduled date of 14 November 2013. Only 4 States (India, Japan, New Zealand and Singapore) had implemented all Phase 1 plus more than half of the Phase 2 elements including P-11 - *Electronic AIP*.

3.2.43 Hong Kong, China stated that while eAIP was important to Phase 2 for transition to AIM, other elements of Phase 2 transition to AIM were equally essential. The AAITF/8 had recognised that the Asia/Pacific region behind the AIM schedule. If non-respondent States were assumed to be behind schedule in implementation of all transition Steps, the following overall regional implementation could be expected when Amendment 37 comes into effect:

- Phase 1 AIM Transition would be 33% completed;
- Phase 2 AIM Transition would be 25% completed
- Phases 1 & 2 Transition would be 28% completed.

3.2.44 A summary of State AIM Implementation Plans is provided at **Appendix C** to the Report on Agenda Item 3.2. There was clearly a need for guidance material on this subject. Accordingly, the following Decision was made by the meeting:

AAITF Decision 8/1: Small Working Group to Formulate Guidance Material on Steps of the AIS – AIM Transition Phases.

That a Small Working Group comprising Australia, Hong Kong China, Japan, Singapore and the Secretariat be established to develop guidance material for Asia/Pacific Region on the requirements for completion of AIS – AIM transition Steps

3.2.45 The Air Navigation Deficiencies list did not reflect the Region's performance in implementation of Phase 1 of the AIS – AIM Roadmap. The Phase 1 Steps became effective on 18 November 2010, in line with the effective date of Amendment 36 to Annex 15. It was agreed that the Deficiencies List should be updated to record AIS – AIM related deficiencies where States have reported that they have not yet completed Phase 1 Steps, or where they have failed to provide any progress reports.

3.2.46 Further potential deficiencies arising when Amendment 37 to Annex 15 came into effect on 14 November 2013, including the AIS-AIM Transition Phase 2 steps, were also discussed. A summary of anticipated AIS – AIM related deficiencies for AIS - AIM Phase 1 and Phase 2 Transition Steps on 15 November 2013 is provided at **Appendix D** to the Report on Agenda Item 3.2.

3.2.47 The meeting discussed the continuing problem of significant AIP changes being promulgated with unacceptable lead times before becoming effective, and without appropriate quality control of accuracy.

3.2.48 In considering the critical importance of the accuracy and timeliness of information used in automated databases for day to day aviation operations, and the promulgation requirements set down in Annex 15, APANPIRG had adopted the following Conclusion:

APANPIRG Conclusion 23/8 – Annex 15 Promulgation Requirements Compliance

That, States should be urged to recognise the importance of Annex 15 compliance in respect of aeronautical data affected by major projects, by:

a) establishing formal coordination between change originators and Aeronautical Information Service (AIS) units to ensure appropriate planning and that promulgation requirements were taken into account; and

b) creating a mechanism to allow AIS personnel to decline requests that did not comply with Annex 15, except for urgent corrections, emergencies, and matters of national security.

3.2.49 Instances of non-compliance with accuracy and advance notification requirements continued to occur; thus there were a number of States not complying with the APANPIRG Conclusion.

3.2.50 To improve the effectiveness of corrective action on this safety-critical issue ICAO Regional Office, using verifiable reports received from IATA or other valid sources would provide a summary of all reported instances of non-compliance to future ATM Sub-Group meetings for further consideration by APANPIRG. The summary would include the information type and reference number (e.g. AIP SUP, NOTAM), the issuing State, the publication date and effective date, and a brief description of the issue. This information would also be used as the basis for a discussion paper at the annual DGCA meeting.

3.2.51 It had become apparent that further guidance for the submission of Basic Air Navigation Plan (BANP) proposals for amendment (PfA) for ATS routes was needed. The following Conclusion was adopted by APANPIRG/24:

Conclusion 24/20: Basic Air Navigation Plan Amendment Procedure and Guidance for Submission of ATS Route Amendments

That, to further improve the quality and processing time of proposals to amend ATS route information in the Basic Air Navigation Plan, the Doc 9673 Amendment Procedure provided on the Asia/Pacific website should be replaced with the Amendment Procedure and Guidance for Submission of ATS Route Amendments appended as **Appendix E** to the Report on Agenda Item 3.2.

3.2.52 Japan had proposed that there was a need to clarify differences between States' NOTAM operations and the descriptions in the Asia/Pacific Operating Procedures for AIS Dynamic Data (OPADD), and to facilitate the global harmonization of NOTAM operations. OPADD edition 3.0 was included in Chapter 3 of *Guidance Manual for Aeronautical Information Services in the Asia/Pacific Region.* APANPIRG/24 adopted the following conclusion:

Conclusion 24/21: Survey of Differences between States NOTAM Operations and Chapter 3 of the Guidance Manual for AIS in the Asia/Pacific Region - OPADD Edition 3.0

That, recognizing the potential for inconsistencies in NOTAM format within the Asia Pacific Region, States should complete the OPADD Survey attached at **Appendix F** to the Report on Agenda Item 3.2 and forward the completed survey to the ICAO Asia/Pacific Office by 31 December 2013.

Asia/Pacific Search and Rescue Task Force Outcomes

3.2.53 The First Meeting of the Asia/Pacific Regional Search and Rescue Task Force (APSAR/TF/1, Bangkok, Thailand, 5 to 7 February 2013) was attended by 18 Asia/Pacific SAR Administrations, ICAO and the International Maritime Organization (IMO).

3.2.54 The meeting discussed the difficulties of enacting agreements between States, which often involved waiting for long periods for political agreement. The meeting noted that ICAO/IMO may be able to facilitate some agreements involving high-level decision-makers. The APSAR/TF Chair agreed to examine the suggestion to draft a template that might be adopted by the ANSPs for extending cooperation between ATS units, until such time as the formal SAR Agreements were signed by competent authorities.

3.2.55 APANPIRG/24 adopted to the following conclusion:

Conclusion 24/22: Search and Rescue Agreements

Recognising the difficulties of enacting Search and Rescue (SAR) Agreements, States should be urged to make arrangements for senior civil and military decision-makers to facilitate the implementation and maintenance of SAR Agreements as early as possible.

3.2.56 New Caledonia, on behalf of the Secretariat of the Pacific Community (SPC) presented an overview of the work undertaken to support search and rescue (SAR) efforts in the Pacific. These efforts, primarily funded by the IMO, had been consistently supported by the SAR authorities from Australia, French Polynesia, New Caledonia, New Zealand, and the United States. The SPC recognized the importance of the need to harmonize aeronautical and maritime SAR efforts in the Pacific.

3.2.57 The desirability for States to establish joint Rescue Coordination Centres (RCCs) and Joint RCCs (JRCCs) was noted. The Secretariat presented information on possible methods that an Asia/Pacific SAR Plan could be developed, as required by the Terms-of-Reference (TOR). The APSAR/TF was expected to deliver a plan within two years of establishment for enhancement of SAR capability within the Asia/Pacific Region, which would include the current status of SAR preparedness, and recommendations for SAR planning and preparedness in terms of compliance with Annex 12, the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR) and accepted best practice.

3.2.58 The analysis of information and subsequent recommendations was expected to be incorporated into a Regional SAR Plan for submission to APANPIRG/26, due to be held in 2015.

3.2.59 Planning material germane to regional SAR services was contained in Part VII, Volume 1 of the Asia and Pacific Regions Air Navigation Plan Basic Air Navigation Plan, Doc 9673. The meeting noted that much of this material appeared to be superfluous, considering the SARPs contained within Annex 12, and the three volumes of the IAMSAR.

3.2.60 In addition, Table SAR 1 in the Facilities and Services Implementation Document (FASID, Volume II of Doc 9673) theoretically provided planning information such as required rescue facilities. However this material did not appear to be up-to-date and the value of the material appeared to be very limited, with the FASID cover page containing the statement that the material was 'Not to be used for operational purposes'. The SAR/TF/1 meeting noted that Annex 15 (Appendix 1, page APP 1-8) required that State Aeronautical Information Publications (AIP) provide information on the provision of SAR services.

3.2.61 The APSAR/TF meeting discussed the need for the status of Doc 9673 SAR material to be reviewed, to determine whether some could be contained within the Asia/Pacific Regional SAR Plan, or deleted due to duplication by SARPs or State AIPs. The meeting noted that it was not intended to remove regional-specific planning material. It was agreed that the Chairperson and the IMO would make a preliminary review of the material before circulation to the other APSAR/TF members.

3.2.62 The meeting reviewed and updated the current List of SAR Agreements, SAR Agreement Matrix, SAR Capability Matrix Table. The SAR Status data indicated that only three Asia/Pacific administrations had Annex 12 compliance in all elements. The Regional SAR Compliance Overview indicated particular weaknesses in South Asia and the Southwest Pacific areas (**Figure 2**).

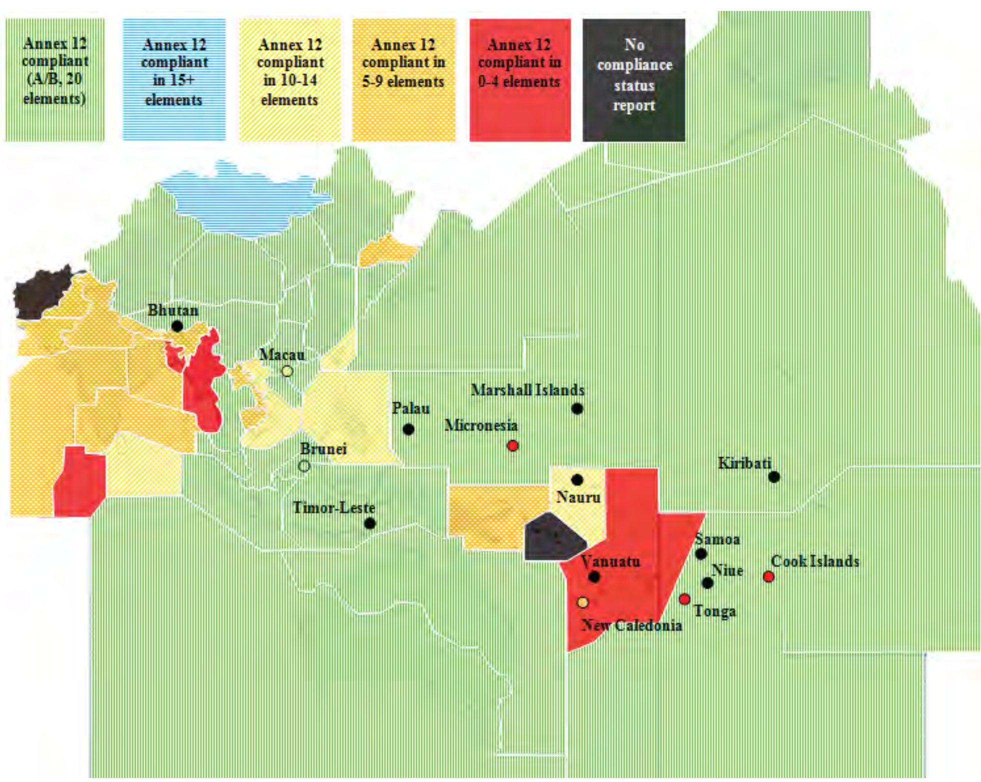


Figure 2: Regional SAR Overview

3.2.63 Australia suggested the establishment of an Asia/Pacific Aeronautical SAR Contact List, with a focal point for each administration and relevant International Organization. Australia stated that the nominated contact(s) should preferably be a SAR manager or senior SAR qualified person who could respond in a timely and effective manner to coordinate aeronautical non-emergency and administrative SAR matters.

3.2.64 Australia emphasised that the Contact List should not be confused with any listings of SAR Points of Contact (SPOCs) used for 24 hour SAR emergency communications associated with RCCs and the COSPAS-SARSAT distress beacon system. The following Conclusion was adopted by APANPIRG/24:

Conclusion 24/23: Asia/Pacific SAR Contact List

That, States should be urged to provide contact details of SAR managers or senior SAR staff who may respond in a timely manner to aeronautical non-emergency and administrative SAR matters to the Asia/Pacific Regional Office, for incorporation into an Asia/Pacific SAR Contact List.

First Meeting of the Aerodrome Operations Working Group

3.2.65 APANPIRG/24 outcomes related to the First Meeting of the APANPIRG Aerodromes Operations and Planning Working Group (AOPWG/1, Bangkok, Thailand, 21 to 23 May 2013), including **Conclusions 24/6 to 24/9** and **Decision 24/10,** are separately reported under Agenda Item 3.1.

Transitioning to RNAV-2 in Enroute Airspace

3.2.66 India presented information in WP19 on their New Airspace Management Strategy which envisaged a single continuum of upper airspace through the integration of ATM Automation, radar and ADS-B sensors and cross coupling of VHF. This would enable enhanced implementation of PBN-based ATS routes structure such as RNAV 2/RNP 2 routes. Seamless surveillance through RADAR and ADS-B would permit reduction in separation, thereby optimising airspace capacity.

Cost-Benefit Analysis of RNAV 2 Parallel Routes Y711 and Y722

3.2.67 The Republic of Korea presented the findings of a cost-benefit analysis performed on newly implemented RNAV 2 parallel routes Y711 and Y722 (implemented on 27 June 2012), to determine the benefits derived by implementing RNAV route with 8NM lateral separation (WP24). By the end of 2013, based on the traffic sample data gathered, the estimated benefits of implementation were USD27.66 million per annum. India thanked the Republic of Korea for its work, noting that they were studying it for possible application in India

ASIA/PACIFIC REGION ATS ROUTE CATALOGUE

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA/PACIFIC REGIONAL OFFICE

VERSION 12

26 June 2013

Table of Contents

Foreword

The *Air Navigation Plan – Asia and Pacific Regions* (Doc 9673), Volume I, Basic ANP (BANP) contains ATS route requirements which were developed by the Third Asia and Pacific Regional Air Navigation Meeting (Bangkok, May 1993). The requirements have been revised from time to time to reflect current operational needs. There is also an ongoing need to revise and update these requirements.

The fourteenth meeting of the ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG/14, August 2004) under Conclusion 14/5 established the ATS Route Network Review Task Force (ARNR/TF) to review the Asia and Pacific ATS route network as contained in the BANP, determine present and future route requirements, and revise the BANP as appropriate. To facilitate the amendment process and keep track of route implementation and future requirements, and with the objective of providing more up to date information on route developments, ARNR/TF prepared the draft *Asia/Pacific ATS Route Catalogue* as a supplement to the BANP.

APANPIRG/16 (August 2005, Bangkok), recognizing the value of a consolidated reference document for the regional ATS routes and future route requirements of States and airspace users, accepted the Route Catalogue under Decision 16/9. The Route Catalogue is intended to be a living document, supplementing the BANP and maintained by ICAO Asia and Pacific Office. Communication in relation to the Route Catalogue should be made via email to the ICAO Asia and Pacific Office at icao_apac@bangkok.icao.int.

A Contracting State or qualifying international organization identifying a need for a new route requirement to be included in the BANP or to change an existing route contained in the BANP, may submit an amendment proposal to the Secretary General for approval by the President of the Council in accordance with established procedures summarized below.

Appropriately presented and documented proposals to amend the BANP are submitted to the ICAO Secretary General through the Regional Office and circulated to States and International Organizations for comment. Once all parties concerned agree to the proposal, the Secretary General will submit the proposal to the President of the Council for approval. The Regional Office will inform States and international organizations concerned of the approval and the BANP will be amended accordingly.

The Regional Office, which is responsible for maintaining the ATS Route Catalogue, will update the Route Catalogue from time to time as amendment proposals are presented, progressed and agreed or not agreed. The revision number and date shown on the cover page of the catalogue, which is posted on the ICAO APAC website (http://www.bangkok.icao.int/).

The Reformatted ATS Route Catalogue is now revised as follows:

Chapter A: Routes in BANP

Chapter 1, 2, 3 and 4: Future Requirements – Users & States

Chapter A lists ATS routes which have been contained in the BANP. Chapter A will be amended by the Regional Office subsequent to approval of an amendment to the BANP by the President of the Council. It is expected that Chapter A will become redundant when the electronic ANP (e-ANP) formats become available in 2013.

Note: — As the ATS Route Catalogue Chapter A *is intended for use as a supplement to the BANP, it does not replace the BANP nor should it be used as an operational document. Its primary purpose is to assist States and airspace users by providing more up to date information, to develop and maintain the ATS routes in the Asia and Pacific Region.*

Chapters 1 to 4 list ATS routes proposed by States and international organizations in accordance with their geographical disposition. These routes have not been included in the BANP or implemented, and have no specific status, other than having been presented as a proposal and subject to consultation and review.

Regional ATS route proposals affecting Asia/Pacific airspace should be presented as part of a paper to ATM coordination groups or other suitable bodies, and then may be entered into the Route Catalogue by the Regional Office. The Regional Office will periodically present to appropriate ATM coordination groups or other suitable bodies the proposals within their geographical area of interest for review. After review, the ATS Route Catalogue may be updated by:

- Amendment to transfer proposals to Chapter A that have been agreed after subsequent proposal for amendment of the BANP; or
- Deletion of the proposal when it has been decided that there is no possibility of implementation in the foreseeable future; or
- Amendment with the addition of supplementary information; or
- Addition of a new ATS route proposal.

Amendment Record

Version/Amendment Number	Date	Amended by	Comments
0.1	14 February 2005	-	ARNR/TF/2 developed the draft version.
0.2	5 May 2005	ARNR/TF/3	Finalized the format following contribution from the members.
0.3	29 July 2005	ATM/AIS/SAR/SG/15	Sub-Group concluded that the Catalogue be adopted (Draft Conclusion 15/3).
1	26 August 2005	APANPIRG/16	APANPIRG/16 decided that the Catalogue be accepted (Decision 16/9).
2	24 January 2006	BBACG/17	Reviewed and updated the Catalogue.
3	19 May 2006	SEACG/13	Reviewed and updated the Catalogue.
4	26 January 2007	BBACG/18	Reviewed and updated the Catalogue.
5	23 May 2008	SEACG/15	Reviewed and updated the Catalogue.
6	15 May 2009	SEACG/16	Reviewed and updated the Catalogue.
7	27 May 2010	SEACG/17	Reviewed and updated the Catalogue.
8	10 March 2011	BBACG/21	Reviewed and updated the Catalogue.
9	6 May 2011	SEACG/18	Reviewed and updated the Catalogue.
10	22 September 2011	SAIOACG/1	Reviewed and updated the Catalogue.
11	22 June 2012	ATM/AIS/SAR/SG/22 APANPIRG/23	Reviewed, reformatted, and updated the Catalogue, approved by APANPIRG/23.
12	26 June 2013	SAIOACG/SEACG, ATM/SG	Reviewed, reformatted, and updated the Catalogue, approved by APANPIRG/24.

Chapter A: Routes in BANP

The segments which have not been implemented are shown by **bold** significant points.

LOWER ATS ROUTES

Route	Significant points
A1	LIMLA 1546.0N 09836.0E
	BANGKOK
	UBON
	DANANG
	IKELA 1839.7N 11214.7E
	CHEUNG CHAU
	ELATO 2220.0N 11730.0E
	MAKUNG
	TAIBEI
	KAGOSHIMA
	MIYAKE JIMA
A91	(KYAKHTA)
	SERNA 5018.5N 10628.1E
	ULAN BATOR
A201	LASHIO
	AGARTALA
	RAJSHAHI
	MONDA 2521.00N 08626.25E
	PATNA
	LUCKNOW
A202	CHEUNG CHAU
	SIKOU 2050.6N 11130.0E
	SAMAS 2030.3N 11029.7E
	ASSAD 182028N 1074053E
	XONUS 1804.2N 10714.0E
	DONGHOI
	VILAO 1718.0N 10600.0E
	SAVANNAKET
	KORAT
	BANGKOK
A204	YOROI 4500.5N 14147.1E
	RISHIRI
	AKSUN 4545.1N 14054.3E
	(SELTI) (4713.3N 14013.3E)
A206	Proposed by Vietnam and Laos
	ASSAD
	VINH
	NONGT
	LUANG PRABANG
A211	MANADO
	TARAKAN
	TAWAU
A212	PUPIS
	PAGO PAGO
	NIUE
A215	PORT MORESBY
	MERAUKE
	HASANUDDIN
	KEVOK 0425.0S 11500.0E
A216	COOKTOWN
	AKMIP 1200.0S 14448.6E
	KIKORI
	GUNNY 0500.00N 14400.00E
	RICHH 1711.49N 14249.12E
A218	HARBIN
	(EKIMCHAN)
	(MYS SHMIDTA)
	BARROW
A219	KARACHI
	NAWABSHAM
	KALAT 2902.0N 06635.0E
	SERKA 2951.0N 06615.0E
	KANDAHAR
	(TERMEZ)
A220	CLUKK 3605.0N 12450.0E
	TAHITI
A221	GUAM
	ROTA IS
	TINIAN IS
	SAIPAN
A222	GUAM
	POHNPEI
	KOSRAE
	KWAJALEIN
A224	JOHOR BAHRU
	MERSING
A325	PRARATAPGARH
	TASOP 2514.1N 07045.0E
	KARACHI

	JIWANI	
A326	SHIGEZHUANG	
	OKTON	3911.2N 11653.5E
	TIANJIN	
	MAKNO	3827.6N 12110.0E
	SANKO	3814.2N 12228.4E
	DONVO	3734.0N 12320.0E
	AKARA	3130.0N 12330.0E
A331	ZIGIE	2419.0N 15717.5W
	SEDAR	4530.4N 12643.0W
A332	APACK	2402.8N 15619.3W
	AMITY	2626.0N 15229.0W
	HEMLO	4318.2N 12640.8W
A334	HAT YAI	
	KOTA BHARU	
A337	ADKAK	3354.0N 14210.0E
	TEGOD	2100.0N 14512.0E
	JUNIE	1132.5N 14706.3E
	KISME	0500.0N 14805.4E
A338	CHRISTCHURCH	
	APORO	5000.0S 17120.0E
	BYRD	
A339	PERTH	
	CURTIN	
	ELBIS	0905.9S 12743.7E
	SHREE	0539.0N 13109.2E
	KEITH	2100.0N 13456.8E
	SABGU	2529.9N 13459.3E
	MAKDA	2716.0N 13551.2E
	TAXON	3000.0N 13714.5E
	MIYAKE JIMA	
A340	RAYONG	
	BISOR	1221.0N 10247.0E
	PHNOM PENH	
A341	KOTA KINABALU	
	SANDAKAN	
	ZAMBOANGA	
A342	COLD BAY	
	OLCOT	5125.8N 16533.3E
A344	ROZAX	0245.6S 11140.0E
	SUMBAWA	
A345	PYONGYANG	
	GOLOT	4012.5N 12430.5E
	FENGCHENG	
	KAIYUAN	
	HAILAR	
	KAGAK	4916N 11806E
	MANLI	4935N 11727E
	TELOK	4938N 11722E
	(CHITA)	
A346	HAMILTON IS	
	AUCKLAND	
A347	MUMBAI	
	BODAR	2236.3N 07413.3E
	PRATAPGAPH	
	DELHI	
A348	MELBOURNE	
	EAST SALE	
	NISEP	4146.6S 15601.5E
A364	SHACHE	
	KASHI	
	KURUM	4006.0N 07407.0E
A450	DENPASSAR	
	HASSANUDDIN	
	CAHYO	033000N 1333000E
	YAP IS	
	GUAM	
	WAKE	
	KATHS	2104.6N 16123.4W
A453	(KANDAHAR)	
	(ZAHEDAN)	
	(BANDER ABBAS)	
A454	KARACHI	
	PARET	2527.2N 06451.5E
	TAPDO	2424.0N 06120.0E
	(VUSET)	
A455	PESHAWAR	
	METAR	3406.0N 07128.0E
	KOTAL	3406.0N 07109.0E
A456	AMRITSAR	
	LAHORE	
	MOLTA	3012.0N 07236.2E
	BINDO	
A457	HAT YAI	
	TAMOS	0632.2N 10024.0E
	ALOR SETAR	
	PENANG	

	KUALA LUMPUR	
	JOHOR BAHRU	
A460	KUQA	
	REVKI	4232.5N 8013.2E
	(KIRBALTABAY)	
A461	DAWANGZHUANG	
	WEIXIAN	
	ZHOUKOU	
	HEKOU	
	LONGKOU	
	LILING	
	YINGDE	
	SHILONG	
	BEKOL	2232.6N 11408.0E
	CHEUNGCHAU	
	NOMAN	2000.0N 11640.3E
	MUMOT	1930.4N 11714.5E
	AVMUP	1843.3N 11808.3E
	SAN FERNANDO	
	CABANATUAN	
	MANILA	
	SAN JOSE	
	ZAMBOANGA	
	AMBON	
	DARWIN	
	ALICE SPRINGS	
	LEIGH CREEK	
A462	KOLKATA	
	DHAKA	
A464	CHIANG MAI	
	BANGKOK	
	HAT YAI	
	IPOH	
	BATU ARANG	
	KUALA LUMPUR	
	SINGAPORE	
	TINDAL	
	TAROOM	
	LORD HOWE IS	
	AUCKLAND	
A465	KOLKATA	
	VISHAKAPATNAM	
	CHENNAI	
	COLOMBO	
A466	(KABUL)	
	SANAM	3305.0N 07003.0E
	DERA ISMAIL KHAN	
	JHANG	3116.0N 07218.0E
	SAMAR	3120.8N 07434.0E
	ASARI	3048.3N 07509.6E
	DELHI	
A467	BIRATNAGAR	
	KATIHAR	
	KOLKATA	
A468	KUQA	
	KAMUD	4134.0N 07850.0E
A469	HO CHI MINH	
	CONSON IS	
A470	HONG KONG	
	MAGOG	2217.3N 11549.4E
	SHANTOU	
	XINGLIN	
	FUZHOU	
	YUNHE	
	TONGLU	
	HANGZHOU	
	LISHUI	
	BANTA	
	PIXIAN	
A472	KOTAL	3406.0N 07109.0E
	METAR	3406.0N 07128.0E
	BAREV	3406.0N 07135.0E
	PESHAWAR	
A474	DELHI	
	ASOVO	
	MUMBAI	
	MURUS	0600.0S 06319.7E
	(PLAISANCE)	
A575	PYONGYANG	
	GOLOT	4012.5N 12430.5E
	FENGCHENG	
	DONGYANGJIAO	
	DAHUSHAN	
	CHAOYANG	
	ANDIN	4106.0N 11843.5E
	GUBEIKOU	
	FENGNING	
	EREN	
	INTIK	4341.5N 11155.0E
	SAINSHAND	
	ULAN BATOR	
	(KYZYL)	

A576	MEDAN	
	SINGAPORE	
	DENPASAR	
	CURTIN	
	ALICE SPRINGS	
	PARKES	
	SYDNEY	
A577	SHIKANG	
	KADET	2100.0N 11934.0E
A578	TONIK	3200.0N 14600.0E
	PHONPEI	
	NAURU	
	TARAWA	
	NADI	
	AUCKLAND	
A579	SYDNEY	
	NADI	
	CARRP	1904.4N 15935.0W
A580	AUCKLAND	
	NAUSORI	
	APIA	
A581	BAGO	
	CHIANG MAI	
	CHIANG RAI	
	PONUK	2018.8N 10023.0E
	SAGAG	2111.5N 10137.4E
	BIDRU	
	KUNMING	
	MAGUOHE	
	QIANXI	
	HUAYUAN	
	LINLI	
	WUHAN	
A582	JOMALIG	
	CHINEN	
	KAGOSHIMA	
	IKISHIMA	
	PUSAN	
	SEOUL	
A583	HONG KONG	
	SABNO	1859.1N 11550.7E
	MAVRA	1814.4N 11615.1E
	AKOTA	1706.6N 11651.6E
	IBOBI	1354.4N 11832.6E
	REKEL	1324.1N 11848.3E
	LEGED	1301.9N 11859.6E
	TOKON	1142.0N 11940.3E
	ZAMBOANGA	
A584	TONGA	
	NIUE	
	APIA	
	FUNAFUTI	
	NAURU	
A585	PALEMBANG	
	JAKARTA	
	PORT HEDLAND	
	CEDUNA	
	ADELAIDE	
A586	INTOS	3722.00N 13120.00E
	PUSAN	
	CHEJU	
	ERABU	
	NAHA	
A587	SUMBAWA	
	ALICE SPRINGS	
A588	DALIAN	
	WAFANGDIAN	
	WANGBINGOU	
	KAIYUAN	
	CHANGCHUN	
	HARBIN	
	SIMLI	5017.4N 12722.1E
A589	DELHI	
	BUTOP	2919.7N 07523.9E
	ASARI	3048.3N 07509.5E
A590	MANILA	
	JOMALIG	
	MINAMI DAITO	
	MIYAKEJIMA	
	KAGIS	3549.0N 14234.0E
	PABBA	3700.0N 14400.0E
	PASRO	1417.1N 16040.5E
	(AMOTT)	6054.0N 15121.6W
A591	QINDAO	
	XUEJIADAO	
	LATUX	3532.0N 12044.0E
	MUDAL	3651.0N 12322.0E
	AGAVO	3710.0N 12400.0E
A592	PUPIS	1000.0S 17105.5W
	APIA	
	VAVA'U	

	TONGA	
A593	TANGHEKOU	
	XILIUHETUN	
	SHIGEZHUANG	
	POTOU	
	PIXIAN	
	WUXI	
	SHANGHAI	
	NANHUI	
	FUKUE	
A595	FUKUOKA	
	IKISHIMA	
	CHEJU	
A596	HUAIROU	
	HUAILAI	
	TIANZHEN	
	LIANGCHENG	
	BAOTOU	
	DENGKOU	
	YABRAI	
A597	GOBOH	
	KUSHIMOTO	
	MONPI	2100.0N 14036.0E
	GUAM	
	NOUMEA	
	AUCKLAND	
A598	BRISBANE	
	HONIARA	
	NAURU	
	MAJURO	
A599	CHITTAGONG	
	LINSO	2322.5N 09855.0E
	GENGMA	
	KUNMING	
	LUXI	
	BOSE	
	LAIBIN	
	GAOYAO	
	PINGZHOU	
	ZHULIAO	
	WONGYUAN	
	NANXIONG	
	GANZHOU	
	NANFENG	
	SHANGRAO	
	TONGLU	
	NANXUN	
	SHANGHAI	
A791	(IMLOT)	
	JIWANI	
	KARACHI	
	PRATAGARH	
	BHOPAL	
	JAMSHEDPUR	
	KOLKATA	
B200	ENKIP	3547.0S 17730.0E
	FICKY	3133.6N 12123.5W
B202	UBON	
	PAKSE	
	PLEIKU	
B203	KATHMANDU	
	BAGDOGRA	
	GUWAHATI	
	SILCHAR	
	IMPHAL	
	LASHIO	
B204	GOMES	1324.0N 10135.3E
	SIEM REAP	
B205	RAYONG	
	BOKAK	1257.5N 10230.0E
	SIEM REAP	
B206	URUMQI	
	FUKANG	
	ALTAY	
	GOPTO	4905.5N 08728.0E
	(AKTASH)	
B209	JAMSHEDPUR	
	KHAJURAHO	
	TIGER	2828.8N 07214.9E
B210	TASOP	2513.3N 07048.9E
	NAWABSHAH	
B211	MUMBAI	
	EPKOS	1653.1N 07407.2E
	CHENNAI	
B213	LHASA	
	CHENGDU	
B214	NASAN	
	LADON	2106.2N 10258.0E
	AKSAG	2049.1N 10027.3E
B215	DAWANGZHUANG	

	TAIYUAN	
	YINCHUAN	
	YABRAI	
	JIUQUAN	
	HAMI	
	FUKANG	
	URUMQI	
	KUQA	
	SHACHE	
	HONGQILAPU	
	PURPA	3656.5N 07524.5E
	GILGIT	
	ISLAMABAD	
B218	KUNMING	
	SIMAO	2243.1N 16058.2E
	SAGAG	2111.5N 10137.4E
	VIENTIANE	
	LOEI	
	CHUM PHAE	
B219	PENANG	
	KOTA BHARU	
B220	BRISBANE	
	PORT MORESBY	
B221	NINAS	3100.0N 12215.0E
	PINOT	3125.2N 12214.2E
	SAGUT	3500.0N 12040.3E
	XUEJIADAO	
B222	VINIK	0838.6N 11613.8E
	KOTA KINABALU	
B223	(DABUR	5147.1N 14235.9E)
	LUMIN	4545.0N 14150.3E
	WAKKANAI	
B326	HONIARA	
	CHOKO	2022.6N 16053.0W
B328	EREN	
	TAMURTAI	
	TIANZHEN	
	NANCHENGZI	
	WEIXIAN	
B329	PHNOM PENH	
	PAKSE	
	VILAO	1722.0N 10605.0E
	NAM HA	2023.2N 10607.1E
B330	HONG KONG	
	TAMOT	
	PINGZHOU	
	GAOYAO	
	DOUJIANG	
	QUIANXI	
	FUJIACHANG	
	JINGTAI	
	YABRAI	
	MORIT	4202.0N 10249.0E
	NIDOR	5029.4N 09125.8E
	(LIKAR)	
B331	CHEUNG CHAU	
	KAPLI	2110.0N 11730.0E
	HENGCHUN	
B332	SANKO	3814.2N 12228.4E
	TOMUK	3843.0N 12400.0E
	PYONGYANG	
	SINSONGCHON	
	SONDO	3947.0N 12713.6E
	KANSU	3838.0N 13228.5E
B333	AUCKLAND	
	PORT MORESBY	
B334	BEIJIN	
	TANGHEKOU	
	FENGNING	
	TONGLIAO	
B337	(TAKHTOYAMSK)	
	ANIMO	4508.3N 14337.8E
	ASAHIKAWA	
B338	MERSING	
	TEKONG	
	ANITO	0017.0S 10452.0E
B339	ULAN BATOR	
	POLHO	4447.0N 11315.0E
	FENGNING	
B345	KATHMANDU	
	BHARATPUR	
	BHAIRAHAWA	
	LUCKNOW	
B346	LUANG PRABANG	
	NOBER	1516.6N 10040.1E
	BANGKOK	
B348	HENGCHUN	
	POTIB	2100.0N 12045.5E

	LAOAG	
	SAN FERNANDO	
	MANILA	
	TOKON	1142.0N 11940.3E
	PUERTOPRINCESA	
	OSANU	0741.4N 11717.6E
	KOTA KINABALU	
	BRUNEI	
	KAMIN	0235.1N 10855.7E
	SABIP	0209.7N 10750.5E
	TOMAN	0121.5N 10547.0E
B349	BALI	
	POTIP	2141.6S 12508.0E
B450	SYDNEY	
	LORD HOWE IS	
	NORFORK IS	
	PAGO PAGO	
B451	HAILAR	
	QIQIHAR	
	HARBIN	
	BISUN	4314.0N 13111.8E
	(VLADIVOSTOK)	
	IGROD	4139.0N 13647.0E
	KADBO	3914.0N 13745.0E
B452	TONIK	3200.0N 14600.0E
	HONIARA	
	NADI	
B453	MIDDLETON IS	
	KATCH	5400.0N 13600.0W
	DAASH	4226.5N 12600.1W
B454	PAGO PAGO	
	RAROTONGA	
	TONYS	3019.9N 12249.2W
B455	VAVA'U	
	NISEX	1547.3S 17136.4W
B456	WEWAK	
	JAYAPURA	
B459	MUMBAI	
	CLAVA	0134.0N 06000.0E
	(PRASLIN)	
B460	KHORAT	
	SAVANNAKET	
B462	MACKAY	
	HAMILTON IS.	
	PORT MORESBY	
	KADAB	0458.0S 14100.0E
	BIDOR	0400.0S 13130.0E
	TACLOBAN	
	MANILA	
	CABANATUAN	
	LAOAG	
	MIYAKO JIMA	
	OKINAWA	
B463	BAGO	
	MANDALAY	
	LASHIO	
B465	KOLKATA	
	CHITTAGONG	
	MANDALAY	
	LUANG PRABANG	
	HANOI	
B466	JOHOR BAHRU	
	BATU ARANG	
	CHENNAI	
	MUMBAI	
B467	KANGWON	
	INTOS	3722.0N 13120.0E
	KANSU	3838.0N 13228.5E
	NULAR	4059.2N 13411.0E
	(TEKUK)	4241.0N 13527.4E
B468	DIENBIEN	
	LADON	2106.2N 10258.0E
	LUANG PRABANG	
B469	SINGAPORE	
	JAKARTA	
	CARNARVON	
	GERALDTON	
	PERTH	
	CAIGUNA	
	WHYALLA	
	GRIFFITH	
	SYDNEY	
B470	SINGAPORE	
	PANGKALPINANG	
	JAKARTA	
B472	LIPA	
	ILO ILO	
	COTABATO	
	SELSO	0400.0N 12616.0E

	TOREX	0724.0N 13335.0E
	GOVE	
	NORMANTON	
B473	LIPA	
	ROXAS	
	CAGAYAN-DE-ORO	
	DAVAO	
	SADAN	0400.0N 12805.0E
	CAIRNS	
B474	SYDNEY	
	SANTO	
	NANUMEA	
	CHOKO	2022.6N 16053.0W
B480	(RAZDOLITE)	
	LETBI	5011.9N 10330.6E
	BULGAN	
	MORIT	4202.0N 10249.0E
B575	AUCKLAND	
	TONGA	
	PAGO PAGO	
B576	TAIBEI	
	CHEJU	
	SEOUL	
B577	NADI	
	WALLIS IS	
	APIA	
	PAGO PAGO	
	FICKY	3133.5N 12123.5W
B578	BRISBANE	
	NOUMEA	
	TAHITI	
B579	PHUKET	
	LANGKAWI	
	PENANG	
B580	SYDNEY	
	NOUMEA	
	CHOKO	2022.6N 16053.0W
B581	NADI	
	FICKY	3133.5N 12123.5W
B583	BRUNEI	
	DARWIN	
B584	DENPASAR	
	ELANG	0056.0S 11449.5E
	KOTA KINABALU	
B586	NOUMEA	
	SEKMO	
	KAPKI	
	PORT MORESBY	
	GUAM	
	OMLET	2100.0N 14259.2E
	TATEYAMA	
B587	ST GEORGE	
	KOWANYAMA	
	OPABA	0851.5S 13804.0E
	TIMIKA	
	BIAK	
	RENAN	0330.0N 13416.6E
	ENDAX	1415.0N 13000.0E
	ATVIP	2100.0N 12422.0E
	HUALIEN	
B589	PORT MORESBY	
	KAPKI	1014.9S 14817.7E
	BUKA	
	MAJURO	
B590	NOUMEA	
	PORT VILA	
	NAURU	
B591	SHANGHAI	
	TAIBEI	
	HENCHUN	
	(Partially implemented)	
B592	KOTA KINABALU	
	JAKARTA	
B593	KOLKATA	
	COMILLA	
	AGARTALA	
	GUWAHATI	
B595	TAHITI	
	KONA	
B596	RAROTONGA	
	DOVRR	1843.0N 15740.0W
B597	ERABU	
	TANEGASHIMA	
	SHIMIZU	
B598	DARWIN	
	THURSDAY ISLAND	
	PORT MORESBY	

	KAPKI	1014.9S 14817.7E
	HONIARA	
	PORT VILA	
	NADI	
	NAUSORI	
	TONGA	
	RAROTONGA	
B599	NOUMEA	
	NADI	
	TAHITI	
B757	KATCH	5400.0N 13600.0W
	CAPE NEWENHAM	
	NULUK	5822.9N 17706.1W
B932	BAMOK	5625.5N 17249.3E
	(NETRI	4739.3N 15000.0E)
	ODERI	4439.0N 14515.2E
	MEMANBETSU	
G200	CHRISTMAS IS.	
	COCOS IS	
	(PLAISANCE)	
G202	(KANDAHAR)	
	ZHOB	
	RAHIM YAR KHAN	
G203	MIHO	
	PUSAN	
G204	ELNEX	
	SHENGXIAN	
	METAN	
	SHANGHAI	
G205	HAMILTON IS.	
	GURNEY	
	JUNIE	
G206	DILARAM	
	KABUL	
	SABAR	
	PURPA	
G208	MUMBAI	
	PARTY	2414.6N 07052.0E
	KARACHI	
	PANJGUR	
	(ZAHEDAN)	
G209	LAERMONTH	
	CHRISTMAS ISLAND	
	PALEMBANG	
G210	PANJGUR	
	KARACHI	
	MUMBAI	
G212	(KHABAROVSK)	
	ARGUK	4753.5N 13439.4E
	HAIQING	
	JIAMUSI	
	HARBIN	
	TONGLIAO	
	GUBEIKOU	
	QINBAIKOU	
	NANCHENGZI	
	TAIYUAN	
	YIJUN	
	SANYUAN	
	XIAOYANZHUANG	
	NINGSHAN	
	WUFENGXI	
	FUJIACHANG	
	WEINING	
	MAGUOHE	
	KUNMING	
G213	BIAK	
	BEKUB	0350.0N 13845.0E
	GUAM	
G214	JIWANI	
	PANJGUR	
	RAHIM YAR KHAN	
	MOLTA	3012.0N 07236.2E
G215	DUTCH HARBOR	
	OLCOT	5125.8N 16533.3E
G216	(DORAB)	
	ALPOR	2404.7N 06120.0E
	LATEM	2431.7N 06449.7E
	KARACHI	
G218	HOHHOT	
	TUMURTAI	
	POLHO	4447.0N 11315.0E
	SOLOK	4954.0N 11545.0E
G219	VIRUT	0230.8N 10402.7E
	TEKONG	
G221	PHUCAT	
	BUNTA	1650.0N 10923.7E
	BAOLONG	

	HAIKOU	
	SAMAS	
	SIKOU	
G222	SAPDA	
	BROOME	
	AYERS ROCK	
	PARKES	
G223	TATEYAMA	
	TONIK 3200.0N 14600.0E	
	NAURU	
	NADI	
	NAUSORI	
	NIUE	
	AITUTAKI	
	TAHITI	
	(LIMA)	
G224	NORFORK IS	
	NADI	
	PAGO PAGO	
	TAHITI	
	ISLA DE PASCUA	
	(SANTIAGO)	
G325	COLOMBO	
	TIRUCHCHIRAPPALLI	
G326	BALI	
	TENNANT CREEK	
	BRISBANE	
G327	NANHUI	
	NINAS	3100.0N 12215.0E
	AKARA	3130.0N 12330.0E
G329	BRISBANE	
	NORFORK IS	
G330	SHANGHAI	
	POMOK	
	NANTONG	
	GURNI	3209.2N 12058.5E
	PIMOL	3215.0N 11944.0E
G331	PHUKET	
	PADET	
	DAWEI	
G332	TANGHEKOU	
	CHAOYANG	
G333	DELHI	
	ESDEM	
	TIGER	2828.8N 07214.9E
G334	KUALA LUMPUR	
	TIOMAM	
	BUNTO	0242.0N 10600.0E
	DOTAS	0201.1N 10820.5E
	SIBU	
G335	KATHMANDU	
	JANAKPUR	
	PATNA	
G336	DHANBAD	
	PATNA	
	SIMRA	
	KATHMANDU	
G337	PERTH	
	CHRISTMAS IS	
	PEKANBARU	
G338	CHOIBALSAN	
	KAGAK	
G339	PUSAN	
	FUKUOKA	
	KAGOSHIMA	
	TANEGASHIMA	
	PAKDO	
	GUAM	
G340	QINGBAIKOU	
	HUAILAI	
G341	CHANGCHUN	
	WANGQING	
G342	CAIRNS	
	HONIARA	
G344	COMFE	3624.0N 14618.0E
	CUTEE	4624.9N 16218.6E
	CUDDA	5647.9N 16018.1W
G345	UNTAN	
	CHANGZHOU	
	LISHUI	
G346	KIMCHAEK	
	NULAR	4059.2N 13411.0E
	IGROD	4139.0N 13647.0E
G347	AUCKLAND	
	POPIR	2500.0S 17804.8W
	PADDI	1825.7N 15854.8W

G348 PARO
BAGDOGRA
MECHI
KATHMANDU

G424 (DAR ES SALAAM)
VUTAS 0912.0N 06000.0E
ALATO 1340.7N 06344.0E

G450 (MOGADISHU)
MUMBAI
NAGPUR
KOLKATA

G451 AHMEDBAD
SASRO 2404.3N 07100.0E
PARTY 2414.6N 07052.0E

G452 (ZAHEDAN)
RAHIM YAR KHAN
TIGER 2828.8N 07214.9E
DELHI

G453 KUALA LUMPUR
KOTA BHARU

G454 (PLAISANCE)
BOBOD 0600.0S 06941.1E
PADLA 0446.1N 07800.0E
COLOMBO

G455 SHANGHAI
PINOT 3125.2N 12214.2E
AKARA 3130.0N 12330.0E

G457 DOVRR 1843.0N 15740.0W
ELLMS 0500.0S 16704.1W
PAGO PAGO
FAROA 2500.0S 17502.3W
DIVSO 3452.3S 17624.5E

G458 BANGKOK
SURAT THANI
PHUKET

G459 CAIRNS
TIMIKA

G460 KUCHING
SIBU
BINTULU
BRUNEI

G463 RAJSHAHI
DHAKA
CHITTAGONG
BAGO
BETNO 1505.8N 09812.7E
BANGKOK

G464 PONTIANAK
ROZAX 0245.0S 11140.0E
BALI
KARRATHA
BALLIDU
PERTH

G465 (PRASLIN)
MALE
COLOMBO

G466 HO CHI MINH
PHUCAT
HENGCHUN

G467 LUBANG
JOMALIG
GUAM

G468 PENANG
MEDAN

G469 PORT HEIDEN
ST PAUL IS
NYMPH 5324.5N 16814.4E

G470 XIANYANG
FENGHUO
CHANGWU
JINGNING
JINGTAI
QITAI

G471 SHILONG
LONGMEN
GANGZHOU

G472 KARACHI
AHMEDABAD
NAGPUR
BHUBANESHWAR
PATHEIN
BAGO

G473 BAGO
MAKAS 1649.7N 09830.0E
PHITSANULOKE
UBON

G474 BANGKOK

	MENAM	1357.3N 10247.7E
	SOURN	1345.5N 10600.0E
	ANINA	1359.0N 10725.0E
	PHUCAT	
G575	TAHITI	
	RANGIROA	
	FICKY	3133.5N 12123.5W
G576	CHEER	5310.0N 14000.1W
	SPONJ	4992.0N 13005.1W
G578	GURAG	2100.0N 12725.0E
	DILIS	1431.0N 12600.0E
	TACLOBAN	
	MACTAN	
	ZAMBOANGA	
	DENPASAR	
	PORT HEDLAND	
	PARABURDOOD	
	PERTH	
G579	JAKARTA	
	PALEMBANG	
	SINGAPORE	
	JOHOR BAHRU	
G580	TOMAN	0121.5N 10547.0E
	NIMIX	0124.9N 10759.2E
	ATETI	0125.7N 10830.1E
	KUCHING	
	MIRI	
	BRUNEI	
G581	HONG KONG	
	ELATO	2220.0N 11730.0E
	HENGCHUN	
	MIYAKO JIMA	
	BISIS	2647.0N 12633.0E
	ERABU	
	MIYAKE JIMA	
G582	PUGER	0324.1N 10017.6E
	BATU ARANG	
	PEKAN	
G583	EMMONAK	
	BESAT	5945.0N 17925.1W
	(UST-BOLSHERETSK)	
	BISIV	4456.3N 14412.3E
	MONBETSU	
G584	KUALA LUMPUR	
	PEKAN	
	KUCHING	
G585	MIHO	
	POHANG	
	SEOUL	
G586	YINGDE	
	ERTANG	
G587	TAIBEI	
	PABSO	2538.0N 12252.0E
	BULAN	2704.0N 12400.0E
G588	MOOREN	
	KHOVD	
	TEBUS	4725.1N 09027.7E
	TESAN	4701.7N 08947.8E
	FUKANG	
G590	SIMRA	
	VARANASI	
	KHAJURAHO	
	BHOPAL	
	INDORE	
	BODAR	2236.3N 07413.3E
G591	CAIRNS	
	NOUMEA	
	NORFORK IS	
	AUCKLAND	
G593	FUNAFUTI	
	NAUSORI	
	NIUE	
	RAROTONGA	
G594	TIAMU	
	TAHITI	
	RAROTONGA	
	AUCKLAND	
	SOLIT	2355.0S 07500.0E
	(PLAISANCE)	
G595	(TAHITI)	
	SYDNEY	
	MABAD	2648.4S 07500.0E
	(PLAISNACE)	
G597	DONVO	3734.0N 12320.0E
	AGAVO	3710.0N 12400.0E
	SEOUL	
	KANGNUNG	
	MIHO	
	OTSU	

	KOWA	
	OSHIMA	
	VENUS	3618.2N 14042.1E
G598	LUCKNOW	
	APIPU	2658.6N 08300.0E
	SIMARU	
G599	AUCKLAND	
	TAHITI	
R200	PINGZHOU	
	LIANSHENGWEI	
	BIGRO	
	ZHANJIANG	
R201	BANGKOK	
	UTAPAO	
R203	SAPAM	0804.6N 09733.0E
	PHUKET	
R204	KEITH	2100.0N 13456.5E
	KALIN	0000.0N 14200.0E
	LIDIT	0918.0S 14220.0E
	HORN IS	
	CAIRNS	
R205	ANARAK	
	BIRJAND	
R206	PORT HEDLAND	
	CHRISTMAS IS	
	JAKARTA	
R207	VIENTIANE	
	NAN	
	CHIANG MAI	
	MANDALAY	
R208	KUALA LUMPUR	
	KUALA TRENGGANU	
	KANTO	0649.9N 10348.3E
R209	TATOX	0857.0N 09702.0E
	LANGKAWI	
R210	PORT MORESBY	
	CAIRNS	
R211	KASMI	3601.3N 14040.3E
	DAIGO	
	NIIGATA	
	KADBO	3914.0N 13745.4E
	AVGOK	4336.0N 13815.0E
	VELTA	4529.0N 13710.0E
R212	(DIEGO GARCIA)	
	GUDUG	0704.6S 07500.0E
	PIBED	0520.2S 09044.0E
R215	CHIANG RAI	
	NAN	
	LUANG PRABANG	
R217	NODAN	4025.0N 14500.0E
	SENDAI	
	NIIGATA	
R218	DELHI	
	DIPAS	2738.3N 07551.9E
	JAIPUR	
R220	DAIGO	
	IWAKI	
	NANAC	3854.2N 14313.9E
	NIPPI	4942.6N 15920.8E
	NODLE	6117.0N 15200.0W
R221	MERSING	
	PULAU TIOMAN	
R222	AVGOK	4336.0N 13815.0E
	(YEDINKA)	
R223	BRUNEI	
	ELANG	0056.0S 11449.5E
R325	KATHMANDU	
	JANAKPUR	
	DUMKA	2411.0N 08721.3E
	KOLKATA	
	PHUKET	
	HAT YAI	
	IPOH	
	JOHOR BAHRU	
R326	NORFOLK IS	
	CHRISTCHURCH	
R327	GISBORNE	
	FAROA	
R329	KAGLU	1231.2N 07200.0E
	MALE	
	GAN	
	(DIEGO GARCIA)	
R330	SHEMYA	
	POWAL	5024.3N 16530.8E

R332	MAJURO	
	BONRIKI	
	AKUMO	0614.9S 17535.5E
	ROTUMA	
	NADI	
R334	RAYONG	
	KOH KONG	
	SIHANOUK	
	PADMA	1025.8N 10402.3E
	PHU QUOC	
R336	ADAK	
	CARTO	4840.5N 16847.0E
R337	TACLOBAN	
	KOROR	
R338	NOME	
	NINNA	5455.7N 17158.8E
R339	SIKOU	2050.6N 11130.0E
	HUGUANG	
	NANNING	
	BOSE	
R340	AMBON	
	WALGETT	
R341	KODIAK	
	NINNA	5455.7N 17158.8E
R342	MANADO	
	BONDA	0200.0N 12451.2E
	PEDNO	0400.0N 12521.0E
	GENERAL SANTOS	
	DAVAO	
R343	NANXIANG	
	WUXI	
	LISHUI	
	HEFEI	
	WUHAN	
	LONGKOU	
	LAOLIANGCANG	
	DARONGJIANG	
	LAIBIN	
	NANNING	
R344	KATHMANDU	
	BIRATNAGAR	
	KATIHAR	
	RAJSHAHI	
R345	ROIET	
	BIDEM	142153.57N 1034750.07E
	SIEM REAP	
R346	TOWNSVILLE	
	PORT MORESBY	
R347	NIIGATA	
	SADO	
	EKVIK	3944.7N 13636.5E
	IGROD	4139.0N 13647.0E
	(VELTA)	4529.0N 13710.0E
R348	KADAP	0200.0S 08409.6E
	LATEP	0610.3S 07500.0E
	(DIEGO GARCIA)	
R349	LEMOK	1000.0N 10302.2E
	RASER	1000.0N 10506.0E
	HO CHI MINH	
R450	KIETA	
	HONIARA	
R451	ADAK	
	OGDEN	4929.2N 16102.3E
R452	SONDO	3947.0N 12713.6E
	HAMUN	3955.1N 12731.1E
	KIMCHAEK	
	UAMRI	4217.6N 13041.8E
	(TEKUK)	4241.0N 13527.4E
R453	NADI	
	APIA	
R455	PONTIANAK	
	KUCHING	
R458	MUMBAI	
	EPKOS	1653.0N 07407.2E
	BELGAUM	
R457	CHENNAI	
	TIRUCHCHIRAPPALLI	
	MADUDAI	
	TRIVANDRUM	
	MALE	
R460	DELHI	
	ALIGARH	
	LUCKNOW	
	VARANASI	

	GAYA	
	KOLKATA	
R461	MUMBAI	
	MABTA	1708.5N 07321.8E
	BELGAUM	
	COIMBATORE	
	COLOMBO	
	MEDAN	
	KUALA LUMPUR	
R462	(SEEB)	
	DENDA	2442.5N 06054.8E
	JIWANI	
	KARACHI	
	UPAIPUR	
	DELHI	
R463	APACK	2402.6N 15619.2W
	ALCOA	3750.0N 12550.0W
R464	BITTA	2332.0N 15529.0W
	BEBOP	3700.0N 12500.0W
R465	CLUTS	2300.0N 15439.0W
	CLUKK	3605.0N 12450.0W
R467	KUALA LUMPUR	
	GUNIP	0429.9N 09931.9E
R468	BANGKOK	
	BOKAK	1257.5N 10230.0E
	PHNOM PENH	
	SAPEN	1102.2N 10611.0E
	HO CHI MINH	
R469	PEKANBARU	
	SINGAPORE	
R470	VIENTIANE	
	UDON THANI	
	KHON KAEN	
R472	KOLKATA	
	RAJSHAHI	
	GUWAHATI	
R473	LILING	
	NANXIONG	
	WONGYUANG	
	ZHULIAO	
	PINGZHOU	
	TAMOT	2221.5N 11352.0E
R474	GAOYAO	
	NANNING	
	LONGZHOU	
	HANOI	
	VIENTIANE	
	BANGKOK	
R575	PAPRA	1546.0N 10711.0E
	KOH KONG	
	UPNEP	0942.2N 10029.6E
	SURAT THANI	
R576	DENNS	2222.0N 15353.0W
	DINTY	3329.0N 12235.0W
R577	EBBER	2143.0N 15309.0W
	ELKEY	3241.0N 12203.0W
R578	FITES	2049.0N 15300.0W
	FICKY	3133.5N 12123.5W

(R579 in Chapter 2)

R580	OATIS	3800.0N 14345.0E
	OMOTO	4859.7N 16000.7E
	AMOTT	6053.9N 15121.8W
R581	KOLKATA	
	MONDA	2521.0N 08626.4E
	SIMARA	
R582	NORFOLK IS	
	RAROTONGA	
R583	TAIBEI	
	BISIS	2647.1N 12633.1E
	OKINAWA	
	MINAMIDAITO	
	SABGU	
	BUNGO	
R584	OKINAWA	
	KEITH	2100.0N 13456.5E
	GUAM	
	TRUK	
	POHNPEI	
	KWAJALEIN	
	MAJURO	
	JOHNSTON IS	
	CHOKO	2022.9N 16053.2W
R585	CITTA	2818.9N 14507.2W
	GATES	3412.7N 12303.9W
R587	BRISBANE	
	PORT VILA	

R588 PHUKET
RELIP
PHNOM PENH
PLEIKU

R590 AMBON
COTABATO

R591 CAPE NEWENHAM
AKISU 4734.3N 16119.3E
ABETS 3605.0N 14425.0E

R592 BALI
ONSLOW
PERTH

R594 LUCKNOW
JALALABAD
DELHI

R595 ANPU
MIYAKO JIMA
KEITH 2100.0N 13456.5E
GUAM

R597 CABANATUAN
SARSI 1642.0N 12316.9E
SKATE 1716.7N 12423.0E

R598 KOLKATA
RAJSHAHI
SAIDPUR
COOCH BEHAR
BOGOP
PARO

R599 KIETA
GIZO
HONIARA
PORT VILA
WHANGAREI
AUCKLAND

RNAV ROUTES

L301 BANGKOK
DAWEI
VISHAKHAPATNAM
BUSBO 1914.9N 07807.6E
NOBAT 2109.0N 06800.0E
RASKI 2303.5N 06352.0E
(VAXIM 2319.0N 06111.0E)

L333 KHAJURAHO
JAIPUR
TIGER 2828.8N 07214.9E

L500 (SANTIAGO)
AUCKLAND

L501 (RIO GALLEGOS)
AUCKLAND

L502 ISLA DE PASCUA
(LOS ANGELES)

L503 BRISBANE
IGEVO 3636.5S 16300.0E
CHRISTCHURCH

L504 SINGAPORE
MANADO

L505 BUSBO 1914.9N 07807.6E
KAMOL 1938.1N 07340.0E
NOBAT 2109.0N 06800.0E

L507 KOLKATA
BAGO
BANGKOK

L508 RAROTONGA
CHRISTCHURCH
MELBOURNE

L509 GAYA
ASARI 3048.3N 07509.5E

L510 IBANI 250000N 0764311E
ELBAB 201333N 0815954E
LEKIR 071632N 0965243E
GIVAL 070000N 0980000E

L512 INTOS 3722.0N 13120.0E
NIIGATA

L513 PERTH
HOBART
AUCKLAND

L515 OBMOG 1154.1N 09623.5E
IKULA 1000.0N 09721.2E
PHUKET

L516 KITAL 2003.0N 06018.0E
ELKEL 0149.0N 06911.0E
(DIEGO GARCIA)

L517 MIRI

	GULIB	0409.3N 11028.1E
	TERIX	0415.4N 10934.9E
L518	HIA 171340.1N0782420.9E	
	BBZ 163118.3N0804733.7E	
	GOPNU 155112N0820224E	
	EGOLU 141858N0844952E	
	SADAP 120605.6N0884120.8E	
L521	SYDNEY	
	AUCKLAND	
L625	LUSMO	0333.7N 10655.7E
	AKMON	0812.8N 11013.4E
	ALDAS	1056.9N 11212.3E
	ANOKI	1222.0N 11315.0E
	ARESI	1358.4N 11427.0E
	AKOTA	1706.6N 11651.6E
	AVMUP	1843.3N 11808.3E
	POTIB	2100.0N 12045.5E
L628	LUBANG	
	IBOBI	1354.4N 11832.6E
	GUKUM	1356.8N 11637.2E
	ARESI	1358.4N 11427.0E
	MESOX	1358.4N 11427.0E
	DAMEL	1358.7N 11130.6E
	VEPAM	1358.0N 11000.0E
	PHUCAT	
L629	PEKAN	
	DOLOX	0448.7N 10522.9E
L635	PEKAN	
	MABLI	0417.3N 10612.9E
L637	BITOD	0715.3N 10612.9E
	TANSONNHET	
L642	CHEUNG CHAU	
	EPDOS	1900.0N 11333.3E
	ENBOK	1833.4N 11329.5E
	EGEMU	1700.0N 11217.0E
	VEPAM	1358.0N 11000.0E
	PHANTHIET	
	CONSON IS	
	ESPOB	0700.0N 10533.4E
	ENREP	0452.4N 10414.8E
	MERSING	
L643	TANSONNHET	
	CONSON	
L644	CONSON	
	JAKARTA	
L645	COLOMBO	
	SULTO	0738.6N 08801.9E
	SAMAK	0758.7N 09425.0E
	SAPAM	0804.6N 09733.0E
	PHUKET	
L626	KATHUMANDU	
	ONISA	2858.1N 08005.5E
	DELHI	
L756	CLAVA	
	MALE	
L759	DELHI	
	POSIG	2713.0N 07734.9E
	AGRA	
	KHAJURAHO	
	PHUKET	
L760	AGRA	
	GURTI	2743.8N 07747.8E
	DELHI	
L774	(PLAISANCE)	
	LELED	116.5S 07500.0E
	ELATI	0200.0S 08957.7E
	KETIV	0042.0S 09200.0E
	MEDAN	
L888	BIDRU	2243.1N 10057.9E
	NIVUX	2600.0N 10000.0E
	SANLI	3200.0N 10000.0E
	TEMOL	3527.1N 09412.2E
	TONAX	3745.5N 09011.3E
	KUCA VOR (KCA)	
L894	KITAL	2003.0N 06018.0E
	MALE	
	SUNAN	0028.7S 07800.0E
	DADAR	0200.0S 07927.1E
	PERTH	
L896	SAPDA	1200.0S 11125.6E
	NISOK	0302.9N 09200.0E
	DUGOS	0853.1N 08447.9E

CHENNAI

L897 CHRISTMAS ISLAND
KETIV 0042.0S 09200.0E
COLOMBO

L899 HANIMAADHOO
TRIVANDRUM

M300 (EMURU 2215.6N 05849.8E)
LOTAV 2037.0N 06057.0E
CALICUT
MADURAI
SALAX 0212.4N 10133.7E

M501 GUAM
LIMLE 1639.7N 13000.0E
SKATE 1722.2N 12425.6E
LAOAG
NOMAN 2000.0N 11640.3E

M502 BANGKOK
AKATO 1337.3N 09910.3E
LALIT 1252.4N 09225.1E

M504 ALPOR 2404.7N 06120.0E
NODER 2350.0N 06700.0E
TELEM 2402.0N 06846.0E

M505 BUON MA THUOT
MONDULKIRI
SIEM RIEP

M510 CAN THO
PHNOM PENH

M512 COLOMBO
ANIVE 0540.9N 07800.0E
MALE

M520 SERNA 5018.5N 10628.1E
POLHO 4447.0N 11315.0E

M522 VINIK 0838.5N 11613.8E
KOTA KINABALU
MAMOK 0405.1N 11547.2E
DENPASAR

M625 MELBOURNE
WELLINGTON

M626 KOTA BHARU
DAWEI
BAGO

M635 SINGAPORE
RAMPY 0615.0 11320.8E
CURTIN

M638 DOSTI 2558.0N 06503.0E
KARACHI
MINAR 2350.0N 06800.0E
SAPNA 2330.0N 06750.0E
NOBAT 2109.0N 06800.0E
MUMBAI

M639 IGEVO 3636.5S 16300.0E
WELLINGTON

M641 MADURAI
BIKOK 0817.0N 07836.0E
COLOMBO
COCOS IS
PERTH

M643 HOBART
CHRISTCHURCH

M644 RAYONG
KOTA BHARU

M750 KILOG 2152.5N 11441.6E
ENVAR 2159.5N 11730.0E
MOLKA 2639.5N 12400.0E
MOMPA 3050.5N 12955.1E
MANEP 3242.9N 13340.0E
SOPHY 3327.2N 13721.9E
MIYAKE JIMA

M751 MERSING
PEKAN
KOTA BHARU
REGOS 1200.0N 10035.1E
BANGKOK

M753 ENREP 0452.4N 10414.8E
BITOD 0715.3N 10407.3E
PHUQUOC
CAMPU 1030.0N 10402.3E
PHNOM PENH

M754 BRUNEI

	VINIK	0838.6N 11613.8E
	TENON	0915.3N 11616.5E
	LULBU	1104.7N 11624.4E
	NOBEN	1234.4N 11631.1E
	GUKUM	1356.8N 11637.2E
	AKOTA	1706.6N 11651.6E
M755	PHNOM PENH	
	KISAN	1032.3N 10440.5E
	BITOD	0415.4N 10407.1E
M758	PEKAN	
	LUSMO	0333.7N 10655.7E
	TERIX	0415.4N 10934.7E
	OLKIT	0450.1N 11149.1E
	KOTA KINABALU	
M759	OLKIT	0450.1N 11149.1E
	BRUNEI	
M761	PEKAN	
	BOBOB	0222.1N 10706.1E
	SABIP	0209.7N 10750.5E
	AGOBA	0158.7N 10830.0E
	KUCHING	
M766	COLOMBO	
	JAKARTA	
	INDRAMAYU	
	MADIN	0617.9S 11023.0E
	CUCUT	0617.7S 11106.0E
	SURABAYA	
	BALI	
	DARWIN	
M765	KOTA BHARU	
	IGARI	0656.2N 10335.2E
	BITOD	0715.3N 10407.3E
	CONSON	
	DAGAG	0927.8N 10826.5E
	MAPNO	1013.1N 11020.1E
M767	JOMALIG	
	TOKON	1142.0N 11940.3E
	TENON	0915.3N 11616.5E
	TEGID	0857.2N 11551.6E
	TODAM	0631.7N 11235.4E
M768	DARWIN	
	BRUNEI	
	DOGOG	0525.3N 11407.5E
	ASISU	0559.1N 11320.8E
	TODAM	0631.6N 11235.6E
	LAGOT	0716.5N 11132.7E
	AKMON	0812.9N 11013.1E
	MOXON	0849.5N 10921.3E
	DAGAG	0927.8N 10826.5E
	TANSONNHAT	
M770	KOTA BHARU	
	RANONG	
	BUBKO	1911.1N 08839.8E
	KAKID	2038.6N 08659.9E
	JAMSHEDPUR	
M771	MERSING	
	DOLOX	0448.7N 10522.9E
	DUDIS	0700.0N 10648.6E
	DAGAG	0927.8N 10826.5E
	DOXAR	1222.0N 11022.7E
	DAMEL	1358.7N 11130.6E
	DONDA	1442.2N 11201.3E
	DOSUT	1702.0N 11340.8E
	DULOP	1814.2N 11432.6E
	DUMOL	1900.0N 11426.8E
	HONG KONG	
M773	BUBKO	1911.1N 08839.8E
	LEGOS	2138.0N 08805.3E
	KOLKATA	
M774	SINGAPORE	
	KIKEM	0952.9S 12607.4E
M875	KAKID	2038.6N 08659.9E
	BUTOP	2919.7N 07523.9E
	GUGAL	3014.5N 07358.0E
	DERA ISMAIL KHAN	
M890	LUCKNOW	
	CHANDIGARH	
	SAMAR	3120.8N 07434.0E
M904	BANGKOK	
	U-TAPHAO	
	DIPUN	
	SIRAT	
	TONIK	
	TIDAR	
	ODONO	
	UPRON	
	ENREP	
N502	PARDI	0034.0S 10413.0E
	BOBAG	0102.5N 10329.9E

N509 ELATI 0200.0S 08957.7E
PORT HEDLAND

N519 MUMBAI
SAPNA 2330.0N 06750.0E
MINAR 2350.0N 06800.0E
KARACHI

N563 (EMURU 2214.0N 05853.6E)
REXOD 2112.5N 06138.5E
BANGALORE
MEDAN
SALAX 0212.4N 10133.7E

N564 DUGOS 0853.1N 08447.9E
AKMIL 1151.6N 08006.9E

N571 (RAGMA 2306.0N 06105.7E)
PARAR 2226.5N 06307.0E
VAMPI 0610.9N 09735.1E
GUNIP 0429.9N 09931.8E

N628 PEKANBARU
BUSUX 0355.0S 06000.0E
(PRASLIN)

N633 KUALA LUMPUR
PEKANBARU
POSOD 0329.5S 09409.9E
PEDPI 1316.6S 07500.0E
(PLAISANCE)

N640 TRIVANDRUM
BIKOK 0817.0N 07836.0E
COLOMBO
LEARMONTH
MOUNT HOPE
ADELAIDE

N645 BRUNEI
ELANG
005535.64S 1145003.10E
SURABAYA

N750 SYDNEY
CHRISTCHURCH

N759 MELBOURNE
AUCKLAND

N774 AUCKLAND
SYDNEY

N875 DENPASAR
PONTIANAK
ARUPA 0031.7N 10848.8E
NIMIX 0124.9N 10759.4E
BOBOB 0222.1N 10706.0E
ENREP 0452.4N 10414.7E

N877 LAGOG 0835.6N 09159.8E
VISHAKHAPATNAM
NAGPUR
PRATAGRAPH

N884 MERSING
LUSMO 0333.7N 10655.7E
LAGOT 0716.6N 11131.5E
LAXOR 0949.6N 11448.5E
LULBU
110936.07N 1163217.70E
LEGED
130113.24N 1190006.94E
LUBANG
CABANATUAN
MIYAKOJIMA

N891 PAPA UNIFORM
ENREP 0452.4N 10414.8E
IGARI 0656.2N 10335.2E
SAMOG 0800.0N 13014.6E
RAYONG
BANGKOK

N892 HENGCHUN
KABAM 2100.0N 11925.7E
MUMOT 1930.4N 11714.5E
MAVRA 1814.4N 11615.1E
MIGUG 1516.4N 11400.0E
MESOX 1358.8N 11302.7E
MUGAN 1222.0N 11152.3E
MAPNO 1013.1N 11020.1E
MOXON 0849.5N 10921.3E
MELAS 0704.9N 10808.4E
MABLI 0417.3N 10612.9E
MERSING

N893 TELEM 2407.0N 06846.0E
AHMEDABAD

N895 BETNO 1505.8N 09812.7E
PATHEIN
BHUBANESWAR
NAGPUR
BODAR 2236.3N 07413.3E
AHMEDABAD
PARTY 2414.6N 07052.0E

P501	ARAMA	0136.9N 10307.2E
	BOBAG	0102.5N 10329.9E
	ANITO	0017.0S 10452.0E
P518	NOBAT	2109.0N 06800.0E
	PARET	2527.2N 06451.5E
	PANJGUR	
P570	(MIBSI	2341.7N 05755.4E)
	KITAL	2003.0N 06018.0E
	TRIVANDRUM	
	KATUNAYAKE	
	PEKANBARU	
P574	(KUSRA)	
	TOTOX	2150.5N 06222.5E
	BISET	1823.4N 06918.1E
	BELGAUM	
	CHENNAI	
	PUGER	0324.0N 10017.5E
P627	PHUKET	
	KADAP	0200.0S 08409.6E
	KALBI	
	(PLAISANCE)	
P628	LANGKAWI	
	PORT BLAIR	
	RAHIM YAR KHAN	
P646	BANGKOK	
	JAMSHEDPUR	
	PATHEIN	
	VARANASI	
P648	KOTA KINABALU	
	JAKARTA	
P751	(ADEN)	
	ANGAL	1614N 06000E
	MUMBAI	
P756	MALE	
	MEDAN	
P761	CHENNAI	
	PORT BLAIR	
P762	DAWEI	
	PORT BLAIR	
	COLOMBO	
P880	IGEVO	03636.29S 16300.00E
	SLOPE HILL VOR	04459.03S 16846.57E
P901	IKELA	1839.7N 11214.7E
	CHEUNG CHAU	

UPPER ATS ROUTES

UB467	YEDINKA	
	VELTA	4529N 13710E
	TEKUK	4241N 13527.4E
	NULAR	4059.2N 13411E
	(KANSU)	3838.0N 13228.5E
UL425	(KUTVI)	
	ASPUX	1744.00N 06000.00E
	DONSA	1434.14N 06511.32E
	VANVO	1043.00N 07200.00E
UM551	DONSA	1435.3N 06511.6E
	ANGAL	1614.1N 06000.1E
	(AVAVO)	1646.3N 05526.1E

Note1: Acronyms used for route names are only intended as a rough guide to the location of the routes. They are explained below:

IND - India
SEA - South East Asia
SCS - South China Sea
PHI - Philippines
THA - Thailand
TPE - Taipei
PRD - Pearl River Delta
KAB - Kabul
IDO - Indonesia
COL - Colombo
CHA - China
IATA - earlier IATA requested routes in China
WPC - West Pacific Area

Note 2: Route names in parenthesis refer to the original names from an earlier route catalogue. They are renamed following consolidation of China routes and ARNR TF 3 meeting.

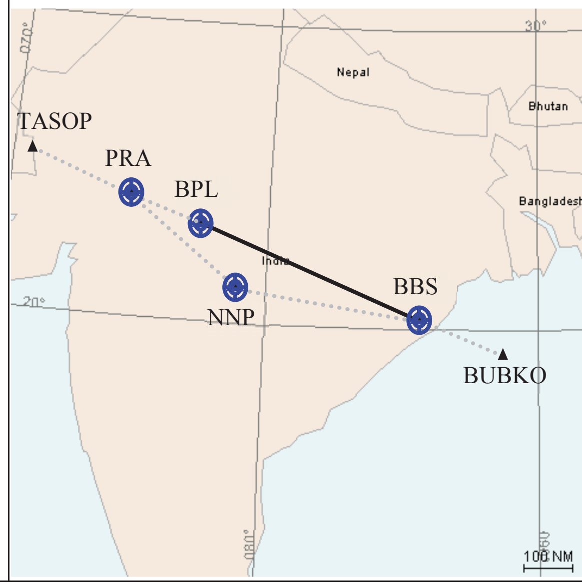
Chapter 1: South Asia

(referred to: SAIOACG, BOBASIO, ASIOACG as appropriate for review)

ATS ROUTES	SIGNIFICANT PTS	COORDINATES	FIR	REMARKS
IND 1	BBS BPL	N2014.6 E08548.8 N2317.0 E07720.2	KOLKATTA MUMBAI	
IND 7	PRA SERKA KAMAR BIRJAND	N2401.8 E07445.0 N2951.0 E06615.0 N3239.0 E06044.0 N3258.3 E05912.0	MUMBAI DELHI KABUL TEHERAN	N877 Extension
IND 09	TELEM BHU RKT BBB	N2407 E068 46 N2316.5 E06940.0 N2218.8 E07046.7 N1905.2 E072 52.5	MUMBAI	New Entry 1/1/13
IND 10	AAE MORVI RASKI	N2304.1 E07237.7 N2249.0 E07050.0 N2303.5 E06352.0	MUMBAI	New Entry 1/1/13
PAK 01	KC MELOM	N2454.6 E06710.6 N2505.0 E06632.0	KARACHI	New Entry 1/1/13
PAK02	INDEK CHG	N3246.0 E07316.0 N3040.1 E07648.3	LAHORE DELHI	New Entry M890 extension 1/1/13
THA 1	KORAT DAWEI	N1455.0 E10208.4 N1405.9 E09812.2	BANGKOK YANGON	
IDO 1	SJ MABIX	N0113.4 E10351.3 N0316.0 E09450.9	SINGAPORE JAKARTA	
COL 1	KAT TNV	N0709.7 E07952.1 S1842.2 E04731.1	COLOMBO MADAGASCA R	
IND 8	VABB APANO WPT “X”	Details in chart	MUMBAI KARACHI	2 Route Options
HIMALAY A 1	KOLKATA NEPALGUNJ INDEK	2238.7N 08827.2E 2806.1N 08139.1E 3246N 7316E	KOLKATA KATHMANDU LAHORE	Moved from Chapter 4. Route requested by Nepal
HIMALAY A 2	KATHMANDU BAGHDOGRA GUWAHATI SILCHAR IMPHAL KUNMING	2740.5N 08521.0E 2641.3N 08819.8E 2606.1N 09135.3E 2454.8N 09258.9E 2446.0N 09354.5E 2501N 10244E	KATHMANDU KOLKATA KOLKATA KOLKATA KOLKATA KUNMING	Moved from Chapter 4. Route requested by Nepal

HIMALAYA 3	**LELAX QIM FKG**	N3223.5 E07737.9 N3809.1 E08532.2 N4410.0 E08759.0	DELHI URUMQI	New Entry 10/1/13
IRAN1	**a. ALROT-BIRJAND-SOKIR-NH** **b. ALROT-BIRJAND-SOKIR-GASIR**	?	IRAN KABUL PAKISTAN	Requested by IRAN and amended by IATA at SAIAOCG/3 Mtg.

ATS ROUTE NAME: IND1 REQUESTED BY: IATA

ENTRY/EXIT POINT **BBS / BPL** **ROUTE DESCRIPTION** **BBS .. BPL** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW**	**CHART** 

Action Required	IATA
	ICAO

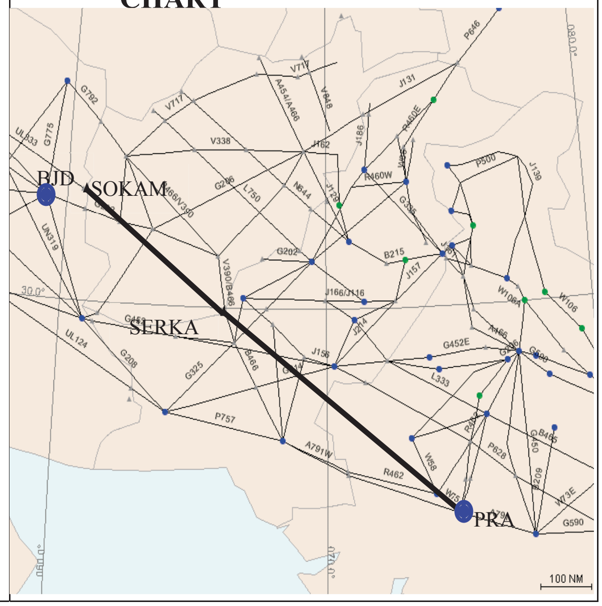
Saving	Per flight	Annual
Mileage / Time	25nm /3 mins	
Fuel	406kg	148190 kg
CO_2	1250kg	456250kg
No_x		

Remarks: Provides extension from N895 linking traffic from BKK and Northern Sub-continent and ME. Provides a 25nm reduction in track mileage

Potential City Pairs: Europe/South East Asia

ATS ROUTE NAME: IND 7 (N877 Extension)

REQUESTED BY: IATA

ENTRY/EXIT POINT	CHART
PRA - KAMAR **ROUTE DESCRIPTION** **Direct Route Track from PRATAGARH** **PRA – SERKA– SOKAM** **FLIGHT LEVEL BAND** **28000-46000** **PRIORITY: HIGH/MED/LOW** **HIGH**	

Action Required	IATA.
	ICAO

Saving	Per flight	Annual
Mileage / Time	294 nm/37 min.	
Fuel	4777kg	1,743 tonnes
CO_2	147,000kg	5,365 tonnes
No_x		

Remarks: This proposal predates the extension of UL333 through Kabul FIR and has been under consideration for a number of years. The extension of UL333 is under utilised against other Kabul routes largely due the 45nm "penalty" in track mileage the current route structure requires. The routes primary benefit at this stage will be westbound and during BOBCAT traffic flow. As such a restricted route that accommodates this would be acceptable in the short term. *Update 08/02/13PRA SERKA has been "approved" by India after lengthy consultation with the Military, complementary action from Pakistan awaited.*

Potential City Pairs: KUL/SIN – MID-EAST/EUROPE

ATS ROUTE NAME: *IND 08*
REQUESTED BY: IATA Date: 25 June 2012 (ATM/AIS/SAR/SG-22)

ENTRY/EXIT POINT
VABB-APANO-AAE-VIKIT-MURLI-BI

ROUTE DESCRIPTION
Option 1 Routing:
VABB-APANO-W13N.AAE."WP1" (Mumbai/Delhi FIR waypoint) dct VIKIT

Option 2 Routing:
VABB-APANO-W13N.AAE."WP1"(Mumbai/Delhi FIR waypoint) dct "WP3"(10Nm clearance from POKHARAN{VI(D)123}) dct VIKIT

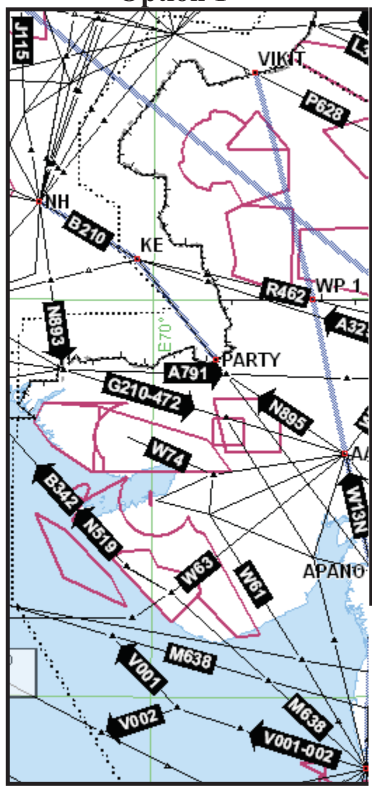
Pakistan Routing:
VAKIT dct MURLI dct BI then via existing route network.

FLIGHT LEVEL BAND

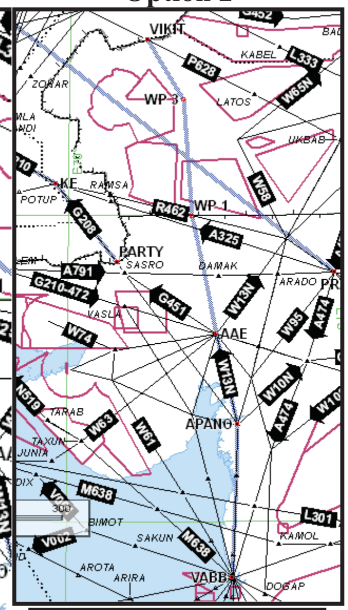
PRIORITY:
High/Medium/Low

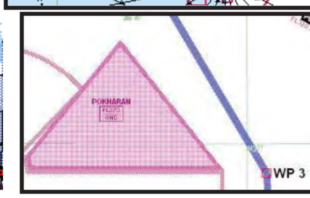
CHART

Option 1

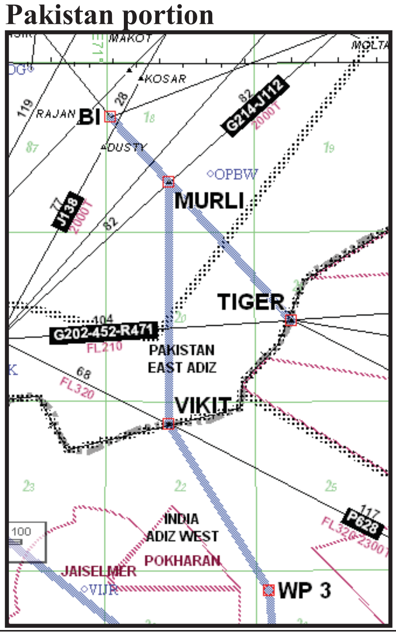


Option 2





Pakistan portion



Action Required	IATA
	ICAO

Option 1

Saving	Per flight	Annual
Mileage / Time	62 nm / 6 mins	
Fuel	589 kg	
CO_2	1826 kg	
No_x		

Option 2

Saving	Per flight	Annual
Mileage / Time	101 nm / 13 mins	
Fuel	1132 kg	
CO_2	3510 kg	
No_x		

Remarks: Initial request time specific (1600 – 2359) to support late night operations to North America.

Potential City Pairs: Mumbai to North American cities

ATS ROUTE NAME: *IND 09*

REQUESTED BY: IATA Date: 01/01/2013

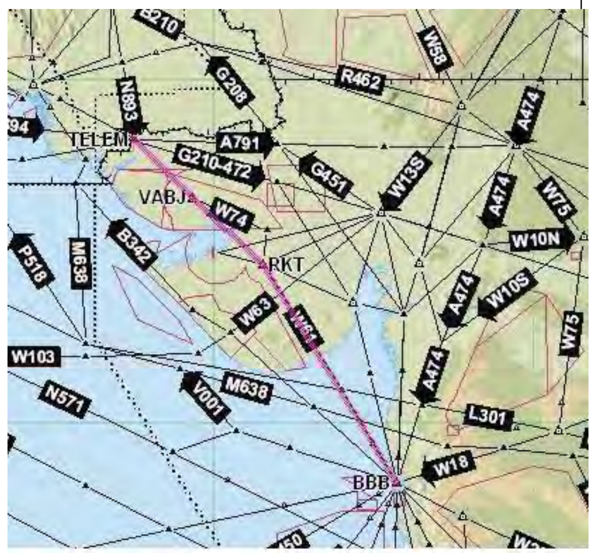
ENTRY/EXIT POINT
TELEM – BBB

ROUTE DESCRIPTION
TELEM – BHJ (Bhuj) – RKT (Rajkot) - BBB (Mumbai)

FLIGHT LEVEL BAND
29000 – 46000

PRIORITY: HIGH/MED/LOW
HIGH

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual potential
Mileage / Time	35nm / 5 min	
Fuel	300 kg	4,954 Ton
CO_2	945 kg	15,604 Ton
No_x		
SO_2		

Remarks: Facilitates Arrivals in to Mumbai, Bangalore from Europe. Reduces congestion around AMD with respect to BOM DEL BOM busy corridor, will assist CDOs that will add further fuel savings. (Route proposed at ANSCG Delhi meeting on 28/11/2008.)

Potential City Pairs: Europe / BOM, BLR

ATS ROUTE NAME: *IND10*

REQUESTED BY: IATA Date: 01/01/2013

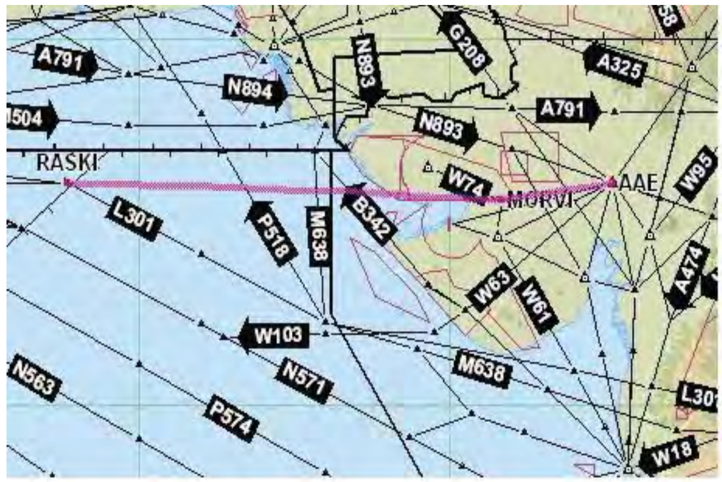
ENTRY/EXIT POINT
AAE- RASKI

ROUTE DESCRIPTION
AAE (Ahmadabad) – MORVI- RASKI

FLIGHT LEVEL BAND
29000 – 46000

PRIORITY: HIGH/MED/LOW
HIGH

CHART



Action Required	
	IATA
	ICAO

Saving	Per flight	Annual potential
Mileage / Time	80 nm / 9min	
Fuel	765 Kg	8,800 Ton
CO_2	2409 kg	27,700 Ton
No_x		
SO_2		

Remarks: Facilitates From / To Ahmadabad Middle East and overflying traffic between Far East Asia to Middle East.

Potential City Pairs: AMD, DAC, HKG, PVG, BJS / Middle East

ATS ROUTE NAME: *PAK01*

REQUESTED BY: IATA Date: 01/01/2013

ENTRY/EXIT POINT
Karachi (KC) – MELOM

ROUTE DESCRIPTION
Direct KARACHI (KC) to MELOM

FLIGHT LEVEL BAND
29000 – 46000

PRIORITY: HIGH/MED/LOW
HIGH

CHART

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	12 nm / 2 min	
Fuel	100 kg	380 Ton
CO_2	307 kg	1168 Ton
No_x		
SO_2		

Remarks: Supports traffic South Asia – Europe, Middle East region

Potential City Pairs: South Asia – Europe

ATS ROUTE NAME: *PAK 02*

REQUESTED BY: IATA Date: 01/01/2013

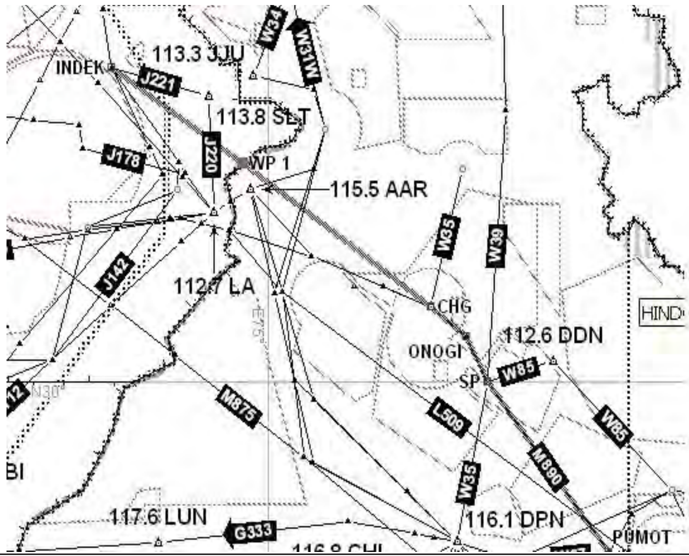
ENTRY/EXIT POINT
INDEK – CHG

ROUTE DESCRIPTION
INDEK .. CHG
(Chandigarh)

FLIGHT LEVEL BAND
29000 – 46000

PRIORITY:
HIGH/MED/LOW
HIGH

CHART



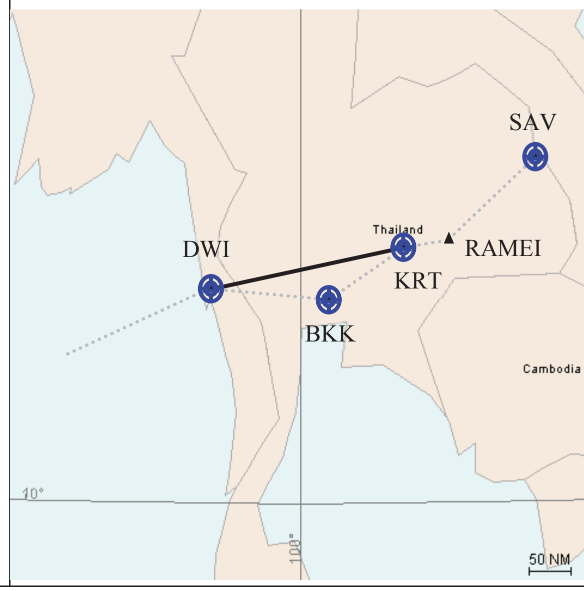
Action Required	IATA
	ICAO

Saving	Per flight	Annual potential
Mileage / Time	10 nm	
Fuel	175 kg	320 Ton
CO_2	552 kg	1008Ton
No_x		
SO_2		

Remarks: Route will facilitate separating overflying traffic from Delhi ARR/DEP traffic, especially when L509 closes. Although small distance savings but it will help in reducing traffic congestion and facilitating Optimum flight levels.

Potential City Pairs: Europe / South East Asia/ South Asia

ATS ROUTE NAME: THA1 REQUESTED BY: IATA

ENTRY/EXIT POINT **KRT / DWI** **ROUTE DESCRIPTION** **KRT .. DWI** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW**	**CHART** 

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	15nm/ 2min	
Fuel	245kg	89,000kg
CO_2	750kg	274,000kg
No_x		

Remarks

Potential City Pairs:

ATS ROUTE NAME: IDO1

REQUESTED BY: IATA

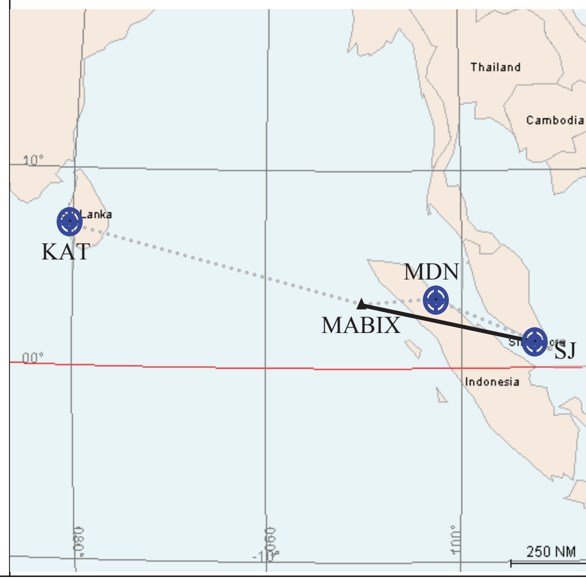
ENTRY/EXIT POINT
SJ / MABIX

ROUTE DESCRIPTION
SJ .. MABIX

FLIGHT LEVEL BAND
28000 – 46000 feet

PRIORITY: HIGH/MED/LOW

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	16nm/ 2min	
Fuel	260kg	95,000kg
CO_2	800kg	292,000kg
No_x		

Remarks: This route supports traffic from SIN to CBI, TVM and an alternative to the Middle East. It provides a 10 nm reduction in track mileage (16nm if traffic route via MDN).

Potential City Pairs:

ATS ROUTE NAME: COL 1

REQUESTED BY: IATA

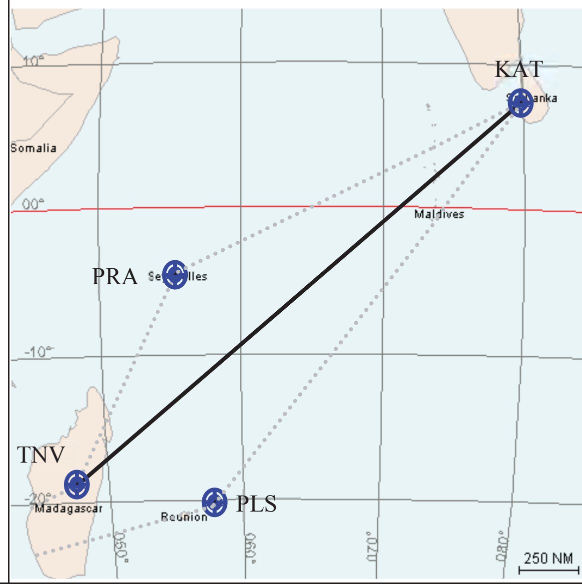
ENTRY/EXIT POINT
KAT / TNV

ROUTE DESCRIPTION
KAT .. TNV (ANTANANARIVO)

FLIGHT LEVEL BAND
28000 – 46000 feet

PRIORITY: HIGH/MED/LOW

CHART



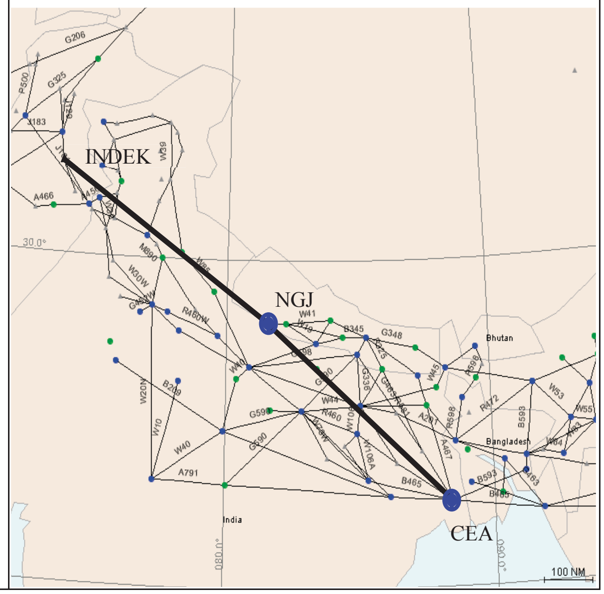
Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	130nm /16 min	
Fuel	2110kg	770,000kg
CO_2	6,500kg	2,370 tonnes
No_x		

Remarks: This proposal supports traffic between THA/HKG/ South China and Southern Africa. A proposal already exists to establish a User Preferred Route (UPR) geographic area which will support the same traffic flow however this proposal needs to be retained in the short term.

Potential City Pairs:

ATS ROUTE NAME: Himalaya 1 Requested by : Nepal

ENTRY/EXIT POINT **XXXXX** **ROUTE DESCRIPTION** **Kolkata (CEA) .. Nepalgunj (NGJ) .. INDEK** **FLIGHT LEVEL BAND** **PRIORITY: HIGH/MED/LOW**	**CHART** 

Action Required	States to coordinate implementation.
	.

Benefit		
Cost		
Fuel Saving		
Emission	CO_2	
	NO_X	

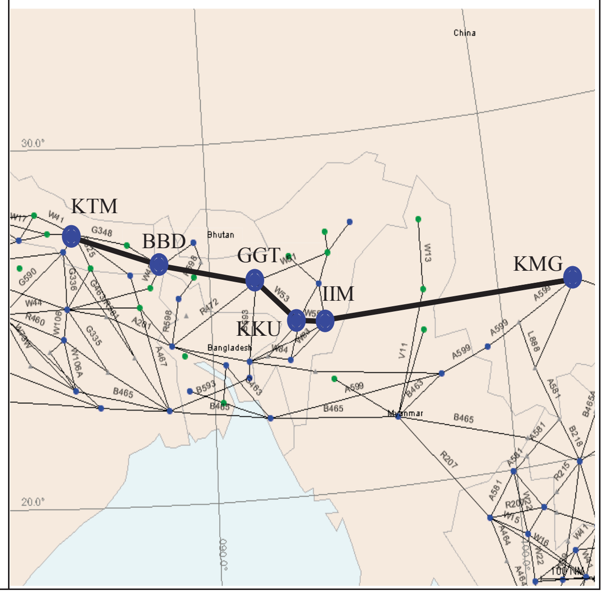
Remarks: Remarks: The route has been implemented except for Imphal to Kunming which China had undertaken to review (as per current remarks)

IATA Nth Asia Office approached China who have indicated this route will be considered as part of the overall China route review - no timeline was given.

The extension to L509 serves the purpose at present although is only available for

limited hours daily. The availability of another route to the north will provide extra capacity but will need to be amended to link with a new transit route through Kabul.

ATS ROUTE NAME: Himalaya 2 Requested by : Nepal

ENTRY/EXIT POINT	CHART
XXXXX **ROUTE DESCRIPTION** **Kathmandu (KTM) .. Baghdogra (BBD) .. Guwahati (GGT) .. Silchar (KKU) .. Imphal (IIM) .. Kunming (KTM)** **FLIGHT LEVEL BAND** **PRIORITY: HIGH/MED/LOW**	

Action Required	States to coordinate imeplementation.
	.

Benefit		
Cost		
Fuel Saving		
Emission	CO_2	
	NO_X	

Remarks: China advised that they would seriously look at the proposal and would coordinate with Nepal (ref. para 8.4of the SEA-RR/TF/4 report). This was also presented at the 22nd Meeting of the BBACG.

ATS ROUTE NAME: *Himalaya 3*

REQUESTED BY: IATA Date: 10 January 2013

ENTRY/EXIT POINT
LELAX-QIM-FKG
(Or LELAX-QIM-POSOT-FKG)

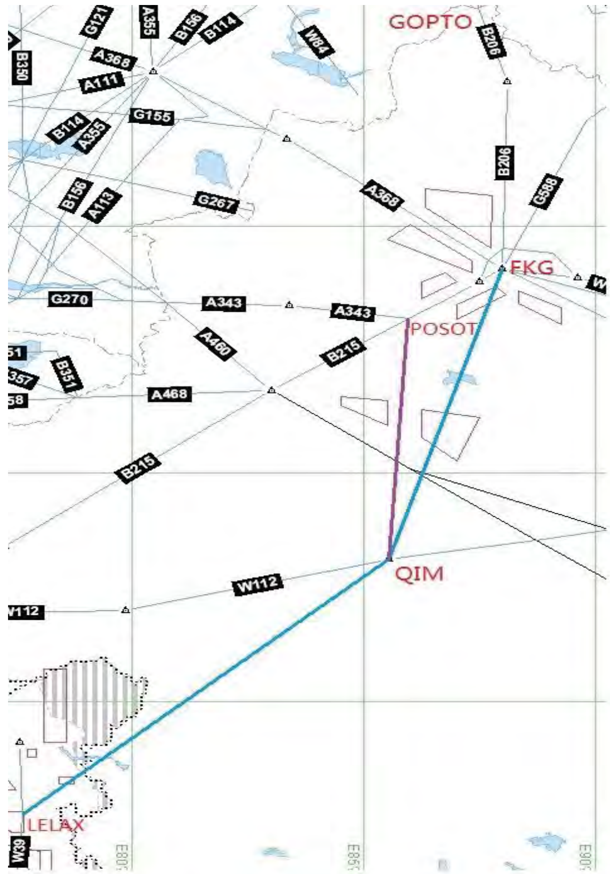
Connecting to FKG-TAI-GOPTO-LANBI

ROUTE DESCRIPTION
LELAX direct to QIM over the Himalaya to support a new route from India into China connecting to Russia onwards polar / trans polar gateways.

FLIGHT LEVEL BAND:

PRIORITY:
HIGH

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	257NM / 23 mins	
Fuel	3500 kgs	1,265 Ton
CO_2	11 Tons	4,000 Ton
No_x		

Remarks: New 787 aircraft equipped with more than the standard cabin oxygen supply capable of operating at higher altitude longer in the event of depressurization over the Himalayas.

Potential City Pairs: India -North America

ATS ROUTE NAME: IRAN 1

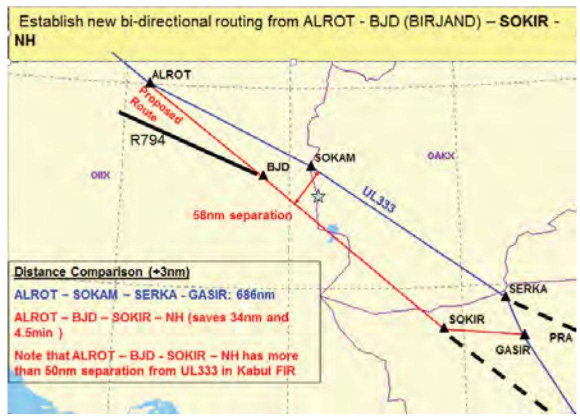
Requested by : Iran

ENTRY/EXIT POINT
XXXXX

ROUTE DESCRIPTION
a. ALROT-BIRJAND-SOKIR -NH
b. ALROT-BIRJAND-SOKIR-GASIR

FLIGHT LEVEL BAND

PRIORITY: HIGH/MED/LOW



CHART

Action Required	States to coordinate imeplementation.
	.

Benefit		
Cost		
Fuel Saving		
Emission	CO_2	
	NO_X	

Remarks: Requested bu IRAN and amended by IATA at SAIOACG /3 meeting.

Chapter 2: Southeast Asia

(referred to: SEACG for review)

ATS ROUTES	SIGNIFICANT PTS	COORDINATES	FIR	REMARKS
SEA 2	DANANG SYX	N1603.2 E10811.9 N1818.4 E10910.4	HOCHIMINH SANYA	
SEA 6	PAKSE ASSAD	N1511.8 E10544.5 N1820.5 E10740.9	VIENTIANE ASSAD	
SEA 10	LENKO QUNGI SAMUI	 N1507.0 E10848.0 N0932.8 E10003.7	SANYA HOCHIMINH PNOMPENH BANGKOK	New chart provided by IATA QUNGI-LENKO
SEA 12	ROT HUGUANG	N1607.0 E10346.7 N2107.9 E11020.2	HOCHIMINH GUANGZHOU	
SCS1	DAMEL CH	N1358.7 E11136.4 N2213.2 E11401.8	HOCHIMINH HONGKONG	
SCS 2	VEPAM CH	N1358.0 E11000.0 N2213.2 E11401.8	HOCHIMINH HONGKONG	
SCS 4	VKL CONSON	N0243.5 E10144.3 N0843.8 E10637.9	LUMPUR HOCHIMINH	
SCS 5	EXOTO DAMVO MELAS LUSMO	N1521.5 E11103.0 N1106.5 E10932.7 N0705.3 E10809.2 N0333.7 E10655.6	HOCHIMINH HOCHIMINH HOCHIMINH SINGAPORE	
SCS 7	BRUNEI LAXOR DULOP	N04 52.5E11453.1 N0949.6 E11448.5 N1814.2E11432.6	KINABALU SINGAPORE HONGKONG	TO JOIN M772 AT LAXOR
SCS8	DULOP ELATO ENVAR DULOP KAPLI	N1814.2E11432.6 N2220.0 E11730.0 N2159.5 E11730.0 N1814.2E11432.6 N2110.0 E11730.0	HONGKONG HONGKONG HONGKONG HONGKONG HONGKONG	EITHER DULOP/ KAPLI G86, OR DULOP/ ELATO& ENVAR
Unnamed	NOIBAI KUNMING	2112.8N 10550.1E 2501.0N 10244.0E	HANOI KUNMING	Moved from Chapter 4. Route Requested by Vietnam
Unnamed	NOIBAI CATBI	2112.8N 10550.1E 2049.1N 10642.5E	HANOI HANOI	Moved from Chapter 4.

	SAMAS OR HUGUANG	2030.3N 11029.7E 2107.9N 11020.2	GUANGZHOU/ SANYA GUANGZHOU	Route Requested by Vietnam
SCS10	PHUCAT ASISU		HO CHI MINH SINGAPORE KOTA KINABALU	
PHI 5	ENDAX VJN		MANILA	
SEA 5	STUNG TRENG DANANG	N1331.5 E10600.9 N1603.2 E10811.9	PNOMPENH HOCHIMINH	Moved from Chapter 5 part A
SCS9	TOKON DILIS TOKON ENDAX	N1142.0 E11940.5 N1431.1 E12600.1 N1142.0 E11940.5 N1415.0 E13000.0	MANILA MANILA MANILA MANILA	Moved from Chapter 5 part A

ATS ROUTE NAME: SEA2

REQUESTED BY: IATA

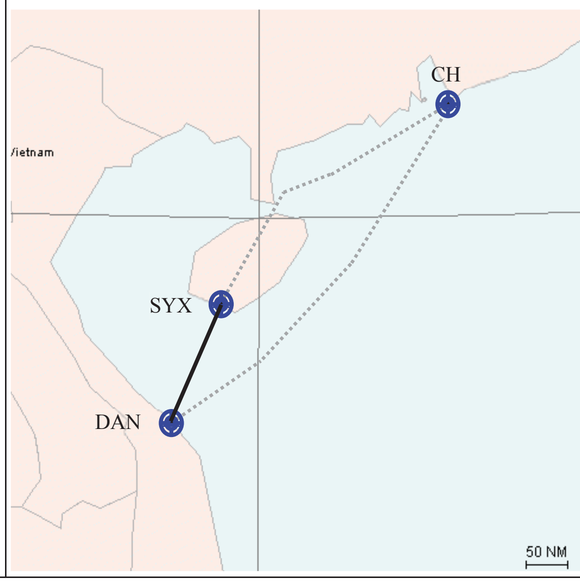
ENTRY/EXIT POINT
DAN / XXXXX / SYX

ROUTE DESCRIPTION
DAN .. SYX

FLIGHT LEVEL BAND
29000 – 46000 feet

PRIORITY: HIGH/MED/LOW

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	739nm/93 mins	
Fuel	12090 kg	4,412 tonnes
CO_2	37200kg	13,578 tonnes
No_x		

Remarks: Supports traffic Southeast Asia – Haian Island and possible alternative routing for the Pearl River Delta area.

Potential City Pairs: South East Asia - Hainan

ATS ROUTE NAME: SEA 6

REQUESTED BY: IATA

ENTRY/EXIT POINT
PAKSE - ASSAD

ROUTE DESCRIPTION

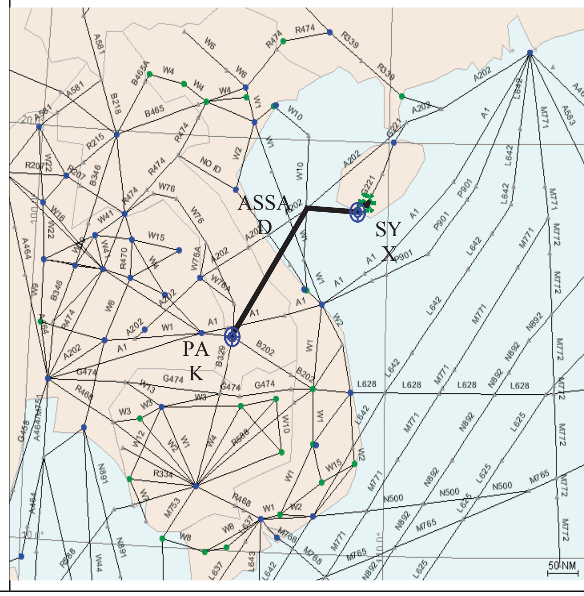
Direct PAKSE to ASSAD
FLIGHT LEVEL BAND

29000 – 46000 feet

PRIORITY: HIGH/MED/LOW

MED

CHART



Action Required	IATA
	ICAO

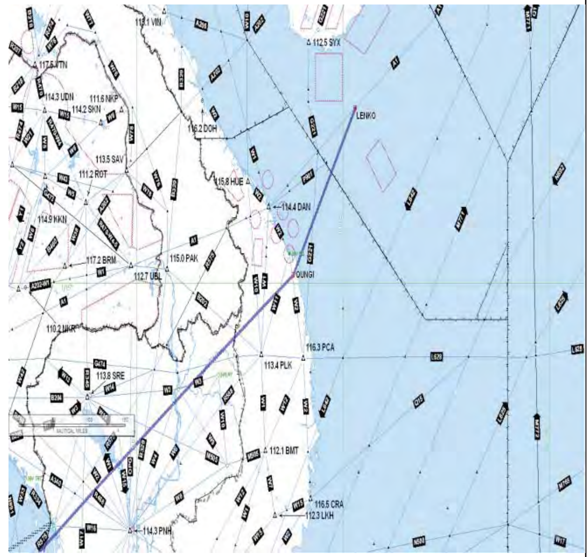
Saving	Per flight	Annual
Mileage / Time	126 nm / 16 min	
Fuel	2047 kg	747.338 kg
CO_2	6300 kg	2299,500 kg
No_x		

Remarks: Supports traffic Southeast Asia – the Perl River Delta area/South China.

Potential City Pairs: KUL/SIN/Phnom Penh/JKT – Hainan/ Hong Kong

ATS ROUTE NAME: SEA 10 Alternative route proposed from QUNGI to LENKO by IATA at SEACG/20 mtg

REQUESTED BY: IATA

ENTRY/EXIT POINT	CHART
ENTRY/EXIT POINT **XXXXX** **ROUTE DESCRIPTION** **~~CAVOI and IGNIS~~ LENKO ..** **Quangngai/QUNGI .. SAMUI (SMU)** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW**	**CHART** 

Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks: Supports traffic from Northeast Asia to Phuket and beyond. Will require linkages to/from QUNGI as original proposed points CAVOI and IGNIS no longer exist. **IATA propose to link QUNGI to LENKO**

Potential City Pairs: Colombo/ Phuket - Pearl River Delta

ATS ROUTE NAME: SEA 12

REQUESTED BY: IATA

ENTRY/EXIT POINT
ROT - HUGUANG

ROUTE DESCRIPTION

Direct ROT - HUGUANG

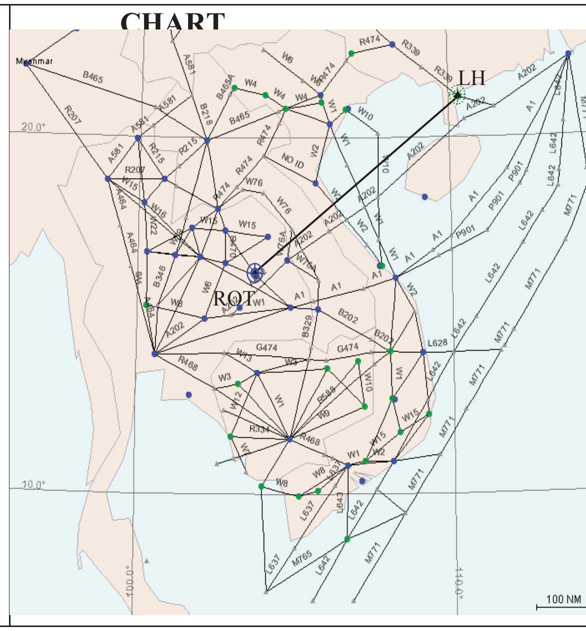
FLIGHT LEVEL BAND

29000 - 46000

PRIORITY: HIGH/MED/LOW

HIGH

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks: Provide parallel to the A202 route similar to proposal for uni-directional routes proposed through Southeast Asia Route Review Task Force.

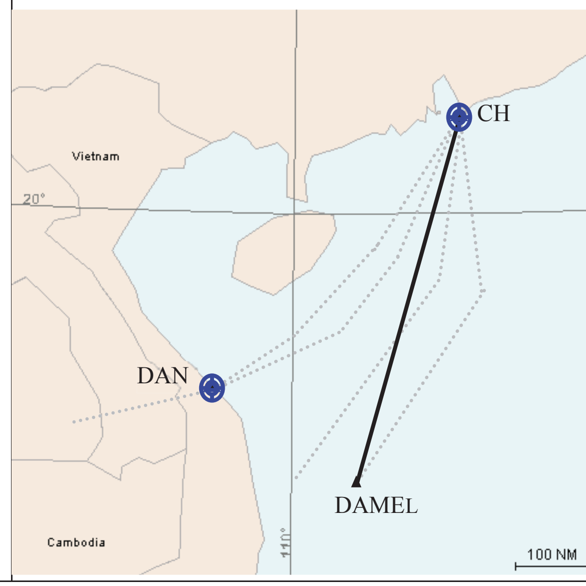
Potential City Pairs: KUL/SIN/Phnom Penh/JKT – SANYA/HKG

ATS ROUTE NAME: SCS1 REQUESTED BY: IATA

<table>
<tr><td>ENTRY/EXIT POINT
DAMEL / CH

ROUTE DESCRIPTION
DAMEL .. CH

FLIGHT LEVEL BAND
28000 – 46000 feet

PRIORITY: HIGH/MED/LOW</td><td>CHART

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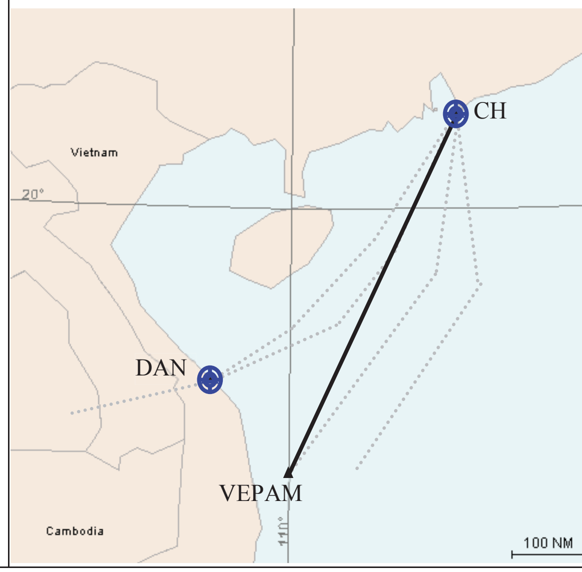
Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	35nm / 4mins	
Fuel	568kg	207594kg
CO_2	1750kg	638,750kg
No_x		

Remarks: Proposed route shortening for M771 into the Pearl River Delta area. Similar proposals have been made through Southeast Asia Route Review Task Force. During SEACG/19 in WP09 Hong Kong China advised they had studied the proposal for track shortening and advised the proposed change would reduce capacity of A1/P901. It would also require an extensive change in the flight route system and ATC sectors in Hong Kong FIR. However Hong Kong, China would continue to study this proposal for the implementation of RNP4/2. . **(IATA – 5/02/2013- Remains as high priority in view of the savings impact for many airlines)**

Potential City Pairs: Singapore-Pearl River Delta Airports

ATS ROUTE NAME: SCS2 REQUESTED BY: IATA

ENTRY/EXIT POINT **CH / VEPAM** **ROUTE DESCRIPTION** **CH .. VEPAM** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW**	**CHART** 

Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time	17nm/ 2 mins	
Fuel	276kg	100,831kg
CO_2	850kg	310,250kg
No_x		

Remarks: Proposed route shortening for L642 out of the Pearl River Delta area. Similar proposals have been made through Southeast Asia Route Review Task Force. During SEACG/19 in WP09 Hong Kong China advised they had studied the proposal for track shortening and advised the proposed change would reduce capacity of A1/P901. It would also require an extensive change in the flight route system and ATC sectors in Hong Kong FIR. However Hong Kong, China would continue to study this proposal for the implementation of RNP4/2 ...**(IATA - 5/01/2013 - Remains as high priority in view of the savings impact for many airlines)**

Potential City Pairs: Singapore-Pearl River Delta Airports

ATS ROUTE NAME: SCS4

REQUESTED BY: IATA

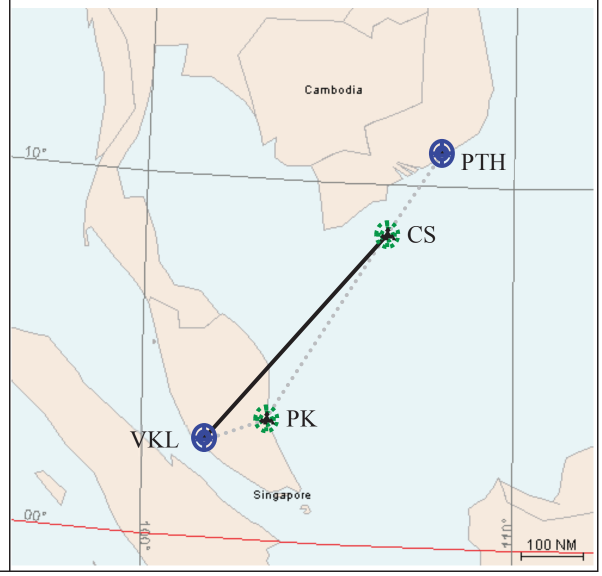
ENTRY/EXIT POINT
CS / VKL

ROUTE DESCRIPTION
CS .. VKL

FLIGHT LEVEL BAND
28000 – 46000 feet

PRIORITY: HIGH/MED/LOW

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	18nm / 2.25 mins	
Fuel	292kg	106,763kg
CO_2	900kg	328,500kg
No_x		

Remarks: Supports traffic to and from Kula Lupur from and to the northeast.

Potential City Pairs: Kuala Lumpur-Pearl River Delta Airports

ATS ROUTE NAME: SCS5

REQUESTED BY: IATA

ENTRY/EXIT POINT
EXOTO / MELAS / LUSMO

ROUTE DESCRIPTION
EXOTO .. DAMVO .. MELAS .. LUSMO

FLIGHT LEVEL BAND
28000 – 46000 feet

PRIORITY: HIGH/MED/LOW

CHART

Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time	76nm/ 9.5 mins	
Fuel	1235kg	450,775kg
CO_2	3800kg	1,387 tonnes
No_x		

Remarks: Need to be considered in conjunction with developments with L642/M771 and possibly South China Sea ADS-B project.

Potential City Pairs: Jakarta- Pearl River Delta Airports

ATS ROUTE NAME: SCS7

REQUESTED BY: IATA

ENTRY/EXIT POINT
DULOP/ M772 / LAXOR / XXXXX / BRU

ROUTE DESCRIPTION
DULOP M772 LAXOR .. XXXXX .. BRU

FLIGHT LEVEL BAND
28000 – 46000 feet

PRIORITY: HIGH/MED/LOW

CHART

Action Required	IATA	
	ICAO	

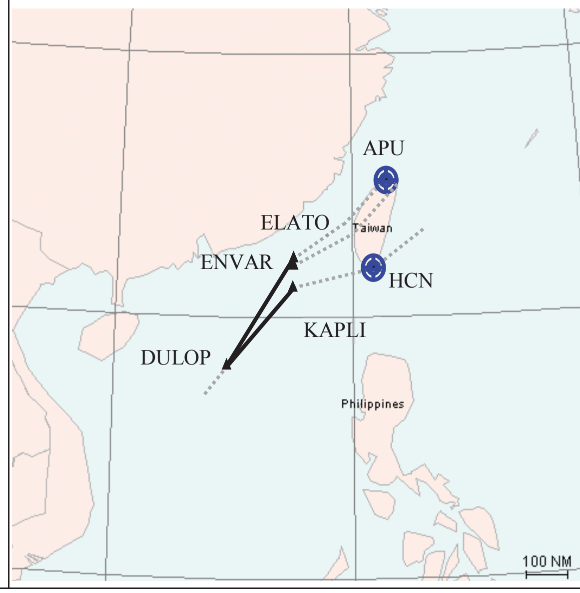
Saving	Per flight	Annual
Mileage / Time	60nm/ 7.5mins	
Fuel	975kg	355,875kg
CO_2	3000kg	1,095 tonnes
No_x		

Remarks: Supports traffic from Perth, eastern Malaysia and eastern Indonesia to the Perl River Delta area, China. Segment DULOP and LAXOR exists as M772.

Potential City Pairs: Pearl River Delta Airports-Bali/ Surabaya/ Perth

ATS ROUTE NAME: SCS 8

REQUESTED BY: IATA

ENTRY/EXIT POINT	CHART
1. DULOP / ELATO(ENVAR) **2. DULOP / KAPLI** **ROUTE DESCRIPTION** **DULOP .. ELATO (A1)/ENVAR (M750) or DULOP .. KAPLI (G86)** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW**	

Action Required	IATA
	ICAO

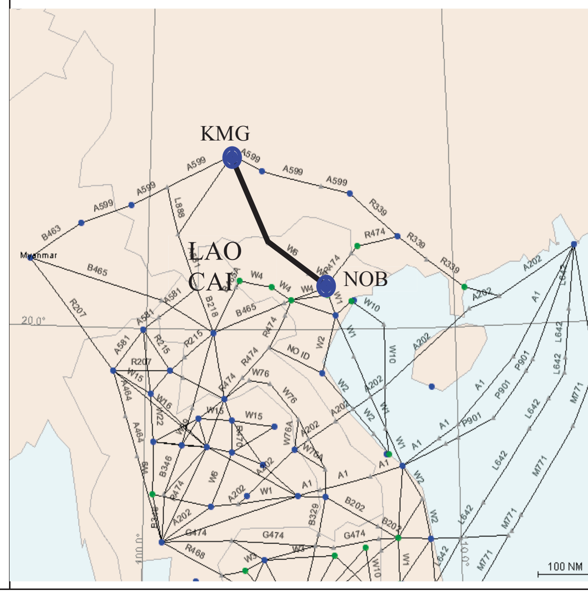
Saving	Per flight	Annual
Mileage / Time	a.DULOP/ENVAR 140nm/17.5min b.DULOP/KAPLI 238nm/ 30min	
Fuel	a.2275kg b.3867kg	a.830,000kg b.1,411 tonnes
CO_2	a. 7000kg b.11,900kg	a.2,555tonnes b.4,343 tonnes
No_x		

Remarks: Supports traffic Northeast Asia/Southeast Asia. Potentially problematic as will impact Touth China Sea's traffic arrangements. IATA to review. During SEACG/19 in WP09 Hong Kong China advised they had studied the proposal for track shortening and advised that allowing flights to proceed from M771 DUMOL to ELATO/ENVAR/KAPLI will likely create a bottle neck at these points and result in flights not getting optimum levels or increase ground delay to departures from Hong Kong and Macao to East Asia. However Hong Kong, China would continue to study this proposal.

Potential City Pairs: SEAsia-North Asia Airports

ATS ROUTE NAME:

Requested by : Vietnam

ENTRY/EXIT POINT **XXXXX** **ROUTE DESCRIPTION** **Noibai (NOB) .. LAOCAI .. Kunming (KMG)** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW**	**CHART** 

Action Required	States to coordinate imeplementation.
	ICAO to circulate proposal for deletion from BANP.

Benefit		
Cost		
Fuel Saving		
Emission	CO_2	
	NO_X	

Remarks: Because of small traffic demand and cost/benefit considerations, this route is impossible and can not be implemented at present.

ATS ROUTE NAME:

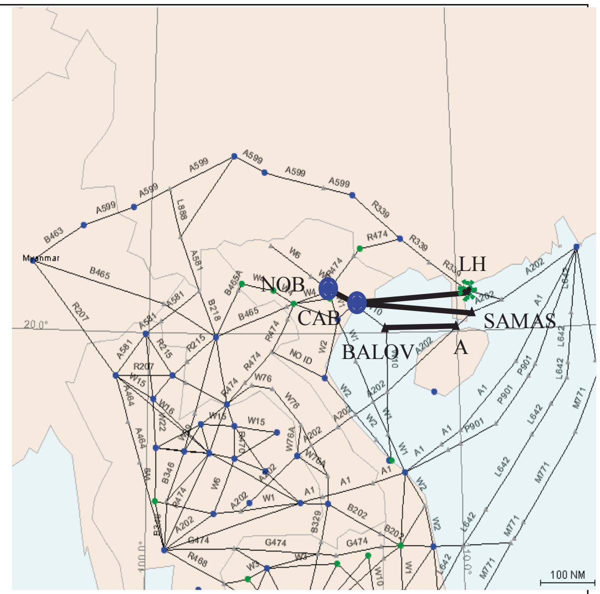
Requested by : Vietnam

ENTRY/EXIT POINT
XXXXX

ROUTE DESCRIPTION
Three Options:
A) Noibai (NOB) .. Catbi (CAB) .. SAMAS
B) Noibai (NOB) .. Catbi (CAB) .. BALOV .. A .. SAMAS
C) Noibai (NOB) .. Catbi (CAB) .. Huguang (LH)

FLIGHT LEVEL BAND
28000 – 46000 feet

PRIORITY: HIGH/MED/LOW



Action Required	States to coordinate to submit proposal for deletion of the requirement.
	ICAO to circulate proposal for deletion from BANP.

Benefit		
Cost		
Fuel Saving		
Emission	CO_2	
	NO_X	

Remarks: Because of small traffic demand and cost/benefit considerations, this route is impossible and can not be implemented at present.

Appendix 3

ATS ROUTE NAME: *SCS 10 (Propose Route designator R321)*

REQUESTED BY: IATA Date: 25 June 2012 (ATM/AIS/SAR/SG-22)

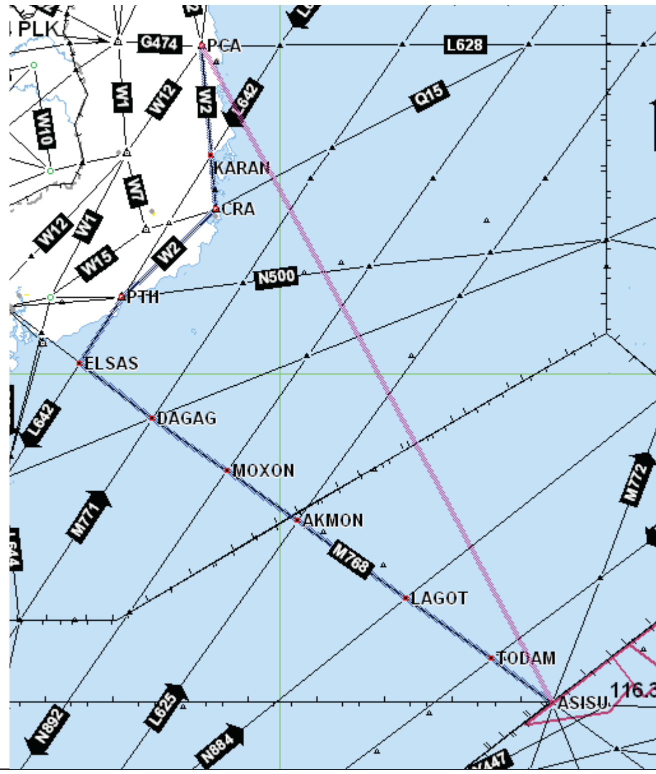
ENTRY/EXIT POINT
Phu CAT (PCA) - ASISU

ROUTE DESCRIPTION
PCA to ASISU

FLIGHT LEVEL BAND

PRIORITY:
HIGH
(VN commencing SGN-SYD service in October 2012)
Plan for 3 flights per week….
Potential for other airlines to use?

CHART



Action Required	IATA
	ICAO

Existing 692.9
New PCA-ASISU = 541.6

Saving	Per flight	Annual
Mileage / Time	151nm / 22 mins	
Fuel	1827kg	kg
CO_2	5664kg	kg
No_x		

Remarks

Potential City Pairs: SGN-SYD, any others

Appendix 2

ATS ROUTE NAME: *PHI 05 (Propose Route ENDAX-VJN)*

REQUESTED BY: IATA Date: 25 June 2012 (ATM/AIS/SAR/SG-22)

ENTRY/EXIT POINT
ENDAX-VJN

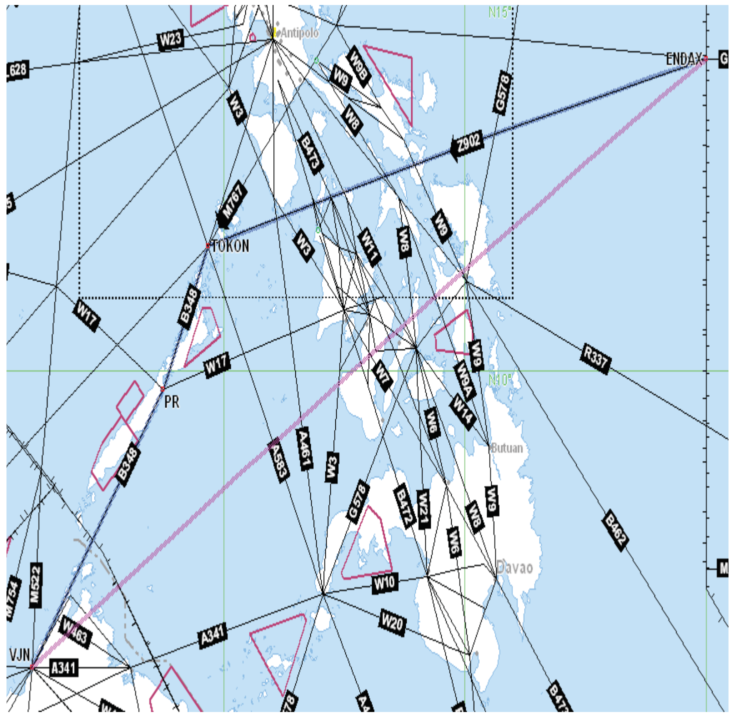
ROUTE DESCRIPTION

FLIGHT LEVEL BAND

PRIORITY:
High/Medium/Low

ENDAX-VJN 964.5NM
ENDAX-TOKON-PR-VNJ
1033.7NM

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	69.2nm / 8.65 mins	
Fuel	836kg	kg
CO_2	2592kg	kg
No_x		

Remarks

Potential City Pairs:

ATS ROUTE NAME: SEA 5
REQUESTED BY: IATA

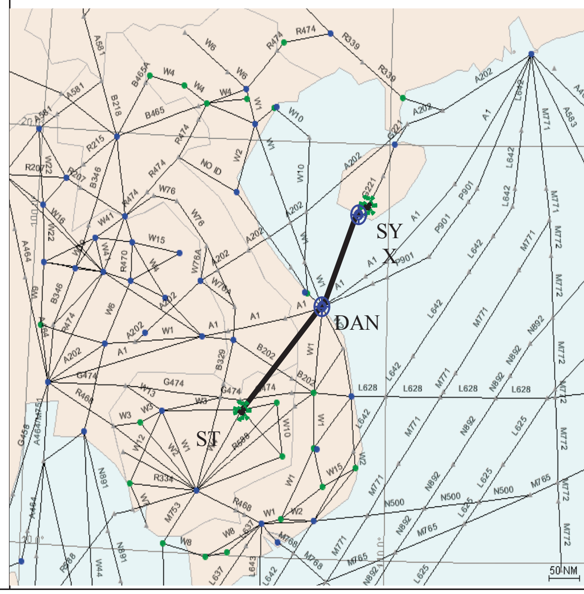
ENTRY/EXIT POINT
STUNG TRENG (ST) – DANANG (DAN)

ROUTE DESCRIPTION
Direct STUNG TRENG (ST) to DANANG (DAN)

FLIGHT LEVEL BAND
29000 – 46000

PRIORITY: HIGH/MED/LOW
MED

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	64 nm / 8 min	
Fuel	1040 kg	379,600kg
CO_2	3200 kg	1168 tonnes
No_x		
SO_2		

Remarks: Supports traffic Southeast Asia – Hainan Island. Link with SEA2.

Potential City Pairs: Singapore/ KL –Hainan/Hong Kong

ATS ROUTE NAME: SCS 9

REQUESTED BY: IATA

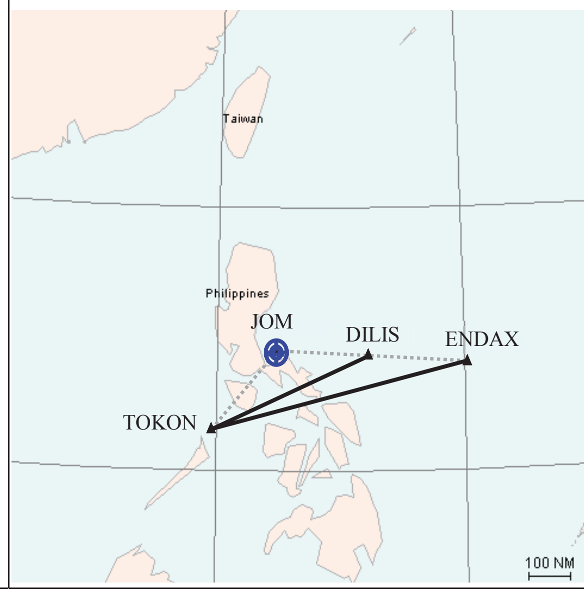
ENTRY/EXIT POINT
1. ENDAX (FIR Boundary between Oakland and Manila FIRs) or DILIS on G467
2. **TOKON on M767 (Manila FIR)**

ROUTE DESCRIPTION
ENDAX .. TOKON or
DILIS .. TOKON

FLIGHT LEVEL BAND
28000 – 46000 feet

PRIORITY: HIGH/MED/LOW (Immediate request with DILIS – TOKON)

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	a.TOKON-DILIS 45nm/ 5.5in b.TOKON-ENDAX 110nm/14min	
Fuel	a.731kg b. 1788kg	a.266,906kg b.652,440kg
CO_2	a.2250kg b.5,500kg	a.821,250kg b.2,007 tonnes
No_x		

Remarks this route has already been implemented as domestic route Z902, except that it is not a domestic route. It should be a regional route but has not been entered into the BANP and consultation with Oakland is unclear.

Potential City Pairs: SEA –San Francisco/Los Angeles

Chapter 3: East Asia/Russian Federation

(referred to: Russia/East Asian States, CPWG or EATMCG as appropriate for review)

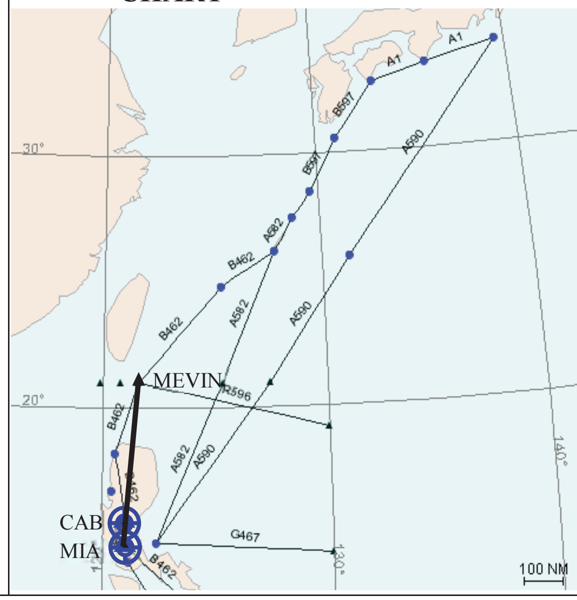
ATS ROUTES	SIGNIFICANT PTS	COORDINATES	FIR	REMARKS
PHI 1	MIA CAB MEVIN	N1430.5 E12101.3 N1528.9 E12101.5 N2100.0 E12233.0	MANILA MANILA MANILA	
PHI 3	TKK MUMOT	N2308.1 E12012.4 N1901.7 E11747.4	TAIPEI MANILA	
PHI 4	HCN AKOTA	N2155.7 E12050.6 N1627.7 E11712.4	TAIPEI MANILA	
TPE 1	APU MIKES	N2510.6 E12131.3 N2935.2 E12544.9	TAIPEI NAHA	
CHA 1 (CHA 5)	YNC GUPAD CGO SB	N3819.4 E 10623.8 N3618.7 E11028.4 N3430.9 E11350.6 N3150.4 E11714.0	LANZHOU LANZHOU WUHAN SHANGHAI	
CHA 2 (CHA 7)	KUQA CHW	N4143.0 E08300.0 N3951.0E09821.0	URUMQI LANZHOU	
CHA 3 (CHA 9A)	FKG OMBON	N4410.0 E08759.0 N3238.5 E10420.0	URUMQI KUNMING	
CHA 4 (CHA 10A)	MORIT NSH POU	N4202.0 E10249.0 N3319.1 E10818.7 N2301.2 E11311.4	LANZHOU LANZHOU GUANGZHOU	
CHA 5 (CHA 11A)	YIN INTIK	N2412.4E11324.6 N4340.8 E11154.1	GUANGZHOU BEIJING	
CHA 6 (CHA14)	OMBON NSH OBLIK SB (LUOGANG)	N3238.5 E10420.0 N3319.1 E10818.7 N3218.0 E11432.0 N3146.8 E11718.1	KUNMING LANZHOU WUHAN SHANGHAI	
CHA 7 (CHA 15)	KANSU KICHA CGQ HLD	N3838.0 E13228.5 N4041.0 E12911.5 N4338.0 E12400.5 N4912.1 E11949.4	PYONGYANG PYONGYANG SHENYANG SHENYANG	
CHA 8 (CHA16)	SCH HTN CHW	N3825.7 E07714.4 N3702.2 E07952.3 N3951.0E09821.0	URUMQI URUMQI LANZHOU	

CHA 9 (CHA17)	YBL SANLI	N3925.7 E10246.3 N3200.0 E100.00.0	LANZHOU KUNMING	
CHA 10 (CHA18)	ARGUK DALIAN HEFEI BEMAG	N4753.0E13439.5 N3857.6 E12130.8 N3146.8 E11718.1 N2601.1 E11400.1	SHENYANG SHENYANG SHANGHAI GUANGZHOU	
CHA 11 (CHA19)	DALIAN XJT	N3857.6 E12130.8 N3557.7 E12014.4	SHENYANG SHANGHAI	
CHA 12	UNWW WXI	N3621.8 E11455.0	SHANGHAI	
IATA2	OMBON RO	N3238.5 E10420.0 N2546.1 E10936.4	KUNMING GUANGZHOU	
IATA3	OMBON SB (LUOGANG)	N3238.5 E10420.0 N3146.8 E11718.1	KUNMING SHANGHAI	
JAP 1	TIC R583 BISIS APITO		FUKUOKA INCHOEN	
RUS 1	SESUR XXXXX KAE	N4217.5 E13041.5 N3838.0 E12924.7 N3742.0 E12845.2	VLADIVOSTO K INCHOEN	
RUS 2	TEKUK XXXXX KAE	N4241.0 E13527.0 N3838.0 E12924.7 N3742.0 E12845.2	VLADIVOSTO K INCHOEN	
RUS 3	BG TELOD XXXXX KAE	N 4353.0 E13315.0 N4219.6 E13211.8 N3838.0 E12924.7 N3742.0 E12845.2	VLADIVOSTO K VLADIVOSTO K INCHOEN	
RUS 4	AVGOK-GTC			
RUS 5	SIBIR – LURED – EKVIK			
CHA13	FENGNING (GM) – DAILAN (DBL)			
RUS 6	NALEB - SIBIR			
RUS 7	DIKUT or SANAR - SAMON			
RUS 8	KANSU -			

	TOMMY			
RUS 9	RITEK- new waypoint 495025N 1182854E - HLD			
RUS 10	TIKUN - URILA - GINUR - GU			
RUS 11	SIMLI - new waypoint 492000N 1270600E - DIKUT			
RUS 12	HRB - 493236N 1281936E - AMERA – WZ			
RUS 13	SIMLI - HEK - 492000N 12706E - LEPNI - 422624.7N 1294454.7E - KANSU			
RUS 14	NEW WAYPOINT - KANSU			
RUS 15	LEPNI 435542N 1285030E - new waypoint 493236N			

ATS ROUTE NAME: PHI 1

REQUESTED BY: IATA

ENTRY/EXIT POINT	CHART
ROUTE DESCRIPTION **Manila (MIA) .. MEVIN or** **Cabanatuan (CAB) .. MEVIN** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW**	

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	11nm/1.5min	
Fuel	179kg	59,300kg
CO_2	550kg	200,750kg
No_x		

Remarks: Supports traffic between Manila and Japan/North America.

Potential City Pairs: Philippines-Japan/North America

ATS ROUTE NAME: PHI 3

REQUESTED BY: IATA

ENTRY/EXIT POINT
XXXXX

ROUTE DESCRIPTION
Shikang (TNN) … XXXXX … MUMOT

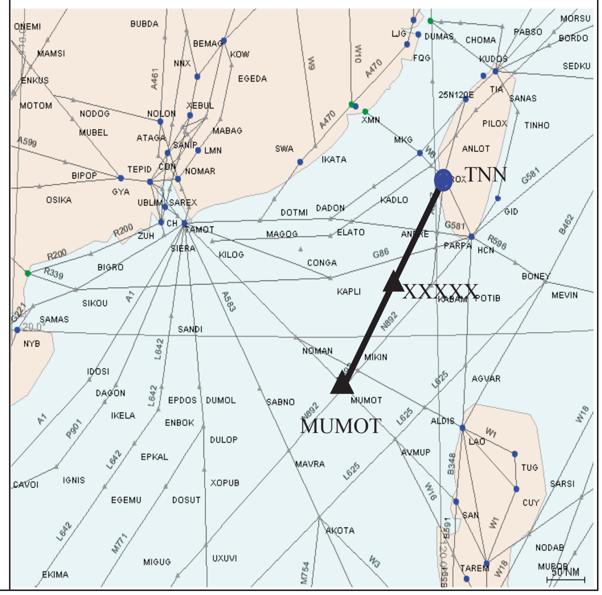
FLIGHT LEVEL BAND

29000 - 46000

PRIORITY: HIGH/MED/LOW

HIGH

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks: Supports traffic from TNN to Southeast Asia

Potential City Pairs:

ATS ROUTE NAME: PHI 4

REQUESTED BY: IATA

ENTRY/EXIT POINT
XXXXX

ROUTE DESCRIPTION
AKOTA… XXXXX … Hengchun (HCN)

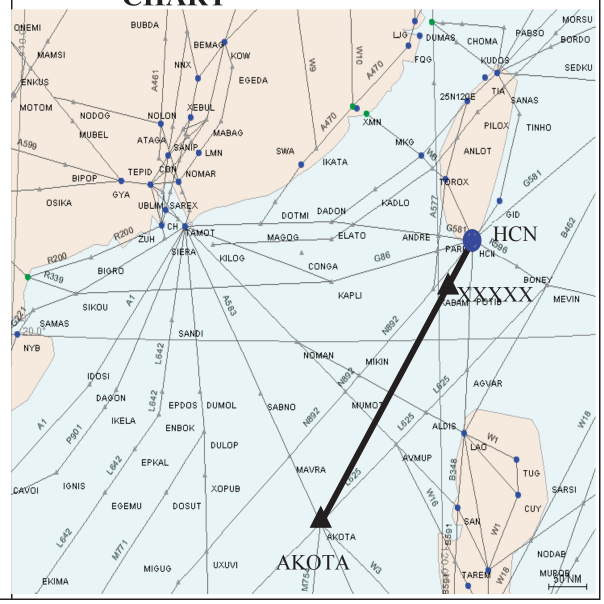
FLIGHT LEVEL BAND

29000 - 46000

PRIORITY: HIGH/MED/LOW

HIGH

CHART



Action Required	IATA
	ICAO

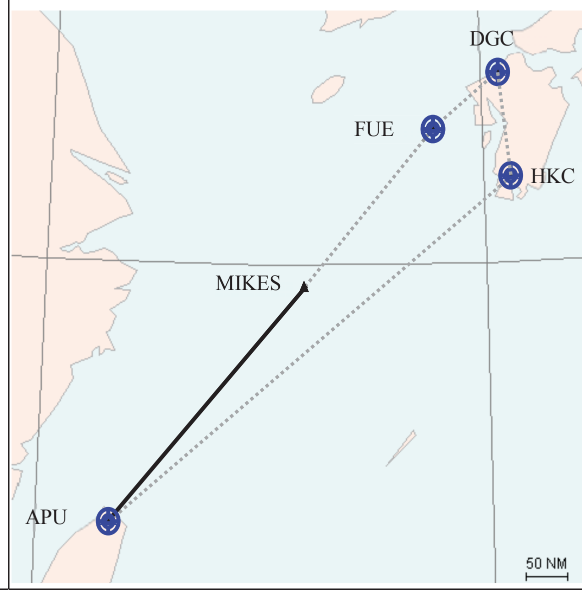
Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks: Supports traffic from Southeast Asia to HCN

Potential City Pairs:

ATS ROUTE NAME: TPE 1

REQUESTED BY: IATA

ENTRY/EXIT POINT	**CHART**
APU / XXXXX / MIKES **ROUTE DESCRIPTION** **APU- MIKES** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW**	

Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time	40nm/ 5min	
Fuel	650kg	237,000kg
CO_2	2,000kg	730,000kg
No_x		

Remarks: Supports traffic between APU and Japan.

Potential City Pairs: SEA/HKG/TPE-Fukuoka

ATS ROUTE NAME: CHA 1 (Renumbered from CHA5)

REQUESTED BY: IATA

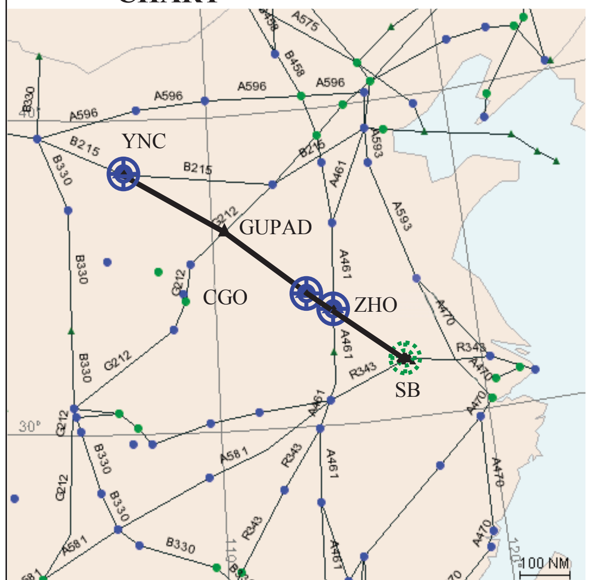
ENTRY/EXIT POINT

ROUTE DESCRIPTION
Yinchuan (YNC) .. GUPAD .. Zhengzhou (CGO) .. Zhoukou (ZHO) .. Luogang (SB)

FLIGHT LEVEL BAND
8400 – 15000 meters

PRIORITY: HIGH/MED/LOW

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks

Potential City Pairs: Europe-Shanghai

ATS ROUTE NAME: CHA2 (Renumbered from CHA 7)

REQUESTED BY: IATA

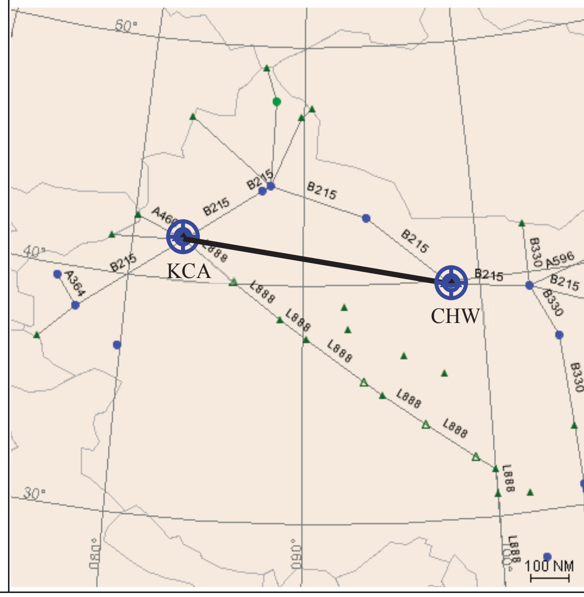
ENTRY/EXIT POINT

ROUTE DESCRIPTION
Kuqa (KCA) .. Jiayuguan (CHW)

FLIGHT LEVEL BAND
8400 – 15000 meters

PRIORITY: HIGH/MED/LOW

CHART



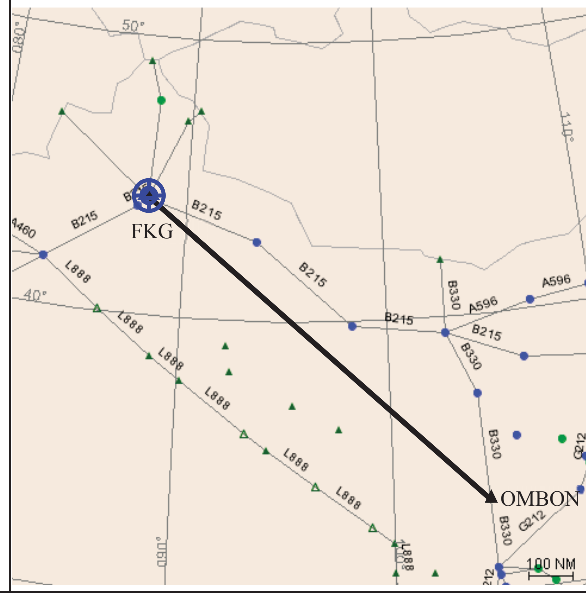
Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	93nm/ 12min	
Fuel		
CO_2		
No_x		

Remarks: There are exiting routes between KCA and CHW. Direct route is impossible.

Potential City Pairs: Middle East/Pakistan-China/Korea/Japan

ATS ROUTE NAME: CHA 3 (Renumbered from CHA 9A) REQUESTED BY: IATA

ENTRY/EXIT POINT	**CHART**
ROUTE DESCRIPTION **Fukang (FKG) .. OMBON** **FLIGHT LEVEL BAND** **8400 – 15000 meters** **PRIORITY: HIGH/MED/LOW**	

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	123nm/ 15.5min	
Fuel	2000kg	730,000kg
CO_2	6,150kg	2,245 tonnes
No_x		

Remarks: This direct route is impossible and can not be implemented at present.

Potential City Pairs: Europe/Russia-Pearl River Delta Airports

ATS ROUTE NAME: CHA4 (Renumbered from CHA 10A)

REQUESTED BY: IATA

ENTRY/EXIT POINT

ROUTE DESCRIPTION
MORIT .. Ningshan (NSH) .. Pingzhou (POU)

FLIGHT LEVEL BAND
8400 – 15000 meters

PRIORITY: HIGH/MED/LOW

CHART

Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time	152nm/ 19min	
Fuel	2470kg	901,000kg
CO_2	7,600kg	2,774 tonnes
No_x		

Remarks: This direct route is impossible and can not be implemented.

Potential City Pairs: Europe Russia-Pearl River Delta Airports

ATS ROUTE NAME: CHA 5 (Renumbered from CHA 11A)

REQUESTED BY: IATA

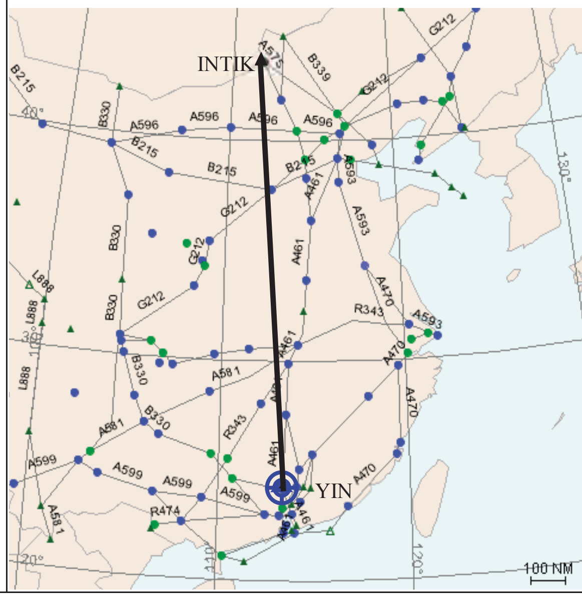
ENTRY/EXIT POINT

ROUTE DESCRIPTION
Yingde (YIN) .. INTIK

FLIGHT LEVEL BAND
8400 – 15000 meters

PRIORITY: HIGH/MED/LOW

CHART



Action Required	IATA
	ICAO

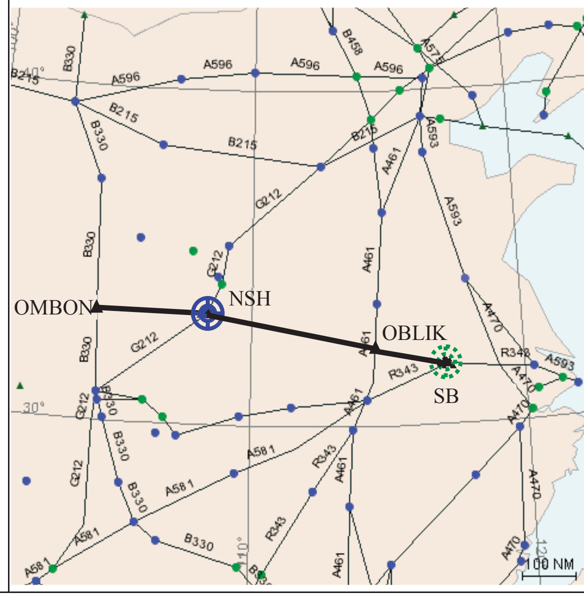
Saving	Per flight	Annual
Mileage / Time	140nm/17.5min	
Fuel	2275kg	830,000kg
CO_2	7,000kg	2,555 tonnes
No_x		

Remarks: This direct route is impossible and can not be implemented.

Potential City Pairs: Europe/Russia –Pearl River Delta Airports

ATS ROUTE NAME: CHA 6 (Renumbered from CHA 14)

REQUESTED BY: IATA

ENTRY/EXIT POINT **ROUTE DESCRIPTION** **OMBON .. Ningshan (NSH) .. OBLIK .. Luogang (SB)** **FLIGHT LEVEL BAND** **8400 – 15000 meters** **PRIORITY: HIGH/MED/LOW**	**CHART** 

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks: This route is impossible and can not be implemented at present.

Potential City Pairs: Europe-Shanghai

ATS ROUTE NAME: CHA 7 (Renumbered from CHA 15)

REQUESTED BY:IATA

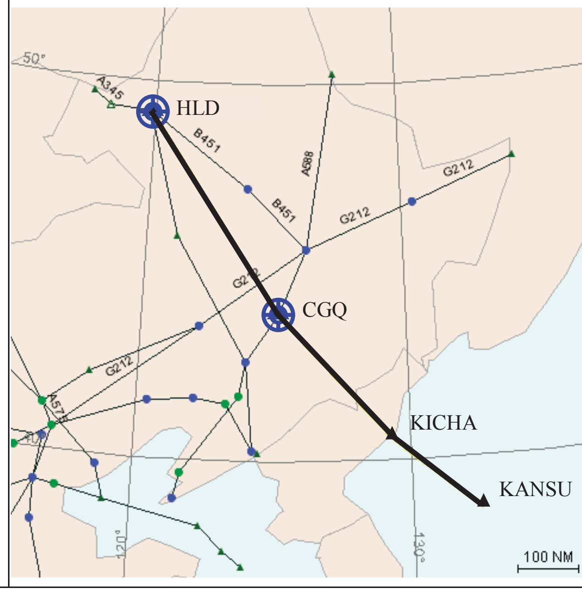
ENTRY/EXIT POINT
KANSU/XXXXX

ROUTE DESCRIPTION
KANSU .. KICHA .. Changchun (CGQ) .. Hailar (HLD)

FLIGHT LEVEL BAND
8400 – 15000 meters

PRIORITY: HIGH/MED/LOW

CHART



Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks

Potential City Pairs: Europe-Korea /Japan

ATS ROUTE NAME: CHA 8 (Renumbered from CHA 16)

REQUESTED BY: IATA

ENTRY/EXIT POINT

ROUTE DESCRIPTION
Shache (SCH) .. Hotan (HTN) .. Jiayuguan (CHW)

FLIGHT LEVEL BAND
8400 – 15000 meters

PRIORITY: HIGH/MED/LOW

CHART

Action Required	IATA
	ICAO

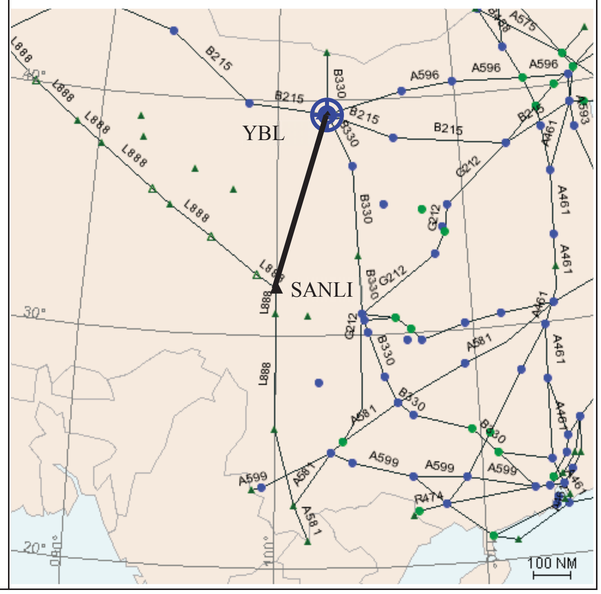
Saving	Per flight	Annual
Mileage / Time	69nm/9min	
Fuel	1121kg	409,000kg
CO_2	3,450 kg	1,260 tonnes
No_x		

Remarks: Direct route between HTN and CHW is impossible and can not be implemented at present.

Potential City Pairs: Middle East /Pakistan-China/Korea/Japan

ATS ROUTE NAME: CHA 9 (Renumbered from CHA 17)

REQUESTED BY: IATA

ENTRY/EXIT POINT	CHART
ROUTE DESCRIPTION **Yabrai (YBL) .. SANLI** **FLIGHT LEVEL BAND** **8400 – 15000 meters** **PRIORITY: HIGH/MED/LOW**	

Action Required	IATA.
	ICAO

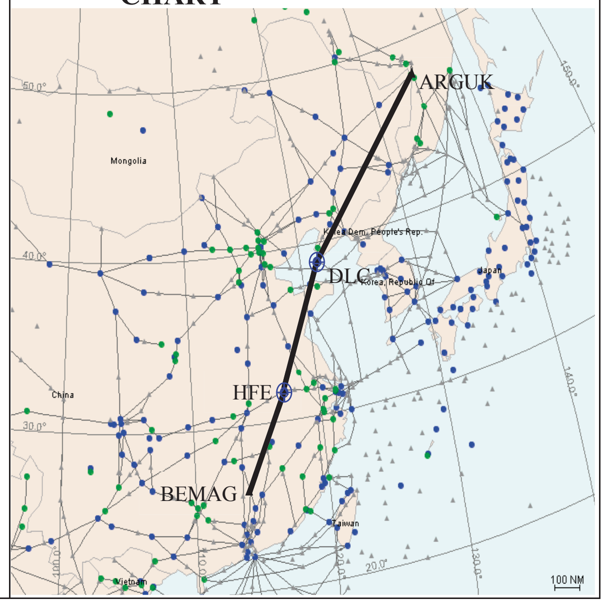
Saving	Per flight	Annual
Mileage / Time	48nm/ 6min	
Fuel	780kg	284,000kg
CO_2	2,400kg	876,000kg
No_x		

Remarks: This direct route is impossible and can not be implemented at present.

Potential City Pairs: North America-SE Asia

ATS ROUTE NAME: CHA 10 (Renumbered from CHA18-formerly SE1 in CTF/2000)

REQUESTED BY: IATA

ENTRY/EXIT POINT	**CHART**
ARGUK/BEMAG **ROUTE DESCRIPTION** ARGUK/DALIAN/HEFEI/BEMAG **FLIGHT LEVEL BAND** 8400-15000 metres **PRIORITY: HIGH/MED/LOW** HIGH	

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks: There are exiting routes between ARGUK-DLC-HFE-BEMAG. Direct route between ARGUK-DLC-HFE-BEMAG is impossible.

Potential City Pairs: North America- Pearl River Delta

ATS ROUTE NAME: CHA 11 (Renumbered from CHA19 formerly SE2 in CTF/2000)

REQUESTRED BY:IATA

ENTRY/EXIT POINT

DALIAN/(DLC) to XJT/B221

ROUTE DESCRIPTION

DALIAN/ XJT /B221

FLIGHT LEVEL BAND

8400-15000 metres

PRIORITY: HIGH/MED/LOW

HIGH

CHART

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks: There are exiting routes between DLC and XJT. Direct route is impossible.

Potential City Pairs: North America-Shanghai

ATS ROUTE NAME: CHA 12

Requested by : IATA

ENTRY/EXIT POINT

UNWW to WXI

ROUTE DESCRIPTION

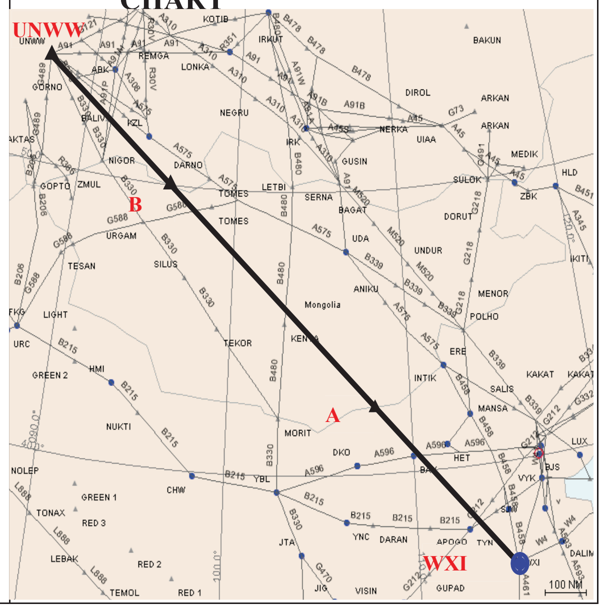
Weixian (WXI) .. A (ZBPE/ZMUB) .. B (ZMUB/UNKY) .. Novokuznetsk (UNWW)
Uni-directional

FLIGHT LEVEL BAND

28000 – 46000 feet

PRIORITY: HIGH/MED/LOW

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time	166nm/20min	
Fuel	2620kg	956,000kg
CO_2	8070kg	2,944 tonnes
No_x		

Remarks: This would allow following city pair flights to avoid the congested airspace around the Beijing Capital Airport.

Potential City Pairs: Pearl River Delta – Europe and Shanghai – Europe.

ATS ROUTE NAME: IATA 2

REQUESTED BY: IATA

ENTRY/EXIT POINT

ROUTE DESCRIPTION

FLIGHT LEVEL BAND
8400 – 15000 meters

PRIORITY: HIGH/MED/LOW

CHART

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks: There are exiting routes between OMBON and RO. Direct route is impossible at present.

Potential City Pairs: Europe –Pearl River Delta Airports

ATS ROUTE NAME: IATA 3

REQUESTED BY: IATA

ENTRY/EXIT POINT

ROUTE DESCRIPTION

FLIGHT LEVEL BAND
8400 – 15000 meters

PRIORITY: HIGH/MED/LOW

CHART

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Remarks: There are exiting routes between OMBON and SB; direct route is impossible at present.

Potential City Pairs: Europe-Shanghai

ATS ROUTE NAME: *JAP 1*
REQUESTED BY: IATA Date: 25 June 2012 (ATM/AIS/SAR/SG-22)

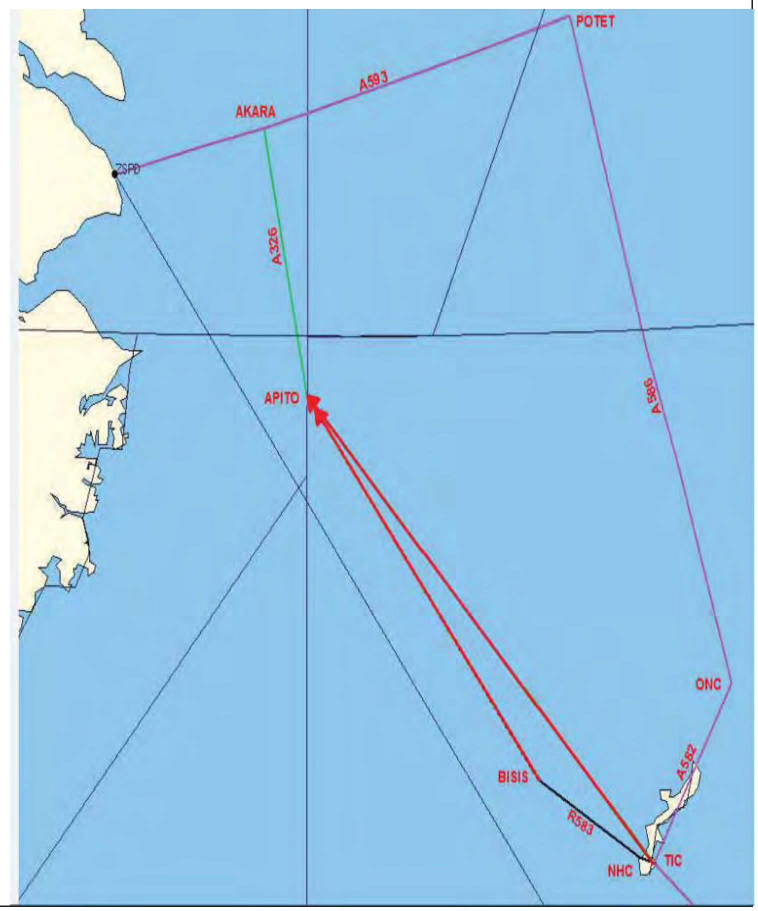
ENTRY/EXIT POINT
TIC - APITO

ROUTE DESCRIPTION
PIC - APITO
Alternative:
TIC – R583- BISIS – APITO

FLIGHT LEVEL BAND

PRIORITY:

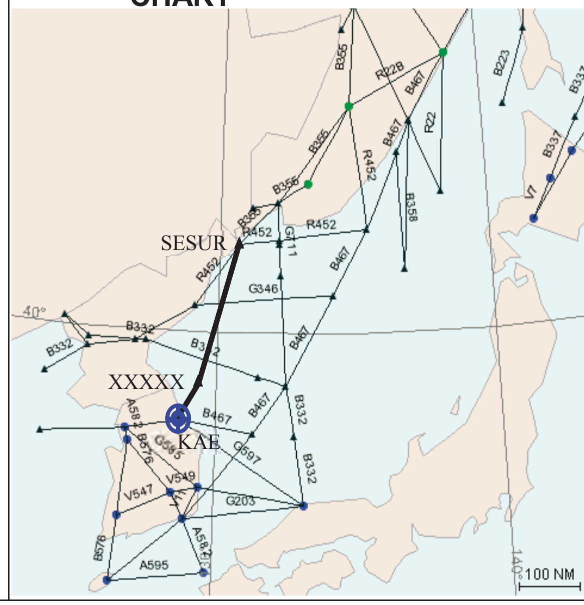
CHART



Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time	19 mins/19 mins	
Fuel	3094kg/3021kg	kg
CO_2	9591kg/9365	kg
No_x		

ATS ROUTE NAME R	
Re e ted IA A	

	CHART
ENTRY/EXIT POINT **XXXXX** **ROUTE DESCRIPTION** **SESUR .. XXXXX .. Gangwon (KAE)** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW** **"XXXXX" Approx N38 38.0 E129 24.7**	

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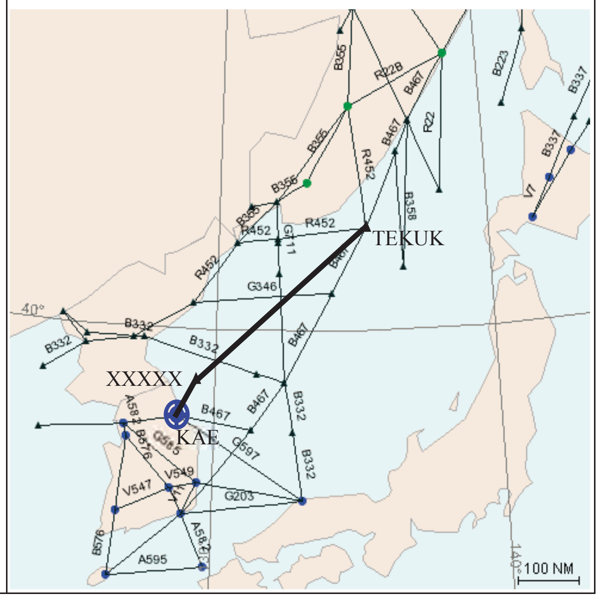
e	g	g
2	g	2 2 tonne
No		

Remarks

Potent a t Pa r North Amer a In hoen

ATS ROUTE NAME R 2 Re e ted IA A

ENTRY/EXIT POINT	CHART
XXXXX **ROUTE DESCRIPTION** **TEKUK .. XXXXX .. Gangwon (KAE)** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW** **“XXXXX” Approx N38 38.0 E129 24.7**	

A t on Re red	IA A
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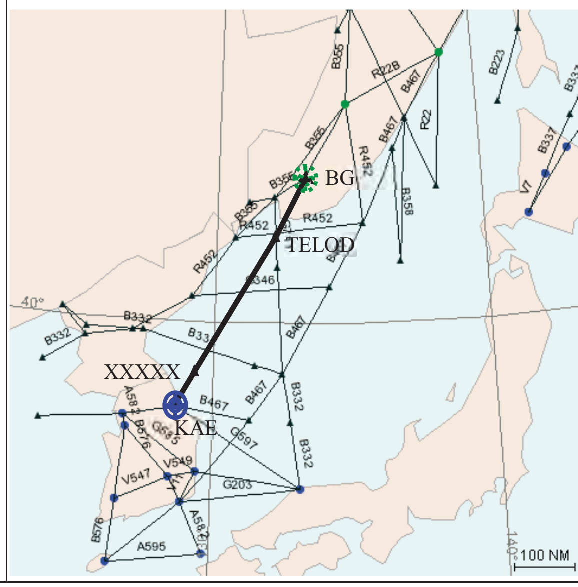
e	g	222 tonne
2	33 g	3 4 g
No		

Remarks

Potent a t Pa r North Amer a In hoen

ATS ROUTE NAME R 3 Re e ted IA A

ENTRY/EXIT POINT	CHART
XXXXX **ROUTE DESCRIPTION** **Muraveyka (BG) .. TELOD .. XXXXX .. Gangwon (KAE)** **FLIGHT LEVEL BAND** **28000 – 46000 feet** **PRIORITY: HIGH/MED/LOW** **“XXXXX” Approx N38 38.0 E129 24.7**	

A t on Re red	IA A	
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e	2 4 g	g
2	g	2 4 4 tonne
No		

Remarks

Potent a t Pa r North Amer a In hoen

ATS ROUTE NAME: *RUS 4*
REQUESTED BY: IATA

ENTRY/EXIT POINT

ROUTE DESCRIPTION

AVGOK-GTC

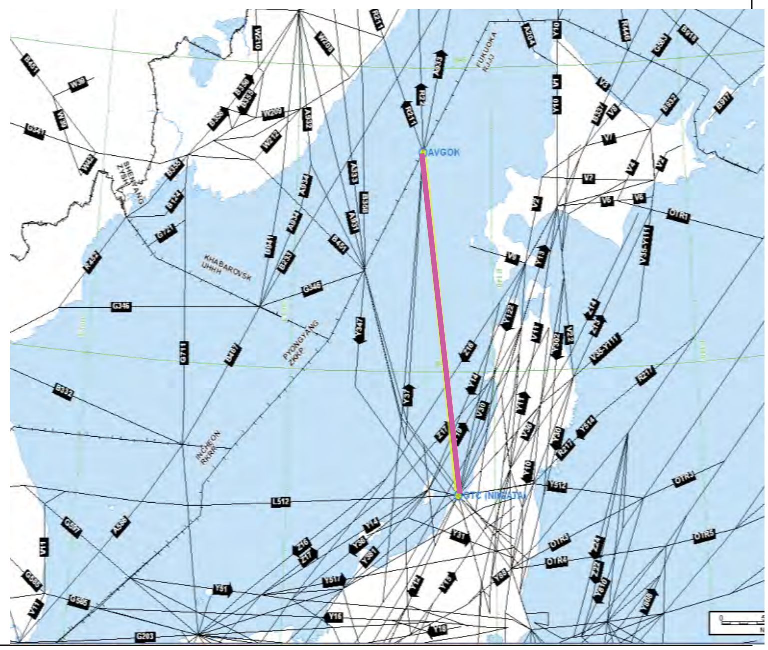
FLIGHT LEVEL BAND

PRIORITY:

States concerned

JAPAN
RUSSIAN FEDERATION

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Russian Federation: Further discussion with Japan required through the ICAO APAC Office.

Objective:
To reduce route distance of 13 NM as compared to current routing AVGOK-KADBO-RJSN.

ATS ROUTE NAME: *RUS 5*
REQUESTED BY: IATA /RUSSIA

ENTRY/EXIT POINT

ROUTE DESCRIPTION
bidirectional ATS route **SIBIR – LURED – EKVIK.**

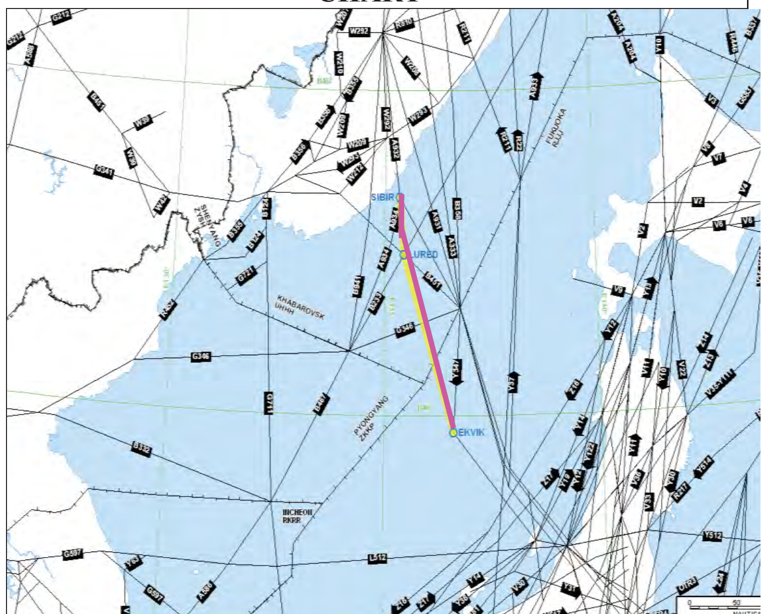
FLIGHT LEVEL BAND

PRIORITY:

States concerned

JAPAN
RUSSIAN FEDERATION

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Russian Federation: New waypoint needed 404751N1361021E (FIR Boundary), coordination with Japan (Fukuoka FIR) required.
Alternative bi-directional route to EN15. Implementation planned for 2Q 2013.

Objective:
To improve north-south traffic flows between Khabarovsk FIR and Fukuoka FIR.

ATS ROUTE NAME: *CHA13*
REQUESTED BY: IATA

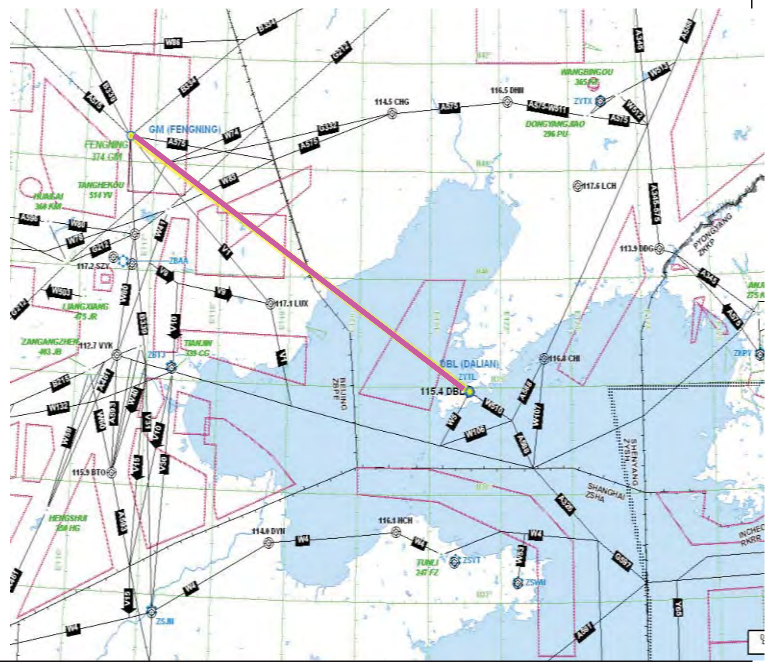
ENTRY/EXIT POINT

ROUTE DESCRIPTION
FLIGHT LEVEL BAND
GM - DBL.
PRIORITY:

States concerned

CHINA

CHART



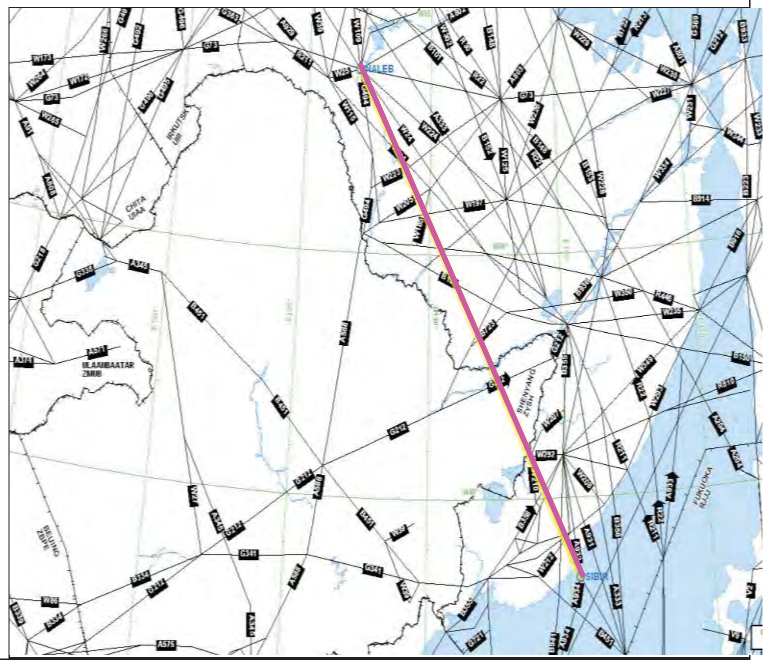
Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Part of IATA EUR-North Asia package - #EN13.

China: Further discussions required via ICAO APAC Office.
Objective:
To reduce route distance of 67 NM as compared to current routing GM-LADIX-MAKNO.

ATS ROUTE NAME: *RUS 6*
REQUESTED BY: IATA

ENTRY/EXIT POINT	CHART
ROUTE DESCRIPTION **FLIGHT LEVEL BAND** **NALEB - SIBIR.** **PRIORITY:** **States concerned** CHINA RUSSIAN FEDERATION	

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Part of IATA EUR-North Asia package - #EN6.
Objective:
To reduce route distance of 63 NM as compared to current routing LALIR-SOVIK-HAB-TD-SIBIR.

ATS ROUTE NAME: *RUS 7*
REQUESTED BY: IATA

ENTRY/EXIT POINT

ROUTE DESCRIPTION
ATS route segment **DIKUT** or **SANAR - SAMON**.

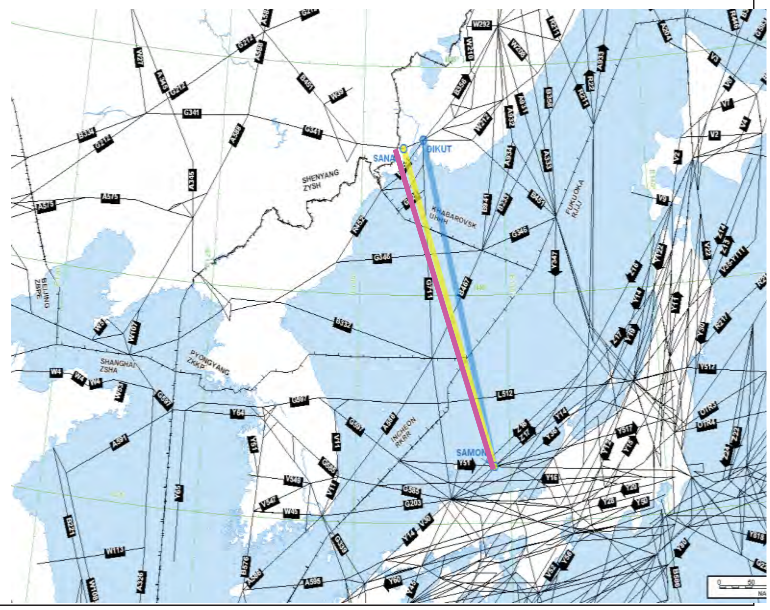
FLIGHT LEVEL BAND

PRIORITY:

States concerned

JAPAN
RUSSIAN FEDERATION
DEM. PEOPLE'S REP. OF KOREA

CHART



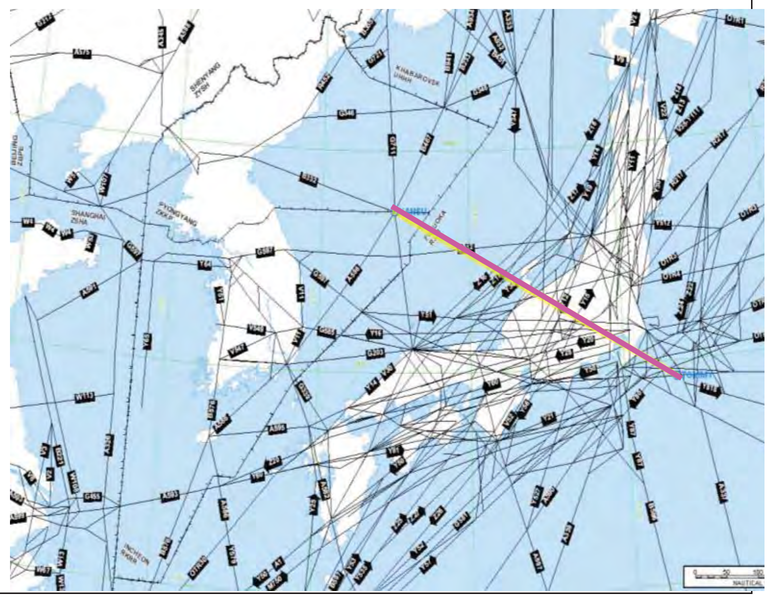
Action Required	
	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Part of IATA EUR-North Asia package - #EN9.

Russian Federation: Further discussion/studies required. Difficult to implement.
Objective:
To reduce route distance of 160 NM as compared to current routing DIKUT-KANSU-JEC.

ATS ROUTE NAME: *RUS 8*
REQUESTED BY: IATA

ENTRY/EXIT POINT	**CHART**
ROUTE DESCRIPTION **KANSU - TOMMY**. **FLIGHT LEVEL BAND** **PRIORITY:** **States concerned** KOREA JAPAN	

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Part of IATA EUR-North Asia package - #EN14.

China: Further discussion between China and Korea also required via ICAO APAC Office.
Objective:
To reduce route distance of 64 NM as compared to current routing KANSU-IGRAS-TOMMY.

ATS ROUTE NAME: *RUS 9*
REQUESTED BY: IATA/RUSSIA

<table>
<tr><td>

ENTRY/EXIT POINT

ROUTE DESCRIPTION

RITEK- new waypoint 495025N 1182854E - HLD

FLIGHT LEVEL BAND

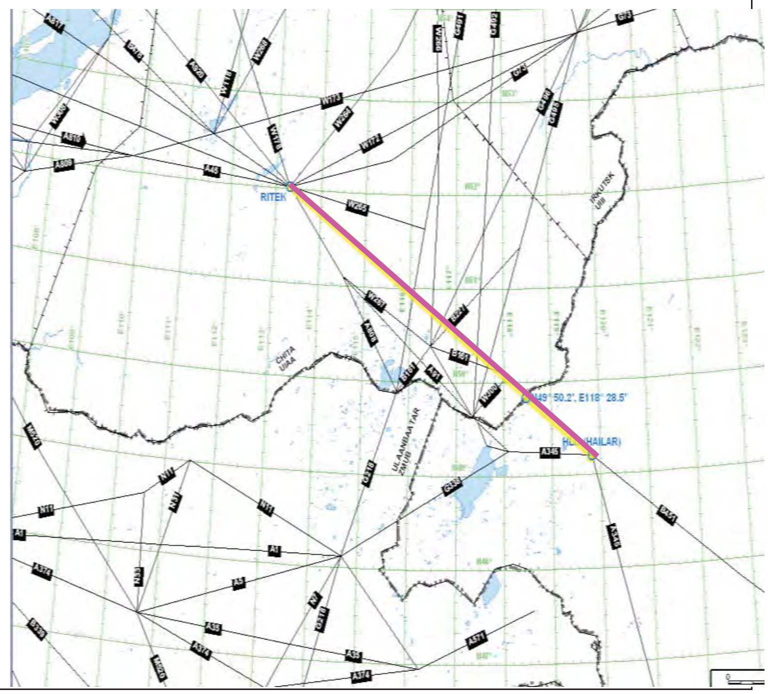
PRIORITY:

States concerned

CHINA
RUSSIAN FEDERATION

</td><td>

CHART



</td></tr>
</table>

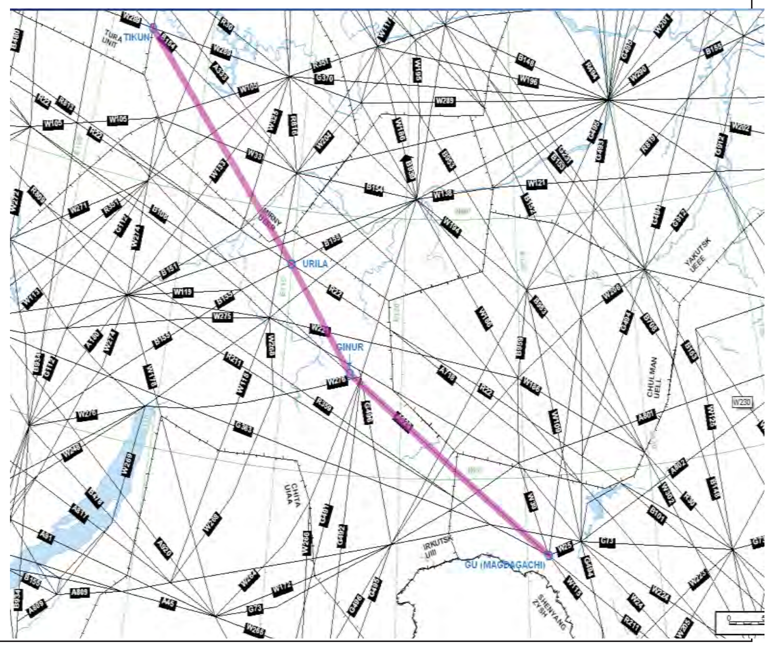
Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Further studies/coordination required. Updates will be given when available.

Alternative uni-directional eastbound route proposal for EN11, proposal 13.035 (deleted from catalogue).
Objective:
To reduce route distance of 159 NM as comparred to current routing PTG-RITEK-HLD-DIKUT-KANSU

ATS ROUTE NAME: *RUS 10*
REQUESTED BY: IATA/RUSSIA

ENTRY/EXIT POINT	**CHART**
ROUTE DESCRIPTION **TIKUN - URILA - GINUR - GU.** **FLIGHT LEVEL BAND** **PRIORITY:** **States concerned** CHINA RUSSIAN FEDERATION	

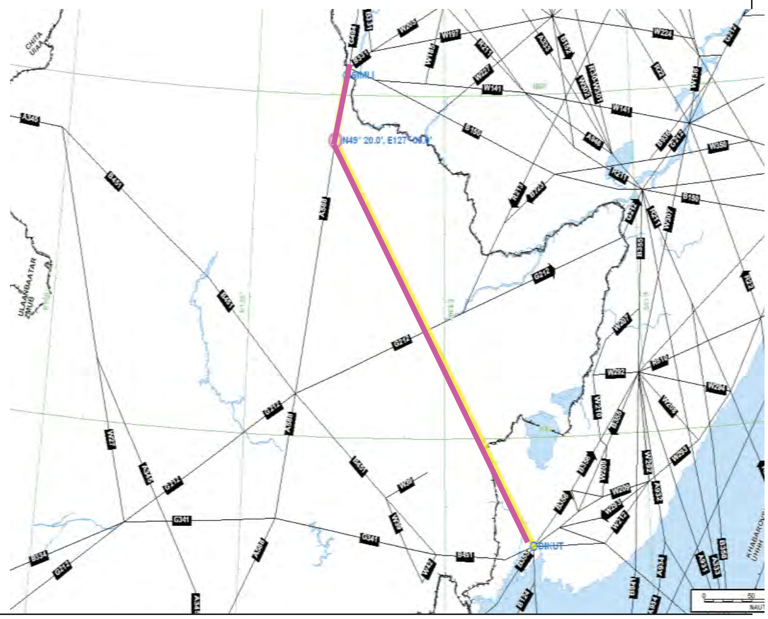
Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Part of IATA EUR-North Asia package - #EN10.

China: Proposal can partly be withdrawn due to lack of CNS capabilities for the segment URILA-492000N1270600E. Alternative proposal made.
Russian Federation: Further studies/discussion required.
Objective:
To reduce route distance of 150 NM as compared to current routing TIKUN IVADA TD DIKUT.

ATS ROUTE NAME: *RUS 11*
REQUESTED BY: IATA/RUSSIA

ENTRY/EXIT POINT	**CHART**
ROUTE DESCRIPTION **SIMLI - new waypoint 492000N 1270600E - DIKUT**. **FLIGHT LEVEL BAND** **PRIORITY:** **States concerned** CHINA RUSSIAN FEDERATION	

Action Required	IATA
	ICAO

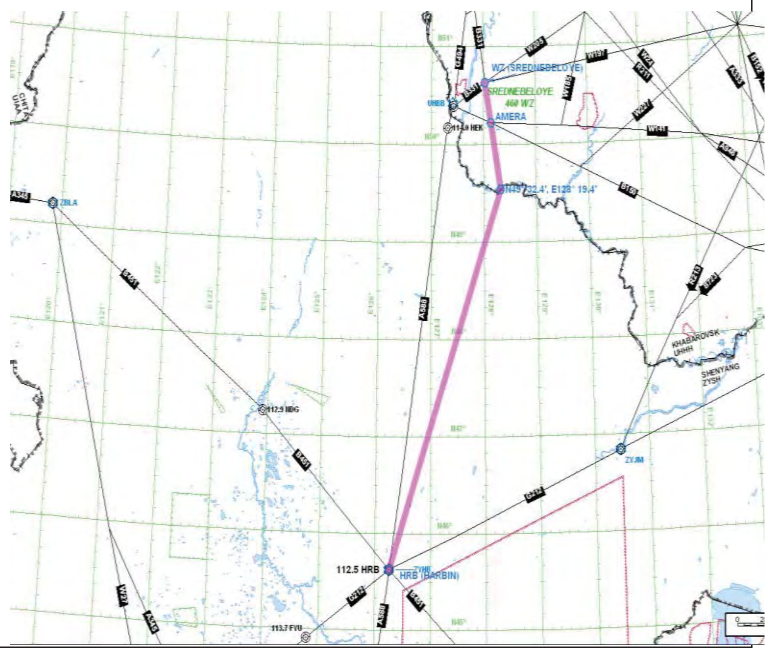
Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Further studies/coordination required. Updates will be given when available.
Objective:
To reduce route distance of 150 NM as compared to current routing TIKUN IVADA TD DIKUT.

ATS ROUTE NAME: *RUS 12*
REQUESTED BY: IATA/RUSSIA

ENTRY/EXIT POINT

CHART



ROUTE DESCRIPTION

Unidirectional Westbound route **HRB - 493236N 1281936E - AMERA – WZ**

FLIGHT LEVEL BAND

PRIORITY:

States concerned

CHINA
DEM. PEOPLE'S REP. OF KOREA
RUSSIAN FEDERATION

Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Russian Federation: westbound ATS route is needed for unloading traffic from SIMLI

ATS ROUTE NAME: *RUS 13*
REQUESTED BY: IATA/RUSSIA

ENTRY/EXIT POINT

CHART

ROUTE DESCRIPTION

unidirectional Eastbound route **SIMLI - HEK - 492000N 12706E - LEPNI - 422624.7N 1294454.7E - KANSU**

FLIGHT LEVEL BAND

PRIORITY:

States concerned

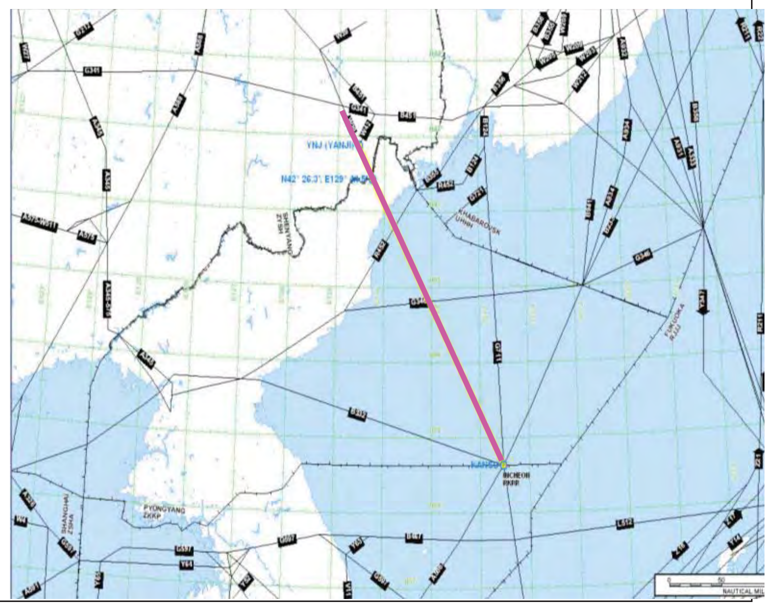
CHINA
DEM. PEOPLE'S REP. OF KOREA
RUSSIAN FEDERATION

Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Russian Federation: eastbound ATS route is needed for unloading traffic from SIMLI.
China: Confirmation of interest in this ATS route but further studies/coordination are needed, updates will be given when available.

ATS ROUTE NAME: *RUS 14*
REQUESTED BY: IATA/RUSSIA

ENTRY/EXIT POINT	CHART
ROUTE DESCRIPTION **FLIGHT LEVEL BAND** **PRIORITY:** **States concerned** CHINA DEM. PEOPLE'S REP. OF KOREA RUSSIAN FEDERATION	

Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Alternative bi-directional route

Objective:
To reduce route distance of 159 NM as compared to current routing PTG RITEK HLD DIKUT KANSU.

ATS ROUTE NAME: *RUS 15*
REQUESTED BY: IATA/RUSSIA

ENTRY/EXIT POINT

ROUTE DESCRIPTION
Westbound ATS route **LEPNI 435542N 1285030E - new waypoint 493236N**

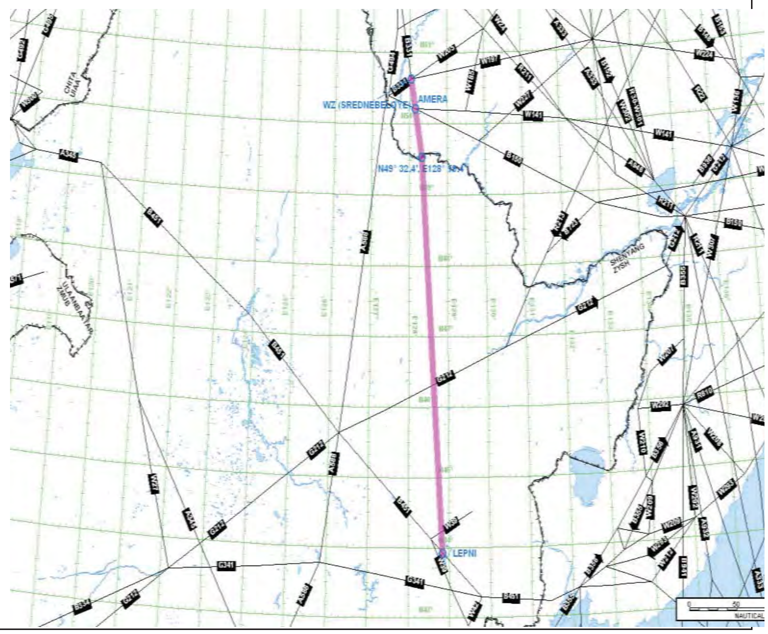
FLIGHT LEVEL BAND

PRIORITY:

States concerned

CHINA
RUSSIAN FEDERATION

CHART



Action Required	IATA
	ICAO

Saving	Per flight	Annual
Mileage / Time		
Fuel		
CO_2		
No_x		

Further studies/coordination required. Updates will be given

ATS ROUTES	SIGNIFICANT PTS	COORDINATES	FIR	REMARKS

Chapter 4: Pacific

(referred to: IPACG, ISPACG as appropriate for review)

WPC 1	PY VNO ROR ENDAX ELMAS TINHO	S0927.2 E14712.9 S0240.7 E14118.2 N0722.1 E13433.0 N1415.0 E13000.0 N2027.0 E12500.0 N2421.2 E12201.7	PT MORESBY PT MORESBY OAKLAND MANILA MANILA TAIPEI	
R582	KRILL MAITO Tahiti PAERE TOLAB TAMUR TIERE TARAO TUNBA TIAMU	2016.1N 15700.0E 1732.8S 14936.1E 1625.0S 14752.6W 1428.0S 14500.0W 1104.0S 14000.0W	Auckland Ocn/Tahiti Tahiti Tahiti Tahiti Tahiti Tahiti Tahiti Tahiti Tahiti Tahiti	Moved from Chapter 4. Route Requested by Tahiti

ATS ROUTE NAME: WPC 1

Requested by : IATA

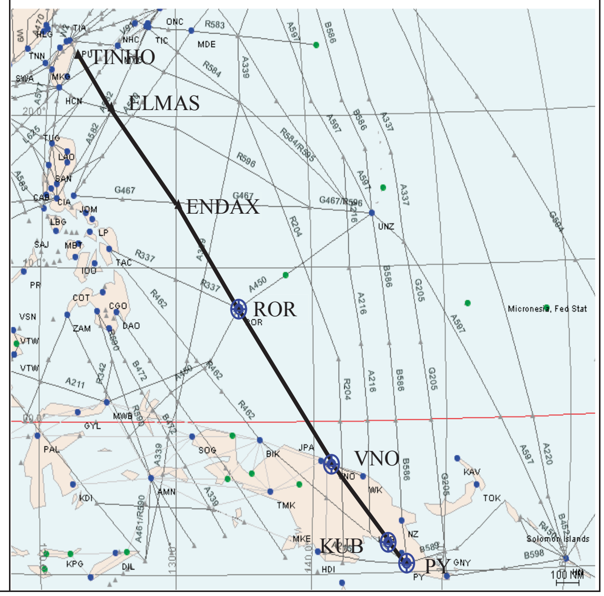
ENTRY/EXIT POINT
PY-TINHO

ROUTE DESCRIPTION
Port Moresby (PY) .... Vanimo (VNO) .. Koror (ROR) .. ENDAX .. ELMAS .. TINHO

FLIGHT LEVEL BAND
28000 – 46000 feet

PRIORITY: HIGH/MED/LOW
HIGH

CHART



Action Required	IATA	
	ICAO	

Saving	Per flight	Annual
Mileage / Time	160 nm/20min	
Fuel	2600kg	949,000kg
CO_2	8000kg	2,920 tonnes
No_x		

Remarks

Potential City Pairs: Auckland-Taipei.

Remarks Potential City Pairs: NZAA - ZSPD, YSSY - ZSPD

ATS ROUTE NAME: **R582**

Requested by : Tahiti

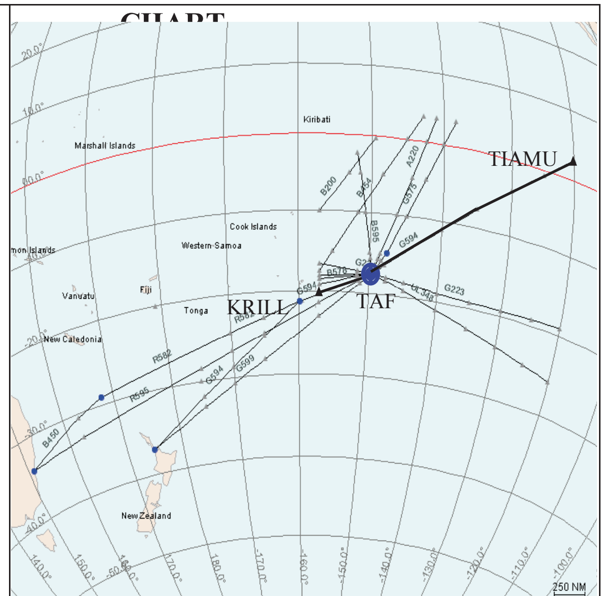
ENTRY/EXIT POINT

ROUTE DESCRIPTION
Decommissioned G594 and realigned R582 as KRILL .. MAITO .. Tahiti (TAF) .. PAERE .. TOLAB .. TAMUR .. TIERE.. TARAO .. TUNBA .. TIAMU

FLIGHT LEVEL BAND

PRIORITY: HIGH/MED/LOW

CHART



Action Required	States to coordinate imeplementation.
	ICAO to circulate proposal for deletion from BANP.

Benefit		
Cost		
Fuel Saving		
Emission	CO_2	
	NO_X	

Remarks:

State AIS AIM Transition Table

Phase 1
P-03 — AIRAC adherence monitoring
P-04 — Monitoring of States' differences to Annex 4 and Annex 15
P-05 — WGS-84 implementation
P-17 — Quality
Phase 2
P-01 — Data quality monitoring
P-02 — Data integrity monitoring
P-06 — Integrated aeronautical information database
P-07 — Unique identifiers
P-08 — Aeronautical information conceptual model
P-11 — Electronic AIP
P-13 — Terrain
P-14 — Obstacles
P-15 — Aerodrome mapping
Phase 3
P-09 — Aeronautical data exchange
P-10 — Communication networks
P-12 — Aeronautical information briefing
P-16 —Training
P-18 — Agreements with data originators
P-19 — Interoperability with meteorological products
P-20 — Electronic aeronautical charts
P-21 — Digital NOTAM

Date Last Amended: 18 June 2013

	Phase 1 Consolidation (Am. 36 November 2010)				Phase 2 Going Digital (Amendment 37 November 2013)									Phase 3 Information Management (Amendment 38 November 2016)							
	P-03	P-04	P-05	P-17	P-01	P-02	P-06	P-07	P-08	P-11	P-13	P-14	P-15	P-09	P-10	P-12	P-16	P-18	P-19	P-20	P-21
Afghanistan										part											
Australia	√	√	√	90%	80%	√	√	√	60%	Link	√	75%				10%	60%			90%	5%
Bangladesh	√	√	25%																		
Bhutan																					
Brunei Darussalam																					
Cambodia	√	√	√																		
China	√	√	√	√													√			√	
Hong Kong, China	√	√	√	√	√	√				Link	10%	10%					20%				
Macao, China	√	√	√	√						Link											
Cook Islands																					
DPR Korea			√																		
Fiji	√	√	√				√	√				√	√		√	√	√				
India	√	√	√	√	√	√	√	√	√	Link		√									
Indonesia	√	√	√		50%	50%	20%								80%		60%	20%	10%	20%	
Japan	√	√	√	√	80%	80%	√	√		Link	20%	20%		20%	20%	60%	80%	√		20%	20%
Kiribati																					
Lao PDR	√	√	25%																		
Malaysia	√	√	√	10%						Link											
Maldives										Link											
Marshall Islands																					
Micronesia																					
Mongolia	√	√	√	√	80%	80%	30%	√	√	Link	10%	10%		60%	10%	50%	90%	√			
Myanmar	√	√	√				20%				20%	20%				10%				25%	
Nauru																					
Nepal																					
New Zealand	√	√	√	√	√	√	√	√	75%	Link	√	80%	15%	80%							
Niue (NZ)																					
Pakistan	√	√	√									√		√	√	√		√			√
Palau										part											
Papua New Guinea	√	√	√	90%				√								10%					
Philippines	√	√	40%	√	√	√	√	√	√												
Republic of Korea	√	√	√	√	80%															40%	90%
Samoa																					
Singapore	√	√	√	√	√	√	√	√		Link				√	√	√	√	√		√	
Solomon Islands			√																		
Sri Lanka	√	√	90%	90%						Link					10%	25%	15%	25%			
Thailand	√	√	80%	40%	40%	30%					25%	25%		10%	5%						
Timor Leste			√																		
Tonga																					
Vanuatu																					
Viet Nam	√	√	√	25%	50%	50%	50%		√					√	√		70%	50%			
USA[1]	√			√	√		√	√	√	part	√	√	√	√	√					√	√
France[2]										Link											

% means the percentage progress towards achievement of the element. Link = AIP Book + AIP SUP + AIC. part = AIP Book, but no AIP SUP and/or AIC.

[1] Includes American Samoa, Guam, Johnston, Kingman, Midway, Mariana, Palmyra, Wake

[2] Includes French Polynesia, New Caledonia, Wallis and Futuna Islands

E-AIP Internet Addresses

Afghanistan	http://www.motca.gov.af/ *(Partially compliant with Annex 15 requirements – No AIC)*
Australia	http://www.airservicesaustralia.com/
Bangladesh	http://www.caab.gov.bd/adinfo/adinfo0.html *(Link removed. eAIP only has airport information, no AIP SUP or AIC)*
Bhutan	http://www.dca.gov.bt/aip *(Link removed; inoperative)*
Brunei Darussalam	
Cambodia	
China	
Hong Kong, China	http://www.hkatc.gov.hk
Macao, China	http://www.aacm.gov.mo
Cook Islands	
DPR Korea	
Fiji	
India	http://www.aai.aero/public_notices/aaisite_test/eAIP/Home_india_01.html
Indonesia	http://www.aimindonesia.info *(Link to AIS homepage works, but link to AIP inoperative)*
Japan	https://aisjapan.mlit.go.jp
Kiribati	
Lao PDR	
Malaysia	http://aip.dca.gov.my/
Maldives	http://www.aviainfo.gov.mv
Marshall Islands	
Micronesia	
Mongolia	http://ais.mcaa.gov.mn/index.php?lang=en
Myanmar	http://www.ais.gov.mm *(No AIP book. AIP AMD, SUP and AIC are provided)*
Nauru	
Nepal	
New Zealand	http://www.aip.net.nz/
Niue (NZ)	
Pakistan	No AIP book.
Palau	http://www.faa.gov/air_traffic/publications/atpubs/AIP/aip.pdf *(Partially compliant with Annex 15 requirements. No AIP SUP or AIC)*
Papua New Guinea	
Philippines	http://ats.caap.gov.ph *(Requires registration, but registration functionality inoperative)*
Republic of Korea	
Samoa	
Singapore	http://www.caas.gov.sg/caas/en/Regulations/Aeronautical_Information/AIP/index.html
Solomon Islands	
Sri Lanka	http://airport.lk/AIS/141.htm
Thailand	
Tonga	
Vanuatu	
Viet Nam	
USA	http://www.faa.gov/air_traffic/publications/atpubs/AIP/aip.pdf *(Partially compliant with Annex 15 requirements – No AIP SUP or AIC)*
France (Wallis et Futuna, Iles) (French Polynesia)	E-AIP France

	Phase 1 Consolidation (Amendment 36 **November 2010**)				Phase 2 Going Digital (Amendment 37 **November 2013**)									Phase 3 Information Management (Amendment **38 November 2016**)							
	AIRAC Adherence Monitoring	Monitoring Annex 4 and Annex 15 differences	WGS-84 Implementation	Quality	Data Quality Monitoring	Data Integrity Monitoring	Integrated Aeronautical Information Database	Unique Identifiers	Aeronautical Information Conceptual Model	Electronic AIP	Terrain	Obstacles	Aerodrome Mapping	Aeronautical Data Exchange	Communication Networks	Aeronautical Information Briefing	Training	Agreements with Data Originators	Interoperability with Meteorological Products	Electronic Aeronautical Charts	Digital Notam
	P-03	P-04	P-05	P-17	P-01	P-02	P-06	P-07	P-08	P-11	P-13	P-14	P-15	P-09	P-10	P-12	P-16	P-18	P-19	P-20	P-21
Australia	√	√	√	Q 4 2013	Q4 2013	√	Q4 2013	√	Q3 2013	√	√	Q4 2015	Q4 2015	Q4 2013	Q4 2015	Q4 2015	Q4 2013	Q4 2013	Q4 2015	Q4 2015	Q4 2015
Bangladesh	√	√	DEC '13	DEC '13	DEC '13	DEC '13	DEC '14	√	DEC '14	JUN '13	JUN '14	DEC '14	DEC '13	DEC '14	DEC '14	DEC '14	JUN '14	JUN '14	DEC '13	JUN '14	DEC '15
China	√	√	√	√	2016	2016	2018	2016	40% 2015	30% 2013	Area3,4: 2016 Area 1:	Area3,4: 2016 Area 2:	2020	2018 (researching and waiting	2017	2016	2014	2017	2018	30% 2018	2020
Hong Kong, China	√	√	√	√	√	√	2014 Q3	2014	2014	2014	√	√	√	2016	Date not AVBL (Note 2)	2014	2014	√	Date not AVBL (Note 3)	2014	Date not AVBL (Note 4)
Macao, China	√	√	√	√	2015	2015	2014	2014	2015	2015	2015	2015	2015	2016	2016	2016	√	2016	2016	2016	2016
India	√	√	√	√	√	√	√	√	√	APR 2013	Update 31 JUL 2013	Update 31 JUL 2013	Update 31 JUL 2013	41820	41820	41820		Update 31 JUL 2013	41820	Update 31 JUL 2013	30 JUN 2014; guidance
Indonesia	√	√	√	2013	2013	2015	2015								2013 - 2020	2013 - 2020	2013				
Japan	√	√	√	√	√	√	√	√	√	√	Developme nt 2013-2015	Developme nt 2013-2015	No Plan	requests exchange with neighbourin	Requiremen ts are not clear	Requiremen ts are not clear	√	√	requiremen ts are not clear	requiremen ts are not clear	Developme nt 2020-2021. Start Provision
Malaysia	√	√	√	End 2014	End 2014	End 2014	End 2014	√	End 2014	End 2014	End 2014	End 2014	End 2014	End 2014	End 2014	End 2014	End 2014	In progress	Early 2015	End 2014	End 2016
Mongolia	√	√	√	√	Q2 2014	Q2 2014	Q4 2016	√	√	√	Q4 2015	Q2 2014	Q4 2016	√	Q4 2016	Q4 2013	Q4 2016	√	Q4 2016	Q4 2015	Q4 2016
New Zealand	√	√	√	√	√	√	√	√	2015	√	√	2011-2014	2013	2010-2018	2011-TBA	2012	2015	2012	2015+	2015	2012-2017
Pakistan	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2014	Dec 2015	Dec 2015	Dec 2015	Dec 2015	Dec 2015	Dec 2015	Dec 2015	Dec 2015
Philippines	√	√	Jun 2014	Dec 2013	√	Dec 2013	√	√	√	Jan 2013	further study	further study	CNS/ ATM Project	Dec 2014	CNS/ ATM Project	CNS/ ATM Project	Dec 2013	Dec 2013	CNS/ ATM Project	CNS/ ATM Project	CNS/ ATM Project
Republic of Korea	√	√	√	√	√	Jan 2015	Jan 2015	√	√	Complete (on testing)	Jan 2015	Jan 2015	Jan 2014	Jan 2014	Partially complete	Complete (on testing)	√	√	Jan 2015	Jan 2015	Complete (ontesting)
Singapore	√	√	√	√	Complete (manually)	Complete (manually)	Target end 2013	√	Target end 2013	√	Target mid 2014	Target mid 2014	Target mid 2014	√	√	√	In progress	√	Target end 2013	Target mid 2014	Pending confirmation
Viet Nam	√	2000-2015	1998-2018	2013-2014	2009-2018	2009-2018	2009-2018	2009-2022	2009 and onward	√	2013-2018	2013-2018	2013-2028	2009 and onward	2009 and onward	2009-2028	2011-2020	2010 and onward	2009-2020	2013-2028	2018-2028
USA[1]	√	Ongoing	Feb 2016	√	Feb 2016	Feb 2016	Mar 2018	Mar 2018	√	√	Feb 2016	Feb 2016	Jan 2020	Feb 2016	Feb 2016	N/A US Difference filed	Feb 2016	Feb 2016	Mar 2018	Ongoing	Aug 2016
France[2]	√	√	√	√	√	√	2013	√	2013	2013	2015	2015	2015	2017	2017	√	√	√	2017	2017	2017

√ = Completed   = On Schedule   = Behind Schedule   = No plan to implement

	Phase 1 Consolidation				Phase 2 Going Digital								
	Amendment 36 November 2010				**Amendment 37 November 2013**								
	AIRAC Adherence Monitoring	Monitoring Annex 4 and Annex 15 differences	WGS-84 Implementation	Quality	Data Quality Monitoring	Data Integrity Monitoring	Integrated Aeronautical Information Database	Unique Identifiers	Aeronautical Information Conceptual Model	Electronic AIP	Terrain	Obstacles	Aerodrome Mapping
	P-03	**P-04**	**P-05**	**P-17**	**P-01**	**P-02**	**P-06**	**P-07**	**P-08**	**P-11**	**P-13**	**P-14**	**P-15**
Afghanistan	X	X	X	X	X	X	X	X	X	X	X	X	X
Australia	√	√	√	X	Q4 2013	√	Q4 2013	√	Q3 2013	√	√	X	X
Bangladesh	√	√	X	X	X	X	X	√	X	***JUN '13***	X	X	X
Bhutan	X	X	X	X	X	X	X	X	X	X	X	X	X
Brunei Darussalam	X	X	X	X	X	X	X	X	X	X	X	X	X
Cambodia	√	√	√	X	X	X	X	X	X	X	X	X	X
China	√	√	√	√	X	X	X	X	X	30% 2013	X	X	X
Hong Kong, China	√	√	√	√	√	√	X	X	X	X	√	√	√
Macao, China	√	√	√	√	X	X	X	X	X	X	X	X	X
Cook Islands	X	X	X	X	X	X	X	X	X	X	X	X	X
DPR Korea	X	X	√	X	X	X	X	X	X	X	X	X	X
Fiji	√	√	√	X	X	X	√	√	X	X	X	√	√
India	√	√	√	√	√	√	√	√	√	***APR 2013***	X	X	X
Indonesia	√	√	√	X	2013	X	X	X	X	X	X	X	X
Japan	√	√	√	√	√	√	√	√	√	√	X	X	X
Kiribati	X	X	X	X	X	X	X	X	X	X	X	X	X
Lao PDR	√	√	X	X	X	X	X	X	X	X	X	X	X
Malaysia	√	√	√	X	X	X	X	√	X	X	X	X	X
Maldives	X	X	X	X	X	X	X	X	X	√	X	X	X
Marshall Islands	X	X	X	X	X	X	X	X	X	X	X	X	X
Micronesia	X	X	X	X	X	X	X	X	X	X	X	X	X
Mongolia	√	√	√	√	X	X	X	√	√	√	X	X	X
Myanmar	√	√	√	X	X	X	X	X	X	X	X	X	X
Nauru	X	X	X	X	X	X	X	X	X	X	X	X	X
Nepal	X	X	X	X	X	X	X	X	X	X	X	X	X
New Zealand	√	√	√	√	√	√	√	√	X	√	√	X	2013
Niue (NZ)	X	X	X	X	X	X	X	X	X	X	X	X	X
Pakistan	X	X	X	X	X	X	X	X	X	X	X	X	X
Palau	X	X	X	X	X	X	X	X	X	X	X	X	X
Papua New Guinea	√	√	√	X	X	X	X	√	X	X	X	X	X
Philippines	√	√	X	X	√	Dec 2013	√	√	√	***Jan 2013***	X	X	X
Republic of Korea	√	√	√	√	√	X	X	√	√	Complete (on testing)	X	X	X
Samoa	X	X	X	X	X	X	X	X	X	X	X	X	X
Singapore	√	√	√	√	Complete (manually)	Complete (manually)	Target end 2013	√	Target end 2013	√	X	X	X
Solomon Islands	X	X	√	X	X	X	X	X	X	X	X	X	X
Sri Lanka	√	√	X	X	X	X	X	X	X	√	X	X	X
Thailand	√	√	X	X	X	X	X	X	X	X	X	X	X
Timor Leste	X	X	√	X	X	X	X	X	X	X	X	X	X
Tonga	X	X	X	X	X	X	X	X	X	X	X	X	X
Vanuatu	X	X	X	X	X	X	X	X	X	X	X	X	X
Viet Nam	√	X	***1998-2018***	X	X	X	X	X	***2009 and onward***	√	X	X	X
	X	X	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X	X	X
USA	√	X	X	√	X	X	X	X	√	√	X	X	X
France	√	√	√	√	√	√	2013	√	2013	2013	X	X	X

√ = Completed

X = Anticipated Deficiency - information provided

= On Schedule

X = Anticipated Deficiency - no information provided

PROPOSAL FOR AMENDMENT OF THE ASIA/PACIFIC BASIC AIR NAVIGATION PLAN (Doc 9673)

(Serial No.: APAC XX/X – ATS)

a) **Plan:**

Doc 9673

b) **Proposed by:**

(Name of State or Organisation)

c) **Proposed amendment:**

Editorial Note**:** Amendments are arranged to show deleted text using strikeout (~~text to be deleted~~), and added text with grey shading (text to be inserted)

Add, Amend or Delete requirement for ATS routes as follows:

d) **Date when proposal received:**

[Regional Office Use Only]

e) **Proposers reason for amendment:**

xxxxxx

Note: Where the amendment affects adjacent FIRs, the proposer should provide information on consultation and agreement.

f) **Proposed implementation date of the amendment:**

Upon approval by the Council.

g) **Action by the Regional Office:**

The proposal is circulated to the following States.

(i) xxxx, (ii) xxxx, (iii) xxxx, (iv) xxxx, ……

Note: The list should include the States or organisations affected by the route change. The proposal for amendment may also be circulated to some interested states, for information.

h) **Secretariat's comments:**

1. xxxxxxxxxxxxxxxx
2. xxxxxxxxxxxxxxxx

Note: States should ensure that-

a) detailed and accurate information with regard to the route is provided;
b) an appropriate chart be provided for reference; and
c) prior consultation and agreement is sought with the affected FIRs, and information on such consultation and agreement be provided (joint proposals are recommended).

Guidance for Submission of BANP ATS Route Amendments.

Page V-A-1 of Appendix A of Doc 9763 – *Asia and Pacific Regions Air Navigation Plan* provides the following explanation of Table ATS 1 – ATS Routes:

> *Significant points defining the ATS routes are given. Only prominent locations have been listed. Additional points where facilities are provided to complete navigational guidance along a route, but not otherwise marking significant characteristics of the route (change of heading of centre line, intersection with other routes, etc.) have normally not been included. Locations shown in parentheses indicate significant points outside the ASIA/PAC regions.*

It is not necessary that the ATS route definition in the BANP includes all information intended to be defined in AIP. The following guidance is provided for the submission of new or amended ATS route information.

STEPS

1. Obtain ATS Route Designator from ICAO Regional Office (advise if RNAV or non-RNAV route);
2. Obtain waypoint 5 Letter Name Codes from ICARD system (*each State must nominate at least one, and preferably two ICARD_5LNC_PLANNERs. Contact Regional Office for details*);
3. Coordinate proposed change with affected States;
4. Submit BANP Proposal for Amendment (PfA) to Regional Office; then, after PfA approved
5. Promulgate AIP amendment. ***Annex 15 notification requirements must be met (minimum 56 days).***

BANP Amendment Proposal

Required Detail *(in sequence from start to end of route)*	**Example**	
ATS Route Designator	A1 or A12 or A123	
Route Start Point:		
• Location, e.g. NAVAID name in full; or	SMALLPORT	
• Waypoint (5LNC).	STATA	1546.0N 09836.0E
Intersection with major ATS route:		
• Location; or	BIGVILLE	
• Waypoint (5LNC).	CROSA	1505.2N 09914.6E
Item to be deleted:		
• Location; or	~~OLDVILLE~~ or	
• Waypoint (5LNC)	~~GONER~~	~~1505.2N 09914.6E~~
Route Turn Point:		
• Location; or	MIDTOWN	
• Waypoint (5LNC).	TURNA	1431.4N 09921.9E
Route End Point:		
• Location; or	LASTPORT	
• LocatioWaypoint (5LNC)	ENDER	14.08.2N 09927.0E
Any relevant point outside the ICAO Asia/Pacific Region	(OUTATOWN)	
	(YONDA)	1358.1N 09938.3E

OPADD articles	Check	Summary	Proposed action	Remark
1 INTRODUCTION				
1.1 Preface	☐			
1.2 Context	☐			
1.3 Purpose	☐			
1.4 Scope	☐			
1.5 Applicability	☐			
1.6 Referenced Documents	☐			
2 NOTAM CREATION				
2.1 Introduction	☐			
2.2 Basic Rules for NOTAM Creation	☐			
2.3 Detailed Procedures	☐			
2.3.1 NOTAM Series Allocation	☐			
2.3.2 NOTAM Number	☐			
2.3.3 NOTAM Type	☐			
2.3.4 NOTAM Qualification Item Q) – General Rules	☐			
2.3.5 Qualifier ‘FIR’	☐			
2.3.6 Qualifier ‘NOTAM CODE’	☐			
2.3.7 Qualifier ‘TRAFFIC’	☐			
2.3.8 Qualifier ‘PURPOSE’	☐			
2.3.9 Qualifier ‘SCOPE’	☑	see 2.3.15		
2.3.10 Qualifiers ‘LOWER/UPPER’	☐			
2.3.11 Qualifier ‘GEOGRAPHICAL REFERENCE’ – General Rules	☐			
2.3.12 Qualifier ‘GEOGRAPHICAL REFERENCE’ – Co-ordinates	☐			
2.3.13 Qualifier ‘GEOGRAPHICAL REFERENCE’ – Radius	☐			
2.3.14 Item A) – Single Location (FIR or AD)	☐			

2.3.15 Item A) – Multi-Location (FIR or AD)	☑	The article requires issuing separate NOTAM for each AD if navigation aid serves multiple AD. Japan sets Area of Jurisdiction for ATS units including airports (GEN 3.3-6). A NOTAM is issued for one airport according to the position of navigation aid in the Area of Jurisdiction. Data users request AISC to issue separate NOTAM for each AD because it is possible for them to overlook the NOTAM regarding navigation aid. Tracking multiple AD that are affected by a navigation aid is difficult. It requires man-power to keep such list up-to-date and it's error-prone	Retrofitting of function to airspace planning system that makes it possible to output the list of AD affected by each navigation aid. It may take years. For a while, AISC considers that the NOTAM for navigation aid used for enroute is issued as RJJJ (Japan's FIR) to avoid overlooking the information.	Example: YAO VOR/DME (YOE) is in Yao AP's Area of Jurisdiction. A NOTAM regarding YOE is issued as Yao AP/RJOY. Though YOE serves five airports around Yao AP.
2.3.16 Item B) – Start of Activity	☐			
2.3.17 Item C) – End of Validity	☐			
2.3.18 Item D) – Day/Time Schedule – General Rules	☐			
2.3.19 Item D) – Day/Time Schedule – Abbreviations and Symbols Used	☐			
2.3.20 Item D) – Day/Time Schedule – Special Cases	☐			
2.3.21 Item D) – Day/Time Schedule – Examples.	☐			
2.3.22 Item E) – NOTAM Text	☐			
2.3.23 Items F) and G) – Lower and Upper Limit	☐			
2.4 Creation of NOTAMR and NOTAMC.	☐			
2.4.1 General Procedures Related to NOTAMR and NOTAMC Creation	☐			
2.4.2 Specific Procedures Related to NOTAMR Creation	☐			
2.4.3 Specific Procedures Related to NOTAMC Creation	☐			
2.5 Checklist Production	☐			
2.5.1 Checklists – General	☐			
2.5.2 Checklist Qualification – Item Q)	☐			
2.5.3 Checklist Format – Item E)	☐			
2.5.4 Checklist Errors	☐			
2.6 Publication of Information by NOTAM, AIP Amendment or AIP Supplement	☐			
2.6.2 Publication of permanent information by NOTAM.	☐			
2.6.3 Incorporation of NOTAM information in AIP Amendment	☐			

2.6.4 Incorporation of NOTAM information in AIP Supplement	☐			
2.7 Trigger NOTAM and Related Procedures	☐			
2.7.1 Trigger NOTAM – Definition	☐			
2.7.2 Trigger NOTAM – General Rules	☐			
2.7.3 Trigger NOTAM relative to AIRAC AIP AMDT	☐			
2.7.4 Trigger NOTAM relative to AIP SUP (AIRAC and Non-AIRAC)	☐			
2.7.5 Notification of changes to AIP SUP	☐			
2.8 NIL Notification	☐			
3 NOTAM PROCESSING				
3.1 Introduction	☐			
3.2 Objective	☐			
3.3 Applicability	☐			
3.4 Procedures for the processing of NOTAM	☐			
3.5 General Principles	☐			
3.6 Conversion of original NOTAM Class I	☐			
3.7 Triggering of printed publications	☐			
3.8 Translation of NOTAM	☐			
3.9 Syntax correction	☐			
3.10 Data correction	☐			
3.11 Editing	☐			
3.12 Procedures for dealing with NOTAM Subject to Query	☐			
3.13 Procedures for the creation of NOTAM Series ‘T’	☐			
3.13.1 General procedures	☐			
3.13.2 Trigger NOTAM in Series ‘T’	☐			
3.13.3 NOTAM in Series ‘T’	☐			
3.14 Procedures for Correction of NOTAM	☐			
3.15 NOTAM Verification	☐			
3.16 NOTAM Identification	☐			
3.16.2 Publishing NOF Identification	☐			
3.16.3 NOTAM Series Allocation	☐			
3.16.4 NOTAM Number	☐			
3.16.5 NOTAM Sub-Number (Multi-part NOTAM)	☐			
3.17 NOTAM Type	☐			
3.18 NOTAM Qualification (Item Q)	☐			
3.18.1 General rule	☐			
3.18.2 Qualifier ‘FIR’	☐			
3.18.3 Qualifier ‘NOTAM CODE’	☐			
3.18.4 Qualifier ‘TRAFFIC’.	☐			
3.18.5 Qualifier ‘PURPOSE’	☐			

3.18.6 Qualifier ‘SCOPE’	☐			
3.18.7 Qualifiers ‘LOWER/UPPER’	☐			
3.18.8 Qualifier ‘GEOGRAPHICAL REFERENCE’	☐			
3.19 NOTAM Items	☐			
3.19.1 Item A) – Location ‘FIR/AD’ – General	☐			
3.19.2 Item A) – Location ‘FIR/AD’ – Single-Location NOTAM	☐			
3.19.3 Item A) – Location ‘FIR/AD’ – Multi-Location NOTAM	☐			
3.19.4 Item B) – Start of Activity	☐			
3.19.5 Item C) – End of Validity	☐			
3.19.6 Item D) – Day/Time Schedule	☐			
3.19.7 Item E) – NOTAM Text	☐			
3.19.8 Items F) and G) – Lower and Upper Limit	☐			
3.20 Procedures Related to NOTAM ‘R’ Processing	☐			
3.21 Procedures Related to NOTAM ‘C’ Processing	☐			
3.22 Checklist Processing	☐			
3.22.1 General Principles	☐			
3.22.2 Checklist Received as a NOTAM	☐			
3.22.3 Checklist Not Received as a NOTAM	☐			
3.23 Missing NOTAM	☐			
3.24 NOTAM Deletion	☐			
4 DATABASE COMPLETENESS AND COHERENCE MESSAGES				
4.1 General Principles	☐			
4.2 Request for the Repetition of NOTAM (RQN)	☐			
4.2.1 Codes and Symbols used	☐			
4.2.2 Examples of the Request for NOTAM	☐			
4.3 Request for the original version of NOTAM (RQO)	☐			
4.3.1 General Specification	☐			
4.3.2 Codes and Symbols used	☐			
4.3.3 Example of the Request for Original NOTAM	☐			
4.4 Request for the Repetition of ASHTAM (RQA)	☐			
4.4.1 Codes and Symbols used	☐			
4.4.2 Examples of the Request for ASHTAM	☐			
4.5 Content of the Reply Messages (RQR)	☐			
4.5.1 General Specification	☐			
4.5.2 Standard Expressions in Reply Messages	☐			
4.5.3 Examples for Status of NOTAM	☐			
4.6 Request for a List of valid NOTAM (RQL)	☐			

4.6.1 General Specification	☐			
4.6.2 Codes and Symbols used	☐			
4.6.3 Examples of the request for a List of valid NOTAM	☐			
4.7 Incorrect Requests (RQN, RQO, RQL)	☐			
4.7.1 General Specification	☐			
4.7.2 Standard Expressions	☐			
5 PROCEDURES FOR SNOWTAM, ASHTAM AND SPECIAL CONDITIONS				
5.1 Introduction	☐			
5.2 SNOWTAM	☐			
5.2.1 Definition.	☐			
5.2.2 Procedures for SNOWTAM creation.	☐			
5.2.3 Procedures for SNOWTAM processing	☐			
5.3 ASHTAM	☐			
5.3.1 Definition.	☐			
5.3.2 Procedures for ASHTAM creation	☐			
5.3.3 Procedures for ASHTAM processing	☐			
5.4 Bird Hazards	☐			
5.4.1 Definition	☐			
5.4.2 Procedure	☐			
6 OTHER PROCEDURES				
6.1 Multi-Part NOTAM	☐			
6.1.1 General Principles	☐			
6.1.2 Procedures for Multi-Part NOTAM	☐			
6.1.3 Examples	☐			
7 GUIDELINES FOR THE CREATION AND PROVISION OF PRE-FLIGHT				
INFORMATION BULLETINS (PIB)	☐			
7.1 Introduction	☐			
7.1.1 Understanding and Background	☐			
7.1.2 The basic user requirements related to Briefing	☐			
7.2 Data Selection Layers	☐			
7.3 Types of Bulletins - PIB	☐			
7.3.1 Area type Bulletin	☐			
7.3.2 Route type Bulletin	☐			
7.3.3 Aerodrome type Bulletin	☐			
7.3.4 Administrative Bulletins.	☐			
7.4 Types of Messages/elements to be included in the PIB	☐			
7.5 Criteria for PIB Customisation – Query Filters				
7.5.1 Time window for PIB validity	☐			
7.5.2 NSC qualifiers applied	☐			
7.5.3 Vertical Criteria (Flight Levels)	☐			
7.5.4 Geographical criteria	☐			

7.6 Principle structure of a PIB	☐			
7.6.1 NOTAM sorting	☐			
7.7 PIB - specific presentation considerations	☐			
7.7.1 General layout considerations	☐			
7.7.2 Presentation of dates/times	☐			
7.7.3 Location Indicators	☐			
7.8 Delivery of PIB	☐			
7.9 PIB - additional elements to be considered	☐			
7.9.1 Provision of AIP-SUP in relation to PIB	☐			
7.9.2 Special areas	☐			

Agenda Item 3: Performance Framework for Regional air navigation planning and implementation

3.3: RASMAG Report Excerpt

Meetings

3.3.1 The Data-link Performance Monitoring Seminar was held at Bangkok, Thailand on 27 March 2013 in conjunction with the Second Meeting of the Future Air Navigation Systems Interoperability Team-Asia (FIT-Asia/2, 28-29 March 2013).

3.3.2 The Eighteenth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/18) was held from 1-4 April 2013 at Bangkok.

Problem Reports and CRA Arrangements

3.3.3 The FIT-Asia Terms of Reference (TOR) required that it supports FIT-Asia States' compliance with ICAO Annex 11 – Air Traffic Services and Global Operational Data-Link Document (GOLD) requirements for data-link performance. There was a considerable lack of data-link problem reporting among FIT-Asia States and airspace users, and few FIT-Asia States had arrangements in place for the analysis of problem reports (PRs) by a competent Central Reporting Agency (CRA).

3.3.4 The meeting recognised that monitoring, reporting and analysis of data-link performance and problems was essential for the achievement and maintenance of the level of system performance required for application of RNP-based separation standards.

3.3.5 The meeting was further informed that improvements to the Informal South Pacific Air Traffic Services Coordinating Group (ISPACG) website (http://www.ispacg-cra.com/) would soon be made to include FIT-Asia as a participating body, and enabling the filtering of region-specific PRs. The meeting noted that the results of problem report analysis were provided to the originator as well as being posted on the CRA web site. Accordingly, the meeting agreed to a draft Conclusion regarding Automatic Dependent Surveillance-Contract (ADS-C) and Controller Pilot Data-Link Communications (CPDLC) problem reporting and analysis for RASMAG's consideration.

3.3.6 The lack of PRs from airspace users was also discussed. IATA agreed to bring this issue to the attention of its members.

Data-Link Performance

3.3.7 Data obtained from post-implementation monitoring was used to measure FANS 1/A system performance against GOLD Required Communications Performance (RCP) and Required Surveillance Performance (RSP), System availability measurement was based on outages reported by the Communications Service Provider (CSP), and those observed by the Air Navigation Service Provider (ANSP).

3.3.8 Annex 11 required that agreements be put in place to share information from monitoring programs between regions. Due to the implication that ANSPs would aggregate their data to meet this requirement, it was suggested that FIT-Asia ANSPs would need to agree to both data gathering and aggregation, and FIT-Asia should consider how this may be progressed at the ICAO Regional level.

3.3.9 An upgrade of the I3 satellite Ground Earth Station (GES) for the Indian Ocean Region took place on 19 March 2013, and an upgrade to new I4 GES hardware was expected to improve GES availability within the region due to improved redundancy monitoring capability.

3.3.10 Overall data link performance was similar to that observed in the previous year, with performance reports being presented from Australia, China, India, Indonesia, Myanmar and New Zealand. The data analysis demonstrated stable performance meeting FOM requirements for both uplink and downlink messages. From this data it was anticipated that RSP180 and RCP240 performance would be achieved.

3.3.11 An unreported outage at an Inmarsat CSP in third quarter of 2012 of 220 minutes (UPS maintenance) and another in early February 2013 of 48 minutes degraded availability in 2012. There were no reported issues with Remote Ground Station (RGS) stability during 2012. The upgrade of the I3 satellite RGS to I4 standard from 26 February at Perth was expected to enhance RGS reliability. **Figure 3** provides an analysis of Inmarsat network outages from December 2008 to February 2013 for the Auckland Oceanic Flight Information Region (FIR), indicating the major outages.

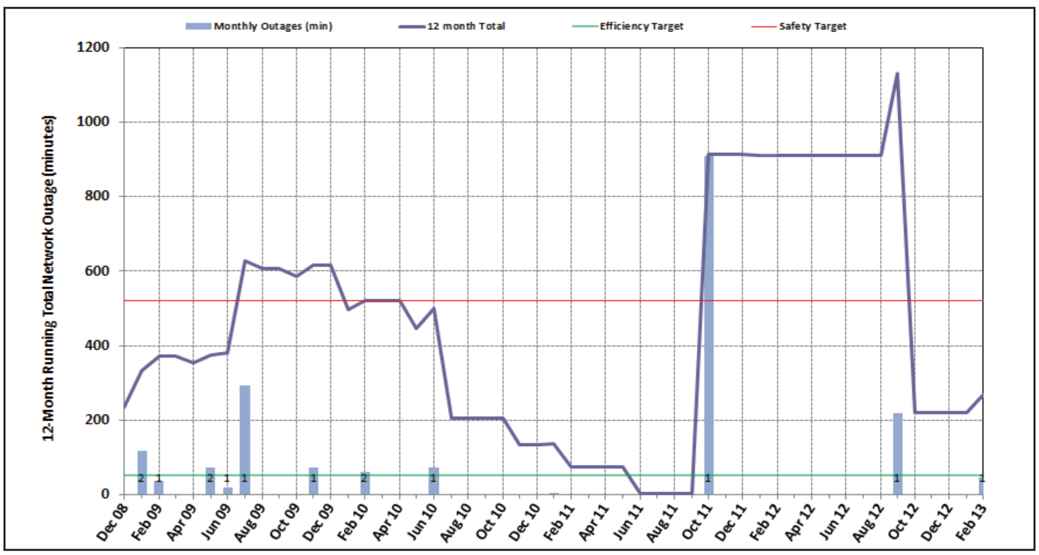


Figure 3: NZZO FIR Inmarsat Network Outages Dec 2008 – Feb 2013

3.3.12 Analysis by New Zealand of High Frequency Data Link (HFDL) ADS-C reports extracted from the Satellite Communication (SATCOM) plus HF data showed that HFDL performance did not meet the RSP180 latency requirement, falling well below the normal 95% operating level.

3.3.13 Analysis of Aircraft Communications Addressing and Reporting System (ACARS) data for the Brisbane FIR (YBBB) had revealed that during December 2012, 263 logons were rejected, representing a logon failure rate of 3%. Logon rejections were much more common among some operators. 55 of the rejected logons were due to incorrect aircraft identification, and the majority of the remaining rejected logons were due to incorrect aircraft registration.

3.3.14 The most common reason for logon rejection was a different airframe than that notified in the flight plan being used for the flight. The meeting was reminded of the requirements in ICAO Doc 4444 (PANS/ATM) for flight crews or operators to notify affected ATSU's of any information which had changed from that in the original flight plan. If the airframe had changed, the CHG message should, as a minimum, notify both the change in registration and the aircraft address, if this information was contained in the original flight plan.

3.3.15 Australia provided an overview of the procedures associated with reporting back on route by CPDLC following a weather deviation. CPDLC functionality supported the up-linking of weather deviation clearances, and allowed the controller to append an instruction for the flight crew to report when the aircraft was 'back on route'. CPDLC also supported the flight crew downlinking a notification that they were 'BACK ON ROUTE'. Observation showed that many flight crews send a CPDLC BACK ON ROUTE downlink when in fact they were still off-track. This could result in controllers providing inappropriate separation between the aircraft and other airspace users. As the incorrect reporting of BACK ON ROUTE was a safety issue, IATA was requested to distribute the information in the working paper to its members.

3.3.16 The FIT-Asia meeting was reminded that a task arising from FIT-Asia/1 was the formulation of a template for the provision of data-link performance data such as Actual Communications Technical Performance (ACTP), ACP, Pilot Operational Response Time (PORT) and surveillance latency information. The meeting discussed the benefits of using the output of the G-PAT analysis tool as a standardized form of performance reporting, as it provided both graphical and tabular data. The meeting agreed to a Decision on a Data-Link Performance Report Template intended to be used by States or their Central Reporting Agency for the reporting of data-link performance to FIT-Asia

<u>RASMAG18</u>

3.3.17 The FIT-Asia/2 meeting noted that improvements to the ISPACG website would be made to include FIT-Asia as a participating body, and enabling the filtering of region-specific problem reports. Accordingly, RASMAG reviewed and endorsed the draft Conclusion. APANPIRG adopted to the following Conclusion:

Conclusion 24/24: ADS/C and CPDLC Problem Reporting and Analysis

That, FIT-Asia States are requested to:

- register on the FIT-Asia website (http://www.ispacg-cra.com), and report their registration to the ICAO Asia/Pacific Regional Office by 31 December 2013;
- report problems relating to Automatic Dependent Surveillance-Contract (ADS-C) and Controller Pilot Data-Link Communications (CPDLC) services to the Central Reporting Agency (CRA) for analysis, utilizing the FIT-Asia website; and
- ensure the CRA analysis is reported to FIT-Asia.

<u>Regional Monitoring Agency RVSM Safety Reports</u>

3.3.18 The Australian Airspace Monitoring Agency (AAMA) report showed that for Indonesian airspace, the Reduced Vertical Separation Minimum (RVSM) target level of safety (TLS) was met for the reporting period with the assessed risk calculated as **1.81×10^{-9}**.

3.3.19 The report showed that for the Australian, Nauru, Papua New Guinea (PNG) and Solomon Islands airspace, the TLS was not met, primarily as the result of a single operational error of long duration that occurred in March 2012. That single occurrence had an assessed duration of 89 minutes and contributed $3.64 \times 10^{-}$ to the calculated risk for the 12 month period, which had an overall risk estimation of **8.82×10^{-9}**. **Figure 4** presents the collision risk estimate trends for Australian, Nauru, PNG and Solomon Islands Airspace.

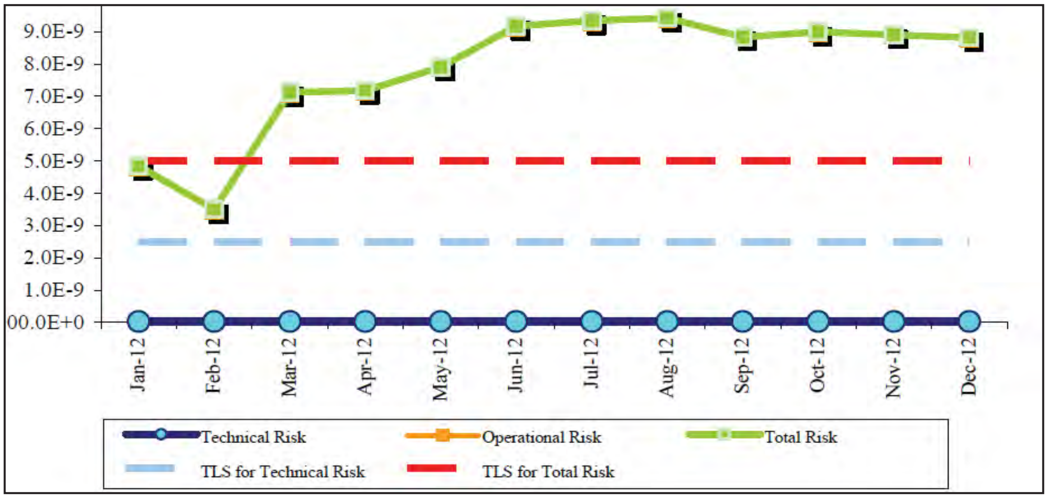


Figure 4: Australian, Nauru, PNG and Solomon Islands Airspace Risk Estimate Trends

3.3.20 RASMAG noted that the AAMA paper did not contain much information on the actions being undertaken to minimise, mitigate, or prevent safety risk, and nor was there information on how effective these actions were. AAMA acknowledged that feedback of this nature was very important, so lessons could be learnt and other Regional Monitoring Agencies (RMAs) could become more effective. The Chairperson noted that AAMA did not directly receive feedback on the operational effectiveness of safety actions related to identify Large Height Deviations (LHD).

3.3.21 China presented the results of the airspace safety oversight for the RVSM operation in the airspace of Chinese FIRs and the Pyongyang FIR (Democratic Republic of Korea – DPRK) from 01 January 2012 until 31 December 2012. The estimates of technical and total risks for the airspace of Chinese FIRs satisfied the agreed TLS value of no more than 2.5 x 10-9 and 5.0 x 10-9 fatal accidents per flight hour, with an overall risk estimate of **3.38 x 10^{-9}**.

3.3.22 China RMA noted that a significant portion of LHDs (22 of 55) was attributable to Category E (ATC transfer of control coordination errors due to human factors). Significant long duration Category E LHDs occurred in the Sanya FIR. The lack of communication between Urumqi Area Control Centre (ACC) and the Lahore ACC meant that direct communications between Pakistan and China was difficult. Urumqi ACC had made contact several times with Lahore ACC to discuss the possibility of establishing direct communication via satellite. However, neither China nor Pakistan had made an agreement on this investment, and the plan had been suspended. China RMA suggested that ICAO might be able to assist coordination with Pakistan to resolve this matter.

3.3.23 Based on the data from the DPRK, no LHD had occurred during 2012 within the Pyongyang FIR. Considering the long-term nil LHD reports, to make a conservative estimate for the operational risk, China RMA used the operational risk value of Chinese FIRs. The estimate of the overall vertical collision risk for the Pyongyang FIR was **3.43 x 10^{-9}** fatal accidents per flight hour, which satisfied the globally agreed TLS value of 5 x 10-9 fatal accidents per flight hour.

3.3.24 Japan presented the results of the airspace safety assessment of the Fukuoka FIR by the Japan Airspace Safety Monitoring Agency (JASMA) for the period from 1 January 2012 to 31 December 2012. The report shows that for the Fukuoka FIR, the target level of safety (TLS) was met for the reporting period with the assessed risk calculated as **4.34 x 10^{-9}**.

3.3.25 The Monitoring Agency for Asia Region (MAAR) provided the results of the airspace safety oversight for the RVSM operation in the Bay of Bengal (BOB), Western Pacific/South China Sea (WPAC/SCS), and Mongolian airspace. The BOB RVSM airspace overall risk was estimated to be **1.96×10^{-9}**.

3.3.26 MAAR noted that the number of 12-month cumulative LHD occurrences had increased from 31 to 46 compared to the data provided to RASMAG/17, while the total duration increased from 70 to 117 minutes. The increase was attributed to an increasing number of non-nil reports from States that were starting to actively provide reports to the monitoring agency. MAAR noted that most of the Category E LHDs occurred at the boundary of Chennai FIR and the Kuala Lumpur FIR, which was part of a major traffic flow.

3.3.27 The WPAC/SCS RVSM airspace total risk was estimated to be **2.62×10^{-9}**. MAAR noted that a significant portion of WPAC/SCS LHD occurrences (78 of 96) as well as duration (84 of 98 minutes) was attributable to Category E causes. In addition to a reduction in the number of LHD occurrences, there had been no LHD report involving aircraft operating in an incorrect direction since March 2012. All of the Mongolian LHD occurrences were Category E, but occurred within radar coverage; thus ATC intervention ensured durations of less than one minute in each case. The Mongolian RVSM airspace total risk was estimated at **1.56×10^{-9}**

3.3.28 IFATCA commented on the concern by MAAR regarding aircraft operating within SCS airspace at the wrong level for direction, and the workload involved in the transitions between the Flight Level Allocation Scheme (FLAS) and the normal Annex 2 Appendix 3a Flight Level Orientation Scheme (FLOS). IFATCA suggested that APSAPG may be an appropriate forum for identifying remedies to this problem. The meeting recalled that the fragmented airspace of the SCS was partly a cause for the airspace complexity. The Secretariat advised that APSAPG had identified the SCS FLAS problem, noting the difficulty of removing the FLAS entirely while there were ATS communications and surveillance gaps in the SCS.

3.3.29 The Pacific Approvals Registry and Monitoring Organization (PARMO) presented a safety assessment of RVSM in portions of Pacific and North East Asia (Republic of Korea - ROK) airspace for the most recent reporting period of 1 January to 31 December 2012. Pacific airspace total risk was estimated to be **4.46×10^{-9}**.

3.3.30 The Incheon FIR RVSM total risk was estimated to be **0.53×10^{-9}**. No new reports of risk-bearing events within ROK airspace during the current twelve-month reporting period had been received. The meeting noted the possible lack of reporting within the Incheon FIR. The ROK noted this and were reviewing their internal LHD reporting process and would continuously cooperate with ICAO and PARMO in this matter.

En-Route Monitoring Agency Horizontal Safety Reports

3.3.31 The USA presented the horizontal safety monitoring report for the Anchorage and Oakland FIRs for the period from 01 January until 31 December 2012. The Anchorage and Oakland oceanic airspace horizontal risk estimates using Large Longitudinal Errors (LLE) and Large Lateral Deviations (LLD) reports both met the 5.0 x 10-9 TLS. Similar results were presented at RASMAG/17, except for the 50NM lateral risk, which had increased above, and then below TLS during the assessment period to be **4.33×10^{-9}**.

3.3.32 India presented the horizontal safety monitoring report of the Bay of Bengal Arabian Sea Monitoring Agency (BOBASMA) for the period 01 January 2012 to 31 December 2012. The results of the safety assessment confirmed that the TLS was satisfied in the airspace concerned at **0.74×10^{-9}** (lateral) and **0.90×10^{-9}** (longitudinal).

3.3.33 Singapore presented the horizontal safety assessment report from the South East Asia Safety Monitoring Agency (SEASMA) for operations on the six major ATS routes within the SCS from 01 January 2012 until 31 December 2012. The assessment concluded that the TLS was conservatively satisfied for the lateral (**1.89×10^{-9}**) and longitudinal (**0.79×10^{-9}**) separation standards, despite a small increase in the risk estimate since the RASMAG/17 report.

3.3.34 Japan provided the results of the horizontal airspace safety assessment by JASMA of the time-based longitudinal, distance-based longitudinal and lateral collision risk in the North Pacific (NOPAC) route system within the Fukuoka FIR. The calculation yielded an overall safety estimate result of **0.000004×10^{-9}** (lateral) and **1.79×10^{-9}** (longitudinal).

3.3.35 The Southeast Asia Safety Monitoring Agency (SEASMA) presented the results of the safety assessment associated with the use of 50NM lateral and 50NM longitudinal separation standards on RNAV routes M635 and M774. The assessment indicated that the TLS was satisfied, with risk estimates of **0.00171×10^{-9}** (lateral) and **0.0241×10^{-9}** (longitudinal). IATA stated that it was disappointing to use resources to validate a conservative procedural standard within a surveillance environment.

3.3.36 The meeting extensively discussed the need for EMAs to have a greater link with CRAs and ANSPs in order to support the application of horizontal separation standards based on data-link. The meeting noted that there was potential for EMAs to analyse safety risks in order to provide guidance to ANSPs on more efficient standards that would still achieve TLS.

3.3.37 Furthermore, the RASMAG meeting recognised that the EMAs could have a role like an RMA in respect of identifying airframes that were not performing as expected in respect of their data-link performance data. Thus the meeting agreed that it was logical to expand the EMA roles to include monitoring of RCP/RSP approvals, although it was recognised that EMAs were not assigned to all the FIRs in the region. APANPIRG adopted to the following Conclusion:

Conclusion 24/25: En-Route Monitoring Agency Role and Tasks

Considering the requirement for a defined process of monitoring airframe Required Communication Performance (RCP) and Required Surveillance Performance (RSP) compliance, and analysis of data-link performance affecting horizontal separation standards that utilise data-link, Asia/Pacific States should:

a) in collaboration with RASMAG, assign an En-Route Monitoring Agency (EMA) for each FIR; and

b) support the assigned EMA with the provision of information regarding -

   i. observed aircraft horizontal navigation performance; and

   ii. observed non-compliant data-link performance of individual aircraft; and

   iii. aircraft data-link approvals, and

c) recognise the potential benefit of EMAs in providing risk analysis to support horizontal separation implementation.

Assessment of Non-RVSM Approved Aircraft

3.3.38 Australia presented a brief discussion of the benefits of data sharing and cooperation between RMAs in terms of determining the Altimetry System Error (ASE) for an aircraft. The Working Paper indicated that data sharing allowed an accurate determination of the aircraft's geoid height reference as Height Above Mean Sea Level (HAMSL) or Height Above Ellipsoid (HAE), whereas data from each RMA alone was in a number of cases insufficient. Additionally, obtaining data from a wide range of geographic locations enabled a more robust averaging of ASE, which could be biased if sampled from the same region or at similar times of the day.

3.3.39 AAMA provided the outcome of the February 2013 check to identify non-RVSM aircraft which had also been identified in previous assessments. The RASMAG/16 assessment in January 2012 identified 148 individual airframes, with the Philippines showing the highest number of 22. The 2013 assessment identified a reduction to 98 individual airframes in the data set, with airframes from the Philippines again showing the highest number (11). Other Asia/Pacific States with significant numbers were Indonesia (10), Thailand (5) and Australia, India and New Caledonia with three each.

3.3.40 Brunei Darussalam and Vanuatu both had registered airframes that had been previously identified in April 2011, while China, India, Malaysia, Philippines and Saudi Arabia all had airframes previously identified up until July 2012.

3.3.41 The China RMA assessment of Chinese FIRs and the Pyongyang FIR during the period December 2011 until February 2013 for non-RVSM approved aircraft revealed a total of 43 airframes. The assessment results up until December 2012 identified a reduction to 26 airframes, which is shown in **Figure 5**. This reflected the worldwide reduction that occurred after September 2012, mainly due to enhanced cross-checking and follow-up of aircraft approval status.

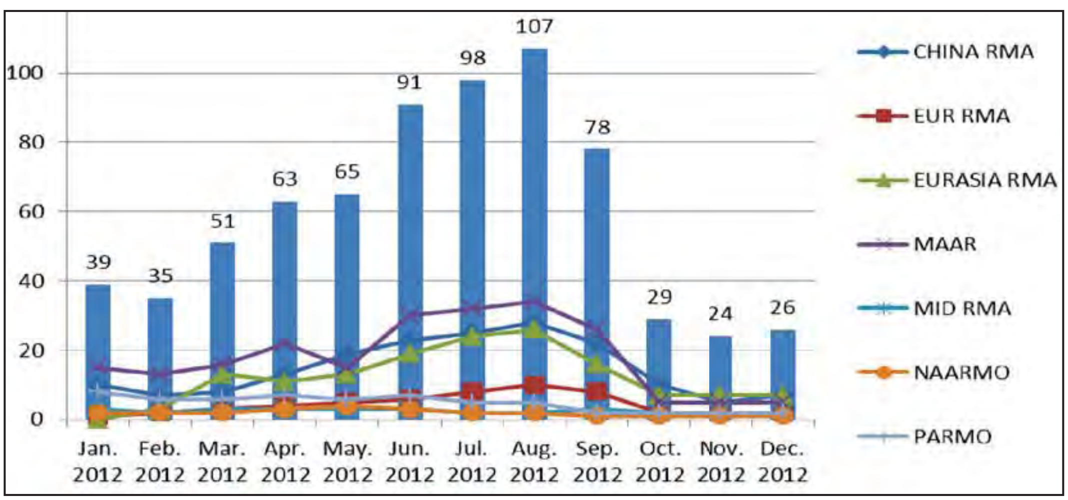


Figure 5: Traffic Scrutiny Results by RMA

3.3.42 In December 2012, JASMA identified 40 non-RVSM approved airframes, including 10 from the Republic of Korea and six from the Philippines.

3.3.43 The MAAR assessment of non-RVSM approved aircraft for RASMAG/16 was 118, with Indian aircraft constituting half this number. For the December 2012 TSD, there was an increased total of 124 aircraft registrations found operating within RVSM airspace without proof of RVSM approval. Of these, 20 were registered in India and 13 from the Philippines. Of note were two of the five airframes from the Republic of Korea which had been also previously detected in the 2011 TSD.

3.3.44 In the assessment of non-State-approved operators and aircraft type combinations using RVSM airspace overseen by PARMO for the period of December 2012, 15 unique airframes from the six Pacific and Northeast Asia traffic movement samples were identified following the initial verification process. One aircraft registered in Vanuatu had been observed 18 times in the sample.

3.3.45 IATA advised that they were happy to assist with follow-up to operators if necessary but felt this was mainly a regulatory issue, so supported denial of service for repeat offenders. The meeting discussed the need to take firmer action against such operators, which sometimes had non-compliant aircraft operating within the RVSM stratum for years.

3.3.46 The meeting recognised that the way in which the Asia/Pacific region dealt with non-compliant aircraft would become increasingly important with the implementation of other airspace mandates such as for ADS-B, noting that the previous APANPIRG Conclusion 23/15: Long-Term Non-RVSM Approved Aircraft had not resulted in a significant reduction of errant operators.

3.3.47 Recognising the serious risk to safety, as well as the continued non-compliance by some operators with RVSM requirements over many years, RASMAG/18 endorsed a Draft Conclusion. APANPIRG's adopted the following Conclusion:

Conclusion 24/26: Repetitive Non-RVSM Approved Aircraft Operating as RVSM Approved Flights

That, Asia/Pacific States should, except where a specific non-RVSM operation is authorised, deny entry to operate within RVSM airspace for aircraft that have been confirmed as non-RVSM approved over a significant length of time, or by intensive checking.

<u>Long-Term Height Monitoring Burden Estimates</u>

3.3.48 Australia presented the current monitoring burden for aircraft registered and operated by Australia, Indonesia, the Solomon Islands and Papua New Guinea. The assessment noted that a significant number of identified aircraft (102 aircraft of 276) did not meet the Annex 6 requirements by the agreed November 2012 target when applying the Minimum Monitoring Requirements (MMR).

3.3.49 China RMA presented detailed information regarding its progress developing methods to use ADS-B data to monitor the Altimetry System Error (ASE). With assistance from the FAA Technical Centre, China RMA was able to understand the process of ASE calculation, while AAMA and MAAR assisted China RMA to conduct ASE estimate comparison using domestic ADS-B data. The comparison indicated that China RMA's ASE calculations were consistent with FAA results.

<u>Regional Safety Monitoring Assessment</u>

3.3.50 The Secretariat presented an overview of regional safety assessment results. **Figure 6** indicated the following sub-regional regional trends.

- **South Asia** continued to operate below the TLS, although there were hot spots evident at the interface between Indian, Indonesian and Malaysian airspace. India had previously noted potential lack of reporting of safety issues by ATC, and this was evident by the lack of LHD reports from within the Mumbai and Kolkata FIRs. In addition, there appears to have been a lack of reporting within the Karachi and Lahore FIRs (Pakistan airspace).

- **Southeast Asia** had dropped below the TLS after some years not meeting the target, indicating that some of the corrective and preventive actions taken had been effective. However, the overall positive result tended to mask continuing problems associated with the Manila FIR, which saw a large number of LHD hot spots close to the FIR boundary with adjacent States.

- **East Asia** (particularly Mongolia and Japan) had made improvements, and the overall assessment met the TLS. However, there were a number of LHD hot spots at the interface between Mongolia and China, Pakistan and China, and internally within China near Wuhan and Beijing. The continued lack of reporting over many years from the Pyongyang FIR was also a concern.

- **Southwest Pacific** had maintained an upwards trend from RASMAG/17 to be consistently above the TLS. However, the prime driver for the high risk figure was a single LHD from March 2012 that remained within the data sample used for calculations. The monthly risk for the Southwest Pacific airspace is well below the average monthly risk which gives an annual risk of $5.0 \times 10^{-9.}$ There were a number of LHD hot spots, including the interface between Australia and Indonesian airspace (particularly Jakarta FIR), and between Australia and Papua New Guinea airspace.

- **Pacific** airspace had been consistently below TLS.

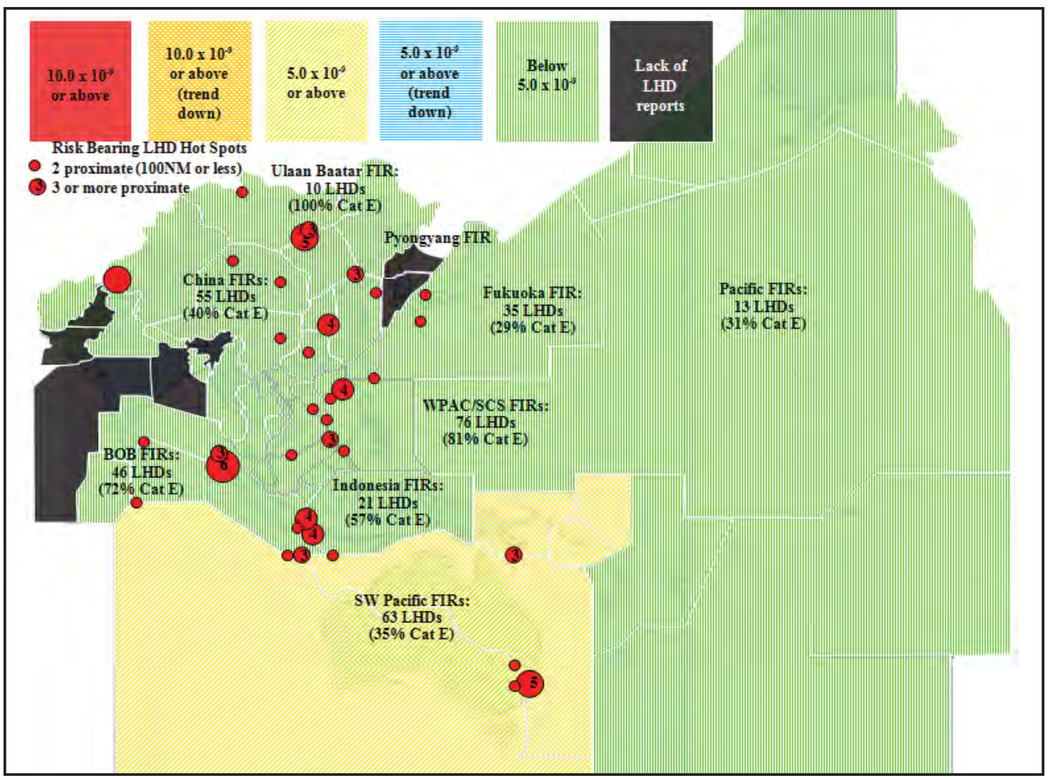


Figure 6: Asia/Pacific TLS compliance reported to RASMAG/18

3.3.51 Stemming from the analysis of hot spots, there appeared to be an urgent need for prioritisation of AIDC (ATS Inter-facility Data Communications) implementation as a risk mitigation measure at the following interface hot spots. These hot spots were also where category E LHDs (ATC to ATC transfer errors as a result of human factors issues) formed a significant portion of the total reports.

3.3.52 India stated that AIDC interoperability was very important, while Thailand advised that the Mekong ATM Coordinating Group had already been working on an AIDC implementation plan, for implementation of AIDC by 2015.

3.3.53 APANPIRG adopted the following Conclusion:

Conclusion 24/27: Prioritization of AIDC Implementation to Address LHDs

Considering that ATS Inter-facility Data Communications (AIDC) is an important means of minimizing Large Height Deviations (LHD), Asia/Pacific States should support the expedition of AIDC through collaborative projects at the following significant LHD interface areas:

a) Indonesia: between Jakarta and Chennai/Ujung Pandang/Brisbane/Melbourne FIRs;

b) India: between Chennai and Kuala Lumpur FIRs;

c) Philippines: between Manila and Fukuoka/Taibei/Hong Kong/Ho Chi Minh/Singapore/Kota Kinabalu/ Ujung Pandang FIRs; and

d) China: between –

   i. Urumqi and Lahore FIRs; and

   ii. Beijing and Ulaan Baatar FIRs.

3.3.54 A comparison was made of the number of LHD reports and the estimated flight hours, which determined that the average LHD occurred approximately every 22,684 flight hours. Thus at least one LHD might be expected on average from the Incheon FIR, although none had been reported in the last two RASMAG meetings. The ROK took note of this, for further discussion with their operational managers. The Bay of Bengal, Indonesian and Chinese airspace indicated reports of LHDs at a significantly lower rate than the average. However this may be due to differences between ATM systems and airspace, and an increased number of reports from this airspace since RASMAG/17 was noted. The potential lack of reporting from the Mumbai and Kolkata FIRs had already been noted.

3.3.55 Overall, the Asia/Pacific total remaining regional monitoring burden had decreased from 903 in 2009 to 620 in 2013, a 32% reduction (**Figure 7**).

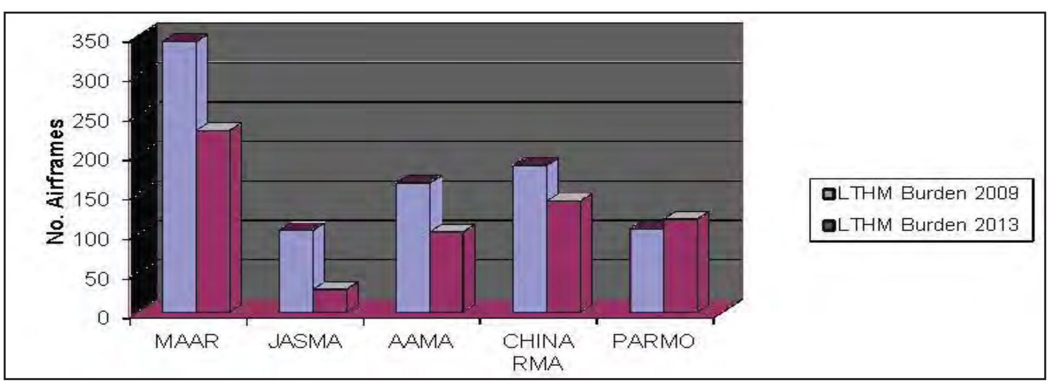


Figure 7: Asia/Pacific LTHM Burden Comparison 2009-2013

3.3.56 **Table 2** provided a comparison of Asia/Pacific RVSM risk as a measure against the TLS, either by RMA 'sub-region', or by FIRs. There had been significant improvement overall, particularly with a reduction of LHDs in the WPAC/SCS. However the 94 WPAC/SCS occurrences still constituted 28% of all Asia/Pacific LHDs within a dense traffic area.

	2011	2012	2013
RMA 'sub-regions'	67%	78%	89%
FIRs	73%	73%	90%

Table 2: Comparison of Sub-Regional and Regional RVSM TLS Achievement

<u>Collaboration to Support Regional Monitoring Agencies</u>

3.3.57 India presented WP23, regarding the need for the collaboration between States to support Regional Monitoring Agencies for the Bay of Bengal Arabian Sea Indian Ocean (BOBASIO) airspace for post RVSM implementation system performance monitoring. India highlighted the workload of the MAAR RMA and offered assistance to the Bay of Bengal Arabian Sea Indian Ocean Safety Monitoring Agency (BOBASMA). They noted that the duties and Responsibilities of an RMA were very similar to that of an EMA since both agencies are involved in the monitoring of safety risks.

3.3.58 Moreover, BOBASMA was willing to undertake the additional responsibility of providing support services for the member states of BOBASMA. It was also ready to participate in training programs under the guidance of any of the established RMAs to acquire the additional technical competence required to carry out the functions of an RMA in general, and the use of ADS-B geometric height data in calculating ASE in particular.

3.3.59 The meeting noted that increases in traffic should not affect RMA workload, as most work was undertaken to set up the RMA systems. In addition, more ADS-B data will make the RMA's work more effective and more efficient in the future. Hong Kong, China and Bangladesh supported the concept of collaborating to share monitoring results in order to enhance overall safety levels in the region. The United States noted that India had some innovative ideas in this area, and suggested that this matter should be managed within the RASMAG meeting.

Agenda Item 3: Performance Framework for Regional air navigation planning and implementation

3.4 CNS Matters

3.4.1 The meeting reviewed the outcome of the Seventeenth Meeting of the Communications, Navigation and Surveillance Sub-group (CNS SG/17) held at the ICAO Asia and Pacific Regional Office, Bangkok, Thailand from 14 to 17 May 2013 as presented in WP/14. The meeting noted with appreciation the work done by the SG. The meeting discussed the CNS related issues and took following actions on the report of the CNS SG/17.

Election of Chairperson of the Sub-group

3.4.2 The meeting noted that the SG elected Mr. Lo Weng Kee, Head Technical Standards, Civil Aviation Authority of Singapore (CAAS) as Chairman of the CNS SG and Mr. Richard Wu, Chief Electronics Engineer of the Civil Aviation Department (CAD), Hong Kong China as Vice Chairman of the group.

Terms of Reference of the CNS Sub-group

3.4.3 The CNS SG meeting reviewed the new TOR adopted by APANPIRG for the SG. The meeting noted the recommendation by the SG for APANPIRG to provide some guidance on the delegation of its power to the SG particularly with reference to the adoption of regional guidance materials in their own respective areas. APANPIRG/24 discussed this recommendation under Agenda Item 6.

Status of the SWIM Operational Concept

3.4.4 The SG meeting noted the outcome of AN-Conf/12 concerning the SWIM Operational Concept Projects prioritization and the outcome of ACP WG I/16 (28-30 January 2013, Montreal) as to a regional IP-based network and the SWIM Operational Concept presented by USA. The meeting was informed that FAA had conveyed the APAC region support for SWIM environment and requested ACP to develop an IMS Operational Concept and expedite the finalization of IPv6 network configuration by ICAO. It was supported by ACP WG I/16 and ANC-12 set the priority of SWIM Operational Concept development as one of their top five actions to be presented at the ICAO Assembly to be held in September 2013. The meeting reconfirmed the need to continue the AMHS implementation and support efforts to explore the possibility of a common IP network in the APAC region to replace point-to-point circuits between the States.

The Mini-global Demonstration

3.4.5 The meeting noted that the FAA was developing a program called the Mini-Global Demonstration. This project was aimed at collaborating with other air navigation service providers (ANSPs) working together with them to simulate seamless operations across Flight Information Regions (FIRs). The demonstration was planned for 2014. The demonstration intended to show how ANSPs and flight operators could share common flight information to:

- Improve collaborative decision-making (CDM)
- Improve air traffic management (ATM), and
- Promote international standardization of flight information.

3.4.6 The compatibility of partner ATM systems with respect to FO standards (FIXM / WXXM / AIXM) would be assessed. Administrations, ANSP, flight operators in the APAC Region were invited to participate in or observe the 2014 Mini-Global Demonstration. States may contact the Federal Aviation Administration's Office in Singapore for further information about participation in the Mini-Global Demonstration.

PIRG-RASG Global Coordination Meeting-outcomes

3.4.7 The meeting noted the outcome of the Global Co-ordination meeting including the agreement on establishing of regional priorities and targets for air navigation by May 2014 consistent with the GANP/ASBU framework. The meeting discussed the APAC regional priorities and targets as presented to the coordination meeting by ICAO regional office and confirmed the items and their specified targets related to CNS items. Nevertheless, it was felt that target dates for the implementation of ADS-B in South China Sea and Bay of Bengal area should be more specific, i.e. relate to partial implementation of surveillance based service for specific major air traffic routes.

3.4.8 The meeting further identified the need for ICAO Regional Office to organize more educational workshops/seminars on the implementation of ASBU in order to develop better and common understanding of the relationship between modules of ASBU Blocks.

Eighth ATNICG Meeting

3.4.9 The meeting reviewed the outcome of the Eighth Meeting of Aeronautical Telecommunication Network Implementation Co-ordination Group of APANPIRG (ATNICG/8) held in Jakarta, Indonesia in March, 2013.

3.4.10 The meeting reviewed and adopted following conclusions which were formulated by the ATNICG/8 and endorsed by CNS SG/17.

Conclusion 24/28 –Timely implementation of ATN/AMHS

That,

a) States/Administrations hosting BBIS hubs be urged to review the feasibility and realize interim ATN connectivity using IDRP prior to complete readiness of all the member States in the Region by 2014/15. This will realize early operational benefits of network resiliency and AMHS operations, particularly in the instances where incompatible versions of AMHS currently preclude AMHS connectivity;

b) BBIS and BIS States/Administrations be urged to resolve bilateral issues on urgent basis paving the way for effective use of the network and thereby ensuring utilization of resources and the investment made by the States; and

c) States hosting BIS nodes be urged to aggressively take up implementation of ATN/AMHS connectivity as per the Regional Plan to complete regional ATN/AMHS network in the whole APAC region by the end of 2015.

Conclusion 24/29 – Interface Control Document for ATN IPS (IP V.4)

That, the ICD for ATN IPS (IP v.4) as provided in **Appendix A** to the Report on Agenda Item 3.4 be adopted as the regional guidance material.

Conclusion 24/30 - XML Trial over ATN/AMHS

That, ICAO be invited to provide guidance on the requirements for end-user product/message in respect of XML coded NOTAM and OPMET messages.

Revised TOR and updated Subject/Tasks List and Action Items

3.4.11 The meeting noted the proposed revision to the TOR of the ATN Implementation Coordination Group. Considering the need to be in line with recommendations of AN Conf/12 on AFS and SWIM and requirements to provide communication and information management services for operational needs, the meeting agreed on the proposed name change of the group and adopted following Decision:

Decision 24/31 - Aeronautical Communication Services Implementation Coordination Group – (ACSICG)

That,

a) the name "ATN Implementation Coordination Group" be replaced by "Aeronautical Communication Services Implementation Coordination Group" and

b) the revised TOR of ACSICG provided in **Appendix B** to the Report on Agenda Item 3.4 be adopted.

Proposed APAC Internet Protocol (IP) Virtual Private Network (VPN) (WP/20)

3.4.12 On behalf of Australia, Fiji, Hong Kong China, Japan, New Zealand, Republic of Korea, Singapore and Thailand, USA presented a proposal for an IP VPN using a private commercial network to provide service for Air Traffic Service Message Handling System (AMHS) and possible future IP-based services.

3.4.13 Currently, Aeronautical Fixed Telecommunication Network (AFTN) and Air Traffic Service Message Handling System (AMHS) services in the Asia/Pacific Region operate over point-to-point international leased circuits. Such bilateral point-to-point circuits would not be able to support dynamic routing for AMHS or a true System Wide Information System (SWIM) environment.

3.4.14 A dedicated, common network operated by a service provider is an approach to be considered to replace the current configuration. Common networks had successfully been deployed in some other ICAO regions (e.g. PENS in the EUR Region and MEVA in the CAR Region).

3.4.15 A preliminary finding concluded that using an IP VPN could result in 30% cost saving and significant additional bandwidth when compared to point-to-point circuits. It was determined that the establishment of such a network would require careful consideration of all issues involved as well as the evaluation of common network proposals as compared to the current point-to-point configuration.

3.4.16 Some of the issues to be considered include following:

- Technical requirements
- Cost, including arrangement for division/allocation of cost
- Methods of billing and payment

- Process for contract award
- Responsibility for network administration
- Need for single point of contact to deal with service provider
- Handling of network service issues
- Performance specifications
- Network security issues
- Network redundancy issues
- Capacity for growth and expansion
- Required lead time for implementation
- Business Continuity / Disaster Recovery issues relating to the network
- Performance management, measurement, monitoring, reporting and control

3.4.17 A number of steps were suggested to be taken to further pursue this direction. The proposal of establishing a dedicated group was supported by a number of member Administrations including Singapore, Japan, Hong Kong China, India, Pakistan and Nepal. Several issues were highlighted by few States including network security, connectivity, disaster recovery and redundancy that would need to be addressed and taken into consideration by the dedicated group. The meeting also noted that the CNS SG had endorsed the recommendation for the creation of a dedicated group of Subject Matter Experts (SMEs) that would further consider and investigate the proposed solution and issues described above, and develop a detailed proposal. Accordingly, the meeting adopted the following decision:

Decision 24/32 - Common Regional Virtual Private Network (VPN) Task Force

That, a Task Force with Subject Matter Experts (SME) be established to study the virtual private network and develop a detailed proposal by 2016. The Task Force reports the outcome of its study to APANPIRG through ACSICG and CNS SG.

Inter-regional APAC/NAT AIDC Document Updates

3.4.18 The meeting noted the activities of the inter-regional AIDC task force (IRAIDCTF) started in January 2013. The Task Force was established in accordance with NAT SPG Conclusion 48/28 and APANPIRG Conclusion 23/20. The first meeting of the IRAIDTF (IRAIDTF/1) was held on 16-18 January 2013 in ICAO Paris Office. The 2nd meeting was scheduled to be held from 22 to 26 July 2013 at ICAO Regional Office Bangkok, Thailand. The latest version (Version 0.7) of the PAN Regional APAC/NAT ICD for AIDC was noted by the meeting.

3.4.19 States/Administrations were encouraged to participate in the activities of the IRAIDCTF and provide contribution to the work of the Task Force.

AIDC Implementation Status in the APAC Region

3.4.20 The meeting noted the AIDC implementation status in the APAC Region as provided in **Appendix C** to the Report on Agenda Item 3.4.

COM Coordination Meeting

3.4.21 A COM Coordination Meeting participated by China, Myanmar and Nepal was held in Kunming, China from 18 to 20 February 2013. The meeting was pleased to note the initiatives taken by States concerned and the coordinated Action Plan agreed for improving the performance of some of the concerned circuits to satisfy the established operational requirements. The meeting urged States concerned to take timely action to implement the action items agreed.

Aeronautical Mobile Service (AMS)

RCP/RSP Workshop

3.4.22 A SIP Workshop on the Required Communication Performance (RCP) and Required Surveillance Performance (RSP) was conducted in accordance with APANPIRG Conclusion 23/24. The objective of the workshop was to develop better understanding of participants for implementation of a performance based framework for communication and surveillance (RCP and RSP) specified in the Global Operational Data Link Document (GOLD). It was understood that the RCP and RSP framework would initially apply to data link performance specifications and monitoring. 14 presentations on RCP and RSP were discussed at the Workshop.

3.4.23 A survey indicated that the RCP/RSP workshop had been well received by all the participants.

3.4.24 The meeting further noted that RCP/RSP requirements for data link performance monitoring are specified in the GOLD Edition 2. The development of a plan for the performance-based RCP and RSP framework is included in the regional Aeronautical Communication Strategy.

3.4.25 The meeting also recalled that IP/26 from USA recommended at APANPIRG/23 to adopt a draft Decision resulting from recommendation of SOCM/2 meeting on that matter. IP/26 called for inclusion of a RCP & RSP framework in the APANPIRG Sub-groups' work program. APANPIRG/23 did not adopt the Draft Decision, pending a better understanding of RCP and RSP and rather APANPIRG/23 adopted Conclusion 23/24 and 23/13 calling for a Seminar on data-link monitoring and a RCP/RSP Workshop. The seminar on data link performance reporting and monitoring was held in March 2013 and the RCP/RSP Workshop was held in May 2013 in conjunction with CNS SG/17 meeting. Considering the positive feedback on the merits of RCP and RSP from the workshop and seminar, the meeting adopted the following Decision on RCP and RSP which would enable:

a) States to prescribe RCP and RSP, for operators, aircraft systems and infrastructure, when applying separations predicated on such performance ;

b) ANSPs to ensure infrastructure, including communication/satellite services, meets RCP and RSP allocations

c) Operators to obtain operational authorizations from State of Registry or State of the Operator for RCP/RSP operations, to ensure qualified flight crews, properly configured aircraft systems and participation in regional data link monitoring programs; and

d) ANSPs to manage and support regional data link monitoring programs that identify substandard performance for appropriate action.

Decision 24/33 - APAC RCP/RSP Implementation Framework

That, APANPIRG Sub-groups include in their work program and implementation initiatives, consideration of the required communication performance (RCP) and required surveillance performance (RSP) framework.

Edition 2 of Global Operational Data Link Document (GOLD)

3.4.26 The meeting noted the activities of the GOLD ad-hoc working group and that the milestones of the GOLD work programme were completed since its 1st edition was adopted by APANPIRG in 2010. 120 participants from 27 States and 56 different Organisations assisted in the development of Edition 2.0. International Organisations including IATA, IFATCA, IFALPA, IBAC, CANSO, Eurocontrol, and EASA significantly contributed towards the development of the document. In total more than 1000 comments were submitted and more than 900 were resolved.

3.4.27 The meeting noted the main changes versus Edition 1.0 as follows:

a) Edition 2.0 applies to all airspace;

   i) Where procedural separations are applied

   ii) Where ATS surveillance services are provided

b) Applies to FANS 1/A, ATN B1 and FANS 1/A ATN B1 aircraft and ground systems;

   i) Generalized Chapter 2 data link description

   ii) Common procedures (for most part) in Chapter 4-6)

c) Addresses High Level Safety Conference (HLSC) recommendations;

   i) For ADS-C conformance monitoring

   ii) CPDLC failure procedure

d) Added advanced air traffic services supported by data link;

   i) CPDLC for ATC-initiated re-route procedure (NAT originated)

   ii) CPDLC for ADS-B in trail procedure (ITP)

e) Clarified position reporting requirements in ADS-C environments, e.g. reporting revised time estimates;

f) Additional guidance on RCP – RSP and post-implementation monitoring; and

g) Updated Appendix E, Region/ State specifics, with new look, to include European Region.

In view of the foregoing, the meeting adopted the following Conclusion:

Conclusion 24/34 – Adoption of Global Operational Data Link Document (GOLD) Edition 2

That, the Global Operational Data Link Document (GOLD) Edition 2 provided in **Appendix D** to the Report on Agenda Item 3.4 be adopted.

Satellite data link related activities & Data link Monitoring Result

3.4.28 The meeting noted that an upgrade of Inmarsat 3 satellite Ground Earth Station (GES) for Indian Ocean Region (IOR) took place on 19 March 2013 and an upgrade to new Inmarsat 4 GES hardware was expected to improve GES availability. It was anticipated that RSP 180 and RCP 240 performance would be achievable. The meeting noted information on apparent deficiencies in data-link problem reporting amongst FIT-Asia States and airspace users.

3.4.29 The meeting noted the results of data-link performance monitoring within the Auckland Oceanic FIR. The CRA of the Informal South Pacific ATS Coordinating Group, the ISPACG CRA, has for some time published a collection of data-link monitoring data on its website at http://www.ispacg-cra.com/performance.asp.

3.4.30 New Zealand explained that safety targets for the Inmarsat network availability were being achieved but efficiency target consisting of operational efficiency and orderly flow of air traffic was not met. While the Iridium network may meet the safety target, the availability was unsatisfactory. The meeting was informed that the nominal targets for CPDLC and ADS-C continuity were being achieved, but some improvement would be necessary to reach the target for expiration time for CPDLC and delivery time for ADS-C.

Satellite Voice Guidance Material (SVGM) Amendment

3.4.31 The meeting noted the amendment proposed by NAT Region to the 1st Edition of the SVGM adopted by APANPIRG/23. The meeting was informed that the OPLINKP, at its meeting held in March 2013, agreed that SVGM should become an ICAO document with its own document number. It was also agreed that the SVGM be circulated among the OPLINKP members for review and comments to develop a draft amendment for the OPLINKP/WG/WHL6 meeting, planned for October 2013. The target date for publication of SVGM is 1st quarter, 2014. ICAO HQ had already distributed the SVGM to OPLINKP members requesting for their comments. In view of the foregoing, the CNS SG/17 meeting decided to defer its endorsement for the proposed amendment by the NAT Region.

Deployment of 8.33 kHz channel spacing in the band 117.975-137 MHz in APAC Region

3.4.32 India proposed to consider a smooth implementation of 8.33 kHz channel spacing for upper airspace services under the guidance of the ICAO APAC Regional Office. India explained that airborne equipment would need to be backward compatible. The meeting discussed the proposal. The Secretariat informed that for implementation of 8.33 kHz channel spacing, following factors should be taken into consideration:

- the need for a regional air navigation agreement on the implementation of 8.33 kHz channel spacing;
- the need to identify the airspace within which 8.33 kHz channel spacing requires to be introduced ; and
- an appropriate lead time.

3.4.33 The meeting noted that the CNS SG had made a decision (17/6) to establish a small working group to investigate the need for an increase in available VHF COM channels and, on the basis of the outcome, to develop recommendations for further consideration by the SG.

Regional Aeronautical Mobile Service (AMS) Strategy

3.4.34 The meeting reviewed the updated regional strategy on AMS and Satellite voice developed by the CNS SG. It was recalled that the strategy was adopted by APANPIRG/18 meeting in 2007 under Conclusion 18/29. It was also noted that APANPIRG (Conclusion 14/17) in 2003 developed an approach on the use of SATVOICE. The meeting adopted the following Conclusion:

Conclusion 24/35 – Revised regional Aeronautical Mobile Service Strategy

That, the revised regional AMS strategy provided in **Appendix E** to the Report on Agenda Item 3.4 be adopted.

Navigation

GNSS Landing System Seminar Report of PBN/TF/10

3.4.35 The meeting noted the report of the Tenth Meeting of the Performance-Based Navigation Task Force (PBN/TF/10) held in Nadi, Fiji from 11 to 13 December 2012. A PBN Workshop was conducted from 10 to 11 December 2012 in conjunction with the meeting. A Ground-based Augmentation System (GBAS) Landing System (GLS) Seminar was held in Sydney, Australia from 6 to 7 December 2012.

3.4.35.1 It was recalled that APANPIRG/23 did not adopt the draft PBN/TF Conclusion regarding conventional instrument flight procedures flown using GNSS/RNP aircraft, requesting further clarification on what was expected from the Draft Conclusion. During PBN/TF/10, more information was provided on the issues that precipitated the overlay matter earlier.

3.4.35.2 In the United States, AC 90-108 allowed the substitution of approved RNAV aircraft to fly enroute, terminal and approach procedures based on conventional aids without the aids being either on the aircraft or in operation. However, the AC did not make any reference to either the flight planning requirements or the separation standards to be applied. The United States provided the ATS service the operator requested. Australia advised that they already used GNSS in lieu of conventional navigation aid information, as did other Asia/Pacific States. Moreover, most modern RNP capable aircraft had approval to conduct enroute, terminal and approach procedures based on using their RNP capabilities in their Aircraft Flight Manual (AFM).

3.4.35.3 Amendment 1 to Doc 4444 (Flight Plan 2012) still required the flight plan to contain information on equipment carried by the AIG rather than its capabilities. As a result, aircraft could not include capabilities to fly conventional enroute, terminal and approach procedures on the flight plan, and in turn, ATS could not technically apply conventional aid separation standards to these aircraft, imposing significant operational restrictions and costs on operators.

3.4.35.4 The issue of GNSS overlays of conventional navigation aids was considered by the ICAO Separation and Airspace Safety Panel (SASP), which produced the Draft Circular 322 in 2009. IATA accepted the use of GNSS overlays as an interim measure. In view of the foregoing, the meeting adopted the following Conclusion formulated by the PBN Task Force:

Conclusion 24/36 - RNAV Substitution for Conventional Instrument Flight Procedures

That, considering the intent of US AC 90-108 and issues concerning the application of GNSS capability for aircraft flying conventional instrument flight procedures:

a) Asia/Pacific States should publish material that:

   i) includes approval for authorized operators with the appropriate RNAV capability to include the listing of conventional navigation aids in flight plans, provided the operator has approval for navigation aid substitution and an appropriate, up-to-date database;

   ii) includes acceptance of navigation substitution approvals of foreign States; and

   iii) supports ATC separation standards for navigation aid substitution; and

b) ICAO HQ be invited to:

   i) expedite development of global navigation aid substitution provisions; and

   ii) review the current Flight Plan contents to consider the listing of aircraft navigation capabilities rather than the listing of specific equipment carried (revisions should include the addition of Item 18 PBN codes for navigation specifications not currently included).

3.4.35.5 The PBN Task Force meeting identified the need to develop the Advanced RNP applications before the training material could be produced. The meeting considered that the most practical way to undertake these tasks and update the PBN Manual Doc 9613 was through the reconvening of the ICAO PBN Study Group. The meeting adopted the following Conclusion:

Conclusion 24/37 - New PBN Navigation Specifications

Considering that the RNP2, RNP0.3 and Advanced RNP Navigation Specifications were to be significantly valuable for future planning, ICAO be urged to:

a) expedite standards and guidance associated with these navigation specifications;

b) provide adequate training material and courses to enable effective implementation; and

c) expedite the development of procedure design standards in Doc 8168 for low RNP value missed approach and departure operations.

3.4.36 In accordance with APANPIRG Conclusion 21/32 – *Develop State PBN Implementation Plan* and DGCA Action Item 47/4, Asia/Pacific PBN State Plans had been categorized into three categories based on quality:

- Robust – when 8 to 10 basic plan elements (BPE) were satisfied;
- Marginal – when 5 to 7 BPE were satisfied; and
- Incomplete – when 4 or less BPE were satisfied.

3.4.37 State Plan of 42 administrations had been assessed which include New Caledonia and French Polynesia separately or 43 if the US was included in regards to its territories (American Samoa, Guam, Johnston, Kingman, Midway, Mariana, Palmyra, and Wake Islands). The following Table provides an overall summary of the status of Asia/Pacific PBN Plans.

Asia/Pacific PBN Plan Status	**2011 (PBN/TF/8)**	**2012 (PBN/TF/9)**	**2012 (PBN/TF/10)**
Robust	9 (21%)	14 (33%)	18 (43%)
Marginal	4 (10%)	5 (12%)	3 (7%)
Incomplete	8 (19%)	5 (12%)	4 (10%)
Total Plans (of 42)	**21 (50%)**	**24 (57%)**	**25 (60%)**
Administrations with no plan	21 (50%)	18 (43%)	17 (40%)

3.4.38 There had been a significant improvement in the number of administrations with a 'Robust' plan since PBN/TF/9. Bangladesh, Maldives, Malaysia and Tonga had successfully transitioned to 'Robust' category. The number of administrations with satisfactory PBN planning had more than doubled in less than two years.

Additional Guidelines for APV Approach

3.4.39 The meeting discussed the implementation targets for APV approaches in accordance with Assembly Resolution 37-11. The conclusion was that the wording of the resolution 37-11 was not clear enough and that it may lead to States setting unrealistic implementation targets, or misdirecting scarce IFP design resources.

3.4.40 The meeting suggested the following additional guidelines for the States to use in their planning for implementation of APV approaches in accordance with Assembly Resolution A37-11:

- planning for APV implementation should be carried out at those instrument runways where the configuration of terrain allows for a runway-aligned approach;

- the primary focus should be on the runways served by scheduled air-transport operations by APV-capable aircraft with a maximum certificated take-off mass of 5 700 kg or more; and

- priority should be given to the aerodromes with the best operational and safety benefit-to-cost of implementation ratio.

3.4.41 The meeting noted that Asia/Pacific would not achieve compliance with Resolution A37-11 even if the timeline was amended. Therefore additional guidelines may be considered by ICAO. Accordingly, the meeting adopted the following Conclusion:

Conclusion 24/38 - PBN Procedures with Vertical Guidance

That, given the difficulties that some States had with insufficient fleet capability for Baro-VNAV and no Space Based Augmentation System (SBAS), ICAO was urged to consider additional guidelines on alternative provisions to enable compliance so as to better align with the intent of Assembly Resolution A37-11 where practicable.

3.4.42 The Regional PBN Implementation Plan included Short-Term (2008-2012) strategies and a Medium-Term Implementation Plan (2013-2016). The PBN/TF/10 meeting extensively discussed proposed amendments to the Regional Navigation Strategy for the Asia/Pacific Region and the Regional PBN Implementation Plan, and also took the opportunity to provide feedback on the early draft excerpt of the Asia/Pacific Seamless ATM Plan related to PBN.

3.4.43 It was recognized that while the original intention of PBN was to create a harmonized world-wide navigation scheme, unfortunately there was no hierarchy between specifications; thus an aircraft with a higher performing capability such as RNP2 was not able to utilize a route with a lower specification such as RNAV5. Australia had deemed higher performing navigation specifications as being able to be used on RNAV5 routes, in effect creating a hierarchy between specifications. The meeting adopted the following Conclusion endorsed by CNS SG/17:

Conclusion 24/39 - Asia/Pacific Regional PBN Implementation Plan Ver. 4

That, recognizing the need for alignment of PBN Strategies and Guidance Material, as well as development of the Asia/Pacific Seamless ATM Plan, the Asia/Pacific Regional PBN Implementation Plan Version 4.0, provided in **Appendix F to** the Report on Agenda Item 3.4 be adopted.

3.4.44 The meeting discussed the proposal from the PBNTF to dissolve the PBN TF. It was considered that CNS Sub-Group could oversee PBN development, and that the Regional Sub-Office (RSO) which will be established in Beijing, China in later June 2013 could also play an important part in day-to-day PBN implementation assistance, along with the Asia/Pacific Flight Procedures Programme (FPP). The meeting agreed to the proposal to dissolve the PBN Task Force and suggested that the on-going work of the PBN Task Force may be followed up by the ICAO Secretariat and the CNS Sub-group. As result of discussion, the meeting adopted following Decision:

Decision 24/40 - Dissolution of the PBN Task Force

That, the Performance-based Navigation Task Force (PBN/TF) be dissolved.

Report of Second Meeting of Ionospheric Study Task Force (ISTF/2)

3.4.45 The Second Meeting of the Ionospheric Studies Task Force (ISTF/2) held from 15 to 17 October 2012 agreed to develop guidance material such as siting criteria of receivers, their performance and collection of scintillation data at strategic locations. Draft guidance material finalized by December 2012. To facilitate its study, ISTF/2 requested APEC GIT to share its test-bed data. Also, the ISTF/2 meeting decided to acquire the Long-term Ionosphere Anomaly Monitoring (LTIAM) tool from the International GBAS Working Group (IGWG).

3.4.46 ISTF/2 agreed to categorise the ionospheric delay and scintillation measurements collected into geographical regions to verify if there was an even spread of all observation sites in the APAC region. Japan presented a plan to set up a data server in ENRI, Japan for the collection, integration, administration and distribution of data collected from the States and Administrations. ISTF/2 also discussed issues related to the handling of huge quantum of data and restrictions imposed by some contributing States regarding the use of their data. ISTF/2 agreed to develop a mechanism to support data usage restrictions imposed by the contributing States and Administrations.

Alternate Position, Navigation and Time (APNT)

3.4.47 Australia presented "Characteristics of an Alternative Position, Navigation and Timing for the Asia/Pacific Region" to the CNS SG. Australia proposed CNS SG to study related issues and to develop some guidance material to assist States in choosing appropriate near term contingency navigation.

3.4.48 The meeting expressed encouragement to the Standards bodies (RTCA, EuroCAE) and ICAO HQ to develop standards for multi-constellation, multi-frequency GNSS avionics.

GAST-D Prototype for Low Latitude Region

3.4.49 Ground-based augmentation system (GBAS) is a GNSS-based system which supports precision approach services. Japan has developed a prototype CAT-I GBAS adapted to low magnetic latitude ionospheric conditions and has tested it at Osaka Kansai International Airport since December 2010.

3.4.50 SARPs of the GBAS Approach Service Type D (GAST-D) which allows for CAT-III approach using GPS L1 signals are under development by the ICAO Navigation Systems Panel. The baseline SARPs of GAST-D were available since 2011 and are now under operational validation by States. Japan has been involved in the development and validation of the SARPs of GAST-D.

3.4.51 Electronic Navigation Research Institute (ENRI), Japan had since April 2011 launched a project of GAST-D baseline SARPs operational validation consisting of following three parts:

a) A prototype of GAST-D ground subsystem;

b) A GAST-D ionospheric threat model for low latitude; and

c) An experimental airborne system.

3.4.52 Outcome of this baseline validation would be beneficial to the States in the Asia-Pacific Region which have similar ionospheric conditions to Japan.

Space Weather Studies

3.4.53 APANPIRG/23 adopted a Decision inviting CNS and MET Sub Groups to review the impact of Space Weather on their areas of activity. The CNS SG meeting reviewed the impact of Space Weather on aeronautical Communication and Navigation Services.

3.4.54 The meeting noted that global harmonization of space weather information was required to facilitate uniform interpretation of the effects and development of procedures that would support seamless operations and mitigate cost to the airlines. It was recommended that international aviation community should have a standardized format for information and impact scenarios by adopting one of the existing international standards. Space Weather and its effect on aeronautical navigation came up for discussion in the Navigation Systems Panel (NSP) Working Group of the Whole meeting held in 2012. The NSP noted that the work for the Development of Operational Requirements for Space Weather prepared by the ICAO Meteorology section was on-going to derive operational requirements for providing the international civil aviation with space weather related services.

3.4.55 Information on Space Weather studies was also presented to the Ionospheric Studies Task Force (ISTF) which agreed that space weather was very closely relevant to the activities of the Task Force.

3.4.56 In the Asia/Pacific Region, Ionospheric Prediction Service (IPS), a service of the Australian Department of Industry, Science and Resource had also related activities like impact assessment of space weather on Ground Based Augmentation System (GBAS). NICT in Japan conducted activities in the field of space weather and its influence on radio propagation. Electronic Navigation Research Institute (ENRI) and National Institute of Information and Communication Technology (NICT) (both from Japan) were also conducting extensive study on Space Weather effect on GNSS performance.

3.4.57 The meeting noted that CNS SG made a Decision (17/13) supporting further study on the subject by the ISTF.

Navigation Strategy

3.4.58 The meeting reviewed and agreed to the amendment to the Navigation Strategy proposed by PBNTF/10 meeting and endorsed by the CNS SG/17. The meeting adopted the following Conclusion:

Conclusion 24/41 - Navigation Strategy for the Asia/Pacific Region

That, the revised navigation strategy provided in **Appendix G** to the Report on Agenda Item 3.4 be adopted for the Asia/Pacific Region.

Surveillance

Outcome of ADS-B SITF/12 Meeting

3.4.59 The meeting reviewed the report of the Twelfth Meeting of Automatic Dependent Surveillance – Broadcast (ADS-B) Study and Implementation Task Force (ADS-B SITF/12). An ADS-B Seminar and the ADS-B SITF/12 meeting, hosted by India, was held from 15 to 18 April 2013 in Kolkata India. The deliberations during the Seminar were taken into consideration at the 12th meeting of the Task Force. The complete report of the ADS-B SITF/12 meeting is posted at: http://www.bangkok.icao.int/cns/meeting.do?method=MeetingDetail&meeting_id=277

ADS-B Equipage Requirement and Required lead time for Mandate

3.4.60 The meeting was informed that by the end of 2013, DCA Myanmar will issue a mandate for ADS-B equipage of aircraft flying above FL260 on ATS routes M770 and L759 with target date 2015.

ADS-B Data Sharing in the Bay of Bengal Sub-region

3.4.61 India expressed willingness to share ADS-B data with Myanmar, Maldives, Sri Lanka, Malaysia and Indonesia. In addition to in-principle agreement on sharing data with Myanmar, India and Sri Lanka may also share the ADS-B data from Trivandrum (India) and Pidurutalagala in Sri Lanka. The Chennai Upper Airspace Harmonization had already led to significant improvement in operational efficiency and the sharing of ADS-B data with Sri Lanka would yield northbound flights from the island State significant benefits. Sharing of ADS-B data between India and Maldives – Hanimadhoo and Male ADS-B (Maldives) and Trivandrum/Cochin (India) would also result in significant improvement in service quality in the Indian Ocean region.

3.4.62 Full benefits of ADS-B would only be achieved by its harmonized implementation and seamless operations. The meeting reviewed the agreement on the timeframe for ADS-B data sharing between States in Bay of Bengal area and adopted following Conclusion:

Conclusion 24/42 – Timeframe for Data-sharing in the Bay of Bengal Sub-region

That, States concerned be urged to consider the timeframe established for data-sharing in the Bay of Bengal Sub-region as provided in **Appendix H** to the Report on Agenda Item 3.4.

3.4.63 The meeting noted the deliberations on the framework regarding avionics standards, optimal flight levels, and ATC and engineering handling procedures on routes M770, N895, P646 and L507 in the Bay of Bengal area. An harmonization Framework for ADS-B Implementation along ATS Routes M770, N895, P646 and L507 was recommended for the Bay of Bengal. States concerned were requested to work closely together to achieve an agreement as shown in the Harmonization Framework for implementation of ADS-B based service in the Bay of Bengal Sub-region.

Barometric and Geometric altitude Information in ADS-B message

3.4.64 The meeting discussed the safety implications of processing and displaying the geometric altitude information to air traffic controllers by ATM automation system. The meeting concluded that the geometric altitude information shall not be provided to air traffic controllers. It was considered important for Administrations to be fully aware of this safety issue about processing and displaying altitude information in ADS-B messages. Accordingly, the meeting adopted following Conclusion:

Conclusion 24/43 – Processing altitude information in ADS-B Message

That, States/Administrations implementing ADS-B based surveillance services be urged to be fully aware of the safety implications and difference between geometric and barometric altitude. Geometric altitude information shall not be displayed on ATC displays used for the provision of air traffic services. States may choose to use geometric altitude in ATM systems for other purposes.

Comprehensive Amendment to the ADS-B Implementation and Operation Guidance Document (AIGD)

3.4.65 The meeting reviewed and agreed to the proposed comprehensive amendments to the AIGD which contains the latest ADS-B developments and applications including:

- relevant Aviation System Block Upgrades (ASBU);
- new avionics standards;
- safety risk assessment guidance material;
- ADS-B regulations;
- safety implications of ADS-B geometric altitude;
- procedures for handling non-compliant aircraft and misleading ADS-B transmissions;
- a framework for harmonizing implementation;
- Guidance on the generation and sharing of ASTERIX Category 21 messages;
- Reference to Security considerations;
- Reference to Guidance on ATC automation functionalities to support ADS-B;
- Reference to regulatory guidance material;
- Checklist for commissioning of an airways facility;
- Spares and maintenance support; and
- Co-ordination with Military organizations about ADS-B data sharing.

3.4.66 Hong Kong China highlighted that ADS-B Out is one of the key elements for Block 0 modules of the ICAO ASBU Framework with highest implementation priority in the ASIA/PAC Region. To reap full benefits and achieve better synergy, the meeting agreed that the AIGD for ASIA/PAC Region would be shared with other Regions as guidance material to facilitate global harmonization and interoperability of seamless ATM systems. ICAO Regional Office was requested to coordinate with ICAO HQs and other Regional Offices in this respect.

3.4.67 The meeting reviewed and agreed to the proposed changes. The meeting appreciated the efforts made by Hong Kong China and Australia and adopted the following Conclusion:

Conclusion 24/44 – Amendment to ADS-B Implementation and Operation Guidance Document (AIGD)

That, the revised AIGD provided in **Appendix I** to the Report on Agenda Item 3.4 be adopted.

ADS-B performance monitoring

3.4.68 The meeting reviewed a number of working papers from Australia, India, Hong Kong China and Singapore regarding their practice and experience of ADS-B performance monitoring. It was suggested that States should include monitoring of adequate NUC/NIC availability relevant to their FIR. In view of the foregoing, the meeting adopted the following Conclusion:

Conclusion 24/45 - Exchange ADS-B performance monitoring result

That, States be encouraged to exchange findings/result of their ADS-B performance monitoring including experience gained in conducting the required performance monitoring.

3.4.69 In this connection, the meeting requested Secretariat to seek the possibility of establishing a central database for the safety data sharing at the ICAO Regional Sub-office.

Need for Adequate Logistics and Spares for ADS-B Ground Stations

3.4.70 The meeting recognized the importance of adequate support for the provision and repair of modules for the availability and reliability of ADS-B services. The meeting noted that the use of a spares pool and the module repair contract as part of the system acquisition purchase were efficient ways to ensure that adequate number of modules were always available. Such arrangements would improve certainty of funding for both supplier and ANSPs to ensure continuity of service. States were therefore advised to consider including requirements for a spares pool and maintenance support contract in all ADS-B system acquisition. Accordingly, the meeting adopted the following Conclusion:

Conclusion 24/46 - Need for adequate Logistics and Spares Support for ADS-B service

That, States consider making maintenance arrangements including requirements for spares pool and/or maintenance contract for all ADS-B system acquisitions and existing systems already in operation if these arrangements do not yet exist.

3.4.71 While supporting the adopted Conclusion, India highlighted their experience as provided in IP/17. The spare parts including hardware and software provided by Industry are subject to frequent updates according to the latest development. The design of COTS (Commercial off-the-shelf) products used for CNS/ATM systems would need to be standardized so that the same could be accommodated with and remain compatible to subsequent software/hardware upgrades done within the framework of the initial design. .

3.4.72 The meeting was informed that logistics considerations should also include supporting systems such as power and air-conditioning. The meeting discussed the inclusion of software upgrades in maintenance contracts, and the consequent difficulty involved in establishing a contract which included unknown future requirements.

Report of CANSO Focus Group meetings

3.4.73 CANSO presented reports to both the WG and TF meetings regarding the focus group meetings held in Singapore in July 2012. In following up the outcome of the ADS-B SITF/11 meeting, CANSO facilitated two focus group meetings in Singapore in July 12 for the relevant parties to focus on specific project deliverables and milestones using the framework/model developed for the initial phase of the South China Sea project. The meeting for BOB was attended by

CAAs/ANSPs/organization from Singapore, India, Myanmar, CANSO and IATA. The meeting for SEA was attended by CAAS, CAAP and CANSO.

Discussion on transition to DO 260B

3.4.74 The meeting discussed whether the Task Force need to consider how to transition to RTCA DO260B recognizing that DO 260B is being adopted by ICAO as Version 2. It was decided that the regional strategy on equipage requirement for DO 260B (Version 2) should be developed. The best way would be a forward fit from a specified date. The difficulty would be in requiring those aircraft already equipped with DO-260 or -260A avionics to retrofit. The question would be when to discontinue the support for DO-260/260A. Australia, Hong Kong China and Singapore agreed to work together to develop a proposal for consideration by the ADS-B SITF.

Review of Regional Surveillance Strategy

3.4.75 The meeting reviewed and endorsed the changes to the regional Surveillance Strategy for Asia/Pacific Region proposed by the ADS-B SITF/12 meeting. As a result of the review, the meeting adopted the following Conclusion:

Conclusion 24/47 – Surveillance Strategy for the Asia/Pacific Region

That, the revised surveillance strategy for the Asia/Pacific Region provided in **Appendix J** to the Report on Agenda Item 3.4 be adopted.

Update on Australian Mandates for Aircraft GNSS and ADS-B Equipment

3.4.76 Australia informed the meeting about rulemaking undertaken in 2012 by CASA to support the future air traffic management system, establishing aircraft avionics mandates for satellite based navigation, and the interoperability with Mode S SSR and ADS-B based surveillance systems.

3.4.77 In addition to the existing mandate for ADS-B equipage effective on 12 December 2013, equipment mandates were established for GNSS navigation under the IFR, fitment of Mode S transponders with ADS-B OUT capability, future forward-fit and retro-fit of ADS-B OUT equipment.

3.4.78 As some of these mandates did not apply to foreign registered aircraft, further rulemaking would be undertaken in the next year to additionally require ADS-B fitment to IFR flights below FL290 commencing in 2017.

3.4.79 More detailed information about the Australian Mandates is available at following CASA website: http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_101452

Aeronautical electromagnetic spectrum utilization Preparations for ITU WRC – 2015

3.4.80 The meeting noted that the ICAO's position on various Agenda Items for WRC-2015 was approved by the ICAO Council on 28 May 2013A copy of the approved ICAO Position is provided in the Appendix to IP/09. States/Administrations were requested to defend ICAO Position at various national/regional forums where spectrum allocation issues are discussed. States were also urged to make sure that ICAO Position is suitably reflected in the national position of the State.

3.4.81 New Zealand informed the CNS SG meeting that forums in Australia and New Zealand usually gather ANSP, frequency planners and CAAs. It was confirmed that the ICAO's draft position would be considered as a basis for aviation position in the New Zealand's forum.

AN Conf/12 Recommendations on Spectrum Management

3.4.82 Issues related to spectrum management of the radio frequency bands used for aeronautical applications were discussed in the 12th Air Navigation Conference under Agenda Item 1 and Agenda Item 6.

3.4.83 The meeting reviewed the related recommendations of the AN-Conf/12: Recommendation 2/3 on Security of air navigation systems, Recommendation 6/7 – Assistance to States in mitigating global navigation satellite system vulnerability, and the Recommendation 6/8 – Planning for mitigation of global navigation satellite system vulnerabilities.

Radio Frequency Handbook (Doc 9718) Volume I and Volume II

3.4.84 The meeting was informed about the latest status of the updated Volume I - of Doc 9718 Vol. I which includes the ICAO Position for WRC-15, the Frequency Spectrum Policy Statements (Chapter 7) and the new Frequency Spectrum Strategy (Chapter 8). The updated document was reviewed and agreed by the Air Navigation Commission on 2 May 2013.

3.4.85 The material in the new Volume II of Doc 9718, which is in support of Amendment 88 to Annex 10 Vol. V, is mature and stable. It was approved by the ICAO Secretary General. There will only be minor formatting changes in the formal published version later this year.

3.4.86 Both the documents can be downloaded from ACP website:
http://legacy.icao.int/anb/panels/acp/repository.cfm

Performance Framework Forms (PFF) transit to Air Navigation Reporting Form (ANRF) and Electronic Air Navigation Plan (eANP)

3.4.87 The meeting recalled that the PFFs were adopted by APANPIRG/20 under Conclusion 20/2 in support of the ICAO's planning objective to achieve a performance based global air traffic management (ATM) system. The meeting reviewed and updated relevant PFFs which are provided in **Appendix K** to the Report on Agenda Item 3.4.

3.4.88 The meeting was informed that currently used Performance Framework Forms (PFFs) were being redesigned and aligned with the ASBU framework to be called Air Navigation Report Form (ANRF). This work had just started and is in the very initial stage. Reporting and monitoring results gathered through this scheme would be analyzed by ICAO and aviation partner stakeholders and then utilized in developing the annual Global Air Navigation Report planned to be released from 2014 onwards.

Development of an electronic ANP (eANP)

3.4.89 The CNS SG noted that the eANP development was expected to be completed by May 2014. Then regional offices would take up the preparation of their regional eANP and circulate it within the regions for comments by States. The updated draft regional eANP is expected to be approved by the ICAO Council prior to their uploading on a web-based platform by September 2014.

ASBU into APANPIRG work Methodology (also WP21 from Australia)

3.4.90 Australia provided CNS SG/17 meeting with a path to continue bringing the GANP/ASBU integrated planning methodology into the APANPIRG realm. The proposed path consists of three steps:

- Step 1) Methodological Convergence;
- Step 2) APAC Regional Coordinated Implementation Priorities; and
- Step 3) All-Regions Coordinated Implementation Priorities.

3.4.91 The meeting noted that the CNS SG endorsed the proposed three steps and invited APANPIRG to consider endorsing the three steps as well. More discussion on the proposal is provided under Agenda Item 2.

Review of CNS/ATM Implementation and Planning Matrix

3.4.92 The meeting noted the CNS/ATM Implementation and Planning Matrix updated by the CNS SG. The CNS/ATM Implementation Matrix reflects the status of implementation of major CNS/ATM elements in the region which includes ATN, AIDC, CPDLC, GNSS, ADS-C and ADS-B. The updated Matrix is provided in **Appendix L** to the Report on Agenda Item 3.4.

Subject and Task List of CNS SG

3.4.93 The meeting noted the updated Subject and Task list of CNS SG appended to the Report of CNS SG/17 meeting.

Information on CNS related developments provided by States

3.4.94 Under this Agenda Item, the meeting also noted the following information provided by States:

– Status of ATC surveillance in Mongolia (IP/13);
– Updates on FAA System Wide Information Management (SWIM) Program (IP/15);
– Harmonization activities for CNS/ATM Implementation between Japan and Republic of Korea (IP/16);
– Use of COTS products for CNS/ATM Systems in India (IP/17);
– Progress on Implementation of ATN/AMHS, AIDC, ADS-B and PBN and ATM Automation system up-gradation by Bangladesh (IP/14);
– CNS development including improved surveillance system in Cambodia (IP/28,IP/29); and
– ATS Surveillance Coverage in Ho Chi Minh FIR (IP/24)

Note of appreciation

3.4.95 The meeting expressed appreciation to States for hosting following ICAO regional activities:

– DGCA, Indonesia for hosting ATNICG/8 meeting in Jakarta;
– CASA, Australia for hosting GLS Seminar in Sydney;
– CAA, Fiji for hosting PBN Workshop and PBNTF/10 meeting in Nadi;
– ATMB, China for hosting the COM Coordination meeting in Kunming;
– DCA, Myanmar for hosting the SEA/BOB ADS-B WG/8 meeting in Yangon; and
– AAI, India for hosting the ADS-B SITF/12 meeting in Kolkata

Acknowledgement of the contribution of PBN Task Force

3.4.96 With the dissolution of the PBN Task Force, the meeting recorded its appreciation to the PBN Task Force led by Mr. Ian Mallett of CASA, Australia and Task Force members in the development of the Asia/Pacific Regional PBN Implementation Plan and facilitation of PBN implementation in the Region.

Change in the Secretariat

3.4.97 Dr. Sujan Saraswati, Regional Office CNS retired in October 2012 after almost 6 years of service with ICAO. The meeting recorded appreciation to Dr. Sujan Saraswati for his dedication and contribution to the CNS implementation in the Region.

3.4.98 The meeting also noted and welcomed Mr. Frederic Lecat, a new member of the Secretariat team, joined ICAO recently as a Regional Officer, CNS from France.

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INTERNATIONAL CIVIL AVIATION ORGANIZATION

INTERFACE CONTROL DOCUMENT FOR ATN IPS (IPV4) ROUTER

VERSION 1.1

EXECUTIVE SUMMARY

The Aeronautical Telecommunication Network (ATN) is a global telecommunications network being established to provide digital communications between ICAO member States.

This Interface Control Document (ICD) the provides Internet Protocol Suite (IPS) router guidelines for the routers that form nodes of the ATN backbone to ensure interoperability between States

CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

This document provides ATN IPS router ICD guidelines for the routers that form nodes of the network Backbone. This ICD addresses the Network Interface and Internet layers of the ATN IPS router using the TCP/IP model.

1.1 Purpose and Scope

The general requirements for the ATN IPS router cover the lower two layers of the TCP/IP four-layer model. The TCP/IP model defines a four-layer network model as shown in Figure 1-1. Only the lower two layers are covered under this document.

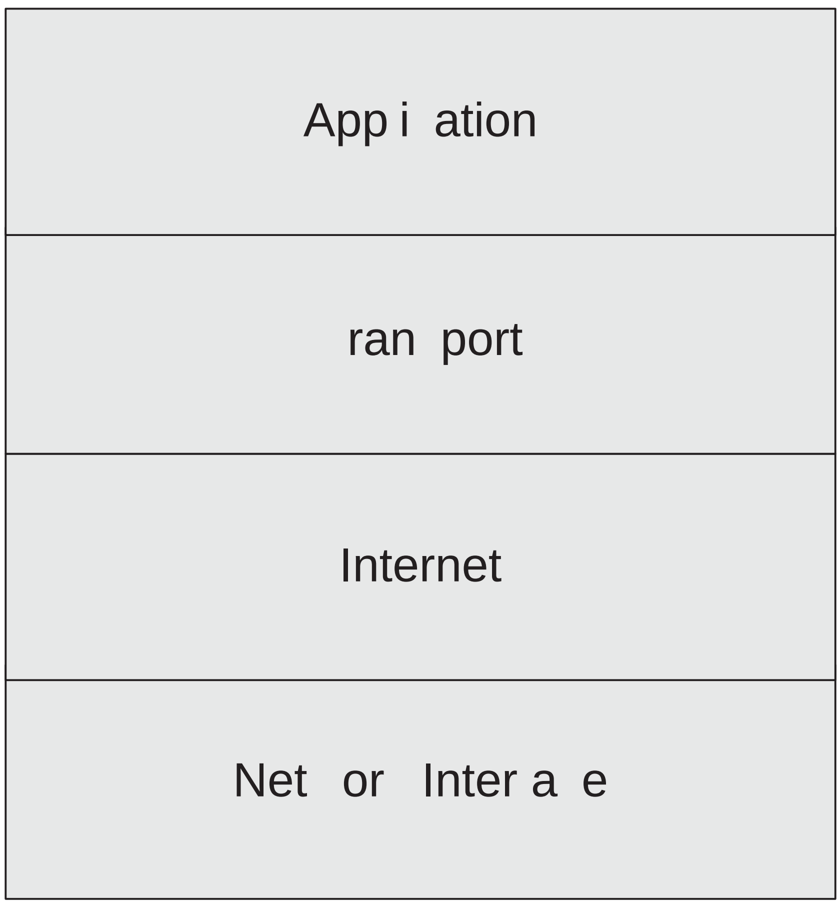

Figure 1-1 TCP/IP Layer Model

1.2 Document Structure

This document is structured as follows:

- Section 1, Introduction, summarizes the contents of this document and reference documents.

- Section 2, Internet Protocol Addressing, specifies the Internet Protocol (IP) address allocation.
- Section 3, Interface Design Characteristics, provides the layer 1 and 2 requirements for interface between ATN IPS routers.

1.3 Applicable Documents

The following documents form a part of this ICD to the extent specified herein. In the event of a conflict between the documents referenced herein and the contents of this ICD, the contents of this ICD shall be the superseding requirements

1.3.1 Internet Standards

RFC 791 Internet Protocol, September 1981
RFC 792 Internet Control Message Protocol, September 1981, as updated by RFCs 950, 4884, and 6633
RFC 793 Transmission Control Protocol, September 1981, as updated by RFC 3168
RFC 796 Address Mappings, September 1981
RFC 826 An Ethernet Address Resolution Protocol, November 1982
RFC 894 Standard for the Transmission of IP Datagrams over Ethernet Networks, April 1984
RFC 2427 Multiprotocol Interconnect over Frame Relay (FR), September 1998
RFC 950 Internet Standard Subnetting Procedure, August 1985
RFC 1812 Requirements for IP Version 4 Routers, June 1995, as updated by RFC 2644 and RFC 6633
RFC 2328 Open Shortest Path First (OSPF) Version 2, April 1998
RFC 2439 BGP Route Flap Damping, November 1998
RFC 2644 Changing the Default for Directed Broadcasts in Routers, August 1999
RFC 3168 The Addition of Explicit Congestion Notification (ECN) to IP, September 2001
RFC 4271 A Border Gateway Protocol 4 (BGP-4), January 2001, as updated by RFC 6286
RFC 4884 Extended ICMP to Support Multi-Part Messages, April 2007
RFC 6286 Autonomous-System-Wide Unique BGP Identifier for BGP-4, June 2011
RFC 6633 Deprecation of ICMP Source Quench Messages, May 2012

1.3.2 ICAO Documents

ATNICG/5-WP/11 11 “Proposed Asia/Pacific IPv4 Address Planning” presented and accepted at The Fifth Meeting of Aeronautical Telecommunication Network (ATN) Implementation Co-ordination Group of APANPIRG (ATNICG/5) in Kuala Lumpur, Malaysia, on 31 May – 4 June 2010

2.0 INTERNET PROTOCOL ADDRESSING

Network addressing should be in accordance with RFC 796 for IPv4 implementations. Addresses shall conform to ICAO Asia/Pacific and CAR/SAM Regional IPv4 Address Planning. The address table is included in Appendix B.

3.0 INTERFACE DESIGN CHARACTERISTICS

This section provides the general functional and physical design characteristics for the interfacing communication devices.

3.1 General Characteristics

The ATN IPS routers are Commercial off the Shelf (COTS) routers that can be easily procured and implemented. The use of these routers will tremendously decrease the time of deployment and final implementation of the ATN.

3.2 Functional Design Characteristics

This section describes the functional requirements of this interface.

3.2.1 Network Interface Layer

The network interface layer handles the hardware details or the physical interfacing to the transmission medium (e.g., cable, radio link). It provides the mechanical, electrical, functional, and procedural methods necessary to activate, maintain, and deactivate physical connections for data links.

The following standards are allowable physical interface implementations.

3.2.1.1 TIA/EIA-232-E/F

The TIA/EIA-232-E/F should be implemented according to TIA/EIA-232-E/F documents.

3.2.1.2 TIA/EIA-530-A

The TIA/EIA-530-A should be implemented according to TIA/EIA-530-A document.

3.2.1.3 V.35

The V.35 should be implemented according to ITU-T V.35 document.

3.2.1.4 Ethernet

Transmission of IPv4 datagrams over Ethernet networks should be in accordance with RFC 894.

3.2.1.5 Frame Relay (FR)

Transmission of IPv4 datagrams over Frame Relay should be done in accordance with RFC 2427.

3.2.2 Internet Layer

The Internet layer specifies the protocols that provide services corresponding to the internet layer. The protocol used in this layer shall be Internet Protocol (IP). IP is designed for use in interconnected packet-switched computer communication networks and provides addressing and fragmentation services.

3.2.2.1 Internet Protocol

IPv4 implementations shall be in accordance with RFC 791.

3.2.3 Routing

The Border Gateway Protocol 4 (BGP-4) shall be used to build and maintain routing tables in the ATN IPS routers, in accordance with RFC 4271. BGP route flap damping shall be used in accordance with RFC 2439.

3.2.4 Monitoring

ATN IPS routers shall support monitoring, to include, at a minimum, properly responding to an ICMP (RFC 792) Echo Request (ping).

APPENDIX A - ACRONYMS

A.0 Acronyms
This appendix defines the acronyms used in this document.

A/G	AIR-GROUND
AAC	Aeronautical Administrative Control
ABM	Asynchronous Balanced Mode
AIDC	ATS Interfacility Data Communications
AMHS	ATS Message Handling System
AOC	Aeronautical Operational Control
APC	Aeronautical Passenger Communication
APRLs	ATN Protocol Requirement Lists
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Service
ATSC	Air Traffic Service Control
BGP	Border Gateway Protocol
CLNP	Connectionless Network Protocol
CLNS	Connection-Less Network Service
CPDLC	Controller Pilot Data Link Communications
DCE	Data Circuit-terminating Equipment
DM	Disconnected Mode
DTE	Data Terminal Equipment
E/R	Error Report
ECN	Explicit Congestion Notification
EIA	Electrical Industry Association
ERD	End Routing Domain
ES	End System
FIB	Forwarding Information Base
FR	Frame Relay
FSM	Finite State Machine
G-G(G/G)	Ground-Ground
GRE	Generic Routing Encapsulation

ICAO	International Civil Aviation Organization
ICD	Interface Control Document
ICMP	Internet Control Message Protocol
IDRP	Inter Domain Routing Protocol
IEC	International Electrotechnical Commission
IPS	Internet Protocol Suite
ISO	International Standardization Organization
IP	Internet Protocol
ITU	International Telecommunications Union
ITU-T	ITU Telecommunications Sector
LAPB	Link Access Procedure Balanced
NET	Network Entity Title
NPDU	Network Protocol Data Unit
NSAP	Network Service Access Point
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PIB	Policy Information Base
PICS	Protocol Implementation Compliance Statement
PSDN	Public Switched Data Network
PSN	Packet Switched Network
PVC	Permanent Virtual Circuit
QOS	Quality of Service
RD	Routing Domain
RDC	Routing Domain Confederation
RIB	Routing Information Base
SARPs	Standards and Recommended Practices
SNDCF	Sub Network Dependent Convergence Functions
SNPA	Sub Network Point of Attachment
SVC	Switched Virtual Circuit
TBD	to be Determined
TBR	to be Reviewed
TCP	Transmission Control Protocol

APPENDIX B - PROPOSED IPV4 ADDRESS PLAN

B.0 Network Assignment by Region

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
SAM	1	Argentina	10.0.0.0 / 19	Primera	10 . 0 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 0 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	2	Chile	10.0.32.0 / 19	Primera	10 . 0 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 0 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	3	Brasil	10.0.64.0 / 19	Primera	10 . 0 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 0 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	4	Uruguay	10.0.96.0 / 19	Primera	10 . 0 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 0 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	5	Paraguay	10.0.128.0 / 19	Primera	10 . 0 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 0 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	6	Bolivia	10.0.160.0 / 19	Primera	10 . 0 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 0 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	7	Peru	10.0.192.0 / 19	Primera	10 . 0 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 0 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	8	Ecuador	10.0.224.0 / 19	Primera	10 . 0 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 0 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	9	Colombia	10.1.0.0 / 19	Primera	10 . 1 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 1 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	10	Venezuela	10.1.32.0 / 19	Primera	10 . 1 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 1 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	11	Guyana	10.1.64.0 / 19	Primera	10 . 1 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 1 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0

<u>Asignación de Redes por Estado/Territorio.</u>

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
SAM	12	Surinam	10.1.96.0 / 19	Primera	10 . 1 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 1 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	13	Guyana Francesa (France)	10.1.128.0 / 19	Primera	10 . 1 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 1 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	VACANTE	10.1.160.0 / 19	Primera	10 . 1 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 1 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	VACANTE	10.1.192.0 / 19	Primera	10 . 1 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 1 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	VACANTE	10.1.224.0 / 19	Primera	10 . 1 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 1 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 0 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	VACANTE	10.2.0.0 / 19	Primera	10 . 2 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 1 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 2 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	0 0 1 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-		-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	128 (ULTIMA)	RESERVADA	10.15.224.0 / 19	Primera	10 . 15 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 0 0	1 1 1 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 15 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 0 0	1 1 1 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
	1	Antigua y Barbuda	10.16.0.0 / 19	Primera	10 . 16 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 16 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	2	Bahamas	10.16.32.0 / 19	Primera	10 . 16 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 16 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	3	Barbados	10.16.64.0 / 19	Primera	10 . 16 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 16 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	4	Belize	10.16.96.0 / 19	Primera	10 . 16 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 16 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	5	Canada	10.16.128.0 / 19	Primera	10 . 16 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 16 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
NACC	6	Costa Rica	10.16.160.0 / 19	Primera	10 . 16 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 16 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	7	Cuba	10.16.192.0 / 19	Primera	10 . 16 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 16 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	8	Republica Dominicana	10.16.224.0 / 19	Primera	10 . 16 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 16 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	9	El Salvador	10.17.0.0 / 19	Primera	10 . 17 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 17 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	10	Granada	10.17.32.0 / 19	Primera	10 . 17 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 17 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	11	Guatemala	10.17.64.0 / 19	Primera	10 . 17 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 17 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
NACC	12	Haiti	10.17.96.0 / 19	Primera	10 . 17 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 17 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	13	Honduras	10.17.128.0 / 19	Primera	10 . 17 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 17 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	14	Jamaica	10.17.160.0 / 19	Primera	10 . 17 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 17 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	15	Mexico	10.17.192.0 / 19	Primera	10 . 17 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 17 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	16	Nicaragua	10.17.224.0 / 19	Primera	10 . 17 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 17 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 0 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	17	Saint Kitts and Nevis	10.18.0.0 / 19	Primera	10 . 18 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 18 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	18	Santa Lucia	10.18.32.0 / 19	Primera	10 . 18 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 18 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	19	Saint Vincent and the Grenadines	10.18.64.0 / 19	Primera	10 . 18 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 18 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	20	Trinidad y Tobago	10.18.96.0 / 19	Primera	10 . 18 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 18 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	21	United States	10.18.128.0 / 19	Primera	10 . 18 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 18 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	22	Martinique (France)	10.18.160.0 / 19	Primera	10 . 18 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 18 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

<u>Asignación de Redes por Estado/Territorio.</u>

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
NACC	23	Guadalupe (France)	10.18.192.0 / 19	Primera	10 . 18 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 18 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	24	St Martin (France)	10.18.224.0 / 19	Primera	10 . 18 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 18 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	25	St. Barthelemy (France)	10.19.0.0 / 19	Primera	10 . 19 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 19 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	26	Aruba (Netherlands)	10.19.32.0 / 19	Primera	10 . 19 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 19 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	27	Curacao (Netherlands)	10.19.64.0 / 19	Primera	10 . 19 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 19 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	28	Bonaire (Netherlands)	10.19.96.0 / 19	Primera	10 . 19 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 19 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	29	St. Maarten (Netherlands)	10.19.128.0 / 19	Primera	10 . 19 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 19 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	30	Saba (Netherlands)	10.19.160.0 / 19	Primera	10 . 19 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 19 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	31	St. Eustatius (Netherlands)	10.19.192.0 / 19	Primera	10 . 19 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 - 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 19 . 192 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 - 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	32	Anguilla (United Kingdom)	10.19.224.0 / 19	Primera	10 . 19 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 - 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 19 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 0 1 1 - 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	33	Bermuda (United Kingdom)	10.20.0.0 / 19	Primera	10 . 20 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 20 . 0 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0

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Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria	Región	Estado / Territorio	Host's
NACC	34	British Virgin Islands (United Kingdom)	10.20.32.0 / 19	Primera	10 . 20 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 20 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	35	Cayman Islands (United Kingdom)	10.20.64.0 / 19	Primera	10 . 20 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 20 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	36	Montserrat (United Kingdom)	10.20.96.0 / 19	Primera	10 . 20 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 20 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	37	Turks and Caicos Islands (United Kingdom)	10.20.128.0 / 19	Primera	10 . 20 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 20 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	38	Puerto Rico (United States)	10.20.160.0 / 19	Primera	10 . 20 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 20 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	39	Virgin Islands (United States)	10.20.192.0 / 19	Primera	10 . 20 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 20 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	40	VACANTE	10.20.224.0 / 19	Primera	10 . 20 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 20 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	0 1 0 0 - 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-		-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	128 (ULTIMA)	RESERVADA	10.31.224.0 / 19	Primera	10 . 31 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 0 1	1 1 1 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 31 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 0 1	1 1 1 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

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Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria	Región	Estado / Territorio	Host's
APAC	1	Australia	10.32.0.0 / 19	Primera	10 . 32 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 32 . 15 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	2	Bangladesh	10.32.32.0 / 19	Primera	10 . 32 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 32 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	3	Bhutan	10.32.64.0 / 19	Primera	10 . 32 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 32 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	4	Brunei Darussalam	10.32.96.0 / 19	Primera	10 . 32 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 32 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	5	Cambodia	10.32.128.0 / 19	Primera	10 . 32 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 32 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	6	China	10.32.160.0 / 19	Primera	10 . 32 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 32 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	7	Cook Islands	10.32.192.0 / 19	Primera	10 . 32 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 32 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	8	Cook Islands	10.32.224.0 / 19	Primera	10 . 32 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 32 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	9	Democratic people's Republic of Korea	10.33.0.0 / 19	Primera	10 . 33 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 33 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	10	Fiji	10.33.32.0 / 19	Primera	10 . 33 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 33 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	11	India	10.33.64.0 / 19	Primera	10 . 33 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 33 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
APAC	12	Indonesia	10.33.96.0 / 19	Primera	10 . 33 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 33 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	13	Japan	10.33.128.0 / 19	Primera	10 . 33 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 33 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	14	Kiribati	10.33.160.0 / 19	Primera	10 . 33 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 33 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	15	Lao People's Democratic Republic	10.33.192.0 / 19	Primera	10 . 33 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 33 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	16	Malaysia	10.33.224.0 / 19	Primera	10 . 33 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 33 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 0 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	17	Maldives	10.34.0.0 / 19	Primera	10 . 34 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 34 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	18	Marshall Islands	10.34.32.0 / 19	Primera	10 . 34 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 34 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	19	Micronesia	10.34.64.0 / 19	Primera	10 . 34 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 34 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	20	Mongolia	10.34.96.0 / 19	Primera	10 . 34 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 34 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	21	Myanmar	10.34.128.0 / 19	Primera	10 . 34 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 34 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	22	Nauru	10.34.160.0 / 19	Primera	10 . 34 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 34 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

<u>Asignación de Redes por Estado/Territorio.</u>

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
	23	Nepal	10.34.192.0 / 19	Primera	10 . 34 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 34 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	24	New Zealand	10.34.224.0 / 19	Primera	10 . 34 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 34 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	25	Palau	10.35.0.0 / 19	Primera	10 . 35 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 35 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	26	Papua New Guinea	10.35.32.0 / 19	Primera	10 . 35 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 35 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	27	Philippines	10.35.64.0 / 19	Primera	10 . 35 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 35 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
APAC	28	Republic of Korea	10.35.96.0 / 19	Primera	10 . 35 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 35 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	29	Samoa	10.35.128.0 / 19	Primera	10 . 35 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 35 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	30	Singapore	10.35.160.0 / 19	Primera	10 . 35 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 35 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	31	Solomon Islands	10.35.192.0 / 19	Primera	10 . 35 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 35 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	32	Sri Lanka	10.35.224.0 / 19	Primera	10 . 35 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 35 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 0 1 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	33	Thailand	10.36.0.0 / 19	Primera	10 . 36 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 36 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria	Región	Estado / Territorio	Host's
APAC	34	Timor leste	10.36.32.0 / 19	Primera	10 . 36 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 36 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	35	Tonga	10.36.64.0 / 19	Primera	10 . 36 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 36 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	36	Vanuatu	10.36.96.0 / 19	Primera	10 . 36 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 36 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	37	Viet Nam	10.36.128.0 / 19	Primera	10 . 36 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 36 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	38	Isla de Pascua (Chile)	10.36.160.0 / 19	Primera	10 . 36 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 36 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	39	Polynesia Francesa (Francia)	10.36.192.0 / 19	Primera	10 . 36 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 36 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	40	New Caledonia (Francia)	10.36.224.0 / 19	Primera	10 . 36 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 36 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	41	Wallis and Futuna Islands (Francia)	10.37.0.0 / 19	Primera	10 . 37 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 37 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	42	Niue (New Zealand)	10.37.32.0 / 19	Primera	10 . 37 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 37 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	43	Pitcairn Island (United Kingdom)	10.37.64.0 / 19	Primera	10 . 37 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 37 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	44	American Samoa (United States)	10.37.96.0 / 19	Primera	10 . 37 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 37 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
APAC	45	Guam (United States)	10.37.128.0 / 19	Primera	10 . 37 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 37 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	46	Johnston Island Kingman Reef(United States)	10.37.160.0 / 19	Primera	10 . 37 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 37 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	47	Midway (United States)	10.37.192.0 / 19	Primera	10 . 37 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 37 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	48	Northern Mariana Islands(United States)	10.37.224.0 / 19	Primera	10 . 37 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 37 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 0 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	49	Palmyra (United States)	10.38.0.0 / 19	Primera	10 . 38 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 1 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 38 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 1 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	50	Wake Island (United States)	10.38.32.0 / 19	Primera	10 . 38 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 1 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 38 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 1 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	51	VACANTE	10.38.64.0 / 19	Primera	10 . 38 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 1 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 38 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	0 1 1 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-		-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	128 (ULTIMA)	RESERVADA	10.47.224.0 / 19	-	10 . 47 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 0	1 1 1 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				-	10 . 47 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 0	1 1 1 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
MID	1	Afghanistan	10.48.0.0 / 19	Primera	10 . 48 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 48 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	2	Bahrain	10.48.32.0 / 19	Primera	10 . 48 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 48 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	3	Egypt	10.48.64.0 / 19	Primera	10 . 48 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 48 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	4	Islamic Republic of IraN	10.48.96.0 / 19	Primera	10 . 48 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 48 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	5	Iraq	10.48.128.0 / 19	Primera	10 . 48 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 48 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	6	Israel	10.48.160.0 / 19	Primera	10 . 48 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 48 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	7	Jordan	10.48.192.0 / 19	Primera	10 . 48 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 48 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	8	Kuwait	10.48.224.0 / 19	Primera	10 . 48 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 48 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	9	Lebanon	10.49.0.0 / 19	Primera	10 . 49 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 49 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	10	Libyan Arab Jamahiriya	10.49.32.0 / 19	Primera	10 . 49 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 49 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	11	Oman	10.49.64.0 / 19	Primera	10 . 49 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 49 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
	12	Pakistan	10.49.96.0 / 19	Primera	10 . 49 . 96 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 49 . 127 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	13	Qatar	10.49.128.0 / 19	Primera	10 . 49 . 128 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 49 . 159 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	14	Saudi Arabia	10.49.160.0 / 19	Primera	10 . 49 . 160 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 49 . 191 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	16	Sudan	10.49.192.0 / 19	Primera	10 . 49 . 192 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 49 . 223 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	17	Syrian Arab Republic	10.49.224.0 / 19	Primera	10 . 49 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 49 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 0 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
MID	18	United Arab Emirates	10.50.0.0 / 19	Primera	10 . 50 . 0 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 1 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 50 . 31 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 1 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	19	Yemen	10.50.32.0 / 19	Primera	10 . 50 . 32 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 1 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 50 . 63 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 1 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	20	VACANTE	10.50.64.0 / 19	Primera	10 . 50 . 64 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 1 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 50 . 95 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	0 0 1 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	128 (ULTIMA)	VACANTE	10.63.224.0 / 19	Primera	10 . 63 . 224 . 1	0 0 0 0 1 0 1 0 .	0 0 1 1	1 1 1 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 63 . 255 . 254	0 0 0 0 1 0 1 0 .	0 0 1 1	1 1 1 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
WACAF	1	Benin	10.64.0.0 / 19	Primera	10 . 64 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 64 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	2	Burkina Faso	10.64.32.0 / 19	Primera	10 . 64 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 64 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	3	Cameroon	10.64.64.0 / 19	Primera	10 . 64 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 64 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	4	Cape Verde	10.64.96.0 / 19	Primera	10 . 64 . 96 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 64 . 127 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	5	Central African Republic	10.64.128.0 / 19	Primera	10 . 64 . 128 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 64 . 159 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	6	Chad	10.64.160.0 / 19	Primera	10 . 64 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 64 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	7	Congo	10.64.192.0 / 19	Primera	10 . 64 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 64 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	8	Cote de I'voire	10.64.224.0 / 19	Primera	10 . 64 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 1 1 1	1 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 64 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	9	Democratic Republic of the Congo	10.65.0.0 / 19	Primera	10 . 65 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 65 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	10	Equatorial Guinea	10.65.32.0 / 19	Primera	10 . 65 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 65 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	11	Gabon	10.65.64.0 / 19	Primera	10 . 65 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 65 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
WACAF	12	Gambia	10.65.96.0 / 19	Primera	10 . 65 . 96 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 65 . 127 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	13	Ghana	10.65.128.0 / 19	Primera	10 . 65 . 128 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 65 . 159 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	14	Guinea	10.65.160.0 / 19	Primera	10 . 65 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 65 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	15	Guinea-Bissau	10.65.192.0 / 19	Primera	10 . 65 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 65 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	16	Liberia	10.65.240.0 / 19	Primera	10 . 65 . 240 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 1 1 1	1 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 65 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 0 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	17	Mali	10.66.0.0 / 19	Primera	10 . 66 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 66 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	18	Mauritania	10.66.32.0 / 19	Primera	10 . 66 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 66 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	19	Niger	10.66.64.0 / 19	Primera	10 . 66 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 66 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	20	Nigeria	10.66.96.0 / 19	Primera	10 . 66 . 96 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 66 . 127 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	21	Sao Tome and Principe	10.66.128.0 / 19	Primera	10 . 66 . 128 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 66 . 159 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	22	Senegal	10.66.160.0 / 19	Primera	10 . 66 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 66 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria	Región	Estado / Territorio	Host's
WACAF	23	Sierra Leone	10.66.192.0 / 19	Primera	10 . 66 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 66 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	24	Togo	10.66.224.0 / 19	Primera	10 . 66 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 66 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	25	VACANTE	10.67.0.0 / 19	Primera	10 . 67 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 67 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	26	VACANTE	10.67.32.0 / 19	Primera	10 . 67 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 67 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	0 0 1 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
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				-	-			-	
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	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	128 (ULTIMA)	RESERVADA	10.79.224.0 / 19	Primera	10 . 79 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 0 0	1 1 1 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 79 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 0 0	1 1 1 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
ESAF	1	Angola	10.80.0.0 / 19	Primera	10 . 80 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 80 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	2	Botswana	10.80.32.0 / 19	Primera	10 . 80 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 80 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	3	Burundi	10.80.64.0 / 19	Primera	10 . 80 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 80 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	4	Comoros	10.80.96.0 / 19	Primera	10 . 80 . 96 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 80 . 127 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	5	Djibouti	10.80.128.0 / 19	Primera	10 . 80 . 128 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 80 . 159 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	6	Eritrea	10.80.160.0 / 19	Primera	10 . 80 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 80 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	7	Ethiopia	10.80.192.0 / 19	Primera	10 . 80 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 80 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	8	Kenya	10.80.224.0 / 19	Primera	10 . 80 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 80 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	9	Lesotho	10.81.0.0 / 19	Primera	10 . 81 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 81 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	10	Madagascar	10.81.32.0 / 19	Primera	10 . 81 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 81 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	11	Malawi	10.81.64.0 / 19	Primera	10 . 81 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 81 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
ESAF	12	Mauritius	10.81.96.0 / 19	Primera	10 . 81 . 96 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 81 . 127 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	13	Mozambique	10.81.128.0 / 19	Primera	10 . 81 . 128 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 81 . 159 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	14	Namibia	10.81.160.0 / 19	Primera	10 . 81 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 81 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	15	Rwanda	10.81.192.0 / 19	Primera	10 . 81 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 81 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	16	Seychelles	10.81.224.0 / 19	Primera	10 . 81 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 81 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 0 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	17	Somalia	10.82.0.0 / 19	Primera	10 . 82 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 82 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	18	South Africa	10.82.32.0 / 19	Primera	10 . 82 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 82 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	19	Swaziland	10.82.64.0 / 19	Primera	10 . 82 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 82 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	20	Uganda	10.82.96.0 / 19	Primera	10 . 82 . 96 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 82 . 127 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	21	United Republic of Tanzania	10.82.128.0 / 19	Primera	10 . 82 . 128 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 82 . 159 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	22	Zambia	10.82.160.0 / 19	Primera	10 . 82 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 82 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

<u>Asignación de Redes por Estado/Territorio.</u>

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
ESAF	23	Zimbabwe	10.82.192.0 / 19	Primera	10 . 82 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 82 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	24	VACANTE	10.82.224.0 / 19	Primera	10 . 82 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 82 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	25	VACANTE	10.83.0.0 / 19	Primera	10 . 83 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 83 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	0 0 1 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	-	-	-	-	-			-	
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	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	128 (ULTIMA)	VACANTE	10.95.224.0 / 19	Primera	10 . 95 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 0 1	1 1 1 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 95 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 0 1	1 1 1 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

<u>Asignación de Redes por Estado/Territorio.</u>

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
EUR/NAT	1	Albania	10.96.0.0 / 19	Primera	10 . 96 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 96 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	2	Algeria	10.96.32.0 / 19	Primera	10 . 96 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 96 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	3	Andorra	10.96.64.0 / 19	Primera	10 . 96 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 96 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	4	Armenia	10.96.96.0 / 19	Primera	10 . 96 . 96 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 96 . 127 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	5	Austria	PENS user						
	6	Azerbaijan	10.96.160.0 / 19	Primera	10 . 96 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 96 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	7	Belarus	10.96.192.0 / 19	Primera	10 . 96 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 96 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	8	Bosnia and Herzegovina	10.96.224.0 / 19	Primera	10 . 96 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 96 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	9	Bulgaria	Planned PENS user						
	10	Croatia	PENS user						
	11	Czech Republic	10.97.64.0 / 19	Primera	10 . 97 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 97 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 0 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria (Región / Estado / Territorio / Host's)
EUR/NAT	12	Denmark	PENS user			
	13	Estonia	10.97.128.0 / 19	Primera	10 . 97 . 128 . 1	0 0 0 0 1 0 1 0 . 0 1 1 0 0 0 0 1 . 1 0 0 0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-	-
				-	-	-
				Ultima	10 . 97 . 159 . 254	0 0 0 0 1 0 1 0 . 0 1 1 0 0 0 0 1 . 1 0 0 1 1 1 1 1 . 1 1 1 1 1 1 1 0
	14	Finland	PENS user			
	15	France	PENS user			
	16	Georgia	10.97.224.0 / 19	Primera	10 . 97 . 224 . 1	0 0 0 0 1 0 1 0 . 0 1 1 0 0 0 0 1 . 1 1 1 0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-	-
				-	-	-
				Ultima	10 . 97 . 255 . 254	0 0 0 0 1 0 1 0 . 0 1 1 0 0 0 0 1 . 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 0
	17	Germany	PENS user			
	18	Greece	10.98.32.0 / 19	Primera	10 . 98 . 32 . 1	0 0 0 0 1 0 1 0 . 0 1 1 0 0 0 1 0 . 0 0 1 0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-	-
				-	-	-
				Ultima	10 . 98 . 63 . 254	0 0 0 0 1 0 1 0 . 0 1 1 0 0 0 1 0 . 0 0 1 1 1 1 1 1 . 1 1 1 1 1 1 1 0
	19	Hungary	PENS user			
	20	Iceland	10.98.96.0 / 19	Primera	10 . 98 . 96 . 1	0 0 0 0 1 0 1 0 . 0 1 1 0 0 0 1 0 . 0 1 1 0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-	-
				-	-	-
				Ultima	10 . 98 . 127 . 254	0 0 0 0 1 0 1 0 . 0 1 1 0 0 0 1 0 . 0 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 0
	21	Ireland	Planned PENS user			
	22	Italy	PENS user			

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
EUR/NAT	23	Kazakhstan	10.98.192.0 / 19	Primera	10 . 98 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 98 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	24	Kyrgyzstan	10.98.224.0 / 19	Primera	10 . 98 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 98 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	25	Latvia	10.99.0.0 / 19	Primera	10 . 99 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 99 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	26	Lithuania	10.99.32.0 / 19	Primera	10 . 99 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 99 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	27	Luxemburgo	10.99.64.0 / 19	Primera	10 . 99 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 99 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	28	Malta	10.99.96.0 / 19	Primera	10 . 99 . 96 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 99 . 127 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	29	Monaco	10.99.128.0 / 19	Primera	10 . 99 . 128 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 99 . 159 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	30	Montenegro	10.99.160.0 / 19	Primera	10 . 99 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 99 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	31	Morocco	10.99.192.0 / 19	Primera	10 . 99 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 99 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	32	Netherlands	10.99.224.0 / 19	Primera	10 . 99 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 99 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 0 1 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	33	Norway	PENS user						

Asignación de Redes por Estado/Territorio.

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
EUR/NAT	34	Poland	Planned PENS user						
	35	Portugal	PENS user						
	36	Republic of Moldova	10.100.96.0 / 19	Primera	10 . 100 . 96 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 0 . 0 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 100 . 127 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 0 . 0 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	37	Romania	Planned PENS user						
	38	Russian federation	10.100.160.0 / 19	Primera	10 . 100 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 0 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 100 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 0 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	39	San Marino	10.100.192.0 / 19	Primera	10 . 100 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 0 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 100 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 0 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	40	Serbia	10.100.224.0 / 19	Primera	10 . 100 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 0 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 100 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 0 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	41	Slovakia	PENS user						
	42	Slovenia	PENS user						
	43	Spain	PENS user						
	44	Sweden	PENS user						

<u>Asignación de Redes por Estado/Territorio.</u>

Región	Nro	Estado / Territorio	Red	Direcciones utilizables	Notacion Decimal	Notacion Binaria			
							Región	Estado / Territorio	Host's
EUR/NAT	45	Switzerland	PENS user						
	46	Tajikistan	10.101.160.0 / 19	Primera	10 . 101 . 160 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 1 . 1 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 101 . 191 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 1 . 1 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	47	The Former Yugoslav Republic of Macedonia	10.101.192.0 / 19	Primera	10 . 101 . 192 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 1 . 1 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 101 . 223 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 1 . 1 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	48	Tunisia	10.101.224.0 / 19	Primera	10 . 101 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 101 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 0 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	49	Turkey	10.102.0.0 / 19	Primera	10 . 102 . 0 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 1 0 . 0 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 102 . 31 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 1 0 . 0 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	50	Turkmenistan	10.102.32.0 / 19	Primera	10 . 102 . 32 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 1 0 . 0 0 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 102 . 63 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 1 0 . 0 0 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	51	Ukranie	10.102.64.0 / 19	Primera	10 . 102 . 64 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 1 0 . 0 1 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 102 . 95 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 1 0 . 0 1 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	52	United Kingdom	PENS user						
	53	Uzbekistan	10.102.128.0 / 19	Primera	10 . 102 . 128 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 1 0 . 1 0 0	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 102 . 159 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	0 1 1 0 . 1 0 0	1 1 1 1 1 . 1 1 1 1 1 1 1 0
	-	-	-	-	-			-	
				-	-			-	
				-	-			-	
				-	-			-	
	128 (ULTIMA)	RESERVADA	10.111.224.0 / 19	Primera	10 . 111 . 224 . 1	0 0 0 0 1 0 1 0 .	0 1 1 0	1 1 1 1 . 1 1 1	0 0 0 0 0 . 0 0 0 0 0 0 0 1
				-	-			-	
				-	-			-	
				Ultima	10 . 111 . 255 . 254	0 0 0 0 1 0 1 0 .	0 1 1 0	1 1 1 1 . 1 1 1	1 1 1 1 1 . 1 1 1 1 1 1 1 0

REVISED TERMS OF REFERENCE FOR ACSICG

Name and Terms of Reference

Name: "ATN Implementation Coordination Group (ATNICG)" be replaced by "Aeronautical Communication Services Implementation Co-ordination Group (ACSICG)"

Terms of Reference (TORs)

Complete implementation of Asia and Pacific (APAC) Aeronautical Communication Network (ATN) and ensure the underlying communications backbone continues to support the evolving ICAO operational requirements for the exchange and management of aeronautical information and data.

Composition

The Group will be composed of experts nominated by ICAO member States/Administrations in the Asia and Pacific Regions.

Reporting

The Group will present its report to APANPIRG through the CNS Sub-group.

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AIDC IMPLEMENTATION STATUS IN THE APAC REGION

Country Administration /Country Administration	ATS Unit A	ATS Unit B (Counterpart)	Remark: Date of implementation
Australia	Brisbane	Melbourne	
Australia/New Zealand	Brisbane	Auckland	
Australia/New Zealand	Melbourne	Auckland	
Australia/Fiji	Brisbane	Nadi (Oceanic)	
Australia/Mauritius	Melbourne	Mauritius	
Australia/South Africa	Melbourne	Johannesburg	
Australia/USA	Brisbane	Oakland	
Australia/Indonesia	Brisbane	Ujung Pandang	Undergoing operational trial from May 2013
China	Sanya	Hong Kong	8 Feb. 2007
	Hong Kong	Taipei	12 Nov. 2012
	Guangzhou	Nanning	
	Guangzhou	Zhanjiang	
	Guangzhou	Zhuhai	
	Nanning	Kunming	
	Nanning	Zhanjiang	
	Zhanjiang	Haikou	
	Chengdu	Chongqing	
	Chengdu	Guiyang	
	Guiyang	Chongqing	
	Guiyang	Kunming	
Fiji/USA	Nadi	Oakland	
India			Being implemented at all ATCC plus 32 Aerodromes
India/Pakistan	Mumbai	Karachi	Under Trial
Japan/USA	Fukuoka ATM Center	Oakland ARTCC	
	Fukuoka ATM	Anchorage ARTCC	
Japan/Republic of Korea	Tokyo ACC	Incheon ACC	
	Fukuoka ACC	Incheon ACC	
Japan/Taipei, China	Fukuoka ACC	Taipei ACC	March 2012
	Naha ACC	Taipei ACC	
Malaysia	Kota Kinabalu	Kuching	
New Zealand/Fiji	Auckland	Nadi (Oceanic)	
New Zealand/USA	Auckland	Oakland	
New Zealand/France	Auckland	Tahiti	
Pakistan	Karachi	Lahore	

SOME AIDC CIRCUITS BEING PLANNED AND/OR UNDER TRIAL ARE LISTED FOLLOWS:

Country Administration /Country Administration	ATS Unit A	ATS Unit B (Counterpart)	Remark: Date of implementation
Bangladesh	Dhaka	Chittagong Dhaka	System being updated
	Dhaka	Sylhet	
China/Republic of Korea	Qingdao	Incheon	Planned for 2013
DPR. Korea	Pyongyang	Adjacent ACCs	Being planned
Indonesia/Australia	Makassar	Brisbane	On-going trial
Malaysia	Kuala Lumpur	With adjacent ATS Units	By end of 2013
Maldives	Male	With neighboring ACCs	ATM system software already upgraded to support AIDC
Maldives/Sri Lanka	Male	Colombo	Planned for 2013
Mongolia	Ulaanbaatar	With China (AIDC) and Russia (OLDI)	ATM supports OLDI and AIDC discussion with the concerned for implementation
Myanmar	Yangon	All adjacent ATS units	ATM system is ready in 2013
Philippines	Manila	Fukuoka ATM	Planned for 2015
Thailand	Bangkok		Together with ATM system upgrades
Viet Nam			Trial conducted in 2012, implementation planned for 2013

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Global Operational Data Link Document (GOLD)

This edition has been issued by the GOLD ad hoc Working Group for the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG), the North Atlantic Systems Planning Group (NAT SPG), the European Air Navigation Planning Group (EANPG), the South American Region Implementation Group (SAM/IG) and the African-Indian Ocean Planning and Implementation Regional Group (APIRG).

Second Edition — 26 April 2013

International Civil Aviation Organization

This document is available by accessing any of the following ICAO regional websites.

Asia and Pacific (APAC) Office	http://www.icao.int/apac
Eastern and Southern African (ESAF) Office	www.icao.int/esaf
European and North Atlantic (EUR/NAT) Office	http://www.paris.icao.int
Middle East (MID) Office	www.icao.int/mid
North American, Central American and Caribbean (NACC) Office	http://www.mexico.icao.int
South American (SAM) Office	http://www.lima.icao.int
Western and Central African (WACAF) Office	http://www.icao.int/wacaf

For more information, contact the ICAO regional office.

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Second Edition — 26 April 2013

International Civil Aviation Organization

AMENDMENTS

The issue of amendments is announced by the ICAO Regional Offices concerned, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS			
No.	Date applicable	Date entered	Entered by

CORRIGENDA			
No.	Date applicable	Date entered	Entered by

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Appendices

FOREWORD.

1. Historical background

1.1 The *Global Operational Data Link Document* (GOLD) is the result of the progressive evolution of the ICAO Asia-Pacific (APAC) *Initial Future Air Navigation System (FANS 1/A) Operations Manual*, the North Atlantic (NAT) *Guidance Material for ATS Data Link Services in North Atlantic Airspace* and the *Eurocontrol LINK2000+ Guidance Material* for the aeronautical telecommunication network baseline 1 (ATN B1).

1.2 Each of these founding documents provided guidance on a regional basis. However, in recognition of the need to provide globally harmonized guidance on data link operations, the GOLD, First Edition, merging initially the APAC and NAT guidance material, was adopted by the APAC and NAT Regions in 2010. The Second Edition of the GOLD enabled integration of the LINK2000+ guidance material.

1.3 The GOLD addresses data link service provision, operator readiness, controller and flight crew procedures, performance-based specifications and post-implementation monitoring and analysis.

2. Scope and purpose

2.1 The GOLD provides guidance and information concerning data link operations and is intended to facilitate the uniform application of Standards and Recommended Practices contained in Annex 2 — *Rules of the Air*, Annex 10 — *Aeronautical Telecommunications* and Annex 11 — *Air Traffic Services*, the provisions in the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) and, when necessary, the *Regional Supplementary Procedures* (Doc 7030).

2.2 This guidance material is intended to improve safety and maximize operational benefits by promoting seamless and interoperable data link operations throughout the world. This edition applies to the FANS 1/A and ATN B1 data link operations using automatic dependent surveillance — contract (ADS-C), controller-pilot data link communications (CPDLC) and the flight management computer waypoint position reporting (FMC WPR). Additional guidance is provided on the use of automatic dependent surveillance – broadcast (ADS-B) in-trail procedures (ITP). It also addresses the performance of the data link applications taking into consideration the transmission media used by those applications.

2.3 The following personnel and organizations should be familiar with relevant aspects of its contents: regulators, airspace planners, aircraft operators, dispatchers, air navigation service providers (ANSPs), aeronautical stations, communication service providers (CSPs), satellite service providers (SSPs) and radio operators, training organizations, regional/State monitoring agencies, automation specialists at centers and radio facilities, and aircraft manufacturers and equipment suppliers.

2.4 The guidance will support the following activities:

a) The States' roles and responsibilities in relation to the following:

   1) Safety regulatory oversight of air navigation services;

   2) Operational authorizations, flight crew training and qualification; and

   3) Design approval of aircraft data link systems.

b) The development of agreements and/or contractual arrangements between ANSPs and aircraft operators and their respective communication service providers;

c) The development of operational procedures; and

d) Operational monitoring, analysis, and exchange of operational data among regions, States, and communication service providers.

3. Status

This guidance is approved and maintained by the respective participating PIRGs and has a status of an ICAO regional guidance material. It contains material that may eventually become Standards and Recommended Practices (SARPs) or PANS provisions when it has reached the maturity and stability necessary for adoption or approval. It also comprises material prepared as an amplification of the basic principles in the corresponding SARPs, and designed particularly to assist the user in the application of the SARPs and PANS.

4. Implementation

With a view of facilitating implementation of the provisions herein by States, this guidance material has been prepared using language that permits direct use by all users.

5. References

6.1 The following references are cited in this document:

a) ICAO Annex 1 — *Personnel Licensing*

b) ICAO Annex 2 — *Rules of the Air*

c) ICAO Annex 4 — *Aeronautical Charts*

d) ICAO Annex 6 — *Operation of Aircraft – Part I — International Commercial Air Transport — Aeroplanes*

e) ICAO Annex 10 — *Aeronautical Telecommunications – Volume II* — Communication Procedures including those with PANS status

f) ICAO Annex 10 — *Aeronautical Telecommunications – Volume III* — Communication Systems

g) ICAO Annex 11 — *Air Traffic Services*

h) ICAO Annex 15 — *Aeronautical Information Services*

i) *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, ICAO Doc 4444)

j) *Regional Supplementary Procedures* (Regional SUPPs, ICAO Doc 7030)

k) *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, ICAO Doc 8400)

l) *Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services* (ICAO Doc 8585)

m) *Aircraft Type Designators* (ICAO Doc 8643)

n) *Manual on Airspace Planning Methodology for the Determination of Separation Minima* (ICAO Doc 9689)

o) *Performance-based Navigation Manual* (PBN) (ICAO Doc 9613)

p) *Manual on Required Communication Performance* (RCP) (ICAO Doc 9869)

q) *Manual on Airborne Surveillance Applications* (Doc 9994)

r) *In Trail Procedure (ITP) Using Automatic Dependant Surveillance - Broadcast (ADS-B)"* (ICAO Circular 325)

s) *Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace* (Oceanic SPR Standard, RTCA DO-306/EUROCAE ED-122)

t) *Safety and Performance Standard for Air Traffic Data Link Services in Continental Airspace* (Continental SPR Standard, RTCA DO-290/EUROCAE ED-120, Change 1 and Change 2)

u) *Interoperability Requirements for ATS Applications Using ARINC 622 Data Communications* (FANS 1/A INTEROP Standard, RTCA DO-258A/EUROCAE ED-100A)

v) *Interoperability Requirements Standard for Aeronautical Telecommunication Network Baseline 1* (ATN B1 INTEROP Standard, RTCA DO-280B/EUROCAE ED-110B)

w) *Future Air Navigation System 1/A — Aeronautical Telecommunication Network Interoperability Standard* (FANS 1/A — ATN B1 INTEROP Standard, RTCA DO-305A/EUROCAE ED-154A)

x) *Safety, Performance and Interoperability Requirements Document for In-Trail Procedure in Oceanic Airspace* (RTCA DO-312/EUROCAE ED-159) and Supplement

y) *Navigation Systems Data Base* (ARINC 424)

z) *Advanced Flight Management Computer System* (ARINC 702A)

6. Changes to the document

This document is maintained as a regional document in coordination with all ICAO planning and implementation regional groups (PIRGs) providing data link services within their region. Each participating PIRG establishes a mechanism for submitting and administering change proposals.

Change proposals (CPs) can be submitted by any stakeholder participating in data link operations. The stakeholder should submit a Change Proposal to their ICAO regional office (see Appendix E). The ICAO regional office will coordinate the change proposal within its own region, other regions, and ICAO HQ, to determine the acceptability of the change proposal. Once the ICAO regional office has completed coordination and the participating PIRGs accept the change proposal, the change is concluded by each of the PIRGs.

Amendments to the GOLD

Amendment	Source(s)	Subject(s)	Approved Applicable
1st Edition (2010)	Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/20 – 2009) North Atlantic Systems Planning Group (NAT SPG/46 – 2010)	*Global Operational Data Link Document* (GOLD)	Applicable within participating Regions on 1 July 2010.
2nd Edition (2013)	European Air Navigation Planning Group (EANPG/52 – 2010) South American (SAM) Implementation Group (SAM/IG/8 – 2011) African Indian Ocean Planning and Implementation Regional Group (APIRG/18 – 2012)	This Edition will allow GOLD to be applicable to data link implementations based on existing data link capabilities (i.e. FANS 1/A, ATN B1 and FANS 1/A-ATN B1 aircraft and ground systems) in airspace where procedural separations are applied and where ATS surveillance services are provided. This Edition includes: a) general data link descriptions and common procedures; b) changes to address High Level Safety Conference (HLSC) recommendations; c) CPDLC procedures and messages for ATC-initiated re-route procedure and ADS-B in trail procedure (ITP); d) guidance related to the position reporting requirements in ADS-C environments (e.g. reporting revised time estimates); e) additional guidance on RCP – RSP and post-implementation monitoring; and f) A modified section to facilitate Region / State specific guidance and new material specific to European Region.	Applicable within participating Regions on 1 December 2013.

Chapter 1. Definitions

1.1 Terms and definitions

When the following terms are used in this document they have the following meanings. Where the term has "(ICAO)" annotated, the term has already been defined as such in SARPs and/or PANS.

Term

ADS-C service. A term used to indicate an ATS service that provides surveillance information by means of the ADS-C application.

Note.— ICAO Doc 4444 does not include ADS-C in its definition for ATS surveillance system. Therefore, an ATS surveillance service does not consider those provided by means of the ADS-C application, unless it can be shown by comparative assessment to have a level of safety and performance equal to or better than monopulse SSR.

Aeronautical fixed telecommunication network (AFTN). A worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics. (ICAO)

Aeronautical Information Publication (AIP). A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation. (ICAO)

Aeronautical operational control (AOC). Communication required for the exercise of authority over the initiation, continuation, diversion or termination of flight for safety, regularity and efficiency reasons. (ICAO)

Aeronautical telecommunication network (ATN). A global internetwork architecture that allows ground, air-ground and avionic data subnetworks to exchange digital data for the safety of air navigation and for the regular, efficient and economic operation of air traffic services. (ICAO)

Air navigation services provider (ANSP). An organization responsible for the provision of air traffic services.

Air traffic control (ATC) clearance. Authorization for an aircraft to proceed under conditions specified by an air traffic control unit.

Note 1.— For convenience, the term "air traffic control clearance" is frequently abbreviated to "clearance" when used in appropriate contexts.

Note 2.— The abbreviated term "clearance" may be prefixed by the words "taxi", "take-off", "departure", "en-route", "approach" or "landing" to indicate the particular portion of flight to which the air traffic control clearance relates.

(ICAO)

Term

Air traffic control (ATC) service. A service provided for the purpose of:

a) Preventing collisions:

   1) Between aircraft, and

   2) On the manoeuvring area between aircraft and obstructions; and

b) Expediting and maintaining an orderly flow of air traffic. (ICAO)

Air traffic management (ATM). The dynamic, integrated management of air traffic and airspace including air traffic services, airspace management and air traffic flow management — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions. (ICAO)

Air traffic service (ATS). A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service). (ICAO)

Air traffic services unit (ATSU). A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office. (ICAO)

Airborne collision avoidance system (ACAS). An aircraft system based on secondary surveillance radar (SSR) transponder signals which operates independently of ground-based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR transponders. (ICAO)

Aircraft active flight plan. (See flight plan).

Aircraft address. A unique combination of 24 bits available for assignment to an aircraft for the purpose of air-ground communications, navigation and surveillance. (ICAO)

Aircraft identification. A group of letters, figures or a combination thereof which is either identical to, or the coded equivalent of, the aircraft call sign to be used in air-ground communications, and which is used to identify the aircraft in ground-ground air traffic services communications. (ICAO)

Note 1.— The aircraft identification does not exceed 7 characters and is either the aircraft registration or the ICAO designator for the aircraft operating agency followed by the flight identification.

Note 2.— ICAO designators for aircraft operating agencies are contained in ICAO Doc 8585.

Aircraft registration. A group of letters, figures or a combination thereof which is assigned by the State of Registry to identify the aircraft.

Note.— Also referred to as registration marking.

Term

Aircraft system availability ($A_{AIRCRAFT}$). The required probability of available capability on an aircraft with an average flight of 6 hours.

<u>Note</u>.— *The actual aircraft system availability is computed assuming that the service is available in the relevant airspace.*

Air-report. A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting. (ICAO)

Altitude reservation (ALTRV). Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special requirements which cannot otherwise be accomplished.

Appropriate ATS authority. The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned. (ICAO)

Appropriate authority.

a) Regarding flight over the high seas: The relevant authority of the State of Registry.

b) Regarding flight other than over the high seas: The relevant authority of the State having sovereignty over the territory being overflown. (ICAO)

Area control centre (ACC). A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction. (ICAO)

Area navigation (RNAV) specification. See navigation specification. (ICAO)

ATC waypoint. A waypoint contained in Item 15 of the ICAO flight plan, or as amended by ATC.

<u>Note</u>.— *A waypoint inserted by the flight crew for purposes of conducting flight operations such as points of no return are not ATC waypoints.*

ATS interfacility data communication (AIDC). Automated data exchange between air traffic services units, particularly in regard to co-ordination and transfer of flights. (ICAO)

ATS surveillance service. A term used to indicate a service provided directly by means of an ATS surveillance system. (ICAO)

ATS surveillance system. A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft.

<u>Note</u>.— *A comparable ground-based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.*

(ICAO)

Term

Automatic dependent surveillance — broadcast (ADS-B). A means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link. (ICAO)

Automatic dependent surveillance — contract (ADS-C). A means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports. (ICAO)

<u>Note</u>.— *The abbreviated term "ADS contract" is commonly used to refer to ADS event contract, ADS demand contract, ADS periodic contract or an emergency mode.*

C for RCTP. The proportion of intervention messages and responses that can be delivered within the specified RCTP time for intervention.

C for $RCTP_{AIR}$. The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{AIR}$ time for intervention.

C for $RCTP_{ATSU}$. The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{ATSU}$ time for intervention.

C for $RCTP_{CSP}$. The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{CSP}$ time for intervention.

C for $RSTP_{AIR}$. The proportion of surveillance messages that can be delivered within the specified $RSTP_{AIR}$ time.

C for $RSTP_{ATSU}$. The proportion of surveillance messages that can be delivered within the specified $RSTP_{ATSU}$ time.

C for $RSTP_{CSP}$. The proportion of surveillance messages that can be delivered within the specified $RSTP_{CSP}$ time.

C for TRN. The proportion of intervention messages and responses that can be delivered within the specified TRN time for intervention.

Call sign. The designator used in air-ground communications to identify the aircraft and is equivalent to the encoded aircraft identification.

Closed message. A message that:

a) Contains no message elements that require a response; or

b) Has received a closure response.

Term

Closure response. A message containing a message element that has the ability to close another message.

Compulsory reporting point. An ATC waypoint for which a position report is required by the aircraft.

Control area (CTA). A controlled airspace extending upwards from a specified limit above the earth. (ICAO)

Controller. A person authorized by the appropriate authority to provide air traffic control services.

Controller-pilot data link communications (CPDLC). A means of communication between controller and pilot, using data link for ATC communications. (ICAO)

CPDLC dialogue. (See ICAO definition for "dialogue.")

a) A single message that is a closed message; or

b) A series of messages beginning with an open message, consisting of any messages related to the original open message and each other through the use of a Message Reference Number (MRN) and ending when all of these messages are closed.

CPDLC message. Information exchanged between an airborne application and its ground counterpart. A CPDLC message consists of a single message element or a combination of message elements conveyed in a single transmission by the initiator.

Note.— The abbreviated term 'message' is commonly used to refer to a CPDLC message.

CPDLC message element. A component of a message. A message element is defined for specific uses (e.g. vertical clearance, route modification). A"free text message element" provides additional capability.

Note.— The abbreviated term 'message element' is commonly used to refer to a CPDLC message element.

Current data authority (CDA). The designated ground system through which a CPDLC dialogue between a pilot and a controller currently responsible for the flight is permitted to take place. (ICAO)

Current flight plan. (See flight plan).

Data link initiation capability (DLIC). A data link application that provides the ability to exchange addresses, names and version numbers necessary to initiate data link applications. (ICAO)

Dialogue. A co-operative relationship between elements which enables communication and joint operation. (ICAO)

Downlink message (DM). A CPDLC message sent from an aircraft.

Term

Dynamic airborne re-route procedure (DARP). The procedure for executing a re-route clearance initiated by a request from AOC.

Filed flight plan. (See flight plan).

Flight crew member. A person authorized by the appropriate authority charged with duties essential to the operations of an aircraft on the flight deck during a flight duty period.

Flight identification. A group of numbers, which is usually associated with an ICAO designator for an aircraft operating agency, to identify the aircraft in Item 7 of the flight plan.

Flight information region (FIR). An airspace of defined dimensions within which flight information service and alerting service are provided. (ICAO)

Flight level (FL). A surface of constant atmospheric pressure which is related to a specific pressure datum, 1 013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals. (ICAO)

Note 1.— A pressure type altimeter calibrated in accordance with the Standard Atmosphere:

a) when set to a QNH altimeter setting, will indicate altitude;

b) when set to QFE altimeter setting, will indicate height above the QFE reference datum;

c) when set to a pressure of 1 013.2 hPa, may be used to indicate flight levels.

Note 2.— The terms "height" and "altitude", used in Note 1 above, indicate altimetric rather than geometric heights and altitudes.

Flight plan. Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft. (ICAO)

A flight plan can take several forms, such as:

Current flight plan (CPL). The flight plan, including changes, if any, brought about by subsequent clearances. (ICAO)

Note 1.— When the word "message" is used as a suffix to this term, it denotes the content and format of the current flight plan data sent from one unit to another.

Filed flight plan (FPL). The flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes. (ICAO)

Note 2.— When the word "message" is used as a suffix to this term, it denotes the content and format of the filed flight plan data as transmitted.

Aircraft active flight plan. The flight plan used by the flight crew. The sequence of legs and associated constraints that define the expected 3D or 4D trajectory of the aircraft from takeoff to landing. (RTCA/EUROCAE)

Term

FMC WPR service. A term used to indicate an ATS service that provides surveillance information by means of the FMC WPR application.

Note.— ICAO Doc 4444 does not include FMC WPR in its definition for ATS surveillance system. Therefore, an ATS surveillance service does not consider those provided by means of the FMC WPR application, unless it can be shown by comparative assessment to have a level of safety and performance equal to or better than monopulse SSR.

Figure of merit. An indication of the aircraft navigation system's ability to maintain position accuracy.

Free text message element. A message element used to exchange information not conforming to a defined message element.

Lateral deviation event (LDE). A type of event that triggers an ADS-C report when the absolute value of the lateral distance between the aircraft`s actual position and the aircraft`s expected position on the aircraft active flight plan becomes greater than the lateral deviation threshold.

Level range deviation event (LRDE). A type of event that triggers an ADS-C report when the aircraft`s level is higher than the level ceiling or the aircraft`s level is lower than the level floor.

Note.— Sometimes referred to as altitude range change event or altitude range event.

Maximum accumulated unplanned outage time (min/yr). Measured by accumulating ***only*** the duration times for unplanned outages greater than the unplanned outage duration limit during any 12-month period. The accumulation is performed separately for each relevant operational airspace.

Maximum number of unplanned outages. Measured separately for each relevant operational airspace over any 12-month period.

Message. Basic unit of user information exchanged between an airborne application and its ground counterpart or between two ground applications. Messages are passed in one or more data blocks from one end user to another through different subnetworks. (ICAO Doc 9880)

Note.— Used in this document to mean CPDLC message.

Message element. A component of a message used to define the context of the information exchanged. (ICAO Doc 9880)

Note.— Used in this document to mean CPDLC message element.

Message element identifier. The ASN.1 tag of the ATCUplinkMsgElementId or the ATCDownlinkMsgElementId. (ICAO)

Message identification number (MIN). An integer in the range 0 to 63 (inclusive) that uniquely identifies specific uplink and downlink messages for each CPDLC connection.

Military assumes responsibility for the separation of aircraft (MARSA). Procedures between the controller and the aircraft that delegate the separation responsibility temporarily to the military authority operating the flights, thereby relieving ATC of the separation workload.

Term

Minimum equipment list (MEL). A list which provides for the operation of aircraft, subject to specified conditions, with particular equipment inoperative, prepared by an operator in conformity with, or more restrictive than, the MMEL established for the aircraft type. (ICAO)

Monitored operational performance (TRN). The portion of the transaction time (used for intervention) that does not include the times for message composition or recognition of the operational response.

Multi-element message. A CPDLC message consisting of more than one message element (clearance, instruction or information), handled by the controller of the flight crew as a single message.

Navigation specification. A set of aircraft and flight crew requirements needed to support performance-based navigation operations within a defined airspace. There are two kinds of navigation specifications:

Required navigation performance (RNP) specification. A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP (e.g. RNP 4, RNP APCH).

Area navigation (RNAV) specification. A navigation specification based on area navigation that does not include the requirement for performance monitoring and alerting, designated by the prefix RNAV (e.g. RNAV 5, RNAV 1).

Note 1.— The Performance-based Navigation (PBN) Manual (Doc 9613), Volume II, contains detailed guidance on navigation specifications.

Note 2.— The term RNP, previously defined as "a statement of the navigation performance necessary for operation within a defined airspace", has been removed from this Annex as the concept of RNP has been overtaken by the concept of PBN. The term RNP is now solely used in the context of navigation specifications that require performance monitoring and alerting (e.g. RNP 4 refers to the aircraft and operating requirements, including a 4 NM lateral performance with on-board performance monitoring and alerting that are detailed in Doc 9613).

Next data authority. The ground system so designated by the current data authority through which an onward transfer of communications and control can take place. (ICAO)

NOTAM. A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations. (ICAO)

Open message. A message that contains at least one message element that requires a response. An open message remains open until the required response is received.

Operational communication transaction. The process a human uses to initiate the transmission of an instruction, clearance, flight information, and/or request, and is completed when that human is confident that the transaction is complete.

Term

Performance-based communication (PBC). ATS communication services and capability based on performance requirements for air traffic service provision, aircraft and flight operations along an ATS route, on an instrument approach procedure or in a designated airspace.

Note.— Communication performance requirements are allocated to system components in an RCP specification in terms of communication transaction time, continuity, availability, integrity, safety and functionality needed for the proposed operation in the context of a particular airspace concept.

Performance-based navigation (PBN). Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

Note.— Performance requirements are expressed in navigation specifications (RNAV specification, RNP specification) in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept. (ICAO)

Performance-based surveillance (PBS). ATS surveillance services and capability based on performance requirements for air traffic service provision, aircraft and flight operations along an ATS route, on an instrument approach procedure or in a designated airspace.

Note.— Surveillance performance requirements are allocated to system components in an RSP specification in terms of surveillance data delivery time, continuity, availability, integrity, accuracy of the surveillance data, safety and functionality needed for the proposed operation in the context of a particular airspace concept.

Preformatted free text message. A free text message element that is stored within the aircraft system or ground system for selection.

Procedural control. Term used to indicate that information derived from an ATS surveillance system is not required for the provision of air traffic control service. (ICAO)

Procedural separation. The separation used when providing procedural control. (ICAO)

Radio operator. A person authorized by the appropriate authority to relay a radiotelephony communication between the ATSU and the flight crew.

RCP availability (A). The required probability that an operational communication transaction can be initiated when needed.

RCP continuity (C). The required probability that an operational communication transaction can be completed within the communication transaction time, either ET or TT 95%, given that the service was available at the start of the transaction.

RCP expiration time (ET). The maximum time for the completion of the operational communication transaction after which the initiator is required to revert to an alternative procedure.

Term

RCP integrity (I). The required probability that an operational communication transaction is completed with no undetected errors.

Note.— Whilst RCP integrity is defined in terms of the "goodness" of the communication capability, it is specified in terms of the likelihood of occurrence of malfunction on a per flight hour basis (e.g. 10^{-5}*), consistent with RNAV/RNP specifications.*

RCP nominal time (TT 95%). The maximum nominal time within which 95% of operational communication transactions is required to be completed.

RCP type. A label (e.g. RCP 240) that represents the values assigned to RCP parameters for communication transaction time, continuity, availability and integrity. (ICAO)

Note.— This document uses the term RCP specification to align RCP with RNP and RNAV specifications provided in the Performance Based Navigation Manual.

$RCTP_{AIR}$. The summed critical transit times for an ATC intervention message and a response message, allocated to the aircraft system.

$RCTP_{ATSU}$. The summed critical transit times for an ATC intervention message and a response message, allocated to the ATSU system.

$RCTP_{CSP}$. The summed critical transit times for an ATC intervention message and a response message, allocated to the CSP system.

Required communication performance (RCP) specification. A set of requirements for air traffic service provision, aircraft capability, and operations needed to support performance-based communication within a defined airspace.

Note 1.— See ICAO Doc 9869 and Appendix B of this document for RCP specifications.

Note 2.— The term RCP, currently defined by ICAO as "a statement of performance requirements for operational communication in support of specific ATM functions", is used in this document to align the concept of PBC with the concept of PBN. The term RCP is now used in the context of a specification that is applicable to the prescription of airspace requirements, qualification of ATS provision, aircraft capability, and operational use, including post-implementation monitoring (e.g. RCP 240 refers to the criteria for various components of the operational system to ensure an acceptable intervention capability for the controller is maintained.

Required communication technical performance (RCTP). The portion of the (intervention) transaction time that does not include the human times for message composition, operational response, and recognition of the operational response.

Required surveillance technical performance (RSTP). The technical transit time for surveillance data delivery from the time associated with the aircraft's position to when the recipient (e.g. ATSU) receives the report, but does not include the generation or processing of the report.

Required navigation performance (RNP) specification. See navigation specification. (ICAO)

Term

Required surveillance performance (RSP) specification. A set of requirements for air traffic service provision, aircraft capability, and operations needed to support performance-based surveillance within a defined airspace.

Note 1.— See ICAO Doc 9869 and Appendix C of this document for RSP specifications.

Note 2.— The term RSP is used in the context of a specification that is applicable to the prescription of airspace requirements, qualification of ATS provision, aircraft capability, and operational use, including post-implementation monitoring (e.g. RSP 180 refers to the criteria for various components of the operational system to ensure an acceptable surveillance capability for the controller is maintained).

Responder performance criteria. The operational portion of the transaction time to prepare the operational response, and includes the recognition of the instruction, and message composition (e.g. flight crew/HMI) for intervention transactions.

$RSTP_{AIR}$. The overdue (OD) and nominal (DT) transit times for surveillance data from the aircraft system to the antenna.

$RSTP_{ATSU}$. The overdue (OD) and nominal (DT) transit times for surveillance data from the CSP interface to the ATSU's flight data processing system.

$RSTP_{CSP}$. The overdue (OD) and nominal (DT) transit times for surveillance data allocated to the CSP.

Service availability (A_{CSP}). The required probability that the communication service is available to all users in a specific airspace when desired.

Standardized free text message. A message element that uses a defined free text message format, using specific words in a specific order which has been agreed by stakeholders. Standardized free text message elements may be manually entered by the user or may be a preformatted free text message.

Standard message element. Any message element defined by ICAO Doc 4444 that does not contain the [free text] parameter.

RSP availability (A). The required probability that surveillance data can be provided when needed.

RSP continuity (C). The required probability that surveillance data can be delivered within the surveillance delivery time parameter, either OT or DT 95%, given that the service was available at the start of delivery.

Surveillance data. Data pertaining to the identification of aircraft and/or obstructions for route conformance monitoring and safe and efficient conduct of flight.

Surveillance data delivery. The process for obtaining surveillance data.

RSP data transit time. The required time for surveillance data delivery.

Term

RSP integrity (I). The required probability that the surveillance data is delivered with no undetected error.

Note 1.— Surveillance integrity includes such factors as the accuracy of time, correlating the time at aircraft position, reporting interval, data latency, extrapolation and/or estimation of the data.

Note 2.— Whilst surveillance integrity is defined in terms of the "goodness" of the surveillance capability, it is specified in terms of the likelihood of occurrence of malfunction on a per flight hour basis (e.g. 10^{-5}), consistent with RCP and RNAV/RNP specifications.

RSP nominal delivery time (DT 95%). The maximum nominal time within which 95% of surveillance data is required to be delivered.

RSP overdue delivery time (OT). The maximum time for the successful delivery of surveillance data after which the initiator is required to revert to an alternative procedure.

RSP specification. A set of ATS provision, including communication services, aircraft and operator requirements (e.g. RSP 180) needed for surveillance supporting a performance-based operation within a defined airspace.

Required surveillance performance (RSP). A statement of the performance requirements for operational surveillance in support of specific ATM functions.

Tailored arrival (TA). A 4-dimentional (4-D) arrival procedure, based on an optimized ATC clearance, including, as necessary, vertical and/or speed restrictions, from the aircraft's current position, normally just prior to top of descent, to the designated destination runway. The TA clearance is issued via CPDLC data link message(s) to the aircraft and automatically loaded into the aircraft's 4-D trajectory guidance capability.

Time critical situation. A situation when a prompt controlling action is required in the provision of air traffic services.

Note.— Time-criticality is mainly determined by the following factors: ATC traffic situation, end-to-end performance (systems and flight crew/controller response time), recovery time and controller/flight crew confidence and experience on the means of communication that are available.

Unplanned outage duration limit (minutes). Time after the unplanned outage begins at which there is an operational impact. Measured from when an unplanned outage begins to when the ATSU receives notification that the service has been restored.

Unplanned outage notification delay (min). Notification to the ATSU of an unplanned outage. Measured from when the unplanned outage begins to when the ATSU receives notification.

Uplink message (UM). A CPDLC message sent from a ground system.

Vertical rate change event (VRE). A type of event that triggers an ADS-C report when the aircraft`s rate of climb or descent is greater than the vertical rate threshold.

Term
Waypoint change event (WCE). A type of event that triggers an ADS-C report when there is a change in the next waypoint or the next plus 1 waypoint on the aircraft active flight plan.

1.2 Acronyms

When the following acronyms are used in this document they have the following meanings. Where the term has "(ICAO)" annotated, the acronym has already been defined as such in SARPs and/or PANS.

Acronym	Description
AAR	Air-to-air refueling.
ACARS	Aircraft communications addressing and reporting system.
ACAS	Aircraft collision avoidance system. (ICAO)
ACC	Area control centre. (ICAO)
ACL	ATS clearance (data link service).
ACM	ATS communications management (data link service).
ACP	Actual communication performance.
ACTP	Actual communication technical performance.
ADS	Automatic dependent surveillance (retained for reference with non-updated documents. This term would normally be used to refer to ADS-C).
ADS-B	Automatic dependent surveillance – broadcast. (ICAO)
ADS-C	Automatic dependent surveillance – contract. (ICAO)
AFN	ATS facilities notification.
AFTN	aeronautical fixed telecommunication network. (ICAO)
AGL	Above ground level (ICAO)
AIC	Aeronautical information circular. (ICAO)
AIDC	ATS interfacility data communications. (ICAO)
AIP	Aeronautical Information Publication. (ICAO)

Acronym	Description
AIREP	Air-report. (ICAO)
ALTRV	Altitude reservation.
AMC	ATS microphone check (data link service).
AMS(R)S	Aeronautical mobile satellite (route) service. (ICAO)
ANSP	Air navigation service provider.
AOC	Aeronautical operational control. (ICAO)
ARCP	Air refueling control point. (ICAO abbreviation?)
AREX	Air refueling exit point. (ICAO abbreviation?)
ARIP	Air refueling initial point. (ICAO abbreviation?)
ARP	Air-report message. (See AIREP)
ATC	Air traffic control. (ICAO)
ATM	Air traffic management. (ICAO)
ATN	Aeronautical telecommunication network. (ICAO)
ATN B1	Aeronautical telecommunication network baseline 1, as defined by RTCA DO-280B/EUROCAE ED-110B. *Note.— ATN B1 generally means that the data link system on an aircraft, the ATSU ground system, and communication service provision comply with the standard as adapted by Eurocontrol Specification on Data Link Services (EUROCONTROL-SPEC-0116). ATN B1 consists of the following data link applications:* *a) Context management (CM) for data link initiation capability (DLIC); and* *b) Limited CPDLC for ATS communications management (ACM), ATS clearance (ACL), and ATC microphone check (AMC).*
ATS	Air traffic service. (ICAO)
ATSU	ATS unit. (ICAO, sort of)
CADS	Centralized ADS-C system.
CDA	Current data authority. (See ICAO definition for current data authority)
CFRS	Centralized FMC waypoint reporting system.

Acronym	Description
CM	Context management (data link application).
CNS	Communications, navigation and surveillance. (ICAO)
CNS/ATM	Communications, navigation and surveillance/air traffic management. (ICAO)
CPDLC	Controller-pilot data link communications. (ICAO)
CRC	Cyclic redundancy check.
CSP	Communication service provider.
CTA	Control area. (ICAO)
DARP	Dynamic airborne re-route procedure.
D-ATIS	Data link – automatic terminal information service (data link service).
DCL	Departure clearance (data link service).
DCPC	Direct controller-pilot communications.
DLIC	Data link initiation capability. (ICAO)
DM	Downlink message.
DSC	Downstream clearance (data link service).
EMERG	Emergency. (ICAO)
ETD	Estimated time of departure or estimating departure. (ICAO)
FANS	Future air navigation system.
FANS 1/A	Future air navigation system - initial, as defined by RTCA DO-258A/EUROCAE ED-100A, or previous standards that defined the FANS 1/A capability. *Note.— FANS 1/A generally means that the data link system on an aircraft, the ATSU ground system, and communication service provision comply with the standard. In certain cases, specific reference is made to a particular type of FANS 1/A aircraft as follows:* *a). FANS 1/A+ means that the aircraft completely complies with Revision A of the standard, which includes message latency monitor; and* *b) FANS 1/A ADS-C means that the aircraft complies with AFN and ADS-C applications, but does not include the CPDLC application.*
FDPS	Flight data processing system. (ICAO)

Acronym	Description
FIR	Flight information region. (ICAO)
FL	Flight level.
FLIPCY	Flight plan consistency (data link service).
FMC	Flight management computer.
FMC WPR	Flight management computer waypoint position reporting.
FMS	Flight management system.
GPS	Global positioning system (USA).
HF	High frequency (3-30 Mhz). (ICAO)
IATA	International Air Transport Association.
ICAO	International Civil Aviation Organization. (ICAO)
ICD	Interface control document.
ITP	In trail procedure
LDE	Lateral deviation event.
LRDE	Level range deviation event.
MARSA	Military assumes responsibility for separation of aircraft.
MAS	Message assurance.
MASPS	Minimum aviation system performance standards.
MEL	Minimum equipment list. (ICAO)
MET	Meteorological or meteorology. (ICAO)
MIN	Message identification number.
MRN	Message reference number.
MTBF	Mean time between failures.
MTTR	Mean time to repair.
NDA	Next data authority. (See ICAO definition for next data authority.)

Acronym	Description
ORT	Operational requirements table.
PANS-ATM	Procedures for Air Navigation Services — Air Traffic Management (ICAO Doc 4444). (ICAO)
PBC	Performance-based communication
PBCS	Performance-based communication and surveillance
PBN	Performance-based navigation
PBS	Performance-based surveillance
PORT	Pilot operational response time.
POS	Position report message.
RCP	Required communication performance.
RCTP	Required communication technical performance.
RGS	Radio ground station.
RNAV	Area navigation.
RNP	Required navigation performance.
RSP	Required surveillance performance
RSTP	Required surveillance technical performance.
SARPs	Standards and Recommended Practices. (ICAO)
SATCOM	Satellite communication. (ICAO)
SELCAL	Selective calling system. (ICAO)
TA	Tailored arrival.
TRN	Monitored operational performance.
UM	Uplink message.
UPR	User preferred route.
VDL M0/A	VHF data link mode 0/A subnetwork.

Acronym	Description
VDL M2	VHF data link mode 2 subnetwork,
VHF	Very high frequency (30-300 Mhz). (ICAO)
VRE	Vertical rate change event.
WCE	Waypoint change event.

Chapter 2. Overview of data link operations

2.1 Data link operational capabilities

2.1.1 Data link benefits

2.1.1.1 Data link services provide communications that are intended to support more efficient air traffic management and increase airspace capacity.

2.1.1.2 In addition, in airspace where procedural separation is being applied, the data link services improve communications, surveillance and route conformance monitoring to support operational capabilities that enable:

a) Reduced separations, for example, in addition to navigation performance requirements, the following reduced separations require FANS 1/A aircraft, FANS 1/A ATSU, RCP 240 and RSP 180;

1) 50 NM longitudinal separation;

2) 30 NM longitudinal separation;

3) 30 NM lateral separation;

b) User preferred route (UPR);

c) Dynamic airborne re-route procedure (DARP); and

d) Weather deviation management.

2.1.1.3 CPDLC improves communication capabilities by reducing voice channel congestion and enabling the use of CPDLC-related automation.

2.1.1.4 Depending on the specific implementation, other advantages associated with CPDLC include:

a) Providing direct controller-pilot communications (DCPC) in airspace where it was not previously available;

b) Allowing the flight crew to print messages;

c) Allowing messages to be stored and reviewed as needed;

d) Reducing flight crew-input errors by allowing the loading of information from specific uplink messages, such as route clearances or frequency change instructions, into other aircraft systems, such as the FMS or radios;

e) Allowing the flight crew to request complex route clearances, which the controller can respond to without having to manually enter a long string of coordinates;

f) Reducing flight crew workload by supporting automatically transmitted reports when a specific event occurs, such as crossing a waypoint and the loading of clearance information directly into the flight management system;

g) Reducing controller workload by providing automatic flight plan updates when specific downlink messages (and responses to some uplink messages) are received.

2.1.2 Data link systems – interoperability standards

2.1.2.1 "Data link" is a generic term that encompasses different types of data link systems and subnetworks. Figure 2-1 provides an overview of a data link system, including subnetworks. While all data link capable aircraft have access to VHF data link, not all aircraft have access to additional satellite, and/or HF data link capability. Similarly, not all CSPs have HF data link capability. Some ANSPs do not operationally require, nor allow use of, some of the subnetworks (e.g. SATCOM).

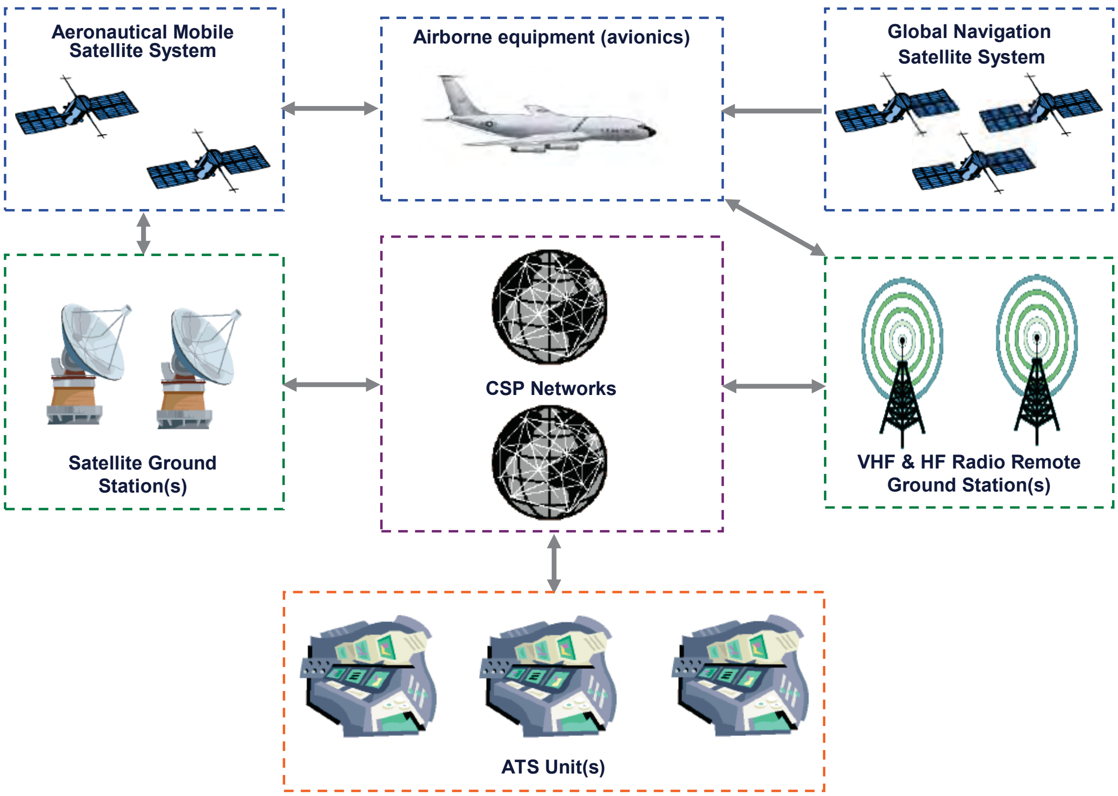


Figure 2-1. Overview of a data link system

2.1.2.2 Figure 2-2 shows different ATSU ground systems and aircraft systems that are interoperable. A designator is assigned to each type of ATSU and aircraft data link system. Table 2-1 provides a brief description for each designator and identifies the applicable interoperability standards.

Note 1.— RTCA DO-305A/EUROCAE ED-154A chapter 4 provides additional requirements to support automatic CPDLC transfers between ATSUs using different technologies (i.e. FANS 1/A and ATN B1). Refer to paragraph 3.1.2.2 for applicability of chapter 4 in RTCA DO-305A/EUROCAE ED-154A to ATN B1, FANS 1/A-ATN B1 and FANS 1/A ground systems.

Note 2.— A single aircraft or a single ATSU may employ multiple types of data link systems. FANS 1/A-ATN B1 aircraft are not specifically depicted in Figure 2-2.

2.1.2.3 Table 2-2 provides a brief description of each type of subnetwork that supports the different data link systems and identifies the applicable interoperability standards. A designator is assigned to each type of subnetwork shown in Figure 2-1.

2.1.2.4 The applicable interoperability standards for each type of data link system and each type of subnetwork allocate requirements to the operator, the aircraft data link system, and the ANSP to ensure that the aircraft system, the ATSU ground system, and subnetworks are compatible.

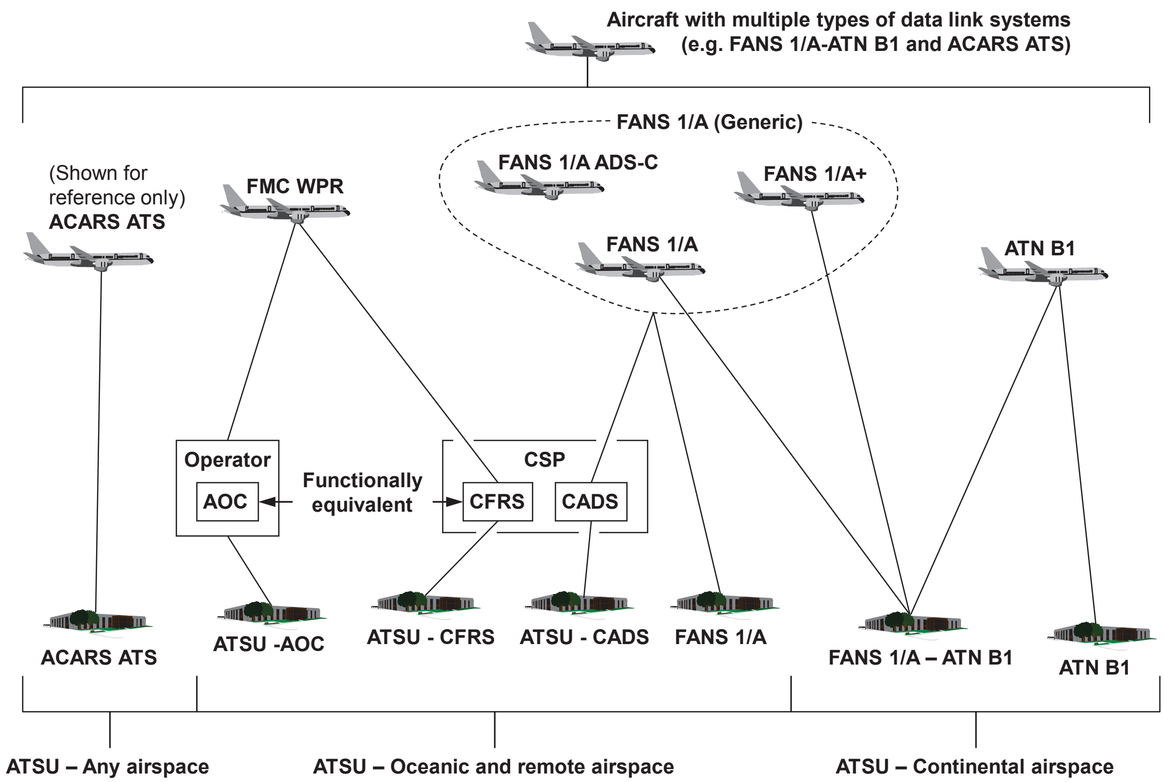


Figure 2-2. Different ATSU/aircraft interoperable connectivity

Table 2-1. Designators for aircraft and ATSU (ground) data link systems

Designator	Description of designator	Applicable interoperability standard(s)	Applicable system
ACARS ATS	ATS applications, departure clearance (DCL), oceanic clearance (OCL) and data link – automatic terminal information service (D-ATIS), supported by aircraft communications addressing and reporting system (ACARS). *Note.— ACARS ATS is defined for reference only. Guidance for these applications is not provided in this document.*	a) ED-85A (DCL) b) ED-106A (OCL) c) ED-89A (D-ATIS) d) ARINC 623-3	ATSU and Aircraft
FMC WPR	Flight management computer waypoint position reporting (FMC WPR) ATS application, generates and sends waypoint position reports, supported by flight management system and ACARS.	ARINC 702A-3	Aircraft
ATSU CFRS	Communication service provider's (CSP's) centralized flight management computer waypoint reporting system (CFRS) enables ATSU to receive waypoint position reports in ICAO format from any FMC WPR aircraft.	a) ARINC 702A-3 b) CFRS Common Specification, Version 2.0, April 2004 (Available from ICAO Regional Office in Paris)	ATSU
ATSU AOC	Operator's aeronautical operational control (AOC) facility enables ATSU to receive waypoint position reports in ICAO format from the operator's FMC WPR aircraft.	a) ARINC 702A-3 b) Aeronautical fixed telecommunication network (AFTN) specifications	ATSU
ATSU CADS	CSP's centralized ADS-C system (CADS) enables an ATSU without FANS 1/A capability to receive ADS-C reports from any FANS 1/A, FANS 1/A+ or FANS 1/A ADS-C aircraft.	a) DO-258A/ED-100A, or previous versions. b) CADS Common Specification, Version 2.0, April 2004 (Available from ICAO Regional Office in Paris)	ATSU

Designator	Description of designator	Applicable interoperability standard(s)	Applicable system
FANS 1/A	Initial future air navigation system (FANS 1/A) ATS applications, AFN, CPDLC and ADS-C, supported by FANS 1/A over ACARS. *Note.— FANS 1/A typically involve communication (CPDLC), navigation (RNAV/RNP) and surveillance (ADS-C). This document refers to the FANS 1/A for the data link system, which includes the CPDLC and ADS-C applications. Refer to ICAO Doc 9613 for guidance material on navigation (RNAV/RNP) qualification and use.*	a) DO-258A/ED-100A, or previous versions. b) Boeing document D6-84207, Loading of ATC Clearances into the Flight Management System (FMS), August 2009 c) Airbus document X4620RP1133312, FANSA/A+ Function Integration with FMS Technical Report	ATSU and Aircraft
FANS 1/A+	Same as FANS 1/A, except with additional features, such as the message latency monitor function, described in DO-258A/ED-100A, paragraph 4.6.6.9. See also this document, paragraph 3.1.2.6, for procedures on its use. FANS 1/A+ - complies with Revision A of the standard (i.e. not previous versions)	a) DO-258A/ED-100A only b) Boeing document D6-84207, Loading of ATC Clearances into the Flight Management System (FMS), August 2009 c) Airbus document X4620RP1133312, FANSA/A+ Function Integration with FMS Technical Report	Aircraft
FANS 1/A ADS-C	ATS applications, AFN and ADS-C, supported by FANS 1/A over ACARS. FANS 1/A ADS-C - complies with AFN and ADS-C applications, No CPDLC.	DO-258A/ED-100A	Aircraft

Designator	Description of designator	Applicable interoperability standard(s)	Applicable system
ATN B1	ATS applications, CM and CPDLC, supported by aeronautical telecommunication network – baseline 1 (ATN B1): a) Context management (CM) application for data link initiation capability (DLIC); b) CPDLC for ATS communications management (ACM), ATS clearance (ACL), and ATC microphone check (AMC), except that: 1) UM 135 CONFIRM ASSIGNED LEVEL and UM 233 USE OF LOGICAL ACKNOWLEDGEMENT PROHIBITED will not be used by the ATSU; and 2) DM 38 ASSIGNED LEVEL (level) is not required by the aircraft. *Note.— Interoperability for departure clearance (DCL), downstream clearance (DSC), data link – automatic terminal information service (D-ATIS), and flight plan consistency (FLIPCY) data link services, which are defined in DO-280B/ED-110B, are not supported.*	a) DO-280B/ED-110B b) Eurocontrol Specification on Data Link Services (EUROCONTROL-SPEC-0116)	ATSU and Aircraft
FANS 1/A – ATN B1	Enables ATSU with ATN B1 ground system to provide data link service to FANS 1/A aircraft.	a) ATN B1 standards are applicable and, in addition, b) DO-305A/ED-154A	ATSU
	Enables the use of CPDLC along a route of flight where data link services are provided by FANS 1/A technology in some airspaces and ATN B1 in other airspaces.	a) ATN B1 and FANS 1/A standards are applicable and, in addition, b) DO-305A/ED-154A *Note.— Some aircraft (see Appendix F, paragraph F.1) implement FANS 1/A and ATN B1 capabilities as separate systems and do not comply with ED154A/ DO305A. Such aircraft do not benefit from automatic CPDLC transfers.*	Aircraft

Table 2-2. Designators for subnetworks

Designator	Description of designator	Applicable standard(s)
VDL M0/A	Very high frequency data link – mode 0/A	ARINC 618-6 (INTEROP) for air/ground protocol
VDL M2	Very high frequency data link – mode 2	a) ICAO Annex 10, Vol III b) ICAO Doc 9776, Manual on VDL Mode 2 c) RTCA DO-224C (MASPS) d) ARINC 631-6 (INTEROP)
HFDL	High frequency data link	a) ICAO Annex 10, Vol III b) ICAO Doc 9741, Manual on HF Data Link c) RTCA DO-265 (MASPS) d) ARINC 753-3 (INTEROP)
SATCOM (Inmarsat)	Inmarsat or MT-SAT – aero classic satellite communications	a) ICAO Annex 10, Vol III b) ICAO Doc 9925, AMS(R)S Manual c) RTCA DO-270 (MASPS) d) ARINC 741P2-11 (INTEROP)
SATCOM (Iridium)	Iridium short burst data satellite communications	a) ICAO Annex 10, Vol III b) ICAO Doc 9925, AMS(R)S Manual c) RTCA DO-270, Change 1 (MASPS) d) ARINC 741P2-11 (INTEROP)

2.1.3 Data link services – safety and performance specifications

2.1.3.1 Oceanic SPR Standard (RTCA DO-306/EUROCAE ED-122)

2.1.3.1.1 The *Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace* (Oceanic SPR Standard, RTCA DO-306/EUROCAE ED-122), provides operational, safety and performance criteria for data link services that are applicable in airspace, where procedural separation is being applied, for normal ATC communication and surveillance to support separation assurance, route conformance monitoring, re-routes, and weather deviation management. These criteria include specifications for required communication performance (RCP) and required surveillance performance (RSP), taking into consideration the following data link applications:

a) Data link initiation capability (DLIC);

b) CPDLC for ATC communication;

    1) RCP 240 operations; and

    2) RCP 400 operations;

c) ADS-C for surveillance - automatic position reporting;

    1) RSP 180 operations; and

    2) RSP 400 operations;

d) FMC WPR for surveillance - automatic position reporting at ATC waypoints.

Note.— When RCP and RSP specifications are prescribed in Regional SUPPs, AIP (or other appropriate publication), the specifications are associated with any required interoperability (e.g. FANS 1/A or ATN B1) and functionality (e.g, ADS periodic and event contracts and parameter values to be used.)

2.1.3.1.2 If the data link operation is dependent on certain performance, then the ANSP may prescribe RCP and/or RSP specifications. Table 2-3 provides examples of intended uses for which the RCP specifications defined in Appendix B are applicable. Table 2-4 provides examples of intended uses for which the RSP specifications defined in Appendix C are applicable.

Table 2-3. Examples of applying RCP specifications to intended uses

RCP specification	Intended uses for which the RCP specification is applicable
RCP 240	When CPDLC is the normal means of communications supporting the application of separation minima predicated on communication performance (e.g. 30 NM lateral and 30 NM or 50 NM longitudinal).
RCP 400	When a technology other than HF voice radio is the normal means of communication and the ATS function specifies a requirement for RCP 400.
	When a technology other than HF voice radio is the alternative means of communication supporting the application of separation minima predicated on communication performance (e.g. 30 NM lateral and 30 NM or 50 NM longitudinal).

Table 2-4. Examples of applying RSP specifications to intended uses

RSP specification	Intended uses for which the RSP specification is applicable
RSP 180	When ADS-C is the normal means of surveillance supporting the application of separation minima predicated on surveillance performance (e.g. 30 NM lateral and 30 NM or 50 NM longitudinal).
RSP 400	When ADS-C or FMC WPR is the normal means of surveillance supporting the application of lateral separation greater than or equal to 50 NM and time-based longitudinal separation.
	When a technology other than HF voice radio provides an alternative means of surveillance (e.g. position reporting via satellite voice) supporting the application of separation minima predicated on surveillance performance (e.g. 30 NM lateral and 30 NM or 50 NM longitudinal).

Note 1.— For example, satellite voice and CPDLC over the HFDL subnetwork may provide ATC communication other than by HF voice radio. Appendix B and Appendix C provide criteria only when the communication is a data link system.

2.1.3.1.3 Data link operations that use certain subnetworks (e.g. HFDL) or take place in subnetwork transition areas (e.g. VHF fringe coverage area) may not meet the criteria for some RCP or RSP specifications.

2.1.3.1.4 Aircraft capability that supports multiple RCP and/or RSP operations needs to include appropriate indications and/or procedures to enable the flight crew to notify ATC when aircraft equipment failures result in the aircraft's inability to meet its criteria for any of the RCP or RSP specifications. (See Appendix B and Appendix C.)

2.1.3.1.5 An ATSU that supports multiple RCP and/or RSP operations needs to include appropriate indications and/or procedures to enable the controller to notify all affected aircraft when infrastructure failures result in the ground system's inability to meet its criteria for any of the RCP or RSP specifications.

2.1.3.1.6 If no RCP or RSP specification is prescribed for the data link operation, then any subnetwork provided in Table 2-2 is acceptable, unless otherwise prescribed by airspace requirements.

2.1.3.2 Continental SPR Standard (RTCA DO-290/EUROCAE ED-120)

2.1.3.2.1 The *Safety and Performance Standard for Air Traffic Data Link Services in Continental Airspace* (Continental SPR Standard, RTCA DO-290/EUROCAE ED-120, Change 1 and Change 2), provides operational, safety and performance criteria for data link services in airspace where ATS surveillance services (e.g. radar services) are provided and where certain specific criteria for sector densities and separation minima apply. Specific criteria for data link services to support ATS surveillance under circumstances where lower densities and/or higher minima apply would be locally assessed taking into consideration the appropriate safety and performance standards.

2.1.3.2.2 Appendix B provides an RCP 150 specification based on the performance criteria provided in RTCA DO-290/EUROCAE ED-120 for CPDLC supporting ACM, AMC and ACL in airspace where ATS surveillance services are provided.

2.1.3.2.3 An ATSU that prescribes RCP 150 for CPDLC in its airspace needs to include appropriate indications and/or procedures to enable the controller to notify all affected aircraft when infrastructure failures result in the ground system's inability to meet its RCP allocation.

2.1.3.2.4 Data link operations that use certain subnetworks (e.g. VDL M0/A), or take place in subnetwork transition areas (e.g. VHF fringe coverage area), may not meet the performance criteria.

2.1.3.3 Performance-based communication and surveillance (PBCS)

2.1.3.3.1 Where beneficial, performance-based communication and surveillance performance is a concept that enables the management of communication and surveillance capabilities by prescription of RCP and RSP specifications (See Appendix B and Appendix C). When an ATS operation is predicated on communication and surveillance performance, RCP and RSP specifications provide operational requirements and allocations that apply to infrastructure as well as aircraft and operations. For example:

a) RCP 240 includes a four-minute time requirement for a controller capability to intervene with an aircraft; the requirement is specified from when the controller initiates the communication to when the controller receives the operational response from the flight crew; and

b) RSP 180 includes an accuracy requirement on the "position at time" based on the prescribed RNP/RNAV specification and a +/- one-second accuracy on Coordinated Universal Time (UTC). It also includes a time requirement from when the aircraft is at the compulsory reporting point to when the report is received by the controlling ATS unit.

Note.— RCP 240 and RSP 180 also include requirements associated with continuity, service availability, integrity and functionality.

2.1.3.3.2 Based on RCP and RSP, PBCS will enable:

a) ICAO to specify communication and surveillance requirements for specific ATS operations (e.g. application of separation minimum) by reference to RCP and RSP specifications;

b) Regions/States to prescribe RCP and RSP specifications in Regional Supplementary Procedures and Aeronautical Information Publications (AIPs or equivalent publication);

c) Aircraft systems to be approved in accordance with prescribed RCP and RSP specifications;

d) Operators to be authorized by the State of Registry or State of the Operator, as appropriate, and to file the prescribed performance based designators (e.g. RCP 240, RSP 180) in their flight plans;

e) ANSPs to ensure infrastructure in accordance with prescribed RCP and RSP specifications and assess aircraft capability from flight plan information, to safely apply the appropriate ATS (e.g. reduced separation) to eligible aircraft; and

f) ICAO Regions to conduct post-implementation monitoring of operational performance, in accordance with Appendix D, against RCP and RSP specifications, and initiate corrective action to the appropriate party, as necessary, for continued operational safety. Operators will need to establish programs that support post-implementation monitoring activities.

2.1.4 Airspace types and their data link operational capabilities

Note 1.— Depending on airspace type, RTCA DO-306/EUROCAE ED-122 (see section 2.1.3.1) or RTCA DO-290/EUROCAE ED-120 (see section 2.1.3.2) can be considered for operational, safety and performance requirements.

Note 2.— Operational, safety and performance requirements applicable in an airspace are specified by the appropriate ATS authority.

2.1.4.1 Airspace where procedural separation is being applied

2.1.4.1.1 The data link system in airspace where procedural separation is being applied, as shown in Figure 2-2, comprises a variety of ground systems that may provide data link services to FANS 1/A (generic) aircraft, FMC WPR aircraft and ACARS ATS aircraft.

2.1.4.1.2 The data link services improve communications, surveillance and route conformance monitoring to support operational capabilities that enable:

a) Reduced separations, for example, in addition to navigation performance requirements, the following reduced separations require FANS 1/A aircraft, FANS 1/A ATSU, RCP 240 and RSP 180;

1) 50 NM longitudinal separation;

2) 30 NM longitudinal separation;

3) 30 NM lateral separation;

b) User preferred route (UPR) may require data link in some airspace;

c) Re-route, may require data link in some airspace; dynamic airborne re-route procedure (DARP) requires FANS 1/A aircraft and FANS 1/A ATSU;

d) Weather deviation management may require data link in reduced separation environments;

e) More efficient air traffic management and increases in airspace capacity. For example, ADS-C provides automatic surveillance capability that an ANSP may use to replace CPDLC and/or voice position reporting; and

f) Reduced flight crew workload through, for example, automatic position reporting and the ability to load clearance information directly into the flight management system.

2.1.4.2 Airspace where ATS surveillance services are provided

2.1.4.2.1 As shown in Figure 2-2, the data link system in airspace where ATS surveillance services are provided comprises a variety of ground systems:

a) ATN B1 ground systems, that may provide data link services to ATN B1 aircraft and FANS 1/A-ATN B1 aircraft;

b) FANS 1/A-ATN ground systems, that may provide data link services to ATN B1 aircraft, FANS 1/A aircraft and FANS 1/A-ATN B1 aircraft;

c) FANS 1/A ground systems, that may provide data link services to FANS 1/A aircraft, FANS 1/A+ aircraft and FANS 1/A-ATN B1 aircraft; and

d) ACARS ATS ground systems, that may provide data link services to ACARS ATS aircraft.

Note.— FANS 1/A aircraft are technically interoperable with a FANS 1/A-ATN ATSU. However, operationally, FANS-1/A+ may be required for data link operations in applicable airspace as specified in Regional SUPPs and/or AIP (or other appropriate publication, such as AIC or NOTAM). (refer to Table 2-1).

2.1.4.3 Global overview of data link operational capabilities

2.1.4.3.1 Table 2-5 provides an overview of the operational capabilities that are supported by each of the different data link systems.

Note.— In Table 2-5, the term "surveillance" includes conformance monitoring and conflict detection.

Table 2-5. Types of data link systems and operations

Aircraft equipment and capability	ATSU ground data link system				
	ACARS ATS	**CADS, CFRS or AOC**	**FANS 1/A**	**ATN B1**	**FANS 1/A–ATN B1**
ACARS ATS	ATC communication • DCL or PDC • OCL Flight information • D-ATIS	N/A	N/A	N/A	N/A
FMC WPR	N/A	Surveillance • FMC WPR (CFRS or AOC)	N/A	N/A	N/A
FANS 1/A ADS-C	N/A	Surveillance • ADS-C (CADS)	Surveillance • ADS-C	N/A	N/A
FANS 1/A	N/A	Surveillance • ADS-C (CADS)	ATC communication • CPDLC Surveillance • ADS-C	N/A	ATC communication • CPDLC for ACM, ACL, and AMC data link services
FANS 1/A+	N/A	Surveillance • ADS-C (CADS)	ATC communication • CPDLC Surveillance • ADS-C	N/A	ATC communication • CPDLC for ACM, ACL, and AMC data link services
ATN B1	N/A	N/A	N/A	ATC communication • CPDLC for ACM, ACL, and AMC data link services	ATC communication • CPDLC for ACM, ACL, and AMC data link services
FANS 1/A–ATN B1	N/A	Surveillance • ADS-C (CADS)	ATC communication • CPDLC Surveillance • ADS-C	ATC communication • CPDLC for ACM, ACL, and AMC data link services	ATC communication • CPDLC for ACM, ACL, and AMC data link services

2.2 Data link systems and services

2.2.1 Network descriptions and message acknowledgements

2.2.1.1 ACARS network and message acknowledgement

2.2.1.1.1 The FANS 1/A data link system (including FANS 1/A+, FANS 1/A ADS-C and FANS 1/A-ATN B1 defined in paragraph 2.1.2) relies on the ACARS network, which is provided and maintained by various communication service providers (CSPs).

2.2.1.1.2 The ACARS network evolved from the need to be able to exchange messages between an aircraft and its AOC.

2.2.1.1.3 The ACARS network consists mainly of VHF (VDL M0/A and VDL M2) and satellite subnetworks, but also includes the HFDL subnetwork. The performance characteristics of each subnetwork varies and its use for ATS communications will depend on the performance required for the intended operation (refer paragraph 2.1.3).

2.2.1.1.4 While there are no technical provisions to indicate to the ATSU that an uplink message is available for display to the flight crew, the ACARS network allows the ATSU to receive a message assurance (MAS) indicating that an uplink message has been delivered to the aircraft, as shown in Figure 2-3.

Note.— It is possible that after successful delivery of an uplink message to the aircraft, the delivery of the associated MAS success response to the ATSU fails. Therefore, non-reception of a MAS-S by the ATSU is not necessarily a confirmation that the uplink was not delivered to the aircraft.

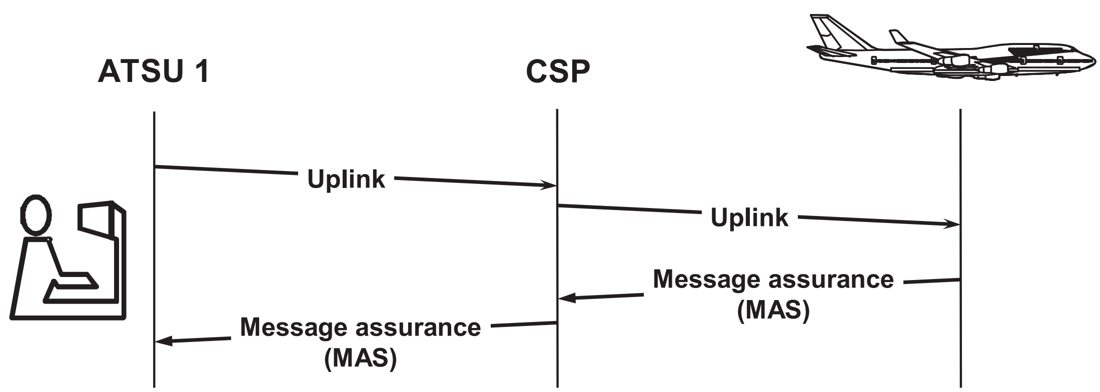


Figure 2-3. Uplink and message assurance

2.2.1.1.5 While there are no technical provisions to indicate to the aircraft that a downlink message has been delivered to the ATSU and is available for display to the controller, the ACARS network allows the aircraft to receive a network acknowledgement indicating that a downlink message has been delivered to the CSP system, as shown in Figure 2-4.

Note 1.— Some aircraft may re-send the downlink if the network acknowledgement is not received within a given time. This may result in the ATSU receiving a duplicated downlink message.

Note 2.— In some cases, the aircraft may have sent a downlink message that was not received by the ATSU. For example, this is one reason the ATSU will not rely solely on some event reports, such as the lateral deviation event report, for protecting airspace.

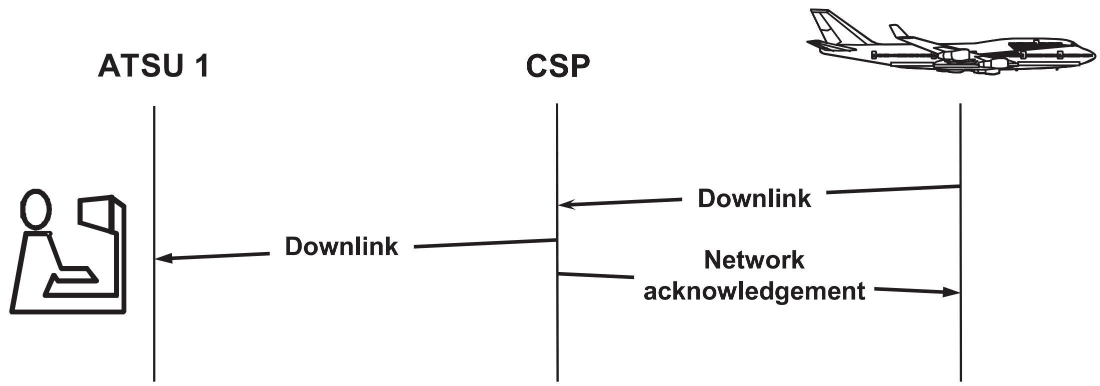


Figure 2-4. Downlink and network acknowledgement

2.2.1.1.6 As the controller does not have a means to ensure that a clearance was made available for display to the flight crew, procedures are in place to mitigate the effects of non-delivery (refer to paragraph 4.3.1.2).

2.2.1.2 ATN network and message acknowledgement

2.2.1.2.1 The ATN B1 data link system relies on the aeronautical telecommunication network (ATN), which is provided and maintained by various communication service providers (CSPs) and/or ANSPs.

2.2.1.2.2 The ATN was developed by ICAO to support the need for ATS communications.

2.2.1.2.3 The ATN relies only on VHF (VDL M2) to meet the performance required for the intended operations (refer paragraph 2.1.3.2).

2.2.1.2.4 There are technical provisions, as shown in Figure 2-5 and Figure 2-6, for the sender to ensure that a message has been delivered and made available for display to the receiver (end-to-end acknowledgement).

Note 1.— This acknowledgement mechanism is based on the use of dedicated CPDLC message elements (e.g. UM 227 and DM 100). The ATS system (air or ground) will send a logical acknowledgement for any incoming message as long as it is requested by the sender (a dedicated field in each individual message allows the sender to indicate if LACK is required or not).

Note 2.— In areas where logical acknowledgements are not intended to be used, the ground system will instruct the aircraft:

a) By sending UM 233 USE OF LOGICAL ACKNOWLEDGEMENT PROHIBITED, not to require the UM 227 LOGICAL ACKNOWLEDGEMENT response for any future downlink message for the rest of the CPDLC connection; and

b) By specifying LackNotRequired within each of its uplink messages for the rest of the CPDLC connection, not to send a DM 100 LOGICAL ACKNOWLEDGEMENT message in response to the related uplink message.

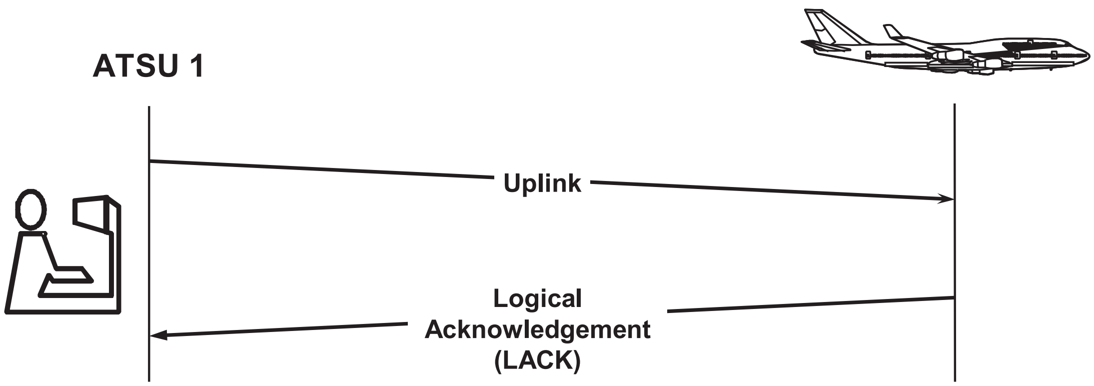


Figure 2-5. Uplink and logical acknowledgement

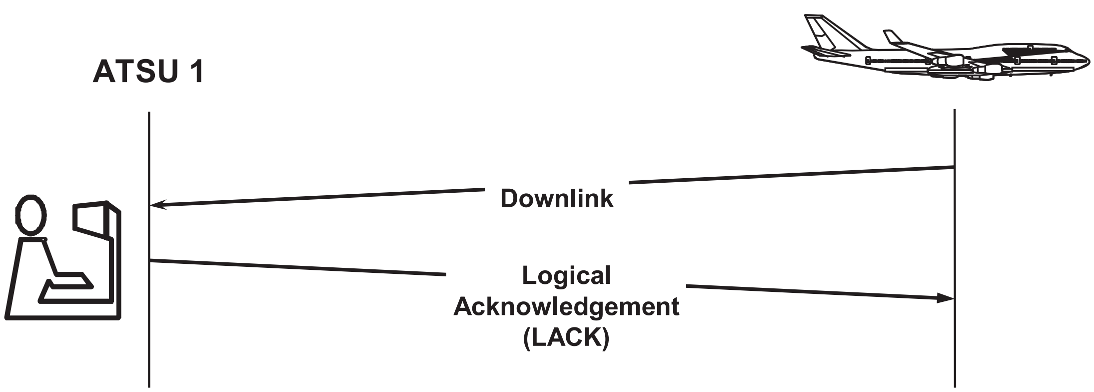


Figure 2-6. Downlink and logical acknowledgement

2.2.2 Data link messages

2.2.2.1 Table 2-6 provides the list of air-ground data link messages that support the data link initiation capability service. It defines a generic term for each message that will be used in this document. It also provides the purpose and specific content for FANS 1/A and ATN B1 messages.

Table 2-6. Air-ground data link messages for DLIC

Generic Message Name	Purpose	FANS-1/A Messages	ATN B1 Messages
Air-ground logon procedure			
Logon Request	To provide the ATSU with information to confirm the identity of the aircraft and its data link capabilities, and to notify the ATSU of the flight crew's intention to use data link services.	FN_CON	CM_LOGON_REQUEST
Logon Response	To notify the aircraft of the status of its logon request.	FN_AK	CM_LOGON_RESPONSE
Air-ground address forwarding procedure			
Contact Request	To instruct the aircraft to send a logon request to the specified ATSU.	FN_CAD	CM_CONTACT
Contact Response	To indicate to the initiating ATSU that the logon request will be sent to the specified ATSU.	FN_RESP	No ATN equivalent
Contact Complete	To provide to the initiating ATSU the status of the logon request to the specified ATSU.	FN_COMP	CM_CONTACT_RESPONSE

2.2.2.2 Table 2-7 provides the list of ground-ground data link messages that support the ground-ground coordination for address forwarding between initiating and receiving ATSUs.

Table 2-7. Ground-ground data link messages for DLIC

Generic Message Name	Purpose	AIDC	OLDI (See note)
Ground-ground address forwarding procedure			
Logon Forwarding	To provide an ATSU with logon information from an aircraft.	AIDC FAN	OLDI LOF
Next Authority Notified	To provide the receiving ATSU with the information that the aircraft has been notified about its next data authority. *Note.— This message is to prevent the receiving ATSU from attempting to establish a CPDLC connection prior to the NDA message being uplinked to the aircraft.*	No equivalent	OLDI NAN

Generic Message Name	Purpose	AIDC	OLDI (See note)
Ground-ground address forwarding procedure			
Connection Forwarding	To advise an ATSU that the transferring ATSU has terminated its CPDLC connection with the aircraft using a CPDLC Connection Status identifier (CPD =0). *Note.— This message can also be used to notify the status of the inactive connection.*	AIDC FCN	Not applicable.

Note.— OLDI is implemented in European Region to provide AIDC capability.

2.2.2.3 Table 2-8 provides the list of data link messages that support the CPDLC connection. It defines a generic term for each message that will be used in this document. It also provides specific content and purpose for FANS 1/A and ATN B1.

Table 2-8. Data link messages for CPDLC connection

Generic Message Name	FANS-1/A Message	ATN B1 Message
CPDLC Connection Establishment		
Connection Request	CR1 containing UM 163 *[icao facility designation] [tP4+Table]*	CPDLC_START_REQUEST
Connection Rejection	DR1 optionally containing error message element DM 64 [facility designation]	CPDLC_START_CONFIRM (rejected) and optionally containing error message element DM 107 NOT AUTHORIZED NEXT DATA AUTHORITY
Connection Confirm	CC1 containing DM 73 [version number]	CPDLC_START_CONFIRM (accepted)

Generic Message Name	FANS-1/A Message	ATN B1 Message
CPDLC Connection Termination		
Termination Request	CPDLC message containing UM 161 END SERVICE and optionally a CONTACT or MONITOR message element. *Note 1.— Under normal circumstances, FANS 1/A ATSU will send a CONTACT or MONITOR message and then the termination request message containing UM 161 END SERVICE message element only.* *Note 2.— Under normal circumstances, FANS 1/A-ATN B1 ATSU will send a termination request message containing both UM 161 END SERVICE message element and a CONTACT or MONITOR message element.*	CPDLC_END_REQUEST and optionally containing a CONTACT or MONITOR message element.
Termination Rejection	CPDLC message containing: DM 63 NOT CURRENT DATA AUTHORITY, or if a CONTACT or MONITOR message is included in the termination request, DM 1 UNABLE	CPDLC_END_CONFIRM (rejected) containing: DM 63 NOT CURRENT DATA AUTHORITY, or if a CONTACT or MONITOR message is included in the termination request, DM 1 UNABLE
Termination Confirmation	DR1	CPDLC_END_CONFIRM (accepted) containing DM 0 WILCO
CPDLC Connection Abort		
Abort Request (downlink)	DR1	USER_ABORT
Abort Request (uplink)	CPDLC message containing UM 161 END SERVICE and UM 159 ERROR (commanded termination).	USER_ABORT

2.2.3 Data link initiation capability (DLIC)

2.2.3.1 Purpose of the logon (flight plan correlation)

2.2.3.1.1 The logon is the first step in the data link process. A logon, initiated either by the flight crew or by another ATSU, is performed prior to the ATSU establishing a CPDLC and/or ADS-C connection. The purpose of the logon is to:

a) Provide the ATSU with the data link application "context" of the aircraft, namely:

1) The ATS data link applications supported by the aircraft system (e.g. CPDLC, ADS-C) and the associated version numbers of these applications; and

2) The unique identification of the aircraft;

b) Provide the ATSU with the relevant aircraft information required to allow the ATSU to correlate the logon information with the aircraft's corresponding flight plan.

Note 1.— For FANS 1/A, the unique identification of the aircraft is the aircraft registration and/or aircraft address; for ATN B1 the unique identification of the aircraft is the aircraft address.

Note 2.— Under certain circumstances, it may be operationally desirable for an ATSU to set up an ADS-C connection (perhaps for a single demand contract) without a preceding logon. When this is done, correlation with the flight plan can be achieved by requesting the optional flight identification group and checking this against the aircraft registration in the flight plan. See also section 4.5.3 for guidelines on ADS-C connection management.

2.2.3.1.2 On receipt of a logon request, the ATSU correlates the logon information with the relevant information in the flight plan held by the ATSU. This ensures that messages are sent to the correct aircraft and that automation associated with ADS-C reports or CPDLC messages updates the correct flight plan.

2.2.3.1.3 When making this correlation, the ground system:

a) Ensures that the aircraft identification in the logon request matches that in Item 7 of the associated flight plan and at least one of the aircraft registration or aircraft address provided match the corresponding descriptors (following the REG and/or CODE indicators, respectively) in Item 18 of the flight plan; and

b) Only uses the information contained within the portion of the logon request message that is protected by the cyclic redundancy check (CRC).

Note 1.— The data used for correlation are:

a) For FANS-1/A, the aircraft identification, aircraft registration, and optionally, the aircraft's current position (lat/long) and the aircraft address (if available);

b) For ATN B1, the aircraft identification, departure and destination airports, the aircraft address, and optionally estimated off-block time (EOBT), if available.

Note 2.— For FANS 1/A, the aircraft identification in the ACARS message header is not protected by the CRC and the flight crew does not use this information to verify aircraft identification. Additionally, the format for the aircraft identification in the ACARS message header is different from the format used by the ground system. For example, the ground system uses a three alpha character ICAO designator for the operating agency followed by up to four numeric characters for the flight identification.

FANS 1/A Example
The following example of an AFN logon indicates the appropriate information in the ACARS message to correlate the AFN logon with a flight plan.
QU <ACARS “TO” address> . <ACARS “FROM” address> 010000 AFD FI AB0123/AN ST-XYZ DT QXT POR1 010000 J59A - AFN/FMH***ABC123,.ST-XYZ,DEF456***,000002/FPOS30000E160000,0/FCOADS,01/ FCOATC,01<CRC>
The ATSU only uses the information in the CRC-protected portion of the ACARS message. In the example above, the CRC portion is highlighted, and contains the following information: • aircraft identification is ABC123 (not the AB0123 contained in the ACARS header); • aircraft registration is ST-XYZ (hyphen is removed by ATS automation per paragraph 3.1.2.1.2); and • aircraft address is DEF456.
Note.— *Some ATSUs may operate a ground system that does not integrate data link capability with a flight data processing system. Under these circumstances, the ATSU will need to ensure that the logon information is available for the controller to manually cross-check the information with the details in the flight plan.*

ATN B1 Example	
The following example of a CM logon indicates the appropriate information in the CM message to correlate the CM logon with a flight plan.	
CMLogonRequest	
aircraftFlightIdentification	**ABC123**
cMLongTSAP	ATN address of the aircraft CM application (string of 18 or 19 octets), including the aircraft address **DEF456** (3 octets).
groundInitiatedApplications	1 (CMA) and 22 (PM-CPDLC)
airOnlyInitiatedApplications	1 (CMA)
facilityDesignation	None
airportDeparture	**LFBO**
airportDestination	**ENGM**

dateTimeDepartureETD	None
The ATSU only uses the information in the CRC-protected portion of the message: • aircraft identification is ABC123; • aircraft address is DEF456 and is included in the cMLongTSAP; and • departure airport is LFBO (Toulouse) and destination airport is ENGM (Oslo). *Note.— The facilityDesignation field would be used to require a logon to a facility different from the one to which the logon request will be addressed. Such capability (commonly referred to as DLIC server) is not implemented by ATN B1 systems.*	

2.2.3.2 Initial logon request

2.2.3.2.1 An initial logon request is needed when the aircraft does not already have an ADS-C or CPDLC connection, such as when:

a) The aircraft is preparing for departure; or

b) The aircraft will enter an area where data link services are available from an area where data link services are not available; or

c) Instructed by ATC (e.g. following a failed data link transfer).

2.2.3.2.2 To perform an initial logon request, the flight crew enters the four character ICAO identifier of the ATSU to which the logon request is to be sent and includes the following flight-specific information:

a) Aircraft identification (same as item 7 of the flight plan);

b) Aircraft registration and/or aircraft address (same as item 18, preceded by REG and/or CODE, of the flight plan); and

c) Departure and destination aerodromes, when required (same as items 13 and 16 of the flight plan).

Note 1.— In accordance with ICAO Doc 4444, the aircraft identification entered into the aircraft system is either the ICAO designator for the aircraft operating agency followed by the flight identification or the aircraft registration.

Note 2.— The aircraft identification and registration may have been loaded prior to departure.

Note 3.— When the aircraft identification includes a numeric component, this component matches exactly that included in the flight plan. In other words, "ABC3" does not match "ABC003."

Note 4.— While the ATSU identifier is only 4-characters, ATN B1 is capable of supporting up to 8 characters.

2.2.3.2.3 To avoid an automatic rejection of the logon request, the flight crew ensures that the flight-specific information entered into the aircraft system is the same as the corresponding details filed in the flight plan.

2.2.3.2.4 When the flight crew performs the logon request, the aircraft system transmits the logon information in a logon request message (as per Table 2-6) to the specified ATSU.

Note.— The flight crew procedure for performing an initial logon request is provided in paragraph 5.2.

2.2.3.3 Logon response

2.2.3.3.1 As shown in Figure 2-7, the ground system automatically responds to a logon request with a logon response (as per Table 2-6). The logon response message provides information to the aircraft system concerning whether:

a) The logon request was successful (e.g. could be correlated with a flight plan); or

b) The logon request was unsuccessful (e.g. could not be correlated with a flight plan). Refer to paragraph 3.1.2.1.1 for conditions when an ATSU rejects a logon request.

2.2.3.3.2 The logon response message also provides information concerning the ATS data link applications the ATSU supports.

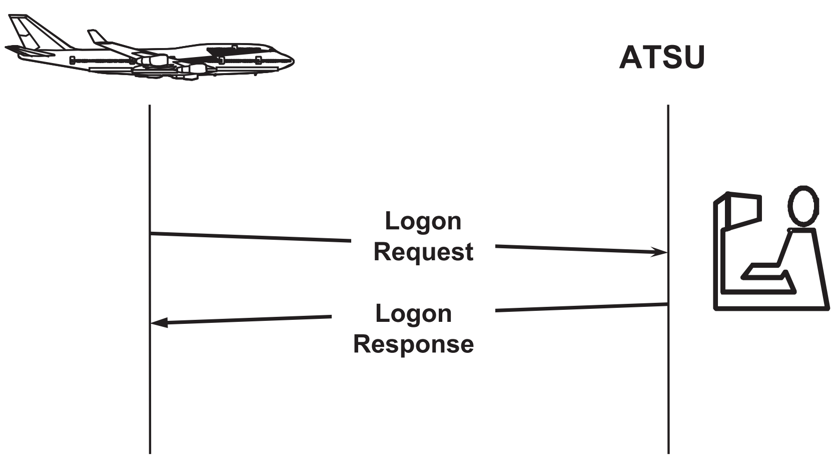


Figure 2-7. Initial logon exchanges

2.2.3.4 Logon request triggered by contact request

2.2.3.4.1 The air-ground address forwarding procedure is the process whereby one ATSU instructs the aircraft system to initiate a logon request to another ATSU (e.g. when the flight is leaving one ATSU where a logon had already been completed and the flight is transferred to another ATSU).

2.2.3.4.2 When triggered by a contact request, a logon request is initiated without flight crew input.

2.2.3.4.3 The CDA typically initiates address forwarding to permit a downstream or adjacent ATSU (NDA) to establish an inactive CPDLC connection and/or an ADS contract for monitoring purposes.

2.2.3.4.4 Any ATSU can initiate address forwarding by sending a contact request message to the aircraft. Upon receipt, the aircraft automatically transmits a logon request to the ATSU whose address was included in the contact request message.

Note.— Some aircraft will not accept a CPDLC connection with an ATSU to which they have been instructed to log on unless the ATSU issuing the instruction had itself established a CPDLC connection with the aircraft. Refer to Appendix F, paragraph F.3

2.2.3.4.5 The messages associated with address forwarding are listed in Table 2-6, and the sequence is depicted in Figure 2-8.

Note 1.— Only FANS 1/A aircraft will send a contact response message to the initiating ATSU.

Note 2.— For some ATN B1 aircraft, the contact complete message indicates a positive result even though the logon response from the receiving ATSU indicated failure.

2.2.3.4.6 The ATSU initiating the address forwarding procedure receives an indication of the status of the air-ground logon procedure with the specified ATSU upon receipt of the contact complete message.

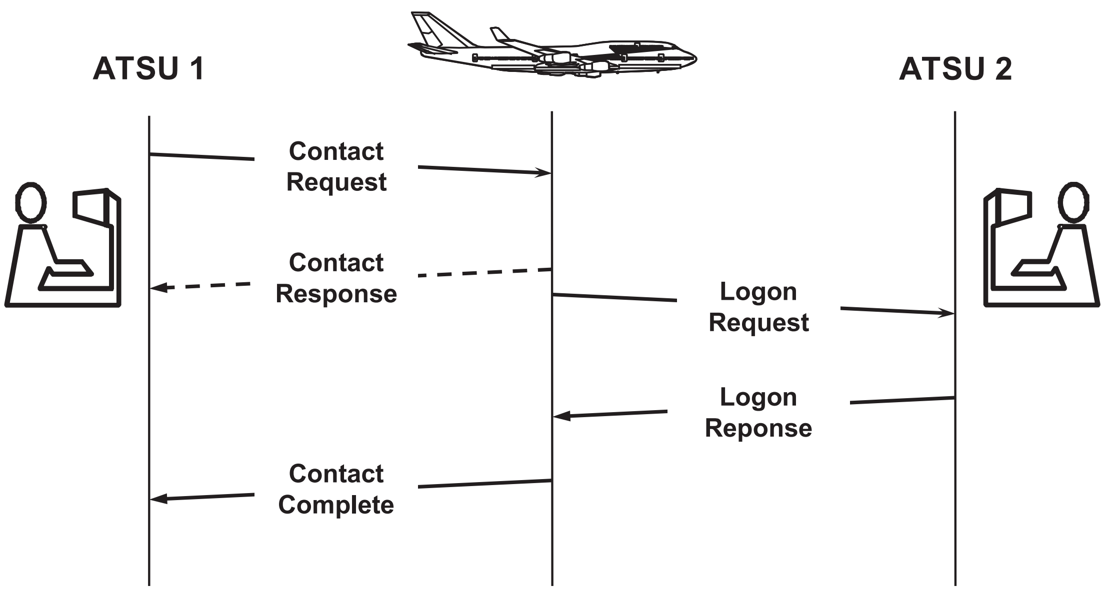


Figure 2-8. Air-ground address forwarding message sequence (Transfer between areas where data link is provided)

2.2.3.4.7 Where the functionality is available, an ATSU can imitate the air-ground address forwarding procedure with a ground-ground address forwarding procedure that uses messages listed in Table 2-7. The logon forwarding message contains the same information as a logon request, but is transmitted by one ATSU to another as depicted in Figure 2-9.

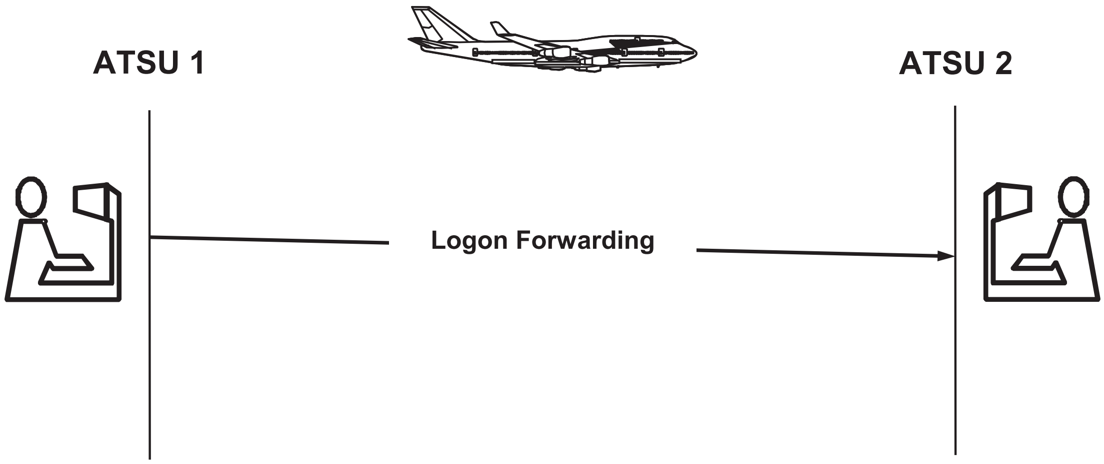


Figure 2-9. Ground-ground address forwarding using logon forwarding message

2.2.4 CPDLC connection management

2.2.4.1 Purpose of a CPDLC connection

2.2.4.1.1 The purpose of a CPDLC connection is to allow the exchange of CPDLC messages between an aircraft and an ATSU (active connection), and also to provide an advance connection with the next ATSU (inactive connection). An aircraft can have a maximum of two CPDLC connections established concurrently, each with a different ATSU. Only one CPDLC connection can be active at any given time; any second connection is inactive.

2.2.4.2 Active and inactive CPDLC connections

2.2.4.2.1 An active CPDLC connection can be established upon completion of the logon procedure if no previous CPDLC connection exists with the aircraft. An active CPDLC connection allows an ATSU and the aircraft to exchange CPDLC messages. The ATSU with which an aircraft has an active CPDLC connection is referred to as the CDA.

Note.— In some circumstances an active connection may not be operational (e.g. the connected ATSU is not controlling the aircraft). Refer to paragraph 4.9.4.1 and paragraph 5.2.2.2.

2.2.4.2.2 An inactive CPDLC connection can be established upon completion of the logon procedure if a previous CPDLC connection exists with the aircraft. The ATSU and the aircraft cannot exchange CPDLC messages when the CPDLC connection is inactive. The ATSU with an inactive CPDLC connection is referred to as the next data authority (NDA).

2.2.4.3 Establishing a CPDLC connection

2.2.4.3.1 The ATSU can only initiate a CPDLC connection request after successfully correlating an aircraft with the associated flight plan (paragraph 2.2.3.1 refers).

Note.— Flight plan correlation can occur as the result of the air-ground address forwarding procedure, or as the result of ground-ground address forwarding procedure. The connection request can generally be sent automatically by the ATSU system, or manually by the controller. Depending on the functionality of the ground system, the ATSU may send the connection request upon completion of a successful logon procedure, or at some later time (e.g. as the aircraft approaches the ATSU's airspace, or manually by the controller).

2.2.4.3.2 The ATSU initiates a CPDLC connection by sending a CPDLC connection request to the aircraft as shown in Figure 2-10.

2.2.4.3.3 Provided there is no existing CPDLC connection, the aircraft system:

a) Accepts the connection request;

b) Establishes this CPDLC connection as the active connection; and

c) Responds with a CPDLC connection confirm.

Note.— If the logon procedure was not successful with the requesting ATSU, some aircraft will reject the CPDLC connection request. Refer to Appendix F, paragraph F.3.

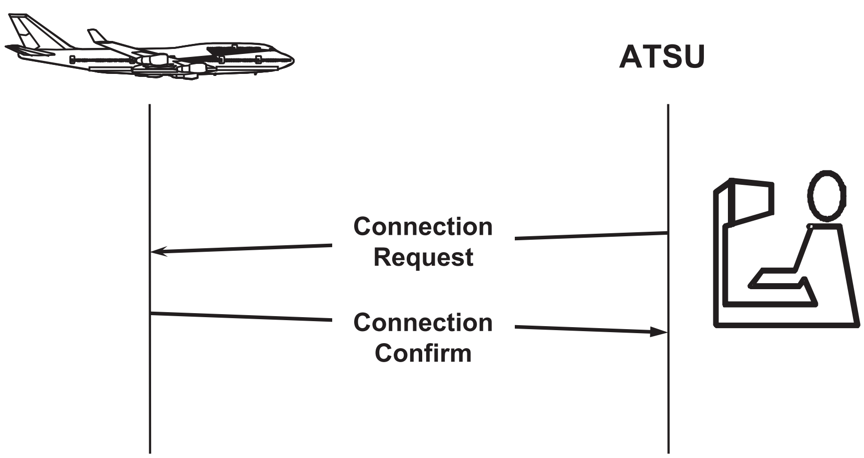


Figure 2-10. CPDLC connection sequence

2.2.4.3.4 If there is an existing CPDLC connection when a CPDLC connection request is received, the aircraft system verifies that the ATSU sending the CPDLC connection request has been specified as the next data authority. In this case, as shown in Figure 2-11, the aircraft system:

a) Accepts the CPDLC connection request;

b) Establishes the connection, which is inactive; and

c) Responds with a CPDLC connection confirm.

Otherwise, the aircraft system rejects the CPDLC connection request by sending a connection rejection message.

Note.— In addition to the connection rejection message, FANS 1/A aircraft will include the identity of the CDA, while ATN B1 aircraft will include DM 107 NOT AUTHORIZED NEXT DATA AUTHORITY, notifying that the ATSU is not the authorized NDA.

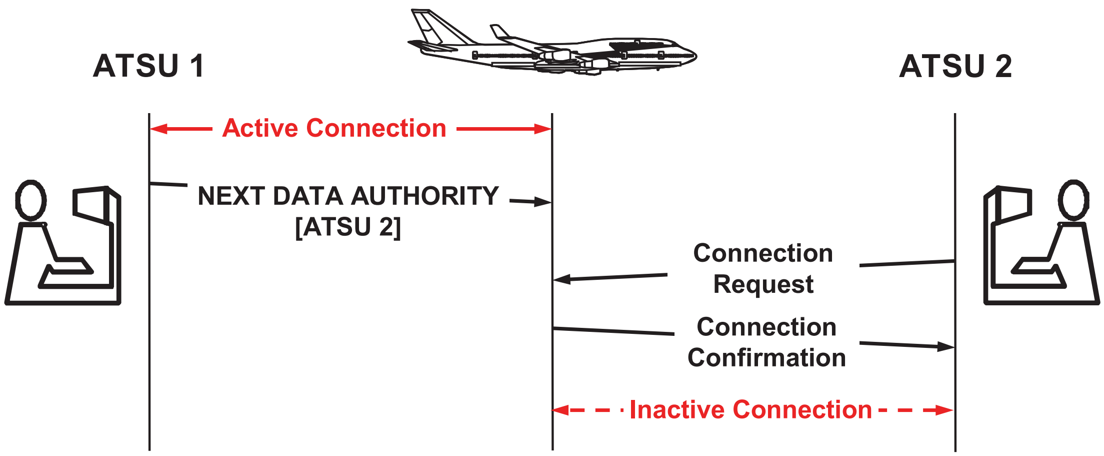


Figure 2-11. Successful attempt to establish a CPDLC connection (inactive)

2.2.4.4 Terminating a CPDLC connection (termination request message)

2.2.4.4.1 The CDA initiates the termination of the CPDLC connection by sending a termination request message (Table 2-8 refers) to the aircraft as depicted in Figure 2-12.

Note.— A ground system can only terminate an active CPDLC connection. It is not possible for the ground system to terminate an inactive CPDLC connection.

2.2.4.4.2 On receipt of a termination request message (without any additional message elements), the aircraft system will downlink a CPDLC termination confirmation message. The aircraft system will consider the aircraft to be disconnected as soon as the termination confirmation message has been sent.

2.2.4.4.3 On receipt of a termination request message containing a CONTACT or MONITOR message element as per Table 2-8, the aircraft system will:

a) Display the message contained in the termination request message for flight crew processing; and

b) If the flight crew responds with DM 0 WILCO, send a CPDLC termination confirmation message containing DM 0 WILCO and then consider the aircraft to be disconnected.

Note 1.— In case the flight crew sends an DM 1 UNABLE response to the message, the aircraft system sends a CPDLC termination rejection message containing DM 1 UNABLE and maintains the CPDLC connection with the CDA (and the next data authority, if any).

Note 2.— Any CPDLC termination request message that would contain a message with a response attribute different from DM 0 or DM 1 would be considered as a CPDLC abort request by the aircraft *system. This would cause all CPDLC connections to be aborted by the aircraft system, leading to the failure of the transfer of CPDLC connections.*

2.2.4.4.4 If the next data authority attempts to uplink a termination request message to the aircraft, the aircraft system will maintain the inactive CPDLC connection and send a termination rejection message including DM 63 NOT CURRENT DATA AUTHORITY.

Note.— Some aircraft may include the MRN in the termination rejection message.

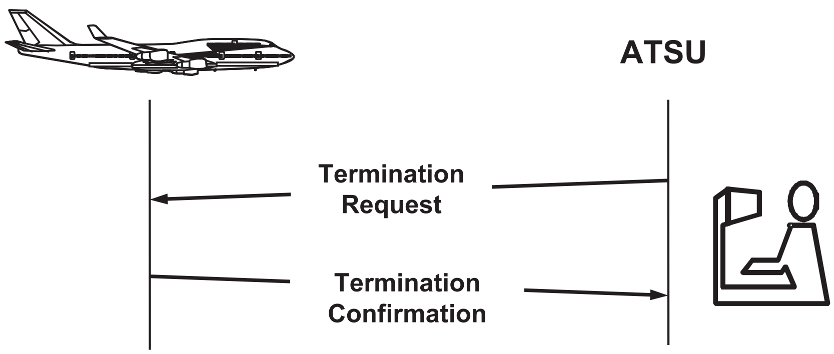


Figure 2-12. Termination of the CPDLC connection

2.2.4.5 Transferring CPDLC connections

2.2.4.5.1 ATSUs manage CPDLC connections to ensure that the ATSU with control for the flight holds the active CPDLC connection, except in certain circumstances. (See paragraph 4.2.1.1). The flight crew can also terminate a CPDLC connection. (See paragraph 5.2.5).

2.2.4.5.2 Under normal circumstances, the CDA will initiate a CPDLC transfer to an adjacent ATSU as the aircraft transits from the current ATSU to another CPDLC-capable ATSU. These transfers are normally automatic, without flight crew action.

Note 1.— Paragraph 2.2.4.8 provides non-standard events associated with CPDLC transfers that may require controller action per paragraph 4.2 and/or the flight crew action per paragraph 5.2.3.

Note 2.— Material for CPDLC connection transfers in the document are applicable independently of the supporting technology (e.g. FANS or ATN B1).

2.2.4.5.2.1 The CDA performs the following steps in the exact order listed to transfer a CPDLC connection to the next ATSU:

a) Sends a NDA message to notify the aircraft of the identity of the next ATSU permitted to establish a CPDLC connection;

b) Initiates address forwarding with the next ATSU; and

c) Sends a CPDLC termination request message when the aircraft is in the vicinity of the boundary with the next ATSU.

Note.— The aircraft system will only accept a CPDLC connection request from the ATSU specified in the NDA message.

2.2.4.5.2.2 Only the CDA can specify the next data authority by including the four-character ICAO identifier for the appropriate ATSU in the NDA message, as shown in Figure 2-13.

Note.— ATSU 1 may optionally send a ground-ground next authority notified message.

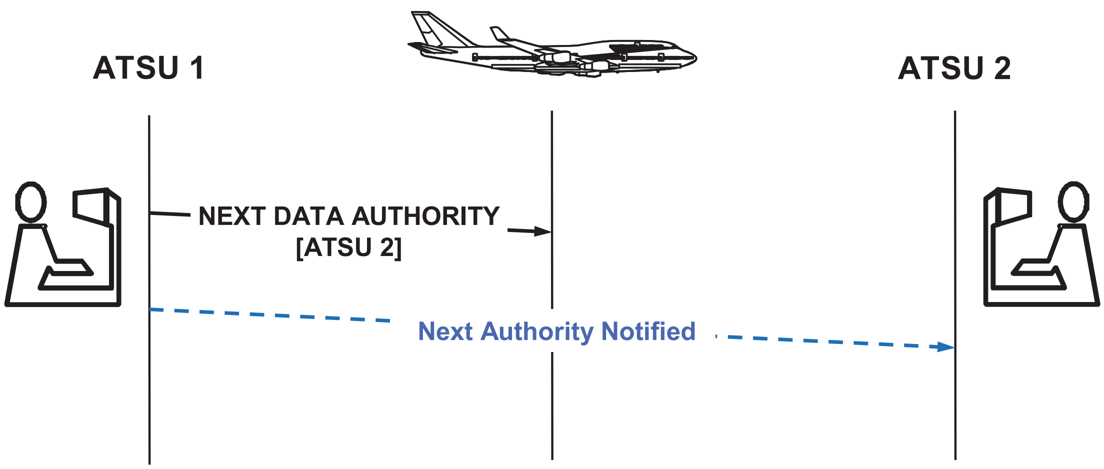


Figure 2-13. Next data authority notification

2.2.4.5.2.3 When the active CPDLC connection is terminated, the aircraft will activate any inactive connection. In this case, the next data authority becomes the CDA and is now able to exchange CPDLC messages with the aircraft.

2.2.4.5.2.4 ATSU 1 may use the connection forwarding message described in paragraph 2.2.2.2, to provide notification to the next ATSU that ATSU 1 has terminated its CPDLC connection, as depicted in Figure 2-14.

Note.— If the connection forwarding message is not used, then when a CPDLC connection has been transferred between ATSUs:

a) For FANS 1/A aircraft, the new ATSU (CDA) has no indication that it has the active CPDLC connection until a CPDLC downlink is received from the aircraft (See paragraph 2.2.4.7.3).

b) For ATN B1 aircraft, the new ATSU (CDA) has an indication that it has the active CPDLC connection (See paragraph 2.2.4.7.2).

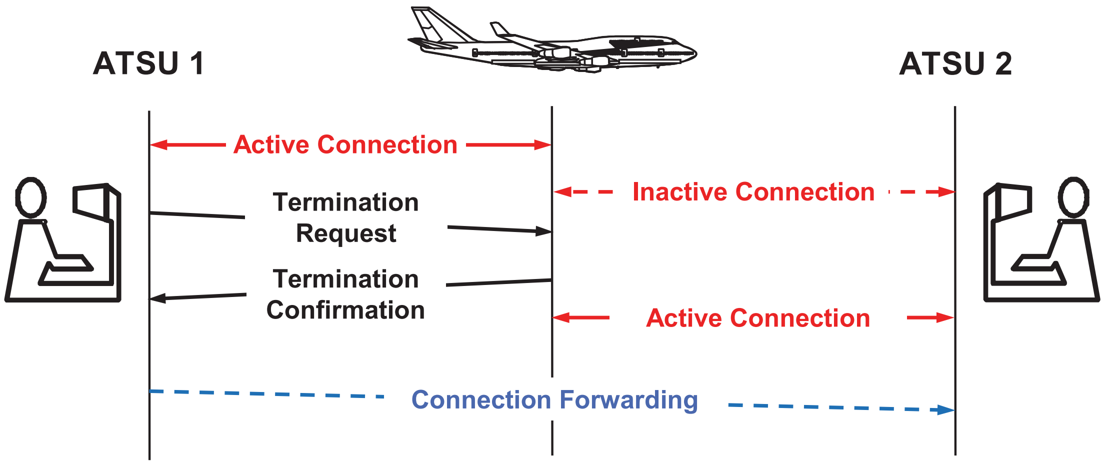


Figure 2-14. Connection forwarding

2.2.4.5.2.5 A successful CPDLC transfer is dependent upon the next ATSU establishing its own CPDLC connection prior to the termination request message being received by the aircraft.

2.2.4.5.2.6 Failure of the next ATSU to establish a CPDLC connection before the termination request message reaches the aircraft will have the following consequence:

a) The aircraft will not have CPDLC connectivity and the previous ATSU will no longer be able to exchange CPDLC messages with the aircraft, and,

b) The first ATSU to send a CPDLC connection request message to the aircraft will become the CDA.

Note.— Some FANS 1/A aircraft may require a logon request to be completed with that ATSU before it can accept the connection request. See Appendix F, paragraph F.14.

2.2.4.5.3 If the aircraft is entering an airspace where data link services are not provided, no NDA message is sent, nor is the address forwarding process performed.

2.2.4.5.3.1 When the active CPDLC connection is terminated, the aircraft will no longer have a CPDLC connection.

2.2.4.6 The CPDLC connection sequence

2.2.4.6.1 As the aircraft transits from one CPDLC-capable ATSU to another, the same CPDLC transfer process is repeated. The cyclical nature of this process is depicted in Figure 2-15.

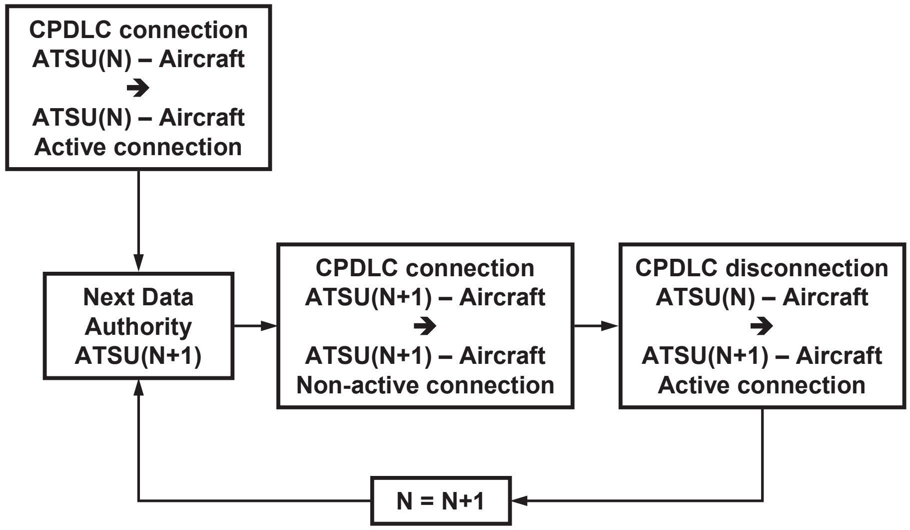


Figure 2-15. Life cycle of the CPDLC connection process

2.2.4.6.2 The sequence of messages from the logon request to the completion of the CPDLC transfer when using air-ground address forwarding is depicted in Figure 2-16.

Note.— Only FANS 1/A aircraft will send Contact Response message to the initiating ATSU.

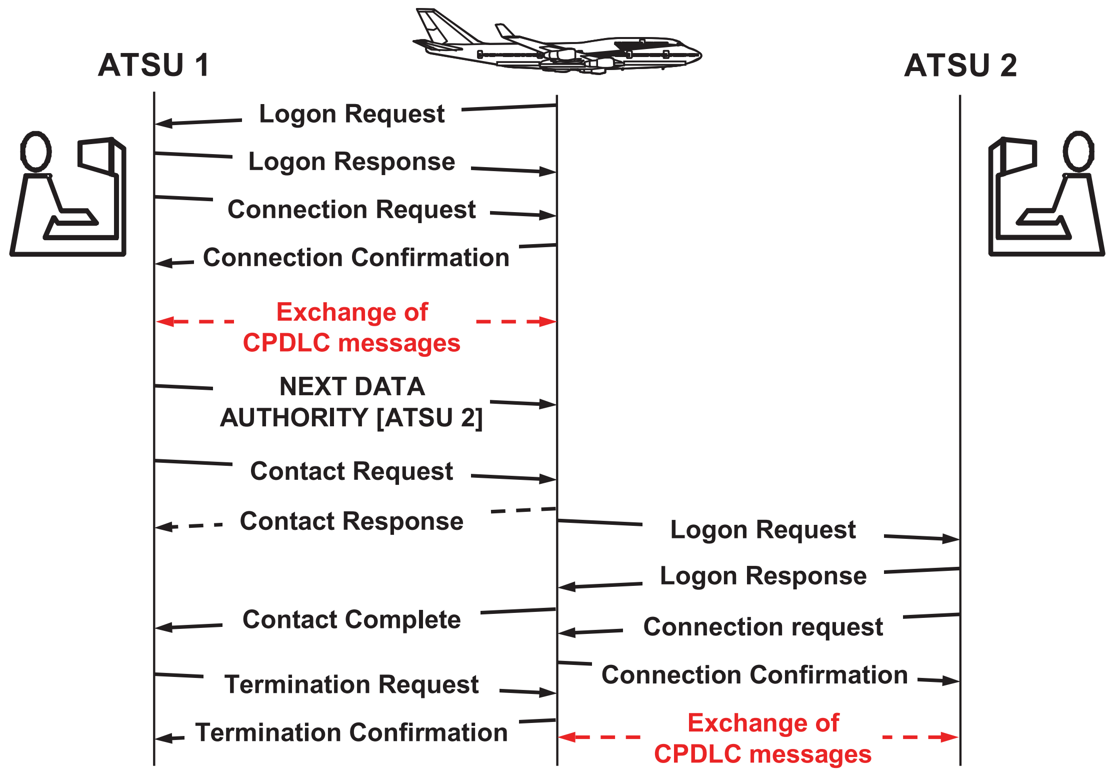


Figure 2-16. Nominal sequence for initial CPDLC connection establishment and transfer of CPDLC connection using air-ground address forwarding

2.2.4.6.3 The sequence of messages from the logon request to the completion of the CPDLC transfer when using ground-ground address forwarding (no use of Next Authority Notified) is depicted in Figure 2-17.

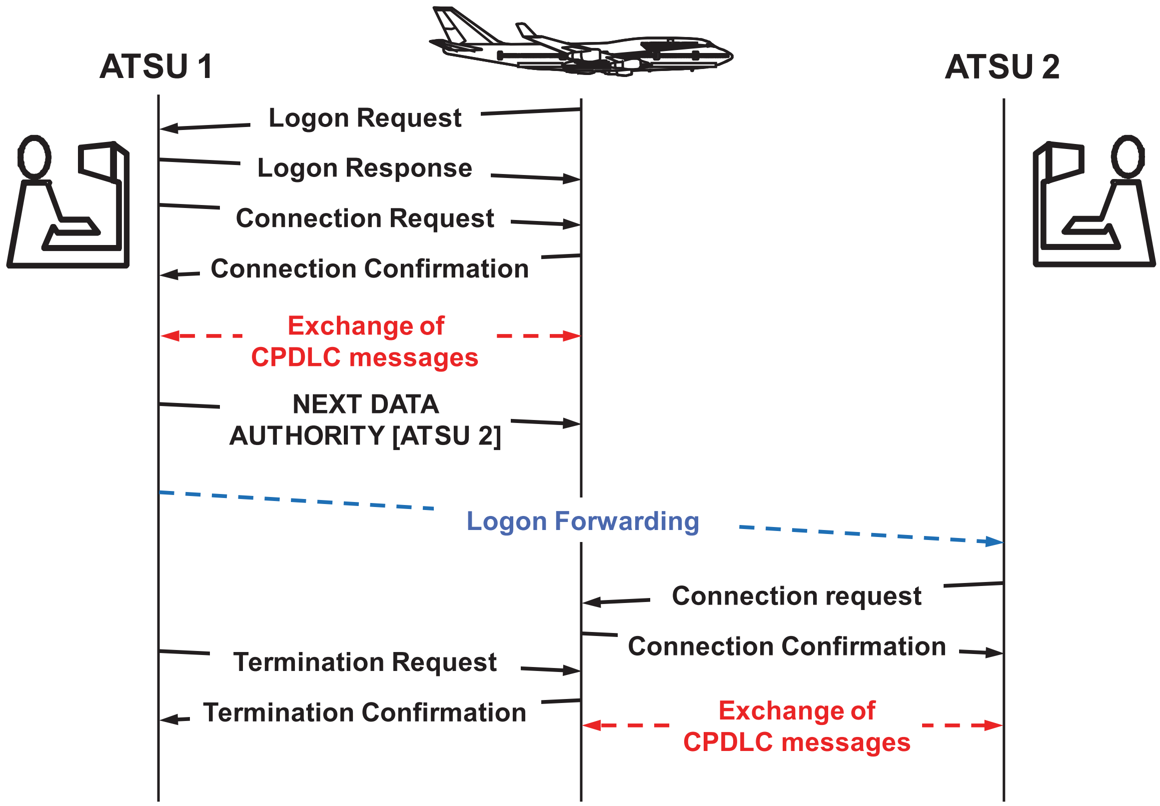


Figure 2-17. Nominal sequence for initial CPDLC connection establishment and transfer of CPDLC connection using ground-ground address forwarding (no use of Next Authority Notified)

2.2.4.6.4 The sequence of messages from the logon request to the completion of the CPDLC transfer when using ground-ground address forwarding (use of Next Authority Notified) is depicted in Figure 2-18.

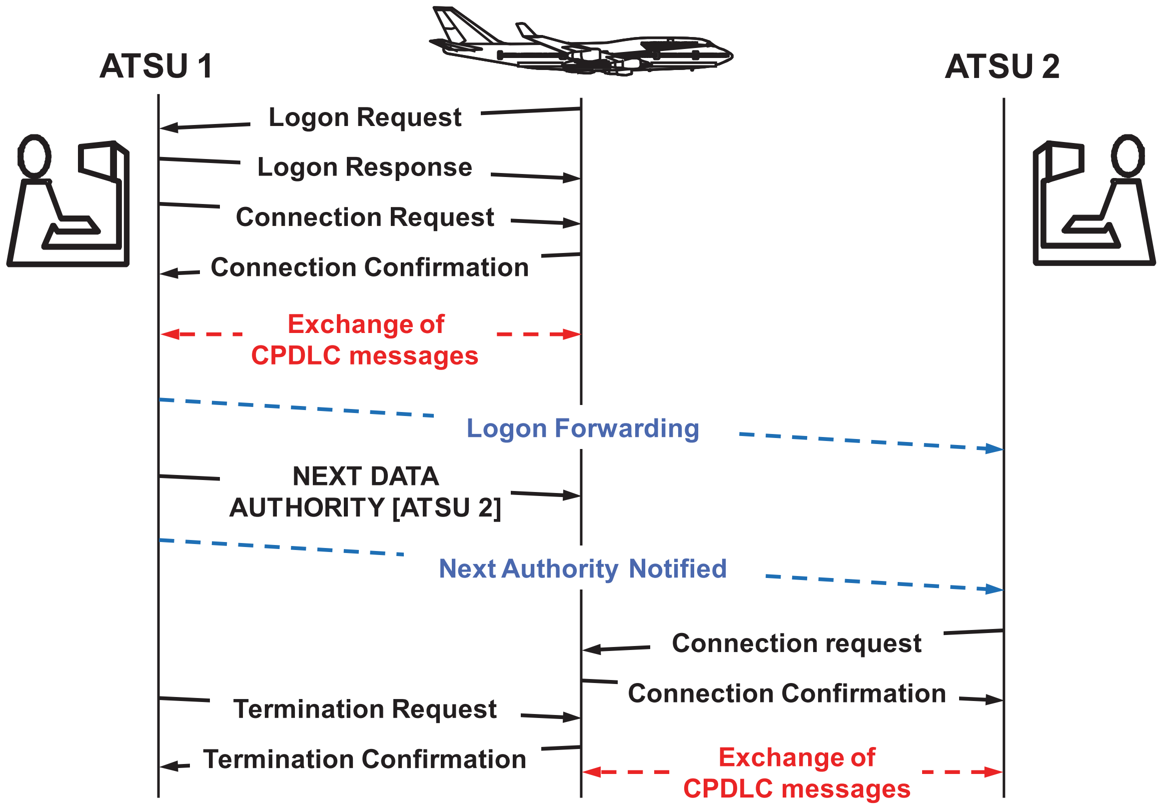


Figure 2-18. Nominal sequence for initial CPDLC connection establishment and transfer of CPDLC connection using ground-ground address forwarding (use of Next Authority Notified)

2.2.4.7 Determining an active CPDLC connection

2.2.4.7.1 CPDLC messages can only be exchanged between the aircraft and the CDA. If the ATSU with the inactive connection uplinks a CPDLC message to the aircraft, the aircraft system rejects the message by sending DM 63 NOT CURRENT DATA AUTHORITY to the ATSU (Refer to Figure 2-19).

2.2.4.7.2 As soon as the CPDLC connection becomes active, ATN B1 aircraft will notify the CDA by sending DM 99 CURRENT DATA AUTHORITY.

Note.— A FANS 1/A aircraft does not provide such automated capability.

2.2.4.7.3 When connected with a FANS 1/A aircraft, the receiving ATSU can use the following methods to confirm a CPDLC connection is active:

a) Wait until a CPDLC downlink message is received from the aircraft per paragraph 5.2.3.5; or

b) Wait until the ground-ground connection forwarding message for the flight is received from the transferring ATSU (if in use between the ATSUs); or

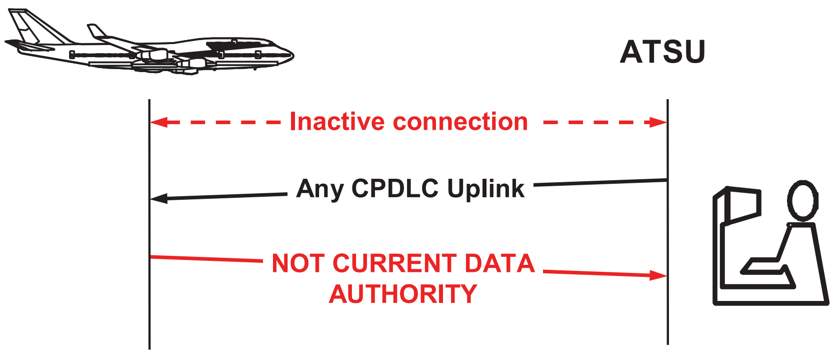


Figure 2-19. Rejection of CPDLC uplinks from the NDA

2.2.4.8 Non-standard events associated with CPDLC transfers

2.2.4.8.1 Multiple NDA messages

2.2.4.8.1.1 Under normal circumstances, the CDA sends only a single NDA message to an aircraft. Exceptions to this may include:

a) Following a re-route (e.g. due to weather) that affects the identity of the next ATSU whose airspace the aircraft will enter; or

b) If the initial NDA message was not delivered to the aircraft.

2.2.4.8.1.2 When a NDA message is received, the aircraft system replaces any previous NDA message the aircraft may have received unless the facility designation in the message is the same as the facility designation already held by the aircraft system. If the facility designation is different, the aircraft terminates any inactive CPDLC connection that an ATSU may have established.

Note.— Some aircraft types may terminate an inactive CPDLC connection even if the facility designation in the NDA message is the same. See Appendix F, paragraph F.3.

2.2.4.8.1.3 In Figure 2-20, the next ATSU on the aircraft's route was ATSU 2. Shortly after ATSU 1 had commenced the CPDLC transfer sequence to ATSU 2, the aircraft was re-routed in such a way that ATSU 3 is now the next ATSU.

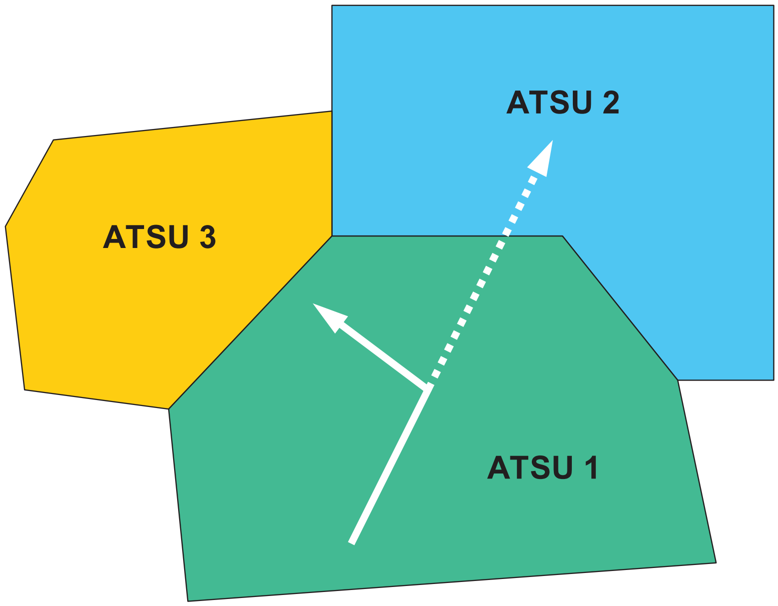


Figure 2-20. Depiction of the change in route of an aircraft

2.2.4.8.1.4 Figure 2-21 shows that ATSU 1 sends a new NDA message specifying ATSU 3 as the next data authority. On receipt of this NDA message, the aircraft disconnects its CPDLC connection from ATSU 2 (if it had an inactive connection). In addition, ATSU 1 initiates address forwarding for the aircraft to ATSU 3.

2.2.4.8.1.5 In the case that ATSU 3 does not support CPDLC services, ATSU 1 requests the aircraft to terminate the CPDLC connection with ATSU 2 by:

a) Sending a CPDLC abort request in order to terminate all connections, or

b) Alternatively, for ATN B1 aircraft, sending a new NDA message specifying that there is now no next data authority, which will ensure that the aircraft terminates the connection with ATSU 2.

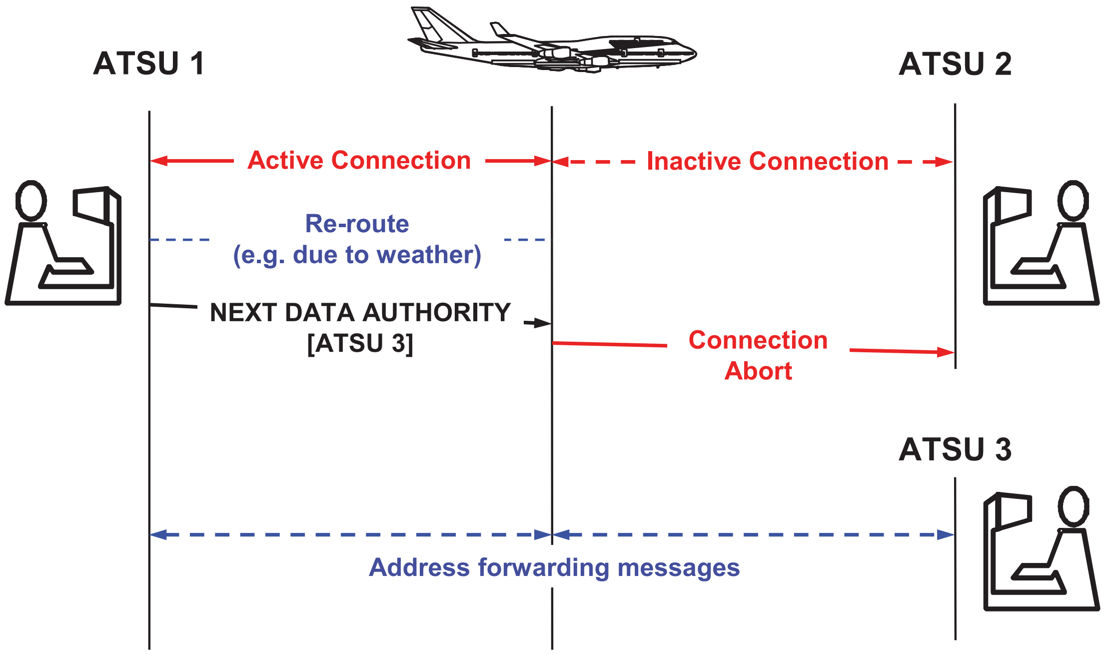


Figure 2-21. Sending a new NDA following a re-route

2.2.4.8.2 Failures of the CPDLC connection establishment

2.2.4.8.2.1 Upon receipt of a CPDLC connection request, the aircraft system sends a CPDLC connection rejection message to the next ATSU when the aircraft system receives the:

a) CPDLC connection request message from the next ATSU before the NDA message from the CDA, as shown in Figure 2-22; or

b) NDA message designating an ATSU that is different from the ATSU sending the CPDLC connection request, as shown in Figure 2-23.

Note 1.— To prevent rejection of the CPDLC connection request:

– The CDA sends the NDA message prior to initiating air-ground address forwarding to the next ATSU (Refer to Figure 2-16),

– When it is known that the ground-ground address forwarding would trigger a CPDLC connection request by next ATSU, CDA sends the NDA message prior to initiating ground-ground address forwarding to the next ATSU (Refer to Figure 2-17).

– When it is known that the next ATSU will wait for a Next Authority Notified message prior to initiating a CPDLC connection request, CDA can send the NDA message after completing ground-ground address forwarding to the next ATSU (Refer to Figure 2-18).

Note 2.— In addition to the connection rejection message, FANS 1/A aircraft will send DM 64, which provides the identity of the CDA, while ATN B1 aircraft will send DM 107, which is a notification that the ATSU is not authorized to become the next data authority.

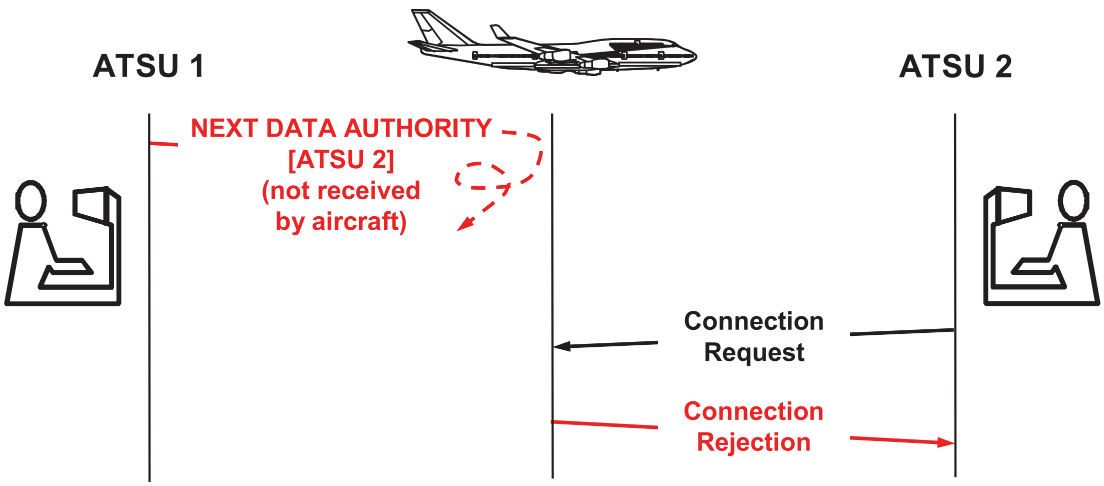


Figure 2-22. Non-receipt of the NDA message

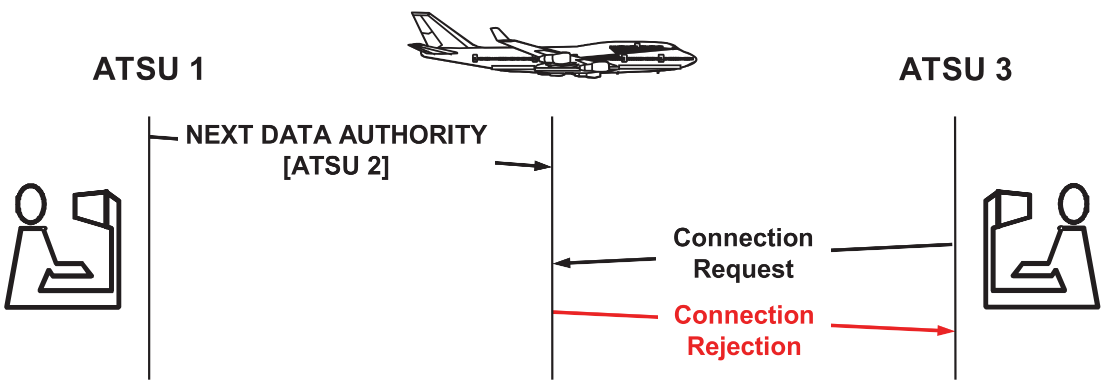


Figure 2-23. Connection request from an ATSU not designated as the NDA

2.2.4.8.2.2 The flight crew has no indication that the CPDLC connection request has been rejected.

2.2.4.8.2.3 If the controlling ATSU sends another NDA message specifying the correct ATSU to the aircraft, the next ATSU will need to send a subsequent CPDLC connection request to establish the connection, as shown in Figure 2-24.

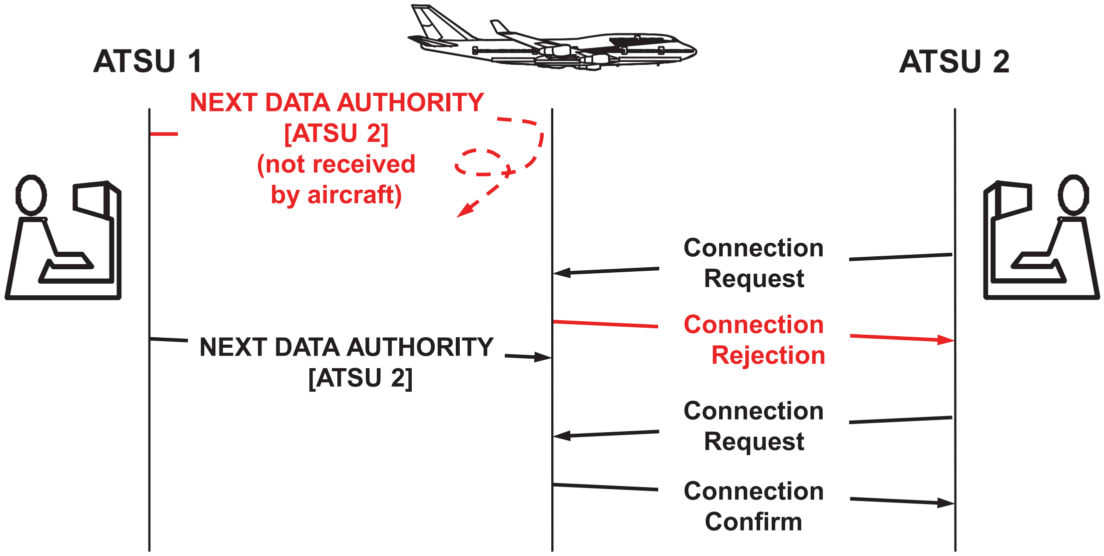


Figure 2-24. Successful CPDLC connection following a re-send of the NDA message

2.2.4.8.3 Termination of both active and inactive CPDLC connections

2.2.4.8.3.1 Normally, on receipt of a termination request message from the CDA, the aircraft system will only terminate the active CPDLC connection. However, if the termination request message element is part of a multi-element message where none of the elements require a WILCO/UNABLE (W/U) response, the aircraft system will terminate all CPDLC connections (active and inactive) by sending abort request messages, as shown in Figure 2-25.

Note 1.— Some FANS 1/A aircraft will also abort all connections when open uplinks exist when the termination request message is received. Refer to Appendix F, paragraph F.8 for variations in aircraft processing of open uplinks at time of transfer of communications.

Note 2.— Some ATN B1 aircraft will also abort all connections when the termination request message includes any message element other than UM 117, UM 120 and UM 135. Refer to Appendix F, paragraph F.8 for variations in aircraft processing of open uplinks at time of transfer of communications.

Note 3.— For FANS 1/A. the termination request message is normally sent as a single-element message. Refer to paragraph 3.1.2 for ATC automated data link functions and paragraph 4.2 for controller procedures related guidance.

Note 4.— For ATN B1. the termination request message is normally sent as a single-element message or as a multi-element message that includes UM 117 or UM 120 and UM 135. Refer to paragraph 3.1.2 for ATC automated data link functions and paragraph 4.2 for controller procedures related guidance.

Note 5.— See Appendix A for message elements that require a W/U response.

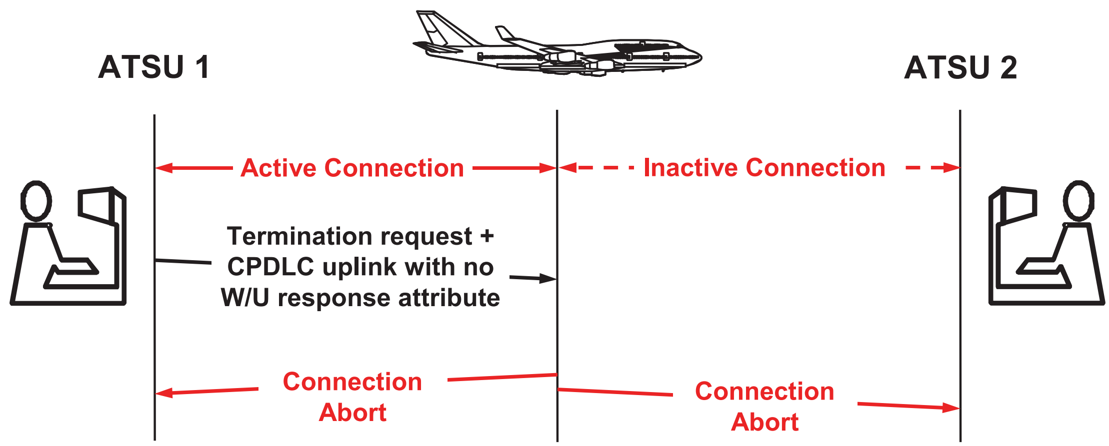


Figure 2-25. Disconnection of both active and inactive connections

2.2.5 Controller-pilot data link communications (CPDLC)

2.2.5.1 CPDLC - general

2.2.5.1.1 CPDLC is a data link application that supports the exchange of data messages directly between a controller and a flight crew.

2.2.5.1.2 When communicating with an aircraft that is operating within airspace beyond the range of DCPC VHF voice communication, CPDLC is available, and local ATC procedures do not state otherwise, the controller and flight crew would normally chose CPDLC as the means of communication. The controller and flight crew would use voice as an alternative means of communication (e.g. VHF, HF or SATVOICE direct or via a radio operator). However, in any case, the controller and flight crew will determine the communication medium that they deem to be the most appropriate at any given time.

2.2.5.1.3 In airspace where both DCPC VHF voice and CPDLC communication services are provided, and local ATC procedures do not state otherwise, the controller and flight crew will determine the communication medium to use at any given time.

Note.— ICAO Doc 4444, paragraph 8.3.2, requires that DCPC be established prior to the provision of ATS surveillance services, unless special circumstances, such as emergencies, dictate otherwise. This does not prevent the use of CPDLC for ATC communications, voice being immediately available for intervention and to address non-routine and time critical situations.

2.2.5.2 CPDLC message set

2.2.5.2.1 The CPDLC message set consists of a set of message elements, most of which correspond to a radiotelephony phraseology.

2.2.5.2.2 CPDLC message elements are referred to as:

a) Uplinks (message elements that are sent to an aircraft); or

b) Downlinks (message elements that are sent by the aircraft).

2.2.5.2.3 Each message element has a number of attributes associated to it, including:

a) A message number that uniquely identifies each type of message element. Uplink message elements are prefixed UM and downlink message elements are prefixed with DM;

b) A response attribute that defines whether or not a response is required for a message element, and, in the case of an uplink message element, the type of response required.

Note.— Other attributes include the urgency and alert attributes to specify precedence in message presentation and indication to the recipient. However, these attributes are currently not used.

2.2.5.2.4 The CPDLC message set, including the possible responses associated with each response attribute, is included in Appendix A.

2.2.5.2.5 Table 2-9 provides examples of responses that may be required for a CPDLC uplink message depending on its response attribute. See Appendix A, paragraph A.2 for a complete description of the responses associated with each response attribute.

Table 2-9. Examples of responses to CPDLC uplink messages

Response attribute	Description
W/U	A DM 0 WILCO or DM 1 UNABLE is required in response to this CPDLC uplink message element.
A/N	An DM 4 AFFIRM or DM 5 NEGATIVE is required in response to this CPDLC uplink message element.
R	A DM 3 ROGER or DM 1 UNABLE is required in response to this CPDLC uplink message element. *Note 1.— FANS 1/A allows only DM 3 ROGER message as a response to uplink message with a R response attribute.*
Y	A response is required to close the CPDLC uplink message element. Any CPDLC downlink message satisfies the requirement. *Note 2.— FANS 1/A does not include any message element with Y response attribute.*
NE (for FANS 1/A) N (for ATN B1)	A response is not required to close the CPDLC uplink message element even though a response may be required operationally.

2.2.5.3 CPDLC messages

2.2.5.3.1 A CPDLC message consists of either a single message element, or a combination of up to five message elements. A CPDLC message that consists of more than one message element is a multi-element message.

Note.— As a general rule, the size of a CPDLC message needs to be kept to a minimum. Refer to paragraphs 4.3.6, 4.4.4, 5.3.1.2 and 5.4.1.4 for guidelines on use of multi-element messages.

2.2.5.4 Responses to CPDLC messages

2.2.5.4.1 A CPDLC message may be a multi-element message containing a number of message elements that have different response types. However, the flight crew or controller can only provide a single response, based on the highest precedence of the response type for the message elements in the message. Table 2-10 lists the response types in order of decreasing precedence for CPDLC uplink and downlink messages.

2.2.5.4.2 When a multi-element message contains at least one message element with a Y response type, the flight crew or controller responds with a single message element response associated with the highest precedence response type for the elements in the message (as per Table 2-10), and additionally the message element(s) associated with the message element(s) with a Y response type.

Note.— Some aircraft send all elements in a multi-element response message, others send the initial response associated with the highest precedence response type for the elements in the message first, and then send the message element(s) associated with the message element(s) with a Y response type.

Table 2-10. Precedence of responses

CPDLC uplink messages	
Response type	**Precedence**
W/U	1
A/N	2
R	3
Y (for ATN B1) NE (for FANS 1/A)	4
N (for ATN B1)	5
CPDLC downlink messages	
Response type	**Precedence**
Y	1
N	2

2.2.5.4.3 Table 2-11 provides examples of the appropriate responses to various multi-element CPDLC uplink messages.

Table 2-11. Examples of multi-element CPDLC uplink messages

Multi-element message	(Individual) response required for each message element	Response required for entire message
UM 20 **CLIMB TO FL370** or *CLIMB TO AND MAINTAIN FL370* UM 129 **REPORT MAINTAINING FL370** or *REPORT LEVEL FL370*	W/U **W/U** or *R*	W/U
UM 20 **CLIMB TO FL370** or *CLIMB TO AND MAINTAIN FL370* UM 107 MAINTAIN PRESENT SPEED	W/U W/U	W/U
UM 147 REQUEST POSITION REPORT UM 169 ADS-C HAS FAILED	**Y** or *NE* R	R and additionally DM 48 POSITION REPORT [position report] (appended to R response message or as separate message)
UM 150 CAN YOU ACCEPT FL370 AT 2200 UM 87 EXPECT DIRECT TO MINNY	A/N R	A/N
UM 190 FLY HEADING 350 UM 231 STATE PREFERRED LEVEL	W/U Y	W/U and additionally DM 106 **PREFERRED LEVEL [level]** or *FL[altitude]* (appended to W/U response message or as separate message)

2.2.5.5 Open and closed CPDLC messages

2.2.5.5.1 A CPDLC message is open if the aircraft or ground system has not yet received a required response.

2.2.5.5.2 A CPDLC message is closed if the aircraft or ground system either:

a) Does not require a response; or

b) Has already received a required response.

Note 1.— UM 1 STANDBY and UM 2 REQUEST DEFERRED responses do not close a downlink CPDLC message.

Note 2.— DM 2 STANDBY response does not close an uplink CPDLC message.

2.2.5.6 CPDLC dialogues

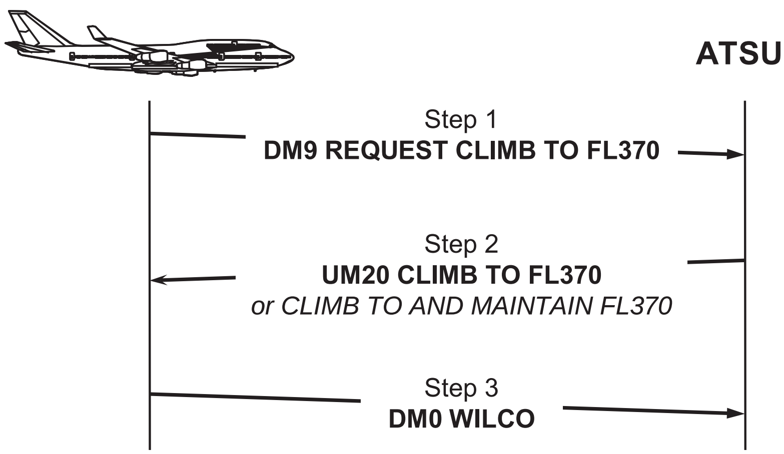
2.2.5.6.1 Messages that are related (e.g. a CPDLC downlink request, the corresponding CPDLC uplink clearance and the subsequent pilot response) constitute a CPDLC dialogue.

a) A CPDLC dialogue is open if any of the CPDLC messages in the dialogue are open;

b) A CPDLC dialogue is closed if all CPDLC messages in the dialogue are closed.

Note.— A dialogue can be technically closed, but still be operationally open. For example, when a DM 0 WILCO has been sent for a UM 129 REPORT MAINTAINING [level], the dialogue is technically closed, but not operationally closed until the ATSU receives the DM 37 MAINTAINING [level].

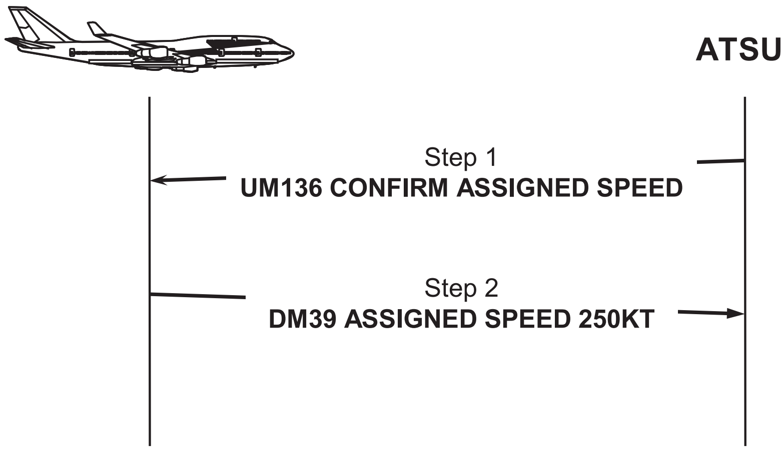
2.2.5.6.2 Figure 2-26 provides an example of the individual message and dialogue status for a CPDLC request and clearance exchange.



Step	CPDLC Message	Response Attribute	UM Status	DM Status	Dialogue Status
1	Downlink request	Y	N/A	Open	Open
2	Uplink response	W/U	Open	Closed	Open
3	Downlink response	N	Closed	Closed	Closed

Figure 2-26. Message/dialogue status for CPDLC request and clearance exchange

2.2.5.6.3 Figure 2-27 provides an example of the individual messages and dialogue status for a CPDLC confirmation request and report exchange.



Step	CPDLC Message	Response Attribute	UM Status	DM Status	Dialogue Status
1	Uplink request	**Y** *or* *NE*	**Open** *or* *Closed*	**N/A**	**Open** *or* *Closed*
2	Downlink response	N	Closed	Closed	Closed

Figure 2-27. Message/dialogue status for CPDLC confirmation request and report exchange

2.2.5.7 Message identification numbers (MIN)

2.2.5.7.1 For each CPDLC connection, the aircraft and ground systems assign every CPDLC uplink and downlink message an identifier, known as a message identification number (MIN). The MIN is an integer in the range 0 to 63 (inclusive). The ground system assigns the MIN for uplink messages, and the aircraft system assigns the MIN for downlink messages.

Note.— Some aircraft and ground systems assign MINs sequentially through the allowed range, while others re-assign MINs as soon as the dialogues using them have been closed. The numbers used as MINs by the ground and aircraft systems are entirely independent.

2.2.5.8 Message reference numbers (MRN)

2.2.5.8.1 The aircraft and ground systems assign a message reference number (MRN) to a CPDLC message when it is a response to another CPDLC message. The MRN of the response message is the same as the MIN of the corresponding CPDLC message in the dialogue.

2.2.5.8.2 The aircraft and ground systems associate corresponding CPDLC messages within a dialogue by their message identification numbers and message reference numbers.

2.2.5.8.3 This functionality ensures that the aircraft and ground systems associate a CPDLC response message with the correct CPDLC message in the dialogue.

2.2.5.8.4 Table 2-12 provides an example of a CPDLC dialogue to illustrate the way in which the aircraft and ground systems track the CPDLC messages using the MIN and MRN. In this example, the last MIN assigned by the aircraft system was 7 and by the ground system was 11.

Table 2-12. Example of CPDLC dialogue

CPDLC message	MIN	MRN	Comment
DM 6 REQUEST FL350	8		The aircraft system assigns a MIN of 8 to this message. The downlink request is open.
UM 1 STANDBY	12	8	The ground system assigns a MIN of 12 to this uplink. Because this uplink is a response to the downlink, the ground system assigns the MRN equal to the MIN of the downlink request (i.e. MRN = 8). UM 1 STANDBY is not a closure message. The status of the downlink request is open.
UM 20 **CLIMB TO FL350** or *CLIMB TO AND MAINTAIN FL350* UM 129 **REPORT MAINTAINING [level]** or *REPORT LEVEL FL350*	13	8	The ground system assigns a MIN of 13 to this uplink (i.e. the ground system increments the MIN of the previous uplink message by one). Because this uplink is a response to the downlink, the ground system assigns the MRN equal to the MIN of the downlink request (i.e. MRN = 8).
DM 0 WILCO	9	13	The aircraft system assigns a MIN of 9 to this downlink (i.e. the aircraft system increments the MIN of the previous downlink message by one). Because this downlink is a response to the uplink, the aircraft system assigns the MRN equal to the MIN of the uplink (i.e. MRN = 13). DM 0 WILCO is a closure message. The status of the uplink message is closed.
DM 37 **MAINTAINING FL350** or *LEVEL FL350*	10		The aircraft system assigns a MIN of 10 to this downlink (i.e. the aircraft system increments the MIN of the previous downlink message by one). The aircraft system does not assign an MRN because the associated uplink message has already been closed with the WILCO response. The ground system does not respond to this downlink message because it does not require a response.

2.2.6 Automatic dependent surveillance – contract (ADS-C)

2.2.6.1 ADS-C – general

2.2.6.2 ADS-C uses various systems on board the aircraft to automatically provide aircraft position, altitude, speed, intent and meteorological data, which can be sent in a report to an ATSU or AOC facility ground system for surveillance and route conformance monitoring.

2.2.6.2.1 One or more reports are generated in response to an ADS contract, which is requested by the ground system. An ADS contract identifies the types of information and the conditions under which reports are to be sent by the aircraft. Some types of information are included in every report, while other types are provided only if specified in the ADS contract request. The aircraft can also send unsolicited ADS-C emergency reports to any ATSU that has an ADS contract with the aircraft.

2.2.6.2.2 An ATSU system may request multiple simultaneous ADS contracts to a single aircraft, including one periodic and one event contract, which may be supplemented by any number of demand contracts. Up to five separate ground systems may request ADS contracts with a single aircraft.

Note.— Although the terms are similar, ADS-C and ADS-B are two different applications. In comparison, ADS-B (PSR, SSR or any comparable ground-based system that enables the identification of aircraft) is an ATS surveillance system. An ADS-B-capable aircraft supports ATS surveillance services and broadcasts information at a relatively high rate, and any appropriate receiver on the ground or in another aircraft within range can receive the information.

2.2.6.3 ADS contract

2.2.6.3.1 After receiving a logon request, the ATSU will need to establish ADS contract(s) with the aircraft before it can receive any ADS-C reports. There are three types of ADS contracts:

a) Periodic contract;

b) Demand contract; and

c) Event contract.

2.2.6.3.2 The ground system can establish ADS contracts without flight crew action provided that ADS-C in the aircraft system is not selected off. The flight crew has the ability to cancel all contracts by selecting ADS-C off and some aircraft systems allow the flight crew to cancel an ADS contract with a specific ATSU.

Note.— The ADS-C capability on the aircraft is normally not turned off per paragraph 5.5.1. ADS contracts are managed by ATSUs based on their surveillance requirements (refer to paragraph 4.5.2).

2.2.6.3.3 Periodic contract

2.2.6.3.3.1 A periodic contract allows an ATSU to specify:

a) The time interval at which the aircraft system sends an ADS-C report; and

b) The optional ADS-C groups that are to be included in the periodic report. Each optional group may have a unique modulus which defines how often the optional group is included with the periodic report (e.g. a modulus of five indicates that the optional group would be included with every fifth periodic report sent).

2.2.6.3.3.2 The range and resolution of the time interval parameter in the periodic contract allows for an interval to be specified between 1 second and 4,096 seconds (approximately 68 minutes). However, RTCA DO-258A/EUROCAE ED-100A limits the minimum interval to 64 seconds. If the ground system specifies a time interval less than 64 seconds, the aircraft system will respond with a non-compliance notification and establish a periodic contract with a 64-second reporting interval. If the ground system does not specify a time interval, the aircraft will establish a periodic contract of 64 seconds for emergency periodic reporting and 304 seconds for normal periodic reporting.

2.2.6.3.3.3 The ground system may permit the controller to alter the periodic reporting interval to allow for situations where the controller desires a longer or shorter reporting interval. The controller may select a shorter reporting interval to obtain more frequent surveillance information, for example, during an off-route deviation or an emergency.

Note.— The ANSP ensures that separation minima are applied in accordance with appropriate standards. The ground system may prevent the controller from selecting a periodic reporting interval that is longer than the maximum interval specified in the standard for the separation minima being applied.

2.2.6.3.3.4 An ATSU can establish only one periodic contract with an aircraft at any one time. A number of ATSUs can each establish their own periodic contract and specify their own conditions for the report with the same aircraft at the same time.

2.2.6.3.3.5 A periodic contract remains in place until it is either cancelled or modified. Whenever an ATSU establishes a new periodic contract, the aircraft system automatically replaces the previous periodic contract with the new one.

2.2.6.3.3.6 As shown in Figure 2-28, in response to a new ADS-C periodic contract, the aircraft:

a) Sends an acknowledgement; and

b) Sends the first periodic report of the new contract.

Note.— The contract acknowledgement and first ADS-C report may be transmitted in a single downlink message.

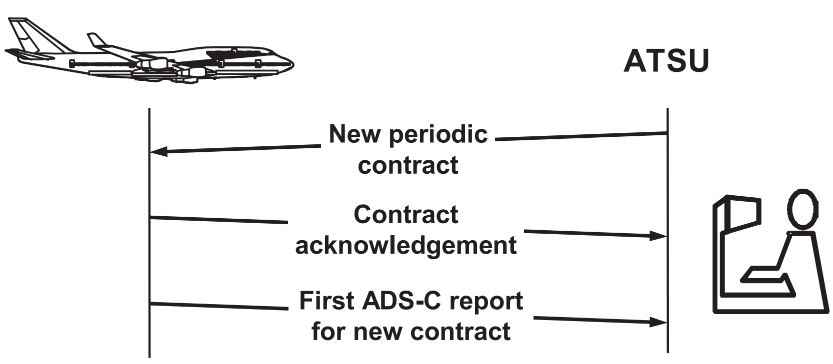


Figure 2-28. ADS-C periodic contract sequence

2.2.6.3.4 Demand contract

2.2.6.3.4.1 A demand contract allows an ATSU to request a single ADS-C periodic report. A demand contract does not cancel or modify any other ADS contracts that may be in effect with the aircraft.

2.2.6.3.5 ADS-C emergency reports

2.2.6.3.5.1 The ADS-C application also supports emergency alerting. An ADS-C emergency report is a periodic report that is tagged as an "emergency" report, allowing the emergency situation to be highlighted to ATC.

2.2.6.3.5.2 An ADS-C emergency can be triggered by the flight crew in a number of ways:

a) Manually, by selecting the ADS-C emergency function;

b) Indirectly, by triggering another type of emergency alerting system (e.g. transmission of a CPDLC position report or selection of an SSR emergency code); and

c) Covertly.

Note.— The availability of the above functionality may vary between aircraft types.

2.2.6.3.5.3 There have been reported instances of inadvertent ADS-C emergencies being transmitted. To check for inadvertent or covert activation of the ADS-C emergency function, refer to paragraph 4.8.3.3.

2.2.6.3.5.4 Once an ADS-C emergency has been triggered, under normal circumstances the avionics will continue to transmit ADS-C emergency periodic reports until the flight crew de-selects the ADS-C emergency function.

2.2.6.3.5.5 When this occurs, a "cancel ADS-C emergency" report is transmitted with the next ADS-C periodic report. Depending on the current ADS-C periodic reporting interval, this may be 20-30 minutes after the flight crew has actually cancelled the emergency, as shown in Figure 2-29.

2.2.6.3.5.6 To reduce the time interval between the flight crew cancelling the ADS-C emergency and the transmission of the "cancel ADS-C emergency" report, a recommended practice is to reduce the ADS-C reporting interval (refer to paragraph 4.8.2.5). This also provides enhanced situational awareness for an aircraft that is potentially in an emergency situation. Refer paragraph 4.5.4.

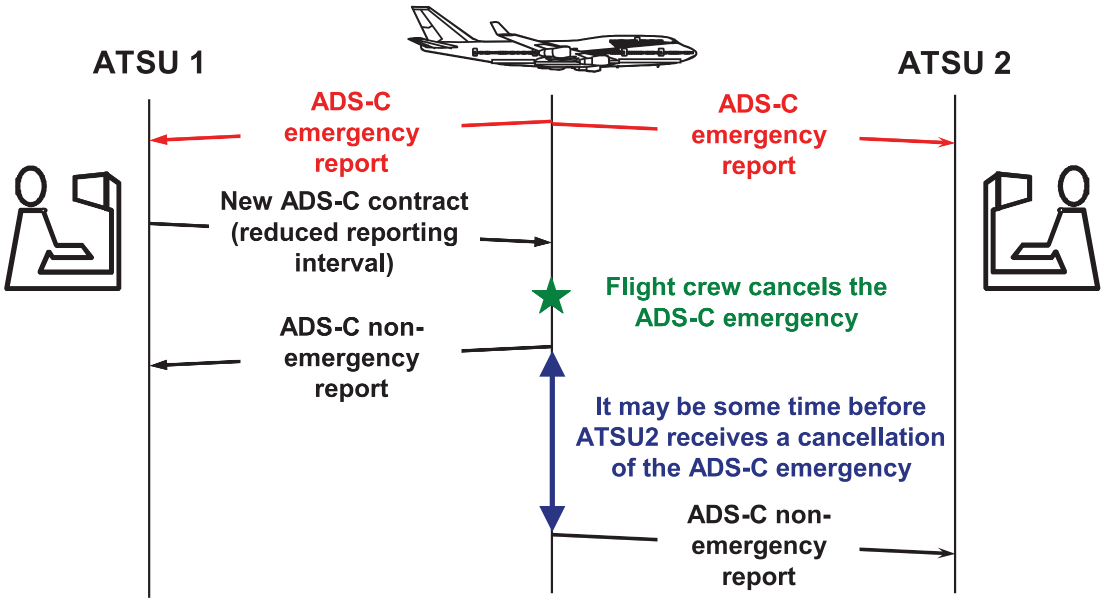


Figure 2-29. ADS-C emergency and non-emergency report sequence

2.2.6.3.6 Event contract

2.2.6.3.6.1 An event contract allows an ATSU to request an ADS-C report whenever a specific event occurs. An ATSU can establish only one event contract with an aircraft at any one time. However, the event contract can contain multiple event types. These types of optional events include:

a) Waypoint change event (WCE);

b) Level range deviation event (LRDE);

c) Lateral deviation event (LDE); and

d) Vertical rate change event (VRE).

2.2.6.3.6.2 As shown in Figure 2-30, in response to a new ADS-C event contract, the aircraft separately sends an acknowledgement and then an ADS-C report(s) is transmitted only after one of the specified events occurs.

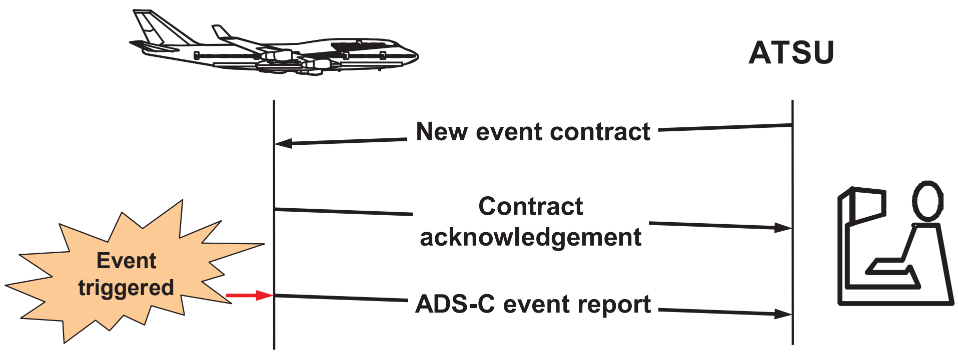


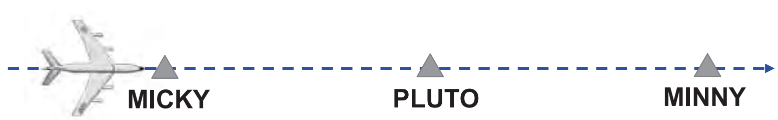
Figure 2-30. ADS-C event contract sequence

2.2.6.3.6.3 An event contract remains in effect until the ATSU cancels it or until the event(s) used to trigger the report occurs. The waypoint change event contract will trigger a report for all waypoint changes. All other event contracts will trigger a report on the first occurrence and then, if necessary, the ATSU will need to request a new event contract indicating all desired event types.

2.2.6.3.6.4 Waypoint change event (WCE)

2.2.6.3.6.4.1 The aircraft system sends a WCE report when a change occurs to the Next and/or Next + 1 waypoint (due to a flight plan change or waypoint sequence) in the FMS.

2.2.6.3.6.4.2 As shown in Figure 2-31, when the aircraft sequences MICKY, the Next and Next + 1 waypoints contained in the FMS change. This results in sending a WCE report to all ATSUs that have an event contract containing a WCE with this aircraft.



	Next	Next + 1
Before sequencing MICKY	MICKY	PLUTO
After sequencing MICKY	PLUTO	MINNY

Figure 2-31. ADS-C waypoint change event

2.2.6.3.6.4.3 Other events that may cause the aircraft system to send a WCE report include:

a) The flight crew executing a clearance direct to a waypoint (i.e. next waypoint is changed);

b) The flight crew inserting a waypoint ahead of the aircraft (resulting in a change to the Next or Next + 1 waypoint); and

c) The flight crew executing a lateral offset (resulting in a change to the Next waypoint).

2.2.6.3.6.4.4 A waypoint change event report contains the following ADS-C groups:

a) Basic group; and

b) Predicted route group.

2.2.6.3.6.5 Level range deviation event (LRDE)

2.2.6.3.6.5.1 The ATSU specifies the LRDE by defining the lower and upper limits of the level range.

2.2.6.3.6.5.2 For example, in Figure 2-32, the LRDE has been defined with a lower limit of FL368 and an upper limit of FL372.

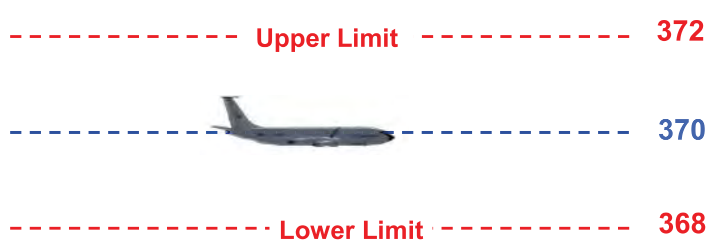


Figure 2-32. ADS-C level range deviation event

2.2.6.3.6.5.3 The aircraft system sends a LRDE report when the aircraft's flight level is outside the level range tolerances defined in the ADS-C event contract (Figure 2-33).

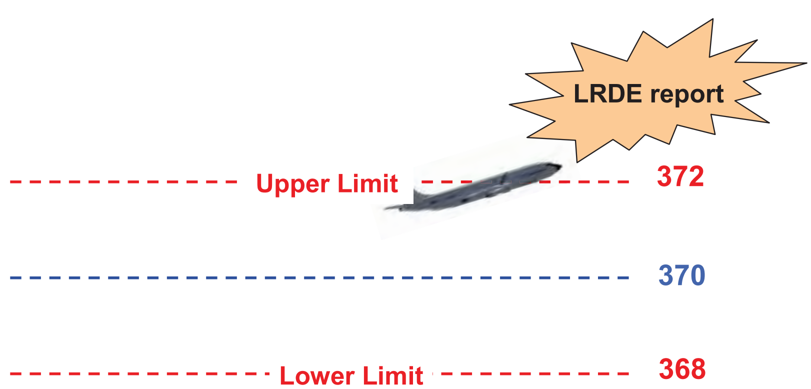


Figure 2-33. ADS-C level range deviation event report

2.2.6.3.6.5.4 Once an aircraft sends an LRDE report, it will not send another LRDE report until the ATSU establishes a new ADS-C LRDE contract.

2.2.6.3.6.5.5 An LRDE report contains the ADS-C basic group only.

2.2.6.3.6.6 Lateral deviation event

2.2.6.3.6.6.1 The ATSU specifies the lateral deviation event by defining a lateral deviation threshold, which is a maximum off-route distance either side of the route as specified by the ATSU. It is not possible to define different distances on each side of the route.

2.2.6.3.6.6.2 For example, in Figure 2-34, the lateral deviation event has been defined to be triggered for a lateral deviation threshold of greater than 5NM either side of the route.

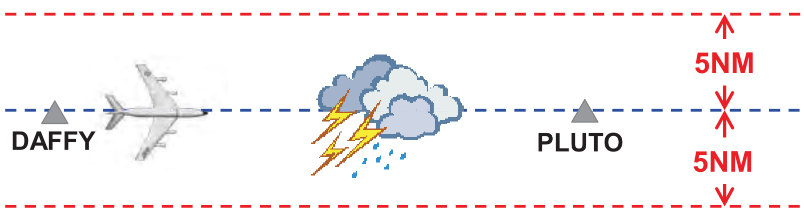


Figure 2-34. ADS-C lateral deviation event

2.2.6.3.6.6.3 The lateral deviation event is triggered when the lateral distance between the aircraft's actual position and its expected position, as defined in the aircraft active flight plan, exceeds the lateral deviation threshold defined in the ADS-C event contract (Figure 2-35).

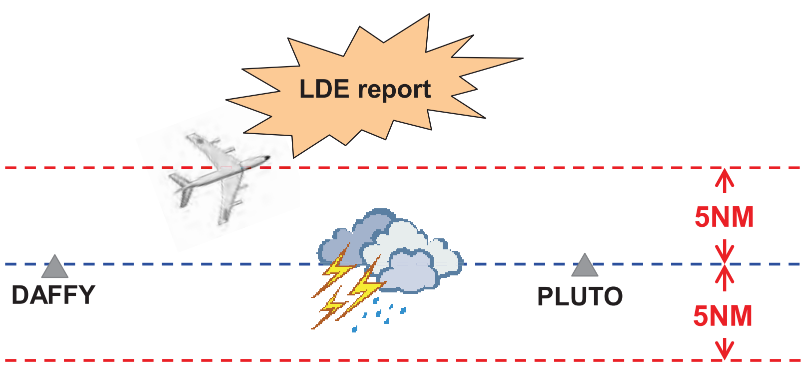


Figure 2-35. ADS-C lateral deviation event report

2.2.6.3.6.6.4 Under certain circumstances, such as when the flight crew activates an offset that is greater than the lateral deviation threshold, the aircraft may transmit a lateral deviation event report immediately while still on the cleared route. This should be interpreted as an early warning of an impending lateral deviation.

2.2.6.3.6.6.5 As shown in Figure 2-36, after the offset has been activated, the aircraft system compares the current position of the aircraft ① (on route) with the expected position of the aircraft on the offset route ②, and concludes that it is off route by the intervening distance. If this off-route distance exceeds the lateral deviation threshold, the aircraft will transmit a lateral deviation event report, containing the current position of the aircraft ①.

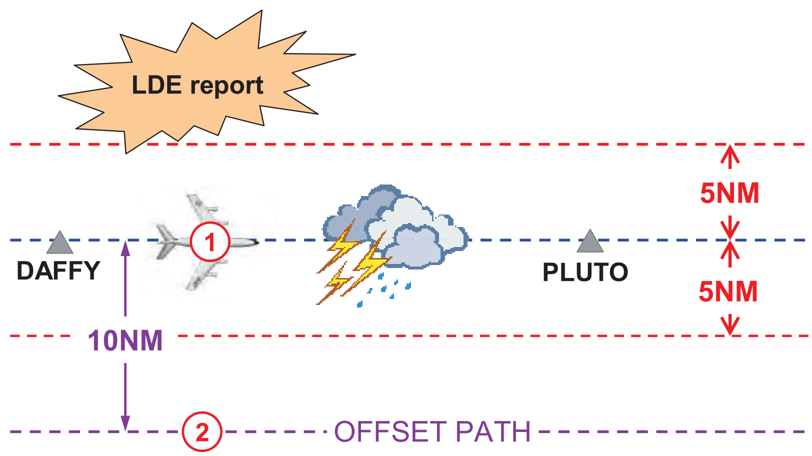


Figure 2-36. Effect of offset on ADS-C lateral deviation event report

2.2.6.3.6.6.6 As shown in Figure 2-37, LDE reports are based on deviations from the aircraft active flight plan. If the aircraft active flight plan is different to the flight plan held by the ATSU, and the aircraft remains within the lateral deviation threshold (as defined by the ADS contract) of the aircraft active flight plan, no lateral deviation event report will be triggered.

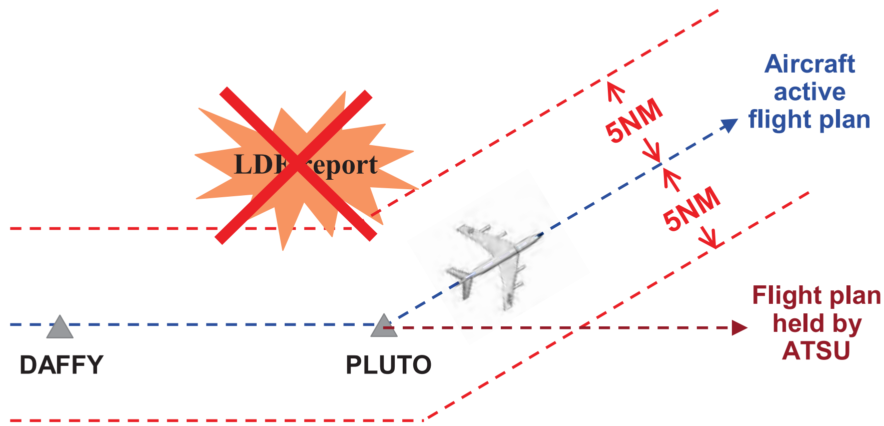


Figure 2-37. No lateral deviation event report if active route is different to route held by ATSU

2.2.6.3.6.6.7 Once an aircraft has downlinked a lateral deviation event report, no further deviations will trigger another report until the ATSU re-establishes an ADS-C event contract containing a lateral deviation event.

2.2.6.3.6.6.8 A lateral deviation event report contains the ADS-C basic group only.

2.2.6.3.6.7 Vertical rate change event (VRE)

2.2.6.3.6.7.1 The vertical rate change event is triggered in one of two ways:

a) Positive vertical rate: aircraft`s rate of climb is greater than the vertical rate threshold; or

b) Negative vertical rate: aircraft`s rate of descent is greater than the vertical rate threshold.

Note.— The vertical rate change event does not detect a reduction in either the climb or descent rate.

2.2.6.3.6.7.2 A vertical rate change event report contains the following ADS-C groups:

a) Basic group; and

b) Earth reference group.

2.2.6.3.7 Cancelling ADS contracts

2.2.6.3.7.1 Cancelling ADS contracts assists in:

a) Minimizing costs associated with unnecessary ADS-C reports;

b) Reducing congestion in the communication network; and

c) Ensuring that subsequent ATSUs can establish ADS contracts with the aircraft (there is a limit to the number of ADS-C connections that an aircraft can support).

2.2.6.3.7.2 The ATSU cancels an ADS contract and terminates the ADS-C connection when it no longer needs ADS-C reports to avoid unnecessary loading of the data link system. The ground system terminates the ADS-C connection when:

a) The aircraft has crossed the boundary and the transferring ATSU needs no further surveillance information from the flight;

b) The ATSU has cancelled or finished the flight plan for the aircraft; or

c) The controlling authority or an adjacent ATSU needs no further surveillance information from the flight.

2.2.6.3.7.3 The flight crew is able to terminate ADS-C connections, which in turn cancels ADS contracts. This capability is used in accordance with guidelines provided in paragraph 5.5.

2.2.6.4 ADS-C report

2.2.6.4.1 The aircraft system sends specific aircraft data in different groups of an ADS-C report. Each group contains different types of data. An ADS-C event report contains only some of the groups, which are fixed. The ADS-C periodic report can contain any of the ADS-C groups, which the ATSU specifies in the contract request.

2.2.6.4.2 ADS-C groups include:

a) Basic group (Figure 2-38);

b) Flight identification group (Figure 2-39);

c) Earth reference group (Figure 2-40);

d) Air reference group (Figure 2-41);

e) Airframe identification group (Figure 2-42);

f) Meteorological group (Figure 2-43);

g) Predicted route group (Figure 2-44);

h) Fixed projected intent group (Figure 2-45); and

i) Intermediate projected intent group (Figure 2-46).

2.2.6.4.3 At a minimum, all ADS-C reports contain the basic group.

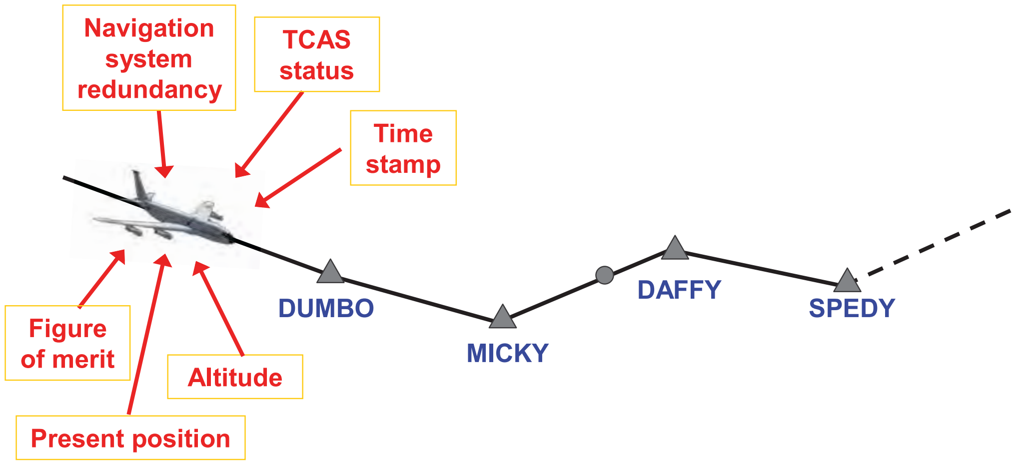


Figure 2-38. ADS-C basic group

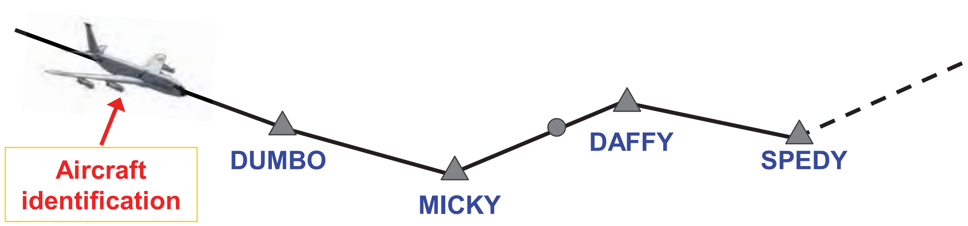


Figure 2-39. ADS-C flight identification group

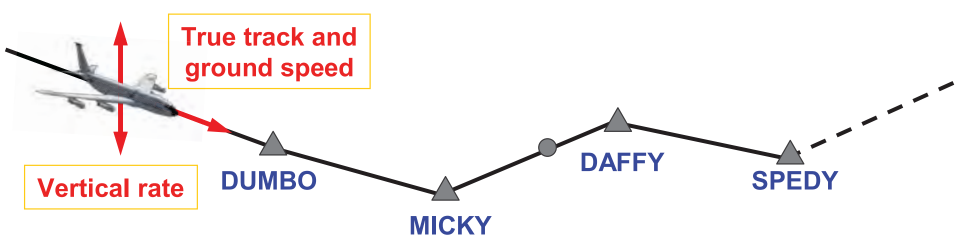


Figure 2-40. ADS-C Earth reference group

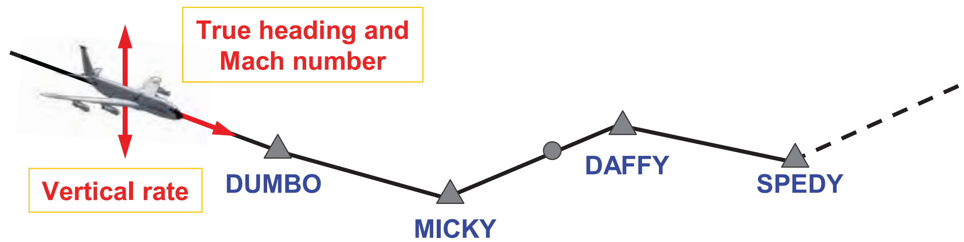


Figure 2-41. ADS-C air reference group

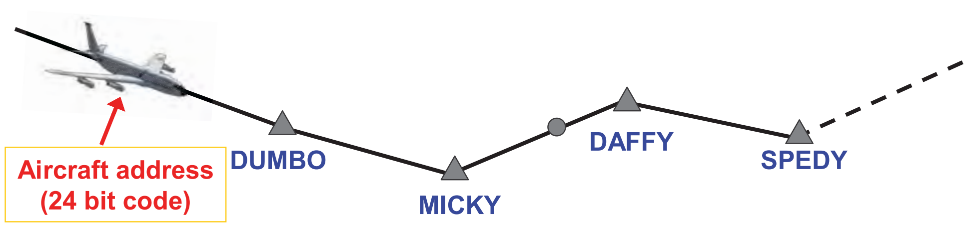


Figure 2-42. ADS-C airframe identification group

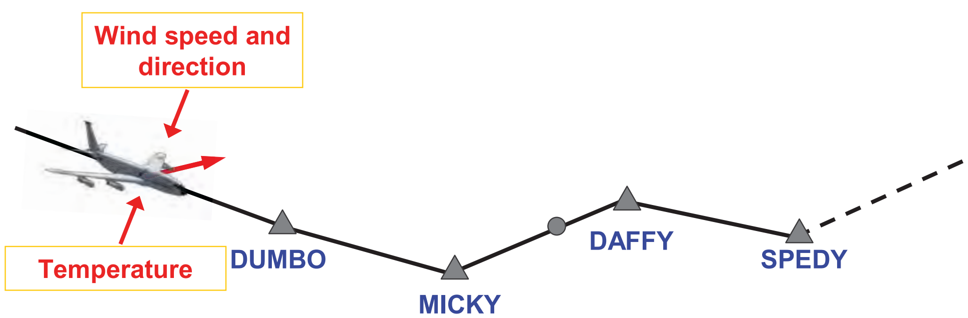


Figure 2-43. ADS-C meteorological group

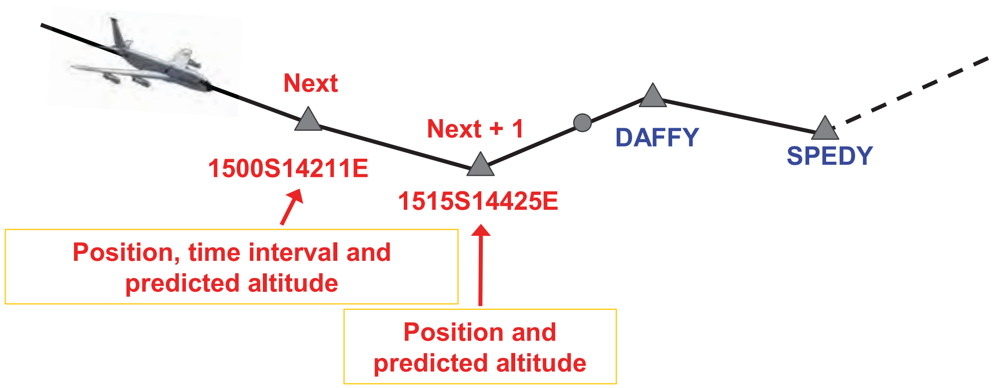


Figure 2-44. ADS-C predicted route group

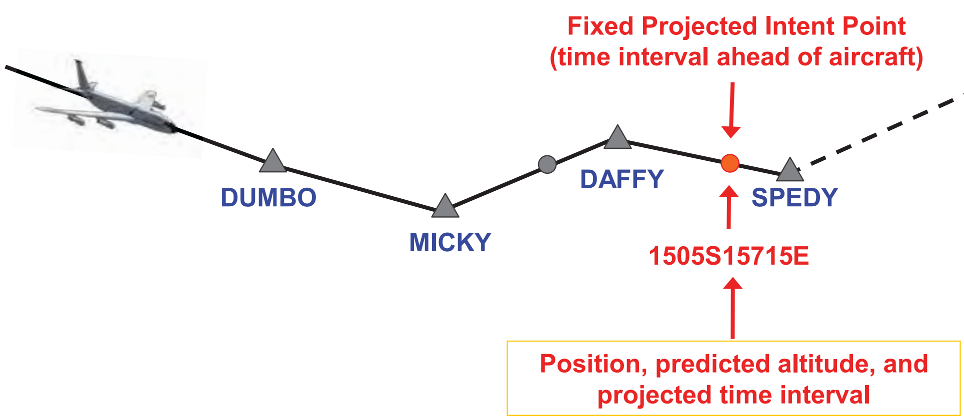


Figure 2-45. ADS-C fixed projected intent group

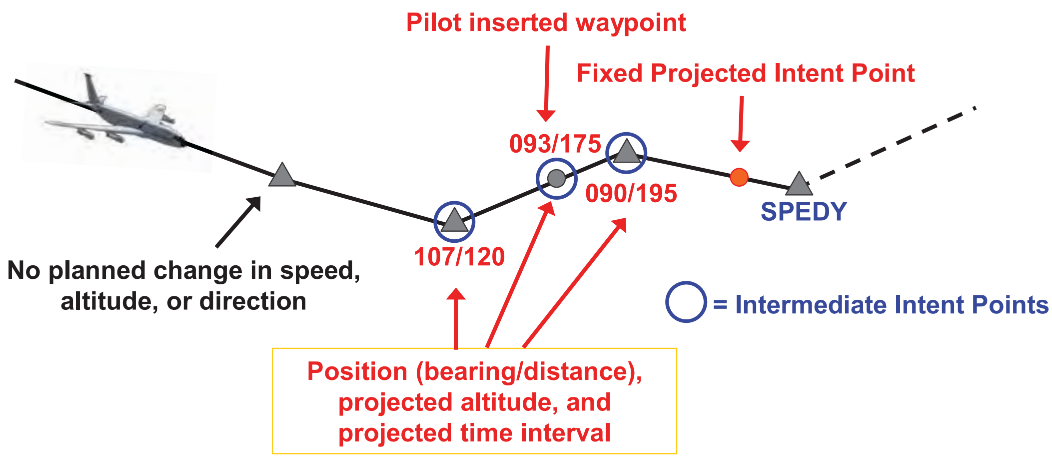


Figure 2-46. ADS-C intermediate projected intent group

2.2.6.5 Contents of ADS-C groups

2.2.6.5.1 The contents of the various ADS-C groups are depicted in the figures identified in paragraph 2.2.6.4.2.

Note 1.— Up to 10 points can be included in the intermediate projected intent group. For a point to qualify to be included in the intermediate projected intent group, the point needs to be:

a) between the current position and the fixed projected point; and

b) associated with a planned speed, altitude or route change.

Note 2.— The intermediate projected intent group may include a FMS generated point, for example, the top of descent (TOD) point (planned altitude change), which does not correspond to any waypoint in the flight plan.

2.2.6.5.2 The aircraft system defines the:

a) Present position (in the basic group) and Next and Next + 1 information (in the predicted route group and fixed projected intent group) as latitude/longitude; and

b) Positional information (in the intermediate projected intent group) as a bearing/distance from the present position in the basic group.

Note.— Positional information in an ADS-C report does not contain the name(s) of waypoints.

2.2.6.5.3 The time stamp is expressed in seconds past the last hour

2.2.6.5.4 Estimates are expressed as estimated time intervals (in seconds) from the time stamp at the present position in the basic group.

2.2.6.6 Using ADS-C reports

2.2.6.6.1 The ATSU may use an ADS-C report for a variety of purposes. These include:

a) Establishing and monitoring of traditional time-based separation minima;

b) Establishing and monitoring of distance-based separation standards;

c) Flagging waypoints as 'overflown';

d) Updating estimates for downstream waypoints;

e) Route and level conformance monitoring;

f) Updating the display of the ADS-C position symbol, and the associated extrapolation;

g) Generating (and clearing) alerts;

h) Generating (and clearing) ADS-C emergencies;

i) Updating meteorological information; and

j) Updating other information in the flight plan held by the ATSU.

2.2.6.6.2 Predicted route conformance

2.2.6.6.2.1 The ATSU may use information from the basic group, the intermediate projected intent group, the fixed projected intent group and the predicted route group for route conformance monitoring.

2.2.6.6.2.2 The ATSU can compare information from the predicted route group, the fixed projected intent group or intermediate projected intent group against the expected route in the flight plan to provide an indication to the controller when a discrepancy exists.

Note.— To prevent nuisance indications, route conformance monitoring may include tolerances, consistent with safety criteria, when comparing the reported data against the expected route (e.g. to accommodate 1 or 2 nm strategic lateral offset procedures).

2.2.6.6.2.3 A ground system supporting ATS or AOC can specify periodic and event contracts differently from other ground systems, such as:

a) Different ADS-C groups as shown in Figure 2-47;

b) Different periodic reporting interval as shown in Figure 2-48; and

c) Different types of event contracts as shown in Figure 2-49.

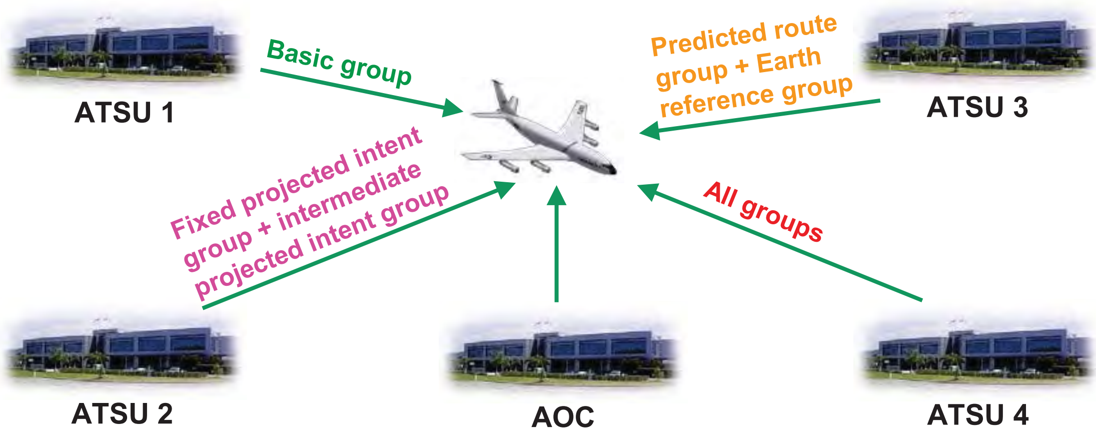


Figure 2-47. Multiple ADS periodic contracts with different groups

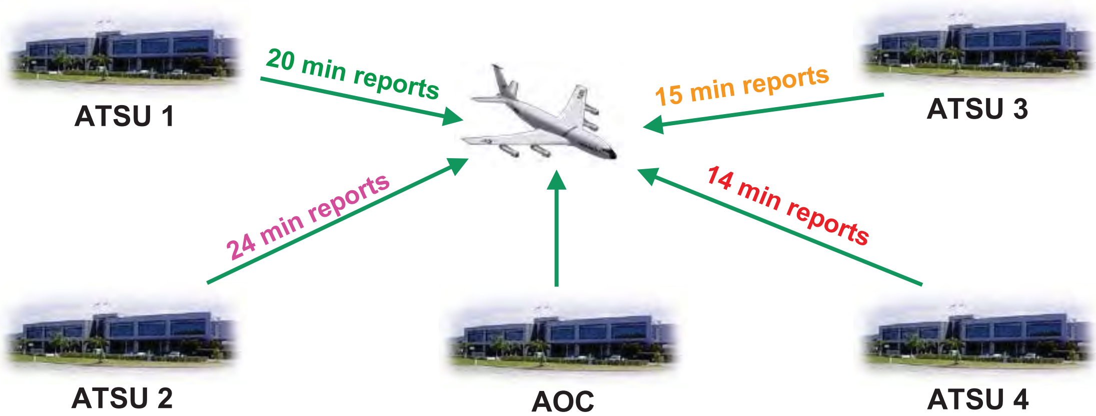


Figure 2-48. Multiple ADS periodic contracts with different reporting intervals

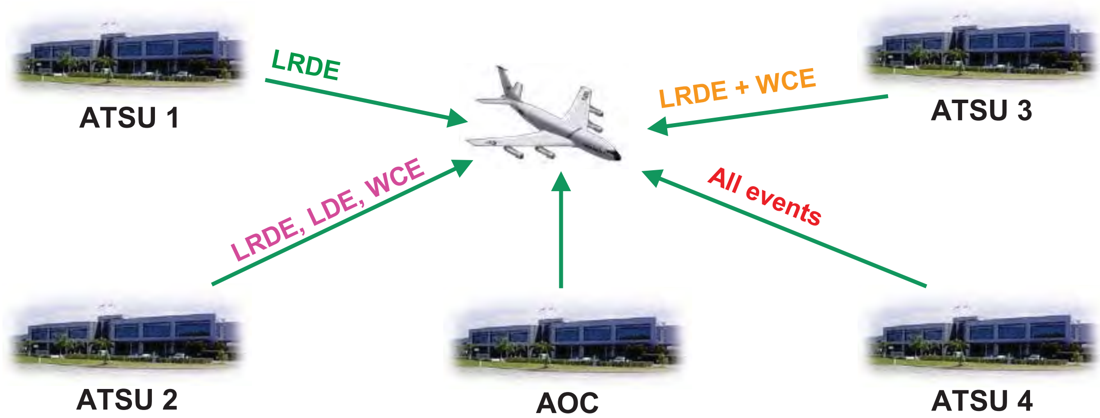


Figure 2-49. Multiple and different ADS event contracts

2.2.6.6.3 Level conformance

2.2.6.6.3.1 The ATSU may use level range deviation events (LRDE) to monitor an aircraft conformance with cleared level.

2.2.6.6.4 Generating emergency alerts

2.2.6.6.4.1 The ATSU may use the vertical rate change event (VRE) to assist in the provision of Alerting service. The VRE can be used in this context to provide an indication of an uncontrolled descent from cruise level where flight crew incapacity prevents activation of the ADS-C emergency.

Note.— A VRE of negative 5000 feet per minute (descent rate) is suggested as a suitable value.

2.2.6.6.5 Route conformance

2.2.6.6.5.1 The ATSU may use the lateral deviation event (LDE) to detect deviations from the aircraft active flight plan.

2.2.6.6.6 Updating other information in the flight plan.

2.2.6.6.6.1 The ATSU may use the Mach number in the air reference group to monitor conformance with filed flight plan speed and provide updates as required.

2.2.6.6.7 Figure of merit

2.2.6.6.7.1 The ADS-C basic report contains a figure of merit (FOM) that provides the navigational accuracy of position data in the basic report in accordance with Table 2-13.

Table 2-13. Figure of merit values

Figure of merit value	Accuracy of position	Remarks
0	Complete loss of navigational capabilities	Inability to determine position within 30 nautical miles is considered total loss of navigation. Includes the inability to associate a valid time with the position.
1	< 30 nm	Consistent with inertial navigation on long flight without updates.
2	< 15 nm	Consistent with inertial navigation on intermediate length flight without updates.
3	< 8 nm	Consistent with inertial navigation on short length flight and beyond 50 nautical miles from VOR.
4	< 4 nm	Consistent with VOR accuracies at 50 nautical miles or less and with GPS worldwide.
5	< 1 nm	Consistent with RHO-RHO applications of ground-based DME, RNAV using multiple DME or GPS position updates.
6	< 0.25 nm	Consistent with RNAV using GPS.
7	< 0.05 nm	Consistent with augmented GPS accuracies.

2.2.6.6.8 ADS-C reporting interval

2.2.6.6.8.1 While ADS-C reporting intervals are generally referred to in whole minutes, they are not actually defined that way in the ADS contract. The required ADS-C reporting interval is uplinked to the aircraft in one byte (eight bits) of data, in accordance with Figure 2-50.

<table>
<tr><td colspan="4">Reporting Interval = (1 + Rate) x SF, where</td></tr>
<tr><td>Rate</td><td colspan="3">is the value contained in bits one to six. These six bits allow a range of values between 0 and 63.</td></tr>
<tr><td rowspan="6">SF</td><td colspan="3">is the scaling factor in bits seven and eight where:</td></tr>
<tr><td>Bit 7</td><td>Bit 8</td><td>Definition</td></tr>
<tr><td>0</td><td>0</td><td>0 seconds, used for a Demand Contract Request</td></tr>
<tr><td>1</td><td>0</td><td>1 second</td></tr>
<tr><td>0</td><td>1</td><td>8 seconds</td></tr>
<tr><td>1</td><td>1</td><td>64 seconds</td></tr>
</table>

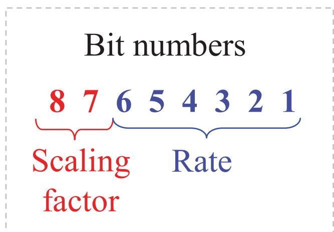


Figure 2-50. Calculation of ADS-C periodic reporting interval

2.2.6.6.8.2 For example, to establish a “40 minute” reporting interval, the SF would equal 64 seconds and the rate would equal 36. The actual reporting interval specified in the ADS contract would be 64 x (1 + 36) = 2368 seconds (39 minutes 28 seconds).

2.2.7 FMC WPR data link system

2.2.7.1 FMC WPR - general

2.2.7.1.1 An aircraft may be ACARS-capable, but not be CPDLC or ADS-C-capable. These aircraft can exchange data link messages with the operator’s aeronautical operational control (AOC) facility, but not with an ATSU.

2.2.7.1.2 The operator configures these aircraft to send ACARS position reports to their aeronautical operational control (AOC) facility for flight monitoring. Additional ground-based functionality can reformat the ACARS position report and forward it to an ATSU via AFTN as a replacement for voice position reports.

2.2.7.1.3 The method of delivery for the ACARS position report from an aircraft to an ATSU is referred to as flight management computer waypoint position reporting (FMC WPR).

2.2.7.1.4 FMC WPR provides the operator an alternative to FANS 1/A ADS-C position reporting, in cases where FANS 1/A equipage is impractical or cost prohibitive for the operator. FMC WPR is not intended to replace or delay FANS 1/A equipage.

2.2.7.2 Description

2.2.7.2.1 In some airspace, the aircraft sends the FMC waypoint position report to a central FMC waypoint reporting system (CFRS) or to the operator's AOC host computer. The CFRS or operator's AOC host computer converts the position report to a suitable format and delivers it via AFTN to appropriate ATSUs. A CFRS may also convert the report to standard AFTN format and deliver it to appropriate meteorological facilities to support weather forecasting.

Note.— Because there is no format defined, formats may vary slightly between ATSUs. The CFRS or AOC host computer should support different formats for different ATSUs.

2.2.7.2.2 Appendix E indicates which of the above two approaches each ATSU uses.

2.2.7.3 Position report - description

2.2.7.3.1 A logon request is not necessary to initiate FMC WPR.

2.2.7.3.2 An FMC WPR is a position report that:

a) Consists entirely of data entered automatically by the FMS;

b) Consists of data CRC protected by the FMS;

c) Consists of data formatted and populated in accordance with the ARINC 702A; and

d) Contains geographical coordinates in ICAO format (Refer to paragraph 5.6.1.2).

2.2.7.3.3 An FMC WPR can be initiated automatically or manually as prescribed by flight deck procedures (Refer to paragraphs 3.2, 3.4, and 5.6.4).

2.2.7.3.4 An operator participating in FMC WPR ensures that the FMC WPR:

a) Is generated at each ATC waypoint of a cleared route; and

b) Contains data only for an ATC waypoint.

Chapter 3. Administrative provisions related to data link operations

This chapter includes the prerequisites for data link operations, including service provision, operator eligibility, and flight planning.

3.1 ANSP service provision

3.1.1 ANSP system validation

3.1.1.1 The ANSP should ensure a validation process that confirms the integrity of their equipment and procedures meets system integrity requirements. This process should include:

a) A system safety assessment which demonstrates that the service provision meets the safety objectives. The ANSP should conduct a system safety assessment through a functional hazard analysis or a documented system safety case for initial implementation as well as for future enhancements. These assessments should include:

1) Identifying failure conditions;

2) Assigning levels of criticality;

3) Determining probabilities for occurrence; and

4) Identifying mitigating measures;

b) Integration test results confirming interoperability for operational use of the aircraft and ground systems; and

c) Confirmation that the ATS operation manuals are compatible with those of adjacent providers.

3.1.1.2 Following the safety assessment, the ANSP should institute measures through automation or procedures to mitigate the identified failure conditions. For example:

a) If the ANSP uses integrated measurement tools for the purpose of determining separation, they may need to publish limitations on the use of such tools for establishing and monitoring separation standards;

b) If an ANSP receives both an ADS-C and a CPDLC position report containing ETA that differ by 3 minutes or more, the controller should request confirmation of the estimate for the waypoint in question; and

c) To fulfill the requirements of Annex 10, paragraph 8.2.8, the controller should be provided with automation and/or procedures to ensure that the appropriate ATC unit has established an active CPDLC connection with the aircraft. Refer to Appendix E for the mitigating measures used for confirming CDA.

3.1.1.3 The ANSP should ensure that it provides communication services that meet the performance specifications provided at Appendix B and Appendix C, and that the contracted CSP meets its performance allocations. The risks represented by the requirements are regarded as being minimum for the specified ATS function to maintain operational efficiency while meeting its required safety needs.

3.1.1.4 If the ANSP uses free text messages, it should include an evaluation of the effects associated with the use of free text messages in operational and system safety assessments. When the intent/use of the free text message impacts seamless operations, the ANSP should globally coordinate the free text message to define the operational contents, format, and use as a new standardized free text message. The standardized free text messages are provided in Appendix A, paragraph A.5.

a) The results of an operational assessment may conclude that a free text message needs to be pre-formatted and readily available for the flight crew or the controller because it is too workload intensive to manually enter the message. Pre-formatted free text messages should only be selected from standardized free text messages, which are appropriate for the intended use.

b) When the ANSP establishes procedures that require the controller or flight crew to use a free text message element to mimic ICAO Doc 4444 standard message elements, the ANSP should apply the following criteria:

1) The ground system should apply any range, resolution, and units of measure restrictions prior to use of the message;

2) The ground system and aircraft system should provide a human interface for message composition and recognition of free text messages consistent with operational, safety, and performance requirements associated with use of the free text message;

3) The ATSU should not use free text to mimic an ICAO Doc 4444 message element with a W/U response attribute, unless the free text is combined with a standard message element with a W/U response attribute as part of a multi-element message (see paragraph 4.3.6); and

4) When a free text message (with a R response attribute) is used to mimic a message element with a Y response attribute, the ATSU should provide procedures and/or automation to ensure the appropriate operational response is received.

Note.— The ground system will technically close the uplink message when it receives the R response from the aircraft.

3.1.1.5 The ANSP should conduct trials with aircraft to ensure that the system meets the requirements for interoperability such as is defined for FANS 1/A in RTCA DO-258A/EUROCAE ED-100A. Refer to paragraph 2.1 for applicable interoperability standards for the different data link system.

3.1.1.6 The ANSP should develop appropriate procedures or other means to:

a) Respond to CPDLC downlink message elements defined in Appendix A (See paragraph 3.1.4.2 for publication of unsupported downlink messages);

b) Ensure that data are correct and accurate, including any changes, and that security of such data is not compromised;

c) Notify adjacent ATSUs of system failures, software upgrades (or downgrades) or other changes, which may impact them. Such notification procedures will normally be detailed in letters of agreement between adjacent units; and

d) Ensure that the ATSU only establishes an ADS contract with aircraft for which that ATSU has direct control or monitoring responsibility.

Note.— An ATSU may need to establish ADS contracts with aircraft operating in their area of responsibility for purposes other than direct control or monitoring (e.g. testing of ground system software before operational release).

3.1.1.7 The ANSP should ensure that its controllers receive appropriate training in accordance with ICAO Annex 1 and obtain any necessary approval from the State.

3.1.2 ATC automated data link functions

3.1.2.1 Logon request

3.1.2.1.1 To ensure that CPDLC messages are sent only to aircraft for which the ATSU has a flight plan, the ATSU should reject a logon request if:

a) There is no flight plan for the flight;

b) The flight plan does not contain the aircraft registration/address; or

c) The aircraft registration/address in the logon request message does not match the aircraft registration/address in the flight plan.

3.1.2.1.2 Hyphens or spaces contained in an aircraft registration are not valid characters in the ICAO flight plan and therefore are not present in the filed flight plan. The ground system should be configured to prevent the logon request being rejected due to hyphens or spaces being included in the aircraft registration sent in the logon request message, but not in the flight plan.

3.1.2.2 Transfers between FANS 1/A and ATN B1 adjacent ATSUs

3.1.2.2.1 To ensure transfers of CPDLC between FANS 1/A and ATN B1 areas, the ANSP should ensure its FANS 1/A and ATN B1 ATSUs comply with chapter 4 in ED-154A/DO-305A standard.

Note 1— Compliance with the full ED-154A/DO-305A standard is not required to support automatic CPDLC transfer. Only one particular requirement in chapter 4 applies to the T-ATSU:

a) FANS 1/A T-ATSU ground systems include, in the contact request message, a specific 7-character ACARS address based on the 4-character ICAO identifier of the ATN B1 R-ATSU combined with "ATN".

b) ATN B1 and FANS 1/A-ATN B1 T-ATSU ground systems include, in the contact request message, a specific ATN address as a binary string made of zeroes.

Note 2— When ED-154A/DO-305A chapter 4 applies for a given transition, the T-ATSU behavior is systematic whatever the aircraft type.

Note 3.— Table 3-1 identifies the different combinations of transfers that can occur between two different types of ground systems and specifies when ED-154A/DO-305A chapter 4 applies to the T-ATSU, in addition to the standards per Table 2-1.

Table 3-1. Supporting technology for transfers between FANS 1/A and ATN B1

T-ATSU technology	R-ATSU technology	Aircraft technology	Additional standards to support CPDLC transfer	Resulting technology with R-ATSU
FANS 1/A	FANS 1/A	FANS 1/A	None	FANS 1/A
		ATN B1	Not applicable	Voice

T-ATSU technology	**R-ATSU technology**	**Aircraft technology**	**Additional standards to support CPDLC transfer**	**Resulting technology with R-ATSU**
		FANS 1/A-ATN B1	None	FANS 1/A
FANS 1/A	FANS 1/A-ATN B1	FANS 1/A	ED154A/DO305A Chapter 4.2.2 (IR-208) for ground FANS 1/A T-ATSU	FANS 1/A
		ATN B1	Not supported	No CPDLC with T-ATSU. *Note.— ATN B1 may be used after a manual logon procedure is initiated.*
		FANS 1/A-ATN B1	ED154A/DO305A Chapter 4.2.2 (IR-208) for ground FANS 1/A T-ATSU	ATN B1 *Note.— Some aircraft (see Appendix F, paragraph F.1) implement both FANS 1/A and ATN B1 capabilities as separate systems and do not comply with ED154A/DO305A. For such aircraft, the transfer results in using FANS 1/A for the receiving ATSU.*
FANS 1/A	ATN B1	FANS 1/A	Not supported	Voice
		ATN B1	Not supported	No CPDLC with T-ATSU. *Note.— ATN B1 may be used after a manual logon procedure is initiated.*
		FANS 1/A-ATN B1	ED154A/DO305A Chapter 4.2.2 (IR-208) for ground FANS 1/A T-ATSU	ATN B1 *Note.— Some aircraft (see Appendix F, paragraph F.1) implement both FANS 1/A and ATN B1 capabilities as separate systems and do not comply with ED154A/DO305A. Such aircraft do not benefit from automatic transfer. ATN B1 may be used after a manual logon procedure is initiated.*
FANS 1/A-ATN B1	FANS 1/A	FANS 1/A	None	FANS 1/A
		ATN B1	Not supported	Voice
		FANS 1/A-ATN B1	ED154A/DO305A Chapter 4.3.2 (IR-213) for ground FANS 1/A-ATN B1 T-ATSU	FANS 1/A *Note.— Some aircraft (see Appendix F, paragraph F.1) implement FANS 1/A and ATN B1 capabilities as separate systems and do not comply with ED154A/DO305A. Such aircraft may be using FANS 1/A with T-ATSU. The transfer will succeed as a nominal FANS 1/A to FANS 1/A transfer.*

T-ATSU technology	**R-ATSU technology**	**Aircraft technology**	**Additional standards to support CPDLC transfer**	**Resulting technology with R-ATSU**
FANS 1/A-ATN B1	FANS 1/A-ATN B1	FANS 1/A	None	FANS 1/A
		ATN B1	None	ATN B1
		FANS 1/A-ATN B1	None	Same as with T-ATSU (ATN B1 or FANS 1/A)
FANS 1/A-ATN B1	ATN B1	FANS 1/A	Not supported	Voice
		ATN B1	None	ATN B1
		FANS 1/A-ATN B1	None	ATN B1 *Note.— Some aircraft (see Appendix F, paragraph F.1) implement FANS 1/A and ATN B1 capabilities as separate systems and do not comply with ED154A/DO305A. Such aircraft may be using FANS 1/A with T-ATSU and do not benefit from automatic transfer. ATN B1 may be used after a manual logon procedure is initiated.*
ATN B1	FANS 1/A	FANS 1/A	Not supported	No CPDLC with T-ATSU. *Note.— FANS 1/A may be used after manual logon procedure.*
		ATN B1	Not supported	Voice
		FANS 1/A-ATN B1	ED154A/DO305A Chapter 4.3.2 (IR-213) for ground ATN B1 T-ATSU	FANS 1/A *Note.— Some aircraft (see Appendix F, paragraph F.1) implement FANS 1/A and ATN B1 capabilities as separate systems and do not comply with ED154A/DO305A. Such aircraft do not benefit from automatic transfer. FANS 1/A may be used after a manual logon procedure is initiated.*
ATN B1	FANS 1/A-ATN B1	FANS 1/A	Not supported	No CPDLC with T-ATSU. *Note.— FANS 1/A may be used after manual logon procedure.*
		ATN B1	None	ATN B1
		FANS 1/A-ATN B1	None	ATN B1
ATN B1	ATN B1	FANS 1/A	Not supported	Voice
		ATN B1	None	ATN B1
		FANS 1/A-ATN B1	None	ATN B1

3.1.2.3 CPDLC and ADS-C connection management

3.1.2.3.1 To prevent the aircraft rejecting the CPDLC connection request message from the receiving ATSU, the CDA should ensure completion of the NDA process prior to initiating address forwarding to the next ATSU.

3.1.2.3.2 To avoid interruption of data link service, the ATSU should:

a) Initiate address forwarding at an agreed time prior to the estimated time at the boundary of a downstream unit; or

b) When short transit times preclude this, as soon as possible after becoming CDA. Confirmation of CDA status may be necessary to ensure that the NDA message, which needs to precede address forwarding, is not rejected by the aircraft (see paragraph 4.2.4).

3.1.2.3.3 If the ground system does not receive the contact complete message within a specified time (e.g. 15 minutes) from sending the contact request message, it should provide an indication to the controller. Refer to paragraph 4.2.2.3 for associated controller procedures.

3.1.2.3.4 If open uplink or downlink messages exist for the aircraft, the ground system should provide indication to the controller and confirm messages are closed prior to sending the CPDLC termination request message.

3.1.2.3.5 When a CPDLC connection cannot be established by any ATSU, the ground system should indicate to the controller at that ATSU that no connection has been established.

3.1.2.4 Emergency message element handling

3.1.2.4.1 The ground system should provide a clear indication to the controller of downlinked messages that contain any of the message elements from the emergency message elements (see Appendix A, paragraph A.4, for the list of emergency message elements.)

3.1.2.4.2 When the ground system receives an emergency-mode ADS-C report, it should present it to the controller. If a periodic contract is active, the emergency report will be transmitted at the existing periodic interval. Otherwise, the interval will default to a value determined by the aircraft system (see Appendix F, paragraph F.10). Only the flight crew can cancel the emergency mode (see paragraph 4.8.3 for associated controller procedures).

3.1.2.5 Automated responses

3.1.2.5.1 With the exception of UM 1 STANDBY or UM 2 REQUEST DEFERRED, the ground system should assign an MRN to only one uplink message in response to a particular downlink message. If the ground system sends two separate messages with the same MRN, and neither of the messages is UM 1 or UM 2, the aircraft system will discard the second message and not display it to the flight crew.

3.1.2.5.2 The ground system should only assign a MRN to an uplink message that is responding to a downlink message with the associated MIN and the downlink message requires a response. If the ATSU sends an uplink message with a MRN and the downlink message with the associated MIN did not require a response, the aircraft system will discard the uplink message and not display it to the flight crew.

Note.— If an uplink message is discarded for the reasons described in paragraph 3.1.2.5.1 or paragraph 3.1.2.5.2, the aircraft system will send an error message to the ground system indicating that the MRN was not recognized.

3.1.2.5.3 If a downlink message contains a message element that is not supported, then the ATSU should:

a) For a FANS 1/A ATSU, send CPDLC free text UM 169u MESSAGE NOT SUPPORTED BY THIS ATS UNIT rather than terminating the connection; or

b) For an ATN B1 ATSU, send UM 162 **MESSAGE NOT SUPPORTED BY THIS ATS UNIT** or *SERVICE UNAVAILABLE*.

Note.— For UM 162, some FANS 1/A aircraft may display SERVICE UNAVAILABLE, which may be confusing to the flight crew. An ATN B1 aircraft will display MESSAGE NOT SUPPORTED BY THIS ATS UNIT.

3.1.2.5.4 ATSUs may automate the sending of the CPDLC termination request message, based upon the estimated time or location the aircraft is expected to cross the boundary. Refer to paragraph 2.2.4 and paragraph 4.2 for the proper sequence and timing for sending the CPDLC termination request message and associated controller procedures. Refer to paragraph 3.1.4.8 for guidance on detailing the parameters for this operation in interfacility agreements.

3.1.2.6 Message latency monitor

3.1.2.6.1 An ATSU may implement automation to support use of a message latency monitor on the aircraft. The extent to which automation supports controller procedures that use the message latency monitor is a local matter.

3.1.2.6.2 The use of the message latency monitor, available on all ATN B1 aircraft and FANS 1/A+ aircraft, can provide the ANSP a means to mitigate the effects of a delayed CPDLC message that is delivered to the aircraft, and contributes to meeting the safety requirements for the ATSU and the aircraft. Refer to Appendix B for specific safety requirements associated with each RCP specification.

3.1.2.6.3 The ANSP should consider the effects of a delayed CPDLC message in accordance with paragraph 3.1.1.1 and identify mitigating measures.

Note 1.— A FANS 1/A ATSU or a FANS 1/A–ATN B1 ATSU, providing CPDLC services to FANS 1/A aircraft, does not use the message latency monitor. To mitigate the effects of a delayed CPDLC message, the ATSU may apply the following alternative mitigation measures:

a) Specify, in a contract or service agreement with the communication service provider, provisions that would preclude the delivery of a delayed CPDLC message to an aircraft; or

b) Perform the procedure from paragraph 4.3.1.2 a); or

c) For FANS 1/A–ATN B1 ATSU, perform the procedure from paragraph 4.3.1.2 c).

Note 2.— An ATN B1 ATSU or a FANS 1/A-ATN B1 ATSU that provides CPDLC services to ATN B1 aircraft may use the message latency monitor as mitigation against a delayed CPDLC message. The procedures are applicable only in the European Region and are described in Appendix E, paragraph E.4.3.2.

3.1.2.7 Abnormal cases with ADS-C

3.1.2.7.1 When more than one ADS-C report for the same waypoint (or position) are received, the ground system should update the flight data with the first report and provide an indication to the controller if there are significant discrepancies in subsequent reports.

3.1.2.7.2 When the time stamp in the basic group is determined to be invalid for the position in an ADS-C report, the ground system should not use it to update any flight data.

Note 1.— When the time stamp is invalid, the figure of merit (FOM) will be set to 0 and any value could be expected in the basic group.

Note 2.— The time stamp in a FANS 1/A ADS-C report is provided only as seconds past the last hour. Therefore, when an ADS-C report is received with a time stamp greater than the current ground system seconds past the hour, the time stamp in the report may be related to the previous hour (possibly even the previous day/month/year). The ground system may need to determine the full time stamp (i.e. including hours/day/month/year) for the ADS-C report when determining the validity of the time stamp with the associated position in the ADS-C report.

3.1.2.7.3 If the aircraft is in heading select mode and the aircraft passes abeam an ATC waypoint by more than a defined distance, the FMS will not sequence this or subsequent waypoints. Consequently, the aircraft will not send an ADS-C waypoint change event report. However, if the aircraft sends an ADS-C periodic report with a predicted route group, the NEXT waypoint data in the report will continue to indicate the waypoint that was passed. As a result, the ground system could use invalid data for display of the aircraft position or extrapolating the correct route for the aircraft. Refer to paragraph 5.6.1.1 for flight crew procedures.

Note.— When the aircraft is in heading select mode, the intent and predicted route information transmitted by the aircraft will contain the next waypoint in the aircraft active flight plan regardless of the actual position and heading of the aircraft. Predicted information is based on the FMS intent, which may not necessarily reflect the intentions of the flight crew.

3.1.2.8 Satcom channel numbers in CPDLC messages

3.1.2.8.1 The CPDLC standard provides a [Frequencysatchannel] variable that is intended for ATSUs to send satellite voice telephone numbers in MONITOR and CONTACT messages (UM 117 to UM 122). However, the decoding of this variable varies by aircraft type. Therefore, the ATSU should not use this variable in these messages unless the ground system can determine the appropriate decoding in use by the receiving aircraft and encode the uplink accordingly.

3.1.3 Contractual considerations for CSP

3.1.3.1 The CSP should meet the performance criteria for communication services, in accordance with Appendix B and Appendix C.

3.1.3.2 If an aircraft generated downlink message passes all validation criteria, the CSP should send an acknowledgement (ACK) to the aircraft and deliver the message to the address identified in the downlink message.

Note.— If the message is not delivered to the address identified in the downlink message, the CSP should not send an acknowledgement (ACK) to the aircraft.

3.1.3.3 For those situations when a CSP cannot continue to provide data communications, it should inform ANSPs and operators in accordance with established coordination procedures.

Note.— A CSP that holds a contract with an operator per paragraph 3.2.1.8 but not with the ANSP should notify the ANSP when such situations occur and that operator is conducting data link operations in the ANSP's airspace.

3.1.3.4 In the event of a centralized ADS-C (CADS) failure, the CSP for the CADS service should inform ATS.

3.1.3.5 In the event of a CFRS failure, the CSP for the CFRS service should inform ATS.

3.1.4 Aeronautical information, notifications, and interfacility agreements

3.1.4.1 The ANSP should notify operators of data link services using the AIP (or other appropriate publication). Notification includes:

a) The ICAO 4-letter location indicator assigned to the ATSU serving the airspace;

b) Logon address, The logon address should preferably match the 4-letter location indicator. The ANSP should ensure that the logon address for the ATSU serving the airspace is provided on the appropriate aeronautical charts (ICAO Annex 4);

c) Applications, including for each application; application name, version interoperability coverage, scheduled service, shutdowns, and information/alert bulletins;

d) Differences between national regulations and practices, and related ICAO SARPs and procedures;

e) Requirements for use, for example:

1) Procedures for initiation - When an ATSU is unable to accept a logon request sent between 15 and 25 minutes prior to either the ETD or the estimate for entering its airspace, the ANSP should publish in appropriate AIP (or other appropriate publication) the criteria for when a logon request will be accepted. Refer to paragraph 2.2.3.1.2;

2) ADS-C and CPDLC position reporting requirements;

Note.— The AIP may specify that ADS-C reports may fulfill all normal position reporting requirements. Refer to paragraph 5.6.3 for position reporting guidelines in an ADS-C environment.

3) Supporting reduced separations, re-routes, tailored arrival and associated RCP and/or RSP specification(s); and

4) Any required functionality, such as the message latency monitor provided by FANS 1/A+ aircraft (Refer to paragraph 3.1.2.6); and

f) Flight plan form and submission requirements.

3.1.4.2 The ANSP should support all downlink message elements as defined in Appendix A, unless the ANSP publishes the differences in the appropriate regional/State supplement along with procedures for handling unsupported message elements.

Note 1.— Emergency messages, as a minimum, are displayed to the controller per paragraph 3.1.2.4.

Note 2.— When a reduced CPDLC message set is used across a group of adjoining ATSUs, the ANSP(s) need to ensure that the reduced message set is common and adequate for the applicable airspace.

3.1.4.3 An ANSP may suspend ADS-C, FMC WPR and/or CPDLC use (including trials) for the control area under its jurisdiction. Notification to affected ATSUs should be carried out in accordance with coordination requirements specified in applicable interfacility agreements.

3.1.4.4 The ANSP should issue a timely NOTAM for scheduled and/or extended outages of the ADS-C or FMC WPR service and advise the operators to conduct position reporting via CPDLC or voice communications.

3.1.4.5 When an ANSP suspends CPDLC operations or when a planned system shutdown of the communications network or the ATS system occurs, the ANSP should publish a NOTAM to inform all affected parties of the shutdown period and advise operators to use voice communications during that time. The ANSP should ensure procedures are established for the ATSU to notify flight crews by voice or CPDLC of any imminent loss of CPDLC service.

3.1.4.6 In the event of an unexpected outage of ADS-C service, the ANSP should establish interfacility agreements with other ATSUs concerned and issue a NOTAM if required to inform affected parties.

3.1.4.7 In the event of an unexpected outage of CPDLC service, or if an ATSU suspends CPDLC operations without prior notice, the ANSP should:

a) Inform aircraft currently in communication with the ATSU of the loss of CPDLC service;

b) Inform other ATSUs concerned;

c) Specifically advise whether the outage also affects ADS-C service; and

d) Issue a NOTAM, if required.

3.1.4.8 When one or more ANSPs provide CPDLC service with adjoining ATSUs, the ANSP(s) should establish interfacility agreements to allow the uninterrupted transfer of the CPDLC connection. The interfacility agreements should include:

a) The time or location at which address forwarding occurs taking into consideration any automation requirements;

b) The time at which CPDLC termination request message is sent (see paragraph 3.1.2.5.4 regarding related ATC automation and paragraph 4.1.2 for associated ATC procedures) taking into consideration;

1) Sufficient time to allow the NDA (if established) to establish an active CPDLC connection prior to the aircraft crossing the common boundary; and

2) Sufficient time to prevent an inappropriate active CPDLC connection from continuing with an aircraft while it is transiting airspace where CPDLC is not available.

3.1.4.9 When an ATSU will only have control of a CPDLC-capable aircraft for a relatively short duration, the ANSP may establish procedures in appropriate interfacility agreements to coordinate the transfer of communications for the aircraft among the controlling and the affected ATSUs. Refer to paragraph 4.2.4.

3.1.4.10 The ANSP should establish interfacility agreements, as appropriate, to ensure that adjacent FIRs can establish ADS contracts to monitor aircraft in the vicinity of the common boundary.

3.1.4.11 When CPDLC is used to assign frequencies, the ANSP should establish the frequencies to be used by interfacility agreements.

3.1.4.12 If the message latency monitor described in paragraph 3.1.2.6 is used, the ANSP should establish interfacility agreements, as necessary, to ensure that its use or non-use is consistent with data link operations in airspace controlled by any of the adjacent ATSUs.

3.1.5 Monitoring and data recording

3.1.5.1 The CNS/ATM environment is an integrated system including physical systems (hardware, software, and communication network), human elements (the flight crew and the controller), and the related procedures.

3.1.5.2 The ANSP should establish end-to-end system monitoring in accordance with the guidelines provided in Appendix D. The guidelines aim to ensure end-to-end system integrity through post-implementation monitoring, identifying, reporting and tracking of problems, and corrective action.

Note.— The guidelines presented herein do not replace the ATS incident reporting standards and guidelines, as specified in ICAO Doc 4444, Appendix 4; ICAO Air Traffic Services Planning Manual (Doc 9426), Chapter 3; or applicable State regulations, affecting the parties directly involved in a potential ATS incident.

3.1.5.3 The ANSP and its CSP(s) should retain records for at least 30 days to allow for accident/incident investigation purposes. The ANSP and CSPs should make these records available for air safety investigative purposes on demand. These recordings should allow replaying of the situation and identifying the messages that the ATSU sent or received.

3.2 Operator eligibility

3.2.1 Operational authorization to use data link

3.2.1.1 An operator intending to use CPDLC or ADS-C service should obtain an operational authorization with the State of registry or State of the operator, if required, in accordance with their rules and means of compliance. This operational authorization should address flight crew training and qualification, maintenance, MEL, user modifiable software, service agreements with the CSP, and procedures for submitting problem reports and data to the regional/State monitoring agencies. The operator should also ensure that aircraft equipment has been approved for the intended use per interoperability standards (e.g. FANS 1/A or ATN B1), described in paragraph 2.1.2, performance specifications (e.g. RCP 240 or RCP 400), described in paragraph 2.1.3, and in accordance with airworthiness requirements and related means of compliance.

3.2.1.2 The operator is not required to obtain an operational authorization to use FMC WPR. However, the operator should ensure that the aircraft equipment has been approved by the State of

Registry or State of the Operator for FMC WPR (e.g. meets appropriate software assurance criteria). See paragraph 3.4 for additional guidance on operational use of FMC WPR.

3.2.1.3 The operator should establish policy and procedures for flight crews and operational staff involved in data link operations, and incorporate them in appropriate operations manuals. The operations manuals should include:

a) Procedures for use of the data link system specific to the aircraft type in accordance with operating manuals provided by the aircraft or system manufacturer;

Note.— See Appendix F, paragraph F.4, for aircraft-specific display of responses and acknowledgements to CPDLC messages and any constraints on processing these responses and acknowledgements.

b) Procedures for the data link operations taking into account the guidance provided in Chapter 5 and Chapter 6, as necessary;

c) Minimum equipment lists (MEL) modifications (if required); and

d) Flight crew and operational staff procedures, including procedures for establishing and maintaining voice communications (including any required SELCAL check(s)) with every ATSU along the route of flight.

3.2.1.4 The operator should ensure the flight crews and operational staff (e.g. dispatcher) receives appropriate training in accordance with Annex 1 and Annex 6 to the Convention on International Civil Aviation.

3.2.1.5 If applicable, the operator should ensure the operational staff is trained in data link operations. This training should include:

a) Description of the data link system, including applications, network and subnetworks;

b) Flight planning requirements for data link flights;

c) Implications of flights departing under minimum equipment list (MEL) relief; and

d) Implications of planned and unplanned network outages on data link operations.

3.2.1.6 From time to time aircraft manufacturers release new software which will often rectify in service issues and may add increased functionally. The operator should update their software as new releases become available to ensure best possible performance.

3.2.1.7 The operator should initially coordinate with its CSP(s) to initiate ground system configuration for its aircraft. In operations involving CFRS, to ensure FMC WPR downlinks are properly routed to the appropriate CFRS system(s), the operator should coordinate with their CSP(s) to configure for routing their FMC WPRs to the appropriate CFRS system(s).

3.2.1.8 The operator should ensure that their CSP(s) meets the performance criteria for communication services, in accordance with Appendix B and Appendix C, and notifies them and appropriate ANSPs when data communication services as prescribed for the intended operations cannot be provided.

3.2.1.9 The operator should ensure that flight operations, the flight crews and the appropriate ANSPs are notified of failures with the aircraft equipment or the operator's AOC system related to data link operations (such as when used to provide FMC WPR service to ANSPs).

3.2.1.10 The operator should provide flight operations and the flight crew with procedures, as appropriate, when the following occurs:

a) The operator is notified of data link system failures per paragraph 3.2.1.8; or

b) The AOC system or aircraft equipment fails such that the aircraft capability can no longer meet the performance specifications (Appendix B and Appendix C) prescribed for the intended operation.

3.2.1.11 The operator may be required to make special arrangements with an ATSU for the purposes of undertaking trials using ATC data link equipment.

3.2.2 Regional/State monitoring agencies

Note.— Guidelines on problem reporting and corrective action can be found at Appendix D. Contact information for the appropriate regional/State monitoring agency can be found at Appendix E.

3.2.2.1 The operator should indicate their intention to participate in data link operations by contacting the appropriate regional/State monitoring agency and providing the following information thirty days in advance:

a) Operator name;

b) Operator contact person; and

c) The appropriate 8-letter aeronautical fixed telecommunication network (AFTN) address(es) if the operator requires receipt of converted ADS-C waypoint change event reports or FMC waypoint position reports.

3.2.2.2 If any of the information provided in paragraph 3.2.2.1 changes, the operator should advise the appropriate regional/State monitoring agency.

3.2.2.3 The operator should establish procedures to report to the appropriate regional/State monitoring agency, as soon as practicable, any problems its flight crews and dispatchers have with data link operations.

Note.— Filing a report with regional/State monitoring agencies does not replace the ATS incident reporting procedures and requirements, as specified in ICAO Doc 4444, Appendix 4; ICAO Doc 9426, Chapter 3; or applicable State regulations affecting parties involved in a potential ATS incident.

3.3 Flight planning

3.3.1 General

3.3.1.1 When filing data link capability, the operator should ensure that the planned use of data link for the flight will be in accordance with regulations, policies and procedures applicable in individual

States and/or FIRs for the flight, as published in documents such as regional supplementary (SUPPs) procedures and AIPs (or other appropriate publications).

Note.— Refer to paragraph 3.2 for guidance on operator eligibility to participate CPDLC and ADS-C operations and paragraph 3.4 to participate in FMC WPR.

3.3.1.2 The operator should ensure that the proper information is included in the ICAO flight plan.

Note.— Refer to ICAO Doc 4444, Appendix 2, for flight plan requirements.

3.3.2 CPDLC and ADS-C

3.3.2.1 In Item 10 of the flight plan, the operator should insert one or more of the descriptors, as appropriate, listed in Table 3-2, to identify an aircraft's data link equipment and capabilities:

Table 3-2 Descriptors for CPDLC/ADS-C equipment and capabilities in Item 10

Item 10a - CPDLC equipment and capabilities	Descriptor
CPDLC ATN VDL Mode 2 (ATN B1)	J1
CPDLC FANS 1/A HFDL	J2
CPDLC FANS 1/A VDL Mode 0/A	J3
CPDLC FANS 1/A VDL Mode 2	J4
CPDLC FANS 1/A SATCOM (INMARSAT)	J5
CPDLC FANS 1/A SATCOM (MTSAT)	J6
CPDLC FANS 1/A SATCOM (Iridium)	J7
RCP 400	P1
RCP 240	P2

Item 10b – ADS-C equipment and capabilities	Descriptor
ADS-C with FANS 1/A capabilities	D1
ADS-C with ATN capabilities	G1

3.3.2.2 In Item 18 of the flight plan, the operator should insert the following other information relevant to CPDLC and ADS-C equipment and capabilities:

a) The indicator REG/ followed by the aircraft registration;

b) The indicator CODE/ followed by the aircraft address expressed in the form of an alphanumerical code of six hexadecimal characters; and

c) The indicator SUR/ followed by RSP400 or RSP180, as appropriate.

Note 1.— The ATSU compares information contained in the flight plan, which may also include aircraft identification (item 7), departure aerodrome (item 13) and destination aerodrome (item 16) with the information contained in the logon request message prior to accepting the logon request (paragraph 2.2.3.2 refers).

Note 2.— The hyphen is not a valid character to include in a flight plan. Any hyphen that may be contained in the aircraft registration needs to be omitted when including the aircraft registration in the flight plan.

3.3.3 FMC WPR

3.3.3.1 In Item 10a of the flight plan, the operator should insert the "E1" descriptor, to identify an aircraft's FMC WPR capability.

Note.— The aircraft identification (ACID) provided in the FMC WPR is correlated with the ID provided in the filed flight plan and will be rejected if they do not match.

3.4 FMC WPR – additional guidance

3.4.1.1 In addition to the guidelines provided in paragraph 3.2, an operator who intends to participate in FMC WPR data link operations should advise participating ANSPs of the following information at least thirty days in advance:

a) Whether the FMC WPRs will be manually triggered by the flight crew or be fully automated;

b) That the necessary coordination has taken place with the CSP, in operations involving a CFRS; and

c) The aircraft type(s) and associated aircraft registration(s) of aircraft, in operations involving a CFRS, since CFRS reports can only be received from aircraft whose aircraft registration is known to the system.

3.4.1.2 The participating operator should demonstrate to the appropriate planning and implementation regional group (PIRG) that they meet the RSP specifications (see Appendix C) for the provision of FMC WPRs for ATS purposes. Once this has been demonstrated, the operator will be able to participate in FMC WPR operations. Utilizing FMC WPR will be at the discretion of the operator.

3.4.1.3 An operator participating in FMC WPR should ensure that:

a) The FMC WPR is generated at each ATC waypoint of a cleared route in airspace where FMC WPR is available;

b) Any waypoint uplinked to the FMS for the purposes of generating automatically initiated FMC WPRs is an ATC waypoint; and

c) The FMC WPR contains the data elements that are required for ATC, per ICAO Doc 4444.

3.4.1.4 The operator should use numeric characters in the flight identification portion (e.g. ABC123) of the aircraft identification. When use of alphabetic characters (e.g. ABC123A) in the flight identification is unavoidable, the operator should ensure the flight crew provides position reports by voice.

Note.— Per ARINC 618, the flight identifier in the ACARS downlink message consists of a two character airline identifier and a four character flight number field. Aircraft identifications such as ABC124A (flight identification 124A) or ABC324W (flight identification 324W) cannot be encoded in the ACARS message, therefore making FMC WPR for these flights unavailable.

3.4.1.5 Early versions of Airbus software are prone to large errors in position data. Operators should ensure they have updated software before using FMC WPR.

Chapter 4. Controller and radio operator procedures

4.1 Overview

4.1.1 General

4.1.1.1 This chapter provides guidance on procedures and recommended practices for the controller and the radio operator in airspace where data link services are available.

4.1.1.2 This information is intended to assist in the development of:

a) Local procedures and associated documentation; and

b) Appropriate training programs.

4.1.1.3 Controllers should be knowledgeable in the ATC automation. Refer to paragraph 3.1.2 for guidelines for implementation of ground systems supporting data link operations.

4.1.1.4 Controllers should be knowledgeable in data link operations. Refer to Chapter 2 for an overview of data link operations.

4.1.1.5 Radio operator procedures specific to data link operations can be found in paragraphs 4.9 and 4.9.3.

4.1.2 When to use voice and when to use CPDLC

4.1.2.1 When communicating with an aircraft that is operating within airspace beyond the range of DCPC VHF voice communication, CPDLC is available and local ATC procedures do not state otherwise, the controller should normally choose CPDLC as the means of communication. The controller would use voice as an alternative means of communication (e.g. VHF, HF or SATVOICE direct or via a radio operator). However, in any case, the controller will determine the appropriate communication medium to use at any given time.

4.1.2.2 In airspace where both DCPC VHF voice and CPDLC communication services are provided, and local ATC procedures do not state otherwise, the controller will determine the appropriate communication medium to use at any given time.

Note.— ICAO Doc 4444, paragraph 8.3.2, requires that DCPC be established prior to the provision of ATS surveillance services, unless special circumstances, such as emergencies, dictate otherwise. This does not prevent the use of CPDLC for ATC communications, voice being immediately available for intervention and to address non-routine and time critical situations.

4.1.2.3 To minimize pilot head down time and potential distractions during critical phases of flight, the controller should use voice to communicate with aircraft operating below 10,000 ft AGL.

4.1.2.4 While the CPDLC message set, as defined in Appendix A, generally provides message elements for common ATC communications, the controller may determine voice to be a more appropriate means depending on the circumstances (e.g. some types of non-routine communications).

Note 1.— Refer to paragraph 4.8 and paragraph 4.9 for guidelines on use of voice and data communications in emergency and non-routine situations, respectively.

Note 2.— During an emergency, the flight crew would normally revert to voice communications. However, the flight crew may use CPDLC for emergency communications depending on the situation. Refer to paragraph 5.8.1 for flight crew procedures on use of voice and data communications in emergency situations.

4.1.2.5 The controller should respond to a CPDLC message via CPDLC, and should respond to a voice message via voice.

4.1.2.6 If a conflicting CPDLC and voice communication is received, the controller should obtain clarification using voice.

4.2 CPDLC connection management and voice communication transfers

4.2.1 General

4.2.1.1 The ATSU should manage its CPDLC connections, including initiating, transferring and terminating the connection when no longer needed.

Note.— The controlling ATSU coordinates with the next ATSU, establishing clearly when or where the address forwarding will have to occur.

4.2.1.2 An ATSU may have an active connection with an aircraft not in that ATSU's airspace. Some examples are:

a) When the aircraft is within a non-CPDLC service area and the flight crew initiates a logon to the next controlling ATSU which is a CPDLC service area;

b) During the CPDLC connection transfer process;

c) Where the active connection is retained by the transferring ATSU subject to prior coordination; or

d) In emergency circumstances.

4.2.1.3 Regardless of its connection status, an ATSU should never issue a clearance or instruction to an aircraft outside its control area unless it has been coordinated with the ATSU in whose airspace the aircraft is operating.

4.2.1.4 The ATSU should conduct any transfer of the CPDLC connection, or termination when the aircraft leaves CPDLC airspace, in conjunction with an instruction (CONTACT or MONITOR) identifying the appropriate ATSU for further communication.

4.2.2 Establish CPDLC connection

Note.— See paragraph 2.2.4 for a description of CPDLC connection management.

4.2.2.1 The first ATSU should establish a CPDLC connection if no previous CPDLC connection exists with the aircraft.

4.2.2.2 The next ATSU should establish a CPDLC connection prior to the CDA terminating the active CPDLC connection.

4.2.2.3 An ATSU should confirm that its CPDLC connection is active as soon as practicable after the controller has assumed control of the aircraft, using one of the following methods:

a) For FANS 1/A, receipt of a DM 3 ROGER in response to UM 169 [free text];

b) For FANS 1/A, receipt of a DM 48 POSITION REPORT [position report], either initiated by the flight crew or in response to UM 147 REQUEST POSITION REPORT; or

c) For ATN B1, receipt of a DM 99 CURRENT DATA AUTHORITY message; or

Note 1.— If the receiving ATSU has not confirmed its CPDLC connection as being active, the receipt of any response to an uplink (other than DM 63 NOT CURRENT DATA AUTHORITY), or any unsolicited downlink message, will confirm that the connection is active.

Note 2.— Refer Appendix E for regional/State differences.

4.2.3 Transfer voice communications with CPDLC connection transfer

4.2.3.1 When using CPDLC to effect voice communications transfers, the CDA should complete the voice frequency change process with the CPDLC connection transfer, as shown in Figure 4-1, using the CONTACT/MONITOR message elements (UM 117 through UM 122):

a) If the frequency change is to be made immediately, sending UM 117 CONTACT [unit name] [frequency] or UM 120 MONITOR [unit name] [frequency] and then, as soon as possible after the receipt of the DM 0 WILCO response to the CONTACT or MONITOR message, terminate the CPDLC connection; or

Note.— For ATN B1, the termination request message is sent as a multi-element message that includes UM 117 or UM 120.,while the termination confirmation is sent as a multi-element message that includes the WILCO response. Refer to paragraph 2.2.4.8.3 for CPDLC termination.

b) If the frequency change is to be made at some time or position in the future, such as at the boundary, sending UM 118 or UM 119 AT [position/time] CONTACT [unit name] [frequency] or UM 121 or UM 122 AT [position/time] MONITOR [unit name] [frequency] and then, after the receipt of the DM 0 WILCO response, terminate the CPDLC connection in accordance with interfacility agreements (See paragraph 3.1.4.8).

4.2.3.2 When using the (UM 117 through UM 122) CONTACT/MONITOR message elements, the CDA should use the facility name for the [unit name] parameter.

Note.— See Appendix F, paragraph F.9 for aircraft that do not support a <space> within the [unit name] parameter.

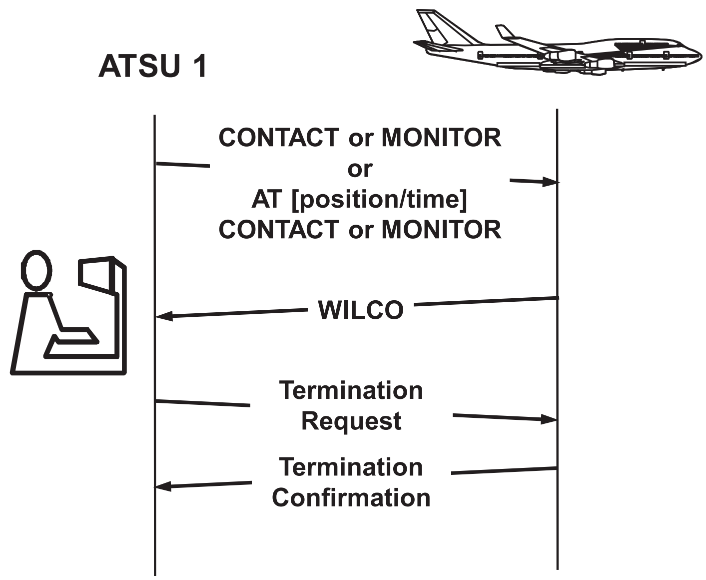


Figure 4-1. CPDLC connection transfer - separate messages

4.2.3.3 Since the CONTACT/MONITOR message elements listed in Table 4-1 include only one [frequency] parameter, the controller should only use these message elements when instructing the flight crew to change the primary frequency. In areas of poor radio coverage, the controller may append CPDLC free text UM 169o SECONDARY FREQUENCY [frequency] to specify a secondary frequency.

Table 4-1. CONTACT/MONITOR message elements

Ref #	Message element
UM 117	CONTACT [unit name] [frequency]
UM 118	AT [position] CONTACT [unit name] [frequency]
UM 119	AT [time] CONTACT [unit name] [frequency]
UM 120	MONITOR [unit name] [frequency]
UM 121	AT [position] MONITOR [unit name] [frequency]
UM 122	AT [time] MONITOR [unit name] [frequency]

4.2.3.4 In the FANS 1/A CPDLC message set, the option of RADIO per ICAO Annex 10, Volume II, paragraph 5.2.1.7.1.2 is not a possible value for the [unit name] parameter used in CONTACT and MONITOR messages. In the absence of this option, some ANSPs use CENTER to apply to an aeronautical station (RADIO). Other ANSPs use CPDLC free text to mimic the MONITOR/CONTACT instructions and indicate the facility name followed by RADIO.

4.2.4 Termination of the CPDLC connection

4.2.4.1 Normally, the transferring ATSU should terminate the CPDLC connection prior to the aircraft crossing a common boundary with the next ATSU. If for operational reasons the transferring ATSU needs to delay the transfer until after the aircraft has passed the transfer point, the controller should coordinate the transfer with the downstream ATSU and then notify the flight crew of the intended delay using CPDLC free text UM 169l EXPECT CPDLC TRANSFER AT [time/position] or equivalent voice phraseology.

Note.— A termination request message is used to terminate a CPDLC connection (paragraph 2.2.4.4 refers). The controller may also initiate CPDLC termination via voice communication with the flight crew.

4.2.4.2 The transferring ATSU should avoid terminating any CPDLC connection with open dialogues. In cases where it is necessary, then prior to terminating the CPDLC connection, the transferring ATSU should either:

a) Advise the flight crew using CPDLC free text UM 169j CHECK AND RESPOND TO OPEN CPDLC MESSAGES or equivalent voice phraseology; or

b) Coordinate with the receiving ATSU, as necessary, any CPDLC messages that were still open after terminating the CPDLC connection.

Note.— Upon termination of the CPDLC connection, the open uplink CPDLC messages are technically closed at the transferring ATSU and the aircraft.

4.2.4.3 Before terminating the CPDLC connection, the transferring ATSU should respond to open CPDLC downlink messages.

Note.— For an ATN B1 ground or aircraft system, an open downlink message is closed upon receipt of the uplink response UM 0 UNABLE or UM 237 REQUEST AGAIN WITH NEXT UNIT.

4.2.4.4 If the controller receives an indication that the CPDLC termination was unsuccessful, the controller may attempt to resend the termination request message. If the termination is still unsuccessful, the controller should instruct the flight crew to terminate the CPDLC connection and initiate a logon to the next unit. The controller should use the CPDLC free text UM 169am or UM 183am AUTOMATIC TRANSFER OF CPDLC FAILED. WHEN ENTERING [unit name] AREA DISCONNECT CPDLC THEN LOGON TO [facility designation] or equivalent voice phraseology.

Note 1.— The [unit name] is expressed as the radiotelephony name, not the 4-character code. The [facility designation] is the four character ICAO code.

Note 2.— Instructing the flight crew to DISCONNECT CPDLC will result in loss of CPDLC connectivity. This procedure should only be applied approaching the boundary with the next ATSU.

4.2.5 CPDLC connection with aircraft transiting small data link area

4.2.5.1 Unless otherwise agreed in inter-facility agreements, the current ATSU should complete the process for establishing a CPDLC connection and for communication transfer to the next ATSU, even though the transit time through the current airspace and/or the next airspace may be very short.

Note.— CPDLC connection transfer failures can be caused by controllers or systems not completing the establishment of a CPDLC connection and/or the connection transfer during a short transit time through an ATSU's airspace.

4.2.5.2 As a consequence, even though the short transit period through an ATSU's airspace is not adequate to complete the communication transfer before the aircraft leaves the airspace, the current ATSU should ensure that all messages are sent in the proper sequence at the correct time to successfully establish a CPDLC connection and transfer the connection to the next ATSU (e.g. NDA, address forwarding, MONITOR/CONTACT, and termination request message) and manually intervene, if necessary.

Note 1.— The transferring ATSU will need to be the CDA before any of these messages can be sent successfully. For example, if the transferring ATSU tries to send the NDA message prior to becoming the CDA to account for a short transit time, the aircraft system will reject the NDA. As a result, the communication transfer may not be completed until the aircraft has traveled a significant distance into the receiving ATSU's airspace.

Note 2.— In areas where short-term transfers are common, facilities may establish agreements, per paragraph 3.1.4.9, to facilitate improved connection transfers. In some instances, an advantage may be gained by skipping the CPDLC connection to an ATSU (ATSU 2 in the Figure 4-2) where a short transit occurs and transferring the NDA to the next downstream ATSU (ATSU 3)

4.2.5.3 As shown in Figure 4-2, if ATSU 2 requires ADS contracts to monitor the transit of the aircraft across its area of responsibility, but the transfer of communications is not required, then ATSU 1 should send the NDA message specifying ATSU 3 as the NDA. In this case, a system with manual capability should perform address forwarding to ATSU 3 first and then to ATSU 2 to give ATSU 3 a higher priority ADS-C connection.

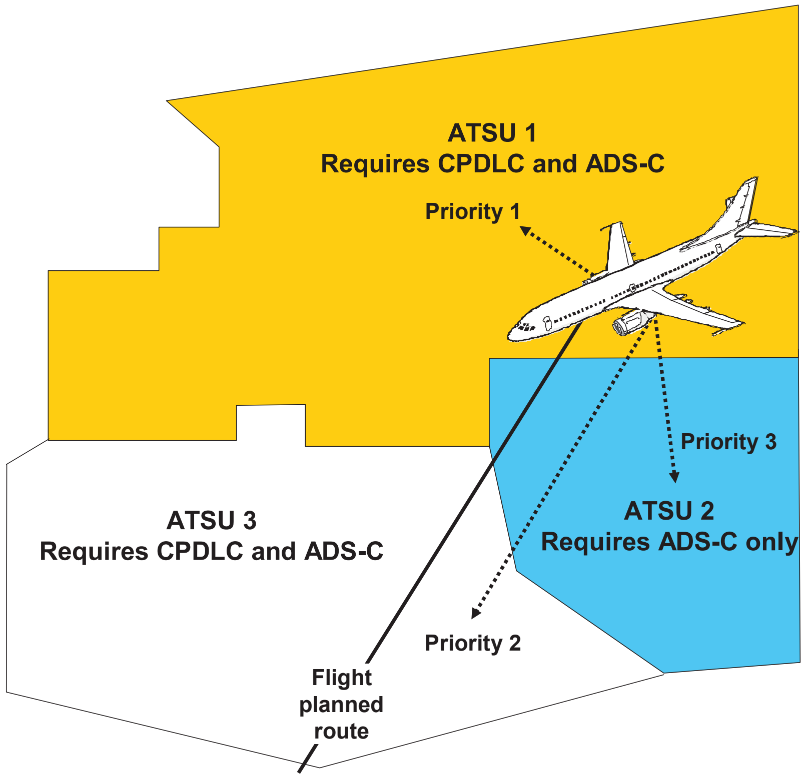


Figure 4-2. Transiting small data link area

4.2.5.4 When the CPDLC connection is transferred from ATSU 1 to ATSU 3, these ATSUs should agree on the location or time the connection transfer is to occur.

4.2.5.5 In this circumstance, ATSU 1 may inform the flight crew by CPDLC free text UM 169m (or voice equivalent): EXPECT NEXT CENTER [facility designation]. CONTACT WITH [facility designation] NOT REQUIRED.

Example:

Controller (free text)	UM 169m EXPECT NEXT CENTER ATSU 3. CONTACT WITH ATSU 2 NOT REQUIRED

4.2.5.6 When applying this procedure for transferring CPDLC from ATSU 1 to ATSU 3, if the interfacility agreement requires voice to also be transferred to ATSU 3, then ATSU 1 should specify ATSU 3 in the CONTACT or MONITOR message prior to ending the CPDLC connection or alternatively use voice. However, it may be advantageous to transfer voice communications to ATSU 2 even though ATSU 2 will not need a CPDLC connection. To achieve this, ATSU 1 may specify ATSU 2 in the CONTACT/MONITOR message sent prior to ending the CPDLC connection or alternatively use voice.

4.2.5.7 If address forwarding can be manually initiated, then ATSU 1 (priority 1) should initiate address forwarding to ATSU 3 (priority 2) prior to initiating address forwarding to ATSU 2 (priority 3). A system that performs automatic address forwarding would normally perform the address forwarding in sequence (i.e. ATSU 2 first and then ATSU 3).

Note.— The order in which the ATSU 1 performs address forwarding will ensure that the limited number of ADS-C connections available are used in the priority assigned to each ATSU.

4.3 CPDLC – Uplink messages

4.3.1 General

4.3.1.1 If an unexpected or inappropriate response to a CPDLC uplink message is received or there is any misunderstanding or doubt about the intent of a CPDLC dialogue, the controller should initiate voice contact to clarify the meaning or intent. (see Appendix A for intent and use of CPDLC uplink and downlink message elements).

4.3.1.2 When a closure response to an open CPDLC uplink message is not received within a reasonable time period as determined by the ATSU, the controller should:

a) Continue to protect any airspace reserved by an outstanding clearance until an appropriate operational response is received from the flight crew;

b) For a FANS 1/A ATSU, send CPDLC free text UM 169j CHECK AND RESPOND TO OPEN CPDLC MESSAGES, rather than re-sending the original message. Alternatively, the controller may use voice communication to clarify the status of the open CPDLC uplink message; or

c) For an ATN-B1 ATSU or a FANS 1/A-ATN B1 ATSU providing services to a FANS 1/A aircraft, use voice communication to resolve the operational situation resulting from the timed out CPDLC uplink message.

Note 1.— A closure response is a response that operationally closes the dialogue. A DM 2 STANDBY response to an open CPDLC uplink message does not operationally close the dialogue.

Note 2.— The use of a CPDLC free text message by a FANS 1/A ATSU avoids multiple open messages involving the same instruction.

Note 3.— An ATN B1 aircraft system and ground system close the uplink message after the aircraft timer (ttr) expiration and receipt of an ERROR response. In normal circumstances, the aircraft-timer (ttr) expires before the ground-timer (tts) expires.

Note 4.— Some FANS 1/A-ATN B1 ATSUs automatically initiate a Provider Abort (commanded termination) message to the aircraft upon expiration of the ground timer (tts).

4.3.1.3 The controller should only use standard message elements when composing clearances or instructions. However, circumstances may exist where the controller may use free text to supplement the standard message elements (See paragraph 4.3.2).

Note.— The use of standard message elements will minimize the risk of input errors and misunderstandings, and facilitate use by a non-native English speaking controllers and flight crews. The use of standard message elements allows the aircraft and ground systems to automatically process the information in the messages that are exchanged, which allows the flight crew to respond more quickly to *a standard clearance. For example, the ground system can be capable of automatically updating flight plan data for route conformance monitoring, the aircraft system can be capable of allowing the flight crew to load clearance information into the FMS with a LOAD prompt and review the clearance, and both aircraft and ground systems can associate responses to messages.*

4.3.2 Use of free text

4.3.2.1 The controller should avoid the use of the free text message element. However, its use may offer a viable solution to enhance operational capability.

Note.— See paragraph 3.1.1.4 for guidelines for the ANSP to validate the use of the free text message element.

4.3.2.2 The controller should only use a free text message when an appropriate standard message element does not exist and the intended use does not change the volume of protected airspace.

4.3.2.3 When free text is used, the controller should use standard ATS phraseology and format and avoid nonessential words and phrases. The controller should only include abbreviations in free text messages when they form part of standard ICAO phraseology, for example, ETA.

4.3.3 "EXPECT" uplink messages

4.3.3.1 The controller should only use the EXPECT message elements:

a) When responding to a flight crew request using the appropriate message element provided in Table 4-2; or

b) When procedurally required to advise the flight crew using the appropriate message element provided in Table 4-3.

Note.— The FANS 1/A CPDLC message set contains EXPECT uplink message elements that the controller should NOT use because of potential misinterpretation in the event of a total communication failure. Some of these message elements have been reserved by Doc 4444. See Appendix A, paragraph A.3, and Appendix E, paragraph E.7.1.3, for specific uplink message elements that should not be used.

Table 4-2. "EXPECT" uplink message elements for flight crew requests

Ref DL	Request message Element	Ref UL	Response message element
			"EXPECT" Vertical Clearances
DM 53	**WHEN CAN WE EXPECT HIGHER LEVEL** or *WHEN CAN WE EXPECT HIGHER ALTITUDE*	UM 7	EXPECT CLIMB AT [time]
		UM 8	EXPECT CLIMB AT [position]
DM 52	**WHEN CAN WE EXPECT LOWER LEVEL** or *WHEN CAN WE EXPECT LOWER ALTITUDE*	UM 9	EXPECT DESCENT AT [time]
		UM 10	EXPECT DESCENT AT [position]

Ref DL	Request message Element	Ref UL	Response message element
			“EXPECT” Lateral Offsets
DM 51	WHEN CAN WE EXPECT BACK ON ROUTE	UM 70	EXPECT BACK ON ROUTE BY [position]
		UM 71	EXPECT BACK ON ROUTE BY [time]
			“EXPECT” Speed Changes
DM 49	WHEN CAN WE EXPECT [speed]	UM 100	AT [time] EXPECT [speed]
		UM 101	AT [position] EXPECT [speed]

Table 4-3. Procedural “EXPECT” uplink message elements

Ref UL	Intent	Advisory message element
		“EXPECT” Route Modifications
UM 93	Notification that an onwards clearance may be issued at the specified time.	EXPECT FURTHER CLEARANCE AT [time]
UM 99	Notification that a clearance may be issued for the aircraft to fly the specified procedure.	EXPECT [procedure name]
		“EXPECT” Air Traffic Advisories
UM 169k	Notification that a SELCAL check on the specified HF frequency should be expected.	EXPECT SELCAL CHECK HF [frequency]
UM 169l	Notification that the CPDLC transfer process will not be completed at the boundary and will be delayed until the specified time or position. If the CPDLC transfer is not completed by the specified time or position, the flight crew should manually disconnect CPDLC and initiate a logon to the next center.	EXPECT CPDLC TRANSFER AT [time/position]
UM 169m	Notification that a CPDLC connection is not required by the next ATSU (e.g. due to short transition time through the next ATSU’s airspace) and CPDLC connection will be transferred to the subsequent ATSU.	EXPECT NEXT CENTER [facility designation]. CONTACT WITH [facility designation] NOT REQUIRED
UM 169p	Notification that a previously issued speed can be expected to be maintained until the specified position or time.	EXPECT TO MAINTAIN [speed] UNTIL [time / position]

4.3.4 Vertical clearances

4.3.4.1 When a vertical clearance contains a constraint for starting the climb or descent, the controller should precede the conditional vertical clearance with UM 19 MAINTAIN [level]:

Controller	UM 19 MAINTAIN [level] UM 21 **AT [time] CLIMB TO [level]** or *AT [time] CLIMB TO AND MAINTAIN [altitude]*
Controller	UM 19 MAINTAIN [level] UM 22 **AT [position] CLIMB TO [level]** or *AT [position] CLIMB TO AND MAINTAIN [altitude]*
Controller	UM 19 MAINTAIN [level] UM 24 **AT [time] DESCEND TO [level]** or *AT [time] DESCEND TO AND MAINTAIN [altitude]*
Controller	UM 19 MAINTAIN [level] UM 25 **AT [position] DESCEND TO [level]** or *AT [position] DESCEND TO AND MAINTAIN [altitude]*

Note 1.— Conditional clearances add to the operational efficiency of the airspace. Conditional clearances, however, have been associated with a large number of operational errors. Conditional clearances are therefore used only when necessary.

Note 2.— The potential exists for the AT [time/position] constraint at the beginning of a conditional vertical clearance to be missed by the flight crew and consequently the clearance may be executed prematurely. Including the UM 19 MAINTAIN [level] message element indicates to the flight crew that the current level/altitude is to be maintained until the specified condition has been satisfied and may prevent such clearances being executed prematurely.

Note 3.— For ATN-B1 systems, these vertical clearance message elements are not available.

4.3.4.2 When a vertical clearance contains a constraint that is applicable during the flight maneuver, the controller may use a conditional vertical clearance, as provided in Table 4-4, as either:

a) A single-element message, when the conditional vertical clearance is independent; or

b) A multi-element message, when another vertical clearance is dependent on the conditional vertical clearance (see also paragraph 4.3.6).

Table 4-4. Conditional vertical clearances applicable during flight maneuver

Ref #	Message element
UM 26	CLIMB TO REACH [level] BY [time]
UM 27	CLIMB TO REACH [level] BY [position]
UM 28	DESCEND TO REACH [level] BY [time]
UM 29	DESCEND TO REACH [level] BY [position]
UM 171	CLIMB AT [vertical rate] MINIMUM
UM 172	CLIMB AT [vertical rate] MAXIMUM

Ref #	Message element
UM 173	DESCEND AT [vertical rate] MINIMUM
UM 174	DESCEND AT [vertical rate] MAXIMUM

Example 1: The controller issues a vertical clearance for the aircraft to climb to FL 390 and maintain FL 390 AT or BEFORE 2200Z.

Controller	UM 26 CLIMB TO REACH FL390 BY 2200Z

Example 2: The controller issues a vertical clearance for the aircraft to climb to FL 390 at a vertical rate of 2000 feet per minute (or greater).

Controller	UM 20 **CLIMB TO FL390** or *CLIMB TO AND MAINTAIN FL390* UM 171 CLIMB AT 2000 FEET PER MINUTE MINIMUM UM 129 **REPORT MAINTAINING FL390** or *REPORT LEVEL FL390*

Example 3: The controller issues a vertical clearance for the aircraft to climb to FL 390, and reach an intermediate level of FL 370 (or higher) AT or BEFORE 0100Z.

Controller	UM 20 **CLIMB TO FL390** or *CLIMB TO AND MAINTAIN FL390* UM 26 CLIMB TO REACH FL370 BY 0100Z UM 129 **REPORT MAINTAINING FL390** or *REPORT LEVEL FL390*

Note.— A more appropriate procedure would be for the controller to use the message element UM 192 REACH [level] BY [time], defined in ICAO Doc 4444. However, this message element is not available in the FANS 1/A message set. The example uses the message element UM 129 ***REPORT MAINTAINING [level]*** *or REPORT LEVEL [altitude] to highlight the final level intended by the clearance.*

4.3.4.3 If a level restriction is required after sending the initial clearance, the controller should resend the entire clearance with the level restriction in a single CPDLC message.

Note.— The controller should not send a vertical clearance in a CPDLC message and then subsequently send a related level restriction in a separate message. If the controller sends the vertical clearance and the related level restriction in two separate CPDLC messages, the controller would be unintentionally amending the final cleared level of the aircraft (to FL 370) with the level restriction. The flight crew may misinterpret the two separate instructions.

4.3.4.4 If a CPDLC level report is needed, the controller should append UM 129 **REPORT MAINTAINING [level]** or *REPORT LEVEL [altitude]* to the vertical clearance message element that is used to assign a single level/altitude.

Note 1.— When UM 129 ***REPORT MAINTAINING [level]*** *or REPORT LEVEL [altitude] is appended, the flight crew has access to the standard message element UM 19* ***MAINTAINING [level]*** *or*

LEVEL [altitude]. If the report request is not appended, the flight crew may not report when maintaining the cleared flight level.

Note 2.— Some States do not request a CPDLC level report when using ADS-C.

Note 3.— The controller should not use UM 175 REPORT REACHING [level]. ICAO Doc 4444 has reserved this message element. The programmed intent of this message element was to request a report if the aircraft occupies the specified level, which occurs as the aircraft is about to level at the specified level, but also occurs if the aircraft passes through the specified level during a climb or descent. To obtain a report at an intermediate level, use UM 128 REPORT LEAVING [level].

Example: The controller issues a conditional clearance to a flight currently cruising at FL310 requesting climb to FL350 when the climb can not be executed until the aircraft is at MICKY. The controller appends a request for a report when level at FL350.

Controller	UM 19 MAINTAIN FL310 UM 25 **AT MICKY CLIMB TO FL350** or *AT MICKY CLIMB TO AND MAINTAIN FL350* UM 129 **REPORT MAINTAINING FL350** or *REPORT LEVEL FL350*

4.3.4.5 To cancel a previously issued vertical range (i.e. block level) clearance and limit the aircraft to one specific level, the controller should issue an appropriate vertical clearance.

Example 1:

Controller	UM 19 MAINTAIN FL390 UM 129 **REPORT MAINTAINING FL390** or *REPORT LEVEL FL390*
Flight crew	DM 0 WILCO

Example 2:

Controller	UM 20 **CLIMB TO FL390** or *CLIMB TO AND MAINTAIN FL390* UM 129 **REPORT MAINTAINING FL390** or *REPORT LEVEL FL390*
Flight crew	DM 0 WILCO

Note.— The DM 0 WILCO response to the vertical clearance uplink cancels any previously issued vertical range clearance.

4.3.5 Report/confirmation requests

Note.— For ATN-B1 systems, report/confirmation request message elements are not available, except as indicated in Appendix A.

4.3.5.1 If the controller requests the aircraft's Mach number or indicated airspeed, then the controller should use the standard message element UM 134 (or UM 169b) **REPORT [speed type] [speed type] [speed type] SPEED** or *CONFIRM SPEED.*

Note.— Use of standard message elements allows the flight crew to use an automated response.

4.3.5.2 If ADS-C indicates a deviation from cleared route, level or assigned speed, the controller may query the flight crew via CPDLC per Table 4-5.

Table 4-5. ADS-C out-of-conformance messages

	Message element
UM 169f	ADS-C INDICATES OFF ROUTE. ADVISE INTENTIONS.
UM 169t	ADS-C INDICATES LEVEL DEVIATION. ADVISE INTENTIONS.
UM 169v	ADS-C INDICATES SPEED DEVIATION. ADVISE INTENTIONS.

4.3.5.3 If a scheduled CPDLC position report is not received, the controller may request the report by uplinking message UM 147 REQUEST POSITION REPORT.

4.3.6 Creating multi-element uplink messages

4.3.6.1 The controller should minimize the use of CPDLC multi-element uplink messages and keep message size to a minimum.

4.3.6.2 The controller should only combine clearance or instruction message elements that are dependent on each other into a single uplink message.

Note.— The flight crew can only respond to the entire message with a single response and would have to respond DM 1 UNABLE if they cannot comply with any part of the message. In addition, an aircraft system may present long multi-element messages on multiple screens or pages, which increases the complexity for the flight crew in reading and understanding the message in the correct sequence prior to responding (paragraph 5.3.1 refers).

Example 1: The controller sends a single multi-element uplink message containing message elements for each of the different parts of the clearance and/or instruction.

Controller	UM 164 WHEN READY or UM 177 AT PILOTS DISCRETION UM 23 **DESCEND TO FL280** or *DESCEND TO AND MAINTAIN FL280* UM 129 **REPORT MAINTAINING FL280** or *REPORT LEVEL FL280*

Example 2: The controller sends a single multi-element uplink message containing message elements for each of the different parts of the clearance and/or instruction.

Controller	UM 23 **DESCEND TO FL280** or *DESCEND TO AND MAINTAIN FL280* UM 48 CROSS DAFFY AT OR ABOVE FL310

Note 1.— The flight crew may misinterpret messages that contain unrelated clearances or instructions.

Note 2.— The controller should not send two independent clearances in a single message because the flight crew cannot individually respond to each clearance, if necessary (e.g. WILCO one clearance and UNABLE the other). The following is not recommended:

Controller	*~~CLIMB TO AND MAINTAIN FL350~~* *~~INCREASE SPEED TO .84~~*

4.3.6.3 The controller should send all elements of a dependent clearance in a single unambiguous uplink message.

Example 1: Level FL330 is only available for a flight if the speed is adjusted with other flights in the same route to Mach .80 minimum, so the controller can only clear the aircraft to climb FL330 if its speed is Mach .80 or more. Both clearances are mutually dependent. If the aircraft is unable to climb then a speed adjustment is not required. If the aircraft cannot meet the speed constraint then a climb clearance is not available.

Controller	UM 108 MAINTAIN M.80 OR GREATER UM 20 **CLIMB TO FL330** or *CLIMB TO AND MAINTAIN FL330*

Note 1.— A dependent clearance is a message consisting of more than one clearance element, where the flight crew is required to comply with each of the elements. A rejection of any of the elements, either singly or in combination, renders the entire clearance invalid.

Note 2.— Sending the elements as individual messages may compromise safety or separation if the flight crew accepts the first uplink of a dependent clearance, complies with the instruction, and then responds DM 1 UNABLE to the next message when received.

Note 3.— The flight crew will respond to the multi-element uplink message with either DM 0 WILCO or DM 1 UNABLE, which applies to the entire message, per paragraph 5.3.1.2.

Note 4.— The controller should not send a dependent clearance in a single multi-element uplink message containing the condition THEN. In the following example, the message element UM 165 THEN followed by the route clearance message element UM 74 PROCEED DIRECT TO [position] does not clearly convey that the flight crew needs to complete the climb clearance prior to commencing the route clearance change.

Controller	*~~CLIMB TO AND MAINTAIN FL330~~* *~~THEN~~* *~~PROCEED DIRECT TO TUNTO~~*

Example 2: The controller sends a single multi-element uplink message containing an amended route clearance that is dependent on a vertical clearance. To eliminate any potential ambiguity, the controller chose the second element to reinforce that the flight crew needs to comply with the vertical clearance prior to complying with the amend route clearance.

Controller	UM 20 **CLIMB TO FL330** or *CLIMB TO AND MAINTAIN FL330* UM 78 AT FL330 PROCEED DIRECT TO TUNTO UM 129 **REPORT MAINTAINING FL330** or *REPORT LEVEL FL330.*

4.3.7 Weather deviations

Note.— For an ATN-B1 ATSU, message elements supporting weather deviations are not available.

4.3.7.1 When issuing a deviation clearance, the controller should use UM 82 CLEARED TO DEVIATE UP TO [specified distance] [direction] OF ROUTE and append UM 127 REPORT BACK ON ROUTE.

Note.— If a clearance direct to a waypoint is issued before the deviating aircraft has reported back on route, the controller will need to determine the aircraft's location or continue to protect the airspace affected by the weather deviation clearance until the aircraft sequences the specified waypoint.

4.3.7.2 A weather deviation clearance remains in effect until either:

a) A "back on route" report is received; or

b) The aircraft reaches a subsequent waypoint to which it has been cleared when clear of weather.

4.4 CPDLC – Downlinks

4.4.1 General

4.4.1.1 The ATSU should respond to a downlink message that it does not support according to paragraph 3.1.2.5.3.

4.4.1.2 The ATSU should respond to an incoming request as soon as practicable to avoid the flight crew initiating a duplicate request.

Note.— ATN B1 ground systems provide for automatic timeout of messages that are not responded to, while FANS 1/A ground system messages can remain open indefinitely.

4.4.2 Clarifying a downlink message

4.4.2.1 In the case of a controller having any doubt as to the intent of a downlink message, or if any other ambiguity exists, the controller should seek clarification using CPDLC or voice. The controller should then respond to the downlink message with a CPDLC message consistent with the clarification to prevent confusion and to close the open downlink message.

4.4.3 Responses/acknowledgements

4.4.3.1 The controller should respond to a clearance request by issuing a clearance using an appropriate standard message element, UM 1 STANDBY or UM 0 UNABLE.

4.4.3.2 When a clearance request is denied, the controller should send UM 0 UNABLE and, when practicable, append a reason for the non-availability of the clearance.

Note.— The controller should not restate the aircraft's current clearance.

4.4.3.3 The controller should send UM 1 STANDBY to provide advice to the flight crew that the requested clearance is being assessed, but is not readily available, for example, due to traffic or delays in coordination with the next sector or ATSU.

Note 1.— Some ATSUs automatically send a UM 1 STANDBY to acknowledge that it received a downlink request (refer to Appendix E).

Note 2.— Some FANS 1/A aircraft may reject the actual response after having received a preliminary UM 1 STANDBY for the downlink request (refer to Appendix F, paragraph F.24).

4.4.3.4 If a UM 1 STANDBY response is sent, the controller should subsequently send another response within a reasonable period of time, or as required to prevent message timeout or flight crew confusion.

Note.— The downlink message remains open. If the controller does not respond within this time, the flight crew may query the controller per paragraph 5.4.1.5.

4.4.3.5 If a duplicate CPDLC request is received prior to having responded to the first request, the controller should send appropriate responses to both of the requests.

Note.— Responding to both requests will close the downlink messages. Depending on the ground system, the closure response for the second request may be:

a) a re-iteration of the response for the first downlink request (e.g. a clearance or UM 0 UNABLE); or

b) some other uplink message that does not contradict any previous clearance that may have been sent (i.e. avoid sending a clearance to one downlink request and UM 0 UNABLE to the duplicated downlink message)

Example 1:

	Dialogue 1	**Dialogue 2**
Flight crew	DM 9 REQUEST CLIMB TO FL370	
Flight crew		DM 9 REQUEST CLIMB TO FL370
Controller	UM 0 UNABLE	
Controller		UM 0 UNABLE

Example 2:

	Dialogue 1	**Dialogue 2**
Flight crew	DM 9 REQUEST CLIMB TO FL370	
Flight crew		DM 9 REQUEST CLIMB TO FL370
Controller	UM 20 **CLIMB TO FL370** or *CLIMB TO AND MAINTAIN FL370*	
Controller		UM 20 **CLIMB TO FL370** or *CLIMB TO AND MAINTAIN FL370*; or (for example) UM 169 CLEARANCE ALREADY SENT
Flight crew	DM 0 WILCO	
Flight crew		DM 0 WILCO or DM 3 ROGER, as appropriate

4.4.3.6 If a UM 1 STANDBY message had previously been sent when a duplicated request is received, and additional time is required before the clearance is available, the controller should respond with UM 2 REQUEST DEFERRED, when appropriate.

Example:

	Dialogue 1	**Dialogue 2**
Flight crew	DM 9 REQUEST CLIMB TO FL370	
Controller	UM 1 STANDBY	
Flight crew		DM 9 REQUEST CLIMB TO FL370
Controller		UM 2 REQUEST DEFERRED
Time passes until clearance is available.		
Controller	UM 20 **CLIMB TO FL370** or *CLIMB TO AND MAINTAIN FL370*	
Controller		UM 20 **CLIMB TO FL370** or *CLIMB TO AND MAINTAIN FL370*; or (for example) UM 169 CLEARANCE ALREADY SENT
Flight crew	DM 0 WILCO	
Flight crew		DM 0 WILCO

4.4.4 Responding to multi-element requests

4.4.4.1 While it is recommended that the flight crew avoid requests for multiple clearances in a single CPDLC message per paragraph 5.4.1.4, such requests can occur.

4.4.4.2 If the controller receives multiple clearance requests in a single message and can approve all clearance requests, the controller should respond in a single message that includes the appropriate clearance for each request in the message.

Example:

Flight crew	DM 9 REQUEST CLIMB TO FL370 DM 22 REQUEST DIRECT TO TUNTO
Controller	UM 20 **CLIMB TO FL370** or *CLIMB TO AND MAINTAIN FL370* UM 74 PROCEED DIRECT TO TUNTO

4.4.4.3 If the controller receives multiple clearance requests in a single message and cannot approve all of the clearance request elements, the controller should send, in a single message, UM 0 UNABLE, which applies to all elements of the original message.

Note 1.— The controller should not restate the aircraft's current clearance.

Note 2.— The controller should not send a single message containing UM 0 UNABLE for elements of the multiple clearance request that cannot be granted and a clearance for the remaining elements.

Note 3.— The controller may include a reason to remove any ambiguity and, if appropriate, information on when the portions of the clearance request that are available might be expected.

Note 4.— The controller may, following the UM 0 UNABLE [reason] message, send a separate CPDLC message (or messages) to respond to those elements for which they can issue an appropriate clearance.

Example 1:

Flight crew	DM 9 REQUEST CLIMB TO FL370 DM 22 REQUEST DIRECT TO TUNTO
Controller	UM 0 UNABLE

Example 2:

Flight crew	DM 9 REQUEST CLIMB TO FL370 DM 22 REQUEST DIRECT TO TUNTO
Controller (provide reason using standard message element)	UM 0 UNABLE UM 166 DUE TO TRAFFIC
Controller (separate message element)	UM 74 PROCEED DIRECT TO TUNTO

4.4.5 Offering alternative clearances to requests

4.4.5.1 If a clearance request contained in a CPDLC message cannot be issued, the controller should send UM 0 UNABLE to deny the request prior to issuing any subsequent clearances.

a) If an alternative clearance (intermediate level or deferred climb) can be issued, the controller may subsequently uplink the clearance in a separate CPDLC message; and

b) If an alternative clearance that the flight crew might not be able to accept (higher level or route modification) can be issued, the controller should negotiate the clearance with the flight crew prior to issuing it.

Note.— The procedures for issuing alternative clearances are not applicable to a clearance request associated with an ADS-B ITP. See paragraph 6.3.

Example 1: The aircraft is maintaining FL330. The controller is unable to issue the requested clearance and issues an alternative clearance to a flight level that is lower than requested.

Flight crew	DM 9 REQUEST CLIMB TO FL370
Controller	UM 0 UNABLE

	UM 166 DUE TO TRAFFIC
Controller	UM 20 **CLIMB TO FL350.** UM 129 **REPORT MAINTAINING FL350** or UM 20 *CLIMB TO AND MAINTAIN FL350.* UM 129 *REPORT LEVEL FL350*

Example 2. The aircraft is maintaining FL330. The controller is unable to issue the requested clearance, and queries whether the aircraft can accept a flight level that is higher than requested.

Flight crew	DM 9 REQUEST CLIMB TO FL370
Controller	UM 0 UNABLE UM 166 DUE TO TRAFFIC
Controller	UM 148 WHEN CAN YOU ACCEPT FL390
Flight crew	DM 81 WE CAN ACCEPT FL390 AT 2200

Note.— The controller should not simply respond to the downlink request with the alternative clearance. The following procedure is not a recommended practice. The controller does not provide the correct ATC response.

Flight crew	*REQUEST CLIMB TO FL370*
Controller	*~~UNABLE. CLIMB TO FL350. REPORT MAINTAINING FL350~~ or* *~~UNABLE. CLIMB TO AND MAINTAIN FL350. REPORT LEVEL FL350~~*

4.5 ADS-C

Note.— For ATN B1, the ADS-C application is not supported.

4.5.1 General

4.5.1.1 ADS-C reports contain FMS information relating to the figure of merit (FOM), ACAS and the aircraft's navigational redundancy. Some automated ground systems use the FOM value received in an ADS-C report to determine whether to display the report to controllers, or to display a "high" or "low" quality ADS-C symbol.

4.5.1.2 If a FOM-reported navigational performance is being used and a change to the FOM value is observed, the controller should seek clarification from the flight crew as to the extent of any observed navigational degradation.

Note.— In accordance with ICAO Doc 4444, paragraph 5.2.2, the flight crew advises ATC of degraded performance below the level required for the airspace and where the reported degradation affects the separation minimum currently being applied, the controller would take action to establish another appropriate type of separation.

4.5.1.3 If a flight crew inserts a non-ATC waypoint into the aircraft active flight plan, the aircraft may send a waypoint change event report, which contains information on the non-ATC waypoint in the predicted route group, as well as the intermediate and fixed projected intent groups of the report. The

ATSU may receive information on the next, or the next-plus-one waypoints from that report that do not correlate with the waypoint information provided in the current flight plan or flight data record held by the ATSU. Refer to Appendix F, paragraph F.5 for FMS processing of waypoints on different aircraft types.

Note.— The flight crew normally would not insert non-ATC waypoints per paragraph 5.6.4.4.

4.5.1.4 Unless required for safety purposes, such as to monitor aircraft operating close to, but not entering its airspace, the ATSU should only establish ADS contracts for aircraft within its area of responsibility.

4.5.1.5 A controller who becomes aware of corrupt or incorrect data from an ADS-C report should establish voice contact with the aircraft concerned in order to correct the situation.

4.5.1.6 When an ATSU is using both ADS-C and CPDLC position reporting and detects a discrepancy of 2 minutes or less between the reports, the controller should reconcile the time difference. Where the time difference is more than 2 minutes, the controller should request confirmation of the estimate for the waypoint in question.

Note.— CPDLC and ADS-C estimates received from the same aircraft for the same position may differ as a result of the ADS-C application reporting time to the second and the time reported by CPDLC application either being truncated or rounded to the nearest full minute (depending on aircraft type). The flight crew also has the ability to modify the estimate for the next position in the CPDLC position report. Any such modification will not be reflected in the ADS-C report.

4.5.1.7 Whenever an ADS-C report (either a periodic or waypoint change event report) is not received within a parameter of the expected time, the controller should ascertain the position of the aircraft by initiating a demand contract request, re-establish a new periodic contract with the aircraft, or request a CPDLC or voice position report.

4.5.1.8 When the application of specified separation minima is dependent on the reporting interval of periodic position reports, the ATC unit should only establish a periodic contract with a reporting interval less than the required reporting interval.

4.5.1.9 If the controller becomes aware of a data link communications failure, the controller should advise affected aircraft to revert to voice position reporting in accordance with paragraph 4.9.3.

4.5.2 ADS contracts

4.5.2.1 In airspace where procedural separation is being applied, the ATSU should establish the following:

a) ADS periodic contract at an interval appropriate to the airspace requirements; and

b) ADS event contract for the following events:

   1) Waypoint change event;

   2) Lateral deviation event;

   3) Level range deviation event; and

   4) Vertical rate change event of negative 5000 feet per minute (descent rate).

4.5.3 ADS-C connection management

4.5.3.1 The ATSU should terminate ADS contracts when they are no longer operationally required.

4.5.3.2 When the ATS ground system receives a logon request message, the ATSU may initiate an ADS-C connection by sending an ADS contract request(s) to the aircraft. The ADS-C application does not assign any technical priority to ADS-C connections; therefore, the controlling ATSU may not be aware of other connections established with the aircraft. As a result, when the ground system functionality permits it, and where circumstances make it advantageous, the controlling ATSU should initiate address forwarding in an order that would provide ATSUs that will control the aircraft with an opportunity to have the highest priority for ADS-C connections.

Note1.— ADS-C reports are assembled and sent in a sequential process based on the order of the ADS contracts established with the various ATSUs. For example, the first ATSU to establish contracts with the aircraft will continue to receive the reports from the aircraft first, even if it no longer has control of the flight. When this connection is terminated, the next ATSU to have established ADS contracts begins to receive the reports first. This may have the effect of reducing the apparent ADS-C performance of aircraft for which the ATSU is not the first unit to be receiving the ADS-C report.

Note2.— The following guidance is for ground systems that allow the controller to manually initiate the address forwarding process. Other systems have automated this process, often linking it to the automated coordination of the aircraft. Those systems will normally forward aircraft in the order in which they need to be coordinated.

4.5.3.3 The order for address forwarding should be as follows:

a) The NDA;

b) An ATSU requiring an ADS-C connection for close boundary monitoring; and

c) Other miscellaneous connections.

Note 1.— The NDA may not be the next ATSU on route in the situation where there is a short sector transition and the next ATSU has advised that it wants to assume NDA.

4.5.3.4 For example, as shown in Figure 4-3, an ADS contract is required by ATSU 2 to monitor the aircraft's progress. To ensure that the next unit with direct control responsibility for the aircraft (ATSU 3) has priority over the ADS-C connections, ATSU 1 should initiate address forwarding to ATSU 3 prior to address forwarding to ATSU 2.

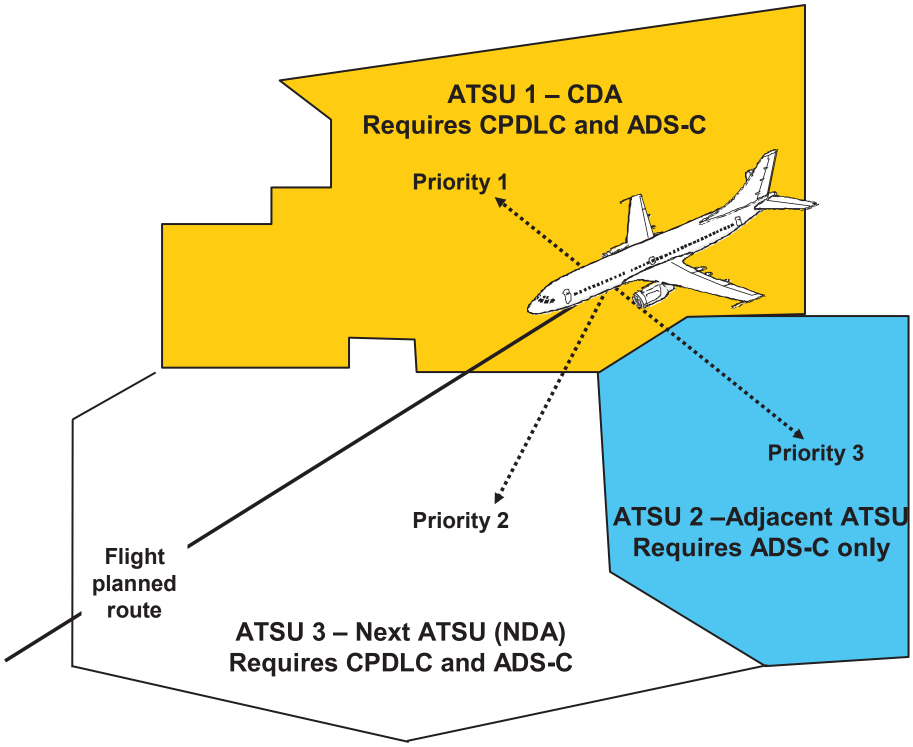


Figure 4-3. Priorities for ADS-C connections

4.5.3.5 When all available ADS-C connections with a particular aircraft have been established, such as shown in Figure 4-4, any other ATSUs attempting to connect with the aircraft will receive a DISCONNECT REQUEST (DIS) message with "reason code 1" (congestion).

4.5.3.6 When such a DIS message is received by an ATSU that would normally have priority for an ADS-C connection, the ATSU should notify the current controlling ATSU. The controlling ATSU should attempt to resolve the situation.

4.5.3.7 The controlling ATSU has a number of options available, such as coordination with the previous ATSU or other adjacent ATSUs to determine if the existing ADS-C connections are still required or, when considered absolutely necessary, instructing the flight crew to terminate ADS-C connections per Appendix F, paragraph F.11.

4.5.3.8 Depending on aircraft type, the latter option may terminate all current ADS contracts; therefore, the controlling authority should consider the operational effect on other ATSUs prior to employing this method. For example, as shown in Figure 4-4, the aircraft has allocated priority for ADS-C connections with four ATSUs and one AOC facility:

Connection:	1 - with ATSU 1 2 - with ATSU 2 3 - with the previous controlling ATSU 4 - with the AOC facility 5 - with a ground facility collecting test data

ATSU 3, the next controlling authority, is unable to establish an ADS-C connection with the aircraft due to congestion.

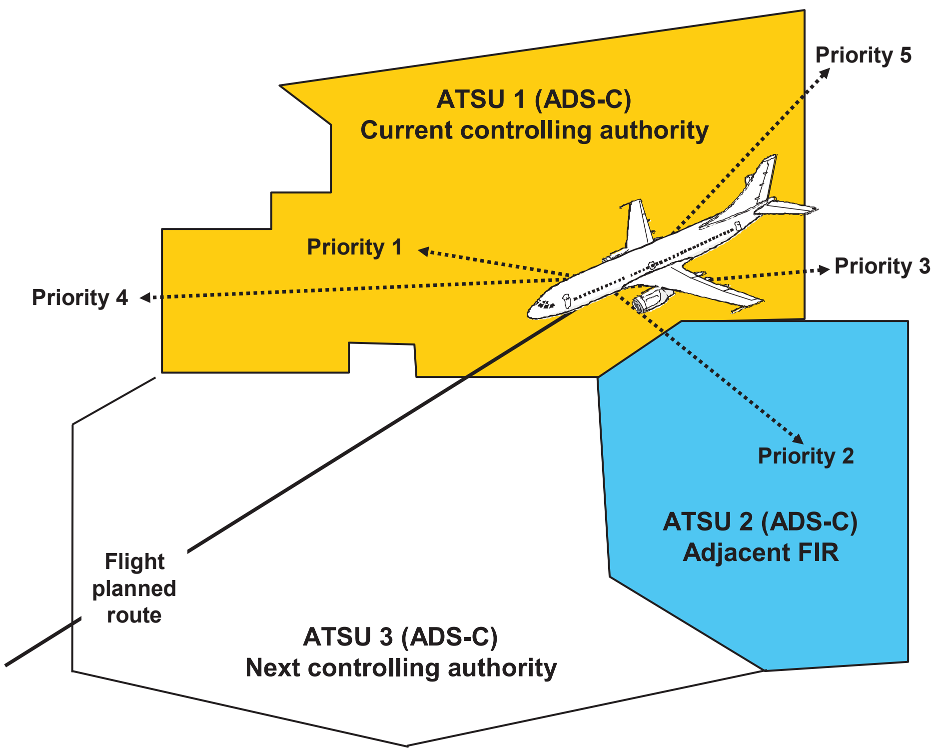


Figure 4-4. ADS-C connection not available due to congestion

4.5.4 ADS contract - periodic

4.5.4.1 When setting a default periodic reporting interval, the ANSP should take into account requirements for the separation standard in use, conformance monitoring, traffic levels, and alerting service. Typically, default periodic contract intervals are set to satisfy the position reporting requirements of the default separation standard in use.

4.5.4.2 The ANSP should avoid arbitrarily selecting short periodic default intervals because of the economic cost to the users and the unnecessary system loading imposed by these short default intervals.

4.5.4.3 There are a number of situations where a controller or ground automation may use a reporting interval other than the default interval in the periodic contract. A change to the default interval for an aircraft may be warranted or useful when:

a) The aircraft is cleared to deviate from areas of known significant weather;

b) The application of a smaller separation standard requires a shorter periodic interval;

c) There are periods of turbulence;

d) An unauthorized deviation from the clearance is detected; or

e) The aircraft is approaching a crossing route on which there is other traffic.

4.5.4.4 The ANSP should ensure that the periodic reporting interval in use is in accordance with the position reporting requirements of the separation standard being used. In some circumstances, such as an emergency situation, the ATSU may establish a shorter periodic reporting interval. When not required for the application of separation, or other circumstances, the ANSP should return to a longer periodic reporting interval to reduce operators costs and unnecessary loading of the system.

Note.— Normally, the controlling ATSU should not establish ADS-C periodic reporting at an interval shorter than five minutes. An adjacent non-controlling ATSU should not establish ADS-C periodic reporting at an interval shorter than what is required for application of any reduced separation in effect for the flight. In unusual circumstances, the ATSU may specify a periodic reporting interval for a few aircraft as short as 64 seconds, per paragraph 2.2.6.3.3.2.

4.5.5 ADS contract - waypoint change event

4.5.5.1 A waypoint event report will be sent at any waypoint contained in the aircraft active flight plan, which may include compulsory and non-compulsory reporting points. These waypoints are reflected in the predicted route group.

4.5.6 ADS contract - vertical range change and lateral deviation events

4.5.6.1 When the level range deviation event and lateral deviation event contracts are established, the controller will only be alerted to vertical or lateral variations that exceed the associated tolerances.

Note.— If a regular periodic report is sent as the aircraft is deviating from cleared level or route (but still within the level or lateral tolerances) the controller will still be alerted to the variation despite no event report having been sent.

4.6 Separation

4.6.1 General – ADS-C

4.6.1.1 The ATSU may use ADS-C for the application of procedural separation within a mixed environment, such as airspace where position reports are provided by a mixture of aircraft reporting by ADS-C and aircraft reporting by other means.

4.6.1.2 For example, the ATSU may use a combination of ADS-C, voice reports, radar or ADS-B information to determine separation between two or more aircraft.

4.6.1.3 When ADS-C is used for route conformance monitoring to support the separation, the ATSU should establish appropriate ADS contracts that specify the periodic reporting interval and tolerances on events in accordance with separation standards.

Note.— This will ensure that estimates being used for route conformance monitoring are acceptable for the separation and the controller receives an indication when the aircraft is not in conformance with its current flight plan.

4.6.1.4 The controller should advise the flight crew when the controller observes that the aircraft has deviated significantly from its cleared flight profile. The controller should take action as appropriate if the deviation is likely to affect the air traffic service being provided.

4.6.2 Vertical separation –ADS-C

4.6.2.1 Where practical, the tolerances used to determine whether a specific level is occupied by an ADS-C reporting aircraft within the airspace of a specific ATSU should be consistent with other tolerances used throughout the airspace. For example, the vertical tolerances for ADS-C should be consistent with vertical tolerances used for level adherence monitoring by other forms of surveillance, such as radar.

4.6.2.2 Where other vertical tolerances do not exist, the ATSU should apply a vertical tolerance of +/– 300 feet for ADS-C applications. However, an individual ATSU may specify in local instructions and the AIP (or other appropriate publication) that it uses a tolerance of not less than +/– 200 feet to provide consistency with other vertical tolerances applied within its airspace.

4.6.2.3 If displayed ADS-C level information does not satisfy the required tolerance for an individual ATSU, then the controller should advise the flight crew accordingly and request confirmation of the aircraft's level. If following confirmation of the level, the displayed ADS-C level information is still beyond the required tolerance, the controller may need to apply another method of separation or another method of determining level information.

4.6.2.4 When displayed ADS-C level information is within the specified tolerance of the expected or cleared flight level, the ATSU may use the ADS-C level information to apply vertical separation and to determine that an aircraft has reached or is maintaining a specified level.

4.6.2.5 The controller can consider that an aircraft has left a specified level when the displayed ADS-C level information indicates that the aircraft has passed the level in the required direction by more than the required tolerance.

4.6.3 Lateral separation – ADS-C

4.6.3.1 An ATSU can use ADS-C report information to automatically detect when an aircraft is beyond an area of lateral conflict and provide an indication when this occurs to the controller.

4.6.3.2 When conflict detection tools are not available, the controller can determine lateral conflicts by observing the ADS-C report information and determining if the aircraft is within or outside the area of conflict.

Note.— The adequacy of the procedures used to detect lateral conflicts is a matter of the State.

4.6.4 Longitudinal separation – ADS-C

4.6.4.1 ATSUs that use approved or integrated measurement tools for the purpose of determining screen-based separation should publish in local documentation any limitations on the use of such tools for the establishment and monitoring of separation standards.

4.6.4.2 The ATSU may use ADS-C reports to establish and monitor longitudinal time and distance separation standards.

4.6.4.3 Some ground systems display an extrapolated or interpolated ADS-C symbol between the receipt of ADS-C reports. Provided that the periodic reporting interval in use is in accordance with any maximum reporting interval specified by the separation standard, the ATSU may determine separation between the extrapolated/interpolated symbols by the use of screen-based measurement tools, or by the use of automated conflict detection tools.

4.6.4.4 When the ATSU uses extrapolated or interpolated ADS-C symbols to provide separation and any doubt exists as to the integrity or validity of the information being presented, the controller should send a demand contract to update the relevant information. If doubt still exists, the controller should consider using an alternative method of separation.

4.6.4.5 The ATSU may use ground system flight data records updated by ADS-C reports in the application of appropriate time-based separation standards. Methods of determination may include reference to:

a) Estimates at waypoints;

b) Calculated estimates for positions not contained in the flight plan;

c) Screen-based measurement tools; or

d) Automated conflict detection tools.

4.6.4.6 The ATSU may use ADS-C reports for the application of appropriate longitudinal distance standards. Methods of determination may include:

a) The use of automated system tools to measure the displayed positions of two or more aircraft reporting by ADS-C;

b) Comparing the displayed position of an ADS-C aircraft with the position of another aircraft determined by an alternative form of surveillance; or

c) The use of automated conflict detection tools.

4.6.5 Using FMC WPR for position reporting

4.6.5.1 Whenever an FMC waypoint position report is overdue by more than a specific interval, as determined by ATC, the controller should take action to advise the aircraft concerned and request a voice position report. If either the flight crew or the controller notices intermittent operation, either may revert to voice reporting at any time. (The flight crew would be expected to report by voice for the remainder of the flight.)

4.6.5.2 A controller who becomes aware of corrupt or incorrect data in the FMC waypoint position report should establish voice contact with the aircraft concerned in order to correct the situation.

4.6.5.3 A controller who becomes aware of a FMC WPR service failure should advise affected aircraft to revert to voice position reporting in accordance with paragraph 4.9.3.

4.7 Alerting service

4.7.1 For ADS-C aircraft, the ATSU should base the provision of the alerting service on any missed scheduled report (i.e. provided by either the periodic contract or the waypoint event contract).

4.8 Emergency procedures

4.8.1 General

4.8.1.1 The flight crew will use whatever means are appropriate (i.e. CPDLC and/or voice) to communicate during an emergency.

Note.— For ATN B1 aircraft, emergency message elements are not supported. See Appendix A, paragraph A.4, for a list of emergency message elements.

4.8.1.2 When emergency situations are communicated via CPDLC, the controller may respond via CPDLC. However, the controller may also attempt to make voice contact with the aircraft.

4.8.1.3 The controller should follow normal emergency response procedures, as appropriate, depending on the nature of the emergency.

4.8.2 CPDLC and ADS-C emergency

4.8.2.1 If the ATSU receives an ADS-C emergency report without a corresponding CPDLC emergency message, then the controller should request confirmation of the emergency in accordance with the guidelines provided in paragraph 4.8.3.

4.8.2.2 The controller should treat any CPDLC downlink message that contains an emergency message element (see Appendix A, paragraph A.4 for the list of emergency message elements) as an emergency message.

*Note 1.— For FANS 1/A, DM 80 **DEVIATING UP TO [specified distance] [direction] OF ROUTE** or DEVIATING [distanceoffset] [direction] OF ROUTE is used in normal operations and is not an emergency message element.*

Note 2.— When the ATSU receives DM 55 PAN PAN PAN or DM 56 MAYDAY MAYDAY MAYDAY, additional message elements (e.g. DM 61DESCENDING TO [level]) may be appended. These additional message elements may not accurately reflect the current level/altitude, attitude, tracking information, or the intentions of the flight crew.

4.8.2.3 If the ATSU receives a CPDLC emergency message such as DM 55 PAN PAN PAN or DM 56 MAYDAY MAYDAY MAYDAY, the controller should acknowledge receipt of the CPDLC message using the most appropriate means (voice or CPDLC). If responding by CPDLC, the controller should use either of the following free text message elements (as appropriate):

a) UM 169r ROGER PAN if the downlink message contains DM 55 PAN PAN PAN; or

b) UM 169q ROGER MAYDAY if the downlink message contains DM 56 MAYDAY MAYDAY MAYDAY.

Note 1.— For FANS 1/A, the CPDLC emergency messages do not require a closure response. Therefore, the aircraft system will reject receipt of any technical response (i.e. including a MRN), such as the DM 3 ROGER message element.

Note 2.— For FANS 1/A, if the controller sends a CPDLC free text message to respond to an emergency message, the flight crew may not send the required response (i.e. DM 3 ROGER) to the free text message, depending on workload and the nature of the emergency .

4.8.2.4 The controller should attempt to determine the nature of the emergency and ascertain any assistance that may be required.

4.8.2.5 The ATSU with control responsibility for the flight may choose to:

a) Shorten the ADS-C periodic reporting interval; or

b) Send a demand contract request.

Note 1.— Shortening the ADS-C reporting interval reduces the period between cancellation of the ADS-C emergency and receipt of the ADS-C CANCEL EMERGENCY message.

Note 2.— Adjacent ATSUs should not shorten the ADS-C periodic reporting interval.

Note 3.— A demand contract request is not required if the periodic reporting interval has been shortened – an ADS-C report will have already been triggered by the aircraft when the new periodic contract is received.

4.8.3 ADS-C emergency report without a CPDLC emergency message

4.8.3.1 When an ATSU not having control responsibility for the aircraft receives an indication of an ADS-C emergency, they should confirm that the controlling authority has also received the emergency report (see paragraph 3.1.2.4.2 for related information).

4.8.3.2 When an ATSU having control responsibility for the aircraft receives an indication of an ADS-C emergency report without either a CPDLC emergency message or voice confirmation, then it is possible that the aircraft may be subject to unlawful interference or inadvertent activation of the ADS-C emergency mode. If a subsequent ADS-C report indicates that the aircraft is maintaining normal operations (i.e. the aircraft is operating in accordance with its clearance), the controller should confirm the ADS-C emergency using CPDLC or voice.

4.8.3.3 To confirm activation of the ADS-C emergency mode using CPDLC, the controller should send the following CPDLC free text uplink (or voice equivalent).

Controller	UM 169ak CONFIRM ADS-C EMERGENCY

4.8.3.3.1 If the emergency mode has been activated inadvertently, the controller expects the flight crew to cancel the ADS-C emergency and advise the controller either by voice or the following CPDLC messages.

Flight crew	DM 3 ROGER, then DM 67ab ADS-C RESET

4.8.3.3.2 If the aircraft continues with the ADS-C emergency mode activated, the controller should assume the aircraft is in emergency conditions and follow normal alerting procedures.

Note.— The aircraft may not send the ADS-C CANCEL EMERGENCY message until the next ADS-C periodic report is due.

4.9 Non-routine procedures

4.9.1 General

4.9.1.1 Refer to current ICAO procedures for standards and recommended practices on complete communications failure (CPDLC and voice).

4.9.2 Voice communications related to data link

4.9.2.1 When CPDLC fails and open messages existed at the time of failure, the controller should re-commence any dialogues involving those messages by voice.

4.9.2.2 The controller or radio operator should use the standard voice phraseology under certain conditions as indicated in Table 4-6.

Note.— See paragraph 5.9.2.2 for standard voice phraseology used by the flight crew.

Table 4-6. Voice phraseology related to CPDLC

Condition	Voice phraseology
To advise all stations or a specific flight of a complete ground system failure and provide further instructions. (ICAO Doc 4444)	[ALL STATIONS] CPDLC FAILURE (instructions). Example: ALL STATIONS CPDLC FAILURE. DISCONNECT CPDLC. CONTINUE ON VOICE
To instruct the flight crew of a single CPDLC message failure. (ICAO Doc 4444)	CPDLC MESSAGE FAILURE (appropriate clearance, instruction, information or request)
To instruct the flight crew of a correction to a CPDLC clearances, instructions, information or requests. (ICAO Doc 4444)	DISREGARD CPDLC (message type) MESSAGE, BREAK (correct clearance, instruction, information or request)
To instruct all stations or a specific flight to avoid sending CPDLC requests for a limited period of time. (ICAO Doc 4444)	[ALL STATIONS] STOP SENDING CPDLC REQUESTS [UNTIL ADVISED] [(reason)]
To instruct the flight crew to manually initiate a logon to the subsequent ATSU *Note.— No equivalent to ICAO Doc 4444.*	DISCONNECT CPDLC THEN LOGON TO [facility designation] *Note 1.— The [facility designation] is the four character ICAO code.* *Note 2.— Use this voice phraseology when the CPDLC transfer to an adjacent ATSU has failed.*
To advise the flight crew prior to the commencement of a CPDLC shutdown and instruct them to continue on voice. *Note.— No equivalent to ICAO Doc 4444.*	CPDLC WILL BE SHUT DOWN. DISCONNECT CPDLC. CONTINUE ON VOICE.
To advise all stations or a specific flight to resume normal CPDLC operations and provide the logon address. *Note.— Modified from ICAO Doc-4444 to include logon address.*	[ALL STATIONS] RESUME NORMAL CPDLC OPERATIONS. LOGON TO [facility designation]

4.9.3 Data link initiation failure

4.9.3.1 In the event of a log on failure by an aircraft in or approaching an ATSU's airspace, and when a flight plan is available, the ATSU should check that the aircraft identification and aircraft registration or address, as well as other details contained in the data link initiation request, correspond with details in the flight plan.

Note.— In the case of FANS 1/A, the geographic position of the aircraft at the time of initiating the logon is contained in the logon request message.

4.9.3.1.1 If initiation request details differ from the flight plan details, the controller should contact the flight crew to resolve differences between the aircraft details and the flight plan and make the appropriate changes in either the flight plan or the aircraft; and then arrange a re-initiation of the logon process by the flight crew.

4.9.3.1.2 If initiation request details match the flight plan details but the flight is not eligible for log on at this time, the controller should contact the flight crew to arrange a re-initiation of the logon process at an appropriate time.

4.9.3.2 In the event of a log on failure by an aircraft in or approaching an ATSU's airspace, and, when no flight plan is available, the controller should:

a) If possible, contact the flight crew to obtain sufficient flight plan data to enable a successful log on; and then

b) Arrange a re-initiation of the logon process.

4.9.3.3 The ANSP should ensure that procedures are in place to notify the appropriate State/regional monitoring agency via a problem report of the failure.(paragraph 3.2.2 refers)

Note.— When it can be determined that the log on is inappropriate, no action is required.

4.9.4 Data link service failures

4.9.4.1 CPDLC connection failure

4.9.4.1.1 If a CPDLC dialogue is interrupted by a data link service failure, the controller should re-commence the entire dialogue by voice communication.

4.9.4.1.2 When the controller recognizes a failure of the CPDLC connection, the controller should instruct the flight crew to terminate the connection and then initiate another logon. The controller or radio operator should use the following voice phraseology:

Controller (or radio operator)	CPDLC FAILURE. DISCONNECT CPDLC THEN LOGON TO [facility designation]
Flight crew	ROGER

Note.— The [facility designation] is the 4 character ICAO code.

4.9.4.2 Transferring the CPDLC connection – abnormal conditions

4.9.4.2.1 When the automatic transfer of the CPDLC connection fails, the controller should use the following messages via CPDLC. When using voice, use the equivalent voice phraseology:

Controller	UM 169am or UM 183am AUTOMATIC TRANSFER OF CPDLC FAILED. WHEN ENTERING [unit name] AREA DISCONNECT CPDLC THEN LOGON TO [facility designation]
Flight crew	DM 3 ROGER

Note 1.— The [unit name] is expressed as the radiotelephony name, not the 4-character code. The [facility designation] is the relevant four character ICAO code.

Note 2.— Instructing the flight crew to DISCONNECT CPDLC will result in loss of CPDLC connectivity. This procedure should only be applied approaching the boundary with the next ATSU.

4.9.4.3 Data link service failure

4.9.4.3.1 In the event of an unplanned data link shutdown, the relevant ATSU should inform:

a) All affected aircraft using the following voice phraseology:

Controller (or radio operator)	ALL STATIONS CPDLC FAILURE. DISCONNECT CPDLC. CONTINUE ON VOICE
Flight crew	ROGER

b) The adjacent ATSUs by direct coordination; and

c) All relevant parties via the publication of a NOTAM, if appropriate.

Note.— In the event of a planned or unexpected network or satellite data service outage (e.g. ground earth station failure), the CSP will notify all ATSUs within the affected area in accordance with paragraph 3.1.3.1 so the controller can inform affected aircraft.

4.9.4.4 Planned data link shutdown

4.9.4.4.1 During the time period of a planned data link shutdown, the ANSP will advise the operators of the requirements to use voice communication procedures.

4.9.4.4.2 When advising the flight crew prior to the commencement of a planned data link shutdown, the controller should use the following CPDLC message or the radio operator should use the equivalent voice phraseology:

Controller (or radio operator, if voice)	UM 169ax CPDLC WILL BE SHUT DOWN. DISCONNECT CPDLC. CONTINUE ON VOICE *Note 1.— The controller could optionally provide the voice frequency.*
Flight crew	DM 3 ROGER *Note 2.— The controller expects the flight crew to terminate the CPDLC connection and continue on voice.*

4.9.4.5 CPDLC or ADS-C service failure

4.9.4.5.1 Some ATSUs are not equipped with both CPDLC and ADS-C and consequently may experience a failure of either the CPDLC or ADS-C service. For ATSUs that have both CPDLC and ADS-C, both components can fail independently or simultaneously.

4.9.4.5.2 When the ADS-C service is shut down, the affected ATSU should inform all other affected parties of the shutdown and likely duration.

4.9.4.5.3 If the CPDLC service is still available, the controller should revert to either CPDLC or voice to fulfill the position reporting requirement. The controller should then send a CPDLC message to notify the flight crew of position reporting requirements using either of the following free text messages:

Controller	UM 169ao ADS-C SHUT DOWN AT [facility designation]. REVERT TO CPDLC POSITION REPORTS. LEAVE ADS-C ARMED.
Flight crew	DM 3 ROGER

or

Controller	UM 169at ADS-C SHUT DOWN AT [facility designation]. REVERT TO VOICE POSITION REPORTS. LEAVE ADS-C ARMED.
Flight crew	DM 3 ROGER

Note.— The [facility designation] is the 4 character ICAO code.

4.9.4.5.4 When an ADS-C contract cannot be established, or if ADS-C reporting from an aircraft ceases unexpectedly, the controller should instruct the flight crew, using the following CPDLC message or use equivalent voice phraseology:

Controller	UM 169an CONFIRM ADS-C ARMED
Flight crew	DM 3 ROGER

Note.— The flight crew may have inadvertently selected ADS-C off. If ADS-C had been turned off, re-arming it will not re-initiate previous ADS contracts. The ATSU will need to establish new ADS contracts.

4.9.4.6 Resuming data link operations

4.9.4.6.1 The controller or radio operator should use the following voice phraseology to advise the flight crew that the CPDLC system has resumed operations.

Controller (or radio operator)	[ALL STATIONS] RESUME NORMAL CPDLC OPERATIONS. LOGON TO [facility designation]
Flight crew	LOGON [facility designation]

Note.— The [facility designation] is the 4 character ICAO code.

4.9.4.6.2 The controller or radio operator should use the following voice phraseology to advise the flight crew that the CPDLC and ADS-C system has resumed operations.

Controller (or radio operator)	[ALL STATIONS] RESUME NORMAL CPDLC and ADS-C OPERATIONS. CPDLC AND VOICE POSITION REPORTS NOT REQUIRED
Flight crew	LOGON [facility designation]

Note.— The [facility designation] is the 4 character ICAO code.

4.9.4.6.3 The controller or radio operator should use the following CPDLC message or use equivalent voice phraseology to advise the flight crew that the ADS-C system has resumed operations and CPDLC and voice position reports are not required.

Controller (or radio operator)	UM 169aw RESUME NORMAL ADS-C OPERATIONS. CPDLC AND VOICE POSITION REPORTS NOT REQUIRED
Flight crew	DM 3 ROGER

4.9.4.7 Inaccurate time estimates

4.9.4.7.1 If ADS-C or CPDLC position reports indicate inaccurate time estimates. The controller should notify the flight crew using voice or the following free text message:

Controller	UM 169h ADS-C ESTIMATES APPEAR INACCURATE. CHECK FMS.
Flight crew	DM 3 ROGER

4.9.4.8 SATCOM failure

4.9.4.8.1 If the flight crew advises that a SATCOM failure has occurred on the aircraft and the failure affects the separation minimum currently being applied, the controller should establish an appropriate separation minimum.

4.9.5 Using CPDLC to relay messages

4.9.5.1 In airspace where procedural separation is being applied, when an ATSU and an aircraft cannot communicate, the controller may use CPDLC to relay messages via an intermediary CPDLC-capable aircraft. Depending on circumstances, the controller may first confirm that the CPDLC-capable aircraft is in contact with the subject aircraft, and should obtain concurrence from the flight crew that they will act as an intermediary. The controller should only use free text, with the following form:

Controller	UM 169ap RELAY TO [call sign] [unit name] [text of message to be relayed] Where: • [call sign] is expressed as the radiotelephony call sign, rather than the ICAO three letter or IATA two letter designator; • [unit name] is expressed as the radiotelephony name, not the 4-character code; and • [text of message to be relayed] conforms to the guidelines provided paragraph 3.1.1.4 and 4.3.2 (e.g. CLEARS [call sign] CLIMB TO AND MAINTAIN FL340). *Note.— The use of standard message elements is prohibited because the intermediary aircraft's FMS could be unintentionally armed.*
Flight crew	DM 3 ROGER
Flight crew	DM 67ae RELAY FROM [call sign] [response parameters]

Example:

Controller	UM 169ap RELAY TO UNITED345 OAKLAND CLEARS UNITED345 CLIMB TO AND MAINTAIN FL340
Flight crew	DM 3 ROGER
Flight crew	DM 67ae RELAY FROM UNITED345 CLIMBING FL340

Chapter 5. Flight crew procedures

5.1 Overview

5.1.1 General

5.1.1.1 The operator may be required to obtain an operational authorization by the State of the Operator or State of Registry to use CPDLC and ADS-C services in accordance with paragraph 3.2. This chapter provides guidance on procedures for the flight crew in airspace where data link services are available.

5.1.1.2 These procedures are intended to assist operators in the development of:

a) Operating procedures and associated documentation; and

b) Appropriate training programs.

5.1.1.3 Flight crews should be knowledgeable in operating manuals for use of the data link system specific to the aircraft type.

Note.— Refer to paragraph 3.2.1.3.

5.1.1.4 Flight crews should be knowledgeable in data link operations.

Note 1.— Refer to Chapter 2 for an overview of data link operations.

Note 2.— Where applicable, the communication procedures for the provision of CPDLC shall be in line with ICAO Annex 10, Volume II and Volume III, Part I, Chapter 3. CPDLC message element intent and text and associated procedures are, in general, consistent with ICAO Doc 4444 PANS-ATM Chapter 12 – Phraseologies and Chapter 14 – CPDLC.

5.1.2 Operational differences between voice communications and CPDLC

5.1.2.1 Development, testing, and operational experience have highlighted fundamental differences between CPDLC and voice communications. These differences need to be considered when developing or approving flight crew procedures involving the use of CPDLC.

5.1.2.2 For example, when using voice communications, each flight crew member hears an incoming or outgoing ATS transmission. With voice, the natural ability for each flight crew member to understand incoming and outgoing transmissions for their own aircraft has provided a certain level of situational awareness among the flight crew. With CPDLC, flight crew procedures need to ensure that the flight crew has an equivalent level of situational awareness associated with understanding the content and intent of a message in the same way.

5.1.2.3 Each flight crew member (e.g. pilot flying and pilot monitoring) should individually review each CPDLC uplink message prior to responding to and/or executing any clearance, and individually review each CPDLC downlink message prior to transmission.

5.1.2.4 If an operator uses augmented crews, the flight crew carrying out the 'handover' briefing should thoroughly brief the 'changeover' flight crew or flight crew member on the status of ADS-C and CPDLC connections and messages, including a review of any pertinent uplink and downlink CPDLC messages (e.g. conditional clearances).

5.1.2.5 Uplink messages require special attention to prevent the flight crew from responding to a clearance with DM 0 WILCO, but not complying with that clearance. To minimize errors, when responding to a clearance with DM 0 WILCO, each flight crew member should read the uplink message individually (silently) before initiating a discussion about whether and how to act on the message. Reading a message individually is a key element to ensuring that each flight crew member does not infer any preconceived intent different from what is intended or appropriate. Use of this method can provide a flight crew with an acceptable level of situational awareness for the intended operations.

5.1.2.6 In a similar manner, each flight crew member should individually review CPDLC downlink messages before the message is sent. Having one flight crew member (e.g. the pilot monitoring) input the message and having a different flight crew member (pilot flying) review the message before it is sent provides an adequate level of situational awareness comparable to or better than voice communication.

5.1.2.7 The flight crew should coordinate uplink and downlink messages using the appropriate flight deck displays. Unless otherwise authorized, the flight crew should not use printer-based information to verify CPDLC messages as printers are not usually intended for this specific purpose.

Note.— For aircraft that have CPDLC message printing capabilities, there are constraints associated with the use of the flight deck printer. Printers may not produce an exact copy of the displayed clearance with the required reliability, and should not be used as the primary display for CPDLC. However, in some cases, printed copies may assist the flight crew with clearances and other information that are displayed on more than one page, conditional clearances and crew handover briefings.

5.1.3 When to use voice and when to use CPDLC

5.1.3.1 When operating within airspace beyond the range of DCPC VHF voice communication, CPDLC is available and local ATC procedures do not state otherwise, the flight crew should normally choose CPDLC as the means of communication. The flight crew would use voice as an alternative means of communication (e.g. VHF, HF or SATVOICE direct or via a radio operator). However, in any case, the flight crew will determine the appropriate communication medium to use at any given time.

5.1.3.2 In airspace where both DCPC VHF voice and CPDLC communication services are provided, and local ATC procedures do not state otherwise, the flight crew will determine the communication medium to use at any given time.

Note.— ICAO Doc 4444, paragraph 8.3.2, requires that DCPC be established prior to the provision of ATS surveillance services, unless special circumstances, such as emergencies, dictate otherwise. This does not prevent the use of CPDLC for ATC communications, voice being immediately available for intervention and to address non-routine and time critical situations.

5.1.3.3 To minimize pilot head down time and potential distractions during critical phases of flight, the flight crew should use voice for ATC communications when operating below 10,000 ft AGL.

5.1.3.4 While the CPDLC message set, as defined in Appendix A, generally provides message elements for common ATC communications, the flight crew may determine voice to be a more appropriate means depending on the circumstances (e.g. some types of non-routine communications).

Note.— Refer to paragraph 5.8 for guidelines on use of voice and data communications in emergency and non-routine situations.

5.1.3.5 During an emergency, the flight crew would normally revert to voice communications. However, the flight crew may use CPDLC for emergency communications if it is either more expedient or if voice contact cannot be established. Refer to paragraph 5.8.2 for guidelines on use.

Note.— For ATN B1 aircraft, emergency message elements are not supported. See Appendix A, paragraph A.4, for a list of emergency message elements.

5.1.3.6 Except as provided in paragraph 5.8.1.2, the flight crew should respond to a CPDLC message via CPDLC, and should respond to a voice message via voice.

Note.— This will lessen the opportunity for messages to get lost, discarded or unanswered between the ATSU and the flight crew and cause unintended consequences.

5.1.3.7 If the intent of an uplink message is uncertain, the flight crew should respond to the uplink message with DM 1 UNABLE and obtain clarification using voice.

Note.—For FANS 1/A aircraft, some uplink messages do not have a DM 1 UNABLE response. On these aircraft, the flight crew should respond with DM 3 ROGER and then obtain clarification via voice.

5.1.3.8 Regardless of whether CPDLC is being used, the flight crew should continuously monitor VHF/HF/UHF guard frequency. In addition, the flight crew should continuously maintain a listening or SELCAL watch on the specified backup or secondary frequency (frequencies). On aircraft capable of two SATCOM channels, one channel may be selected to the phone number for the radio facility assigned to the current ATSU to enable timely voice communications. The second channel may be selected to the company phone number to enable timely voice communications with company dispatch.

5.2 Logon

5.2.1 General

5.2.1.1 A CPDLC connection requires a successfully completed logon procedure before the ATSU can establish a CPDLC connection with the aircraft.

Note.— Refer to paragraph 2.2.1.2 for an overview of the logon procedure.

5.2.1.2 Prior to initiating the logon, the flight crew should verify the following:

a) The aircraft identification provided when initiating the logon exactly matches the aircraft identification (Item 7) of the filed flight plan;

b) The flight plan contains the correct aircraft registration in Item 18 prefixed by REG/;

c) The flight plan contains the correct aircraft address in Item 18 prefixed by CODE/, when required;

d) The flight plan contains the correct departure and destination aerodromes in Items 13 and 16, when required; and

e) The aircraft registration provided when initiating the logon exactly matches the aircraft placard, when the flight crew manually enters the aircraft registration. Refer to Appendix F, paragraph F.1 for aircraft types that require manual entry.

Note.— If a logon request has been initiated with incorrect aircraft identification and aircraft registration, the logon process will fail. The flight crew will need to correct the information and reinitiate the logon request.

5.2.1.3 If any of the information described in paragraph 5.2.1.2 do not match, the flight crew will need to contact AOC or ATC, as appropriate, to resolve the discrepancy.

Note 1: In accordance with ICAO Doc 4444, the aircraft identification is either the:

a) ICAO designator for the aircraft operating agency followed by the flight identification; or

b) aircraft registration.

Note 2.— The aircraft registration entered into the aircraft system can include a hyphen(-), even though the aircraft registration in the flight plan message cannot include a hyphen.

Note 3.- The ATSU correlates the data sent in a logon request message with flight plan data. If the data does not match, the ATSU will reject the logon request.

5.2.1.4 The flight crew should then manually initiate a logon using the logon address, as indicated on aeronautical charts (See Figure 5-1 for example).

Note 1.— Often the logon address is the same as the 4-letter facility designator but in some airspace a different logon address is used. Refer to Appendix E.

Note 2.— Some aircraft (see Appendix F, paragraph F.1) implement FANS 1/A and ATN B1 capabilities as separate systems and do not comply ith ED154A/DO305A. For these aircraft, the flight crew will have to select the appropriate system (FANS 1/A or ATN B1) to initiate the logon.

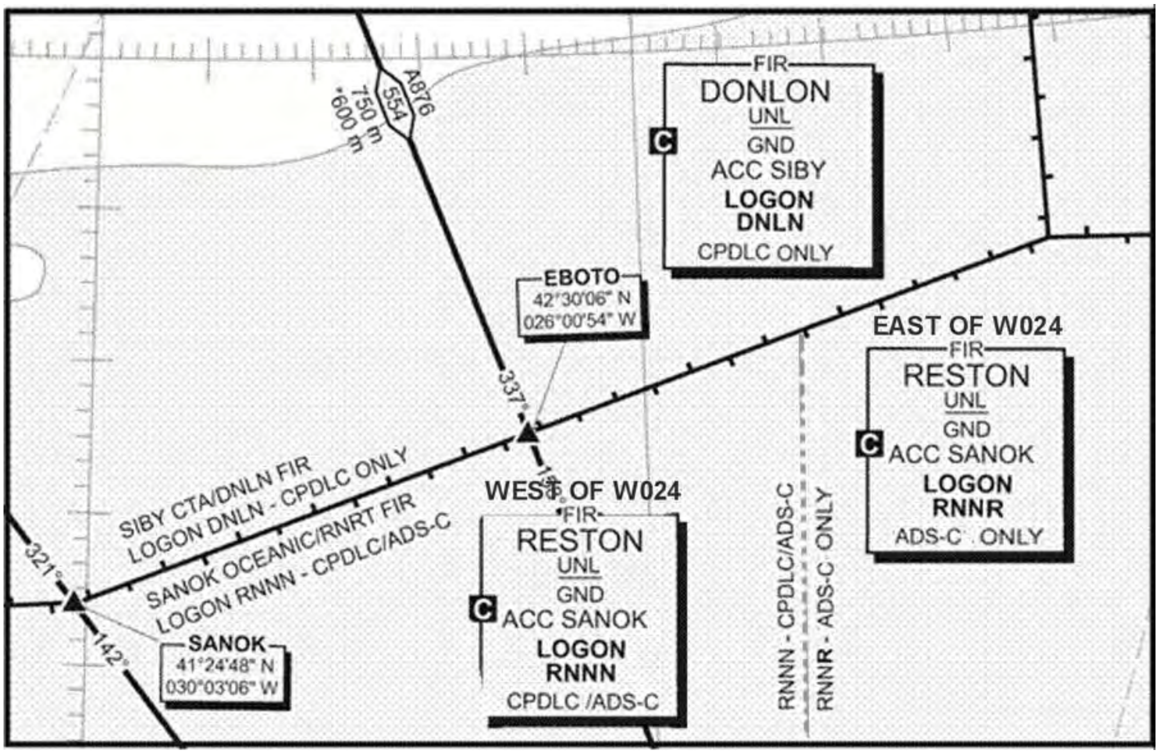


Figure 5-1. Depiction of logon addresses and CPDLC/ADS-C services on en route chart

5.2.1.5 If there are no indications that the logon procedure was unsuccessful, the flight crew can assume that the system is functioning normally and that they will receive a CPDLC connection prior to entry into the next ATSU's airspace.

5.2.1.6 If an indication that the logon procedure was unsuccessful is received, the flight crew should reconfirm that the logon information is correct per paragraphs 5.2.1.2 and 5.2.1.4 and reinitiate a logon.

Note.— If the logon information is correct and the logon process fails, see paragraph 5.9.3 for more information.

5.2.1.7 Each time a CPDLC connection is established, the flight crew should ensure the identifier displayed on the aircraft system matches the logon address for the controlling authority.

5.2.1.8 In the event of an unexpected CPDLC disconnect, the flight crew may attempt to reinitiate a logon to resume data link operations.

5.2.1.9 The flight crew may receive a CPDLC free text message from the ATSU or a flight deck indication regarding the use of the message latency monitor on FANS 1/A+ aircraft. When this message is received, the flight crew should respond as described in Table 5-1 and in accordance with procedures for the specific aircraft type.

Note 1.— Procedures associated with the message latency monitor are applicable only in the European Region and are described in Appendix E, paragraph E.4.3.2.

Note 2.— FANS 1/A aircraft do not support the message latency monitor. Refer to Appendix F, paragraph F.1, for availability of a FANS 1/A+ upgrade on different types of aircraft. Refer to Appendix F, paragraph F.11, for the specifications of the message latency monitor on different types of aircraft.

Table 5-1. Messages and indications regarding use of message latency monitor

	Instruction to switch message latency monitor off	
ATSU	UM 169au CONFIRM MAX UPLINK DELAY VALUE IS NOT SET	
Flight crew	**FANS 1/A+ aircraft**	**Message latency monitor not available**
	The flight crew should: a) Confirm that the message latency monitor is off (or not set); and b) Respond to the uplink [free text] message with DM 3 ROGER.	The flight crew should respond to the CPDLC [free text] message with DM 3 ROGER.
	Instruction to set the maximum uplink delay value	
ATSU	UM 169w SET MAX UPLINK DELAY VALUE TO [delayed message parameter] SECONDS where the [delayed message parameter] is an integer value (e.g. 40).	
Flight crew	**FANS 1/A+ aircraft**	**Message latency monitor not available**
	The flight crew should: a) Set the value; and b) Respond to the uplink message with DM 3 ROGER.	The flight crew should respond to the uplink [free text] message with DM 3 ROGER and append the DM 67af TIMER NOT AVAILABLE.
	Indication of delayed CPDLC uplink message (Some FANS 1/A+ aircraft only)	
ATSU/ aircraft system	(any CPDLC uplink message displayed with indication of delayed message)	
Flight crew	**Some FANS 1/A+ aircraft only**	
	The flight crew should: a) Revert to voice communications to notify the ATSU of the delayed message received and to request clarification of the intent of the CPDLC message (paragraph 5.9.2.2 refers); and b) Respond, appropriately, to close the message per the instructions of the controller.	

5.2.2 When to log on initially for data link services

5.2.2.1 When operating outside data link airspace, the flight crew should initiate a logon 10 to 25 minutes prior to entry into airspace where data link services are provided.

Note.— When departing an aerodrome close to or within such airspace, this may require the logon to be initiated prior to departure.

5.2.2.2 Where a data link service is only provided in upper airspace and where local procedures do not dictate otherwise, the flight crew should log on to that ATSU in whose airspace a data link service will first be used.

5.2.2.3 When failure of a data link connection is detected, the flight crew should terminate the connection and then initiate a new logon with the current ATSU.

5.2.3 Automatic transfer of CPDLC and ADS-C services between ATSUs

5.2.3.1 Under normal circumstances, the current and next ATSUs automatically transfer CPDLC and ADS-C services. The transfer is seamless to the flight crew.

Note.— The flight crew should not need to reinitiate a logon.

5.2.3.2 The flight crew should promptly respond to CPDLC uplinks to minimize the risk of an open CPDLC uplink message when transferring to the next ATSU.

Note.— If a flight is transferred to a new ATSU with an open CPDLC message, the message status will change to ABORTED. If the flight crew has not yet received a response from the controller, the downlink request will also display the ABORTED status. Refer also to Appendix F, paragraph F.8.

5.2.3.3 Prior to the point at which the current ATSU will transfer CPDLC and/or ADS-C services, the flight crew may receive an instruction to close any open CPDLC messages.

5.2.3.4 When entering the next ATSU's airspace, the flight crew should confirm the successful transfer from the current ATSU to the next ATSU by observing the change in the active center indication provided by the aircraft system.

5.2.3.5 When required by local procedures, the flight crew should send DM 48 POSITION REPORT [position report]. Alternatively, the flight crew may be required to respond to a CPDLC message exchange initiated by the ATSU.

Note.— Since FANS 1/A aircraft do not report that the downstream ATSU has become the CDA, the only way to confirm that it has taken place is for the ATSU to receive a CPDLC message from the aircraft (refer to Appendix E).

5.2.4 Transfer voice communications with the CPDLC connection transfer

5.2.4.1 Prior to crossing the boundary, the active center may initiate transfer of voice communications with the CPDLC connection transfer using any of the message elements containing CONTACT or MONITOR. Refer to paragraph 4.2.3 for guidelines on the controller's use of these message elements.

5.2.4.2 A CONTACT or MONITOR message instructs the flight crew to change to the specified frequency and may include a position or time for when to change to the new frequency.

a) When a MONITOR message is received, the flight crew should change to the specified frequency upon receipt of the instruction or at the specified time or position. The flight crew should not establish voice contact on the frequency.

b) When a CONTACT message is received, the flight crew should change to the specified frequency upon receipt of the instruction or at the specified time or position, and establish voice contact on the frequency.

Note 1.— Some States do not require HF SELCAL checks. If, following a MONITOR instruction, a SELCAL check is specifically required by operator procedures, this will usually be accommodated on the allocated frequency.

Note 2.— If the next ATSU provides CPDLC services, the flight crew should not expect that CPDLC will be terminated or suspended once voice contact is established per receipt of a CONTACT message, unless otherwise advised per paragraph 4.2.4.4.

5.2.4.3 If the ATSU assigns a single HF frequency, the flight crew should select another frequency from the same 'family' as a secondary frequency.

Note.— In areas of poor radio coverage, the controller may append UM 238 SECONDARY FREQUENCY [frequency] to specify a secondary frequency.

5.2.5 Exiting CPDLC and ADS-C service areas

5.2.5.1 The flight crew should consult the current ATSU prior to the manual termination of any ADS contract with the aircraft, even if it is suspected to be unnecessary or that its termination has failed.

Note.— ADS contracts are managed (e.g. established and terminated) by ATSUs per paragraph 4.5.3.

5.2.5.2 Approximately 15 minutes after exiting CPDLC and/or ADS-C service areas, the flight crew should ensure there are no active CPDLC or ADS-C connections. Ensuring that connections are not active eliminates the possibility of inadvertent or inappropriate use of the connections, and reduces operating costs and loading of the system.

Note.— Some ATSUs may maintain ADS contracts with an aircraft for a period of time (e.g. 15 minutes) after the aircraft has left the airspace.

5.3 CPDLC – ATS uplink messages

5.3.1 General

5.3.1.1 When a CPDLC uplink is received, each flight crew member (e.g. pilot flying and pilot monitoring) should read the message from the flight deck displays individually to ensure situational awareness is maintained. Once the message has been individually read, the flight crew should then discuss whether to respond to the message with DM 0 WILCO or DM 3 ROGER, as appropriate, or DM 1 UNABLE.

5.3.1.2 When processing an uplink multi-element message, the flight crew should ensure that the entire uplink has been read and understood in the correct sequence prior to responding.

Note.— A CPDLC multi-element message is one that contains multiple clearances and/or instructions. The display may only show part of a CPDLC multi-element message and require flight crew interaction to see the entire message.

Example:

Controller	UM 20 **CLIMB TO FL350** or *CLIMB TO AND MAINTAIN FL350.* UM 128 REPORT LEAVING FL330. UM 129 **REPORT MAINTAINING FL350** or *REPORT LEVEL FL350.*
Flight crew	DM 0 WILCO

5.3.1.3 If multiple clearances are received in a single message, the flight crew should only respond with DM 0 WILCO if all the clearances in the entire message can be complied with.

5.3.1.4 If the flight crew cannot comply with any portion of a multi-element message, the flight crew should respond to the entire message with DM 1 UNABLE.

Note.— The flight crew can only provide a single response to the entire multi-element uplink message. The flight crew cannot respond to individual elements of a multi-element message and should not execute any clearance contained in the message.

5.3.1.5 When an uplink responded to with DM 0 WILCO or DM 3 ROGER, the flight crew should take appropriate action to comply with the clearance or instruction.

Note.- Although a DM 0 WILCO or DM 3 ROGER response technically closes the uplink message, in some cases, other responses may follow to provide additional information, as requested, to operationally close the message.

5.3.1.6 The flight crew should respond to an uplink message with the appropriate response(s), as provided in Appendix A, paragraph A.4.

Note 1.— The flight crew may need to perform some action before a subsequent CPDLC message can be displayed.

Note 2.- For ATN-B1 systems, if the ground system does not receive a response within 120 seconds from the time the uplink message was sent, the ATSU will send an ERROR message for display to the flight crew and both the aircraft and ground system close the dialogue.

5.3.1.7 When a message is received containing only free text, or a free text element combined with elements that do not require a response, the flight crew should respond to the message with DM 3 ROGER before responding to any query that may be contained in the free text message element.

Example:

Controller (free text)	UM 169b REPORT GROUND SPEED.
Flight crew	DM 3 ROGER

Flight crew (free text)	DM 671 **GROUND SPEED 490** or *GS 490*

5.3.2 Flight crew response times for CPDLC uplink messages

5.3.2.1 System performance requirements have been established to support reduced separation standards. Specific latency times have been allocated to the technical performance, and flight crew and controller response times. Regional/State monitoring agencies analyze actual performance to ensure the technical and operational components of the system meet required standards. For example, to support RCP 240 operations, the flight crew is expected to be able to respond to a CPDLC uplink message within one minute.

5.3.2.2 For an ATN-B1 aircraft, the flight crew should respond to a CPDLC uplink message within 100 seconds to prevent the CPDLC uplink message from automatically timing out.

Note.- ATN-B1 aircraft use a CPDLC message response timer, which is set at 100 seconds upon receipt of the CPDLC uplink message. If the flight crew has not sent a response within this time:

a) the flight crew is no longer provided with any response prompts for the message;

b) the aircraft sends an ERROR message for display to the controller; and

c) the aircraft and ground systems close the dialogue.

5.3.2.3 When a CPDLC uplink message automatically times out, the flight crew should contact ATC by voice.

5.3.2.4 The flight crew should respond to CPDLC messages as soon as practical after they are received. For most messages, the flight crew will have adequate time to read and respond within one minute. However, the flight crew should not be pressured to respond without taking adequate time to fully understand the CPDLC message and to satisfy other higher priority operational demands. If additional time is needed, the flight crew should send a DM 2 STANDBY response.

Note.— For ATN B1 aircraft systems, if the flight crew does not send an operational response within 100 seconds after the DM 2 STANDBY was sent, the CPDLC uplink message will time out (refer to paragraph 5.3.2.3).

5.3.2.5 If a DM 2 STANDBY response has been sent, the flight crew should provide a subsequent closure response to the CPDLC message.

Note 1.— In the case of a DM 2 STANDBY response, the uplink message remains open until the flight crew responds with a DM 0 WILCO orDM 1 UNABLE. If the closure response is not received within a reasonable period of time, the controller is expected to query the flight crew per paragraph 4.3.1.2.

Note 2.— Transmission times for messages may vary for a number of reasons including the type of transmission media, network loading, or the criteria for transitioning from one media to another (e.g. VHF/Satcom). Operational response times may vary depending on workload and complexity of the instruction or clearance.

5.3.3 Conditional clearances

5.3.3.1 Conditional clearances require special attention by the flight crew, particularly for a non-native English speaking flight crew. A conditional clearance is an ATC clearance given to an aircraft with certain conditions or restrictions such as changing a flight level based on a time or place. Conditional clearances add to the operational efficiency of the airspace. Conditional clearances, however, have been associated with a large number of operational errors. Following guidelines provided in paragraphs 5.1.2 and 5.3.1, such as each flight crew member individually reading the uplinked clearances and conducting briefings with augmented crews, should aid in reducing errors.

5.3.3.2 The flight crew should correctly respond to conditional clearances containing "AT" or "BY", taking into account the intended meaning and any automation features provided by the aircraft systems. Table 5-2 clarifies the intended meaning for conditional clearance message elements. (Refer also to Appendix A, paragraph A.3.)

Table 5-2. Conditional clearance clarification of vertical clearances

Message Intent	**Message element**
Instruction that at the specified time a climb to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that, NOT BEFORE the specified time, a climb to the specified level is to commence and, once reached, the specified level is to be maintained.* *Note 2.— This message element would be preceded with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	UM 21 **AT [time] CLIMB TO [level]** or *AT [time] CLIMB TO AND MAINTAIN [altitude]*
Instruction that at the specified position a climb to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that, AFTER PASSING the specified position, a climb to the specified level is to commence and, once reached, the specified level is to be maintained.* *Note 2.— This message element would be preceded with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	UM 22 **AT [position] CLIMB TO [level]** or *AT [position] CLIMB TO AND MAINTAIN [altitude]*
Instruction that at a specified time a descent to a specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that, NOT BEFORE the specified time, a descent to the specified level is to commence and, once reached, the specified level is to be maintained.* *Note 2.— This message element would be preceded with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	UM 24 **AT [time] DESCEND TO [level]** or *AT [time] DESCEND TO AND MAINTAIN [altitude]*

Message Intent	**Message element**
Instruction that at the specified position a descent to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that, AFTER PASSING the specified position, a descent to the specified level is to commence and, once reached, the specified level is to be maintained.* *Note 2.— This message element would be preceded with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	UM 25 **AT [position] DESCEND TO [level]** or *AT [position] DESCEND TO AND MAINTAIN [altitude]*
Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a climb is to commence at a rate such that the specified level is reached NOT LATER THAN the specified time.*	UM 26 CLIMB TO REACH [level] BY [time]
Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a climb is to commence at a rate such that the specified level is reached BEFORE PASSING the specified position.*	UM 27 CLIMB TO REACH [level] BY [position]
Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a descent is to commence at a rate such that the specified level is reached NOT LATER THAN the specified time.*	UM 28 DESCEND TO REACH [level] BY [time]
Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a descent is to commence at a rate such that the specified level is reached BEFORE PASSING the specified position.*	UM 29 DESCEND TO REACH [level] BY [position]

5.3.4 "EXPECT" uplink messages

5.3.4.1 "EXPECT" uplink messages are typically received in response to a flight crew request, and, in some cases, when procedurally required per paragraph 4.3.3.

5.3.4.2 When receiving an EXPECT uplink message, the flight crew should respond with DM 3 ROGER, meaning that the message was received and understood.

Note 1.— The flight crew should NOT comply with an EXPECT message as if it was a clearance.

Note 2.— The FANS 1/A CPDLC message set contains EXPECT uplink message elements that the controller should NOT use because of potential misinterpretation in the event of a total communication failure. Some of these message elements have been reserved by Doc 4444. As a consequence, some "WHEN CAN WE EXPECT" downlink messages are not supported. See Appendix A, paragraph A.3, and Appendix E, paragraph E.7.1.3, for specific message elements that are not supported.

5.3.5 Uplinks containing FMS-loadable data

5.3.5.1 CPDLC allows aircraft systems to be capable of loading route clearance information from CPDLC messages directly into an FMS. The flight crew can use this capability to minimize the potential for data entry errors when executing clearances involving loadable data. It also enables advanced air traffic services supported by data link, such as a re-route or a tailored arrival, as described in Chapter 6, which otherwise may not be possible via voice.

Note.— Not all aircraft have the capability to load information from CPDLC message directly into the FMS.

5.3.5.2 If a clearance is received that can be automatically loaded into the FMS, the flight crew should load the clearance into the FMS and review it before responding with DM 0 WILCO.

5.3.5.3 The flight crew should verify that the route modification in the FMS is consistent with the CPDLC route clearance. A discontinuity in a CPDLC route clearance is not necessarily a reason to respond to the clearance with DM 1 UNABLE, as these can be appropriate in some circumstances.

5.3.5.4 The flight crew should respond to the clearance with DM 1 UNABLE when:

a) The FMS indicates that it cannot load the clearance (e.g. partial clearance loaded or unable to load); or

Note.— The FMS checks the clearance to ensure it is correctly formatted and compatible with the FMS navigation database.

b) The FMS indicates any inconsistencies or discontinuities with the route modification that are not addressed by AIP (or other appropriate publication) or cannot be resolved by the flight crew.

5.3.5.5 The flight crew should use CPDLC or voice to clarify any clearance that was responded to with DM 1 UNABLE due to any loading failures, route discontinuities or inconsistencies.

5.3.5.6 If the clearance loads successfully and is acceptable, the flight crew may execute an FMS route modification and respond to the clearance with DM 0 WILCO.

Note.— The flight crew will ensure the route in the FMC matches the ATC clearance.

5.4 CPDLC – ATS downlink messages

5.4.1 General

5.4.1.1 Downlink messages can only be sent to the ATSU that holds the active CPDLC connection. To provide situational awareness, procedures should ensure that each flight crew member has read each downlink message before it is sent.

5.4.1.2 When the aircraft has an active CPDLC connection with an ATSU, the flight crew should downlink a clearance request only if the flight is in that ATSU's airspace.

5.4.1.3 The flight crew should use standard downlink message elements to compose and send clearance requests, CPDLC position reports, and other requested reports. Additional qualifying standard message elements, such as DM 65 DUE TO WEATHER, should also be used as needed.

Note.— The use of standard message elements will minimize the risk of input errors, misunderstandings, and confusion, and facilitate use by a non-native English speaking flight crew. The use of standard message elements allows the aircraft and ground systems to automatically process the information in the messages that are exchanged. For example, the flight crew can automatically load clearance information into the FMS and review the clearance, the ground system can automatically update flight plan data for route conformance monitoring, and both aircraft and ground systems can associate responses to messages.

5.4.1.4 To avoid potential ambiguity, the flight crew should avoid sending multiple clearance requests in a single downlink message. For example, the flight crew should send separate downlink messages for DM 9 REQUEST CLIMB TO [level] and DM 22 REQUEST DIRECT TO [position] unless there is an operational need to combine them in a single message (i.e. the flight crew does not want to climb unless they can re-route).

5.4.1.5 When a closure response to an open CPDLC downlink message is not received within a reasonable time period, the flight crew should:

a) For a FANS 1/A aircraft, send a query using one of the Negotiation Requests messages or a DM 67 [free text] message rather than resending the downlink message. Alternatively, the flight crew may use voice communication to clarify the status of the open CPDLC downlink message; or

b) For an ATN-B1 aircraft, the flight crew should use voice communication to resolve the operational situation resulting from the timed out CPDLC downlink message.

Note 1.— A closure response is a response that operationally closes the dialogue. A UM 1 STANDBY response to an open CPDLC downlink message does not operationally close the dialogue.

Note 2.— The use of a CPDLC free text message by a FANS 1/A aircraft avoids multiple open messages involving the same downlink message.

Note 3.- ATN-B1 ground systems will reject duplicate requests and return an ERROR message for display to the flight crew TOO MANY (dialogue type) REQUESTS - EXPECT ONLY ONE REPLY.

Example:

Flight crew	DM 9 REQUEST CLIMB TO FL350
	Reasonable period of time has passed

Flight crew	DM 53 **WHEN CAN WE EXPECT HIGHER LEVEL** (or *ALTITUDE*) or DM 87 WHEN CAN WE EXPECT CLIMB TO FL350

5.4.1.6 If the flight crew receives an indication of non-delivery of a downlink message, they may elect to re-send an identical message within a reasonable amount of time or as required. Alternatively, they may use voice communication to clarify the status of the downlink message.

5.4.2 Free text

5.4.2.1 The flight crew should avoid the use of the free text message element. However, its use may offer a viable solution to enhance operational capability.

Note 1.— The use of standard message elements is intended to reduce the possibility of misinterpretation and ambiguity.

Note 2.— A free text message (such as DM 67k REVISED ETA [position] [time]) does not require a response from the ATSU.

5.4.2.2 Free text messages should be used only when an appropriate standard message element does not exist.

5.4.2.3 When composing a free text message, the flight crew should use standard ATS phraseology and format and avoid nonessential words and phrases. Abbreviations should only be included in free text messages when they form part of standard ICAO phraseology, for example, ETA.

5.4.3 Unsupported messages

5.4.3.1 While ATSUs should provide CPDLC service using the complete message set provided in Appendix A, some ATSUs provide a CPDLC service using a limited message set. The flight crew should be are aware of any unsupported downlink message elements that are described in regional or State documentation.

5.4.3.2 If a downlink message, containing a message element that is not supported by the ATSU, is sent, the flight crew will typically receive the uplink message, UM 162 or UM 169u MESSAGE NOT SUPPORTED BY THIS ATS UNIT. If this message is received, the flight crew should respond to the message with DM 3 ROGER and use voice for the communication transaction.

5.4.4 CPDLC reports and confirmation requests

5.4.4.1 The flight crew should respond to CPDLC reports and confirmation requests, when appropriate.

Note 1.— ATSUs may send a CPDLC message that combines a REPORT instruction with a clearance. The flight crew may use automation, procedures, and/or a combination to remind them when to send the reports requested in the CPDLC message.

Example:

Controller	UM 20 **CLIMB TO FL350** or *CLIMB TO AND MAINTAIN FL350*. UM 128 REPORT LEAVING FL330. UM 129 **REPORT MAINTAINING [level]** or *REPORT LEVEL FL350*.
Flight crew	DM 0 WILCO

Note 2.— The controller may send a CPDLC message to request the flight crew to advise intentions when ADS-C indicates the aircraft has deviated from its cleared route, level or assigned speed (paragraph 4.3.5.2 refers).

5.5 Automatic dependant surveillance – contract (ADS-C)

5.5.1 General

5.5.1.1 ADS-C allows the ATSU to obtain position reports from the aircraft without flight crew action to update the current flight plan, to check conformance and to provide emergency alerting.

Note.— In airspace where ADS-C services are available, the flight crew need not send position reports via voice or CPDLC, except as described in paragraph 5.6.3 or when required by regional supplementary procedures or AIP (or other appropriate publication).

5.5.1.2 When using ADS-C services, the flight crew should check to ensure ADS-C is armed prior to initiating a logon with an ATSU.

Note.— The flight crew can switch ADS-C off, which will cancel any ADS-C connections with the aircraft. While ADS-C is disabled, the ground system will not be able to establish an ADS-C connection.

5.5.1.3 Normally, the flight crew should leave ADS-C armed for the entire flight. However, in airspace where ADS-C services are available, if the flight crew switches ADS-C off for any reason, or they receive indication of avionics failure leading to loss of ADS-C service, the flight crew should advise ATC and follow alternative procedures for position reporting per paragraphs 5.6 and 5.9.4.4.

5.5.1.4 In airspace where ADS-C services are not available, the flight crew may switch ADS-C off to cancel inadvertent ADS-C connections. In such cases, the flight crew should ensure that ADS-C is armed when re-entering airspace where ADS-C services are again available.

5.5.1.5 If ADS-C is disabled in an ADS-C environment, the ATSU may send the flight crew an inquiry per paragraph 5.9.4.6.

5.6 Position reporting

5.6.1 General

5.6.1.1 The flight crew should ensure that waypoints are sequenced correctly. If an aircraft passes abeam a waypoint by more than the aircraft FMS waypoint sequencing parameter, the flight crew should sequence the waypoints in the FMS, as appropriate.

Note.— As shown in Figure 5-2, when an aircraft passes abeam a waypoint in excess of the defined sequencing parameter (refer to Appendix F, paragraph F.7) for specific aircraft types), the FMS will not sequence the active waypoint. If the flight crew does not sequence the waypoint, incorrect information will be contained in ADS-C reports, CPDLC position reports and FMC waypoint position reports – the next waypoint in these reports will actually be the waypoint that the aircraft has already passed.

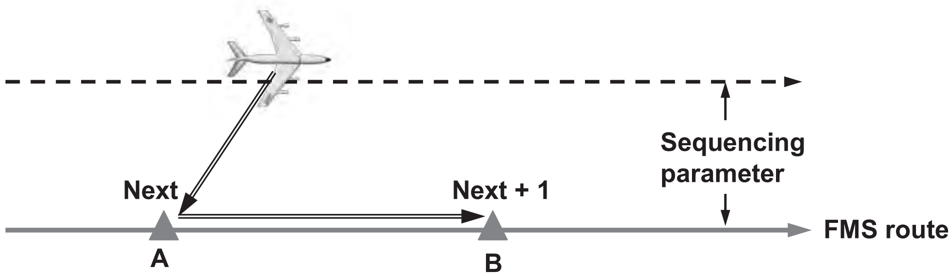


Figure 5-2. Waypoint sequencing anomaly

5.6.1.2 When using CPDLC or FMC WPR to provide position information, the flight crew should use latitudes and longitudes encoded as waypoint names in the ICAO format.

Note 1.— The flight crew should not use the ARINC 424 format.

Note 2.— ARINC 424 describes a 5-character latitude/longitude format for aircraft navigation databases (e.g. 10N40 describes a lat/long of 10N140W). The ATSU will likely reject any downlink message containing waypoint names in the ARINC 424 format.

5.6.2 Position reporting in a non-ADS-C environment

5.6.2.1 When ADS-C is not available, the flight crew should conduct position reporting by voice or CPDLC. When using CPDLC, the flight crew should send DM 48 POSITION REPORT [position report] whenever an ATC waypoint is sequenced, (or passed abeam when offset flight is in progress).

5.6.2.2 When using CPDLC for position reporting, the flight crew should send position reports only at compulsory reporting points and ensure that the position and next position information applies to compulsory reporting points, unless requested otherwise by ATC. The ensuing significant point after the next position may be either a compulsory or non-compulsory reporting point (Refer AIREP form ICAO Doc 4444, Appendix 1).

5.6.3 Position reporting in an ADS-C environment

Note.— In an ADS-C environment, the flight crew should not provide position reports or revised waypoint estimates by CPDLC or voice, unless otherwise instructed or under conditions in certain airspace as stipulated in Regional Supplementary Procedures or AIP (or other appropriate publication) (See also Appendix E).

5.6.3.1 If required by regional supplementary procedures or AIP (or other appropriate publication), the flight crew should provide a CPDLC position report when either of the following events occurs:

a) An initial CPDLC connection is established; or

b) The CPDLC connection transfer has been completed (i.e. at the associated boundary entry position).

Note.— Some ANSPs require a single CPDLC position report, even when in an ADS-C environment, to provide the controlling ATSU confirmation that it is the CDA and the only ATSU able to communicate with the aircraft via CPDLC (refer to Appendix E).

5.6.3.2 The flight crew should include only ATC waypoints in cleared segments of the aircraft active flight plan.

Note.— If the flight crew inserts non-ATC waypoints (e.g. mid-points) into the aircraft active flight plan and activates the change, the aircraft system may trigger an ADS-C waypoint change event report at the non-ATC waypoint, or include information about the non-ATC waypoint in the predicted route group, as well as the intermediate and fixed projected intent groups. As a result, the ADS-C report will include information about the non-ATC waypoint, which is not expected by the ATC ground system.

5.6.3.3 The flight crew should maintain the active route in the aircraft system to be the same as the ATC cleared route of flight.

Note.— If the flight crew activates a non-ATC cleared route into the aircraft system, the ADS-C reports will include information that will indicate the aircraft is flying a route that is deviating from the cleared route.

5.6.3.4 When reporting by ADS-C only, the flight crew should include ATC waypoints in the aircraft active flight plan even if they are not compulsory reporting points.

5.6.4 Position reporting using FMC WPR

5.6.4.1 Prior to using FMC WPR for position reporting, the flight crew should verify the aircraft identification (ACID) entered into the system is the same as filed in Item 7 of the flight plan.

5.6.4.2 When FMC waypoint position reports are manually initiated, the flight crew should send the report within 3 minutes of crossing each waypoint. If this cannot be achieved, the FMC WPR should not be triggered, but a voice report made instead.

5.6.4.3 The flight crew may assume that the estimate for the next waypoint, shown on the FMS at the time a waypoint is crossed, is the estimate transmitted to ATC in the FMC waypoint position report. If that estimate subsequently changes by more than 2 minutes, the flight crew should transmit a revised estimate via voice to the ATSU concerned as soon as possible.

Note.— Some regions permit a revised FMC WPR to be transmitted to update a previously notified estimate.

5.6.4.4 The flight crew should avoid inserting non-ATC waypoints (e.g. mid-points) in route segments because non-ATC waypoints may prevent the provision of proper ETA data in the FMS reports required for ATC purposes.

5.6.4.5 If the flight identification portion of the aircraft identification contains an alphabetic character (such as ABC132A or ABC324W, where 132A or 324W is the flight identification) the flight cannot participate in FMC WPR (see paragraph 3.4.1.4 for more information regarding this limitation).

5.7 Weather deviations and offsets

5.7.1 General

5.7.1.1 The flight crew may use CPDLC to request a weather deviation clearance or an offset clearance. The difference between a weather deviation and an offset is portrayed in Figure 5-3.

a) A weather deviation clearance authorizes the flight crew to deviate up to the specified distance at their discretion in the specified direction from the route in the flight plan; and

b) An offset clearance authorizes the flight crew to operate at the specified distance in the specified direction from the route in the flight plan. A clearance is required to deviate from this offset route.

Note.— CPDLC offers more timely coordination of weather deviation clearances. However, the flight crew may deviate due to weather under the provisions of ICAO Doc 4444, paragraph 15.2.3. The extent to which weather deviations are conducted may be a consideration when applying reduced separations, as noted in ICAO Doc 4444, paragraph 5.4.2.6.4.3.

5.7.1.2 Flight crews should use the correct message element when requesting an off-route clearance.

Note.— The difference between a weather deviation and an offset affects how ATC separate aircraft.

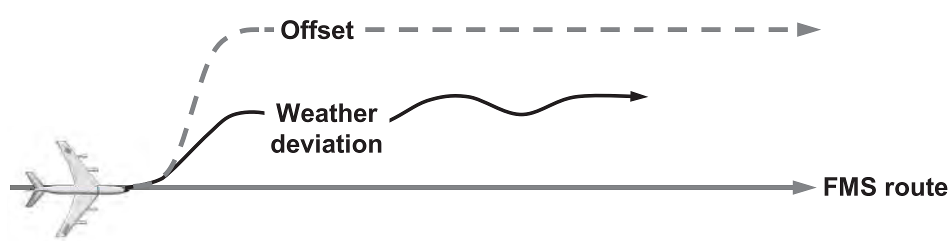


Figure 5-3. Offset and weather deviation

5.7.2 Weather deviation requests and offsets

5.7.2.1 When requesting a weather deviation or offset clearance, the flight crew should specify the distance off route with respect to the cleared route of the aircraft. If the flight crew has received an off-route clearance and then requests and receives a subsequent off-route clearance, the new clearance supersedes the previous clearance (i.e. only the most recent clearance is valid).

Note.— When an off-route clearance has been received, the flight crew will need to ensure that waypoints are sequenced correctly per paragraph 5.6.1.1.

Example 1: As shown in Figure 5-4, the flight crew requests a weather deviation clearance to operate up to 20NM left of route. The controller issues the appropriate clearance.

Flight crew	DM 27 REQUEST WEATHER DEVIATION UP TO 20NM LEFT OF ROUTE
Controller	UM 82 CLEARED TO DEVIATE UP TO 20NM LEFT OF ROUTE UM 127 REPORT BACK ON ROUTE
Flight crew	DM 0 WILCO

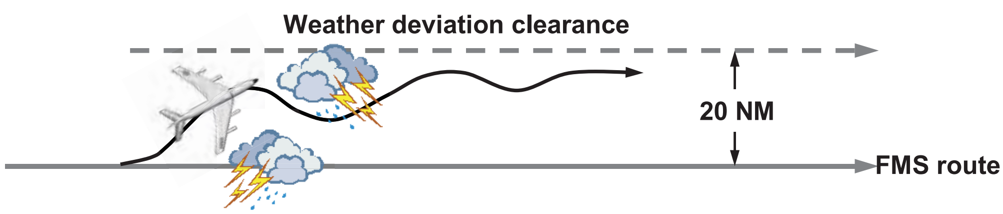


Figure 5-4. Weather deviation clearance up to 20 NM left of route

Example 2: As shown in Figure 5-5, the flight crew is operating on a weather deviation clearance up to 20 NM left of route and then requests another weather deviation clearance to operate up to a further 30NM left of route. In the clearance request, the flight crew specifies a deviation distance from the cleared route rather than from the current weather deviation clearance. The controller issues the appropriate clearance.

Flight crew	DM 27 REQUEST WEATHER DEVIATION UP TO 50NM LEFT OF ROUTE
Controller	UM 82 CLEARED TO DEVIATE UP TO 50NM LEFT OF ROUTE UM 127 REPORT BACK ON ROUTE
Flight crew	DM 0 WILCO

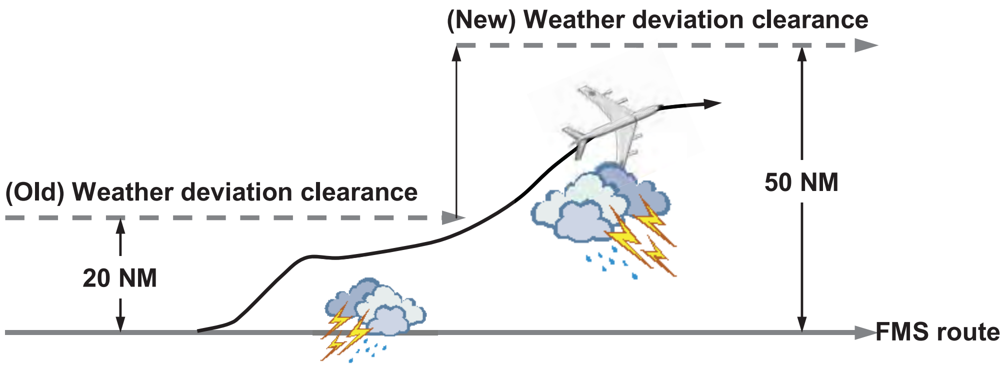


Figure 5-5. Subsequent weather deviation clearance up to 50 NM left of route

Example 3: As shown in Figure 5-6, the aircraft then requests a weather deviation clearance to operate 30NM right of route. The controller issues the appropriate clearance. The flight crew expeditiously navigates from one side of route to the other in accordance with the above clearance.

Note.— The ATSU applies the appropriate separation standards during the maneuvers.

Flight crew	DM 27 REQUEST WEATHER DEVIATION UP TO 30NM RIGHT OF ROUTE
Controller	UM 82 CLEARED TO DEVIATE UP TO 30NM RIGHT OF ROUTE UM 127 REPORT BACK ON ROUTE
Flight crew	DM 0 WILCO

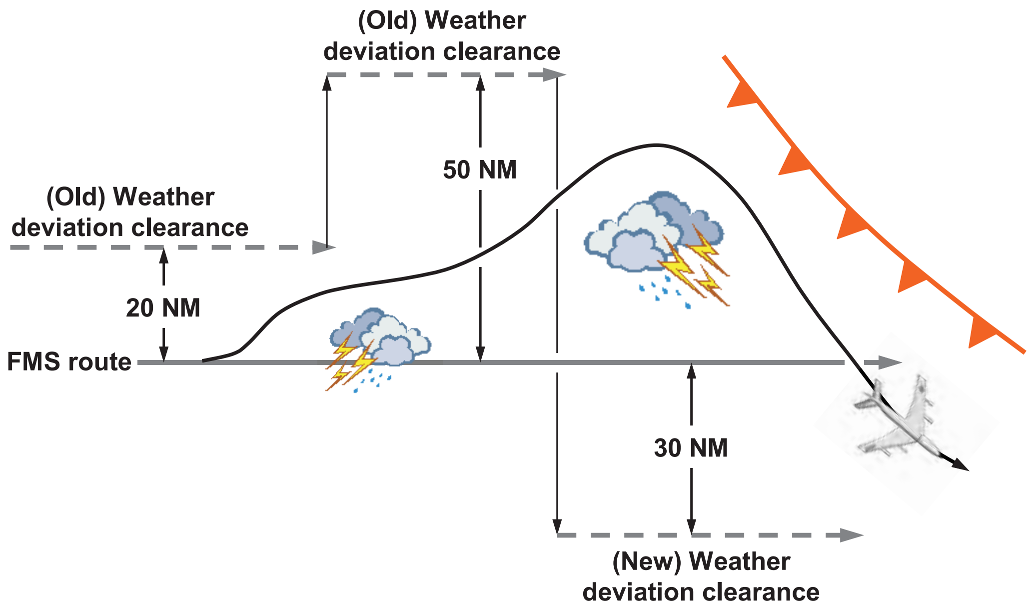


Figure 5-6. Subsequent weather deviation clearance up to 30 NM right of route

5.7.3 Deviations either side of route

5.7.3.1 There are a number of valid formats for the CPDLC [direction] variable. A number of aircraft types, however, can only request one direction (left or right) in weather deviation requests. When operating these aircraft types, the flight crew should request a deviation left and right of route using the following procedures:

a) Construct a weather deviation request for a deviation on one side of route using DM 27 REQUEST WEATHER DEVIATION UP TO [specified distance] [direction] OF ROUTE; and

b) Append free text DM 67ac AND [specified distance] [direction] describing the distance to the other side of route.

Example: The flight crew requests a deviation left and right of route. The controller issues the appropriate clearance.

Flight crew	DM 27 REQUEST WEATHER DEVIATION UP TO 20NM LEFT OF ROUTE. DM 67ac AND 20NM RIGHT
Controller	UM 82 CLEARED TO DEVIATE UP TO 20NM EITHER SIDE OF ROUTE UM 127 REPORT BACK ON ROUTE
Flight crew	DM 0 WILCO

5.7.4 Reporting back on route

5.7.4.1 When the flight crew no longer needs the deviation clearance and is back on the cleared route, the flight crew should send a DM 41 BACK ON ROUTE report.

a) If during the weather deviation, the flight crew receives a clearance to proceed direct to a waypoint – and the flight crew responds to the clearance with DM 0 WILCO – the aircraft is considered to be on the cleared route. Therefore, the flight crew should send a DM 41 BACK ON ROUTE report after they execute the "direct to" clearance; and

b) If the aircraft is off route during a weather deviation clearance and proceeding direct to a waypoint on the cleared route, the flight crew should send a DM 41 BACK ON ROUTE report after the aircraft has sequenced the waypoint on the cleared route.

Note.— If a DM 41 BACK ON ROUTE report is received while the aircraft is still off route, the incorrect information provided to ATC may affect the separation standards in use. Alternatively, the flight crew may consider requesting a clearance direct to the waypoint – on receipt of the uplink clearance, the procedure specified in item a) above applies.

5.8 Emergency procedures

5.8.1 General

5.8.1.1 In accordance with established emergency procedures, the ATSU within whose airspace the aircraft is operating remains in control of the flight. If the flight crew takes action contrary to a clearance that the controller has already coordinated with another sector or ATSU and further coordination is not possible in the time available, then the flight crew performs this action under their emergency command authority.

5.8.1.2 The flight crew will use whatever means are appropriate (i.e. CPDLC and/or voice) to communicate during an emergency.

5.8.1.3 During an emergency, the flight crew would normally revert to voice communications. However, the flight crew may use CPDLC for emergency communications if it is either more expedient or if voice contact cannot be established.

Note.— For ATN B1 aircraft, emergency message elements are not supported. See Appendix A, paragraph A.4, for a list of emergency message elements.

5.8.2 CPDLC and ADS-C emergency

5.8.2.1 When using CPDLC to indicate an emergency situation or degraded operations to an ATSU, the flight crew should use the CPDLC emergency downlink message, either DM 56 MAYDAY MAYDAY MAYDAY or DM 55 PAN PAN PAN.

Note 1.— The flight crew may enter PERSONS on BOARD during preflight preparation, prior to initiating a logon, or prior to sending the emergency message.

Note 2.— The CPDLC emergency downlink message will automatically select the ADS-C function to emergency mode. When a situation prohibits sending a CPDLC emergency message (e.g. in an ADS-C *only environment), the flight crew may activate ADS-C emergency mode directly via ADS-C control functions.*

5.8.2.2 If a CPDLC emergency downlink message is inadvertently sent or the emergency situation is resolved, the flight crew should send DM 58 CANCEL EMERGENCY as soon as possible to advise the controller and automatically set the ADS-C emergency mode to off. After sending DM 58 CANCEL EMERGENCY, the flight crew should confirm the status of the flight and their intentions via either voice or CPDLC.

5.8.2.3 To check for inadvertent activation of the ADS-C emergency mode using CPDLC, the controller may send the following CPDLC free text uplink or use equivalent voice phraseology:

Controller	UM 169ak CONFIRM ADS-C EMERGENCY

The flight crew should then check the status of the aircraft's ADS-C emergency mode and if the emergency mode has been activated inadvertently, the flight crew should select ADS-C emergency mode to off and advise the controller either by voice or by the following CPDLC messages.

Flight crew	DM 3 ROGER, then (free text) DM 67ab ADS-C RESET

5.9 Non-routine procedures

5.9.1 General

5.9.1.1 Refer to current ICAO procedures for standards and recommended practices on complete communications failure (CPDLC and voice).

5.9.2 Voice communications related to data link

5.9.2.1 When CPDLC fails and open messages existed at the time of failure, the flight crew should re-commence any dialogues involving those messages by voice.

5.9.2.2 The flight crew should use the standard voice phraseology under certain conditions as indicated in Table 5-3.

Note.— See paragraph 4.9.2.2 for standard voice phraseology used by the controller or radio operator.

5.9.2.3 Except as provided in Table 5-3 and paragraph 4.9.2.2, voice communication procedures related to data link operations are not standardized among the regions. Refer to Appendix E for any additional voice communication procedures for a specific region.

Table 5-3. Voice phraseology related to CPDLC

Condition	Voice phraseology
To notify ATC of a correction to a CPDLC message. (ICAO Doc 4444)	DISREGARD CPDLC (message type) MESSAGE, BREAK (correct information or request)
To notify ATC of a single CPDLC message failure. (ICAO Doc 4444)	CPDLC MESSAGE FAILURE (appropriate information or request)
To notify ATC of an aircraft data link system or CPDLC connection failure. (ICAO Doc 4444)	CPDLC FAILURE (requests/notifications) *Note.— This voice phraseology is included only with the first transmission made for this reason.* Example: CPDLC FAILURE. CONTINUING ON VOICE.
To advise ATC that the CPDLC connection is being terminated manually and logon procedure is being initiated with the next ATSU. *Note.— No equivalent to ICAO Doc 4444.*	DISCONNECTED CPDLC WITH [facility designation]. LOGGING ON TO [facility designation] *Note.— The facility designation is the ICAO four-character facility code or facility name.*
To advise ATC that a logon procedure is being initiated following restoration of data link service. *Note.— No equivalent to ICAO Doc 4444.*	LOGGING ON TO [facility designation]
To advise ATC that a delayed CPDLC uplink has been received and to request clarification of the intent of the CPDLC message. *Note.— No equivalent to ICAO Doc 4444.*	DELAYED CPDLC MESSAGE RECEIVED (requests) Note.— See paragraph 5.2.1.9 and Appendix F, paragraph F.11 for associated procedures.

5.9.3 Data link initiation failure

5.9.3.1 In the event of a logon failure, the flight crew should confirm the aircraft identification matches the information provided in the FPL and, as appropriate:

a) Make the necessary corrections; and then

b) Re-initiate the logon.

5.9.3.2 If no reason for the failure is evident, the flight crew should:

a) Contact the ATSU by voice to advise of the failure; and

b) Contact AOC to advise of the failure.

Note.— The ATSU will attempt to resolve the problem.

5.9.3.3 The flight crew should report log-on failures to the appropriate State/regional monitoring agency in accordance with procedures established by the operator (paragraph 3.2.2 refers).

5.9.4 Data link system failures

5.9.4.1 When operating CPDLC and the aircraft data link system provides an indication of degraded performance resulting from a failure or loss of connectivity, the flight crew should notify the ATSU of the failure as soon as practicable, including:

a) When operating outside of VHF coverage area and the SATCOM data link system fails; and

b) When operating in airspace where ATS surveillance services are provided and the VHF data link system fails.

Note.— Timely notification is appropriate to ensure that the ATSU has time to assess the situation and apply a revised separation standard, if necessary.

5.9.4.2 If an automatic transfer of the CPDLC connection does not occur at the boundary, the flight crew should contact the transferring ATSU by sending DM 67j CPDLC TRANSFER FAILURE (or voice equivalent), advising them that the transfer has not occurred.

5.9.4.3 In the event of an aircraft data link system failure, the flight crew should notify the ATSU of the situation using the following voice phraseology:

Flight crew	CPDLC FAILURE. CONTINUING ON VOICE
Controller	ROGER. CONTINUE ON VOICE

Note.— The flight crew continues to use voice until the functionality of the aircraft system can be re-established.

5.9.4.4 When the ATSU provides notification that the CPDLC service has failed or will be shut down, the flight crew should follow the instructions provided in the notification (e.g. disconnect CPDLC and continue on voice until informed by the ATSU that the data link system has resumed normal CPDLC operations).

5.9.4.5 If only the ADS-C service is terminated, then during that time period, the flight crew should conduct position reporting by other means (e.g. CPDLC, if available, or via voice).

5.9.4.6 If the ATSU cannot establish ADS contracts with an aircraft, or if ADS-C reporting from an aircraft ceases, the flight crew may have inadvertently switched ADS-C off. If CPDLC is still available and the flight crew receives the CPDLC message UM 169an CONFIRM ADS-C ARMED (or voice equivalent), they should check to ensure that ADS-C is not switched off and respond to the controller as follows:

Controller	UM 169an CONFIRM ADS-C ARMED

Flight crew	DM 3 ROGER

5.9.4.7 If the aircraft is operating on a vertical profile that is different from the profile programmed in the FMS, the time estimates in the ADS-C report will be inaccurate. If the flight crew receives the message UM 169h ADS-C ESTIMATES APPEAR INACCURATE. CHECK FMS, the flight crew should check the FMS, correct any the discrepancy and respond to the CPDLC message with DM 3 ROGER.

5.9.5 Using CPDLC to relay messages

5.9.5.1 When an ATSU and an aircraft cannot communicate, the controller may use CPDLC or voice to relay messages. When it had been determined to use CPDLC, the controller may first confirm that the CPDLC-capable aircraft is in contact with the subject aircraft. The flight crew should concur that they will act as an intermediary.

5.9.5.2 When using CPDLC to relay messages, the flight crew should:

a) Only respond with DM 3 ROGER to CPDLC messages consisting entirely of free text; and

b) Respond with DM 1 UNABLE to any CPDLC message containing standard message elements to avoid confusion.

5.9.5.3 After sending DM 3 ROGER, the flight crew should only use free text to respond to the controller's uplink free text message.

Example, using:

a) UM 169ap RELAY TO [call sign] [unit name] [text of message to be relayed]; and

b) DM 67ae RELAY FROM [call sign] [response parameters]; where.

1) [call sign] is expressed as the radiotelephony call sign, rather than the ICAO three letter or IATA two letter designator; and

2) [response parameters] conform to the guidelines provided paragraph 5.4.2.3.

Controller	UM 169ap RELAY TO UNITED345 OAKLAND CLEARS UNITED345 CLIMB TO AND MAINTAIN FL340
Flight crew	DM 3 ROGER
Flight crew	DM 67ae RELAY FROM UNITED345 CLIMBING FL340

Chapter 6. Advanced air traffic services supported by data link

6.1 Re-route procedures

6.1.1 General

6.1.1.1 When re-routing an aircraft, the flight crew, AOC and each ATSU should follow standardized procedures using appropriate CPDLC message elements. For flight crews performing re-routes, see paragraph 5.3.5.

6.1.1.2 The availability of new weather forecasts on long-haul routes may provide the potential for economic and/or safety benefits for operators by allowing them to propose revised routes for airborne aircraft.

6.1.1.3 The flight crew may initiate a re-route request. Each ATSU along the route may initiate an amended route clearance.

6.1.1.4 For flights that cross the common boundary between two automated ATSUs, the ATSUs can coordinate revised route information, reducing the requirement for AOC to transmit modification messages to all the ATSUs along the route.

6.1.1.5 If a re-route clearance changes the NEXT or NEXT+1 waypoint, the flight crew should update the re-route clearance with most current available weather information for the new waypoints/levels.

6.1.2 Re-route procedures – AOC initiated (DARP)

6.1.2.1 The purpose of the dynamic airborne re-route procedure (DARP) is to allow aeronautical operational control (AOC) to initiate the process for an airborne aircraft to be issued an amended route clearance by the ATSU.

6.1.2.2 An operator should only initiate these procedures where the re-route will occur in FIRs where DARP services are available (Refer to Appendix E).

Note.— DARP service requires Air Traffic Services Interfacility Data Communications (AIDC) to permit the electronic exchange of revised route information.

6.1.2.3 To be eligible for DARP, the operator will need an aircraft with operational CPDLC capability. Additionally, the flight crew should downlink the route request:

a) At least 60 minutes prior to crossing the next boundary to permit AIDC messaging to take place between the affected ATSUs. This time period may be reduced between ATSUs that support AIDC CDN messaging to coordinate the modification of route information; and

b) At least 20 minutes prior to the divergence waypoint to allow processing time by the ATSU and the flight crew.

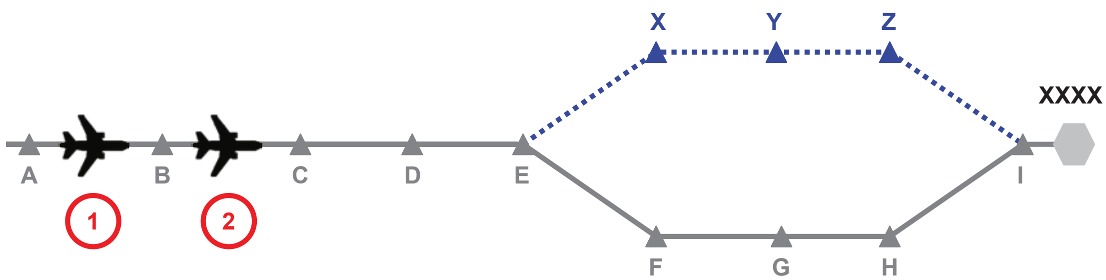
Note.— A downlink route request may be made to a new ATSU immediately after crossing the boundary provided the above requirements are still met.

6.1.2.4 Table 6-1 provides the procedures for an AOC initiated re-route and Figure 6-1 provides an overview of the DARP process.

Table 6-1. AOC initiated re-route procedures

Who	Procedures
AOC (Step 1)	a) The AOC should generate the amended route in compliance with standard UPR flight planning requirements (e.g. common boundary waypoints).
	b) The AOC ensures that the elements used to define the amended route comply with the requirements of ICAO Doc 4444. The elements that may be used to describe the amended route include: 1) Fix Names; *Note 1.— ARINC 424 fix names should not be used to define latitude and longitude.* 2) Airway Designators; *Note 2.— Where an airway designator is used it should be preceded and followed by a fix name or navaid designator that is defined on the airway described.* 3) Navaid Designators; and 4) Latitude and Longitude. *Note 3.— The ICAO requirement is that position should be defined in either whole degrees of latitude and longitude (e.g. 35S164E), or degrees and minutes for both latitude and longitude (e.g. 2513S15645E). A mixture of these formats should be avoided (e.g. 35S15725E).*
	c) The AOC uplinks the proposed route to the aircraft via ACARS.
Flight crew (Step 2)	a) Where applicable, delete any waypoints on the proposed route that have already been sequenced.
	b) Providing that the proposed route is acceptable to the flight crew, downlink the route request to the controlling ATSU using the CPDLC message element: DM 24 **REQUEST CLEARANCE [route clearance]** or *REQUEST [route clearance]* where the first fix in the route clearance is the next waypoint ahead of the aircraft. *Note 4.— The route request may also contain additional information such as departure airport, destination airport, etc.* *Note 5.— Flight crew procedures should include guidance on downlinking CPDLC route clearance requests.*

Who	Procedures
ATSU (Step 3)	a) Where the requested clearance is available, uplink the amended route clearance to the aircraft. Example: UM 83 AT [position] CLEARED [route clearance] where [position] = [(fix1)] is the next waypoint ahead of the aircraft and [route clearance] = [(fix2) (fix3) …]. *Note 6.— The route clearance may also contain additional information such as departure airport, destination airport, etc.* *Note 7. — On occasions, other CPDLC message elements may be more appropriate than UM 83.*
	b) Where the requested clearance is not available, uplink UM 0 UNABLE and append the [reason]. Example: UM 0 UNABLE. UM 166 DUE TO TRAFFIC *Note 8.— ATSUs should not modify the content of the route without advising the flight crew. This requirement does not apply to the removal of waypoints that have been sequenced prior to the clearance being uplinked or minor changes to the route.*
Flight crew (Step 4)	a) On receipt of a CPDLC route clearance from the ATSU, the flight crew should: 1) Load the uplink into the FMS and review the clearance. If the clearance is acceptable, respond with DM 0 WILCO to confirm that the flight crew will comply with the clearance; or 2) Otherwise: i) Respond with DM 1 UNABLE; and ii) Continue in accordance with the current ATC clearance.
	b) Where the requested clearance is rejected by the ATSU, the flight crew should continue in accordance with the existing clearance.
	c) The flight crew should request new route data from AOC.



1	The AOC uplinks the proposed amended route "B C D E X Y Z I " to destination XXXX starting from the next point ahead of aircraft (B) and diverging from the current clearance at E. The flight crew reviews the proposed route and downlinks "REQUEST [B C D E X Y Z I]" to ATC.
2	ATC reviews the route request and uplinks the clearance "AT [C] CLEARED [D E X Y Z I]" to the aircraft using UM83. *Note.— In this example, by the time the clearance is uplinked, the aircraft has passed B and so this is not included in the clearance. Point C must also be removed from the [route clearance] parameter of UM 83 because point C is the [position] at which the reroute clearance begins.* The flight crew responds to the clearance with a WILCO.

Figure 6-1. The DARP process

6.1.2.5 While the method described in Figure 6-1, step (2), is the preferred method, the following examples show how other CPDLC route clearance message elements could be used in this scenario:

a) UM 83 AT [E] CLEARED [X Y Z I];

b) UM 80 CLEARED [C D E X Y Z I]; or

c) UM 79 CLEARED TO [I] VIA [C D E X Y Z].

Note.— When using UM 79, the position [I] should be a position on the original route of the aircraft

6.1.3 Re-route procedures – ATC initiated

6.1.3.1 The purpose of the ATC initiated re-route procedure is to allow an ATSU to initiate the process to issue an amended route clearance to an airborne aircraft.

6.1.3.2 ATC should be aware that any waypoint that is sent in an uplink message and loaded as part of a new route in the FMS will not contain forecast weather data. It does not make any difference whether the waypoint was previously in the route or not. As a consequence, the flight crew will lose from the FMS all forecast weather data for waypoints that were previously in the route but are uploaded again as part of the new route. ATC should therefore, as far as possible, restrict the uplinked waypoints to that part of the route that is being amended. Some flight crews may be able to request the missing forecast weather data from the operator.

6.1.3.3 If the re-route clearance changes the NEXT or NEXT+1 waypoint, then ATC may receive an ADS-C report based on zero wind at the next waypoint which may result in an inaccurate estimate for that waypoint.

Note.— See also paragraph 6.1.1.5.

6.1.3.4 ATC should uplink the re-route as soon as practicable to allow processing time by the flight crew prior to the divergence waypoint. For those cases where the aircraft is getting close to the divergence waypoint when the clearance is issued, the controller should consider the option of clearing the aircraft direct to the next waypoint.

6.1.3.5 If the aircraft has passed the divergence waypoint when the CPDLC re-route message is received, the flight crew should select DM 1 UNABLE and continue on the currently cleared route.

6.1.3.6 Aircraft operators should establish procedures for the flight crew to deal with clearances that create route discontinuities. Such procedures should include the flight crew taking an initiative to obtain further route clearance before reaching the waypoint where the route discontinuity occurs if such route clearance has not been received from ATC a reasonable time before reaching the discontinuity waypoint.

6.1.3.7 ATC should only use UM 83 AT [position] CLEARED [route clearance] to issue CPDLC re-route clearances if the following conditions are satisfied:

a) The route is specified to destination; and

b) The [position] in UM 83 is on the currently cleared route.

Note.—All forecast weather data after [position] is lost from the FMS when the new route is activated.

6.1.3.8 ATC should only use UM 80 CLEARED [route clearance] to issue CPDLC re-route clearances if the route is specified from the aircraft present position to destination. All forecast weather data is lost from the FMS when the new route is activated.

6.1.3.9 When using UM 79 CLEARED TO [position] VIA [route clearance], ATC should not populate the [position] field with the destination airport unless the route is specified to destination. All forecast weather data for the uplinked waypoints is lost from the FMS when the new route is activated.

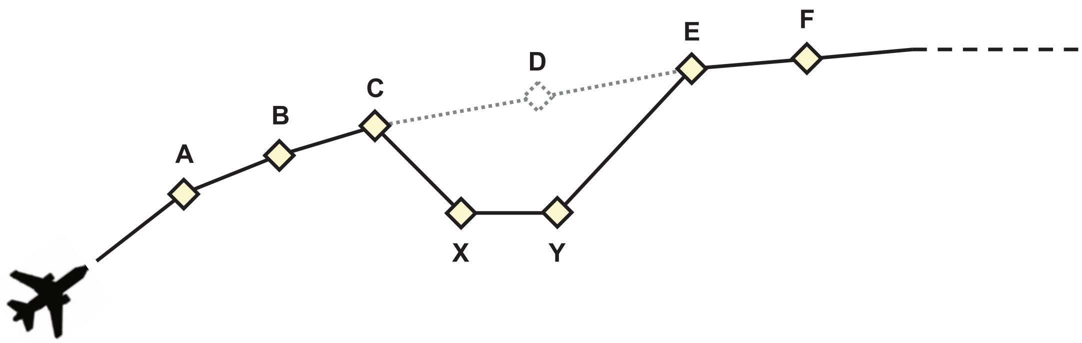
6.1.3.10 The [position] in UM 79 CLEARED TO [position] VIA [route clearance] does NOT change the clearance limit for the flight. The clearance limit remains unchanged unless explicitly changed by ATC. Although UM 79 semantically resembles a clearance limit ("CLEARED TO [position] VIA [route]"), it is important to note that the FMS has no concept of a clearance limit. The word "TO" in UM 79 merely signifies the far end of the route segment that is being changed. Although it may coincidentally be identical to the clearance limit previously specified by ATC, this will not normally be the case.

6.1.3.11 Table 6-2 provides the procedures for an ATC initiated re-route, and figures provide an overview of the process for the following cases:

	Figure 6-2	Figure 6-3	Figure 6-4	Figure 6-5	Figure 6-6
First waypoint in new route is on current route.	✓	✓			
There is route discontinuity.		✓		✓	
Aircraft is cleared direct to a fix located downstream in current route.					✓

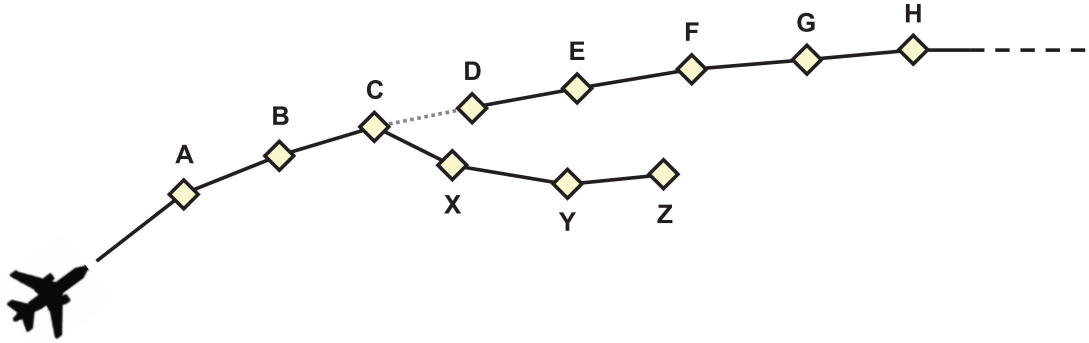
Table 6-2. ATC initiated re-route procedures

Who	Procedures
ATSU (Step 1)	a) Uplink an amended route clearance to the aircraft and append the [reason] if possible. Example: UM 83 AT [position] CLEARED [route clearance] UM 166 DUE TO TRAFFIC
Flight crew (Step 2)	a) On receipt of a CPDLC route clearance initiated by an ATSU, the flight crew should: 1) Load the uplink into the FMS and review the clearance. If the clearance is acceptable, respond with DM 0 WILCO to confirm that the flight crew will comply with the clearance; or 2) Otherwise: i) Respond with DM 1 UNABLE; and ii) Continue in accordance with the current ATC clearance.
	b) Where an uplinked clearance is acceptable to the flight crew but creates a route discontinuity, the flight crew should proceed to overcome the potential discontinuity by applying their existing company practices.



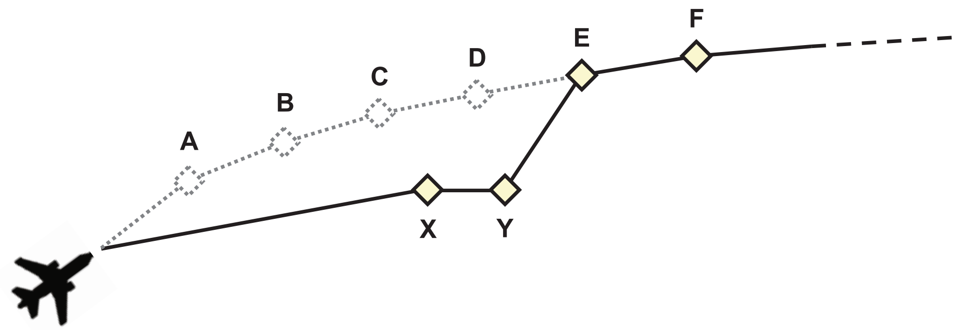
1	a) ATC uplinks the clearance CLEARED TO [E] VIA [A B C X Y] to the aircraft using UM 79 CLEARED TO [position] VIA [route clearance]. There is no discontinuity because the uplink fix (E) is in the existing cleared flight plan; or *Note 1.— Forecast weather data in the FMS is lost for waypoints A, B, C, D, waypoints X, Y do not contain any forecast weather data, forecast weather data for waypoints E, F, …. remains intact.* b) ATC uplinks the clearance CLEARED [A B C X Y E F …] to the aircraft using UM 80 CLEARED [route clearance]. There is no discontinuity because the entire route has been replaced. The route must be specified to destination; or *Note 2.— Forecast weather data in the FMS is lost for the whole route.* c) ATC uplinks the clearance AT [C] CLEARED [X Y E F …] to the aircraft using UM 83 AT [position] CLEARED [route clearance]. There is no discontinuity because the entire route after C was specified. The route must be specified to destination. *Note 3.— Forecast weather data in the FMS is lost for all waypoints after C.*
2	The flight crew responds to the clearance with DM 0 WILCO or DM 1 UNABLE, as appropriate.

Figure 6-2. ATC initiated re-route – first waypoint in the new route is on the current route and there is no route discontinuity



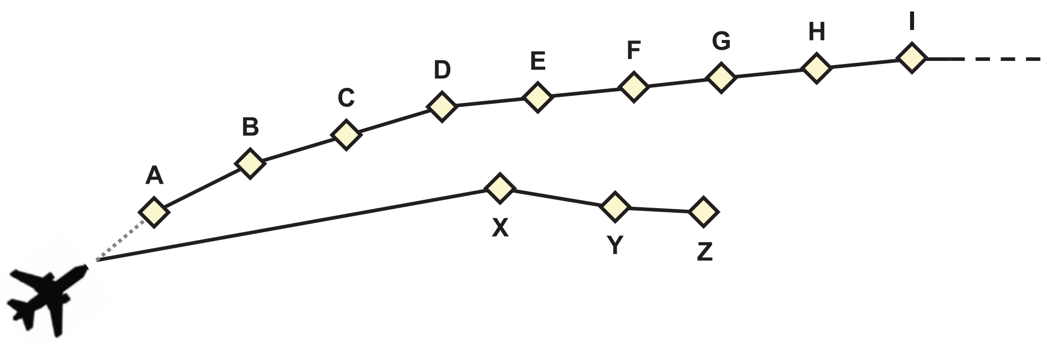
1	ATC uplinks the clearance CLEARED TO [Z] VIA [A B C X Y] to the aircraft using UM 79 CLEARED TO [position] VIA [route clearance]. *Note 1.— Forecast weather data in the FMS is lost for waypoints A, B, C waypoints. X, Y, Z do not contain any forecast weather data. Forecast weather data for waypoints D, E F, G, H etc remains intact.* *Note 2.— In this case, ATC should not use CPDLC message elements UM 80 CLEARED [route clearance] or UM 83 AT [position] CLEARED [route clearance].*
2	a) The flight crew responds to the clearance with DM 0 WILCO or DM 1 UNABLE, as appropriate. b) This clearance creates a route discontinuity at Z. The flight crew should obtain further route clearance from ATC before the aircraft reaches Z (that clearance could, for example, be from Z direct to G). In the meantime, the flight crew should overcome the discontinuity at Z by applying their existing company practices under the assumption that a further route clearance will be received before reaching Z.

Figure 6-3. ATC initiated re-route – first waypoint in the new route is on the current route and there is route discontinuity



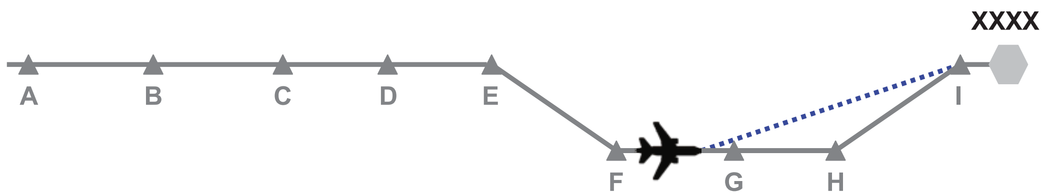
1	a) ATC uplinks the clearance CLEARED TO [E] VIA [X Y] to the aircraft using <u>UM 79</u> CLEARED TO [position] VIA [route clearance]. There is no discontinuity at E because the uplink fix (E) is in the existing cleared flight plan; or *<u>Note 1</u>.— Forecast weather data in the FMS is lost for waypoints A, B, C, D, waypoints X, Y do not contain any forecast weather data, forecast weather data for waypoints E, F, etc, remains intact).* b) ATC uplinks the clearance CLEARED [X, Y, E, F …] to the aircraft using <u>UM 80</u> CLEARED [route clearance]. The entire route is replaced and the route must be specified to destination. *<u>Note 2</u>.— Forecast weather data in the FMS is lost for the whole route.* *<u>Note 3</u>.— The clearance in a) and b) above takes immediate effect and, since the first fix specified (X) is not on the existing route of flight, the new route effectively starts with "present position direct X," although this is not explicitly stated in the uplink message.* *<u>Note 4</u>.— In this case, ATC should not use CPDLC message element <u>UM 83</u> AT [position] CLEARED [route clearance].*
2	The flight crew responds to the clearance with <u>DM 0</u> WILCO or <u>DM 1</u> UNABLE, as appropriate.

Figure 6-4. ATC initiated re-route – first waypoint in the new route is not on the current route and there is no route discontinuity



1	ATC uplinks the clearance CLEARED TO [Z] VIA [X Y] to the aircraft using UM 79 CLEARED TO [position] VIA [route clearance]. *Note 1.— Waypoints X, Y, Z do not contain any forecast weather data, forecast weather data for waypoints A, B, C, D, E, F,G, H, I etc remains intact).* *Note 2.— The clearance above takes immediate effect and, since the first fix specified (X) is not on the existing route of flight, the new route effectively starts with "present position direct X," although this is not explicitly stated in the uplink message.* *Note 3. — In this case, ATC should not use CPDLC message elements UM 80 CLEARED [route clearance] or UM 83 AT [position] CLEARED [route clearance].*
2	a) The flight crew responds to the clearance with DM 0 WILCO or DM 1 UNABLE, as appropriate. b) This clearance creates a route discontinuity at Z. The flight crew should obtain further route clearance from ATC before the aircraft reaches Z (that clearance could, for example, be from Z direct to I). In the meantime, the flight crew should overcome the discontinuity at Z by applying their existing company practices under the assumption that a further route clearance will be received before reaching Z.

Figure 6-5. ATC initiated re-route – first waypoint in the new route is not on the current route and there is route discontinuity



1	ATC uplinks the clearance UM 74 PROCEED DIRECT TO [fix I] to the aircraft.
2	The flight crew responds to the clearance with DM 0 WILCO, immediately loading the clearance into the FMC and proceeding direct to the cleared direct-to fix I.

Figure 6-6. ATC initiated re-route – aircraft is cleared direct to a fix that is located downstream in the current route

6.2 Tailored arrival (TA)

6.2.1 General

6.2.1.1 The tailored arrival (TA) is a 4-dimensional (4-D) arrival procedure, based on an optimized ATC clearance, including, as necessary, vertical and/or speed restrictions, from the aircraft's current position, normally just prior to top of descent, to the designated destination runway. This optimized ATC clearance, or TA clearance, is issued via CPDLC data link message(s) to the aircraft and, upon flight crew selection, automatically loaded into the aircraft's FMS (i.e. 4-D trajectory guidance). The TA clearance generally consists of the lateral path, vertical and speed constraints, published approach procedure, and runway assignment.

6.2.1.2 This section provides guidelines and procedures for delivering and executing the TA clearance. These guidelines and procedures are intended for ANSPs that provide the TA service and participating operators.

Note.— As ANSPs plan for providing the TA service throughout the world, ground system capability and geographical constraints may lead to some variations in local implementations. As experience is gained, these variations and other refinements will need to be coordinated in future amendments to the guidelines provided herein.

6.2.2 Provisions for the TA service

6.2.2.1 The operator should establish operating and notification procedures for the flight crew and conduct training to be eligible to participate in tailored arrivals.

6.2.2.2 At each of the ATSUs where the TA service is available, the ANSP should provide procedures to the controllers and conduct training for constructing and issuing the TA clearance. If the flight crew from an eligible operator requests a TA clearance and the traffic situation permits, the controller should accommodate the request. All other standard operating procedures apply.

6.2.2.3 When the TA service is provided, the ANSP should:

a) Assign a TA designator to the TA clearance. The TA designator should:

1) Contain more than five letters so that it is not easily confused with a published or public procedure;

2) Relate to the geographical arrival area (e.g. PACIFIC 1 TA); and

3) Be easy to pronounce when communicating on voice.

Note.— The flight crew and the controller use the TA designator throughout the procedure to unambiguously convey the route and vertical and speed constraints associated with the TA.

b) Define and notify operators of the TA request point as a time in minutes from the estimated top of descent (TOD) or from the airspace boundary where CPDLC service is terminated.

Note.— For example, the TA request point for the PACIFIC 1 TA at San Francisco airport is 45 minutes before the aircraft enters U.S. domestic airspace.

6.2.3 Clearance delivery and execution

6.2.3.1 Table 6-3 provides the procedures for delivering and executing a tailored arrival clearance.

Table 6-3. Tailored arrival clearance delivery and execution

Who	**Procedures**
Flight crew (Step 1)	At the TA request point, the flight crew should request a TA using the CPDLC standard free text message element: DM 67ad **REQUEST TAILORED ARRIVAL [TA designator] [speed]** or *REQ TA [TA designator] [speed]*, where [TA designator] and [speed] are optional. *Note 1.— When the ANSP and operators are evaluating a TA, the flight crew may include additional information such as an intended descent speed, using the format M[nn] for Mach or [nnn]KIAS for IAS. When this information is included, the controller and flight crew procedures should include message formats and intended use to avoid misunderstanding or confusion with the operational procedures.* Example 1: DM 67ad REQ TA PACIFIC 1. Example 2: DM 67ad REQ TA PACIFIC 1 M.83 Example 3: DM 67ad REQ TA 280KIAS
Controller (Step 2)	a) If the situation permits, the controller should uplink the TA clearance via CPDLC using: UM 169 [TA designator] UM 83 AT [position] CLEARED [route clearance] UM 19 MAINTAIN [level] Example: The controller uses the name PACIFIC 1 TA, which is unambiguous for the specific route and vertical and speed constraints. The route clearance includes lateral route, crossing restrictions, approach procedure, and runway assignment, and FL370 is the currently assigned flight level. PACIFIC 1 TA AT CINNY CLEARED [Route Clearance] MAINTAIN FL370.
	b) The controller may issue a vertical clearance after delivery of the tailored arrival clearance, without interfering with the TA clearance. In such cases, the controller should reissue the TA clearance to ensure no ambiguity.

Who	Procedures
Flight crew (Step 3)	a) The flight crew should load the TA clearance into the FMS and review it. If acceptable, the flight crew should activate the route in the FMS and respond to the clearance with DM 0 WILCO. If unacceptable, the flight crew should respond to the clearance with DM 1 UNABLE.
	b) The flight crew should select the appropriate descent speed schedule (e.g. 280kts (+/- 10kts)) above 10,000ft. *Note 2.— This procedure provides additional descent profile predictability to the controllers, increasing the potential for the controllers to allow a full TA during congested periods when increased predictability is required due to other traffic. This function will eventually be replaced by ground automation which advises the optimum speed for the descent, based on the entire airspace situation at the expected time of the arrival.*
	c) If possible, the flight crew should request FMC waypoint wind and temperature data from AOC.
AOC (Step 4)	AOC should uplink cruise and descent winds to the arriving aircraft to optimize the FMS-calculated profile for the most predictable execution of that profile.
Controller (Step 5)	When required, the controller should transfer control to the next sector and terminate CPDLC and ADS-C connections. *Note 3.— The transferring sector either manually or automatically advises the next sector that the aircraft is on a particular TA.*
Flight crew (Step 6)	When instructed, the flight crew should establish voice contact with the next sector using the phraseology [call sign] [TA designator] TAILORED ARRIVAL. [level].

Who	Procedures
Controller (Step 7)	a) The controller should advise [call sign] MAINTAIN [level]. *Note 4.— The controller has access to the uplinked lateral routing and currently assigned level/altitude on the flight strip through ATC interfacility coordination.*
	b) If the controller needs to add speed control (e.g. to increase the potential for issuing a TA clearance), the controller should advise the flight crew as soon as possible to expect a restriction. Example: [call sign] EXPECT TO DESCEND AT 260 KTS
	c) When appropriate, the controller should issue a descent clearance along the cleared route, using [TA designator] TAILORED ARRIVAL. [dest/area] ALTIMETER/QNH [nnnn] and, as necessary, include a speed or vertical restriction. Example 1: The controller does not issue a speed or vertical restriction. [call sign] DESCEND VIA PACIFIC 1 TAILORED ARRIVAL. KSFO ALTIMETER 29.92. Example 2: The controller issues a speed restriction. [call sign] DESCEND VIA RADFORD 1 TAILORED ARRIVAL. DO NOT EXCEED 260KTS. NZAA QNH 1014. Example 3: The controller issues a vertical restriction. [call sign] DESCEND VIA THE CATALINA 1 TAILORED ARRIVAL BUT AFTER SLI. MAINTAIN [level/altitude].
	d) The controller should transfer control to the next controller.
Flight crew (Step 8)	The flight crew should initiate contact with the next controller using: [call sign] PASSING FLIGHT LEVEL [FLnnn]/ALTITUDE [nn,nnn feet] ON THE [TA designator] TAILORED ARRIVAL. [ATIS code]. *Note 5.— Subsequent exchanges on different frequencies with the same ATSU do not require the flight crew to state the passing level/altitude.*

Who	Procedures
Controller (Step 9)	If continuation of the TA profile is acceptable to the approach controller, the controller should clear the aircraft for the approach by stating: a) [call sign] AFTER [fix name] CLEARED [approach name]; or b) [call sign] DESCEND VIA [TA designator] TAILORED ARRIVAL. CROSS [fixname] AT OR ABOVE [level/altitude]. CLEARED [approach name]; or c) DESCEND VIA THE [TA designator] TAILORED ARRIVAL. EXPECT [runway or procedure name]. Example 1: [call sign] AFTER MENLO CLEARED ILS RW28L APPROACH. Example 2: [call sign] DESCEND VIA THE FLORIDA 8 (or 9) TAILORED ARRIVAL, CROSS PABOY AT OR ABOVE 3000FT. CLEARED LOCALIZER DME RUNWAY 8L APPROACH. Example 3: [call sign] DESCEND VIA THE FLORIDA 9 TAILORED ARRIVAL. EXPECT RUNWAY 09.
Flight crew (Step 10)	If all conditions are acceptable, the flight crew should execute the cleared FMS-directed profile and apply standard approach and landing procedures.
Controller (Step 11)	a) At any time, the controller may issue alternative level/altitude, routing, or vectors and discontinue the TA to best suit traffic conditions. When the controller discontinues the TA, the controller should provide instructions including an assigned level/altitude to the flight crew. *Note 6.— The controller must include an assigned level/altitude because the flight crew does not know the minimum vectoring level/altitude nor do they know the level/altitude of other traffic.*
	b) The controller may clear the aircraft back onto the TA by stating: [call sign] CLEARED DIRECT [Waypoint on TA]. RESUME THE [TA designator] TAILORED ARRIVAL.

6.3 Automatic dependent surveillance – broadcast in-trail procedure (ADS-B ITP)

6.3.1 General

6.3.1.1 The ADS-B ITP is intended to increase the chances of receiving a clearance to climb or descend to a specified flight level as requested by the flight crew. The ADS-B ITP permits the flight crew to request a climb or descent manoeuvre past a maximum of two reference aircraft, in compliance with a longitudinal separation minimum based on distance as determined by the aircraft's ADS-B system during the ITP manoeuvre.

Note.— See ICAO Doc 4444, paragraph 5.4.2.7, for standards for applying the longitudinal separation minimum during an ADS-B ITP manoeuvre. Further guidance can be found in the:

a) Manual on Airborne Surveillance Applications (Doc 9994);

b) In Trail Procedure (ITP) Using Automatic Dependant Surveillance - Broadcast (ADS-B)" (ICAO Circular 325); and

c) Safety, Performance and Interoperability Requirements Document for In Trail Procedure in Oceanic Airspace (EUROCAE ED-159 / RTCA DO-312) and Supplement.

6.3.1.2 Prior to requesting an ITP climb or descend manoeuvre, the flight crew uses the ADS-B system to determine if the ITP criteria are met. The ITP criteria are designed such that two aircraft will maintain the ITP separation minimum (specified by ICAO Doc 4444) throughout the manoeuvre while vertical separation is not maintained.

6.3.1.3 This section provides guidelines and procedures for delivering and executing the ADS-B ITP clearance using CPDLC. These guidelines and procedures are intended for ANSPs that provide the ADS-B ITP service and participating operators.

6.3.2 Provisions for the ADS-B ITP service and operator eligibility

6.3.2.1 When using CPDLC to support the ADS-B ITP, the ANSP should adhere to the guidelines for the provision of CPDLC services provided in paragraph 3.1.

6.3.2.2 In addition to an operational authorization to use CPDLC per paragraph 3.2, an operator intending to use ADS-B ITP service is required to obtain an operational authorization from the State of registry or State of the operator, in accordance with airspace and State regulatory requirements.

6.3.3 Clearance delivery and execution

6.3.3.1 When performing an ADS-B ITP supported by CPDLC, the controller should issue CPDLC clearance messages throughout the ADS-B ITP procedure, as appropriate, in response to the flight crew request. The flight crew should respond appropriately to the CPDLC clearance messages and ensure conformance to its clearance. Table 6-4 provides procedural guidance for delivering and executing an ADS-B ITP clearance using CPDLC.

Table 6-4. ADS-B ITP clearance delivery and execution

<table>
<tr><th>Who</th><th>Procedures</th></tr>
<tr><td rowspan="3">Flight crew

Step 1 – requests clearance</td><td>The flight crew should check if the ITP criteria are met.

<u>Note</u>.— The display of surrounding traffic enhances flight crew awareness.</td></tr>
<tr><td>If the ITP criteria are met, then to request a climb or descent to a specified flight level, the flight crew should send a CPDLC downlink message containing:

a) <u>DM 9</u> REQUEST CLIMB TO [level] or <u>DM 10</u> REQUEST DESCENT TO [level], as appropriate; and

b) One of the following free text message elements, depending on the number and the position of the reference aircraft, to convey traffic information to the controller:
<table>
<tr><th>Number and relative position of reference aircraft</th><th>Free Text content</th></tr>
<tr><td>1 reference aircraft (ahead)</td><td><u>DM 67a</u> ITP [distance] BEHIND [aircraft identification]</td></tr>
<tr><td>1 reference aircraft (behind)</td><td><u>DM 67r</u> ITP [distance] AHEAD OF [aircraft identification]</td></tr>
<tr><td>2 reference aircraft (both ahead)</td><td><u>DM 67s</u> ITP [distance] BEHIND [aircraft identification] AND [distance] BEHIND [aircraft identification]</td></tr>
<tr><td>2 reference aircraft (both behind)</td><td><u>DM 67t</u> ITP [distance] AHEAD OF [aircraft identification] AND [distance] AHEAD OF [aircraft identification]</td></tr>
<tr><td>2 reference aircraft (one ahead and one behind)</td><td><u>DM 67ag</u> ITP [distance] BEHIND [aircraft identification] AND [distance] AHEAD OF [aircraft identification]</td></tr>
</table>
<u>Note 1</u>.— [distance] is an integer value followed by NM and represents the ITP distance from the reference aircraft identified in the request.

<u>Note 2</u>.— [aircraft identification] is defined by ICAO PANS ATM, item 7 of the flight plan (i.e. 2 to 7 characters).</td></tr>
<tr><td>Example of a request for an ADS-B ITP climb clearance:

<u>DM 9</u> REQUEST CLIMB TO FL360

<u>DM 67ag</u> ITP 25NM BEHIND SIA228 AND 21NM AHEAD OF AFR008</td></tr>
</table>

<table>
<tr><th>Who</th><th>Procedures</th></tr>
<tr><td>Controller

Step 2 – issues clearance</td><td>
If the parameters contained in the ITP request (i.e. number of reference aircraft and distance) and the aircraft information available to the controller (e.g. surrounding traffic and differential Mach) are within the allowance for the ITP procedure, then to issue a vertical clearance for the ITP request, the controller should send a CPDLC uplink message containing:

a) One of the free text message elements (in the table that follows), depending on the number and the position of the reference aircraft, to convey traffic information to the flight crew; and, as a minimum,

b) UM 20 **CLIMB TO [level]** or *CLIMB TO AND MAINTAIN [altitude]*, or UM 23 **DESCEND TO [level]** or *DESCEND TO AND MAINTAIN [altitude]*, as appropriate.

<table>
<tr><th>Number and relative position of reference aircraft</th><th>Free Text content</th></tr>
<tr><td>1 reference aircraft (ahead)</td><td>UM 169ac ITP BEHIND [aircraft identification]</td></tr>
<tr><td>1 reference aircraft (behind)</td><td>UM 169ad ITP AHEAD OF [aircraft identification]</td></tr>
<tr><td>2 reference aircraft (both ahead)</td><td>UM 169ae ITP BEHIND [aircraft identification] AND BEHIND [aircraft identification]</td></tr>
<tr><td>2 reference aircraft (both behind)</td><td>UM 169af ITP AHEAD OF [aircraft identification] AND AHEAD OF [aircraft identification]</td></tr>
<tr><td>2 reference aircraft (one ahead and one behind)</td><td>UM 169al ITP BEHIND [aircraft identification] AND AHEAD OF [aircraft identification]</td></tr>
</table>
Note 1.— Depending on the operational context, the free text message element may be combined with:

a) UM 26 CLIMB TO REACH [level] BY [time] or UM 27 CLIMB TO REACH [level] BY [position] instead of UM 20; or

b) UM 28 DESCEND TO REACH [level] BY [time] or UM 29 DESCEND TO REACH [level] BY [position] instead of UM 23.

Note 2.— The message may also include other message elements such as UM 129 ***REPORT MAINTAINING [level]*** *or REPORT LEVEL [altitude].*
</td></tr>
</table>

Who	**Procedures**
	Example of ADS-B ITP climb clearance message: UM 169al ITP BEHIND SIA228 AND AHEAD OF AFR008 UM 20 **CLIMB TO FL360** or *CLIMB TO AND MAINTAIN FL360* UM 129 **REPORT MAINTAINING FL360** or *REPORT LEVEL FL360* Example of ADS-B ITP descent clearance message: UM 169al ITP BEHIND SIA228 AND AHEAD OF AFR008 UM 28 DESCEND TO REACH FL320 BY 1234Z
Controller Step 2 – unable to issue clearance	If for any reason the clearance requested by the flight crew is not available, the controller should respond to the request by sending UM 0 UNABLE.
	The ADS-B ITP is terminated.
	If an intermediate flight level is available, the controller may send UM 169av SEND NEW ITP REQUEST IF ABLE [level]), where level can be more than one level. *Note.— The flight crew will return to Step 1.*
Flight crew Step 3 – responds to clearance	Upon receipt of the ADS-B ITP clearance, the flight crew should assess the clearance (in accordance with applicable standards and regulations taking into account the provisions of Chapter 5).
	If the ADS-B ITP criteria are still met, the flight crew should respond to the ADS-B ITP clearance with DM 0 WILCO message and perform the vertical manoeuvre accordingly. If the ADS-B ITP criteria are no longer met, the flight crew should respond to the ADS-B ITP clearance with DM 1 UNABLE.

Chapter 7. State aircraft data link operations

7.1 General

7.1.1 The data link and voice communication requirements for CNS/ATM are being defined by international, regional, and national civil aviation authorities and are based on use of commercial communication systems. In airspace where procedural separation is being applied, data link has seen increased use and is normally used as the means of communication. The military has unique requirements insofar as using CPDLC. These requirements were never considered when the CPDLC message set was being developed.

7.1.2 Many air and maritime air forces have the capability to conduct air-to-air refueling (AAR) operations. Although detailed procedures are dependent on aircraft type, mode of employment and national requirements, there is sufficient commonality for standard procedures to be developed to enhance operational interoperability. Many of these air and maritime air forces are making the transition to aeronautical data links and the use of controller pilot data link communications (CPDLC) and automatic dependent surveillance - contract (ADS-C).

7.1.3 The procedures outlined below describe the communications to be utilized by military aircraft in the attempt to promote harmonization in CPDLC and ADS-C procedures. These procedures have been developed utilizing a combination of existing CPDLC message elements and standardized free text. Standardized free text messages have been created to support these military operations in the attempt to avoid the general use of free text messages and for overall standardization. To the maximum extent possible, data link capable aircraft should adhere to procedural guidelines provided in Chapter 5 and Chapter 6.

7.1.4 The aim of this chapter is to provide a reference document covering military procedures to be used in an aeronautical data link environment. This chapter will provide guidance for the flight crew and the ANSP to promote harmonized military AAR operations in an aeronautical data link environment and lead to a better understanding of AAR procedures and terminology.

7.2 Military assumes responsibility for separation of aircraft (MARSA)

7.2.1 Prior to commencing AAR or maneuvers with receiver aircraft, the tanker will notify ATC that the military assumes responsibility for separation of aircraft (MARSA). The tanker will use the term, MARSA, to notify ATC that the tanker and receiver aircraft are accepting the responsibility for their actions within the AAR route and the tanker is the lead of the formation. ATC controls all other traffic to preclude conflicts between civil and military traffic involved in the AAR while at the same time still controlling the tanker and receiver. The actual refueling commences at the air refueling control point (ARCP) and continues as the aircraft proceed down the refueling route. Normally, the refueling is completed prior to the aircraft reaching the air refueling exit point (AREX) point. At AREX, both aircraft need to receive ATC clearances to continue on their filed routing.

Table 7-1. MARSA initiation and termination procedures

Who	Procedures
Flight crew (Tanker) (Step 1)	a) The tanker can initiate MARSA after it receives clearance for the block level/altitude and, optionally, reports passing the ARCP. The tanker informs the controller that the flight crew is accepting MARSA procedures with the receiver. DM 67z ACCEPT MARSA WITH [call sign(s) of receiver aircraft] where [receiver aircraft call sign(s)] exactly matches the filed flight plan(s) for the receiver aircraft.
	b) The tanker performs MARSA with receiver aircraft.
Flight crew (Tanker and Receiver) (Step 2)	To terminate MARSA, each aircraft should first notify the controller of their assigned level/altitude. DM 37 **MAINTAINING [level]** *or LEVEL [altitude]*
Controller (to Tanker) (Step 3)	Then, when the controller receives notification that each aircraft is at its assigned level/altitude, the controller sends a free text message to terminate MARSA between the tanker and the receiver aircraft. UM 169aq MARSA TERMINATED WITH [call sign(s) of receiver aircraft] MARSA is terminated when the tanker receives notification.

7.3 Air-to-air refueling (AAR)

7.3.1 Air-to-air refueling is normally accomplished between 10,000 and 28,000 feet depending on receiver type, requiring both aircraft to descent for refueling.

7.3.2 Refueling routes are numbered and depicted on charts used in airspace where ATS surveillance services are being provided and a few are depicted on charts used in airspace where procedural separation is being applied. Refueling may also be conducted on non-designated routes with an altitude reservation (ALTRV). In all cases, the refueling procedure is part of the filed flight plan. The flight plan always includes time, requested block level/altitude, air refueling control point (ARCP), air refueling initial point (ARIP), air refueling exit point (AREX) and intermediate refueling route points. If the procedure is depicted, its designation (ARxxx) is sufficient to define the route. In a procedurally controlled environment, a refueling pattern may be part of an existing ALTRV.

7.3.3 During the refueling phase all aircraft operate within the block level/altitude and fly the route along the refueling route in the flight plan. An ADS contract may be set with any aircraft but it is only necessary with the lead tanker and needs to correspond with a filed flight plan. Additionally, any other CPDLC report (i.e. UM 130 REPORT PASSING [position], etc.) may be requested of the tanker in order to track the progress of the flight. The aircraft may or may not remain in a single formation in the block level/altitude for the remainder of the flight. There are no special CPDLC messages developed during this phase.

7.3.4 A typical air-refueling pattern is illustrated in Figure 7-1. The light green route represents the tanker's intended route to the ARCP. The light blue route is the receiver's intended route. Both aircraft file separate flight plans showing the specific aerial refueling locations. The dark blue route is the tanker's orbit and rendezvous flight paths with the dark green route depicting the AAR route. Three or more points can define the AAR route. The ARIP is the point where the receiver enters the AAR route. The ARCP is the reference point for the holding pattern where the tanker awaits the receiver. The AAR route is between the ARCP and the AREX.

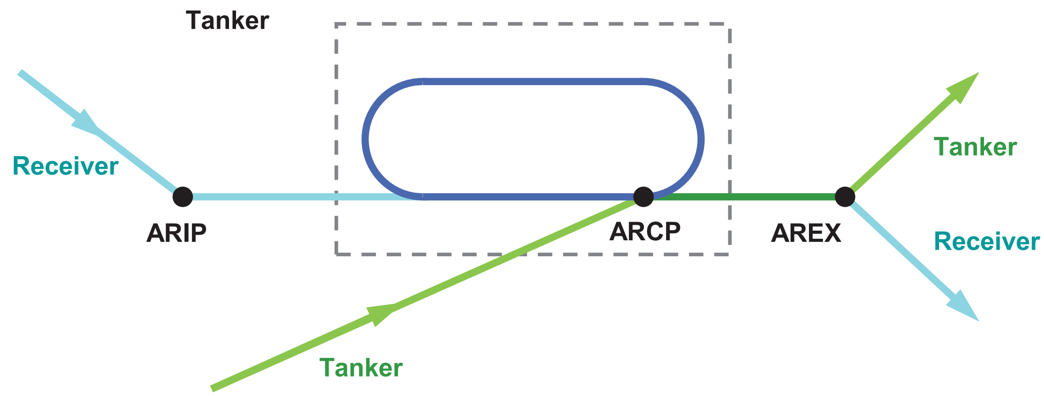


Figure 7-1. Air refueling pattern

Table 7-2. Air refueling data link procedures

Who	**Procedures**
Flight crew (Tanker) (Step 1)	At approximately 10 minutes from the ARCP, the tanker requests a clearance to delay at the ARCP until the rendezvous with the receiver and request a block level/altitude for air refueling. DM 25 REQUEST CLEARANCE DM 67w TO DELAY FOR AIR REFUEL AT [position] UNTIL [time] DM 7 REQUEST BLOCK [level] TO [level] Where: [position] is the ARCP as filed in the tanker's flight plan. [time] is the time the tanker expects to pass the ARCP and commence refueling along the refueling route. It is also the end of the delay time.

Who	Procedures
Controller (to Tanker) (Step 2)	a) The controller clears the tanker to delay at the ARCP, as requested. UM 169ar CLEARED TO DELAY FOR AIR REFUEL AT [position] UNTIL [time] *Note.— This message may need to be appended with a "free text" message in the event the controller needs to specify a specific area of operations or if the area to delay is different than the filed flight plan.*
	b) If block level/altitude is available, the controller issues one of the following instructions: UM 31 CLIMB TO AND MAINTAIN BLOCK [level] TO [level]; or UM 32 DESCEND TO AND MAINTAIN BLOCK [level] TO [level]; or UM 30 MAINTAIN BLOCK [level] TO [level]. Optionally, the controller may append the following: UM 180 REPORT REACHING BLOCK [level] TO [level]; and/or UM 130 REPORT PASSING [position]
	c) If the block level/altitude clearance is not available, the controller issues the following: UM 0 UNABLE UM 166 DUE TO TRAFFIC Optionally, the controller may append the following: UM 19 MAINTAIN [level], then any one of the following UM 9 or UM 10 EXPECT DESCENT AT [position/time]; or UM 7 or UM 8 EXPECT CLIMB AT [position/time]. Optionally, the controller may request a report. UM 130 REPORT PASSING [position].
Flight crew (Tanker) (Step 3)	The tanker responds to the controller instructions in accordance with the guidance provided in paragraph 2.2.5.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.

Who	Procedures
Flight crew (Tanker) (Step 4)	If ATC has instructed the aircraft to report passing the ARCP, then when the tanker crosses the ARCP, the flight crew notifies the controller that it has crossed the ARCP and has entered the air-refueling orbit. DM 31 PASSING [position]
Controller (to Tanker) (Step 5)	If block level/altitude was NOT previously available, when traffic permits, the controller issues the block level/altitude clearance for the tanker. UM 31 CLIMB TO AND MAINTAIN BLOCK [level] TO [level]; or UM 32 DESCEND TO AND MAINTAIN BLOCK [level] TO [level]; or UM 30 MAINTAIN BLOCK [level] TO [level]. Optionally, the controller may append the following: UM 180 REPORT REACHING BLOCK [level] TO [level].
Flight crew (Tanker) (Step 6)	The tanker responds to the controller instructions in accordance with the guidance provided in paragraph 2.2.5.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.
Flight crew (Tanker) (Step 7)	When the receiver approaches the ARIP, the tanker informs the controller that the flight crew is accepting MARSA procedures with the receiver. DM 67z ACCEPT MARSA WITH [call sign(s) of receiver aircraft] where [call sign(s) of receiver aircraft] exactly matches the filed flight plan(s) for the receiver aircraft.
Flight crew (Receiver(s)) (Step 8)	Prior to entering the ARIP – ARCP route, each receiver aircraft requests a level/altitude change to conduct refueling. DM 7 REQUEST BLOCK [level] TO [level]

Who	Procedures
Controller (to Receiver(s)) (Step 9)	a) If the controller has received the MARSA message from the tanker, the controller clears the receiver(s) to operate in the block level/altitude required for refueling. *Note.— If the controller did not receive the MARSA message from the tanker, the controller would UNABLE any requests from the receiver(s) until MARSA could be confirmed.* UM 31 CLIMB TO AND MAINTAIN BLOCK [level] TO [level]; or UM 32 DESCEND TO AND MAINTAIN BLOCK [level] TO [level]; or UM 30 MAINTAIN BLOCK [level] TO [level]; and UM 169as CLEARED TO CONDUCT REFUELING. Optionally, the controller may append the following: UM 180 REPORT REACHING BLOCK [level] TO [level].
Controller (to Tanker)	b) The controller clears the tanker for refueling. UM 169 CLEARED TO CONDUCT REFUELING.
Flight crew (Tanker and Receiver) (Step 10)	The tanker and receiver respond to the controller instructions in accordance with the guidance provided in paragraph 2.2.5.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.
Flight crew (Tanker and Receiver) (Step 11)	When the tanker is commencing the rendezvous with the receiver, each aircraft sends the following: DM 11 AT [position] REQUEST CLIMB TO [level]; or DM 12 AT [position] REQUEST DESCENT TO [level]; Where: [position] is the EXIT point; and [level] is the requested level for each aircraft after refueling is complete.
Flight crew (Tanker) (Step 12)	When approaching the end of refueling, the tanker notifies the controller when to expect the end of refueling. DM 67x EXPECT END OF REFUEL AT [time/position].

Who	Procedures
Controller (to Tanker and Receiver) (Step 13)	The controller issues instructions to assign different flight levels/altitudes to each of the aircraft upon completion of refueling. UM 164 WHEN READY; and UM 19 MAINTAIN [level]; and UM 129 **REPORT MAINTAINING [level]** *or REPORT LEVEL [altitude]* *Note.— Climb or descent clearances may be issued as appropriate.*
Flight crew (Tanker and Receiver) (Step 14)	a) The tanker and receiver respond to the controller instructions in accordance with the guidance provided in paragraph 2.2.5.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.
	b) When the aircraft is maintaining the assigned level, each aircraft notifies the controller. DM 37 **MAINTAINING [level]** *or LEVEL [altitude]*
Controller (to Tanker) (Step 15)	When the controller receives notification that each aircraft is at its assigned level/altitude, the controller sends a free text message to terminate MARSA between the tanker and the receiver aircraft. UM 169aq MARSA TERMINATED WITH [call sign(s) of receiver aircraft]

7.4 Formation flight data link procedures

7.4.1 Formation flying in a standard formation is usually one in which a proximity of no more than 1 mile laterally or longitudinally and within 100 feet vertically from the flight leader is maintained by each aircraft. Non-standard formations are those operating under conditions other than standard formation dimensions that the flight leader has requested and air traffic control (ATC) has approved, or when operating within an authorized ALTRV.

7.4.2 For each flight plan, the lead aircraft will initiate a logon at the correct time (refer to paragraph 5.2.2). Once in formation, only the lead aircraft will make position reports in accordance paragraph 5.6. Use CPDLC standard messages for level/altitude requests, routing requests (if different from what was filed), and speed or ETA requests with ATC to effect any en-route changes.

7.4.3 In the event a formation wants to break-up the formation or depart an ALTRV the aircraft desiring to break off of the formation will coordinate their departure a minimum of ten (10) minutes prior to separation with appropriate requests, and the following data link procedures will be used. Air traffic control will need separate flight plans for each flight in the event that the formation splits.

Table 7-3. Single aircraft or formation joining an ALTRV data link procedures

Who	Procedures
Flight crew	When a single aircraft or formation is joining an ALTRV, the flight crew notifies the controller of its intention to join the formation. DM 67y JOINING ALTRV [ALTRV designator] AT [time/position] Example: JOINING ALTRV CW413 AT HEMLO or JOINING ALTRV CW413 AT 1530Z

Table 7-4. Formation break-up or departure from ALTRV data link procedures

Who	Procedures
Controller	ATC responds to the request. UM 74 PROCEED DIRECT TO [position]; or UM 76 AT [time] PROCEED DIRECT TO [position];or UM 77 AT [position] PROCEED DIRECT TO [position]; or UM 79 CLEARED TO [position] VIA [route clearance]; or UM 80 CLEARED [route clearance]; or UM 83 AT [position] CLEARED [route clearance]
Flight crew	The flight crew responds to the controller instructions in accordance with the guidance provided in paragraph 2.2.5.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.
Flight crew or Controller	The flight crew may further request desired level/altitude and the controller would respond with the appropriate instructions.

7.5 ADS-C reports

7.5.1 If suitably equipped, State aircraft should ensure ADS-C is armed because ADS contracts may be established by ATC. ATC will establish ADS contracts with the lead aircraft as identified in the filed flight plan.

Appendix A CPDLC message elements and standardized free text messages

A.1 General

A.1.1 This appendix contains the CPDLC message elements and standardized and preformatted free text messages for the FANS 1/A, ATN B1, and ATN B1-FANS 1/A data link systems described in paragraph 2.1.2. The CPDLC message elements are based on ICAO Doc 4444, 15th Edition.

- Section A.2 provides a CPDLC message element response requirements key;
- Section A.3 provides the CPDLC uplink message elements and intended uses;
- Section A.4 provides the CPDLC downlink message elements; and
- Section A.5 provides CPDLC standardized free text messages.

A.1.2 The following guidelines apply:

a) Normal text is taken from ICAO Doc 4444 (e.g. message response key or message intent/use) and represents the global baseline. *Italic text* supplements the ICAO Doc 4444 guideline either as a *Note* or specific to *FANS 1/A*, *ATN B1*, or *ATN B1-FANS 1/A* data link system.

b) In cases where there is a choice for the message element or the response attribute, the first choice that appears in the row for that message element is shown in **bold text** and indicates the preferred choice, per ICAO Doc 4444, and should be used for new implementations. The second choice is shown in *italic text* and indicates legacy implementations (e.g. FANS 1/A), that are considered acceptable.

c) The following variables are considered operationally interchangeable in this document respecting range and resolution variations as defined in interoperability standards:

ICAO Doc 4444 variable	Equivalent FANS 1/A variable
[level]	[altitude] *(See Note)*
[specified distance] [direction]	[distance offset] [direction]
[departure clearance]	[predeparture clearance]
[unit name]	[icao unit name]
[code]	[beacon code]
[facility designation]	[icao facility designation]
[persons on board]	[remaining souls]

Note.— ICAO Doc 4444 notes that message elements that contain the [level] variable can be specified as either a single level or a vertical range (i.e. block level). **FANS 1/A** *only considers the [level] variable as a single level and uses message elements that are intended exclusively for specifying a vertical range (e.g. UM 30, UM 31, UM 32, UM 180, DM 7, DM 76, DM 77, etc).* **ATN B1** *uses the [level] variable to specify a vertical range and does not use the message elements intended exclusively for specifying a vertical range, except in cases where an ATN B1 ground system provides data link service to FANS 1/A aircraft.*

d) The "CPDLC message set" column indicates which of the CPDLC message sets, FANS 1/A, ATN B1 or FANS 1/A-ATN B1, supports the message element. The cell is shaded green if they are valid messages in the ICAO Doc 4444 message set and red if they are reserved.

1) If a CPDLC message set supports a message element that is reserved in ICAO Doc 4444, then the cell will be red and the data link system will be highlighted in green. In these cases, the ANSPs and operators should establish procedures or automation to avoid the use of these message elements.

2) In some cases, a CPDLC message set supports a message element that is also a valid message element in ICAO Doc 4444, but its use should be avoided due to potential misinterpretation. In these cases, a note has been added to the "Message intent/use" column, and the ANSPs and operators should establish procedures or automation to avoid the use of these message elements.

3) ***N/A*** in this column indicates that none of the CPDLC message sets support the message element.

e) The CPDLC message set in use will depend on the aircraft system and ground system capabilities and is shown as follows:

Ground systems	**Aircraft systems (See Note 2)**	**CPDLC message set (See Note 1)**
FANS 1/A	FANS 1/A	FANS 1/A
FANS 1/A	FANS 1/A-ATN B1	FANS 1/A
FANS 1/A	ATN B1	N/A
ATN B1	FANS 1/A	N/A
ATN B1	FANS 1/A-ATN B1	ATN B1
ATN B1	ATN B1	ATN B1
FANS 1/A-ATN B1	FANS 1/A	FANS 1/A-ATN B1
FANS 1/A-ATN B1	ATN B1	ATN B1
FANS 1/A-ATN B1	FANS 1/A-ATN B1	ATN B1 or FANS 1/A-ATN B1
Note 1.— The FANS 1/A-ATN B1 message set provides the ground system the equivalent of an ATN B1 message set for FANS 1/A aircraft, either through the use of UM 183 and UM 169 [free text] or other message elements that are operationally equivalent, except UM 215, UM 190, UM 227 and UM 196 are not supported. *Note 2.— A FANS 1/A-ATN B1 aircraft system fully supports FANS 1/A and ATN B1 CPDLC message sets.*		

Note.— The FOREWORD suggests that this guidance material may contain material that may eventually become Standards and Recommended Practices (SARPs), or PANS provisions. In particular, ICAO should strongly consider appropriate changes where experience has shown that valid message elements should be avoided, as indicated in this appendix.

A.2 CPDLC message element response requirements key

Response column	Description
	For uplink message
W/U	Response required. Yes Valid responses. WILCO, UNABLE, STANDBY, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, LOGICAL ACKNOWLEDGEMENT (only if required), ERROR *<u>Note</u>.— WILCO, UNABLE, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY and ERROR will close the uplink message.* *<u>FANS 1/A</u>.— WILCO, UNABLE, STANDBY, ERROR, NOT CURRENT DATA AUTHORITY.*
A/N	Response required. Yes Valid responses. AFFIRM, NEGATIVE, STANDBY, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, LOGICAL ACKNOWLEDGEMENT (only if required), ERROR *<u>Note</u>.— AFFIRM, NEGATIVE, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY and ERROR will close the uplink message.* *<u>FANS 1/A</u>.— AFFIRM, NEGATIVE, STANDBY, ERROR, NOT CURRENT DATA AUTHORITY.*
R	Response required. Yes Valid responses. ROGER, UNABLE, STANDBY, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, LOGICAL ACKNOWLEDGEMENT (only if required), ERROR *<u>Note</u>.— ROGER, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY and ERROR will close the uplink message.* *<u>FANS 1/A</u>.— ROGER, STANDBY, ERROR, NOT CURRENT DATA AUTHORITY. FANS 1/A aircraft do not have the capability to send UNABLE in response to an uplink message containing message elements with an "R" response attribute. For these aircraft, the flight crew may use alternative means to UNABLE the message. These alternative means will need to be taken into consideration to ensure proper technical and operational closure of the communication transaction.*
Y	Response required. Yes Valid responses: Any CPDLC downlink message, LOGICAL ACKNOWLEDGEMENT (only if required)
N	Response required. No, unless logical acknowledgement required. Valid Responses (only if LOGICAL ACKNOWLEDGEMENT is required). LOGICAL ACKNOWLEDGEMENT, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, ERROR *<u>FANS 1/A</u>.— Defined "Response not required," but not used. Under some circumstances, an ERROR message will also close an uplink message.*

Response column	Description
NE	[Not defined in ICAO Doc 4444] *FANS 1/A.— The WILCO, UNABLE, AFFIRM, NEGATIVE, ROGER, and STANDBY responses are not enabled (NE) for flight crew selection. An uplink message with a response attribute NE is considered to be closed even though a response may be required operationally. Under some circumstances, a downlink error message may be linked to an uplink message with a NE attribute.*
	For downlink messages
Y	Response required. Yes Valid responses. Any CPDLC uplink message, LOGICAL ACKNOWLEDGEMENT (only if required).
N	Response required. No, unless logical acknowledgement required. Valid responses (only if LOGICAL ACKNOWLEDGEMENT is required). LOGICAL ACKNOWLEDGEMENT, SERVICE UNAVAILABLE, FLIGHT PLAN NOT HELD, ERROR *FANS 1/A.— Aircraft do not have the capability to receive technical responses to downlink message elements with an "N" response attribute (other than LACK or ERROR for ATN B1 aircraft). In some cases, the response attribute is different between FANS 1/A aircraft and ICAO Doc 4444. As an example, most emergency messages have an "N" response attribute for FANS 1/A whereas ICAO Doc 4444 defines a "Y" response attribute for them. As a consequence, for FANS 1/A aircraft, the ATC will need to use alternative means to acknowledge to the flight crew that an emergency message has been received.*

A.3 CPDLC uplink message elements

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Responses/Acknowledgements (uplink)			
UM 0	Indicates that ATC cannot comply with the request.	UNABLE	**N** or *NE*	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 1	Indicates that ATC has received the message and will respond. *Note.— The flight crew is informed that the request is being assessed and there will be a short-term delay (e.g. as appropriate, given the situation, but not to exceed 10 minutes). The exchange is not closed and the request will be responded to when conditions allow.*	STANDBY	**N** or *NE*	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 2	Indicates that ATC has received the request but it has been deferred until later. *Note.— The flight crew is informed that the request is being assessed and a long-term delay can be expected. The exchange is not closed and the request will be responded to when conditions allow.*	REQUEST DEFERRED	**N** or *NE*	FANS 1/A
UM 3	Indicates that ATC has received and understood the message.	ROGER	**N** or *NE*	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 4	Yes.	AFFIRM	**N** or *NE*	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 5	No	NEGATIVE	**N** or *NE*	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 235	Notification of receipt of unlawful interference message.	ROGER 7500	N	N/A (Urgent)
UM 211	Indicates that the ATC has received the request and has passed it to the next control authority. *FANS 1/A and FANS 1/A-ATN B1.— Uses UM 169x free text for FANS 1/A aircraft.*	REQUEST FORWARDED	N	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
UM 218	Indicates to the pilot that the request has already been received on the ground.	REQUEST ALREADY RECEIVED	N	N/A
UM 237	Indicates that the request cannot be responded to by the current unit and that it should be requested from the next unit. *FANS 1/A and FANS 1/A-ATN B1.— Uses UM 169ab free text for FANS 1/A aircraft.*	REQUEST AGAIN WITH NEXT UNIT	N	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
	Vertical Clearances (uplink)			
UM 6	Notification that a level change instruction should be expected. *Note.— Avoid use of this message element due to potential misinterpretation.*	EXPECT [level]	R	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 7	Notification that an instruction should be expected for the aircraft to commence climb at the specified time. *<u>Note</u>.— The controller should only use this message to respond to a flight crew request (e.g. WHEN CAN WE EXPECT).*	EXPECT CLIMB AT [time]	R	FANS 1/A
UM 8	Notification that an instruction should be expected for the aircraft to commence climb at the specified position. *<u>Note</u>.— The controller should only use this message to respond to a flight crew request (e.g. WHEN CAN WE EXPECT).*	EXPECT CLIMB AT [position]	R	FANS 1/A
UM 9	Notification that an instruction should be expected for the aircraft to commence descent at the specified time. *<u>Note</u>.— The controller should only use this message to respond to a flight crew request (e.g. WHEN CAN WE EXPECT).*	EXPECT DESCENT AT [time]	R	FANS 1/A
UM 10	Notification that an instruction should be expected for the aircraft to commence descent at the specified position. *<u>Note</u>.— The controller should only use this message to respond to a flight crew request (e.g. WHEN CAN WE EXPECT).*	EXPECT DESCENT AT [position]	R	FANS 1/A
UM 11	Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified time. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	EXPECT CRUISE CLIMB AT [time]	R	FANS 1/A
UM 12	Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified position. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	EXPECT CRUISE CLIMB AT [position]	R	FANS 1/A
UM 13	(Reserved) *<u>Note</u>.— Avoid use of this message element, AT [time] EXPECT CLIMB TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 14	(Reserved) *<u>Note</u>.— Avoid use of this message element, AT [position] EXPECT CLIMB TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 15	(Reserved) *<u>Note</u>.— Avoid use of this message element, AT [time] EXPECT DESCENT TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 16	(Reserved) *<u>Note</u>.— Avoid use of this message element, AT [position] EXPECT DESCENT TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 17	(Reserved) *<u>Note</u>.— Avoid use of this message element, AT [time] EXPECT CRUISE CLIMB TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 18	(Reserved) *<u>Note</u>.— Avoid use of this message element, AT [position] EXPECT CRUISE CLIMB TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 19	Instruction to maintain the specified level.	MAINTAIN [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 20	Instruction that a climb to a specified level is to commence and once reached the specified level is to be maintained.	**CLIMB TO [level]** or *CLIMB TO AND MAINTAIN [altitude]*	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 21	Instruction that at the specified time a climb to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that NOT BEFORE the specified time, a climb to the specified level is to commence and once reached the specified level is to be maintained.* *Note 2.— Precede this message element with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [time] CLIMB TO [level]** or *AT [time] CLIMB TO AND MAINTAIN [altitude]*	W/U	FANS 1/A
UM 22	Instruction that at the specified position a climb to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that AFTER PASSING the specified position, a climb to the specified level is to commence and once reached the specified level is to be maintained.* *Note 2.— Precede this message element with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [position] CLIMB TO [level]** or *AT [position] CLIMB TO AND MAINTAIN [altitude]*	W/U	FANS 1/A
UM 185	(Reserved)	N/A	W/U	N/A
UM 23	Instruction that a descent to a specified level is to commence and once reached the specified level is to be maintained.	**DESCEND TO [level]** or *DESCEND TO AND MAINTAIN [altitude]*	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 24	Instruction that at a specified time a descent to a specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that NOT BEFORE the specified time, a descent to the specified level is to commence, and once reached, the specified level is to be maintained.* *Note 2.— Precede this message element with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [time] DESCEND TO [level]** or *AT [time] DESCEND TO AND MAINTAIN [altitude]*	W/U	FANS 1/A
UM 25	Instruction that at the specified position a descent to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that AFTER PASSING the specified position, a descent to the specified level is to commence and once reached the specified level is to be maintained.* *Note 2.— Precede this message element with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [position] DESCEND TO [level]** or *AT [position] DESCEND TO AND MAINTAIN [altitude]*	W/U	FANS 1/A
UM 186	(Reserved)	N/A	W/U	N/A
UM 26	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a climb is to commence at a rate such that the specified level is reached NOT LATER THAN the specified time.*	CLIMB TO REACH [level] BY [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 27	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a climb is to commence at a rate such that the specified level is reached BEFORE PASSING the specified position.*	CLIMB TO REACH [level] BY [position]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 28	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a descent is to commence at a rate such that the specified level is reached NOT LATER THAN the specified time.*	DESCEND TO REACH [level] BY [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 29	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a descent is to commence at a rate such that the specified level is reached BEFORE PASSING the specified position.*	DESCEND TO REACH [level] BY [position]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 192	Instruction that a change of level is to continue, but at a rate such that the specified level is reached at or before the specified time.	REACH [level] BY [time]	W/U	N/A
UM 209	Instruction that a change of level is to continue, but at a rate such that the specified level is reached at or before the specified position.	REACH [level] BY [position]	W/U	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 30	Instruction that a level within the defined vertical range specified is to be maintained. *FANS 1/A-ATN B1.— FANS 1/A aircraft only. ATN B1 aircraft accepts UM 19 MAINTAIN [level], where [level] is a vertical range.*	MAINTAIN BLOCK [level] TO [level]	W/U	FANS 1/A FANS 1/A-ATN B1
UM 31	Instruction that a climb to a level within the vertical range defined is to commence. *FANS 1/A-ATN B1.— FANS 1/A aircraft only. ATN B1 aircraft accepts UM 20 CLIMB TO [level], where [level] is a vertical range.*	CLIMB TO AND MAINTAIN BLOCK [level] TO [level]	W/U	FANS 1/A FANS 1/A-ATN B1
UM 32	Instruction that a descent to a level within the vertical range defined is to commence. *FANS 1/A-ATN B1.— FANS 1/A aircraft only. ATN B1 aircraft accepts UM 23 DESCEND TO [level], where [level] is a vertical range.*	DESCEND TO AND MAINTAIN BLOCK [level] TO [level]	W/U	FANS 1/A FANS 1/A-ATN B1
UM 34	Instruction that a cruise climb to the specified level is to commence and continue and, once reached the specified level is to be maintained. *Note.— Avoid use of this message element due to potential misinterpretation.*	CRUISE CLIMB TO [level]	W/U	FANS 1/A
UM 35	Instruction to be used in conjunction with an associated level instruction indicating that a cruise climb can commence once above the specified level. *Note.— Avoid use of this message element due to potential misinterpretation.*	**WHEN ABOVE (level) COMMENCE CRUISE CLIMB** or *CRUISE CLIMB ABOVE [level]*	W/U	FANS 1/A
UM 219	Instruction to stop the climb at the specified level and, once reached, this level is to be maintained. The specified level will be below the previously assigned level.	STOP CLIMB AT [level]	W/U	N/A (Urgent)
UM 220	Instruction to stop the descent at the specified level and, once reached, this level is to be maintained. The specified level will be above the previously assigned level.	STOP DESCENT AT [level]	W/U	N/A (Urgent)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 36	Instruction that the climb to the specified level should be made at the aircraft's best rate.	EXPEDITE CLIMB TO [level]	W/U	FANS 1/A
UM 37	Instruction that the descent to the specified level should be made at the aircraft's best rate.	EXPEDITE DESCENT TO[level]	W/U	FANS 1/A
UM 38	Urgent instruction to immediately climb to the specified level and, once reached, the specified level is to be maintained.	IMMEDIATELY CLIMB TO [level]	W/U	FANS 1/A (Distress)
UM 39	Urgent instruction to immediately descend to the specified level and, once reached, the specified level is to be maintained.	IMMEDIATELY DESCEND TO [level]	W/U	FANS 1/A (Distress)
UM 40	(Reserved) *<u>Note</u>.— Avoid use of this message element, IMMEDIATELY STOP CLIMB AT [altitude], as it is reserved in ICAO Doc 4444.*	(Not defined)	**Y** or *W/U*	FANS 1/A
UM 41	(Reserved) *<u>Note</u>.— Avoid use of this message element, IMMEDIATELY STOP DESCENT AT [altitude], as it is reserved in ICAO Doc 4444.*	(Not defined)	**Y** or *W/U*	FANS 1/A
UM 171	Instruction to climb at not less than the specified rate.	CLIMB AT [vertical rate] MINIMUM	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 172	Instruction to climb at not above the specified rate.	CLIMB AT [vertical rate] MAXIMUM	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 173	Instruction to descend at not less than the specified rate.	DESCEND AT [vertical rate] MINIMUM	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 174	Instruction to descend at not above the specified rate.	DESCEND AT [vertical rate] MAXIMUM	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 33	(Reserved) *Note.— Avoid use of this message element, CRUISE [altitude], as it is reserved in ICAO Doc 4444.*	(Not defined)	**Y** or *W/U*	FANS 1/A
	Crossing Constraints (uplink)			
UM 42	(Reserved) *Note.— Avoid use of this message element, EXPECT TO CROSS [position] AT [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 43	(Reserved) *Note.— Avoid use of this message element, EXPECT TO CROSS [position] AT OR ABOVE [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 44	(Reserved) *Note.— Avoid use of this message element, EXPECT TO CROSS [position] AT OR BELOW [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 45	(Reserved) *Note.— Avoid use of this message element, EXPECT TO CROSS [position] AT AND MAINTAIN [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 46	Instruction that the specified position is to be crossed at the specified level. This may require the aircraft to modify its climb or descent profile.	CROSS [position] AT [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 47	Instruction that the specified position is to be crossed at or above the specified level.	CROSS [position] AT OR ABOVE [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 48	Instruction that the specified position is to be crossed at or below the specified level.	CROSS [position] AT OR BELOW [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 49	Instruction that the specified position is to be crossed at the specified level and that level is to be maintained when reached.	CROSS [position] AT AND MAINTAIN [level]	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 50	Instruction that the specified position is to be crossed at a level between the specified levels.	CROSS [position] BETWEEN [level] AND [level]	W/U	FANS 1/A
UM 51	Instruction that the specified position is to be crossed at the specified time.	CROSS [position] AT [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 52	Instruction that the specified position is to be crossed at or before the specified time.	CROSS [position] AT OR BEFORE [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 53	Instruction that the specified position is to be crossed at or after the specified time.	CROSS [position] AT OR AFTER [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 54	Instruction that the specified position is to be crossed at a time between the specified times.	CROSS [position] BETWEEN [time] AND [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 55	Instruction that the specified position is to be crossed at the specified speed and the specified speed is to be maintained until further advised.	CROSS [position] AT [speed]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 56	Instruction that the specified position is to be crossed at a speed equal to or less than the specified speed and the specified speed or less is to be maintained until further advised.	CROSS [position] AT OR LESS THAN [speed]	W/U	FANS 1/A
UM 57	Instruction that the specified position is to be crossed at a speed equal to or greater than the specified speed and the specified speed or greater is to be maintained until further advised.	CROSS [position] AT OR GREATER THAN [speed]	W/U	FANS 1/A
UM 58	Instruction that the specified position is to be crossed at the specified time and the specified level.	CROSS [position] AT [time] AT [level]	W/U	FANS 1/A
UM 59	Instruction that the specified position is to be crossed at or before the specified time and at the specified level.	CROSS [position] AT OR BEFORE [time] AT [level]	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 60	Instruction that the specified position is to be crossed at or after the specified time and at the specified level.	CROSS [position] AT OR AFTER [time] AT [level]	W/U	FANS 1/A
UM 61	Instruction that the specified position is to be crossed at the specified level and speed, and the level and speed are to be maintained.	CROSS [position] AT AND MAINTAIN [level] AT [speed]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 62	Instruction that at the specified time the specified position is to be crossed at the specified level and the level is to be maintained.	AT [time] CROSS [position] AT AND MAINTAIN [level]	W/U	FANS 1/A
UM 63	Instruction that at the specified time the specified position is to be crossed at the specified level and speed, and the level and speed are to be maintained.	AT [time] CROSS [position] AT AND MAINTAIN [level] AT [speed]	W/U	FANS 1/A
	Lateral Offsets (uplink)			
UM 64	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction.	OFFSET [specified distance] [direction] OF ROUTE	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 65	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified position.	AT [position] OFFSET [specified distance] [direction] OF ROUTE	W/U	FANS 1/A
UM 66	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified time.	AT [time] OFFSET [specified distance] [direction] OF ROUTE	W/U	FANS 1/A
UM 67	Instruction that the cleared flight route is to be rejoined.	PROCEED BACK ON ROUTE	W/U	FANS 1/A
UM 68	Instruction that the cleared flight route is to be rejoined at or before the specified position.	REJOIN ROUTE BY [position]	W/U	FANS 1/A
UM 69	Instruction that the cleared flight route is to be rejoined at or before the specified time.	REJOIN ROUTE BY [time]	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 70	Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified position.	EXPECT BACK ON ROUTE BY [position]	R	FANS 1/A
UM 71	Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified time.	EXPECT BACK ON ROUTE BY [time]	R	FANS 1/A
UM 72	Instruction to resume own navigation following a period of tracking or heading clearances. May be used in conjunction with an instruction on how or where to rejoin the cleared route.	RESUME OWN NAVIGATION	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
	Route Modifications (uplink)			
UM 73	Instruction to be followed from departure until the specified clearance limit.	[departure clearance]	W/U	FANS 1/A
UM 74	Instruction to proceed directly from its present position to the specified position.	PROCEED DIRECT TO [position]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 75	Instruction to proceed, when able, directly to the specified position.	WHEN ABLE PROCEED DIRECT TO [position]	W/U	FANS 1/A
UM 76	Instruction to proceed, at the specified time, directly to the specified position.	AT [time] PROCEED DIRECT TO [position]	W/U	FANS 1/A
UM 77	Instruction to proceed, at the specified position, directly to the next specified position.	AT [position] PROCEED DIRECT TO [position]	W/U	FANS 1/A
UM 78	Instruction to proceed, upon reaching the specified level, directly to the specified position.	AT [level] PROCEED DIRECT TO [position]	W/U	FANS 1/A
UM 79	Instruction to proceed to the specified position via the specified route.	CLEARED TO [position] VIA [route clearance]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 80	Instruction to proceed via the specified route.	CLEARED [route clearance]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 81	Instruction to proceed in accordance with the specified procedure.	CLEARED [procedure name]	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 236	Instruction to leave controlled airspace.	LEAVE CONTROLLED AIRSPACE	W/U	N/A
UM 82	Approval to deviate up to the specified distance from the cleared route in the specified direction.	CLEARED TO DEVIATE UP TO [specified distance] [direction] OF ROUTE	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 83	Instruction to proceed from the specified position via the specified route.	AT [position] CLEARED [route clearance]	W/U	FANS 1/A
UM 84	Instruction to proceed from the specified position via the specified procedure.	AT [position] CLEARED [procedure name]	W/U	FANS 1/A
UM 85	Notification that a clearance to fly on the specified route may be issued. *Note.— Avoid use of this message element due to potential misinterpretation.*	EXPECT [route clearance]	R	FANS 1/A
UM 86	Notification that a clearance to fly on the specified route from the specified position may be issued. *Note.— Avoid use of this message element due to potential misinterpretation.*	AT [position] EXPECT [route clearance]	R	FANS 1/A
UM 87	Notification that a clearance to fly directly to the specified position may be issued. *Note.— Avoid use of this message element due to potential misinterpretation.*	EXPECT DIRECT TO [position]	R	FANS 1/A
UM 88	Notification that a clearance to fly directly from the first specified position to the next specified position may be issued. *Note.— Avoid use of this message element due to potential misinterpretation.*	AT [position] EXPECT DIRECT TO [position]	R	FANS 1/A
UM 89	Notification that a clearance to fly directly to the specified position commencing at the specified time may be issued. *Note.— Avoid use of this message element due to potential misinterpretation.*	AT [time] EXPECT DIRECT TO [position]	R	FANS 1/A
UM 90	Notification that a clearance to fly directly to the specified position commencing when the specified level is reached may be issued. *Note.— Avoid use of this message element due to potential misinterpretation.*	AT [level] EXPECT DIRECT TO [position]	R	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 91	Instruction to enter a holding pattern with the specified characteristics at the specified position and level.	**HOLD AT [position] MAINTAIN [level] INBOUND TRACK [degrees] [direction] TURNS [leg type]** or *HOLD AT [position] MAINTAIN [altitude] INBOUND TRACK [degrees][direction] TURN LEG TIME [leg type]*	W/U	FANS 1/A
UM 92	Instruction to enter a holding pattern with the published characteristics at the specified position and level.	HOLD AT [position] AS PUBLISHED MAINTAIN [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 93	Notification that an onwards clearance may be issued at the specified time.	EXPECT FURTHER CLEARANCE AT [time]	R	FANS 1/A
UM 94	Instruction to turn left or right as specified on to the specified heading.	TURN [direction] HEADING [degrees]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 95	Instruction to turn left or right as specified on to the specified track.	TURN [direction] GROUND TRACK [degrees]	W/U	FANS 1/A
UM 215	Instruction to turn a specified number of degrees left or right.	TURN [direction] [degrees] DEGREES	W/U	ATN B1 FANS 1/A-ATN B1
UM 190	Instruction to fly on the specified heading.	FLY HEADING [degrees]	W/U	ATN B1 FANS 1/A-ATN B1
UM 96	Instruction to continue to fly on the current heading.	**CONTINUE PRESENT HEADING** or *FLY PRESENT HEADING*	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 97	Instruction to fly on the specified heading from the specified position.	AT [position] FLY HEADING [degrees]	W/U	FANS 1/A
UM 221	Instruction to stop turn at the specified heading prior to reaching the previously assigned heading.	STOP TURN HEADING [degrees]	W/U	N/A (Urgent)
UM 98	Instruction to turn immediately left or right as specified on to the specified heading.	IMMEDIATELY TURN [direction] HEADING [degrees]	W/U	FANS 1/A (Distress)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 99	Notification that a clearance may be issued for the aircraft to fly the specified procedure.	EXPECT [procedure name]	R	FANS 1/A
	Speed Changes (uplink)			
UM 100	Notification that a speed instruction may be issued to be effective at the specified time.	AT [time] EXPECT [speed]	R	FANS 1/A
UM 101	Notification that a speed instruction may be issued to be effective at the specified position.	AT [position] EXPECT [speed]	R	FANS 1/A
UM 102	Notification that a speed instruction may be issued to be effective at the specified level. *Note.— Avoid use of this message element due to potential misinterpretation.*	AT [level] EXPECT [speed]	R	FANS 1/A
UM 103	Notification that a speed range instruction may be issued to be effective at the specified time. *Note.— Avoid use of this message element due to potential misinterpretation.*	AT [time] EXPECT [speed] TO [speed]	R	FANS 1/A
UM 104	Notification that a speed range instruction may be issued to be effective at the specified position. *Note.— Avoid use of this message element due to potential misinterpretation.*	AT [position] EXPECT [speed] TO [speed]	R	FANS 1/A
UM 105	Notification that a speed range instruction may be issued to be effective at the specified level. *Note.— Avoid use of this message element due to potential misinterpretation.*	AT [level] EXPECT [speed] TO [speed]	R	FANS 1/A
UM 106	Instruction that the specified speed is to be maintained.	MAINTAIN [speed]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 188	Instruction that after passing the specified position the specified speed is to be maintained.	AFTER PASSING [position] MAINTAIN [speed]	W/U	N/A
UM 107	Instruction that the present speed is to be maintained.	MAINTAIN PRESENT SPEED	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 108	Instruction that the specified speed or a greater speed is to be maintained.	MAINTAIN [speed] OR GREATER	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 109	Instruction that the specified speed or a lesser speed is to be maintained.	MAINTAIN [speed] OR LESS	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 110	Instruction that a speed within the specified range is to be maintained.	MAINTAIN [speed] TO [speed]	W/U	FANS 1/A
UM 111	Instruction that the present speed is to be increased to the specified speed and maintained until further advised.	INCREASE SPEED TO [speed]	W/U	FANS 1/A
UM 112	Instruction that the present speed is to be increased to the specified speed or greater, and maintained at or above the specified speed until further advised.	INCREASE SPEED TO [speed] OR GREATER	W/U	FANS 1/A
UM 113	Instruction that the present speed is to be reduced to the specified speed and maintained until further advised.	REDUCE SPEED TO [speed]	W/U	FANS 1/A
UM 114	Instruction that the present speed is to be reduced to the specified speed or less and maintained at or below the specified speed until further advised.	REDUCE SPEED TO [speed] OR LESS	W/U	FANS 1/A
UM 115	Instruction that the specified speed is not to be exceeded.	DO NOT EXCEED [speed]	W/U	FANS 1/A
UM 116	Instruction that the aircraft's normal speed be resumed. The previously issued speed restriction(s) are cancelled.	RESUME NORMAL SPEED	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 189	Instruction that the present speed is to be changed to the specified speed.	ADJUST SPEED TO [speed]	W/U	N/A
UM 222	Notification that the aircraft may keep its preferred speed without restriction. *FANS 1/A and FANS 1/A-ATN B1.— Uses UM 169z free text for FANS 1/A aircraft.*	NO SPEED RESTRICTION	R	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
UM 223	Instruction to reduce present speed to the minimum safe approach speed.	REDUCE TO MINIMUM APPROACH SPEED	W/U	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Contact/Monitor/Surveillance Requests (uplink)			
UM 117	Instruction that the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	CONTACT [unit name] [frequency]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 118	Instruction that at the specified position the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	AT [position] CONTACT [unit name] [frequency]	W/U	FANS 1/A
UM 119	Instruction that at the specified time the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	AT [time] CONTACT [unit name] [frequency]	W/U	FANS 1/A
UM 238	Notification that the secondary frequency is as specified. *FANS 1/A.— Uses UM 169o free text for FANS 1/A aircraft.*	SECONDARY FREQUENCY [frequency]	R	FANS 1/A [free text]
UM 120	Instruction that the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. *Note.— The flight crew is not required to check in.*	MONITOR [unit name] [frequency]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 121	Instruction that at the specified position the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. *Note.— The flight crew is not required to check in.*	AT [position] MONITOR [unit name] [frequency]	W/U	FANS 1/A
UM 122	Instruction that at the specified time the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. *Note.— The flight crew is not required to check in.*	AT [time] MONITOR [unit name] [frequency]	W/U	FANS 1/A
UM 123	Instruction that the specified code (SSR code) is to be selected.	SQUAWK [code]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 124	Instruction that the SSR transponder responses are to be disabled.	STOP SQUAWK	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 239	Instruction that the ADS-B transmissions are to be terminated.	STOP ADS-B TRANSMISSION	W/U	N/A
UM 125	Instruction that the SSR transponder responses should include level information.	**SQUAWK MODE CHARLIE** or *SQUAWK ALTITUDE*	W/U	FANS 1/A
UM 240	Instruction that the ADS-B transmissions should include level information.	TRANSMIT ADS-B ALTITUDE	W/U	N/A
UM 126	Instruction that the SSR transponder responses should no longer include level information.	**STOP SQUAWK MODE CHARLIE** or *STOP ALTITUDE SQUAWK*	W/U	FANS 1/A
UM 241	Instruction that the ADS-B transmissions should no longer include level information.	STOP ADS-B ALTITUDE TRANSMISSION	W/U	N/A
UM 179	Instruction that the 'ident' function on the SSR transponder is to be actuated.	SQUAWK IDENT	W/U	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 242	Instruction that the "ident" function of the ADS-B emitter is to be activated. *FANS 1/A.— Uses UM 169ai free text for FANS 1/A aircraft. The free text message is considered acceptable as the intended use does not change the volume of protected airspace (i.e. not a clearance).*	TRANSMIT ADS-B IDENT	**W/U** or *R (free text)*	FANS 1/A [free text]
UM 243	Instruction to report when the aircraft is clear of adverse meteorological conditions, and a clearance to regain cleared flight route can be accepted.	REPORT CLEAR OF WEATHER	W/U	N/A
	Report/Confirmation Requests (uplink)			
UM 127	Instruction to report when the aircraft is back on the cleared route.	REPORT BACK ON ROUTE	**W/U** or *R*	FANS 1/A
UM 128	Instruction to report when the aircraft has vacated the specified level that has either been maintained or passed through on climb or descent. *Note.— Either a level that has been maintained, or a level passed through on climb or descent.*	REPORT LEAVING [level]	**W/U** or *R*	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 129	Instruction to report when the aircraft is in level flight at the specified level. *Note.— This message element is only to be used with single altitude clearances.*	**REPORT MAINTAINING [level]** or *REPORT LEVEL [altitude]*	**W/U** or *R*	FANS 1/A
UM 175	(Reserved) *Note.— Avoid use of this message element, REPORT REACHING [level], as it is reserved in ICAO Doc 4444.*	N/A	**W/U** or *R*	FANS 1/A
UM 200	Instruction used in conjunction with a level clearance to report maintaining the level assigned.	REPORT MAINTAINING	W/U	N/A
UM 180	Instruction to report when the aircraft is within the specified vertical range.	REPORT REACHING BLOCK [level] TO [level]	**W/U** or *R*	FANS 1/A
UM 130	Instruction to report when the aircraft has passed the specified position.	REPORT PASSING [position]	**W/U** or *R*	FANS 1/A
UM 181	Instruction to report the present distance to or from the specified position.	REPORT DISTANCE [to/from] [position]	**Y** or *NE*	FANS 1/A
UM 184	Instruction to report at the specified time the distance to or from the specified position.	AT TIME [time] REPORT DISTANCE [to/from] [position]	Y	N/A
UM 228	Instruction to report the estimated time of arrival at the specified position. *FANS 1/A.— Uses UM 169d free text for FANS 1/A aircraft.*	REPORT ETA [position]	Y DM 104	FANS 1/A [free text]
UM 131	Instruction to report the amount of fuel remaining and the number of persons on board.	**REPORT REMAINING FUEL AND PERSONS ON BOARD** or *REPORT REMAINING FUEL AND SOULS ON BOARD*	**Y** or *NE*	FANS 1/A (Urgent)
UM 132	Instruction to report the present position.	**REPORT POSITION** or *CONFIRM POSITION*	**Y** or *NE*	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 133	Instruction to report the present level.	**REPORT PRESENT LEVEL** or *CONFIRM ALTITUDE*	**Y** or *NE* *DM 32*	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 134	Instruction to report the requested speed. *Note.— Instruction to report the present speed.* *FANS 1/A.— Uses UM 169b free text for FANS 1/A aircraft when the controller is requesting the flight crew to report the present ground speed.*	**REPORT [speed type] [speed type] [speed type] SPEED** or *CONFIRM SPEED*	**Y** or *NE* or *R* *DM 113*	FANS 1/A [free text]
UM 135	Instruction to confirm the currently assigned level.	**CONFIRM ASSIGNED LEVEL** or *CONFIRM ASSIGNED ALTITUDE*	**Y** or *NE* *DM 38* *DM 77* *(TBC)*	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 136	Instruction to confirm the currently assigned speed.	CONFIRM ASSIGNED SPEED	**Y** or *NE*	FANS 1/A
UM 137	Instruction to confirm the currently assigned route.	CONFIRM ASSIGNED ROUTE	**Y** or *NE*	FANS 1/A
UM 138	Instruction to confirm the previously reported time over the last reported waypoint.	CONFIRM TIME OVER REPORTED WAYPOINT	**Y** or *NE*	FANS 1/A
UM 139	Instruction to confirm the identity of the previously reported waypoint.	CONFIRM REPORTED WAYPOINT	**Y** or *NE*	FANS 1/A
UM 140	Instruction to confirm the identity of the next waypoint.	CONFIRM NEXT WAYPOINT	**Y** or *NE*	FANS 1/A
UM 141	Instruction to confirm the previously reported estimated time at the next waypoint.	CONFIRM NEXT WAYPOINT ETA	**Y** or *NE*	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 142	Instruction to confirm the identity of the next but one waypoint.	CONFIRM ENSUING WAYPOINT	**Y** or *NE*	FANS 1/A
UM 143	The request was not understood. It should be clarified and resubmitted.	CONFIRM REQUEST	**Y** or *NE*	FANS 1/A
UM 144	Instruction to report the selected (SSR) code.	CONFIRM SQUAWK	**Y** or *NE*	FANS 1/A
UM 145	Instruction to report the present heading.	**REPORT HEADING** or *CONFIRM HEADING*	**Y** or *NE*	FANS 1/A
UM 146	Instruction to report the present ground track.	**REPORT GROUND TRACK** or *CONFIRM GROUND TRACK*	**Y** or *NE*	FANS 1/A
UM 182	Instruction to report the identification code of the last ATIS received.	CONFIRM ATIS CODE	**Y** or *NE*	FANS 1/A
UM 147	Instruction to make a position report. *Note.— To be used if the controller does not receive a scheduled position report.*	REQUEST POSITION REPORT	**Y** or *NE*	FANS 1/A
UM 216	Instruction to file a flight plan.	REQUEST FLIGHT PLAN	Y	N/A
UM 217	Instruction to report that the aircraft has landed.	REPORT ARRIVAL	Y	N/A
UM 229	Instruction to report the preferred alternate aerodrome for landing.	REPORT ALTERNATE AERODROME	Y	N/A
UM 231	Instruction to indicate the pilot's preferred level. *FANS 1/A and FANS 1/A-ATN B1.— uses UM 169c free text for FANS 1/A aircraft.*	STATE PREFERRED LEVEL	Y *DM 106*	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
UM 232	Instruction to indicate the pilot's preferred time and/or position to commence descent to the aerodrome of intended arrival. *FANS 1/A and FANS 1/A-ATN B1.— Uses UM 169aa free text for FANS 1/A aircraft.*	STATE TOP OF DESCENT	Y *DM 109*	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Negotiation Requests (uplink)			
UM 148	Request for the earliest time or position at which the specified level can be accepted.	WHEN CAN YOU ACCEPT [level]	**Y** or *NE* *DM 81* *DM 82*	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 149	Instruction to report whether or not the specified level can be accepted at the specified position.	CAN YOU ACCEPT [level] AT [position]	A/N	FANS 1/A
UM 150	Instruction to report whether or not the specified level can be accepted at the specified time.	CAN YOU ACCEPT [level] AT [time]	A/N	FANS 1/A
UM 151	Instruction to report the earliest time or position when the specified speed can be accepted.	WHEN CAN YOU ACCEPT [speed]	**Y** or *NE* *DM 83* *DM 84*	FANS 1/A
UM 152	Instruction to report the earliest time or position when the specified offset track can be accepted.	WHEN CAN YOU ACCEPT [specified distance] [direction] OFFSET	**Y** or *NE* *DM 85* *DM 86*	FANS 1/A
	Air Traffic Advisories (uplink)			
UM 153	ATS advisory that the altimeter setting should be the specified setting.	ALTIMETER [altimeter]	R	FANS 1/A
UM 213	ATS advisory that the specified altimeter setting relates to the specified facility. *FANS 1/A and FANS 1/A-ATN B1.— Uses UM 169y free text for FANS 1/A aircraft.*	[facility designation] ALTIMETER [altimeter]	R	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
UM 154	ATS advisory that the radar service is terminated.	**RADAR SERVICE TERMINATED** or *RADAR SERVICES TERMINATED*	R	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 244	ATS advisory that the radar and/or ADS-B service is terminated. *FANS 1/A.— uses UM 169aj free text for FANS 1/A aircraft.*	IDENTIFICATION TERMINATED	R	FANS 1/A [free text]
UM 191	ATS advisory that the aircraft is entering airspace in which no air traffic services are provided and all existing air traffic services are terminated.	ALL ATS TERMINATED	R	N/A
UM 155	ATS advisory that radar contact has been established at the specified position.	RADAR CONTACT [position]	R	FANS 1/A
UM 156	ATS advisory that radar contact has been lost.	RADAR CONTACT LOST	R	FANS 1/A
UM 210	ATS advisory that the aircraft has been identified on radar and/or ADS-B at the specified position.	IDENTIFIED [position]	R	N/A
UM 193	Notification that radar and/or ADS-B identification has been lost.	IDENTIFICATION LOST	R	N/A
UM 157	Instruction that a continuous transmission is detected on the specified frequency. Check the microphone button.	CHECK STUCK MICROPHONE [frequency]	N or *R*	FANS 1/A ATN B1 FANS 1/A-ATN B1 (Urgent)
UM 158	ATS advisory that the ATIS information identified by the specified code is the current ATIS information.	ATIS [atis code]	R	FANS 1/A
UM 212	ATS advisory that the specified ATIS information at the specified airport is current.	[facility designation] ATIS [atis code] CURRENT	R	N/A
UM 214	ATS advisory that indicates the RVR value for the specified runway.	RVR RUNWAY [runway] [rvr]	R	N/A
UM 224	ATS advisory that no delay is expected.	NO DELAY EXPECTED	R	N/A
UM 225	ATS advisory that the expected delay has not been determined.	DELAY NOT DETERMINED	R	N/A
UM 226	ATS advisory that the aircraft may expect to be cleared to commence its approach procedure at the specified time.	EXPECTED APPROACH TIME [time]	R	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	System Management Messages (uplink)			
UM 159	A system generated message notifying that the ground system has detected an error.	ERROR [error information]	**N** or *NE*	FANS 1/A ATN B1 FANS 1/A-ATN B1 (Urgent)
UM 160	Notification to the avionics that the specified data authority is the next data authority. If no data authority is specified, this indicates that any previously specified next data authority is no longer valid.	NEXT DATA AUTHORITY [facility designation]	**N** or *NE*	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 161	Notification to the avionics that the data link connection with the current data authority is being terminated.	END SERVICE	**N** or *NE*	FANS 1/A
UM 162	Notification that the ground system does not support this message. *FANS 1/A and FANS 1/A ATN B1.— Uses UM 169u free text for FANS 1/A aircraft.*	**MESSAGE NOT SUPPORTED BY THIS ATS UNIT** or *SERVICE UNAVAILABLE*	**N** or *NE*	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
UM 234	Notification that the ground system does not have a flight plan for that aircraft.	FLIGHT PLAN NOT HELD	N	N/A
UM 163	Notification to the pilot of an ATSU identifier.	**[facility designation]** or *[icao facility designation] [tP4+Table]*	**N** or *NE*	FANS 1/A
UM 227	Confirmation to the aircraft system that the ground system has received the message to which the logical acknowledgement refers and found it acceptable for display to the responsible person. *FANS 1/A-ATN B1.— ATN B1 only. Not available for FANS 1/A.*	LOGICAL ACKNOWLEDGEMENT	N	ATN B1 FANS 1/A-ATN B1
UM 233	Notification to the pilot that messages sent requiring a logical acknowledgement will not be accepted by this ground system.	USE OF LOGICAL ACKNOWLEDGEMENT PROHIBITED	N	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Additional Messages (uplink)			
UM 164	The associated instruction may be complied with at any future time. *Note.— See also UM 177 AT PILOTS DISCRETION.*	WHEN READY	**N** or *NE*	FANS 1/A
UM 230	The associated instruction is to be complied with immediately.	IMMEDIATELY	N	N/A (Distress)
UM 165	Used to link two messages, indicating the proper order of execution of clearances/ instructions.	THEN	**N** or *NE*	FANS 1/A ATN B1 FANS 1/A-ATN B1
UM 166	The associated instruction is issued due to traffic considerations.	**DUE TO [traffic type] TRAFFIC** or *DUE TO TRAFFIC*	**N** or *NE*	FANS 1/A
UM 167	The associated instruction is issued due to airspace restrictions.	DUE TO AIRSPACE RESTRICTION	**N** or *NE*	FANS 1/A
UM 168	The indicated communication should be ignored. *Note.— The previously sent uplink CPDLC message should be ignored. DISREGARD should not refer to a clearance or instruction. If DISREGARD is used, another element should be added to clarify which message is to be disregarded.*	DISREGARD	R	FANS 1/A
UM 176	Instruction that the pilot is responsible for maintaining separation from other traffic and is also responsible for maintaining visual meteorological conditions.	MAINTAIN OWN SEPARATION AND VMC	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 177	Used in conjunction with a clearance/instruction to indicate that the pilot may execute when prepared to do so. *Note 1.— When used in conjunction with altitude assignments, means that ATC has offered the pilot the option of starting climb or descent whenever he/she wishes and conducting the climb or descent at any rate he/she wishes. He/she may temporarily level off at any intermediate altitude. However, once he/she has vacated an altitude, he/she may not return to that altitude.* *Note 2.— There are considerable differences regarding the interpretation of "pilot's discretion" and "when ready" and their meanings/intended uses.* *Note 3.— See also UM 164 WHEN READY.*	AT PILOTS DISCRETION	N	FANS 1/A
UM 178	(Reserved) *Note.— Avoid use of this message element, TRACK DETAIL MESSAGE, as it is reserved in ICAO Doc 4444.*	(not defined)	**Y** or *W/U*	FANS 1/A
	Free Text Normal-(uplink)			
UM 169	Normal urgency attribute, low alert attribute *FANS 1/A – ATN B1.— FANS 1/A only. Ground system uses UM 183 [free text] for ATN B1 aircraft.*	[free text]	R	FANS 1/A FANS 1/A-ATN B1
	Free Text Distress (uplink)			
UM 170	Distress urgency attribute, high alert attribute	[free text]	R	FANS 1/A
	Free Text – Other			
UM 183	Normal urgency attribute, medium alert attribute *FANS 1/A-ATN B1.— ATN B1 only. Ground system uses UM 169 [free text] for FANS 1/A aircraft.*	[free text]	N	ATN B1 FANS 1/A-ATN
UM 187	low urgency, normal alert	[free text]	N	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 194	normal urgency, low alert	[free text]	Y	N/A
UM 195	low urgency, low alert	[free text]	R	N/A
UM 196	normal urgency, medium alert	[free text]	W/U	ATN B1 FANS 1/A-ATN B1
UM 197	urgent urgency, medium alert	[free text]	W/U	N/A (Urgent)
UM 198	distress urgency, high alert	[free text]	W/U	N/A (Distress)
UM 199	normal urgency, low alert	[free text]	N	N/A
UM 201	Not used, low urgency, low alert	[free text]	N	N/A
UM 202	Not used, low urgency, low alert	[free text]	N	N/A
UM 203	normal urgency, medium alert	[free text]	R	N/A
UM 204	normal urgency, medium alert	[free text]	Y	N/A
UM 205	normal urgency, medium alert	[free text]	A/N	N/A
UM 206	low urgency, normal alert	[free text]	Y	N/A
UM 207	low urgency, low alert	[free text]	Y	N/A
UM 208	low urgency, low alert	[free text]	N	N/A

A.4 CPDLC downlink message elements

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Responses/Acknowledgements (downlink)			
DM 0	The instruction is understood and will be complied with.	WILCO	N	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 1	The instruction cannot be complied with.	UNABLE	N	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 2	Wait for a reply. *Note.— The controller is informed that the request is being assessed and there will be a short-term delay (within 10 minutes). The exchange is not closed and the request will be responded to when conditions allow.*	STANDBY	N	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 3	Message received and understood. *Note.— ROGER is the only correct response to an uplink free text message. Under no circumstances will ROGER be used instead of AFFIRM.*	ROGER	N	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 4	Yes. *Note.— AFFIRM is an appropriate response to an uplinked negotiation request message (e.g. UM 150 CAN YOU ACCEPT [level] at [time]).*	AFFIRM	N	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 5	No. *Note.— NEGATIVE is an appropriate response to an uplinked negotiation request message (e.g. UM 150 CAN YOU ACCEPT [level] at [time]).*	NEGATIVE	N	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Vertical Requests (downlink)			
DM 6	Request to fly at the specified level.	REQUEST [level]	Y *UM 0* *UM 1* *UM 19* *UM 20* *UM 23* *UM 26* *UM 27* *UM 28* *UM 29* *UM 46* *UM 47* *UM 48* *UM 159* + *UM 183* *UM 162* *UM 211*	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 7	Request to fly at a level within the specified vertical range. *FANS 1/A-ATN B1.— FANS 1/A aircraft only. ATN B1 aircraft uses DM 6 REQUEST [level], where [level] is a vertical range.*	REQUEST BLOCK [level] TO [level]	Y	FANS 1/A FANS 1/A –ATN B1
DM 8	Request to cruise climb to the specified level. *Note.— Avoid use of this message element due to potential misinterpretation.*	REQUEST CRUISE CLIMB TO [level]	Y	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 9	Request to climb to the specified level.	REQUEST CLIMB TO [level]	Y *UM 0* *UM 1* *UM 19* *UM 20* *UM 23* *UM 26* *UM 27* *UM 28* *UM 29* *UM 46* *UM 47* *UM 48* *UM 159* + *UM 183* *UM 162* *UM 211*	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 10	Request to descend to the specified level.	REQUEST DESCENT TO [level]	Y *UM 0* *UM 1* *UM 19* *UM 20* *UM 23* *UM 26* *UM 27* *UM 28* *UM 29* *UM 46* *UM 47* *UM 48* *UM 159* + *UM 183* *UM 162* *UM 211*	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 11	Request that at the specified position a climb to the specified level be approved.	AT [position] REQUEST CLIMB TO [level]	Y	FANS 1/A
DM 12	Request that at the specified position a descent to the specified level be approved.	AT [position] REQUEST DESCENT TO [level]	Y	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 13	Request that at the specified time a climb to the specified level be approved.	AT [time] REQUEST CLIMB TO [level]	Y	FANS 1/A
DM 14	Request that at the specified time a descent to the specified level be approved.	AT [time] REQUEST DESCENT TO [level]	Y	FANS 1/A
DM 69	Request that a descent be approved on a see-and-avoid basis. *Note.— Avoid use of this message element due to potential misinterpretation.*	REQUEST VMC DESCENT	Y	FANS 1/A
	Lateral Off-Set Requests (downlink)			
DM 15	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved.	REQUEST OFFSET [specified distance] [direction] OF ROUTE	Y	FANS 1/A
DM 16	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified position.	AT [position] REQUEST OFFSET [specified distance] [direction] OF ROUTE	Y	FANS 1/A
DM 17	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified time.	AT [time] REQUEST OFFSET [specified distance] [direction] OF ROUTE	Y	FANS 1/A
	Speed Requests (downlink)			
DM 18	Request to fly at the specified speed.	REQUEST [speed]	Y *UM 0* *UM 1* *UM 162* *UM 211* *UM 55* *UM 61* *UM 106* *UM 107* *UM 108* *UM 109* *UM 116* *UM 222* *UM 159* + *UM 183*	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 19	Request to fly within the specified speed range.	REQUEST [speed] TO [speed]	Y	FANS 1/A
	Voice Contact Requests (downlink)			
DM 20	Request for voice contact.	REQUEST VOICE CONTACT	Y	FANS 1/A
DM 21	Request for voice contact on the specified frequency.	REQUEST VOICE CONTACT [frequency]	Y	FANS 1/A
	Route Modification Requests (downlink)			
DM 22	Request to track from the present position direct to the specified position.	REQUEST DIRECT TO [position]	Y *UM 0* *UM 162* *UM 211* *UM 74* *UM 96* *UM 190* *UM 159* + *UM 183*	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 23	Request for the specified procedure clearance.	REQUEST [procedure name]	Y	FANS 1/A
DM 24	Request for a route clearance.	**REQUEST CLEARANCE [route clearance]** or *REQUEST [route clearance]*	Y	FANS 1/A
DM 25	Request for a clearance. *Note.— Either pre-departure or route.*	**REQUEST [clearance type] CLEARANCE** or *REQUEST CLEARANCE*	Y	FANS 1/A
DM 26	Request for a weather deviation to the specified position via the specified route.	REQUEST WEATHER DEVIATION TO [position] VIA [route clearance]	Y	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 27	Request for a weather deviation up to the specified distance off track in the specified direction.	REQUEST WEATHER DEVIATION UP TO [specified distance] [direction] OF ROUTE	Y *UM 0* *UM 162* *UM 211* *UM 64* *UM 74* *UM 82* *UM 96* *UM 190* *UM 159* + *UM 183*	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 70	Request a clearance to adopt the specified heading.	REQUEST HEADING [degrees]	Y	FANS 1/A
DM 71	Request a clearance to adopt the specified ground track.	REQUEST GROUND TRACK [degrees]	Y	FANS 1/A
	Reports (downlink)			
DM 28	Notification of leaving the specified level.	LEAVING [level]	N	FANS 1/A
DM 29	Notification of climbing to the specified level.	CLIMBING TO [level]	N	FANS 1/A
DM 30	Notification of descending to the specified level.	DESCENDING TO [level]	N	FANS 1/A
DM 31	Notification of passing the specified position.	PASSING [position]	N	FANS 1/A
DM 78	Notification that at the specified time, the aircraft's position was as specified.	AT [time] [distance] [to/from] [position]	N	FANS 1/A
DM 32	Notification of the present level.	**PRESENT LEVEL [level]** or *PRESENT ALTITUDE [altitude]*	N	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 33	Notification of the present position.	PRESENT POSITION [position]	N	FANS 1/A
DM 34	Notification of the present speed.	PRESENT SPEED [speed]	N	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 113	Notification of the requested speed. *<u>FANS 1/A</u>.— Uses <u>DM 67l</u> free text for partial intent. The flight crew notifies the controller of present ground speed, in response to <u>UM 169b</u>,* REPORT GROUND SPEED.	[speed type] [speed type] [speed type] SPEED [speed]	N	FANS 1/A
DM 35	Notification of the present heading in degrees.	PRESENT HEADING [degrees]	N	FANS 1/A
DM 36	Notification of the present ground track in degrees.	PRESENT GROUND TRACK [degrees]	N	FANS 1/A
DM 37	Notification that the aircraft is maintaining the specified level.	**MAINTAINING [level]** or *LEVEL [altitude]*	N	FANS 1/A
DM 72	(Reserved) *<u>Note</u>.— Avoid use of this message element, REACHING [level], as it is reserved in ICAO Doc 4444.*	N/A	N	FANS 1/A
DM 76	Notification that the aircraft has reached a level within the specified vertical range.	REACHING BLOCK [level] TO [level]	N	FANS 1/A
DM 38	Read-back of the assigned level.	**ASSIGNED LEVEL [level]** or *ASSIGNED ALTITUDE [altitude]*	N	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 77	Read-back of the assigned vertical range. *<u>FANS 1/A-ATN B1</u>.— FANS 1/A aircraft only. ATN B1 aircraft uses <u>DM 38</u> ASSIGNED LEVEL [level], where [level] is a vertical range.*	ASSIGNED BLOCK [level] TO [level]	N	FANS 1/A FANS 1/A-ATN B1
DM 39	Read-back of the assigned speed.	ASSIGNED SPEED [speed]	N	FANS 1/A
DM 40	Read-back of the assigned route.	ASSIGNED ROUTE [route clearance]	N	FANS 1/A
DM 41	The aircraft has regained the cleared route.	BACK ON ROUTE	N	FANS 1/A
DM 114	Notification that the aircraft is clear of weather and is able to accept a clearance to regain cleared flight route.	CLEAR OF WEATHER	N	N/A
DM 42	The next waypoint is the specified position.	NEXT WAYPOINT [position]	N	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 43	The ETA at the next waypoint is as specified.	NEXT WAYPOINT ETA [time]	N	FANS 1/A
DM 44	The next plus one waypoint is the specified position.	ENSUING WAYPOINT [position]	N	FANS 1/A
DM 45	Clarification of previously reported waypoint passage.	REPORTED WAYPOINT [position]	N	FANS 1/A
DM 46	Clarification of time over previously reported waypoint.	REPORTED WAYPOINT [time]	N	FANS 1/A
DM 47	The specified (SSR) code has been selected.	SQUAWKING [code]	N	FANS 1/A
DM 48	Position report. *Note.— Reports the current position of the aircraft when the flight crew presses the button to send this message. ATC expects position reports based on this downlink message.*	POSITION REPORT [position report]	N	FANS 1/A
DM 79	The code of the latest ATIS received is as specified.	ATIS [atis code]	N	FANS 1/A
DM 89	The specified ATS unit is being monitored on the specified frequency. *FANS 1/A-ATN B1.— FANS 1/A aircraft uses DM 67aa free text. May require to be preformatted.*	MONITORING [unit name] [frequency]	N	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
DM 102	Used to report that an aircraft has landed.	LANDING REPORT	N	N/A
DM 104	Notification of estimated time of arrival at the specified position. *FANS 1/A.— Uses free text DM 67n. Response to free text UM 169d REPORT ETA [position]*	**ETA [position] [time]** or *[position] [time]*	N	FANS 1/A [free text]
DM 105	Notification of the alternative aerodrome for landing.	ALTERNATE AERODROME [airport]	N	N/A
DM 106	Notification of the preferred level. *FANS 1/A.— Uses DM 67m. Response to free text UM 169c STATE PREFERRED LEVEL.* *FANS 1/A – ATN B1.— FANS 1/A aircraft response to UM 231 STATE PREFERRED LEVEL.*	**PREFERRED LEVEL [level]** or *FL[altitude]*	N	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 109	Notification of the preferred time to commence descent for approach. *FANS 1/A.— Uses DM 67v. Response to free text UM 169aa STATE TOP OF DESCENT.* *FANS 1/A – ATN B1.— FANS 1/A aircraft response to UM 232 STATE TOP OF DESCENT.*	**TOP OF DESCENT [time]** or *TOD [time]*	N	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
DM 110	Notification of the preferred position to commence descent for approach.	TOP OF DESCENT [position]	N	N/A
DM 111	Notification of the preferred time and position to commence descent for approach.	TOP OF DESCENT [time] [position]	N	N/A
	Negotiation Requests (downlink)			
DM 49	Request for the earliest time at which a clearance to the specified speed can be expected.	WHEN CAN WE EXPECT [speed]	Y	FANS 1/A
DM 50	Request for the earliest time at which a clearance to a speed within the specified range can be expected. *Note.— This message should not be used as it is not supported by the appropriate uplink message response: UM 103, UM 104 or UM 105.*	WHEN CAN WE EXPECT [speed] TO [speed]	Y	FANS 1/A
DM 51	Request for the earliest time at which a clearance to regain the planned route can be expected.	WHEN CAN WE EXPECT BACK ON ROUTE	Y	FANS 1/A
DM 52	Request for the earliest time at which a clearance to descend can be expected.	**WHEN CAN WE EXPECT LOWER LEVEL** or *WHEN CAN WE EXPECT LOWER ALTITUDE*	Y	FANS 1/A
DM 53	Request for the earliest time at which a clearance to climb can be expected.	**WHEN CAN WE EXPECT HIGHER LEVEL** or *WHEN CAN WE EXPECT HIGHER ALTITUDE*	Y	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 54	Request for the earliest time at which a clearance to cruise climb to the specified level can be expected. *<u>Note</u>.— This message should not be used as it is not supported by the appropriate uplink message response: <u>UM 11</u>, <u>UM 12</u>, <u>UM 17</u>, or <u>UM 18</u>.*	WHEN CAN WE EXPECT CRUISE CLIMB TO [level]	Y	FANS 1/A
DM 87	Request for the earliest time at which a clearance to climb to the specified level can be expected. *<u>FANS 1/A</u>.— Uses preformatted free text <u>DM 67h</u>.*	WHEN CAN WE EXPECT CLIMB TO [level]	Y	FANS 1/A [free text]
DM 88	Request for the earliest time at which a clearance to descend to the specified level can be expected. *<u>FANS 1/A</u>.— Uses preformatted free text <u>DM 67i</u>.*	WHEN CAN WE EXPECT DESCENT TO [level]	Y	FANS 1/A [free text]
	Emergency Messages (downlink)			
DM 55	*Urgency prefix.* *<u>FANS 1/A – ATN B1</u>.— Ground system will display message to controller for FANS 1/A aircraft.*	PAN PAN PAN	**Y** or *N*	FANS 1/A FANS 1/A-ATN B1 (Urgent)
DM 56	*Distress prefix.* *<u>FANS 1/A – ATN B1</u>.— Ground system will display message to controller for FANS 1/A aircraft.*	MAYDAY MAYDAY MAYDAY	**Y** or *N*	FANS 1/A FANS 1/A-ATN B1 (Distress)
DM 112	Indicates specifically that the aircraft is being subjected to unlawful interference.	SQUAWKING 7500	N	N/A (Urgent)
DM 57	*Notification of fuel remaining and number of persons on board.* *<u>FANS 1/A – ATN B1</u>.— Ground system will display message to controller for FANS 1/A aircraft.*	**[remaining fuel] OF FUEL REMAINING AND [persons on board] PERSONS ON BOARD** or *[remaining fuel] OF FUEL REMAINING AND [remaining souls] SOULS ON BOARD*	**Y** or *N*	FANS 1/A FANS 1/A-ATN B1 (Urgent)
DM 58	*Notification that the pilot wishes to cancel the emergency condition.* *<u>FANS 1/A – ATN B1</u>.— Ground system will display message to controller for FANS 1/A aircraft.*	CANCEL EMERGENCY	**Y** or *N*	FANS 1/A FANS 1/A-ATN B1 (Urgent)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 59	*Notification that the aircraft is diverting to the specified position via the specified route due to an urgent need.* *FANS 1/A – ATN B1.— Ground system will display message to controller for FANS 1/A aircraft.*	DIVERTING TO [position] VIA [route clearance]	**Y** or *N*	FANS 1/A FANS 1/A-ATN B1 (Urgent)
DM 60	*Notification that the aircraft is deviating the specified distance in the specified direction off the cleared route and maintaining a parallel track due to an urgent need.* *FANS 1/A – ATN B1.— Ground system will display message to controller for FANS 1/A aircraft.*	OFFSETTING [specified distance] [direction] OF ROUTE	**Y** or *N*	FANS 1/A FANS 1/A-ATN B1 (Urgent)
DM 61	*Notification that the aircraft is descending to the specified level due to an urgent need.* *FANS 1/A – ATN B1.— Ground system will display message to controller for FANS 1/A aircraft.*	DESCENDING TO [level]	**Y** or *N*	FANS 1/A FANS 1/A-ATN B1 (Urgent)
DM 80	Notification that the aircraft is deviating up to the deviating distance from the cleared route in the specified direction due to an urgent need. *FANS 1/A.— Notification that the aircraft is operating on an offset. The urgency attribute for this message element is not defined.*	**DEVIATING UP TO [specified distance] [direction] OF ROUTE** or *DEVIATING [distanceoffset] [direction] OF ROUTE*	**Y** or *N*	FANS 1/A (Urgent)
	System Management Messages (downlink)			
DM 62	A system-generated message that the avionics has detected an error.	ERROR [error information]	N	FANS 1/A ATN B1 FANS 1/A-ATN B1 (Urgent)
DM 63	A system-generated denial to any CPDLC application message sent from a ground facility that is not the current data authority.	NOT CURRENT DATA AUTHORITY	N	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 99	A system-generated message to inform a ground facility that it is now the current data authority.	CURRENT DATA AUTHORITY	N	ATN B1 FANS 1/A-ATN B1 (Urgent)
DM 64	Notification to the ground system that the specified ATSU is the current data authority. *<u>FANS 1/A – ATN B1</u>.— FANS 1/A aircraft uses this message.*	[facility designation]	N	FANS 1/A FANS 1/A-ATN B1
DM 107	A system-generated message sent to a ground system that tries to connect to an aircraft when a current data authority has not designated the ground system as the NDA. *<u>FANS 1/A – ATN B1</u>.— ATN B1 aircraft uses this message.*	NOT AUTHORIZED NEXT DATA AUTHORITY	N	ATN B1
DM 73	A system-generated message indicating the software version number. *<u>FANS 1/A – ATN B1</u>.— FANS 1/A aircraft uses this message.*	[version number]	N	FANS 1/A FANS 1/A-ATN B1
DM 100	Confirmation to the ground system that the aircraft system has received the message to which the logical acknowledgement refers and found it acceptable for display to the responsible person. *<u>FANS 1/A – ATN B1</u>.— ATN B1 ground systems uses alternate means, such as MAS message assurance received from FANS 1/A aircraft, to mimic LOGICAL ACKNOWLEDGEMENT.*	LOGICAL ACKNOWLEDGEMENT	N	ATN B1
	Additional Messages (downlink)			
DM 65	Used to explain reasons for pilot's message.	DUE TO WEATHER	N	FANS 1/A ATN B1 FANS 1/A-ATN B1
DM 66	Used to explain reasons for pilot's message.	DUE TO AIRCRAFT PERFORMANCE	N	FANS 1/A ATN B1 FANS 1/A-ATN B1

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 74	States a desire by the pilot to provide his/her own separation and remain in VMC.	**REQUEST TO MAINTAIN OWN SEPARATION AND VMC** or *MAINTAIN OWN SEPARATION AND VMC*	**Y** or *N*	FANS 1/A
DM 75	Used in conjunction with another message to indicate that the pilot wishes to execute request when the pilot is prepared to do so.	AT PILOTS DISCRETION	N	FANS 1/A
DM 101	Allows the pilot to indicate a desire for termination of CPDLC application with the current data authority.	REQUEST END OF SERVICE	Y	N/A
DM 103	Allows the pilot to indicate that he/she has cancelled IFR flight plan.	CANCELLING IFR	Y	N/A
DM 108	Notification that de-icing action has been completed.	DE-ICING COMPLETE	N	N/A
	Free Text – Normal (downlink)			
DM 67	Normal urgency, low alert *FANS 1/A – ATN B1.— FANS 1/A aircraft only. ATN B1 aircraft uses DM 98.*	[free text]	N	FANS 1/A FANS 1/A-ATN B1
	Free Text - Distress (downlink)			
DM 68	Distress urgency, high alert *Note.— Selecting any of the emergency message elements will result in this message element being enabled for the flight crew to include in the emergency message at their discretion.*	[free text]	Y	FANS 1/A
DM 90	normal urgency, medium alert	[free text]	N	N/A
DM 91	normal urgency, low alert	[free text]	Y	N/A
DM 92	low urgency, low alert	[free text]	Y	N/A
DM 93	urgent urgency, high alert	[free text]	N	N/A (Urgent)
DM 94	distress urgency, high alert	[free text]	N	N/A (Distress)
DM 95	urgent urgency, medium alert	[free text]	N	N/A (Urgent)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 96	urgent urgency, low alert	[free text]	N	N/A (Urgent)
DM 97	low urgency, low alert	[free text]	N	N/A
DM 98	normal urgency, normal alert *FANS 1/A – ATN B1.— ATN B1 aircraft only. FANS 1/A aircraft uses DM 67.*	[free text]	N	ATN B1 FANS 1/A-ATN B1
	Negotiation Responses (downlink)			
DM 81	We can accept the specified level at the specified time. *FANS 1/A.— Uses preformatted free text DM 67b.*	WE CAN ACCEPT [level] AT [time]	N	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
DM 115	We can accept the specified level at the specified position.	WE CAN ACCEPT [level] AT [position]	N	N/A
DM 82	We cannot accept the specified level. *FANS 1/A.— Uses preformatted free text DM 67e.*	WE CANNOT ACCEPT [level]	N	FANS 1/A [free text] ATN B1 FANS 1/A-ATN B1
DM 83	We can accept the specified speed at the specified time. *FANS 1/A.— Uses preformatted free text DM 67c.*	WE CAN ACCEPT [speed] AT [time]	N	FANS 1/A [free text]
DM 116	We can accept the specified speed at the specified position.	WE CAN ACCEPT [speed] AT [position]	N	N/A
DM 84	We cannot accept the specified speed. *FANS 1/A.— Uses preformatted free text DM 67f.*	WE CANNOT ACCEPT [speed]	N	FANS 1/A [free text]
DM 85	We can accept a parallel track offset the specified distance in the specified direction at the specified time. *FANS 1/A.— Uses preformatted free text DM 67d.*	WE CAN ACCEPT [specified distance] [direction] AT [time]	N	FANS 1/A [free text]
DM 117	We can accept a parallel track offset the specified distance in the specified direction at the specified position.	WE CAN ACCEPT [specified distance] [direction] AT [position]	N	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 86	We cannot accept a parallel track offset the specified distance in the specified direction. *FANS 1/A.— Uses preformatted free text DM 67g.*	WE CANNOT ACCEPT [specified distance] [direction]	N	FANS 1/A [free text]

A.5 CPDLC standardized free text messages

A.5.1 CPDLC standardized free text uplink messages

A.5.1.1 When a free text uplink message has been received, the flight crew should respond with ROGER before responding to the message.

Ref #	Message Intent/Use	Message Element	Resp.
	Standardized Free Text Responses/Acknowledgements (uplink)		
UM 169q	Acknowledgement of receipt of a CPDLC downlink MAYDAY message. *Note.— No equivalent to ICAO Doc 4444.*	ROGER MAYDAY	R
UM 169r	Acknowledgement of receipt of a CPDLC downlinked PAN message. *Note.— No equivalent to ICAO Doc 4444.*	ROGER PAN	R
UM 169ak	Notification that an ADS-C emergency report has been received from the aircraft. *Note.— No equivalent to ICAO Doc 4444.*	CONFIRM ADS-C EMERGENCY	R
UM 169s	Notification that the CPDLC downlink request was: 1) part of the approved message set; and 2) received by the controller. The aircraft will receive any further communication about the request via voice contact with the specified unit. [unit_description] is the name of the radio facility with which the response will be communicated. *Note.— No equivalent to ICAO Doc 4444.*	REQUEST RECEIVED RESPONSE WILL BE VIA [unit_description]	R
UM 169x	Indication that the request has been received and has been forwarded on to the next ATSU. *Note.— Same intent as ICAO Doc 4444 UM 211.*	REQUEST FORWARDED	R

Ref #	Message Intent/Use	Message Element	Resp.
UM 169ab	Indicates that the request cannot be responded to by the current unit and that it should be requested from the next unit. *Note.— Same intent as ICAO Doc 4444 UM 237.*	REQUEST AGAIN WITH NEXT UNIT	R
	Standardized Free Text Vertical Clearances (uplink)		
UM 169ac	Used with a vertical clearance, indicating an ITP clearance when there is one reference aircraft ahead. *Note.— No equivalent to ICAO Doc 4444.*	ITP BEHIND [aircraft identification]	R
UM 169ad	Used with a vertical clearance, indicating an ITP clearance when there is one reference aircraft behind. *Note.— No equivalent to ICAO Doc 4444.*	ITP AHEAD OF [aircraft identification]	R
UM 169ae	Used with a vertical clearance, indicating an ITP clearance when there are two reference aircraft, both ahead. *Note.— No equivalent to ICAO Doc 4444.*	ITP BEHIND[aircraft identification] AND BEHIND [aircraft identification]	R
UM 169af	Used with a vertical clearance, indicating an ITP clearance when there are two reference aircraft, both behind: *Note.— No equivalent to ICAO Doc 4444.*	ITP AHEAD OF [aircraft identification] AND AHEAD OF [aircraft identification]	R
UM 169al	Used with a vertical clearance, indicating an ITP clearance when there are two reference aircraft, one ahead and the other behind. *Note.— No equivalent to ICAO Doc 4444.*	ITP BEHIND [aircraft identification] AND AHEAD OF [aircraft identification]	R
	Standardized Free Text Speed Changes (uplink)		
UM 169p	Notification that a previously issued speed can be expected to be maintained until the specified position or time. *Note.— No equivalent to ICAO Doc 4444.*	EXPECT TO MAINTAIN [speed] UNTIL [time / position]	R
UM 169z	Notification that the aircraft may keep its preferred speed without restriction. *Note.— Same intent as ICAO Doc 4444 UM 222.*	NO SPEED RESTRICTION	R

Ref #	Message Intent/Use	Message Element	Resp.
	Standardized Free Text Contact/Monitor/Surveillance Requests (uplink)		
UM 169ai	Instruction that the "ident" function of the ADS-B emitter is to be activated. *Note.— Same intent as ICAO Doc 4444 UM 242.*	TRANSMIT ADS-B IDENT	R
	Standardized Free Text Report/Confirmation Requests (uplink)		
UM 169b	Instruction to report the ground speed of the aircraft. *Note.— Intent similar partially to ICAO Doc 4444 UM 134.*	REPORT GROUND SPEED	R, then DM 67l
UM 169c	Instruction to advise the preferred flight level for the flight. *Note.— Same intent as ICAO Doc 4444 UM 231*	STATE PREFERRED LEVEL	R, then DM 67m
UM 169d	Instruction to report the estimated time of arrival at the specified position. *Note.— Same intent as ICAO Doc 4444 UM 228.*	REPORT ETA [position]	R, then DM 67n
UM 169e	Instruction to notify when the specified traffic has been observed by visual contact to have passed. *Note.— No equivalent to ICAO Doc 4444.*	REPORT SIGHTING AND PASSING OPPOSITE DIRECTION [traffic description] ETP [time]	R, then DM 67o DM 67p
UM 169f	Instruction to notify of receipt of any ADS-C report indicating a deviation from cleared route and to request the flight crew to advise of intentions. *Note.— No equivalent to ICAO Doc 4444.*	ADS-C INDICATES OFF ROUTE. ADVISE INTENTIONS.	R, and then DM 67
UM 169t	Instruction to notify of receipt of any ADS-C report indicating a deviation from cleared level and to request the flight crew to advise of intentions. *Note.— No equivalent to ICAO Doc 4444.*	ADS-C INDICATES LEVEL DEVIATION. ADVISE INTENTIONS.	R, and then DM 67
UM 169v	Instruction to notify of receipt of any ADS-C report indicating a deviation from cleared speed and to request the flight crew to advise of intentions. *Note.— No equivalent to ICAO Doc 4444.*	ADS-C INDICATES SPEED DEVIATION. ADVISE INTENTIONS.	R, and then DM 67

Ref #	Message Intent/Use	Message Element	Resp.
UM 169h	Instruction to notify of receipt of any ADS-C report that appears to contain inaccurate time estimates and to request the flight crew to check FMS. *Note.— No equivalent to ICAO Doc 4444.*	ADS-C ESTIMATES APPEAR INACCURATE. CHECK FMS.	R
UM 169aa	Instruction to indicate the preferred time to commence descent to the aerodrome of intended arrival. *Note.— Same intent as ICAO Doc 4444 UM 232 for time only.*	STATE TOP OF DESCENT	R, then DM 67v
	Standardized Free text Air Traffic Advisories (uplink)		
UM 169k	Notification that a SELCAL check on the specified HF frequency should be expected. *Note.— No equivalent to ICAO Doc 4444.*	EXPECT SELCAL CHECK HF [frequency]	R
UM 169l	Notification that the CPDLC transfer process will not be completed at the boundary and will be delayed until the specified time or position. If the CPDLC transfer is not completed by the specified time or position, the flight crew should manually disconnect CPDLC and initiate a logon to the next center. *Note.— No equivalent to ICAO Doc 4444.*	EXPECT CPDLC TRANSFER AT [time/position]	R
UM 169aj	ATS advisory that the radar and/or ADS-B service is terminated. *Note.— Same intent as ICAO Doc 4444 UM 244.*	IDENTIFICATION TERMINATED	R
UM 169m	Notification that a CPDLC connection is not required by the next ATSU (e.g. due to short transition time through the next ATSU's airspace) and CPDLC connection will be transferred to the subsequent ATSU. *Note.— No equivalent to ICAO Doc 4444.*	EXPECT NEXT CENTER [facility designation]. CONTACT WITH [facility designation] NOT REQUIRED	R
UM 169n	Notification of traffic significant to the flight. *Note.— No equivalent to ICAO Doc 4444.*	TRAFFIC IS [traffic description]	R, then, (optionally) DM 67q
UM 169o	Notification of the secondary frequency for the area. *Note.— Same intent as ICAO Doc 4444 UM 238.*	SECONDARY FREQUENCY [frequency]	R

Ref #	Message Intent/Use	Message Element	Resp.
UM 169ag	ATS advisory that normal voice communication is not available. *Note.— No equivalent to ICAO Doc 4444.*	TRY SATCOM VOICE OR RELAY THROUGH ANOTHER AIRCRAFT	R
UM 169y	ATS advisory that the specified altimeter setting relates to the specified facility. *Note.— Same intent as ICAO Doc 4444 UM 213.*	[facility designation] ALTIMETER [altimeter]	R
UM 169av	Used after ATC cannot comply with an ITP request to advise of intermediate flight levels that are available for an ITP. *Note.— No equivalent to ICAO Doc 4444.*	SEND NEW ITP REQUEST IF ABLE [level]	R
	Standardized Free Text System Management Messages (uplink)		
UM 169j	Instruction to check the status of CPDLC messages and to respond to unanswered uplink messages. *Note.— No equivalent to ICAO Doc 4444.*	CHECK AND RESPOND TO OPEN CPDLC MESSAGES	R
UM 169w	Instruction to set the message latency monitor to the specified value. *Note.— No equivalent to ICAO Doc 4444.*	SET MAX UPLINK DELAY VALUE TO [delayed message parameter] SECONDS	R
UM 169au	Instruction to check that the message latency monitor function is off. *Note 1.— No equivalent in ICAO Doc 4444.*	CONFIRM MAX UPLINK DELAY VALUE IS NOT SET	R
UM 169u	Notification that an element contained in a CPDLC downlink message was not part of the approved CPDLC message set. *Note.— Equivalent to ICAO Doc 4444 UM 162.*	MESSAGE NOT SUPPORTED BY THIS ATS UNIT	R
UM 169ah	Notification that an element contained in a CPDLC downlink message was not part of the approved message set. The message should be communicated by voice (i.e. radiotelephone (RTF)). *Note.— No equivalent to ICAO Doc 4444.*	MESSAGE NOT SUPPORTED BY THIS ATS UNIT, CONTACT RTF	R
UM 169am or UM 183am	Instruction to turn the CPDLC application off and to initiate a logon to the specified ATSU.	AUTOMATIC TRANSFER OF CPDLC FAILED. WHEN ENTERING [unit name] AREA DISCONNECT CPDLC THEN LOGON TO [facility designation]	R

Ref #	Message Intent/Use	Message Element	Resp.
UM 169an	Instruction for the flight crew to check that the ADS-C function is armed.	CONFIRM ADS-C ARMED	R
UM 169ao	Instruction to transmit CPDLC position reports due to the failure of ADS-C.	ADS-C SHUT DOWN AT [facility designation]. REVERT TO CPDLC POSITION REPORTS. LEAVE ADS-C ARMED.	R
UM 169at	Instruction to transmit voice position reports due to the failure of ADS-C.	ADS-C SHUT DOWN AT [facility designation]. REVERT TO VOICE POSITION REPORTS. LEAVE ADS-C ARMED.	R
UM 169aw	Instruction to advise that CPDLC and voice position reports are not required due to ADS-C resuming operations.	RESUME NORMAL ADS-C OPERATIONS. CPDLC AND VOICE POSITION REPORTS NOT REQUIRED	R
UM 169ax	Instruction to continue on voice due to the failure of CPDLC.	CPDLC WILL BE SHUT DOWN. DISCONNECT CPDLC. CONTINUE ON VOICE	R
UM 169ap	Instruction for intermediary CPDLC-capable aircraft to relay message to aircraft not in communication with ATC.	RELAY TO [call sign] [unit name] [text of message to be relayed]	R, then DM 67ae
	Standardized Free Text Military (uplink)		
UM 169aq	Notification that MARSA procedures with the specified aircraft have been terminated.	MARSA TERMINATED WITH [call sign(s) of receiver aircraft]	R
UM 169ar		CLEARED TO DELAY FOR AIR REFUEL AT [position] UNTIL [time]	R
UM 169as		CLEARED TO CONDUCT REFUELING	R

A.5.2 CPDLC standardized free text downlink messages

Ref #	Message Intent/Use	Message Element	Resp.
	Standardized Free Text Route Modification Requests (downlink)		
DM 67ad	Request for a tailored arrival. The TA designator and speed are optional. *Note 1.— No equivalent in ICAO Doc 4444.* *Note 2.— When pre-formatting of the downlink message is not available, the flight crew can shorten to: REQ TA [TA designator]*	**REQUEST TAILORED ARRIVAL [TA designator]** [speed] or *REQ TA [TA designator] [speed]*	N
DM 67a	Used with a vertical request, indicating an ITP request when there is one reference aircraft ahead. *Note 1.— No equivalent in ICAO Doc 4444.*	ITP [distance] BEHIND [aircraft identification]	N
DM 67r	Used with a vertical request, indicating an ITP request when there is one reference aircraft behind. *Note 1.— No equivalent in ICAO Doc 4444.*	ITP [distance] AHEAD OF [aircraft identification]	N
DM 67s	Used with a vertical request, indicating an ITP request when there are two reference aircraft, both ahead. *Note 1.— No equivalent in ICAO Doc 4444.*	ITP [distance] BEHIND[aircraft identification] AND [distance] BEHIND [aircraft identification]	N
DM 67t	Used with a vertical request, indicating an ITP request when there are two reference aircraft, both behind. *Note 1.— No equivalent in ICAO Doc 4444.*	ITP [distance] AHEAD OF [aircraft identification] AND [distance] AHEAD OF [aircraft identification]	N
DM 67ag	Used with a vertical request, indicating an ITP request when there are two reference aircraft, one ahead and the other behind. *Note 1.— No equivalent in ICAO Doc 4444.*	ITP [distance] BEHIND [aircraft identification] AND [distance] AHEAD OF [aircraft identification]	N
	Standardized Free Text Reports (downlink)		
DM 67k	Notification of a revised estimate for the specified position. *Note.— Intent similar to DM 43.*	REVISED ETA [position] [time]	N
DM 67l	Notification of the ground speed. *Note 1.— Intent partial to ICAO Doc 4444 DM 113.* *Note 2.— When pre-formatting of the downlink message is not available, the flight crew can shorten to: GS [speed]*	**GROUND SPEED [speed]** or *GS [speed]*	N

Ref #	Message Intent/Use	Message Element	Resp.
DM 67m	Notification of the preferred level. *Note 1.— Same intent as ICAO Doc 4444 DM 106.* *Note 2.— When pre-formatting of the downlink message is not available, the flight crew can shorten to: FL[altitude]*	**PREFERRED LEVEL [level]** or *FL [altitude]*	N
DM 67n	Notification of estimated time of arrival at the specified position. *Note 1.— Same intent as ICAO Doc 4444 DM 104.* *Note 2.— When pre-formatting of the downlink message is not available, the flight crew can shorten to: [position] [time]*	**ETA [position] [time]** or *[position] [time]*	N
DM 67o	Notification that the flight crew has visually sighted and passed the specified traffic. *Note.— No equivalent in ICAO Doc 4444.*	[traffic identification] SIGHTED AND PASSED	N
DM 67p	Notification that the flight crew did NOT visually sight the specified traffic. *Note.— No equivalent in ICAO Doc 4444.*	[traffic identification] NOT SIGHTED	N
DM 67q	Notification that the previously described traffic has been sighted. *Note.— No equivalent in ICAO Doc 4444.*	TRAFFIC SIGHTED	N
DM 67v	Notification of the preferred time to commence descent for an approach. *Note 1.— Same intent as ICAO Doc 4444 DM 109.* *Note 2.— When pre-formatting of the downlink message is not available, the flight crew can shorten to: TOD [time]*	**TOP OF DESCENT [time]** or *TOD [time]*	N

Ref #	Message Intent/Use	Message Element	Resp.
DM 67aa	The specified ATSU is being monitored on the specified frequency. *Urgent urgency attribute.* *Note 1.— Airborne automation (i.e. preformatted message rather than the flight crew typing the text) may be necessary for message composition and to ensure accuracy of the message content. Consequently, not all aircraft will be equipped with such automation.* *Note 2.— Same intent as ICAO Doc 4444 DM 89.*	MONITORING [unit name] [frequency]	N
	Standardized Free Text System Management Messages (downlink)		
DM 67u or DM 98u	Notification that the delivery time of an uplink message exceeded the maximum permitted by the latency timer. The uplink message should be re-sent or communicated by other means. *Note.— No equivalent in ICAO Doc 4444.*	UPLINK DELAYED IN NETWORK AND REJECTED - RESEND OR CONTACT BY VOICE	N
DM 67j	Notification that the transfer of the CPDLC connection has failed. *Note.— No equivalent in ICAO Doc 4444.*	CPDLC TRANSFER FAILURE	N
DM 67ab	Notification that the ADS-C emergency mode was inadvertent and has been set to OFF. *Note.— No equivalent in ICAO Doc 4444.*	ADS-C RESET	N
DM 67ae	Notification from the intermediary CPDLC-capable aircraft that the aircraft not in communication received the instructions.	RELAY FROM [call sign] [response parameters]	N
DM 67af	Notification that the aircraft does not have the functionality of a message latency monitor. *Note 1.— No equivalent in ICAO Doc 4444.* *Note 2.— Response to free text UM 169au CONFIRM MAX UPLINK DELAY VALUE IS NOT SET or UM 169w SET MAX UPLINK DELAY VALUE TO [delayed message parameter] SECONDS.*	TIMER NOT AVAILABLE	N
	Standardized Free Text Additional messages (downlink)		
DM 67ac	Used with DM 27, indicating a request for a weather deviation on both sides of route.	AND [specified distance] [direction]	N

Ref #	Message Intent/Use	Message Element	Resp.
	Standardized Free Text Negotiation Responses (downlink)		
DM 67b	We can accept the specified level at the specified time. *Note.— Intent equivalent to ICAO Doc 4444 DM 81.*	WE CAN ACCEPT [altitude] AT [time]	N
DM 67c	We can accept the specified speed at the specified time. *Note.— Intent equivalent to ICAO Doc 4444 DM 83.*	WE CAN ACCEPT [speed] AT [time]	N
DM 67d	We can accept a parallel track offset the specified distance in the specified direction at the specified time. *Note.— Intent equivalent to ICAO Doc 4444 DM 85.*	WE CAN ACCEPT [specified distance] [direction] AT [time]	N
DM 67e	We cannot accept the specified level. *Note.— Intent equivalent to ICAO Doc 4444 DM 82.*	WE CANNOT ACCEPT [altitude]	N
DM 67f	We cannot accept the specified speed. *Note.— Intent equivalent to ICAO Doc 4444 DM 84.*	WE CANNOT ACCEPT [speed]	N
DM 67g	We cannot accept a parallel track offset the specified distance in the specified direction. *Note.— Intent equivalent to ICAO Doc 4444 DM 86.*	WE CANNOT ACCEPT [specified distance] [direction]	N
DM 67h	Request for the earliest time at which a clearance to climb to the specified level can be expected. *Note.— Intent equivalent to ICAO Doc 4444 DM 87.*	WHEN CAN WE EXPECT CLIMB TO [altitude]	N
DM 67i	Request for the earliest time at which a clearance to descend to the specified level can be expected. *Note.— Intent equivalent to ICAO Doc 4444 DM 88.*	WHEN CAN WE EXPECT DESCENT TO [altitude]	N

Ref #	Message Intent/Use	Message Element	Resp.
	Standardized Free Text Military (downlink)		
DM 67w	Request for a delay at the specified position until a specified time to rendezvous with the receiver aircraft. *<u>Note 1</u>.— [position] is the ARCP as filed in the tanker's flight plan. [time] is the time the tanker expects to pass the ARCP and commence refueling along the refueling route. It is also the end of the delay time.* *<u>Note 2</u>.— No equivalent in ICAO Doc 4444.*	TO DELAY FOR AIR REFUEL AT [position] UNTIL [time]	N
DM 67x	Notification that refueling will end at the specified time or position. *<u>Note</u>.— No equivalent in ICAO Doc 4444.*	EXPECT END OF REFUEL AT [time/position]	N
DM 67y	Notification that the aircraft will be joining the specified ALTRV at the specified position or time. *<u>Note</u>.— No equivalent in ICAO Doc 4444.*	JOINING ALTRV [ALTRV designator] AT [time/position]	N
DM 67z	Notification that the tanker will accept MARSA with the specified (receiver) aircraft. *<u>Note</u>.— No equivalent in ICAO Doc 4444.*	ACCEPT MARSA WITH [call sign(s) of receiver aircraft]	N

Appendix B RCP specifications

B.1 General

B.1.1 This appendix includes specifications for RCP 240 and RCP 400. These specifications support:

a) Safety oversight of air traffic service provisions and operations;

b) Agreements/contractual arrangements that ANSPs and aircraft operators make with their respective CSPs;

c) Operational authorizations, flight crew training and qualification;

d) Design approval of aircraft data link systems; and

e) Operational-monitoring, analysis, and exchange of operational data among regions and states.

B.1.2 The RCP specifications are derived mainly from a safety assessment. However, in cases where it has been determined to be beneficial, the RCP specification may include criteria to support operational efficiency and orderly flow of air traffic. In these cases, the RCP specification indicates the distinction between safety and efficiency.

B.1.3 The RCP specifications provide a means of compliance, in general. Additional guidance related to service provision, aircraft approval and operational authorizations can be found in Chapter 3. Guidance and requirements on post-implementation monitoring can be found at Appendix D.

B.1.4 The RCP specifications include allocations for data communications. The /D designator is used to indicate the RCP allocations associated with the CPDLC application.

B.2 Terms and acronyms

Note.— The terms applied to the RCP specifications are taken from ICAO Doc 9869, First Edition, Manual on Required Communication Performance, dated 2008. Additional terms are provided, as appropriate, to clarify meaning and measurement points for the RCP allocations.

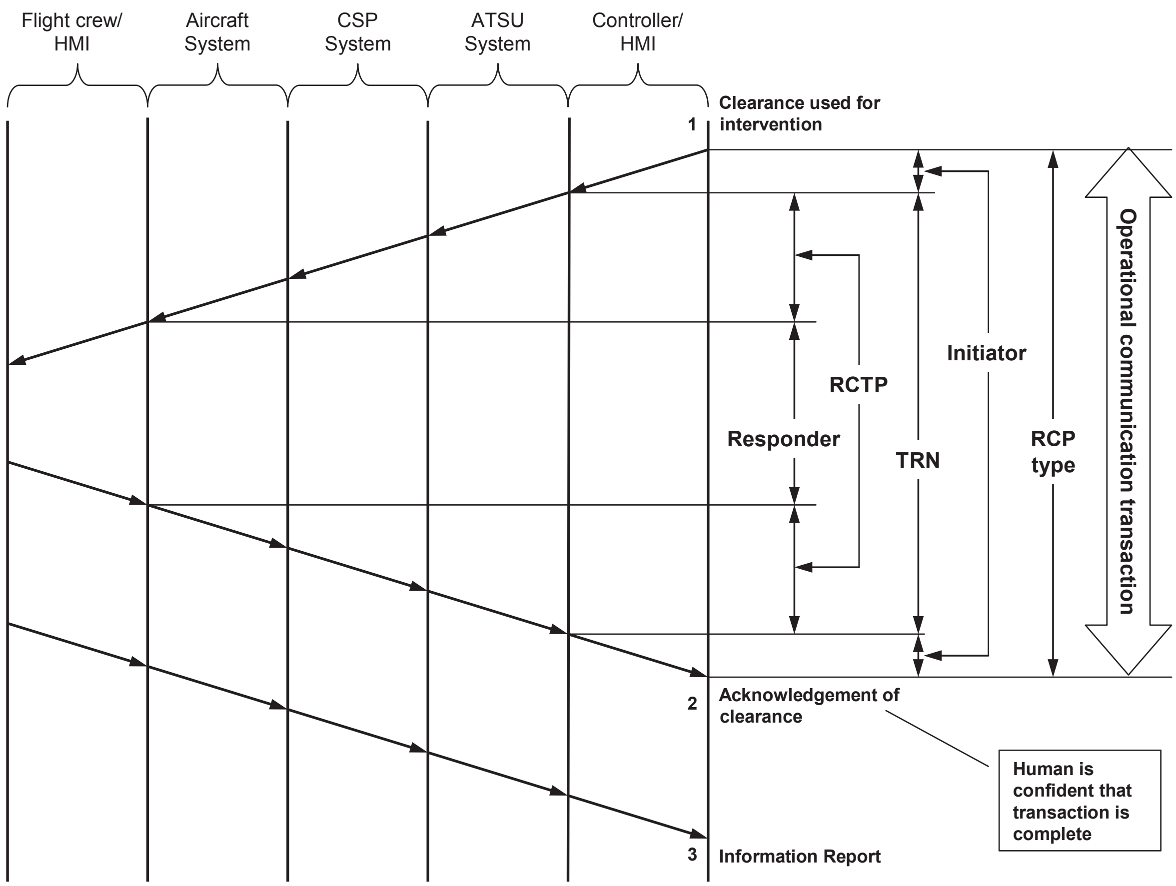
RCP specification	
Term	**Description**
Operational communication transaction	The process a human uses to initiate the transmission of an instruction, clearance, flight information, and/or request, and is completed when that human is confident that the transaction is complete.
RCP specification	A set of ATS provision, including communication services, operator and flight crew requirements (e.g. RCP 240) needed for communications supporting a performance-based operation within a defined airspace.

RCP specification	
Term	**Description**
RCP type	A label (e.g. RCP 240) that represents the values assigned to RCP parameters for communication transaction time, continuity, availability and integrity. (ICAO) *Note.— This document uses the term RCP specification to align RCP with RNP and RNAV specifications provided in the Performance Based Navigation Manual.*
RCP expiration time (ET)	The maximum time for the completion of the operational communication transaction after which the initiator is required to revert to an alternative procedure.
RCP nominal time (TT 95%)	The maximum nominal time within which 95% of operational communication transactions is required to be completed.
RCP continuity (C)	The required probability that an operational communication transaction can be completed within the communication transaction time, either ET or TT 95%, given that the service was available at the start of the transaction.
RCP availability (A)	The required probability that an operational communication transaction can be initiated when needed.
RCP integrity (I)	The required probability that an operational communication transaction is completed with no undetected errors. *Note.— Whilst RCP integrity is defined in terms of the "goodness" of the communication capability, it is specified in terms of the likelihood of occurrence of malfunction on a per flight hour basis (e.g. 10^{-5}), consistent with RNAV/RNP specifications.*

RCP transaction time	
Term	**Description**
Monitored operational performance (TRN)	The portion of the transaction time (used for intervention) that does not include the times for message composition or recognition of the operational response.
Required communication technical performance (RCTP)	The portion of the (intervention) transaction time that does not include the human times for message composition, operational response, and recognition of the operational response.
Responder performance criteria	The operational portion of the transaction time to prepare the operational response, and includes the recognition of the instruction, and message composition (e.g. flight crew/HMI) for intervention transactions.
$RCTP_{ATSU}$	The summed critical transit times for an ATC intervention message and a response message, allocated to the ATSU system.
$RCTP_{CSP}$	The summed critical transit times for an ATC intervention message and a response message, allocated to the CSP system.

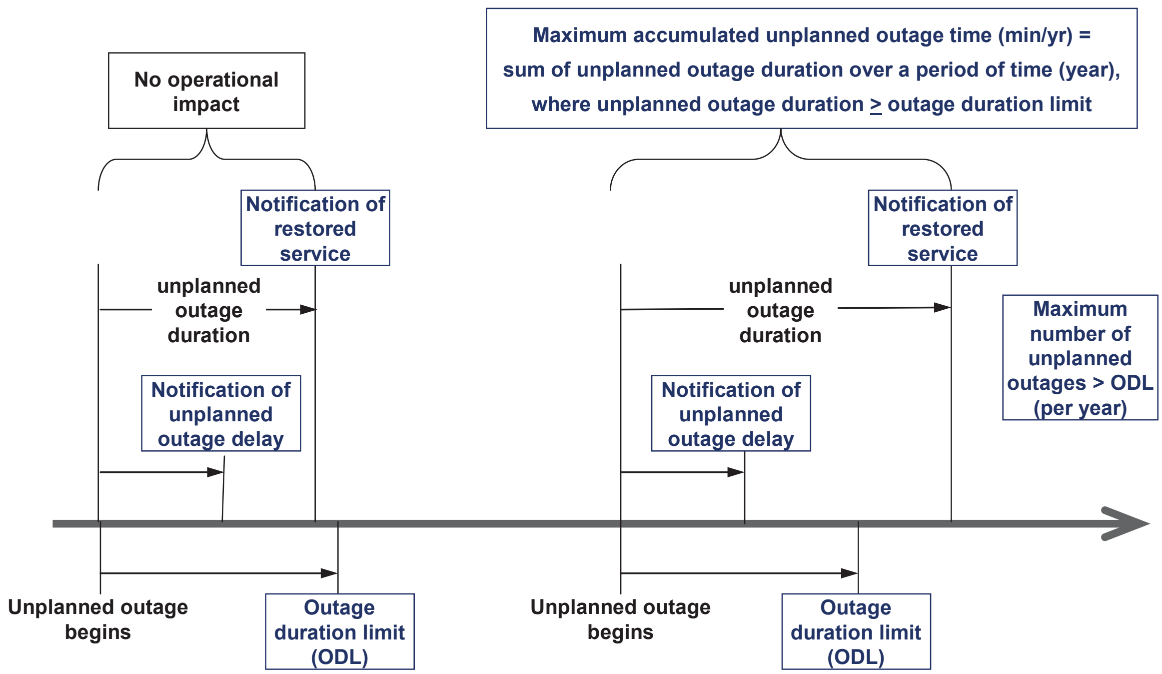
RCP transaction time	
Term	**Description**
$RCTP_{AIR}$	The summed critical transit times for an ATC intervention message and a response message, allocated to the aircraft system.

RCP Continuity	
Term	**Description**
C for TRN	The proportion of intervention messages and responses that can be delivered within the specified TRN for intervention.
C for RCTP	The proportion of intervention messages and responses that can be delivered within the specified RCTP for intervention.
C for $RCTP_{ATSU}$	The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{ATSU}$ for Intervention.
C for $RCTP_{CSP}$	The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{CSP}$ for Intervention.
C for $RCTP_{AIR}$	The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{AIR}$ for Intervention.



RCP Availability	
Term	**Description**
Service availability (A_{CSP})	The required probability that the communication service is available to all users in a specific airspace when desired.
Unplanned outage duration limit (minutes)	Time after the unplanned outage begins at which there is an operational impact. Measured from when an unplanned outage begins to when the ATSU receives notification that the service has been restored.
Maximum number of unplanned outages	Measured separately for each relevant operational airspace over any 12-month period.
Maximum accumulated unplanned outage time (min/yr)	Measured by accumulating ***only*** the duration times for unplanned outages greater than the unplanned outage duration limit during any 12-month period. The accumulation is performed separately for each relevant operational airspace.
Unplanned outage notification delay (min)	Notification to the ATSU of an unplanned outage. Measured from when the unplanned outage begins to when the ATSU receives notification.

RCP Availability	
Term	**Description**
Aircraft system availability (A_{AIR})	The required probability of available capability on an aircraft with an average flight of 6 hours. *Note.— The actual aircraft system availability is computed assuming that the service is available in the relevant airspace.*



B.3 RCP 240 specification

RCP Specification			
RCP specification		**RCP 240**	
Airspace specific considerations			
Interoperability	Specify interoperability criteria (e.g. FANS 1/A)		
ATS Function	Specify ATS function(s) (e.g. applicable separation standard)		
Application	Specify controller-pilot ATC communication intervention capability (e.g. CPDLC application per ICAO Doc 4444, and RTCA DO-306/EUROCAE ED-122, Annex A)		
RCP parameter values			
Transaction time (sec)	**Continuity (C)**	**Availability (A)**	**Integrity (I)**
ET = 240	C(ET) = 0.999	0.999 0.9999 (efficiency)	Malfunction = 10^{-5} per flight hour
TT 95% = 210	C(TT 95%) = 0.95		
RCP monitoring and alerting criteria			
Ref	**Criteria**		
MA-1	The system shall be capable of detecting failures and configuration changes that would cause the communication service to no longer meet the RCP specification for the intended function.		
MA-2	When the communication service can no longer meet the RCP specification for the intended function, the flight crew and/or the controller shall take appropriate action.		
Notes			
Note 1.— Rationale for the criteria provided in this specification can be found in ICAO Annex 11, ICAO Doc 4444, ICAO Doc 9689, and RTCA DO-306/ED-122. *Note 2.— The values for transaction times are to be applied to transactions that are representative of communication capability for the controller to intervene with a specific operator, aircraft type, and aircraft identification.* *Note 3.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the RCP specification, this would be considered a change in system configuration.* *Note 4.— DO-306/ED-122 specifies an availability value based on safety assessment of the operational effects of the loss of the service. The availability value herein is more stringent, based on an additional need to maintain orderly and efficient operations.*			

B.3.1 RCP 240/D allocations

B.3.1.1 General

B.3.1.1.1 The RCP 240/D allocations are applicable to the CPDLC application.

B.3.1.2 Air navigation service provider (ANSP)

RCP communication transaction time and continuity criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: ANSP**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
Transaction Time Value	240	210	Analysis, CSP contract/service agreement. See also paragraph B.3.1.3.
RCP Time Allocations			
Initiator	30	30	Analysis, simulations, safety and human factors assessments
TRN	210	180	Monitored, CSP contract/service agreement. See also paragraph B.3.1.3.
TRN Time Allocations			
Responder	60	60	Initially, by analysis, simulations, safety human factors assessments Post-implementation, monitored, estimated
RCTP	150	120	Monitored, estimated, CSP contract/service agreement. See also paragraph B.3.1.3.
RCTP Time Allocation			
$\mathbf{RCTP_{ATSU}}$	15	10	Pre-implementation demonstration

RCP availability criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: ANSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability ($\mathbf{A_{CSP}}$)	0.9999	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.3.1.3, RCP 240/D allocation to CSP for RCP availability criteria.*

RCP integrity criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: ANSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level commensurate with integrity level, (compliance shown prior to operational implementation). See also RCP related safety requirement SR-26 for the ANSP. CSP contract/service agreement. See also RCP integrity criteria for CSP, paragraph B.3.1.3.

RCP monitoring and alerting criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: ANSP**
Ref:	**Criteria**	**Compliance means**
MA-1a	The ground system shall be capable of detecting ground system failures and configuration changes that would cause the communication service to no longer meet the requirements for the intended function. *Note.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the RCP specification, this would be considered a change in system configuration.*	System design, implementation. CSP contract/service agreement. See also paragraph B.3.1.3, RCP availability criteria.
MA-1b	When the communication service no longer meets the requirements for the intended function, the ground system shall provide indication to the controller.	System design, implementation. CSP contract/service agreement. See also paragraph B.3.1.3, RCP availability criteria.
MA-2	When the controller receives an indication that the communication service no longer meets the requirements for the intended function (e.g. reduced longitudinal separation), the controller shall take action to resolve the situation, (e.g. apply an alternative form of separation).	System design, procedures, implementation

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: ANSP**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-1a (ANSP)	A	The ATSU shall display the indication provided by the aircraft system when a data link service request initiated by the ground system or the controller is rejected at the application layer.

RCP related safety requirements		
Specification: RCP 240/D	Application: CPDLC	Component: ANSP
Ref	**Related RCP Parameter**	**Safety requirement**
SR-1b (ANSP)	A	The ATSU shall provide to the aircraft system an indication when it rejects a data link service request initiated by the flight crew at the application layer.
SR-2 (ANSP)	A, C	The ATSU shall indicate to the controller a detected loss of data link service.
SR-3 (ANSP)	A	Data link service shall be established in sufficient time to be available for operational use.
SR-4 (ANSP)	A, C	ATSU shall be notified of planned outage of data link service sufficiently ahead of time.
SR-5 (ANSP)	A, C	The ATSU shall indicate to the controller when a message cannot be successfully transmitted.
SR-6 (ANSP)	C, I	The ATSU end system shall provide unambiguous and unique identification of the origin and destination with each message it transmits.
SR-7 (ANSP)	C, I	The ATSU shall indicate in each response to which messages it refers.
SR-8 (ANSP)	I	The ATSU shall send the route clearance information with the route clearance via data link.
SR-9 (ANSP)	C, I	The ATSU end system shall time stamp to within one second UTC each message when it is released for onward transmission.
SR-11 (ANSP)	C, I	Any processing performed by ATSU (data entry/ encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message.
SR-12 (ANSP)	C, I	The ATSU end system shall reject messages not addressed to itself.
SR-13 (ANSP)	C, I	The ATSU shall transmit messages to the designated aircraft system.
SR-14 (ANSP)	A, C, I	The ATSU system shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).
SR-15 (ANSP)	C, I	When the ATSU receives a message whose time stamp exceeds ET_{TRN}, the ATSU shall provide appropriate indication.
SR-16 (ANSP)	C, I	The ATSU shall prevent the release of clearance without controller action.
SR-17 (ANSP)	C, I	The ATSU shall prohibit operational processing by controller of corrupted messages.

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: ANSP**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-18 (ANSP)	C, I	The ATSU shall be able to determine the message initiator.
SR-19 (ANSP)	C, I	The ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU.
SR-20 (ANSP)	C, I	ATSU shall only establish and maintain data link services when the aircraft identifiers in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.
SR-21 (ANSP)	C, I	The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).
SR-23 (ANSP)	C, I	An ATSU system shall not permit data link services when there are non-compatible version numbers.
SR-24 (ANSP)	C, I	The ATSU shall respond to messages in their entirety.
SR-25 (ANSP)	I	The ATSU end system shall be capable of detecting errors that would result in misdelivery introduced by the communication service.
SR-26 (ANSP)	I	The ATSU end system shall be capable of detecting errors that would result in corruption introduced by the communication service.

B.3.1.3 Communication service provider (CSP)

Note.— The RCP allocations for the CSP are intended to aid the ANSP and the aircraft operator in the development of contracts and service agreements.

RCP communication transaction time and continuity criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: CSP**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance means**
RCTP Time Allocation			
$RCTP_{CSP}$	120	100	Contract/service agreement terms. Pre-implementation demonstration.

RCP availability criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: CSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms
Unplanned outage duration limit (min)	10	10	Contract/service agreement terms
Maximum number of unplanned outages	4	48	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	52	520	Contract/service agreement terms
Unplanned outage notification delay (min)	5	5	Contract/service agreement terms
Note.— DO-306/ED-122 specifies a requirement to indicate loss of the service. Unplanned outage notification delay is an additional time value associated with the requirement to indicate the loss to the ANSP per the RCP related safety requirement SR-4 for the ANSP.			

RCP integrity criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: CSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Not specified	Contract/service agreement terms. Per RCP related safety requirements SR-26 for the ANSP and SR-26 for the aircraft system, the end system is required include provisions, consistent with the overall RCP integrity criteria, to mitigate the effects of errors introduced by the network. These provisions require the network to pass protected information (or data) to the end system without manipulating the protected information (or data) it passes. *Note.— In formulating contract terms with the CSP, the ANSP and/or operator may specify an integrity value and other related criteria, as appropriate, for the network, including subnetworks, that will ensure acceptable data integrity, consistent with the assumptions used to define the end system provisions (e.g. CRC or Fletcher's checksum).*

B.3.1.4 Aircraft system

RCP communication transaction time and continuity criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: Aircraft system**
Transaction Time Parameter	**ET (sec)** **C = 99.9%**	**TT (sec)** **C = 95%**	**Compliance Means**
RCP Time Allocation			
Initiator	30	30	Human-machine interface capability, pre-implementation demonstration
TRN Time Allocation			
Responder	60	60	Human-machine interface capability, pre-implementation demonstration
RCTP Time Allocation			
$RCTP_{AIR}$	15	10	Pre-implementation demonstration

RCP availability criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: Aircraft system**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	N/A	0.999	Analysis, architecture, design, pre-implementation demonstration

RCP integrity criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft system**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level (e.g. Level C software) commensurate with integrity level, pre-implementation demonstration. See also RCP related safety requirement SR-26 for the aircraft system.

RCP monitoring and alerting criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft system**

Ref:	Criteria	Compliance means
MA-1a	The aircraft system shall be capable of detecting aircraft system failures or loss of air/ground communication that would cause the aircraft communication capability to no longer meet the requirements for the intended function.	System design, implementation
MA-1b	When the aircraft communication capability no longer meets the requirements for the intended function, the aircraft system shall provide indication to the flight crew.	System design, implementation

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft system**

Ref	Related RCP Parameter	Safety requirement
SR-1a (Air)	A	The aircraft system shall provide to the ATSU an indication when it rejects a data link service request initiated by the ground system or the controller at the application layer.
SR-1b (Air)	A	The aircraft system shall display the indication provided by the ATSU when a data link service request initiated by the flight crew is rejected at the application layer.
SR-2 (Air)	A, C	The aircraft system shall indicate to the flight crew a detected loss of data link service.
SR-5 (Air)	A, C	The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.
SR-6 (Air)	C, I	The aircraft end system shall provide unambiguous and unique identification of the origin and destination with each message it transmits.
SR-7 (Air)	C, I	The aircraft system shall indicate in each response to which messages it refers.
SR-8 (Air)	I	The aircraft shall execute the route clearance per the route clearance received from the ATSU via data link.
SR-9 (Air)	C, I	The aircraft end system shall time stamp to within one second UTC each message when it is released for onward transmission.
SR-1 (Air)0	C, I	The aircraft end system shall include in each ADS-C report the time at position to within one second of the UTC time the aircraft was actually at the position provided in the report.
SR-11 (Air)	C, I	Any processing performed by aircraft system (data entry/ encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft system**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-12 (Air)	C, I	The aircraft end system shall reject messages not addressed to itself.
SR-13 (Air)	C, I	The aircraft system shall transmit messages to the designated ATSU.
SR-15 (Air)	C, I	When the aircraft system receives a message whose time stamp exceeds ET_{TRN}, the aircraft system shall provide appropriate indication.
SR-16 (Air)	C, I	The aircraft end system shall prevent the release of responses to clearances without flight crew action.
SR-17 (Air)	C, I	The aircraft system shall prohibit operational processing by flight crew of corrupted messages.
SR-18 (Air)	C, I	The aircraft system shall be able to determine the message initiator.
SR-19 (Air)	C, I	The aircraft system shall prohibit to the flight crew operational processing of messages not addressed to the aircraft.
SR-21 (Air)	C, I	The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).
SR-24 (Air)	C, I	The aircraft system shall respond to messages in their entirety or allow the flight crew to do it.
SR-25 (Air)	I	The aircraft end system shall be capable of detecting errors that would result in misdelivery introduced by the communication service
SR-26 (Air)	I	The aircraft end system shall be capable of detecting errors that would result in corruption introduced by the communication service.
SR-27 (Air)	C, I	The aircraft and/or flight crew shall ensure the correct transfer into or out of the aircraft's FMS of route data received/sent via data link that will be used to define the aircraft active flight plan.

B.3.1.5 Aircraft operator

RCP communication transaction time and continuity criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: Aircraft operator**
Transaction Time Parameter	**ET (sec)** **C = 99.9%**	**TT (sec)** **C = 95%**	**Compliance Means**
RCP Time Allocations			
Initiator	30	30	Procedures, flight crew training and qualification in accordance with safety requirements.
TRN Time Allocations			
Responder	60	60	Procedures, flight crew training and qualification in accordance with safety requirements.
RCTP Time Allocation			
$RCTP_{AIR}$	15	10	Aircraft type design approval, maintenance, properly configured user-modifiable software (e.g. owner requirements table)
$RCTP_{CSP}$	120	100	CSP contract/service agreement. See also paragraph B.3.1.3. Pre-implementation demonstration.

RCP availability criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: Aircraft operator**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	N/A	0.999	Aircraft type design approval, maintenance, properly configured user-modifiable software (e.g. owner requirements table or airline policy file).
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.3.1.3, RCP 240/D allocation to CSP for RCP availability criteria.*

RCP integrity criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft operator**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Aircraft type design approval, establish procedures, training, and qualification to meet safety requirements. CSP contract/service agreement. See also RCP integrity criteria for CSP, paragraph B.3.1.3.

RCP monitoring and alerting criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft operator**
Ref:	**Criteria**	**Compliance means**
MA-2	When the flight crew determines that the aircraft communication capability no longer meets the requirements for the intended function, the flight crew shall advise the ATC unit concerned.	Procedures, flight crew training and qualification

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft operator**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-22 (Operator)	C, I	The flight crew shall perform the initiation data link procedure again with any change of the flight identifier.
SR-24 (Operator)	C, I	The flight crew shall respond to a message in its entirety when not responded by the aircraft system.
SR-27 (Operator)	C, I	The aircraft and/or flight crew shall ensure the correct transfer into or out of the aircraft's FMS of route data received/sent via data link that will be used to define the aircraft active flight plan.

B.4 RCP 400 specification

<table>
<tr><td colspan="4">RCP Specification</td></tr>
<tr><td colspan="2">RCP specification</td><td colspan="2">RCP 400</td></tr>
<tr><td colspan="4">Airspace specific considerations</td></tr>
<tr><td>Interoperability</td><td colspan="3">Specify interoperability criteria (e.g. FANS 1/A)</td></tr>
<tr><td>ATS Function</td><td colspan="3">Specify ATS function(s) (e.g. applicable separation standard)</td></tr>
<tr><td>Application</td><td colspan="3">Specify controller-pilot ATC communication intervention capability (e.g. CPDLC application per ICAO Doc 4444, and RTCA DO-306/EUROCAE ED-122, Annex A)</td></tr>
<tr><td colspan="4">RCP parameter values</td></tr>
<tr><td>Transaction time (sec)</td><td>Continuity (C)</td><td>Availability (A)</td><td>Integrity (I)</td></tr>
<tr><td>ET = 400</td><td>C(ET) = 0.999</td><td rowspan="2">0.999</td><td rowspan="2">Malfunction = 10^{-5} per flight hour</td></tr>
<tr><td>TT 95% = 350</td><td>C(TT 95%) = 0.95</td></tr>
<tr><td colspan="4">RCP monitoring and alerting criteria</td></tr>
<tr><td>Ref:</td><td colspan="3"><u>Criteria</u></td></tr>
<tr><td>MA-1</td><td colspan="3">The system shall be capable of detecting failures and configuration changes that would cause the communication service to no longer meet the RCP specification for the intended function.</td></tr>
<tr><td>MA-2</td><td colspan="3">When the communication service can no longer meet the RCP specification for the intended function, the flight crew and/or the controller shall take appropriate action.</td></tr>
<tr><td colspan="4">Notes</td></tr>
<tr><td colspan="4"><u>Note 1</u>.— Rationale for the criteria provided in this specification can be found in ICAO Annex 11, ICAO Doc 4444, ICAO Doc 9689, and RTCA DO-306/ED-122.
<u>Note 2</u>.— The values for transaction times are to be applied to transactions that are representative of communication capability for the controller to intervene with a specific operator, aircraft type, and aircraft identification.
<u>Note 3</u>.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the RCP specification, this would be considered a change in system configuration.</td></tr>
</table>

B.4.1 RCP 400/D allocations

B.4.1.1 General

B.4.1.1.1 The RCP 400/D allocations are applicable to the CPDLC application.

B.4.1.2 Air navigation service provider (ANSP)

RCP communication transaction time and continuity criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: ANSP**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
Transaction Time Value	400	350	Analysis, CSP contract/service agreement. See also paragraph B.4.1.3.
RCP Time Allocations			
Initiator	30	30	Analysis, simulations, safety and human factors assessments
TRN	370	320	Monitored, CSP contract/service agreement. See also paragraph B.4.1.3.
TRN Time Allocations			
Responder	60	60	Initially, by analysis, simulations, safety human factors assessments Post-implementation, monitored, estimated
RCTP	310	260	Monitored, estimated, CSP contract/service agreement. See also paragraph B.4.1.3.
RCTP Time Allocation			
$RCTP_{ATSU}$	15	10	Pre-implementation demonstration

RCP availability criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: ANSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.4.1.3, RCP 400/D allocation to CSP for RCP availability criteria.*

RCP integrity criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: ANSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— RCP integrity criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.2.*	

RCP monitoring and alerting criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: ANSP**
Ref:	**Criteria**	**Compliance means**
All	*Note.— RCP monitoring and alerting criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.2.*	

RCP related safety requirements		
Specification: RCP 400/D	**Application: CPDLC**	**Component: ANSP**
Ref	**Related RCP Parameter**	**Safety requirement**
All	A, C, I	*Note.— Safety requirements related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.2.*

B.4.1.3 Communication service provider (CSP)

Note.— The RCP allocations for the CSP are intended to aid the ANSP and the aircraft operator in the development of contracts and service agreements.

RCP communication transaction time and continuity criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: CSP**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance means**
RCTP Time Allocation			
$RCTP_{CSP}$	280	240	Contract/service agreement terms

RCP availability criteria			
Specification: RCP 400/D	**Application: CPDLC**	**Component: CSP**	
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms
Unplanned outage duration limit (min)	N/A	20	Contract/service agreement terms
Maximum number of unplanned outages	N/A	24	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	N/A	520	Contract/service agreement terms
Unplanned outage notification delay (min)	N/A	10	Contract/service agreement terms

RCP integrity criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: CSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— RCP integrity criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.3.*	

B.4.1.4 Aircraft system

RCP communication transaction time and continuity criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: Aircraft system**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
RCP Time Allocation			
Initiator	30	30	Human-machine interface capability, pre-implementation demonstration
TRN Time Allocation			
Responder	60	60	Human-machine interface capability, pre-implementation demonstration
RCTP Time Allocation			
$RCTP_{AIR}$	15	10	Pre-implementation demonstration

RCP availability criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: Aircraft system**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	N/A	0.999	Analysis, architecture, design, pre-implementation demonstration

RCP integrity criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft system**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— RCP integrity criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.4.*	

RCP monitoring and alerting criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft system**
Ref:	**Criteria**	**Compliance means**
All	*Note.— RCP monitoring and alerting criteria related to RCP allocations 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.4.*	

RCP related safety requirements		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft system**
Ref	**Related RCP Parameter**	**Safety requirement**
All	A, C, I	*Note.— Safety requirements related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.4.*

B.4.1.5 Aircraft operator

RCP communication transaction time and continuity criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: Aircraft operator**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
RCP Time Allocations			
Initiator	30	30	Procedural capability, flight crew training and qualification in accordance with safety requirements.
TRN Time Allocations			
Responder	60	60	Procedural capability, flight crew training and qualification in accordance with safety requirements.
RCTP Time Allocation			
$RCTP_{AIR}$	15	10	Aircraft type design approval, maintenance, properly configured user-modifiable software (e.g. owner requirements table)
$RCTP_{CSP}$	280	240	CSP contract/service agreement. See also paragraph B.4.1.3.

RCP availability criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: Aircraft operator**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	N/A	0.999	Aircraft type design approval, maintenance, properly configured user-modifiable software (e.g. owner requirements table)
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.4.1.3, RCP 400/D allocation to CSP for RCP availability criteria.*

RCP integrity criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft operator**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— RCP integrity criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.5.*	

RCP monitoring and alerting criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft operator**
Ref:	**Criteria**	**Compliance means**
All	*Note.— RCP monitoring and alerting criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.5.*	

RCP related safety requirements		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft operator**
Ref	**Related RCP Parameter**	**Safety requirement**
All	C, I	*Note.— Safety requirements related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.3.1.5.*

B.5 RCP 150 specification

<table>
<tr><td colspan="4">RCP Specification</td></tr>
<tr><td colspan="2">RCP specification</td><td colspan="2">RCP 150</td></tr>
<tr><td colspan="4">Airspace specific considerations</td></tr>
<tr><td>Interoperability</td><td colspan="3">Specify interoperability criteria (e.g. ATN B1, ATN B1-FANS 1/A)</td></tr>
<tr><td>ATS Function</td><td colspan="3">Specify ATS function(s) (e.g. ATS communication means (Controller-initiated ACM and ACL)</td></tr>
<tr><td>Application</td><td colspan="3">Specify controller-pilot ATC communication intervention capability (e.g. CPDLC application per ICAO Doc 4444, and RTCA DO-290/EUROCAE ED-120, Annex A)</td></tr>
<tr><td colspan="4">RCP parameter values</td></tr>
<tr><td>Transaction time (sec)</td><td>Continuity (C)</td><td>Availability (A)</td><td>Integrity (I)</td></tr>
<tr><td>ET = 150</td><td>C(ET) = 0.999</td><td rowspan="2">0.999 (Provision
0.993 (Use)</td><td rowspan="2">Malfunction = 10^{-5} per flight hour</td></tr>
<tr><td>TT 95% = 80</td><td>C(TT 95%) = 0.95</td></tr>
<tr><td colspan="4">RCP monitoring and alerting criteria</td></tr>
<tr><td>Ref:</td><td colspan="3"><u>Criteria</u></td></tr>
<tr><td>MA-1</td><td colspan="3">The system shall be capable of detecting failures and configuration changes that would cause the communication service to no longer meet the RCP specification for the intended function.</td></tr>
<tr><td>MA-2</td><td colspan="3">When the communication service can no longer meet the RCP specification for the intended function, the flight crew and/or the controller shall take appropriate action.</td></tr>
<tr><td colspan="4">Notes</td></tr>
<tr><td colspan="4"><u>Note 1</u>.— Rationale for the criteria provided in this specification can be found in ICAO Annex 11, ICAO Doc 4444, ICAO Doc 9689, and DO-290/ED-120.
<u>Note 2</u>.— The values for transaction times are to be applied to transactions that are representative of communication capability for the controller to intervene with a specific operator, aircraft type, and aircraft identification.
<u>Note 3</u>.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the RCP specification, this would be considered a change in system configuration.
<u>Note 4</u>.— DO-290/ED-120 specifies an availability value based on service Provision (A_{PROV}) and on Use (A_{USE}). A_{PROV} value herein is more stringent and is equally shared between ATSU and CSP.</td></tr>
</table>

B.5.1 RCP 150/D allocations

B.5.1.1 General

B.5.1.1.1 The RCP 150/D allocations are applicable to the CPDLC application.

B.5.1.2 Air navigation service provider (ANSP)

RCP communication transaction time and continuity criteria			
Specification: RCP 150/D	**Application: CPDLC**		**Component: ANSP**
Transaction Time Parameter	**ET (sec)** **C = 99.9%**	**TT (sec)** **C = 95%**	**Compliance Means**
Transaction Time Value	150	80	Analysis, CSP contract/service agreement. See also paragraph B.5.1.3.
RCP Time Allocations			
Initiator	30	20	Analysis, simulations, safety and human factors assessments
TRN	120	60	Monitored, CSP contract/service agreement. See also paragraph B.5.1.3.
TRN Time Allocations			
Responder	100	44	Initially, by analysis, simulations, safety human factors assessments Post-implementation, monitored, estimated
RCTP	20	16	Monitored, estimated, CSP contract/service agreement. See also paragraph B.5.1.3.
RCTP Time Allocation			
$\text{RCTP}_{\text{ATSU}}$ (See Note 1)	14	12	Pre-implementation demonstration
Notes			
Note 1.— DO-290/ED-120 specifies Timing values for ANSP based on the combined value of ATSU and CSP. The split between each ATSU and CSP is made through local contract/service agreements. *Note 2.- RCP 150 specification is for controller-initiated messages. Therefore, the Responder represents the flight crew.*			

RCP availability criteria			
Specification: RCP 150/D	**Application: CPDLC**		**Component: ANSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{ATSU})	0.9995	N/A	Contract/service agreement terms. *Note 1.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.5.1.3, RCP 150/D allocation to CSP for RCP availability criteria.*
Unplanned outage duration limit (min)	6	N/A	Contract/service agreement terms
Maximum number of unplanned outages	40	N/A	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	240	N/A	Contract/service agreement terms
Unplanned outage notification delay (min)	5	N/A	Contract/service agreement terms

RCP integrity criteria		
Specification: RCP 150/D	**Application: CPDLC**	**Component: ANSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level commensurate with integrity level (compliance shown prior to operational implementation). See also RCP related safety requirement SR-ACL-18 for the ANSP.

RCP monitoring and alerting criteria		
Specification: RCP 150/D	**Application: CPDLC**	**Component: ANSP**
Ref:	**Criteria**	**Compliance means**
MA-1a	The ground system shall be capable of detecting ground system failures and configuration changes that would cause the communication service to no longer meet the requirements for the intended function. *Note.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the RCP specification, this would be considered a change in system configuration.*	System design, implementation. CSP contract/service agreement. See also paragraph B.5.1.3, RCP availability criteria.

RCP monitoring and alerting criteria		
Specification: RCP 150/D	**Application: CPDLC**	**Component: ANSP**

Ref:	**Criteria**	**Compliance means**
MA-1b	When the communication service no longer meets the requirements for the intended function, the ground system shall provide indication to the controller.	System design, implementation. CSP contract/service agreement. See also paragraph B.5.1.3, RCP availability criteria.
MA-2	When the controller receives an indication that the communication service no longer meets the requirements for the intended function, the controller shall take action to resolve the situation (e.g. revert to voice)	System design, procedures, implementation

RCP related safety requirements		
Specification: RCP 150/D	**Application: CPDLC**	**Component: ANSP**

Ref	**Related RCP Parameter**	**Safety requirement**
SR-DLIC-1	I	When flight plan correlation is performed as part of DLIC, an ATSU shall reject the initiation request if the flight identifier, departure or arrival aerodrome contained in the DLIC message does not match the ATSU's corresponding flight plan information.
SR-DLIC-2	I	An ATSU system shall not permit data link services when there are incompatible version numbers
SR-DLIC-4	I	The ATSU system shall perform the correlation function again when the flight plan information used for correlation changes after correlation has been completed, but prior to initiating an application requiring such correlation (e.g. CPDLC).
SR-DLIC-5	I	The ATSU system shall delete and replace all previously held application data relating to an aircraft after a successful DLIC initiation function.
SR-DLIC-6	I	The ATSU system shall not permit data link services when the aircraft flight plan information fails to correlate with the ATSU's corresponding flight plan information.
SR-DLIC-7	I	Any ATSU processing (data entry/encoding/ transmitting/decoding/ displaying) shall not affect the intent of the DLIC message.
SR-ACM-1	I	An ATSU shall only send operational CPDLC messages to an aircraft when it has control of that aircraft unless it is a D-ATSU conducting DSC.

RCP related safety requirements		
Specification: RCP 150/D	**Application: CPDLC**	**Component: ANSP**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-ACM-3	I	Only the ATSU that has control (CDA) of the aircraft shall be permitted to indicate the next data authority (NDA) to the aircraft.
SR-ACM-5	I	An ATSU shall reject any aircraft request for CPDLC establishment.
SR-ACM-6	I	When a request for CPDLC establishment is rejected by an ATSU, an indication of the rejection shall be provided to the aircraft.
SR-ACM-7	A	The ATSU system shall be capable of indicating any loss of CPDLC service to the controller.
SR-ACM-10	I	The controller shall have the capability to terminate CPDLC
SR-ACM-11	I	After the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off, ACM shall be conducted prior to using any CPDLC service.
SR-ACM-12 SR-ACL-8	I	Any processing (data entry/encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message.
SR-ACL-2 SR-AMC-1	I	Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.
SR-ACL-4	I	A response message shall indicate to which message it refers.
SR-ACL-7	C, I	Te controller shall respond to a message in its entirety.
SR-ACL-9 SR-AMC-5	I	The ATSP shall reject messages not addressed to its end system.
SR-ACL-10 SR-AMC-6	I	The ATSP shall transmit messages to the designated end system.
SR-ACL-11	C	An indication shall be provided to the controller and information shall be sent to the flight crew when a message is rejected because the response is not sent within the required time ($ET_{RESPONDER}$).
SR-ACL-12	C	The ATSU system shall be capable of indicating to the controller when a required response is not received within the required time (ET_{TRN}).
SR-ACL-13	C	When a received message contains a time stamp that indicates that the ET_{TRN} time has been exceeded, the ATSU shall either discard the message and inform the initiator or display the message to the receiver with an appropriate indication.

RCP related safety requirements			
Specification: RCP 150/D		**Application: CPDLC**	**Component: ANSP**
Ref	**Related RCP Parameter**	**Safety requirement**	
SR-ACL-14	C	When the controller is informed that a message has been rejected by the ATSU system because the response has not been sent within the required response time ($ET_{RESPONDER}$), the controller shall clarify the status of the message (e.g. using voice).	
SR-ACL-15 SR-AMC-8	C	When using data link for ATC communications, the ATSU shall be synchronized to within one second of UTC.	
SR-ACL-16	I	The ATSU shall prevent release of a clearance without controller action.	
SR-ACL-18	I	The ATSU system shall be capable of detecting a corrupted message.	
SR-ACL-19	I	The ATSU system shall prohibit operationally processing of detected corrupted messages	
SR-ACL-20	I	The ATSU system shall be able to determine the aircraft that transmitted the message.	
SR-ACL-21	C	Whenever a message is discarded an indication shall be provided by the ATSU system to the aircraft that sent the message.	

B.5.1.3 Communication service provider (CSP)

Note.— The RCP allocations for the CSP are intended to aid the ANSP and the aircraft operator in the development of contracts and service agreements.

RCP communication transaction time and continuity criteria			
Specification: RCP 150/D	**Application: CPDLC**		**Component: CSP**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance means**
RCTP Time Allocation			
$RCTP_{CSP}$	14	12	Contract/service agreement terms. *Note.— See paragraph B.5.1.2, RCP 150/D allocation to ANSP for $RCTP_{ANSP}$.*
Notes			
Note .— DO-290/ED-120 does not specify Timing values for CSP, but is incorporated in the value for ANSP. $RCTP_{ANSP}$ represents the combined value of ATSU and CSP.			

RCP availability criteria				
Specification: RCP 150/D	**Application: CPDLC**		**Component: CSP**	
Availability parameter		**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})		0.995	N/A	Contract/service agreement terms
Unplanned outage duration limit (min)		6	N/A	Contract/service agreement terms
Maximum number of unplanned outages		40	N/A	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)		240	N/A	Contract/service agreement terms
Unplanned outage notification delay (min)		5	N/A	Contract/service agreement terms
Notes				
Note.— A_{CSP} is derived from A_{PROV} and is equally shared between ATSU and CSP.				

RCP integrity criteria			
Specification: RCP 150/D	**Application: CPDLC**		**Component: CSP**
Integrity parameter	**Integrity value**	**Compliance means**	
Integrity (I)	Not specified	Contract/service agreement terms. Per RCP related safety requirements SR-ACL-18 for the ANSP and SR-ACL-18 for the aircraft system, the end system is required include provisions, consistent with the overall RCP integrity criteria, to mitigate the effects of errors introduced by the network. These provisions require the network to pass protected information (or data) to the end system without manipulating the protected information (or data) it passes. *Note.— In formulating contract terms with the CSP, the ANSP and/or operator may specify an integrity value and other related criteria, as appropriate, for the network, including subnetworks, that will ensure acceptable data integrity, consistent with the assumptions used to define the end system provisions (e.g. CRC or Fletcher's checksum).*	

B.5.1.4 Aircraft system

RCP communication transaction time and continuity criteria			
Specification: RCP 150/D	**Application: CPDLC**		**Component: Aircraft system**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
RCP Time Allocation			
Initiator	See note	See note	Human-machine interface capability, pre-implementation demonstration
TRN Time Allocation			
Responder	100	44	Human-machine interface capability, pre-implementation demonstration
RCTP Time Allocation			
$RCTP_{AIR}$	6	4	Pre-implementation demonstration
Notes			
Note.— RCP 150 specification is for controller-initiated messages. Therefore, the INITIATOR time is not provided.			

RCP availability criteria			
Specification: RCP 150/D	**Application: CPDLC**		**Component: Aircraft system**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	0.994	N/A	Analysis, architecture, design, pre-implementation demonstration
Notes			
Note.— A_{AIR}, is derived from A_{USE} and $A_{PROVISION}$, where A_{AIR} equals A_{USE} / $A_{PROVISION}$.			

RCP integrity criteria		
Specification: RCP 150/D	**Application: CPDLC**	**Component: Aircraft system**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level (e.g. Level C software) commensurate with integrity level, pre-implementation demonstration. See also RCP related safety requirement SR-ACL-18 for the aircraft system.

RCP monitoring and alerting criteria		
Specification: RCP 150/D	**Application: CPDLC**	**Component: Aircraft system**
Ref:	**Criteria**	**Compliance means**
MA-1a	The aircraft system shall be capable of detecting aircraft system failures or loss of air/ground communication that would cause the aircraft communication capability to no longer meet the requirements for the intended function.	System design, implementation
MA-1b	When the aircraft communication capability no longer meets the requirements for the intended function, the aircraft system shall provide indication to the flight crew.	System design, implementation

RCP related safety requirements		
Specification: RCP 150/D	**Application: CPDLC**	**Component: Aircraft system**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-DLIC-2	I	An aircraft system shall not permit data link services when there are non-compatible version numbers
SR-DLIC-3	I	The aircraft system shall perform the initiation function again with applicable ATSUs when any of the application or flight information changes.
SR-DLIC-7	I	Any aircraft system processing (data entry/encoding/ transmitting/decoding/ displaying) shall not affect the intent of the DLIC message.
SR-DLIC-8	I	The aircraft system shall insert the relevant initiation data in initiation message.
SR-ACM-2	I	Once an aircraft accepts operational CPDLC messages from an ATSU, it shall reject operational CPDLC messages from any other ATSU except from a D-ATSU until the first ATSU indicates that it has transferred control of that aircraft.
SR-ACM-4	I	A rejection indication shall be provided to the ATSU when an aircraft rejects a request for CPDLC.

RCP related safety requirements		
Specification: RCP 150/D	**Application: CPDLC**	**Component: Aircraft system**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-ACM-7	A	The aircraft system shall be capable of indicating any loss of CPDLC service to the flight crew.
SR-ACM-11	I	After the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off, ACM shall be conducted prior to using any CPDLC service.
SR-ACM-12 SR-ACL-8	I	Any processing (data entry/encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message.
SR-ACL-3	I	Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.
SR-ACL-4	I	A response message shall indicate to which message it refers.
SR-ACL-9 SR-AMC-5	I	The aircraft system shall reject messages not addressed to its end system.
SR-ACL-10	I	The aircraft system shall transmit messages to the designated end system.
SR-ACL-11	C	An indication shall be provided to the flight crew and information shall be sent to the ATSU when a message is rejected because the response is not sent within the required time ($ET_{RESPONDER}$).
SR-ACL-13	C	When a received message contains a time stamp that indicates that the ET_{TRN} time has been exceeded, the aircraft system shall either discard the message and inform the ATSU or display the message to the flight crew with an appropriate indication.
SR-ACL-15 SR-AMC-8	C	When using data link for ATC communications, the aircraft system shall be synchronized to within one second of UTC.
SR-ACL-17	C	The aircraft system shall prevent release of a report without flight crew action.
SR-ACL-18	I	The aircraft system shall be capable of detecting a corrupted message.
SR-ACL-19	I	The aircraft system shall prohibit operational processing of detected corrupted messages
SR-ACL-20	I	The aircraft system shall be able to determine the ATSU that transmitted the received message.
SR-ACL-21	C	Whenever an operational message is discarded an indication shall be provided to the ATS that sent the message.

B.5.1.5 Aircraft operator

RCP communication transaction time and continuity criteria			
Specification: RCP 150/D	**Application: CPDLC**		**Component: Aircraft operator**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
RCP Time Allocations			
Initiator	See note 1	See note 1	Procedural capability, flight crew training and qualification in accordance with safety requirements.
TRN Time Allocations			
Responder	100	44	Procedural capability, flight crew training and qualification in accordance with safety requirements.
RCTP Time Allocation			
$RCTP_{AIR}$	6	4	Aircraft type design approval, maintenance, properly configured user-modifiable software (e.g. owner requirements table)
$RCTP_{CSP}$	See note 2	See note 2	CSP contract/service agreement. See also paragraph B.5.1.3.
Notes			
Note 1.— RCP 150 specification is for controller-initiated messages. Therefore, the INITIATOR time is not provided. *Note 2.— DO-290/ED-120 does not specify timing values for CSP, but is incorporated in the value for ANSP. $RCTP_{ANSP}$ represents the combined value of ATSU and CSP.*			

RCP availability criteria			
Specification: RCP 150/D	**Application: CPDLC**		**Component: Aircraft operator**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	0.994	N/A	Aircraft type design approval, maintenance, properly configured user-modifiable software (e.g. owner requirements table)
Service availability (A_{CSP})	0.9995	N/A	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.5.1.3, RCP 150/D allocation to CSP for RCP availability criteria.*
Notes			
Note.— A_{AIR}, is derived from A_{USE} and $A_{PROVISION}$, where A_{AIR} equals A_{USE} / $A_{PROVISION}$.			

RCP integrity criteria		
Specification: RCP 150/D	**Application: CPDLC**	**Component: Aircraft operator**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level (e.g. Level C software) commensurate with integrity level, pre-implementation demonstration. See also RCP related safety requirement SR-ACL-18 for the aircraft system.

RCP monitoring and alerting criteria		
Specification: RCP 150/D	**Application: CPDLC**	**Component: Aircraft operator**
Ref:	**Criteria**	**Compliance means**
MA-2	When the flight crew determines that the aircraft communication capability no longer meets the requirements for the intended function, the flight crew shall advise the ATC unit concerned.	Procedures, flight crew training and qualification.

RCP related safety requirements			
Specification: RCP 150/D		**Application: CPDLC**	**Component: Aircraft operator**
Ref	**Related RCP Parameter**	**Safety requirement**	
SR-DLIC-3	C, I	The flight crew shall perform the initiation function again with applicable ATSUs when any of the application or flight information changes (upon operator input).	
SR-ACL-7	C, I	The flight crew shall respond to a message in its entirety.	
SR-ACL-14	C	When the flight crew is informed that a message has been rejected by the local system because the response has not been sent within the required response time ($ET_{RESPONDER}$), the flight crew shall clarify the status of the message (e.g. using voice).	
SR-ACL-17	C	The flight crew shall be responsible for releasing an ACL report.	

Appendix C RSP specifications

C.1 General

C.1.1 This appendix includes specifications for RSP 180 and RSP 400. These specifications support:

a) Safety oversight of air traffic service provisions and operations;

b) Agreements/contractual arrangements that ANSPs and aircraft operators make with their respective CSPs;

c) Operational authorizations, flight crew training and qualification;

d) Design approval of aircraft data link systems; and

e) Operational-monitoring, analysis, and exchange of operational data among regions and states.

C.1.2 The RSP specifications are derived mainly from a safety assessment. However, in cases where it has been determined to be beneficial, the RSP specification may include criteria to support operational efficiency and orderly flow of air traffic. In these cases, the RSP specification indicates the distinction between safety and efficiency.

C.1.3 The RSP specifications provide a means of compliance, in general. Additional guidance related to service provision, aircraft approval and operational authorizations can be found in Chapter 3. Guidance and requirements on post-implementation monitoring can be found at Appendix D.

C.1.4 The RSP specifications include allocations for data communications. The /D designator is used to indicate the RSP allocations associated with the ADS-C or FMC WPR application.

C.2 Terms and acronyms

Note.— The terms applied to the RSP specifications are derived from ICAO Doc 9869, First Edition, Manual on Required Communication Performance, dated 2008 and ICAO Doc 9613, Performance Based Navigation Manual. Additional terms are provided, as appropriate, to clarify meaning and measurement points for the RSP allocations.

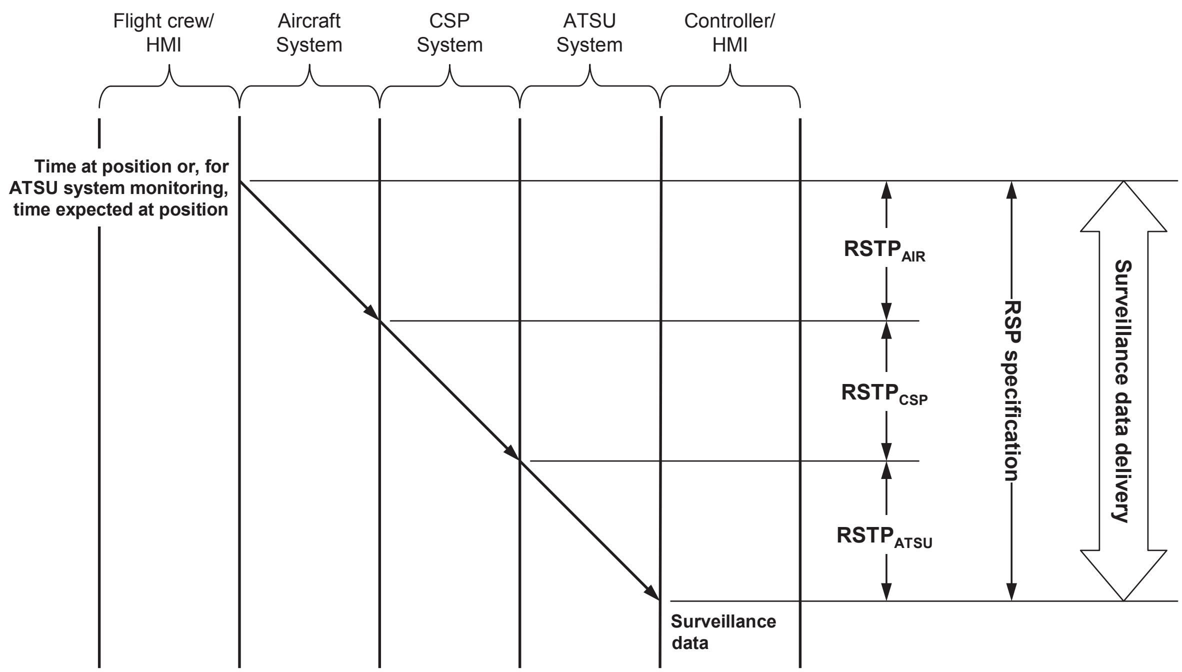
RSP specification	
Term	**Description**
ATS surveillance service	A term used to indicate a service provided directly by means of an ATS surveillance system. (ICAO)
ADS-C service	A term used to indicate an ATS service that provides surveillance information by means of the ADS-C application. *Note.— ICAO Doc 4444 does not include ADS-C in its definition for ATS surveillance system. Therefore, an ATS surveillance service does not consider those provided by means of the ADS-C application, unless it can be shown by comparative assessment to have a level of safety and performance equal to or better than monopulse SSR.*

RSP specification	
Term	**Description**
FMC WPR service	A term used to indicate an ATS service that provides surveillance information by means of the FMC WPR application. *<u>Note</u>.— ICAO Doc 4444 does not include FMC WPR in its definition for ATS surveillance system. Therefore, an ATS surveillance service does not consider those provided by means of the FMC WPR application, unless it can be shown by comparative assessment to have a level of safety and performance equal to or better than monopulse SSR.*
ATS surveillance system	A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft. *<u>Note</u>.— A comparable ground-based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.* (ICAO)
Automatic dependent surveillance — broadcast (ADS-B)	A means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link. (ICAO)
Automatic dependent surveillance — contract (ADS-C)	A means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports. *<u>Note</u>.— The abbreviated term "ADS contract" is commonly used to refer to ADS event contract, ADS demand contract, ADS periodic contract or an emergency mode.* (ICAO)
Surveillance data	Data pertaining to the identification of aircraft and/or obstructions for route conformance monitoring and safe and efficient conduct of flight. *<u>Note</u>.— In this document, surveillance data applies to ADS-C reports, CPDLC position reports and FMC waypoint position reports.*
Required surveillance performance (RSP)	A statement of the performance requirements for operational surveillance in support of specific ATM functions.
RSP specification	A set of ATS provision, including communication services, aircraft and operator requirements (e.g. RSP 180) needed for surveillance supporting a performance-based operation within a defined airspace.

RSP specification	
Term	**Description**
Surveillance data delivery	The process for obtaining surveillance data. *<u>Note</u>.— In this document, the delivery is defined for the following reports:* *a) ADS-C periodic report, from the start of the periodic interval to when the ATSU receives the report. The start of the periodic interval occurs when the periodic report is sent by the aircraft/flight crew;* *b) ADS-C event reports and FMC waypoint position reports, from the time the aircraft system detects that the event has occurred to when the ATSU receives the report; and* *c) CPDLC position report, from the time at which the aircraft reported its position and when the ATSU receives the report.*
RSP data transit time	The required time for surveillance data delivery.
RSP overdue delivery time (OT)	The maximum time for the successful delivery of surveillance data after which the initiator is required to revert to an alternative procedure.
RSP nominal delivery time (DT 95%)	The maximum nominal time within which 95% of surveillance data is required to be successfully delivered.
RSP continuity (C)	The required probability that surveillance data can be delivered within the surveillance delivery time parameter, either OT or DT 95%, given that the service was available at the start of delivery.
RSP availability (A)	The required probability that surveillance data can be provided when needed.
RSP integrity (I)	The required probability that the surveillance data is delivered with no undetected error. *<u>Note</u>.— Surveillance integrity includes such factors as the accuracy of time, correlating the time at aircraft position, reporting interval, data latency, extrapolation and/or estimation of the data.*

RSP data transit time	
Term	**Description**
$RSTP_{ATSU}$	The overdue (OD) or nominal (DT) transit time for surveillance data from the CSP interface to the ATSU's flight data processing system.
$RSTP_{AIR}$	The overdue (OD) or nominal (DT) transit time for surveillance data from the aircraft's avionics to the antenna.
$RSTP_{CSP}$	The overdue (OD) or nominal (DT) transit time for surveillance data allocated to the CSP.

RSP continuity	
Term	**Description**
C for $RSTP_{ATSU}$	The proportion of surveillance messages that can be delivered within the specified $RSTP_{ATSU}$.
C for $RSTP_{AIR}$	The proportion of surveillance messages that can be delivered within the specified $RSTP_{AIR}$.
C for $RSTP_{CSP}$	The proportion of surveillance messages that can be delivered within the specified $RSTP_{CSP}$.



Note.— The terms and acronyms used to specify the criteria for surveillance availability are the same as the terms and acronyms used to specify the criteria for RCP availability. See Appendix B, paragraph B.2.

C.3 RSP 180 specification

RSP specification	
RSP specification	**RSP 180**

Airspace specific considerations	
Interoperability	Specify interoperability criteria (e.g. FANS 1/A)
ATS Function	Specify ATS function(s) (e.g. applicable separation standard)
Application	Specify the required surveillance capability. FMC WPR or, for ADS-C, specify the types of contracts required to support the ATS function (e.g. periodic contract at [nn] min, waypoint change event contract, lateral deviation event contract at [n] NM).

RSP parameter values

Transit time (sec)	**Continuity (C)**		**Availability (A)**	**Integrity (I)**	
OT = 180	C(OT) = 0.999		0.999 0.9999 (efficiency) *See Note 3.*	**Navigation FOM**	*See Note 4.*
DT 95% = 90	C(DT 95%) = 0.95			**Time at position accuracy**	+/- 1 sec (UTC)
				Data integrity	Malfunction = 10^{-5} per flight hour

RSP monitoring and alerting criteria

Ref	**Criteria**
MA-1	The system shall be capable of detecting failures and configuration changes that would cause the ADS-C or FMC WPR service to no longer meet the surveillance parameter values for the intended function.
MA-2	When the ADS-C or FMC WPR service can no longer meet the surveillance parameter values for the intended function, the flight crew and/or the controller shall take appropriate action.

Notes

Note 1.— Rationale for the criteria provided in this specification can be found in ICAO Annex 11, ICAO Doc 4444, ICAO Doc 9689, and RTCA DO-306/ED-122.

Note 2.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the surveillance parameter values, this would be considered a change in system configuration.

Note 3.— DO-306/ED-122 specifies an availability value based on safety assessment of the operational effects of the loss of the service. The availability value herein is more stringent, based on an additional need to maintain orderly and efficient operations.

Note 4.— The navigation figure of merit (FOM) is specified based on the navigation criteria associated with this spec. For example, if RNP 4 is prescribed, then for ADS-C surveillance service, the FOM level would need to be 4 or higher. In all cases, when the navigation capability no longer meets the criteria specified for the operation, the flight crew is responsible for reporting the non-compliance to ATC in accordance with ICAO procedures.

C.3.1 RSP 180/D allocations

C.3.1.1 General

C.3.1.1.1 The RSP 180/D allocations can be applied to the ADS-C or FMC WPR applications.

C.3.1.2 Air navigation service provider (ANSP)

RSP data transit time and continuity criteria			
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**		**Component: ANSP**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95%(sec) C = 95%**	**Compliance Means**
Delivery Time Value	180	90	Analysis, CSP contract/service agreement. See also paragraph C.3.1.3.
RSTP Time Allocation			
$RSTP_{ATSU}$	5	3	Pre-implementation demonstration

RSP availability criteria			
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**		**Component: ANSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph C.3.1.3, RSP 180/D allocation to CSP for surveillance availability criteria.*

RSP integrity criteria		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: ANSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level commensurate with integrity level, (compliance shown prior to operational implementation). See also related safety requirement SR-26 for the ANSP. CSP contract/service agreement. See also surveillance integrity criteria for CSP, paragraph C.3.1.3.

RSP monitoring and alerting criteria		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: ANSP**
Ref:	**Criteria**	**Compliance means**
MA-1a	The ground system shall be capable of detecting ground system failures and configuration changes that would cause the ADS-C or FMC WPR service to no longer meet the requirements for the intended function. *Note.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the RSP specification, this would be considered a change in system configuration.*	System design, implementation. CSP contract/service agreement. See also paragraph C.3.1.3, surveillance availability criteria.
MA-1b	When the ADS-C or FMC WPR service no longer meets the requirements for the intended function, the ground system shall provide indication to the controller.	System design, implementation. CSP contract/service agreement. See also paragraph C.3.1.3, surveillance availability criteria.
MA-2	When the controller receives an indication that the ADS-C or FMC WPR service no longer meets the requirements for the intended function (e.g. reduced longitudinal separation), the controller shall take action to resolve the situation, (e.g. apply an alternative form of separation).	System design, procedures, implementation

RSP related safety requirements		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: ANSP**
Ref	**Related Surveillance Parameter**	**Safety requirement**
All	A, C, I	*Note.— Safety requirements related to RSP 180/D are the same as those related to RCP 240/D, unless otherwise modified in this table. See Appendix B, paragraph B.3.1.2.*

C.3.1.3 Communication service provider (CSP)

Note.— The RSP allocations for the CSP are intended to aid the ANSP and the aircraft operator in the development of contracts and service agreements.

RSP data transit time and continuity criteria			
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**		**Component: CSP**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance means**
RSTP Time Allocation			
$RSTP_{CSP}$	170	84	Contract/service agreement terms. Pre-implementation demonstration

RSP availability criteria			
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**		**Component: CSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms
Unplanned outage duration limit (min)	10	10	Contract/service agreement terms
Maximum number of unplanned outages	4	48	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	52	520	Contract/service agreement terms
Unplanned outage notification delay (min)	5	5	Contract/service agreement terms
Note.— The RSP availability criteria for RSP 180/D are the same as those provided for RCP 240/D. See Appendix B, paragraph B.3.1.3.			

RSP integrity criteria		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: CSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Not specified	Contract/service agreement terms. Per surveillance related safety requirements SR-26 for the ANSP and SR-26 for the aircraft system, the end system is required include provisions, consistent with the overall data integrity criteria, to mitigate the effects of errors introduced by the network. These provisions require the network to pass protected information (or data) to the end system without manipulating the protected information (or data) it passes. *Note.— In formulating contract terms with the CSP, the ANSP and/or operator may specify an integrity value and other related criteria, as appropriate, for the network, including subnetworks, that will ensure acceptable data integrity, consistent with the assumptions used to define the end system provisions (e.g. CRC or Fletcher's checksum).*

C.3.1.4 Aircraft system

RSP data transit time and continuity criteria			
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft system**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95%(sec) C = 95%**	**Compliance Means**
RSTP Time Allocation			
$RSTP_{AIR}$	5	3	Pre-implementation demonstration

RSP availability criteria			
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft system**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR} (probability)	N/A	0.999	Analysis, architecture, design, pre-implementation demonstration
Note.— The surveillance availability criteria for RSP 180/D are the same as those provided for RCP 240/D. See Appendix B, paragraph B.3.1.4.			

RSP integrity criteria		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft system**

Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level (e.g. Level C software) commensurate with integrity level, pre-implementation demonstration. See also related safety requirement SR-26 for the aircraft system.

RSP monitoring and alerting criteria		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft system**

Ref:	**Criteria**	**Compliance means**
MA-1a	The aircraft system shall be capable of detecting aircraft system failures or loss of air/ground communication that would cause the aircraft surveillance capability to no longer meet the requirements for the intended function.	System design, implementation
MA-1b	When the aircraft surveillance capability no longer meets the requirements for the intended function, the aircraft system shall provide indication to the flight crew.	System design, implementation

RSP related safety requirements		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft system**

Ref	**Related Surveillance Parameter**	**Safety requirement**
All	A, C, I	*Note.— Safety requirements related to RSP 180/D are the same as those related to RCP 240/D, unless otherwise modified in this table. See Appendix B, paragraph B.3.1.4.*

C.3.1.5 Aircraft operator

RSP data transit time and continuity criteria			
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft operator**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance Means**
RSTP Time Allocation			
$RSTP_{AIR}$	5	3	Aircraft type design approval, maintenance, properly configured user-modifiable software (e.g. owner requirements table)
$RSTP_{CSP}$	170	84	CSP contract/service agreement. See also paragraph C.3.1.3. Pre-implementation demonstration.

RSP availability criteria			
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft operator**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR} (probability)	N/A	0.999	Aircraft type design approval, maintenance, properly configured user-modifiable software (e.g. owner requirements table or airline policy file).
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms. Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph C.3.1.3, RSP 180/D allocation to CSP for surveillance availability criteria.

RSP integrity criteria		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft operator**

Integrity parameter	Integrity value	Compliance means
Integrity (I)	Malfunction = 10^{-5}	Aircraft type design approval, establish procedures, training, and qualification to meet safety requirements. CSP contract/service agreement. See also surveillance integrity criteria for CSP, paragraph C.3.1.3.

RSP monitoring and alerting criteria		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft operator**

Ref:	Criteria	Compliance means
MA-2	When the flight crew determines that the aircraft surveillance capability no longer meets the requirements for the intended function, the flight crew shall advise the ATC unit concerned.	Procedures, flight crew training and qualification

RSP related safety requirements		
Specification: RSP 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft operator**

Ref	Related Surveillance Parameter	Safety requirement
All	C, I	*Note.— Safety requirements related to RSP 180/D are the same as those related to RCP 240/D. See Appendix B, paragraph B.3.1.5.*

C.4 RSP 400 specification

<table>
<tr><th colspan="7">RSP specification</th></tr>
<tr><td colspan="4">RSP specification</td><td colspan="3">RSP 400</td></tr>
<tr><td colspan="7">Airspace specific considerations</td></tr>
<tr><td>Interoperability</td><td colspan="6">Specify interoperability criteria (e.g. FANS 1/A)</td></tr>
<tr><td>ATS Function</td><td colspan="6">Specify ATS function(s) (e.g. applicable separation standard)</td></tr>
<tr><td>Application</td><td colspan="6">Specify the required surveillance capability. FMC WPR or, for ADS-C, specify the types of contracts required to support the ATS function (e.g. periodic contract at [nn] min, waypoint change event contract, lateral deviation event contract at [n] NM).</td></tr>
<tr><td colspan="7">Surveillance parameter values</td></tr>
<tr><td>Transit time (sec)</td><td>Continuity (C)</td><td rowspan="5"></td><td>Availability (A)</td><td colspan="3">Integrity (I)</td></tr>
<tr><td>OT = 400</td><td>C(OT) = 0.999</td><td rowspan="4">0.999</td><td colspan="2">Navigation FOM</td><td>See <u>Note 3</u>.</td></tr>
<tr><td rowspan="3">DT 95% = 300</td><td rowspan="3">C(DT 95%) = 0.95</td><td colspan="2">Time at position accuracy</td><td>+/- 1 sec (UTC)</td></tr>
<tr><td colspan="2">Data integrity</td><td>Malfunction = 10^{-5} per flight hour</td></tr>
<tr></tr>
<tr><td colspan="7">Surveillance monitoring and alerting criteria</td></tr>
<tr><td>Ref</td><td colspan="6">Criteria</td></tr>
<tr><td>MA-1</td><td colspan="6">The system shall be capable of detecting failures and configuration changes that would cause the ADS-C or FMC WPR service to no longer meet the surveillance parameter values for the intended function.</td></tr>
<tr><td>MA-2</td><td colspan="6">When the ADS-C or FMC WPR service can no longer meet the surveillance parameter values for the intended function, the flight crew and/or the controller shall take appropriate action.</td></tr>
<tr><td colspan="7">Notes</td></tr>
<tr><td colspan="7"><u>Note 1</u>.— Rationale for the criteria provided in this specification can be found in ICAO Annex 11, ICAO Doc 4444, ICAO Doc 9689, and RTCA DO-306/ED-122.
<u>Note 2</u>.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the surveillance parameter values, this would be considered a change in system configuration.
<u>Note 3</u>.— The navigation figure of merit (FOM) is specified based on the navigation criteria associated with this spec. For example, if RNP 10 is prescribed, then for ADS-C surveillance service, the FOM level would need to be 3 or higher. In all cases, when the navigation capability no longer meets the criteria specified for the operation, the flight crew is responsible for reporting the non-compliance to ATC in accordance with ICAO procedures.</td></tr>
</table>

C.4.1 RSP 400/D allocations

C.4.1.1 General

C.4.1.1.1 The RSP 400/D allocations can be applied to the ADS-C or FMC WPR applications.

C.4.1.2 Air navigation service provider (ANSP)

RSP data transit time and continuity criteria			
Specification: RSP 400/D	**Application: ADS-C, FMC WPR**		**Component: ANSP**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance Means**
Delivery Time Value	400	300	Analysis, CSP contract/service agreement. See also paragraph C.4.1.3.
RSTP Time Allocation			
$RSTP_{ATSU}$	30	15	Pre-implementation demonstration

RSP availability criteria			
Specification: RSP 400/D	**Application: ADS-C, FMC WPR**		**Component: ANSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph C.4.1.3, RSP 180/D allocation to CSP for surveillance availability criteria.*

Note.— The RSP integrity criteria, monitoring and alerting criteria, and related safety requirements for RSP 400/D are the same as the criteria provided for RSP 180/D. See paragraph C.3.1.2.

C.4.1.3 Communication service provider (CSP)

Note.— The RSP allocations for the CSP are intended to aid the ANSP and the aircraft operator in the development of contracts and service agreements.

RSP data transit time and continuity criteria			
Specification: RSP 400/D	**Application: ADS-C, FMC WPR**		**Component: CSP**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance Means**
RSTP Time Allocation			
$RSTP_{CSP}$	340	270	Contract/service agreement terms. Pre-implementation demonstration

RSP availability criteria			
Specification: RSP 400/D	**Application: ADS-C, FMC WPR**		**Component: CSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms
Unplanned outage duration limit (min)	N/A	20	Contract/service agreement terms
Maximum number of unplanned outages	N/A	24	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	N/A	520	Contract/service agreement terms
Unplanned outage notification delay (min)	N/A	10	Contract/service agreement terms
Note.— The RSP availability criteria for RSP 400/D are the same as those provided for RCP 400/D. See Appendix B, paragraph B.4.1.3.			

RSP integrity criteria		
Specification: RSP 400/D	**Application: ADS-C, FMC WPR**	**Component: CSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— RSP integrity criteria related to RSP 400/D are the same as those related to RSP 180/D. See paragraph C.3.1.3.*	

C.4.1.4 Aircraft system

RSP data transit time and continuity criteria			
Specification: RSP 400/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft system**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance Means**
RSTP Time Allocation			
RSTP$_{AIR}$	30	15	Pre-implementation demonstration

Note.— The RSP availability, integrity and monitoring and alerting criteria, and related safety requirements for RSP 400/D are the same as the criteria and related safety requirements provided for RSP 180/D. See *paragraph C.3.1.4*.

C.4.1.5 Aircraft operator

RSP data transit time and continuity criteria			
Specification: RSP 400/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft operator**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance Means**
RSTP Time Allocation			
RSTP$_{AIR}$	30	15	Aircraft type design approval, maintenance, properly configured user-modifiable software (e.g. owner requirements table)
RSTP$_{CSP}$	340	270	CSP contract/service agreement. See also paragraph C.4.1.3. Pre-implementation demonstration.

Note.— The RSP availability, integrity and monitoring and alerting criteria, and related safety requirements for RSP 400/D are the same as the criteria and related safety requirements provided for RSP 180/D. See *paragraph C.3.1.5*.

Appendix D Post-implementation monitoring and corrective action

D.1 General

D.1.1 The ICAO Global Plan calls for the implementation of a performance based system and ICAO Annex 11 requires that data link system performance is monitored to verify that an acceptable level of safety continues to be met. Annex 11 at paragraph 2.2.7.5 states:

> "Any significant safety-related change to the ATC system, including the implementation of a reduced separation minimum or a new procedure, shall only be effected after a safety assessment has demonstrated that an acceptable level of safety will be met and users have been consulted. When appropriate, the responsible authority shall ensure that adequate provision is made for post-implementation monitoring to verify that the defined level of safety continues to be met."

D.1.2 For continental European airspace, EC Regulation 29/2009 (the DLS IR) stipulates:

> "The quality of service of air-ground data link communications should be regularly monitored by ATS Providers".

D.1.3 It also states:

> "ATS providers shall monitor the quality of service of communication services and verify their conformance with the level of performance required".

D.1.4 The CPDLC system, data link system (ATN or FANS 1/A) and A/G radio links (SATCOM, VDL M2, etc) must operate successfully as a whole to ensure smooth CPDLC operations and to verify that an acceptable level of safety continues to be met. As such a *central* function performing the overall monitoring of normal data link operations, service disruptions and restorations not only at the level of communication service provision but also at CPDLC, data link system and A/G radio link level, will be needed to:

- guarantee performance and inter-operability;
- investigate problems;
- share lessons learned.

D.1.5 Without such a central function this may prove difficult to achieve. This function will need to continue once the data link service is in place to guarantee capacity, performance and inter-operability in the years following successful implementation.

D.1.6 Oversight of the compliance to the Annex 11 requirements is a matter for the States. However, States participate in planning and implementation regional groups (PIRGs), and most use a regional monitoring agency to facilitate monitoring activities within their respective region. The individual states/ANSPs will need to provide the data and information and analysis that will portray regional performance measures. The ANSPs, operators, CSPs, airframe manufacturers, and equipment suppliers all need to participate in reporting and resolving problems associated among the ANSPs and with aircraft.

D.1.7 While individual ANSP will develop the data collection mechanisms, monitoring tools, and internal reporting requirements best suiting their own environment, all ANSP should collect and maintain a database of performance data using the data formats specified in this appendix. These databases will provide the means to aggregate ADS-C surveillance transit time and CPDLC RCP transaction time on a regional and global basis.

D.1.8 Monitoring of data communications performance in terms of RCP and RSP is an important part of the performance based system described in the ICAO global plan. To successfully achieve this performance monitoring on a global scale will require the use of a common data set. It is only through this common data set that RCP and RSP data can be aggregated from an ANSP level through to a regional monitoring agency level and then to global level. This aggregation of performance data is in accordance with the guidelines provided in ICAO Doc 9883 Manual on Global Performance of the Air Navigation System.

D.1.9 In addition to monitoring data communications performance future development of data link communications applications would be assisted if existing message use statistics were available. ANSP should maintain message use statistics.

D.1.10 This appendix contains the following guidance material:

a) ANSP data collection and analysis - This section defines a common data reporting format. Guidance material is included on how to obtain the required data points from the FANS 1/A ACARS and ATN B1 messages and on the calculation of actual communication performance (ACP), actual communication technical performance (ACTP), pilot operational response time (PORT), actual surveillance performance (ASP), and how they are calculated. Examples of the type of analysis that can be carried out at an ANSP level are also included. Issues regarding data filtering are discussed including guidance on how to manage this.

b) Problem reporting and resolution – This section provides guidance on the problem identification and resolution process

c) Regional performance monitoring – This section provides guidance on the monitoring of ADS-C actual surveillance performance and CPDLC actual communication performance at a regional level.

D.2 ANSP data collection and analysis

D.2.1 General

D.2.1.1 Data link performance requirements for the application of reduced separation standards, as defined in ICAO Doc 4444, are contained in the following documents:

a) RTCA DO-306/EUROCAE ED-122 – Oceanic SPR standard. These requirements are specified in terms of RCP and RSP.

b) RTCA DO-290/EUROCAE ED-120 – Continental SPR standard. The EUR instantiation of DO290/ED120 comprises the performance requirements for DLIC (Logon and Contact) and CPDLC (ACM, ACL).

Note.— The intention is to specify an RCP type for ACM and ACL-Controller initiated messages for the EUR region. An update of DO-290/ED-120 is expected.

D.2.1.2 ANSP that are currently monitoring data link performance have found that a monthly monitoring interval usually provides enough data points to detect any performance variation and is adequate for post implementation monitoring.

D.2.2 ANSP data collection for CPDLC application

D.2.2.1 General

D.2.2.1.1 This section provides guidance on data collection and performance measurement for the CPDLC application.

D.2.2.1.2 For procedural airspace, the measurements are taken from CPDLC ground-initiated transactions.

D.2.2.1.3 For EUR continental airspace, the following measurements are taken:

a) DLIC-contact transactions;

b) CPDLC ground-initiated and air-initiated transactions.

Note.— Air-initiated and ground initiated transactions will be analysed separately since they have different performance requirements (refer to Appendix B).

D.2.2.2 Measuring CPDLC communication performance

D.2.2.2.1 CPDLC analysis is based on the calculation of actual communication performance (ACP) used to monitor RCP time allocation for communication transaction (TRN), actual communications technical performance (ACTP) used to monitor required communication technical performance (RCTP) time allocation, and pilot operational response time (PORT) used to monitor the responder performance criteria of the transaction.

Note.— For EUR Region, ANSPs that provide data link service to FANS 1/A aircraft, monitor the performance of ATN aircraft separately from FANS1/A aircraft as the underlying technology is different.

D.2.2.2.2 CPDLC controller-initiated transactions

D.2.2.2.2.1 The analysis uses the measurement of transit and response times to a subset of CPDLC uplinks that receive a single DM 0 WILCO response. Responses not measured are where an uplink receives DM 1 UNABLE, DM 2 STANDBY, DM 3 ROGER, DM 4 AFFIRM, DM 5 NEGATIVE responses. A DM 0 WILCO response following a DM 2 STANDBY is also not measured. The rationale behind this is that the critical communications requirement is provided by intervention messages when applying reduced separation standards. Incorporating other message types such as free text queries, information requests not requiring a DM 0 WILCO response, messages with DM 1 UNABLE responses, or DM 2 STANDBY responses followed by DM 0 WILCO, or non-intervention re-route messages UM 79, UM 80, and UM 83 will skew the observed data because of the longer response times from the flight deck.

D.2.2.2.2.2 Typically all intervention messages with a W/U response attribute, except for non-intervention route messages (UM 79, UM 80, UM 81, UM 82, UM 83, UM 84, UM 91, and UM 92), contact instructions (UM 117 – UM 123) and UM 116 "RESUME NORMAL SPEED" messages are assessed. Data analysis has shown that Pilot Operational Response Time (PORT) to these non-intervention messages can be significantly skewed and will significantly impact measured ACP. However, the removal of all contact instructions (UM 117 – UM 123) will drastically reduce the monthly data set for some smaller ANSP and make it difficult to assess ACTP for individual fleets or aircraft on a monthly basis. For this reason some ANSP retain these (UM 117 – UM 123) transactions when assessing ACTP. ANSP should decide on a data set that provides them with the best performance modeling for their operation.

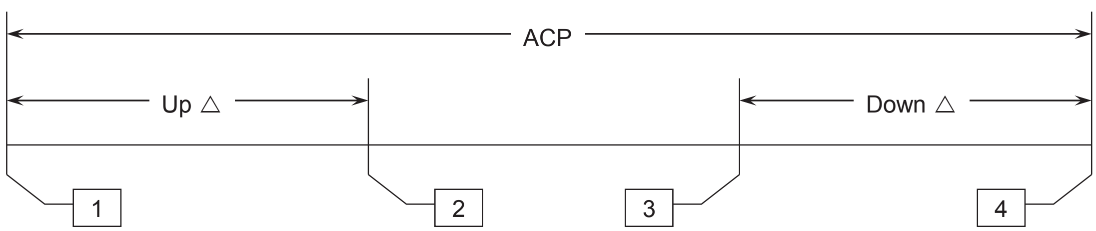
Note.— The EUR region measures all implemented controller–initiated messages, including all received responses.

D.2.2.2.2.3 To calculate ACP, the difference between the times that the uplink message is originated at the ANSP to the time that the corresponding response downlink is received at the ANSP is used.

D.2.2.2.2.4 To calculate ACTP, the difference between the downlink's aircraft time stamp and the received time is added to half the round trip time determined by the difference between the uplink time when the message is sent from the ANSP and the receipt of the MAS response for the uplink at the ANSP ((uplink transmission time – MAS receipt)/2 + downlink time).

D.2.2.2.2.5 The EUR region measures ACTP by taking the difference between the MAS/LACK reception time and CPDLC Uplink message transmission time. The uplink messages are associated with their corresponding MAS/LACKs through the use of the CPDLC Message Reference Number (See Figure D- 2).

D.2.2.2.2.6 PORT is calculated by the difference between ACP and ACTP. Figure D- 1 illustrates these measurements.



1. Uplink Sent. This is the date/time that the CPDLC clearance was sent to the aircraft.
2. MAS Received. This is the date/time that the MAS for the CPDLC clearance was received.
3. WILCO Sent. This is the date/time that the WILCO reply is transmitted.
4. WILCO Received. This is the date/time that the WILCO reply for the CPDLC clearance was received.

The measurements (in seconds) are calculated as follows:

$$\text{ACP} = (\text{WILCO\_Received}) - (\text{Uplink\_Sent}) \quad \rightarrow \textbf{TRN}$$

$$\text{ACTP} \cong \left(\left(\frac{\text{Up}\Delta}{2} \right) + (\text{Down}\Delta) \right) \quad \rightarrow \textbf{RCTP}$$

$$\text{PORT} \cong \text{ACP} - \text{ACTP} \quad \rightarrow \textbf{Responder}$$

Figure D- 1. CPDLC transaction calculations

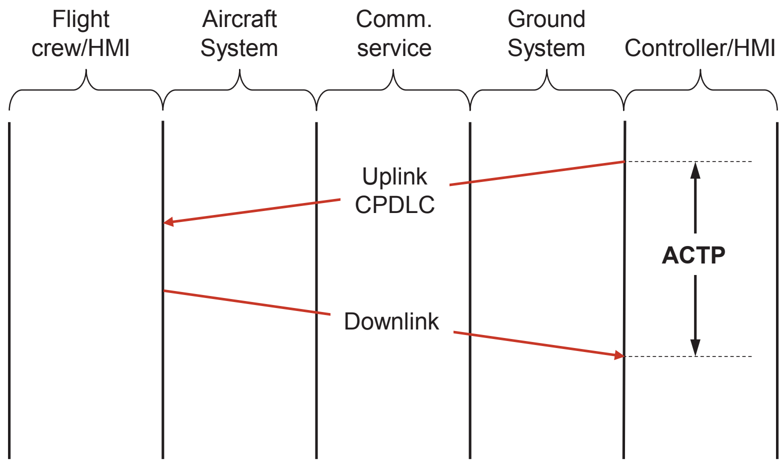


Figure D- 2. EUR Region – ACTP measurement

D.2.2.2.2.7 The values for ACTP and PORT are only approximations. Uplink transit times are estimated by taking half the time for the MAS/LACK response round trip. This assumption is flawed in a small percentage of cases because we know it is possible for the MAS to be received at the ANSP after the operational response is received; or for the timestamp on the operational response to be earlier than the MAS receipt time. This will happen if the CSP does not hear the network ACK from the aircraft (which is sent on uplink receipt) and resends the uplink later. The CSP receives the network ACK to this second uplink and sends the MAS to the ANSP. In the meantime, the aircraft has already responded with the operational response. ANSP will see this issue reflected in their data with crew response times with negative or extremely small values. All transactions with zero or negative crew response times should be filtered from data prior to analysis. The time sequence diagram below in Figure D- 2 illustrates the issue. Errors can also arise if there are delays between the ANSP and the CSP on the uplink path. These delays will result in excessive calculated PORT and skewed ACP.

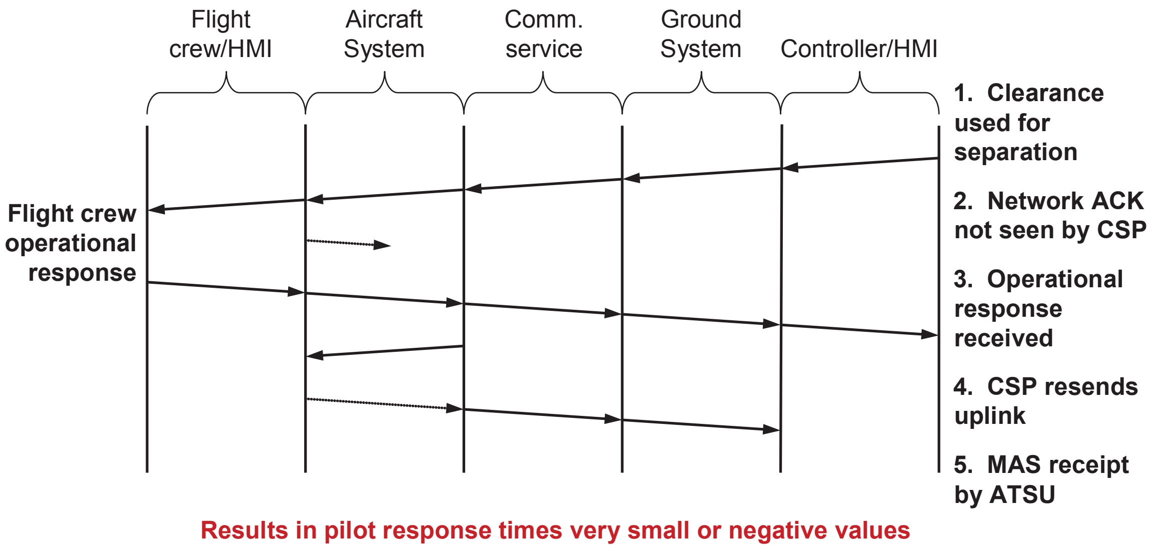


Figure D- 3 Issue with estimating uplink transit time as half MAS roundtrip

D.2.2.2.3 CPDLC flight crew-initiated transactions

D.2.2.2.3.1 The EUR region measures the transit and response times to a subset of CPDLC downlinks that receive a single UNABLE or Clearance response.

D.2.2.2.3.2 To calculate ACP, the difference between the time in the header of the LACK message acknowledging the response to the time in the CPDLC header of the downlinked request message. Figure D- 4 illustrates the measurements.

Note.— The time provided in the header of the LACK message, sent from the aircraft, can be considered as giving a fairly accurate indication of when the associated uplink response has been processed and is available to the flight crew.

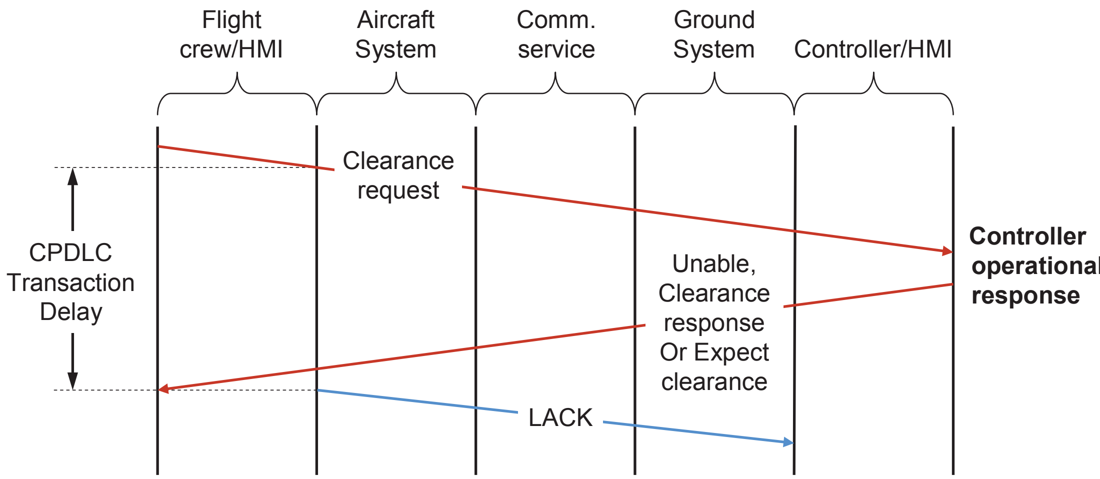


Figure D- 4 Flight crew-initiated ACP delay

D.2.2.2.4 DLIC contact transactions

D.2.2.2.4.1 The EUR region measures the DLIC-Contact transaction delay. The ACP is calculated by the difference between the Contact response reception time and the Contact request transmission time as is illustrated in Figure D- 4.

Note.— It is not possible to accurately measure DLIC-Logon transactions. Moreover, a logon is normally initiated well in advance of establishing a CPDLC connection with the first ATSU.

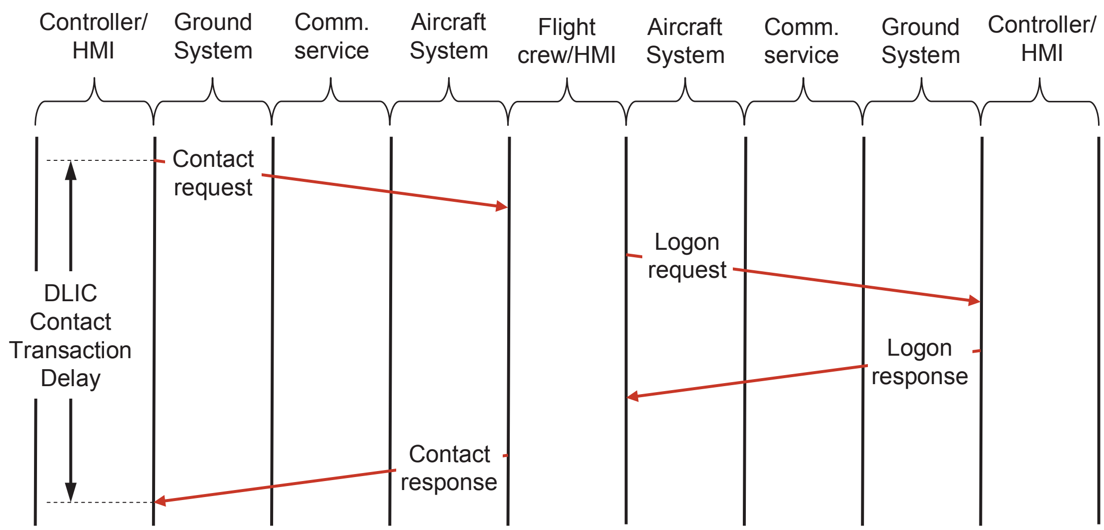


Figure D- 5 DLIC Contact transaction

D.2.2.3 Recording the data points for each CPDLC transaction

D.2.2.3.1 The following data points in Table D-1 are recommended as the minimum set that should be extracted from ANSP data link system recordings to enable RCP analysis and provide sufficient information for problem analysis. This does not preclude individual ANSP from extracting additional data points for their own analysis requirements and some possibilities are listed below. To obtain these data points ANSP should note that they will require additional database information to enable the aircraft type and operator to be obtained by correlation to the aircraft registration extracted from the data link recordings. All of the other data points are extracted from either the ACARS or ATN B1 header or the CPDLC application message.

Table D-1 CPDLC data collection points

Ref	Label	Description and/or remarks
1	ANSP	The four letter ICAO designator of the facility (e.g. NZZO).
2	Aircraft registration (FANS 1/A)	The aircraft registration in ICAO Doc 4444 Format (no hyphens, packing dots, etc.) (e.g. N104UA). *<u>Note</u>.— Extracted from ACARS header or application message.*
2	Aircraft address (ATNB1)	The 24 bit address in ICAO Doc4444 Format (alphanumerical character, in six hexadecimals) *<u>Note</u>.— Extracted from CM application message.*
3	Aircraft type designator	The ICAO aircraft type designator (e.g. B744). *<u>Note</u>.— Extracted from ANSP database using aircraft registration as key.*
4	Operator designator	The ICAO designator for the aircraft operating agency (e.g. UAL). *<u>Note</u>.— Extracted from ANSP database using aircraft registration as key.*
5	Date	In YYYYMMDD format (e.g. 20081114). *<u>Note</u>.— Extracted from ANSP system data recording time stamp, synchronized to within 1 second of Universal Time Coordinated (UTC).*
6	MAS RGS	Designator of the RGS that MAS downlink was received from (e.g. POR1). *<u>Note</u>.— This is a 3 or 4 letter designator extracted from the ACARS header DT line.*
7	OPS RGS	Designator of the RGS that the operational response was received from (e.g. AKL1). *<u>Note</u>.— This is a 3 or 4 letter designator extracted from the ACARS header DT line.*
8	Uplink time	The timestamp on the uplink CPDLC message sent by the ANSP in HH:MM:SS format (e.g. 03:43:25). *<u>Note</u>.— Extracted from ANSP system data recording time stamp, synchronized to within 1 second of UTC.*
9	MAS/LACK receipt time	The ANSP timestamp on receipt of the MAS/LACK in HH:MM:SS format (e.g. 03:43:35). *<u>Note</u>.— Extracted from ANSP system data recording time stamp, synchronized to within 1 second of UTC.*

Ref	Label	Description and/or remarks
10	MAS/LACK round trip time	In seconds (#9-#8) (e.g. 10).
11	Aircraft FMS time stamp	In the operational response messages in HH:MM:SS (e.g. 03:44:15). *Note.— For FANS 1/A, extracted from the ATCmessageHeader timestamp in the decoded operational response message. See RTCA DO-258AEUROCAE ED-100A section 4.6.3.3.*
12	ANSP timestamp on the receipt of the operational response	In HH:MM:SS (e.g. 03:44:45). *Note.— Extracted from ANSP system data recording time stamp, synchronized to within 1 second of UTC.*
13	Operational message round trip time	From sending uplink (#8) to receipt of operational response (#12) in seconds (e.g. 80).
14	Downlink response transit time	In seconds (#12-#11) (e.g. 30).
15	Uplink message elements	All uplink message element identifier preceded by U encapsulated between quotation marks with a space between each element (e.g. "U118 U80") *Note.— Extracted from the decoded operational uplink that initiated the transaction.*
16	Downlink message elements	All downlink message elements encapsulated between quotation marks with a space between each element if required (e.g. "D0") *Note.— Extracted from the decoded operational downlink.*
17	ACTP	Actual communication technical performance in seconds (e.g. 35). *Note.— Truncated to whole seconds.*
18	ACP	Actual communications performance in seconds measured as the difference between time uplink sent (#8) to operational response received (#12) (e.g. 80).
19	PORT	Pilot Operational Response Time = ACP (#18) - ACTP(#17) (e.g. 45). *Note.— Implementers should allow for negative values where the operational response is received before the MAS as per Figure D- 3 above. When graphing PORT negative values should be counted as 0.*

D.2.2.3.2 ANSP may find that the following additional data may be useful for performance analysis:

a) The aircraft call sign extracted from either the Flight Plan (e.g. ANZ123) or the logon request message for the flight (e.g. NZ123) or the FI line in the ACARS header (e.g. NZ0123);

b) Direction of flight calculated by the flight data processor and displayed as a three figure group representing degrees true (e.g. 275); and

c) The estimated position in latitude and longitude of the aircraft when a CPDLC downlink is sent. Calculated by the flight data processor. For consistency the following formats are recommended: For latitude use “+” for North or “-” for South followed by a decimal number of degrees (e.g. -33.456732). For longitude use “+” for East or “-” for West followed by a decimal number of degrees (e.g. +173.276554).

d) The data link communications type (COMTYP). Extracted from the MAS RGS and OPS RGS identifying the media used for the uplink and downlink message. There are nine possible entries for COMTYP: SAT, VHF, HF, SV, SH, VS, VH, HS, HV. Value is based on the MAS RGS field (#6) and OPS RGS (#7) and are listed in Table D-2.

e) The regional CRA should consider promulgating a list of RGS designators that are applicable to their region.

Table D-2. Determination of COMTYP indicators

MAS RGS Communication Type	OPS RGS Communication Type	COMTYP
SAT (e.g. MAS RGS = POR1)	SAT (e.g. OPS RGS = POR1)	SAT
VHF (e.g. MAS RGS = ADK)	VHF (e.g. OPS RGS = ADK)	VHF
HF (e.g. MAS RGS = H02)	HF (e.g. OPS RGS = H02)	HF
SAT (e.g. MAS RGS = POR1)	VHF (e.g. OPS RGS = ADK)	SV
SAT (e.g. MAS RGS = POR1)	HF (e.g. OPS RGS = H02)	SH
VHF (e.g. MAS RGS = ADK)	SAT (e.g. OPS RGS = POR1)	VS
VHF (e.g. MAS RGS = ADK)	HF (e.g. OPS RGS = H02)	VH
HF (e.g. MAS RGS = H02)	VHF (e.g. OPS RGS = ADK)	HV
HF (e.g. MAS RGS = H02)	SAT (e.g. OPS RGS = POR1)	HS

D.2.2.3.3 For ATN B1 and FANS 1/A service provision in EUR Region, the following additional data should be provided:

a) ***DLIC Initiation Logon Counts***. The number of unsuccessful logon attempts, the number of successful logon attempts followed by the establishment of a CPDLC connection, and the number of successful logon attempts that are not followed by the establishment of a CPDLC connection.

b) ***Continuity for DLIC-Contact and CPDLC ground-initiated and air-initiated transactions***. As the performance requirements are different for ground-initiated transactions and air-initiated transactions, the actual probability for Continuity is calculated separately for ground-initiated and air-initiated transactions

c) ***Availability (Use)***. The number of Provider Aborts experienced by the ANSP and manually reported availability problems affecting a single aircraft.

Note.— Measuring actual probability of A(USE) according to formal definition is problematic. An acceptable indication is by counting the number of provider aborts (The Air-Ground connectivity is lost after 6 minutes)

d) ***Availability(Provision)***. Defined as Actual hours of CPDLC Operations / Planned Hours of CPDLC Operations, where:

1) ***Actual hours*** of CPDLC Operations = Planned Hours of CPDLC Operations - Accumulated declared unplanned service outages.

2) ***Planned Hours of CPDLC Operations*** = 24x7 operations over a certain period – planned service outages

3) ***Accumulated declared unplanned service outages*** = sum of all partial failures (affecting multiple aircraft) or total failure (affecting all aircraft) over a certain period.

4) ***Unplanned service outages*** affecting more than one aircraft are due to problems, originated from, for example, FDP, ACSP, VDL GS, router.

e) ***Deployment indicators*** using:

1) ***Fleet Equipage***. The percentage of the aircraft fleet equipped to use CPDLC.

2) ***Fleet Usage***. The percentage of the aircraft fleet equipped to use CPDLC that are actually using CPDLC operationally.

f) ***System health indicators***, using:

1) ***User Aborts***. The number of user aborts.

2) ***Error messages***. The number of different types of error message.

3) ***Message Usage***. The number of different ACL and ACM messages sent.

4) ***Transport level (TP4) retries (ATN B1)***. The number of uplink retries per ground end-system identifying which aircraft were involved, along with the ratio of the number of uplink TP4 retransmissions to the number of successfully transmitted Data TPDUs per ground end- system. Monitoring the rate of TP4 retries for each system on the ground and identifying which aircraft are involved will allow the identification of problems occurring within the network/ground system or with a particular aircraft.

Note.— A TP4 retry could occur as the result of i) temporary delays , ii) unavailability of a component of the network, iii) a dysfunctional VDL handoff or iv) a problem in an end- system (ATSU or avionics).

5) ***Failed transport connection attempts (ATN B1)***. The number of failed transport connection attempts measured per ground end-system identifying which aircraft were involved. Monitoring the number of failed attempts to establish a transport level connection will give an indication of problems with the slightly longer term availability of one of the end-systems or the underlying network.

6) ***TP4 Round Trip Delay (ATN B1)***. The time taken from the transmission of a Data TPDU to its acknowledgement.

g) ***Inconsistency in flight plan and log on association***. The number of inconsistencies found in flight plan - logon association criteria (i.e. aircraft registration/aircraft address, data link equipment and capability in item 10a).

ANSP may find that the following additional data may be useful for performance analysis:

h) ***Air-ground VDLM2 data***. CSP sends VDLM2 data to the CRO, which may be supplemented with VDLM2 data from ANSPs for VDLM2 frequency capacity planning and problem investigation.

D.2.2.4 Data record for each CPDLC transaction

D.2.2.4.1 If required for regional monitoring agency analysis CPDLC transaction data as described above may be sent to the regional/State monitoring agency at as a comma delimited text file. The format for each record will at minimum contain the 20 data points specified in Table D-1. Using the example in the previous paragraph the data record for the transaction described above in comma delimited format is:

NZZO,N104UA,B744,UAL,20081114,POR1,AKL1,03:43:25,03:43:35,10,03:44:15,03:44:45,80,30,"U118 U80","D0",35,80,45

D.2.2.4.2 Guidance on the type of analysis carried out at an ANSP or regional level is provided later in paragraphs D.2.4 and D.3.1.

D.2.2.4.3 Because different ANSPs may use different data sets for analysis within their area of interest the data sent to a regional state monitoring agency should at minimum contain all transactions that contain a WILCO response. The regional monitoring agency will filter transactions as agreed by their regional forum.

D.2.3 ANSP data collection for ADS-C application

D.2.3.1 General

D.2.3.1.1 This section provides guidance on data collection and performance measurement for the ADS-C application.

D.2.3.2 Measuring actual surveillance performance (ASP)

D.2.3.2.1 The analysis of actual communication performance (ASP) is based on the measurement of the transit times of the ADS-C periodic and event reports between the aircraft and the ANSP ground system. This is measured as the difference between the time extracted from the decoded ADS-C basic group timestamp when the message originated from the FMS and the time the message is received at the ANSP.

D.2.3.3 Recording the ADS-C data points for each ADS-C downlink

D.2.3.3.1 The following data points in Table D-3 are recommended as the minimum set that should be extracted from ANSP data link system recordings to enable an analysis of ADS-C performance and provide sufficient information for problem analysis. This does not preclude individual ANSP from extracting additional data points for their own analysis and some possibilities are listed below. To obtain all of these data points ANSP should note that they will require additional database information to enable the Aircraft Type and Airline to be obtained by correlation to the aircraft registration extracted from the data link recordings. All of the other data points are extracted from either the ACARS header or the ADS-C application message.

Table D-3 ADS-C data collection points

Ref	Label	Description and/or remarks
1	ANSP	The four letter ICAO designator for the facility (e.g. NZZO).

Ref	Label	Description and/or remarks
2	Aircraft Registration	The aircraft registration in ICAO Doc 4444 Format (no hyphens, packing dots, etc.) (e.g. N104UA). *<u>Note</u>.— Extracted from ACARS header or application message.*
3	Aircraft Type Designator	The ICAO aircraft type designator (e.g. B744). *<u>Note</u>.— Extracted from ANSP database using aircraft registration as key.*
4	Operator Designator	The IATA designator for the aircraft operating agency (e.g. UAL). *<u>Note</u>.— Extracted from ANSP database using aircraft registration as key.*
5	Date	In YYYYMMDD format (e.g. 20081114). *<u>Note</u>.— Extracted from ANSP system data recording time stamp, synchronized to within 1 second of UTC.*
6	RGS	Designator of the RGS that ADS-C downlink was received from (e.g. POR1). *<u>Note</u>.— This is a 3 or 4 letter designator extracted from the ACARS header DT line.*
7	Report Type	The type of ADS-C report extracted from the ADS-C basic group report tag where tag value 7=PER, 9=EMG, 10=LDE, 18=VRE, 19=ARE, 20=WCE. As some aircraft concatenate more than one report in the same downlink extract the ADS-C report tag from each ADS-C basic group and identify them in the REP_TYPE column by using the first letter of the report type as an identifier (e.g. for a concatenated report containing two ADS-C basic groups for a periodic report and a waypoint event report the field will contain PW). Where a downlink does not contain an ADS-C basic group, the REP_TYPE field will be left blank.
8	Latitude	The current latitude decoded from the ADS-C basic group. The format is “+” for North or “-“ for South followed by a decimal number of degrees (e.g. -33.456732).
9	Longitude	The current longitude decoded from the ADS-C basic group. The format is “+” for East or “-“ for West followed by a decimal number of degrees (e.g. +173.276554).
10	Aircraft Time	The time the ADS-C message was sent from the aircraft in HH:MM:SS (e.g. 03:44:15). *<u>Note</u>.— Decoded from the ADS-C basic group timestamp extracted as seconds since the most recent hour. See RTCA DO-258A/EUROCAE ED-100A, section 4.5.1.4.*
11	Received Time	The ANSP timestamp on the receipt of the ADS-C message in HH:MM:SS (e.g. 03:44:45). *<u>Note</u>.— Extracted from ANSP system data recording time stamp, synchronized to within 1 second of UTC.*
12	Transit Time	The transit time of the ADS-C downlink in seconds calculated as the difference between #10 Aircraft Time and #11 Received Time (e.g. 30).

D.2.3.3.2 ANSP may find that the following additional data may be useful for performance analysis:

a) The aircraft call sign extracted from either the Flight Plan (e.g. ANZ123), the AFN logon for the flight (e.g. NZ123) or the FI line in the ACARS header (e.g. NZ0123).

b) Direction of flight calculated by the ANSP flight data processor and displayed as a three figure group representing degrees true (e.g. 275).

c) The current altitude (e.g. 35,000) decoded from the ADS-C basic group. The altitude combined with the latitude, longitude, and time provide the aircraft position at the time the report was generated. Aircraft movement data is needed in airspace safety assessments and/or airspace safety monitoring analyses. Inclusion of altitude in the GOLD data sample would allow for GOLD data to be used for both data link performance monitoring and airspace safety monitoring analyses,

d) ADS-C predicted position latitude and longitude and time when available. (Note.— time decoded from the ADS-C predicted group where timestamp is extracted as seconds since the most recent hour. (See RTCA DO-258A section 4.5.1.4)) For consistency the following formats are recommended: For latitude use "+" for North or "-" for South followed by a decimal number of degrees (e.g. -33.456732). For longitude use "+" for East or "-" for West followed by a decimal number of degrees (e.g. +173.276554).

e) The data link communications type (COMTYP) based on the RGS field (#6). Satellite (SAT), Very High Frequency (VHF), High Frequency (HF). Refer to Table D-2.

D.2.3.4 Data record for each ADS-C downlink

D.2.3.4.1 If required for regional/State monitoring agency analysis ADS-C transaction data as described above may be sent to the regional regional/State monitoring agency as a comma delimited text file. The format for each record will at minimum contain the 12 data points specified in Table D-2. Using the example in the previous paragraph the data record for the transaction described above in comma delimited format is:

NZZO,N104UA,B744,UAL,20081114,POR1,PER,-33.456732,+173.276554,03:44:15,03:44:45,30

D.2.3.4.2 Guidance on the type of analysis carried out at an ANSP or regional level is provided later in paragraphs D.2.4 and D.3.1.

D.2.4 ANSP data analysis

D.2.4.1 General

D.2.4.1.1 To enable adequate system performance monitoring ANSP should at minimum perform a monthly analysis of CPDLC RCP and ADS-C performance data. This monitoring will verify system performance and also enable continuous performance improvement by detecting where specific aircraft or fleets are not meeting the performance standards.

D.2.4.1.2 While this analysis could be carried out by a regional monitoring agency, it is thought the analysis will be more efficient if done by the ANSP. It is the ANSP that will usually have the operational expertise and local area knowledge that is important when identifying problems from any data analysis.

At least one region has had considerable success by using some of the regional ANSP to complete a monthly data analysis and reporting the identified problems to the regional monitoring agency for resolution.

D.2.4.1.3 A regional monitoring agency is best suited to manage problems reported from the ANSP analysis, and to develop actual regional performance figures from information supplied by the ANSP. Analysis by the individual ANSP will also avoid the regional monitoring agency having to manage a large quantum of data that the ANSP already holds.

D.2.4.2 Graphical analysis

D.2.4.2.1 It is recommended that ANSP perform a graphical analysis of the performance data gathered. This graphical analysis is useful for depicting in a readily assimilated fashion actual performance, and has proved extremely useful when identifying performance problems.

D.2.4.2.2 Monitoring can be completed at a number of levels and similar levels can be used for both CPDLC and ADS-C performance monitoring. The following structure is recommended:

a) Monitoring Communication Media Performance. An analysis of:

    1) Data from all aircraft via all Remote Ground Station (RGS) types.

    2) Data from all aircraft via SATCOM RGS

    3) Data from all aircraft via VHF RGS

    4) Data from all aircraft via HF RGS

    5) Data from all aircraft via HF and SATCOM RGS

Note.— The monitoring of combined HF and SATCOM data is to allow verification that the performance obtained from those aircraft using HFDL for downlinks only when SATCOM is not available does not degrade performance by an unacceptable level.

b) Monitoring Airline Fleet Performance. An analysis of:

    1) The observed performance of each type of aircraft operated by an operator:

        i) Via SATCOM

        ii) Via SATCOM + HF

        iii) Via HF

        iv) Via VHF

        v) Via All RGS

    2) Comparative analysis of the observed performance from the same type of aircraft from different operators.

Note.— When measuring CPDLC performance for a specific media type(s) then only those transactions where both the RGS for the MAS and the RGS of the operational response are from that media type would be measured. Mixed media transactions such as where the MAS is received via a VHF RGS and the operational response is via a SATCOM RGS would be excluded from a SATCOM analysis. Mixed media transactions would be counted in the SATCOM + HF, and All RGS analysis above.

D.2.4.3 Data filtering

D.2.4.3.1 It is important that consistent data filtering is employed to ensure that all ANSP measure against the same baseline. Raw data obtained from the ANSP recordings will include delayed transactions measured during periods of system outage and these should not be used when assessing CPDLC transaction time or surveillance data transit time. The data may also include duplicated messages which will also skew the measurements if not removed. This data should be filtered from the raw data before any performance assessment is made.

D.2.4.3.2 System Outages

D.2.4.3.2.1 In accordance with the provisions of paragraph 3.1.3, the ANSP should ensure that the service level agreement with their CSP includes a requirement for the reporting of all system outages that will affect the delivery of traffic to and from the ANSP. CSP reporting should include for each outage:

a) Type of outage and the media affected;

b) Outage start time;

c) Outage end time; and

d) Duration of Outage.

D.2.4.3.2.2 The raw data should be checked for any delayed transactions observed during system outages. These delays are easily identified during outages that have been notified by the CSP, but the data should be carefully reviewed for outages that have not been notified. Delays observed from multiple aircraft where the downlinks completing the transactions are received at similar times indicate a system outage. CPDLC transactions and surveillance data delivery measurements during these outage periods should be removed. A typical outage not notified by any DSP is illustrated in Table D- 4 showing ADS-C downlink delays from 3 aircraft between 1120 and 1213.

Table D- 4. ADS-C outages not notified

Aircraft registration	Aircraft time	ANSP system time	Downlink time (Seconds)
ZK-SUI	11:55:38	12:12:52	1034
ZK-SUI	11:44:42	12:12:19	1657
ZK-SUJ	11:41:54	12:12:01	1807
ZK-SUJ	11:26:18	12:09:42	2604
ZK-SUI	11:23:21	12:08:32	2711
ZK-SUJ	11:20:34	12:07:39	2825
ZK-OKG	11:53:52	12:12:51	1139

D.2.4.3.3 Duplicated ADS-C reports

D.2.4.3.3.1 Numerous instances of duplicate ADS-C reports are observed in FANS-1/A data records. A particular report is often duplicated with the second and sometimes third record duplicated at some later time as illustrated in Table D- 5. These duplicate records will skew ADS-C surveillance data delivery measurements and should be removed.

Table D- 5. ADS-C duplicate reports

LAT_LON	Aircraft time	ANSP system time	Downlink time (Seconds)
350225S1694139E	22:29:45	22:31:04	79
350225S1694139E	22:29:45	22:34:56	311
350225S1694139E	22:29:45	22:40:05	620

D.2.4.4 CPDLC performance analysis

D.2.4.4.1 Monitoring of CPDLC performance involves an assessment of ACP, ACTP, and PORT by a graphical analysis of data using the structure outline in paragraph D.2.4.2.

D.2.4.4.2 Monitoring communications media performance

D.2.4.4.2.1 Graphs illustrating ACP and ACTP are used to assess CPDLC transaction performance through the various communications media. Since PORT is independent of media this would normally only be assessed over one media. The graphs depict measured performance against the TRN and RCTP requirements at the 95% and 99.9% level and would be completed for the performance specifications in use (e.g. RCP 240, RCP 400). An analysis is completed for:

a) Data from all aircraft via all remote ground station (RGS) types.

b) Data from all aircraft via SATCOM RGS

c) Data from all aircraft via VHF RGS

d) Data from all aircraft via HF RGS

e) Data from all aircraft via HF and SATCOM RGS

D.2.4.4.2.2 A typical graph illustrating SATCOM ACTP performance constructed using a spreadsheet application is illustrated in Figure D- 6. Similar graphs are used to assess ACTP and ACP for other communications media.

D.2.4.4.2.3 Figure D- 6 graphs ACTP against the 95% 120” and 99.9% 150” requirements of the RCP240 specification for the years 2009-2012 as observed in the NZZO FIR.

D.2.4.4.2.4 Figure D- 7 and Figure D- 8 illustrate other methods of reporting performance.

D.2.4.4.2.5 Data transactions used for the measurement of SATCOM, VHF, and HF ACTP and ACP are where both the MAS and operational response are received via the media being assessed. The exception to this is the assessment of combined HF and SATCOM performance where any transaction involving HF or SATCOM is used.

D.2.4.4.2.6 Similar graphs are used to assess ACTP and ACP for other communications media.

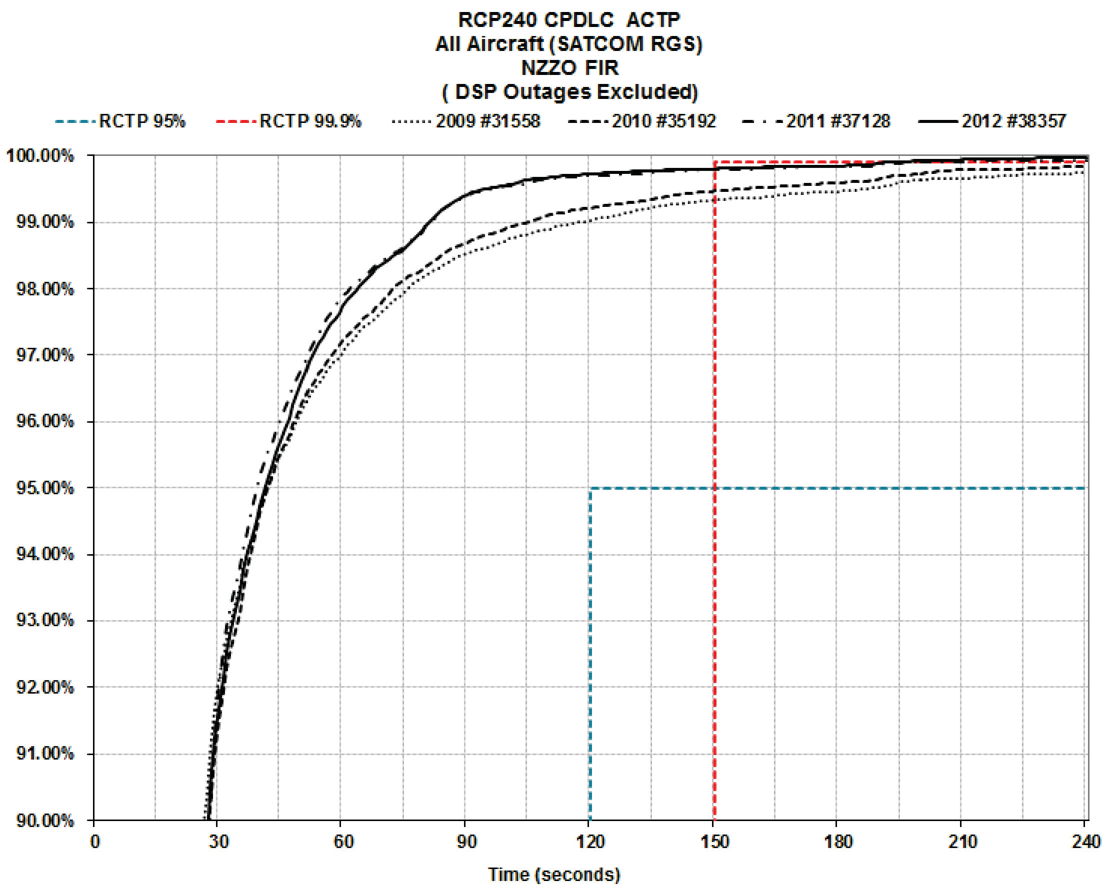


Figure D- 6. CPDLC ACTP performance - Example 1 graphical by year

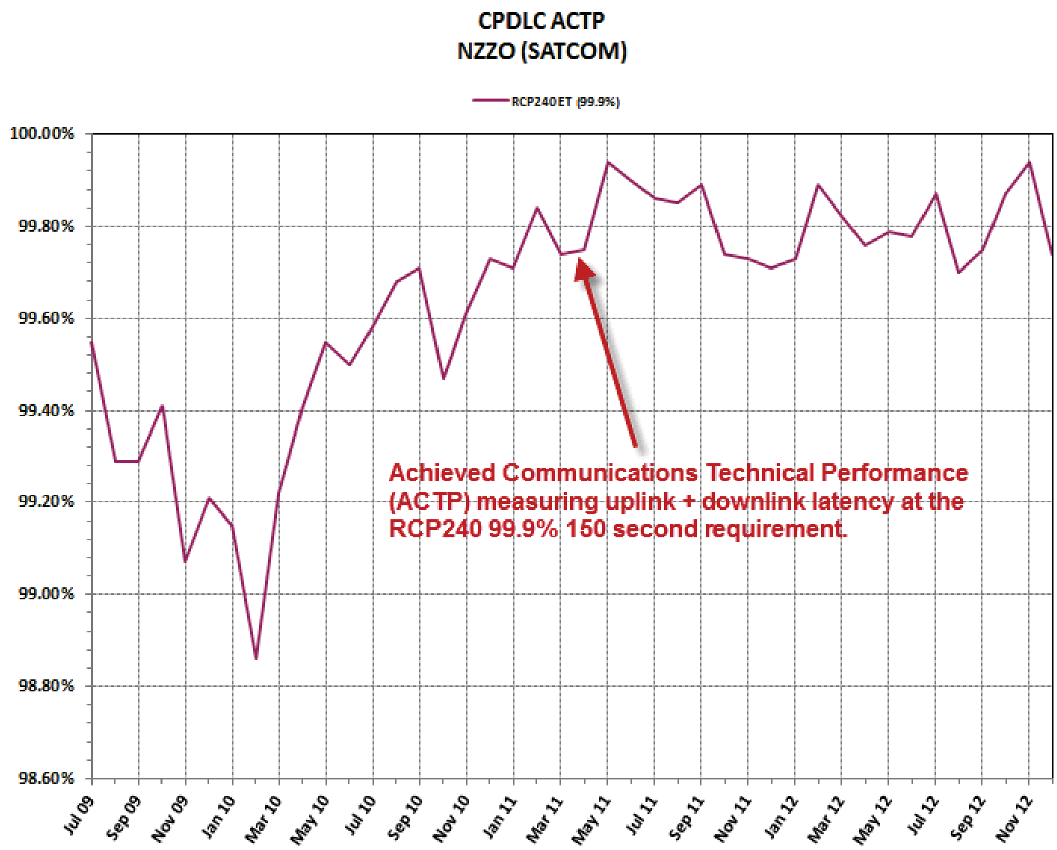


Figure D- 7 CPDLC ACTP performance – Example 2 graphical Analysis by Month

Operator	Type	# Messages	% of Total	RCTP 95% 120sec	RCTP 99.9% 150 sec
DDD	B772	457	13.08%	100.00%	100.00%
OOO	B77W	414	11.85%	100.00%	100.00%
XXX	B744	392	11.22%	100.00%	100.00%
GGG	B744	218	6.24%	100.00%	100.00%
VVV	B772	118	3.38%	100.00%	100.00%
SSS	A388	104	2.98%	100.00%	100.00%
AAA	A343	85	2.43%	100.00%	100.00%
YYY	B77W	76	2.18%	100.00%	100.00%
UUU	A388	67	1.92%	100.00%	100.00%
RRR	B772	63	1.80%	100.00%	100.00%
MIL	VARIOUS	60	1.72%	100.00%	100.00%
FFF	B772	59	1.69%	100.00%	100.00%
A2F	A332	50	1.43%	100.00%	100.00%
KKK	B744	43	1.23%	100.00%	100.00%
JJJ	A332	37	1.06%	100.00%	100.00%
A2E	A333	36	1.03%	100.00%	100.00%
TTT	A333	34	0.97%	100.00%	100.00%
HHH	B744	31	0.89%	100.00%	100.00%
A2C	B744	92	2.63%	98.91%	100.00%
OTHER	VARIOUS	31	0.89%	93.55%	100.00%
MMM	A332	258	7.38%	98.84%	99.61%
ZZZ	A343	219	6.27%	99.54%	99.54%
QQQ	B77W	155	4.44%	99.35%	99.35%
PPP	B77W	220	6.30%	98.18%	98.64%
NNN	B744	114	3.26%	97.37%	97.37%
A2D	A332	61	1.75%	91.80%	93.44%

Figure D- 8 CPDLC ACTP performance – Example 3 tabular analysis for a month

D.2.4.4.3 Monitoring airline fleet performance

D.2.4.4.3.1 Graphs illustrating ACP, ACTP, and PORT can be used to monitor the performance of each aircraft type in an operator's fleet. These should be maintained on a monthly basis and can be used to observe the performance of each type when using different media such as: via SATCOM; via SATCOM + HF; via HF; via VHF; and via all RGS. A SATCOM ACP analysis between 2009-2012 for a B744 fleet operating in the NZZO FIR is illustrated in Figure D- 10.

D.2.4.4.3.2 Figure D- 10 graphs CPDLC ACP against the 95% 180" and 99.9% 210" requirements for RCP240 annual aggregates for the years 2009-2012. Performance variations may be observed from month to month and these variations can be monitored over a number of months to detect any significant performance degradation that should be investigated further. Typical monthly variations are depicted in Figure D- 10. Performance variations in any month may be the result of poor performance from an individual aircraft or may simply be the result of routes changing month to month with varying weather patterns. Any significant degradation may be investigated further using an analysis of individual tails in a fleet as discussed in paragraph D.2.4.6.

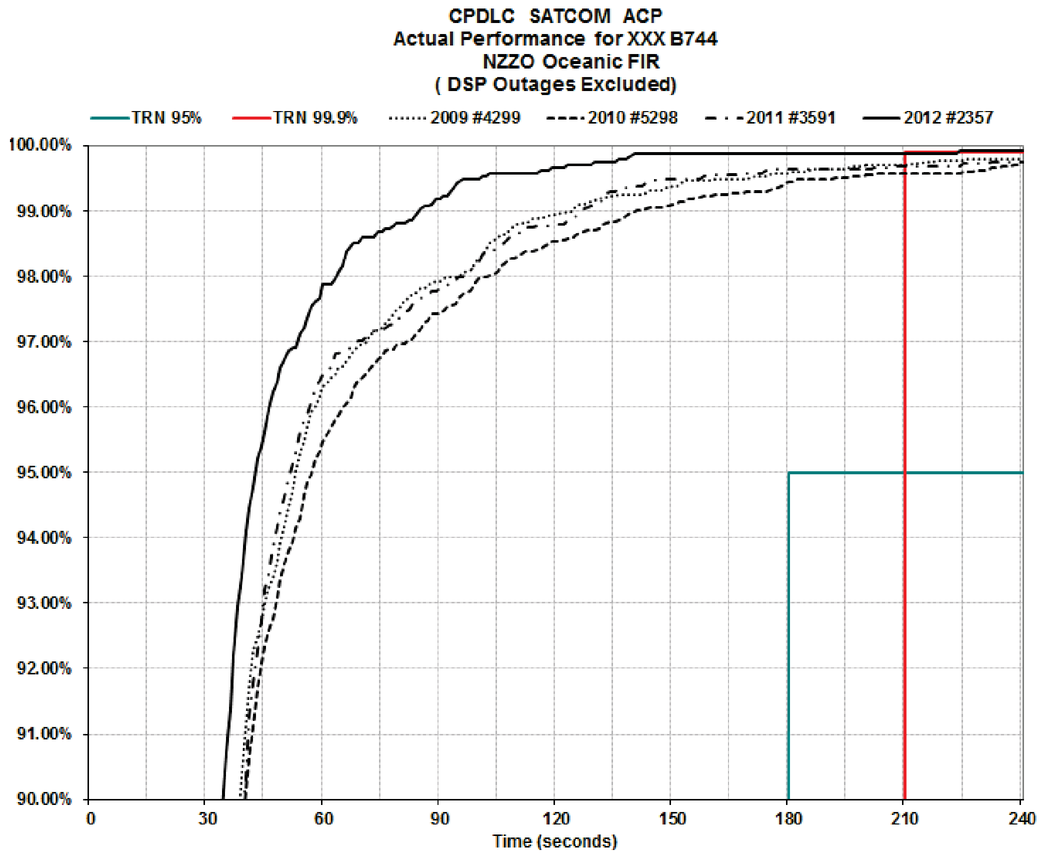


Figure D- 9 CPDLC ACP Airline XXX B744 2009-2012

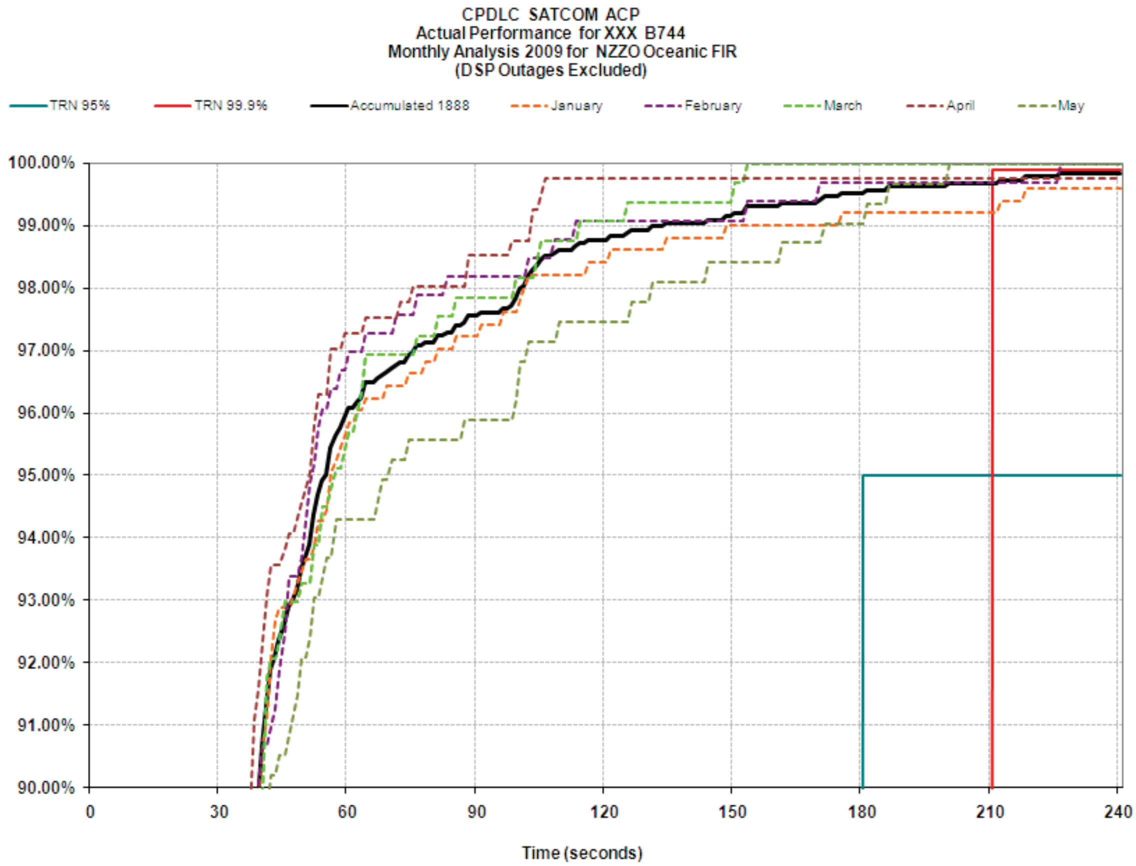


Figure D- 10. Typical monthly variation in CPDLC ACP

D.2.4.4.3.3 A comparative analysis of the performance of different fleets operating in an ATSU's airspace particularly of fleets of the same type is useful. Under performing fleets can be identified for further analysis and a picture of typical performance from all fleets can be built up. These can be compared with the same fleets operating in other ATSUs' airspace.

D.2.4.4.3.4 Figure D- 11 graphs SATCOM ACTP for a number of fleets operating in NZZO FIR during 2012. Significant variations in observed performance should be flagged for further analysis as discussed in paragraph D.2.4.6.

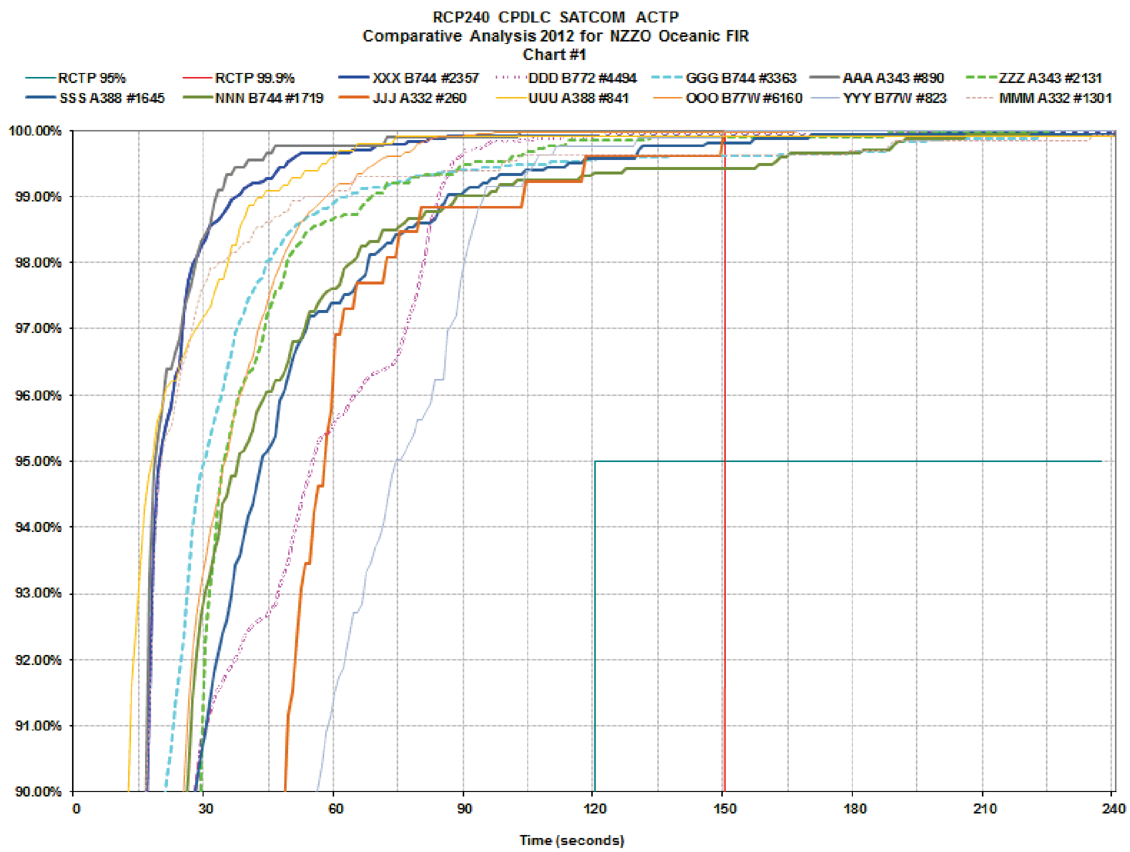


Figure D- 11. CPDLC ACTP comparative operator type performance

D.2.4.5 ADS-C surveillance data transit time analysis

D.2.4.5.1 Monitoring of ADS-C surveillance data transit time involves an assessment of observed delay from a graphical analysis of data using the structure outlined in paragraph D.2.4.2.

D.2.4.5.2 Monitoring communications media performance

D.2.4.5.2.1 Graphs illustrating ADS-C surveillance data transit time are used to assess performance through the various communications media. The graphs depict measured performance against the surveillance requirements at the 95% and 99.9% level. An analysis is completed for:

a) Data from all aircraft via all remote ground station (RGS) types.

b) Data from all aircraft via SATCOM RGS

c) Data from all aircraft via VHF RGS

d) Data from all aircraft via HF RGS

e) Data from all aircraft via combined HF and SATCOM RGS

D.2.4.5.2.2 A typical graph illustrating ADS-C surveillance data transit time observed from SATCOM and constructed using a spreadsheet application is illustrated in Figure D- 12. Similar graphs are used to assess delay through individual communications media.

D.2.4.5.2.3 Figure D- 12 graphs ADS-C surveillance data transit time against the 95% 90-second and 99.9% 180-second requirements for the RSP specification provided in Appendix C, paragraph C.3 using the ADS-C transactions recorded during the period 2009 -2012 in the NZZO FIR.

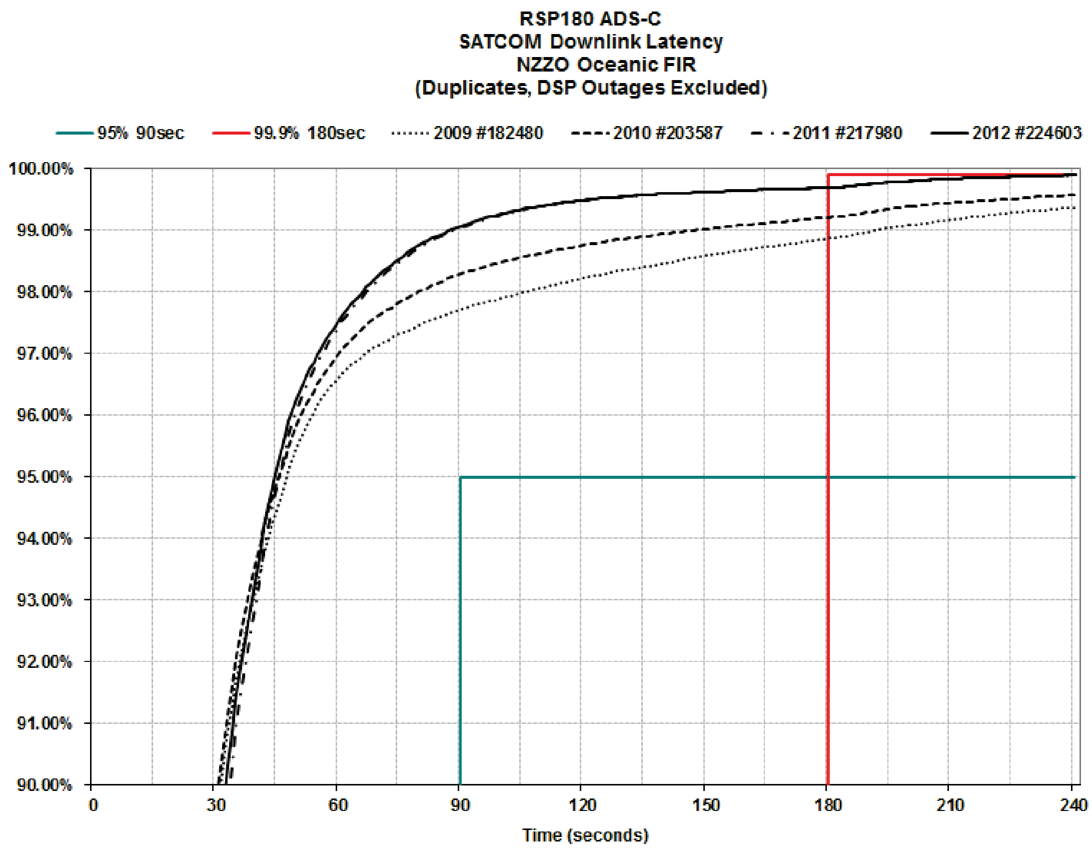


Figure D- 12. ADS-C via SATCOM NZZO FIR 2009 – 2012

D.2.4.5.3 Monitoring operator fleet performance

D.2.4.5.3.1 Graphs illustrating ADS-C surveillance data transit time can be used to monitor the performance of each aircraft type in an operator's fleet. These should be maintained on a monthly basis and can be used to observe the performance of each type when using different media such as: via SATCOM; via SATCOM + HF; via HF; via VHF; and via all RGS. The January to May 2009 SATCOM delay analysis of the A343 fleet for an operator in the NZZO FIR is illustrated in Figure D- 13.

D.2.4.5.3.2 Figure D- 13 graphs ADS-C surveillance data transit time against the 95% 90-second and 99.9% 180-second requirements for RSP 180D using the 3195 ADS-C downlinks recorded for the fleet during the period January-May 2009. Considerable performance variation may be seen month to month on some fleets and significant degradation in any month may be the result of poor performance from an individual aircraft or may be the result of routes changing month to month with varying weather patterns. These may be investigated further using an analysis of individual tails in a fleet as discussed in D1.3.5 below. The fleet illustrated shows little variation between the months and for clarity only the high and low months are depicted. Over a number of years a representative picture of the expected performance for a fleet will emerge. This assists in detecting any performance degradation. Figure D- 14 illustrates observed yearly performance for the same fleet from 2009-2012.

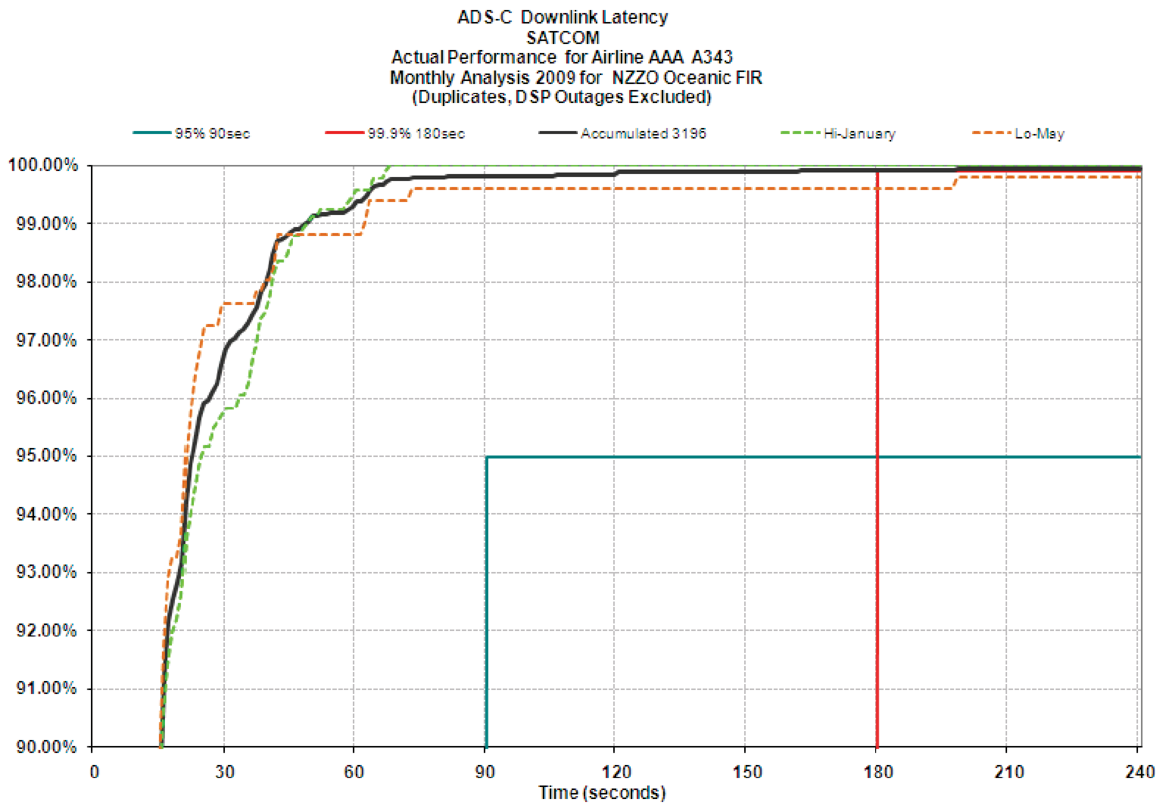


Figure D- 13. ADS-C A343 AAA via SATCOM NZZO FIR Jan – May 2009

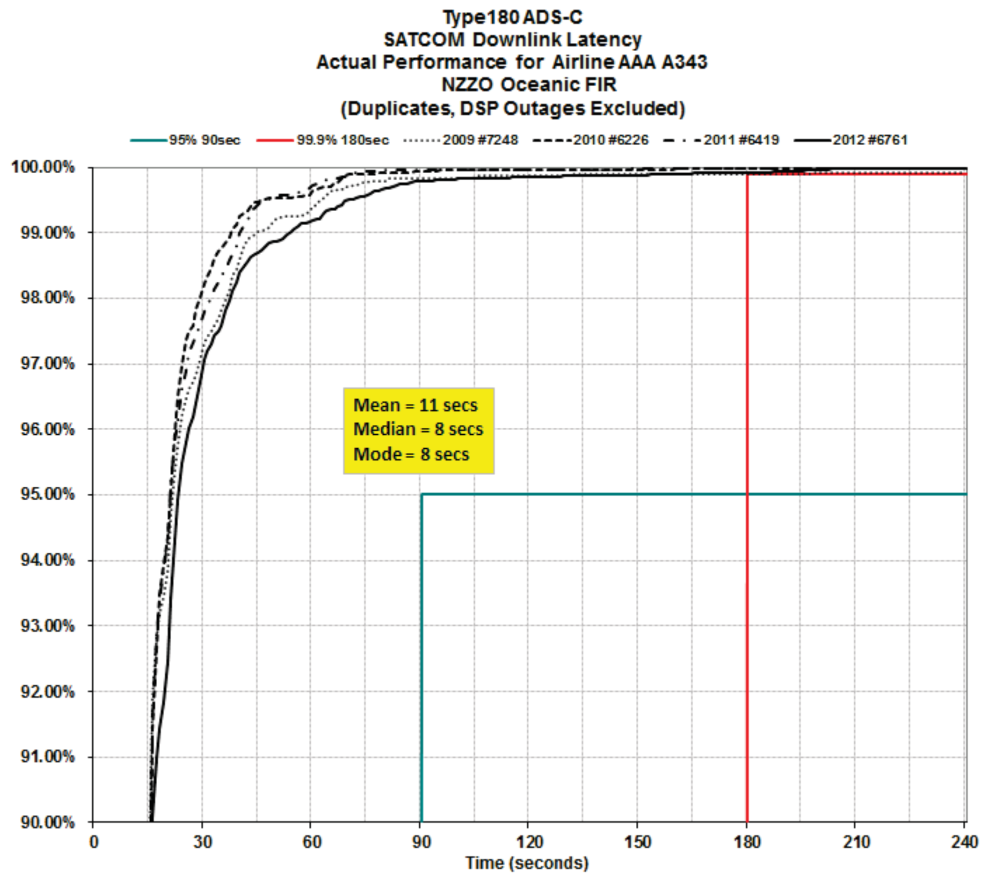


Figure D- 14 ADS-C A343 AAA via SATCOM NZZO FIR 2009-2012

D.2.4.5.3.3 A comparative analysis of the performance of different fleets operating in an ATSU's airspace particularly of fleets of the same type is useful. Under performing fleets can be identified for further analysis and a picture of typical performance from all fleets can be built up. These can be compared with the same fleets operating in other ATSUs' airspace.

D.2.4.5.3.4 Figure D- 15 below graphs SATCOM transit times for a number of fleets operating in NZZO FIR for the period January – May 2009. Significant variations in observed performance such as with operator DDD B772 fleet can be flagged for further analysis as discussed in paragraph D.2.4.6.

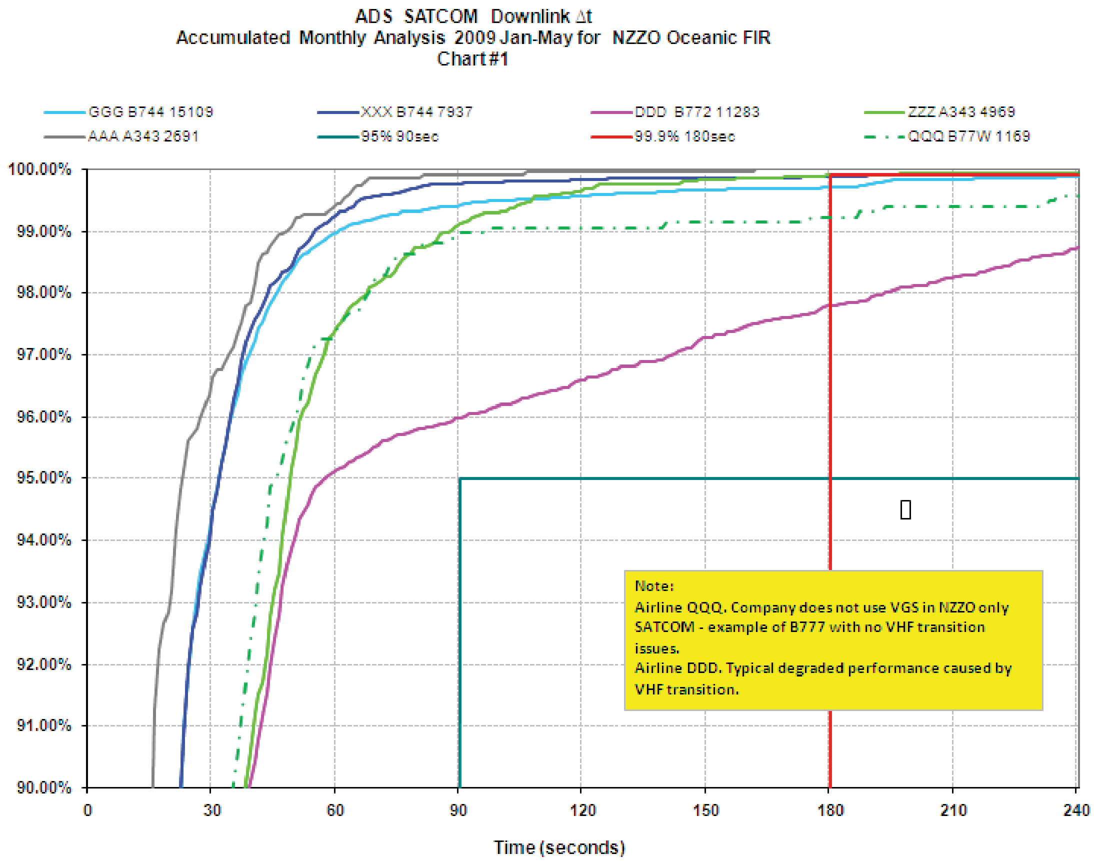


Figure D- 15. Comparative SATCOM ADS-C for different operators

D.2.4.5.3.5 The issue affecting operator DDD B772 fleet in Figure D- 15 was identified by the regional CRA as an aircraft issue that affected all B777 aircraft. This was eventually resolved by a software upgrade. ANSP should note that software upgrades to aircraft may take some time to be implemented by all airlines. The current performance of operator DDD B772 fleet is depicted in Figure D- 16.

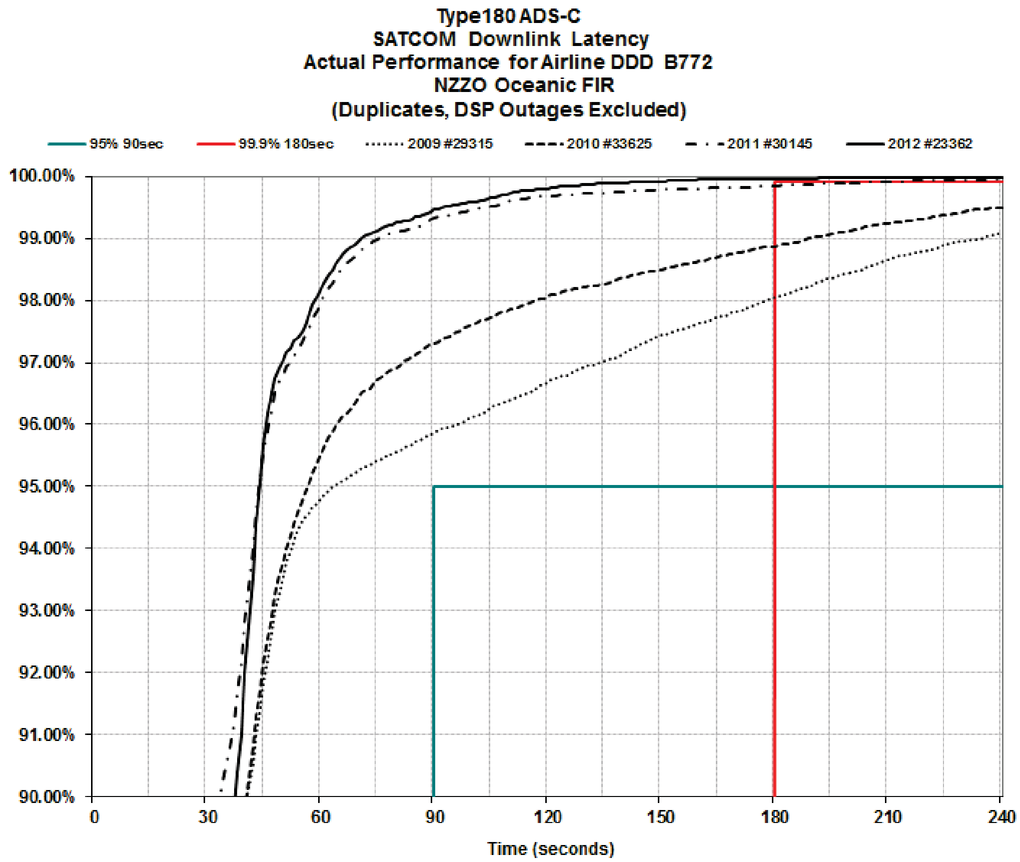


Figure D- 16 SATCOM ADS-C Operator DDD B777 2009-2012

D.2.4.6 Identifying poor performers

D.2.4.6.1 The reasons behind degraded performance are many and varied. Considerable analysis may be required before the reasons behind poor performing fleets are identified and it is difficult to provide guidance for all situations. Some analysis techniques that have been used by some ANSP with some success to identify reasons behind poor performance are provided in the following paragraphs.

D.2.4.6.2 On a number of occasions poor performance has been attributed to a specific aircraft in a fleet. Usually these poor-performing aircraft can be identified by the visual inspection of monthly data ordered in terms of transit time, or more accurately by graphing the monthly data for a fleet by aircraft registration.

D.2.4.6.3 Techniques such as graphing the positions of all delayed messages on a geographical display have identified areas for further investigation.

D.2.4.6.4 There are low speed (600 bps and 1200 bps) and high speed (10500 bps) data rates defined for the P, R, and T SATCOM channels. Some aircraft are capable of low speed SATCOM only. Other aircraft are capable of both high speed and low speed. However, not all aircraft that are capable of high speed operation have enabled the use of high speed SATCOM and, instead operate in low speed only. It is recommended an operator using low speed SATCOM channels change to the high speed channels where possible. Low or high speed channel use is selectable by an individual operator in the aircraft operational requirements table (ORT).

D.2.4.6.5 Significant performance benefits accrue with the use of the high speed channels as illustrated in the figure D-10 below.

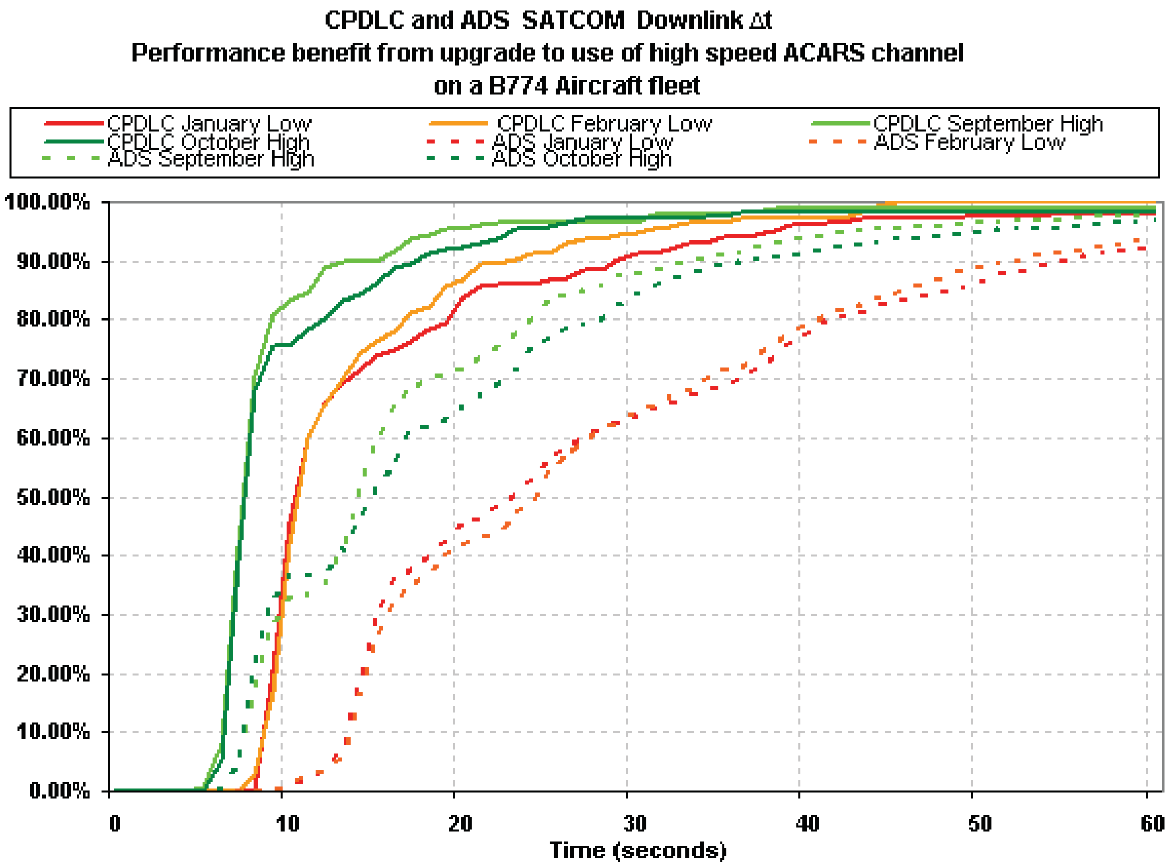


Figure D- 17. Effect of ACARS channel speed on ADS-C surveillance data transit time

D.2.4.6.6 An ANSP can assess ACARS channel speed use by evaluating the monthly downlink times for ADS-C reports via SATCOM. For users of high speed channels ANSP will consistently see a small percentage of reports in the 6-8 second time bands. Low speed channels users usually have very few reports less than 10 seconds.

D.2.4.6.7 ANSP should identify those operators using the low speed channels and stakeholders should work with those operators to achieve an upgrade to the high speed channels.

D.2.4.7 Assessing periodic monitoring results

D.2.4.7.1 The 95% and 99.9% criteria are provided as operationally significant benchmarks against which the surveillance and communication applications supporting ATM functions can be assessed.

D.2.4.7.2 Typically post implementation monitoring is carried out on a monthly basis and observed performance assessed to detect any performance degradation.

D.2.4.7.3 99.9% criteria

D.2.4.7.3.1 The 99.9% criteria define the Expiry Time (ET) for communication transactions and the Overdue Time (OT) for surveillance transactions following which the initiator is required to revert to an alternative procedure. When using data link to provide reduced separations, the RCP240 ET and RSP180 OT are the times after which if a CPDLC intervention transaction is not completed or an ADS-C position report is not received, then the controller is obliged to revert to alternative separation procedure as defined in the separation specification. If monthly monitoring shows that a specific fleet is not meeting the criteria then a local safety assessment by the ANSP should be carried out to assess if the reduced separation standard can continue to be applied. Some ANSP have set monitoring guidelines as to trigger a safety assessment and further investigation. The safety assessment would consider the density of traffic and traffic patterns flown in the region together with the frequency of application of the reduced separation to assess whether the increased probability of having to revert to an alternative separation would have workload and thus safety implications for the controllers. The safety assessment would also consider the performance of other fleets operating in the airspace.

D.2.4.7.4 95% criteria

D.2.4.7.4.1 The 95% criteria define the nominal time acceptable for normal CPDLC and ADS-C operations. If monthly monitoring shows that measured performance is consistently below the 95% criteria then consideration may be given to the withdrawal of data link services to the fleet. Experience has shown that observed fleet performance below the specified RCP240/RSP180 95% criteria will usually be accompanied by controller complaints of unacceptable performance by that fleet.

D.2.4.7.5 Setting guidelines

D.2.4.7.5.1 In airspace where procedural separation is being applied, it has been observed that complete withdrawal of data link may not be required even if performance is observed to fall below the RCP240/RSP180 criteria. While safety services such as reduced separation standards requiring RCP240/RSP180 would be withdrawn the observed performance may still meet RCP/RSP400 criteria and the local safety assessment may also conclude that maintaining the data link connection is viable.

D.2.4.7.5.2 Some ANSP have set monitoring guidelines to assist with their data analysis. These include:

a) If the performance observed for a fleet by monthly monitoring at the 99.9% level is better than 99.75% then the fleet is considered to meet the 99.9% performance level.

b) Observed fleet performance consistently falling below 99.0% will be subject to CRA problem reports and investigation that will attempt to determine the cause of the degradation.

c) Any monthly performance degradation (0.5%) by a fleet below observed historical performance will be subject to investigation.

D.2.4.7.6 Case study

D.2.4.7.6.1 In early 2009 analysis of the performance data for December 2008 in NZZO detected a slight performance degradation for both ADS-C and CPDLC against the monitored RCP240/RSP180 standard. Further performance deterioration was observed mid February 2009 when the January 2009 data was assessed.

D.2.4.7.6.2 During this period further local analysis was initiated and by March 2009 a CRA problem report had been raised and a full investigation was underway by the CRA and the CSP's. Further deterioration in performance was noted in the following months through to October 2009.

D.2.4.7.6.3 ADS-C performance for the fleet as measured against the RSP180 performance standard is illustrated in Figure D-17 and CPDLC performance as measured against the RCP240 performance standard is illustrated in Figure D-18.

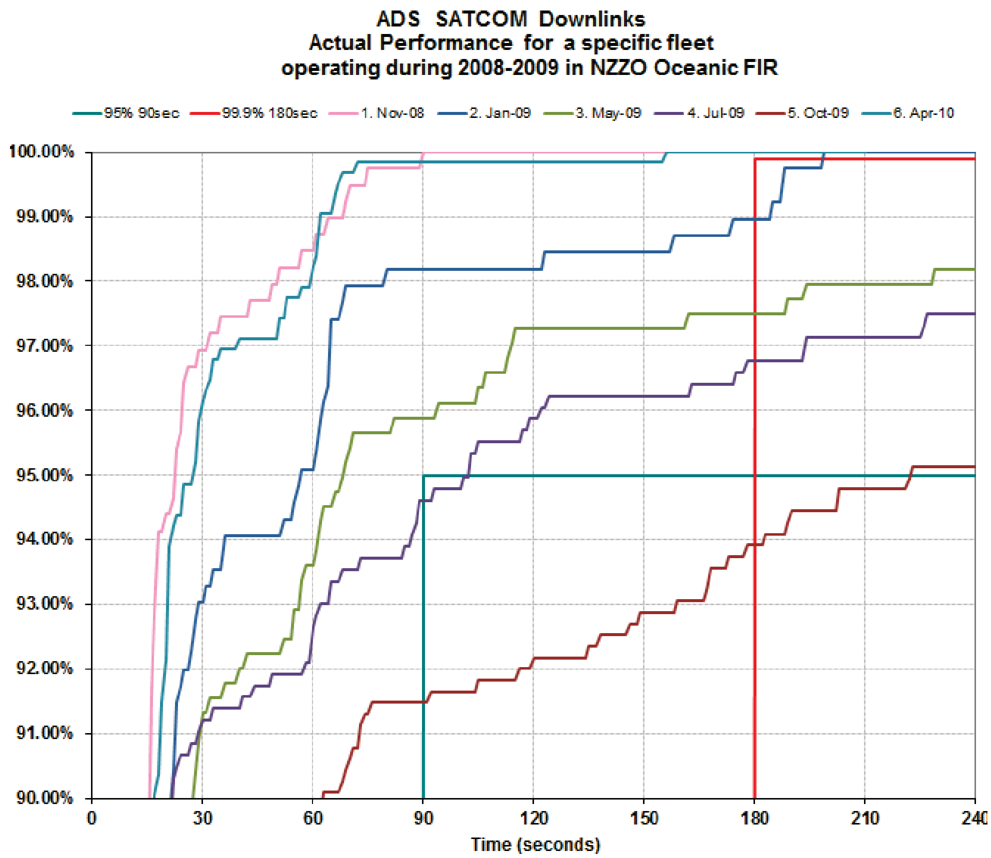


Figure D- 18 Example of ADS-C performance deterioration

D.2.4.7.6.4 A safety assessment in early 2009 concluded that reduced separation standards using data link would be withdrawn although CPDLC and ADS-C would continue to be used.

D.2.4.7.6.5 The cause of the problem was identified in mid 2009 as a system level GES issue. This was caused by the implementation of new cabin services on the aircraft that were gradually installed on the fleet from late 2008 until the middle of 2009. This explained the continuing performance degradation through this period.

D.2.4.7.6.6 A software fix was released in early 2010 with observed performance levels for the fleet returning to normal immediately and meeting the RSP180/RCP240 standard.

D.2.4.7.6.7 Reduced separation standards were restored to the fleet in April 2009 after monitoring had demonstrated that performance standard compliance had been achieved.

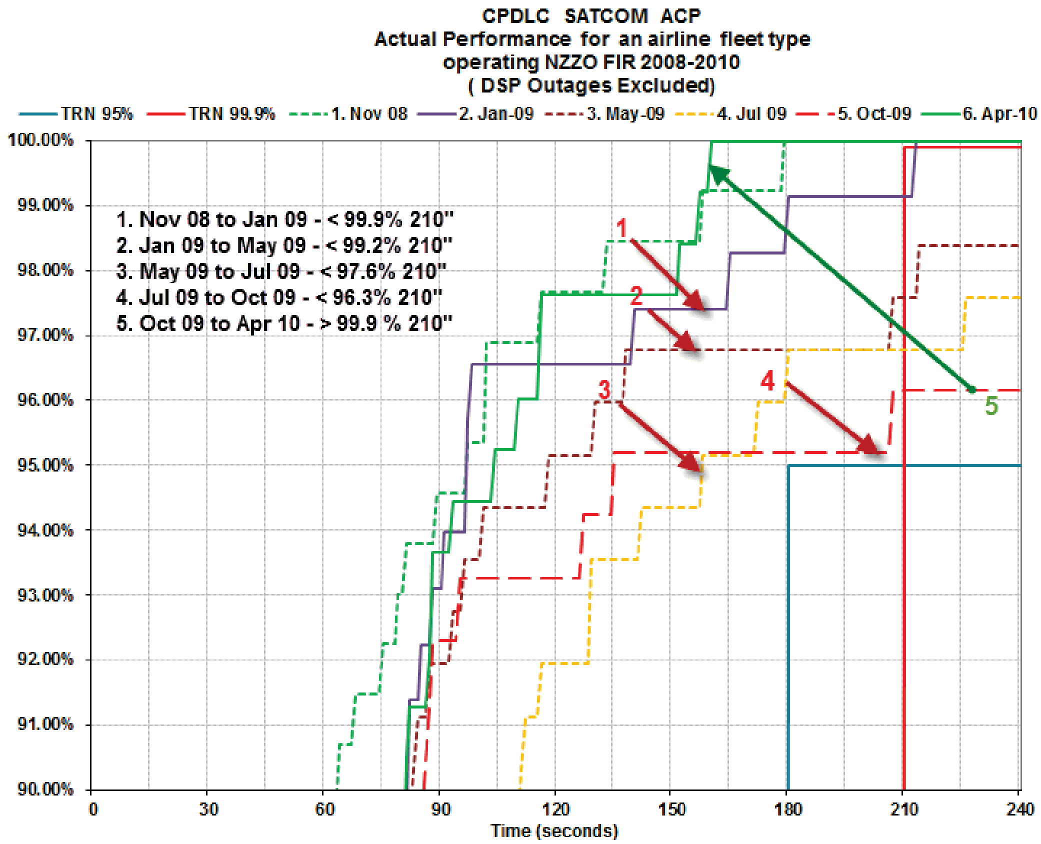


Figure D- 19 Example of CPDLC ACP performance deterioration

D.3 Problem reporting and resolution

D.3.1 General

D.3.1.1 The working principles in this guidance material result from the combined experience of the North Atlantic, Asia-Pacific, South American, African-Indian Ocean, and European Regions. Many regions have formed a regional monitoring agency to manage the problem reporting and resolution process.

D.3.1.2 All stakeholders should be actively involved in the problem reporting and resolution process. It is essential that all aircraft operators in a region have the opportunity to become involved in the process and CRA's should be pro-active in getting all aircraft operators and other stakeholders to register and participate in the process.

D.3.1.3 The problem identification and resolution process, as it applies to an individual problem, consists of a data collection phase, followed by problem analysis and coordination with affected parties to secure a resolution, and recommendation of interim procedures to mitigate the problem in some instances. This is shown in the Figure D- 20.

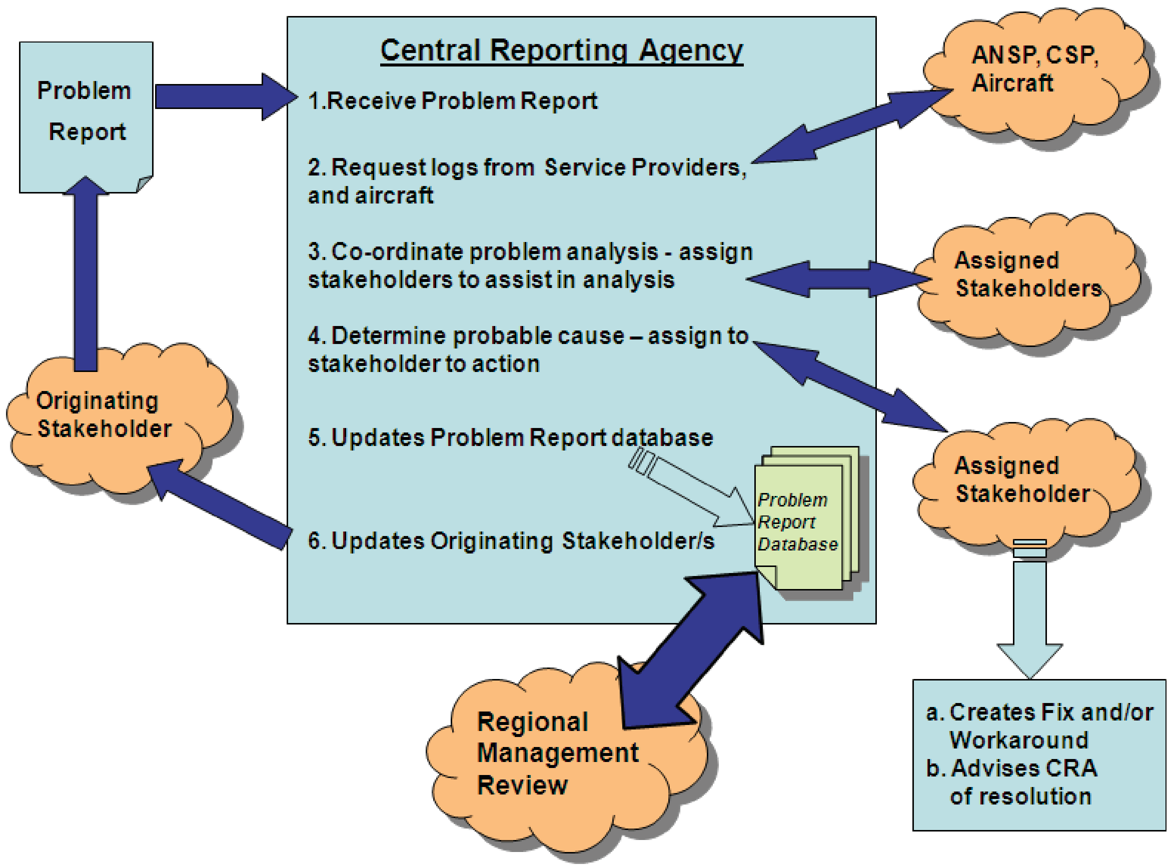


Figure D- 20. Problem reporting and resolution process

D.3.2 Problem report form

D.3.2.1.1 The problem identification task begins with receipt of a problem report from a stakeholder, usually an operator, ANSP or CSP but may include aircraft or avionics manufacturers. Standard reporting forms should be developed and regions should investigate the use of a website to receive and store problem reports.

D.3.2.1.2 As an example, the EUR region uses JIRA (http://www.eurocontrol.int/link2000/wiki/index.php/), a secured web-based problem reporting and tracking application, which is managed by the LINK2000+/Central Reporting Office of EUROCONTROL. Problems should be reported, regardless whether it can be resolved locally or needs to be handled to promote knowledge sharing across the data link community.

D.3.2.1.3 An example of an online problem reporting form currently used on-line by regional CRA in the NAT, and Asia Pacific regions is shown in Figure D- 21. The fields used in the form are as follows:

a) Originator's Reference Number: Originators problem report reference (e.g. ANZ_2009-23);

b) Title: A short title which conveys the main issue of the reported problem (e.g. CPDLC transfer failure);

c) Date UTC: Date in YYYYMMDD format (e.g. 20090705);

d) Time UTC: Time in HHMM (e.g. 2345);

e) Aircraft registration: ICAO flight plan aircraft registration (e.g. ZKADR);

f) Aircraft identification: ICAO flight plan call sign if applicable (e.g. NZA456);

g) Flight Sector: If applicable the departure and destination airfield of the flight (e.g. NZAA-RJBB);

h) Organization: Name of the originators organization (e.g. Airways NZ);

i) Active Center: Controlling Centre at time of occurrence if applicable (e.g. NZZO);

j) Next Center: Next controlling centre at time of occurrence if applicable (e.g. NFFF);

k) Position: Position of occurrence (e.g. 3022S16345E);

l) Problem Description: Detailed description of problem;

m) Attach File: Area of web page where originator and assigned stakeholders can attach data files or other detailed information such as geographic overlays; and

n) Additional Data: Area set aside for feedback from stakeholders assigned by the regional/State monitoring agency. This will includes the results of the investigation and the agreed action plan.

<u>Note</u>.— *A number of regional monitoring agencies are developing websites to manage the problem reporting process. Website addresses and the regional monitoring agency to which they are applicable are listed in <u>Appendix E</u>.*

FANS 1/A Problem Report Form

Form Details			
		Originators Reference Number	
Title			
Date UTC		Time UTC	
Registration		Flight Number	
Flight Sector			
Originator		Aircraft Type	
Organisation			
Active Center		Next Center	
Postion			
Problem Description (box will expand as you type)			
Attach File	Browse...	(click browse - do not type in this field)	
	Browse...	(click browse - do not type in this field)	
	Browse...	(click browse - do not type in this field)	
	Browse...	(click browse - do not type in this field)	
	Browse...	(click browse - do not type in this field)	
Additional Data			
	Submit PR		

Figure D- 21, Example on-line problem reporting form

D.3.3 Problem assessment

D.3.3.1 Data collection

D.3.3.1.1 The data collection phase consists of obtaining message logs from the appropriate parties (which will depend on which ANSPs and CSPs were being used and operator service contracts). Today, this usually means obtaining logs for the appropriate period of time from the CSPs involved. Usually, a log for a few hours before and after the event that was reported will suffice, but once the analysis has begun, it is sometimes necessary to request additional data, (perhaps for several days prior to the event if the problem appears to be an on-going one).

D.3.3.1.2 Additionally, some aircraft-specific recordings may be available that may assist in the data analysis task. These are not always requested initially as doing so would be an unacceptable imposition on the operators, but may occur when the nature of the problem has been clarified enough to indicate the line of investigation that needs to be pursued. These additional records include:

a) Aircraft maintenance system logs.

b) Built-In Test Equipment data dumps for some aircraft systems.

c) SATCOM activity logs.

d) Logs and printouts from the flight crew and recordings/logs from the ANSPs involved in the problem may also be necessary. It is important that the organization collecting data for the analysis task requests all this data in a timely manner, as much of it is subject to limited retention.

D.3.3.2 Data analysis

D.3.3.2.1 Once the data has been collected, the analysis can begin. For this, it is necessary to be able to decode all the messages involved, and a tool that can decode every ATS data link message type used in the region is essential. These messages include:

a) AFN (ARINC 622), ADS-C and CPDLC (RTCA DO-258/EUROCAE ED-100) in a region operating FANS-1/A.

b) Context Management, ADS-C and CPDLC applications (ICAO Doc 9705 and RTCA DO-280B/ED-110B) in a region using ATN B1.

c) ARINC 623 messages used in the region.

D.3.3.2.2 The analysis of the decoded messages requires a thorough understanding of the complete message traffic, including:

a) Media management messages.

b) Relationship of ground-ground and air-ground traffic.

c) Message envelope schemes used by the particular data link technology (ACARS, ATN, etc).

D.3.3.2.3 The analyst must also have a good understanding of how the aircraft systems operate and interact to provide the ATS data link functions, as many of the reported problems are aircraft system problems.

D.3.3.2.4 This information will enable the analyst to determine a probable cause by working back from the area where the problem was noticed to where it began. In some cases, this may entail manual decoding of parts of messages based on the appropriate standard to identify particular encoding errors. It may also require lab testing using the airborne equipment (and sometimes the ground networks) to reliably assign the problem to a particular cause.

D.3.3.2.5 Once the problem has been identified, then the task of coordination with affected parties begins. The stakeholder who is assigned responsibility for fixing the problem must be contacted and a corrective action plan agreed. The stakeholder who initiated the problem report shall be provided with regular updates on the progress and resolution of the problem

D.3.3.2.6 This information (the problem description, the results of the analysis and the plan for corrective action) is then entered into a database covering data link problems, both in a complete form to allow continued analysis and monitoring of the corrective action and in a de-identified form for the information of other stakeholders. These de-identified summaries are reported at the appropriate regional management forum and made available to other regional central reporting/monitoring agencies on request.

D.3.4 Mitigating procedures – problem resolution

D.3.4.1 The regional monitoring agency's responsibility does not end with determining the cause of the problem and identifying a fix. As part of that activity, and because a considerable period may elapse while software updates are applied to all aircraft in a fleet, procedural methods to mitigate the problem may have to be developed while the solution is being coordinated. The regional monitoring agency should identify the need for such procedures and develop recommendations for implementation by the ANSPs, CSPs and operators involved.

D.4 Regional performance monitoring

D.4.1 General

D.4.1.1 This section provides guidance on periodic reporting by individual ANSP of observed system performance in their airspace that will enable regional performance metrics to be developed for the availability, CPDLC transaction time and ADS-C surveillance data transit time requirements specified in Appendix B and Appendix C.

D.4.1.2 These regional performance metrics should be made available to all interested stakeholders. The use of regional websites to enhance the distribution of these metrics should be considered. An example of such a website can be viewed at http://www.ispacg-cra.com/.

D.4.1.3 It is recommended that regions implement monthly performance reporting to obtain system performance metrics. These reports will provide data on observed availability, CPDLC transaction time and ADS-C surveillance data transit time as described herein.

D.4.2 Reporting on availability

D.4.2.1 ANSP should report on CSP notified system outages and on detected outages that have not been notified as described in paragraph D.2.4.3.2. This is used to calculate the actual availability of service provision.

D.4.2.2 For each outage the following information should be reported:

a) Time of CSP outage notification: In YYYYMMDDHHMM format or "Not Notified" if no CSP notification received.

b) CSP Name: Name of CSP providing outage notification if applicable.

c) Type of outage: Report media affected SATCOM, VHF, HF, ALL.

d) Outage start time: In YYYYMMDDHHMM format

e) Outage end time: In YYYYMMDDHHMM format

f) Duration of Outage: In minutes.

D.4.2.3 As per Appendix B only outages greater than 10 minutes are reported. An example form is shown in Figure D- 24.

D.4.2.4 For EUR region, the number of Provider Aborts experienced by the ANSP and manually reported availability problems affecting a single aircraft should be reported. This provides an acceptable indication of the actual Availability of Use.

D.4.2.5 ANSP can use graphical analysis to track availability as illustrated in Figure D- 22 and Figure D- 23.

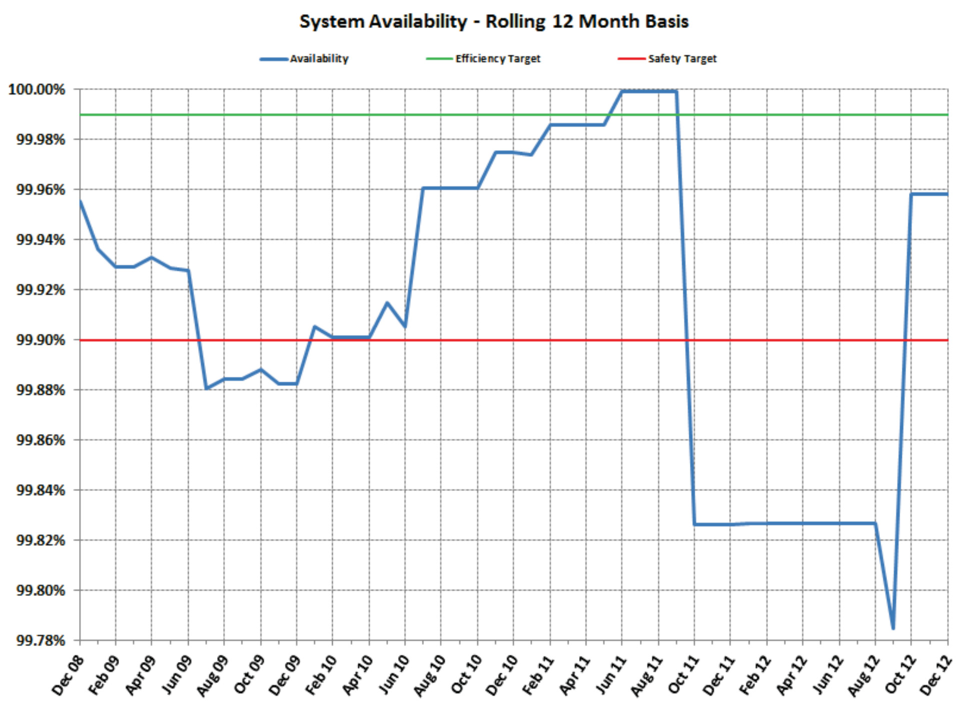


Figure D- 22 Example system availability graph

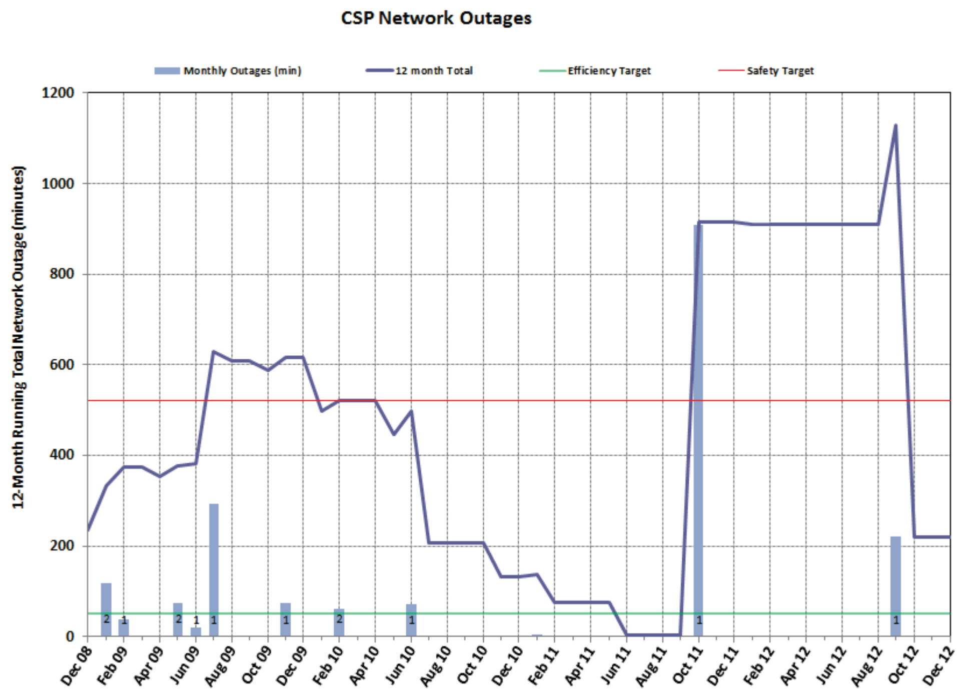


Figure D- 23 Example network outage graph

D.4.3 Reporting on CPDLC actual communications performance

D.4.3.1 ANSP should report observed ACP and ACTP for RCP240 and RCP400 for different media paths using all transactions involving a WILCO response as described in paragraph D.2.4. The media paths to report are:

a) From all aircraft via all remote ground station (RGS) types.

b) From all aircraft where both uplink and downlink are via SATCOM RGS

c) From all aircraft where both uplink and downlink are via VHF RGS

d) From all aircraft where both uplink and downlink are via HF RGS

e) From all aircraft where either uplink and downlink are via HF or SATCOM RGS

D.4.3.2 A tabular reporting format can be used to capture the observed performance at the 95% and 99.9% RCP240/400 times.

D.4.3.3 As PORT is independent of media path, this need only be reported for all RGS types. An example form is shown in Figure D- 24.

D.4.3.4 ANSPs within the EUR region should record the observed ACP and ACTP for RCP 150 and CPDLC-flight crew-initiated log files for different media paths using all transactions requiring a response. In addition, it should record the observed ACP and ACTP for DLIC-Contact/CPDLC log files and ATN B1 transport level log files, deployment and system health log files in the standardised XML-format as described in paragraph D.1.1.2. All ANSPs send the log files to the CRO for importing into PRISME (Pan-European Repository of Information Supporting the Management of EATM). PRISME is an integrated ATM data ware house for creation of various performance monitoring reports (e.g. EUR network, an ANSP, an Aircraft Operator, particular avionics configuration).

D.4.3.5 The EUR network performance monitoring reports are published on the CRO website. The reports at the other levels (per ANSP, per Aircraft Operator and per Avionics configuration) would normally be restricted to just EUROCONTROL and the relevant stakeholder.

D.4.4 Reporting on RSP data transit time

D.4.4.1 ANSP should report observed RSP data transit time for RSP 180 and RSP 400 and DO290/ED120 based performance specifications for different media paths as described in paragraph D.2.4. The media paths to report are:

a) From all aircraft via all Remote Ground Station (RGS) types.

b) From all aircraft where both uplink and downlink are via SATCOM RGS

c) From all aircraft where both uplink and downlink are via VHF RGS

d) From all aircraft where both uplink and downlink are via HF RGS

e) From all aircraft where either uplink and downlink are via HF or SATCOM RGS

D.4.4.2 A tabular reporting format can be used to capture the observed performance at the 95% and 99.9% RSP 180 and RSP 400 times. An example form is shown in Figure D- 24.

Monthly Report of Datalink Performance by < ANSP Name> for < FIR Name > for <month> <year>

Section 1: Availability

CSP Notification	CSP Name	Outage Type	Start	End	Duration (Mins)
200907150005	ARINC	SATCOM	200907150001	200907150020	19
Not Notified	N/A	SATCOM	200907212233	200907212255	22
200907281515	SITA	VHF	200907281510	200907281525	15

Section 2: CPDLC

ALL RGS			SATCOM		
ACTP RCP240	120sec	98.20%	ACTP RCP240	120sec	
	150sec	100%		150sec	
ACP RCP240	180sec	98%	ACP RCP240	180sec	
	210sec	99.70%		210sec	
PORT	60sec	98%			
ACTP RCP400	260sec		ACTP RCP400	260sec	
	310sec			310sec	
ACP RCP400	320sec		ACP RCP400	320sec	
	370sec			370sec	
VHF			**HF**		
ACTP RCP240	120sec		ACTP RCP240	120sec	
	150sec			150sec	
ACP RCP240	180sec		ACP RCP240	180sec	
	210sec			210sec	
ACTP RCP400	260sec		ACTP RCP400	260sec	
	310sec			310sec	
ACP RCP400	320sec		ACP RCP400	320sec	
	370sec			370sec	
SATCOM + HF					
ACTP RCP240	120sec				
	150sec				
ACP RCP240	180sec				
	210sec				
ACTP RCP400	260sec				
	310sec				
ACP RCP400	320sec				
	370sec				

Section 3: ADS-C

ALL RGS			SATCOM		
ASP RSP180	90sec	98.80%	ASP RSP180	90sec	
	180sec	100%		180sec	
ASP RSP400	300sec		ASP RSP400	300sec	
	400sec			400sec	
VHF			**HF**		
ASP RSP180	90sec		ASP RSP180	90sec	
	180sec			180sec	
ASP RSP400	300sec		ASP RSP400	300sec	
	400sec			400sec	
SATCOM + HF					
ASP RSP180	90sec				
	180sec				
ASP RSP400	300sec				
	400sec				

Figure D- 24. Example ANSP monthly report

D.4.5 Reporting data to enable graphical reports

D.4.5.1 In addition to the tabular performance reporting described above regions should consider presenting performance data using graphical means. Performance graphs illustrating regional communications and surveillance performance for the different media paths can be readily obtained by aggregating spreadsheet data from individual ANSP as illustrated in Figure D- 25. This figure illustrates part of an ANSP report of actual performance for ACTP, ACP, and PORT against the RCP240 requirements for a particular media type where the number of messages received within a time is recorded at one second intervals. This type of data can be included in an ANSP monthly report to enable regional aggregation of agreed performance information to allow it to be presented in graphical form. Regions could present all or some of the data reported in tabular form per paragraphs D.4.3 and D.4.4 above in graphical form if desired. This method of reporting would also assist global aggregation.

ACTP#	ACTP%	ACP#	ACP%	CREW#	CREW%	t"
0	0.00%	0	0.00%	149	0.89%	0
0	0.00%	0	0.00%	176	1.05%	1
0	0.00%	0	0.00%	210	1.26%	2
0	0.00%	0	0.00%	322	1.93%	3
0	0.00%	0	0.00%	673	4.03%	4
0	0.00%	0	0.00%	1444	8.64%	5
1	0.01%	0	0.00%	2330	13.94%	6
29	0.17%	0	0.00%	3133	18.74%	7
988	5.91%	0	0.00%	3946	23.60%	8
3939	23.56%	0	0.00%	4731	28.30%	9
6726	40.23%	0	0.00%	5667	33.90%	10
8519	50.96%	0	0.00%	6763	40.45%	11
9566	57.22%	3	0.02%	7811	46.72%	12
10585	63.31%	13	0.08%	8794	52.60%	13
11356	67.93%	33	0.20%	9594	57.39%	14
11910	71.24%	67	0.40%	10355	61.94%	15
12401	74.18%	136	0.81%	10964	65.58%	16
12962	77.53%	232	1.39%	11483	68.69%	17
13530	80.93%	609	3.64%	11899	71.17%	18
13938	83.37%	1949	11.66%	12267	73.38%	19
14247	85.22%	3280	19.62%	12595	75.34%	20
14415	86.22%	4326	25.88%	12867	76.96%	21
14586	87.25%	5362	32.07%	13145	78.63%	22
14724	88.07%	6308	37.73%	13387	80.08%	23
14839	88.76%	7057	42.21%	13588	81.28%	24
14943	89.38%	7766	46.45%	13764	82.33%	25
15029	89.90%	8388	50.17%	13930	83.32%	26
15128	90.49%	8977	53.70%	14098	84.33%	27
15220	91.04%	9494	56.79%	14249	85.23%	28
15323	91.66%	9968	59.62%	14425	86.28%	29
15402	92.13%	10373	62.05%	14562	87.10%	30
15448	92.40%	10763	64.38%	14696	87.91%	31
15501	92.72%	11102	66.41%	14826	88.68%	32
15543	92.97%	11433	68.39%	14938	89.35%	33
15599	93.31%	11720	70.10%	15049	90.02%	34
15640	93.55%	11985	71.69%	15160	90.68%	35
15683	93.81%	12235	73.18%	15258	91.27%	36
15720	94.03%	12477	74.63%	15338	91.75%	37
15747	94.19%	12703	75.98%	15405	92.15%	38
15790	94.45%	12908	77.21%	15476	92.57%	39
15813	94.59%	13111	78.42%	15533	92.91%	40
15851	94.81%	13289	79.49%	15603	93.33%	41
16660	99.65%	16540	98.94%	16655	99.62%	200
16660	99.65%	16543	98.95%	16656	99.63%	201
16662	99.67%	16547	98.98%	16656	99.63%	202
16662	99.67%	16549	98.99%	16656	99.63%	203
16662	99.67%	16549	98.99%	16656	99.63%	204
16662	99.67%	16550	99.00%	16657	99.64%	205
16662	99.67%	16553	99.01%	16657	99.64%	206
16662	99.67%	16556	99.03%	16657	99.64%	207
16662	99.67%	16561	99.06%	16657	99.64%	208
16664	99.68%	16563	99.07%	16659	99.65%	209
16664	99.68%	16564	99.08%	16662	99.67%	210
16664	99.68%	16565	99.08%	16662	99.67%	211
16664	99.68%	16566	99.09%	16662	99.67%	212
16666	99.69%	16567	99.10%	16663	99.67%	213
16667	99.69%	16571	99.12%	16663	99.67%	214
16667	99.69%	16572	99.13%	16665	99.68%	215
16667	99.69%	16574	99.14%	16665	99.68%	216
16667	99.69%	16575	99.14%	16665	99.68%	217
16667	99.69%	16576	99.15%	16666	99.69%	218
16669	99.71%	16577	99.16%	16666	99.69%	219
16669	99.71%	16579	99.17%	16666	99.69%	220
16669	99.71%	16580	99.17%	16666	99.69%	221
16672	99.72%	16581	99.18%	16666	99.69%	222
16673	99.73%	16583	99.19%	16666	99.69%	223
16674	99.74%	16586	99.21%	16666	99.69%	224
16675	99.74%	16586	99.21%	16667	99.69%	225
16675	99.74%	16589	99.23%	16667	99.69%	226
16675	99.74%	16589	99.23%	16667	99.69%	227
16676	99.75%	16593	99.25%	16668	99.70%	228
16677	99.75%	16594	99.26%	16668	99.70%	229
16677	99.75%	16596	99.27%	16668	99.70%	230
16677	99.75%	16597	99.28%	16668	99.70%	231
16677	99.75%	16598	99.28%	16668	99.70%	232
16677	99.75%	16601	99.30%	16668	99.70%	233
16677	99.75%	16604	99.32%	16668	99.70%	234
16678	99.76%	16604	99.32%	16668	99.70%	235
16678	99.76%	16605	99.32%	16668	99.70%	236
16679	99.77%	16606	99.33%	16668	99.70%	237
16679	99.77%	16607	99.34%	16668	99.70%	238
16680	99.77%	16609	99.35%	16668	99.70%	239
16681	99.78%	16609	99.35%	16668	99.70%	240
37	0.22%	109	0.65%	50	0.30%	>240
16718	100.00%	16718	100.00%	16718	100.00%	Total

Figure D- 25. Example ANSP monthly report that will enable graphical analysis

Appendix E Regional/State-specific information

E.1 General

E.1.1 This Appendix provides Regional/State specific information grouped per ICAO Regions pertaining to the data link operations.

E.2 Africa-Indian Ocean (AFI) Region

E.2.1 Administrative provisions related to data link operations

Table E-AFI- 1. Data link services by control area (CTA)

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Accra				DGAC			
Abidjan				DIII			
Algeria (Alger)	O	O	N	DAAA			
Antananarivo (Madagascar)	O	O	N	FMMM			
Brazzaville				FCCC			
Canarias				GCCC			
Capetown	O	O	N	FACT			
Casablanca							
Dakar Oceanic (Senegal)	O	O	N	GOOO	DKRCAYA		
Johannesburg Oceanic	O	O	N	FAJO	JNBCAYA		Confirm CPDLC CDA: One CPDLC position report at boundary.
Luanda							
Mauritius	O	O	N	FIMM			Confirm CPDLC CDA: One CPDLC position report at boundary.
Niamey (Niger)	O	O	N	DRRR			
Sal Oceanic				GVSC			

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Tunis							

E.2.2 Controller and radio operator procedures

NIL

E.2.3 Flight crew procedures

NIL

E.2.4 Advanced data link operations

NIL

E.2.5 State aircraft data link operation

NIL

E.3 Caribbean (CAR) Region

E.3.1 Administrative provisions related to data link operations

Table E-CAR- 1. Data link services by control area (CTA)

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Central American	T	T	N	MHCC		ANIWG	Currently trialing ADS-C and CPDLC. Primary communication via voice. Full HF reporting still required.
Curacao							
Habana							
Houston Oceanic							

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Kingston							
Mazatlan Oceanic	T	T	N	MMMX		ANIWG	Currently trialing ADS-C and CPDLC. Primary communication via voice. Full HF reporting still required.
Mexico							
Miami Oceanic							
Nassau							
New York Oceanic (south of 27 N)	O	O	N	KZWY	NYCODYA	NAT CNSG	DO NOT use CPDLC for position reporting. Use ADS-C or voice only. SELCAL check via HF are required for all FANS connected aircraft prior to entering the CTA/FIR. DO NOT send a CPDLC position report to confirm CDA prior to, or upon crossing the FIR.
Port-Au-Prince							
PIARCO	T	T	N	TTZP		ANIWG (NAM/CAR Air Navigation Implementation Working Group)	Currently trialing ADS-C and CPDLC. Primary communication via voice. Full HF reporting still required.
San Juan							
Santo Domingo							

E.3.2 Controller and radio operator procedures

NIL

E.3.3 Flight crew procedures

NIL

E.3.4 Advanced data link operations

NIL

E.3.5 State aircraft data link operation

NIL

E.4 European (EUR) Region

E.4.1 Administrative provisions related to data link operations

E.4.1.1 ANSP service provision

E.4.1.1.1 Table E-EUR- 1 lists the flight information regions (FIRs) and Upper flight information regions (UIRs), where ATN B1, FANS 1/A or FANS 1/A-ATN B1 data link service is provided and indicates Logon address, ATSU ACARS Address (where applicable), the year of implementation (where available) and responsible regional coordinating group.

Note 1.— For foreseen implementation date and the CPDLC message set used by each State, refer to the AIP/AIC concerned.

E.4.1.1.2 ATN B1 data link services are provided above FL285. FL285 aims to govern data link equipage However, this does not mean that CPDLC operations are limited above FL285. Several ANSPs use CPDLC in their upper airspace below FL285.

E.4.1.1.3 The use of CPDLC is conducted at the discretion of each responsible ACC and at the initiative of the flight crew. CPDLC is used for routine exchanges during en-route operations in the upper airspace and is not for time-critical situations. Communication exchanges by voice have priority over CPDLC exchanges at all times.\

Table E-EUR- 1. Data link services by control area (CTA)

Control area (CTA)	CPDLC	ADS-C	FMC WPR	Logon address	ATSU ACARS Address	Coord Group	Remarks
Bucuresti FIR	O	N	N	LRBB	N/A	LINK 2000+	ATN B1
Budapest FIR	O	N	N	LHCC	N/A	LINK 2000+	ATN B1

Control area (CTA)	CPDLC	ADS-C	FMC WPR	Logon address	ATSU ACARS Address	Coord Group	Remarks
Barcelona UIR	O	N	N	LECB	N/A	LINK 2000+	ATN B1
Bordeaux UAC	O	N	N	LFBB	N/A	LINK 2000+	ATN B1
Brest UAC	O	N	N	LFRR	N/A	LINK 2000+	ATN B1
Brindisi FIR	O	N	N	LIBB	N/A	LINK 2000+	ATN B1
Canarias UIR	O	N	N	GCCC	N/A	LINK 2000+	ATN B1
Finland UIR	O	N	N	EFIN	N/A	LINK 2000+	ATN B1 only in the area south of 61°30’N
Geneva UIR	O	N	N	LSAG	N/A	LINK 2000+	ATN B1
Hellas UIR	O	N	N	LGGG	N/A	LINK 2000+	ATN B1
Kobenhavn FIR	O	N	N	EKDK	N/A	LINK 2000+	ATN B1
Lisboa UIR	O	N	N	LPPC	TBD	LINK 2000+	ATN B1 FANS 1/A
Ljubljana FIR	O	N	N	LJLA	N/A	LINK 2000+	ATN B1
London UIR	O	O	N	EGTT	TBD	LINK 2000+	ATN B1 FANS 1/A.
Madrid UIR	O	N	N	LECM	N/A	LINK 2000+	ATN B1
Magadan (Russia)	O	O	N	GDXB		???	FANS 1/A
Malta UIR	O	N	N	LMMM	N/A	LINK 2000+	ATN B1
MUAC Amsterdam FIR Brussels FIR Hannover FIR	O	O	N	EDYY	TBD	LINK 2000+	ATN B1 FANS 1/A

Control area (CTA)	CPDLC	ADS-C	FMC WPR	Logon address	ATSU ACARS Address	Coord Group	Remarks
Marseille UAC	O	N	N	LFMM	N/A	LINK 2000+	ATN B1
Milano ACC	O	N	N	LIMM	N/A	LINK 2000+	ATN B1
Nicosia FIR	O	N	N	LCCC	N/A	LINK 2000+	ATN B1
Oslo FIR	O	N	N	ENOS	N/A	LINK 2000+	ATN B1
Padova ACC	O	N	N	LIPP	N/A	LINK 2000+	ATN B1
Paris UAC	O	N	N	LFFF	N/A	LINK 2000+	ATN B1
Praha FIR	O	N	N	LKAA	N/A	LINK 2000+	ATN B1
Reims UAC	O	N	N	LFEE	N/A	LINK 2000+	ATN B1
Rhein UIR	O	N	N	EDMM	N/A	LINK 2000+	ATN B1
Riga UIR	O	N	N	EVRR	N/A	LINK 2000+	ATN B1
Roma FIR	O	N	N	LIRR	N/A	LINK 2000+	ATN B1
Scottish UIR	O	O	O	EGPX	TBD	LINK 2000+	ATN B1 FANS 1/A
Shannon UIR	O	O	O	EISN	TBD	LINK 2000+	ATN B1 FANS 1/A
Sofia FIR	O	N	N	LBSR	N/A	LINK 2000+	ATN B1
Sweden UIR	O	N	N	ESAA	N/A	LINK 2000+	ATN B1 Only in the area south of 61°30′N
Tallinn UIR	O	N	N	EETT	N/A	LINK 2000+	ATN B1
Vilnius UIR	O	N	N	EYVC	N/A	LINK 2000+	ATN B1
Warszaw FIR	O	N	N	EPWW	N/A	LINK 2000+	ATN B1

Control area (CTA)	CPDLC	ADS-C	FMC WPR	Logon address	ATSU ACARS Address	Coord Group	Remarks
Wien FIR	O	N	N	LOVV	N/A	LINK 2000+	ATN B1
Zurich UIR	O	N	N	LSAZ	N/A	LINK 2000+	ATN B1

E.4.1.1.4 Table E-EUR- 2 lists the contact information of the EUR region and the website URL of the Central Reporting Office (CRO).

Table E-EUR- 2. Contact information and monitoring agency website URL

Coordinating group or regional monitoring agency	Contact information/website URL
EUROCONTROL LINK2000+	Soren Dissing Coordination Manager EUROCONTROL - Central Reporting Office (CRO) Tel: +3227293446 Email: soren.dissing@eurocontrol.int
EUROCONTROL Central Reporting Office (CRO)	http://www.eurocontrol.int/articles/central-reporting-office

E.4.1.2 EUR - NSAP address registry

E.4.1.2.1 In order to allow the air crew to perform a first LOGON with any of the participating ATN B1 ACCs, Context Management application addressing information of the ATS Units involved in the ATN/OSI based Air/Ground Data Link Communications, is required in the ATN avionics system.

E.4.1.2.2 The ATN NSAP addresses for all EUR Air Traffic Control Centres (ACCs) are published in EUR Doc 028 - EUR NSAP Address Registry – Ed 2.0.

E.4.1.2.3 The focal point for the EUR NSAP Address Registry is the EUR/NAT ICAO Regional Office. All requests, modifications and proposals concerning should be forwarded to: http://icaoeurnat@paris.icao.int.

Note 1.— The ICAO EUR/NAT Office ensures that the information is forwarded to the appropriate working groups (e.g. AFSG Planning Group).

Note 2.— The EUR NSAP Address Registry will be available at the ICAO website: http://www.paris.icao.int/documents_open/categories.php.

E.4.1.3 Flight plan provisions

E.4.1.3.1 In the EUR airspace where ATN B1 CPDLC is available and aircraft are equipped and capable ATN B1 CPDLC, J1 shall be included in Item 10a of the flight plan:

a) Operators of FANS 1/A – ATN B1 (independent or integrated) equipped aircraft shall insert one or more of the appropriate indicators among J1 –J7 in Item 10a.

b) For flights conducted wholly or partly in the EUR airspace where ATN B1 CPDLC is available but not equipped with CPDLC capabilities but which have been granted an exemption, the letter Z shall be included in Item 10A and the indicator DAT/CPDLCX shall be included in Item18 of the flight plan.

E.4.1.3.2 For a flight operating based on a repetitive flight plan (RPL), during which the pilot intends to use CPDLC, a modification message (CHG) shall be submitted to indicate that the flight is capable of, and authorized for CPDLC, in accordance with paragraph 3.3.

E.4.1.3.3 When there is a change to the CPDLC capability status for a flight planned to operate in the area specified in Table E-EUR- 1, the operator should send a modification message (CHG) with the appropriate indications in the relevant items of the ICAO flight plan form, including any change to the aircraft address. A modification message for the day of operation should be sent not earlier than 20 hours before the estimated off-block time.

E.4.1.4 Logon criteria

E.4.1.4.1 In addition to the logon FPL correlation criteria, described in paragraph 3.3, the CPDLC aircraft equipment capabilities in Item 10a are also used as criterion for a successful logon. Absence of item J1 and/or one or more of the items J2 to J7 in Item 10a will lead to a logon rejection.

E.4.1.5 Lack Timer

E.4.1.5.1 Logical Acknowledgement (LACK) messages (downlink message element DM 100 and uplink message element UM 227) are used in ATN B1 based ACL and ACM message exchanges.

Note 1.— Ground systems do not request a LACK for the messages ERROR (UM 159), Service Unavailable (UM 162) and LACK (UM 227).

Note 2.— When a LACK is received after expiry of the LACK timer, the LACK may be discarded.

E.4.2 Controller procedures

E.4.2.1 Reverting from CPDLC to voice

E.4.2.1.1 The following circumstances describe potential situations where the controller should revert to voice to instruct the controller/pilot to ignore the CPDLC message:

a) When it is required to clarify the meaning or the intent of any unexpected, inappropriate or ambiguous CPDLC message;

b) Whenever it is deemed necessary to ensure the timely execution of a clearance or instruction previously issued by CPDLC.

c) Whenever corrective actions are required with respect to unintended clearances, instructions or information that has been sent using CPDLC.

E.4.2.1.2 Controllers should be aware that once a message is sent via CPDLC, no means exist to cancel or to recall that message.

Note.— In case of reversion to voice, controllers should be aware of the possibility that the CPDLC message they want the addressee to ignore may not be yet displayed to the addressee.

E.4.2.1.3 In that respect, the following actions should be taken by the addressee:

a) If response to the referred CPDLC message was sent, cancel any action initiated on the basis of the initial CPDLC message and comply with the voice message;

b) If the referred message is not responded to or not displayed, let the dialogue close on time-out. Since it may be possible to be asked to ignore a message that was not yet displayed, the controller/pilot should take all measures to ensure that the message is no longer valid.

c) In case the controller/pilot has already received an operational response to the initial CPDLC message, he/she shall use appropriate voice phrases to stop/cancel the actions of the addressee.

d) Whenever a system generates a time-out or an error for a CPDLC message.

E.4.2.1.4 ***Use of Free Text***. In support of the recommendation in ED-110B/DO-280B on 'free text', some ANSPs don't allow the controller to enter free text on the HMI.

E.4.2.2 Preconditions for the operational exchange of CPDLC messages

E.4.2.2.1 "When CPDLC is transferred, the transfer of voice communications and CPDLC shall commence concurrently" (Annex 10 V2, 8.2.9.6.1; PANS-ATM, 14.3.3.1).

E.4.2.2.2 The active connection status, as described in paragraph 2.2.4.2, only allows for technical air-ground CPDLC exchanges between the aircraft and the ground system of the CDA.

E.4.2.2.3 The minimum condition required for an operationally functional 2-way communication connection, is that the aircraft is under the responsibility of the CDA (i.e. the ATSU has assumed the control of the flight after initial voice contact establishment and a CPDLC message, indicating the name and function of the current ATC unit, is received by the flight crew).

Note.— Additional local conditions (boundary proximity, etc.), which will vary from ATSU to ATSU, may apply.

E.4.2.2.4 If an aircraft sends a request to an ATSU before the minimum conditions have been fulfilled, the request is rejected by the ground system. An error message is displayed to the flight crew TRANSFER NOT COMPLETED REPEAT REQUEST.

E.4.2.3 Uplink messages

E.4.2.3.1 Operational use of LACK

E.4.2.3.1.1 Each time the controller uplinks an operational message, the ATN B1 aircraft system returns a DM 100 logical acknowledgement (LACK).

E.4.2.3.1.2 The LACK timer value should be set by the ground system at 40 seconds.

E.4.2.3.1.3 If the ground system does not receive a LACK within 40 seconds, the controller will be notified.

Note 1.— The ground system does not request a LACK for messages UM 159 (ERROR), UM 162 (SERVICE UNAVAILABLE), UM 227 (LACK).

Note2.— Local implementers may decide whether the controller is notified on the receipt of each LACK (positive feedback) or is only notified upon a LACK time out (negative feedback).

Note3.— When a LACK is received after expiry of the LACK timer, the LACK may be discarded.

E.4.2.3.2 UM 120 MONITOR [unitname] [frequency]

E.4.2.3.2.1 The UM 120 MONITOR message is not used for inter-ATSU and intra-ATSU flight transfers. This is because controllers want to have the assurance that voice communication is established at "initial call" to the next sector or ATSU. Moreover, the “initial call” is used to communicate cleared level and passing level, to reconfirm clearance previously given and to verify the accuracy of Mode-C at the first sector of the receiving ATSU.

E.4.2.3.2.2 In response to UM 120 MONITOR, sent by the transferring ATSU, DM 89 MONITORING is sent to the receiving ATSU which provides a confirmation message to the controller that the flight crew has switched to the instructed VHF frequency. It appears that in many aircraft, the uplinked frequency is not automatically loaded in the RMP and that the frequency and the ATSU’s Facility designator in the ‘DM 89 Monitoring’ message are manually keyed in, making frequency switching more prone to errors.

E.4.2.3.2.3 As voice is the primary means of communications, controllers are not confident that silent transfers can be used.

E.4.2.3.3 ATC Microphone Check service (AMC)

E.4.2.3.3.1 The AMC service is achieved by the use of either of the following 2 Uplink messages:

a) UM 157 CHECK STUCK MICROPHONE [frequency], or

b) Free text UM 183 CHECK STUCK MICROPHONE

Note 1.— No flight crew acknowledgement of the instruction is required.

Note 2.— LACK is not used for AMC.

E.4.2.3.4 Uplink messages from a FANS 1/A – ATN B1 ATSU

E.4.2.3.4.1 A FANS 1/A – ATN B1 ATSU also provides CPDLC services to FANS 1/A aircraft. The following two procedures exist as mitigation against mis-delivered- and excessively delayed uplink message:

a) Misdelivery. For some of the FANS 1/A – ATN B1 ATSUs, the local safety assessment requires additional measures against the risk of misdelivery, when sending a CPDLC uplink message to a FANS 1/A aircraft. These ATSUs will automatically ‘prepend’ a free text message UM 169, containing the Flight Identification (FID), to each uplink message for verification by the flight crew (refer to E.3.3.1.1).

Note.— The mitigation measure is an identical mimic, when transmitting the clearance or instruction, using voice.

b) Delayed Uplink message, received by an aircraft. A FANS1/A –ATN B1 ATSU does not uplink message UM 169w SET MAX UPLINK DELAY VALUE TO [delayed message parameter] SECONDS to a FANS 1/A+ aircraft, instructing the flight crew to use the LTM function. Instead, the following procedure is used for FANS 1/A and FANS 1/A+ aircraft, when such aircraft receive an excessively delayed message. Upon expiry of ground-timer tts:

1) The ATSU should provide an indication to the controller, and,

2) The controller should return to voice and clarify the situation, and

3) Optionally, the controller may instruct the flight crew to terminate the CPDLC connection and logon to the next unit. The controller should use the following voice phraseology:

i) DISREGARD CPDLC [message type]. DISCONNECT CPDLC CONTINUE ON VOICE THEN LOGON TO [facility designation]

Note.— Upon tts timeout, some FANS 1/A- ATN ATSUs may automatically initiate a Provider Abort (commanded termination) message to the aircraft.

E.4.2.3.5 Concatenated uplink messages

E.4.2.3.5.1 ATSUs should only uplink a concatenated message containing maximum 2 clearances, instructions or report/information requests.

E.4.2.3.5.2 The use of concatenations of a message element with the 'W/U', A/N, R or Y response attribute and a message element with the 'Y' response attribute should be avoided.

E.4.2.3.5.3 Based on these principles, the use of concatenated messages should be limited to the following combinations:

a) Level instruction concatenated with Speed instruction,

b) Level instruction concatenated with Level Constraint,

1) UM 20 CLIMB TO [level] (resp. UM 23 DESCEND TO [level]) clearance being incompatible with UM 173 DESCEND AT [verticalRate] MINIMUM or UM 174 DESCEND AT [verticalRate] MAXIMUM (resp. UM 171 CLIMB AT [verticalRate] MINIMUM or UM 172 CLIMB AT [verticalRate] MAXIMUM)

c) Level instruction concatenated with Route modification instruction,

d) Level instruction concatenated with Heading instruction,

e) Route modification instruction concatenated with Speed instruction,

f) Heading instruction concatenated with Speed instruction

Note.— most of these instructions added as suffixes of uplinked concatenated messages being optional. ANSPs will publish in aeronautical information publication the set of messages actually implemented.

E.4.2.3.6 Multiple open dialogues of CPDLC messages of the same type

E.4.2.3.6.1 In European Continental airspace, the controller should perform the exchange of CPDLC messages with only one open dialogue of the same type with the same aircraft at any given time.

Note.— Appropriate consideration should be given to system support procedures, so as to not allow the initiation of clearance dialogues with the same recipient, already involved in the same type of clearance dialogue.

Example 1: If a level instruction has been sent to an aircraft via CPDLC, a subsequent level instruction to the same aircraft can be initiated only if the CPDLC dialogue pertaining to the initial level instruction has been closed. If action is required before the dialogue is closed, the communications should be reverted to voice

Example 2: When the ground system receives a downlink request and there is an existing open uplink, containing the same type, the downlink request is discarded.

E.4.2.4 Operational timers used by ATSU

E.4.2.4.1 Controller initiated dialogue

E.4.2.4.1.1 When the controller uplinks a CPDLC message, requiring an operational response, the ground system starts the ground-timer (tts) which value is set at 120 seconds.

a) When this timer expires (i.e. non receipt of operational closure response within tts) the controller is notified and reverts to voice to resolve the situation (refer to paragraph E.4.2.1 – Reverting from CPDLC to voice).

Note 1.— ATN B1 aircraft systems also have implemented an aircraft-timer (ttr), which is set at 100s. In normal circumstances, the aircraft-timer (ttr) expires before the ground-timer (tts) expires and consequently follows the procedure in paragraph E.4.2.4.1.

Note 2.— FANS 1/A aircraft do not have ttr timer.

b) The dialogue is closed locally by the ground system, ensuring that the dialogue doesn't remain open at the ground side.

E.4.2.4.1.2 If the flight crew responds to a clearance with a STANDBY, the aircraft and ground timers are re-started.

E.4.2.4.2 Flight crew initiated dialogue

E.4.2.4.2.1 When the ground system receives a request, then it starts the expiration timer-responder (ttr), which value is set at 250 seconds.

a) The timer-responder (ttr) expires, if the controller fails to respond within 250 seconds. The controller is notified and reverts to voice to complete the dialogue (Refer to paragraph E.4.2.1 – Reverting from CPDLC to voice).

b) The ground system closes the dialogue and uplinks an error response 'ATC TIME OUT – REPEAT REQUEST'. The error response ensures that the dialogue will also be closed at the aircraft side.

Note.— Some ATN B1 aircraft systems also have implemented an aircraft-timer (tts), which is set at 270s. In normal circumstances, the ground-timer (ttr) expires before the aircraft-timer (tts) expires.

E.4.2.4.2.2 If the controller responds to a request with a STANDBY, the aircraft- and ground timer are re-started.

E.4.2.5 Transfer of data communications with open dialogues

E.4.2.5.1 Open ground-initiated dialogues

E.4.2.5.1.1 When a transfer of CPDLC results in a change of data authority and the transfer instruction has been initiated, but not yet sent, the controller transferring the CPDLC is informed of the open ground-initiated dialogues. The controller:

a) Waits for the responses to the open ground-initiated dialogues and then continues with the transfer instruction, or

b) Resolves the open ground initiated dialogues (via voice instructions) and then continues with the transfer instructions, or

c) Ignores the open ground initiated dialogues and continues with the transfer instruction.

Note.— When open-ground initiated dialogues are ignored, the ground system closes all outstanding dialogues.

E.4.2.5.1.2 When there are open ground-initiated dialogues, and the flight crew responds to the transfer instruction with a WILCO, the airborne system cancels all open ground initiated dialogues. When responding with UNABLE or STANDBY, the aircraft system maintains the open dialogues.

E.4.2.5.1.3 When a transfer of CPDLC does not result in a change of data authority and assuming that the T-sector is not the same as the R-sector, local procedures will define system behaviour, allowing ground systems to cancel or maintain all open ground-initiated dialogues. The airborne system maintains open ground-initiated dialogues.

E.4.2.6 Abnormal situations

E.4.2.6.1 Use of CPDLC in the event of voice radio communication failure

E.4.2.6.1.1 The existence of a CPDLC connection between the ATS unit and the aircraft should not pre-empt the pilot and ATC from applying all the ICAO provisions in the event of radio communication failure.

E.4.2.6.1.2 When the pilot cannot comply with the requirement above, he/she will have to apply the provisions stipulated for the event of radio communication failure.

E.4.2.6.2 Failure of logon forwarding procedure

E.4.2.6.2.1 The ground-ground forwarding (OLDI) procedure is used as default procedure for inter-ATSU flight transfers. In case of failure of the ground-ground forwarding (OLDI) procedure, or when this is temporarily not available, the transferring ATSU should automatically initiate a DLIC-contact request.

Note.— No OLDI exchanges exist between ATSUs at the NAT boundary. DLIC-contact is used in this case.

E.4.2.6.3 Controller commanded CPDLC termination

E.4.2.6.3.1 When the controller initiates termination, the ground system uplinks a free text message element (UM 183), containing the text "CONTROLLER TERMINATED CPDLC", followed by a CPDLC-User–abort request.

E.4.2.6.3.2 To reinstate CPDLC after a controller initiated commanded termination, the controller initiates CPDLC on the HMI, triggering the ground system for a CPDLC-start request to the aircraft.

E.4.2.6.4 Suspension of CPDLC operations within a sector

E.4.2.6.4.1 Ground systems capable to provide CPDLC may allow the controller CPDLC to be turned "ON" and "OFF" on a sector basis as an additional protection to suspend CPDLC. When this is done on a sector basis, the CPDLC connection is maintained.

Note.— Setting CPDLC "OFF/ON" is a local implementation issue.

E.4.2.6.4.2 When the controller sets for his sector CPDLC to “OFF”, the ground system should send a free text message UM 183 “NEXT SECTOR CPDLC NOT IN USE UNTIL NOTIFIED – USE VOICE”.

Note.— Setting CPDLC to “OFF” may be executed as an additional protection when the controller intends to suspend the use of CPDLC.

E.4.2.6.4.3 When the controller sets for his a sector CPDLC to “ON”, the ground system should send a free text message (UM 183) “CPDLC NOW IN USE”. After the generation of this message, the ground system should generate a free text message (UM 183), containing the text “CURRENT ATC UNIT [unitname]”

Note.— Setting CPDLC to “ON” may be executed in addition when the controller intends to resume the use of CPDLC.

E.4.2.7 Downlink error messages

E.4.2.7.1 ATN B1 systems use a number of operational errors, when uplinking an operational message. An operational error occurs when the ATN B1 ground system does not behave according to the ATN B1 requirements or local constraints prevent an operational response.

E.4.2.7.2 When receiving an ‘ERROR’ (DM 62) + free text message (DM 98) in response to operational uplink messages, the controller should revert to voice to clarify the situation with the flight crew.

E.4.2.7.3 Table E-EUR- 3 provides a list of operational error messages displayed to the controller.

Table E-EUR- 3. Operational error downlink messages

Free Text message	Description	Procedure
AIRCREW HAS INHIBITED CPDLC	The aircraft is in CPDLC inhibited state and receives a CPDLC-start request from the ground. The aircraft reverts to the CPDLC inhibited state: 1. After the end of a flight, or 2. After a power cycle resulting in a cold start, or 3. When CPDLC is turned off by the pilot.	The controller should instruct the flight crew to initiate a CLM-logon request to leave the inhibited state.
MESSAGE DOES NOT CONTAIN THE POSITION TO BE NAVIGATED TO	The aircraft rejects UM 72 [RESUME OWN NAVIGATION] because UM 72 is not concatenated with UM 74 [PROCEED DIRECT TO [position], UM 79 CLEARED TO [position] VIA [routeClearance] or UM 80 CLEARED[routeClearance]. *Note.— When uplinking UM 72, ground systems are required to concatenate UM 72 with UM 74, UM 79 or UM 80, denoting the position to be navigated to.*	The controller should resend UM 72, concatenated with UM 74, UM 79 or UM 80.

Free Text message	**Description**	**Procedure**
THIS CONCATENATION NOT SUPPORTED BY THIS AIRCRAFT	The aircraft receives a concatenated uplink message that it does not support (invalid element combination, or at least one message element is not supported, or invalid element order). *Note.— Examples of obvious invalid combinations: Climb To + Descend To.*	The controller may resend the messages in the form of single messages, or use voice.
MESSAGE NOT SUPPORTED BY THIS AIRCRAFT	The aircraft receives an uplink message that it does not support. *Note.— All ATN B1 aircraft implementations support all uplink messages.*	The controller should revert to voice.
FREE TEXT MESSAGE TOO LARGE	The aircraft receives an uplink free text message element containing more than 80 characters, and the aircraft system cannot support the number of characters in a free text message element.	The controller should revert to voice. *Note.— For use of free text, see also paragraph 4.3.2.*
UNACCEPTABLE DATA COMBINATION IN ROUTE CLEARANCE	The aircraft receives UM 79 CLEARED TO [position] VIA [route clearance] or UM 80 CLEARED [route clearance], for which the [ATS route designator] parameter is not followed by a [published identifier] parameter or an [ATS route designator] parameter.	The controller should resend UM 79 or UM 80 with the appropriate parameters.
CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST	Until CPDLC is enabled, the ground system rejects any downlink message; except DM99 (CURRENT DATA AUTHORITY), DM89 (MONITORING), DM62 (ERROR), and DM62 concatenated with DM98 (ERROR + Free text).	The flight crew cannot use data link now, but when CPDLC is fully operational, a CPDLC message is uplinked and displayed to the flight crew, indicating the name and function of the current ATC unit. The flight crew should not attempt to repeat the request until the CPDLC transfer has been completed and they are under the control of the ACC, being the CDA.

Free Text message	Description	Procedure
AIRSYSTEM TIME-OUT	The flight crew receives an instruction/ clearance, but fails to respond within 100s at time of reception. The aircraft-timer ttr expires and automatically downlinks the error message. The aircraft system closes the dialogue. Up on receipt of the error message, the ground systems closes the dialogue.	The controller should revert to voice.
UPLINK DELAYED IN NETWORK AND REJECTED. RESEND OR CONTACT BY VOICE	The aircraft rejects a message, because the difference between the timestamp of sending by ground and aircraft reception time is more than 40 seconds.	The controller should revert to voice or may resend the message by CPDLC.
DOWNLINK TIMESTAMP INDICATES FUTURE TIME.	The aircraft receives a message timestamp that indicates a future time greater than 2 seconds from the current time.	The controller should revert to voice.

E.4.3 Flight crew procedures

E.4.3.1 General

E.4.3.1.1 Reception of uplink messages received by FANS 1/A aircraft

E.4.3.1.1.1 Some of the FANS 1/A – ATN B1 ATSUs 'prepend' a free text message UM 169, containing the FID, to each uplink message, sent to a FANS 1/A aircraft. (Refer to paragraph E.4.2.3.4 a) - Misdelivery)

E.4.3.1.1.2 Flight crew should verify that the 'prepended' FID matches with the aircraft's FID as filed in the flight plan, item 7a.

E.4.3.1.1.3 In case the FID doesn't match, the flight crew should reject the uplinked message, revert to voice communications to notify the ATSU of the misdelivered message.

E.4.3.1.2 Reverting from CPDLC to voice

E.4.3.1.2.1 The following circumstances describe potential situations where the flight crew communications should revert to voice:

a) When it is required to clarify the meaning or the intent of any unexpected, inappropriate or ambiguous CPDLC message;

b) Whenever corrective actions are required with respect to unintended or spurious request that have been sent using CPDLC. The flight crew should be aware that once a message is sent via CPDLC, no means exist to cancel or to recall that message. The following actions should be taken by the flight crew after the controller has reverted to voice:

1) If response to the referred CPDLC message was sent, cancel any action initiated on the basis of the initial CPDLC message and comply with the voice message;

2) If the referred message is not responded to or not displayed, let the dialogue close on time-out. Since it may be possible to be asked to ignore a message that was not yet displayed, the flight crew should take all measures to ensure that the message is no longer valid.

3) In case the flight crew has already received an operational response to the initial CPDLC message, he/she shall use appropriate voice phrases to stop/cancel the actions of the addressee; and

Note.— In case of reversion to voice, flight crew should be aware of the possibility that the CPDLC message they want the addressee to ignore may not be yet displayed to the addressee.

c) Whenever a system generates a time-out or an error for a CPDLC message.

E.4.3.1.3 Use of concatenated messages - air initiated

E.4.3.1.3.1 Aircraft and ground systems should allow for a downlink concatenated message containing a maximum of two message elements.

E.4.3.1.3.2 The only downlink concatenated messages, which ground systems are required to support, are those that result from a concatenation of one message element from the left column and one message element from the right column.

First message element in message	Second message element in message
DM 6 REQUEST [level]	DM 65 DUE TO WEATHER
DM 9 REQUEST CLIMB TO [level]	DM 66 DUE TO AIRCRAFT PERFORMANCE
DM 10 REQUEST DESCENT TO [level]	
DM 22 REQUEST DIRECT TO [position]	

E.4.3.1.4 Responding to concatenated message elements with response attribute other than Y

E.4.3.1.4.1 The permitted response will be messages containing one of the following message elements: DM 100 LOGICAL ACKNOWLEDGMENT (if required), DM 2 STANDBY, DM 0 WILCO, DM 1 UNABLE, DM 63 NOT CURRENT DATA AUTHORITY, DM 107 NOT AUTHORIZED NEXT DATA AUTHORITY or DM 62 ERROR message element.

E.4.3.1.4.2 The closure response message will be a message containing one of the following message elements: DM 0 WILCO, DM 1 UNABLE, DM 63 NOT CURRENT DATA AUTHORITY, DM 107 NOT AUTHORIZED NEXT DATA AUTHORITY or DM 62 ERROR message element.

E.4.3.1.4.3 The DM 0 WILCO or DM 1 UNABLE response messages will operationally apply to the entire uplink concatenated message – see paragraph 5.3.1.3 and paragraph 5.3.1.4.

E.4.3.1.4.4 As responses to a ground initiated dialogue, ground systems are required to also support the following downlink concatenated messages:

First message element in message	Second message element in message
DM 1 UNABLE	DM 65 DUE TO WEATHER
DM 82 WE CANNOT ACCEPT [level]	DM 66 DUE TO AIRCRAFT PERFORMANCE

E.4.3.2 Latency time monitor (LTM)

E.4.3.2.1 In accordance with safety requirement SR-ACL-13 of ED120/DO290, the message latency monitor defined in ED100A/DO258A, paragraph 4.6.6.9, and ED110B/DO280B (ATN), paragraph 3.3.4, provides to the ANSP a means to mitigate the effects of an excessively delayed CPDLC message. In Europe, this message latency monitor is referred to as the Latency Time Monitor (LTM).

Note.— The LTM function is not used by FANS 1/A+ aircraft (Refer to para E.4.2.3.4 b) – Delayed uplink message, for alternative procedure).

E.4.3.2.2 An ATN B1 compliant aircraft has a Latency Time Monitor (LTM) function in the form of a hard-coded LTM value in the avionics. The LTM value is set at 40 seconds.

E.4.3.2.3 Upon activation of LTM, the aircraft system will:

a) Display the message to the flight crew with a delayed message indication. The flight crew should contact the controller and advise him/her of the situation and/or request verification of ATC intent; or

b) Discard the message without any indication to the flight crew and notify the controller with a message consisting of DM 62 ERROR [error information] and DM 98 [UPLINK DELAYED IN NETWORK AND REJECTED. RESEND OR CONTACT BY VOICE]. The controller should revert to voice to clarify the situation.

Note.— Refer to Appendix F, paragraph F.11 for the specifications on the LTM function implemented in different aircraft types.

E.4.3.3 Operational use of LACK

E.4.3.3.1 Each time the flight crew downlinks an operational message, the ATN B1 ground system returns a UM 227 logical acknowledgement (LACK).

E.4.3.3.2 The LACK timer value should be set by the aircraft system at 40 seconds.

E.4.3.3.3 If the aircraft system does not receive a UM 227 LACK within 40 seconds, the flight crew will be notified.

Note 1.— The aircraft system does not request a UM 227 LACK for messages DM 62 (ERROR), DM 63 NOT CURRENT DATA AUTHORITY), DM 100 (LACK) and DM 107 (NOT AUTHORIZED NEXT DATA AUTHORITY).

Note 2.— Local implementers may decide whether the flight crew is notified on the receipt of each LACK (positive feedback) or is only notified upon a LACK time out (negative feedback).

Note3.— When a UM 227 LACK is received after expiry of the LACK timer, the UM 227 LACK may be discarded.

E.4.3.4 Operational timers used by the aircraft

E.4.3.4.1 Controller initiated dialogue

E.4.3.4.1.1 When an ATN B1 aircraft system receives an uplink message, requiring a response, it starts the expiration timer-responder (ttr), which value for the response to be sent is set at 100 seconds.

a) The timer-responder (ttr) expires if the flight crew fails to respond within 100 seconds. The flight crew is notified and reverts to voice to complete the dialogue;

Note.— FANS 1/A aircraft do not have a ttr timer.

b) The ATN B1 aircraft system closes the dialogue and downlinks an error response 'AIRSYSTEM TIME-OUT'. The error response ensures that the dialogue will also be closed within the ATSU.

Note.— In normal circumstances, the aircraft-timer (ttr) expires before the ground-timer (tts) expires.

E.4.3.4.1.2 If the flight crew responds to a clearance with a DM 2 STANDBY, the aircraft- and ground timers are re-started.

E.4.3.4.2 Flight crew initiated dialogue

E.4.3.4.2.1 When the flight crew downlinks a request, requiring an operational response, and when implemented, the ATN B1 aircraft system starts the expiration timer-initiator (tts). If used, the timer value for the operational response to be received is set at 270 seconds.

a) The timer-initiator (tts) expires, if no operational response has been received by the aircraft system within 270 seconds. The flight crew is notified and reverts to voice to resolve the situation.

b) The dialogue is closed locally by the aircraft system, ensuring that the dialogue doesn't remain open at the aircraft side.

Note.— ATN B1 ground systems have implemented ground-timer. In normal circumstances, the ground-timer (ttr) expires before the aircraft-timer (tts) expires. Refer to paragraph E.4.2.4.2.

E.4.3.4.2.2 If the controller responds to a request with a UM 1 STANDBY, the aircraft and ground timers are re-started.

E.4.3.5 Use of degrees in ACL messages

E.4.3.5.1 The Display of [degrees] parameter is used in the following three CPDLC messages:

a) UM 94 TURN (direction) HEADING (degrees)

b) UM 190 FLY HEADING (degrees)

c) UM 215 TURN (direction) (degrees) DEGREES

E.4.3.5.2 UM 94 and UM 190 represent an absolute change towards the instructed HEADING, while UM 215 is a relative change with reference to the current HEADING.

E.4.3.5.3 ICAO requires that the HEADING in UM 94 and UM 190 is expressed in 3 digits (e.g. '015°) and should be displayed accordingly.

E.4.3.5.4 Flight crews should be aware that Airframe and avionics manufacturers are adding a leading '0' for degrees less than 100° for UM 94 and UM 190.

E.4.3.5.5 However, UM 215 is expressed in two digits (e.g. 15 degrees). To ensure that flight crews execute UM 215 as a relative change, UM 215 is displayed as TURN (direction) (degrees) DEGREES (e.g. TURN RIGHT 15 DEGREES).

E.4.3.6 Transfer of data communications with open dialogues

E.4.3.6.1 Open air-initiated dialogues

E.4.3.6.1.1 When there are open air-initiated dialogues, the ground system closes each of these dialogues with a closure response before sending the transfer instruction. The closure uplink responses are one of the following:

a) UNABLE (UM 0), or

b) REQUEST AGAIN WITH NEXT UNIT (UM 237), or

c) Concatenated message 'ERROR' (UM 159) + REQUEST AGAIN WITH NEXT UNIT (UM 183 - free text), or

d) REQUEST AGAIN WITH NEXT UNIT (UM 183 - free text)

E.4.3.6.1.2 When there are open air-initiated dialogues, and the flight crew responds to the transfer instruction with a DM 0 WILCO, the airborne system cancels all open air initiated dialogues. When responding with DM 1 UNABLE or DM 2 STANDBY, the aircraft system maintains the open dialogues.

E.4.3.7 Multiple open requests for a same type

E.4.3.7.1 To avoid ambiguity and request being discarded by the ATSU, the flight crew should avoid sending multiple requests for a same type of dialogue, dialogue type being one of the following: a) level; b) heading; c) speed; d) route.

Note.— The flight crew should be aware that only one downlink request for a single type will be presented to the controller and that this open dialogue must be closed before a second request of that type may be treated.

E.4.3.8 Abnormal situations

E.4.3.8.1 Inability to contact the assigned voice communication channel

E.4.3.8.1.1 When the flight crew is unable to contact the assigned voice communication channel when instructed to do so by the transferring controller via CPDLC, the flight crew should revert to the voice communication channel of the transferring ATC unit for instructions.

E.4.3.8.2 Use of CPDLC in the event of voice radio communication failure

E.4.3.8.2.1 The existence of a CPDLC connection between the ATS unit and the aircraft should not pre-empt the flight crew and ACC from applying all the ICAO provisions in the event of radio communication failure.

E.4.3.8.2.2 When the flight crew cannot comply with the requirement above, he/she will have to apply the provisions stipulated for the event of radio communication failure.

E.4.3.8.3 Flight crew commanded CPDLC termination

E.4.3.8.3.1 When flight crew initiates CPDLC termination, the ATN B1 airborne system sends a CPDLC-User-abort to the ground system. The controller is notified of the abort.

Note.— Subject to local designs, ground systems may not provide facilities for CPDLC connect request to be re-issued upon notification by the flight crew that they want to resume CPDLC with the ground.

E.4.3.8.3.2 To reinstate CPDLC after a flight crew initiated commanded termination, the flight crew initiates a CM-logon request.

E.4.3.9 Uplink error messages

E.4.3.9.1 ATN B1 systems use a number of operational errors, when downlinking an operational message. An operational error occurs when the ATN B1 ground system does not behave according to the ATN B1 requirements or local constraints prevent an operational response.

E.4.3.9.2 When receiving an 'ERROR' (UM 159) + free text message (UM 183) in response to operational downlink messages, the flight crew should revert to voice to clarify the situation with the controller.

E.4.3.9.3 Table E-EUR- 4 provides a list of operational error messages displayed to the flight crew.

Table E-EUR- 4. Operational error uplink messages

Free Text message	Description	Procedure
DOWNLINK MESSAGE REQUEST REJECTED - SEND (number) ELEMENTS	The ground system receives a message that contains more message elements than it can support in a message. Example: The flight crew sends a combined message (DM 6 REQUEST [level], DM 70 REQUEST HEADING [degrees], DM 65 DUE TO WEATHER) and the ground system accepts only a maximum of two message elements. *Note.— It is a local choice of the ground system to reject downlink messages containing more than 1, 2 or 3 message elements or to accept up to 5 message elements.*	The flight crew may resend the request in the form of separate messages, or make the request/s by voice.
(Dialogue type) NOT AVAILABLE AT THIS TIME – USE VOICE Dialogue type is one of the following: LEVEL, HEADING, SPEED, ROUTE REQUEST	The ground system receives a downlink message that is discarded because the associated dialogue type is disabled.	The flight crew should make the request by voice.

Free Text message	Description	Procedure
ELEMENT COMBINATION REJECTED – USE VOICE	The ground system receives a concatenated downlink message that it does not support (invalid element combination, or at least one message element is not supported, or invalid element order). *Note.— Whether a combination of message elements is valid or not, is determined through local choice of the ground system.* *Examples of obvious invalid combinations: Request Climb To + Request Descend To; WILCO + UNABLE, etc.*	The flight crew may resend the message/request in the form of separate messages, or make the request/s by voice
TOO MANY (dialogue type) REQUESTS – EXPECT ONLY ONE REPLY Dialogue type is one of the following: LEVEL, HEADING, SPEED, ROUTE.	The ground system receives a downlink request, and there is an existing open downlink request containing the same type and it discards the second request.	The flight crew should be aware that only one downlink request for a single type will be presented to the controller, and that this open dialogue must be closed before a second request of that type may be treated.
REQUEST REJECTED – REPLY TO (dialogue type) UPLINK FIRST Dialogue type is one of the following: LEVEL, HEADING, SPEED, ROUTE.	The ground system receives a downlink request, and there is an existing open uplink containing the same type. The downlink request is discarded. *Note.— Ground systems only accept one data link exchange of a given type at the same moment.*	The flight crew must respond to the uplink before being able to send a downlink request of this type.
TOO MANY CPDLC REQUESTS - USE VOICE	The ground system receives a downlink request, and discards a message because the maximum number of open operational dialogues with the aircraft is exceeded and there is no pending uplink message. *Note.— The total number of data link exchanges with an aircraft may be limited by some ground systems. This means that further requests will be rejected.*	The flight crew should make the request/s by voice. If there are only downlink requests, the flight crew cannot do anything about it. If there is at least one uplink expecting a response, the flight crew can respond to that clearance first to enable reception of a downlink request.

Free Text message	Description	Procedure
CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST	Until CPDLC is enabled, the ground system rejects any downlink message; except DM 99 (CURRENT DATA AUTHORITY), DM 89 (MONITORING), DM 62 (ERROR), and DM 62 concatenated with DM 98 (ERROR + Free text).	The flight crew cannot use data link now, but when CPDLC is fully operational, a CPDLC message is uplinked and displayed to the flight crew, indicating the name and function of the current ATC unit. The flight crew should not attempt to repeat the request until the CPDLC transfer has been completed and they are under the control of the ACC, being the CDA.
ATC TIME OUT – REPEAT REQUEST	If the controller fails to respond within 250 seconds the timer-responder (ttr) expires. The ground system closes the dialogue and automatically uplinks an error message in response to the downlink message request.	The flight crew is notified that the controller has not responded in the due time. The flight crew should repeat the request/s by voice
DOWNLINK DELAYED – USE VOICE.	The ground system receives a message and discards the message because it contains a timestamp that is older than the allowed limit.	The flight crew should revert to voice.
DOWNLINK DELAYED-USE VOICE’	Upon activation of the latency time monitor, the ground system automatically uplinks an error message. Note.— *The use of the LTM function for the ATSU is a recommendation.*	The flight crew should revert to voice.
DOWNLINK TIMESTAMP INDICATES FUTURE TIME.	The ground system receives a message timestamp that indicates a future time greater than 2 seconds from the current time.	The flight crew should revert to voice.
MESSAGE NOT SUPPORTED BY THIS ATS UNIT	The ground system receives a downlink message that it does not support, whether or not the message contains a message reference number, and discards the received message.	The flight crew should revert to voice.

Free Text message	Description	Procedure
FREE TEXT MESSAGE TOO LARGE - USE VOICE.	The ground system receives a downlink free text message element containing more than 80 characters, and the system cannot support the number of characters in a free text message element, and discard the received message.	The flight crew should revert to voice. *Note.— Ground systems may not accept downlink free text messages, or may not display them to the controller.*
CPDLC MESSAGE FAILED - USE VOICE.	A CPDLC downlink message is received that results in an error that is not already covered in the ATN SARPs, and the ground system discards the message.	The flight crew should revert to voice.
INVALID USE OF FREE TEXT MESSAGE - CONTACT ATC	The ground system does not support a message containing a free text message element because the message does not also contain the DM 62 ERROR (error information) message element and discards the message.	The flight crew should revert to voice.
RADAR TRACKING TERMINATED - TERMINATING CPDLC.	The ground system decides to terminate a CPDLC connection with an aircraft because it has lost radar data.	The flight crew should revert to voice.
CPDLC FOR (dialogue type) FAILED - USE VOICE. Dialogue type is one of the following: LEVEL, HEADING, SPEED, ROUTE	The ground system receives a downlink message containing a dialogue type that it does not support and discards the message.	The flight crew should revert to voice.
MESSAGE DOES NOT CONTAIN FACILITY NAME.	The ground system receives a downlink message that contains the unitname data type, but rejects the message because it does not also contain the facilityname data type and discards the message.	The flight crew should revert to voice.

E.4.4 Advanced data link operations

NIL

E.4.5 State aircraft data link operation

NIL

E.5 Middle East/Asia (MID/ASIA) Region

E.5.1 Administrative provisions related to data link operations

Table E-MID/ASIA- 1. Data link services by control area (CTA)

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Bahrain							
Emirates							
Ho Chi Minh				VVTS			
Kuala Lumpur				WMFC			
Kuwait							

E.5.2 Controller and radio operator procedures

NIL

E.5.3 Flight crew procedures

NIL

E.5.4 Advanced data link operations

NIL

E.5.5 State aircraft data link operation

NIL

E.6 North-America (NAM) Region

E.6.1 Administrative provisions related to data link operations

Table E-NAM- 1. Data link services by control area (CTA)

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Edmonton (Canada)	O	O	N	CZEG	YEGE2YA for CPDLC and YEGCDYA for ADS-C	NAT CNSG	
Gander domestic	O	N	N	CDQX	YQXD2YA	NAT CNSG	
Montreal domestic	O	N	N	CZUL	YULE2YA	NAT CNSG	,
Vancouver Domestic	O	N	N	CZVR	YVRE2YA	NAT CNSG	
Winnipeg Domestic	O	N	N	CZWG	YWGE2YA	NAT CNSG	
Moncton Domestic	O	N	N	CZQM	YQME2YA	NAT CNSG	
Albuquerque	N	N	N				
Anchorage and Anchorage Arctic	O	N	N	PAZA	ANCXFXA	IPACG FIT	CPDLC voice transfer: CONTACT PAZA CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary.
Anchorage continentalOceanic (south of N63 and west of W165)	O	O	N	PAZN	ANCATYA	IPACG FIT	CPDLC voice transfer: CONTACT PAZA CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary.
Atlanta	N	N	N				
Boston	N	N	N				
Chicago	N	N	N				
Cleveland	N	N	N				
Denver	N	N	N				
Ft. Worth	N	N	N				
Houston	N	N	N				
Indianapolis	N	N	N				

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Jacksonville	N	N	N				
Kansas City	N	N	N				
Los Angeles	N	N	N				
Memphis	N	N	N				
Miami	N	N	N				
Minneapolis	N	N	N				
New York	O	O	N	KZWY	NYCODYA	NAT CNSG	DO NOT use CPDLC for position reporting. Use ADS-C or voice only. SELCAL check via HF are required for all FANS connected aircraft prior to entering the CTA/FIR. DO NOT send a CPDLC position report to confirm CDA prior to, or upon crossing the FIR.
Oakland	O	O	N	KZAK	OAKODYA	IPACG FIT ISPACG FIT	CPDLC voice transfer: CONTACT KSFO CENTER [frequency] KSFO (San Francisco Radio) will provide all primary and secondary HF frequencies, and HF transfer points along the route of flight. Confirm CPDLC CDA: One CPDLC position report at FIR boundary.
Salt Lake	N	N	N				
Seattle	N	N	N				
Washington	N	N	N				

Note.— Also see the NAT part for additional information.

E.6.2 Controller and radio operator procedures

NIL

E.6.3 Flight crew procedures

NIL

E.6.4 Advanced data link operations

NIL

E.6.5 State aircraft data link operation

NIL

E.7 North Atlantic (NAT) Region

E.7.1 Administrative provisions related to data link operations

E.7.1.1 ANSP service provision

E.7.1.1.1 Table E-NAT- 1 lists the flight information regions (FIRs) and Upper flight information regions (UIRs), where data link service is provided and indicates Logon address, ATSU ACARS Address, coordinating group, CPDLC Contact or Monitor message requirements and position reporting requirements. For CPDLC, ADS-C and FMC WPR columns, O=operational, T=trial, and N=not available.

E.7.1.1.2 Table E-NAT- 2 lists the contact information of the NAT CSNG and Table E-NAT- 3 provides the website URL of the CRA.

Table E-NAT- 1. Data link services by control area (CTA).

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Bodø	N	O	O	ENOB		NAT CNSG	
Edmonton (Canada)	O	O	N	CZEG	YEGE2YA for CPDLC and YEGCDYA for ADS-C	NAT CNSG	
Gander Oceanic	O	O	O	CZQX	YQXE2YA	NAT CNSG	Report revised ETA: Next waypoint ETA error 3 minutes or more, use free text DM 67k REVISED ETA [position] [time]. See paragraph E.7.1.4.

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Gander domestic	O	N	N	CDQX	YQXD2YA	NAT CNSG	
Montreal domestic	O	N	N	CZUL	YULE2YA	NAT CNSG	,
Moncton Domestic	O	N	N	CZQM	YQME2YA	NAT CNSG	
New York	O	O	N	KZWY	NYCODYA	NAT CNSG	DO NOT use CPDLC for position reporting. Use ADS-C or voice only. SELCAL check via HF is required for all FANS connected aircraft prior to entering the New York CTA. DO NOT send a CPDLC position report to confirm CDA prior to, or upon crossing the New York CTA.
Reykjavik	O	O	O	BIRD	REKCAYA	NAT CNSG	Confirm CPDLC CDA: Free text uplink message. Report revised ETA: Next waypoint ETA error 3 minutes or more, use free text DM 67k REVISED ETA [position] [time]. See paragraph E.7.1.4.
Santa Maria	O	O	O	LPPO	SMACAYA	NAT CNSG	Confirm CPDLC CDA: CPDLC UM 160 (NDA). Report revised ETA: Next waypoint ETA error 3 minutes or more, use free text DM 67k REVISED ETA [position] [time]. See paragraph E.7.1.4.

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Shanwick	O	O	O	EGGX	PIKCPYA	NAT CNSG	Report revised ETA: Next waypoint ETA error 3 minutes or more, use free text DM 67k REVISED ETA [position] [time]. See paragraph E.7.1.4. Respond with immediate STANDBY to acknowledge receipt of downlink message.
Vancouver Domestic	O	N	N	CZVR	YVRE2YA	NAT CNSG	
Winnipeg Domestic	O	N	N	CZWG	YWGE2YA	NAT CNSG	

Table E-NAT- 2. Contact information

Coordinating group or regional monitoring agency	Contact information
NAT CNSG ICAO	Elkhan Nahmadov Phone +33 1 4641 8529 Fax +33 1 4641 8500 Email icaoeurnat@paris.icao.int
NAT CNSG Operations	Shelley Bailey Operational System Requirements Phone +1-709-651-5240 Fax +1(709) 651 5235 Email bailesh@navcanada.ca Pedro Vicente Operational System Requirements – Domestic Phone +1(613) 248 -6965 Email vicentpe@navcanada.ca
NAT CNSG Engineering	Tim Murphy Team Leader, Engineering Operations Support Phone +44 1292 692 772 Fax +44 1292 692 640 Email: tim.murphy@nats.co.uk

Coordinating group or regional monitoring agency	Contact information
NAT CNSG Operators using ARINC as their CSP contact	Pete Grogan Phone (410) 266-2344 Email PGROGAN@arinc.com
NAT CNSG Operators using SITA as their CSP contact	Kathleen Kearns Manager, AIRCOM ATC Business, North America Phone: (703) 491-0661 Fax: (703) 491-0662 e-Mail: Kathleen.Kearns@sita.aero

Table E-NAT- 3. Regional monitoring agency websites available for problem reporting

Regional monitoring agency	Website URL
NAT Data Link Monitoring Agency (NAT DLMA) co-managed with the Informal South Pacific ATC Coordinating Group (ISPACG) and ISPACG Central Reporting Agency (CRA) and CRASA	http://www.ispacg-cra.com/

E.7.1.2 Uplink message elements unsuited for NAT operations

E.7.1.2.1 The following uplink message elements are unsuited for NAT operations and NAT ANSPs should avoid their use:

a) UM 171 CLIMB AT [vertical rate] MINIMUM

b) UM 172 CLIMB AT [vertical rate] MAXIMUM

c) UM 173 DESCEND AT [vertical rate] MINIMUM

d) UM 174 DESCEND AT [vertical rate] MAXIMUM

e) UM 115 DO NOT EXCEED [speed]

f) UM 116 RESUME NORMAL SPEED

g) UM 146 REPORT GROUND TRACK

h) UM 182 CONFIRM ATIS CODE

E.7.1.3 Unsupported CPDLC downlink message elements – NAT

E.7.1.3.1 This paragraph provides the CPDLC downlink message elements that are supported by a data link system but are not supported within a specific region. If the appropriate ATSU receives any of the message elements listed in Table E-NAT- 4, they will send UM 169u MESSAGE NOT SUPPORTED BY THIS ATS UNIT.

Note.— See Appendix A for CPDLC message elements that are supported by a data link system but their use should be avoided due to potential misinterpretation and should not be supported globally.

Table E-NAT- 4. Unsupported CPDLC downlink message elements

Data link system	Unsupported downlink message elements
FANS 1/A	DM 49 WHEN CAN WE EXPECT [speed] DM 50 WHEN CAN WE EXPECT [speed] TO [speed] DM 51 WHEN CAN WE EXPECT BACK ON ROUTE DM 52 WHEN CAN WE EXPECT LOWER ALTITUDE DM 53 WHEN CAN WE EXPECT HIGHER ALTITUDE DM 54 WHEN CAN WE EXPECT CRUISE CLIMB TO [altitude] DM 67h WHEN CAN WE EXPECT CLIMB TO [altitude] DM 67i WHEN CAN WE EXPECT DESCENT TO [altitude] *Note.— The downlink messages are not supported because of potential misinterpretation of appropriate uplink responses in the event of a total communication failure. In addition to highlighted messages in Appendix A, the following uplink messages are not used in the NAT:* *UM 70 EXPECT BACK ON ROUTE BY [position]* *UM 71 EXPECT BACK ON ROUTE BY [time]* *UM 99 EXPECT [procedure name]* *UM 100 AT [time] EXPECT [speed]* *UM 101 AT [position] EXPECT [speed]*

E.7.1.4 Reporting requirements in NAT airspace where ADS-C is available

E.7.1.4.1 In the NAT Region, if the estimated time for the next position last provided to air traffic control is found to be in error by three minutes or more, the flight crew should provide a revised estimated time.

E.7.1.4.2 The flight crew may assume that the estimate for the next waypoint, shown on the FMS at the time a waypoint is crossed, is the estimate transmitted to ATC.

E.7.1.4.3 The flight crew should provide the revised estimate to the controlling ATS unit as soon as possible via voice or CPDLC using free text DM 67k REVISED ETA [position] [time].

E.7.2 Controller and radio operator procedures

E.7.2.1 Voice communication procedures

E.7.2.1.1 Aeradio - response to initial contact

E.7.2.1.1.1 Aeradio operators should:

a) Respond to an aircraft that identifies itself by including a data link term after the aircraft call sign by restating the data link term after the aircraft call sign (see paragraph E.7.3.1.1.3 for the list of data link terms); and

b) Complete the SELCAL check (see paragraph E.7.3.1.1.4 and paragraph E.7.3.1.1.5 for examples of the initial contact procedures to be used by the flight crew).

E.7.2.1.1.2 If a flight uses the term "A-D-S" after the aircraft call sign, the aeradio operator should issue:

a) Communication instruction for the next CTA/FIR; or

b) Communications instructions and the frequency to contact the appropriate ATSU approaching, or over, the exit point; or

c) Instructions for the flight to contact the aeradio station serving the next CTA/FIR at a time or location prior to the next CTA/FIR boundary or exit point.

E.7.2.1.1.3 When the CTA/FIR does not offer FMC WPR services, if a flight uses the term "F-M-C" after the aircraft call sign, the aeradio operator should advise the flight crew to make position reports by HF voice.

E.7.2.1.1.4 When the CTA/FIR offers FMC WPR services, if a flight uses the term "F-M-C" after the aircraft call sign, the aeradio operator should issue:

a) Communication instruction for the next CTA/FIR; or

b) Communications instructions and the frequency to contact the appropriate ATSU approaching, or over, the exit point; or

c) Instructions for the flight to contact the aeradio station serving the next CTA/FIR at a time or location prior to the next CTA/FIR boundary or exit point.

E.7.2.1.1.5 When the CTA/FIR does not offer CPDLC services, if a flight uses the term "C-P-D-L-C" after the aircraft call sign, the aeradio operator should:

a) Advise the flight that ""CPDLC SERVICE NOT AVAILABLE IN (name) CTA/FIR"; and

b) Issue:

1) Communication instruction for the next CTA/FIR; or

2) Communications instructions and the frequency to contact the appropriate ATSU approaching, or over, the exit point; or

3) Instructions for the flight to contact the aeradio station serving the next CTA/FIR at a time or location prior the next CTA/FIR boundary or exit point.

E.7.2.1.1.6 During CPDLC operations, if a flight uses the term "C-P-D-L-C" after the aircraft call sign, the aeradio operator should:

a) Advise the flight that “(type) FREQUENCIES WILL BE ASSIGNED VIA CPDLC”; or

b) Issue:

1) Communication instructions for the next CTA/FIR; or

2) Communication instructions and the frequency to contact the appropriate ATSU approaching, or over, the exit point; or

3) Instructions for the flight to contact the aeradio station serving the next CTA/FIR at a time or location prior to the next CTA/FIR boundary or exit point.

E.7.2.1.2 Aeradio - delayed CPDLC messages

E.7.2.1.2.1 If the flight crew advises “DELAYED CPDLC MESSAGE RECEIVED”, they are explaining that a CPDLC message was received late. Flight crew procedures require voice contact to verify the message status. Aeradio operators should include this notation when relaying the associated communication to ATC (see paragraph 5.2.1.9 and Appendix F, paragraph F.11 for flight crew procedures and paragraph 3.1.2.6 for further information regarding delayed CPDLC uplinks).

E.7.3 Flight crew procedures

E.7.3.1 Voice communication procedures

E.7.3.1.1 Flight crew – contact with aeradio

E.7.3.1.1.1 The integrity of the ATC service remains wholly dependent on establishing and maintaining HF or VHF voice communications with each ATSU along the route of flight. The procedures in this section are applicable only in NAT airspace and pertain only to ATS data link operations.

E.7.3.1.1.2 Prior to entering each NAT oceanic CTA, the flight crew should contact the appropriate aeradio station.

E.7.3.1.1.3 Table E-NAT- 5 provides the data link terms the flight crew should use to identify the flight. The flight crew should continue to use the data link term until either the SELCAL check has been completed or the frequency assignment has been received.

Table E-NAT- 5. Terms to identify data link capability

Term	Data link status of aircraft
“A-D-S”	Participating in ADS-C only.
“F-M-C”	Participating in FMC WPR
“C-P-D-L-C and A-D-S	Participating in CPDLC and ADS-C

E.7.3.1.1.4 If the flight will exit the CTA into oceanic and remote airspace, on initial contact with the CTA the flight crew should:

a) Not include a position report;

b) Use the appropriate data link term after the aircraft call sign (see paragraph E.7.3.1.1.3);

c) State the name of the next CTA/FIR to be entered; and

d) Request the SELCAL check.

Example 1 (initial contact from an eastbound ADS-C-only flight about to enter the Gander CTA):

GANDER RADIO, AIRLINE 123 A-D-S, SHANWICK NEXT, REQUEST SELCAL CHECK CDAB.

Example 2 (initial contact from a westbound FMC WPR flight about to enter the Santa Maria CTA):

SANTA MARIA RADIO, AIRLINE 123 F-M-C, NEW YORK NEXT, REQUEST SELCAL CHECK AFMP.

Example 3 (initial contact from an eastbound CPDLC flight about to enter the New York Data Link service area):

NEW YORK ARINC, AIRLINE 123 C-P-D-L-C, GANDER NEXT, REQUEST SELCAL CHECK CKFM.

E.7.3.1.1.5 If the flight will exit the CTA into continental airspace, on initial contact with the CTA, the flight crew should:

a) Not include a position report;

b) Use the appropriate data link term after the aircraft call sign (see paragraph E.7.3.1.1.3);

c) State the track letter if operating on the organized track system;

d) State the last two fixes in the cleared route of flight if operating outside the organized track system; and

e) Request the SELCAL check.

Example 1 (initial contact from an eastbound ADS-C-only flight about to enter the Shanwick CTA):

SHANWICK RADIO, AIRLINE 123 A-D-S, TRACK ZULU, REQUEST SELCAL CHECK CDAB.

Example 2 (initial contact from a westbound CPDLC flight about to enter the Gander CTA):

GANDER RADIO, AIRLINE 123 C-P-D-L-C, SCROD VALIE, REQUEST SELCAL CHECK DMCS.

Example 3 (initial contact from an eastbound FMC WPR flight about to enter the Shanwick CTA):

SHANWICK RADIO, AIRLINE 123 F-M-C, TRACK ZULU, REQUEST SELCAL CHECK CDAB.

E.7.3.1.1.6 Depending on which data link services are offered in the CTA and the operational status of those services, the aeradio operator will provide appropriate information and instructions to the flight crew (see paragraph E.7.2.1.1 for information regarding associated aeradio procedures).

E.7.3.1.1.7 In the event an onboard systems failure prevents CPDLC, ADS-C or FMC WPR or if any of these services is terminated:

a) If the failure/termination occurs prior to initial contact with the aeradio station, do not use the phrase "A-D-S", "C-P-D-L-C" or "F-M-C" after the aircraft call sign;

b) Resume normal voice communications, including providing all subsequent position reports via voice;

c) Do not inform aeradio that the service has been terminated; and

d) Inform Company Operations Department in accordance with established problem reporting procedures.

E.7.3.1.1.8 For ADS-C & FMC WPR flights, the flight crew should not submit position reports via voice to reduce frequency congestion, unless otherwise advised by aeradio operator.

E.7.3.1.1.9 ADS-C flights are exempt from all routine voice meteorological reporting, however the flight crew should use voice to report unusual meteorological conditions such as severe turbulence to the aeradio station.

E.7.3.1.1.10 The flight crew should not ask aeradio questions regarding the status of the ADS-C connections or whether an ADS-C or an FMC WPR has been received. Should the ATSU fail to receive an expected position report, the controller will follow guidelines in paragraph 4.5.1.7 for late or missing ADS-C reports or request a voice report for a late or missing FMC waypoint position report.

E.7.3.1.1.11 When leaving CPDLC, ADS-C-only, or FMC WPR environment, the flight crew should comply with all communication requirements applicable to the airspace being entered.

E.7.3.1.1.12 If the flight crew does not receive its domestic frequency assignment by 10 minutes prior to the flight's entry into continental airspace, the flight crew should contact aeradio and request the frequency, stating the oceanic exit fix.

E.7.4 Advanced data link operations

NIL

E.7.5 State aircraft data link operation

NIL

E.8 Pacific (PAC) Region

E.8.1 Administrative provisions related to data link operations

E.8.1.1 ANSP service provision

Table E-PAC- 1. Data link services by control area (CTA).

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Anchorage and Anchorage Arctic (north of N63 and east of W165)	O	N	N	PAZA	ANCXFXA	IPACG FIT	CPDLC voice transfer: CONTACT PAZA CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary.
Anchorage Oceanic (south of N63 and west of W165)	O	O	N	PAZN	ANCATYA	IPACG FIT	CPDLC voice transfer: CONTACT PAZA CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary.
Auckland Oceanic	O	O	O	NZZO	AKLCDYA	ISPACG FIT	CPDLC voice transfer: MONITOR NZZO CENTER [frequency] SELCAL check by CPDLC equipped aircraft is not required on entering NZZO CTA. Aircraft filing a SELCAL code in FPL Item18 will be assumed to have serviceable SELCAL and be maintaining a SELCAL watch on the HF frequency advised in the monitor instruction passed by the transferring CPDLC authority. Confirm CPDLC CDA: One CPDLC position report at boundary.
Bangkok	O	O	O	VTBB	BKKGWXA	FIT BOB FIT SEA	Confirm CPDLC CDA: CPDLC UM 160 (NDA).
Brisbane	O	O	T	YBBB	BNECAYA	ISPACG FIT	CPDLC voice transfer: MONITOR BRISBANE CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary.

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Chengdu (China)	O	O	N	ZUUU	CTUGWYA		
Chennai (India)	O	O	N	VOMF	MAACAYA	FIT BOB	
Delhi (India)	N	O	N	VIDF			
Fukuoka	O	O	N	RJJJ	FUKJJYA	IPACG FIT	CPDLC voice transfer: CONTACT TOKYO CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at boundary.
Honiara	O	O	N	YBBB	BNECAYA		
Kolkata (India)	O	O	N	VECF			
Kunming (China)	O	O	N	ZPPP	KMGGWYA		
Lanzhou (China)	O	O	N	ZLLL	LHWGWYA		
Mauritius	O	O	N	FIMM			Confirm CPDLC CDA: One CPDLC position report at boundary.
Melbourne	O	O	N	YMMM	MELCAYA	ISPACG FIT	CPDLC voice transfer: MONITOR MELBOURNE CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at boundary.
Mumbai (India)	O	O	N	VABF	BOMCAYA		
Nadi	O	O	N	NFFF	NANCDYA	ISPACG FIT	CPDLC voice transfer: MONITOR NFFF CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at boundary.
Nauru	O	O	N	YBBB	BNECAYA		MONITOR BRISBANE CENTER [frequency]

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Oakland	O	O	N	KZAK	OAKODYA	IPACG FIT ISPACG FIT	CPDLC voice transfer: CONTACT KSFO CENTER [frequency] Note.— KSFO (San Francisco Radio) will provide all primary and secondary HF frequencies, and HF transfer points along the route of flight. Confirm CPDLC CDA: One CPDLC position report at boundary.
Seychelles	O	O	N	FSSS			
Singapore	O	O	O	WSJC	SINCDYA	FIT SEA	Confirm CPDLC CDA: One CPDLC position report at boundary.
Tahiti	O	O	N	NTTT	PPTCDYA	ISPACG FIT	CPDLC voice transfer: CONTACT NTTT CENTER [frequency] Note.— A SELCAL check is required. Confirm CPDLC CDA: One CPDLC position report at boundary.
Ujung Pandang (Makassar) (Indonesia)	T	T	N	WAAF	UPGCAYA		Position reporting: CPDLC position report at each waypoint. Note.— Currently trialing ADS-C and CPDLC.
Ulan Bator (Mongolia)	O	O	N	ZMUA			
Urumqi (China)	O	O	N	ZWWW			
Colombo	T	T	N	VCCC			Position reporting: CPDLC position report at each waypoint. Note.— Currently trialing ADS-C and CPDLC. Primary communication via voice. Full HF reporting still required.
Yangon (Myanmar)	O	O	N	VYYF			

Table E-PAC- 2. Contact information

Coordinating group or regional monitoring agency	Contact information
TBD	TBD

Table E-PAC- 3. Regional monitoring agency websites available for problem reporting

Regional monitoring agency	Website URL
Informal South Pacific ATC Coordinating Group (ISPACG) and ISPACG Central Reporting Agency (CRA) and CRASA	http://www.ispacg-cra.com/

E.8.1.2 Exchange of turbulence information in Fukuoka FIR

E.8.1.2.1 In the Fukuoka FIR, the flight crew should report moderate or severe turbulence information. Turbulence information is provided for aircraft which fly around location of observation within height difference of ±4,000 feet from altitude of observation and will pass within two hours from time of observation.

E.8.1.2.2 The flight crew may use CPDLC for reporting and receiving moderate or severe turbulence information. For aircraft which does not have a CPDLC connection, the exchange of turbulence information is implemented by voice. The turbulence information provided to flight crews, whether by CPDLC or voice, will be the same.

E.8.1.2.3 Report of turbulence information by CPDLC

E.8.1.2.3.1 When reporting turbulence information via CPDLC, aircraft should downlink in the following form by free text message.

DM 67 [MOD or SEV] TURB [location of observation] [altitude of observation] [time of observation]Z

Note 1.— Aircraft should report location of observation in the following form. When observing turbulence continuously, aircraft is able to report location of observation in the following form; "[beginning location of observation] [end location of observation]".

a) FIX (e.g. "NIPPI")

b) Distance and radial from FIX (e.g. "20NM SW NIPPI")

c) Latitude and longitude (e.g. "4020N14532E")

d) When observing turbulence continuously (e.g. "RIPKI GARRY")

Note 2.— When observing turbulence while cruising, aircraft is able to report by omitting altitude of observation. When observing turbulence continuously while climbing or descending, aircraft should *report altitude of observation in the following form; "[lower limit altitude of observation] [upper limit altitude of observation]" (e.g. "FL330 FL350").*

Note 3.— When reporting turbulence information within 5 minutes after observing, aircraft is able to report by omitting time of observation.

Examples of downlink messages:

"SEV TURB 35N160E FL330 0924Z"

"MOD TURB 20NM N ASEDA 35NM S ASEDA FL350 1152Z"

"MOD TURB NIPPI 2114Z"

"SEV TURB 3530N15451E FL370 FL390 0304Z"

"SEV TURB POXED FL320"

"MOD TURB CELIN"

E.8.1.2.4 Provision of turbulence information by CPDLC

E.8.1.2.4.1 When providing via CPDLC, turbulence information is uplinked in the following form by free text message:

UM 169 [MOD or SEV] TURB [location of observation] [altitude of observation] [time of observation]Z [type of aircraft]

E.8.1.2.4.2 The downlink response DM 3 ROGER should be used to acknowledge receipt of turbulence information issued.

Examples of uplink messages:

"MOD TURB NIPPI F360 0130Z B772"

"SEV TURB FM 37N160E TO 37N158E F320 0418Z A332"

"MOD TURB 20NM N ASEDA F330F350 1152Z B744"

E.8.2 Controller and radio operator procedures

NIL

E.8.3 Flight crew procedures

NIL

E.8.4 Advanced data link operations

NIL

E.8.5 State aircraft data link operation

NIL

E.9 South-America (SAM) Region

E.9.1 Administrative provisions related to data link operations

Table E-SAM- 1. Data link services by control area (CTA).

Control area (CTA)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Atlantico (Brazil)	O	O	N	SBAO	RECOEYA		
Cayenne (French Guiana)	O	O	N	SOOO	CAYCAYA		CPDLC voice transfer: MONITOR SOOO CENTER [frequency] SELCAL check by CPDLC equipped aircraft is not required on entering SOOO FIR. Aircraft filing a SELCAL code in FPL Item18 will be assumed to have serviceable SELCAL and be maintaining a SELCAL watch on the HF frequency advised in the monitor instruction passed by the transferring authority. Confirm CPDLC CDA: One CPDLC position report at SOOO boundary entry point.
Rochambeau				SOOO			

E.9.2 Controller and radio operator procedures

NIL

E.9.3 Flight crew procedures

NIL

E.9.4 Advanced data link operations

NIL

E.9.5 State aircraft data link operation

NIL

Appendix F Operator/aircraft specific information

F.1 FANS 1/A and ATN B1 product availability

Remarks
FANS 1/A, FANS 1/A+ and ATN B1 packages are available on aircraft as listed below. The list is intended only to indicate availability of products on aircraft models. It does not indicate, for example: a) Actual equipage and use; b) Capability to load route clearance information from CPDLC messages directly into an FMS; or c) Where FANS 1/A and ATN B1 are available on the same aircraft, that these aircraft support automatic CPDLC transfers.
Airbus A320
FANS A+ (CSB4) FANS A+ Data link Recording (CSB7) FANS B+ (CSB6) as ATN B1
Airbus A330, A340
FANS A (CLR3) FANS A+ (CLR4) FANS A+ Data link Recording (CLR7)
Airbus A380
FANS A+ Data link Recording (CLA3) FANS A+B (CLA4) as FANS 1/A-ATN B1
Airbus A350
FANS A+B (CLV1) as FANS 1/A-ATN B1
Boeing B747-400, 717, MD-90, MD-10, MD-11
FANS 1
Boeing B737, B757, B767
FANS 1+ (all) ATN B1 (without FANS 1)
Boeing B777, B787
FANS 1+ (all) FANS 2 (AIMS-2) as FANS 1+ and ATN B1
Boeing 747-8
FANS 2 as FANS 1+ and ATN B1

Dassault F900/F7X/F2000 EASy
FANS 1/A+ ATN B1 FANS 1/A-ATN B1
Dassault F900 retrofit
FANS 1/A+
Gulfstream GIV/GV
FANS 1/A+
Gulfstream G450/G550
FANS 1/A+ FANS 1/A-ATN B1
Gulfstream G650
FANS 1/A-ATN B1
Embraer Legacy G650
FANS 1/A
Embraer 170/190
ATN B1 FANS 1/A-ATN B1
Bombardier GEX/G5000
FANS 1/A+
Bombardier GlobalExpress6000
FANS 1/A+

F.2 Verifying aircraft registration

Airbus A380
On the A380 aircraft, the flight crew cannot change the aircraft registration in the FN_CON message. The aircraft registration is provided by the aircraft system.
Airbus A320, A330, A340
These aircraft do not have an ***essential*** data source for this datum, which means that the maintenance / flight crew needs to verify that the aircraft registration used for data link comm. is correct.
Boeing B787
On the B787 aircraft, the flight crew cannot change the aircraft registration in the FN_CON message. The aircraft registration is provided by the aircraft system.
Boeing B737, B747-400, B747-8, B777, B757, B767, B717, MD90, MD10, MD11
These aircraft do not have an ***essential*** data source for this datum, which means that the flight crew needs to verify that the aircraft registration is correct.

F.3 CPDLC connection management

Remarks
If the aircraft is establishing or in the process of establishing a connection with a previously designated next data authority, and a message with a new UM 160 NEXT DATA AUTHORITY [icao facility designation] message element is received, the aircraft sends DISCONNECT REQUEST (DR1) for this connection with the next data authority.
Airbus
If the facility designation in the new UM 160 NEXT DATA AUTHORITY is the same as the facility designation that the aircraft already retains, the aircraft discards the new UM 160 NEXT DATA AUTHORITY and the connections will not be affected.
Boeing
In the above case the connection will be terminated. The only CPDLC CR1 message processed normally by FANS 1 is the first CPDLC CR1 following a FN-CON (i.e. FN-CON was initiated when no CPDLC connection exists).

F.4 Flight crew display – response and acknowledgement

Airbus A320, A330, A340, A380

On Airbus aircraft, the flight crew is offered a display prompt according to the following table.

UM Response Attribute	Flight Crew Responses	Flight Deck Display Prompt
W/U	WILCO, UNABLE, STANDBY	WILCO, UNABLE, STBY
A/N	AFFIRMATIVE, NEGATIVE, STANDBY	AFFIRM, NEGATV, STBY
R for FANS A/A+	ROGER, STANDBY	ROGER, STBY
R for ATN B1	ROGER, UNABLE, STANDBY	ROGER, UNABLE, STBY

Boeing

On Boeing aircraft, the flight crew is offered a display prompt according to the following table.

UM Response Attribute	Flight Crew Responses	Flight Deck Display Prompt
W/U	WILCO, UNABLE, STANDBY	ACCEPT, REJECT, STANDBY
A/N	AFFIRMATIVE, NEGATIVE, STANDBY	ACCEPT, REJECT, STANDBY
R for FANS-1	ROGER, STANDBY	ACCEPT, STANDBY
R for ATN B1	ROGER, UNABLE, STANDBY	ACCEPT, REJECT, STANDBY

a) When the flight crew selects either the ACCEPT or the REJECT prompt, the avionics automatically transmits the correct response (DM 0 WILCO, DM 3 ROGER, DM 4 AFFIRM, DM 1 UNABLE, or DM 5 NEGATIVE) for the corresponding message.

b) On FANS 1 equipped aircraft, the flight crew cannot add any other element to a positive response.

c) On some 747-400 airplanes with FANS-1, once the flight crew selects the ACCEPT or REJECT prompt, the VERIFY page displays DM 0 WILCO, DM 3 ROGER, or DM 1 UNABLE.

F.5 FMS processing of waypoints in position reports

Airbus A320, A330, A340, A380
The FMS cannot distinguish between ATC mandatory waypoints and waypoints inserted by the flight crew. However, the flight crew can over-write any system-determined default data contained in reports and confirm messages.
Boeing B747-400
The FMCs on the B747-400 aircraft does not distinguish between ATC mandatory waypoints and FMC sequenced waypoints for position reports. Additionally, the FANS 1 of the B747-400 aircraft does not permit the flight crew to overwrite the FMC-determined default "reported waypoint" position in downlink DM 45 - REPORTED WAYPOINT. However, the FANS 1 of the B747-400 aircraft does allow the flight crew to overwrite the FMC-determined default time (in particular, in response to uplink UM 138 -CONFIRM TIME OVER REPORTED WAYPOINT). Non-use of uplink UM 139 for B747-400 aircraft The uplink message UM 139 - Confirm reported waypoint should not be sent to B747-400 aircraft.
Boeing B737, B777, B757, B767, B717, MD90, MD10, MD11
The FMCs on these Boeing aircraft do not distinguish between ATC mandatory waypoints and FMC sequenced waypoints for position reports. However, the FANS 1 of these aircraft will allow the flight crew to overwrite the FMC-determined default "reported waypoint" position and time (Downlink element DM 45).
Boeing B787
The B787 FANS 1 can be selected to distinguish between ATC mandatory waypoints and non-mandatory waypoints for reporting the NEXT and NEXT+1 waypoints. However, the reported waypoint in a position report will always be the last sequenced waypoint, regardless of whether it is an ATC mandatory one. The FANS 1 will allow the flight crew to overwrite the FMC-determined default "reported waypoint" position and time (Downlink element DM 45).

F.6 Multiple request messages

Airbus A380
There is no network acknowledgement timer on A380 aircraft for the establishment of a connection. Once CPDLC is established, there is an ACK_DSP timer which is set as 3 min 30.
Airbus A320, A330, A340
There is no network acknowledgement timer on these Airbus aircraft for the establishment of a connection. Once CPDLC is established, there is an ACK_DSP timer which is set as follows: FANS A (CLR3) = 2 min FANS A+ (CLR4) = 3 min 30s FANS A+ DR (CLR7) = 6 min.

Boeing B747-400
If the network acknowledgement to a downlink message is not received by the B747-400 aircraft's ACARS Management Unit within a time period set in the Navigation Database or Operational Program Configuration (OPC) file, the FANS 1 closes the message and an alert is triggered to the flight crew. This alert may prompt the flight crew to re-send the message. Once back "IN COMM" the ACARS Management Unit will transmit any "queued" messages. The timer value is set to 5 minutes. If a second message is identical to the first, but with a different message identification number, and both messages have been received and responded to by the controller, the aircraft system will only recognize the message identification number of the second message. The aircraft system considers the first message to have been unsuccessful. In reply to the controller's response to the first message, the aircraft system will send an INVALID REFERENCE NUMBER ERROR. The controller's response to the second message will be processed normally. In this case, if the controller ignores the first message, the connections to both ATS systems will not be lost when an End Service message is received on board the aircraft.
Boeing B737, B747-8, B757, B767, B717, MD90, MD10, MD11
When the network acknowledgement timer expires, it just "unlocks" the request pages, so that the flight crew will be able to send another one. The time at which the network acknowledgement timer expires can be set in the Operational Program Configuration (OPC) file in the FMS. Currently, the value is set to 5 minutes.
Boeing B777, B787
This network acknowledgement timer does not apply to these aircraft.

F.7 Waypoint sequencing

Airbus A320, A330, A340, A380
Waypoint sequencing will only occur when the aircraft is within 7 NM of the aircraft active flight plan route (as modified by any parallel offset that may have been entered). Therefore ADS-C waypoint change event report and armed UM 130 REPORT PASSING message will not be transmitted automatically when the aircraft is outside these limits.
Boeing B737, B747-400, B747-8, B757, B767, B777, B787, MD90
Waypoint sequencing will only occur when the aircraft is within 21 NM of the aircraft active flight plan route (as modified by any parallel offset that may have been entered). Therefore ADS-C waypoint change event report and armed UM 130 REPORT PASSING message will not be transmitted automatically when the aircraft is outside these limits.
Boeing B717, MD10, MD11
Waypoint sequencing will only occur when the aircraft is within 7 NM of the aircraft active flight plan route (as modified by any parallel offset that may have been entered). Therefore ADS-C waypoint change event report and armed UM 130 REPORT PASSING message will not be transmitted automatically when the aircraft is outside these limits.

F.8 Open uplinks at time of transfer of communications

Boeing
If there are OPEN uplinks in the ATC LOG when the CDA initiates transfer of communication to the Next Data Authority, the FMC will allow transfer to the Next Data Authority (i.e. the avionics will not disconnect the next data authority). This allows a smooth transfer to the next Flight Information Region if there are open uplinks at the time of transfer.
Airbus A330, A340 FANS A
If there are OPEN uplinks when the CDA initiates transfer of communication to the Next Data Authority, the avionics will disconnect all CPDLC connection.
Airbus A320, A330, A340, A380 FANS A+
If there are OPEN uplinks when the CDA initiates transfer of communication to the Next Data Authority, the avionics will allow transfer to the Next Data Authority (i.e. the avionics will not disconnect the next data authority). This allows a smooth transfer to the next Flight Information Region if there are open uplinks at the time of transfer.

F.9 Variable constraints

Airbus A320, A330, A340 FANS A & FANS A+
These Airbus aircraft do not support a <space> within a [unit name] parameter.
Airbus A320, A330, A340 and A380 FANS A+ Data Link Recording **Airbus A320 FANS B+** **Airbus A380 and A350 FANS A+B**
These Airbus aircraft support a <space> within a [unit name] parameter.
Boeing
Boeing aircraft support a <space> within a [unit name] parameter.

F.10 ADS-C emergency report interval default

Airbus
If a periodic contract is active, the emergency reports will be transmitted at the existing periodic interval. Otherwise, the interval will default to 64 seconds.
Boeing
If a periodic contract is active, the emergency reports will be transmitted at the existing periodic interval. Otherwise, the interval will default to 304 seconds.

F.11 Message latency monitor

Remarks
For ATN B1 and FANS 1/A-ATN B1 aircraft, when a new ATN B1 CPDLC connection becomes active, this function is hard-coded in the avionics and is activated with a fixed value of 40 seconds (as per applicable standards).

Airbus

For FANS A+ and FANS A+B aircraft, when a new FANS 1/A CPDLC connection becomes active, this function automatically sets the [delayed message parameter] to the default NONE value (i.e. there is no check of a delayed CPDLC message until the flight crew manually sets a new value).

a) It is possible the flight crew may activate the function by setting a value for the [delayed message parameter], even if not instructed to do so.

b) If an ATSU is not using the message latency monitor and receives the above downlink, the following free text message may be sent: SET MAX UPLINK DELAY VALUE TO 999 SEC. This will minimize the possibility of subsequent uplink messages being rejected.

For all Airbus aircraft, the flight crew will not see delayed messages when the function is activated. Such a message is rejected, the ATSU will receive the following downlink message: INVALID DATA UPLINK DELAYED IN NETWORK AND REJECTED RESEND OR CONTACT BY VOICE. This message will refer to the delayed CPDLC uplink message.

Boeing (all except B747-400)

For most Boeing aircraft with a FANS-1+ connection, when a new active CPDLC connection is established, this function is automatically set to OFF with the following exceptions:

a) Boeing aircraft, except B777 and B787, whose FANS 1/A+ CPDLC connection has been transferred will maintain the value of the [delayed message parameter], which was enabled during the previous CPDLC connection;

b) Boeing 777 and 787 aircraft will maintain the value of the [delayed message parameter], which was enabled during any previous CPDLC connection, until the aircraft has landed at which time the value will be set to an operator-specified value in the aircraft's data base;

c) It is possible the flight crew may set a value for the [delayed message parameter], even if not instructed to do so; and

d) For aircraft with a FANS-1+ connection, the message is displayed to the flight crew with a delayed message indication.

F.12 Terminating ADS-C connections

Airbus

For Airbus aircraft:

a) FANS A+ – the flight crew has the capability to turn off the ADS-C application, which will terminate all ADS-C connections, or terminate a specific ADS-C connection.

b) FANS A – the flight crew has the capability to turn off the ADS-C application, which will terminate all ADS-C connections.

Boeing B787

The flight crew has the capability to turn off the ADS-C application, which will terminate all ADS-C connections, or terminate a specific ADS-C connection.

Boeing B737, B747-400, B747-8, B777, B757, B767, B717, MD90, MD10, MD11

For these Boeing aircraft, the flight crew has the capability to turn off the ADS-C application, which will terminate all ADS-C connections.

F.13 SATCOM channel format

Airbus
The Frequencysatchannel parameter is defined as being a NumericString type having the values {space, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9}.
Boeing
The Frequencysatchannel parameter is defined as being a NumericString type having the values {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}.

F.14 Transfer of ATSU

Airbus FANS-A
Whenever an FN_CAD is sent by an ATSU A which does not use CPDLC towards a new ATSU B which uses CPDLC, FANS A Airbus a/c will reject any attempt from ATSU B to make a CPDLC connection (and will trigger a DR1), until the flight crew performs a manual logon with ATSU B.
Airbus FANS-A+
This limitation does not apply to Airbus FANS A+ aircraft.
Boeing
This limitation does not apply to Boeing aircraft.

F.15 Number of ADS-C connections

Airbus
Five ADS-C connections are available for ATS use.
Boeing B747-400
One of the ADS-C connections is reserved for operator use, and will only connect with the address specified in the aircraft's database. The other 4 connections may be used by ATSUs.
Boeing B737, B747-8, B777, B757, B767, B787, B717, MD90, MD10, MD11
Five connections are available for ATS use.

F.16 Lateral deviation events on offsets

Airbus
On all Airbus aircraft with FMS standards prior to Release 1A: When an offset is entered (or modified), the path from which lateral deviation is computed is immediately offset by the requisite distance. If a lateral deviation event contract is in place, and the deviation limit is less than the change in the offset, then an LDE report will be sent as soon as the offset is entered and executed. On all Airbus aircraft with FMS Release 1A: When an offset is entered or modified, the FMS computes a path to fly to reach the new offset. Lateral deviation is the distance the aircraft is from this path, so entry of an offset does not affect the aircraft's lateral deviation, and no LDE report will be issued as a result of an offset entry.

Boeing B747-400, B747-8, B777, B757, B767, B717, MD90, MD10, MD11
When an offset is entered (or modified), the path from which lateral deviation is computed is immediately offset by the requisite distance. If a lateral deviation event contract is in place, and the deviation limit is less than the change in the offset, then an LDE report will be sent as soon as the offset is entered and executed.
Boeing B737, B787
When an offset is entered or modified, the FMS computes a path to fly to reach the new offset. Lateral deviation is the distance the aircraft is from this path, so entry of an offset does not affect the aircraft's lateral deviation, and no LDE report will be issued as a result of an offset entry

F.17 Assigned block altitude

Airbus
Airbus aircraft can only respond to UM 135 CONFIRM ASSIGNED ALTITUDE with DM 38 ASSIGNED ALTITUDE [altitude], and not DM 77 ASSIGNED BLOCK [altitude] TO [altitude]. Assigned block levels will have to be reported with a free text message.
Boeing B777 AIMS-1
B777 aircraft with the AIMS-1 avionics (and those with AIMS-2 prior to Blockpoint v14) can only respond to UM 135 CONFIRM ASSIGNED ALTITUDE with DM 38 ASSIGNED ALTITUDE [altitude], and not DM 77 ASSIGNED BLOCK [altitude] TO [altitude]. Assigned block altitudes will have to be reported with a free text message.
Boeing B777 AIMS-2 and all other Boeing aircraft
Other Boeing aircraft (including B777 aircraft with AIMS-2 and Blockpoint v14 or later) can respond to UM 135 CONFIRM ASSIGNED ALTITUDE with either DM 38 ASSIGNED ALTITUDE [altitude], or DM 77 ASSIGNED BLOCK [altitude] TO [altitude].

F.18 FANS 1/A-ATN B1 aircraft behavior for automatic CPDLC transfers

Airbus, Boeing, Dassault F900/F7X/F2000 EASy, Gulfstream G650, Embraer 170/190
FANS 1/A-ATN B1 aircraft have FANS 1/A+ and ATN B1 capability and comply with ED154A/DO305A. These aircraft benefit from automatic transfer between FANS 1/A and ATN B1 ATSUs. They do not require any particular flight crew/controller procedures compared with ATN B1 and FANS 1/A aircraft.
Gulfstream G450/G550
Independent FANS 1/A-ATN B1 aircraft have FANS 1/A+ and ATN B1 capability but do not comply with ED154A/DO305A. Only one FANS 1/A+ or ATN B1 is active at a time. The flight crew must manually select either FANS 1/A+ or ATN B1 prior to logon. There is no automatic transfer between FANS 1/A and ATN B1 ATSUs.
Dassault F900/F7X/F2000 EASy
Independent FANS 1/A-ATN B1 aircraft have FANS 1/A+ and ATN B1 capability but do not comply with ED154A/DO305A. Only one FANS 1/A+ or ATN B1 is active at a time. The flight crew must manually select either FANS 1/A+ or ATN B1 prior to logon. There is no automatic transfer between FANS 1/A and ATN B1 ATSUs. ADS-C is only available when FANS 1/A+ is selected.

F.19 CM contact procedure

Remarks
ED110B/DO280B requires ATN B1 aircraft to send a successful CM Contact Response to a T-ATSU as soon as a Logon response was received from the R-ATSU, whatever the result (successful or not).
Airbus
FANS B+ and FANS A+B aircraft deviate from this requirement. FANS B+ and FANS A+B aircraft will send a successful CM Contact Response to the T-ATSU only if the Logon procedure with the R-ATSU succeeds. FANS B+ and FANS A+B aircraft will send a unsuccessful CM Contact Response to the T-ATSU : if the sending of the Logon Request to the R-ATSU fails, or if the no Logon Response is received in due time, or if the Logon response from the R-ATSU indicated failure.

F.20 Duplicate CPDLC uplink message processing

Airbus FANS A (CLR3), FANS A+ (CSB4/CLR4 & CLA3)
If a message is received that contains strictly identical coded data to any other pending (open) message, then it will be discarded as a duplicate, with no response to the ground, and no indication to the flight crew.
Airbus FANS A+ Data Link Recording (CSB7/CLR7), FANS A+B (CLA4 & CLV1)
If a message is received that contains strictly identical coded data to any other message, then it will be discarded as a duplicate, with no response to the ground, and no indication to the flight crew.
Boeing B747-400 (before Load 15), B757/B767 (before Peg03), B777 (before BP01), B737 (before U10.5), MD-90, B717, MD-10
If a duplicate message is received (e.g. the same message is received on both VHF and SATCOM), it will be treated like any other new message. If the existing message with the same MIN is still open (has not been responded/dispositioned by the flight crew) it will be rejected as a "duplicate MIN".
Boeing B757/B767 (from Peg03), B777 (from BP01), B737 (from U10.5), B747-8, B787, MD-11
If a message is received that has the identical MIN and CRC to any other message in the log, then it will be discarded as a duplicate, with no response to the ground, and no indication to the flight crew.
Boeing B747-400 (from Load 15)
If a message is received that has the identical MIN and CRC to any other pending (open) message, then it will be discarded as a duplicate, with no response to the ground, and no indication to the flight crew.

F.21 Response to end-service and error uplink messages

Airbus

Boeing
When a FANS uplink containing a concatenated end-service (um161) and ERROR (um159), the flight crew will be presented with a display indicating a DOWNLINK ERROR. While this construct is recommended in DO-258/ED-100, Section 4.6.2.2.2, it was not included in DO-219, which is the basis of FANS designs. ATC should therefore avoid using this type of concatenated message.

F.22 CPDLC connection after logon

Airbus
Boeing B747-400, B757, B767, B717, MD90, MD10, MD11 and B777 or B787 without FANS-2
Once an AFN logon has been performed, the airplane will accept a CPDLC connection request (CR1) from any ATC Center. It is not required to be the center with which the AFN logon was performed.
Boeing B747-8, B777 and B787 with FANS-2
Once a CM or AFN logon has been performed, the airplane will accept a CPDLC connection request or CPDLC start from any center.

F.23 ARINC 424 oceanic waypoints

Remarks
The Flight Management System on most airplanes will contain oceanic waypoints at whole degrees of latitude and longitude (and potentially at half degrees) with names assigned using the naming convention for such waypoints contained in ARINC 424.
Airbus
Boeing B747-400, B747-8, B777, B757, B767, B717, MD90, MD10, MD11
If the route constructed by the flight crew or data linked from the airline contains such waypoints, then downlinked routes, position reports and requests for clearances (such as climbs or offsets) to start at a waypoint on the route will contain the ARINC 424 waypoint names.
Boeing B787
Whole-degree waypoints of this type in the route will be converted to the equivalent latitude/longitude for ATC downlinks.

F.24 STANDBY response to pilot-initiated downlink request

Airbus A320 & A330/A340 FANS A/A+
A 5 minutes timer is set whenever the aircraft downlinks a CPDLC pilot-initiated request message. If a STANDBY uplink response message is received by the aircraft within 5 minutes of the time the message was downlinked from the aircraft, the aircraft will accept any subsequent valid response message. If no response message is received within 5 minutes of the time the message was downlinked from the aircraft, and if a STANDBY associated with the downlink message is received by the aircraft, any subsequent message associated with the downlink message is rejected by the aircraft without being displayed to the flight crew.
Airbus A380 FANS A+ Data link Recording and FANS A+B, Airbus A350 FANS A+B
Any valid uplink message responding to a CPDLC pilot-initiated request message is accepted as a response and displayed to the flight crew, whether a STANDBY was previously received or not.
Boeing
Any valid uplink message responding to a CPDLC pilot-initiated request message is accepted as a response and displayed to the flight crew, whether a STANDBY was previously received or not.

AERONAUTICAL MOBILE SERVICE (AMS) STRATEGY FOR THE ASIA/PAC REGION

The AMS strategy for the Asia/Pac Region is to:

a) ensure that all communications are provided within the Aeronautical Mobile (R) Service - AM(R)S and the Aeronautical Mobile Satellite (R) Service -AMS(R)S;

b) retain the VHF voice service as the primary medium for air ground communication;

c) supplement voice communication with data-link Flight Information Service (DFIS) applications including D-VOLMET, D-ATIS and DCL to reduce congestion of the VHF spectrum, reduce workload, and enhance safety;

d) retain 25 kHz as the minimum channel spacing in the band 118 – 136 MHz;

e) use the frequency band 136 – 137 MHz exclusively for the air-ground VHF data-link applications;

f) use CPDLC to provide DCPC for more efficient communication and enhanced ATM;

g) retain HF voice for communication in areas where VHF coverage is not available;

h) provide satellite voice (SATVOICE) where appropriate. States providing SATVOICE service should publish relevant details in their AIP;

i) plan for enhanced AM(R)S and AMS(R)S applications within a performance-based communication and surveillance (PBCS) framework.

j) plan and implement new communication technologies and applications to meet the demands of aviation in the ASIA/PAC Region with the involvement of all stakeholders and taking account of costs and benefits; and

k) protect all radio frequency bands allocated for AM(R)S and AMS(R)S.

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INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC REGIONAL PERFORMANCE-BASED NAVIGATION IMPLEMENTATION PLAN

VERSION 4.0

ADOPTED BY APANPIRG/24

June 2013

(Effective until 12 November 2015)

RECORD OF AMENDMENT

Version	Activity	Date
0	Adopted by APANPIRG/19 as Interim Edition	September 2008
0.1	RASMAG Proposal	December 2008
0.2	Amended/Finalized by PBN/TF/4	March 2009
0.3	Amended/Finalized by PBN/TF/5	July 2009
1.0	Adopted by APANPIRG/20	September 2009
2.0	Adopted by APANPIRG/21	September 2010
3.0	Adopted by APANPIRG/22	September 2011
4.0	Adopted by APANPIRG/24	June 2013

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ASIA/PACIFIC REGIONAL PERFORMANCE-BASED NAVIGATION IMPLEMENTATION PLAN

1. Executive Summary

1.1 This Asia/Pacific Regional PBN Implementation Plan has been produced in line with Resolution A 36/23 adopted by ICAO Assembly in its 36th Session held in September 2007, Conclusion 18/52 adopted by APANPIRG/18 and other relevant resolutions adopted by ICAO Assembly in its 37th Session held in September 2010. The Regional PBN Plan addresses the strategic objectives for PBN implementation based on clearly established operational requirements, avoiding equipage of multiple on-board or ground based equipment, avoidance of multiple airworthiness and operational approvals and explains in detail contents relating to potential navigation applications. The Plan envisages the conduct of pre- and post-implementation safety assessments and continued availability of conventional air navigation procedures during transition. The Plan also discusses issues related to implementation which include traffic forecasts, aircraft fleet readiness, adequacy of ground-based CNS infrastructure etc. Implementation targets the period 2008-2016 were initially developed for Versions 1-3 of this Plan. However, these PBN implementation expectations have now been placed in the Asia/Pacific Seamless ATM Plan, which has a planning horizon until 2028. For the period 2016 and beyond it was envisaged that GNSS would be the primary navigation infrastructure. It was also expected that precision approach capability using GNSS and its augmentation systems would become available in the long term.

2. Explanation of Terms

2.1 The drafting and explanation of this document is based on the understanding of some particular terms and expressions that are described below:

2.1.1 **Asia/Pacific Regional PBN Implementation Plan.** A document adopted by APANPIRG, often referred to as the “Regional PBN Plan”, offering appropriate guidance for air navigation service providers, airspace operators and users, regulating agencies, and international organizations–on the evolution of navigation capabilities as one of the key systems supporting air traffic management, and which describes the RNAV and RNP navigation applications that should be implemented in the short, medium and long term in the APAC Region.

2.1.2 **Performance Based Navigation** Performance based navigation specifies RNAV and RNP system performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in an airspace.

2.1.3 **Performance requirements.** Performance requirements are defined in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept. Performance requirements are identified in navigation specifications which also identify which navigation sensors and equipment may be used to meet the performance requirement.

3. Acronyms

3.1 The acronyms used in this document along with their expansions are given in the following list:

ABAS	Aircraft-Based Augmentation System
AIS	Aeronautical Information Services
APAC	Asia and Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APCH	Approach
APV	Approach Procedures with Vertical Guidance
ATC	Air Traffic Control
Baro VNAV	Barometric Vertical Navigation
CNS/ATM	Communication Navigation Surveillance/Air Traffic Management
CPDLC	Controller Pilot Data Link Communications
DME	Distance Measuring Equipment
EMA	En-route Monitoring Agency
FASID	Facilities and Services Implementation Document
FIR	Flight Information Region
FMS	Flight Management System
GBAS	Ground-Based Augmentation System
GNSS	Global Navigation Satellite System
GRAS	Ground-based Regional Augmentation System
IATA	International Air Transport Association
IFALPA	International Federation of Air Line Pilots' Associations
INS	Inertial Navigation System
IRU	Inertial Reference Unit
PANS	Procedures for Air Navigation Services
PBN	Performance Based Navigation
PIRG	Planning and Implementation Regional Group
RASMAG	Regional Airspace Safety Monitoring Advisory Group
RCP	Required Communication Performance
RNAV	Area Navigation
RNP	Required Navigation Performance
SARP	Standards and Recommended Practices
SBAS	Satellite-Based Augmentation System
SID	Standard Instrument Departure
STAR	Standard Instrument Arrival
TMA	Terminal Control Area
VOR	VHF Omni-directional Radio-range
WGS	World Geodetic System

4. Introduction

Need for the regional PBN Implementation Plan

4.1 The Thirty-sixth Session of the ICAO Assembly held in Montreal in September 2007 adopted a Resolution to resolve that States and PIRGs complete a regional PBN implementation plan by 2009.

4.2 Recognizing that the PBN concept is now established, States should ensure that all RNAV and RNP operations and procedures are in accordance with the PBN concept as detailed in State letter AN 11/45-07/22 and the ICAO Doc 9613: PBN Manual for ensuring a globally harmonized and coordinated transition of PBN.

4.3 In view of the need for detailed navigation planning, it is advisable to develop a Regional PBN Plan to provide proper guidance to air navigation service providers, airspace operators and users, regulating agencies, and international organizations~~,~~ on the evolution of navigation capabilities as one of the key systems supporting air traffic management, and which describes the RNAV and RNP navigation applications that should be implemented in the short and medium term in the APAC Region.

4.4 Furthermore, the Asia/Pacific Regional PBN Implementation Plan will contain the basic material serving as guidance for regional projects for the implementation of air navigation infrastructure, such as ABAS, SBAS, GBAS, GRAS, etc., as well as for the development of national implementation plans.

Roles of Navigation in supporting ATM operations

4.5 An “airspace concept” may be viewed as a general vision or master plan for a particular airspace. Based on particular principles, an airspace concept is geared towards specific objectives. Strategic objectives drive the general vision of the airspace concept. These objectives are usually identified by airspace users, air traffic management (ATM), airports as well as environmental and government policy. It is the function of the airspace concept and the concept of operations to respond to these requirements. The strategic objectives which most commonly drive airspace concept are safety, capacity, efficiency, access, and the environment.

4.6 Navigation is one of several enablers of an airspace concept. Communications, ATS Surveillance and ATM are also essential elements of an airspace concept.

4.7 The PBN–concept specifies RNAV and RNP system performance requirements in terms of accuracy, integrity, availability, continuity and functionality needed for the proposed operations in the context of a particular Airspace Concept, when supported by the appropriate navigation infrastructure. In that context, the PBN concept represents a shift from sensor-based to performance-based navigation. Performance requirements are identified in navigation specifications which also identify the choice of navigation sensors and equipment that may be used to meet the performance requirements. These navigation specifications are defined at a sufficient level of detail to facilitate global harmonization by providing specific implementation guidance for States and operators.

4.8 Under the PBN concept, the generic navigation requirements are defined based on operational requirements. Thus, users may evaluate the available options. To ensure synchronization of investment and interoperability of the airborne and ground systems, the selection of the solution should be in consultation with aviation stakeholders, including international and domestic airline operators, air navigation service providers, and regulators. The solution selected should also be the most cost-effective one.

4.9 The development of the PBN concept recognized that advanced aircraft RNAV systems are achieving an enhanced and predictable level of navigation performance accuracy which, together with an appropriate level of functionality, allows a more efficient use of available airspace to be realized. It also takes account of the fact that RNAV systems have developed over a 40-year period and as a result there were a large variety of differing implementations globally. Identifying navigation requirements rather than on the means of meeting the requirements will allow use of all RNAV systems meeting these requirements irrespective of the means by which these are met.

Benefits of Performance-Based Navigation

4.10 The main benefits derived from the implementation of PBN are:

a) Increased airspace safety through the implementation of continuous and stabilized descent procedures using vertical guidance;

b) Reduced aircraft flight time due to the implementation of optimal flight paths, with the resulting savings in fuel, noise reduction, and enhanced environmental protection;

c) Use of the RNAV and/or RNP capabilities that already exist in a significant percentage of the aircraft fleet flying in APAC airspace;

d) Improved airport and airspace arrival paths in all weather conditions, and the possibility of meeting critical obstacle clearance and environmental requirements through the application of optimized RNAV or RNP paths;

e) Implementation of more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows;

f) Reduced delays in high-density airspaces and airports through the implementation of additional parallel routes and additional arrival and departure points in terminal areas;

g) Reduction of lateral and longitudinal separation between aircraft to accommodate more traffic;

h) Decrease ATC and pilot workload by utilizing RNAV/RNP procedures and airborne capability and reduce the needs for ATC-Pilot communications and radar vectoring;

i) Increase of predictability of the flight path.

Goals & Objectives of PBN Implementation

4.11 APANPIRG, in its Eighteenth meeting (September 2007), discussed various issues related to an early implementation of PBN in the region. To facilitate coordination between States, a PBN Task Force was formed under Conclusion 18/52 and tasked to develop a harmonized regional PBN implementation plan.

4.12 The Asia/Pacific Regional PBN Implementation Plan has the following strategic objectives:

a) To ensure that the implementation of the navigation item of the CNS/ATM system is based on clearly established operational requirements.

b) To avoid undue equipage of multiple on board equipment and/or ground-based systems.

c) To avoid the need for multiple airworthiness and operational approvals for intra- and inter-regional operations.

d) To explain in detail the contents of the Regional Air Navigation Plan, relating to potential navigation applications.

4.13 Furthermore, the Asia/Pacific Regional PBN Implementation Plan will provide a high-level strategy for the evolution of the navigation applications to be implemented in the APAC Region in the short term (2008-2012) and medium term (2013-2016). This strategy is based on the concepts of Area Navigation (RNAV) and Required Navigation Performance (RNP) in accordance with ICAO Doc. 9613: *Performance Based Navigation Manual*, and will be applied to aircraft operations involving instrument approaches, standard departure (SID) routes, standard arrival (STAR) routes, and ATS routes in oceanic and continental areas.

4.14 The Regional PBN Plan was developed by the APAC States together with the international organizations concerned (including IATA and IFALPA)~~,~~ and is intended to assist the main stakeholders of the aviation community plan a gradual transition to the RNAV and RNP concepts. The main stakeholders of the aviation community that benefit from this Regional Plan are:

- Airspace operators and users.
- Air navigation service providers.
- Regulating agencies.
- International organizations.

4.15 The Regional PBN Plan is intended to assist the main stakeholders of the aviation community plan the future transition and their investment strategies. For example, airlines and operators can use this Plan to derive future equipage and additional navigation capability investments; air navigation service providers can plan a gradual transition for the evolving ground infrastructure. Regulating agencies will be able to anticipate and plan for the criteria that will be needed in the future.

4.16 Recognizing the safety benefits of PBN, the thirty-sixth session of the ICAO Assembly held in Montreal, September 2007 adopted a Resolution to resolve that States and PIRGs prepare ~~a~~ PBN implementation plans by 2009 to achieve:

a) Implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones; and

b) Implementation of APV (Baro-VNAV and/or augmented GNSS) for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014.

The ICAO Assembly also urges that States include in their PBN implementation plan provisions for implementation of APV to all runway ends serving aircraft with a maximum certificated take-off mass of 5700 kg or more, according to established timelines and intermediate milestones.

Planning Principles

4.17 Planning for the implementation of PBN in the APAC Region shall be based on the following principles:

a) Pre- and post-implementation safety assessments will be conducted in accordance with ICAO provisions to ensure the application and maintenance of the established target levels of safety.

b) Continued application of conventional air navigation procedures during the transition period, to guarantee the operations by users that are not RNAV and/or RNP equipped.

c) The first regional PBN implementation plan should address the short term (2008-2012) and medium term (2013-2016) and take into account long term global planning issues.

d) Target date for preparation of the first regional PBN implementation plan is APANPIRG/19 (September 2007).

5. PBN Operational Requirements & Implementation Strategy

5.1 Introduction of PBN should be consistent with the Global Air Navigation Plan. Moreover, PBN implementation shall be in full compliance with ICAO SARPs and PANS and support relevant ICAO Global Plan Initiatives.

5.2 The ICAO Council accepted the second amendment to the Global Air Navigation Plan for the CNS/ATM System in November 2006. The approved plan has been renamed as Global Air Navigation Plan (Doc 9750). The relevant Global Plan Initiatives including implementation of performance based navigation (PBN) and navigation system have been included in the Global Plan. The introduction of PBN must be supported by an appropriate navigation infrastructure consisting of an appropriate combination of Global Navigation Satellite System (GNSS), self-contained navigation system (inertial navigation system) and conventional ground-based navigation aids.

5.3 The consolidated *Navigation Strategy for the Asia/Pacific Region was* reviewed and updated by the Thirteenth meeting of CNS/MET Sub Group of APANPIRG in July 2009. The Strategy was subsequently adopted by APANPIRG in its Twentieth meeting held in September 2009 under Conclusion 20/46 and further updated in its Twenty Second Meeting held in September 2011 through Conclusion 22/29 based on a recommendation by CNS/MET SG/15.

Route Operations

5.4 As the routes structure and en-route operation are extensive and complicated in APAC - region, it is difficult to restructure and include the whole airspace in a single implementation plan for en-route operations.

5.5 Considering the traffic characteristics and CNS/ATM capability, en-route operations can be classified as Oceanic, Remote continental, and Continental en-route.

5.6 In principle, each classification of en-route operation (paragraph 5.5 above) should adopt, but not be limited to, a single RNAV or RNP navigation specification. This implementation strategy should be applied by implementing States in coordination with airspace users.

5.7 APANPIRG established the PBN Task Force to develop a PBN implementation plan for the Asia/Pacific Region and to address related regional PBN implementation issues. Accordingly, States are encouraged to work cooperatively bilaterally, multilaterally and with the PBN Task Force to ensure regional and sub-regional harmonization of en-route PBN implementation.

5.8 In areas where operational benefits can be achieved and appropriate CNS/ATM capability exists or can be provided for a more accurate navigation specification than that specified in this plan, States are encouraged to introduce the more accurate navigation specification on the basis of coordination with stakeholders and affected States.

5.9 Similarly, in circumstances where affected States are agreeable to completing an implementation in advance of the timelines specified in this plan, early implementation is encouraged on the basis of coordination between affected States and airspace users.

TMA Operations

5.10 TMA operations have their own characteristics, taking into account the applicable separation minima between aircraft and between aircraft and obstacles. TMA operations also involve–the diversity of aircraft, including low-performance aircraft flying in the lower airspace and conducting arrival and departure procedures on the same path or close to the paths of high-performance aircraft.

5.11 In this sense and as called for under APANPIRG Conclusion 18/53, States shall develop their own national plans for the implementation of PBN in sovereign TMAs. Such national plans should be based on the Asia/Pacific Regional PBN Implementation Plan, seek the harmonization of the application of PBN and avoid the need for multiple operational approvals for intra- and inter-regional operations. Applicable aircraft separation criteria should also be considered.

Instrument Approaches

5.12 States are encouraged to introduce PBN approaches that provide Vertical Guidance to enhance safety. Conventional approach procedures and conventional navigation aids should be maintained to support non-equipped aircraft during the transitional period.

5.13 During early implementation of PBN, IFR Approaches based on PBN should be designed to accommodate a mixed-equipage (PBN and non-PBN) environment. ATC workload should be taken into account while developing approach procedures. One possible way to accomplish this is to co-locate the Initial Approach Waypoint for both PBN and conventional approaches

6. Current Status & Forecast

APAC traffic forecast

6.1 Traffic forecasts have a special role to play in the planning and implementation processes; they represent the demand for future ATM. Global Air Navigation Plan (Doc 9750) requires that the Planning and Implementation Regional Groups (PIRGs) base their work on well developed traffic density forecasts. Guidance on the preparation of traffic forecasts is provided in *Manual on Air Traffic Forecasting* (Doc 8991). At the Asia/Pacific regional level, the traffic forecasting activities were started with the formation of ICAO Pacific Area Traffic Forecasting Group formed in 1991. The scope of the group was subsequently broadened to include Intra-Asia/Pacific traffic also and the group was renamed as Asia/Pacific Area Traffic Forecasting Group (APA TFG).

6.2 Report of the Fourteenth meeting of Asia/Pacific Area Traffic Forecasting Group (APA TFG/14) has been published as Doc 9915. Report includes medium term forecasts of air traffic in the Transpacific area and for selected Transpacific and Asia/Pacific city pair markets through 2012. Report also contains a long term forecast with a horizon to the year 2025 and the short term forecast for the period 2008 – 2010 and intermediate forecasts for each of the years 2015 and 2020. Forecasts are provided for total passenger traffic and aircraft movements and in the case of the aggregate transpacific market also for peak hour movements on selected groups for the year 2012.

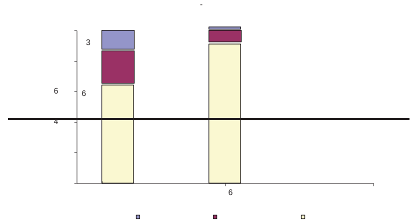
6.3 The February 2008 forecast prepared by IATA–for APAC traffic in respect of passenger, cargo, aircraft movements and new aircraft deliveries in the Regions is also provided in the Appendix B to this plan as reference.

Aircraft fleet readiness status

6.4 2007 was a record year for Asia/Pacific airlines with 418 new aircraft deliveries and more than 1,000 new orders. The overall number of deliveries to Asia/Pacific based airlines in 2008 is expected to total 430 aircraft.

6.5 All major commercial aircraft manufacturers since the 1980's have included RNAV capabilities. The commercial aircraft currently produced incorporate an RNP capability.

6.6 One significant issue for PBN implementation today is directly related to the multitude of FMS installations and varying degrees of capabilities associated with the current fleet of RNAV aircraft. Specifically, there are numerous FMS systems installed in today's fleets, all with varying capabilities.



CNS Infrastructure

Navigation infrastructure

Global Navigation Satellite System (GNSS)

6.7 Global Navigation Satellite System (GNSS) is a satellite-based navigation system utilizing satellite signals, such as Global Positioning System (GPS), for providing accurate and reliable position, navigation, and time services to airspace users. In 1996, the International Civil Aviation Organization (ICAO) endorsed the development and use of GNSS as a primary source of future navigation for civil aviation. ICAO noted the increased flight safety, route flexibility and operational efficiencies that could be realized from the move to space-based navigation. APANPIRG/23 agreed to GNSS being a requirement for all PBN approvals, and the Seamless ATM Plan was expected to include reference to airspace mandates for the carriage and use of GNSS.

6.8 GNSS supports both RNAV and RNP operations. Through the use of appropriate GNSS augmentations, GNSS navigation provides sufficient accuracy, integrity, availability and continuity to support en-route, terminal area, and approach operations. Approval of RNP operations with appropriate certified avionics provides on-board performance monitoring and alerting capability enhancing the integrity of aircraft navigation.

6. 9 GNSS augmentations include Aircraft-Based Augmentation System (ABAS), Satellite-Based Augmentation System (SBAS), Ground-Based Augmentation System (GBAS), and Ground-based Regional Augmentation System (GRAS).

Other PBN navigation infrastructure

6. 10 Other navigation infrastructure includes INS, VOR/DME, DME/DME, and DME/DME/IRU. These navigation infrastructures may satisfy the requirements of RNAV navigation specifications, but not those of RNP.

6. 11 INS may be used to support PBN en-route operations with RNAV 10 and RNAV 5 navigation specifications.

6. 12 VOR/DME may be used to support PBN en-route and STAR operations based on the RNAV 5 navigation specification.

6. 13 Uses of DME/DME and DME/DME/IRU may support PBN en-route and terminal area operations based on RNAV 5, RNAV 2 or RNAV 1 navigation specifications. Validation of DME/DME coverage area and appropriate DME/DME geometry should be conducted to identify possible DME/DME gaps, including identification of critical DMEs, and to ensure proper DME/DME service coverage. The use of ground based radio navigation aids for PBN is a transitional measure while GNSS based infrastructure is implemented. Inertial systems will be integrated with GNSS for improved performance.

Surveillance infrastructure

6. 14 For RNAV operations, States should ensure that sufficient surveillance coverage is provided to assure the safety of the operations. For RNP operations, surveillance coverage may not be required. Details on the surveillance requirements for PBN implementation can be found in the ICAO PBN Manual and ICAO PANS-ATM (Doc 4444), and information on the current existing surveillance infrastructure in APAC can be found in ICAO FASID tables.

Communication infrastructure

6. 15 Implementation of RNAV/RNP routes includes communication requirements. Details on the communication requirements for PBN implementation can be found in ICAO PANS-ATM (Doc 4444), ICAO RCP Manual (Doc 9869), and ICAO Annex 10. Information on the current existing communication infrastructure in APAC can also be found in ICAO FASID tables.

7. Implementation Plan for Performance Based Navigation

ATM Operational Requirements

7.1 The Global ATM Operational Concept (Doc 9854) makes it necessary to adopt an airspace concept able to provide an operational scenario that includes route networks, minimum separation standards, assessment of obstacle clearance, and a CNS infrastructure that satisfies specific strategic objectives, including safety, access, capacity, efficiency, and environment.

7.2 In this regard, the following programmes will be developed:

a) traffic and cost benefit analyses
b) necessary updates on automation
c) operational simulations in different scenarios
d) ATC personnel training
e) Flight plan processing
f) Flight procedure design training to include PBN concepts and ARINC-424 coding standard
g) Enhanced electronic data and processes to ensure appropriate level of AIS data accuracy, integrity and timeliness
h) WGS-84 implementation in accordance with ICAO Annex 15
i) iuniform classification of adjacent and regional airspaces, where practicable
j) RNAV/RNP applications for SIDs and STARs
k) Coordinated RNAV/RNP routes implementation
l) RNP approach with vertical guidance

Implementation Plan

Route Operations

7.3 During the planning phase of any implementation of PBN routes, States should gather inputs from all aviation stakeholders to obtain operational needs and requirements. These needs and requirements should then be used to derive airspace concepts and to select appropriate PBN navigation specification. For specific details of expected PBN applications, reference should be made to the Asia/Pacific Seamless ATM Plan.

Terminal Airspace

7.4 For specific details of expected PBN terminal airspace applications, reference should be made to the Asia/Pacific Seamless ATM Plan.

7.5 The application of RNP APCH with Baro-VNAV procedures is expected to be implemented in the maximum possible number of airports, commencing primarily with international airports. To facilitate transitional period, conventional approach procedures and conventional navigation aids should be maintained for non-equipped aircraft.

7. 6 States should promote the use of APV operations (Baro-VNAV or augmented GNSS) to enhance safety and accessibility of RNP approaches.

7. 7 The application of RNP AR APCH procedures should be considered in selected airports, where obvious safety and operational benefits can be obtained.

7.8 The introduction of application of landing capability using GNSS and its augmentations is expected to guarantee a smooth transition toward high-performance approach and landing capability.

Contingency

7.9 The establishment of a backup system in case of GNSS failure or the development of contingency procedures should be considered as part of the Safety Assessment.

GNSS Implementation Strategies

7.10 GNSS is expected to be a primary navigation infrastructure for PBN implementation. States should work co-operatively on a multinational basis to implement GNSS in order to facilitate seamless and inter-operable systems and undertake coordinated research and development programmes on GNSS implementation and operation.

7.11 States are encouraged to consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance.

7.12 With the expectation that precision approach capability using GNSS and its augmentation systems will become available, States are encouraged to explore the use of such capability where there are operational and financial benefits.

8. Transitional Strategies

8.1 During transition to PBN, sufficient ground infrastructure for conventional navigation systems must remain available to serve non-equipped flights. Before existing ground infrastructure is considered for removal, users should be given reasonable transition time to allow them to equip appropriately to attain equivalent PBN-based navigation performance. States should approach removal of existing ground infrastructure with caution to ensure that safety is not compromised. Performance of safety assessments and consultation with users through regional air navigation planning processes will be necessary.

8.2 States should coordinate to ensure that harmonized separation standards and procedures are developed and introduced concurrently in all flight information regions along major traffic flows to allow for a seamless transition towards PBN.

8.3 States should cooperate on a multinational basis to implement PBN in order to facilitate seamless and inter-operable systems and undertake coordinated research and development programmes on PBN implementation and operation.

8.4 States are encouraged to consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance**,** taking due consideration of the needs of State aircraft.

8.5 States should encourage operators and other airspace users to equip with PBN-capable avionics. This can be achieved through early introductions of RNP approaches, preferably those with vertical guidance.

8.6 ICAO Asia-Pacific Regional Office should provide leadership supporting implementation and transition towards PBN.

9. Safety Assessment & Monitoring Requirements

Need for a safety assessment

9.1 To ensure that the introduction of PBN applications within the Asia/Pacific Region is undertaken in a safe manner, in accordance with relevant ICAO provisions implementation shall only take place following conduct of a safety assessment by the implementing State or group of States that demonstrates that an acceptable level of safety will be met. This assessment may also need to demonstrate that residual levels of risk associated with specific PBN implementations are acceptable. Additionally, after implementation ongoing periodic safety reviews shall be undertaken by the implementing State or group of States, where required, in order to establish that operations continue to meet acceptable levels of safety.

En-route safety assessment and monitoring

9.2 When considering en-route PBN implementations, the ICAO *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444, Chapter 5, Section 5.4) contains procedures and RNAV procedural separation minima for use in the separation of aircraft in the en-route phase. In some cases, these separation minima require specific RNP capabilities and are based on collision risk modelling which determines communications and surveillance requirements. However, this modelling does not include all operational and technical aspects and is dependent upon parameter values that may vary depending on the particular airspace where the separation minimum will be applied. Therefore, prior to implementation, a system verification of sufficient duration and integrity must be performed to assess such parameters and conditions including weather deviations or other contingency events for the airspace concerned and to demonstrate that operational and technical requirements will be met.

9.3 APANPIRG has established the Regional Airspace Safety Monitoring Advisory Group (RASMAG) to facilitate the airspace safety monitoring aspects for implementations of reduced separation minima and CNS/ATM applications within the Asia and Pacific Regions. RASMAG has adopted the term En-route Monitoring Agency (EMA) to describe an organization providing airspace safety assessment, monitoring and implementation services for international airspace in the Asia/Pacific region to assist the implementation and operation of reduced horizontal (lateral and longitudinal) separation minima. To ensure regional harmonization of en-route safety assessment requirements and methodologies, implementing States are encouraged to work cooperatively with RASMAG who will provide guidance and technical assistance to States to support their en-route PBN implementations.

Undertaking a safety assessment

9.4 The implementing State or group of States shall ensure that a safety assessment and, where required, ongoing monitoring of PBN implementations are conducted. The implementing State or group of States may have the capability to undertake such activities or, in the case of en-route implementations, may seek assistance from an En-route Monitoring Agency. The latter course of action is preferred as an EMA can establish the necessary monitoring and data collection activity in an effective manner for the international airspaces in which the EMA holds responsibility.

9.5 In undertaking a safety assessment to enable en-route implementation of PBN, a State authority or EMA shall:

1) Establish and maintain a database of PBN approvals;
2) Pre-implementation - conduct safety and readiness assessments and, for international implementations, report results to RASMAG;
3) Post-implementation - maintain awareness of data link performance and monitor aircraft horizontal-plane navigation performance and the occurrence of large navigation errors (lateral and longitudinal), implement remedial actions as necessary and, for international implementations, report results to RASMAG;
4) Monitor operator compliance with State approval requirements after PBN implementation;
5) Initiate necessary remedial actions in any instances where PBN requirements are not met.

9.6 Detailed information relating to the international airspace jurisdiction, roles and responsibilities of regional EMAs is contained in the *Asia/Pacific En-route Monitoring Agency Handbook*, which is available from the ICAO Asia/Pacific Regional Office.

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Appendix A – CHANGES TO THE ASIA/PACIFIC REGIONAL PBN IMPLEMENTATION PLAN

Whenever a need is identified for a change to this document, the Request for Change (RFC) Form (see below) should be completed and submitted to the ICAO Asia and Pacific Regional Office. The Regional Office will collate RFCs for consideration by the Performance Based Navigation Task Force (CNS/MET Sub-group of APANPIRG).

When an amendment has been agreed by a meeting of the Performance Based Navigation Task Force then a new version of the PBN Regional Plan will be prepared, with the changes marked by an "|" in the margin, and an endnote indicating the relevant RFC, so a reader can see the origin of the change. If the change is in a table cell, the outside edges of the table will be highlighted; e.g.:

Final approval for publication of an amendment to the PBN Regional Plan will be the responsibility of APANPIRG.

PBN Regional Plan REQUEST FOR CHANGE FORM

RFC Nr:	

Please use this form when requesting a change to any part of this PBN Regional Plan. This form may be photocopied as required, emailed, faxed or e-mailed to ICAO Asia and Pacific Regional Office +66 (2) 537-8199 or icao_apac@bangkok.icao.int

1. SUBJECT:			
2. REASON FOR CHANGE:			
3. DESCRIPTION OF PROPOSAL: [expand / attach additional pages if necessary]			
4. REFERENCE(S):			
5. PERSON INITIATING:		**DATE:**	
ORGANISATION:			
TEL/FA/X/E-MAIL:			

6. CONSULTATION		**RESPONSE DUE BY DATE:**		
	Organization	**Name**	**Agree/Disagree**	**Date**
7. ACTION REQUIRE :				
8. PBN REGIONAL PLAN EDITOR			**DATE REC'D :**	
9. FEEDBACK PASSED			**DATE :**	

AMENDMENT RECORD

Amendment Number	Date	Amended by	Comments

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Appendix B – IATA Traffic Forecast

"By 2010 Asia will be the largest single market for aviation" - IATA 27th Feb 2008. Globally predicted passenger traffic will rise by 4.9 per cent per year between 2007 and 2026, almost trebling in two decades as jet planes got bigger and more people flew on them. Meanwhile airfreight will rise by 5.8 per cent annually in the same period.The greatest demand will come from the Asia-Pacific region, where airlines will take delivery of 31 per cent of new planes in the next 20 years, compared with 24 per cent for Europe and 27 per cent for North America.

Passenger
Asia Pacific airlines saw a marginal drop in demand growth from 6.2 per cent in December 2007 to 5.7 per cent in January 2008. Currently, airlines in the region benefited from increased competitiveness due to the strong Euro and the booming economies of both India and China.

Cargo
Steady year-on-year airfreight growth of 4.5 per cent was recorded in January 2008. In the larger freight markets there is continued strength. Asia Pacific airlines saw demand increase 6.5 per cent, up from 6 per cent in December 2007, boosted by the booming economies in China and India.

For the period 2002-2020 aircraft movements are expected to increase at an annual growth rate of 5.4 per cent, to reach almost 294 thousand aircraft movements by the year 2020. Average annual growth rates of 6.5, 5.7 and 5.2 per cent are forecast for the periods 2005 - 2010, 2010-2015 and 2015 - 2020, respectively.

TRANSPACIFIC PASSENGER FORECAST			
Average Annual Percentage Growth Rates			
	Low	Medium	High
2005-2010	5.3	6.5	7.8
2010-2015	4.5	5.7	7.0
2015-2020	4.0	5.2	6.5
2002-2020	4.1	5.4	6.7

The Intra-Asia/Pacific passenger aircraft movements are expected to increase at an average annual growth rate of 4.6 per cent to the year 2020. The growth rates for the intermediate periods of 2005-2010, 2010- 2015 and 2015-2020 are 5.0, 4.3 and 4.2 per cent, respectively.

INTRA ASIA /PACIFIC AIRCRAFT MOVEMENT FORECAST			
Average Annual Percentage Growth Rates			
	Low	Medium	High
2005-2010	3.6	5.0	5.5
2010-2015	3.1	4.3	5.2
2015-2020	3.1	4.2	5.2
2002-2020	3.3	4.6	5.6

New Aircraft Deliveries by Region
Record new aircraft orders were placed by the airline industry in 2005 – 2007. The large numbers of new orders represent strong confidence in the future prospects of the global airline industry. In its latest forecast of aviation growth, European aircraft maker Airbus said the world's fleet of large passenger jets (of more than 100 seats) would double in the next 20 years to nearly 33,000. The greatest demand will come from the Asia-Pacific region, where airlines will take delivery of 31 per cent of new planes in the next 20 years, compared with 24 per cent for Europe and 27 per cent for North America.

New Aircraft Deliveries by Region	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012+**
	Existing						
Africa	**665**	**26**	**15**	**20**	**16**	**13**	**28**
Asia Pacific	**3,578**	**329**	**428**	**407**	**344**	**267**	**440**
Europe	**5,301**	**292**	**348**	**364**	**251**	**153**	**297**
Latin America/Caribbean	**1,031**	**93**	**91**	**45**	**66**	**43**	**65**
Middle East	**626**	**41**	**57**	**44**	**36**	**27**	**164**
North America	**6,987**	**240**	**293**	**309**	**222**	**163**	**412**
Total	**18,188**	**1,026**	**1,237**	**1,208**	**944**	**679**	**1,551**
Increase in Global aircraft fleet (%)	**4.2**	**4.9**	**4.6**	**4.9**	**3.4**	**2.4**	**2.4**

Appendix C - Reference documentation for developing operational and airworthiness approval

General Guidelines for Obtaining Airworthiness and Operational Approvals for PBN Navigation Specifications, Version 1.0, **International Air Transport Association**, August 2008. (URL - http://www2.icao.int/en/pbn/ICAO%20Documentation/State%20and%20International%20Organization%20Publications/IATA%20Guidelines%20for%20PBN%20Operational%20Approval.pdf**)**

States should consider using the COSCAP Operational Approval Handbook http://www.bangkok.icao.int/edocs/COSCAP_PBNOPS_HANDBOOK%20Version%202_4.pdf as a reference until ICAO Operational Approval guidance material is published.

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Appendix D – Practical Example of tangible benefits

Practical examples of tangible benefits derived from the implementation of PBN are:

- Increased airspace safety through the implementation of continuous and stabilized descent procedures using vertical guidance;
- Provision of runway-aligned final approach path which may not be possible from conventional navigation
- Reduced aircraft flight time due to the implementation of optimal flight paths, with the resulting savings in fuel, noise reduction, and enhanced environmental protection;
- Improved airport and airspace arrival paths in all weather conditions, and the possibility of meeting critical obstacle clearance and environmental requirements through the application of optimized RNAV or RNP paths;
- Implementation of more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows;
- Reduced delays in high-density airspaces and airports through the implementation of additional parallel routes and additional arrival and departure points in terminal areas;
- Reduction of lateral and longitudinal separation between aircraft to accommodate more traffic;
- Decrease ATC and pilot workload by utilizing RNAV/RNP procedures and airborne capability and reduce the needs for ATC-Pilot communications and radar vectoring;
- Increase of predictability of the flight path.
- Reduction of maintenance and flight inspection costs associated with conventional navigation aids

Examples of measurable benefits resulting from PBN implementation in Australia are attached as **Attachment A** and **Attachment B**.

An example of measurable benefits resulting from PBN implementation in Thailand is attached as **Attachment C**.

Appendix E: Basic Planning Elements (BPEs) Table

Basic Plan Elements	Regional Plan References
1. Policy and Implementation Planning Formation of a key working group Standards & Requirements in accordance with ICAO Communication with stakeholders	4.0
2. Assessment of CNS infrastructure	6.11-6.16
3. Assessment for PBN fleet readiness Based on actual operator traffic	6.4-6.7
4. Selection of appropriate PBN navigation specification	7.3-7.18
5. Strategies for en-route implementation Key traffic flows and city pairs identified Domestic International Harmonization in en-route, across FIRs	5.4-5.9
6. Strategies for terminal area implementation, including timeline Specify terminal areas selected for implementation by 2010	5.10- 5.11
7. Strategies for Instrument approach implementation, including timeline Specify procedures selected for implementation by 2010 APV (Baron-VNAV and/or augmented GNSS) Designate RNP APRCH (LNAV or LNAV/VNAV) Designate RNP AR APCH (with operational justification)	4.16(b) / 5.12-5.13 / 7.8-7.10 / 7.16- 7.18
8. Transition strategy Include decommissioning plan	4.17(b) / 8.0
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Attachment A

AIRSERVICES AUSTRALIA

RNP Project

BRISBANE GREEN

Stage One Report

March 2008

airspace | airside | **AIRSERVICES AUSTRALIA**

Contents

Executive Summary

The Brisbane Green Project is a world first integration of Required Navigation Performance (RNP) approaches and departures into a busy international airport. The successful introduction of Stage One of the project has laid the foundation for widespread adoption of this technology at all of Australia's major airports. This report represents a work in progress and we have taken a conservative approach to the benefits from this stage of the project. The results are, however very encouraging.

Airservices Australia has worked closely with Naverus inc., Qantas Airways and the Civil Aviation Safety Authority of Australia (CASA) to achieve this successful outcome. Airservices is committed to introducing leading edge ATM capability in close collaboration with our stakeholders. To date there have been RNP approaches deployed to 9 airports across Australia including Alice Springs, Ayers Rock, Brisbane, Cairns, Gold Coast, Hobart, Canberra, Townsville and Sydney. The broad range of environments where RNP is being deployed within Australia demonstrates its suitability as a global solution.

At present there are six RNP approach and twelve RNP departure procedures deployed at Brisbane. In the first twelve months of the project, over 15,500 RNP procedures have been conducted including more than 8,000 approaches.

Of the 8000 approaches, 1612 were conducted in night or instrument conditions that required an instrument approach.

Key findings for Stage One:

- Based on 1612 procedures flown in instrument conditions:
    a. Estimated cumulative savings in flight time are 4,200 minutes achieved through a 17,300NM reduction in distance flown;
    b. Estimated cumulative savings in jet fuel are more than 200,000 kg;
    c. Estimated carbon dioxide emission reductions of 650,000 kg;
- There was a reduction in aircraft noise impact;
- Non-RNP aircraft benefited through reduced delays resulting from shorter arrivals for RNP aircraft;
- There were no reported occurrences of an RNP capable aircraft being denied an RNP clearance upon request;
- Comparing the first quarter and the last quarter of Stage One of the project, there was a 29% increase in the number of flights cleared via an RNP approach;
- There was no reduction to airport acceptance rates and a slight reduction in average delay;
- There have been no weather related go-around events;
- There have been no cases of aircraft exceeding the RNP design parameters; and
- There were no occurrences of the approaches being unavailable due to navigation system outages.

The most important insight gained from the project was that collaboration between stakeholders is essential.

On behalf of Airservices Australia I would like to thank Naverus Inc., Qantas Airways and the Civil Aviation Safety Authority of Australia for their contributions and collaboration in Brisbane Green. I would also like to acknowledge the outstanding efforts of the Airservices project staff and the air traffic controllers who have made this project possible. I look forward to reporting the results of this ongoing work to you as future stages unfold.

Greg Russell
Chief Executive Officer
Airservices Australia
March 2008

Introduction

Airservices Australia has a long tradition of innovation and collaboration to achieve the needs of the aviation industry, particularly in the advancement of safety, efficiency and the environment. In 2006, Airservices Australia and Naverus Inc., in close collaboration with Qantas Airways and the Civil Aviation Safety Authority of Australia (CASA), began work to implement high precision, performance-based instrument approach and departure procedures within Australia.

These procedures, based upon Required Navigation Performance (RNP), are designed to take advantage of the sophisticated navigational capability of modern aircraft. Initially implemented at terrain challenged locations such as Juneau, Alaska, RNP approaches and departures are now demonstrating real safety, efficiency and environmental benefits at a wide range of airports where modern aircraft operate.

The rollout of RNP approach and departures is now in progress for 15 airports across Australia, including the milestone "Brisbane Green" project at Brisbane International Airport.

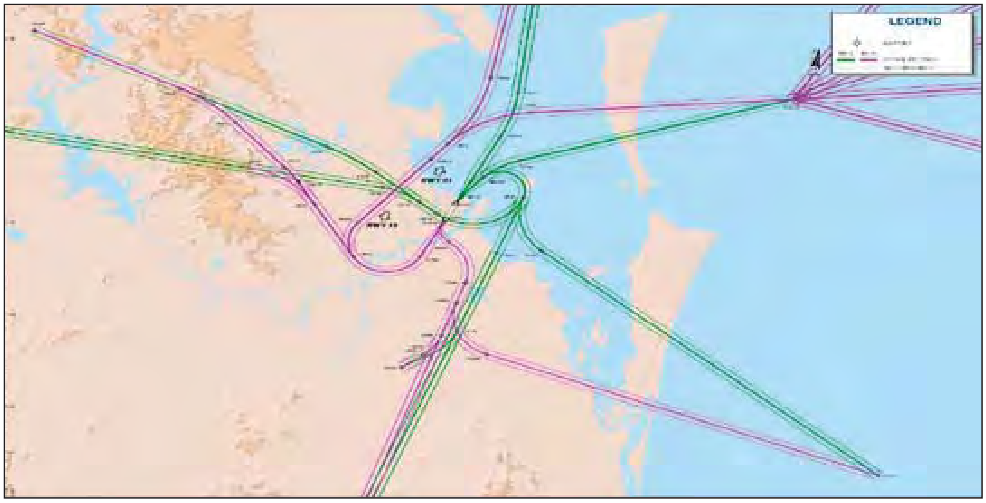
The purpose of Brisbane Green is to determine the most effective way to integrate RNP at a busy international airport supporting mixed (RNP and conventional) operations. The objectives of the project are to:

- identify, measure and report the benefits and costs of RNP to all stakeholders;
- develop ATC and flight crew operating procedures;
- identify, resolve and document issues and consequences; and
- gather a body of data to support the development by ICAO of terminal area RNP separation standards.

Under the project, RNP approaches have been deployed to Brisbane's main runways and connected to the Standard Arrival (FIGURE 1) and Departure (FIGURE 2) Route structure.

FIGURE 1.

FIGURE 2.



The procedures are approved for use by qualifying aircraft in revenue service for day and night operations and in all weather conditions. Track mile savings are significant compared to the track to the ILS for the same runway. Table 1 details the savings from arrival to runway threshold.

TABLE 1.

Track Mile Savings – RNP		
No.	**RNP TRACK**	**Miles Saved**
1.	DAYBO RWY 01	13.1
2.	DAYBO RWY 19	4.9
3.	AMITY RWY 01	12.8
4.	AMITY RWY 19	8.9
5.	AMBERLEY RWY 01	Nil
6.	AMBERLEY RWY 19	17.3

This report is based on the results from Stage One of the project, covering the first year of operation commencing January 2007 through to January 2008. As the project develops, new aircraft types participate, and complementary technologies are introduced, additional reports will be published. The intent is to foster collaboration and harmonisation with the international community in the interests of a safer, environmentally sustainable, more efficient and performance-based Air Traffic Management system.

Supporting this intent is Airservices' commitment to collaboration with other stakeholders to achieve an environmentally sustainable aviation industry. In February 2008, Airservices, the United States Federal Aviation Administration and Airways New Zealand created the Asia and South Pacific Initiative to Reduce Emissions (ASPIRE) Partnership.

Under ASPIRE, the three air navigation service providers undertook to work closely with airlines and other stakeholders in the region, to:

- accelerate the development and implementation of operational procedures to reduce the environmental footprint for all phases of flight on an operation by operation basis, from gate to gate;
- facilitate world-wide interoperability of environmentally friendly procedures and standards;
- capitalise on existing technology and best practices;
- develop shared performance metrics to measure improvements in the environmental performance of the air transport system; and
- provide a systematic approach to ensure appropriate mitigation actions with short, medium and long-term results.

Brisbane Green is an example of the work to be advanced under the ASPIRE initiative and demonstrates the benefits of a collaborative approach.

Background

Airservices Australia

Airservices Australia provides air traffic management (ATM) and related airside services to the aviation industry. Recognised internationally as a leader in the field, Airservices is committed to providing safe and environmentally sound services across Australia and in the surrounding region.

Each year, Airservices manages air traffic operations for more than three million domestic and international passenger flights carrying some 47 million passengers. The aviation industry also relies on Airservices for aeronautical data, telecommunications and navigation services.

The Future

The aviation industry is experiencing unprecedented growth, with air traffic in the Asia-Pacific region forecast to double in the next decade alone. To provide the necessary airspace capacity, while also raising system performance in terms of safety, efficiency, security and environment, the aviation community must turn to new techniques and technologies – an 'information technology revolution' for aviation.

No single technology provides all the solutions, and Airservices is working to integrate a variety of technologies to provide an internationally harmonised, performance-based ATM system that caters for a range of aircraft capabilities in diverse operating environments. However, one of the keystones of the future will be RNP.

RNP, and performance based navigation in general, is identified by the International Civil Aviation Organization (ICAO) as an enabler of the Global Air Navigation Plan (Doc 9750). The deployment of RNP is considered as an essential element in both the US NextGen and European SESAR plans, and the Australian ATM Strategic Plan also notes a major role for RNP in delivering the ATM target operational concept.

Airservices is working with Naverus Inc. to deploy RNP across Australia. This is a strategic relationship that brings together the strengths of both organisations to provide the leading edge in air traffic management capability.

Naverus Inc.

Naverus is based in the United States and Australia, and specialises in the development of "next generation" navigation solutions designed for modern aircraft. Beginning with their involvement in the deployment of RNP in Alaska during the early 1990's, the principals of Naverus have pioneered the use of terminal area RNP procedures.

Naverus is the world's leading RNP procedure designer, having designed the majority of procedures currently operating in revenue service throughout the world.

RNP Technology and Operations

RNP is a way of defining the navigational capability of the aircraft, taking into account the performance of the avionics, on-board systems and flight characteristics. RNP is a level of navigational performance expressed in nautical miles. The RNP defines the width of the airspace corridor required for the procedure.

RNP utilises the aircraft's Flight Management System (FMS) to integrate numerous sources of position data (including inertial, satellite and air data) to provide highly accurate navigation with real-time integrity monitoring and alerting. RNP is able to provide flexible, accurate and safe instrument approaches without the infrastructure demands of conventional approach navigation systems. Today it is used at some of the most remote and challenging environments in the world, providing access and delivering unprecedented improvements to safety.

Significantly however, a number of recent deployments of RNP have been at airports where terrain does not constrain operations. The ability to curve the approach path has allowed the designer to manoeuvre the aircraft around obstacles, and restricted or built up areas. This often results in a shorter approach when compared to the conventional procedure.

Aircraft Capability

Modern Transport Category aircraft equipped with FMS and GNSS are able to meet the airworthiness requirements for RNP operations.

RNP capability is usually certified by the manufacturer of the aircraft at the time of production. In many cases however, older aircraft can be retro-fitted to RNP approach capability by undergoing system upgrades.

RNP approach capability is fast becoming a standard feature of modern aircraft. In Australia, over 60% of the domestic jet transport fleet are certified to RNP0.3 or better.

Australian RNP Implementation

The integration of RNP into day-to-day air traffic flow management is a tangible step toward delivering Airservices' Gate-to-Gate and User Preferred Trajectory objectives. Airservices has offered en-route services based on RNP4 to suitably equipped aircraft since 2005, and is now rolling out RNP approach and departure procedures for 'next generation' aircraft. These procedures, based on aircraft performance ranging from RNP0.3 down to RNP0.1, are some of the most advanced deployed anywhere in the world.

The implementation program for terminal area RNP operations in Australia currently includes 15 airports but will be extended as benefit and need is determined. It is planned that Australia will have an integrated enroute and terminal area RNP network by 2010, ranging from non-towered remote airfields (such as Ayers Rock in central Australia) to capital cities (such as Sydney and Brisbane). To date there have been in excess of 26,000 RNP approach and departure operations conducted nationally.

Completion of Stage One of the Brisbane Green project is a milestone within the RNP program as it marks the successful integration of RNP approach and departure procedures into the air traffic flow management of an international hub.

FINDINGS

1. The broad range of environments where RNP is being deployed within Australia demonstrates its suitability as a global solution.
2. Projected aviation growth demands evolution to satellite and data-link technology to replace legacy infrastructure and procedures.
3. RNP is considered a keystone technology for Australia and ensures harmonisation with ICAO and Regional strategic plans.
4. RNP maximises use of the onboard navigational capability of modern aircraft.
5. The integration of RNP into the ATM system provides greater flexibility to balance operational requirements with community expectations.
6. Industry collaboration has proven the foundation element to ensure benefit realisation from RNP deployment

The Brisbane Green Project

The Brisbane Green project has provided early delivery and demonstration of the safety, economic and environmental benefits of RNP. The project also provides the opportunity to capture data to support safety evidence for development of RNP separation standards and rules.

Brisbane International Airport

Based on passenger throughput Brisbane International Airport is Australia's third busiest. During 2007 the airport had approximately 173,000 aircraft movements with passenger numbers in excess of 17.5 million. This places Brisbane airport within the world's top 100 airports for passenger throughput and is comparable in these terms to San Diego USA, Vienna, Austria or Osaka, Japan. Twenty-one international airlines and five domestic carriers conduct operations at Brisbane Airport, using a variety of aircraft ranging from turbo-prop and helicopter through to heavy jet operations.

Traffic in the Brisbane area is managed by a Terminal Control Unit (TCU) and ATC Towers at Brisbane International and several nearby airports. Surveillance in the terminal area is provided by primary and secondary radar, with upgrade to Mode S SSR planned for 2009. Other Airservices projects will see Automatic Dependent Surveillance - Broadcast (ADS-B), and Advanced Surface Movement Guidance and Control Systems (A-SMGCS) deployed in the Brisbane area within the next few years.

Brisbane Airport is served by a main north south runway (01/19) and a shorter crossing east/west runway (14/32). The airport has ILS CAT-1 approaches to both ends of the main runway.

There are six RNP approach procedures in use to the two main runway ends, providing alternatives to the existing ILS procedures and visual approach paths. The RNP 0.3 procedures provide for a 250ft decision height and were designed by Naverus in close collaboration with Airservices' air traffic control specialists.

Project Schedule

The Project is divided into three stages of approximately 12 months each. Stage One commenced on 18th January 2007 and involved participation of the Qantas 737-800 fleet; 33 airframes. To date there have been in excess of 15,500 RNP operations conducted at Brisbane with more than 8000 approaches. This represents approximately 63% of all RNP operations nationally.

Stage 2 commenced in early 2008, and includes the Jetstar A320/A321 and Air Vanuatu 737NG fleets. To date, this has involved an approval process by CASA and the development and deployment of crew training for the two airlines.

Stage 3, to commence in 2009, is expected to include Virgin Blue Airlines and other international carriers, with additional aircraft types.

Procedures Implementation

All RNP procedures at Brisbane have been designed to RNP 0.3 criteria with their use approved by CASA. Initial design commenced some seven months prior to implementation at Brisbane. Initial designs were distributed to ATC for review and tested in the Qantas 737 flight simulators before being flight checked.

An Online Training (OLT) package was developed for air traffic controller training. The package targeted the specific elements of change within each operational unit. Completion of the OLT package was mandatory for all air traffic control personnel prior to their participation in the Brisbane Green project.

Qantas pilots undertake theoretical and simulator training to qualify for RNP instrument approaches generally. Importantly no additional training was required for these RNP qualified pilots to participate in the project.

New pilot/controller phraseologies were developed in conjunction with CASA and airline participants. These phrases were also applicable to other locations where RNP was being introduced and were therefore standardised throughout Australia. Future enhancements to the ATC automation system may eliminate the need for these measures.

FINDINGS

1. Full integration of RNP into the air traffic flow management of a busy international hub is achievable.
2. Integration of air traffic management considerations from commencement of the design stage is essential.
3. Stage 2 and 3 of the Project will see a four-fold increase of the airframes involved in RNP operations at Brisbane.

Safety Analysis

The approach to safety for the Brisbane Green Project has included both qualitative and quantitative analysis pre and post implementation. Airservices and Qantas both have robust Safety Management Systems (SMS) and these systems have been fully applied.

Reporting Requirements

CASA has put in place specific reporting requirements to ensure timely identification and resolution of issues. Additionally there has been significant information exchange between stakeholders.

Throughout the project, Airservices has recorded 1 instance reported as an "event" and 4 instances reported as an "incident" via its formal reporting process. All instances were fully assessed and where appropriate remedial processes put into effect. In all cases, instances were assessed to be of a minor nature. Given the number of procedures flown, this outcome is considered a very positive result.

Conformance

A study of lateral conformance of Brisbane Green RNP operations was also undertaken. Data was collected from 543 flights, from the period of August 2007 to end January 2008. Aircraft are required to navigate within 1 x RNP (in this case 0.3 nautical miles or 556 metres) of the prescribed path 95% of the time. It was demonstrated that RNP aircraft are exceeding this requirement.

Aircraft conformed to the path prescribed with a standard deviation of 0.0224 nautical miles or 41.5 metres and there were no instances of aircraft exceeding the approach design tolerance. This data will also be used to support a safety assessment by ICAO's Separation and Airspace Safety Panel (SASP) for development of new RNP based separation standards.

Non-normal Operations

RNP procedures deployed in Australia make provision for emergency operations including engine and other system failures at any point in the approach or departure. The safe extraction of a disabled aircraft is provided with an alternative flight path which automatically steers the aircraft over the lowest terrain and delivers it to an altitude where it can safely return to land.

In terrain challenged airports like Queenstown, New Zealand, Cairns and Canberra this capability has reduced the workload on pilots in an emergency and dramatically raised the safety of operations. RNP is valued as an effective weapon in the fight against the Controlled Flight into Terrain (CFIT).

FINDINGS

1. A transparent and collaborative approach to safety activities between the airline, ANSP and regulator are a foundation to project success.
2. A total of 1 event and 4 incidents were reported for more than 8000 approaches and 7000 departures.
3. 100% compliance within the RNP navigation requirement has been achieved.
4. Inherent characteristics of RNP support safety improvements.

Efficiency Analysis

For the 12 months of Stage One, more than 200,000 kg of fuel was saved during RNP approaches. For aircraft conducting an instrument approach, RNP can have a positive impact on delays and fuel consumption through track shortening and Continuous Descent Arrivals (CDA).

Reduced Flight Distance

A conventional instrument approach such as an ILS is constructed by extending a line from a navigation aid (on the ground) to a point in space where the approach commences. In the case of the ILS, this point is approximately 10NM from the runway. An RNP approach is not dependent upon the location of ground aids and is constructed as a series of straight and curved segments. The length of the straight segment immediately before the runway threshold may be as short as one mile. This feature allows the designer to curve the approach around obstacles, restricted and noise sensitive areas and to "abbreviate" the approach to achieve a reduction in the distance flown by the aircraft as it approaches to land.

During Stage One of the Brisbane Green Project the total number of track miles saved is estimated to exceed 17,300 nm (approximately 4,200 minutes of flight time). This result is based upon the instances where a participating B737-800 was able to conduct the RNP approach where otherwise an ILS approach would have been required. This has resulted in approach tracks being shortened by up to 17.3NM.

Track shortening at the end of the approach has far more impact than track shortening at the beginning of the approach because the rate of fuel consumption of a jet engine increases as the aircraft descends and configures for landing.

Reducing fuel consumption during arrival and descent is a key efficiency and environmental objective. The job of the air traffic controller is to safely separate aircraft. Aircraft can be separated both laterally and vertically and therefore it is common for arriving aircraft to level off at intermediate altitudes as air traffic controllers provide vertical separation from aircraft passing below. For the aircraft to interrupt its descent, thrust must be applied and that means more fuel is burned.

Continuous Descent Arrival

A CDA is one where the vertical path of the aircraft is uninterrupted and optimised for use of idle thrust. An RNP approach is designed to allow the FMS to manage the energy during descent, eliminating unnecessary level segments. The accuracy of navigation and speed control during the descent also allows the air traffic controller to predict the progress of the aircraft and aids in the sequencing of landing aircraft. For the controller, the need to intervene in the descent or the navigation of the aircraft is greatly reduced.

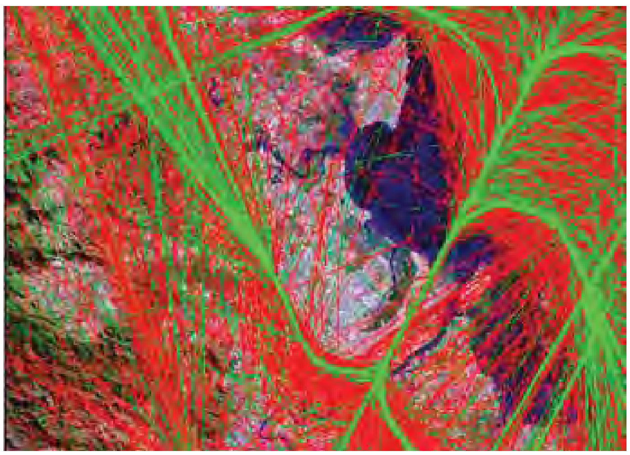
As a result, RNP aircraft arriving into Brisbane are able to conduct a CDA from the top of descent thereby allowing the aircraft to virtually glide at idle thrust for approximately the last 20 minutes of flight.

Airspace Capacity

It was found that the time saved through an RNP approach was consistent and predictable, and that the accumulation of time saved by an RNP approach flows on to following aircraft in the sequence. This generates savings for all flights into an airport where RNP approaches are deployed whether aircraft are RNP or Non-RNP and provides the potential for increased throughput of arriving aircraft to the airport.

FIGURE 3 shows the predictability of RNP approach paths (green) by contrast with the significant variation to flight path for conventional procedures and the associated controller workload.

FIGURE 3.



Use of RNP Procedures

The suitability of RNP approaches in normal airport operations was identified as a success measure for Stage One, specifically how often the controller was able to grant an RNP approach as opposed to an ILS or visual approach was assessed. To date there has been no reported instances of an RNP capable aircraft being denied an RNP approach.

Comparing the first and last quarter of Stage One of the project there was a 29% increase in the number of flights cleared via an RNP approach.

Airport Capacity

Another measurement of success for the project was the impact of RNP approaches on airport capacity. Analysis from the month immediately prior to commencement of Stage One (December 2006) compared to the final month of this stage (December 2007) indicates that no reduction to airport acceptance rates has occurred and indeed, there was a slight overall reduction in average delay of 28 seconds. This initial finding will be the subject of more detailed analysis throughout later stages.

This is a very encouraging outcome and indicates that in Brisbane, RNP has rapidly assimilated into the ATC environment. The presence of an RNAV STAR system and flow management protocol has resulted in a reduced need for tactical intervention through radar vectoring. This has facilitated a high and increasing level of RNP approach clearances.

The potential accumulated benefit to airport capacity is substantial and throughout later stages of the project empirical data will be collected to measure the impact of RNP on the overall capacity of the terminal airspace.

FINDINGS

1. The RNP approaches at Brisbane provided shorter approaches by up to 17.3 NM.
2. The total number of track miles saved during Stage One is estimated to exceed 17,300NM;
3. Identified fuel savings are in excess of 200,000 kg.
4. Flight time savings for arrivals exceeded 4,200 minutes.
5. The RNP approaches at Brisbane provided greater trajectory predictability allowing reduced controller intervention.
6. There has been no reduction to airport acceptance rates and a slight overall improvement to average delay by 28 seconds.
7. RNP facilitates a CDA which provides for significant fuel savings.
8. Non-RNP flights following an RNP aircraft gain benefit through less delay derived from the shorter RNP approach.

Environmental Analysis

The aviation industry has been managing its environmental impacts for many years, and aircraft noise is regularly raised in public debate about the operation and expansion of airports. Aviation's contribution to greenhouse gas emissions, although small when compared to others, is anticipated to grow. Environmentally sound decision-making is therefore critical to the long-term development of the industry.

More broadly, Australia has committed to working on climate change issues. In January 2006, Australia, China, India, Japan, Republic of Korea and the United States launched the Asia Pacific Partnership on Clean Development and Climate (AP6) and in December 2007 Australia became a signatory to the Kyoto Protocol to the United Nations Framework Convention on Climate Change. Airservices' partnership with the FAA and Airways New Zealand in ASPIRE is part of this commitment.

The aviation industry has responded to the issue of emissions with the International Air Transport Association (IATA) and ICAO specifically encouraging the implementation of new ATM practices and technologies in the management of aviation's environmental impacts.

Carbon Dioxide (CO_2)

Every kilogram of fuel saved saves just over three kilograms of CO_2 emissions. By comparing airline fuel consumption data with airport movement records, it has been possible to determine, with a high degree of confidence, that Stage One of Brisbane Green has saved more than 650,000 kg of CO_2 emissions.

This estimate has been based upon the ICAO recommended methodology for converting minutes of flight to CO_2 emissions. Further analysis is underway and based on actual fuel usage it indicates that for some approaches the emissions savings may be considerably higher.

But this is the beginning. This remarkable result has been achieved by just 33 aircraft in 12 months of operations. It is expected that Stage Two will significantly improve on this result with the phased inclusion of more participant aircraft over the coming 12 months.

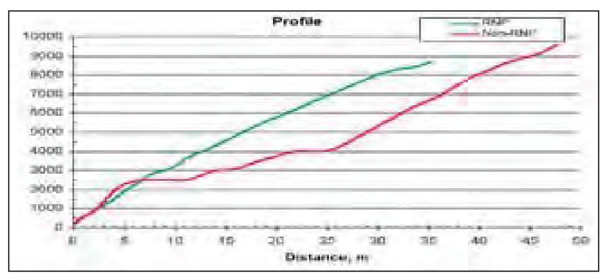
Nitrous Oxide (NOx)

Nitrous Oxide is the third largest greenhouse gas contributor to overall global warming, behind carbon dioxide and methane. Nitrous Oxide emissions by jet aircraft are correlated to the thrust produced by the engine. An approach without level flight segments, that does not require additional thrust to maintain an altitude during the approach, can minimise the production of NOx.

Level segments have traditionally been used to allow aircraft to lose speed, intercept the instrument approach, sequence flows to the runway or facilitate vertical segregation of routes. RNP procedures offer alternative means to achieve these goals, while providing a CDA from high-altitude cruise to the runway.

FIGURE 4 depicts actual data for an RNP and Non-RNP approach in Brisbane within 15mins Actual Time of Arrival (ATA).

FIGURE 4.



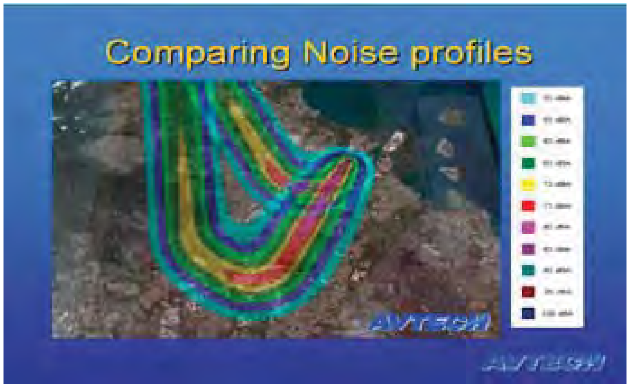
In general terms this data supports our expectation that NOx will be significantly reduced through the introduction of RNP. Stage Two of the project will see the capture and analysis of further detailed data.

Noise

Aircraft noise has been a major focus in Australia and elsewhere in the world, particularly since the development of commercial jet aircraft. Technological developments in the last 40 years have significantly reduced the noise impact from aircraft on communities in the vicinity of airports. In that time perceived noise from individual aircraft has been reduced by a factor of four.

The introduction of stricter Chapter 4 noise requirements in January 2006 have made little, if any, difference to the noise levels around Australian airports due to the modern domestic fleet, most of which were already meeting the Chapter 4 standards. As a result, noise impacts around major Australian airports have been found to increase largely proportional to air traffic increases. Improved ATM techniques will be pivotal in managing noise in the short to medium term.

FIGURE 5.



Noise footprints for the RNP procedures were estimated by AVTECH, Sweden AB (FIGURE 5). This indicated that the 70 dB and 75 dB footprints would be significantly reduced in size, and the accuracy of the RNP design allowed the procedure to be placed over non-residential areas, such as the Brisbane River.

FIGURE 6 shows the flight paths for RNP (green) and Non-RNP (red) aircraft approaching Brisbane runway 01 via the "River" noise abatement procedure. The RNP path ensures that the low level final approach is conducted over the river and industrial areas.

FIGURE 6.

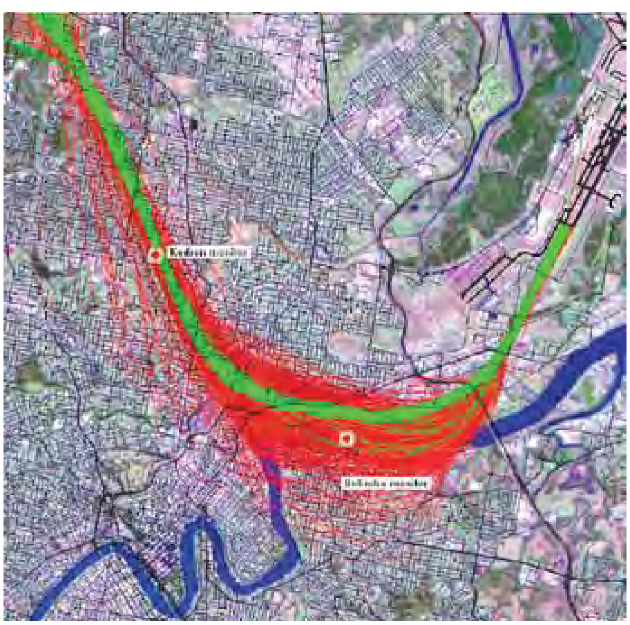
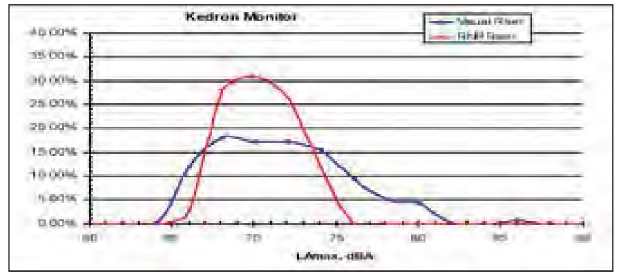


FIGURE 7 demonstrates lower noise levels for RNP flights at the Kedron noise monitor indicating that these aircraft are at higher altitude than typically flown during a visual approach. This shows that very few RNP flights generated noise above 75dB at Kedron.

FIGURE 7.



Noise forecasts for RNP and conventional approaches (FIGURE 5) have been validated using noise monitors at Kedron and Bulimba (FIGURE 6) and other locations.

FINDINGS

1. RNP approach and departure procedures provide practical means to reduce CO_2, NOx and noise emissions.
2. The Brisbane Green Project has saved 650,000 kg of CO_2 emissions in the first year alone.
3. Expectations of reduced NOx emission levels are supported by experience of uninterrupted CDA during RNP approaches.
4. The flexibility and accuracy of RNP operations allows for noise footprints to be placed over non-residential areas.

Future Steps

Stage One of the RNP Project – Brisbane Green has been successful and has exceeded the expectations of the stakeholders. Data gathered in Stage One has validated the benefits which can be realised by the implementation of performance based navigation technology.

The success of the Brisbane Green project and the qualifications of benefits have provided Airservices Australia with the confidence to commit to the deployment of RNP across Australia. Brisbane Green is a model for Airservices and other ANSPs to build on in the development of performance based navigation programs around the world.

A large body of high quality data has been collected from the project validating the benefits of RNP approach and departure operations. Stages Two and Three will continue to capture this data and more, while also focusing upon the introduction of additional aircraft types and complementary technologies. This will further establish the business case for the integration of RNP approach and departures within complex air traffic management environments.

By working with airspace users, regulators, other air navigation service providers and leading edge ATM capability providers such as Naverus, Airservices will continue to advance the Australian CNS/ATM system. Through our RNP implementation program, Airservices and stakeholders will deliver:

- Increased safety in all weather conditions;
- Lower fuel consumption and greenhouse gas emissions;
- Reduced noise for airport communities; and
- Reduced impost of weather and terrain upon operations.

Airservices Australia wishes to acknowledge the contributions of Naverus Inc., Qantas Airways and the Civil Aviation Safety Authority of Australia to the success of the Brisbane Green RNP project.

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Glossary

ABBREVIATION	DETAIL
ANSP	Air Navigation Service Provider
AP6	Asia Pacific Partnership on Clean Development and Climate
ATC	Air Traffic Control
ATM	Air Traffic Management
ASPIRE	Asia and South Pacific Initiative to Reduce Emissions
CASA	Civil Aviation Safety Authority (Australia)
CDA	Continuous Descent Arrival
CFIT	Controlled Flight Into Terrain
CNS	Communication, Navigation and Surveillance
CO_2	Carbon Dioxide
dB	Decibel
FMS	Flight Management System
GNSS	Global Navigation Satellite Systems
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
Kg	Kilogram
NM	Nautical Mile
NO_x	Nitrous Oxide
OLT	Online Training
RNAV	Area Navigation
RNP	Required Navigation Performance
RWY	Runway
SASP	Separation and Airspace Safety Panel (ICAO)
SMS	Safety Management System
STAR	Standard Arrival Route

Attachment B

Brisbane

Efficiency Analysis of simulated RNP Approaches versus ILS with fixed reference.

Version: 2.0

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1. Background

Qantas is currently using RNP Approaches in Brisbane for Runway 01 and 19. Benefits have been identified such as reduced emissions, noise and fuel consumption. Noise has earlier been studied for both real flights using Qantas QAR Data and simulated flights[1].

The objective of this study is to illustrate efficiency using RNP approaches compared to ILS for runway 01 and 19.

We compare here each approach from a fix point in space to 200ft.

Simulation was done using the AVTECH AASES 737 Simulator with GE Avionics FMS version U10.7.

Assumptions used:

- 737-600 (-800 not available)
- Engine Rating 20,000 LB
- Weight leaving cruise approx. 138,000 LB.
- Cost Index 33
- Cruise at FL330
- Speed below 250kt below 10,000ft
- Wind 0
- No level segments except for ILS procedure prior to intercept Glide slope.
- ILS: Gear and flaps (30 degrees) extended and aircraft at Vapp before final descent from 2500ft for runway 19 and 3000ft for runway 01.
- RNP: Gear and flaps (30 degrees) extended and aircraft at Vapp before 1000 ft.

[1] Brisbane – Study of RNP Approaches versus ILS v 1.0 - 080226

2. The Approaches

2.1. Runway 01

For the ILS and the RNP flight into RWY01 we used the following STARs and approaches:

- **RNP**. DAYBO8 / DAYBO - RNAV (RNP) M RWY 01 - 26NM
- **ILS.** GLENN4 / DAYBO-FLYNN-RWY01 ILS - 41NM

As fixed point we chose a point at 321 degrees/100nm from DAYBO. A flight from Cairns would pass close or at such a point.

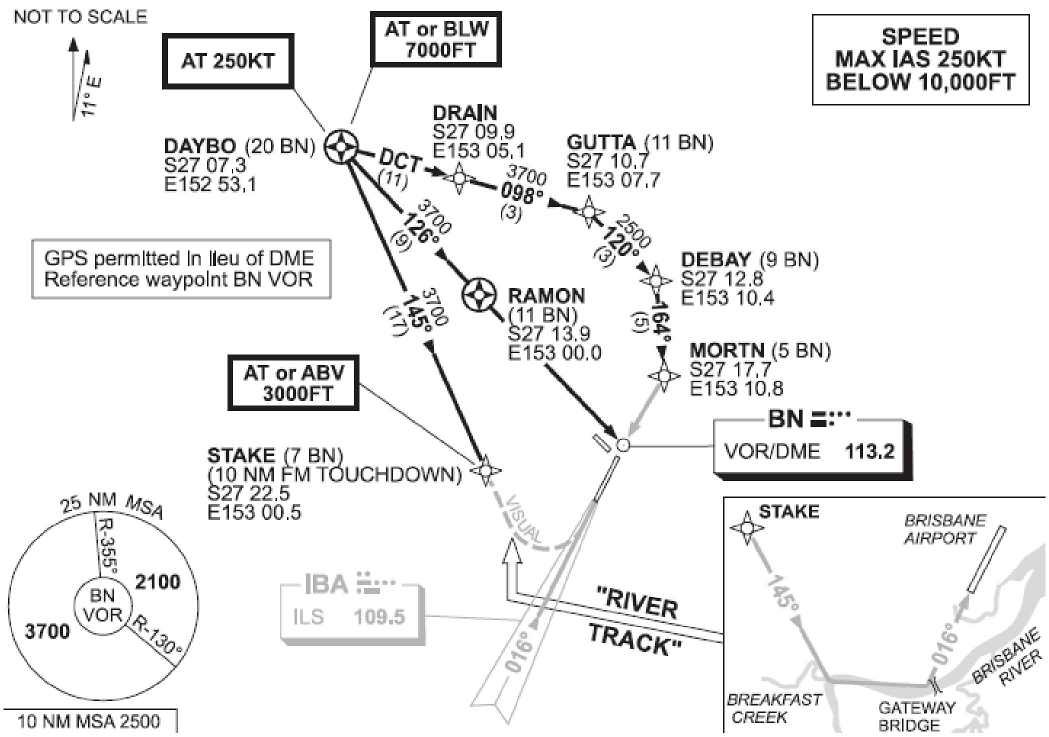


Figure 1 – DAYBO 8

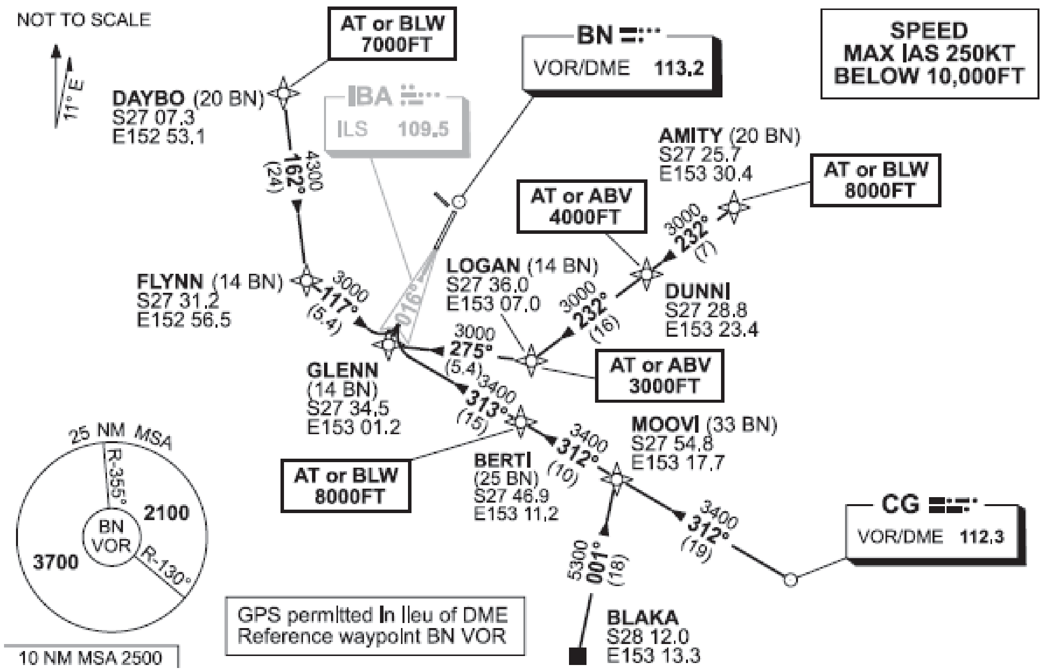


Figure 2 - GLENN4

DME DIST	11.7	11	10	9	8	7	6	5	4.1				
ALT (3° APCH PATH)	3000	2780	2460	2140	1825	1510	1190	865	560				

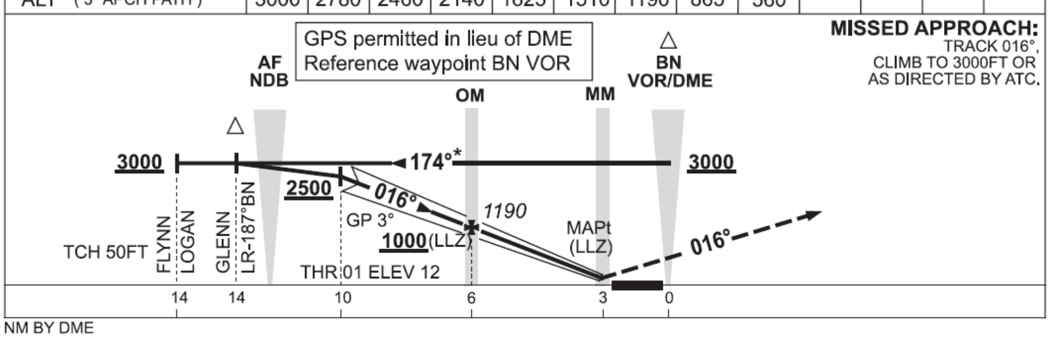


Figure 3 - ILS RWY 01

Runway 19

For the ILS and the RNP flight into RWY 01 we used the following STARs and approaches:

- **RNP**.GOLD COAST4: CG-CRAWS-POODL RNAV (RNP) P RWY 19 - 60NM
- **ILS.** SINNK3: CG-CRAWS-LEAKY-BOATS-SINNK-RWY19 ILS - 73NM

As fixed point we chose a point at 160 degrees/70nm from CG. A flight from Sydney would pass close or at such a point.

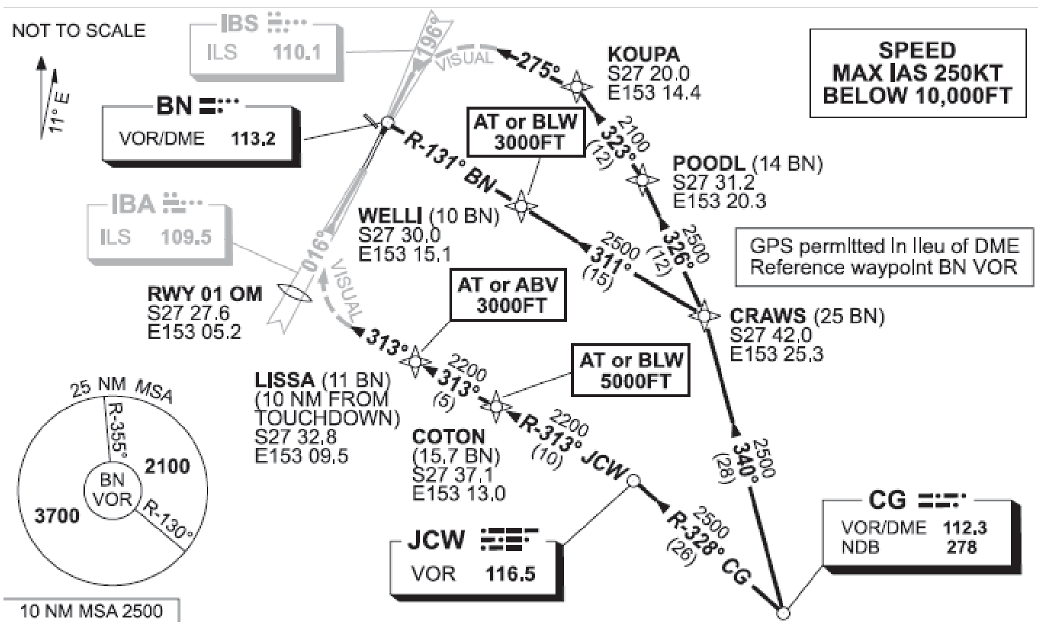


Figure 4 – GOLD COAST 4

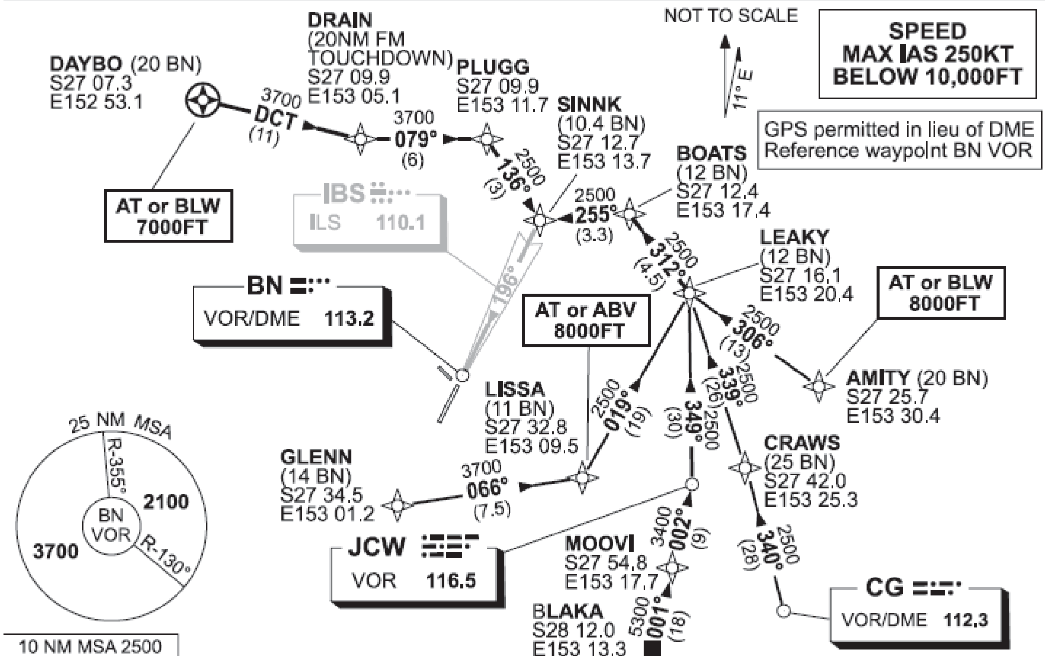


Figure 5 - SINNK 3

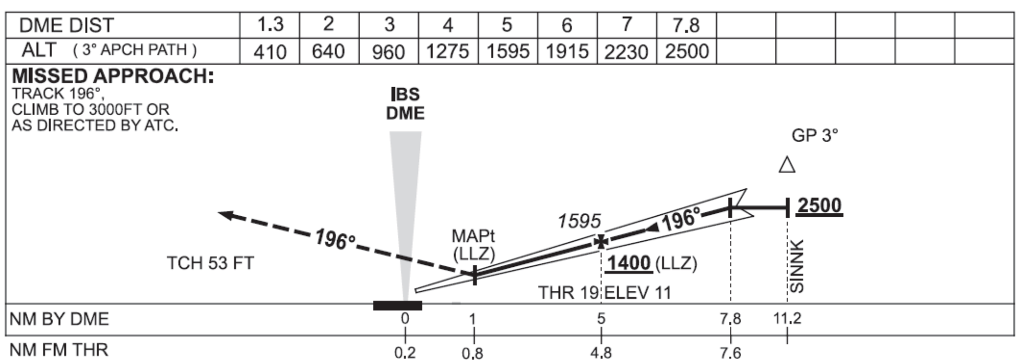


Figure 6 - ILS RWY 19

We note that the approach via SINNK has a long level segment before intercepting ILS Glide compared to a small level segment at GLENN for runway 01.

Figures are parts of Australian AIP by Airservices Australia. Images are for reference only.

3. Results

3.1. Lateral Profile

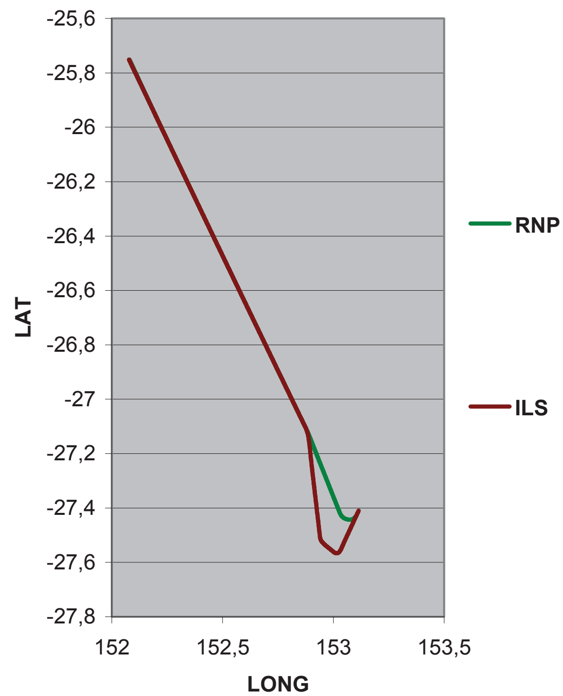


Figure 7 - Brisbane RWY 01 Approach 100nm from DAYBO

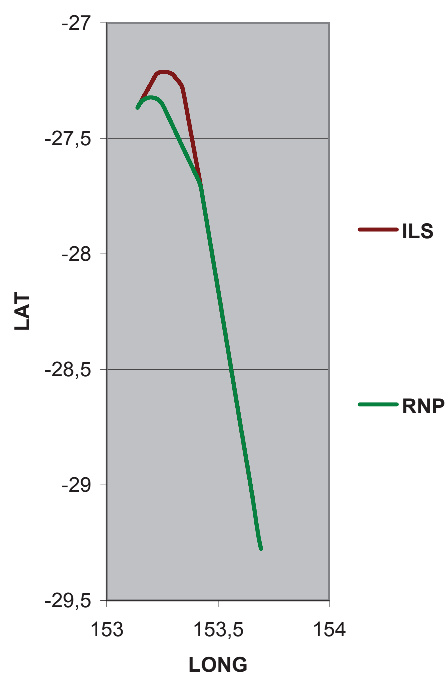


Figure 8 - Brisbane RWY 19 Approach 70nm from CG

3.2. Vertical Profile and fuel burn

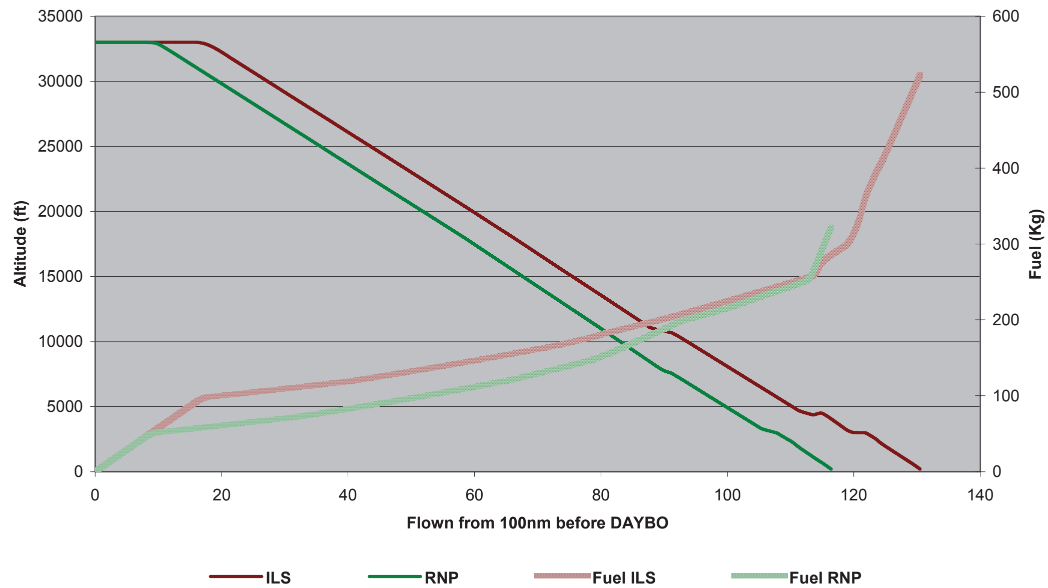


Figure 9 - Brisbane RWY 01 Approach starting 100nm from DAYBO

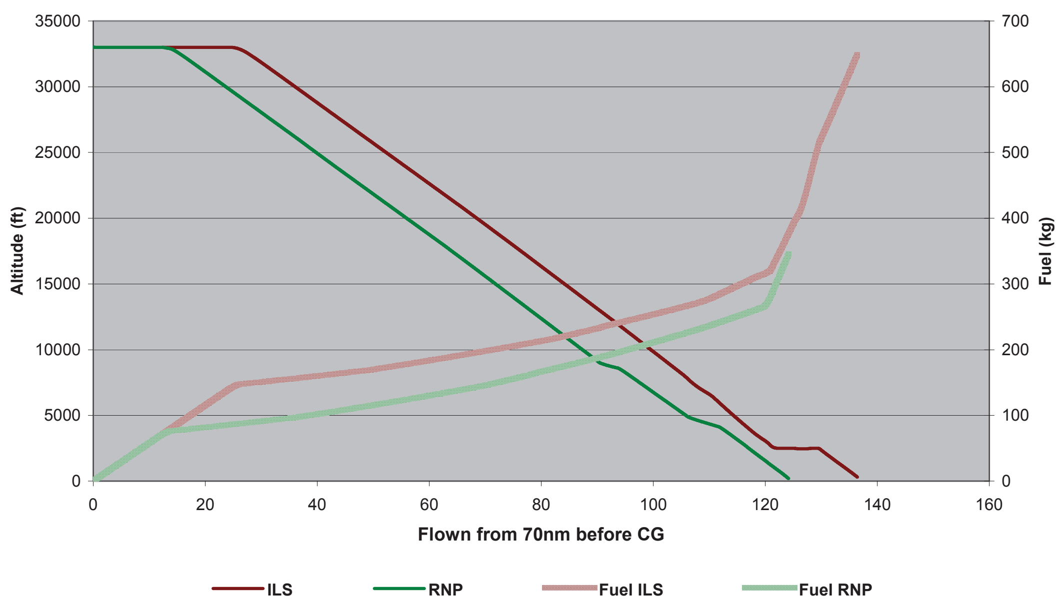


Figure 10 - Brisbane RWY 19 Approach 100nm starting 70 nm before CG

4. Conclusion

Fuel burn is reduced for both RNP procedures compared to ILS. The improvements are linked to differences in drag, track miles and level-offs in the descent.

Reduced track miles will reduce fuel consumption. The savings in track miles are:

- Runway 01: 41nm-26nm = 15nm
- Runway 19: 73nm-60nm = 13nm
-

The remaining difference in consumption is linked to increased thrust and/or increased drag. For the vertical profile on previous page we have identified:

- Runway 19. An increase in fuel consumption during the level segment between SINNK and the intercept point of the ILS descent.

- Runway 01. The level-off segment for the ILS from GLENN at 3000ft is shorter than the level off segment for runway 19 resulting in a lower consumption compared to ILS19.

From FL330 we see the following consumptions and corresponding emissions:

Runway and ILS/RNP	Fuel used (kg)	CO2 (kg)	NOX (kg)
01 ILS	522	1639	5.7
01 RNP	321	1008	3.5
19 ILS	655	2057	7.2
19 RNP	345	1083	3.8

The analysis has determined a reduction in fuel consumption and emissions as follows:

Estimated reduction RNP versus ILS.	Fuel saved (kg)	CO2 (kg)	NOX (kg)
01	201	631	2.2
19	310	973	3.4

These simulations are modeled on the vertical profile from Qantas Brisbane data which exclude radar vectors and associated level segments. Potential gains for RNP would be greater in a terminal area which uses radar vectors and a step down descents.

It is noted that an improved Continuous Descent Approach (CDA) is achieved with an RNP compared to an RNAV-ILS approach as the result of the precise trajectory and improved energy management characteristics of the RNP procedure.

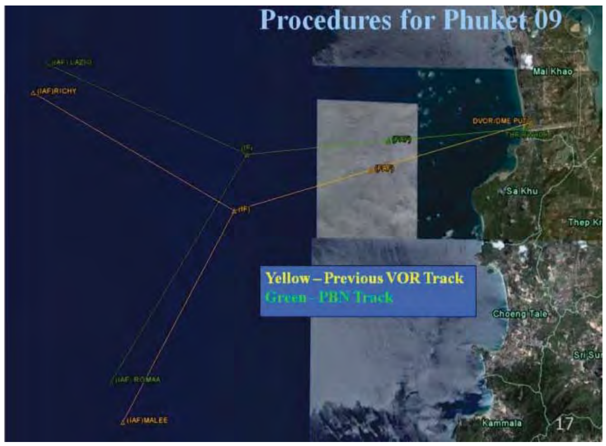
Attachment C

1. **Tangible Benefits of PBN Implementation in Thai Terminal Airspace**

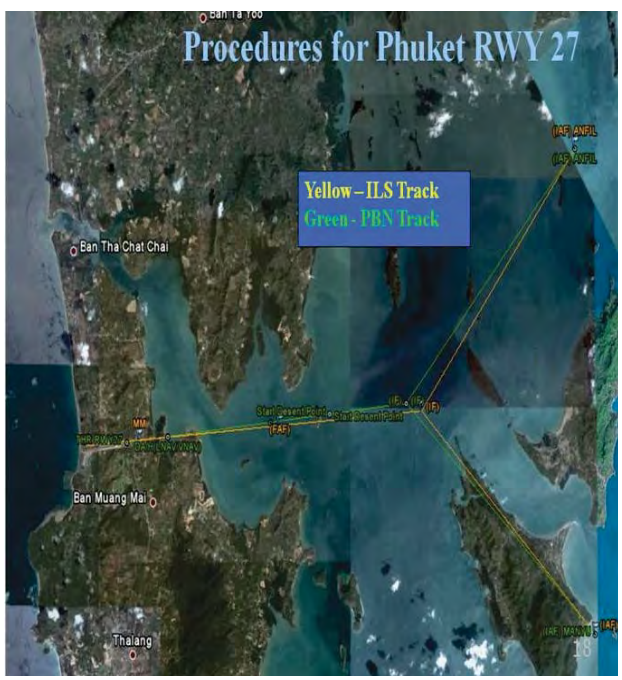
1.1 **Phuket:** Since February 2009, Thai DCA has approved full operation of RNP APCH procedures for Phuket International Airport. These procedures enhance safety and efficiency in the approach operation and also resolve the offset problems caused by the limitation of installation sites of conventional navigation aids.

1.2 The following safety benefits are the results of RNP Approach implementation for Phuket International Airport:

- Runway 27 - Providing a runway-aligned approach path as compared to the current ILS approach which has 1.4 degree offset.
- Runway 09 - Providing a runway-aligned approach path as compared to the current VOR approach which has 5 degree offset.

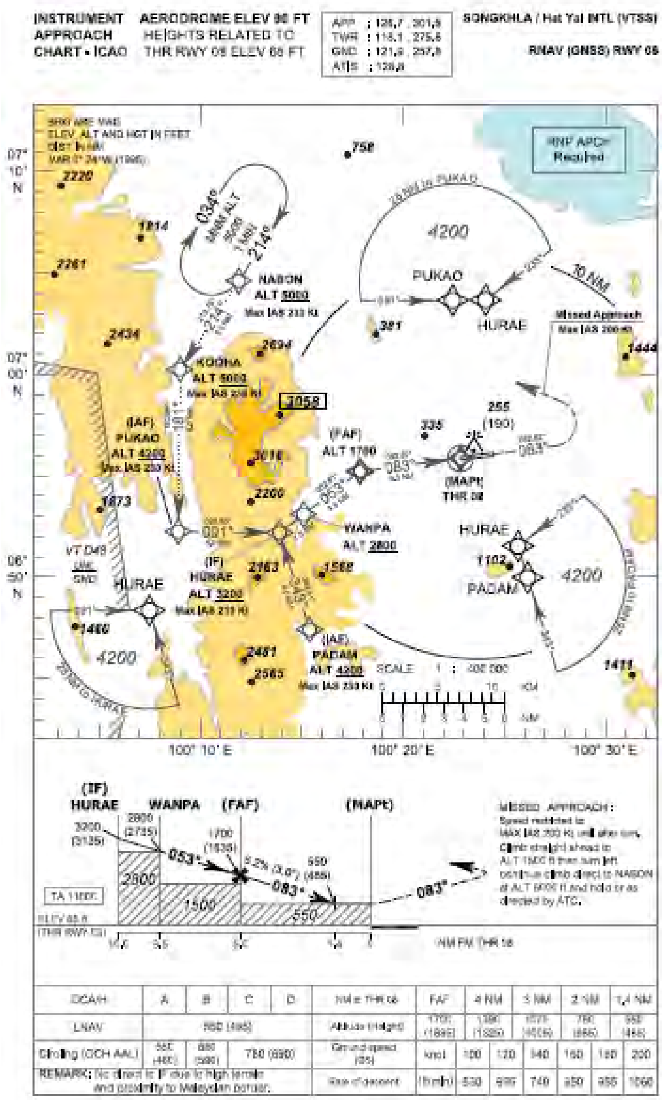


RNP APCH procedures for Phuket Runway 09



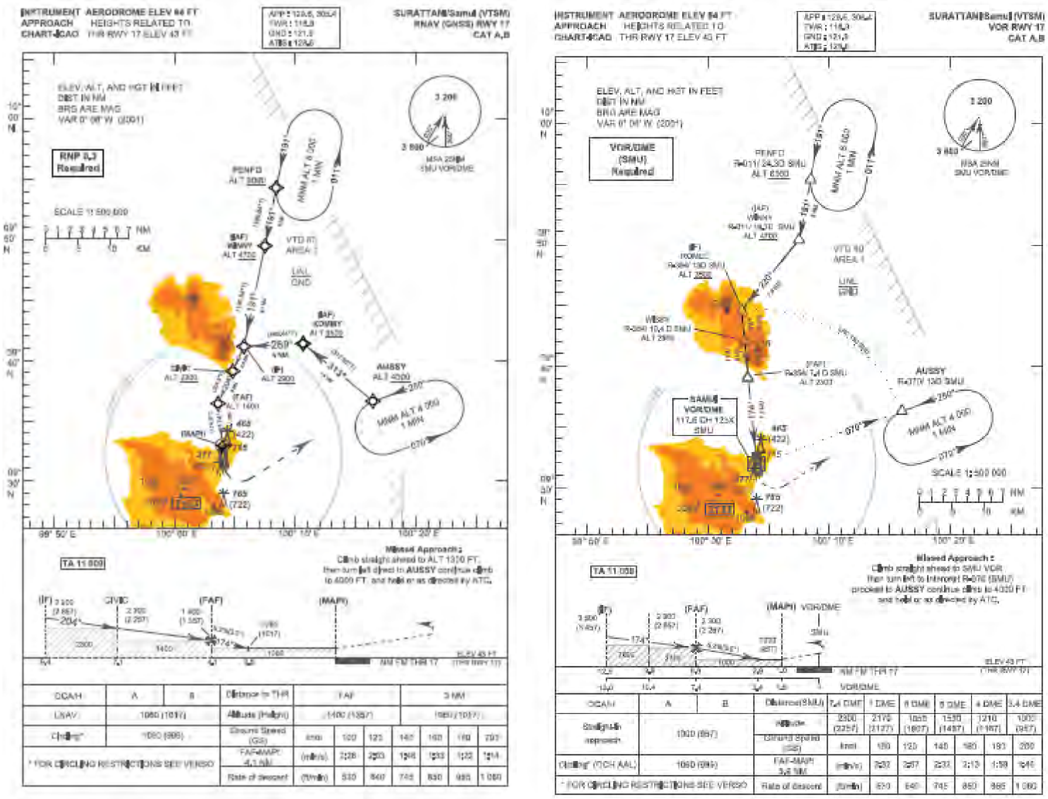
RNP APCH procedures for Phuket Runway 27

1.3 **Hat Yai:** RNP APCH procedures for Hat Yai International Airport have been designed and successfully flight validated by AEROTHAI. The procedures have been available for commercial operations since December 2009. These RNP APCH procedures help enhancing the level of safety and efficiency in approach and landing operations to Hat Yai International Airport, especially to Runway 08, of which no instrument approach procedure with conventional navigation aids was feasible. Moreover, RNP APCH procedures for Runway 26 also provide back-up approach procedures for the existing ILS procedures.



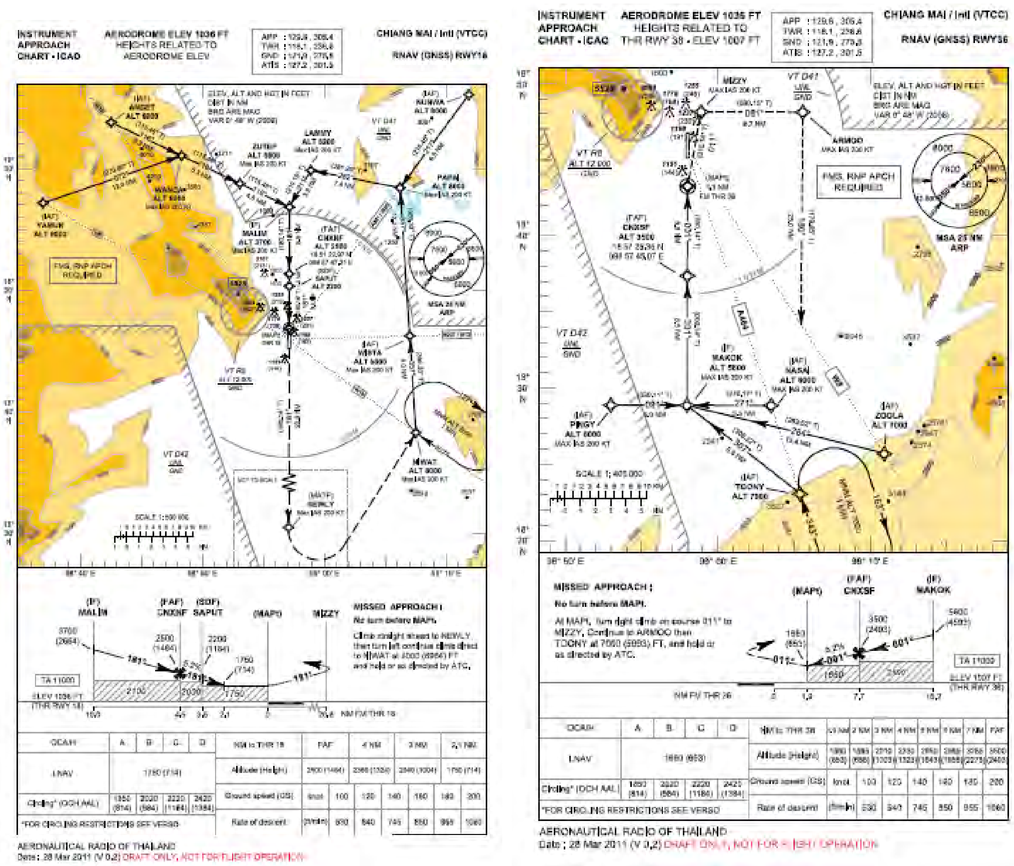
RNP APCH procedure for Hat Yai Runway 08

1.4 **Samui:** Two RNP APCH procedures for Samui Airport have designed and successfully flight validated by AEROTHAI. The procedures have been authorized to be used in commercial operations by the Thai DCA since May 2010. These RNP APCH procedures help enhancing the level of safety and efficiency in approach and landing operations to Samui Airport, especially to Runway 17, since their flexible flight path can navigate the aircraft around mountainous areas while still providing the runway-aligned final segment.



RNP APCH procedure for Samui Runway 17 as compared to VOR Runway 17

1.5 **Chiang Mai:** AEROTHAI in coordination with Thailand's National Working Group for PBN and GNSS implementation has completed the design for additional RNP APCH procedures for Chiang Mai International Airport. As of March 2011, AEROTHAI has successfully flight-validated the two RNP APCH procedures. Commercial operations for the procedures have been expected before the end of 2011. Once completed, these RNP APCH procedures will help enhancing the level of safety and efficiency in approach and landing operations to Chiang Mai International Airport, especially to Runway 18, of which no straight-in, runway-aligned approach procedure is feasible with the existing VOR.



RNP APCH procedures for Chiang Mai International Airport

1.6 The following tables summarize notable safety benefits derived from PBN implementation at Phuket, Hat Yai, Samui and Chiang Mai Airports:

Phuket	**Conventional**	**PBN**
Runway 27	1.4-degree ILS offset	Runway aligned approach
Runway 09	5-degree VOR offset	Runway aligned approach
	OCA at 850 feet	OCA at 750 feet

Samui	**Conventional**	**PBN**
Runway 17	Runway aligned, yet pass through unstable weather area	Runway aligned approach, side-step to avoid the unstable weather area

Hat Yai	**Conventional**	**PBN**
Runway 08	Unavailable due to mountainous terrain	Runway aligned approach

Chiang Mai	**Conventional**	**PBN**
Runway 18	VOR circling approach with high circling OCA/H	Runway aligned approach

REVISED NAVIGATION STRATEGY FOR THE ASIA/PACIFIC REGION

Considering:

a) the material contained in the Performance Based Navigation Manual (Doc 9613) for enroute, approach, landing and departures operations;

b) operators are equipped to support PBN operations;

c) GNSS is the navigation sensor for RNP;

d) APV operations may be conducted with either BARO-VNAV or augmented GNSS;

e) Augmented GNSS to support Category I operations will be available by end 2012 and Category II and III operations by 2015;

f) ILS is capable of meeting the majority of requirements for precision approach and landing in the Asia-Pacific Region;

g) MLS CAT III is operational;

h) the need to maintain aircraft interoperability both within the Region and between the Asia/Pacific Region and other ICAO regions and to provide flexibility for future aircraft equipage.

i) single-frequency GNSS may be susceptible to radio frequency interference and ionospheric disturbances:

Strategy

i) Convert from terrestrial-based instrument flight procedures to PBN operations in accordance with the Asia/Pacific Seamless ATM Plan;

ii) retain ILS as an ICAO standard system for as long as it is operationally acceptable and economically beneficial;

iii) implement GNSS with augmentation as required for APV and precision approach or RNP AR (Authorisation Required) operations where it is operationally required and economically beneficial;

iv) implement the use of APV operation in accordance with the Asia/Pacific Seamless ATM Plan;

v) rationalize terrestrial navigation aids, retaining a minimum network of terrestrial aids necessary to maintain safety of aircraft operations;

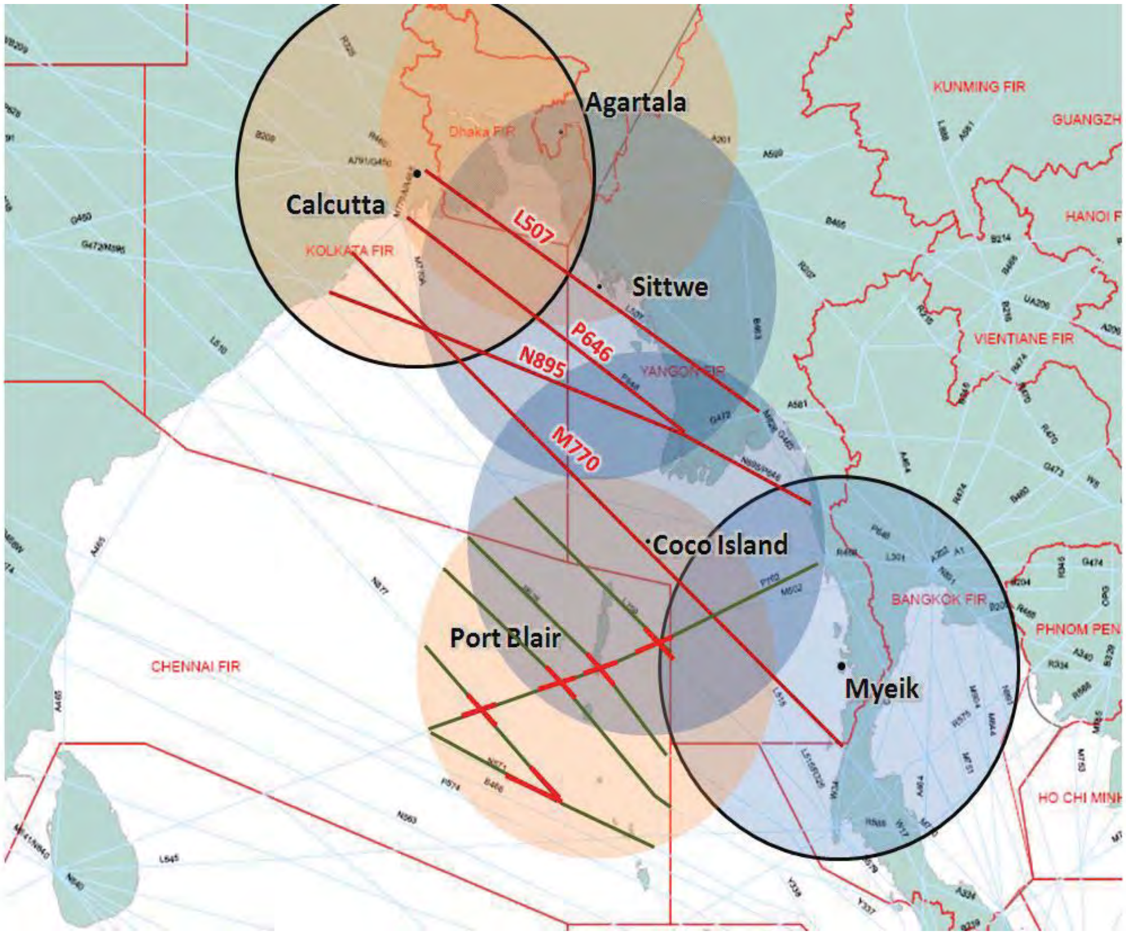
vi) protect all the Aeronautical Radio Navigation Service (ARNS) frequencies; and

vii) ensure civil-military interoperability.

Timeframe on ADS-B Data sharing in the BOB Sub-region

(Between India and Myanmar)

Milestone / Issues	India	Myanmar
Agree in principle to share data from sites	Agreed during SEA/BOB ADS-B WG/7	Agreed during SEA/BOB ADS-B WG/7
Nominated sites	Agartala & Port Blair	Sittwe & Coco Island
Objectives	• Reduce separation through enhanced surveillance / communication coverage • Enhance safety and capacity over crossing routes • Back-up surveillance / communication coverage • Enhancement of surveillance coverage at lower altitude	
Benefits	• End-to-end coverage on M770 and other trunk routes (refer to chart).	
Date to sign data sharing agreement	2 H 2013	2 H 2013
Date to issue NOTAM/AIC for ADS-B mandate	Publish in 2H 2013 Effective from 2H 2015	Publish in 1H 2013 Effective from 2H 2015
Date to sign operational Letter of Agreement	2H 2013	2H 2013
Date to test inter-FIR VSAT link	1H 2014	1H 2014
Date to commission VSAT link	1H 2014	1H 2014
Date to commission ADS-B ground stations	2H 2012	1H 2013
Date to commence testing of ADS-B data from other FIR	1H 2014	1H 2014
Date to complete installation of VHF radio for the other party	1H 2014	1H 2014
Date to commence testing of VHF radio	2H 2014	2H 2014
Date to commence testing of VHF by the other party	2H 2014	2H 2014
Date to commission ADS-B & VHF service	2H 2014	2H 2014


Agartala
Calcutta
Sittwe
Coco Island
Port Blair
Myeik
L507
P646
N895
M770
KOLKATA FIR
Dhaka FIR
YANGON FIR
CHENNAI FIR
BANGKOK FIR
KUNMING FIR
VIENTIANE FIR
HO CHI MINH
PHNOM PEN
HANOI F
GUANGZH

APANPIRG/24

Appendix I to the Report on Agenda Item 3.4

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ADS-B IMPLEMENTATION AND OPERATIONS GUIDANCE DOCUMENT

Edition 6.0

Adopted by APANPIRG/24

June 2013

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TABLE OF CONTENTS

1. INTRODUCTION

The Eleventh ICAO Air Navigation Conference held in 2003 recommended that States recognize ADS-B as an enabler of the global ATM concept bringing substantial safety and capacity benefits; support the cost-effective early implementation of it; and ensuring it is harmonized, compatible and interoperable with operational procedures, data linking and ATM applications.

The Twelve ICAO Air Navigation Conference held in 2012 endorsed the Aviation System Block Upgrades (ASBU) to provide a framework for global harmonization and interoperability of seamless ATM systems. Among the Block Upgrades, the Block 0 module "Initial Capability for Ground Surveillance" recommends States to implement ADS-B which provides an economical alternative to acquire surveillance capabilities especially for areas where it is technically infeasible or commercially unviable to install radars.

This ADS-B Implementation and Operations Guidance Document (AIGD) provides guidance material for the planning, implementation and operational application of ADS-B technology in the Asia and Pacific Regions.

The procedures and requirements for ADS-B operations are detailed in the relevant States' AIP. The AIGD is intended to provide key information on ADS-B performance, integration, principles, procedures and collaboration mechanisms.

The content is based upon the work to date of the APANPIRG ADS-B Study and Implementation Task Force (SITF) and various ANC Panels developing provisions for the operational use of ADS-B. Amendment to the guidance material will be required as new/revised SARPs and PANS are published.

1.1 ARRANGEMENT OF THE AIGD

The AIGD consists of the following Parts:

Section 1	Introduction
Section 2	Acronyms and Glossary of Terms
Section 3	Reference Documents
Section 4	ADS-B Data
Section 5	ADS-B Implementation
Section 6	Template of Harmonization Framework for ADS-B Implementation
Section 7	System Integrity and Monitoring
Section 8	Reliability and Availability Considerations
Section 9	ADS-B Regulations and Procedures
Section 10	Security Issues Associated with ADS-B

1.2 DOCUMENT HISTORY AND MANAGEMENT

This document is managed by the APANPIRG. It was introduced as draft to the first Working Group meeting of the ADS-B SITF in Singapore in October 2004, at which it was agreed to develop the draft to an approved working document that provides implementation guidance for States. The first edition was presented to APANPIRG for adoption in August 2005. It is intended to supplement SARPs, PANS and relevant provisions contained in ICAO documentation and it will be regularly updated to reflect evolving provisions.

1.3 COPIES

Paper copies of this AIGD are not distributed. Controlled and endorsed copies can be found at the following web site: http://www.bangkok.icao.int/edocs/index.html

Copy may be freely downloaded from the web site, or by emailing APANPIRG through the ICAO Asia and Pacific Regional Office who will send a copy by return email.

1.4 CHANGES TO THE AIGD

Whenever a user identifies a need for a change to this document, a Request for Change (RFC) Form (see Section 1.6 below) should be completed and submitted to the ICAO Asia and Pacific Regional Office. The Regional Office will collate RFCs for consideration by the ADS-B Study and Implementation Task Force.

When an amendment has been agreed by a meeting of the ADS-B Study and Implementation Task Force then a new version of the AIGD will be prepared, with the changes marked by an "|" in the margin, and an endnote indicating the relevant RFC, so a reader can see the origin of the change. If the change is in a table cell, the outside edges of the table will be highlighted; e.g.:

Final approval for publication of an amendment to the AIGD will be the responsibility of APANPIRG.

1.5 EDITING CONVENTIONS

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1.6 AIGD REQUEST FOR CHANGE FORM

RFC Nr:	

Please use this form when requesting a change to any part of this AIGD. This form may be photocopied as required, emailed, faxed or e-mailed to ICAO Asia and Pacific Regional Office +66 (2) 537-8199 or icao_apac@bangkok.icao.int

1. SUBJECT:
2. REASON FOR CHANGE:
3. DESCRIPTION OF PROPOSAL: [expand / attach additional pages if necessary]

4. REFERENCE(S):			
5. PERSON INITIATING:		DATE:	
ORGANISATION:			
TEL/FA/X/E-MAIL:			

6. CONSULTATION	RESPONSE DUE BY DATE:		
Organization	Name	Agree/Disagree	Date

7. ACTION REQUIRE :	
8. AIGD EDITOR	DATE REC'D :
9. FEEDBACK PASSED	DATE :

1.7 AMENDMENT RECORD

Amendment Number	Date	Amended by	Comments
0.1	24 December 2004	W. Blythe H. Anderson	Modified draft following contributions from ADS-B SITF Working Group members. Incorporated to TF/3 Working Paper #3.
0.2 (1.0)	24 March 2005	H. Anderson	Final draft prepared at ADS-B SITF WG/3
0.3 (1.1)	03 June 2005	Nick King	Amendments following SASP WG/WHL meeting of May 2005
0.4	15 July 2005	CNS/MET SG/9	Editorial changes made
1.0	26 August 2005	APANPIRG/16	Adopted as the first Edition
2.0	25 August 2006	Proposed by ADS-B SITF/5 and adopted by APANPIRG/17	Adopted as the second Edition
3.0	7 September 2007	Proposed by ADS-B SITF/6 and adopted by APANPIRG/18	Adopted as the second amendment (3rd edition)
4.0	5 September 2011	Proposed by ADS-B SITF/10 and adopted by APANPIRG/22	Adopted amendment on consequential change to the Flight Plan and additional material on the reliability and availability for ADS-B ground system
5.0	14 September 2012	Proposed by ADS-B SITF/11 and adopted by APANPIRG/23	Included sample template on harmonization framework
6.0	26 June 2013	Proposed by ADS-B SITF/12 and adopted by APANPIRG/24	Revamped to include the latest ADS-B developments and references to guidance materials on ADS-B implementation

2. ACRONYM LIST & GLOSSARY OF TERMS

2.1 ACRONYM LIST

ACID	Aircraft Identification
ADS-C	Automatic Dependent Surveillance - Contract
ADS-B	Automatic Dependent Surveillance - Broadcast
AIGD	ADS-B Implementation and Operations Guidance Document
AIP	Aeronautical Information Publication
AIT	ADS-B Implementation Team
AMSL	Above Mean Sea Level
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
ARINC	Aeronautical Radio Incorporate
ATC	Air Traffic Control (or Air Traffic Controller)
ATM	Air Traffic Management
ATS	Air Traffic Services
ATSP	ATS Provider
ATSU	ATS unit
CNS	Communications, Navigation, Surveillance
CRC	Cyclic Redundancy Check
CDTI	Cockpit Display Traffic Information
DAIW	Danger Area Infringement Warning
FIR	Flight Information Region
FLTID	Flight Identification
FMS	Flight Management System
FOM	Figure of Merit used in ASTERIX messaging
GPS	Global Positioning System (USA)
HPL	Horizontal Protection Level
ICAO	International Civil Aviation Organization
MSAW	Minimum Safe Altitude Warning
MTBF	Mean Time Between Failures
MTCA	Medium Term Conflict Alert
MTTR	Mean Time To Restore
NAC	Navigation Accuracy Category
NIC	Navigation Integrity Category
PRS	Problem Reporting System
RAI	Restricted Area Intrusion
RAM	Route Adherence Monitoring
RAIM	Receiver Autonomous Integrity Monitoring
RFC	Request for Change
RNP	Required Navigation Performance
SIL	Surveillance Integrity Level
SITF	Study and Implementation Task Force
STCA	Short Term Conflict Alert

2.2 GLOSSARY OF TERMS

ADS-B In	An ADS-B system feature that enables the display of real time ADS-B tracks on a situation display in the aircraft cockpit.
ADS-B Out	An ADS-B system feature that enables the frequent broadcast of accurate aircraft position and vector data together with other information.
ASTERIX 21	Eurocontrol standard format for data message exchange
FOM (Figure of Merit)	A numeric value that is used to determine the accuracy and integrity of associated position data.
HPL (Horizontal Position Limit)	The containment radius within which the true position of the aircraft will be found for 95% of the time (See DO229c).
NAC (Navigational Accuracy Category)	Subfield used to announce the 95% accuracy limits for the horizontal position data being broadcast.
NIC (Navigational Integrity Category)	Subfield used to specify the containment radius integrity associated with horizontal position data.
NUCp (Navigation Uncertainty Category)	A numeric value that announces the integrity of the associated horizontal position data being broadcast.
SIL (Surveillance Integrity Level)	Subfield used to specify the probability of the true position lying outside the containment radius defined by NIC without being alerted.

3. REFERENCE DOCUMENTS

Id	Name of the document	Reference	Date	Origin	Domain
1	Annex 2: Rules of the Air	Tenth Edition Including Amendment 43 dated 16/7/12	July 2005	ICAO	
2	Annex 4: Aeronautical Chart	Eleventh Edition including Amendment 56 dated 12/7/10	July 2009	ICAO	
3	Annex 10: Aeronautical Telecommunications, Vol. IV – Surveillance Radar and Collision Avoidance Systems	Fourth Edition Including Amendment 87 dated 12/7/10	July 2007	ICAO	
4	Annex 11: Air Traffic Services	Thirteenth Edition including Amendment 48 dated 16/7/12	July 2001	ICAO	
5	Annex 15: Aeronautical Information Services	Thirteen Edition	July 2010	ICAO	
6	PAN-ATM (Doc 4444/ATM501)	Fifteen Edition including Amendment 4 applicable on 15/11/12	2007	ICAO	
7	Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689/AN953)	First Edition including Amendment 1 dated 30/8/02	1998	ICAO	
8	Doc 9859 Safety Management Manual (SMM)	Third Edition	2012	ICAO	
9	ICAO Circular 326 AN/188 "Assessment of ADS-B and Multilateration Surveillance to Support Air Traffic Services and Guidelines for Implementation".	First Edition	2012	ICAO	
10	Regional Supplementary Procedures (Doc 7030)	Fifth Edition including Amendment 5 dated 22/7/11	2008	ICAO	

4. ADS-B DATA

APANPIRG has decided to use 1090MHz Extended Squitter data link for ADS-B data exchange in the Asia and Pacific Regions. In the longer term an additional link type may be required.

To ensure interoperability of ADS-B ground stations in the Asia Pacific (ASIA/PAC) Regions, during the 16th APANPIRG Meeting held in August 2005, the ASTERIX Category 21 version 0.23 (V0.23) which had incorporated DO260 standard was adopted as the baselined ADS-B data format for deployment of ADS-B ground stations and sharing of ADS-B data in the ASIA/PAC Regions. At this time, DO260A and DO260B standards were not defined.

This baselined version provides adequate information so that useful ATC operational services, including aircraft separation, can be provided. V0.23 can be used with DO260, DO260A and DO260B ADS-B avionics/ground stations to provide basic ATC operational services. However, V0.23 cannot fully support the more advanced capabilities offered by DO260A and DO260B.

States intending to implement ADS-B surveillance and share ADS-B data with others might consider to adopt a more updated version of ASTERIX in order to make use of the advanced capabilities offered by DO260A and DO260B compliant avionics.

A guidance material on generation, processing and sharing of ASTERIX Cat. 21 ADS-B messages is provided on the ICAO APAC website “http://www.bangkok.icao.int/edocs/index.html” for reference by States.

In this guidance material, the ADS-B data contained inside ASTERIX Cat 21 are classified as Group 1 (mandatory), Group 2 (Desirable) and Group 3 (Optional). It is required to transmit all data that are operationally desirable (Group 2), when such data are received from the aircraft, in addition to the data that are mandatory (Group 1) in ASTERIX messages. Whether Group 3 optional data will need to be transmitted or not should be configurable on item-by-item basis within the ADS-B ground station depending on specific operational needs.

It is considered necessary that all data that are mandatory in ASTERIX messages (i.e. Group 1 data items) and operationally desirable (i.e. Group 2 data items) when such data are received from aircraft, should be included in data sharing. In the event that the data have to be filtered, the list of optional data items (i.e. Group 3 data items) needs to be shared will be subject to mutual agreement between the two data sharing parties concerned.

5. ADS-B IMPLEMENTATION

5.1 INTRODUCTION

5.1.1 Planning

There are a range of activities needed to progress ADS-B implementation from initial concept level to operational use. This section addresses the issues of collaborative decision making, system compatibility and integration, while the second section of this chapter provides a checklist to assist States with the management of ADS-B implementation activities.

5.1.2 Implementation team to ensure international coordination

5.1.2.1 Any decision to implement ADS-B by a State should include consultation with the wider ATM community. Moreover, where ADS-B procedures or requirements will affect traffic transiting between states, the implementation should also be coordinated between States and Regions, in order to achieve maximum benefits for airspace users and service providers.

5.1.2.2 An effective means of coordinating the various demands of the affected organizations is to establish an implementation team. Team composition may vary by State or Region, but the core group responsible for ADS-B implementation planning should include members with multidiscipline operational expertise from affected aviation disciplines, with access to other specialists where required.

5.1.2.3 Ideally, such a team should comprise representatives from the ATS providers, regulators and airspace users, as well as other stakeholders likely to be influenced by the introduction of ADS-B, such as manufacturers and military authorities. All identified stakeholders should participate as early as possible in this process so that their requirements can be identified prior to the making of schedules or contracts.

5.1.2.4 The role of the implementation team is to consult widely with stakeholders, identify operational needs, resolve conflicting demands and make recommendations to the various stakeholders managing the implementation. To this end, the implementation team should have appropriate access to the decision-makers.

5.1.3 System compatibility

5.1.3.1 ADS-B has potential use in almost all environments and operations and is likely to become a mainstay of the future ATM system. In addition to traditional radar-like services, it is likely that ADS-B will also be used for niche application where radar surveillance is not available or possible. The isolated use of ADS-B has the potential to foster a variety of standards and practices that, once expanded to a wider environment, may prove to be incompatible with neighbouring areas.

5.1.3.2 Given the international nature of aviation, special efforts should be taken to ensure harmonization though compliance with ICAO Standards and Recommended Practices (SARPs). The choice of systems to support ADS-B should consider not only the required performance of individual components, but also their compatibility with other CNS systems.

5.1.3.3 The future concept of ATM encompasses the advantages of interoperable and seamless transition across flight information region (FIR) boundaries and, where necessary, ADS-B implementation teams should conduct simulations, trials and cost/benefit analysis to support these objectives.

5.1.4 Integration

5.1.4.1 ADS-B implementation plans should include the development of both business and safety cases. The adoption of any new CNS system has major implications for service providers, regulators and airspace users and special planning should be considered for the integration of ADS-B into the existing and foreseen CNS/ATM system. The following briefly discusses each element.

5.1.4.2 Communication system

5.1.4.2.1 The communication system is an essential element within CNS. An air traffic controller can now monitor an aircraft position in real time using ADS-B where previously only voice position reports were available. However, a communication system that will support the new services that result from the improved surveillance may be necessary. Consequently, there is an impact of the ongoing ADS-B related work on the communication infrastructure developments.

5.1.4.3 Navigation system infrastructure

5.1.4.3.1 ADS-B is dependent upon the data obtained from a navigation system (typically GNSS), in order to enable its functions and performance. Therefore, the navigation infrastructure should fulfill the corresponding requirements of the ADS-B application, in terms of:

a) Data items; and

b) Performance (e.g. accuracy, integrity, availability etc.).

5.1.4.3.2 This has an obvious impact on the navigation system development, which evolves in parallel with the development of the surveillance system.

5.1.4.4 Other surveillance infrastructure

5.1.4.4.1 ADS-B may be used to supplement existing surveillance systems or as the principal source of surveillance data. Ideally, surveillance systems will incorporate data from ADS-B and other sources to provide a coherent picture that improves both the amount and utility of surveillance data to the user. The choice of the optimal mix of data sources will be defined on the basis of operational demands, available technology, safety and cost-benefit considerations.

5.1.4.4.2 A guidance material on issues to be considered in ATC multi-sensor fusion processing including integration of ADS-B data is provided on the ICAO website http://www.bangkok.icao.int/edocs/index.html" for reference by States.

5.1.4.4.3 A guidance material on processing and displaying of ADS-B data at air traffic controller positions is provided on the ICAO website http://www.bangkok.icao.int/edocs/index.html" for reference by States.

5.1.5 Coverage Predictions

5.1.5.1 Reliable and robust analysis and planning of ADS-B coverage to support seamless ATM initiative requires accurate and reliable coverage modelling. States should ensure that surveillance engineering/technical teams are provided with modelling tools to provide accurate and reliable coverage predictions for ATM planning and analysis.

5.2 IMPLEMENTATION CHECKLIST

5.2.1 Introduction

The purpose of this implementation checklist is to document the range of activities that needs to be completed to bring an ADS-B application from an initial concept to operational use. This checklist may form the basis of the terms of reference for an ADS-B implementation team, although some activities may be specific to individual stakeholders. An example of the checklist used by AirServices Australia is given at Appendix 1.

5.2.2 Activity Sequence

The activities are listed in an approximate sequential order. However, each activity does not have to be completed prior to starting the next activity. In many cases, a parallel and iterative process should be used to feed data and experience from one activity to another. It should be noted that not all activities will be required for all applications.

5.2.3 Concept Phase

a) construct operational concept:

1) purpose;
2) operational environment;
3) ATM functions; and
4) infrastructure;

b) identify benefits:

1) safety enhancements;
2) efficiency;
3) capacity;
4) environmental;
5) cost reductions;
6) access; and
7) other metrics (e.g. predictability, flexibility, usefulness);

c) identify constraints:

1) pair-wise equipage;
2) compatibility with non-equipped aircraft;

3) need for exclusive airspace;
4) required ground infrastructure;
5) RF spectrum;
6) integration with existing technology; and
7) technology availability;

d) prepare business case:

1) cost benefit analysis; and
2) demand and justification.

5.2.4 Design Phase

a) identify operational requirements:

1) security; and
2) systems interoperability;

b) identify human factors issues:

1) human-machine interfaces;
2) training development and validation;
3) workload demands;
4) role of automation vs. role of human;
5) crew coordination/pilot decision-making interactions; and
6) ATM collaborative decision-making;

c) identify technical requirements:

1) standards development;
2) data required;
3) functional processing;
4) functional performance; and
5) required certification levels;

d) equipment development, test, and evaluation:

1) prototype systems built to existing or draft standards/specifications;
2) developmental bench and flight tests; and
3) acceptance test parameters; and
4) select and procure technology;

e) develop procedures:

1) pilot and controller actions and responsibilities;
2) phraseologies;
3) separation/spacing criteria and requirements;
4) controller's responsibility to maintain a monitoring function, if appropriate;
5) contingency procedures;
6) emergency procedures; and
7) develop AIP and Information documentation

f) prepare design phase safety case:

1) safety rationale;
2) safety budget and allocation; and
3) functional hazard assessment.

5.2.5 Implementation phase

a) prepare implementation phase safety case;

b) conduct operational test and evaluation:

1) flight deck and ATC validation simulations; and
2) flight tests and operational trials;

c) obtain systems certification:

1) aircraft equipment; and
2) ground systems;

d) obtain regulatory approvals:

1) flight operations; and
2) air traffic certification of use;

e) implementation transition:

1) Promulgate procedures and deliver training
2) continue data collection and analysis;
3) resolve any unforeseen issues; and
4) continue feedback into standards development processes;

f) performance monitoring to ensure that the agreed performance is maintained.

5.2.5.1 Once the implementation project is complete, ongoing maintenance and upgrading of both ADS-B operations and infrastructure should continue to be monitored, through the appropriate forums.

6. HARMONIZATION FRAMEWORK FOR ADS-B IMPLEMENTATION

6.1 BACKGROUND

6.1.1 It is obvious that full benefits of ADS-B will only be achieved by its harmonized implementation and seamless operations. During the 6th meeting of ADS-B SEA/WG in February 2011, Hong Kong, China initiated to strengthen collaboration among concerned States/Administrations for harmonized ADS-B implementation and seamless operations along two ATS routes L642 and M771 with major traffic flow (MTF). An ad-hoc workgroup comprising concerned CAAs/ANSPs from Hong Kong, China, Mainland China, Vietnam and Singapore was subsequently formed to elaborate and agree on a framework regarding implementation timelines, avionics standards, optimal flight levels, and ATC and engineering handling procedures. As a coherent effort, ADS-B implementation along ATS routes L642 and M771 has been harmonized while Hong Kong, China and Singapore have published respective Aeronautical Information Circulars and Airworthiness Notices on ADS-B mandates for these two routes with effect on 12 December 2013.

6.1.2 It is considered that the above implementation framework for ATS routes L642/M771 would serve as a useful template for extension to other high density routes to harmonize ADS-B implementation. Paragraph 6.2 shows the detailed framework.

6.2 TEMPLATE OF HARMONIZATION FRAMEWORK FOR ADS-B IMPLEMENTATION

Harmonization Framework for ADS-B Implementation along ATS Routes L642 and M771

No.	What to harmonize	What was agreed	Issue / what needs to be further discussed
1	Mandate Effective	Singapore (SG), Hong Kong (HK), China (Sanya) : 12 Dec 2013 Vietnam (VN) : to be confirmed	
2	ATC Operating Procedures	No need to harmonize	Refer to SEACG for consideration of the impact of expanding ADS-B surveillance on ATC Operating Procedures including Large Scale Weather procedures.
3	Mandate Publish Date	No need to harmonize	To publish equipment requirements as early as possible.
4	Date of Operational Approval	No need to harmonize	
5	Flight Level	SG, HK, CN : - At or Above FL290 (ADS-B airspace) - Below FL290 (Non-ADS-B airspace) VN to be confirmed	
6	Avionics Standard (CASA/AMC2024)	SG - CASA or AMC2024 or FAA AC No. 20-165 HK - CASA or AMC2024 or FAA AC No. 20-165 VN - CASA or AMC2024 or FAA AC No. 20-165 CN - CASA or AMC2024 or FAA AC No. 20-165	ADS-B Task Force agreed that DO260B will be accepted as well. SG, HK, and CN agreed their ADS-B GS will accept DO260, DO260A and DO260B by 1 July 2014 (Note 1)

7	Flight Planning	Before 15 Nov 2012, as per AIDG On or after 15 Nov 2012, as per new flight plan format	
8	Aircraft Approval		
8a)	Procedures if Aircraft Not Approved or Aircraft without a Serviceable ADS-B Transmitting Equipment before Flight	SG, HK, CN : FL280 and Below VN to be confirmed	
8b)	Aircraft Approved but Transmitting Bad Data (Blacklisted Aircraft)	For known aircraft, treat as non-ADS-B aircraft.	Share blacklisted aircraft among concerned States/Administration
9	Contingency Plan		
9a)	Systemic Failure such as Ground System / GPS Failure	Revert back to current procedure.	
9b)	Avionics Failure or Approved Aircraft Transmitting Bad Data in Flight	Provide other form of separation, subject to bilateral agreement. From radar/ADS-B environment to ADS-B only environment, ATC coordination may be able to provide early notification of ADS-B failure.	Address the procedure for aircraft transiting from radar to ADS-B airspace and from ADS-B to ADS-B airspace.
10	Commonly Agreed Route Spacing	SEACG	Need for commonly agreed minimal in-trail spacing throughout.

Note 1: Also included two ADS-B GS supplied by Indonesia at Matak and Natuna

7. SYSTEM INTEGRITY AND MONITORING

7.1 INTRODUCTION

The Communications, Navigation, Surveillance and Air Traffic Management (CNS/ATM) environment is an integrated system including physical systems (hardware, software, and communication networks), human elements (pilots, controllers and engineers), and the operational procedures for its applications. ADS-B is a surveillance system that may be integrated with other surveillance technologies or may also operate as an independent source for surveillance monitoring within the CNS/ATM system.

Because of the integrated nature of such system and the degree of interaction among its components, comprehensive system monitoring is recommended. The procedures described in this section aim to ensure system integrity by validation, identification, reporting and tracking of possible problems revealed during system monitoring with appropriate follow-up actions.

These procedures do not replace the ATS incident reporting procedures and requirements, as specified in PANS-ATM (Doc 4444), Appendix 4; ICAO's Air Traffic Services Planning Manual (Doc 9426), Chapter 3; or applicable State regulations, affecting the reporting responsibilities of parties directly involved in a potential ATS incident.

7.2 PERSONNEL LICENSING AND TRAINING

Prior to operating any element of the ADS-B system, operational and technical personnel shall undertake appropriate training as determined by the States, including compliance with the Convention on International Civil Aviation where applicable.

Notwithstanding the above requirement and for the purposes of undertaking limited trials of the ADS-B system, special arrangements may be agreed between the operator and an Air Traffic Services Unit (ATSU).

7.3 SYSTEM PERFORMANCE CRITERIA FOR AN ATC SEPARATION SERVICE

A number of States have started to introduce ADS-B for the provision of Air Traffic Services, including 'radar-like' separation. The ICAO Separation and Airspace Safety Panel (SASP) has completed assessment on the suitability of ADS-B for various applications including provision of aircraft separation based on comparison of technical characteristics between ADS-B and monopulse secondary surveillance radar. It is concluded that that ADS-B surveillance is better or at least no worse than the referenced radar, and can be used to provide separation minima as described in PANS-ATM (Doc 4444) whether ADS-B is used as a sole means of ATC surveillance or used together with radar, subject to certain conditions to be met. The assessment result is detailed in the ICAO Circular 326 AN/188 "Assessment of ADS-B and Multilateration Surveillance to Support Air Traffic Services and Guidelines for Implementation".

States intending to introduce ADS-B separation minima shall comply with provisions of PANS-ATM, Regional Supplementary Procedures (Doc 7030) and Annex 11 paragraph 3.4.1. States should adopt the guidelines contained in this document unless conformance with PANS-ATM specifications requires change.

7.4 ATC SYSTEM VALIDATION

7.4.1 Safety Assessment Guidelines

To meet system integrity requirements, States should conduct a validation process that confirms the integrity of their equipment and procedures. Such processes shall include:

a) A system safety assessment for new implementations is the basis for definitions of system performance requirements. Where existing systems are being modified to utilize additional services, the assessment demonstrates that the ATS Provider's system will meet safety objectives;

b) Integration test results confirming interoperability for operational use of airborne and ground systems; and

c) Confirmation that the ATS Operation Manuals are compatible with those of adjacent providers where the system is used across a common boundary.

7.4.2 System safety assessment

The objective of the system safety assessment is to ensure the State that introduction and operation of ADS-B is safe. This can be achieved through application of the provisions of Annex 11 paragraph 2.27 and PANS-ATM Chapter 2. The safety assessment should be conducted for initial implementation as well as any future enhancements and should include:

a) Identifying failure conditions;

b) Assigning levels of criticality;

c) Determining risks/ probabilities for occurrence;

d) Identifying mitigating measures and fallback arrangements;

e) Categorising the degree of acceptability of risks; and

f) Operational hazard ID process.

Following the safety assessment, States should institute measures to offset any identified failure conditions that are not already categorized as acceptable. This should be done to reduce the probability of their occurrence to a level as low as reasonably practicable. This could be accomplished through system automation or manual procedures.

Guidance material on building a safety case for delivery of an ADS-B separation service is provided on the ICAO APAC website "http://www.bangkok.icao.int/edocs/index.html" for reference by States.

7.4.3 Integration test

States should conduct trials with suitably equipped aircraft to ensure they meet the operational and technical requirements to provide an ATS. Alternatively, they may be satisfied by test results and analysis conducted by another State or organization deemed competent to provide such service. Where this process is followed, the tests conducted by another State or organization should be comparable (i.e. using similar equipment under similar conditions).

Refer also to the *Manual on Airspace Planning Methodology for the Determination of Separation Minima* (Doc9689).

7.4.4 ATS Operation Manuals

States should coordinate with adjacent States to confirm that their ATS Operation Manuals contain standard operating procedures to ensure harmonization of procedures that impact across common boundaries.

7.4.5 ATS System Integrity

With automated ATM systems, data changes, software upgrades, and system failures can affect adjacent units. States shall ensure that:

a) A conservative approach is taken to manage any changes to the system;

b) Aircrew, aircraft operating companies and adjacent ATSU(s) are notified of any planned system changes in advance, where that system is used across a common boundary;

c) ATSUs have verification procedures in place to ensure that following any system changes, displayed data is both correct and accurate;

d) In cases of system failures or where upgrades (or downgrades) or other changes may impact surrounding ATS units, ATSUs should have a procedure in place for timely notification to adjacent units. Such notification procedures will normally be detailed in Letters of Agreement between adjacent units; and

e) ADS-B surveillance data is provided with equal to or better level of protection and security than existing surveillance radar data.

7.5 SYSTEM MONITORING

During the initial period of implementation of ADS-B technology, routine collection of data is necessary in order to ensure that the system continues to meet or exceed its performance, safety and interoperability requirements, and that operational service delivery and procedures are working as intended. The monitoring program is a two-fold process. Firstly, summarised statistical data should be produced periodically showing the performance of the system. This is accomplished through ADS-B Periodic Status Reports. Secondly, as problems or abnormalities arise, they should be identified, tracked, analyzed and corrected and information disseminated as required, utilizing the ADS-B Problem Report.

7.5.1 Problem Reporting System (PRS)

The Problem Reporting System is tasked with the collection, storage and regular dissemination of data based on reports received from ADS-B SITF members. The PRS tracks problem reports and publish information from those reports to ADS-B SITF members. Problem resolution is the responsibility of the appropriate ADS-B SITF members.

The PRS Administrator shall:

a) prepare consolidated problem report summaries for each ADS-B SITF meeting;

b) collect and consolidate ADS-B Problem Reports; and

c) maintain a functional website (with controlled access) to manage the problem reporting function.

7.5.2 The monitoring process

When problems or abnormalities are discovered, the initial analysis should be performed by the organization(s) identifying the problem. In addition, a copy of the problem report should be entered in to the PRS which will assign a tracking number. As some problems or abnormalities may involve more than one organization, the originator should be responsible for follow-up action to rectify the problem and forward the information to the PRS. It is essential that all information relating to the problem is documented and recorded and resolved in a timely manner.

The following groups should be involved in the monitoring process and problem tracking to ensure a comprehensive review and analysis of the collected data:

a) ATS Providers;

b) Organizations responsible for ATS system maintenance (where different from the ATS provider);

c) Relevant State regulatory authorities;

d) Communication Service Providers being used;

e) Aircraft operators; and

f) Aircraft and avionics manufacturers.

7.5.3 Distribution of confidential information

It is important that information that may have an operational impact on other parties be distributed by the authorised investigator to all authorised groups that are likely to be affected, as soon as possible. In this way, each party is made aware of problems already encountered by others, and may be able to contribute further information to aid in the solution of these problems. The default position is that all states agree to provide the data which will be de-identified for reporting and record keeping purposes.

7.5.4 ADS-B problem reports

Problem reports may originate from many sources, but most will fall within two categories; reports based on observation of one or more specific events, or reports generated from the routine analysis of data. The user would document the problem, resolve it with the appropriate party and forward a copy of the report to the PRS for tracking and distribution. While one occurrence may appear to be an isolated case, the receipt of numerous similar reports by the PRS could indicate that an area needs more detailed analysis.

To effectively resolve problems and track progress, the problem reports should be sent to the nominated point of contact at the appropriate organization and the PRS. The resolution of the identified problems may require:

a) Re-training of system operators, or revision of training procedures to ensure compliance with existing procedures;

b) Change to operating procedures;

c) Change to system requirements, including performance and interoperability; or

d) Change to system design.

7.5.5 ADS-B periodic status report

The ATS Providers should complete the ADS-B Periodic Status Report annually and deliver the report to the regional meeting of the ADS-B SITF. The Periodic Status Report should give an indication of system performance and identify any trend in system deficiencies, the resultant operational implications, and the proposed resolution, if applicable.

Communications Service Providers, if used, are also expected to submit Periodic Status Reports on the performance of the networks carrying ADS-B data at the annual regional meeting of the ADS-B SITF. These reports could also contain the details of planned or current upgrades to the network.

7.5.6 Processing of Reports

Each group in the monitoring process should nominate a single point of contact for receipt of problem reports and coordination with the other parties. This list will be distributed by the PRS Administrator to all parties to the monitoring process.
Each State should establish mechanisms within its ATS Provider and regulatory authority to:

a) Assess problem reports and refer them to the appropriate technical or operational expertise for investigation and resolution;

b) Coordinate with aircraft operators;

c) Develop interim operational procedures to mitigate the effects of problems until such time as the problem is resolved;

d) Monitor the progress of problem resolution;
e) Prepare a report on problems encountered and their operational implications and forward these to the PRS;

f) Prepare the ADS-B periodic status report at pre-determined times and forward these to the Secretary of the annual meeting of the ADS-B SITF; and

g) Coordinate with any Communication Service Providers used.

7.6 APANPIRG

APANPIRG, with the assistance of its contributory bodies, shall oversee the monitoring process to ensure the ADS-B system continues to meet its performance and safety requirements, and that operational procedures are working as intended. The APANPIRG'S objectives are to:

a) review Periodic Status Reports and any significant Problem Reports;

b) highlight successful problem resolutions to ADS-B SITF members;

c) monitor the progress of outstanding problem resolutions;

d) prepare summaries of problems encountered and their operational implications; and

e) assess system performance based on information in the PRS and Periodic Status Reports.

7.7 LOCAL DATA RECORDING AND ANALYSIS

7.7.1 Data recording

It is recommended that ATS Providers and Communication Service Providers retain the records defined below for at least 30 days to allow for accident/incident investigation processes. These records should be made available on request to the relevant State safety authority. Where data is sought from an adjacent State, the usual State to State channels should be used.

These recordings shall be in a form that permits a replay of the situation and identification of the messages that were received by the ATS system.

7.7.2 Local data collection

ATS providers and communications service providers should identify and record ADS-B system component failures that have the potential to negatively impact the safety of controlled flights or compromise service continuity.

7.7.3 Avionics problem identification and correction

ATS providers need to develop systems to :

a) detect ADS-B avionics anomalies and faults

b) advise the regulators and where appropriate the aircraft operators on the detected ADS-B avionics anomalies and faults

c) devise mechanisms and procedures to address identified faults

Regulators need to develop and maintain systems to ensure that appropriate corrective actions are taken to address identified faults.

7.8 ADS-B PROBLEM REPORT

7.8.1 Report Form			**PRS #**
Date UTC		**Time UTC**	
Registration		**Aircraft ID**	
Flight ID		**ICAO 24 Bit Code**	
Aircraft Type			
Flight Sector/ Location			
ATS Unit			
Description / additional information			
Originator		**Originator Reference number**	
Organization			

7.8.2 Description of Fields

Field	Meaning
Number	A unique identification number assigned by the PRS Administrator to this problem report. Organizations writing problem reports are encouraged to maintain their own internal list of these problems for tracking purposes. Once the problems have been reported to the PRS and incorporated in the database, a number will be assigned by the PRS and used for tracking by the ADS-B SITF.
Date UTC	UTC date when the event occurred.
Time UTC	UTC time (or range of times) at which the event occurred.
Registration	Registration number (tail number) of the aircraft involved.
Aircraft ID (ACID)	Coded equivalent of voice call sign as entered in FPL Field 7.
ICAO 24 Bit Code	Unique aircraft address expressed in Hexadecimal form (e.g. 7432DB)
Flight ID (FLTID)	The identification transmitted by ADS-B for display on a controller situation display or a CDTI.
Flight Sector/Location	The departure airport and destination airport for the sector being flown by the aircraft involved in the event. These should be the ICAO identifiers of those airports. Or if more descriptive, the location of the aircraft during the event.
Originator	Point of contact at the originating organization for this report (usually the author).
Aircraft Type	The aircraft model involved.
Organization	The name of the organization (airline, ATS provider or communications service provider) that created the report.
ATS Unit	ICAO identifier of the ATC Center or Tower controlling the aircraft at the time of the event.
Description	This should provide as complete a description of the situation leading up to the problem as is possible. Where the organization reporting the problem is not able to provide all the information (e.g. the controller may not know everything that happens on the aircraft), it would be helpful if they would coordinate with the other parties to obtain the necessary information. The description should include: • A complete description of the problem that is being reported • The route contained in the FMS and flight plan • Any flight deck indications • Any indications provided to the controller when the problem occurred • Any additional information that the originator of the problem report considers might be helpful but is not included on the list above If necessary to contain all the information, additional pages may be added. if the originator considers it might be helpful, diagrams and other additional information (such as printouts of message logs) may be appended to the report.

7.9 ADS-B PERFORMANCE REPORT FORM			
Originating Organization			
Date of submission		Originator	
Report Period			
TECHNICAL ISSUES			
OPERATIONAL ISSUES			
GENERAL COMMENTS			

8. RELIABILITY & AVAILABILITY CONSIDERATIONS

Reliability and Availability of ADS-B systems should normally be equivalent or better than the reliability and availability of radar systems.

Guidance material on Reliability and Availability standards for ADS-B systems and supporting voice communications systems are included in the document "Baseline ADS-B Service Performance Parameters" which is available on the ICAO APAC website at:
http://www.icao.int/APAC/Pages/edocs.aspx

The "Baseline ADS-B Performance Parameters" document contains three Tiers of service performance parameters with different reliability and availability standards for each Tier. The appropriate Tier should be selected for the type of ADS-B service intended:

(a) Tier 1 standards are for a high performance traffic separation service;

(b) Tier 2 standards are for a traffic situational awareness service with procedural separation; and

(c) Tier 3 standards are for a traffic advisory service (flight information service)

To achieve high operational availability of ADS-B systems to support aircraft separation services, it is necessary to operate with duplicated/redundant systems. If one system fails, the service continues using an unduplicated system. This is acceptable for a short period, whilst the faulty system is being repaired, because the probability of a second failure during the short time window of repairing is low.

However, it is necessary to ensure that the repair does not take too long. A long repair time increases the risk of an unexpected failure (loss of service continuity); which in turn, introduces potential loss of service (low availability) and loss of aircraft operational efficiency and/or safety impacts.

8.1 Reliability

8.1.1 Reliability is a measure of how often a system fails and is usually measured as Mean Time Between Failure (MTBF) expressed in hours. Continuity is a measure equivalent to reliability, but expressed as the probability of system failure over a defined period. In the context of this document, failure means inability to deliver ADS-B data to the ATC centre. Ie: Failure of the ADS-B system rather than an equipment or component failure.

8.1.2 Poor system MTBF has a safety impact because typically it causes unexpected transition from one operating mode to another. For example, aircraft within surveillance coverage that are safely separated by a surveillance standard distance (say, 5 NM) are unexpectedly no longer separated by a procedural standard distance (say 15 mins), due to an unplanned surveillance outage.

8.1.3 In general, reliability is determined by design (see para 8.3 B below)

8.2 Availability

8.2.1 Availability is a measure of how often the system is available for operational use. It is usually expressed as a percentage of the time that the system is available.

8.2.2 Poor availability usually results in loss of economic benefit because efficiencies are not available when the ATC system is operating in a degraded mode (eg using procedural control instead of say 5 NM separation).

8.2.3 Planned outages are often included as outages because the efficiencies provided to the Industry are lost, no matter what the cause of the outage. However, some organisations do not include planned outages because it is assumed that planned outages only occur when the facility is not required.

8.2.4 Availability is calculated as

Availability (Ao) = MTBF/(MTBF+MDT)

where MTBF= Mean Time Between SYSTEM Failure
MDT = Mean Down Time for the SYSTEM

The MDT includes Mean Time To Repair (MTTR), Turn Around Time (TAT) for spares, and Mean Logistic Delay Time (MLDT)
NB: This relates to the failure of the system to provide a service, rather than the time between individual equipment failures. Some organisations use Mean Time Between Outage (MTBO) rather than MTBF.

8.2.5 Availability is directly a function of how quickly the SYSTEM can be repaired. Ie: directly a function of MDT. Thus availability is highly dependent on the ability & speed of the support organisation to get the system back on-line.

8.3 Recommendations for high reliability/availability ADS-B systems

A : System design can keep system failure rate low with long MTBF. Typical techniques are :

- to duplicate each element and minimise single points of failure. Automatic changeover or parallel operation of both channels keeps system failure rates low. Ie: the system keeps operating despite individual failures. Examples are :
  - Separate communication channels between ADS-B ground station and ATC centre preferably using different technologies or service providers eg one terrestrial and one satellite
- Consideration of Human factors in design can reduce the number of system failures due to human error. E.g. inadvertent switch off, incorrect software load, incorrect maintenance operation.
- Take great care with earthing, cable runs and lightning protection to minimise the risks of system damage
- Take great care to protect against water ingress to cables and systems
- Establish a system baseline that documents the achieved performance of the site that can be later be used as a reference. This can shorten troubleshooting in future.
- System design can also improve the MDT by quickly identifying problems and alerting maintenance staff. Eg Built in equipment test (BITE) can significantly contribute to lowering MDT.

B: Logistics strategy aims to keep MDT very low. Low MDT depends on logistic support providing short repair times. To achieve short repair times, ANSPs usually provide a range of logistics, including the following, to ensure that the outage is less than a few days :

- ensure the procured system is designed to allow for quick replacement of faulty modules to restore operations

- provide remote monitoring to allow maintainers to identify the faulty modules for transport to site
- provide support tools to allow technicians to repair faulty modules or to configure/setup replacement modules
- provide technicians training to identify & repair the faulty modules
- provide local maintenance depots to reduce the time it takes to access to the site
- provide documentation and procedures to "standardise" the process
- use an in-country spares pool to ensure that replacement modules are available within reasonable times
- use a maintenance contract to repair faulty modules within a specified turnaround time. I.e.: to replenish the spares pool quickly.

Whilst technical training and remote monitoring are usually considered by ANSPs, sometimes there is less focus on spares support.

Difficulties can be experienced if States :

a) Fail to establish a spares pool – because procurement of spares at the time of failure can bring extensive delays due to :
b) obtaining funds
c) obtaining approval to purchase overseas
d) obtaining approval to purchase from a "sole source"
e) difficulties and delays in obtaining a quotation
f) delays in delivery because the purchase was unexpected by the supplier
g) Fail to establish a module repair contract resulting in :
    - long repair times
    - unplanned expenditure
    - inability for a supplier to repair modules because the supplier did not have adequate certainty of funding of the work

Spares pool

ANSPs can establish, preferably as part of their acquisition purchase, adequate spares buffer stock to support the required repair times. The prime objective is to reduce the time period that the system operates un-duplicated. It allows decoupling of the restoration time from the module repair time.

Module repair contract

ANSPs can also enter into a maintenance repair contract, preferably as part of their acquisition purchase, to require the supplier to repair or replace and deliver failed modules within a specified time – preferably with contractual incentives/penalties for compliance. Such support contracts are best negotiated as part of the acquisition contract when competition between vendors is at play to keep costs down. Sometimes it is appropriate to demand that the support contractor also keep a certain level of buffer stock of spares "in country".

It is strongly recommended that maintenance support is purchased under the same contract as the acquisition contract.

The advantages of a module repair contract are :

- The price can be determined whilst in the competitive phase of acquisition – hence avoids excessive costs
- The contract can include the supplier bearing all shipping costs

- Can be funded by a define amount per year, which support the budget processes. If the costs are fixed, the supplier is encouraged to develop a reliable system minimising module repairs.
- It avoids delays and funding issues at the time of the module failure

Other typical strategies are:

- Establish availability and reliability objectives that are agreed organization wide. In particular agree System response times (SRT) for faults and system failure to ensure that MDT is achieved. An agreed SRT can help organizations to decide on the required logistics strategy including number, location and skills of staff to support the system.

- Establish baseline preventative maintenance regimes including procedures and performance inspections in conjunction with manufacturer recommendations for all subsystems

- Use remote control & monitoring systems to identify faulty modules before travel to site. This can avoid multiple trips to site and reduce the repair time

- Have handbooks, procedures, tools available at the site or a nearby depot so that travel time does not adversely affect down time

- Have adequate spares and test equipment ready at a maintenance depot near the site or at the site itself. Vendors can be required to perform analysis of the number of spares required to achieve low probability of spare "stock out"

- Have appropriate plans to cope with system and component obsolescence. It is possible to contractually require suppliers to regularly report on the ability to support the system and supply components.

- Have ongoing training programs and competency testing to ensure that staff are able to perform the required role

The detailed set of operational and technical arrangements in place and actions required to maintain a system through the lifecycle are often documented in a Integrated Logistics Support Plan.

C: Configuration Management aims to ensure that the configuration of the ground stations is maintained with integrity. Erroneous configuration can cause unnecessary outages. Normally configuration management is achieved by :

- Having clear organizational & individual responsibilities and accountabilities for system configuration.

- Having clear procedures in place which define who has authority to change configuration and records of the changes made including, inter alia

    - The nature of the change including the reason
    - Impact of the change & safety assessment
    - An appropriate transition or cutover plan
    - Who approved the change
    - When the change was authorized and when the change was implemented

- Having appropriate test and analysis capabilities to confirm that new configurations are acceptable before operational deployment.

- Having appropriate methods to deploy the approved configuration (Logistics of configuration distribution). Suggested methods;

    - Approved configuration published on intranet web pages
    - Approved configuration distributed on approved media

D: Training & Competency plans aim to ensure that staff has the skills to safety repairs Normally this is achieved by:

- Conduct of appropriate Training Needs Analysis (TNA) to identify the gap between trainee skill/knowledge and the required skill/knowledge.

- Development and delivery of appropriate training to maintainers

- Competency based testing of trainees

- Ongoing refresher training to ensure that skills are maintained even when fault rates are low

E: Data collection & Review :

Regular and scheduled review should be undertaken to determine whether reliability/availability objectives are being met. These reviews need to consider :

- Reports of actual achieved availability & reliability

- Data regarding system failures including "down time" needs to be captured and analysed so the ANSP actually knows what is being (or not being) achieved.

- Any failure trends that need to be assessed. This requires data capture of the root cause of failures

- Any environmental impacts on system performance, such coverage obstructions such as trees, planned building developments, corrosion, RFI etc. Changes in infrastructure may also be relevant including air conditioning (temperature/humidity etc) and power system changes.

- System problem reports especially those that relate to software deficiencies (design)

- System and component obsolescence

- Staff skills and need for refresher training

9. ADS-B REGULATIONS AND PROCEDURES

9.1 INTRODUCTION

ADS-B involves the transmission of specific data messages from aircraft and vehicle systems. These data messages are broadcast at approximately 0.5 second intervals and received at compatible ground stations that relay these messages to ATSU(s) for presentation on ATS situation displays. The following procedures relate to the use of ADS-B data in ATS ground surveillance applications.

The implementation of the ADS-B system will support the provision of high performance surveillance, enhancing flight safety, facilitating the reduction of separation minima and supporting user demands such as user-preferred trajectories.

9.2 ADS-B REGULATIONS

As agreed at APANPRIG 22/8, States intending to implement ADS-B based surveillance services may designate portions of airspace within their area of responsibility by:

(a) mandating the carriage and use of ADS-B equipment; or

(b) providing priority for access to such airspace for aircraft with operative ADS-B equipment over those aircraft not operating ADS-B equipment.

In publishing ADS-B mandate/regulations, States should consider to :

- define the ADS-B standards applicable to the State. For interoperability and harmonization, such regulations need to define both the standards applicable for the aircraft ADS-B position source and the ADS-B transmitter.

- define the airspace affected by the regulations and the category of aircraft that the regulation applies to.

- define the timing of the regulations allowing sufficient time for operators to equip. Experience in Asia Pacific Regions is that major international carriers are having high equipage rates of ADS-B avionics. However the equipage rates of ADS-B avionics for some regional fleets, business jets and general aviation are currently low and more time will be required to achieve high equipage rates.

- establish the technical and operational standards for the ground stations and air traffic management procedures used for ADS-B separation services, including the associated voice communications services.

States may refer to the APANPIRG Conclusion 22/36 on the template for ADS-B mandate/regulations on provision of ADS-B based ground surveillance. Some States listed below have published their ADS-B mandate/regulations on their web sites that could be used for reference.

(a) Civil Aviation Safety Authority (CASA) of Australia
Civil Aviation Order 20.18 Amendment Order (No. 1) 2009, Civil Aviation Order 82.1 Amendment Order (No. 1) 2009, Civil Aviation Order 82.3 Amendment Order (No. 2) 2009, Civil Aviation Order 82.5 Amendment Order (No. 2) 2009 and Miscellaneous Instrument CASA 41/09 – Direction – use of ADS-B in foreign aircraft engaged in private operations in Australian territory
"http://www.comlaw.gov.au/Details/F2012C00103/Download"

(b) Civil Aviation Department (CAD) of Hong Kong, China
Aeronautical Information Circular (AIC) No. 09/11 dated 24 May 2011
"http://www.hkatc.gov.hk/HK_AIP/aic/AIC09-11.pdf"

(c) Civil Aviation Authority of Singapore (CAAS)
Aeronautical Information Circular (AIC) No. 14/10 dated 28 December 2010
"http://www.caas.gov.sg/caasWeb2010/export/sites/caas/en/Regulations/Aeronautical_Information/AIC/AIC_PDFs/AIC_14_2010.pdf"

(d) Federal Aviation Administration (FAA)
ADS–B Out Performance Requirements To Support Air Traffic Control (ATC) Service, Final Rule
"http://www.gpo.gov/fdsys/pkg/FR-2010-05-28/pdf/2010-12645.pdf"

9.3 FACTORS TO BE CONSIDERED WHEN USING ADS-B

9.3.1 Use of ADS-B Level data

The accuracy and integrity of pressure altitude derived level information provided by ADS-B are equivalent to Mode C level data provided through an SSR sensor and subject to the same operational procedures as those used in an SSR environment. Where the ATM system converts ADS-B level data to display metric equivalent level data, the displayed data should not be used to determine vertical separation until the data is verified by comparison with a pilot reported metric level.

9.3.2 Position Reporting Performance

The ADS-B data from the aircraft will include a NUC/NIC/SIL categorization of the accuracy and integrity of the horizontal position data. This figure is determined from NIC/ NAC/ SIL values for DO260A/B compliant avionics and NUC values for DO260/ED102 compliant avionics.

In general, for 5NM separation, if the HPL value used to generate ADS-B quality indicators (NUC or NIC) is greater than 2 nautical miles the data is unlikely to be of comparable quality to that provided by a single monopulse SSR. ADS-B data should not be used for separation unless a suitable means of determining data integrity is used.

The key minimum performance requirements for an ADS-B system to enable the use of a 3 NM or 5 NM separation minimum in the provision of air traffic control is provided in the ICAO Circular 326 (especially Appendix C).

ADS-B reports with low integrity may be presented on situation displays, provided the controller is alerted (e.g. by a change in symbology and/or visual alert) to the change and the implications for the provision of separation. An ANS Provider may elect not to display ADS-B tracks that fail to meet a given position reporting performance criterion.

9.3.3 GNSS Integrity Prediction Service

Early implementations of ADS-B are expected to use GNSS for position determination. As such, availability of GNSS data has a direct influence on the provision of a surveillance service.

ATS Providers may elect to use a GNSS integrity prediction service to assist in determining the future availability of useable ADS-B data. The integrity prediction service alerts users to potential future loss or degradation of the ADS-B service in defined areas. When these alerts are displayed, the system is indicating to its users that at some time in the future the ADS-B positional data may be inadequate to support the application of ADS-B separation. It is recommended that the prediction service is made available to each ATSU that is employing ADS-B to provide a separation service, to ensure that air traffic controllers are alerted in advance of any predicted degradation of the GNSS service and the associated reduction in their ability to provide ADS-B separation to flights that are within the affected area. This is similar to having advance warning of a planned radar outage for maintenance.

ADS-B should not be used to provide separation between aircraft that will be affected by an expected period of inadequate position reporting integrity.

If an unpredicted loss of integrity occurs (including a RAIM warning report from aircrew) then;

(a) ADS-B separation should not be applied by ATC to the particular aircraft reporting until the integrity has been assured; and

(b) The controller should check with other aircraft in the vicinity of the aircraft reporting the RAIM warning, to determine if they have also been affected and establish alternative forms of separation if necessary.

9.3.4 Sharing of ADS-B Data

ADS-B Data-sharing for ATC Operations

Member States should consider the benefits of sharing ADS-B data received from aircraft operating in the proximity of their international airspace boundaries with adjacent States that have compatible technology in an effort to maximize the service benefits and promote operational safety.

Data sharing may involve the use of the data to provide separation services if all the requirements for delivery of separation services are satisfied, In some cases, States may choose to use a lower standard that supports surveillance safety nets and situational awareness whilst operations are conducted using procedural separation standards.

Any agreement on the sharing of surveillance data should be incorporated in Letters of Agreement between the States concerned. Such agreements may also include the sharing of VHF communication facilities.

A template for ADS-B data-sharing agreement is provided on the ICAO APAC website "http://www.bangkok.icao.int/edocs/index.html" for reference by States.

ADS-B Data-sharing for Safety Monitoring

With endorsement of the methodology by both the ICAO Separation and Airspace Safety Panel (SASP) and the Regional Monitoring Agencies Coordination Group (RMACG), ADS-B data can be used for calculating the altimetry system error (ASE) which is a measure of the height-keeping performance of an aircraft. It is an ICAO requirement that aircraft operating in RVSM airspace must undergo periodic monitoring on height-keeping performance. The existing methods to estimate aircraft ASE include use of a portable device, the Enhanced GPS Monitoring Unit, and ground-based systems called Height Monitoring Unit/Aircraft Geometric Height Measurement Element. The use of ADS-B data for height-keeping performance monitoring, on top of providing enhanced and alternative means of surveillance, will provide a cost-effective option for aircraft operators. States are encouraged to share ADS-B data to support the height-keeping performance monitoring of airframe.

Civil/Military ADS-B Data-sharing

Civil/military data sharing arrangements, including aircraft surveillance, were a key part of civil/military cooperation in terms of tactical operational responses and increasing trust between civil and military units.

Aircraft operating ADS-B technology transmit their position, altitude and identity to all listeners, conveying information from co-operative aircraft that have chosen to equip and publicly broadcast ADS-B messages. Thus there should be no defence or national security issues with the use and sharing of such data.

Some military transponders may support ADS-B using encrypted DF19 messages, but these data are normally not decoded or used at all by civil systems. In most cases today, tactical military aircraft are not ADS-B equipped or could choose to disable transmissions. In future, increasing numbers of military aircraft will be ADS-B capable, with the ability to disable these transmissions. ADS-B data sharing should not influence the decision by military authorities to equip or not equip with ADS-B. Moreover, it is possible for States to install ADS-B filters that prevent data from sensitive flights being shared. These filters can be based on a number of criteria and typically use geographical parameters to only provide ADS-B data to an external party if aircraft are near the boundary.

A guidance material on advice to military authorities regarding ADS-B data sharing is provided on the ICAO APAC website "http://www.icao.int/APAC/Pages/edocs.aspx " for reference by States.

9.4 Reporting Rates

9.4.1 General

The ADS-B system shall maintain a reporting rate that ensures at least an equivalent degree of accuracy, integrity and availability as for a radar system that is used to provide a similar ATC service. The standard reporting rate is approximately 0.5 second from the aircraft, but the rate of update provided to the ATM system (for the situation display) may be less frequent (e.g. 5 seconds), provided the equivalency with radar is preserved.

9.5 SEPARATION

9.5.1 General

ADS-B data may be used in combination with data obtained by other means of surveillance (such as radar, flight plan track, ADS-C) for the application of separation provided appropriate minima as determined by the State are applied. It should be noted that the quality of communications will have a bearing on the determination of appropriate minima.

All safety net features (MSAW, STCA, MTCA, RAM and DAIW/ RAI etc) should possess the same responsiveness as equivalent radar safety net features.

9.5.2 Identification Methods

Some of the methods approved by ICAO for establishing identification with radar, may be employed with ADS-B (see PANS-ATM chapter 8). One or more of the following identification procedures are suggested:

a) direct recognition of the aircraft identification in an ADS-B label on a situation display;

b) transfer of ADS-B identification;

c) observation of compliance with an instruction to TRANSMIT ADS-B IDENT.

Note: In automated systems, the "IDENT" feature may be presented in different ways, e.g. as a flashing of all or part of the position indication and associated label.

9.5.3 ADS-B Separation

ADS-B Separation minima has been incorporated by ICAO in PANS-ATM (Doc 4444), and in Regional Supplementary Procedures (Doc 7030).

In a mixed surveillance environment, States should use the larger separation standard applicable between aircraft in the conflict pair being considered.

9.5.4 Vertical separation

9.5.4.1 Introduction

The ADS-B level data presented on the controllers situation display shall normally be derived from barometric pressure altitude. In the event that barometric altitude is absent, geometric altitude shall not be displayed on displays used for provision of air traffic services. Geometric altitude may be used in ATM systems for other purposes.

9.5.4.2 Vertical tolerance standard

The vertical tolerances for ADS-B level information should be consistent with those applied to Mode C level information.

9.5.4.3 Verification of ADS-B level information

The verification procedures for ADS-B level information shall be the same as those employed for the verification of Mode C level data in a radar environment.

9.6 AIR TRAFFIC CONTROL CLEARANCE MONITORING

9.6.1 General

ADS-B track data can be used to monitor flight path conformance with air traffic control clearances.

9.6.2 Deviations from ATC clearances

The ATC requirements relating to monitoring of ADS-B traffic on the situation display should be similar to those contained in PANS-ATM Ch.8.

9.7 ALERTING SERVICE

For ADS-B equipped aircraft, the provision of an alerting service should be based on the same criteria as applied within a radar environment.

9.8 POSITION REPORTING

9.8.1 Pilot position reporting requirements in ADS-B coverage

States should establish voice and/or CPDLC position reporting procedures consistent with those applicable with radar for aircraft that have been identified by ATC.

9.8.2 Meteorological reporting requirements in ADS-B airspace

ATSUs may promulgate in the AIP meteorological reporting requirements that apply within the nominated FIR. The meteorological reporting data required and the transmission methods to be used by aircrew shall be specified in AIP.

9.9 PHRASEOLOGY

9.9.1 Phraseology Standard

States should note the requirement for ADS-B specific phraseology equivalent to radar specific phraseology as well as the opportunity to use generic phraseology applicable to multiple systems.

States shall refer to PANS ATM Chapter 12 for ADS-B phraseology:

ADS-B EQUIPMENT DEGRADATION
ADS-B OUT OF SERVICE (appropriate information as necessary).

TO REQUEST THE CAPABILITY OF THE ADS-B EQUIPMENT

a) ADVISE ADS-B CAPABILITY;
*b) ADS-B TRANSMITTER (data link);
*c) ADS-B RECEIVER (data link);
*d) NEGATIVE ADS-B.
* Denotes pilot transmission.

TO REQUEST RESELECTION OF AIRCRAFT IDENTIFICATION
REENTER [ADS-B or MODE S] AIRCRAFT IDENTIFICATION.

TERMINATION OF RADAR AND/OR ADS-B SERVICE
IDENTIFICATION LOST [reasons] (instructions).

TO REQUEST THE OPERATION OF THE ADS-B IDENT FEATURE
TRANSMIT ADS-B IDENT.

TO REQUEST TERMINATION OF SSR TRANSPONDER AND/OR ADS-B TRANSMITTER OPERATION
a) STOP SQUAWK. [TRANSMIT ADS-B ONLY];
b) STOP ADS-B TRANSMISSION [SQUAWK (code) ONLY].
Note: In some cases the ADS-B transmitter cannot be operated independently of the SSR transponder and the loss of SSR and ACAS surveillance derived from the operation of the SSR transponder should be considered.

9.9.2 Operations of Mode S Transponder and ADS-B

It should be noted that independent operations of Mode S transponder and ADS-B may not be possible in all aircraft (e.g. where ADS-B is solely provided by 1090 MHz extended squitter emitted from the transponder). Additionally, some desirable but optional features of ADS-B transmitters may not be fitted in some aircraft. Controller training on this issue, as it relates to the following examples of radio telephony and/or CPDLC phraseology is recommended.

9.9.2.1 STOP ADSB TRANSMISSION or STOP SQUAWK

Issue: In most commercial aircraft a common “transponder control head” is used for SSR transponder, ACAS and ADS-B functionality. In this case, a pilot who complies with the instruction to stop operation of one system will also need to stop operation of the other systems – resulting in a loss of surveillance not intended or expected by the controller.

ATC need to be aware that an instruction to “Stop ADS-B Transmission” may require the pilot to switch off their transponder that will then stop all other functions associated with the transponder operations (such as ACARs etc). Pilots need to be aware of their aircraft’s equipment limitations, the consequences of complying with this ATC instruction, and be aware of their company policy in regard to this. As with any ATC instruction issued, the pilot should advise ATC if they are unable to comply.

Recommendation: It is recommended that the concatenated phrases STOP ADSB TRANSMISSION, SQUAWK (code) ONLY or STOP SQUAWK, TRANSMIT ADSB ONLY are used. It is recommended that controller training highlights the possible consequences of **issuing** these instructions and that pilot training highlights the consequences of **complying** with this instruction. It is also recommended that aircraft operators have a clearly stated policy on procedures for this situation. Should a pilot respond with UNABLE then the controller should consider alternative solutions to the problem that do not remove the safety defences of the other surveillance technologies. This might include manual changes to flight data, coordination with other controllers and/or change of assigned codes or callsigns.

9.9.2.2 STOP ADSB ALTITUDE TRANSMISSION [WRONG INDICATION or reason] and TRANSMIT ADSB ALTITUDE

Issue: Some aircraft may not have separate control of ADSB altitude transmission. In such cases compliance with the instruction may require the pilot to stop transmission of all ADSB data – resulting in a loss of surveillance not intended or expected by the controller.

Recommendation: It is recommended that, should the pilot respond with UNABLE, the controller should consider alternative solutions to the problem that do not remove the safety defences of other surveillance data. This might include a procedure that continues the display of incorrect level information but uses pilot reported levels with manual changes to flight data and coordination with other controllers.

9.9.2.3 TRANSMIT ADS-B IDENT

Issue: Some aircraft may not be capable or the ADSB SPI IDENT control may be shared with the SSR SPI IDENT function.

Recommendation: It is recommended that controllers are made aware that some pilots are unable to comply with this instruction. An alternative means of identification that does not rely on the ADSB SPI IDENT function should be used.

9.10 FLIGHT PLANNING

9.10.1 ADS-B Flight Planning Requirement – Flight Identity

The aircraft identification (ACID) must be accurately recorded in section 7 of the ICAO Flight Plan form as per the following instructions:

Aircraft Identification, not exceeding 7 characters is to be entered both in item 7 of the flight plan and replicated exactly when set in the aircraft (for transmission as Flight ID) as follows:
Either,

a) The ICAO three-letter designator for the aircraft operating agency followed by the flight identification (e.g. KLM511, BAW213, JTR25), when:

in radiotelephony the callsign used consists of the ICAO telephony designator for the operating agency followed by the flight identification (e.g. KLM 511, SPEEDBIRD 213, HERBIE 25).

Or,

b) The registration marking of the aircraft (e.g. EIAKO, 4XBCD, OOTEK), when:

1) in radiotelephony the callsign used consists of the registration marking alone (e.g. EIAKO), or preceded by the ICAO telephony designator for the operating agency (e.g. SVENAIR EIAKO),

2) the aircraft is not equipped with radio.

Note 1: No zeros, hyphens, dashes or spaces are to be added when the Aircraft Identification consists of less than 7 characters.

Note 2: Appendix 2 to PANS-ATM refers. ICAO designators and telephony designators for aircraft operating agencies are contained in ICAO Doc 8585.

9.10.2 ADS-B Flight Planning Requirements

9.10.2.1 ICAO Flight Plan Item 10 – Surveillance Equipment and Capabilities

An appropriate ADS-B designator shall be entered in item 10 of the flight plan to indicate that the flight is capable of transmitting ADS-B messages.

For information, these include:

B1 ADS-B with dedicated 1090 MHz ADS-B “out” capability

B2 ADS-B with dedicated 1090 MHz ADS-B “out” and “in” capability
U1 ADS-B “out” capability using UAT
U2 ADS-B “out” and “in” capability using UAT
V1 ADS-B “out” capability using VDL Mode 4
V2 ADS-B “out” and “in” capability using VDL Mode 4

9.10.2.2 ICAO Flight Plan Item 18 – Other Information

Where required by the appropriate authority the ICAO Aircraft Address (24 Bit Code) may be recorded in Item 18 of the ICAO flight plan, in hexadecimal format as per the following example:

CODE/7C432B

States should note that use of hexadecimal code may be prone to human error and is less flexible in regard to airframe changes for a notified flight.

9.10.2.3 Transponder Capabilities

When an aircraft is equipped with a mode S transponder, that transmits ADS-B messages, an appropriate Mode S designator should also be entered in item 10; i.e.: either

- E Transponder — Mode S, including aircraft identification, pressure-altitude and extended squitter (ADS-B) capability, or
- L Transponder — Mode S, including aircraft identification, pressure-altitude, extended squitter (ADS-B) and enhanced surveillance capability.

9.10.3 Setting Flight Identification in Cockpits

(a) Flight ID Principles
The aircraft identification (sometimes called the flight identification or FLTID) is the equivalent of the aircraft callsign and is used in both ADS-B and Mode S SSR technology. Up to seven characters long, it is usually set in airline aircraft by the flight crew via a cockpit interface. It enables air traffic controllers to identify and aircraft on a display and to correlate a radar or ADS-B track with the flight plan date. Aircraft identification is critical, so it must be entered carefully. Punching in the wrong characters can lead to ATC confusing once aircraft with another.

It is important that the identification exactly matches the aircraft identification (ASID) entered in the flight notification.

Intuitive correlation between an aircraft’s identification and radio callsign enhances situational awareness and communication. Airline aircraft typically use a three letter ICAO airline code used in flight plans, NOT the two letter IATA codes.

(b) Setting Flight ID
The callsign dictates the applicable option below for setting ADS-B or Mode S Flight ID:

(i) the flight number using the ICAO three-letter designator for the aircraft operator if a flight number callsign is being used (e.g. QFA1 for Qantas 1, THA54 for Thai 54).

(ii) the nationality and registration mark (without hyphen) of the aircraft if the callsign is the full version of the registration (e.g .VHABC for international operations).

(iii) The registration mark alone of the aircraft if the callsign is the abbreviated version of the registration (eg ABC for domestic operations).

(iv) The designator corresponding to a particular callsign approved by the ANSP or regulator (e.g. SPTR13 for firespotter 3).

(v) The designator corresponding to a particular callsign in accordance with the operations manual of the relevant recreational aircraft administrative organization (e.g. G123 for Gyroplance 123).

9.11 PROCEDURES TO HANDLE NON-COMPLANT ADS-B AIRCAFT OR MISLEADING ADS-B TRANSMISSIONS

ADS-B technology is increasingly being adopted by States in the Asia/Pacific Region. Asia/Pacific Region adopted 1090 extended squitter technology. Reliance on ADS-B transmissions can be expected to increase over the coming years.

Currently a number of aircraft are transmitting ADS-B data which is misleading or non-compliant with the ICAO standards specified in Annex 10. Examples include:

a) aircraft broadcasting incorrect message formats;

b) aircraft broadcasting inertial positional data and occasionally indicating in the messages that the data has high integrity when it does not;

c) using GPS sources that do not generate correct integrity data, whilst indicating in the messages that the data has high integrity;

d) transmitting ADS-B data with changing (and incorrect) flight identity; and

e) transmitting ADS-B data with incorrect flight identity continuously.

If the benefits of ADS-B are to flow to the aviation industry, misleading and non-compliant ADS-B transmissions need to be curtailed to the extent possible.

The transmission of a value of zero for the NUCp or the NIC or the SIL by an aircraft indicates a navigational uncertainty related to the position of the aircraft or a navigation integrity issue that is too significant to be used by air traffic controllers.

As such, the following procedure, stipulated in the Regional Supplementary Procedures Doc 7030, shall be applicable in the concerned FIRs on commencement of ADS-B based surveillance services notified by AIP or NOTAM:

If an aircraft operates within an FIR where ADS-B-based ATS surveillance service is provided, and

a) carries 1090 extended squitter ADS-B transmitting equipment which does not comply with one of the following:
   1) EASA AMC 20-24; or
   2) the equipment configuration standards in Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia; or
   3) installation in accordance with the FAA AC No. 20-165 – Airworthiness Approval of ADS; or

b) the aircraft ADS-B transmitting equipment becomes unserviceable resulting in the aircraft transmitting misleading information;

then:

a) except when specifically authorized by the appropriate ATS authority, the aircraft shall not fly unless the equipment is:

   1) deactivated; or
   2) transmits only a value of zero for the NUCp or NIC or SIL

States may elect to implement a scheme to blacklist those non-compliant aircraft or aircraft consistently transmitting mis-leading ADS-B information, so as to refrain the aircraft from being displayed to ATC.

A sample template is given below for reference by States to publish the procedures to handle non-compliant ADS-B aircraft or misleading ADS-B transmissions in their ADS-B mandate/regulations:

After <insert earliest date that ADS-B may be used for any relevant operational purpose> if an aircraft carries ADS-B transmitting equipment which does no comply with :

(a) EASA AMC 20-24; or
(b) the equivalent configuration standards in Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia; or
(c) Installation in accordance with the FAA AC No. 20-165 – Airworthiness Approval of ADS;

or the aircraft ADS-B transmitting equipment becomes unserviceable resulting in the aircraft transmitting misleading information;

the aircraft must not fly unless equipment is:

(a) deactivated; or
(b) set to transmit only a value of zero for the NUCp or NIC or SIL.

Note:

1. It is considered equivalent to deactivation if NUCp or NIC or SIL is set to continually transmit only a value of zero;
2. Regulators should take appropriate action to ensure that such regulations are complied with;
3. ATC systems should discard ADS-B data when NUCp or NIC or SIL =0.

9.12 EMERGENCY PROCEDURES

ATC surveillance systems should provide for the display of safety-related alerts and warnings, including conflict alert, minimum safe altitude warning, conflict prediction and unintentionally duplicated SSR codes and aircraft identifications.

The ADS-B avionics may transmit emergency status messages to any ADS-B ground station within coverage. The controller receiving these messages should determine the nature of the emergency, acknowledge receipt if appropriate, and initiate any assistance required. An aircraft equipped with ADS-B might operate the emergency and/or urgency mode as follows:

a) emergency;
b) no communications;
c) unlawful interference;
d) minimum fuel; and/or
e) medical.

Selection of an emergency transponder code (e.g. 7600) automatically generates an emergency indication in the ADS-B message. However, some ADS-B transponders may only generate a generic emergency indication. That means, the specific type of emergency, e.g., communication failure, is not always conveyed to the controller in an ADS-B environment. The controller may only receive a generic emergency indication irrespective of the emergency codes being selected by the pilot.

Due to limitations of some ADS-B transponders, procedures should be developed for ATC to confirm the types of emergency with pilots based on operational needs of States.

Executive control responsibility

The responsibility for control of the flight rests with the ATSU within whose airspace the aircraft is operating. However, if the pilot takes action contrary to a clearance that has already been coordinated with another sector or ATSU and further coordination is not possible in the time available, the responsibility for this action would rest with the pilot in command, and performed under the pilot's emergency authority.

Emergency procedures

The various circumstances surrounding each emergency situation preclude the establishment of exact detailed procedures to be followed. The procedures outlined in PANS-ATM Chapter 15 provide a general guide to air traffic services personnel and where necessary, should be adapted for the use of ADS-B.

10. SECURITY ISSUES ASSOCIATED WITH ADS-B

10.1 INTRODUCTION

ADS-B technologies are currently "open systems" and the openness is an essential component of successful use of ADS-B. It was also noted that ADS-B transmission from commercial aircraft is a "fact of life" today. Many commercial aircraft are already equipped with ADS-B and have been transmitting data for some time.

It was noted that there has been considerable alarmist publicity regarding ADS-B security. To a large extent, this publicity has not considered the nature and complexity of ATC. Careful assessment of security policies in use today for ADS-B and other technologies can provide a more balanced view.

10.2 CONSIDERATIONS

A list of ADS-B vulnerabilities categorised into threats to Confidentiality, Integrity and Availability has been reviewed and documented into the guidance material on security issues associated with ADS-B provided on the ICAO APAC website "http://www.bangkok.icao.int/edocs/index.html" under "Restricted Site" for reference by States. States could contact ICAO Regional Office to get access to the guidance material. The following recommendations are made to States:

(a) While ADS-B is recognized as a key enabling technology for aviation with potential safety benefits, it is recommended that States made aware of possible ADS-B security specific issues;

(b) It is recommended that States note that much of the discussion of ADS-B issues in the Press has not considered the complete picture regarding the ATC use of surveillance data;

(c) For current ADS-B technology implementation, security risk assessment studies should be made in coordination with appropriate national organisations and ANSPs to address appropriate mitigation applicable in each operational environment, in accordance with ATM interoperability requirements; and

(d) Future development of ADS-B technology, as planned in the SESAR master plan for example, should address security issues. Studies should be made to identify potential encryption and authentication techniques, taking into consideration the operational need of air to ground and air to air surveillance applications. Distribution of encryption keys to a large number of ADS-B receivers is likely to be problematic and solutions in the near and medium term are not considered likely to be deployed worldwide. Internet based encryption strategies are not deployable when ground stations are pass receivers.

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Commissioning Readiness

The requirement for this form is specified in the System Management Manual (Section 11.2 of V4), C-MAN0107

Project/Task Name	**SAP Project/Task ID:**	**Sites or Locations affected:**
Documentation prepared by:	**Date:**	**Commissioning Date:**
Affected System(s)	**System Criticality**	**Change Consequence Level**
Brief Description of Change:		

Commissioning Readiness Endorsement

The endorsement of this form by the appropriate authorities as specified in the System Management Manual certifies that the requirements detailed in this form (with the exception of the non-critical deficiencies[1] listed herein) have been completed prior to the commissioning of the system change or new system.

Chief Engineer or Technical or Maintenance Authority

Name:	**Signature:**	**Date**:
Designation:		

Name:	**Signature:**	**Date**:
Designation:		

Chief Operating/User Authority or Operating/User Authority

Name:	**Signature:**	**Date**:
Designation:		

Records Management Instructions

Place the completed Commissioning Readiness Form, together with any support documents on the Project file

Provide a copy of the completed Commissioning Readiness Form to P&E, Asset Lifecycle Manager, Planning and Integration

Note 1: Non-critical deficiencies (NCD) are those outstanding technical and operational issues that do not prevent the safe and effective use or maintenance of the facility, but will be addressed in a specified and agreed time. NCDs shall be listed on the Commissioning Certificate (C-FORMS0300) and recorded in the relevant system (ASID / HEAT / SAIR). It is preferable for each NCD to be recorded as a separate Issue.

Item No:	**Requirement:**	**Requirement Reference:** (Procedure/instruction used to specified required input)	**Completed or N/A**	**Evidence of Compliance** (If a requirement is N/A, a reason why it is N/A is required to be entered)
1	OPERATIONAL SAFETY			
1.1	Provide a link to the completed SCARD **SCARD** Template (AA-TEMP-SAF-0042) Note: For unregulated systems the SCARD shall be used to assess the impact of the change and perform a preliminary hazard analysis	Safety Change Management Requirements **AA-NOS-SAF-0104**	Completed ☐ N/A ☐	**Link to SCARD**
1.2	The outcome of the SCARD will be the requirement for one of the following for commissioning: **Safety Statement** – included in SCARD or standalone Safety Statement which must provide Airservices Australia management with sufficient information to demonstrate that safety has been considered and the change presents minimal or no safety issues. **Safety Plan & Safety Assessment Report, or** **Safety Plan & Safety Case** Safety Plans, Safety Assessment Reports and Safety Cases are required to be available in the Document Search Database	Safety Change Management Requirements **AA-NOS-SAF-0104** Document Search Database	Completed ☐ N/A ☐	**Link to Safety statement or** **Link to Safety Plan & Safety Assessment Report or** **Link to Safety Plan & Safety Case**
1.3	Safety risk management process completed and includes • any new hazards / impact to existing hazards identified? • controls identified and in place? and • residual risk justified and accepted.	Safety Risk Management Procedures **AA-PROC-SAF-0105**	Completed ☐ N/A ☐	
1.4	Impacts on the Operational Risk Assessments from residual risks have been assessed and implemented using Operational Risk Assessment Change Request and Acceptance Record – AA-FORM-SAF-0032	Operational Risk Assessment **AA-NOS-SAF-0006** Safety Risk Management Procedures **AA-PROC-SAF-0105**	Completed ☐ N/A ☐	Link to Operational Risk Assessment Change Request and Acceptance Record:
1.5	Arrangements for monitoring and review of risks are in place including arrangements for safety performance monitoring following the transition.	Safety Risk Management Procedures **AA-PROC-SAF-0105**	Completed ☐ N/A ☐	
1.6	CASA have approved / accepted or been advised of the change, as applicable	Safety Change Management Requirements **AA-NOS-SAF-0104**	Completed ☐ N/A ☐	

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
2	WORKPLACE HEALTH & SAFETY			
2.1	Initial WHS Hazard Identification must be completed as per the template AA-TEMP-SAF-0020	Safety Risk Management Procedures **AA-PROC-SAF-0105** Initial WHS Hazard Identification **AA-TEMP-SAF-0020** Workplace Health and Safety Risk Management Summary **AA-TEMP-SAF-0016**	Completed ☐ N/A ☐	**Link to completed Workplace Health and Safety Management Summary AA-TEMP-SAF-0016**
2.2	Ensure employees and stakeholders are consulted when significant changes to work arrangements are being considered.	Working Together Workplace Consultation **AA-PROC-SAF-0009**	Completed ☐ N/A ☐	
2.3	Tower Access / Classification assessed? Working at Heights Safety Checklist & Daily Toolbox Meeting (F098) Fall arrest facility / equipment available	Working at Heights **PROC-157** Working at Heights Safety Checklist & Daily Toolbox Meeting **F098**	Completed ☐ N/A ☐	
2.4	WHS hazard controls are in place - Safe Work Method Statement completed - Plant risks managed - Radhaz survey completed, published on the Avnet and general public & occupational exposure boundaries identified	Safe Work Method Statement **AA-TEMP-SAF-0017** Managing WHS Risk for Contractors and Projects **AA-PROC-SAF-0012** Plant Risk Management **PROC-134** RF Radiation, Surveys & Health & Safety Mgmt **PROC-121**	Completed ☐ N/A ☐	**Link to completed Safe Work Method Statement AA-TEMP-SAF-0017** **Link to completed F131 Plant Risk Management Checklist**
2.5	At the completion of works ensure WHS Inspections are completed and hazard controls are in place. Building condition; clean, undamaged, all work completed.	Conducting Workplace Safety Inspections **AA-PROC-SAF-0008**	Completed ☐ N/A ☐	

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
3	ENVIRONMENT			
3.1	Environmental Impact must be assessed using the Environmental Impact Screening & Assessment Criteria for Changes to On-ground Activities Assistance in assessing the Environmental Impact can be obtained from Environment and Climate Change Unit in Environment Group.	Environmental Screening & Assessment Criteria for Changes to On-ground Activities **AA-REF-ENV-0010** Environmental Assessment of Changes to On-ground Activities. **AA-NOS-ENV-2.200**	Completed ☐ N/A ☐	**Link to completed Environmental Impact Screening and Assessment Form** **If a stage 2 assessment is required provide ARMS reference and links to any Permits, Master Development Plans and relevant correspondence as required.**
3.2	Environmental Clearance obtained for ATM changes as per **AA-NOS-ENV-2.100** Assistance in assessing the Environmental Impact can be obtained from Environment and Climate Change Unit in Environment Group.	Environment Assessment Process for ATM Changes **AA-NOS-ENV-2.100**	Completed ☐ N/A ☐	**Provide ARMS reference and NRFC reference if ATM change required**
4	PEOPLE- SUPPORT			
ATC TRAINING				
4.1	ATC Training Needs Analysis completed and Training Plan developed?		Completed ☐ N/A ☐	**Link to Training Needs Analysis and Training Plan**
4.2	Sufficient number of trained, rated and endorsed ATC staff available.		Completed ☐ N/A ☐	**Number Trained:**
4.3	ATC staff individual training records in SAP database have been updated		Completed ☐ N/A ☐	
4.4	Plans are in place to complete any outstanding training, rating, and endorsement of remaining ATC staff (Normally an identified hazard)		Completed ☐ N/A ☐	**HAZLOG Register No:**

Item No:	**Requirement:**	**Requirement Reference:** (Procedure/instruction used to specified required input)	**Completed or N/A**	**Evidence of Compliance** (If a requirement is N/A, a reason why it is N/A is required to be entered)
TECHNICAL TRAINING				
4.5	Training Needs Analysis completed and Training Plan developed for system support staff and field maintenance staff?		Completed ☐ N/A ☐	**Link to Training Needs Analysis and Training Plan**
4.6	TechCert codes have been created, assessment criteria developed or existing assessment criteria has been amended	**TechCert codes** **TechCert Guides and Forms**	Completed ☐ N/A ☐	**Link to TechCert Guides and Forms**
4.7	Sufficient system support staff and field maintenance staff appropriately trained?		Completed ☐ N/A ☐	
4.8	Are plans are in place to complete any outstanding training and certification of system support staff and remaining field maintenance staff?		Completed ☐ N/A ☐	
4.9	Field maintenance staff hold the relevant TechCert to perform duties.	Technical Certification **PROC-141**	Completed ☐ N/A ☐	
4.10	Statutory / special licensing obtained by field maintenance staff including high risk work competencies and licensing requirements?		Completed ☐ N/A ☐	
4.11	ABS and FMS staff training details sent to Technical Training Coordinator and training records updated as required?	Training **PROC-119**	Completed ☐ N/A ☐	
4.12	TechCert details sent to FMS System Support to update the Qualifications (TechCert) Database	Technical Certification **PROC-141**	Completed ☐ N/A ☐	
LOGISTICAL SUPPORT				
4.13	CMRD have been consulted regarding special test equipment, test beds, etc		Completed ☐ N/A ☐	

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
4.14	CMRD / NDC have been consulted regarding spares holdings and repair of LRUs from this equipment or in-house support of Depot Level Support Contract / repair contract		Completed ☐ N/A ☐	
4.15	TEMACC advised of any specialised test equipment requirements.	Test Equipment Management **PROC-150**	Completed ☐ N/A ☐	
4.16	Maintenance support contracts in place (external and/or internal)? – Appropriate vendor and/or internal support? – Appropriate Level 3 maintenance arrangements		Completed ☐ N/A ☐	
4.17	Test equipment provided to maintenance base. Note: Test equipment purchasing and calibration requirements detailed in Engineering Execution Readiness form.		Completed ☐ N/A ☐	
4.18	Specialised hardware or software system support and field maintenance tools, test / patch leads, adaptors, isolators, electronic discharge protection (mats, straps), etc supplied?		Completed ☐ N/A ☐	
4.19	System Business Continuity/ Disaster Recovery provisions supplied/updated?		Completed ☐ N/A ☐	
4.20	Spares – Supplied, storage correct, transport cases supplied?	Management of Goods & Supplies **PROC-118**	Completed ☐ N/A ☐	
4.21	Spares – Software / firmware loaded, tested & configured?		Completed ☐ N/A ☐	
4.22	Service Restoration Times (SRT) established?	Airways Service Data **PROC-207**	Completed ☐ N/A ☐	

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
4.23	Conduct Hardware physical configuration audit and ensure SAP Plant Maintenance has updated information of all installed and/or demolished equipment (including monitoring circuits) and sent to System Operations SAP PM DATA CHANGES.	Equipment Installed/Demolished Advice SAP Data Input Form **F104**	Completed ☐ N/A ☐	**Link to Email from SAP PM Support confirming update/s**
5	PROCEDURES			
ATC DOCUMENTATION				
5.1	System Requirements documentation including Operating Concept or Business Process Rules - produced/updated and approved?		Completed ☐ N/A ☐	**Link to documentation**
5.2	Manual of Air Traffic Services (MATS) reviewed / updated. Aeronautical information publications (AIP Book, AIP SUPP, AIC, DAP, ERSA, Charts, etc) reviewed / updated. Amendment times are determined by the AIS Distribution Schedule	 **AA Publications** **AIS Distribution Schedule**	Completed ☐ N/A ☐	**NRFC No.**
5.3	National ATC Procedures Manual (NAPM) and any other relevant ATC procedures reviewed / updated.		Completed ☐ N/A ☐	**NRFC No.**
5.4	ATC contingency / continuity plans reviewed / updated.	**ATS Contingency Plans** Business Continuity Plans **C-BCP**	Completed ☐ N/A ☐	**ATS-CP No:** **C-BCP No:**
5.5	NOTAM and/or AIP SUP issued / amended / cancelled	Works Planning **PROC-213** Refer also **LOA3024**	Completed ☐ N/A ☐	**NOTAM No:**
5.6	ATC Temporary Local Instruction (TLI) issued notifying Operational staff of change?	**Temporary Local Instructions & Database**	Completed ☐ N/A ☐	**NRFC No.**

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
USER DOCUMENTATION				
5.7	User/operator manuals updated		Completed ☐ N/A ☐	
5.8	User/operator procedures provided/updated as applicable		Completed ☐ N/A ☐	
5.9	On-line user/operator documentation completed and published		Completed ☐ N/A ☐	
5.10	ARFF instructions updated		Completed ☐ N/A ☐	
5.11	Other Business Groups instructions updated?		Completed ☐ N/A ☐	
TECHNICAL DOCUMENTATION				
5.12	Software design documents updated, adequate and supplied to system support?		Completed ☐ N/A ☐	
5.13	Software and/or dataset Version or Release Description Documentation supplied and adequate?		Completed ☐ N/A ☐	**Link to Version Description Document or Release Description Document**
5.14	Software installation procedure and instructions supplied/updated and adequate?		Completed ☐ N/A ☐	**Link to Installation Procedure**

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
5.15	**SMP**: System Management Plan created / updated and adequate?	SMP Template	Completed ☐ N/A ☐	**SMP No:**
5.16	**SCP:** System Contingency / continuity plans supplied/updated and adequate?	SCP Template	Completed ☐ N/A ☐	**SCP No:**
5.17	Technical drawings updated and listed in Data Viewer and list supplied to system supporters and field maintenance staff.	Technical Drawing Management PROC-178	Completed ☐ N/A ☐	
5.18	Technical handbooks/manuals supplied to ABS or FMS Engineering/IT support and field maintenance staff (base and site copy).	Document Management PROC-103	Completed ☐ N/A ☐	
5.19	On-line system support and field maintenance documentation completed and published		Completed ☐ N/A ☐	
5.20	Technical documentation registered and placed under documentation control	Document Management PROC-103	Completed ☐ N/A ☐	
5.21	Appropriate engineering performance requirements specified and issued for ongoing use? System Specification documentation supplied/updated and adequate?	System Performance Requirements & Reporting Specification ASYS-106	Completed ☐ N/A ☐	
5.22	**Configuration & Modification AEI:** Equipment and System Modifications and Configuration (for hardware and software), and Software Release Authorisations are documented in a Part 2 AEI (or other approved documentation)	Development of Maintenance Instructions for Equipment PROC-151	Completed ☐ N/A ☐	**AEI No/s:** **Link to documentation detailing configuration and modification**
5.23	**Maintenance AEI:** Maintenance requirements, including Performance Inspection tolerances, have been defined and documented in AEIs (or other approved documentation). (AEI Part 3,4,7)	Development of Maintenance Instructions for Equipment PROC-151	Completed ☐ N/A ☐	**AEI No/s:**

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
5.24	**AEI:** New maintenance AEIs trialled by maintenance staff	Development of Maintenance Instructions for Equipment PROC-151	Completed ☐ N/A ☐	
5.25	**TTD**: Temporary Technical Dispensation raised and published on the Document Search database.	Temporary Technical Dispensations PROC-153	Completed ☐ N/A ☐	**TTD No:**
5.26	Site Manifest updated	Site Manifests FMS-304	Completed ☐ N/A ☐	
6	SYSTEM			
DESIGN REQUIREMENTS				
6.1	System Requirements documentation including Operating Concept or Business Process Rules - supplied/updated and approved?	Design Control PROC-146	Completed ☐ N/A ☐	**Links to documentation**
6.2	Standards – Installation and equipment comply with all relevant Australian Standards? Building Codes - Structures comply with the relevant Building Codes? The relevant Australian Standards and Building Codes are to be determined by the Chief Engineer, Technical Authority or Maintenance Authority	Australian Standards Design Control PROC-146	Completed ☐ N/A ☐	
6.3	Other applicable Federal and/or State licensing requirements met? The relevant licensing requirements are to be determined by the Chief Engineer, Technical Authority or Maintenance Authority	Design Control PROC-146	Completed ☐ N/A ☐	

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
6.4	Electrical Mechanical, Structure and Building impacts have been assessed as adequate or modifications organised and completed through consultation with Engineering Branch, P&E? (Power supply capability / airconditioning capacity / mast loadings)	Design Control **PROC-146**	Completed ☐ N/A ☐	
6.5	Earthing and Lightning Protection meets Airservices requirements?	Earthing and Lightning Protection Systems for Operational Facilities **AEI 3.1504** Site Earthing and Lightning Protection Systems for Existing Installations **AEI 2.3011**	Completed ☐ N/A ☐	
6.6	Battery Procurement as per Airservices requirements?	Lead Acid Batteries (Stationary) Procurement and Acceptance Testing **AEI-3.7050** Panel Contract Arrangement **C-PROC0140**	Completed ☐ N/A ☐	
6.7	Assessing the impact of information systems against corporate objectives (7 Ticks process).	Information Technology Application Certification –'7 Ticks' **MI-0804 and PROC-190**	Completed ☐ N/A ☐	**Link to completed 7 Ticks Interim Certificate or Final Certificate**
6.8	IT Security measures appropriate and in place(ie. to ensure effective security and control practices to minimise the risks of unauthorised access, inappropriate use, modification, destruction or disclosure of electronically held data).	IT Security Roles and Responsibilities Statement **MS-0013** Information Security **MI-0808** ICT Resources – Conditions of Use **MI-0829**	Completed ☐ N/A ☐	

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
6.9	Information Security	Information Security C-PROC0184	Completed ☐ N/A ☐	**Link to completed security risk management plan**
INSTALLATION REQUIREMENTS				
6.10	Has met the regulation and safety requirements for Telecommunications Installations. Cable Markers installed (external)? Equipment complies with ACMA statutory requirement Telecommunication Labelling (Customer Equipment and Customer Cabling) Notice 2001 as amended (i.e. 'A' ticked on the equipment compliance plate)	Implementing Regulation and Safety Requirements for Telecommunications Installations PROC-138 Installation of Optical Fibre Cable - Underground AEI 4.5001 Underground Cable Marking AEI 4.3001	Completed ☐ N/A ☐	**Link to Telecommunications Cabling Advice**
6.11	MDF/IDF Records created / updated? Labelling/Colour Coding – Rack, Cable, Chassis, etc.?	Colour Coding of RJ45 Patch Leads for Voice and Data Installations AEI 7.3241	Completed ☐ N/A ☐	
6.12	Transmitters licence label affixed	Radio Communication Transmitter Labelling AEI 7.4238	Completed ☐ N/A ☐	
6.13	Electrical Certificate of Testing and Safety or Testing and Compliance on connection to a source of electricity (i.e. installation conforms to AS3000) are required to be supplied as soon as possible after connection or testing of any electrical installation or change. Labelling – Switch Boards, etc Meets Airservices Electrical Cable Colour Coding requirements?	Electrical Safety Regulation 2002 Sections 15 and 159 AS 3000 – Aust Standard Electrical Cable Colour Coding AEI 3.1502	Completed ☐ N/A ☐	**Links to Electrical Certificates**

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
6.14	All modifications complete and scratch plate labels affixed to equipments	Identification of Airways Systems Equipment Hardware Modifications **PROC-154**	Completed ☐ N/A ☐	
6.15	Integration with National Technical Monitoring has been organised and completed through Engineering Branch, P&E?		Completed ☐ N/A ☐	
6.16	Alarm monitoring installed and tested at TOC for local and remote site?		Completed ☐ N/A ☐	
6.17	Source media – supplied/backed up, stored, registered with system support?	Software Media Archival and Storage **PROC-147**	Completed ☐ N/A ☐	
6.18	Site installable media – supplied/backed up, appropriately stored and registered by field maintainers?	Software Media Archival and Storage **PROC-147**	Completed ☐ N/A ☐	
6.19	Software licences provided, registered and appropriately stored? (Including details of any third party licensing)		Completed ☐ N/A ☐	
6.20	Update HEAT and/or ASID database to incorporate new system/version number and assign issue management roles?		Completed ☐ N/A ☐	

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
DESIGN CONFIRMATION				
6.21	Airservices Physical Security requirements met. The minimum security requirements are specified in C-GUIDE0157. Physical Security advise can be obtained from the relevant Security Advisor in Security and Crisis Planning, Safety & Environment Physical Access requirements are determined and established Siting and accommodation impact has been assessed as being satisfactory or modifications organised through National Property?	Physical Security – Critical Operational Facilities **C-GUIDE0157** Site Management **PROC-170**	Completed ☐ N/A ☐	
6.22	Network data load impact has been assessed as being satisfactory or modifications organised and completed through Engineering Branch, P&E?		Completed ☐ N/A ☐	
6.23	Spectrum licences (either cancelled if no longer required or for new licenses including if antenna moves by more than 10 metres)	Frequency Management: Obtaining a Frequency Assignment and Licence **AEI 7.4202**	Completed ☐ N/A ☐	
6.24	New system or system change acceptance tests (software and/or hardware) satisfactorily completed against the approved system requirements? – Test Plans provided? – FAT, SAT, UAT test results complete, passed to the required level and provided? – Test identified defect listings and re-test information provided?	System Management Manual **SMM** Design Control **PROC-146**	Completed ☐ N/A ☐	
6.25	Battery Acceptance Tests as per Airservices requirements?	Lead Acid Batteries (Stationary) Procurement and Acceptance Testing **AEI-3.7050**	Completed ☐ N/A ☐	**Link to Battery Acceptance Test Results**

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
6.26	Standard Operating Conditions (SOCs) / Site Configuration Data (SCD) established / approved	Standard Operating Conditions & Site Configuration Data Management **PROC-143**	Completed ☐ N/A ☐	
6.27	Flight Test results supplied and satisfactory	Certification of Radio Navigation Aid Facilities **AEI 7.4003**	Completed ☐ N/A ☐	
6.28	Equipment operation is as per AEI specifications and any additionally specified requirements? Relevant requirements and performance specifications to be determined by the Chief Engineer, Technical Authority or Maintenance Authority		Completed ☐ N/A ☐	
7	TRANSITION			
PLANNING				
7.1	Does the system meet all critical user and technical requirements?		Completed ☐ N/A ☐	
7.2	If non-critical deficiencies are proposed to be accepted into operation, are they managed and tracked via ASID, HEAT or SAIR, including responsibilities and timings and attached to the Commissioning Certificate?		Completed ☐ N/A ☐	
7.3	Cutover Plan prepared and authorised by: – Appropriate level of engineering authority? – Appropriate level of User Authority?	Cutover Plan **C-TEMP0045**	Completed ☐ N/A ☐	**Link to Cutover Plan**
7.4	Works plan created at least 7 days before deployment	Works Planning **PROC-213**	Completed ☐ N/A ☐	**Works Plan No.**

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
NOTIFICATION				
7.5	Industry education / notification been completed?		Completed ☐ N/A ☐	
7.6	Relevant Business Managers advised of impending change?		Completed ☐ N/A ☐	
7.7	Change requester and/or sponsor notified?		Completed ☐ N/A ☐	
7.8	System Operations' TOC and Service Desk notified and accepted operating responsibility for the change.		Completed ☐ N/A ☐	
7.9	ABS/FMS Manager has accepted maintenance responsibility		Completed ☐ N/A ☐	
7.10	Notify the following (as appropriate) that the system is at **"OPERATIONAL READINESS"** and provide details of commissioning and any system changes: **ATC** System Supervisor, Melbourne (ATC) System Supervisor, Brisbane (ATC) National ATC Systems Manager Operating Authority (relevant)	**Sys to Svc List**	Completed ☐ N/A ☐	

Item No:	Requirement:	Requirement Reference: (Procedure/instruction used to specified required input)	Completed or N/A	Evidence of Compliance (If a requirement is N/A, a reason why it is N/A is required to be entered)
7.11	Notify the following (as appropriate) that the system is at **"ENGINEERING READINESS"** and provide details of commissioning and any system changes: **P&E** Technical Authority (relevant) Technical Operations Centre – Director Service Desk -Airways SAP PM Support	**Sys to Svc List**	Completed ☐ N/A ☐	

COMMISSIONING CERTIFICATE

The requirement for this form is specified in the System Management Manual (Section 11.2 of V4), C-MAN0107

Project/Task Name	**SAP Project/Task ID:**	**Sites or Locations affected:**
Documentation prepared by:	**Date:**	**Commissioning Date:**
Affected System(s)	**System Criticality**	**Change Consequence Level**
Brief Description of Change:		

Commissioning Approval

The approval of this document by the appropriate authorities as specified in the System Management Manual certifies that the new system or system change is satisfactory to meet the specified service and performance requirements; that system operating and support requirements are in place; that required user and technical training is adequately provisioned; as detailed in the Commissioning Readiness Form and consequently the new system or system change is declared fit-for-purpose and can be deployed and operated until formally decommissioned or otherwise revoked.

This approval is provided subject to the non-critical deficiencies[1] listed herein.

Chief Engineer, Technical or Maintenance Authority

Name	**Signature:**	**Date**
Designation:		
Name:	**Signature:**	**Date**:
Designation:		

Chief Operating/User Authority or Operating/User Authority

Name:	**Signature:**	**Date**:
Designation:		

Records Management Instructions

Place the completed Commissioning Certificate, together with the completed Commissioning Readiness form on the Project file

Provide a copy of the completed Commissioning Certificate, and the completed Commissioning Readiness Form to P&E, Asset Lifecycle Manager, Planning and Integration

Note 1: **Non-critical deficiencies** are those outstanding technical and operational issues that do not prevent the safe and effective use of the facility by users or prevent effective technical maintenance, but will be addressed in a specified and agreed time.

LIST OF NON-CRITICAL DEFICIENCIES WAIVED AT TIME OF COMMISSIONING

Either list non-critical deficiencies here or attach a list if space insufficient

Issue	Issue Tracking Reference Number	Allocated to	Proposed Completion Date	Comments

REVISED SURVEILLANCE STRATEGY FOR THE ASIA/PACIFIC REGION

Considering that:

1. States are implementing CNS/ATM systems to gain safety, efficiency and environmental benefits, and have endorsed the move toward satellite and data link technologies;

2. The future air traffic environment will require increased use of aircraft-derived surveillance information for the implementation of a seamless automated air traffic flow management system;

3. The 11th Air Navigation Conference endorsed the use of ADS-B as an enabler of the global air traffic management concept and encouraged States to support cost-effective early implementation of ADS-B applications;

4. The 12th Air Navigation Conference endorsed the ICAO Aviation System Block Upgrades (ASBU) Framework with Modules specifying effective use of ADS-B/MLAT and associated communication technologies in bridging surveillance gaps and its role in supporting future trajectory-based ATM operating concepts. Cooperation between States is the key to achieve harmonized ATM system operations;

5. APANPIRG has decided to use the 1090MHz Extended Squitter data link for ADS-B air-ground and air-air applications in the Asia/Pacific Region, noting that in the longer term an additional link type may be required;

6. SSR and ADS-C will continue to meet many critical surveillance needs for the foreseeable future;

7. SARPs, PANS and guidance material for the use of ADS-B have been developed;

8. ADS-B avionics and ground systems are available;

9. Multilateration is a technology that can supplement SSR, ADS-B and SMR; and

10. ADS-B IN applications and equipment are now available in commercial airliners and ICAO ASBUs include ADS-B IN applications in Block 0 and Block 1.

THE SURVEILLANCE STRATEGY FOR THE ASIA/PACIFIC REGION IS TO:

1. Minimise the reliance upon pilot position reporting, particularly voice position reporting, for surveillance of aircraft;

2. Maximise the use of ADS-B on major air routes and in terminal areas, giving consideration to the mandatory carriage of ADS-B Out as specified in Note 1 and use of ADS-B for ATC separation service;

3. Reduce the dependence on Primary Radar for area surveillance;

4. Provide maximum contiguous ATS surveillance coverage of air routes using 1090MHz Extended Squitter ADS-B and Mode S SSR based on operational requirements;

5. Make full use of SSR Mode S capabilities where radar surveillance is used and reduce reliance on 4-digit octal codes;

6. Make use of ADS-C where technical constraint or cost benefit analysis does not support the use of ADS-B, SSR or Multilateration;

7. Make use of Multilateration for surface, terminal and area surveillance where appropriate;

8. Closely monitor ADS-B avionics developments such as Version 2 ES *(DO260B*) implementation and Spaced Based ADS-B application programs. At an appropriate time (circa 2016) APAC should review progress and consider development of transition plans where cost/benefit studies indicate positive advantages for the region; and

9. Carefully monitor ADS-B IN development and cost benefits to ensure that ASIA/PAC States are able to take advantage of ADS-B IN benefits when appropriate, through procedures, rules and ATC automation capabilities.

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Note 1:

a) *Version 0 ES as specified in Annex 10, Volume IV, Chapter 3, Paragraph3.1.2.8.6 (up to and including Amendment 82 to Annex 10) and Chapter 2 of* Technical Provisions for Mode S Services and Extended Squitter *(ICAO Doc 9871) (Equivalent to DO260) to be used till at least 2020.*

b) *Version 1 ES as specified in Chapter 3 of* Technical Provisions for Mode S Services and Extended Squitter *(ICAO Doc 9871) (Equivalent to DO260A);*

c) *Version 2 ES (including provisions for new set of 1 090 MHz extended squitter (ES) messages and traffic information service – broadcast (TIS-B) being developed by the Aeronautical Surveillance Panel (ASP) and scheduled to be incorporated in Annex 10 Vol. IV - Surveillance and Collision Avoidance System as part of Amendment 86 with target applicable date in November 2013. (Equivalent to DO260B and EUROCAE ED-102A which were issued in December 2009).*

ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM

(REGIONAL)

(Amended in March 2013)

REGIONAL PERFORMANCE OBJECTIVE: - *APAC Objective 8*

IMPLEMENTATION OF AERONUTICAL TELECOMMUNICATION NETWORK (ATN) FOR GROUND – GROUND COMMUNICATION NETWORK

Benefits	
Safety	• Will provide reliable means of communication for Air Navigation Services, with the provision of automatic switching capability, in the event of failure of current media
Efficiency	• Routers will have the capability of choosing between different media based on defined criteria. • Multiplicity of protocols used for different communication requirements will be avoided; • Provision for lower case characters and graphic message included;

Strategy

Implementation strategy, short term (2009-2013)

ATM OC COMPONENTS	TASKS	TIME FRAME	RESPONSIBILITY	STATUS
SDM *(ATM Service Delivery Management)*	Ensure implementation of Ground to Ground Aeronautical Telecommunication Network (ATN) in the Asia and Pacific Regions			
	• Review the ATN Implementation Strategy, revise it when necessary taking into account the current developments	2013	ATNICG	Strategy needs to be revised to take into account the emerging communication services like SWIM.
	• Review the Status of implementation of dual stack ATN at the Backbone Boundary Intermediate System hubs	2011	ATNICG	Completed
	• States hosting Backbone Boundary Intermediate Stations to organize Testing of their system on bilateral basis	2013	States hosting Backbone Boundary Intermediate Systems	On-going Planner has been developed to provide up to date implementation and testing status in the region.

	• Implementation of AMHS Off Line Directory Service. Availability of off-line support by Eurocontrol AMC considered essential for the efficient management of AMHS Addresses. ICAO HQ has directed the States to register the operating personnel with AMC. • Update information by the States/Administrations in AMC	2010 Ongoing	ICAO Asia/Pacific Office, AEROTHAI. States	Completed. Off line support by EUROCONTROL AMC established Ongoing. 20 Administrations have registered as on the date of ATNICG/7
	• Completion of Networking with the BIS States	2015	Asia and Pacific Regions States	Some States started implementation and conducted operational trials
	• Review if implementation objectives have been met.	2009 - 2013	ATNICG	ATNICG to periodically review the status and direction in which the implementation is progressing and to ensure that the implementation efforts are leading towards the defined objectives
GPIs	GPI/17: Data link applications, GPI/22: Communication infrastructure			
References	• *Annex 10, Aeronautical Telecommunications, Volume III (Part I – Digital Data Communication Systems)* • *Manual on Detailed Technical Specifications for the Aeronautical Telecommunications Network (ATN) using ISO/OSI (Doc 9880)* • *ICAO Aeronautical Telecommunication Network (ATN) Manual for ATN using IPS Standards and Protocols (Doc 9896)* • *Manual on Required Communication Performance (Doc 9869)* • *Manual of Technical Provisions for the Aeronautical Telecommunication Network (Doc 9705)* • *Regional Implementation guidance materials adopted by APANPIRG*			

ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM

(REGIONAL)

ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM

(REGIONAL)

(Amended in July 2011)

REGIONAL PERFORMANCE OBJECTIVE: *APAC Objective 9*

ENHANCED COMMUNICATIONS AND SURVEILLANCE CAPABILITY IN OCEANIC AREAS

Benefits

Environment	• reductions in fuel consumption and gaseous emissions as a result of efficiency gains;
Safety	• improved monitoring of airspace will result in safety enhancement
Efficiency	• facilitate utilization of advanced technologies (e.g, area navigation, UPRs, DARPs) and ATC decision support tools (e.g., vertical and lateral adherence monitors, short and medium term conflict detection), thereby enhancing safety and increasing efficiency. • enable aircraft to conduct flight more closely to preferred trajectories; • increase airspace capacity by enabling implementation of RHSM using data link;

Strategy
Short term (2009-2011)

ATM OC COMPONENTS	TASKS	TIME FRAME	RESPONSIBILITY	STATUS
AOM *(Airspace Organization and Management)* **CM** *(Conflict Management)* **AUO** *(Airspace Users Operations)*	Improve provision of satellite based communications and surveillance capabilities to enable FANS 1/A data link (ADS-C, CPDLC) to RNP 4 and RCP 240 specifications.			
	• codify/quantify existing anecdotal information and combine with available end-to-end system performance data; to summarise current satellite data link performance;	2009	Regional ANSPS, operators, FITS, CRAs. Communications Service providers (CSP)	Reported to Satellite Operational Continuity Meeting (SOCM/1), Bangkok, Thailand, August 2009
	• identify non conformities in current satellite data link performance against; o specifications in Global Operations Data Link Document (GOLD); o specifications in RCP Manual (Doc 9869); and o specifications in Oceanic SPR)	2009	Regional ANSPS, operators, FITS, CRAs.	reviewed status and identify issues at Satellite Operational Continuity Meeting (SOCM/1), August 2009

	• provide summary information on non conformities in current satellite data link performance to all affected parties in the end-to-end communications chain.	2009	Satellite Operational Continuity Meeting (SOCM) August 2009 to summarize and circulate information to affected parties, including CSP, Ground Earth Station (GES) providers, equipment suppliers and satellite service providers.	Issues identified have been summarized in the report of the first meeting of Satellite Operational Continuity Meeting (SOCM/1).
	• develop a regional strategy and work programme to identify/design suitable long term mitigations and solutions to non conformities that will enable continuous operational compliance with specifications for RNP4 and RCP 240.	2012	Regional ANSPs, operators, FITS, CRAs, CSP, Ground Earth Station (GES) providers, equipment suppliers and satellite service providers.	The Satellite Communication Datalink Service has been improved since late 2009 to some extent. But still does not meet operational requirements satisfactorily.
	• Develop a sample service level agreement for possible use by ANSPs	2012	Regional ANSPs, operators, FITS, CRAs, CSP	SOCM/2 was held in Feb.12. Information has been incorporated in GOLD
	• Implement mitigations and solutions in accordance with timelines in regional strategy	2010	Regional ANSPS, operators, FITS, CRAs, CSP, Ground Earth Station (GES) providers, equipment suppliers and satellite service providers.	State Letter dated 12 July 2010 issued conveying mitigation solution suggested by ICAO
	• monitor implementation progress	2013	Regional FITS, CRAs provide feedback to all affected parties	Assess implementation of mitigation solution in the next relevant meeting (FITASIA)
GPIs	GPI/5: RNAV and RNP, GPI/7: dynamic and flexible ATS route management, GPI/17: data link applications and GPI/22: Communication Infrastructure;			
References	• *Manual on Required Communication Performance (Doc 9869)* • *RTCA DO-306/EUROCAE ED-122, Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace (the "Oceanic SPR')* • *FANS-1/A Operations Manual (FOM)* • *Global Operational Data Link Document (GOLD)* • *Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data Link Systems in the Asia/Pacific Region* • *CEANS Report(2008) on ANS Infrastructure* • *APANPIRG Conclusion 19/24, 20/31, 20/32/20/33, 20/34 and 20/73*			

ASIA/PACIFIC REGION
PERFORMANCE FRAMEWORK FORM
(REGIONAL)

(*Amended in April 2012)*

<table>
<tr><td colspan="6">REGIONAL PERFORMANCE OBJECTIVE: <u>APAC Objective 10</u>

IMPROVED SITUATIONAL AWARENESS AND SURFACE SURVEILLANCE-
IMPLEMENTATION OF THE ADS-B TO GROUND SURVEILLANCE

Benefits</td></tr>
<tr><td>Environment</td><td colspan="5">• Reductions in fuel consumption and subsequent lower gas emissions</td></tr>
<tr><td>Efficiency</td><td colspan="5">• Increased flexibility and flow of traffic operations
• Ultimately, when performing radar-like control, potential redesign of airspace taking into account the application of reduced separation minima, integrate use of aircraft navigation and surveillance capability</td></tr>
<tr><td>Safety</td><td colspan="5">• Introduction of surveillance in a non-radar environment
• Support to search and rescue operations</td></tr>
<tr><td colspan="6">Strategy
Medium Term (2011-2015)
Short term (2010)</td></tr>
<tr><td>ATM OC COMPONENTS</td><td>TASKS</td><td>TIME FRAME STARTED</td><td>RESPONSIBILITY</td><td>STATUS</td><td>REMARKS</td></tr>
<tr><td>AOM
(Airspace Organization and Management)
CM
(Conflict Management)
AUO
(Airspace Users Operations)</td><td colspan="5">Implementation of ADS-B based surveillance service in the sub-regions.</td></tr>
<tr><td>ATM SDM (ATM Service Delivery Management)</td><td>• Compare current technologies with respect to concept of operations, relative costing, technical and operational performance and maturity of alternative technology/solutions (primary, secondary radar including Mode-S, ADS-B, multilateration, ADS-C)</td><td>2009</td><td>ADS-B Study and Implementation Task Force (ADS-B SITF)</td><td>COMPLETED</td><td>Regional Guidance material on comparison of technologies developed and issued, Further updates being proposed.</td></tr>
</table>

	• Develop an implementation plan for near-term ADS-B applications in the Asia Pacific Region including implementation target dates taking into account: o available equipment standards; readiness of airspace users and ATS providers; o identifying sub-regional areas (FIRs) where there is a positive cost/benefit outcome expected for near-term implementation of ADS-B OUT; o developing a standardized and systematic task-list approach to ADS-B OUT implementation; and o holding educational seminars and provide guidance material to educate States and airspace users on what is required to implement ADS-B OUT.	2009-13	ADS-B Study and Implementation Task Force	In progress	The FASID Table CNS 4A and 4B – surveillance and ATM automation being updated; ADS-B Seminar conducted annually in conjunction with Task Force meetings. Potential sub-regions (South China Sea and Bay of Bengal) for using ADS-B and Surveillance data sharing identified; Requirements for avionics specification for the near-term application are developed based on AMC2024, Australian CASA and current version of FAA AC 20-165 document.
	• Develop Guidance Material to support harmonized regulation of ADS-B systems required on board the aircraft.	2010	ADS-B Study and Implementation Task Force	Completed	DGCA Conf.45 through its Action Item 45/3 invited ICAO APANPIRG ADS-B SITF to develop the Guidance material. The GM was developed by Regulators Workshop and ADS-B SITF/9 held in Aug. 2010

	• Study and identify applicable multilateration applications in the Asia and Pacific Region considering: - Concept of use/operations; - Required site and network architecture; - Expected surveillance coverage; Cost of system; Recommended separation minimas; & - If multilateration can be successfully integrated into an ADS-B OUT system for air traffic control	2012	ADS-B Study and Implementation Task Force	In progress	Concept of using multlateration has been developed; Some states have plan in place to introduce multilateration in particular integrate it with A-SMGCS and Terminal area and en-route surveillance application
	• Coordinate ADS-B implementation plan and concept of operations with other ICAO regions where ADS-B implementation is going on and with relevant external bodies such as EUROCONTROL, EUROCARE, RTCA and Industry.	2014	ADS-B Study and Implementation Task Force	On- going	Information on ADS-B in Europe and North American Regions is provided to Task Force Meeting annually; Some Industry representatives provide input at ADS-B Seminar and meetings

	• Develop **Terms of Co-operation** for SEA which will include: • Establishing model documents for possible use by States when - Agreeing to share ADS-B data and DCPC (such as VHF radio voice communication) capability between adjoining States for various ADS-B applications (including a sample letter of agreement); or - Establishing ADS-B avionics fitment mandates Identifying optimum coverage for ADS-B ground stations and associated VHF radio voice communication in the sub-regional FIR boundary areas.	2012	South East Asia and Bay of Bengal (SEA/BOB) Sub-Regional ADS-B Implementation Working Group	In progress	Terms of co-operation updated; sample agreement of data sharing developed further updated Some location for ADS-B ground stations identified. CBA for SEA project has been completed; Implementation plan for Australia-Indonesia and South China Sea Data and VHF communication capacity sharing projects developed .
	• Develop an implementation plan for near- term ADS-B application in SEA which will deliver efficient airspace and increased safety on a sub-regional basis that includes: • Schedule and priority dates to bring into effect ADS-B based services taking into account: - Timing of any equipage mandates; - Timing of any ATC automation upgrades to support ADS-B; - Timing of commissioning of any ADS-B data sharing and associated VHF radio voice communication facilities; • Consideration of major traffic flows.	2013	(SEA/BOB Sub-Regional ADS-B Implementation Working Group	In progress	Major traffic flow from Australia to Singapore through Indonesia and Singapore to Hong Hong along L642 and M771 in South China Sea being progressed. Milestones and timelines have been established. The WG was renamed into SEA/BOB ADS-B WG by APANPIRG/22

linkage to GPIs	GSI-12 Use of Technology to Enhance Safety; GPI/9 Situational Awareness; GPI/5: RNAV and RNP, GPI/7: dynamic and flexible ATS route management, GPI/17: data link applications and GPI/22: Communication Infrastructure;
References	• *Report of AN CONF/11;* • *Global ATM Operational Concept (Doc 9854);* • *Global Air Navigation Plan (Doc 9750);* • *Technical Provisions for Mode S Services and Extended Squitter (Doc 9871)* • *APANPIRG/16, 17, 19, 20,21 reports on ADS-B* • *ADS-B related regional guidance materials adopted by APANPIRG*

ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM

(REGIONAL)

(Amended in July 2011)

<table>
<tr><td colspan="5">REGIONAL PERFORMANCE OBJECTIVE: <u>APAC Objective 11</u>

IMPLEMENTATION OF ATS INTER-FACILITY DATA COMMUNICATION (AIDC) IN ASIA/PACIFIC REGION</td></tr>
<tr><td colspan="5">Benefits</td></tr>
<tr><td>Safety</td><td colspan="4">• Will provide efficient and more reliable means of communication between ACCs in adjacent FIRs for the exchange of traffic coordination related operational messages.
• Significantly reduce the coordination errors observed in controller to controller verbal communication across FIR boundaries thus enhance flight safety</td></tr>
<tr><td>Efficiency</td><td colspan="4">• Increased efficiency for air traffic handover between ATS units
• Will improve ATS direct communication between ATS units along the major traffic
• Will improve the speed and capacity ;
• Will facilitate inter-automation systems communication.</td></tr>
<tr><td colspan="5">Strategy
Short term (2009-2015)</td></tr>
<tr><td>ATM OC COMPONENTS</td><td>TASKS</td><td>TIME FRAME</td><td>RESPONSIBILITY</td><td>STATUS</td></tr>
<tr><td rowspan="5">AOM
(Airspace Organisation and Management)

CM (Conflict management)

SDM (ATM service delivery management)</td><td colspan="4">Facilitate implementation of ATS Inter-facility Data Communication in the Asia and Pacific Regions</td></tr>
<tr><td>• Review the Status of Implementation</td><td>2009</td><td>ATNICG.
ADS-B SITF</td><td>The status to reviewed and updated by ATNICG/4 and ADS-B SITF Meetings held in May 2009</td></tr>
<tr><td>• Review the Options available for the implementation of AIDC in the region. Discuss options adopted by different states.</td><td>2010</td><td>SIP AIDC Seminar</td><td>Options available were reviewed at AIDC Seminar in October 2010</td></tr>
<tr><td>• Review implementation issues related to ATS automation systems and recommend methods of mitigating those issues</td><td>2009</td><td>ADS-B SITF
CNS/MET SG</td><td>The automation issues discussed in the ADS-B SIFT/8</td></tr>
<tr><td>• AIDC Seminar: A Seminar to be conducted to discuss various implementation issues and promote implementation</td><td>2010</td><td>ICAO Asia/Pacific Office</td><td>SIP Seminar was conducted from 12-13 Oct. 2010 in Bangkok</td></tr>
</table>

	• Develop implementation strategy to decide whether to continue pursuing AFTN AIDC or to choose ATN AIDC over OSI or IPS	2010	APANPIRG	ATN AIDC implementation deferred.
	• Trials to be conducted. Monitoring mechanism to be developed	2011	APANPIRG	State Letter be issued urging the States to expedite implementation and status to be monitored.
	• Development harmonized PAN regional ICD for AIDC	2014	APANPIRG and NAT SPG	The Inter-regional Task Force was established in 2012 and work is being progressed.
	• Review to ensure implementation objectives are met.	2009 - 2015	APANPIRG	APANPIRG to periodically review the status and direction in which the implementation is progressing and to ensure that the implementation efforts are leading towards the defined objectives
GPIs	GPI/17: Data link applications, GPI/22: Communication infrastructure			
References	• *Air Traffic Management* (Doc 4444) • *Manual of Air Traffic Services Data Link Applications* (Doc 9694) • *Manual of Technical Provisions for the Aeronautical Telecommunication Network (Doc 9705)* • *Asia/Pacific Regional Interface Control Document (ICD) for ATS Inter-facility Data Communication (AIDC)*			

ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM

(REGIONAL)

(Amended July 2012)

REGIONAL PERFORMANCE OBJECTIVE: *APAC Objective 18*

IMPLEMENTATION OF ICAO PERFORMANCE BASED NAVIGATION PROVISIONS FOR TERMINAL AREA OPERATIONS

Implement ICAO Performance Based Navigation (PBN) provisions for terminal area operations in collaboration with stakeholders based on the Regional PBN Implementation Plan agreed by APANPIRG, to improve terminal area safety and efficiency by use of advanced navigation specifications for SIDs, STARs and instrument approach procedures.

Benefits	
Environment	• reduction in fuel consumption and resulting emissions
Safety	• enhance safety by use of modern capabilities onboard aircraft; • implementation of more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows; • increased airspace safety through the implementation of continuous and stabilized descent procedure using vertical guidance; • improved airport and airspace arrival paths in all weather conditions; and • decrease ATC and pilot workload by utilizing RNAV/RNP procedures and airborne capability and reduce the need for ATC-pilot communication and radar vectoring
Efficiency	• allows for more efficient use of airspace and increase airspace capacity through reduction of lateral and longitudinal separation between aircraft; • increase of predictability of the flight path; • reduced delays in high density airspace and airports through the implementation of additional parallel routes and additional arrival and departure points in terminal areas; • reduces the possibility of missed approaches due to lower approach minima and straight-in procedures; • ability of air navigation service providers to make maximum use of aircraft capabilities; • ability of aircraft to conduct flights more closely to their preferred trajectories; • reduced aircraft flight time due to the implementation of optimal flight paths; • facilitate utilization of advanced technologies thereby increasing efficiency; • optimized demand and capacity balancing through the efficient exchange of information; • reduces the need to maintain sensor-specific route and procedures, and their associated costs; • avoids the need for developing sensor-specific operations with each new evolution of navigation system, which would be cost prohibitive; • GNSS and area navigation based PBN reduces the need for expensive ground-based navigation aids; • clarifies how RNAV systems are used; and • facilitate the operational approval process for operators by providing a limited set of navigation specifications intended for global use.

SAFETY COMPONENTS	TASKS	TIME FRAME	RESPONSIBILITY	STATUS
APANPIRG Conclusion 18/52	**Establishment of a Regional Performance Based Navigation Task Force (PBN/TF)** An Asia/Pacific PBN Task Force, with terms of reference as outlined in Appendix A to the APANPIRG/18 Report on Agenda Item 3.5, be established to develop a PBN implementation plan for the Asia/Pacific Region and address related regional PBN implementation issues.	**PBN TF –** As soon as practicable Regional PBN Implementation Plan – by 2008 (Before APANPIRG-19)	APANPIRG PBN Task Force	Regional PBN/TF established in 2007. PBN T/F meetings: 1st 9–11 Jan 2008 2nd 1 – 3 April 2008 3rd 14-17 July 2008 4th 4-6 March 2009 5th 15-17 July 2009 6th 3-5 Feb..2010 7th 1-3 Sep.2010 8th 12-13 May 2011 9th 27-29 Mar.2012 10th 11-13 Dec.2012 APANPIRG/19 approved the Regional PBN Plan Interim Edition RASMAG reviewed the Plan in Dec 2008 suggested some changes. PBN/TF 4 reviewed RASMAG proposals and incorporated comments in the Version 0.2 of the Plan Plan was further reviewed by: ATM/AIS/SAR/SG/19 ; and CNS/MET/SG /13 Asia/Pac Regional PBN Plan Ver.1.0 was adopted by APANPIRG/20 PBN TF/6 developed revision to the Plan Ver.2.0 PBN TF/8 developed PBN Plan Ver. 3.0

APANPIRG Conclusion 18/53	**Development of State PBN Implementation Plans** The Regional Office should encourage States to begin development of their State PBN implementation plans in harmony with the development of the Asia/Pacific Regional PBN implementation plan being coordinated by the Asia/Pacific PBN Task Force for submission to APANPIRG/19 (2008).	**State PBN Implementatio n Plan** - 2009	STATES PBN TF APAC Office	State PBN Implementation Plan/Road map received from 21 States prior to PBNTF/7. 9 national PBN plans assessed by the PBN Plan Review Team as robust by TF/8, 12 plans reviewed. Total 24 national PBN plans were received by TF/9. Status in Robust 14 (33%)
APANPIRG Conclusion 18/55	**Designation of Contact Person for PBN Implementation** States designate a focal contact person responsible for performance based navigation implementation and provide details of the contact person to ICAO Asia/Pacific Regional Office accordingly.	31 December 2007	STATES APAC Office	28 States and 3 Int'l Organizations have nominated Focal Points As at PBN TF/9, 18 Administrations have not submitted PBN plan.
PBN/TF Report **PBN Report**	**Develop detailed Status (database) regarding current and planned implementation of PBN terminal instrument procedures (SIDs and STARs) and Approaches** **Data Collection – Runway ends /International Aerodromes** **Data Collection – Runway ends /Domestic Aerodromes** **Template developed by PBN TF for reporting progress:** **- Common Template will help in harmonizing the reporting process;** **- States requested to submit PBN Implementation Progress Report by 15 August 2009 for submission to APANPIRG 20.**	 30 June 2008 31 December 2008 15 August 2009 and prior to each future PBN/TF Meeting	 STATE Focal Point STATE Focal Point STATE	ONLY 8 States have provided information Reminders are being sent regularly PBN TF/8 developed an implementation response form to provide information on States PBN procedure development 18 States have submitted PBN Implementation Progress on the new Template.

Strategy **Short term (2008 – 2012)**				
• **TMA–Arrival**	1. RNAV 1 in radar environment and with adequate navigation infrastructure. 2. Basic-RNP 1 in non-radar environment	RNAV 1 STAR for 50% of international airports by 2010 and 75% by 2012. Priority should be given to airports with RNP Approach	STATES APANPIRG PBN TF	
• **TMA-Departure**	1. RNAV 1 in radar environment and with adequate navigation infrastructure. 2. Basic-RNP 1 in non-radar environment	RNAV 1 SID for 50% of international airports by 2010 and 75% by 2012. Priority should be given to airports with RNP Approach	STATES APANPIRG PBN TF	
• **Approach**	1. RNP APCH with Baro-VNAV in most possible airports 2. RNP AR APCH in airport where there are obvious operational benefits.	RNP APCH (with Baro-VNAV) in 30% of instrument runways by 2010 and 50% by 2012. Priority should be given to airports with operational benefits	STATES APANPIRG PBN TF	

Strategy **Medium Term (2013 – 2016)**				
SAFETY COMPONENTS	**TASKS**	**TIME FRAME**	**RESPONSIBILITY**	**STATUS**
• **TMA– Arrival**	1. Expand RNAV 1 or RNP 1 Application 2. Mandate RNAV 1 or RNP 1 approval for aircraft operating in higher air traffic density TMAs	RNAV 1 or RNP 1 STAR for 100% of international airports by 2016 RNAV 1 or RNP 1 STAR for 70% of busy domestic airports where there are operational benefits	STATES PBN TF APANPIRG	
• **TMA- Departure**	1. Expand RNAV 1 or RNP 1 Application 2. Mandate RNAV 1 or RNP 1 approval for aircraft operating in higher air traffic density TMAs	RNAV 1 or RNP 1 SID for 100% of international airports by 2016 RNAV 1 or RNP 1 SID for 70% of busy domestic airports where there are operational benefits	STATES PBN TF APANPIRG	
• **Approach**	1. Expansion of RNP APCH (with Baro-VNAV) and APV 2. Expansion of RNP AR APCH where there are operational benefits 3. Introduction of landing capability using GNSS and its augmentations	RNP APCH with Baro-VNAV or APV in 100% of instrument runways by 2016	STATES APANPIRG PBN TF	This requirement has been modified by Assembly Resolution A37-11, which allows LNAV procedures for airports with no VNAV capable aircraft 5700kg+

Strategy **Long Term (2016 and beyond)**	
In this phase, GNSS is expected to be a primary navigation infrastructure for PBN implementation. States should work co-operatively on a multinational basis to implement GNSS in order to facilitate seamless and inter-operable systems and undertake coordinated research and development programmes on GNSS implementation and operation. During this phase, States are encouraged to consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance. With the expectation that precision approach capability using GNSS and its augmentation systems will become available, States are encouraged to explore the use of such capability where there are operational and financial benefits.	
GPIs	GPI/5: Performance based navigation, GPI/9: Situational awareness, GPI/11: RNP and RNAV SIDs & STARs,
References	• *APANPIRG Decisions and Conclusions n* • *ICAO Guidance Material – Performance-Based Navigation Manual Doc 9613 AN/937 Third Edition – 2008* • *Assembly Resolution 36-23; Resolution A37-11*

CNS/ATM Implementation Planning Matrix

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
AFGHANISTAN									
AUSTRALIA	ATN tests were conducted. BIS Router and Backbone BIS Router and AMHS implemented.	AFTN based AIDC Implemented between Brisbane and Melbourne, Auckland, Nadi and Auckland. AIDC is also in use between Melbourne and Mauritius.	Implemented and integrated with ATM systems to support FANS1/A equipped aircraft.	Implemented	Implemented		A total of 29 UAP and 28 WAM stations are used to provide a 5 Nm separation service using ADS-B mandate at/above FL290 from 12/2013 for domestic & foreign aircraft. A forward fit ADS-B mandate also applies from 2/2014 for all IFR aircraft at all flight levels. An ADS-B for all IFR aircraft applies from 2/2017. ADS-B data sharing with Indonesia operational since 2/2011. Mandates for additional flight level are considered for 2015 & 2017. WAM is operating in Tasmania since 2010 delivery 5 Nm separation service.	FANS 1/A ADS-C implemented	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
							WAM is also operating in Sydney for 3 Nm separation service in TMA and for precision runway monitoring function. ADS-B data sharing with Indonesia operational since 2/2011. ASMGCS using multilateration is operational in Brisbane, Sydney & Melbourne. It is being installed in Perth.		
BANGLADESH	Bangladesh has already installed ATN/AMHS at Dhaka. Commissioning & SAT Completed in March 2013. Official correspondences are going on for the ATN/AMHS link between Dhaka and Mumbai. BIS Router and AMHS planned for 2011.	AIDC between Dhaka and Chittagong Dhaka and Sylhet planned for 2013.		Not yet planned	RNAV design is in progress.	RNAV design is in progress	Bangladesh has a plan to commission two ADS-B ground stations to be installed at Dhaka and Cox's Bazar Airports by December 2015.	Not yet planned	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
BHUTAN	ATN BIS Router and UA service 2011.					Procedures developed for NPA.			
BRUNEI DARUSSALAM	ATN BIS Router planned for 2012 and AMHS planned for 2012								
CAMBODIA	BIS Router and AMHS planned for 2011. AMHS installation is in progress and will be tested with Bangkok soon.	Planned 2009	Planned 2009			Procedure developed for NPA.	3 ADS-B ground stations have been installed in Cambodia since 2011 and able to provide full surveillance coverage for Phnom Penh FIR		

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
CHINA	ATN Router and AMHS deployed in 2008. Tripartite BBIS trial completed with Bangkok and Hong Kong, China in Jan. 2003. ATN trial with Hong Kong using XOT over internet conducted in 2006, Further trials conducted in 2009. Plan for ATN/AMHS implementation with Hong Kong, China (2013). AMHS/ATN technical tests with Macau completed in 2009. Plan for ATN/AMHS implementation with Macau, China (2013). ATN/AMHS circuit with ROK put into operational use since June 2011. ATN/AMHS tests with India are on-going. ATN and AMHS technical trial with Mongolia is TBD. Connection tests with Thailand is 2014 Connection tests with Nepal in 2013.	AIDC between some of ACCs within China has been implemented. AIDC between several other ACCs are being implemented. AIDC between Sanya and Hong Kong put in to operational use in Feb 2007. AIDC between Qingdao and Incheon planned for 2013.	Implemented to ATS Rout. L888 route, Trial on HF data link conducted for use in western China.	Implemented in certain airspace. L888, Y1 and Y2 routes. Total distance of air route with PBN is around 10.4 thousand km. which is approximately 7% of national route distance in China. 4 RNAV10 routes have been implemented in Sanya FIR. RNP 4 has been implemented for ATS routes from Lhasa to Ali, and from Xining to Yushu and Europe-Asia route.	RNAV (GNSS) implemented in certain airports. Beijing, Guangzhou, Tianjin.	Ali, Linzhi and Lhasa airports	5 UAT ADS-B sites are used for flight training of CAFUC. Chengdu-Jiuzhai project finished in 2008 with 2 ADS-B stations and additional site is planned to enhance the surveillance coverage. Chengdu - Lhasa route surveillance project completed with 5 ADS-B stations using 1090ES since 2010. Trials planned from May 2011. 1 ADS-B site installed in Sanya FIR since 2008. 3 additional ground stations planned, Trial planned for Jun, 2011.	FANS 1/A based ADS-C implemented L888 route.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
HONG KONG, CHINA	ATN and AMHS technical trial with Japan conducted in 2003. 64 Kbps ATN Link with Bangkok put into operational use in June 2004. Preliminary ATN/AMHS technical trials with China (Beijing) using VPN over Internet connection in 2006. Operational AMHS commissioned in July2009. ATN/AMHS circuit with Macao put into operation use in Dec. 2009. ATN/AMHS interoperability tests with other adjacent communications centres commenced in late 2009, viz Taibei (2009), Thailand (2012), Japan ((Planned Q3/2016), Philippines (Planned Q2/2015) and Viet Nam (Planned Q4/2014) Plan for ATN/AMHS implementation with China (2013) and Taibei (2013).	AFTN-based AIDC with Sanya put into operational use in Feb. 2007. AIDC trial with other adjacent ATS authorities for new ATC system to be commissioned by 2013. AIDC technical trial with Taibei conducted in 2010 and completed in 2012 and put into operational use in Nov. 2012.	FANS 1/A based CPDLC trials completed in 2002. VDL Mode-2 technical trial conducted in 2002. D-ATIS, D-VOLMET and 1-way PDC implemented in 2001. PDC service upgraded to 2-way data link in June 2008.	Implemented in certain airspace RNP4 Enroute (>FL290 in 2014)	Implemented in certain airspace Basic RNP-1 for SIDs and STARs in 2013.	RNAV (GNSS) departure procedures implemented in July 2005. RNP AR APCH procedures for 07L/25R runways implemented in June 2010.	A larger-scale A-SMGCS covering the whole Hong Kong International Airport put into operational use in April 2009. Data collection/ analysis on aircraft ADS-B equipage in Hong Kong airspace conducted on quarterly basis since 2004. ADS-B trial using a dedicated ADS-B system completed in 2007. ADS-B out operations over PBN routes L642 and M771 at or above FL 290 within HK FIR are planned in December 2013 and within HK FIR at or above FL 290 in December 2014 ADS-B trial using ADS-B signal provided by Mainland China to cover southern part of Hong Kong FIR commenced in 2010	FANS 1A trials for ADS-C completed in 2002.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
MACAO, CHINA	ATN/AMHS interoperability test with Beijing commenced in March 2009. ATN/AMHS circuit with Hong Kong put into operational use in end Dec. 2009.								ATZ within Hong Kong and Guangzhou FIRs. In ATZ full VHF coverage exist. Mode S MSSR coverage available for monitoring purposes.
COOK ISLANDS									
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	The ATN BIS Router and AMHS to be implemented in 2011.	With neighboring ACCs to be implemented TBD		Implemented in certain ATS routes G711, B467		RNAV (GNSS) Non-precision approach to be implemented in 2011.	ADS-B has been used as back-up surveillance of SSR since 2008.		
FIJI ISLANDS	ATN BIS Router and AMHS implemented	AFTN based AIDC implemented between Nadi, Brisbane, Auckland and Oakland.	Implemented and integrated with ATM systems to support FANS1/A equipped aircraft.	Implemented		Implemented	ADS- B /multilateration ground stations installed. Situations awareness service will be provided in 2013.	FANS 1/A ADS-C implemented .	

				Navigation*					
State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AIDC	CPDLC	En-route	Terminal	Approach	ADS-B/ Multilateration	ADS-C	Remarks
FRANCE ***(French Polynesia Tahiti)***		Implementation of limited message sets with adjacent centres under discussion.	FANS-1. Implemented since 1996.					FANS 1/A ADS-C implemented since March 1999.	
INDIA	MUMBAI – SINGAPORE – BBIS – Circuit Implemented MUMBAI – PAKISTAN – BIS – Initial Operational Trial Completed MUMBAI – CHINA – Under operational trials MUMBAI – OMAN – BIS - Presently AFTN over TCP/IP MUMBAI – THAILAND – BBIS - Initial Operational Trials completed. MUMBAI AMHS – Commissioned in APRIL 2011	* Major Indian airports and ATC centres have integrated ATS Automation Systems having AIDC capability. AIDC Trials are under among all Area Control Centres and other 32 Aerodromes within India. AIDC Trials are planned with Kuala Lumpur (Malaysia), Karachi (Pakistan) and Muscat (Oman), depending on the resolving of technical issues.	FANS-1/A based ADS-C and CPDLC system is in operation in Mumbai, Chennai, Delhi and Kolkata FIRs since 2005-2006.	India's SBAS system call GAGAN is being developed. The certified system will be available in the second half of 2013. SBAS procedure for six identified airports are being designed.	PBN based RNAV-1 standard instrument arrivals (STAR) procedures have been implemented at nine Major Airports.	India is planning to implement 38 RNP APCH procedures with LNAV and LNAV/ VNAV minima at major airports. At some airports these approach procedures will be linked with RNP-1 STARs. At Cochin for RWY 27, PBN procedures with vertical guidance are established.	ASMGCS (SMR + Multilat) is operational at Delhi, Mumbai, Chennai, Kolkata, Bangalore and Hyderabad Airports. ASMGCS is also being installed at 05 more international airports. ADS-B Ground Stations installed at 14 locations in phase one across continental and Oceanic airspace at Port Blair. 07 more ADS-B Ground stations in phase two in 2014. Wide area Multilateration pilot project is being planned in Kolkata TMA to augment the	FANS-1/A based ADS-C and CPDLC system is in operation in Mumbai, Chennai, Delhi and Kolkata FIRs since 2005-2006.	

				Navigation*					
State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AIDC	CPDLC	En-route	Terminal	Approach	ADS-B/ Multilateration	ADS-C	Remarks
							surveillance coverage. Project is in planning stage.		
INDONESIA	ATN BIS Router and AMHS planned for trial in 2009. Trial with Singapore planned. ATNBIS Router and AMHS are still on going trial with Singapore planned to complete by 2012. (Part D: AMHS Commission)	Brisbane and Makassar in planned in June 2009. Makasar and Brisbane is still on going trial AIDC, planned operational in 2011	FANS-1/A. CPDLC in Ujung Pandang FIRs already trial start from 2008 and will be implemented in 2009. FANS-1/A CPDLC in Ujung Pandang FIRs is completely trial operational and will be full operational for designated route on September 2010.				30 Ground Station successfully installed. Since 2009, ATC Automation in MATSC has capabilities to support ADS-B application. ADS-B Task Force team established to develop planning and action concerning ADS-B Implementation within Indonesia FIR	FANS-1/A ADS-C trial planned at Jakarta and Ujung Pandang ACC in 2007. FANS-1/A ADS-C in Ujung Pandang FIRs is completely trial operational and will be full operational in September 2010.	
JAPAN	ATN BBIS router and AMHS installed at 2000. Connection tests with USA 2000 - 2004 and put into operational use in 2005. ATN BBIS router (to apply to Dual Stack) and AMHS (to upgrade in 2015. The	AFTN based AIDC implemented with Oakland, Anchorage, Incheon and Taibei. Planned between Fukuoka ACC and Shanghai ACC for 2014.	FANS1/A system Implemented in Fukuoka FIR.	SBAS implemented RNAV5 implemented. RNP AR Approach implemented	RNAV1 implemented Basic RNP implemented	RNP Approach implemented	Two Multilateration Systems have been implemented at Narita and Haneda airports. Multilateration Systems have been implemented at five	FANS 1/A. ADS-C implemented in Fukuoka FIR.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
	connection test with each country which is not currently connecting is started after update.						airports and are being implemented at three airports. PRM (WAM) is planned to be implemented at Narita Airport. (Operation will start in 2014).		
KIRIBATI									
LAO PDR	ATN BIS Router and AMHS completed planned for implementation with Bangkok in 2010.	AIDC with Bangkok planned for 2010.		Implemented. Planned for 2011.					
MALAYSIA	ATN BIS Router completed 2007. AMHS planned in 2012.	AFTN AIDC planned with Bangkok ACC – TBD. AIDC between Kuching and KK FIR already implemented. For Kuala Lumpur FIR, will be implemented by end of 2013.	On trial since July 2008. On 7 oceanic ATS routes i.e. P628, L510, L645, L627, N571, B466 and P574 within the Kuala Lumpur FIR. Implemented in 2011.	Implemented for Oceanic Routes. RNAV-5 domestic Routes implementation in progress and partially implemented.	Basic RNAV implemented	RNP AR APCH for WMKP and WBGG in progress, will be implemented by middle 2013. Other airports next.	Malaysia planned to start mandate ADS-B requirement in KL FIR in 2018 and ADS-B implementation on 2020. Implementation of ADS-B proposed in 2010 - 2015.	FANS 1/A ADS-C already implemented for Bay of Bengal area. Implemented since July 2008 on 7 oceanic ATS routes within KL FIR.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
MALDIVES	Planned for 2015 as existing AFTN was upgraded recently to make it compatible with protocols of interconnected AMHS systems and the flight plan format 12.	System is AIDC ready. Trials with neighbouring ACC's planned for 4th quarter of 2013.	System is put on TEST as experiencing difficulty in establishing connection with all the aircrafts due to system software problem.	Planned for completion in 2012	PBN based SIDS and STARS implemented	RNP approach implemented at Ibrahim Nasir Int'l Airport	ADS-B receivers installed to cover most part of FIR. System's data fusion to be completed in 3rd quarter of 2013.	Implemented since 2008. New software upgrade in progress and planned for completion in Aug. 2012	
MARSHALL ISLANDS						NPA implemented at Majuro Atoll.			
MICRONESIA (EDERATED STATES OF)									
Chuuk				Implemented					
Kosrae				Implemented					
Pohnpei				Implemented					
Yap				Implemented					
MONGOLIA	AMHS/AFTN gateway is implemented in first quarter of 2012. ATNBIS router will be implemented in 2013. Coordinating with China on ATN/AMHS connection technical trial target date TBD.	ATM automation system supports AIDS and OLDI. Coordinating with Russia on OLDI connection in target date TBD. Coordinating with China on AIDC connection	Function available. Regular trials are conducted.		GPS procedures are being developed and implemented at 10 airports.		Five ADS-B ground stations for combination with SSR will be implemented first quarter of 2013. Full coverage for surveillance gaps will be implemented by 2015-2016.	FANS 1/A ADS-C implemented since August 1998.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
		technical trial target date TBD.							
MYANMAR	AMHS implemented Nov. 2011	Plan to support AIDC to the ATM automation system at 2013	Implemented since August 1998. Software upgrading and integration to ATC automation will be completed in 2012.	Three new DVOR installation have been completed by 2012 and plan to operate in 2013.	New ILS system at YGN Int'l AP finished installation by 2012 and plan to operate in 2013.		Plan to implement two ADS-B ground stations at the end of 2012.	Implemented since August 1998. Software upgrading and integration to ATC automation will be complete in 2012.	
NAURU									
NEPAL	BIS Router and AMHS planned for 2011.	AFTN/AMHS based AIDC between KTM-CAL, KTM-BAN, KTM-LHASA planned for 2011.			GPS departure and approach has been developed for 8 airports and planned for implementation in 2008.		ADS-B feasibility study planned for 2007.		

				Navigation*					
State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AIDC	CPDLC	En-route	Terminal	Approach	ADS-B/ Multilateration	ADS-C	Remarks
NEW CALEDONIA	New router and AMHS planned at the end of 2013 with Nadi				Arrival GNSS based RNAV procedures have been developed by for La Tontouta Airport		Three ADS-B ground stations commissioned in 2010 to cover international traffic at La tontouta airport serving Tontouta ACC & APP. It is used for Situation awareness and SAR.		
NEW ZEALAND	Some external AMHS connections 2014.	AFTN based AIDC implemented between New Zealand, Australia, Fiji, Tahiti, Chile and USA.	FANS-1/A. Implemented	Will be implemented as required.	RNAV procedures being implemented as developed.	RNP AR APCH implemented at Queenstown (NZQN).	MLAT being used in Queenstown area (WAM) and Auckland (airport surface movements). ADS-B data available from all MLAT & SSR sites.	FANS 1/A Implemented	
PAKISTAN	ATN/AMHS considered as Phase II implemented since 2010.	Implemented between Karachi and Lahore ACCs Plan to implement AIDC with Mumbai and Muscat for December 2010	Implementation planned from 2005-2010.	Planned for 2005-2010.	RNAV arrival and departure procedure being developed.	NPA (RNP) procedure are being developed and under flight inspection.	Feasibility study for using ADS-B is in hand. One station was installed at ACC Karachi and evaluation is in progress.	Planned for 2005-2010.	Existing Radar system being upgraded.

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
PAPUA NEW GUINEA	Plans to create a newly duplicated digital communications line connecting with existing and new sites and replacing AFTN switch with a AMHS before 2015	Implemented with Australia in April 2011	Plans for new ATM system supporting CPDLC by 2015	Implemented	GNSS based RNAV procedures have been developed by for five airports.	GNSS NPA approach implemented at 22 aerodromes.	Legislation mandating ADS-B and guidelines for aircraft equipage and operational approval to be issued by 31/12/2011 with target mandatory date by mid-2015 and plans to provide ADS-B service above FL245 within Port Moresby FIR and also in specific higher traffic areas domestically.	Plans for new ATM system with ADS-C within UTA airspace by 2015	
PHILIPPINES	ATN G/G BIS Router/AMHS installed in 2006. Pending AMHS Interoperability tests moved to Q3/2015 both for Singapore and Hong Kong. AMHS trials with Singapore by end 2012 and Hong Kong planned in 2012.	Planned for 2013.	CPDLC Planned for 2011. Trials on-going.	New ACC on test.	RNAV routes of MLA. MACTAN for FLT validation.		Two ground stations scheduled for implementation in 2013.	FANS 1/A ADS-C planned for 2013.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
REPUBLIC OF KOREA	ATN/AMHS circuit with China put into operational use in June 2011. ATN/AMHS test with Japan to be conducted	AFTN based AIDC implemented between ACC and Fukuoka ATMC. AIDC between Incheon and Qingdao to be implemented.	PDC & D-ATIS implemented 2003.	Two RNAV5 routes were implemented in 2011. More RNAV5/2 routes will be implemented gradually.	RNAV1 SID/STAR were partially implemented at GIMPO and INCHEON airports. More SIDs/STARs will be implemented gradually.	RNP approaches with Baro were implemented at GIMPO airport in 2011. More RNP approaches with Baro will be implemented gradually.	ADS-B implemented 2008 for SMC in Incheon International Airport.	FANS 1/A based ADS-C implemented since 2003 for contingency purpose.	
SINGAPORE	AMHS implemented. ATN Router trial with Malaysia completed in 2007 ATN/AMHS circuit with India put into operational use in March 2011. Completed ATN/AMHS trial using VPN over internet with Bahrain in 2011. On-going ATN/AMHS trial with Thailand and planned to complete by 2012. ATN/AMHS circuit with UK put into operational use in March 2012.	AFTN based AIDC to be implemented	Implemented since 1997. Integrated in the ATC system in 1999.		RNAV SIDS and STARS implemented in 2006.	NPA Procedure implemented in 2005.	The airport MLAT system was installed in 2007 and “far-range” ADS-B sensor was installed in 2009.	FANS 1/A ADS-C implemented since 1997. Integrated with ATC system in 1999.	

				Navigation*					
State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AIDC	CPDLC	En-route	Terminal	Approach	ADS-B/ Multilateration	ADS-C	Remarks
SRI LANKA	ATN BIS Router Planned for 2013. AMHS (Domestic) and AMHS/AFTN Gateway implemented by Oct. 2011.	Trials with Male' planned in 2013.	Implemented (FANS 1/A based)	14RNAV10 routes already established. 05 RNAV5 routes to be established in 2013. Upgrade airspace above FL225 to RNAV10 and introduce RNP4 routes in a phased manner within 2013-2016.	GNSS based RNAV-1 SIDS and STARS trials being conducted. To be implemented in a phased manner within 2013-2016.	Introduction of RNP APCH (with Baro-VNAV) in a phased manner with 2013-2016. GNSS based Precision Approaches planned beyond 2016.	ADS-B Trials planned for 2012 and implementation in 2013.	Implemented (FANS 1/A based) .	Information pertaining to Navigation are based on the PBN Implementation plan of Sri Lanka .
THAILAND	BBIS/BIS Routers already implemented. AMHS has been implemented. Trial with other BBIS States; Singapore, India and Hong Kong China are ongoing. ATN/AMHS operational links for Singapore, India and Hong Kong, China are planned for completion by Q4 2013	AFTN based AIDC planned for TBD. (as a part of new ATM system)	FANS-1/A Implemented.	Under implementation	Implemented at Phuket Airport	Implemented at Phuket	Multilateration implemented in 2006 at Suvarnbhumi Int'l. Airport. ADS-B is planned to be part of future surveillance infrastructure.	FANS 1/A ADS-C Implemented .	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
TONGA	AMHS planned for 2008. The provider is linked to the New Zealand AFTN				RNAV procedures planned for 2013-2014	NPA planned for 2007. RNP AR APCH planned for 2013-2017	Trial planned for 2017		CPDLC and ADS-C is not considered for lower airspace
UNITED STATES	AMHS implemented. (Salt Lake City & Atlanta)	AFTN based AIDC implemented.	FANS-1/A based CPDLC implemented.	Implemented	Implemented		481 ADS-B radio sites of approximately 700 planned operational from 4 April 2013. 81 Radio Stations under construction or in Final Design (77 in CONUS; 4 in AK) 342 Radio Stations constructed (313 in CONUS; 29 in Alaska) 326 Radio Stations Reporting on the SBS Network (297 in CONUS; 29 in AK) 275 Operational Radio Stations WAM implemented in areas of Colorado for 5nm separation services.	Implemented	
VANUATU									

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
VIET NAM	BIS Routers planned for 2009. ATN/AMHS trial in 2010 and operation in 2012. ATN BIS Router AMHS in 2013	AFTN based AIDC implemented in 2009. Trial for ATN based AIDC planned in 2010. Trial for AIDC in 2012. Plan to implement in 2013	CPDLC operational trial conducted in early 2007. Implemented in 2007	For en-route TBD.	RNAV	GBAS 2015	2013	FANS 1/A ADS-C operational trial conducted for oceanic area of Ho Chi Minh FIR since March 2002. FANS 1/A implemented in 2007	

* Navigation – Navigation including Performance Based Navigation (PBN), APV and precision approach

Agenda Item 3: Performance Framework for Regional Air Navigation Planning and Implementation

3.5. REVIEW OF THE SEVENTEENTH MEETING OF THE MET SUB-GROUP

3.5.1 History of the meeting

3.5.1.1 The Seventeenth Meeting of the Meteorology (MET) Sub-Group (MET SG/17) of APANPIRG was held in Bangkok, Thailand, from 13 to 16 May 2013. The meeting documentation, including papers reviewed and the final report is available at the webpage:
http://www.bangkok.icao.int/cns/meeting.do?method=MeetingDetail&meeting_id=279

3.5.1.2 MET SG/17 was attended by 53 experts from 22 States plus the International Air Transport Association (IATA).

3.5.1.3 This was the first time for the MET SG to meet separately from the (former) CNS/MET SG, in accordance with the new APANPIRG structure (APANPIRG/22 Decision 22/52 refers).

3.5.1.4 In accordance with the revised APANPIRG Procedural Handbook (Fourth Edition, February 2012) MET SG/17 elected a new chairperson, Ms Sue O'Rourke, and new vice chairperson, Dr Cheng Cho Ming. Mr Peter Dunda, ICAO Regional Officer Aeronautical Meteorology, acted as secretary of MET SG/17.

3.5.1.5 MET SG/17 adopted 14 Agenda Items, considered 28 Working Papers and 23 Information Papers in its discussions and formulated 2 decisions for action by the MET SG and 2 Draft Decisions and 4 Draft Conclusions for consideration by APANPIRG.

3.5.2 Follow-up on previous APANPIRG meetings

3.5.2.1 MET SG/17 noted that action required by 5 of the 9 MET-related Decisions/Conclusions from APANPIRG/23 was considered complete and action against 4 Conclusions was in progress. In the Report on Agenda Item 1.2, APANPIRG/24 noted that, post MET SG/17, action was considered complete against 7 MET-related Decisions/Conclusions. Further details are provided in Appendix A to the Report on Agenda Item 1.2.

3.5.2.2 MET SG/17 noted that action required by 2 out of the 10 outstanding MET-related Decisions/Conclusions stemming from APANPIRG/22 or earlier was considered complete and action against the remaining 8 was in progress. In the Report on Agenda Item 1.3, APANPIRG/24 noted that, post MET SG/17, action was considered complete against 3 outstanding MET-related Decisions/Conclusions. Further details are provided in Appendix A to the Report on Agenda Item 1.3.

3.5.2.3 In relation to APANPIRG Conclusions 21/46 and 22/42, although the follow-up actions were considered partially complete, MET SG/17 decided that additional information should be forwarded to the WAFSOPSG (in the form of a working paper for consideration by WAFSOPSG/8) to ensure that the required follow-up actions were fully addressed.

3.5.3 Relevant Action Items of 49th DGCA Conference

3.5.3.1 MET SG/17 reviewed action items from the 49th Conference of Directors General of Civil Aviation (DGCA/49), APAC Region, and noted DGCA/49 Action Item 49/1; under DGCA/49 agenda item 3 – *Air Navigation Planning and Implementation*, which was of direct relevance to the activities of the MET SG.

3.5.4 Outcomes of AN Conf/12 on related issues

3.5.4.1 MET SG/17 reviewed outcomes from the twelfth air navigation conference (AN Conf/12) and noted that the Council proposed follow-up to the AN Conf/12 Recommendation 4/7 – *ICAO aviation system block upgrades relating to meteorological information*, and noted the draft conclusions for adoption by APANPIRG/24 to enable States, organizations and ICAO to initiate and take action on the AN Conf/12 recommendations.

3.5.5 Outcomes of meetings of other related Sub-Groups of APANPIRG

3.5.5.1 MET SG/17 reviewed relevant issues from the third meeting of the APAC seamless Air Traffic Management (ATM) Planning Group (APSAPG/3) and discussed the reference to the implementation of Aviation System Block Upgrades (ASBU), Block B0-AMET – *Meteorological Forecasts, Warnings and Alerts* within the draft seamless ATM plan.

3.5.6 World Area Forecast System (WAFS)

3.5.6.1 MET SG/17 reviewed updates to the work plan of the WAFS Task Force (WAFS TF) and the WAFS service reference document presented by the chairman of the WAFS TF.

3.5.6.2 MET SG/17 discussed the results of a survey conducted by the WAFS TF (December 2012 to mid-January 2013) on the operational use and training needs of WAFS in the APAC Region, which showed that more States/Territories were receiving and using GRIB2[1] WAFS data (compared to the previous survey) but some States/Territories expressed difficulty in migrating from GRIB1[2] to GRIB2 data by the GRIB1 cessation date.

3.5.6.3 In view of the survey results highlighted in 3.5.6.2, above, APANPIRG/24 adopted the following conclusion:

Conclusion 24/48 – Migration to WAFS gridded global forecasts in WMO GRIB Edition 2 code form as soon as possible

That, in view of the cessation of GRIB1 on 14 November 2013, States be invited to:

a) urgently migrate to receiving, decoding and using the WAFS gridded global forecasts in WMO GRIB Edition 2 code form as soon as possible, if they have not already done so; and

b) if required, urgently contact their workstation/software providers or consider contacting another State already using the GRIB2 datasets for assistance in migrating to GRIB2.

Note: States who feel unable to migrate prior to 14 November 2013 should advise ICAO as soon as possible.

3.5.7 WIFS & SADIS/Secure SADIS FTP

3.5.7.1 MET SG/17 reviewed an analysis of SIGMET information received from the Satellite Distribution System (SADIS) and WAFS Internet File Service (WIFS) during the period 1-28

[1] WMO Gridded Binary Edition 2 Code Form
[2] WMO Gridded Binary Edition 1 Code Form

February 2013, presented by the WAFS TF chairman, and noted that, although most (75.2%) of the SIGMET messages were available from both SADIS and WIFS, there were a substantial proportion (24.8%) only distributed by one of the two systems, SADIS or WIFS.

3.5.7.2 In consideration of the results above, MET SG/17 recalled that Annex 3 — *Meteorological Service for International Air Navigation* includes provisions to ensure that, where required by regional air navigation agreement, meteorological watch offices (MWOs) send SIGMET messages to the relevant Regional OPMET Data Base (RODB) for routing to the WIFS and SADIS Provider States, who have a policy of making all information received at the WIFS and SADIS OPMET Gateways available on their respective services. MET SG/17 also noted that OPMET data should be routed to both Provider States, not just one, as all MET bulletins received are not routinely shared between the two Provider States (due to the overheads associated with bandwidth and maintaining routing tables etc.)

3.5.7.3 In view of the discussion above on the availability of SIGMET information, APANPIRG/24 adopted the following conclusion:

Conclusion 24/49 – Improvements to SIGMET Implementation and Distribution

That, the ICAO be invited to urge:

a) MWOs to improve upon the compliance and availability of SIGMET information; and

b) Regional OPMET databanks to ensure that all SIGMET data is forwarded to the SADIS and WIFS Providers in accordance with section 1.2.2 of Appendix 6 to ICAO Annex 3 — Meteorological Service for International Air Navigation.

3.5.7.4 MET SG/17 reviewed the status of WIFS user accounts assigned to the APAC Region. The WIFS Provider State reminded MET SG/17 that user States are responsible for arranging access to WIFS and that any request for new WIFS accounts, or changes to existing WIFS accounts, must be approved by the State's meteorological authority or their designee. Furthermore, the WIFS Provider State coordinates with the SADIS Provider State for approval of backup services to WIFS.

3.5.7.5 In view of the importance expressed by the WIFS Provider State in maintaining up-to-date point of contact information for States' designated WIFS approvers, MET SG/17 decided to invite the secretary to take custodianship and future upkeep and reporting of a list of the approving officials, or designees, to approve requests within respective States for new WIFS accounts, or changes to existing accounts.

3.5.8 Regional Implementation of International Airways Volcano Watch (IAVW)

3.5.8.1 MET SG/17 reviewed recent global discussions on the enhancement of volcanic activity reports and implementation of the Volcano Observatory Notice for Aviation (VONA), noting that the International Airways Volcano Watch Operations Group (IAVWOPSG) has been promoting the use of the VONA format to facilitate efficient and effective notification of volcanic activities.

3.5.8.2 In view of the discussion above, and noting the introduction of a reference to the use of the VONA format in Amendment 76 to ICAO Annex 3 — *Meteorological Service for International Air Navigation*, APANPIRG/24 adopted the following conclusion:

Conclusion 24/50 – Use of VONA format

That, States be invited to consider ways to ensure implementation of the VONA format to report volcanic activities by Volcano Observatories.

3.5.9 Regional Implementation of Tropical Cyclone Watch

3.5.9.1 MET SG/17 noted that, as one of the four designated Tropical Cyclone Advisory Centre (TCAC) provider States in the APAC Region, Japan is developing its tropical cyclone advisory system to provide advisory information in graphical format (TCG), in addition to the text-based advisory information, in accordance with requirements introduced in Amendment 75 to Annex 3 – *Meteorological Service for International Air Navigation*, which became applicable from 15 November 2010.

3.5.10 Review of the MET/H TF/3 meeting

3.5.10.1 MET SG/17 reviewed outcomes of the third meeting of the Meteorological Hazards Task Force (MET/H TF/3), formerly known as the Meteorological Advisories and Warnings Implementation Task Force (METWARN/I TF), which was held in Bangkok, Thailand, from 13-15 March 2013, and noted the election of a new co-chairperson, Mr Pak-wai Chan, for the MET/H TF and that a second co-chairperson was required to be elected for the next MET/H TF meeting. The MET/H TF/3 meeting documentation including papers reviewed and the final report is available at the webpage: http://www.bangkok.icao.int/cns/meeting.do?method=MeetingDetail&meeting_id=270.

3.5.11 Implementation of advisories and warnings

3.5.11.1 MET SG/17 noted improvements to the format of SIGMET information provided by Australia, changes to the arrangements for the provision of tsunami information for the Indian Ocean to assist the respective national authorities to issue warnings and public safety information within their borders and a method for providing SIGMET for radioactive clouds utilizing current practices in the United States for volcanic ash clouds.

3.5.11.2 As part of the follow-up to APANPIRG/23 Decision 23/48, the MET SG/17 reviewed information on space weather outlining the role of the IAVWOPSG in overseeing the development of operational requirements for space weather products, guidelines/guidance to support potential future provisions on space weather and a draft concept of operations for the provision of space weather information. MET SG/17 also noted information on the organization, role and capability of the United States' Space Weather Prediction Center (SWPC) to provide information on space weather in support of international air navigation.

3.5.12 Review of the METWSG SIGMET advisory

3.5.12.1 MET SG/17 noted that the proposal for a global or multi-regional SIGMET advisory system to improve the issuance of SIGMET in regions with deficiencies will be discussed at the next meeting of the Meteorological Warnings Study Group (METWSG) in June 2013 and a final concept of operations is envisaged for endorsement at the proposed MET Divisional Meeting in July 2014.

3.5.13 Regional SIGMET Guide

3.5.13.1 MET SG/17 reviewed proposed changes to the SIGMET Guide and provided suggestions for additional changes, including examples covering SIGMET cancellation, to be incorporated in the next major amendment of the SIGMET Guide, and agreed that updates should be finalized after consideration of any relevant outcomes from the METWSG/5 meeting, which will review generic guidance being developed for regional SIGMET guides, and in time for the applicability of relevant provisions in Amendment 76 to Annex 3 — *Meteorological Service for International Air Navigation*.

3.5.14 Review of the ROBEX TF/11 meeting

3.5.14.1 MET SG/17 reviewed outcomes of the eleventh meeting of the Regional OPMET Bulletins Exchange Working Group (ROBEX WG/11), formerly known as the OPMET management task force (OPMET/M TF), which was held in Bangkok, Thailand, from 11-13 March 2013, and noted that the working group had elected a new chairperson, Ms Sujin Promduang, to commence at the next meeting of the ROBEX WG. The ROBEX WG/11 meeting documentation including papers reviewed and the final report is available at the webpage:
http://www.bangkok.icao.int/cns/meeting.do?method=MeetingDetail&meeting_id=269.

3.5.14.2 MET SG/17 noted that the activities to be undertaken under the revised work programme of the ROBEX WG include:

- Improving the availability of OPMET data;
- Improving the timeliness and regularity of OPMET exchange;
- Identifying gaps in process, procedures and OPMET exchange;
- Review of the guidance material relating to OPMET data;
- Facilitating and monitoring the migration to AIM and the new MET codes such as XML; and
- Review of the RODB structure.

3.5.15 Regional SIGMET tests and VAAC back-up tests

3.5.15.1 MET SG/17 reviewed results of SIGMET tests in the APAC Region in November 2012 and noted with concern that 7 States/MWOs have not participated in any WS SIGMET test conducted since 2006, i.e., Afghanistan/Kabul, Bangladesh/Dhaka, Nauru, Nepal/Kathmandu, Papua New Guinea/Port Moresby, Solomon Islands and Sri Lanka/Colombo.

3.5.15.2 In view of the results discussed above, and noting that, according to the regional air navigation plan, MWOs are not implemented in Nauru and Honiara (Solomon Islands) but SIGMET should be issued by Port Moresby (Papua New Guinea) on behalf of Solomon Islands and Nauru, APANPIRG/24 adopted the following conclusion:

Conclusion 24/51 – Assessment of bilateral agreements for the provision of SIGMET services

That, in coordination with ICAO, States to investigate and assess the feasibility of implementing effective bilateral agreements for the provision of SIGMET services as a corrective action towards resolution of air navigation deficiencies listed in the MET field.

3.5.15.3 MET SG/17 noted the following schedule for SIGMET tests and VAAC back-up tests in 2013, as decided by ROBEX WG/11:

- WC SIGMET test – 12 November
- WV SIGMET test – 19 November
- WS SIGMET test – 26 November
- VAAC Darwin/Wellington back-up test – September/October
- VAAC Darwin/Tokyo back-up test – after November

3.5.16 Update on ROBEX Handbook and ICD

3.5.16.1 MET SG/17 noted proposed updates to the ROBEX handbook and the OPMET data banks Interface Control Document (ICD), including minor updates to both documents that could be published in the short term (including updates provided by Viet Nam and Indonesia) and more significant updates that should be developed in time for a major amendment of the documents in September 2013.

3.5.17 Digital exchange of OPMET using XML/GML

3.5.17.1 MET SG/17 noted that the ICAO Meteorological Information Exchange Model (IWXXM) was being developed under the auspices of the World Meteorological Organization (WMO) Task Team on Aviation XML (TT-AvXML) and the ICAO Meteorological Aeronautical Requirements and Information Exchange Project Team (MARIE-PT) for the future exchange of METAR/SPECI, TAF, SIGMET and other meteorological information. Regional coordination of the digital exchange of OPMET using XML/GML would be managed by the ROBEX WG, as noted in the work plan for the ROBEX WG. This item was also discussed by MET SG/17 in its review of Amendment 76 to Annex 3 — *Meteorological Service for International Air Navigation*.

3.5.18 Review of regional procedures contained in the ANP/FASID

3.5.18.1 MET SG/17 reviewed recent amendments to the Air Navigation Plan/Facilities and Implementation Document (ANP/FASID) and noted the proposals for further amendment to FASID Tables MET 1A, MET 2A, MET 3A and Chart MET 2 originating from ROBEX WG/11 and from information provided by Viet Nam. MET SG/17 also noted that the Basic ANP (section 9, part 6) would require updating to align with the new requirement (filing time of TAF bulletins) in Amendment 76 to Annex 3 — *Meteorological Service for International Air Navigation*.

3.5.19 MET/R TF/3 meeting and MET/ATM Seminar 2013

3.5.19.1 MET SG/17 recalled that the Meteorological Requirements Task Force (MET/R TF) was reformed from the Meteorology/Air Traffic Management Task Force (MET/ATM TF) (CNS/MET SG/16 Decision 16/34 refers) and updated the composition, terms of reference and work plan of the MET/R TF and confirmed Mr Jun Ryuzaki as Chairman.

3.5.19.2 MET SG/17 proposed that the next meeting/event (i.e., MET/R TF/3 meeting and MET/ATM Seminar) be convened to take place in the 4th quarter of 2013.

3.5.20 Other MET issues (QMS)

3.5.20.1 MET SG/17 noted results of a recent survey in the APAC Region on the implementation of quality management systems (QMS) for aeronautical meteorological information, which showed, out of 21 States/Territories that responded, 15 had established and implemented QMS (in accordance with Annex 3, Chapter 2, 2.2.3) and 5 indicated implementation of QMS was expected in 2013 or 2014. Nauru indicated it lacked the resources, in terms of training and equipment, required to establish and implement a QMS.

3.5.20.2 MET SG/17 acknowledged the cooperative assistance already provided by States including New Zealand, Australia and Fiji, as well as the WMO, in the establishment and implementation of QMS in the APAC Region, and encouraged States to continue to provide such assistance to other States where possible and appropriate.

3.5.20.3 In view of the linkage between QMS, the qualification and training of meteorological personnel and the need for cost recovery by States providing meteorological service for international air navigation, APANPIRG/24 adopted the following decisions:

Decision 24/52 – Survey on the implementation of meteorological competency

That, ICAO coordinates a survey on the level of implementation of competency assessment, qualifications and training for meteorological personnel providing service for international air navigation and report the result to the MET SG/18 meeting.

Decision 24/53 – Guidance on QMS, competencies and cost recovery

That, ICAO investigates opportunities to provide States with guidance information regarding implementation of QMS, competencies and cost recovery within the APAC Region

3.5.21 Other MET issues (Amendment 76 to Annex 3)

3.5.21.1 MET SG/17 noted that Amendment 76 to Annex 3 — *Meteorological Service for International Air Navigation* was adopted by the Council (27 February 2013) and, subject to there being no notifications of disapproval expressed by the majority of Contracting States, the Amendment will become effective on 15 July 2013 and applicable on 14 November 2013. MET SG/17 also noted that supporting guidance material, such as the Manual of Aeronautical Meteorological Practice *(Doc 8896)* and the Manual on the Digital Exchange of Aeronautical Meteorological Information *(Doc 10003)*, would be finalized by relevant ICAO global groups and published by the ICAO Secretariat in time for the applicability of Amendment 76.

3.5.22 Next meeting of the MET SG

3.5.22.1 MET SG/17 noted the unavailability of July 2014 due to the proposed MET Divisional Meeting and agreed that the MET SG/18 meeting could be convened (over 4 days) in the week commencing 2 June 2014, back-to-back (either side of a weekend) with SADISOPSG/19.

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Agenda Item 3.6: Other Air Navigation Matter

Implementation of APAC Seamless Operations

3.6.1 IATA submitted in WP22 that with the finalization of the Asia/Pacific Seamless ATM Plan by APSAPG/4 and its submission to APANPIRG/24 for endorsement, it was timely to reflect on implementation issues. IATA felt that the Seamless Plan, based on the ASBU framework, provided a blue print and identified critical elements required to support seamless operations with suggested timeframes. It understood that these were not mandatory or binding on States and that States might for various reasons, plan implementation at different times. However, IATA emphasized the need for timely Harmonized implementation of these critical elements.

3.6.2 Given the importance to the region of Seamless ATM operations and inter-regional connectivity, IATA suggested that APANPIRG consider the establishment of a mechanism to monitor Seamless implementation and, importantly, system performance improvement. IATA also requested the meeting to formally recognize and thank the ICAO APAC Office for the efforts of the officers concerned in the development and production of the Asia/Pacific Seamless ATM Plan.

CDM/ATFM Concept through Sub-Regional Cooperation

3.6.3 Hong Kong, China, Singapore and Thailand presented an update in WP25 on the efforts among to develop a concept of Air Traffic Flow Management (ATFM) based on Collaborative Decision Making (CDM), through sub-regional cooperation.

3.6.4 Hong Kong, China, Singapore and Thailand managed air traffic movements at some of the busiest international air hubs in the region. Given that these hubs handled a large percentage of international traffic, balancing demand and capacity was a challenge, especially during periods when capacity was reduced, due to occurrences such as large scale inclement weather, abnormal operations affecting runway availability, and prolonged runway maintenance works, etc. The predominantly international nature of air traffic between these hubs meant that localized ATFM concepts were inadequate as they did not take into account the upstream and downstream effects of any measures taken in isolation.

3.6.5 At APANPIRG/23, Hong Kong, China, Singapore and Thailand jointly presented a concept of a networked Airport–CDM (A-CDM) implementation which could benefit major international hubs in the Asia and Pacific Regions. Following that, the concept was also presented at the 49th Conference of DGCA Asia and Pacific Regions in New Delhi in October 2012. Recognizing the potential of the concept, DGCA/49 adopted an Action item urging States with major airports to implement A-CDM and to collaborate with other States to further expand the concept and develop an ATFM network through sub-regional cooperation.

3.6.7 The concept involved each of the ANSPs operating an independent, virtual CDM/ATFM node supported by an interconnected information sharing framework. Where possible, A-CDM mechanisms from participating airports would aid the collaborative decision making process between ANSPs. The flows of air traffic would then be managed effectively based on a common set of agreed principles among the participating ANSPs and airports.

3.6.8 A node comprising an ANSP with associated airports within a defined catchment area would be able to manage demand and capacity through adjustments in aircraft Target Landing Times (TLDT) which in turn influence the issuance of Calculated Take-off Times (CTOT) for aircraft at the participating airports within that catchment area. The coordination resulting from the shared awareness of this information within this node would further enable the assignment of Target Start-up Approval Times (TSAT) for aircraft with the aid of A-CDM. The linking of multiple nodes would create a larger network that could eventually connect the Asia and Pacific Regions with other existing ATFM nodes elsewhere beyond these Regions.

3.6.9 The papers urged the planned ICAO Asia Pacific Air Traffic Flow Management Steering Group (ATFM/SG) to develop a common framework and harmonised approach to manage the air traffic flow in the region, and States/Administrations to participate in the ATFM/SG to work together towards a common goal to manage air traffic flow in the region.

APSAPG Outcomes

3.6.10 The Third Meeting of the ICAO Asia/Pacific Seamless Air Traffic Management (ATM) Planning Group (APSAPG/3) was held at the Hotel Trident in Chennai, India from 21 to 25 January 2013.

3.6.11 The Fourth Meeting of the ICAO Asia/Pacific Seamless ATM Planning Group (APSAPG/4) was held at the Headquarters of the Civil Aviation Department, Hong Kong, China from 03 to 07 June 2013.

3.6.12 IATA introduced APSAPG/4/WP03, which provided an economic analysis of transition to Seamless ATM. The study entitled Economic Analysis of Seamless Air Traffic Management was predicated on the assumption that all ASBU Block 0 critical elements would be implemented and extrapolated the impact on Regional Gross Domestic Product (GDP) if there were implementation differences or delays.

3.6.13 In addition to the economic benefits, the study predicted losses which would accrue due to the failure to implement ASBU Block 0 in a timely manner. It noted that Asia Pacific based airlines would suffer economic penalties as the technologies required to obtain the benefits from seamless air traffic management would be deployed in other parts of the world. This will require investment by the Asia/Pacific region’s airlines without the requisite operational benefits in Asia/Pacific.

3.6.14 The draft report was tabled at APSAPG/3 and very limited feedback had been received, which had not questioned the validity of the conclusion. The report was referred for independent review, both within IATA and externally. Both reviews supported the conclusions, noting the assumptions which drove the outcome of the report. The key outcomes of this study were as follows.

a) Aviation currently contributed 2.22% to Asia/Pacific States GDP.

b) With ASBU Block 0 improvement, overall aviation contribution was forecast to reach 4% of the Regional GDP by the year 2030.

c) This represented an overall aviation contribution of USD 2,358 billion to the regional GDP in the year 2030.

d) Without ASBU Block 0 improvements, overall aviation’s contribution to regional GDP would fall to 0.8% by the year 2030.

3.6.15 IATA stated that whilst traditionally ATM improvements were implemented on a State by State basis, and funded from either State revenues or aircraft operators, the critical elements of ASBU Block 0 would rely on a regional capability providing services to all States across the region. Therefore, the development of a cost benefit analysis would need to determine the cost of providing regional services, such as ATFM and AIS, and then distribute these costs to each State on the basis of benefit derived in the State.

3.6.16 The Co-Chair stated that although it was difficult for the meeting to determine the validity of the economic study, there was little doubt that there would be substantial economic benefits from implementation of the ATM seamless plan, and an economic loss as a result of not implementing. IATA also stressed that the economic study indicated that it would be beneficial for the Region to deliver quick wins in certain areas such as ATFM.

3.6.17 Hong Kong, China thanked IATA for the work completed, but noted that the meeting representatives may lack an economic background to verify the outcome of the paper, which should be presented to a relevant body. The Co-Chair considered that the DGCA Conferences could be the right forum, which IATA agreed with.

3.6.18 CANSO commended IATA for the comprehensive study, agreeing that the overall benefits of implementation were indisputable even if the degree of benefit may be arguable. They noted that it was the first time such a study of this type had been conducted to their knowledge. CANSO also emphasized the need for implementation of ASBU and collaboration.

Seamless ATM Assessment Survey

3.6.19 The Secretariat presented the results of the Seamless ATM Survey to the APSAPG/3 and APSAPG/4 meetings, which was conducted to provide information on the status of various factors, including ASBU elements, within the Asia/Pacific Region. The APSAPG was required by its Terms of Reference (TOR) to determine the current status of APAC administration's Seamless ATM capability, including the identification of gaps affecting harmonization and interoperability.

3.6.20 India expressed concern that the Assessment Sheet might not provide a correct impression of Seamless ATM implementation, given the Preferred Aerodrome/Airspace and Route Specifications and Preferred ATM Service Levels (PARS and PASL) elements were not mandatory. IATA noted that it was a useful exercise to track progress, but the implementation reporting process might overtake the Assessment Sheet process as the capabilities provided by States were the primary interest. The Secretariat recalled that the Assessment Sheet was a regional planning tool to assist APANPIRG and provide guidance as to which States may need support, so it was not necessary to include as an Appendix to the Seamless ATM Plan itself.

3.6.21 A copy of the latest iteration of the Seamless ATM Assessment Sheet is appended at **Appendix A** to the Report on Agenda Item 3.6.

MTF and Sample Route Study

3.6.22 The Secretariat presented the results of the Major Traffic Flow (MTF) and Sample Regional Routes to APSAPG/3. This study had been modified by updates following the APSAPG/2 meeting, and was conducted to determine the status of Seamless ATM capability and issues, in order to identify improvements for Seamless ATM capability.

3.6.23 Key issues identified by the Study relevant to Seamless ATM were:

- fragmented FIRs resulting in multiple Transfer of Control points;
- traffic growth which had outpaced ANSP infrastructure, routes and airspace capacity;
- routes reliant on ground based navaids or established for historical reasons, around which SUAs have grown;
- use of Flight Level Allocation Systems (FLAS) for flight level separation instead of use of horizontal separation;

- two different Flight Level Allocation Schemes (FLOS) - metric and imperial in the region;
- routes with flight level, direction, and time restrictions, some uncoordinated with neighbours;
- non-existent or unreliable surveillance/communications capability in some locations;
- ATS capability not fully utilised to provide appropriate level of service;
- hand-off procedures not aligned to ATM facilities and capabilities;
- infrastructure development based only on national requirements, resulting in duplicated and yet uncoordinated facilities;
- unnecessarily conservative separation requirements at transfer of control points;
- apparent reluctance to apply ICAO separation minima, including GNSS separations;
- requirement for effective focus groups to address ATM issues;
- need for regular review of operational issues, and ATM services with users; and
- uncoordinated and limited use of AIDC.

Human Performance

3.6.24 IFATCA presented a paper to APSAPG/3 focused on the need for human performance to be considered at all stages and at all levels of development of any ATM plan, noting that four papers on this subject had been provided at the AN-Conf/12.

3.6.25 IFATCA felt that while there had been much discussion on the automation and modernisation of ATM systems, but there has been very little reference to human factors and human performance. Human performance in the context of new automated ATM systems included such diverse elements as, equipment design, training, acceptance of change, workload, 'just culture' reporting and staffing.

3.6.26 IFATCA also stressed the importance of matching automated systems between units with contiguous airspace, or the efficiency of modern equipment and new procedures would be lost at the transfer point. They stated that although automated ATM systems reduced controller workload, the incremental reliance on automation to complete many current tasks and functions of the controller required a fundamental change in the actions, responsibilities and skills of the controller. Therefore a comprehensive training programme was required.

3.6.27 IFATCA suggested that contrary to belief that the introduction of automated systems reduced the amount of training that was required; the converse was true, as training must cover the automated system and include the traditional control procedures as part of the contingency and fall-back plan. They stated that while a number of States were advanced in Block 0 implementation, the ones that were behind were a concern, as they could affect overall regional progress.

Seamless ATM Draft Plan

3.6.28 The APSAPG/3 meeting extensively discussed the draft Seamless ATM Plan (version 0.7). Comments from Japan, Hong Kong, China and India had been incorporated within a master version 0.8 document, which was reviewed paragraph by paragraph, taking a considerable period of time over an extended day of work.

3.6.29 The APSAPG/4 meeting extensively discussed the draft Seamless ATM Plan (Version 0.9b), which incorporated previous comment from Japan, Hong Kong China, Australia, New Zealand, India, ACI, IATA and Singapore. Papers from Cambodia, Lao PDR, Myanmar, Thailand, and Viet Nam and Hong Kong, China on this matter were also submitted to APSAPG/4.

3.6.30 Hong Kong, China stated that the plan should be collaborative, practical and visionary. Hong Kong, China highlighted the salient points in version 0.9b of the draft plan, which were:

- airspace categorisation by reference to its CNS (Communications, Navigation and Surveillance) capability;
- establishment of two Performance Objectives, namely PARS and PASL, which incorporated system expectations, general performance-oriented requirements, etc.;
- implementation of the two performance objectives in two different phases, Phase I by 12 NOV 2015 and Phase II by 08 NOV 2018, subject to clarification and agreement of Asia/Pacific States; and
- specification of PBN requirements for the operation of different airspace categories, including R (Remote), S (Surveilled) and T (Terminal) airspace.

3.6.31 Hong Kong, China noted that at first they had considered the Hong Kong FIR as containing 'remote' airspace, but after studying the Seamless ATM Plan's categorisation of airspace, they had determined that Hong Kong's airspace was 'S' category, in addition to its 'T' airspace; thus demonstrating the matching of CNS capability to the service level.

3.6.32 Hong Kong, China noted that essential components such as the flight procedure design criteria, separation standards and operational approval guidance were yet to be developed for RNP 2. Taking into account the large amount of outstanding preparation work to be undertaken by operators and ANSPs alike, they urged ICAO to expedite the provision of appropriate guidance material.

3.6.33 The Secretariat clarified to the meeting that PBN navigation specifications could be utilised effectively without procedural separation standards, as long as they were designated within category S and T airspace, in order to apply ATS surveillance-based separation. This had been the case for RNAV 5, which had no established ICAO separation standards.

3.6.34 Hong Kong, China stated that an Implementation Strategy Guide, which listed the agreed actions of the Seamless ATM plan, would be instrumental to guide States in developing their own State Seamless ATM implementation plan. The Secretariat advised that States were expected to report their implementation progress to APANPIRG.

3.6.35 Hong Kong, China recalled that the Seamless ATM Plan was not meant to contain standards or to be imposed on States as mandatory.

3.6.36 Cambodia, Lao PDR, Myanmar, Thailand, and Viet Nam presented comments on Seamless ATM Plan version 0.9 in the areas of PBN, Continuous Climb Operations/Continuous Descent Operations (CCO/CDO) and ATFM. With respect to CCO/CDO, the meeting recognised that the expectations in the PARS did not constrain States from conducting CCO/CDO studies at aerodromes not covered in PARS Phase I (a note to this effect was added to the draft Plan).

3.6.37 Regarding ATFM, it was recalled that the deliverables from the SAIOACG/SEACG Draft Conclusions on Capacity Assessments and Information Sharing were expected to be incorporated into a Regional ATFM Framework to be developed by the ATFM/SG.

3.6.38 In developing the Seamless ATM Plan, an extensive and multi-faceted approach had been taken by the Regional Office, given the time constraint of 18 months imposed by APANPIRG.

The Seamless ATM Plan draft had been mainly developed from research conducted by the Regional Office, in coordination with other Regional Offices and ICAO HQ.

3.6.39 Feedback from the APSAPG Contact Lists had been poor, with little or no response before APSAPG/3. After APSAPG/3, feedback was only provided by a small number of States, some of this being received past cut-off date. The major changes and additions from V0.9 to Version V0.9b were as follows.

- The ATM/SG agreed that a firm date (day) should be chosen as a target for the Phases (the USA strongly supported using the chart AIRAC date).
- The ATM/SG endorsed the ADS-B airspace PARS without comment.
- The CNS/SG and ATM/SG endorsed the Modes S Transponder and ACAS/TAWS airspace PARS after amendment to recognise Mode S carriage is only necessary in airspace where Mode S radars operate.
- The CNS/SG endorsed the PBN airspace and routes PARS without comment.
- The ATM/SG, after some wide ranging discussion, agreed to the Draft Conclusion regarding AIDC (including the five messages) with some amended text.
- The ATM/SG meeting noted Singapore's suggested text for the first two paragraphs of the Research and Development (R and D) Section. Japan agreed with the Singapore submission.
- The ATM/SG discussed the need for the text related to encouraging the use of the minimum ATC separation standard to be as clear as possible; thus this text has been amended.
- The ATM/SG noted the submission by Pakistan on harmonisation of Transition Altitudes as far as practicable, so an item of this nature had been added to the research subjects in section 8.

3.6.40 The APSAPG/3 meeting reviewed the draft Seamless ATM Plan paragraph by paragraph (more than 200 individual observations), taking a considerable time over an extended day of work to develop draft Version 0.9c. The Secretariat then made the final editorial changes for submission to APANPIRG as draft Version 1.0.

3.6.41 The United States, India, Thailand, Japan, Vietnam and IATA supported the Asia/Pacific Seamless ATM Plan, and thanked the Secretariat, the co-Chairs Mr Mike Haines and Mr Colman S. C. Ng, and the APSAPG for its work.

3.6.42 Australia expressed the view that the planning categories within the Seamless ATM Plan might be an issue as they were not globally recognised. The APSAPG Co-Chair clarified that the APSAPG had agreed that the categories were necessary to ensure a correlation between the CNS capability and the service levels.

3.6.43 The APANPIRG meeting was also advised that China, Viet Nam and the ICAO Secretariat agreed to a proposal by Viet Nam to update Figure 3 and reference to Viet Nam in Item paragraph 6.8 a) in the Seamless ATM Plan illustrating ATS surveillance coverage in the area when the additional ATS surveillance capability would become operational (expected December 2013), without affecting the rest of the Seamless ATM Plan.

3.6.44 APANPIRG adopted the following Draft Conclusions and Decision:

Conclusion 24/54: Asia/Pacific Seamless ATM Plan

That, the Asia/Pacific Seamless ATM Plan Version 1.0 attached as **Appendix B to the Report on Agenda Item 3.6** be endorsed, and made available on the ICAO Asia/Pacific Regional Office web site.

Conclusion 24/55: State Seamless ATM Planning

That, given the urgency and priority of Seamless ATM planning for the Asia/Pacific as acknowledged by the 46th Conference of Directors General of Civil Aviation (DGCA, Osaka, Japan, 12-16 October 2009) and APANPIRG/22 (05-09 September 2011), States should be urged to:

a) review Version 1.0 of the Asia/Pacific Seamless ATM Plan and utilise the Plan to develop planning for State implementation of applicable Seamless ATM elements;

b) ensure relevant decision-makers are briefed on the Seamless ATM Plan;

c) submit the first Regional Seamless ATM Reporting Form to the ICAO Regional Office by 01 March 2014; and

d) where possible, participate and contribute to Seamless ATM system collaborative training and research initiatives.

Decision 24/56: Seamless ATM Seminars/Workshops

That, ICAO be urged to facilitate Asia/Pacific Seamless ATM Planning and Implementation Seminars/ Workshops for Asia/Pacific and trans-regional States.

Seamless ATM Implementation Guidance Material

3.6.45 The Secretariat presented a basic guide to the implementation of the Seamless ATM PARS and PASL elements. The meeting noted that the PARS and PASL Phase commencement dates were aspirational targets, and should not be treated like a hard date such as the implementation of Reduced Vertical Separation Minimum (RVSM) or FPL 2012. In these cases, there was a potential major regional problem if all States did not implement at the same time by the specific agreed date, which was clearly not the case for the start of PARS/PASL Phase I or II.

3.6.46 In that regard, APSAPG noted that although it would be ideal if all States achieved capability on day one of Phase I, this was probably not realistic. The Phase dates were chosen as being an achievable target for the majority of States. However the dates were not designed to accommodate the least capable State, otherwise the region as a whole would fall behind the necessary urgent ATM improvements required by the Director's General of Civil Aviation and APANPIRG.

3.6.47 In considering the planning necessary before the PARS/PASL Phase dates, the meeting noted that it was important to ensure everyone in the planning process was aware that the necessary groundwork and capability building must take place as a priority, and that full operational capability by Phase date commencement was a secondary consideration. ICAO expected that it was possible a number of States would be working towards implementation during the Phase, in an effort to implement as soon as possible.

3.6.48 APSAPG/4 discussed the need for each State to verify the applicability of PARS and PASL by analysis of safety, current and forecast traffic demand, efficiency, predictability, cost effectiveness and environment to meet expectations of stakeholders prior to implementation. The PARS/PASL elements would be either:

a) not applicable; or

b) already implemented; or

c) not implemented yet.

3.6.49 The Secretariat had developed draft Seamless ATM Implementation Guidance, which provided a basic process with customised steps for each PARS/PASL element, and derived from this Matrix, a State Seamless ATM Plan Template. This material was designed to assist States but was not mandatory in nature, and would continue to be developed with input from States and International Organizations after APSAPG/4.

3.6.50 APANPIRG agreed that the implementation guidance material would provide useful assistance to States, but needed review and input from experts, therefore it would not be attached to the Seamless ATM Plan itself. The guidance material would be provided on the Regional Office's web site near the Seamless ATM Plan and updated as the material matured with State input.

3.6.51 A Regional Seamless ATM Reporting Form had also been drafted to assist States reporting their progress to the Regional Office. APSAPG provided input into the format of the reporting to assist the finalization of material by ICAO, noting that it was intended that States report by 01 March 2014 to indicate Seamless ATM planning progress to APANPIRG contributory bodies.

3.6.52 Australia were concerned that the reporting was not a duplication of the global Air Navigation Reporting Form (ANRF) process. APANPIRG noted that the regional implementation reporting was not intended to replace the ANRF, and had a quite different function as it was focused on change management aspects of specific Seamless ATM elements (many of which were not in the ASBU).

Dissolution of the APSAPG

3.6.53 The Secretariat noted that DGCA/46 first addressed 'Seamless ATM' and how this may affect the Asia/Pacific Regions. DGCA/46 issued the Kansai Statement, which requested, inter alia, the APANPIRG to be 'a starting platform' for the discussion on 'Seamless ATM'. APANPIRG/21 (Bangkok, Thailand, 6 – 10 September 2010) then developed ICAO Asia/Pacific Seamless ATM Workshop and Conclusion 21/12, which established the Seamless ATM Ad Hoc Meeting.

3.6.54 APANPIRG/22 (5-9 September 2011) reviewed the Report of the ICAO Asia/Pacific Seamless Air Traffic Management Symposium and Ad Hoc Meeting (Bangkok, 15 to 17 August 2011). The meeting reviewed the suggestions made by States and adopted Decision 22/56.

3.6.55 The APSAPG was required by its TOR to produce deliverables within a limited timeframe to submit a preliminary/interim study to APANPIRG/23 in 2012 and a final study to APANPIRG/24 in 2013. Since the draft Seamless ATM Plan was approved by APANPIRG, APSAPG's primary task was complete.

3.6.56 New Zealand expressed its thanks to the Secretariat for its work in compiling the draft Seamless ATM Plan.

3.6.57 The following Decision was adopted by APANPIRG:

Decision 24/57: Dissolution of APSAPG

That, considering the submission of the Draft Seamless ATM Plan to APANPIRG, and subject to the Seamless ATM Plan being approved, the Asia/Pacific Seamless ATM Planning Group (APSAPG) be dissolved, and any on-going tasks be delegated to the appropriate Sub-Group.

Seamless ATM Implementation	ASBU Block 0 elements (18)																		State
	B0-05	B0-10	B0-15	B0-20	B0-25	B0-30	B0-35	B0-40	B0-65	B0-70	B0-75	B0-80	B0-84	B0-85	B0-86	B0-101	B0-102	B0-105	Totals
United States	2	2	2	2	2	1	2	2	2	0	1	2	2	2	1	2	2	2	31
New Zealand	1	2	1	1	2	1	1	2	2	1	2	1	2	0	1	2	2	2	26
Australia	1	2	0	1	2	0	2	2	2	1	2	2	2	2	1	2	2	2	28
Hong Kong, China	1	1	1	1	1	1	1	2	1	1	1	1	1	2	2	1	1	2	22
Singapore	2	2	1	1	0	1	1	2	2	1	2	1	2	2	0	2	2	2	26
Republic of Korea	2	2	0	1	2	1	1	2	2	1	2	0	2	0	2	2	2	2	26
Fiji	1	2	0	0	2	0	0	2	1	1	0	0	1	2	1	2	1	2	18
Japan	2	2	0	1	2	1	2	2	2	1	2	0	2	0	0	2	1	2	24
India	2	2	1	1	1	1	1	2	1	1	2	1	2	0	1	2	2	2	25
Thailand	0	1	1	0	0	0	1	2	0	1	2	1	2	2	2	2	1	2	20
China	1	0	2	1	2	0	0	2	2	2	2	1	0	0	2	2	2	2	23
Malaysia	0	2	1	0	1	0	1	2	0	1	2	0	2	0	0	2	2	2	18
Indonesia	1	0	0	0	1	0	1	2	0	1	0	0	2	0	0	2	2	0	12
Myanmar	1	1	0	1	0	1	1	1	0	1	0	0	0	0	0	2	2	0	11
Philippines	1	2	0	1	0	0	1	0	2	1	0	0	0	0	0	0	0	0	8
Afghanistan	0	0	0	0	0	1	1	0	0	1	0	0	2	2	0	1	0	0	8
Bangladesh	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	2
Maldives	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
French Polynesia	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	4
Cambodia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DPR Korea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lao PDR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mongolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nauru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nepal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pakistan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Papua New Guinea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solomon Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sri Lanka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Element Total	18	23	10	12	20	9	17	29	19	17	20	10	24	14	13	29	24	24	
APAC %	31%	39%	17%	20%	34%	15%	29%	49%	32%	29%	34%	17%	41%	24%	22%	49%	41%	41%	

Gl. Plan	APAC Concept of Ops			Regional Elements (7)			State	Civ/Mil Elements (10)		% Military	SUA	International	Integrated	Joint Aids	Shared	Common	Common	State CM	State Grand Total		
CERT	FIR	NAV	SUR	APT	ACCESS	DAT	Totals	Body	Liaison	SUA	Review	SUA	ATM	Aerodromes	Data	training	procedures	Total	Value	%	
2	0	2	2	2	2	1	11	2	2	1	1	2	1	2	2	2	2	17	59	84%	United States
2	2	2	2	2	2	0	12	0	2	2	2	2	2	2	2	2	2	18	56	80%	New Zealand
1	2	1	2	2	2	2	12	2	1	2	2	0	1	2	2	2	2	16	56	80%	Australia
2	1	2	2	2	1	1	11	2	2	2	2	2	2	2	2	2	2	20	53	76%	Hong Kong, China
2	2	1	2	2	2	2	13	2	2	2	0	0	0	2	1	2	2	13	52	74%	Singapore
2	2	1	2	2	0	0	9	2	2	0	2	0	2	2	2	2	2	16	51	73%	Republic of Korea
2	2	1	0	2	2	2	11	2	2	2	2	2	2	2	2	2	2	20	49	70%	Fiji
2	2	1	2	2	1	0	10	1	2	2	1	0	2	2	0	2	2	14	48	69%	Japan
2	2	1	2	1	1	0	9	0	2	0	2	2	0	2	2	0	2	12	46	66%	India
1	2	1	2	1	2	0	9	2	2	0	2	2	1	2	2	0	0	13	42	60%	Thailand
2	1	1	2	0	2	0	8	2	1	0	0	2	1	2	1	0	2	11	42	60%	China
2	0	1	2	0	0	0	5	2	2	1	0	0	1	2	2	2	2	14	37	53%	Malaysia
1	2	1	2	0	0	2	8	0	2	2	0	2	0	0	1	1	1	9	29	41%	Indonesia
2	2	0	2	1	1	0	8	1	2	1	1	2	0	0	0	0	1	8	27	39%	Myanmar
2	0	1	0	2	0	0	5	2	2	2	0	2	0	0	1	2	2	13	26	37%	Philippines
1	0	1	1	1	0	0	4	2	2	0	0	2	1	2	2	0	2	13	25	36%	Afghanistan
0	1	1	1	1	1	0	5	0	1	0	1	2	0	0	0	1	1	6	13	19%	Bangladesh
0	2	1	2	0	2	0	7	0	0	0	0	0	0	0	0	0	0	0	7	10%	Maldives
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6%	French Polynesia
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Cambodia
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	DPR Korea
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Lao PDR
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Mongolia
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Nauru
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Nepal
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Pakistan
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Papua New Guinea
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Solomon Islands
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Sri Lanka
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	Viet Nam
28	25	20	30	23	21	10		24	31	19	18	24	16	26	24	22	29				
48%	43%	34%	51%	39%	36%	17%		41%	53%	32%	31%	41%	27%	44%	41%	37%	49%				

Element V	0. Non-ASBU/Seamless ATM activity	1. Initial development supporting ASBU/Seamless	2. Mature system supporting ASBU/Seamless ATM
B0-05 CDO	Use of conventional stepped arrival procedures	STAR with flexible PBN procedures or ATS surveillance-based procedures	STAR arrivals to CDO or OPD
B0-10 FUA	SUA is not subject to FUA (such as activation by NOTAM)	Partial flexibility of controlled or special use airspace	FUA principles apply to controlled and special use airspace or not applicable
B0-15 AMA	No formal runway sequencing management	Basic runway sequencing procedures	Electronic, integrated AMAN/DMAN tools in use
B0-20 CCO	Use of conventional departure procedures	Flexible PBN or surveillance-based procedures in use to RNAV SID	CCO PBN procedures with RNAV SID
B0-25 AIDC	ATS messages conducted by voice and/or AFTN	AIDC testing	Full AIDC operational deployment
B0-30 AIS-	Partial Phase 1 AIM transition	Phase 1 and 2 AIM transition	Phase 1 and 2 and partial Phase 3 AIM transition
B0-35 ATFI	No formal ATFM activity	Basic ATFM, no automated decision support tools	Collaborative ATFM with automated support tools
B0-40 ADS	ADS-C, CPDLC not used in oceanic/remote airspace	Either ADS-C or CPDLC used for oceanic airspace	Not applicable, or ADS-C, CPDLC and HF/SATVOICE
B0-65 PBN	Approach procedures with no vertical guidance	Approach procedures with vertical guidance	PBN approach procedures with vertical guidance
B0-70 WAI	Applied minima more conservative than PANS ATM	Application of pre-2012 wake separation minima	Application of new 2012 wake turbulence minima
B0-75 SMS	No electronic surface movements surveillance	Electronic surface movements surveillance	ASMGCS and cockpit moving map in operation or not applicable
B0-80 CDM	No formal airport CDM	Basic airport CDM in use	Integrated airport CDM, automated data exchange
B0-84 ADS	No ADS-B or MLAT ground-based surveillance where possible	ADS-B trial or provided as an add-on to MLAT	Where appropriate, ADS-B ATS surveillance is provided, or is not applicable
B0-85 ATS	No ADS-B aircraft requirements	ADS-B Out aircraft mandate in law	ADS-B Out mandate, certain aircraft require ADS-B In
B0-86 ITP	No use of ITP in oceanic or remote airspace	ITP trial planned or in progress	Not applicable, or ITP approved for use
B0-101 AC	No specific aircraft safety net requirements	ACAS I required	ACAS II required for certain aircraft (TAWS)
B0-102 NE	No ATM safety nets in use	Partial implementation of ATM safety nets, mode S	Mode S, MSAW, STCA and where appropriate, CPAR
AD CERT	No State aerodrome certification rules	Aerodrome certificiation, not covering all four GPI elements	Aerodrome certificiation covering all four areas
AD WARN	No formal aerodrome status warnings	Basic non-digital aerodrome warnings	Full digital, integrated aerodrome warnings service
FIR	More than two FIRs and ACCs, no rationalisation	Rationalisation of FIR boundaries or ACCs planned	Cross-FIRB ATC services, amalgamation of FIRs/ACCs or not applicable
NAV	No PBN ATS route or airspace structure	Partial PBN airspace/route structure, RNAV specifications	PBN airspace/route structure
SUR	Limited or nil ATS surveillance where possible to deploy	Use of procedural systems monitored by ATS surveillance	Use of ATS surveillance based ATC minima
APT	No formal airport capacity analysis	Airport runway capacity analysis undertaken (AAR)	Comprehensive capacity analysis for aircraft and passenger movements to support ATFM
ACCESS	Procedural FLAS within ATS surveillance coverage	Limited FLAS used only for specified occasions	No procedural FLAS
DAT	No data sharing between Area Control Centres	FIRB and inter-ACC ATS surveillance data sharing	ATS surveillance and ATM systems data sharing or not applicable
CM BODY	No formal body to coordinate civil-military activities is in place	Civil-military meetings are held to discuss strategic issues	A formal civil-military body is in place to manage strategic CM matters or not applicable
LIAISON	No formal civil-military liaison takes place for tactical responses	Civil-military tactical liaison is in place for special events	Permanent civil-military liaison positions are in place in relevant ATC Centres or not applicable
% MILITAR	30% or more of airspace is military special use airspace	15-29% of of airspace is military special use airspace	Less than 15% of airspace is military special use airspace or not applicable
SUA REVIE	Special use airspace is not regularly reviewed for use, size, etc.	SUA is regularly reviewed but not by an independent body (not airspace users)	SUA is regularly reviewed by an independent body or not applicable
INTERNATI	Restricted and/or prohibited areas are designated in international waters	Military danger areas are designated in international waters	Military danger areas are designated in international waters, clear of ATS routes or not applicable
INEGRATE	No integration of civil and military ATM systems	Partial integration of civil and military ATM systems	Full integration of civil - military ATM systems (including common procurement) or not applicable
JOINT AIDS	Not civil-military joint provision of navigation aids or aerodromes	Joint provision of some naviation aids	Joint provision of some navigation aids and aerodromes or not applicable
SHARED D	No ATS surveillance data is shared between civil and military ATM units	Civil ATS surveillance data is shared with military ATM units	Military ATS data (filtered as required) is shared with civil ATM units or not applicable
COMMON	Common training is not conducted between civil and military ATM units	Common training is conducted for special events	Common training is conducted for all civil-military matters or not applicable
COMMON	Civil and military ATM units have minimal common procedures	Civil and militry ATM units have common procedures for special events	Civil and military units have common procedures for all relevant liaison or not applicable

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA/PACIFIC SEAMLESS ATM PLAN

Version 1.0, June 2013

This Plan was developed by the Asia/Pacific Seamless ATM Planning Group (APSAPG)

Approved by APANPIRG/24 and published by the
ICAO Asia and Pacific Office, Bangkok

CONTENTS

SCOPE OF THE PLAN

Plan Structure

1.1 The Seamless Air Traffic Management (ATM) Plan (hereinafter referred to as the 'Plan') references different levels. At the upper level is a global perspective, which is guided mainly by references to the *Global Air Navigation Plan* (GANP, Doc 9750), the *Global ATM Operational Concept* (Doc 9854) and the *Global Aviation Safety Plan* (GASP). Beneath this level is regional planning primarily provided by this Plan and other guidance material, in order to define goals and means of meeting State planning objectives, such as:

- Asia/Pacific Regional Air Navigation Plan (RANP, Doc 9673) objectives;
- the Seamless ATM performance framework, with a focus on technological and human performance within Aviation System Block Upgrade (ASBU) Block 0 elements, non-ASBU elements (mainly emanating from the Concept of Operations – CONOPS, which is regional guidance material endorsed by APANPIRG/22), and civil/military cooperation elements;
- a deployment plan with specific operational improvements, transition arrangements, expected timelines and implementation examples; and
- an overview of financial outcomes and objectives, cross-industry business and performance/risk management planning.

1.2 The Plan incorporates and builds upon the Asia/Pacific Air Traffic Flow Management (ATFM) Concept of Operations and the Asia/Pacific Air Navigation Concept of Operations (both hereinafter referred to as 'CONOPS'), and the Asia/Pacific PBN Plan, superseding these documents.

1.3 The RANP is expected to incorporate key components of this Plan and information on the mechanisms that enable these objectives to be met. High-level support may be necessary from regional bodies that can effectively support the Plan's implementation, such as the:

- Association of Southeast Asian Nations (ASEAN);
- Asia Pacific Economic Cooperation (APEC); and
- South Asian Association for Regional Cooperation (SAARC).

1.4 The Plan does not use 'continental', 'remote' and 'oceanic' areas to refer to an assumed geographical application area, as many Asia/Pacific States have islands or archipelagos that can support a higher density of Communications, Navigation, Surveillance (CNS) systems than in a purely 'oceanic' environment. In accordance with the CONOPS that air navigation services should be provided commensurate with the capability of the CNS equipment, it is important to categorise airspace in this manner, and simplify the numerous references to this capability throughout the Plan. Thus the Plan categorises airspace by reference to its CNS (Communications, Navigation and Surveillance) capability as:

a) Category R: remote en-route airspace within Air Traffic Services (ATS) communications and surveillance coverage dependent on a third-party Communication Service Provider (CSP); or

b) Category S: serviced (or potentially serviced) en-route airspace – by direct (not dependent on a CSP) ATS communications and surveillance; or

c) Category T: terminal operations serviced by direct ATS communications and surveillance.

1.5 The word 'States' in the Plan includes Special Administrative Regions and territories.

1.6 The Seamless ATM Plan is expected to be implemented in two phases. Neither phase, nor any element is binding on any State, but should be considered as a planning framework. The Seamless ATM Plan itself is therefore guidance material.

1.7 It was important to note that the Plan's Phase commencement dates are planning targets, and should not be treated like a 'hard' date such as the implementation of Reduced Vertical Separation Minimum (RVSM). In this case, there was a potential major regional problem if all States did not implement at the same time by the specific agreed date, which was clearly not the case for the start of the Plan's Phase I or II.

1.8 In that regard, although it would be ideal if all States achieved capability on day one of Phase I, this was probably not realistic. However States should consider the impact on stakeholders and improving capacity of the ATM system overall by not achieving target implementation dates. The draft Phase dates were chosen as being an achievable target for the majority of States. However the dates were not designed to accommodate the least capable State, otherwise the region as a whole would fall behind the necessary urgent ATM improvements required by the Director's General of Civil Aviation and APANPIRG.

1.9 **Appendix E** provides an example of a Seamless ATM planning framework, **Appendix H** provides a map of ASBU Elements to Plan references, and **Appendix I** provides a List of References.

<u>Plan Review</u>

1.10 The Plan needs to be updated to take into account ASBU Block 1, 2 and 3 modules, when these modules and their associated technology become mature.

1.11 Periodic updates to the Plan are also required in respect of the economic information contained therein.

1.12 As an iterative process, the Plan requires regular updating to keep current with aviation system changes. It is intended that APANPIRG and its contributory bodies conduct a complete review every three years (or a shorter period determined by APANPIRG) of the Plan to align with the review cycle of the GANP. The Plan and its subsequent revisions should be endorsed by APANPIRG.

PLAN OBJECTIVES AND DEVELOPMENT

Plan Objective

2.1 The objective of the Plan is to facilitate Asia/Pacific Seamless ATM operations, by developing and deploying ATM solutions capable of ensuring safety and efficiency of air transport throughout the Asia/Pacific region. The Plan provides a framework for a transition to a Seamless ATM environment, in order to meet future performance requirements.

2.2 The Plan provides the opportunity for the Asia/Pacific region to adopt the benefits from research and development conducted by various States including the NextGen programme (United States of America), the European Single European Sky ATM Research (SESAR), and Japanese Collaborative Actions for Renovation of Air Traffic Systems (CARATS).

2.3 ICAO Doc 9854 contains a vision of an integrated, harmonized, and globally interoperable ATM System, with a planning horizon up to and beyond 2025. In this context, the Plan is expected to encourage more partnering relationships among States within sub-regions.

Plan Development

2.4 The Plan was developed as part of a suite of Asia/Pacific air navigation plans, and thus, the Plan should not be considered in isolation.

2.5 This Plan addresses the full range of ATM stakeholders, including civil and military Air Navigation Services Providers (ANSPs), civil and military aerodrome operators as well as civil and military airspace users. The Plan has been developed in consultation with Asia/Pacific States, administrations and also with International Organizations (IO).

Note: civil airspace users include scheduled aviation, business aviation and general aviation.

2.6 States should consult with stakeholders and determine actions, in order to commit to achieving the objectives of Seamless ATM and the requisite performance objectives in the areas of safety, environment, capacity and cost-efficiency that flow from this Plan.

2.7 ASBU Block 0 modules contain technologies, systems and procedures which are expected to be available from 2013. However, the Plan also has references to ASBU Block 1, 2 and 3 modules, which are expected to be available from 2018, 2023 and 2028 respectively. Where such technology, systems, standards and procedures are available earlier than these dates and appropriate deliverables can be provided, the intention was to develop aggressive yet practical implementation schedules within this Plan in order to provide the earliest possible benefits.

2.8 The ICAO *Manual on Global Performance of the Air Navigation System* (ICAO Doc 9883) provides guidance on implementing a performance-oriented ATM System. The *Manual on ATM System Requirements* (ICAO Doc 9882) contains eleven Key Performance Area (KPA) system expectations, as well as a number of general performance-oriented requirements. In accordance with the expectations of these documents, the APSAPG developed the following performance objectives to facilitate Seamless ATM operations:

a) Preferred Aerodrome/Airspace and Route Specifications (PARS); and

b) Preferred ATM Service Levels (PASL).

2.9 The PARS/PASL introduced two Performance Objectives, which incorporate system expectations, such as general performance-oriented requirements. Each performance objective is composed of a list of expectations of different aspects of the aviation system.

2.10 In considering the planning necessary before the PARS/PASL Phase dates, it is important to ensure everyone in the planning process is aware that the necessary groundwork and capability building must take place as a priority, and that full operational capability by the Phase date commencement was a secondary consideration. It is recognised that it is possible a number of States would be working towards implementation during Phase I, in an effort to implement as soon as possible. Therefore it is considered that States in this position should not be identified as 'deficient' in regard to applicable elements.

2.11 Prior to implementation, each State should verify the applicability of PARS and PASL by analysis of safety, ATM capacity requirements to meet current and forecast traffic demand, efficiency, predictability, cost effectiveness and environment to meet the expectations of stakeholders. The PARS/PASL elements would be either:

a) not applicable; or

b) already implemented; or

c) not implemented.

2.12 The PARS and PASL are expected to be implemented in two phases, Phase I by 12 November 2015 and Phase II by 08 November 2018. Phase II was determined by referencing the charting AIRAC (Aeronautical Information Regulation and Control) cycle for the ASBU Block 1 commencement year. Recognising the economic and environmental costs associated with delay of system improvement using technologies available today, Phase I was considered to be the earliest date possible for ASBU elements and other non-ASBU elements, which mainly involved procedural changes and human training.

2.13 The PARS contain the expectations for airspace and ATS routes, including aircraft equipage to facilitate Seamless ATM operation, and is therefore a matter for the State regulator or the airspace authority, and is of primary interest to airspace planners, flight procedure designers and aircraft operators.

2.14 The PASL contain the expectations for Air Navigation Service Providers (ANSP), and is therefore a matter for the State regulator or the ATS authority. The PASL is of primary interest to ANSPs and aircraft operators. The PARS and PASL together form the foundation of Seamless ATM development, and as such should be enabled by national regulations, rules and policies wherever applicable to enable a harmonised effort by all stakeholders.

<u>Seamless ATM Definition</u>

2.15 The objectives of Seamless ATM was agreed by the Asia/Pacific Seamless ATM Planning Group (APSAPG) as follows:

> *The objective of Seamless ATM is the safe and interoperable provision of harmonized and consistent air traffic management service provided to a flight, appropriate to the airspace category and free of transitions due to a change in the air navigation service provider or Flight Information Region.*

2.16 The APSAPG noted the following description as the CANSO definition of Seamless ATM:

Seamless ATM operations is defined as ATM operations in contiguous airspace that is technically and procedurally interoperable, universally safe, and in which all categories of airspace users transition between Flight Information Regions, or other vertical or horizontal boundaries, without requiring a considered action to facilitate that transition and without any noticeable change in:

1) Type or quality of service received;

2) Air navigation and communications performance standards; and

3) Standard practices to be followed.

2.17 The ICAO Twelfth Air Navigation Conference (AN-Conf/12, Montreal, 19-30 November 2012) endorsed 10 High Level Air Navigation Policy Principles in the GANP, and the Asia/Pacific Seamless ATM Principles are aligned with these high level principles.

EXECUTIVE SUMMARY

<u>Seamless ATM</u>

3.1 ICAO data indicates that the Asia/Pacific Region in 2011 was the busiest in the world in terms of Passenger Kilometres Performed (PKP): 1,496 billion compared to 1,434 for North America and 1,385 for Europe, with growth rates of 8.0 - 8.8%, 2.3 - 3.5% and 4.2 - 4.8% over the 2012-2014 period respectively. In 2012, the Asia/Pacific region had the largest regional market share of total domestic and international Revenue Passenger Kilometres (RPK) at 30%, compared to 27% for both Europe and North America. **Figure 1 and Figure 2** indicating the projected air traffic growth which has necessitated the Seamless ATM approach.

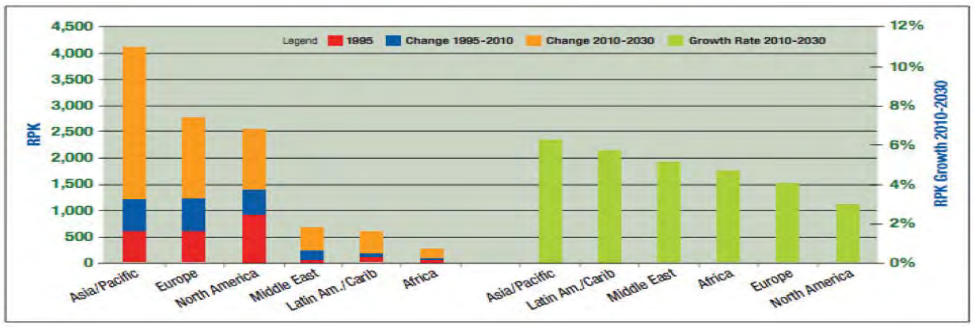

Figure 1: Passenger Traffic Forecasts – Top Traffic Flows in 2030 (ICAO 2010)

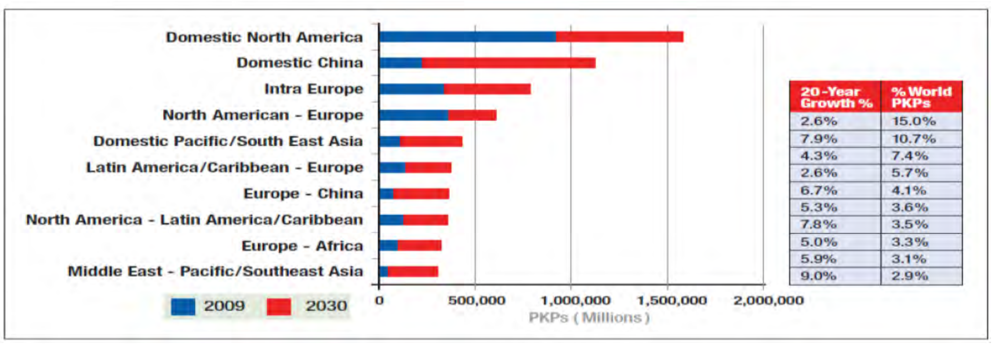

Figure 2: Top 10 Traffic Flows in 2030 (ICAO 2010)

3.2 The 46th Directors General Civil Aviation (DGCA) Conference (Osaka, October 2009) was the genesis of Asia/Pacific Seamless ATM discussion, endorsing the Kansai Statement (**Appendix A**). The DGCA Conference requested the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) to take a lead role in development of Seamless ATM in the Asia/Pacific region.

3.3 The ICAO Asia/Pacific (APAC) Seamless ATM Symposium and Ad Hoc Meeting (Bangkok, Thailand, 15 to 17 August 2011) developed:

a) proposed APSAPG objectives;

b) draft Seamless ATM principles;

c) civil/military cooperation Seamless ATM aspects;

d) the requirement for ASBUs to form a key part of Seamless ATM planning; and

e) the requirement for a capabilities matrix to provide a target and means of progressing to the Seamless ATM objectives.

3.4 APANPIRG/22 created the APSAPG in 2011 under Decision 22/56, with a primary goal to develop an Asia/Pacific Seamless ATM Plan.

3.5 The Global Air Navigation Industry Symposium (GANIS, Montréal, 20-23 September 2011) introduced the ASBU concept. This inferred an iterative improvement, from Block 0 (zero) to 3. Although the implementation of all ASBU elements is not mandatory, it is intended to achieve the highest level of conformance; thus supporting global interoperability and Seamless ATM.

3.6 Subject to several recommendations (**Appendix B**), the AN-Conf/12 endorsed the ASBU concept and the consequential changes to the GANP. The AN-Conf/12 stressed that ASBU Block 0 implementation and requirements needed to be coordinated at a regional level based on operational requirements, and that action plans to address identified impediments to ATM modernization should be developed. This Plan is part of the Asia/Pacific strategy to address the requirement for action plans, and to guide Asia/Pacific administrations in their ATM planning.

Air Navigation Service Provider Summary

3.7 The safety and efficiency of flights transcend national borders and airspace boundaries. Seamless ATM is therefore possible only if there is close regional collaboration among States, their ANSPs and all stakeholders. Cooperation is the key to success.

3.8 Given the size and diversity of the region, ATM harmonisation efforts will require the needs of the least developed ANSPs to be addressed especially in the areas of technical assistance such as funding, expertise and training. Differences in economic development may also mean that traffic demands are not uniform in the region, and therefore ATM solutions should be driven by performance requirements appropriate to the traffic demands.

Aerodrome Operator Summary

3.9 Aerodrome operations are a key component for Seamless ATM, especially in regard to infrastructure and operational efficiencies. The collaborative interaction of various stakeholders is important to ensure that aerodrome operations, facilities and equipment are suitable for all aircraft operators. Aerodrome operators require the airspace, ATM, aerodrome and aircraft operations to be cohesive and interoperable. This includes not only the aerodrome movement areas but the terminal and ancillary services, which may include border protection, fuel, baggage and passenger facilitation, which need to be aware of the interaction of their services with the aircraft operations.

3.10 Short, medium and long term aerodrome planning needs to take into account the seamless system so that capital investment is aligned to ATM operational efficiencies. Aerodrome development and airline changes are catalysts for changes driven by the aerodrome operator, but there is a need to ensure enroute and terminal ATS efficiencies are not impacted or lost, due to poor aerodrome infrastructure and operations. A saving in aircraft flight time can easily be eroded by lack of gates, poor taxiway-runway interface and inadequate terminal facilities. Stakeholder involvement and infrastructure changes needs to be coordinated to maximise the efficiencies from a systemic approach to aerodrome, airspace, air traffic management and aircraft operations.

ABBREVIATIONS AND ACRONYMS

AAR	Aerodrome Arrival Rate
ABI	Advanced Boundary Information (AIDC)
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ACP	Acceptance (AIDC)
ADOC	Aircraft Direct Operating Cost
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
AIDC	ATS Inter-facility Data Communications
AIGD	ICAO ADS-B Implementation and Guidance Document
AIM	Aeronautical Information Management
AIRAC	Aeronautical Information Regulation and Control
AIRD	ATM Improvement Research and Development
AIS	Aeronautical Information Service
AIXM	Aeronautical Information Exchange Model
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
AN-Conf	Air Navigation Conference
AOC	Assumption of Control (AIDC)
AOM	Airspace Organization and Management
APAC	Asia/Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APCH	Approach
APEC	Asia Pacific Economic Cooperation
APSAPG	Asia/Pacific Seamless ATM Planning Group
APV	Approach with Vertical Guidance
APW	Area Proximity Warning
ASBU	Aviation System Block Upgrade
ASD	Aircraft Situation Display
ASEAN	Association of Southeast Asian Nations
ASMGCS	Advanced Surface Movements Guidance Control Systems
ATC	Air Traffic Control
ATCONF	Worldwide Air Transport Conference
ATFM	Air Traffic Flow Management
ATIS	Automatic Terminal Information Service
ATS	Air Traffic Services
ATSA	Air Traffic Situational Awareness
ATM	Air Traffic Management
CANSO	Civil Air Navigation Services Organization
CARATS	Collaborative Actions for Renovation of Air Traffic Systems
CDM	Collaborative Decision-Making
CCO	Continuous Climb Operations
CDO	Continuous Descent Operations
CFIT	Controlled Flight into Terrain
CLAM	Cleared Level Adherence Monitoring
COM	Communication
CONOPS	Concept of Operations
CNS	Communications, Navigation, Surveillance
CPAR	Conflict Prediction and Resolution
CPDLC	Controller Pilot Data-link Communications
CPWG	Cross-Polar Working Group
CSP	Communication Service Provider

CTA	Control Area
CTR	Control Zone
DARP	Dynamic Airborne Re-route Planning
DGCA	Conference of Directors General of Civil Aviation
DMAN	Departure Manager
DME	Distance Measuring Equipment
EST	Coordinate Estimate
FAA	Federal Aviation Administration
FDPS	Flight Data Processing System
FIR	Flight Information Region
FIRB	Flight Information Region Boundary
FL	Flight Level
FLAS	Flight Level Allocation Scheme
FLOS	Flight Level Orientation Scheme
FRMS	Fatigue Risk Management System
FUA	Flexible Use Airspace
GANIS	Global Air Navigation Industry Symposium
GANP	Global Air Navigation Plan
GASP	Global Aviation Safety Plan
GBAS	Ground-based Augmentation System
GDP	Gross Domestic Product
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GPI	Global Plan Initiative
HF	High Frequency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMC	Instrument Meteorological Condition
INS	Inertial Navigation Systems
IO	International Organizations
IPACG	Informal Pacific ATC Coordinating Group
ISPACG	Informal South Pacific ATS Coordinating Group
ITP	In-Trail Procedure
KPA	Key Performance Area
LNAV	Lateral Navigation
LVO	Low Visibility Operations
MET	Meteorological
METAR	Meteorological Aerodrome Report
MLAT	Multilateration
MSAW	Minimum Safe Altitude Warning
MTF	Major Traffic Flow
NextGen	Next Generation Air Transportation System
OPMET	Operational Meteorological
OLDI	On-Line Data Interchange
OTS	Organised Track System
PACOTS	Pacific Organized Track System
PARS	Preferred Aerodrome/Airspace and Route Specifications
PASL	Preferred ATM Service Levels
PBN	Performance-based Navigation
PIA	Performance Improvement Areas
PKP	Passenger Kilometres Performed
PVT	Passenger Value of Time
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Route Adherence Monitoring

RANP	Regional Air Navigation Plan
RPK	Revenue Passenger Kilometres
RNAV	Area Navigation
RNP	Required Navigation Performance
RVSM	Reduced Vertical Separation Minimum
SAARC	South Asian Association for Regional Cooperation
SATVOICE	Satellite Voice Communications
SAR	Search and Rescue
SBAS	Space Based Augmentation System
SCS	South China Sea
SESAR	Single European Sky ATM Research
SHEL	Software, Hardware, Environment and Liveware
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Information
SPECI	Special Weather Report
STAR	Standard Terminal Arrival Route or Standard Instrument Arrival (Doc 4444)
STCA	Short Term Conflict Alert
STS	Special Handling Status
SUA	Special Use Airspace
SUR	Surveillance
SWIM	System-Wide Information Management
TAF	Terminal Area Forecast
TAWS	Terrain Awareness Warning Systems
TBO	Trajectory Based Operations
TCAC	Tropical Cyclone Advisory Centre
TCAS	Traffic Collision Avoidance System
TOC	Transfer of Control
UAS	Unmanned Aircraft Systems
UAT	Universal Access Transceiver
UPR	User Preferred Routes
VHF	Very High Frequency
VMC	Visual Meteorological Systems
VNAV	Vertical Navigation
VAAC	Volcanic Ash Advisory Centre
VMC	Visual Meteorological Conditions
VOLMET	Volume Meteorological
VOR	Very High Frequency Omni-directional Radio Range
VSAT	Very Small Aperture
WAFC	World Area Forecast Centre

BACKGROUND INFORMATION

Principles

5.1 There were considered to be three major areas of Seamless ATM Principles, involving People (human performance), Facilities (physical equipment), and Technology and Information. The 37 Principles agreed by APSAPG and endorsed by APANPIRG are included as **Appendix C**.

Aviation System Block Upgrade (ASBU)

5.2 At the Global level, ICAO started the ASBU initiative as a programme framework that developed a set of aviation system solutions or upgrades intended to exploit current aircraft equipage, establish a transition plan and enable global interoperability. ASBUs comprised a suite of modules organised into flexible and scalable building blocks, where each module represented a specific, well bounded improvement. The building blocks could be introduced and implemented in a State or a region depending on the need and level of readiness, while recognizing that all the modules were not required in all airspaces. ASBUs described a way to apply the concepts defined in the Doc 9854 with the goal of implementing regional performance improvements, and were used in the new edition of the GANP to guide implementation. AN-Conf/12 agreed that the ASBUs and the associated technology roadmaps were integral parts of the GANP and a valuable implementation tool kit.

5.3 ICAO estimated that US$120 billion would be spent on the transformation of air transportation systems in the next decade. While NextGen and SESAR accounted for a large share of this spending, parallel initiatives were underway in many areas including the Asia/Pacific region, North and Latin America, Russia, Japan and China. ATM modernization is a very complex but necessary task, given the benefit of these initiatives as traffic levels increased. It is clear that to safely and efficiently accommodate the increase in air traffic demand — as well as respond to the diverse needs of operators, the environment and other issues, it is necessary to renovate ATM systems, in order to provide the greatest operational and performance benefits.

5.4 ASBU are comprised of a suite of modules, each having the following qualities:

- a clearly-defined measurable operational improvement and success metric;
- necessary equipment and/or systems in the aircraft and on the ground along with an operational approval or certification plan;
- standards and procedures for both airborne and ground systems; and
- a positive business case over a clearly defined period of time.

5.5 ASBU are divided into four Performance Improvement Areas (PIA):

- PIA 1: Airport Operations;
- PIA 2: Globally Interoperable Systems and Data – *Through Globally Interoperable System Wide Information Management*;
- PIA3: Optimum Capacity and Flexible Flights – *Through Global Collaborative ATM*; and
- PIA 4: Efficient Flight Path – *Through Trajectory-based Operations.*

Asia/Pacific ASBU Implementation

5.6 ASBU Block 0 modules were incorporated into the Seamless ATM framework used to assess the uptake by Asia/Pacific States.

5.7 **Table 1** provides a summary of the Block 0 elements, and the expected priority for implementation within the Asia/Pacific region as discussed and agreed by APSAPG/2 (Tokyo, 6-10 August 2012). The allocation of priority was based on factors including its importance in promoting Seamless ATM (Priority 1 = critical upgrade, Priority 2 = recommended upgrade, Priority 3 = may not be universally implemented). A cost-benefit or economic analysis before implementation was identified as essential to determine whether to implement B0-SURF, B0-ASUR and B0-ACAS, but should not preclude an economic analysis of other elements as determined by the State.

PIA	Element	Economic Analysis	Priority
PIA 1	B0-APTA Optimization Of Approach Procedures Including Vertical Guidance	-	2
	B0-WAKE Increased Runway Throughput Through Optimized Wake Turbulence Separation	-	3
	B0-RSEQ Improve Traffic Flow Through Runway Sequencing (AMAN/DMAN)	-	2
	B0-SURF Safety and Efficiency Of Surface Operations (A-SMGCS)	Yes	3
	B0-ACDM Improved Airport Operations Through Airport-Collaborative Decision-Making (A-CDM)	-	2
PIA 2	B0-FICE Increased Interoperability, Efficiency And Capacity Through Ground-Ground Integration (AIDC)	-	1
	B0-DATM Service Improvement Through Digital Aeronautical Information Management	-	1
PIA 3	B0-FRTO Improved Operations Through Enhanced En-Route Trajectories (CDM, FUA)	-	1
	B0-NOPS Improved Flow Performance Through Planning Based On A Network-Wide View	-	1
	B0-ASUR Initial Capability For Ground Surveillance	Yes	1
	B0-ATSA Air Traffic Situational Awareness (ATSA)	-	2
	B0-OPFL Improved Access To Optimum Flight Levels Through Climb/Descent Procedures Using Automatic Dependent Surveillance – Broadcast (ADS-B)	-	3
	B0-ACAS ACAS Improvements	Yes	2
	B0-SNET Increased Effectiveness Of Ground-based Safety Nets	-	2
	B0-AMET Meteorological Information Supporting Enhanced Operational Efficiency and Safety	-	2
PIA 4	B0-TBO Improved Safety And Efficiency Through The Initial Application Of Data Link En-Route	-	1
	B0-CDO Improved Flexibility And Efficiency In Descent Profiles (Continuous Descent Operations - CDO)	-	2
	B0-CCO Improved Flexibility And Efficiency Departure Profiles - Continuous Climb Operations (CCO)	-	2

Table 1: Asia/Pacific ASBU Block 0 Priority

Critical ASBU Upgrades

5.8 The following ASBU Block 0 elements were considered by APSAPG and endorsed by APANPIRG as critical upgrades for Seamless ATM, and thus should be accorded the highest priority in terms of the earliest implementation and the resources required to support this.

Note: This did not suggest that 'critical' elements had a higher priority than safety critical improvements.

5.9 **B0-FRTO** *Enhanced En-route Trajectories*: Flexible Use Airspace (FUA), User Preferred Routes (UPR), Dynamic Airborne Re-route Planning (DARP) and CDM. These will allow the use of airspace which would otherwise be segregated, along with flexible routing adjusted for specific traffic patterns for greater routing possibilities, reducing flight time and fuel burn. The applicable Global Plan Initiatives related to this element are GPI-1 (FUA), GPI-7 Dynamic and Flexible ATS Route Management, and GPI-8 Collaborative Airspace Design and Management.

5.10 **B0-FICE** *Ground – Ground Integration and Interoperability*: ATS Inter-facility Data Communications (AIDC). AIDC application exchanges information between ATS units in support of critical ATC functions, including notification of flights approaching a Flight Information Region (FIR) boundary, coordination of boundary-crossing conditions, and transfer of control. AIDC application improves the overall safety of the ATM system, as well as increasing airspace capacity, as it permits the controller to simultaneously carry out other tasks. While there is no related GPI, this element has been considered to be a high priority to support GPI-7 Dynamic and Flexible ATS Route Management, and is also a key enabler to reduce Air Traffic Control (ATC) coordination errors as a result of human factors.

5.11 **B0-DATM** *Digital Aeronautical Information Management* (AIM). AIM is one of the foundation elements that supports other aspects of ASBU, and as such requires a high priority. A key strategy activity during Block 0 may include the development of the System-Wide Information Management (SWIM) concept of operations to support the next phase of AIM development and integration within the future SWIM framework.

5.12 **B0-NOPS** *Network Flow Management* ATFM: GPI-6 ATFM. The related GPI is GPI-10 Terminal Area Design and Management. ATFM is used to balance demand and capacity to manage the flow of traffic in a manner that minimises delay and maximises the use of the available airspace. ATFM is one of the solutions to ensure a sustainable air traffic growth for the future. Inter-linked and networked ATFM nodes between ANSPs should be developed to serve various sub-regions (refer Doc 9971 *Manual on Collaborative Air Traffic Flow Management*).

5.13 **B0-TBO** *En-route Data-link*: Automatic Dependent Surveillance-Contract (ADS-C), Controller Pilot Data-link Communications (CPDLC). Data-link application for ATC surveillance and communications supports flexible routing, reduced separation and improved safety. In areas where the provision of direct ATS surveillance is possible, ATC separation should be based on these surveillance systems (i.e. radar, multilateration and ADS-B), and that ADS-C and CPDLC with backup provided by High Frequency (HF) and/or Satellite Voice Communications (SATVOICE) were necessary elsewhere. Moreover, the Regional Surveillance Strategy states that ADS-C should be used where technical constraint or cost benefit analysis did not support the use of Automatic Dependent Surveillance-Broadcast (ADS-B), SSR or Multilateration (MLAT).

5.14 **B0-ASUR** *Ground-Based ATS Surveillance*: ADS-B, MLAT. The related GPI is GPI-17 Data-Link Applications. The Regional Surveillance Strategy stated that ADS-B should be used to support ATC separation service, while reducing dependence on Primary Radar for area surveillance and reliance on 4-digit SSR octal codes. ADS-B technology is an initial step in creating a more flexible air transportation system that will create seamless surveillance and shared situational awareness picture for both ground and air operations. Recommendation 1/7C adopted by the AN-Conf/12 urged States to share ADS-B data to enhance safety, increase efficiency, achieve seamless surveillance and work closely together to harmonize their ADS-B plans to optimize benefits. The provision of communication capability such as Very High Frequency (VHF) to support ATS surveillance is also necessary. Furthermore, APANPIRG/22 urged States to support provision of Very High Frequency (VHF) radio voice air/ground communication infrastructure for use by adjacent States to enable a reduction of ATS separation based on surveillance.

<u>Recommended ASBU Upgrades</u>

5.15 **B0-CDO**: *Improved Flexibility and Efficiency in Descent Profiles* CDO and Standard Instrument Arrival (STAR). These arrival procedures allow aircraft to fly their optimum profile, taking into account airspace and traffic complexity. The related GPI is GPI-11 Area Navigation (RNAV) and Required Navigation Performance (RNP) Standard Instrument Departures (SIDs) and STARs. This element has been accorded a high priority by ICAO HQ, due to the improvement in safety regarding Controlled Flight into Terrain (CFIT) and greater efficiency in terms of fuel usage and emissions.

Note: the terms 'Standard Terminal Arrivals' and 'Standard Instrument Arrival' from Doc 9750 and Doc 4444 respectively have the same meaning.

5.16 **B0-RSEQ** *Runway Sequencing*: Arrival Manager (AMAN), Departure Manager (DMAN). AMAN/DMAN procedures are designed to provide automation support for synchronisation of arrival sequencing, departure sequencing and surface information. Training on automation support, operational standards and procedures were necessary.

5.17 Point Merge PBN procedures (Section 6, **Appendix F**) are examples of procedures that may be used to assist sequencing until the following ASBU modules were implemented, to ensure more accurate Trajectory Based Operations (TBO):

- **B1-RSEQ** (*extended arrival metering, integration of surface management with departure sequencing*);
- **B1-NOPS** (*integrated ATFM including airspace management, user driven prioritisation and collaborative ATFM solutions*);
- **B1-TBO** (*synchronisation of traffic flows at merge points through controlled time of arrival capability and airport applications such as D-TAXI*); and
- **B1-AMET** (*weather information supporting automated decision support or aids*).

5.18 **B0-CCO** *Flexible and Efficient Departure Profiles* Continuous Climb Operations (CCO), SID. This element has been accorded a high priority by ICAO HQ, due to greater efficiency in terms of fuel usage and emissions. The related GPI is GPI-11 (RNP and RNAV SIDs, STARs).

5.19 **B0-APTA** *Airport Accessibility*: Performance-based Navigation (PBN) procedures with vertical guidance. The optimal use of appropriate PBN specification is a key enabler to progress Seamless ATM in the Asia/Pacific region. PBN lays the foundation for the airspace system for years to come as future navigation developments such as four-dimensional (4D) user prefer trajectories evolve. This element has been accorded a high priority by ICAO globally. Documents providing guidance on this subject were:

- *PBN Manual*, *GNSS Manual*, *Annex 10*, *PANS-OPS Volume 1 and 2*;
- *Manual on Testing of Radio Navigation Aids Volume 2* (Doc 8071);
- *Quality Assurance Manual for Flight Procedure Design Volume 5* (Doc 9906);
- and for avionics-
    - Basic IFR Avionics (TSO C129 with Receiver Autonomous Integrity Monitoring - RAIM);
    - Basic IFR Global Navigation Satellite System (GNSS) receivers with Baro-VNAV (Vertical Navigation), Space Based Augmentation System - SBAS avionics (TSO C145/146); and
    - GBAS receivers (TSO C161/162).

5.20 **B0-ACDM** *Airport CDM*: the relevant GPI is GPI-13 Airport Collaborative Decision-Making. The decision making process at the airport is enhanced by sharing up-to-date relevant information and by taking into account the preferences, available resources and the requirements of the stakeholders at the airport. Material from the ICAO CDM Manual is being incorporated into a global manual on collaborative ATFM (Doc 9971). .

5.21 **B0-ATSA** *Air Traffic Situational Awareness*: ADS-B OUT enabled for airborne surveillance. ATSA applications will enhance safety and efficiency by providing pilots with the means to achieve quicker visual acquisition of targets. These are cockpit based applications which do not require any support from ground, and hence can be used by any suitably equipped aircraft. The applicable GPI is (GPI-9) Situational Awareness.

5.22 **B0-ACAS** *Airborne Collision Avoidance System Improvements*: ACAS (Airborne Collision Avoidance System). Traffic Collision Avoidance System (TCAS) version 7.0 or 7.1 is the expected standard. The requirement for forward fit from 01 January 2014 and retrofit by 01 January 2017 of aircraft ACAS installations with an upgraded collision avoidance logic known as TCAS V7.1 was adopted in 2010 by the ICAO Council. This element is designed to increase the effectiveness of surveillance and collision avoidance systems through mandatory use of pressure altitude reporting transponders, in accordance with the Regional Surveillance Strategy.

5.23 **B0-SNET** *Ground-Based Safety Nets*: Short Term Conflict Alert (STCA), Area Proximity Warning (APW), Minimum Safe Altitude Warning (MSAW).

5.24 **B0-AMET**: *Meteorological Forecasts, Warnings and Alerts*: Aerodrome warnings, including windshear. World Area Forecast Centre (WAFC), Volcanic Ash Advisory Centre (VAAC), and Tropical Cyclone Advisory Centre (TCAC) forecasts. The relevant GPI is GPI-19: improving the availability of meteorological (MET) information in support of a seamless global ATM system.

5.25 The future, net-centric oriented ATM system requires the smart use of uncertainty characteristics often associated with MET information, enabling decision-makers to make choices according to their own objectively determined thresholds for action. This needs a transition of MET information, specifically in table-driven data representation supporting ATM collaborative, knowledge-based, and decision-making through free-flowing information exchange (ASBU B1-AMET).

5.26 The first evolutionary step in the improved provision of MET information includes the provisions in Amendment 76 to Annex 3 – Meteorological Service for International Air Navigation (applicable November 2013). This will facilitate the exchange of OPMET information (specifically METAR, SPECI, TAF and SIGMET) in a digital form (XML/GML), accompanied by the appropriate metadata, in accordance with the globally interoperable information exchange model. These developments were designed to foster the future SWIM environment, which would include meteorological, aeronautical and flight information, amongst others.

5.27 Amendment 77 to Annex 3 (intended applicability in November 2016) was expected to upgrade these particular provisions to a recommendation, while Amendment 78 to Annex 3 (intended applicability in November 2019) was expected to make it standard practice for States to exchange such OPMET information in digital form. During Amendments 77 and 78 of Annex 3, and beyond, a significant portion of current MET products would transition to supporting digital information exchange within SWIM. In addition, there would be an increased reliance on the automated relay of meteorological information to and from aircraft, including enhanced aircraft-based meteorological reporting capabilities (ASBU B3-AMET).

ASBU Elements Which May Not Be Universally Implemented

5.28 **B0-WAKE, B1-WAKE**: *Enhanced Wake Turbulence Separations*. As a function of local implementation plans, development of automation support (Decision Support Tools) is required to enable the display to ATC of the appropriate wake turbulence separation minima applicable between successive pairs of arriving and departing aircraft, to apply optimized wake turbulence standards. Such automation support is considered desirable for Block 0 (6 category system), and necessary for Block 1 (pair-wise system).

5.29 **B0-SURF**: *Improved Runway Safety*: Advanced Surface Movements Guidance Control Systems (ASMGCS), where weather conditions and capacity warranted. Implementation of ASMGCS may not be a high priority in the Asia/Pacific except at high density aerodromes where the cost benefits of mandating this were positive. The related GPI is GPI-9 (Situational Awareness: **o**perational implementation of data link-based surveillance), and GPI-15 (Match Instrument Meteorological Conditions - IMC and Visual Meteorological Conditions - VMC Operating Capacity: improve the ability of aircraft to manoeuvre on the aerodrome surface in adverse weather conditions).

5.30 **B0-OPFL**: *Climb/Descent Procedures using ADS-B In-trail Procedure* (ITP). This element is applicable only for those ANSPs that provide services within Category R airspace, and may be rarely used in airspace where 30/30NM separation is applied using RNP4 or other more efficient standards, as ITP required a number of steps to apply correctly. Thus, ITP is optional, primarily for higher density Category R airspace with Organised Track Systems (OTS).

Global and Regional Elements

5.31 **Aerodrome Certification**. GPI-13 *Aerodrome Design and Management* promoted, i*nter alia*, the implementation of management and design strategies to improve movement area utilization. ICAO Annex 14, Volume I required States to certify their aerodromes used for international operations in addition to aerodromes open for public use through an appropriate regulatory framework.

5.32 **Aerodrome Capacity Analysis**. GPI-14 *Runway Operations* establishes requirements to maximize runway capacity. In addition, there is a need to determine capacity and related constraints for runways, taxiways and gates, especially for Low Visibility Operations (LVO). Aircraft gate movement predictability affecting ATFM may be influenced by the efficiency of the embarkation and disembarkation of people and goods. In conducting aerodrome capacity analysis, it is important to include an assessment of the capacities of the airport passenger and cargo terminals and landside infrastructure to handle passengers, checked-in baggage, air freight and road traffic to ensure that the airfield, passenger/cargo terminals and landside capacities are balanced as much as possible.

5.33 Apron Management Services need to be integrated with ATC services using interoperable systems (including automated tools), shared data and harmonised procedures. Therefore clear procedures between a provider of aerodrome ATS services and the aerodrome operator are necessary in order to ensure that the planning, operation and review of aerodrome services are conducted collaboratively.

5.34 **Flight Information Regions** (FIRs). FIR boundaries should not limit the delivery of ATS surveillance-based separation services, and where possible the number of FIRs should be minimized, particularly along traffic flows.

Note: FIRs should not necessarily be based strictly on the boundaries of sovereign territories (Annex 11)

5.35 Recommendation 5/1 from the AN-Conf/12 (**Appendix B**) suggested that States fully assess the operational, safety, performance and cost implications of a harmonised transition altitude.

5.36 **Airspace Classification.** The applicable GPI is GPI-4 *Alignment of Upper Airspace Classifications*, which supports the harmonization of upper airspace and associated traffic handling through application of a common ICAO ATS Airspace Class above an agreed division level.

5.37 **Reduced Vertical Separation Minimum** (RVSM). The applicable GPI is GPI-2: the optimization of the utilization of airspace and enhanced aircraft altimetry systems. GPI-3 *Harmonization of Level Systems*: the adoption by all States of the ICAO Flight Level Orientation Scheme (FLOS) based on feet as contained in Appendix 3a to Annex 2. China is the only State that has adopted Appendix 3b to Annex 2, while some adjacent States continued to refer to the metre equivalent of feet (flight levels), as their domestic altimetry systems or regulations are commonly based on metres.

5.38 **Airspace Priority.** At the 6th Worldwide Air Transport Conference (ATCONF, Montréal, 18-22 March 2013) support was expressed for work to be undertaken on the schemes of economic incentives, 'best equipped or capable, best served' and 'most capable, best served' concepts. The CONOPS states that in each case where any aircraft that does not meet specified requirements, it should receive a lower priority, except where prescribed (such as for State aircraft).

5.39 Affording priority for flight levels or making specified levels unavailable for certain ATS routes under a Flight Level Allocation Scheme (FLAS) needs to be minimised, as this may penalise flights without consideration of actual capacity at the time and does not necessarily take advantage of the tactical capability of ATM systems. Thus FLAS should only be imposed to enhance safety and/or capacity, or where there were systemic operational limitations, such as the ability to deliver ATS surveillance-based separation services.

5.40 Establishing equipage mandates requiring operators to equip with a specific technology is an acceptable concept, provided the timeline for compliance is developed after due consultation and the [safety and economic] benefits in equipage were clearly identified and agreed (CONOPS).

5.41 **ATS routes**. The CONOPS establishes the expectation that in upper controlled airspace and within terminal controlled airspace (CTA and CTR) associated with major international aerodromes, ATS routes should be PBN based, with an appropriate specification determined by the Airspace Authority based on the GANP and the Regional Navigation Strategy as endorsed by APANPIRG. However, the RANP amendment of all conventional regional ATS routes to PBN routes would be very time consuming, so changes to PBN are being made on an opportunity basis, or when a new route is established, consistent with this Plan. A harmonised en-route PBN implementation is a key to achieving seamless ATM in order to cater to capacity growth. The applicable GPI is GPI-5: RNAV and RNP: the incorporation of advanced aircraft navigation capabilities into the air navigation system infrastructure.

5.42 The Plan advocates moving to take early advantage of GNSS so Asia/Pacific States do not need to undertake expensive ground-based navigation aid updates to support PBN ATS routes. For any move to a GNSS-based system, consideration must be made of the appropriate backup requirements. The following redundancy should be considered by States in their Safety Assessment with regard to reliance on GNSS:

- use of linked GNSS/Inertial Navigation Systems (INS) that provide a degree of accuracy commensurate with the navigation accuracy requirements until an alternative form of navigation is available;
- retention of terminal VOR/DME at major aerodromes only;
- retention of some radar or MLAT capability supporting terminal operations to provide a degree of navigation assistance if GNSS is not available; and
- the use of multi-modal receivers that can use different GNSS constellations.

5.43 **ATC Separation**. The CONOPS stated that in areas where the provision of direct ATS surveillance is possible, ATC separation should be based on these surveillance systems (i.e.: radar, multilateration and ADS-B). The Regional Surveillance Strategy reinforces this by encouraging the provision of communication, navigation, and data management capabilities necessary to make optimal use of surveillance systems. Moreover, States are expected to enhance ATM automation tools and safety nets through the use of aircraft-derived data such as flight identification, trajectories and intentions.

5.44 ATS surveillance-based separation may be provided with only one ATS surveillance system. Multiple ATS surveillance systems such as radar, ADS-B or MLAT should not be required, unless a single system does not demonstrate reliable performance in terms of availability, or overlapping coverage is required near an ATS sector boundary, or a safety case required enhanced redundancy or for any other economic reason.

5.45 There should be no requirement for radio reports at procedural waypoints when operating within ATS surveillance coverage, unless specifically requested by controllers on a tactical basis (Doc 4444, paragraph 4.11.1.3). When utilising ADS-C with waypoint event contract functionality, there should be no requirement for CPDLC waypoint reports, which should be stated in the State AIP.

5.46 **Civil Data-Sharing**. The provision of ATS surveillance data between civil ANSPs (suitably filtered as appropriate in terms of national security) is important for harmonised Transfer of Control (TOC) procedures between ATC units, unless surveillance coverage extended well into the adjacent unit's airspace. ADS-B system data should not require filtering, as it is publically broadcast information, lending itself to improving safety through the sharing of ATS surveillance data across FIR boundaries, in accordance with the Regional Surveillance Strategy.

Human Performance

5.47 The Global ATM Operational Concept (Doc 9854) states:

> *Humans will play an essential and, where necessary, central role in the global ATM system. Humans are responsible for managing the system, monitoring its performance and intervening, when necessary, to ensure the desired system outcome. Due consideration to human factors must be given in all aspects of the system*.

5.48 The AN-Conf/12 emphasised the importance of human performance considerations by endorsing Recommendation 6/4 (**Appendix B**), which called for the integration of human performance as an essential element for the implementation of ASBU modules and in the planning and design phase of new systems and technologies, as part of a safety management approach.

5.49 The role of the human is especially important in delivering high quality and consistent services supporting Seamless ATM. Therefore it is crucial to ensure that, training and licensing requirements are developed using a competency-based framework, fatigue-related risk is managed appropriately, and safety data, including the reporting of hazards, is collected, analysed and acted upon within ATM systems that support Seamless ATM

5.50 One of the more important human performance aspects in order to deliver a consistent, harmonised and efficient service is ATC training, to change from a procedural mind set to one that used the tactical delivery of services based on ATS surveillance and automated safety nets (airborne and ground).

5.51 Moving from reliance on paper-based flight progress strips to an electronic equivalent connected to the ATS surveillance Flight Data Processing System (FDPS) or direct data inputs to the Aircraft Situation Display (ASD) support this paradigm shift.

5.52 Controllers need to be trained on the application of tactical separation, including the use of positive control techniques, such as vectoring and speed control when conflict pairs approach minimum separation. In this regard, it is important that managers facilitate a modern operating environment in terms of air safety incidents and human factors, so personnel are confident using the full capability provided by the CNS facilities.

5.53 A critical human performance issue is the training of ANSP management and regulators in human performance issues. These decision-makers had an important influence on outcomes in terms of supporting the right environment for Seamless ATM activities, whether that is providing financial resources, or establishing high-level policies and procedures.

5.54 A key component of Seamless ATM is the ability of controllers to operate, and have confidence in, a new operating environment. The appropriate use of ATC simulators to enhance their learning experience is an essential part of the necessary training.

5.55 In planning to deliver Seamless ATM services, it is assumed that each State and aircraft operator will comply with the English language proficiency requirements in accordance with ICAO Standards and Recommended Practices.

Civil/Military Cooperation

5.56 One of the key enablers for improvement of ATM efficiencies supported by Doc 9854 (Global ATM Operational Concept) is the use of FUA. This is an airspace management concept based on the principle that airspace should not be designated as purely civil or military, but rather as a continuum in which all user requirements are accommodated to the greatest possible extent. FUA normally referred to the activation of Special Use Airspace (SUA), but could also include controlled airspace.

5.57 The establishment and operation of SUA required careful assessment, review and management, to ensure the most appropriate airspace designation is used, and the airspace is operated in a cooperative manner. This is ordinarily only possible through discussion between military and civil parties. Thus a key to the establishment of effective FUA is risk-based assessments, determining the risks or security issues involved through coordinated and cooperative methods if possible.

Note: Annex 2 Rules of the Air states that restricted areas were airspace of defined dimensions, above the land areas or territorial waters of a State, which means that restricted areas must not be designated over the high seas or in airspace of undetermined sovereignty

5.58 Restricted areas designed to segregate civil aircraft from airborne military operations or ordnance firing would be expected when the risk of an accident for non-segregated operations is higher than acceptable. However, lower risk military operations (such as using small calibre weapons at an established firing range) may only require the establishment of a danger area or even no SUA. Thus the type, dimensions, activation notice and duration of SUA activity should be appropriate and commensurate with the type of activity affecting the airspace.

5.59 APANPIRG/9 (August 1998) developed the following guidelines for civil/military cooperation in the following areas: military procedures, aeronautical facilities and ground services, civil and military ATS unit personnel, airspace, research and development, common terminology, abbreviations rules and procedures, military exercises, and non-sensitive military data.

- If at all possible, military training should be conducted in locations and/or at times that do not adversely affect civilian operations, particularly those associated with major aerodromes. This requires strategic planning by formal civil/military coordination bodies.
- Consideration of the interoperability and operations of military systems is an integral part of a Seamless ATM environment. With increasingly complex aircraft equipage civil requirements, non-compliant military or other State aircraft may become more difficult to manage using Special Handling Status (STS). The limitations or requirements of military aircraft cockpits, avionics and airframes may even preclude some civil systems, and yet military aircraft still need to transit airspace used predominantly by civil operations.
- Military participation at civil ATM meetings and within ATS Centres will often lead to a better understanding of civil needs, as well as military requirements, including the operation of Unmanned Aircraft Systems (UAS). UAS have been predominately used by the military in segregated airspace, but now many forms of State missions including customs, immigration and police operations are being planned, as well as a myriad of potential civil uses.

- Responses to Search and Rescue (SAR), Civil Defence (normally natural disaster emergencies), and national security events will inevitably require civil/military coordination so this needs to be taken into account during the planning for such operations. As these occurrences could involve a number of States, regional civil/military planning is crucial in order to reduce the response time for emergency services to aid those in need. The response to an international aviation SAR event may well involve a location over the high seas, so all States should have SAR agreements with neighbouring nations to ensure that SAR services were unimpeded to the maximum possible extent.

5.60 The Asia/Pacific Civil/Military Cooperation Seminar/Workshop (Bangkok, 28 February to 1 March 2012) recommended that the following civil/military cooperation/coordination principles and practices should be elevated to the highest political level in the Asia/Pacific regions:

- civil/military working arrangements should be enacted where discussion of both civil and military needs were able to be negotiated in a balanced manner;
- the importance of the interoperability of civil air transport infrastructure and national security was recognized;
- the interoperability of civil and military systems including data-sharing was emphasized; and
- regular review of controlled airspace and special use airspace was encouraged to be undertaken by States to ensure its establishment, size, activation and operation was appropriate in terms of optimal civil/military operations.

5.61 The Asia/Pacific Civil/Military Cooperation Seminar/Workshop requested ICAO to update existing provisions related to civil/military cooperation/coordination and further develop guidance material related to airspace planning and management, including FUA.

5.62 Data sharing arrangements (including aircraft surveillance), are a key part of civil/military cooperation for tactical operational responses, and to increase trust between civil and military units. Data sharing between the civil and military could facilitate CDM, a vital component of ATFM. The Regional Surveillance Strategy espouses civil/military cooperation and system interoperability.

5.63 Aircraft operating ADS-B technology transmit their position, altitude and identity to all listeners, conveying information from co-operative aircraft that have chosen to equip and publicly broadcast ADS-B messages. Thus there should be no defence or national security issues with the use and sharing of such data.

Note: Some military transponders may support ADS-B using encrypted messages, but this data is not normally decoded or used at all by civil systems. In many cases, tactical military aircraft are not ADS-B equipped or could choose to disable transmissions. In future, increasing numbers of military aircraft would be ADS-B capable, with the ability to disable these transmissions. ADS-B data sharing should not influence the decision by defence agencies to equip or not equip with ADS-B. Moreover, it is possible for States to install ADS-B filters that prevent data from sensitive flights being shared. These filters can be based on a number of criteria and typically use geographical parameters to only provide ADS-B data to an external party if aircraft were near the boundary.

5.64 Ten civil/military elements were incorporated into the Seamless ATM framework after analysis of discussion of the APANPIRG/9 principles, and discussion from the Seamless ATM Symposium and Ad Hoc Meeting, APSAPG/1 and the Asia/Pacific Civil/Military Seminar/Workshop.

a) **Strategic Liaison**. This element emphasised the creation of a permanent body and procedures such as participation at appropriate civil ATM meetings, to ensure long and medium-term planning for optimal civil and military operations.

b) **Tactical Liaison**. The daily, safe and efficient tactical management of operations, including airspace scheduling through interaction and communications between civil and military units, which should include military representation within civil ATC Centres where necessary.

c) **Military SUA**. The minimisation of airspace exclusively assigned for civil or military use in accordance with FUA principles, assessed by the percentage of military SUA within an FIR.

d) **SUA Review**. The regular review of SUA, to ensure that the means and notice of activation provide adequate warning for other airspace users, and the airspace designations (SUA types) as well as the lateral and vertical limits are the minimum required to safely contain the activity therein. The review of airspace should be conducted by an airspace authority independent or a collaboration of civil and military airspace users.

e) **International SUA**. The minimisation of SUA that affected international civil ATS routes. Restricted and prohibited areas must not be designated in international airspace or airspace of undefined sovereignty.

f) **Integrated Civil/Military ATM Systems**. The integration of civil and military ATM systems where practicable, including joint procurement of systems where possible.

g) **Joint Civil/Military Aerodromes and Navigation Aids**: The operation of joint civil/military aerodromes if possible, and the provision of navigation aids that could be utilised by both civil and military aircraft where practical.

h) **Shared Civil/Military Data**: The provision of ATS surveillance data from civil surveillance systems to military units to improve monitoring (thereby reducing the need for individual defence identification authorisation), trust and confidence. The provision of surveillance data from military surveillance systems where this would enhance ATS surveillance coverage and redundancy; suitably filtered as appropriate.

i) **Common Civil/Military Training**. The familiarisation of civil and military ATM personnel in each other's systems and procedures where national security allows. Training and licensing of civil and military air traffic controllers to equivalent standards.

j) **Common Civil/Military Procedures**. The implementation of the same or equivalent standards, procedures and policies for the provision of ATS and the management of air traffic.

CURRENT SITUATION

Aerodrome Analysis

6.1 In the 1990s and the first decade of the new millennium, aerodrome operators in Asia-Pacific invested billions of dollars to enhance capacity of existing aerodromes and to build new ones to meet increasing air traffic demand. Notable examples are the opening of Bangalore, Hong Kong, Incheon, Kuala Lumpur International, Shanghai Pudong and Suvarnabhumi airports and the expansion of New Delhi and Beijing Capital airports. The automation and the adoption of self-service technology for passenger handling such as check-in and automated border control has enabled many airports to build up capacity without expanding passenger terminal footprint.

6.2 However new capacities are often taken up quickly by tremendous traffic growth experienced by the Asia-Pacific region in the same period. From year 2000 to 2011, world passenger traffic increased by 56% while the Asia-Pacific region saw an increase of 139%. Runways are typically the capacity bottleneck of aerodromes but aircraft parking stands, baggage sorting and transfer facilities, aprons and passenger security screening points operating close to or over capacity are becoming choke points as well, especially at hub airports. A-CDM promises to alleviate congestion but the close collaboration between airport management and other stakeholders such as its shareholder, ATM and airlines is essential to a coordinated development of the capacity of the regional air transport network in the long-term.

Airspace and FIR Analysis

6.3 The results of the Major Traffic Flow (MTF) and busy city pair route study are at **Appendix D**. As a result of the study, there were several features of the lack of seamless ATM facilities and practices evident in the Asia Pacific region.

a) Size of FIR – fragmented FIRs resulting in flights transiting multiple FIRs with multiple TOC points.

b) Traffic density – the capacity of ANSP infrastructure and airspace had not kept up with traffic growth.

c) Airspace and Route design and capacity –

- route structure based on historical requirements and not on current aircraft navigational capability;
- ground-based navigation aid routes, around which SUAs have grown;
- crossing tracks with and without ATS surveillance, whereby States mainly rely on the use of FLAS for procedural flight level separation;
- requirement for vertical transitions because of the two different FLOS (metric and imperial) in the region;
- routes with flight level, direction, and time restrictions making flight planning more complex;
- routes with restrictions that are un-coordinated with neighbouring FIRs; and
- restrictive route structures agreed to in a historical context which is inadequate for today’s traffic requirements.

d) ATS surveillance and communications capability -

- Non- existent or unreliable surveillance or communications capability in critical locations;
- Capability not fully utilised to provide appropriate level of service; and
- Hand-off procedures not aligned to ATM facilities and capabilities.

e) Compatibility between FIRs –

- Infrastructure development based only on national requirements, resulting in duplicated and yet uncoordinated facilities; and
- Unnecessarily conservative separation requirements at TOC points (it was not clear if this is due to lack of confidence in adjacent FIRs capability to adhere to agreed procedures, or for other operational reasons).

f) ATC standards –

- Apparent reluctance in applying ICAO standard separation minima (it was not clear if this is due a lack of confidence in ATM competence or capability); and
- Although GNSS separation is available in Doc 4444, few ANSPs in the Asia/Pacific Region used this as an alternative means of providing longitudinal separation.

g) Focus groups

- Lack of effective focus groups to address airspace capacity and FIR issues, although there had been a recent increase in informal and bi-lateral ATM coordination;
- Lack of a requirement for regular review mechanisms of operational issues within an FIR, including feedback from aircraft operators.

h) Uncoordinated and limited use of AIDC.

6.4 Generally flights operating on MTFs between large FIRs (particularly where there were multiple FIRs being provided services by one State) in <u>Category R</u> airspace were already reasonably seamless, such as in the Pacific. However, apart from being largely oceanic in nature, these MTFs had the advantage of being usually in an east/west alignment between continents and not impacted by busy crossing routes.

6.5 In addition, lower traffic density MTF enabled flexible tracks such as UPR applications. It was notable that these MTFs tended to have dedicated focus groups like Informal South Pacific ATS Coordinating Group (ISPACG) and Informal Pacific ATC Coordinating Group (IPACG) conducting regular reviews of operational efficiency.

6.6 Where long and short haul routes crossed multiple smaller FIRs, particularly with busy regional flows, there was a greater likelihood of reduced efficiency caused by a combination of inconsistent application of ATM procedures and standards, non-harmonized infrastructure development, route structure, TOC and other legacy issues. However, there were also examples of partly seamless ATM between some busy city pairs (such as Singapore/Kuala Lumpur and the Kuala Lumpur/Bangkok) in the region, resulting from bilateral efforts between ANSPs.

6.7 The Pearl River Delta airspace containing very dense air traffic served by Hong Kong, Macau, Shenzhen, and Guangzhou aerodromes, and associated heliports had Airspace Organization and Management (AOM) and civil/military coordination issues that stemmed largely from the division of responsibility between FIRs. Segregated SIDs and STARs, application of FUA and holistic 'Metroplex' planning principles as well as more integrated ATS systems are needed to achieve greater optimisation of the limited airspace available.

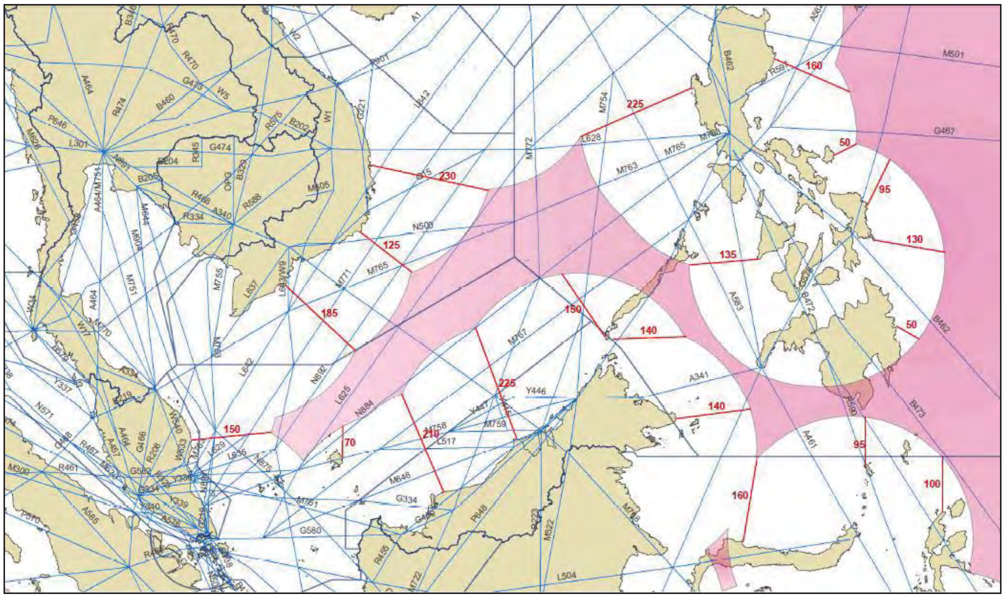

Figure 3: South China Sea ATS surveillance gaps (as at June 2013)

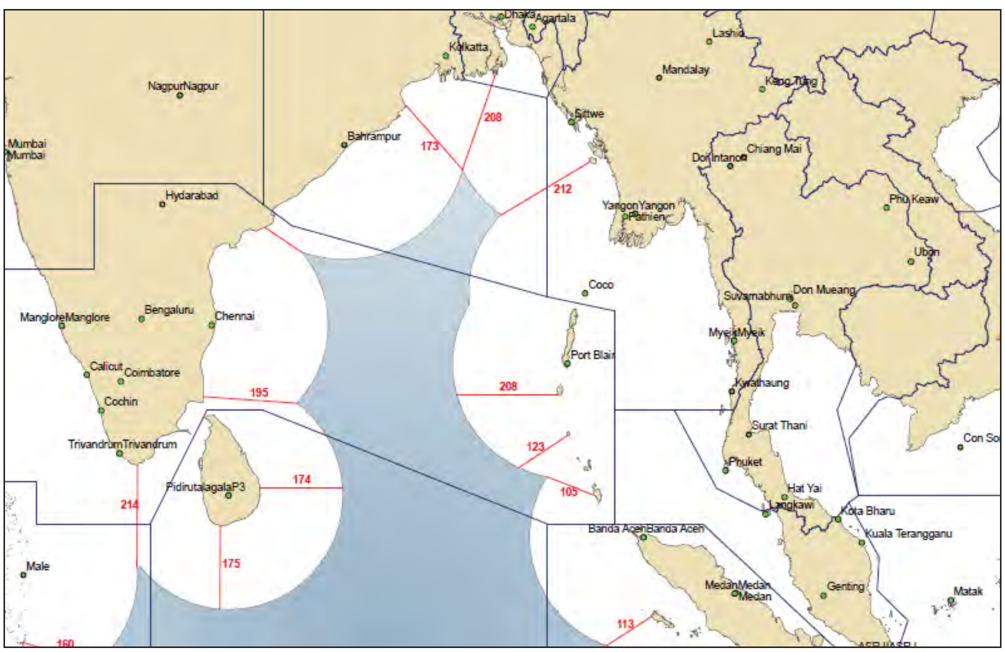

Figure 4: Bay of Bengal ATS surveillance gaps

6.8 The main areas of the Asia/Pacific region lacking ATS surveillance and communication coverage which need to be rectified due to traffic density, weather deviations and contingency responses are as follows:

a) highest priority: South China Sea airspace between Viet Nam, Brunei Darussalam and the Philippines (**Figure 3**);

b) high priority: Bay of Bengal airspace between the Indian subcontinent and the Andaman Islands (**Figure 4**);

c) medium priority:

- airspace between Indonesia and Australia (between Java and West Australia);
- airspace between the Philippines and Indonesia (**Figure 3**); and

d) lower priority: Coral Sea between Papua New Guinea and Australia.

Europe – Asia/Pacific Trans-Regional Issues

6.9 A number of ATS routes from the Russian Federation converged within Mongolian airspace because of the limited number of entry/exit points on the Mongolian/Chinese airspace boundary. Military restrictions had affected ATS route development to China/Mongolia/DPRK and Japanese airspace. An enhancement of civil/military cooperation and ATM coordination is necessary to address these trans-regional issues.

6.10 There is a long-standing problem with the incompatibility of the some elements of the European On-Line Data Interchange (OLDI) system with the more global AIDC messages from the Russian Federation to China and Mongolia. It is possible that a solution may be determined by the Inter-Regional APAC/NAT AIDC Task Force.

6.11 Russia utilised a 30 km (16NM) separation within its upper airspace, while Mongolia initially used 80NM when ATS surveillance was implemented in mid-2012, with an intention to reduce this to a surveillance-based separation after appropriate training.

6.12 Given the need to minimise safety issues such as Large Height Deviations and to improve confidence in order to minimise trans-regional separations, ATS surveillance data-sharing between the Russian Federation and China/Mongolia is necessary in accordance with PASL Phase I, even if only based on ADS-B.

North/South America – Asia/Pacific Trans-Regional Issues

6.13 There were no major trans-regional issues between Asia and North America via the Anchorage Oceanic, Fukuoka and Oakland Oceanic FIR due to the continuing work at the IPACG involving Japan and the United States. The Cross-Polar Working Group (CPWG) also discussed operations extending into the area between Asia and North America. The Fukuoka and Oakland Oceanic FIRs had high-density Category R airspace but is served by an OTS (PACOTS; Pacific Organized Track System). ADS-C, CPDLC and AIDC were fully deployed in the Anchorage Oceanic, Fukuoka and Oakland Oceanic FIRs, and common procedures, including 30NM separation standards based on RNP4, DARP, UPR were applied.

6.14 The Oakland Oceanic FIR and South Pacific utilised technologies consistent with Block 0 and with Conflict Prediction and Resolution (CPAR), AIDC, CPDLC and ADS-C, were able to provide a Seamless ATM service already between Asia/Pacific and North America. This included the provision of UPRs and DARP where operationally possible. These developments had been managed through the ISPACG, and were a model for other oceanic regions in the Asia/Pacific.

6.15 The airspace between the Pacific and South America had very low density traffic. South American States had not yet developed the same Seamless ATM services capability in the trans-regional airspace to support ATM and essential SAR services. However, Chile is an active member of ISPACG, and Ecuador is enhancing services in the airspace adjacent to the Tahiti FIR.

Middle East/Africa – Asia Trans-Regional Issues

6.16 The transition of traffic from the Muscat FIR to the Mumbai FIR is identified as a contributing factor to the congestion in the Bahrain FIR and causal factor for the delayed departures from airports, particularly in the United Arab Emirates. India had recently reduced horizontal separation on some routes to 50/50NM. In addition, a FLAS is also used by India and applied to low density traffic from/to African Regions, against the higher density Middle East (MTF AR-10) routes.

6.17 Oman require 10 minute longitudinal separation between eastbound aircraft from the United Arab Emirates regardless of the level the aircraft were climbing to, with plans to reduce this to seven minutes, consistent with the 50NM standard applied within the Mumbai FIR. However this is still very restrictive, given the ATS surveillance coverage within the Muscat FIR and the fact that the aircraft were climbing to a number of different flight levels.

6.18 Complicating trans-regional operations is the configuration of the Sana'a FIR (OYCS), which projected a triangle of airspace between the Muscat FIR (OOMM) and Mumbai FIR (**Figure 5**). This required aircraft that were operating between the Muscat and Mumbai FIRs to transit a short segment of the Sana'a FIR, which used procedural ATC standards.

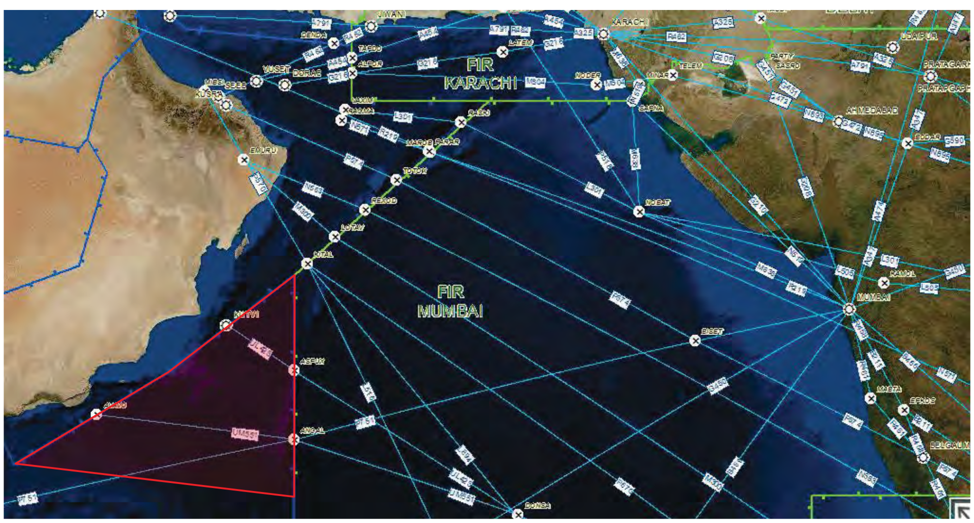

Figure 5: Middle East – Asia Trans-Regional Routes

6.19 One solution to improve Seamless ATM trans-regional operations between FIRs in this area would be to consider an amendment of the southern boundary of the Muscat Flight Information Region Boundary (FIRB) to a line joining N 15^{o} 40', E 53^{o} 24' and N 15^{o}, E 60^{o} 00'. This change would enlarge the Muscat FIR to include the area shown in red in **Figure 5**, and provide an opportunity for ATS surveillance and VHF communications (Category S airspace services) to be provided from Oman. In addition, this would reduce radiotelephone and TOCs, improving ATC workload.

6.20 The problem of OLDI conversions to AIDC between India and the Sultanate of Oman had prevented implementation of AIDC trans-regionally in this area thus far.

APSAPG Discussions on Economic Aspects

6.21 Action Item 48/2 from the DGCA/48 requested the APSAPG to study the ASBU elements and provide advice on the benefits, business case and implications to States and Administrations and explore formulating a regional position prior to the AN-Conf/12. APSAPG/1 discussed the economic aspects of ASBU and determined that the APSAPG itself would not provide detailed economic and business case data because each implementation situation would vary according to the operating environment; thus this is a matter for each State to analyse. However, the APSAPG agreed it is possible to provide high-level guidance such as guidance to States for the development of cost benefit analysis of implementation activity.

ADS-B South China Sea Cost-Benefit Study Summary

6.22 In 2008 CANSO and IATA agreed to conduct a cost-benefit study for the initial phase of the ADS-B project (**Figure 6**) over the South China Sea. The South China Sea (SCS) was identified for this purpose as it contained some of the highest traffic density routes that would benefit most from ADS-B. The initial phase involved ADS-B stations in Indonesia, Vietnam and Singapore. The aim was to enable radar-like separation for suitably equipped aircraft on selected routes in the area covered by the project scope.

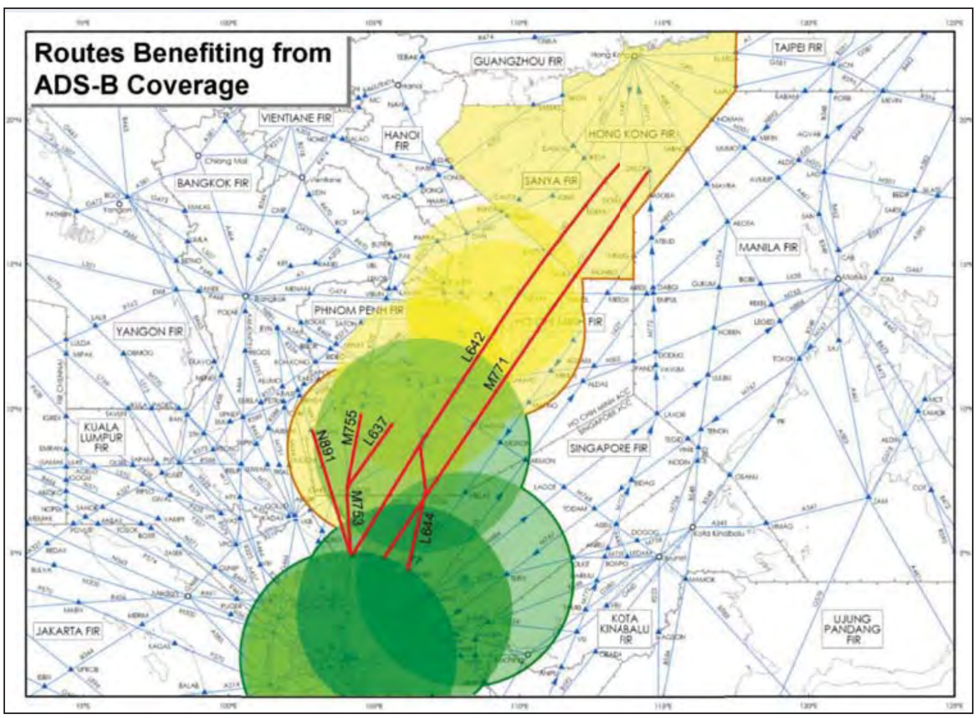

Figure 6: SCS ADS-B Study Area

6.23 The benefits that were monetized comprised the following:

a) Savings in aircraft fuel burn arising from availability of optimum flight levels and reduction in airborne and ground delays;

b) Reduction in carbon emissions; and

c) Reduction in flight delays leading to savings in Aircraft Direct Operating Cost (ADOC) and Passenger Value of Time (PVT).

6.24 The cost estimates were based on data provided by Singapore in consultation with the other ANSPs, while traffic estimates were based on an extrapolation of historical data provided by Singapore over three months in 2008. ADOC and PVT were based on FAA figures, with the latter discounted by about 40% based on the weighted GDP average for the region.

6.25 Based on data provided by Singapore from January 2008 to March 2008 for flights on airways that would benefit from the ADS-B deployment, potential savings from improved airborne efficiency and ground delay reductions were summarized in **Table 2** and **Table 3** respectively:

Airborne Efficiency – Potential Savings 2008	**3 months**	**12 months**
Fuel Burn Savings (kg)	276,585	1,106,342
Fuel Burn Savings (FY09 USD)	$177,097	$708,389
Flight time savings (hours)	117	468
Airborne ADOC w/o fuel savings (FY09 USD)	$346,283	$1,385,134
PVT savings (FY09 US $)	$292,493	$1,169,974
CO2 Emissions Savings (kg)	872,904	3,491,615
CO2 Savings (FY09 USD)	$21,777	$87,108
Total Economic Savings (FY09 USD)	$837, 651	$3,350,605

Table 2: ADS-B Airborne Efficiency

Ground Delay – Potential Savings 2008	
Fuel Burn Savings (kg)	213,531
Fuel Burn Savings (FY09 USD)	$136,724
Time savings (hours)	188
Ground ADOC w/o fuel savings (FY09 USD)	$206,132
PVT savings (FY09 US $)	$469,509
CO2 Emissions Savings (kg)	673,905
CO2 Savings (FY09 USD)	$16,812
Total Economic Savings (FY09 USD)	$829,177

Table 3: Ground Delay Savings

6.26 If it is assumed that ADS-B was 100% effective in overcoming the airborne inefficiencies and ground delays, the annual savings were nearly 1,400,000 kg of fuel burn and 4,500,000 kg of CO_2 emissions, for a relatively few number of airways.

6.27 Based on the estimated infrastructure costs, equipment life cycle of 20 years and an estimated ADS-B effectiveness of 90% and 75% in overcoming the airborne inefficiencies and the ground delays respectively, the cost benefits were calculated using three traffic growth scenarios. The results are shown in **Table 4**:

Factor	**Most Likely Estimate**		
Demand Growth	3%	5%	7%
Costs FY09 $M	$45.66	$45.66	$45.66
Benefits FY09 $M	$127.96	$200.47	$328.11
IRR	17%	22%	27%
Costs PV	$27.17	$27.17	$27.17
Benefits PV	$50.29	$73.60	$112.43
NPV	$23.12	$46.43	$85.26
B/C Ratio	1.9	2.7	4.1
Payback Year	2020	2018	2017

Table 4: Cost Benefit Estimates

6.28 The Cost Benefit Study for the initial phase of ADS-B implementation over the SCS showed clearly that there was a strong positive business case for the project.

United States NextGen Economic Benefits

6.29 The Federal Aviation Administration had conducted a business case study for the Next Generation Air Transportation System (NextGen). NextGen is a wide-ranging transformation of the air transportation system, including ATM technologies and procedures; airport infrastructure improvements; and environmental, safety and security-related enhancements. It is consistent with the GANP and the ASBU initiative.

6.30 The cost and benefit calculations underlying the business case for NextGen were developed based on the FAA's 2011 Mid-Term Concept of Operations and the 2012 NextGen Implementation Plan. Modelling of NextGen benefits and costs was based on various inputs. For basic inputs, the USA used traffic data from 2010, along with traffic and fleet forecasts released in early 2011. Recommended economic values, such as those for passenger value of time, etc., were used from early 2011. Based on these inputs, the FAA's analysis showed that NextGen mid-term improvements (until 2020) would generate more than two-and-a-half times in benefits as costs (**Figure 7**).

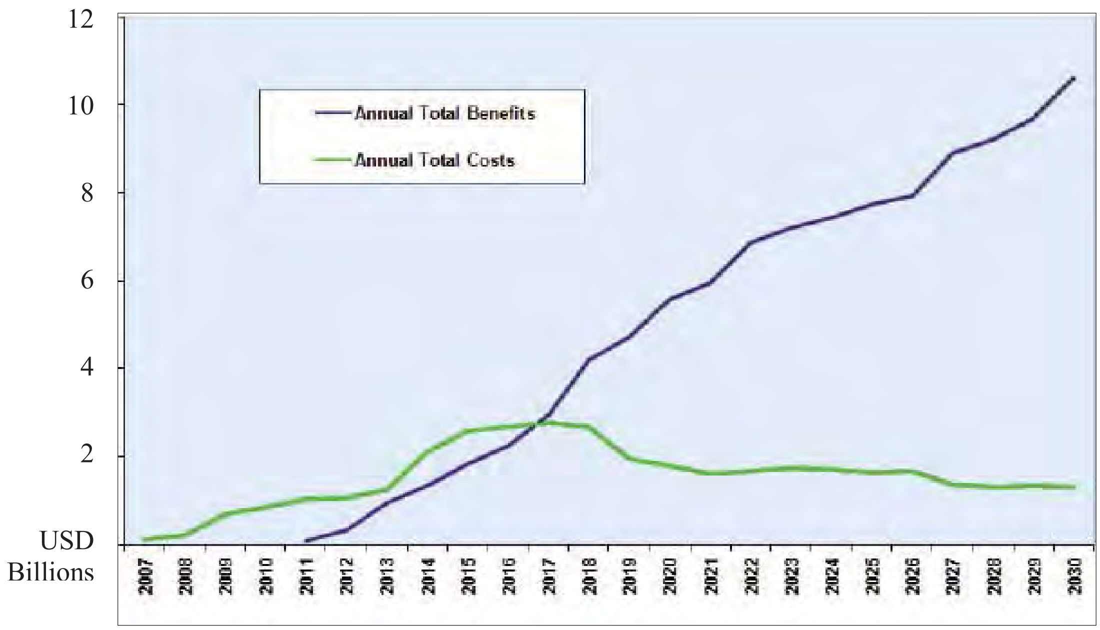

Figure 7: Annual Costs and Benefits

6.31 The NextGen business case focused on the direct benefits to aircraft operators, passengers, and taxpayers from the rollout of NextGen improvements. Benefits identified in the business case were:

- ADOC;
- PVT;
- Reduced FAA operating costs;
- Additional flights enabled by greater capacity;
- Reduced flight cancellations;
- Increased safety; and
- Environmental benefits from reduced aircraft emissions (CO_2 only).

6.32 Types of benefits that were **not** included in the business case were:

- New jobs and economic growth associated with major technology initiatives;
- environmental benefits of bio-fuels or improved engine/aircraft technologies; and
- Environmental benefits from reduced aircraft emissions (NO_X or SO_2).

6.33 The resulting benefit estimates are shown in **Figure 8**:

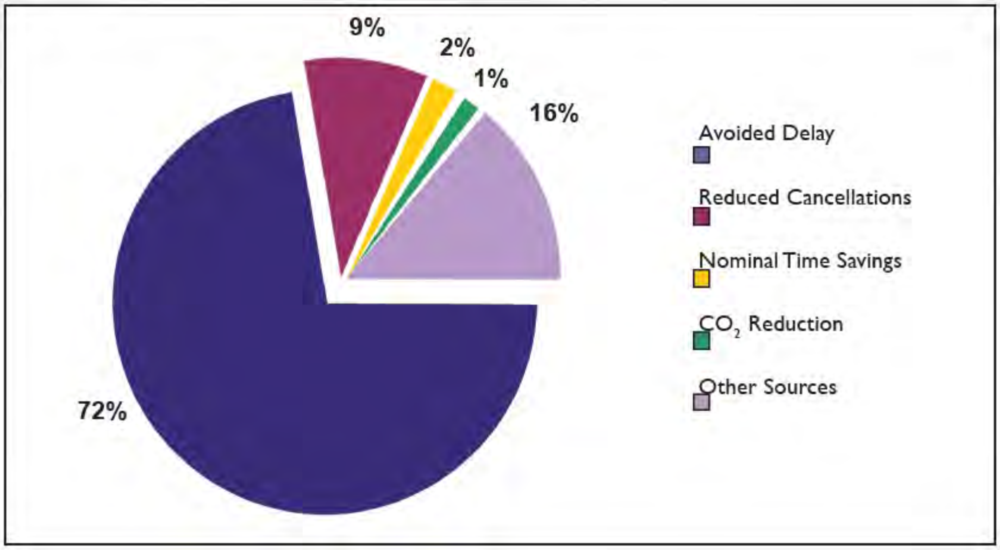

Figure 8: Types of NextGen Benefits until 2030

<u>IATA Seamless ATM Cost-Benefit Analysis</u>

6.34 As general rule, prior to any significant system change, a cost/benefit analysis (CBA) would be conducted to demonstrate the value, negative or positive, of the projected change.

6.35 A CBA of the transition to an Asia Pacific Seamless ATM environment will be developed when the Seamless ATM Plan has been accepted by APANPIRG on behalf of all Asia Pacific States. Although each State retains responsibility for their sovereign airspace, acceptance of the Seamless ATM Plan by APANPIRG, on behalf of all States, creates an obligation on each State to follow the agreed upgrade path. This agreed upgrade path will provide the basis for a Regional CBA.

6.36 Whilst the outcome of the CBA will be determined in future it was felt necessary to demonstrate, at a high level, the benefits of the proposed Seamless ATM Plan.

6.37 IATA conducted an initial economic analysis which was tabled at APSAPG/3 (Chennai, India, 21-25 January 2013).

6.38 Today, demand exceeds capacity at many locations and along some MTF. Many Asia Pacific airports have implemented slot management schemes for part of the day when demand exceeds supply. The consequence of this demand-supply gap is that many MTF are subjected to lengthy delays (e.g. Bay of Bengal) due to capacity limitations.

6.39 Any system delay causes the costs to increase exponentially. When the demand approaches the capacity limits, aircraft must wait to use the system, or various parts of it, until they can be accommodated. These delays impose costs both in terms of aircraft operating expenses and the value of wasted passengers' time.

6.40 In addition to the economic and cost benefits, the existing operational environment also causes longer flight trajectory, inefficient airport capacity usage, flight inefficiencies, higher CO2 emission impacting environment and lower predictability of flight operations.

6.41 IATA's initial economic analysis indicated that if the States in Asia Pacific do not implement the critical ICAO Aviation System Block Upgrade (ASBU) elements of the Seamless ATM Draft Plan, aviation's contribution to the Regional GDP will fall from today's **2.2%** to **0.81%** by 2030.

6.42 Although a "worst case" scenario this would represent a Regional potential economic benefit **loss** of **US$16.63 billion per annum** (based on 2012 data), which will reach an accumulated loss of **US$ 502 billion by 2030**. Upgrading the existing operational environment of ATM is essential in order to enhance the region's economic growth.

6.43 It can be argued that lack of investment in aviation infrastructure will result in this investment being diverted to sectors. However investment in aviation infrastructure, given the reliance in Asia Pacific on aviation, will yield a greater benefit than any other transport modality investment.

6.44 The IATA Economic Study is provided at **Attachment 1**.

<u>Point Merge Procedure Efficiency Analysis (Republic of Korea)</u>

6.45 An analysis of the efficiency and effectiveness of terminal airspace using the Point Merge method based on PBN is at **Appendix F**.

PERFORMANCE IMPROVEMENT PLAN

Preferred Aerodrome/Airspace and Route Specifications (PARS)

Note: prior to implementation, the applicability of PARS should be verified by analysis of safety, current and forecast traffic demand, efficiency, predictability, cost effectiveness and environment to meet expectations of stakeholders.

PARS Phase I (expected implementation by 12 November 2015)

Aerodrome Operations

7.1 All high density international aerodromes (100,000 scheduled movements per annum or more) should:

a) provide an appropriate apron management service in order to regulate entry of aircraft into and coordinate exit of aircraft from the apron;

b) have appropriate ATM coordination (including meetings and agreements) related to:

- airport development and maintenance planning;
- coordination with local authorities regarding environmental, noise abatement, and obstacles;
- ATM/PBN procedures for the aerodrome;

c) conduct regular airport capacity analysis, which included a detailed assessment of passenger, airport gate, apron, taxiway and runway capacity; and

d) provide electronic surface movement guidance and control.

Note 1: the 100,000 movement benchmark must not be viewed as lessening more stringent existing requirements and criteria established by the State, or superseding ICAO Annex 14 Volume I requirements, especially with regard to aerodrome certification.

Note 2: the provision of A-SMGCS should be subject to economic analysis (ASBU Priority 3).

7.2 All high density aerodromes should operate an A-CDM system serving the MTF and busiest city pairs, with priority implementation for the busiest Asia/Pacific aerodromes (ASBU Priority 2)[1].

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[1] Based on 2012 ICAO data, the 21 busiest Asia/Pacific aerodromes were:

- Australia (Sydney, Melbourne);
- China (Beijing, Shanghai Pudong and Hong Jiao, Guangzhou, Hong Kong, Xi'an, Shenzhen, Chengdu, Kunming);
- India (New Delhi, Mumbai);
- Indonesia (Jakarta);
- Japan (Haneda, Narita);
- Malaysia (Kuala Lumpur);
- Philippines (Manila);
- Republic of Korea (Incheon);
- Singapore (Changi); and
- Thailand (Suvarnabhumi).

Terminal Operations (Category T airspace)

7.3 CCO and CDO operations should be considered for implementation at all high density international aerodromes after analysis, based on a performance-based approach (ASBU Priority 2).

Note: this does not preclude a State considering implementation of CCO/CDO at other aerodromes as appropriate.

7.4 All international high density aerodromes should have **RNAV 1** (ATS surveillance environment) or **RNP 1** (ATS surveillance and non-ATS surveillance environments) SID/STAR.

7.5 Where practicable, all high density aerodromes with instrument runways serving aeroplanes should have (ASBU Priority 2):

a) precision approaches; or

b) Approaches with Vertical Guidance (APV), either RNP APCH with Barometric Vertical Navigation (Baro–VNAV) or augmented GNSS (SBAS or GBAS); or

c) if an APV is not practical, straight-in RNP APCH with Lateral Navigation (LNAV).

En-route Operations

7.6 All Category S upper controlled airspace and Category T airspace supporting high density aerodromes should be designated as non-exclusive or exclusive as appropriate ADS-B airspace requiring operation of ADS-B using 1090ES with DO-260/260A and 260B capability, with priority implementation for the following high density FIRs (**Figure 9**) supporting the busiest Asia/Pacific traffic flows (APANPIRG Conclusion 22/8 and 23/5 refer):

a) South Asia: Delhi, Mumbai;

b) Southeast Asia: Bangkok, Hanoi, Ho Chi Minh, Jakarta, Kota Kinabalu, Manila, Sanya, Singapore, Vientiane; and

c) East Asia: Beijing, Fukuoka, Guangzhou, Hong Kong, Kunming, Incheon, Shanghai, Shenyang, Taibei, Wuhan.

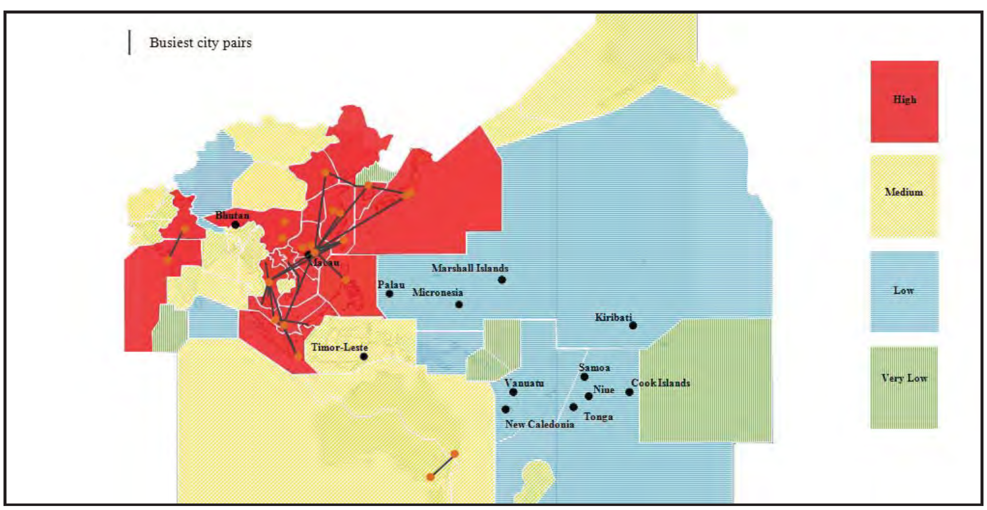

Figure 9: High Density FIRs

Note 1: in areas where ADS-B based separation service was provided, the carriage of ADS-B OUT using 1090ES with DO260/60A and 260B is recommended.

Note 2: States should refer to the ADS-B implementation in the ICAO ADS-B Implementation and Guidance Document (AIGD).

7.7 All Category R and S upper controlled airspace, and Category T airspace supporting high density aerodromes should require the carriage of an operable mode S transponder within airspace where Mode S radar services are provided;, ACAS and Terrain Awareness Warning Systems (TAWS), unless approved by ATC (ASBU Priority 2).

7.8 All Category R and S upper controlled airspace, and Category T airspace supporting high density aerodromes should be designated as non-exclusive or exclusive PBN airspace as appropriate. This is to allow operational priority for PBN approved aircraft, harmonised specifications and to take into account off-track events such as weather deviations, with priority implementation for high density FIRs.

Note: Non-exclusive means that non-PBN aircraft may enter the airspace, but may be accorded a lower priority than PBN aircraft, except for State aircraft.

7.9 All ATS routes should be designated with a navigation performance specification to define the CNS/ATM operational environment. The ATS route navigation performance specification selected should be harmonised and utilise the least stringent requirement needed to support the intended operation. When obstacle clearance or ATC separation requirements demand, a more stringent navigation specification may be selected. ATS routes should be established in accordance with the following PBN specifications:

- Category R airspace – **RNP 4**, **RNP 10** (RNAV 10) (other acceptable navigation specifications – RNP 2 oceanic); and
- Category S airspace –**RNAV 2** or **RNP 2** (other acceptable navigation specifications – RNAV 5).

Note 1: RNP 2 is expected to be utilised before Phase 2, when the RNP 2 instrument procedure design, ATC separation standards and operational approval are in place.

Note 2: within Category R airspace, transition to RNP 4 or RNP 2 oceanic specifications is recommended at the earliest opportunity. RNP 2 oceanic requires dual independent installations, plus CPDLC and ADS-C.

7.10 The ICAO Table of Cruising Levels based on feet as contained in Appendix 3a to Annex 2 should be used.

Civil/Military Cooperation

7.11 Civil/Military Airspace expectations are as follows:

a) SUA should only be established after due consideration of its effect on civil air traffic by the appropriate Airspace Authority to ensure it will be:
   - used for the purpose that it is established;
   - used regularly;
   - as small as possible, including any internal buffers, required to contain the activity therein;
   - if applicable, operated in accordance with FUA principles (ASBU Priority 1); and
   - activated only when it is being utilised; and

b) SUA should be regularly reviewed to ensure the activities that affect the airspace, and size and timing of such activity are accurately reflected by the SUA type, dimensions, activation notice and duration of activation.

PARS Phase II (expected implementation by 08 November 2018)

Aerodrome Operations

7.12 Where practicable, all high density aerodromes should provide the following infrastructure and facilities to optimise runway capacity:

a) additional runway(s) with adequate separation between runway centrelines for parallel independent operations;

b) parallel taxiways, rapid exit taxiways at optimal locations to minimize runway occupancy times and entry/exit taxiways;

c) rapid exit taxiway indicator lights (distance to go information to the nearest rapid exit taxiway on the runway);

d) twin parallel taxiways to separate arrivals and departures;

e) perimeter taxiways to avoid runway crossings;

f) taxiway centreline lighting systems;

g) adequate manoeuvring area signage (to expedite aircraft movement);

h) holding bays;

i) additional apron space in contact stands for quick turnarounds;

j) short length or tailored runways to segregate low speed aircraft;

k) taxi bots or towing systems, preferably controlled by pilots, to ensure efficiency and the optimal fuel loading for departure; and

l) advanced visual docking guidance systems.

7.13 All high density aerodromes should have a declared airport terminal and runway capacity based on a capacity and efficiency analysis, to ensure the maximum possible efficiency of aircraft and passenger movement. Sample runway capacity figures are provided from several States in **Appendix G**.

Terminal Operations (Category T airspace)

7.14 **RNP 0.3** arrival/departure, approach and/or en-route transiting procedures should be considered at high density aerodromes with rotary wing operations.

7.15 All international aerodromes should have **RNAV 1** (ATS surveillance environment) or **RNP 1** (ATS surveillance and non-ATS surveillance environments) SID/STAR.

Note: the Asia/Pacific PBN Plan Version 3 required RNAV 1 SID/STAR for 50% of international airports by 2010 and 75% by 2012 (priority should be given to airports with RNP Approach); and RNAV 1 or RNP 1 SID/STAR for 100% of international airports and 70% of busy domestic airports where there are operational benefits by 2016.

7.16 Where practicable, all aerodromes with instrument runways serving aeroplanes should have (ASBU Priority 2):

a) precision approaches; or

b) APV, either RNP APCH with Barometric Vertical Navigation (Baro–VNAV) or augmented GNSS (SBAS or GBAS); or

c) when an APV is not practical, straight-in RNP APCH with LNAV.

Note: the Asia/Pacific PBN Plan Version 3 required RNP APCH (with Baro-VNAV) for 30% of instrument runways by 2010 and 50% by 2012 (priority should be given to airports with operational benefits); and RNP APCH with Baro-VNAV or APV in 100% of instrument runways by 2016.

7.17 When establishing the implementation of PBN approach procedures in accordance with Assembly Resolution A37-11, States should first conduct an analysis of the instrument runway eligibility for APV approaches. This analysis should include the feasibility of the APV at a particular location, the presence of regular commercial operations and the current or projected user fleet capability for APV. The introduction of landing capability using GNSS and its augmentations such as GNSS Landing System (GLS) is recommended where these systems were economically beneficial. Locations where APV approach were either not feasible or where regular operators could not realise the benefit of APV should implement RNP APCH with LNAV minima instead of APV, to provide the safety benefits of straight-in approach procedures.

7.18 Where a short length or tailored runway designed to segregate low speed aircraft is established, the runway should be served by PBN procedures including SID and STAR that provided segregation from the procedures serving other aerodrome runways as far as practicable.

7.19 PBN procedures that overlay visual arrival and departure procedures should be established where this provided an operational advantage.

7.20 Airspace and instrument flight procedures associated with high density international aerodromes should not be constrained by international borders and political barriers as far as practicable. Airspace and procedures should be established only after appropriate consideration of:

a) environmental efficiencies;

b) noise abatement and local authority regulations;

c) adjacent aerodromes;

d) conflicting instrument flight procedures; and

e) affected ATC units or ATM procedures.

<u>En-route Airspace</u>

7.21 All <u>Category R and S</u> upper controlled airspace, and <u>Category T</u> airspace should, unless approved by the State, require the carriage of an operable:

a) mode S transponder within airspace where Mode S radar services are provided; and

b) ACAS and TAWS (ASBU Priority 2).

7.22 All en-route controlled airspace should be designated as being exclusive PBN airspace with mandatory carriage of GNSS utilising RNP navigation specifications, except for State aircraft. Such implementation mandates should be harmonised with adjacent airspace. ATS routes should be established in accordance with the following PBN specification:

- <u>Category R and S</u> airspace – **RNP 2**.

7.23 All <u>Category S</u> upper controlled airspace and <u>Category T</u> airspace should be designated as non-exclusive or exclusive as appropriate ADS-B airspace requiring operation of ADS-B using 1090ES with DO-260/260A and 260B capability.

7.24 In areas where ADS-B based separation service is provided, the mandatory carriage of ADS-B OUT using 1090ES with DO260/60A and 260B should be prescribed (ASBU Priority 2).

Preferred ATM Service Levels (PASL)

Note: prior to the implementation, the applicability of PASL should be verified by analysis of safety, current and forecast traffic demand, efficiency, predictability, cost effectiveness and environment to meet expectations of stakeholders.

PASL Phase I (expected implementation by 12 November 2015)

Aerodrome Operations

7.25 All high density aerodromes should have AMAN/DMAN facilities (ASBU priority 2).

Terminal Operations

7.26 All high density aerodromes should provide meteorological forecasts, aerodrome warnings and alerts that support efficient terminal operations (ASBU Priority 2).

En-route Operations

7.27 High density FIRs (refer **Figure 9**) supporting the busiest Asia/Pacific traffic flows and high density aerodromes should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements (ASBU Priority 1).

7.28 Harmonization of upper airspace classification should be as follows:

a) Category R controlled airspace– **Class A**; and

b) Category S controlled airspace– **Class A**, or if there are high level general aviation or military VFR operations: **Class B** or **C**.

7.29 Where practicable, all ATC Sectors within the same ATC unit with ATS surveillance capability should have automated hand-off procedures that allow the TOC of aircraft without the necessity for voice communications, unless an aircraft requires special handling.

ATM Systems

7.30 The delivery of CNS/ATM services should be based primarily on the CNS/ATM capability. All ATC units should authorise the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable, taking into account such factors as:

a) the automation of the ATM system;

b) the capability of the ATC communications system;

c) the performance of the ATS surveillance system, including data-sharing or overlapping coverage at TOC points; and

d) ensuring the competency of air traffic controllers to apply the full tactical capability of ATS surveillance systems.

7.31 The efficacy, continuity and availability of ATM services should be supported by adherence with regional planning and guidance material regarding ATM automation and ATM contingency systems.

7.32 ADS-B (using 1090ES) or MLAT or radar surveillance systems should be used to provide coverage of all Category S-capable airspace as far as practicable (ASBU Priority 1). Data from ATS surveillance systems should be integrated into operational ATC aircraft situation displays (standalone displays of ATS surveillance data should not be used operationally).

7.33 Within Category R airspace, ADS-C surveillance and CPDLC should be enabled to support PBN-based separations, as well as UPR and DARP (ASBU Priority 1).

7.34 Subject to appropriate filtering, ATS surveillance data, particularly from ADS-B, should be shared with neighbouring ATC units within high density FIRs (refer **Figure 5**). Direct speech circuits and appropriate handoff procedures should be implemented between controllers providing ATS surveillance in adjacent airspace.

7.35 ATM systems should enable AIDC (version 3 or later) between ATC units where transfers of control are conducted unless alternate means of automated communication of ATM system track and flight plan data are employed (ASBU Priority 1). As far as practicable, the following AIDC messages types should be implemented:

- Advanced Boundary Information (ABI);
- Coordinate Estimate (EST);
- Acceptance (ACP);
- TOC; and
- Assumption of Control (AOC).

Note: the 18th Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/18) determined that the following interface areas required AIDC priority implementation in order to reduce Large Height Deviations:

a) Indonesia: between Jakarta and Chennai/Ujung Pandang/Brisbane/Melbourne FIRs;

b) India: between Chennai and Kuala Lumpur FIRs;

c) Philippines: between Manila and Fukuoka/Taibei/Hong Kong/Ho Chi Minh/Singapore/Kota Kinabalu/ Ujung Pandang FIRs; and

d) China: between –

i. Urumqi and Lahore FIRs; and

ii. Beijing and Ulaan Baatar FIRs.

7.36 Priority for FLAS level allocations should be given to higher density ATS routes over lower density ATS routes. FLAS should comply with Annex 2, Appendix 3a unless part of an OTS. FLAS other than OTS should only be utilised for safety and efficiency reasons within:

a) Category R airspace with the agreement of all ANSPs that provide services:
   - within the airspace concerned; and
   - within adjacent airspace which is affected by the FLAS; or

b) Category S airspace with the agreement of all ANSPs that provide services:
   - where crossing track conflictions occur within 50NM of the FIRB; and
   - ATS surveillance coverage does not overlap the FIRB concerned, or ATS surveillance data is not exchanged between the ATC units concerned.

7.37 ATM systems, including communication and ATS surveillance systems and the performance of those systems, should support the capabilities of PBN navigation specifications and ATC separation standards applicable within the airspace concerned.

Note: guidance on the performance of ATS communication and surveillance systems is available in the Global Operational Data-link Document.

7.38 ATM systems should be supported by digitally-based AIM systems (using Aeronautical Information Exchange Model version 5.1 or later) through implementation of Phase 1 and 2 of the AIS-AIM Roadmap in adherence with ICAO and regional AIM planning and guidance material (ASBU Priority 1).

7.39 ATM systems should be supported by implementation of appropriate meteorological information reporting systems, providing, *inter-alia*, observations, forecasts, warnings and alerts, and also provide for information to meteorological authorities or offices where required.

Priority

7.40 Where a minimum aircraft equipage is specified, any aircraft that does not meet specified equipage requirements should receive a lower priority, except as prescribed (such as for State aircraft). States should require State aircraft to comply with equipage requirements as far as practicable.

Human Performance

7.41 The following should be established to support human performance in the delivery of a Seamless ATM service. The systems should consider all the elements of the SHEL Model (Software, Hardware, Environment and Liveware – humans), in accordance with the ICAO Human Factors Digest No. 1 and related reference material:

a) human performance training for all ANSP managers, including:
   - assessment and management of risks related to human capabilities and limitations;
   - effective participation in a team and team management
   - effective safety reporting systems;
   - human factors in air safety investigation;
   - fatigue management approaches;

b) enhancement and improved application of ATC simulators;

c) safety teams comprising multidisciplinary operational staff and managers which review safety performance and assess significant proposals for change to ATM systems;

d) human performance-based training and procedures for staff providing ATS, including:
   - the application of tactical, surveillance-based ATC separation;
   - control techniques near minimum ATC separation;
   - responses to ATM contingency operations and safety net alerts; and
   - the importance of an effective safety reporting culture.

Civil/Military Cooperation

7.42 Civil/Military ATM expectations are as follows:

a) a national civil/military body should be formed to coordinate strategic civil-military activities(military training should be conducted in locations and/or at times that do not adversely affect civilian operations, particularly those associated with major aerodromes);

b) formal civil-military liaison should take place for tactical responses by encouraging military participation at civil ATM meetings and within ATC Centres;

c) integration of civil and military ATM systems using joint procurement, and sharing of ATS surveillance data (especially from ADS-B systems) should be provided as far as practicable;

d) joint provision of civil/military navigation aids should be encouraged;

e) common training should be conducted between civil and military ATM units in areas of common interest; and

f) civil and military ATM units should utilize common procedures as far as practicable.

PASL Phase II (expected implementation by 08 November 2018)

<u>Aerodrome Operations</u>

7.43 ATM system design (including ATS surveillance, ATS communication systems, ATC separation minimum, aircraft speed control and ATC training) should be planned and implemented to support optimal aerodrome capacity expectations for the runway(s) concerned.

<u>Terminal Operations</u>

7.44 All terminal ATC Sectors should have a nominal aircraft capacity figure based on a scientific capacity study and safety assessment, to ensure safe and efficient aircraft operations.

*Note: A study of the terminal ATC Sector airspace capacity every 15 minutes is provided in **Appendix G**.*

7.45 All AMAN systems should take into account airport gates for runway selection and other aircraft departures from adjacent gates that may affect arriving aircraft.

<u>En-route Operations</u>

7.46 Where practicable, all ATC Sectors with adjacent ATC Centres using ATS surveillance capability should have automated hand-off procedures that allow the TOC of aircraft without the necessity for voice communications, unless an aircraft requires special handling.

7.47 All FIRs supporting Major Traffic Flows should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements (ASBU Priority 1).

7.48 Subject to appropriate filtering, ATS surveillance data, particularly from ADS-B, should be shared with all neighbouring ATC units.

7.49 ATM systems should enable AIDC, or an alternative process that achieves at least the same level of performance as AIDC, between en-route ATC units and terminal ATC units where transfers of control are conducted (ASBU Priority 1).

7.50 To ensure the safety and efficiency of aircraft operations, a nominal aircraft capacity figure based on a scientific capacity study and safety assessment should be available for all enroute ATC sectors.

*Note: a study of the en-route ATC Sector airspace capacity every 15 minutes is provided in **Appendix G**.*

<u>ATM Systems</u>

7.51 ATM systems should be supported by complete implementation of AIM Phase 3.

7.52 ATM systems providing services within <u>Category R</u> airspace should enable appropriate ATC capabilities including CPAR, which is a key enabler for UPR and DARP operations.

7.53 Electronic flight progress strips should be utilised wherever practicable.

<u>Safety Nets</u>

7.54 ATS surveillance systems should enable STCA, APW and MSAW (ASBU Priority 2). Route Adherence Monitoring (RAM) should be utilised when monitoring PBN route separations. Cleared Level Adherence Monitoring (CLAM) should be utilised to monitor RVSM airspace.

Human Performance

7.55 Prevention of fatigue systems should be established to support human performance in the delivery of a Seamless ATM service. The systems should be consistent with guidance within ICAO Doc 9966 *FRMS – Fatigue Risk Management System*.

RESEARCH AND FUTURE DEVELOPMENT POSSIBILITIES

Research and Development

8.1 To develop the tools and systems required to meet foreseeable long-term requirements, there is a need for States to undertake and co-operate on ATM Improvement. This includes major efforts to define concepts, to extend knowledge and invent new solutions to future ATM challenges so these new concepts are selected and applied in an appropriate timely manner. Such efforts could be forged through collaborative partnerships between, States, ANSPs, International Organizations, institutes of higher learning and specialised technical agencies. This concept is consistent with Seamless ATM Principle 36 (*Inter-regional cooperation ('clustering') for the research, development and implementation of ATM projects*).

8.2 The need for concepts beyond current technology and systems had been reinforced at APANPIRG/23. With the end goal of a globally interoperable ATM system in mind, the region will have to consider planning for a long term supporting concept and infrastructure. States should not overlook the need to include the development of future ATM concepts that will ensure the safety and fluidity of air transportation over the next few decades. The following are possible areas that should be considered for future development, in order to continue pursuance of seamless ATM beyond ASBU Block 0 implementations and global interoperability:

a. Space-Based ATS Surveillance - The AN-Conf/12 endorsed Recommendation 1/9 regarding space-based ADS-B systems being included in the GANP (**Appendix 2**);

b. Sub-Regional ATFM - Inter-linked (data-sharing) ATFM units (which may be virtual offices) should be developed to serve various sub-regions. This concept is consistent with Seamless ATM Principle 8 (*Sub-regional ATFM based on system-wide CDM serving the busiest terminal airspace and MTF*). The Global ATM Operational Concept paragraph 2.4.3 states: *Demand and capacity balancing will be integrated within the ATM system*;

c. Collaborative Air Navigation Services - This concept is consistent with the following Seamless ATM Principles: 9 (*Cross-border/FIR cooperation for use of aeronautical facilities and airspace, collaborative data sharing, airspace safety assessment and ATM Contingency planning*) and 15 (*Collaboration by ANSPs for evaluation and planning of ATM facilities*). The AN-Conf/12 endorsed Recommendation 5/1, regarding collaboration in airspace organization and routing, which emphasised, *inter alia*, the need to take advantage of improved models for inter-regional coordination and collaboration to achieve seamless air traffic management and more optimum routes through airspace (**Appendix 2**);

d. Airspace Optimisation - the CONOPS states: *Where possible the number of FIRs should be minimized particularly along traffic flows. FIRs should not necessarily be based strictly on the boundaries of sovereign territories*. This concept is consistent with and the following Seamless ATM Principles: 12 (*The optimisation of airspace structure through amalgamation and use of technology*) and 16 (*Optimization of ATM facilities through amalgamation and the use of technology, including automation, satellite-based systems and remote facilities*). The Global ATM Operational Concept paragraph 2.2.2 states: *While acknowledging sovereignty, airspace will be organized globally. Homogeneous ATM areas and/or routing areas will be kept to a minimum, and consideration will be given to consolidating adjacent areas*;

e. Consistent Operating Practices and Procedures - this is aligned with Seamless ATM Principle 3 (*Harmonised regional or sub-regional rules and guidelines*) and 4 (*Shared ATM operational standards, procedures, guidance materials through common manuals and templates*); and

f. Transition Altitude/Layer Harmonisation – this is consistent with AN-Conf/-12 Recommendation 5/1 b).

MILESTONES, TIMELINES, PRIORITIES AND ACTIONS

Milestones

9.1 Section 7 (Performance Improvement Plan) provides milestones and timelines for a number of elements in the PARS and PASL Phase I and II, being effective 12 November 2015 and 09 November 2018 respectively.

9.2 It should be noted that States should commence planning for the various elements, such as PBN specifications detailed in the PARS to cover overall ATM operations, taking into account the whole phase of flight. This should be planned from the approval of this Plan, to ensure a smooth transition by the onset of Phase I, and should include consideration of issues such as:

- aircraft equipage and certification;
- safety/operational analysis and assessment;
- cost-effectiveness;
- budgetary issues;
- development of operational procedures; and
- training.

9.3 States should commence planning for PBN specifications detailed in the PARS and other initiatives which have been globally documented, to facilitate a smooth transition by the onset of Phase I. The Regional PBN Plan is expected to transition to a general guideline for implementation during this period, with the prescriptive PBN specifications being incorporated into this Plan.

9.4 Section 8 (Research and Future Development Possibilities) provides, subject to future agreement by concerned parties, possible Seamless ATM improvements beyond 2018 until 2028.

Priorities

9.5 It is a matter for each State to determine priorities in accordance with its own economic, environmental, safety and administrative drivers. The ASBU Block 0 priorities determined by APSAPG/2 in Section 5 (Background Information) were used to determine the ASBU elements that should be contained within which PARS and PASL Phase.

Actions

9.6 This Plan necessitated a number of implementation actions. It was expected that Implementation Guidance would be further developed by the ICAO Regional Office. It is expected that each Asia/Pacific State and administration develop Seamless ATM Implementation Planning based on applicable parts of the Implementation Guidance Material, and implementation progress be reported to APANPIRG.

9.7 APANPIRG and its contributory bodies such as the ATM Sub-group and the CNS Sub-group are responsible for the oversight of air navigation issues within the Asia/Pacific, so these bodies needed to be made aware of State implementation progress of Seamless ATM initiatives. APANPIRG and its contributory bodies need to manage the implementation of Seamless ATM through the ASBU framework and this Plan.

9.8 Section 6 (Current Situation) provides detailed analysis and major concerns in the region. Some of the non-ICAO sub-regional collaborative frameworks or actions have successfully achieved ATM operational improvements in the past. These forums will continue to be important in Seamless ATM implementation in the future.

9.9 The ICAO Asia and Pacific Regional Office is responsible for taking actions that assisted the implementation of Seamless ATM within its accredited States. In addition, the Asia and Pacific Regional Office coordinated with adjacent ICAO regional offices on an ad hoc basis or at relevant trans-regional meetings.

Appendix A: KANSAI Statement

The Directors General of Civil Aviation (DGCA) of the Asia and Pacific Regions met for the 46th DGCA Conference in Japan, 12-16 October, 2009. Recalling that the 45th Conference had endorsed the Theme Topic for the 46th DGCA Conference as "Seamless Sky: Bringing Together the Asia/Pacific Regions," Directors General of the Region held a productive discussion focusing on three aspects of the "Seamless Sky," namely Air Traffic Management (ATM), Air Cargo Security, and Aviation Safety, and agreed to issue this Kansai Statement.

KANSAI STATEMENT

1. We recognized that as civil aviation develops and globalization progresses, harmonization in civil aviation systems is becoming critically important in the Asia and Pacific Region, which has been characterized by the diversities of the member States. What people expect from harmonization in civil aviation is that aircraft operators will become capable of seamlessly flying between regions, that the whole of the network will be secured at the agreed level, and that transparent and interoperable standards will be set among States and regions. In this regard, "Seamless Sky" is particularly important in the areas of air traffic management, aviation security and aviation safety.

2. Regarding Air Traffic Management (ATM), we recognized that the ICAO has been leading the development and implementation of the Global Air Traffic Management system with the implementation target of 2025. The Global Air Traffic Management system will be based on the components described in the Global ATM Operational Concept. We also recognized that the United States and Europe have been developing their future air traffic modernization programmes. Taking such global trends of future ATM system into consideration, we recognized the necessity of planning the future ATM system for the Asia and Pacific Region by the active collaboration and participation of the whole of the Region. In this regard, we agreed that APANPIRG be the starting platform to discuss and plan the future ATM system of the Asia and Pacific Region including targets and a time schedule.

3. Regarding aviation security, we recognized the significance of enhancing air cargo security. Such efforts will enable member States to protect the flow of air cargo, raise security standards and facilitate international trade in the Asia and Pacific Region. To achieve these desired outcomes effectively, member States are encouraged to collaborate with one another and with ICAO towards developing internationally harmonized measures and processes in air cargo security. We agreed that the further sharing of information and best practices should be promoted, and to consider including provisions on air cargo security into Annex 17, taking into account the need to protect the entire cargo supply chain.

4. Regarding the aviation safety, we acknowledged the ICAO's leadership in the improvement of aviation safety. We recognized the importance of the member States' role in ensuring that their air operators establish and maintain the highest standards in safety through the proper implementation of Safety Management System as envisaged under the State Safety Programme. In addition, we recognized the importance of the safety monitoring activities regarding foreign aircraft by the member States in the Region. We agreed to further enhance the cooperation in these efforts and activities in the Region in a harmonized manner.

5. We are determined to realize the Seamless Sky in the Asia and Pacific Region from this conference onwards. We agreed to make efforts to move forward toward the harmonized aviation in the Asia Pacific Region in cooperation with all the member States and the ICAO Asia Pacific Regional Office.

Appendix B: Relevant 12th Air Navigation Conference Recommendations

1 Recommendation 1/7 – Automatic dependent surveillance — broadcast

That States:

a) recognize the effective use of automatic dependent surveillance — broadcast (ADS-B) and associated communication technologies in bridging surveillance gaps and its role in supporting future trajectory-based air traffic management operating concepts, noting that the full potential of ADS-B has yet to be fully realized;

b) recognize that cooperation between States is key towards improving flight efficiency and enhancing safety involving the use of automatic dependent surveillance — broadcast technology.

That ICAO:

c) urge States to share automatic dependent surveillance — broadcast (ADS-B) data to enhance safety, increase efficiency and achieve seamless surveillance and to work closely together to harmonize their ADS-B plans to optimize benefits.

2 Recommendation 1/9 – Space-based automatic dependent surveillance — broadcast

That ICAO:

a) support, subject to validation, the inclusion in the GANP, development and adoption of space-based automatic dependent surveillance — broadcast surveillance as a surveillance enabler;

b) develop Standards and Recommended Practices and guidance material to support space-based automatic dependent surveillance — broadcast as appropriate; and

c) facilitate needed interactions among stakeholders, if necessary, to support this technology.

3 Recommendation 2/1 – ICAO aviation system block upgrades relating to airport capacity

That States:

a) according to their operational needs, implement the aviation system block upgrade modules relating to airport capacity included in Block 0;

b) endorse the aviation system block upgrade modules relating to airport capacity included in Block 1 and recommended that ICAO use them as the basis of its standards work programme on the subject;

c) agree in principle to the aviation system block upgrade modules relating to airport capacity included in Blocks 2 and 3 as the strategic direction for this subject.

4 **Recommendation 3/1 – ICAO aviation system block upgrades relating to Interoperability and data – through globally interoperable system-wide information management**

That States:

a) endorse the aviation system block upgrade module relating to interoperability and data – through globally interoperable system-wide information management included in Block 1, and recommend that ICAO use it as the basis of its work programme on the subject;

b) agree in principle with the aviation system block upgrade module relating to interoperability and data – through globally interoperable system-wide information management included in Block 2, as the strategic direction for this subject; and

That ICAO:

c) include, following further development and editorial review, the aviation system block upgrade modules relating to interoperability and data – through globally interoperable system-wide information management for inclusion in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP).

5 **Recommendation 4/2 – ICAO ASBU relating to ground surveillance using ADS-B/MLAT, air traffic situational awareness, interval management and airborne separation**

That States:

a) according to their operational needs, to implement the aviation system block upgrade modules relating to ground surveillance, improved air traffic situational awareness and improved access to optimum flight levels included in Block 0;

b) endorse the aviation system block upgrade modules relating to interval management included in Block 1 and recommend that ICAO use them as the basis of its work programme on the subject;

c) endorse the aviation system block upgrade modules relating to airborne separation included in Blocks 2 and 3 as the strategic direction for this subject;

That ICAO:

d) include, following further development and editorial review, the aviation system block upgrade modules relating to airborne separation in the draft Fourth Edition of the *Global Air Navigation Plan*;

e) adopt "airborne separation" concepts involving controllers assigning tasks to flight crews, with controllers able to apply different, risk-based separation minima for properly equipped ADS-B IN aircraft;

f) in the development of provisions, acknowledge the relationship between airborne separation and airborne collision avoidance system;

g) modify aviation system block upgrade (ASBU) Module B2-85 to reflect e) and f), modify ASBU Module B2-101 to reflect f); and

h) review the concept and terminology supporting B2-25 "airborne separation" and amend the module accordingly.

6 Recommendation 5/1 - Improved operations through enhanced airspace organization and routing

Considering that performance-based navigation (PBN) is one of ICAO's highest air navigation priorities and the potential benefits achievable through creation of additional capacity with PBN:

That States:

a) implement performance-based navigation in the en-route environment;

b) fully assess the operational, safety, performance and cost implications of a harmonization of transition altitude and, if the benefits are proven to be appropriate, undertake further action on a national and (sub) regional basis;

c) take advantage of improved models for inter-regional coordination and collaboration to achieve seamless air traffic management and more optimum routes through the airspace;

d) through the planning and implementation regional groups improve their methods of coordination to increase implementation of en-route performance-based navigation in order to achieve more optimum routes through the airspace;

That ICAO:

e) encourage the planning and implementation regional groups to support the early deployment of performance-based navigation.

7 Recommendation 6/1 – Regional performance framework – planning methodologies and tools

That States and PIRGs:

a) develop and maintain regional air navigation plans consistent with the Global Air Navigation Plan;

b) finalize the alignment of regional air navigation plans with the Fourth Edition of the *Global Air Navigation Plan* by May 2014;

c) focus on implementing aviation system block upgrade Block 0 Modules on the basis of operational requirements, recognizing that these modules are ready for deployment;

d) use the electronic regional air navigation plans as the primary tool to assist in the implementation of the agreed regional planning framework for air navigation services and facilities;

e) consider how the continuous monitoring approach to safety oversight maps to the evaluation of Member States' safety oversight capabilities concerning aviation system block upgrades;

f) involve regulatory and industry personnel during all stages of planning and implementation of aviation system block upgrade modules;

g) develop action plans to address the identified impediments to air traffic management modernization as part of aviation system block upgrade planning and implementation activities.

8 **Recommendation 6/4 – Human performance**

That ICAO:

a) integrate human performance as an essential element for the implementation of ASBU modules for considerations in the planning and design phase of new systems and technologies, as well as at the implementation phase, as part of a safety management approach. This includes a strategy for change management and the clarification of the roles, responsibilities and accountabilities of the aviation professionals involved;

b) develop guidance principles, guidance material and provisions, including SARPs as necessary, on ATM personnel training and licensing including instructors and assessors, and on the use of synthetic training devices, with a view to promoting harmonization, and consider leading this effort with the support of States and industry;

c) develop guidance material on using field experience and scientific knowledge in human performance approaches through the identification of human-centred operational and regulatory processes to address both current safety priorities and the challenges of future systems and technologies;

d) assess the impact of new technologies on competencies of existing aviation personnel, and prioritize and develop competency-based provisions for training and licensing to attain global harmonization;

e) establish provisions for fatigue risk management for safety within air traffic services operations;

f) develop guidance material on different categories of synthetic training devices and their respective usage;

provide human performance data, information and examples of operational and regulatory developments to ICAO for the benefit of the global aviation community;

h) support all ICAO activities in the human performance field through the contribution of human performance expertise and resources;

i) adopt airspace procedures, aircraft systems, and space-based/ground-based systems that take into account human capabilities and limitations and that identify when human intervention is required to maintain optimum safety and efficiency; and

j) investigate methods to encourage adequate numbers of high quality aviation professionals of the future and ensure training programmes are in line with the skills and knowledge necessary to undertake their roles within a changing industry.

9

Recommendation 6/12 – Prioritization and categorization of block upgrade modules

That States and PIRGs:

a) continue to take a coordinated approach among air traffic management stakeholders to achieve effective investment into airborne equipment and ground facilities;

b) take a considerate approach when mandating avionics equipage in its own jurisdiction of air navigation systems provision, taking into account of burdens on operators including foreign registry and the need for consequential regional/global harmonization;

That ICAO:

a) continue to work on guidance material for the categorization of block upgrade modules for implementation priority and provide guidance as necessary to planning and implementation regional groups and States;

b) modify the block upgrade module naming and numbering system using, as a basis, the intuitive samples agreed by the Conference; and

c) identify modules in Block 1 considered to be essential for implementation at a global level in terms of the minimum path to global interoperability and safety with due regard to regional diversity.

Appendix C: Seamless ATM Principles

People: Cultural and Political Background

1. High-level political support (including development of educational information for decision-makers) to support Seamless ATM initiatives, including military cooperation and AIM.
2. Education and implementation of non-punitive reporting and continuous SMS improvement systems.

Aviation Regulations, Standards and Procedures

3. Harmonised regional or sub-regional rules and guidelines, modelled on the regional application of common regulations incorporated by reference into local legislation.
4. Shared ATM operational standards, procedures, guidance materials through common manuals and templates.
5. The promotion of mutual recognition of ATM qualifications between States.
6. An emphasis on delivery of ATM services based on CNS capability, resulting in flexible, dynamic systems.
7. The use of high-fidelity simulators to train controllers on the optimal application of ATC separations and procedures that support Seamless ATM applications, emergency and contingency responses, testing of software releases, and may serve as a backup ATM platform.

ATM Coordination

8. Sub-regional ATFM based on system-wide CDM serving the busiest terminal airspace and MTF.
9. Cross-border/FIR cooperation for use of aeronautical facilities and airspace, collaborative data sharing, airspace safety assessment and ATM Contingency planning.
10. Encouragement of military participation in civil ATM meetings and in ATS Centres where necessary.

Airspace Organisation

11. Promoting flexible use airspace arrangements and regular review of airspace to ensure it is appropriate in terms of purpose, size, activation and designation.
12. The optimisation of airspace structure through amalgamation and use of technology.

Facilities: Aerodromes

13. To encourage aerodrome operators to actively participate in ATM coordination in respect of Airport CDM development and operational planning, including aerodrome complexity and capacity.
14. Planning and coordination with local authorities and government agencies to take into account environmental issues, obstacles, aerodrome and PBN development.

ATS Units

15. Collaboration by ANSPs for evaluation and planning of ATM facilities.
16. Optimization of ATM facilities through amalgamation and the use of technology, including automation, satellite-based systems and remote facilities.

Navigation Aids

17. The continued rationalisation of terrestrial navigation aids to satellite-based procedures, while retaining a minimum network necessary to maintain safety of aircraft operations.
18. Support for a GNSS-based global PBN approval standard.
19. Regional cooperation for augmentation systems in terms of interoperability and increased service areas, and a GNSS ionospheric monitoring network.

Telecommunication

20. Encouragement of the use of ground-ground ATN/AMHS and diverse satellite communication systems.
21. Enhancement of data-link capabilities (VHF including VDL M2, SATCOM).
22. Where cost beneficial and appropriate, the implementation of:
    - SATVOICE technologies and standards;
    - HF data-link;
    - VSAT networks in support of COM and SUR.
23. The prioritisation of AIDC systems to alleviate ATC coordination issues.

ATS Surveillance

24. The encouragement of ADS-B and/or MLAT implementation to improve ATS surveillance coverage, redundancy and multiple tracking capability.
25. Establishment of ADS-C where radar, ADS-B (including satellite –based ADS-B) and/or MLAT is not possible.
26. Expansion of ATS surveillance data-sharing initiatives.

Technology and Information: Flight Operations

27. Implementation of UPR and DARP where practicable.
28. Implementation of CDO and CCO where possible.
29. The encouragement of appropriate technologies that support Trajectory-Based Operations.

Aeronautical Data

30. Early implementation of AIM, including cooperative development of aeronautical databases and SWIM to support interoperable operations.

ATM Systems and Safety Nets

31. Application of ground-based safety nets, which includes tactical and strategic conflict probing (such as APW, STCA) and MSAW.
32. Support for Inter-facility Flight Data Processing System capability.
33. Collaborative development of CDM, ATFM, A/MAN and D/MAN support tools.
34. Encouragement of Digital ATIS and VOLMET information systems.
35. Encourage sharing of air traffic data between military ATM systems and civil ATM systems.

ATM Modernisation Projects

36. Inter-regional cooperation ('clustering') for the research, development and implementation of ATM projects.
37. A focus on technologies for earliest deployment and best cost benefits.

Appendix D: Asia/Pacific Performance Analysis

1 The following tables provide an assessment of the delta between current capabilities and practices of administrations that serve FIRs and Phase 1 of the PARS/PASL (12 November 2015), within Category R, S and T airspace. An 'X' indicates that there is a requirement to upgrade to meet the PASL, while a tick indicates current compliance.

South Asia

Afghanistan	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	√	
ATS surveillance		? (in progress)	√	
Horizontal Separation		X	X	
TOC separation		X		
AIDC		X		
FLAS		X		

Table D1: Kabul FIR Assessment

Bangladesh	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	X	
ATS surveillance		X	X	No en-route service above FL150
Horizontal Separation		NA	X	
TOC separation		X		
AIDC		X		
FLAS		NA		

Table D2: Dhaka FIR Assessment

India	Category R	Category S	Category T	Remarks
Communication	√	√	√	
Navigation	X	X	√	
ATS surveillance	√	X	√	
Horizontal Separation	X	√	√	
TOC separation	X	X		
AIDC	X	X		
FLAS	X	X		Indian Ocean FLAS

Table D3: **Chennai**, Delhi, Kolkata, Mumbai FIR Assessment

Maldives	Category R	Category S	Category T	Remarks
Communication	√	√	√	
Navigation	X	X	√	
ATS surveillance	√	√	√	
Horizontal Separation	X	√	√	
TOC separation	X	X		
AIDC	X	X		
FLAS	√	NA		

Table D4: Male FIR Assessment

Nepal	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	√	
ATS surveillance		√	√	
Horizontal Separation		X	√	
TOC separation		X		
AIDC		X		
FLAS		√		

Table D5: Kathmandu FIR Assessment

Pakistan	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	√	
ATS surveillance		√	√	
Horizontal Separation		√	√	
TOC separation		X		
AIDC		X		
FLAS		X		

Table D6: Karachi, Lahore FIR Assessment

Sri Lanka	Category R	Category S	Category T	Remarks
Communication	√	√	√	CPDLC Unreliable
Navigation	X	X	X	
ATS surveillance	X	√	√	ADSC Unreliable
Horizontal Separation	X	√	X	
TOC separation	X	X		
AIDC	X	X		
FLAS	X	X		

Table D7: Colombo FIR Assessment

Southeast Asia

2 Southeast Asian airspace had a number of features that worked counter to Seamless ATM:

- fragmented FIRS not aligned with the direction of the main traffic flows;
- wide differences in the level of development in ATM infrastructure and capability;
- infrastructure development at national level with little consultation among neighbouring FIRs, resulting in limited or no integration with each other;
- inadequate ATS surveillance cover in some busy traffic junctions, resulting in greater reliance on vertical restrictions as a means of ensuring a safe traffic flow;
- obstacles to the development of ADS-B and data sharing, although regional efforts were underway (a concerted effort is required to accelerate these programs);
- conservative application of horizontal separation standards at TOC points with surveillance, which should be addressed by focus groups; and
- un-coordinated and limited use of AIDC.

Cambodia	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	X	
ATS surveillance		√	√	
Horizontal Separation		√	√	
TOC separation		X		
AIDC		X		
FLAS		X		

Table D8: Phnom Penh FIR Assessment

Indonesia	Category R	Category S	Category T	Remarks
Communication	√	√	√	
Navigation	X	X	X	
ATS surveillance	√	√	√	
Horizontal Separation	X	√	√	
TOC separation	X	X		
AIDC	X	X		
FLAS	X	X		

Table D9: Jakarta, Ujung Pandang FIRs Assessment

Lao PDR	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	X	
ATS surveillance		√	√	
Horizontal Separation		√	√	
TOC separation		X		
AIDC		X		
FLAS		X		

Table D10: Vientiane FIR Assessment

Malaysia	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	√	
ATS surveillance		X	√	Requires ADS-B
Horizontal Separation		√	√	
TOC separation		X		
AIDC		X		
FLAS		√		

Table D11: Kuala Lumpur, Kota Kinabalu FIR Assessment

Myanmar	Category R	Category S	Category T	Remarks
Communication		X	√	
Navigation		X	X	
ATS surveillance		X	√	
Horizontal Separation		√	√	
TOC separation		X		
AIDC		X		
FLAS		X		

Table D12: Yangon FIR Assessment

Philippines	**Category R**	**Category S**	**Category T**	**Remarks**
Communication	X	√	√	Unreliable HF
Navigation	X	X	X	
ATS surveillance	X	X	√	ATM automation upgrade required
Horizontal Separation	X	√	√	
TOC separation	X	X		
AIDC	X	X		
FLAS	√	√		

Table D13: Manila FIR Assessment

Singapore	**Category R**	**Category S**	**Category T**	**Remarks**
Communication		√	√	
Navigation		X	√	
ATS surveillance		X	√	
Horizontal Separation		√	√	
TOC separation		X		
AIDC		X		
FLAS		√		

Table D14: Singapore FIR Assessment

Thailand	**Category R**	**Category S**	**Category T**	**Remarks**
Communication		√	√	
Navigation		X	√	
ATS surveillance		√	√	
Horizontal Separation		√	√	
TOC separation		X		
AIDC		X		
FLAS		√		

Table D15: Bangkok FIR Assessment

Viet Nam	**Category R**	**Category S**	**Category T**	**Remarks**
Communication	√	√	√	Waypoint reports not required with ATS surveillance
Navigation	X	X	X	
ATS surveillance	√	√	√	
Horizontal Separation	X	√	√	
TOC separation	X	X		
AIDC	X	X		
FLAS	X	X		Domestic v. A1

Table D16: Hanoi, Ho Chi Minh FIR Assessment

East Asia

China	**Category R**	**Category S**	**Category T**	**Remarks**
Communication		√	√	
Navigation		X	√	
ATS Surveillance		√	√	
Horizontal Separation		√	√	
TOC separation		X		
AIDC		√		AIDC HKG
FLAS		√		Appendix 3b FLOS

Table D17: Beijing, Guangzhou, Kunming, Lanzhou, Sanya, Shanghai, Shenyang, Urumqi, Wuhan FIRs Assessment

Hong Kong, China	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	√	
ATS Surveillance		√	√	
Horizontal Separation		√	√	
TOC separation		X		
AIDC		√		AIDC Sanya
FLAS		√		

Table D18: Hong Kong FIR Assessment

DPR Korea	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	X	
ATS surveillance		√	√	
Horizontal separation		√	X	
TOC separation		X		
AIDC		X		
FLAS		X		Metre FLOS ≤FL290

Table D19: Pyongyang FIR Assessment

Japan	Category R	Category S	Category T	Remarks
Communication	√	√	√	
Navigation	√	X	√	
ATS surveillance	√	√	√	
Horizontal Separation	√	√	√	
TOC separation	X	X		
AIDC	√	X		
FLAS	√	X		

Table D20: Fukuoka FIR Assessment

Mongolia	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	X	
ATS surveillance		X	√	Partial coverage
Horizontal separation		√	√	
TOC separation		X		
AIDC		X		
FLAS		√		

Table D21: Ulaan Baatar FIR Assessment

Republic of Korea	Category R	Category S	Category T	Remarks
Communication		√	√	
Navigation		X	√	
ATS surveillance		√	√	
Horizontal Separation		√	√	B467, B332, L512 FLAS. AKARA Corridor procedures require review
TOC separation		X		
AIDC		X		
FLAS		X		

Table D22: Incheon FIR Assessment

Note: the Taibei FIR was not assessed.

Pacific

Australia, Nauru, Solomon Islands	Category R	Category S	Category T	Remarks
Communication	√	√	√	
Navigation	√	X	√	
ATS surveillance	√	√	√	
Horizontal Separation	√	√	√	
TOC separation	√	√		
AIDC	√	√		
FLAS	√	√		

Table D23: Brisbane, Honiara, Melbourne, Nauru FIRs Assessment

Fiji	Category R	Category S	Category T	Remarks
Communication	√	√	√	
Navigation	√	X	√	
ATS surveillance	√	√	√	
Horizontal Separation	√	√	√	
TOC separation	√	√		
AIDC	X	NA		
FLAS	√	√		

Table D24: Nadi FIR Assessment

French Polynesia	Category R	Category S	Category T	Remarks
Communication	√	√	√	
Navigation	√	X	√	
ATS surveillance	√	√	√	
Horizontal Separation	√	√	√	
TOC separation	√	X		
AIDC	X	√		
FLAS	√	√		

Table D25: Tahiti FIR Assessment

New Zealand	Category R	Category S	Category T	Remarks
Communication	√	√	√	
Navigation	√	X	√	
ATS surveillance	√	√	√	
Horizontal Separation	√	√	√	
TOC separation	√	√		
AIDC	√	√		
FLAS	√	√		

Table D26: Auckland Oceanic, New Zealand FIRs Assessment

Papua New Guinea	Category R	Category S	Category T	Remarks
Communication	X	√	√	
Navigation	X	X	X	
ATS surveillance	X	X	√	
Horizontal Separation	X	X	X	
TOC separation	X	X		
AIDC	X	X		
FLAS	√	√		

Table D27: Port Moresby FIR Assessment

United States	Category R	Category S	Category T	Remarks
Communication	√	√	√	Cat S/T for islands
Navigation	√	X	√	
ATS surveillance	√	√	√	
Horizontal Separation	√	√	√	
TOC separation	√	√		
AIDC	√	√		
FLAS	√	√		

Table D28: Oakland, Anchorage Oceanic FIRs Assessment

Appendix E: New Zealand Seamless ATM Planning Framework

<u>Background</u>

1 A performance-based planning framework, derived from ICAO planning frameworks, has been adopted for the New Zealand project. The Plan brings together airspace, CNS, ATM, aerodromes, AIM, and meteorology work streams. The Plan also considers over-arching issues, such as regulatory requirements (including rules, operational approvals, etc.), aircraft requirements, licensing and training requirements, security and environmental matters.

2 The following factors are drivers for change from equipment-based to performance-based system:

- many airline and modern general aviation aircraft have been equipped for GNSS navigation;
- RNP approaches have been established;
- the establishment of enhanced ATS surveillance such as MLAT to assist in the situational awareness of air traffic; and
- a single aeronautical database that allows the Aeronautical Information Publication and aeronautical charts to be produced from one database, thereby reducing errors.

3 Considerable effort has been undertaken in recent years on improving individual elements of the New Zealand national airspace and air navigation system, including:

- Airspace Policy;
- a PBN Implementation Plan;
- Aeronautical Information Service (AIS) to AIM Roadmap which includes development of the AIXM database for AIM;
- plans for improved ATM and ATS surveillance.

4 However, a much greater degree of coordination is needed between government and the industry in order to manage change in the airspace and air navigation system effectively, efficiently and safely. In particular, changes are needed to reduce the risk of inappropriate and wasted investment in technologies and equipage, and to reduce any risk of disruption due to lack of coordination between industry, the air navigation services provider (ANSP), the regulator, and government. Five key policy areas that would need to be addressed to enable these changes were identified:

a) implementation of a suitable planning approach to facilitate the changes in the airspace and air navigation system;

b) effective management by phasing the system changes;

c) establishment of principles for the designation of airspace in the future system;

d) better integration of decision-making on airspace and land use management (which involves coordination with local authorities and increasing awareness of aviation requirements); and

e) streamlining of changes to regulatory requirements wherever possible.

5 As part of the Plan development, New Zealand will coordinate with neighbouring States in accordance with the concept of Seamless ATM.

Appendix F: Point Merge Procedure Efficiency Analysis (Republic of Korea)

1 Existing STARs, usually designed to provide the shortest transition, provide information on the expected arrival track to the pilot, allowing planning for the approach to include CDO. However, it was not applicable if the traffic volume exceeded the maximum capacity of the STAR. In this situation, radar vectors were used to accommodate the increased traffic. However, radar vectors increased air traffic controller workload and reduced pilot situational awareness, even when following ATC instructions.

2 To overcome the disadvantages of radar vectors and to improve efficiency and effectiveness of terminal airspace, the Point Merge method based on PBN was implemented at Incheon International Airport on 3 May 2012 (**Figure F1**). The Point Merge method allowed improved:

- safety (due to the reduction of controller-pilot radio communication and enhanced surveillance capability);
- fuel efficiency (mainly through use of CDO); and
- capacity management (with better information on aircraft position supporting 4D Trajectory-Based Operations and enhanced wake turbulence management).

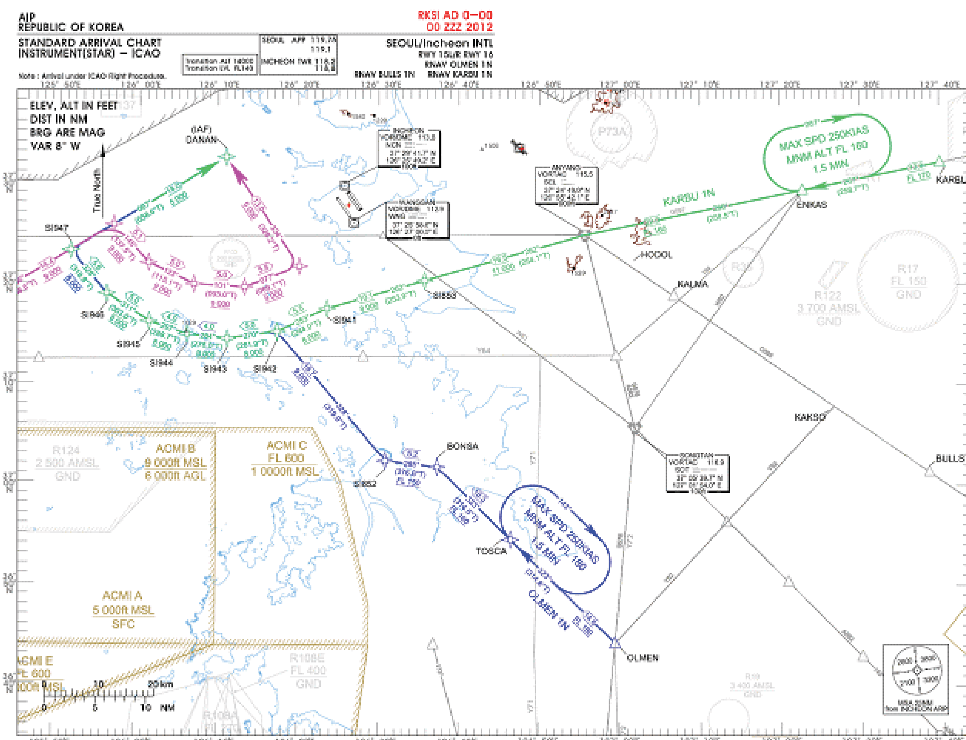

Figure F1: Incheon Airport Point Merge Procedure

3 STARs with Point Merge method were implemented at Incheon International Airport on 3 May 2012. According to the analysis of the initial phase of implementation of point merge method, the average flight distance was decreased by 2.3%, while average flying time was increased by 1.1% (due to speed control for spacing). However, variance related to flight distance and flying time decreased by 35.6% and 42.4% respectively, increasing the predictability of aircraft operations.

4 As for the vertical profiles of aircraft, analysis indicated that the aircraft following STARs with the point merge method descended from it significantly higher altitude comparing to conventional procedures including radar vectors (**Figure F2**). This meant that the Point Merge procedures were enabled to descend continuously. Based on the observed results, the new Point Merge procedures saved fuel consumption by 16%, compared to the replaced procedures.

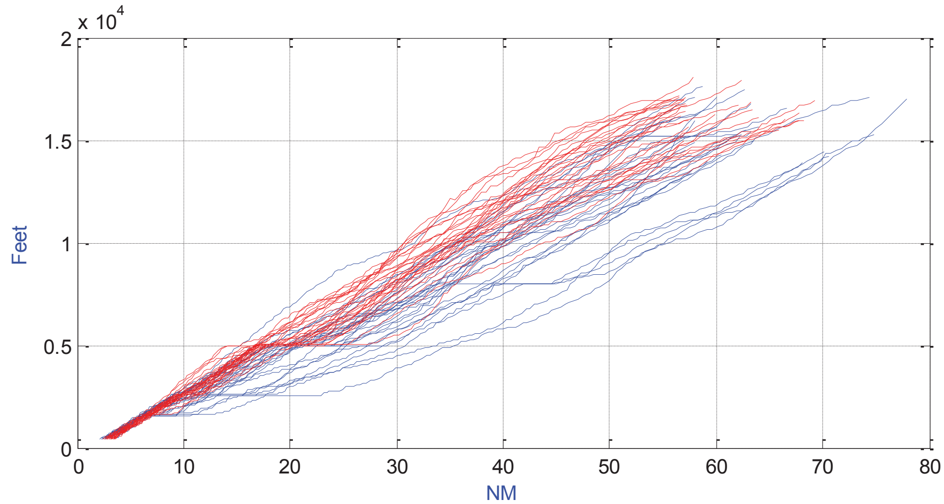

Figure F2: Vertical Profile Comparison – Blue Tracks: Radar Vectors, Red: Point Merge

5 In terms of the workloads of air traffic controllers, the Point Merge procedures reduced average communication time per aircraft and average communication frequency per aircraft by 36.6%, 10.0% respectively. This meant air traffic controllers could concentrate on traffic monitoring, and provide pilot with more information useful for situational awareness.

6 The study showed that there was no significant difference between radar vectors and Point Merge method regarding airspace capacity. However, greater capacity was expected overall due to the improvement in controller workload, and if the arrival management tool was also used, this would further increase capacity (**Figure F3**). Therefore, implementation of the Point Merge method enabled terminal airspace operations to be safer and more efficient (in terms of cost savings, less carbon dioxide, and increased airspace capacity), provided that CDO and arrival management tools were also implemented with the point merge method.

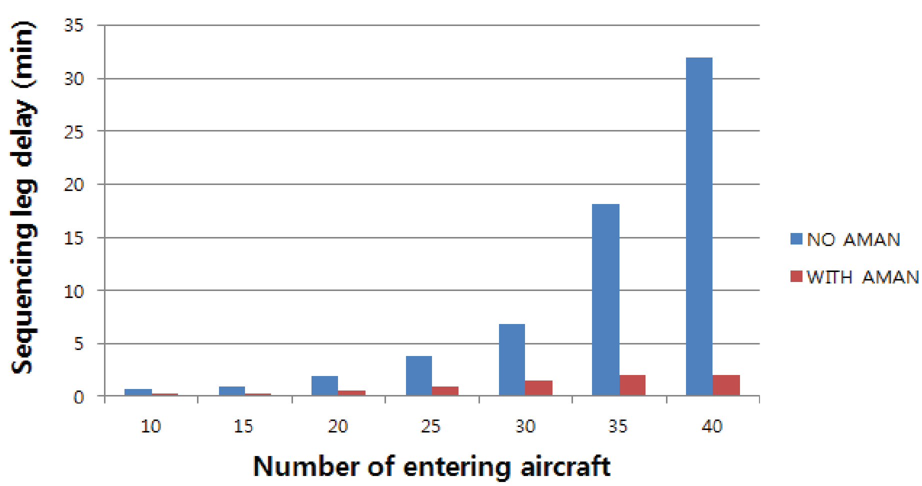

Figure F3: Point Merge Sequence Leg Delay Time

Appendix G: Capacity Expectations

1 Capacity metrics will vary considerably, depending upon many factors such as the COM and SUR capabilities, the presence of terrain, physical attributes of aerodromes and weather. Thus the expectations outlined for the following States need to be treated with caution, however they form a useful guide as to the sort of capability being achieved with modern systems and appropriately trained controllers.

2 **Table G1** provides an indication of potential Aerodrome Arrival Rate (AAR) for a single runway, given aircraft ground speeds and aircraft spacing near the runway threshold (source: *Guide for the Application of a Common Methodology to Estimate Airport and ATC Sector Capacity for the SAM Region, Attachment 7: Calculation of the Aerodrome Acceptance Rate used by the FAA*).

Speed	3NM	3.5NM	4NM	4.5NM	5NM	6NM	7NM	8NM	9NM	10NM
140kt	46	40	35	31	28	23	20	17	15	14
130kt	43	37	32	28	26	21	18	16	14	13
120kt	40	34	30	26	24	20	17	15	13	12

Table G1: Potential Runway Arrival Rate

3 ATC capacity calculations needed to take into account the volume of airspace of each sector, which varied considerably by State, and factors such as automation, density of traffic and complexity of routes/airspace. The ICAO *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) contained guidelines for ATC sector capacity assessment. **Table G2** provides simplified ATC sector calculation guidance from Doc 9971.

Average sector flight time (minutes)	Optimum sector capacity value (aircraft)
3 minutes	5 aircraft
4	7
5	8
6	10
7	12
8	13
9	15
10	17
11	18
12 minutes or more	18

Table G2: Simplified ATC Sector Capacity Table (no complexity/automation allowance)

4 Australia, Japan, New Zealand, Singapore, Thailand and the United States provided runway and airspace (ATC Sector) capacity data, to indicate potential capacity figures in varying Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC) circumstances.

Australia

5 Brisbane and Melbourne aerodrome capacity expectations:

- single runway: **48** (24 arrivals - 150 seconds between arrivals, 24 departures, VMC);
- single runway: **40** (20 arrivals - 180 seconds, 20 departures, IMC).

Japan

6 Aerodrome capacity expectations:

- Narita (dual runways): 56-64;
- Haneda (4 runways): 74.

New Zealand

7 Auckland aerodrome capacity expectations:

- single runway: **40** (VMC);
- single runway: **39** (IMC circling);
- single runway: **37** IMC below circling with missed approach protection for jets);
- single runway: **32** (IMC below circling with missed approach protection)

8 ATC Sector capacity expectations:

- terminal/low level Category T airspace: **12** aircraft; and
- en-route Category S airspace: **15** aircraft;
- en-route Category R airspace: **15** aircraft.

Singapore

8 Changi aerodrome capacity expectations:

- single runway: **30** (IMC); and
- two parallel/near parallel runways: **72** (IMC);
- three parallel/near parallel runways: to be confirmed, possibly 100+ (IMC).

9 ATC Sector capacity expectations:

- terminal/low level Category T airspace: **14** aircraft; and
- en-route Category S airspace (sector dimension of 150NM x 100NM): 7 aircraft (extrapolated √6.66 x airspace volume = 2.58 x 7 = **18**).

Thailand

10 Suvarnabhumi aerodrome capacity expectations:

- single runway: **34** (VMC/IMC).

United States of America

11 **Table G3** provides an indication of optimal aerodrome parallel or near parallel arrival rate runway arrival capacity at selected USA aerodromes. It should be noted that multiple runway combinations or whether runways were used for arrivals, departures, or both yielded a number of permutations from the data.

Aerodrome	Runways	IMC	VMC
ATL	5	104	126
ORD	5	84	112
DFW	5	90	96

ATL	4	92	112
DEN	4	-	114
LAX	4	64	80
ORD	4	-	92
ATL	3	76	96
DEN	3	-	96
IAD	3	72	100
ATL	2	68	82
JFK	2	-	58
SDF	2	40	52
ATL	1	34	42
SDF	1	20	26
SFO	1	25	27

Table G3: Capacity at selected US airports

12 Average aerodrome <u>arrival</u> capacity expectations (range):

- single runway: IMC average **26** (25-34), VMC average **32** (26-42);
- two parallel/near parallel runways: IMC **55** (40-68), VMC **64** (52-82);
- three parallel/near parallel runways: IMC **74** (72-76), VMC **97** (96-100);
- four parallel/near parallel runways: IMC **78** (64-92), VMC **100** (80-112);
- five parallel/near parallel runways: IMC **92** (84-104), VMC **111** (96-126).

13 ATC Sector capacity expectations:

- terminal/low level <u>Category T</u> airspace: **12-18** aircraft; and
- en-route <u>Category S</u> airspace: **16-20** aircraft; and
- en-route <u>Category R</u> airspace: **17-24** aircraft.

<u>Summary</u>

14 **Table G4** summarises runway and airspace capacity expectations from States, with the greatest capacity achieved in optimum conditions highlighted in bold.

	Parallel or Near Parallel Runway Capacity					ATC Sector Capacity		
	1	2	3	4	5	T	S	R
Australia	40-48							
Japan		56-64		74				
NZ	32-40					12	15	15
Singapore	30	72				14	18	
Thailand	34							
USA	**61**	**95**	**150**	**177**	**211**	12-**18**	16-**20**	17-**24**
Doc 9971 Simplified Table Comparison						15	18	18

Table G4: Capacity Expectations Summary

Note: Given the unique operation environment and constraints of individual States, these figures are indicative only and do not represent the same expectation across different States in the region

Appendix H: Elements Map

ASBU Element	Global/Regional Element	Civil/Military Element	Plan	Reference/ Principle
B0-CDO: CDO, STAR			PARS I/II	28
B0-FRTO: FUA, UPR, DARP			PARS I	27, 11
B0-RSEQ: AMAN/DMAN			PARS I/II	8, 33
B0-CCO: CCO, SID			PARS I/II	28
B0-FICE: AIDC, ATN			PASL I	20, 23, 26
B0-DATM: AIM			PASL I/II	30
B0-NOPS: ATFM			PASL I	8
B0-TBO: ADS-C, CPDLC			PARS I PASL I	25, 29
B0-APTA: AIRPORT PBN			PARS I/II	17
B0-WAKE: WAKE TURB			-	3, 4
B0-SURF: ASMGCS, CMM			-	24
B0-ACDM AIRPORT CDM			PARS I/II	13
B0-ASUR: ATS SUR			PARS I PASL I	24, 29
B0-85: ATSA			PARS I	-
B0-OPFL ITP			-	-
B0-ACAS: ACAS			PARS I	Annex 6
B0-SNET: SAFETY NETS			PASL I/II	31
B0-AMET MET WARN			PASL I	34
	AIRPORT CERT.		PARS I	Annex 14
	AIRPORT CAPACITY		PARS I/II	GPI 14
	AIRSPACE: FIRS		PASL 1	CONOPS
	AIRSPACE: CLASS		PASL I	GPI 4
	AIRSPACE: RVSM		PARS I	GPI 2
	AIRSPACE: PRIORITY		PASL I	CONOPS
	NAV: PBN ROUTES		PARS I/II	17, 18
	SUR: ATC STDS		PASL I	CONOPS, 2, 6
	SUR: DATA SHARING		PASL I	26
		STRATEGIC LIAISON	PASL I	10
		TACTICAL LIAISON	PASL I	10
		MILITARY SUA %	PARS I	11
		SUA REVIEW	PARS I/II	11
		INT. SUA	PARS I	11
		ATM INTEGRATION	PASL I	35
		JOINT AD/NAV AIDS	PASL I	-
		SHARED DATA	PASL I	35
		COMMON TRAINING	PASL I	4
		COMMON PROC.	PASL I	4

Appendix I: List of References

Global and Regional Framework

Doc 9673 *Asia/Pacific Regional Air Navigation Plan*
Doc 9750 *Global Air Navigation Plan*
Doc 9854 *Global Air Traffic Management Operational Concept*
Global Aviation Safety Plan

Air Navigation Services

Annex 10 *Aeronautical Telecommunications*
Annex 11 *Air Traffic Services* (particularly Chapter 2 [2.1 and 2.30], and Attachment C)
ASBU Document
ASEAN *Master Plan on ASEAN Connectivity*
Asia/Pacific Air Traffic Flow Management Concept of Operations
Asia/Pacific Air Navigation Concept of Operations
Asia/Pacific Regional Performance-Based Navigation Implementation Plan (V4.0)
Circular 330 *Civil-Military Cooperation in Air Traffic Management*
Doc 4444 *Procedures for Air Navigation Services Air Traffic Management* **(***PANS ATM)*
Doc 8071 Manual on Testing of Radio Navigation Aids Volume 2
Doc 9613 *Performance-based Navigation Manual*
Doc 9882 *Manual on ATM System Requirements*
Doc 9883 *Manual on Global Performance of the Air Navigation System*
Doc 9906 *Quality Assurance Manual for flight Procedure Design Volume 5*
Doc 9971 *Manual on Collaborative Air Traffic Flow Management*
Global Operational Data-link Document
ICAO AN-Conf/12 Yellow Cover Report on Agenda Item 1
Roadmap for the Transition from AIS to AIM

Flight Operations

Annex 6 *Operation of Aircraft*
Doc 8168 *Procedure for Air Navigation Service Aircraft Operations Volume I Flight Procedures*
Doc 8168 *Procedure for Air Navigation Service Aircraft Operations Volume II Flight Procedures*
Doc 9931 Continuous Descent Operations (CDO) Manual
Doc 9993 Continuous Climb Operations (CCO) Manual

Human Factors

Annex 1 *Personnel Licensing*
Circular 214 *Fundamentals on Human Factors*
Circular 227 *Training of Operational Personnel on Human Factors*
Circular 241 *Human Factors in ATC*
Circular 249 *Human Factors in CNS and ATM Systems*
Circular 318 *Language Testing Criteria for Global Harmonization*
Circular 323 *Guidelines for Aviation English Training Programmes*
Doc 9835 *Manual on the Implementation of ICAO Language Proficiency Requirements*
Doc 9966 *Fatigue Risk Management Systems*
Human Factors Digest No. 1

Seamless Asian Skies:
Initial Economic Analysis of Benefits

International Air Transport Association (IATA),

Asia Pacific Office

Seamless Asian Skies: Initial Economic Analysis of Benefits

Executive Summary

This report is the first stage of IATA's commitment to work with States and other agencies to quantify the Seamless Asian Skies (SAS) initiative's likely benefits.

SAS will improve the efficiency of Asia Pacific's air traffic management and deliver the system capacity to meet the projected future demand.

This initial analysis suggests that if Asian Nations implement the critical ICAO Aviation System Block Upgrade (ASBU) elements of the Seamless ATM Draft Plan, aviation's contribution to Regional GDP will increase from 2.2% in 2011 to 4% in 2030. This would represent an Overall Aviation contribution of USD 2358.76 billion to the regional GDP for the year 2030.

However if Asian Nations do not implement ICAO Aviation System Block Upgrade (ASBU), aviation's contribution to the Regional GDP will fall to 0.8% in the year 2030.

Clearly, the figures indicate a demand for a sustainable and mutual development of aviation infrastructure in the Asia Pacific Region.

The next stage of IATA's commitment to SAS is to quantify the investment required to implement 'Block 0' upgrades across Asia Pacific.

Today, most airport and air traffic management upgrades are funded by airport or by the State (whether by airline revenue or consolidated funds) and implemented within that State.

Future air traffic management upgrades, as recommended in ASBU, will require a Regional solution implemented across a number of States and managed cooperatively between the participating Nations.

> If aviation is to continue to drive global economic prosperity and social development to the extent our community and the world have grown accustomed, especially in the face of dramatic regional traffic growth projections and the pressing need for more determined and effective climate related stewardship, States must fully embrace the new Block Upgrade process and follow a unified path to the future global Air Navigation system.
>
> ICAO Global Air Navigation Capacity & Efficiency Plan, 2013-2028, p24

Introduction

A finding of the second meeting of the ICAO Asia/Pacific Seamless ATM Planning Group (APSAPG/2) held in Tokyo 6-10 August 2012 was the need to develop a method to assess the economic implications of operational performance as a result of the implementation of the seamless operational concept (such as how to set the value of time to quantify passenger time savings) within a framework of business cases and cost-benefit analysis (CBA).

In accordance with APSAPG/2 agenda Item 3: 'Drivers for a seamless ATM Environment', IATA made a commitment to work with States and other organizations to define and quantify the likely benefits of Seamless ATM across the Asia Pacific region.

This report provides updated information from the first report which defined and quantified the economic benefits/costs of seamless skies in the Asia Pacific region. This is a "high level" study defining the overall costs and benefits of implementing ICAO's ASBUs as a framework for the harmonization of ATM.

This updated report illustrates extended economic benefits of upgrading current aviation infrastructure in the Asia Pacific region.

It is also a scoping study because it recognizes from the outset that the required information to conduct a detailed, step-by-step, analysis of the costs and benefits of the ASBU program is not readily available in this region. However, with the continued support of Asia Pacific leaders, airlines and ANSPs, it will be possible to collect the data needed to complete a detailed CBA of the seamless skies program from the perspective of individual airlines, ANSP's and Airports in the near future.

> As CANSO (2012)[1] commented, "At the economic and financial level, we may understand the costs but do not fully understand the benefits of ATM modernisation. Yet, billions are expected to be invested. ATM modernisation needs to be supported by a solid business case. ……. "

The study's methodology has been developed in accordance with the principles described in ICAO Doc 9161; ICAO Circular 257-AT/106; Eurocontrol (2000) Guidelines for the economic appraisal of EATMP projects; FAA (1998) Economic Analysis of Investment and Regulatory Decisions; SESAR (2006) Cost Benefit Modeling, and; Boeing C/ATF's (2000) Economic Evaluation of CNS/ATM Transition.

A detailed analysis of seamless skies should utilize the taxonomy of phase-offlight efficiency indicators which have been jointly developed over many years by Eurocontrol and the FAA[2] and which are now being recommended to ICAO's 12th Air Navigation Conference to become the common air navigation services (ANS) performance metrics and indicators[3]. The benefits and costs, such as increased capacity, notional cost of delay

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[1] AN-Conf/12-WP/ /12, Addressing the Impediments to ATM Modernisation.

[2] US/Europe Comparison of ATM-related Operational Performance (2009, updated in 2012). See http://www.eurocontrol.int/documents/useurope-comparison-atm-related-operationalperformance-2010

[3] AN-Conf/12-WP/35

per passenger are subsequently monetized to enable financial analysis. This methodology provides greater transparency and helps users align the cost of services with the benefits provided.

Limitations of the Study

As this initial study has been carried out over a relatively short time frame it therefore uses information that is readily available. Where there is an absence of data, the study makes assumptions, which are stated in the text. Any assumptions are conservative by design and the main results robust.

The first part of the study represents an aggregation of aviation activity across all the Asia Pacific countries. It should be noted there are wide variations in service levels and capacity between the States and often even within a single States.

The second section of the report represents an analysis of ASBU Block 0 Implementation into Manila, which is the gateway to the Philippines and a major traffic constraint point. To obtain more detailed and widespread CBA analysis requires the submission of historical flight data, schedules and demand forecasts from airlines, and projections of project costing for ASBU module implementation by ANSPs throughout the region.

Economic Analysis

When air navigation services projects are publicly funded, a methodology that reflects both the public and private benefits and costs of the project should be considered. Accordingly, this analysis identifies the benefits of aviation activity to the broader national economies. The analysis forecasts the overall contribution of aviation to the regions GDP by 2030 based on the expected growth in passenger and cargo movement.

There are also potential productivity gains for the providers of services, which must be taken into consideration. For example, an investment in modern ATS technology may reduce the number of air traffic controllers required in the future thereby reducing future operating costs. Transportation efficiency benefits may also accrue to operators (e.g. airlines) and would include savings arising from the more efficient operation of aircraft, and greater service reliability and predictability.

At a project level, once the benefits and costs have been identified and forecast, in order to determine if a project is cost-beneficial, or to assess which option yields the greatest net benefits; the net cash stream of benefits and costs is discounted to today's value to produce a single net present value (NPV)[4]. The preferred option, from an economic perspective, would be the one with the highest NPV.

The need for discounting stems from the fact that the value placed on income and expenditures depends on when they occur. One unit of currency to be received a year from now is worth less than the value of one unit of currency in one's pocket today, because of opportunities foregone during the year.

Steps in Cost and Benefit Methodology

[4] The discounted value of benefits from the investment less the discounted value of expected costs. A positive NPV indicates that an investment is worthwhile.

Step 1 - Define the objective
Step 2 - Specify assumptions
Step 3 - Identify alternatives
Step 4 Estimate benefits and costs
Step 5 - Compare the alternatives
Step 6 - Evaluate the outcome

STEP 1 – Define the objective

The purpose of a cost benefit analysis is to identify, measure and aggregate the incremental costs and benefits associated with the replacement of existing technologies and procedures with ASBU Block upgrades to implement Seamless Asian Skies and how to use this information to draw conclusions about the expected economic impact on governments, ANSPs and users. The objective here is to compare the implementation of relevant Block 0 upgrades with a base case[5].

STEP 2 – Specify assumptions

Access to the full potential operational benefits of Block 0 upgrades is conditional on a broad range of aviation, economic and social policies, primarily national but also, in many cases, regional.

The overall model is generated based on the assumption that all benefits are accumulated based on the implementation of all relevant ASBU modules.

Certain assumption must be made in the calculation of projected benefits such as national and regional growth expectations, traffic forecasts, airline fleet configurations, discount rate for net present value calculations, etc.

To compare the implementation of relevant Block 0 upgrades, the base model assumes that there will not be any investment made in the region to upgrade current infrastructure, and overall aviation contribution will remain constant till the year 2030.

STEP 3 – Identify Alternatives

The alternatives available to governments, ANSPs and airlines with regard to the improvement of ATM performance through the implementation of ASBU modules as a framework for Seamless Asian Skies are:

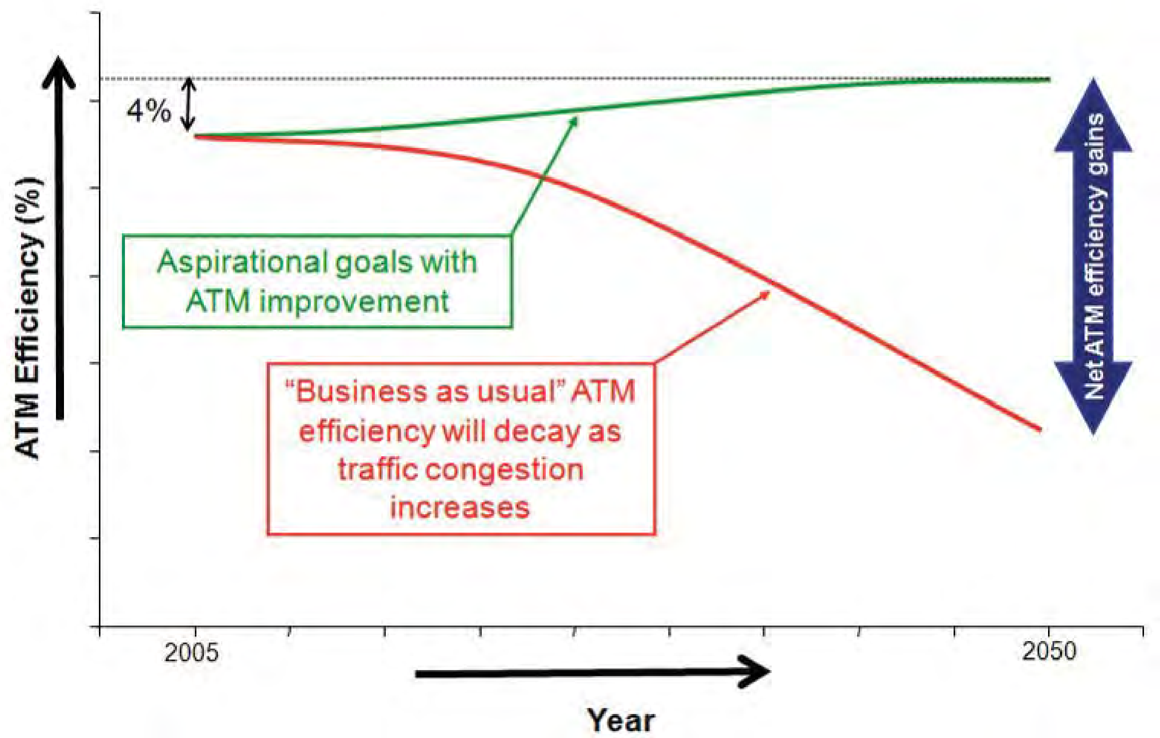
1. **Do nothing (base case)**

In this scenario, the state in the Asia Pacific region maintains the status quo in the face of increasing demand on the system. The current infrastructure, which is already insufficient to accommodate existing demand, is assumed to remain the same.

> CANSO (2008, p. 7) reported that if the industry was to continue with the existing operational environment (business as usual) then the level of global ATM efficiency will decrease as additional traffic increases congestion.

[5] Base Case: Maintaining the level of service available in the base year, with no change to equipment other than direct replacement at the end of service life.

Furthermore, in addition to the increased costs attributable to delays brought about by increased congestion, there will also be a negative impact on the nation's economy from lost aviation activity (refer table page 19). These lost aviation activities will reduce catalytic affect (tourism).



Effect of increases congestion on ATM efficiency, Stollery (2008, p. 4)

2. **Implement Aviation System Block Upgrades**

This scenario considers the implementation of modules of the ICAO ASBUs in accordance with regional plans to enhance the performance of the ATM System. The preferential basis for the development of the modules relies on the applications being adjustable to fit many regional needs as an alternative to being made mandated as one-size fits- all application.

The ASBUs describe a way to apply the concepts defined in the ICAO Global Air Navigation Plan (Doc 9750) with the goal of implementing regional performance improvements. They include the development of technology roadmaps, to ensure that standards are mature and to facilitate synchronized implementation between air and ground systems and between regions. The ultimate goal is to achieve global interoperability. Safety demands this level of interoperability and harmonization. Safety must be achieved at a reasonable cost with commensurate benefits.

Each block and its underlying components are intended to interoperate seamlessly and independently of how they are implemented in neighboring States.

The modules in each block are grouped to provide operational and performance objectives in relation to the environment in which they apply.

The four performance improvement areas are (refer Appendix D),

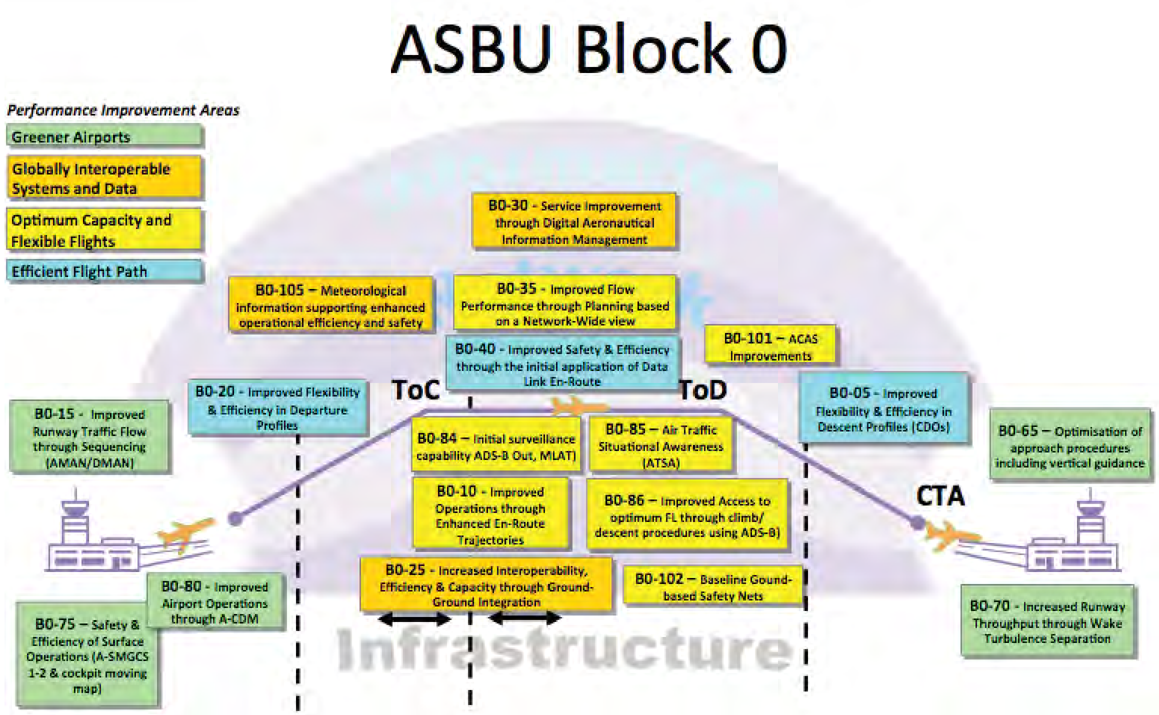
1. Greener airports
2. Globally Interoperable Systems and Data – through Globally Interoperable System-Wide Information Management
3. Optimum Capacity and Flexible Flights – through Global Collaborative ATM
4. Efficient Flight Path – through Trajectory Based Operations

The Aviation System Global Block Upgrade initiative constitutes the framework for a regional agenda towards ATM system modernization. Offering a structure based on expected operational benefits, it should support investment and implementation processes, making a clear relation between the needed technology and operational improvement.

Implement ASBU Block 0 (available now) – Note: IATA is seeking the region wide implementation of ASBU Block 0 by 2018.

For Block 0, no new airborne technologies are required, although modules may imply the deployment of existing technologies to a larger aircraft population depending on chosen modules respectively paired with tied benefits. It is therefore critical for all stakeholders to:

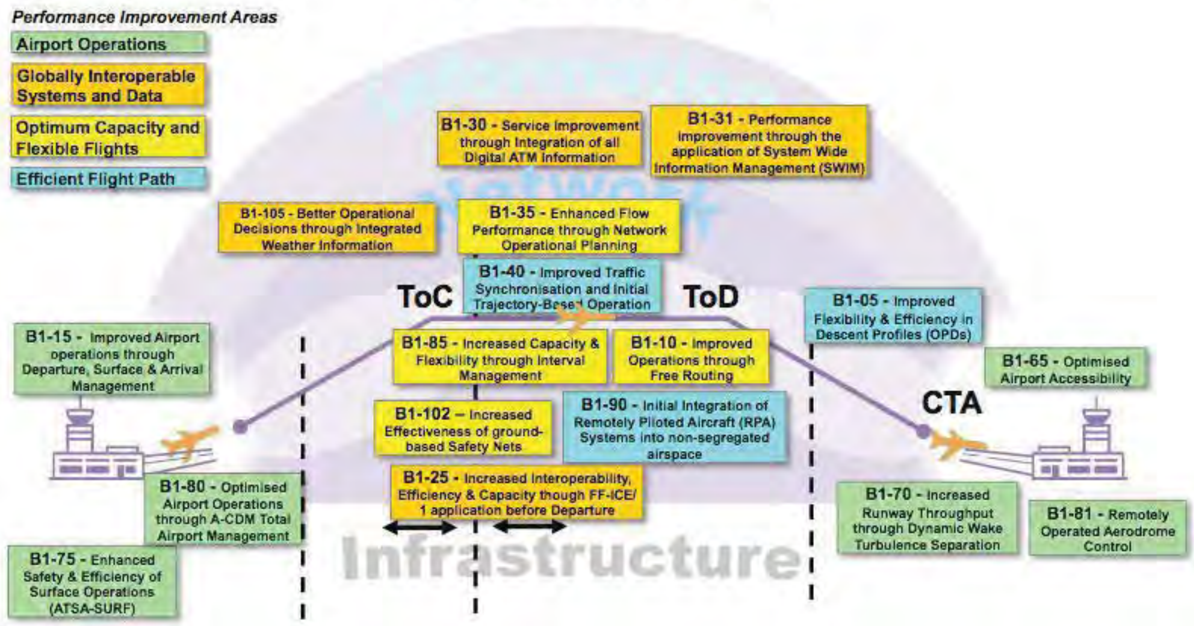
- Fully realizes the benefits and experience of current technology
- Determine and define future requirements (Blocks 1 and above) based on this experience.



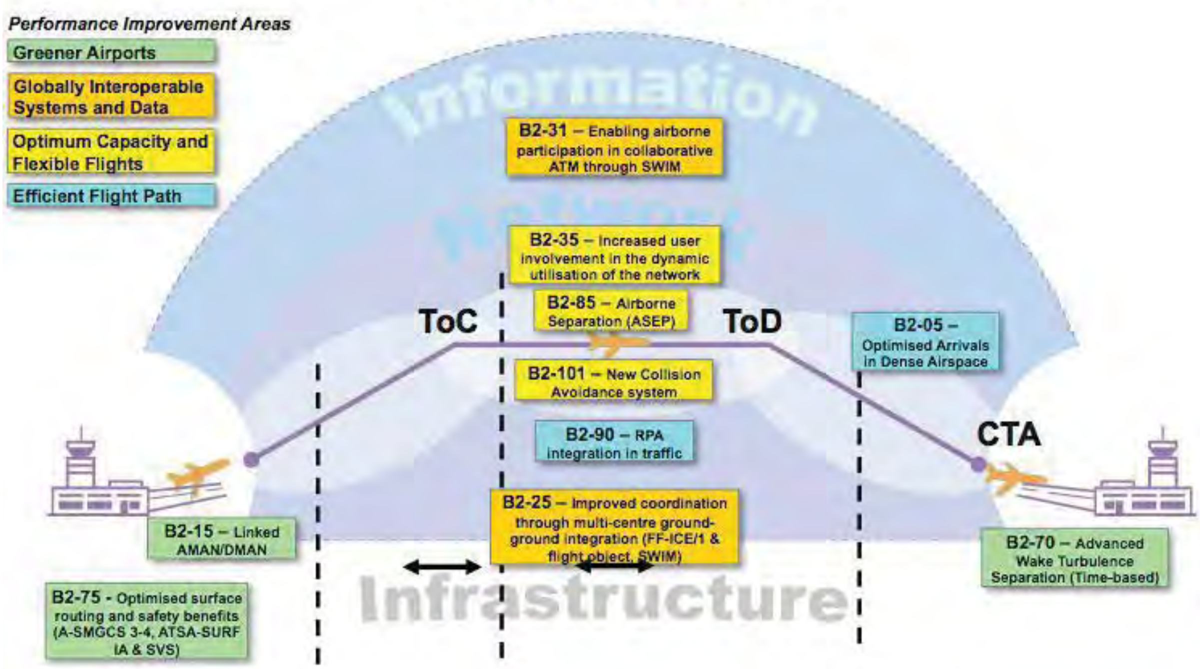
It must be recognized by stakeholders that if Block 0 is not implemented as a foundation, there is a risk certain functionalities may not be available as enablers for future blocks.

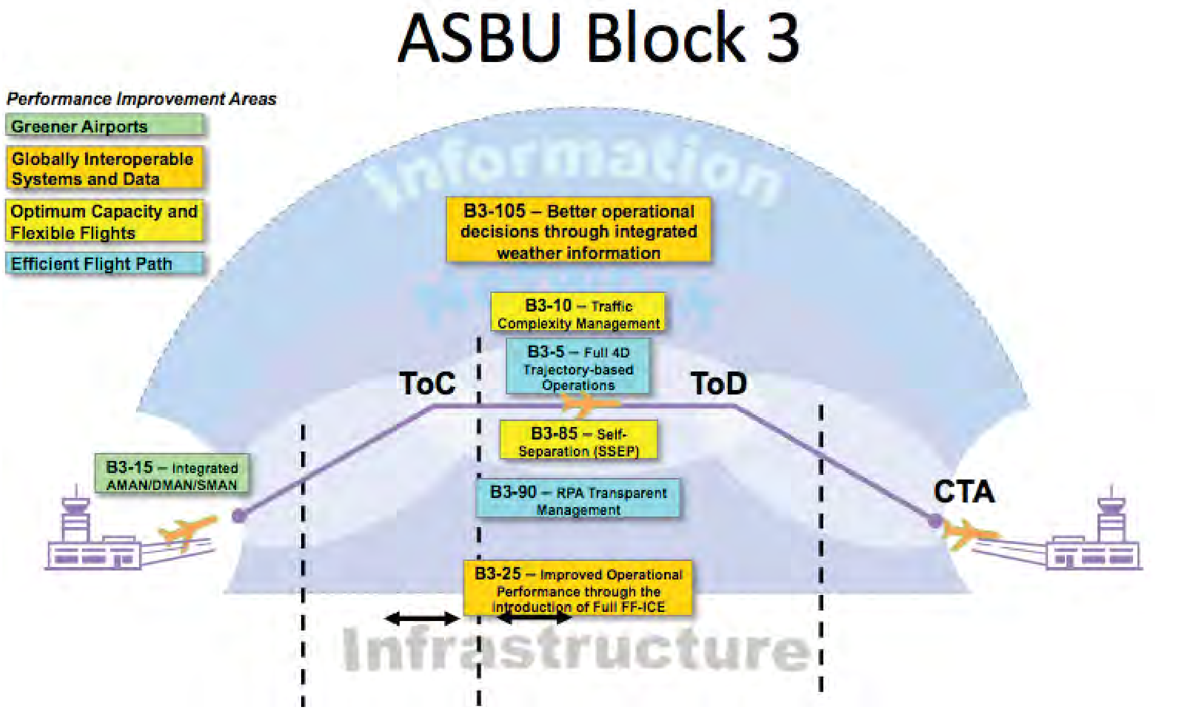
Implement ASBU Stage 1 (from 2018)

ASBU Block 1



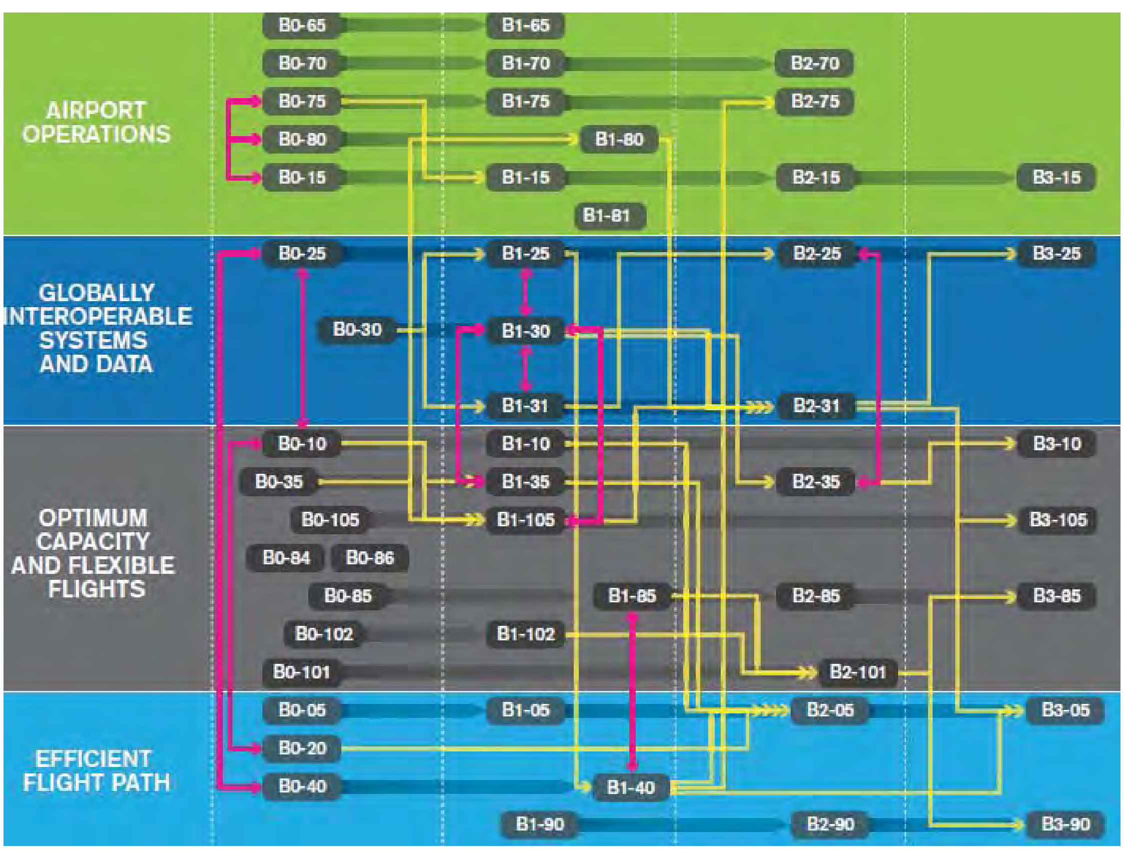
ASBU Block 2





In addition, ICAO's Global Air Navigation Capacity & Efficiency Plan 2013-2028 (in draft) reinforce the dependencies between modules stating that they are:

- Essentially Dependent, and
- The benefits of each module are mutually reinforcing, i.e. implementation of one module enhances the benefits achievable with the other modules.



Module Dependencies

Source: ICAO (2012) Global Air Navigation Capacity   Efficiency Plan 2013-2028, p 12   (in draft).

As the implementation of Blocks 1, 2 3 are dependent on the successful implementation of Block 0 modules this analysis will focus on a comparison between the costs and benefits of implementing the Block 0 modules up until 2018 to achieve seamless skies, with their non-implementation or the businesses-as-usual case.

STEP 4 - Estimate of Benefits and Costs

Air Transportation growth drivers

Growing delays threaten the competitiveness of national economies, by limiting the ability of the air transport system to serve the needs of the nation's economy. The growth in gross domestic product (GDP) and air travel demand are closely linked (Oxford Economics, 200). A recent study that examined the interdependency of air transportation and economic activity in 13 countries (Ishutkina, 200) revealed a correlation coefficient of 0. between air transportation passengers and GDP using world aggregate time-series data during the 1 0-200 time period.

owever underpinning this strong correlation are many factors that can either stimulate or suppress the development of a nation's air transportation system in the shorter term. These factors are categorized as either Supply Side or Demand Side.

Air transport Supply Side Factors	Air transport Supply Side Factors
egulatory Framework • Ownership estrictions • Safety and Environmental estrictions • Geopolitical and Security estrictions Infrastructure Capability • Airport infrastructure Capacity • Air Navigation Services Capability • ATM Shortage of personnel Airlines • Airline Business Factors • Perceived airline fleet safety • Insufficient fleet capacity (due to lack of finance, external factors)	Direct Factors • Exogenous Demand Shocks • Economic downturn (domestic or non-domestic) • Political Economic sanctions • Competition of other transportation modes • Civil Unrest or War Indirect Factors • Political or Macroeconomic factors • Exchange rate Fluctuations

Air Transport System Change Factors. Adapted from (Ishutkina, 200)

While each (or a combination) of the above factors, will at various times, effect the growth of a nation's aviation activity, from a long-term perspective Air Transportation growth is closely aligned to GDP growth.

owever, the scope of this study is to evaluate the costs and benefits of the seamless skies initiative through ASBUs to improve Airport Capacity Air Navigation Services Capability

Infrastructure Capability

Estimate of Benefits and Costs of Seamless Skies

Introduction

Increasing the overall capacity and efficiency of the aviation system in order to accommodate forecast growth in traffic is the principle driver of the Seamless Asian Sky (SAS) initiative. SAS is helping to define the way forward by harmonizing procedures and interoperable technology between states, bearing in mind it needs to be cost efficient at the same time.

"Aviation is a vital part of Asia's economy, supporting 24 million jobs and nearly half-a-trillion dollars of GDP. Connectivity, facilitated by aviation, is a critical link to markets and a generator of wealth—both material and of the human spirit. Ensuring the timely development of sufficient and cost-efficient infrastructure capacity is a priority for the continued successful growth of air transport in Asia- Pacific…We must not repeat the mistakes made in Europe where efforts to implement a Single European Sky are stalled because states are not delivering…. Asia –Pacific is not immune to air traffic congestion issues and these will continue to grow if they are not well managed with a regional perspective." said Tony Tyler, IATA's Director General and CEO.

In an endeavor not to repeat the mistakes of Single European Skies, which continues to suffer from fragmentation of airspace that caused 1 . million minutes of delays in air traffic flow management in 2011 , an analysis to identify the primary areas of capacity constraint and inefficiency in the system is required.

In 1 the Intergovernmental Panel on Climate Change (IPCC) estimated global ATM inefficiency to be between -12 , with large variations by region and by airport. Since then efficiency has improved by 4 with the introduction of procedures such as SM. CANSO (2012) estimate worldwide ATM system fuel inefficiencies are currently between and 8 .

There continues to be intense pressures on governments to further improve ATM systems around the world and recover the remaining inefficiencies.
Pressure on ATM system performance comes from:

- Airlines need for increased efficiency and capacity in the system
- Some ATM systems that are becoming antiquated and costly to maintain
- Multiple parties actively advocating individual technology 'solutions'

To increase ATM performance CANSO (2012, p10) believes stakeholder collaboration is required to plan a phased approach to implement,

- ANSP enhancements that safely increase ATM efficiency and global interoperability
- ANSPs to provide enhanced services to 'better equipped' aircraft as a means of capacity and efficiency improvement
- Better management of fuel efficient delay absorption into congested terminal areas
- Fuel efficient flight tracks while maintaining noise consequences near airports
- egional solutions across major traffic flows (MTF)

ICAO's ASBU initiative is such a programme framework that develops a set of ATM solutions or upgrades that exploits current equipage, establishes a transition plan and

[6] CAPA, http://centreforaviation.com/analysis/europe-to-take-a-third-attempt-at-sorting-outthe-single-european-sky-86383

enables global interoperability. The ASBUs comprise a suite of modules organised into flexible and scalable building blocks, where each module represents specific, well bounded improvements that enable capacity related and or efficiency related benefits.

Benefits

The quantification of economic benefits is based on capacity and efficiency considerations. Examples of benefits are,

- Capacity elated
    - Capacity of en-route airspace and airports
    - eduction in Separation Standards
    - Decision Aids
- Efficiency elated
    - Direct outing
    - Optimum trajectory

Implementing ASBU will bring in aforementioned benefits to the region's aviation capacity and efficiency.

The Cost Benefit Study shows that upgrading the current aviation infrastructure to raise system's capacity to meet the future demand will increase overall aviation contribution to regional GDP from USD 4 0 billion in 2010 to USD 23 8. billion by the year 2030.

> ***Implementing ASBU will increase overall aviation contribution to regional GDP at USD 2358.76 billion by the year 2030.***

Furthermore, increasing system capacity to accommodate future demand will also increase overall aviation contribution to the regions GDP from present 2.2 to 4 by the year 2030.

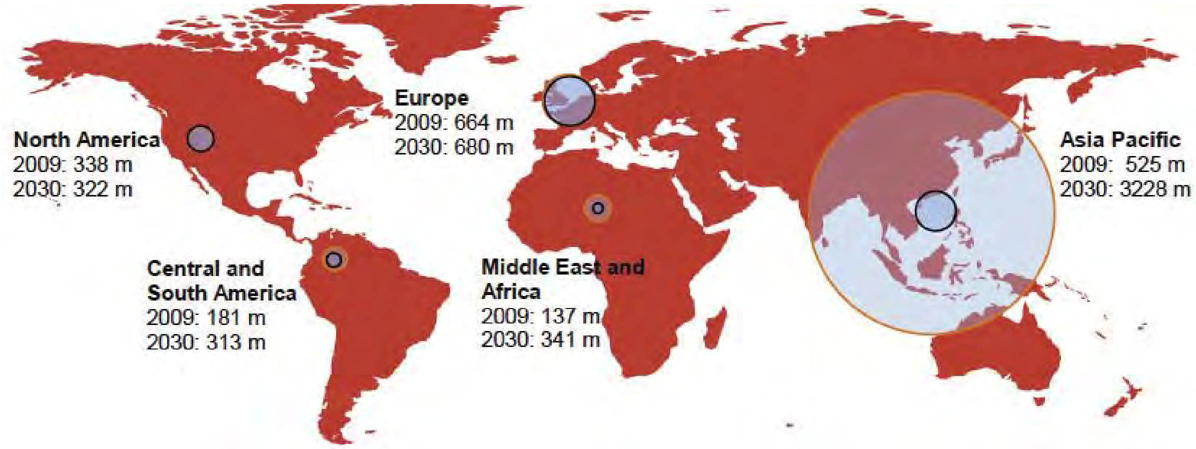
> ***Successful investment in ASBU will raise overall aviation contribution to 4% of the regional GDP by the year 2030.***

Capacity

Capacity is defined as the maximum number of aircraft that can be accommodated in a given time period by the system or one of its components (throughput). The term capacity can be used to refer to a number of factors, any of which could be the limiting factor that might place a constraint on the amount of air traffic that can be handled, e.g. airspace capacity, airport capacity, controller capacity or equipment capacity.

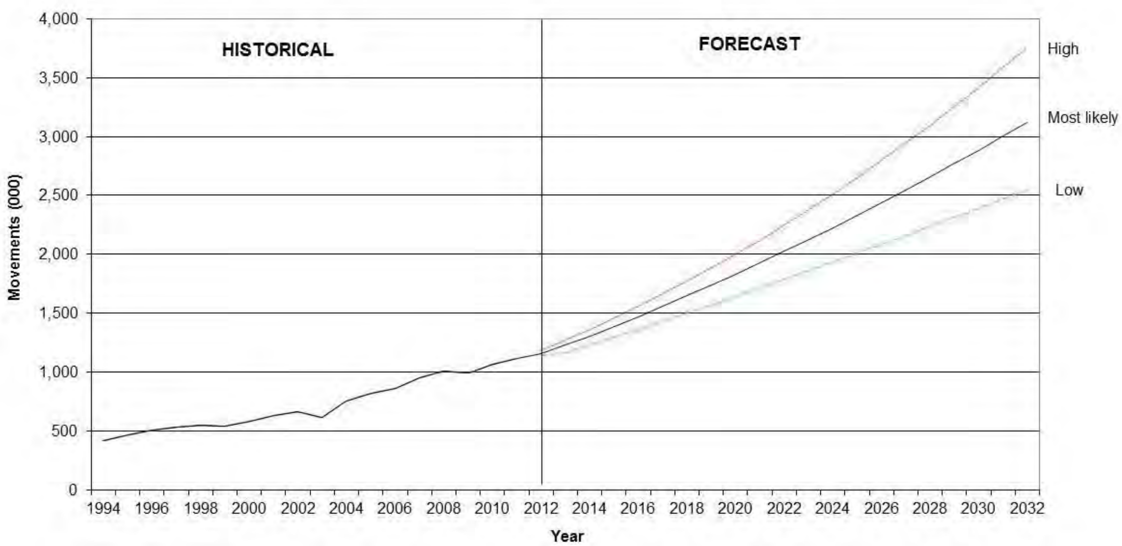
Demand

The Asia Pacific region is expected to be the fastest growing region in the world for air transport over the next 20 years with demand increasing by over per annum. The number of passengers per inhabitant is expected to increase by 1 0 , from 0.1 to 0.44 (trips person year), in the next 1 years (Oxford Economics, 2008:4). The magnitude of the shift towards the region can be seen in the growth of middle-class consumers. An expanding middle class can use its increasing purchasing power to buy high-value products and services, be increasingly mobile, and help drive growth.



Growth of the 'Middle Class'[7] in Asia Pacific region

According to ICAO's Asia Pacific Area Traffic Forecasting Group (APA TFG) eport (Sept, 2012:2), Intra-Asia Pacific passenger aircraft movements are expected to increase from some 1,114. thousand in 2011 to about 3,11 . thousand movements by the year 2032, at an average annual growth rate of .0 per cent. The growth rates for the intermediate periods of 2011-2022 and 2022- 2032 are . and 4.4 per cent, respectively.



Intra-Asia Pacific aircraft movement forecast, Source: ICAO

owever, it is unlikely these forecasts will eventuate due to the "bottlenecks" or constrained demand that already exist throughout the region.

Eurocontrol (1 :40) define three types of constrained demand as,

- **demand generally less than capacity, but exceeding it during peak periods:** Excess demand may be accommodated by allowing delays to build up during the peak period then recovering during the subsequent "quiet" period;
- **demand approaching/exceeding capacity:** If capacity is, on a regular basis, insufficient to meet demand at certain times of the day, airlines may be forced to

[7] 'Middle class' is defined as those households with daily expenditures of between US$10 and US$100 per person. The black border circles and orange border circles depict the size of the middle-class population in 2009 and 2030 respectively. Source: Kharas & Gertz (2010).

operate services at less busy times (demand spreading) or to fly non-optimum routings

- **unaccommodated demand:** Demand may exceed capacity to the extent that there are simply no available slots for further traffic, and therefore demand spreading and re-routing are not possible. In this case airlines would be unable to satisfy any additional demand from passengers for further services.

Constrained Demand

Un-accommodated demand across the Asia Pacific region can be seen in an examination of the busiest city-pairs. As an example, the top 0 city-pairs that transited the ong ong FI during a sample week 1- uly 2012 (as per Table 1 of the aforementioned APA TFG report) show that every airport on the list is classified as an IATA evel III airport[8], with the exceptions of Macao, Osaka aohsiung evel II, and Ching Chuan ang (Military), Anchorage and Busan. A similar picture is painted in the report for aircraft transiting Bangkok, Fukuoka and olkata FI s.

Without airport capacity enhancement through the construction of additional runways or the implementation of ICAO ASBU upgrades such Airport Collaborative Decision Making (A-CDM) and Arrivals Management (AMAN/DMAN), increases to one operator's schedules can only be made at the expense of another's.

Traffic Growth is possible only if there is sufficient aviation infrastructure present in the form of:

- Airport capacity
- Air Navigation System Capability

Many airports in the Asia Pacific egion are currently operating at nearly full capacity due to a long history of traffic growth, while land availability and environmental constraints have hindered expansion. IATA lists 42 evel III and 20 evel II airports in the region . The infrastructure at these airports is not able to accommodate all of the demand and slot availability is subject to coordination and allocation.

The region also suffers from a high degree of variance in Air Navigation Services capability. The lack of sufficient communications, navigation and surveillance and air traffic management (CNS ATM) capability at various locations affects the system's throughput, thus causing increased delays and adds to airline costs. Inadequate aviation infrastructure is also detrimental to the overall air transport system safety and its perception by the flying public. In particular air travel advisories are typically based on the country's total level of safety.

As Ball et al (2010:1) noted, "It is widely recognized that delay increases nonlinearly as demand approaches the capacity in the system (figure below). If current demand in the

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[8] A evel 3 airport is one where:

a) Demand for airport infrastructure significantly exceeds the airport's capacity during the relevant period
b) Expansion of airport infrastructure to meet demand is not possible in the short term
c) Attempts to resolve the problem through voluntary schedule adjustments have failed or are ineffective and
d) As a result, a process of slot allocation is required whereby it is necessary for all airlines and other aircraft operators to have a slot allocated by a coordinator in order to arrive or depart at the airport during the periods when slot allocation occurs.

refer to http: www.wwacg.org FTable ist.aspx list 2 for list of Airports system is D1 with delay at delay1 level, it is likely that, without substantial upgrades to aviation infrastructure, such growth (for example, to D2) would result in flight delays far in excess of any we have hitherto experienced (delay2)".

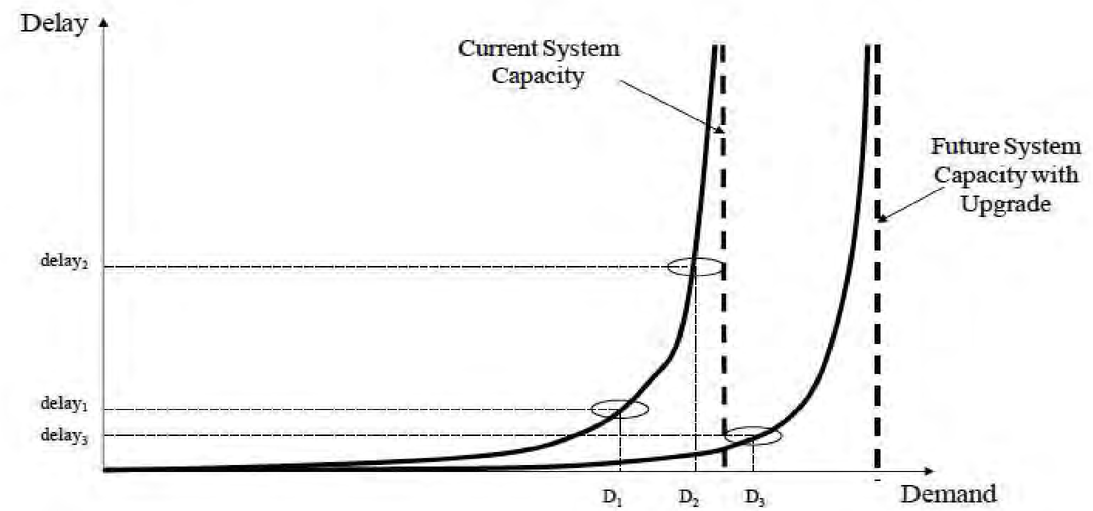

Illustration of the relationship between Demand, Delay and System Capacity Source: Ball et al 2010

The figure above could also be illustrative of a major traffic flow route who's capacity has been increased from point D2 to D3 through a reduction in enroute separation standards associated with the implementation of full surveillance coverage e.g. ADS-B, or NP routes with ADS-C CPD C capability. Airlines then have the ability to increase existing schedules with a commensurate reduction in delay until the future system's capacity is reached.

It is this exponentially increasing delay that leads to a serious concern among users that system capacity must keep up with demand. Thus, capacity constraints in the system take on a level of urgency considerably higher than efficiency constraints, which grow linearly with traffic demands. (Allen, araldsdottir, awler, Pirotte, Schwab, 1) p. .

> *It is important to distinguish between operating costs caused by lack of capacity from cost due to procedural inefficiencies. Allen, et al (1997) p5.*

To accommodate capacity limitations at an airport or through airspace, aircraft may be required to wait (hold) on the ground prior to departure (at gate or on taxiways) deviate en route, or complete holding procedures prior to arrival. When traffic demand approaches available capacity, there is some necessary increase in congestion and fuel inefficient delays to maximize use of available capacity. This congestion reduces efficiency and increases CO_2 emissions.

Cost of Constrained Demand

As the number of flights increases per year, a number of capacity constraints are affecting the efficiency of the air transportation system, as well as its ability to expand further. The two main constraints are airport runway capacity (the number of takeoffs and landings that can be performed per hour), as well as terminal area and enroute capacity. esearch into the identification of these capacity constraints, as well as potential ways of removing bottlenecks from the air transportation system, require the improvement of infrastructure and technology, and or the adoption of new procedures.

As mentioned earlier, the Asia Pacific region boasts 2 level III or II airports, which indicated demand is beyond capacity in many countries. In addition many major traffic flows (MTF) are subjected to lengthy delays (e.g. Bay of Bengal) due to capacity limitations. Unless capacity constraints are identified and their performance elevated, national economies will suffer significant losses due to aviation activity stagnation.

Prudently and in accordance with Ishutkina's (2009) long-term findings, conservative national GDP growth rates have been used as opposed to aviation industry forecasts of aviation growth (e.g. Boeing Airbus). In addition Oxford Economics' average Aviation Contributions to GDP have been used as proxies, where none exist.

The net overall opportunity loss caused by stagnated aviation infrastructure facility to the economic benefits to Asia Pacific countries is valued at USD 1888. billion for the year 2030.

> ***If no action is taken, the lack of aviation capacity will cost Asia Pacific economies an opportunity loss of USD 1888.76 billion.***

Aviation's overall contribution to Asia Pacific regional GDP will reduce from current 2.2 to 0.8 by 2030 if investment to increase aviation capacity and efficiency in infrastructure is not made.

> ***Failure to invest in aviation capacity will reduce overall aviation contribution to 0.8% of regional GDP by the year 2030.***

A consequence of reduced GDP growth is that the emerging economies of the last two decades risk becoming ensnared in 'the middle-income trap', in which middle-income[10] countries don't quite push through to high-income status.

Unfortunately many middle-income countries[11] have seen infrastructure gaps develop and widen. While the existing aviation infrastructure of many countries is inadequate to accommodate the increased passenger and freight transportation, the middle-income trap is avoidable[12] if governments act early and decisively to improve access to infrastructure. The 'trap' can be mitigated to some degree with continued investment in infrastructure to improve regional connectivity (Ag nor, et al, 2012).

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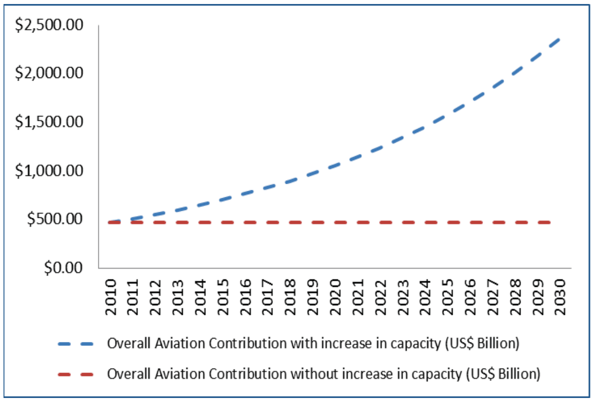
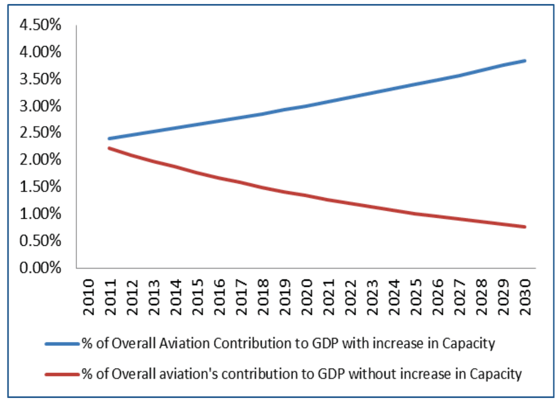
[10] Income Thresholds (GNI per capita) used by the World Bank in 2011 USD. The thresholds are; low income, $1025 or below; lower middle income, $1026-$4035; upper middle income, $4036- $12475; and high income, $12476 or above.

[11] Asia is different from the other developing regions, for some economies (four plus Japan) are already high-income, and five have been low-income since 1950. In Asia there are three (the Philippines and Sri Lanka in the lower middle-income trap, although the latter should get out of it soon; Malaysia in the upper middle-income trap, although it should also get out of it soon; and Indonesia and Pakistan will most likely fall into the lower middle-income trap soon).

[12] Avoiding the middle-income trap is a question of how to grow fast enough so as to cross the lower middle-income segment in at most 28 years (which requires a growth rate of at least 4.7% per annum); and the upper middle-income segment in at most 14 years (which requires a growth rate of at least 3.5% per annum). Only 13 countries were able to transition from middle to high-income status since the 1960s. Of these countries, five were from East Asia – Hong Kong SAR (China), Japan, Korea, Taiwan, China, and Singapore.





Comparison of overall aviation contribution with and without investing in ICAO ASBU

Efficiency

While simply increasing public investment in infrastructure has often been advocated as a strategy for development, research shows that the effect of such investment critically depends on the efficiency of the existing infrastructure network (iojas, 2003). The seamless skies initiative is designed to improve the efficiency of air navigation services through increased harmonization and interoperability and flight path optimization.

A cornerstone of seamless skies is that ATM service delivery management will operate seamlessly from gate-to-gate for all phases of flight and across all service providers (ICAO, 2008). In order to measure the success of seamless skies ANSPs and Airlines need to have quantifiable targets for efficiency and costs in order to develop a sound cost benefit analysis.

The Single European Sky (SES) program for example has set aspirational targets for efficiency as a threefold increase in capacity and significant reduction in delays, while the USA's NextGen program is expecting a 35% reduction in delays by 2018 whilst increasing capacity. SES and NextGen also expect to cut costs through delay reduction by EU 2 0 Million and USD 23 Billion respectively.

From the perspective of a cost-benefit analysis, ATM Efficiency (Economic, Operational, Technical and Airspace) is of prime importance in order to:

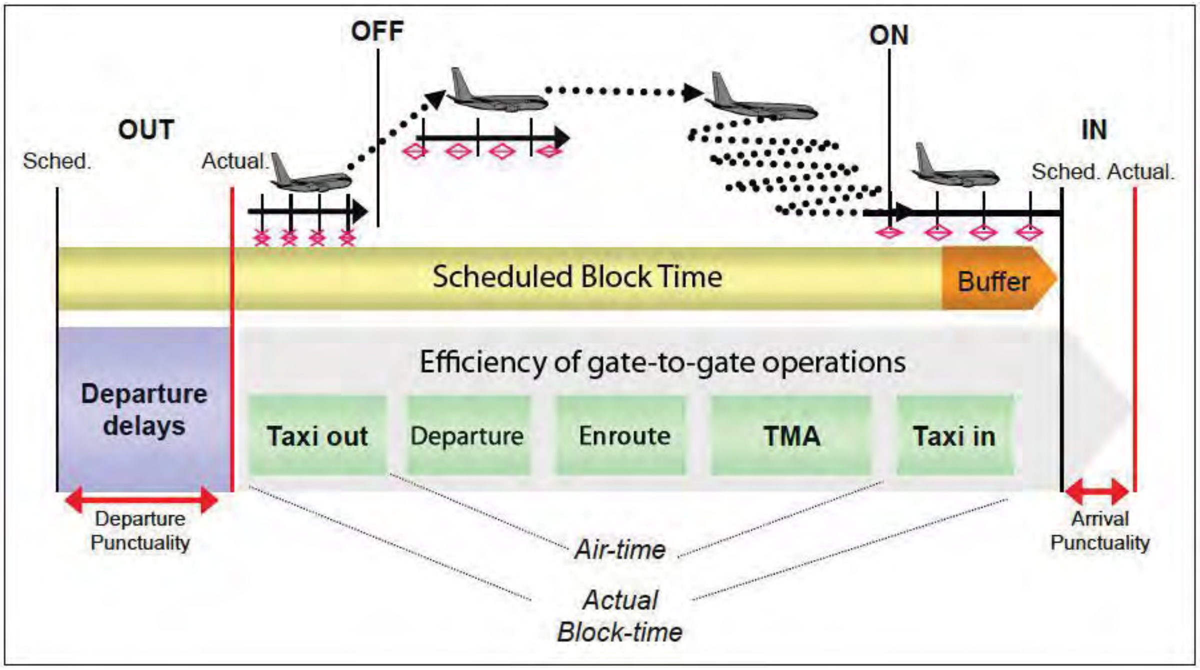
- Improve cost-effectiveness
- Optimize capacity minimize delays
- educe flight inefficiency and minimize environmental impact
- Improve predictability of operations

The quantification of ATM efficiency is most readily addressed through the single-flight perspective. Its value rests in reducing direct operating costs (DOC) by optimizing flight path trajectory and by eliminating excess flight time, route distance, and fuel usage at non-optimum speeds and altitudes. Because airlines fly millions of single operations per year, small incremental DOC savings on every flight can add up to significantly improved financial performance (C AFT, 1).

Therefore the unit of measure used to define ATM efficiency from gate-to-gate, is a single 'optimal' or 'ideal' flight that is not subjected to any delays and allowed to fly via the most direct path with continuous climb and descent profiles.

ATM efficiency is defined as the ratio between actual flight time and an 'ideal[13]' or 'optimum' flight time. The 'ideal' flight can then be disaggregated into different phases of flight, which follows the work of Boeing's CNS/ATM Focused Team (C ATF) in the late nineties, Eurocontrol FAA (2012), and Boeing CANSO (2012)

Phases of Flight



Conceptual framework to measure ATM performance (Adapted from Eurocontrol FAA (2012, p. 24), p.24

ATM system inefficiencies can be analysed gate-to-gate within the following phases of flight,

1. Planning, pre-flight and gate departure
2. Taxi-out
3. Departure
4. Enroute (including Oceanic)
. TMA (descent and arrival)
. Taxi in

According to Boeing CANSO (2012) p12, the inefficiencies for each phase of flight are defined as the difference between actual travel time, travel distance, or fuel use against an unimpeded or benchmark travel time, travel distance, or fuel use. The difference between actual travel time and benchmark travel time is delay.[14]

[13] Ideal flight - Minimum cost travel between origin and destination, assuming still air conditions and no traffic or procedural constraints.

[14] Refer to Boeing & CANSO (2012) p 15-25, and Eurocontrol & FAA (2012) Chapter 6 for extensive discussion of Air Traffic Management efficiencies according to flight phase.

Inefficiencies in the different flight phases have different impacts on aircraft operators and the environment. Whereas ATFM related holdings result in departure delays mainly experienced at the stands, inefficiencies in the gate-togate phases generate additional fuel burn, which also has an environmental impact through gaseous emissions (mainly CO_2),

Gate Departure Delays (1)
educing gate surface delays (by releasing too many aircraft) at the origin airport when the destination airport's capacity is constrained potentially increases airborne delay (i.e. holding or extended final approaches). On the other hand, applying excessive gate surface delays risks under utilization of capacity and thus, increases overall delay. The aim is to keep aircraft at the gate in order to minimise fuel burn due to departure holdings at the runway.

Taxi out phase (2)
The impact of ANSPs on taxi times is marginal when runway capacities are constraining departures. owever, data on taxi delays is useful in developing policies and procedures geared towards keeping aircraft at the gate longer, in readiness for the implementation of Airport Collaborative Decision Making (ACDM). A-CDM initiatives try to optimise the departure queue while minimizing costs to aircraft operators.

Departure (3) & Taxi In (5) phases
The results of the combined Eurocontrol FAA (2012) study on ATM performance found the taxi-in and the TMA departure phases (40 NM ring around departure airport) generally not considered to be large contributors to ATM related inefficiencies.

Vertical Flight Inefficiencies in phases 3,4&5
In addition to time delays and horizontal inefficiencies are vertical inefficiencies, which comprise of two components.

1. Flight level capping: the flight can't reach its optimum cruising level during the flight
2. Interrupted climb descent: during the climb or descent phase, the flight is kept at a suboptimal flight level (Intra-flight vertical inefficiencies)

A Eurocontrol, P C (2008) study found vertical flight inefficiencies increased fuel burn by less than 0. (Average 23kg flight). owever it should be noted that study was conducted in airspace with full surveillance and F communication coverage –a similar study conducted across Asia Pacific airspace with limited surveillance and communication coverage would be expected to result in much higher fuel burn figures. Nevertheless, while vertical flight inefficiencies do generate some negative impacts they remain relatively small when compared to other types of inefficiencies (horizontal, taxi time, airborne delays).

While vertical flight inefficiencies will not be analyzed in this study, there is scope for improvement, and more work on vertical flight inefficiencies and the potential benefits of implementing Continuous Climb Operations (CCO)[1] and Continuous Descent Operations (CDO), as per ASBU B0-20 and B0-0 respectively, would form a more complete picture.

Enroute Inefficiency (Horizontal) phase 4

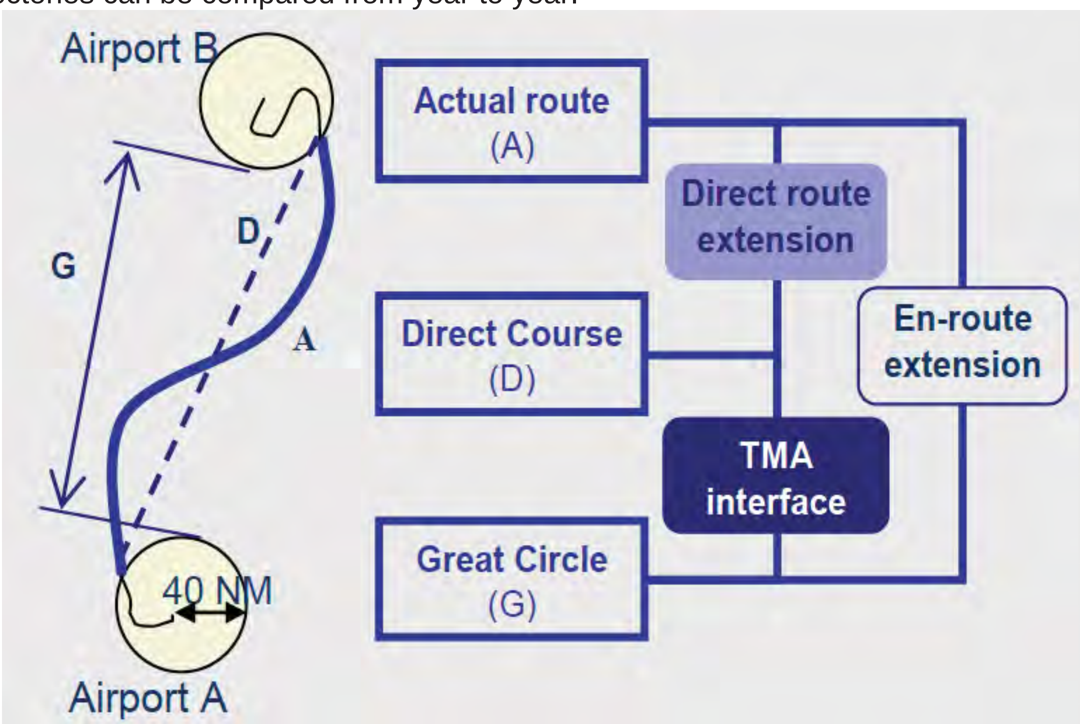
[15] It is important to consider that CCO and CDO benefits are heavily dependent on each specific ATM environment. Nevertheless, if implemented within the ICAO CCO / CDO manual framework, it is envisaged that the benefit/cost ratio (BCR) will be positive

The objective of analyzing Enroute flight inefficiency is to:

- Calculate performance indicators that measure flight inefficiency,
- Identify areas in the Asia Pacific region where ATM system performance
- could be improved,
- Assess economic impact of flight extension on airlines and environment.

Optimum trajectories

The horizontal component of optimum trajectories has been defined by previous studies (E.g. ettunen, et al. 200 Boeing CANSO, 2012 Eurocontrol FAA, 2012) as the great circle distance. In a simplified view of aircraft flight management, this direct route is considered as the cheapest option, as it minimizes fuel costs. In reality, aircraft often do not follow this direct route since airlines have to make tradeoffs between several factors, such as meteorological conditions, which may lead to definitions of optimum, which differ, from great circle distance. owever, great circle distance provides the advantage of being a constant benchmark (independent of individual strategies) against which actual trajectories can be compared from year to year.



The PI used for horizontal en route flight efficiency is enroute extension. Enroute extension is defined as the difference between the length of the actual trajectory (A) and the Great Circle Distance (G) between the departure and arrival terminal areas (radius of 40 NM around airports) (Eurocontrol FAA, 2012:4).

Fragmentation of airspace and military restricted airspace play significant roles in increasing enroute inefficiencies and limits the ability of the enroute facilities to support airport throughput.

TMA (descent and arrival) phase 5.

TMA inefficiencies are defined by the average “additional” time beyond the unimpeded transit time for each airport within the last 100Nm of flight.

The additional time is used as a proxy to measure the tactical management initiatives (TMI) used at an airport irrespective of local ATM strategies (sequencing, flow integration, speed control, mile-in-trail, holding) (refer Annex I , Eurocontrol FAA, 2012 for detailed EU methodology). The fragmentation of Asia Pacific airspace is expected to be a significant contributor to TMA inefficiencies as the support of the en route function is limited and rarely extends beyond the national boundaries. ence, most of the sequencing is done at lower altitudes around the airport.

Conclusion
This conceptual framework enables operational performance to be measured in a consistent way and ATM best practices to be better understood.

While the estimated total ATM inefficiency pool and associated fuel burn in more developed aviation systems such as the US and Europe are similar (estimated to be -8 of the total fuel burn), it is expected to be higher across the Asia Pacific region due to the diverse levels of CNS ATM infrastructure and institutional fragmentation.

The analysis of aircraft operations, broken down by phase of flight (i.e. pre-departure delay, taxi-out, en route, terminal arrival, taxi-in, and arrival delay), will reveal the strengths and weaknesses or bottlenecks of the ATM system at various locations in the Asia Pacific region.

The subsequent implementation of associated ASBU Block 0 modules, which utilize today's best practices, existing technology and operational concepts, should elevate the performance of ATM across Asia Pacific in the relative short term in a standardized, harmonized manner to achieve seamless operations.

Costs

As previously mentioned, delays and their subsequent costs increase exponentially as demand approaches the capacity limits of the system. As these levels are approached, aircraft must wait to use the system, or various parts of it, until they can be accommodated. These delays impose costs both in terms of aircraft operating expenses and the value of wasted passengers time.

Estimation of the delay benefits of new infrastructure projects or procedures requires measurement of the aggregate annual aircraft operating time and passenger time which the new proposal will save.

The saving is the difference between the delays currently experienced and those, which would be experienced with the proposed new project or procedures. Once determined, the value of this saved time can be valued in dollars using standardized values (FAA, 1 8).

Airline Costs

Cost of Delay to airline
A recent study by the University of Westminster (2011)[1] evaluated the costs of delay by four flight phases: at gate, taxi, Enroute extension, and TMA.
These costs are dominated primarily by passenger costs, and then fuel burn differences. Only tactical costs (marginal costs) incurred on the day of operations are considered in this study – network effects and strategic effects have been omitted.

[16] European airline delay cost reference values. Final Report March 2011(Version 3.2)

Fuel

Fuel Cost

As of 2 Nov 2012 (IATA Platts)

- USD 124. barrel or
- USD 0. 82 kg

Rate of fuel burn

The cost of fuel burned per minute is calculated for the three off-gate phases. The at-gate calculations assume the engines and APU are off. As a proxy for fuel burn rates for individual aircraft types at varying weights and altitudes this analysis will use average fuel burn rates representing a 'standard' aircraft in the system as established by Eurocontrol FAA (2012), p 2.

Standard aircraft fuel burn

- Taxi 1 kg min
- Enroute 4 kg min
- TMA holding 41kg min

Direct Aircraft Operating Costs (DOC)

Flight and ground cost per block hour[1] that are linked to the operation of an aircraft, such as fuel, aircraft parking, air bridges and maintenance costs (refer Appendix B for more detail)

Cost of Distance Flown

Marginal Cost (Tactical) USD 11.8 Nm (for track extension calculation)

Passenger Value of Time

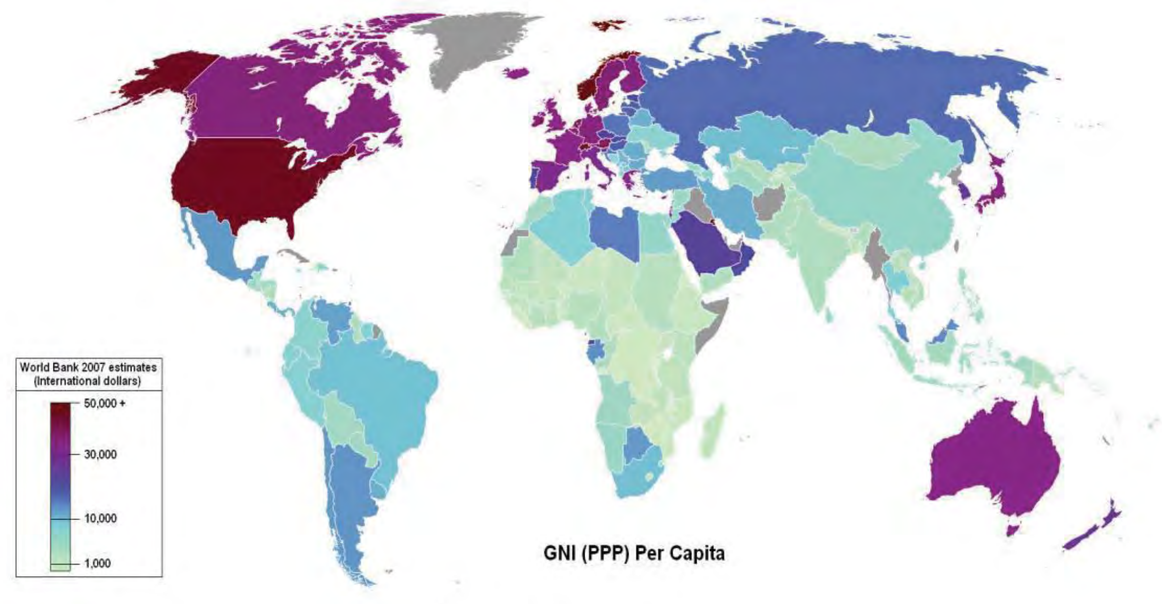
The passenger value of time is an opportunity cost, which corresponds to the monetary value associated with a traveler during a journey. This value of time is approximately equal to 0 per cent of the wage rate (Peterson, et al, 2013)

According to the Air Transport Association of America, the passenger value of time is USD 33[18] passenger hour. Eurocontrol value the opportunity cost of passengers similarly at €24.20 (USD$ 32/passenger/hour) baseline case, and €3.90 (USD $5.13) low scenario.

The diagram below provides an overview of Gross National Income (PPP) per capita. A valid argument could be raised for more similar average incomes for airline passengers across all regions, however due to a lack of research on air passenger incomes outside of the USA and EU, Eurocontrol's low scenario amount USD .13 passenger hour will be used for prudence (Note this figure is expected to produce a result on the extreme low side – a more appropriate figure is being sought).

[17] A block hour is the time an aircraft is utilised from the moment the aircraft door closes at departure of a revenue flight until the moment the aircraft door opens at the arrival gate following its landing.

[18] The time values are derived from the Air Travel Survey last conducted by the Air Transport Association of America in 1998 and adjusted to 2011 prices.



Average Aircraft Capacity

	1 8	1	200
Passenger oad Factor	8		
Aircraft Utilization (hours aircraft year)	2,1 3	2, 0	3, 02
Average aircraft Capacity	181	1 1	1

Source ICAO: 200

Load Factors

- Passenger - Average approx. (International and Domestic)
- Cargo - approx. 1 Available Freight Tonne kilometers (ATF)

Source: IATA, Asia Pacific 2011-2012

Therefore the average passenger cost per aircraft with an average of 1 passengers, a load factor of and USD .13 per hour (1 0. .13) USD per hour USD 10. 3 aircraft minute.

ANSP Costs

The implementation of ABSU Block upgrades will require investment decision to be made by ANSPs. Cost categorisations include,

- D Costs
- Implementation Costs (refer Appendix C for indicative list of CNS ATM costs)
- Operational Costs
- Overheads

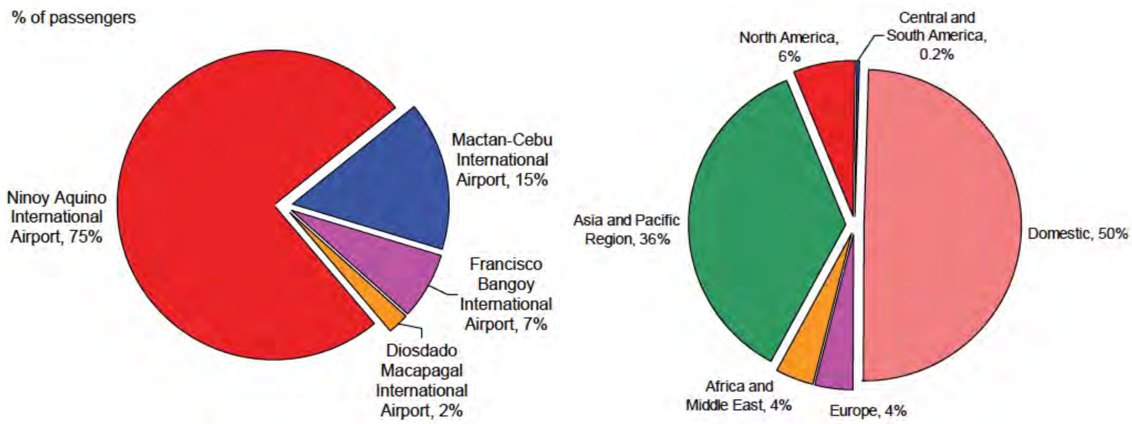
As these costs are context and environmental specific, an accurate CBA requires detailed data from each country.

STEP 5 - Compare the Alternatives

Philippines FIR Business Case

A comparison of the benefits achieved between the ‘business as usual’ case and the implementation of Block 0 ASBU across in the Philippines provides an illustration of the net benefits of the ICAO model.

Current Situation:
The four busiest airports in the Philippines – Ninoy Aquino International (NAIA)(Manila), Mactan-Cebu International, Francisco Bangoy (Davao) and Diosdado Macapagal (Clark) – handle nearly 28 million passengers per year. 0   of these passengers pass through NAIA (   ) and Mactan-Cebu (1   ) airports, with   0   of the total domestic passengers.



Source: IATA

Accordingly, the continued growth of aviation activity at these airports is vital to the Philippines economy. As indicated in Oxford Economics’ (2011) report, the aviation sector contributes PHP 35.5 billion (0.4%) to Philippine GDP, and with the addition of ‘catalytic’ benefits through tourism the overall contribution is raised to P P 1   .2 billion or 2.4   of GDP.
This analysis has been completed but has yet to be shared with relevant stakeholders to verify the assumptions and accuracy of the output.

STEP 6 - Evaluate the Outcome

Benefit of ASBU Block 0 to NAIA

Fuel savings achieved by implementing ASBU Block 0 into NAIA airport are:

	Taxi out Phase SBU	TMA Phase
Without implementing A	2 ,01 ,000 kg	,2 1,400 kg
With implementing ASBU	, 04,300 kg	1 , 8,420 kg
Fuel Savings	1 , 12, 00 kg	41,482, 80 kg

Total Fuel savings: 0 ,   , 80kg

Fuel Cost: USD   0. 82   kg

Total savings on Fuel: , 40,4 4

CO_2 emission: 3.14   kg per kg of fuel

Total CO_2 reduced: 1 2,0   Tonne

Opportunity cost of delay to passengers (based on low scenario)

- Taxi Out phase: 18 Aircraft per hour * (24-6) min * $10.93/aircraft /min = $3,541/hour *11 Hours = 38,954 per day = USD $14,218,210 per year
- TMA Arrival: 18 Aircraft per hour* (20-6) min* $10.93/aircraft/min = $2,754/hour *11 Hours = $30,298 per day = USD $11,058,755 per year

Annual Passenger Opportunity Costs: USD 2 ,2 ,   per annum.

Total Benefit of Implementing ASBU Block 0 to the users of NAIA is USD 8 ,21 ,41 per annum.

The cost of not implementing ASBU Block 0 to the users of NAIA is USD$ 85.2 million per year

Appendix A

Air Traffic Statistics

IFR Flights 2010 (Source ICAO GIS, 2012)				
Member State	FIR	Number of Flights	Total flight time in FIR (Hours)	Average Fight Time in FIR (Hours)
Afghanistan	Kabul	154684	67096	2.31
Australia	Brisbane	449152	495925	1.01
	Melbourne	594383	539255	
Bangladesh	Dhaka	160779	35157	4.57
Bhutan				
Brunei Darussalam				
Cambodia	Phnom Penh	154618	38940	3.97
China	Hong Kong,	558493	99448	1.96
	Sanya,	294,754	94628	
	Guangzhou,	1348761	592660	
	Kunming	691992	364751	
	Shanghai	1689318	1150795	
	Wuhan,	591438	280118	
	Lanzhou	368355	229129	
	Beijing	760757	356517	
	Shenyang	441305	227406	
	Urumqui	153821	127650	
Cook Islands				
Democratic People's Republic of Korea	Pyonngyang	178087	56101	3.17
Fiji	Nadi	62085	51569	1.20
India	Mumbai,	521208	503565	1.29
	Chennai,	449267	311038	
	Delhi	395665	240904	
Indonesia	Jakarta	502768	336942	1.54
	Ujung Panang	373258	300173	
	Kota Kinabalu	202562	63784	
Japan	Fukuoka	1084469	1027206	1.06
Kiribati				
Lao People's Democratic Republic	Vientiane	187894	37705	4.98
Malaysia	Kuala Lumpur	586760	183955	3.19
Maldives	Male	36240	21493	1.69
Marshall Islands				
Micronesia				
Mongolia	Ulan Bator	116635	95518	1.22
Myanmar	Yangon	220439	131179	1.68
Nauru	Nauru	1005	1214	0.83
Nepal	Kathmanu	170031	38050	4.47
New Zealand	New Zealand,	246958	19672	3.33
	Auckland Oceanic	266598	134446	
Pakistan	Karachi,	226444	132528	2.01
	Lahore,	150385	54942	
Palau				
Papua New Guinea	Port Morseby	48592	29021	1.67
Philippines	Manila	315681	258290	1.22
Republic of Korea (Sth)	Incheon	533119	213352	2.50
Samoa				
Singapore	Singapore	359938	174680	2.06
Solomon Islands	Honiara	7520	4928	1.53
Sri Lanka	Colombo	61234	44389	1.38
Thailand	Bangkok	459813	217153	2.12
Timor Leste				
Tonga				
Vanuatu				
Viet Nam	Ho Chi Minh,	332981	164826	2.39
	Hanoi	194592	55634	
(Taipei)	Taipei	303731	94583	3.21
TOTAL	45	17008569	9698315	1.75

Appendix B

Direct Aircraft Operating Costs (DOC)

Flight and ground cost per block hour[1] that are linked to the operation of an aircraft, such as fuel, aircraft parking, air bridges and maintenance costs.

Value:

Aircraft	Fuel con-sumption	Other costs	Cost of Fuel	Total operating costs
A300-600	7,071	1,853	5,671	7,524
A319	3,108	1,349	2,492	3,842
A320	3,354	1,407	2,690	4,096
A321	3,505	1,607	2,811	4,418
A330-200	6,670	2,039	5,349	7,388
A330-300	7,083	2,048	5,680	7,728
A340-300	8,230	2,059	6,600	8,659
A340-600	9,782	2,456	7,844	10,301
A380-800	n/a	n/a	n/a	n/a
ATR-42	757	931	607	1,538
ATR-72	810	1,252	650	1,902
B-727-200	4,028	1,734	3,230	4,964
B-737-200	3,013	1,323	2,416	3,740
B-737-200C	4,300	1,833	3,449	5,282
B-737-300/700	2,612	1,397	2,095	3,492
B-737-400	3,051	1,560	2,447	4,007
B-737-500	3,044	1,400	2,441	3,841
B-737-800	2,135	1,099	1,712	2,812
B747-100	15,176	4,581	12,170	16,751
B-747-200	15,229	5,190	12,213	17,403
B-747-400	14,169	3,832	11,363	15,195
B-757-200	3,407	1,902	2,732	4,634
B-767-200	4,607	2,189	3,695	5,883
B-767-300	4,910	2,304	3,937	6,242
B-777-200	7,301	2,590	5,855	8,446
BAE 146-300	3,240	1,838	2,599	4,437
CRJ-100	1,832	1,027	1,469	2,497
CRJ-200	2,018	701	1,618	2,320
DC-9-10	3,153	1,331	2,529	3,860
DC-9-30	3,422	1,410	2,744	4,155
DC-9-40	3,661	888	2,936	3,824
DC-9-50	2,930	1,117	2,350	3,467
DC-10-10	6,787	3,675	5,443	9,118
DC-10-30	9,467	3,902	7,592	11,494
DC-10-40	8,464	3,576	6,788	10,364
DHC 8-100	931	839	747	1,586
EMB-120	591	868	474	1,342

Aircraft	Fuel con-sumption	Other costs	Cost of Fuel	Total OPS costs
ERJ-135	1,287	607	1,032	1,639
ERJ-145	1,321	710	1,059	1,769
MD-11	8,237	2,862	6,606	9,467
MD-80	3,025	1,597	2,426	4,023
MD-87	2,805	1,204	2,250	3,454
MD-90	2,351	2,129	1,885	4,015
L-1011-500	0	2,846	0	2,846
A300-600	7,071	1,853	5,671	7,524

(Adjusted from 2000 US $ values with 2011 jet fuel prices)

Source:

ICAO Base-line Aircraft Operating Costs, Summer 2000
http://legacy.icao.int/icao/en/ro/allpirg/allpirg4/wp28app.pdf

[19] A block hour is the time an aircraft is utilised from the moment the aircraft door closes at departure of a revenue flight until the moment the aircraft door opens at the arrival gate following its landing.

Appendix C

CNS/ATM Base-line costs (USD)

Systems	Costs				
	Purchase	Upgrade/ retrofit Kit	Installation (same site)	Maintenance	Inspection/ commissioning
Communications aircraft					
AMSS Package (See notes)	$650,000				
HF data upgrade		$20,000			
FMS Retrofit (See Note)		$300,000			
FANS-1 retrofit (see note)		$134,000			
Communications ground					
VHF	$170,000	$51,000	$20,000	$17,000	
HF	$160,000	$48,000	$20,000	$16,000	
AMSS ground Station	$15,000,000		(included)	$1,500,000	
ATN Router	$120,000		(included)	$12,000	
ATN gateway	$100,000		(included)	$10,000	
Navigation aircraft					
GPS for FANS-1 PACKAGE (DUAL)	$58,000				
FMS retrofit (MD-11)	$300,000				
FMS retrofit (b-747-400)	$100,000				
MMR for GBAS (DIGITAL)	$30,000				
MMR for GBAS (ANALOG)	$40,000				
Navigation Ground					
VOR	$135,000	$45,000	$50,000	$9,700	$5000/$50000
DME	$125,000	$38,000	$50,000	$8,000	$5000/$50000
VOR/DME	$17,429	$80,000	$90,000	$12,200	$125000/$50000
DVOR/DME	$525,000	$160,000	$100,000		
NDB (100 WATTS)	$30,000	$10,000	$15,000	$3,000	$5,000
TACAN	$525,000	$240,000			
GNSS Master Station	$8,000,000				
GNSS Uplink	22,000,000/year				
GNSS reference Station	$1,000,000				
GBAS	$850,000				
Landing Aids					
ILS Cat I	$500,000	$290,000	$200,000	$17,100	$50,000
ILS Cat II	$1,100,000	$540,000	$225,000	$17,100	$50,000
ILS Cat III	$1,250,000	$540,000	$225,000	$17,100	$50,000
Control Center					
Work Station (CPDLC)	$350,000		(included)		$35,000.00
FANS-1 Work Station (see Note)	$540,000		(included)		$54,000.00
ATM FDPS	$950,000		(included)		$95,000.00
CNS/ATM Syst. (2 seats)	$2,000,000		(included)		$200,000.00
Additional seats	$650,000		(included)		$65,000.00

Note: 2000 figures require updating to 2012 (Source: A PI G 4-WP 28)

Appendix D
ICAO Aviation System Block 0 & 1 Upgrades by Performance Improvement Area (PIA)

PIA 1. Greener Airports

Block 0	Block 1
B0-65 **Improved Airport Accessibility** This is the first step toward universal implementation of GNSS-based approaches	B1-65 **Optimized Airport Accessibility** This is the next step in the universal implementation of GNSS-based approaches
B0-70 **Increased Runway Throughput through Wake Turbulence Separation** Improved throughput on departure and arrival runways through the revision of current ICAO wake turbulence separation minima and procedures .	B1-70 **Increased Runway Throughput through Dynamic Wake Turbulence Separation** Improved throughput on departure and arrival runways through the dynamic management of wake turbulence separation minima based on the real-time identification of wake turbulence hazards
B0-15 **Improved RunwayTraffic Flow through Sequencing (AMAN/DMAN)** Time-based metering to sequence departing and arriving flights	B1-15 **Improved Airport operations through Departure, Surface and Arrival Management** Extended arrival metering, Integration of surface management with departure sequencing bring robustness to runways management and increase airport performances and flight efficiency
B0-75 **Improved Runway Safety (A-SMGCS Level 1-2)** Airport surface surveillance for ANSP	B1-75 **Enhanced Safety and Efficiency of Surface Operations (A-SMGCS/SURF IA) and EVS** Airport surface surveillance for ANSP and flight crews with safety logic, cockpit moving map displays and visual systems for taxi operations
B0-80 **Improved Airport Operations through Airport-CDM** Airport operational improvements through the way operational partners at airports work together	B1-80 **Optimized Airport Operations through Airport-CDM** Airport operational improvements through the way operational partners at airports work together
	B1-81 **Remote Operated Aerodrome Control Tower** Remotely operated Aerodrome Control Tower contingency and remote provision of ATS to aerodromes through visualisation systems and tools

PIA 2. Globally Interoperable Systems and Data – Through Globally Interoperable, SWIM

Block 0	Block 1
B0-25 **Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration** Supports the coordination of ground-ground data communication between ATSU based on ATS Inter-facility Data Communication (AIDC) defined by ICAO Document 9694	B1-25 **Increased Interoperability, Efficiency and Capacity though FF-ICE/1 application before Departure** Introduction of FF-ICE step 1, to implement ground-ground exchanges using common flight information reference model, FIXM, XML and the flight object used before departure
B0-30 **Service Improvement through Digital Aeronautical Information Management** Initial introduction of digital processing and management of information, by the implementation of AIS/AIM making use of AIXM, moving to electronic AIP and better quality and availability of data	B1-30 **Service Improvement through Integration of all Digital ATM Information** Implementation of the ATM information reference model integrating all ATM information using UML and enabling XML data representations and data exchange based on internet protocols with WXXM for meteorological information
	B1-31 **Performance Improvement through the application of System Wide Information Management (SWIM)** Implementation of SWIM services (applications and infrastructure) creating the aviation intranet based on standard data models, and internet-based protocols to maximize interoperability
B0-105 **Meteorological Forecasts, Warnings and Alerts**. Global, regional and local meteorological information: • Aerodrome warnings to give concise information of meteorological conditions that could adversely affect all aircraft at an aerodrome including windshear. • Forecasts provided by world area forecast centres (WAFC), volcanic ash advisory centres (VAAC) and tropical cyclone advisory centres (TCAC) This information will support flexible airspace management, improved situational awareness and collaborative decision making, and dynamically-optimized flight trajectory planning.	B1-105 **Better Operational Decisions through Integrated Weather Information (Strategic >40 Minutes)** Weather information supporting automated decision process or aids involving: weather information, weather translation, ATM impact conversion and ATM decision support

PIA 3. Optimum Capacity and Flexible Flights – Through Global Collaborative ATM

Block 0	Block 1
B0-10 **Improved Operations through Enhanced En-Route Trajectories** To allow the use of airspace which would otherwise be segregated (i.e. military airspace) along with flexible routing adjusted for specific traffic patterns. This will allow greater routing possibilities, reducing potential congestion on trunk routes and busy crossing points, resulting in reduced flight length and fuel burn.	B1-10 **Operations through Free Routing** Introduction of free routing in defined airspace, where the flight plan is not defined as segments of a published route network or track system to facilitate adherence to the user-preferred profile
B0-35 **Improved Flow Performance through Planning based on a Network-Wide view** Collaborative ATFM measure to regulate peak flows involving departure slots, managed rate of entry into a given piece of airspace for traffic along a certain axis, requested time at a way-point or an FIR/sector boundary along the flight, use of miles-in-trail to smooth flows along a certain traffic axis and re-routing of traffic to avoid saturated areas	B1-35 **Enhanced Flow Performance through Network Operational Planning** ATFM techniques that integrate the management of airspace, traffic flows including initial user driven prioritisation processes for collaboratively defining ATFM solutions based on commercial/operational priorities

B0-84 Initial Capability for Ground-Based Cooperative Surveillance Ground surveillance supported by ADS-B OUT and/or wide area multilateration systems will improve safety, especially search and rescue and capacity through separation reductions. This capability will be expressed in various ATM services, e.g. traffic information, search and rescue and separation provision.	
B0-85 **Air Traffic Situational Awareness (ATSA)** Two *ATSA (Air Traffic Situational Awareness)* applications which will enhance safety and efficiency by providing pilots with the means to achieve quicker visual acquisition of targets: • AIRB (Enhanced Traffic Situational Awareness during Flight Operations). • VSA (Enhanced Visual Separation on Approach).	B1-85 **Increased Capacity and Flexibility through Interval Management** Interval Management (IM) improves the management of traffic flows and aircraft spacing. Precise management of intervals between aircraft with common or merging trajectories maximizes airspace throughput while reducing ATC workload along with more efficient aircraft fuel burn..
B0-86 **Improved access to Optimum Flight Levels through Climb/Descent Procedures using ADS-B** This prevents an aircraft being trapped at an unsatisfactory altitude and thus incurring non-optimal fuel burn for prolonged periods. The main benefit of ITP is significant fuel savings and the uplift of greater payloads	
B0-101 **ACAS Improvements** To provide short term improvements to existing airborne collision avoidance systems (ACAS) to reduce nuisance alerts while maintaining existing levels of safety. This will reduce trajectory perturbation and increase safety in cases where there is a breakdown of separation.	
B0-102: **Increased Effectiveness of Ground-based Safety Nets** This module provides improvements to the effectiveness of the ground-based safety nets assisting the Air Traffic Controller and generating, in a timely manner, alerts of an increased risk to flight safety (such as short terms conflict alert, area proximity warning and minimum safe altitude warning).	B1-102: **Ground-based Safety Nets on Approach** This module enhances the safety provide by the previous module by reducing the risk of controlled flight into terrain accidents on final approach through the use of Approach Path Monitor (APM).

PIA 4. Efficient Flight Path – Through Trajectory-based Operations

Block 0	Block 1
B0-05 **Improved Flexibility and Efficiency in Descent Profiles (CDOs)** Deployment of performance-based airspace and arrival procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with continuous descent operations (CDOs)	B1-05 **Improved Flexibility and Efficiency in Descent Profiles (OPDs)** Deployment of performance-based airspace and arrival procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with Optimized Profile Descents (OPDs)
B0-40 **Improved Safety and Efficiency through the initial application of Data Link En-Route** Implementation of an initial set of data link applications for surveillance and communications in ATC	B1-40 **Improved Traffic Synchronization and Initial Trajectory-Based Operation.** Improve the synchronization of traffic flows at en-route merging points and to optimize the approach sequence through the use of 4DTRAD capability and airport applications, e.g.; D-TAXI, via the air ground exchange of aircraft derived data related to a single controlled time of arrival (CTA).
B0-20 **Improved Flexibility and Efficiency in Departure Profiles** Deployment of departure procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with continuous climb operations (CCOs)	
	B1-90 **Initial Integration of Remotely Piloted Aircraft (RPA) Systems into non-segregated airspace** Implementation of basic procedures for operating RPAs in non-segregated airspace including detect and avoid

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Agenda Item 4: Regional Air Navigation Deficiencies

Status of Air Navigation Deficiencies in the Asia/PAC Region

4.1 Under the Terms of Reference, the APANPIRG has been regularly reviewing the status of implementation of the Asia Pacific Air Navigation Plan through its subgroups to identify and address the air navigation deficiencies according to the uniform methodology approved by the ICAO Council. In meeting this objective, APANPIRG facilitates the development and implementation of action plans by States to resolve identified deficiencies, where necessary.

4.2 The online deficiency database is available through the ICAO APAC website www.bangkok.icao.int via secure access provided by the Regional Office to States and International Organizations.

Deficiencies in the ATM/AIS/SAR fields

4.3 APANPIRG/24 reviewed and discussed the ATM/AIS/SAR Deficiency List which was reviewed and updated by ATM/SG/1. Bangladesh stated that the deficiency related to their provision of safety data should be removed as this action had been completed. The Lao PDR would coordinate with the Regional Office to update their information related to safety data.

4.4 The updated List of Air Navigation Deficiencies in the ATM/AIS/SAR fields is in **Appendix A** to the Report on Agenda Item 4.

Deficiencies in the AOP field

4.5 The meeting noted the List of Air Navigation Deficiencies in the AOP field which was reviewed and updated by AOPWG/1.

4.6 The meeting noted that the air navigation deficiencies listed in Appendix B1 were forwarded to the concerned States by the Regional Office for providing the corrective action plan. APANPIRG agreed to combine the two lists of deficiencies B and B1 into one list B and adopted the Conclusion

Decision 24/58 – Addition of the APANPIRG Air Navigation Deficiencies for Noncompliance with Annex 14 SARPs

That, the AOP Air Navigation Deficiencies reported and identified in **Appendix B1** to Report on Agenda Item 4 be added to the APANPIRG Air Navigation Deficiencies listed in **Appendix B.**

4.7 The updated List of Air Navigation Deficiencies in the AOP field is in **Appendix B** to the Report on Agenda Item 4.

Deficiencies in the CNS field

4.8 The meeting noted the list of Air Navigation Deficiencies in CNS field which was reviewed and updated by CNS/ SG/17.

The current situation of air-ground communications in Yangon FIR

4.9 Based on the reports from operators, about 70% flights had normal air ground communication over Yangon FIR.

4.10 The meeting was informed that the DCA Myanmar had been making efforts in close coordination with IATA and ICAO Regional Office.

4.11 For ADS-C/CPDLC, it was recently reported that the interface between ATM system and SITA was updated from X.25 communication protocol to IP protocol on 14 March 2013. IP connectivity was reported stable. However, the FANS system still exhibits some instability. In March 2013, the FANS uplink success rate had been high at 99.84% including both VHF data link and SATCOM. Airlines logged in were SIA, CPA, UAE, QTR, MAS, THY, DLH, THA, FIN etc.

4.12 IATA informed the meeting, the CPDLC connectivity and availability within Yangon FIR had improved. IATA would conduct another survey by the end of 2013.

Navigation Aids Performance deficiencies in the Philippines

4.13 The disruption of Air Traffic Services in Manila FIR was initially reported on 13 September 2009 for about two hours.

4.14 The meeting was informed that the new CNS/ATM project had been further delayed till 2015. The Philippines informed the meeting that the target date for the completion of remedial action plan for the identified deficiency had been postponed to 2014.

Poor ground/ground communication between Afghanistan and Pakistan

4.15 Issues related to the unreliability of AFS communication between Afghanistan and Pakistan was brought to the notice of APANPIRG/21. Karachi – Kabul AFTN circuit was out of service from 31 August 2011 resulting from unserviceable VSAT system.

4.16 A COM coordination meeting between Afghanistan and Pakistan was held in Karachi, in June 2012. The meeting developed following remedial action plan with three action items. The status was updated by Pakistan at information meeting held in end of May 2013.

- Action Item 1: Near-term by end of September 2012, fully utilize the VPN circuit operational since January 2012 for exchange of AFTN traffic and organize training for users if required;

  - Status: The VPN circuit via U.K. has been operational in normal status. Messages exchanged over the circuit between Karachi and Kabul are as follows:

    March 2013: Received messages from Kabul were 3307 and sent to Kabul: 62152 while April 2013: Received 4062; sent: 57344

4.17 There was still a serious concern reported regarding the absence of flight information received at Lahore/Karachi side for aircraft entering Pakistan airspace from Kabul Low Sector.

- Action Item 2: Mid-term by end of March 2013, harmonize VSAT terminal equipment and select a common network service provider to recover the VSAT Links; and

  - Status: the VSAT at Pakistan side was upgraded with spare parts imported from the supplier in Germany. The VSAT terminals on both sides were aligned with ASIA SAT 5 through the common service provider. However, the compatibility between difference versions of terminal (i.e. 5000 and 7000) needs to be resolved with equipment provider.

- Action Item 3: Long-term by end of June 2014, establish 2 MB dedicated landline connection with multiplexers between Afghanistan and Pakistan to support both data and voice communication between COM centres and ACCs.

  - Status: Pakistan confirmed again that landline cable is available up to the border (Torkhum) on Pakistan's side. No further progress was made, as difficulties were being experienced with coordinating with Afghanistan.

AMHS Backbone implementation in the APAC Region (Fukuoka Centre)

4.18 In 2008, APANPIRG formulated Conclusion 19/20 regarding the adoption of ATN over IPS in addition to OSI. APANPIRG also set up target date of implementation by Administrations hosting backbone hubs by end of 2011. In March 2012, all Administrations hosting BBIS hubs had completed the implementation of dual stack in compliance with the required specification except Japan. Japan was requested by Regional Office on 2 April 2012 to take urgent action to upgrade their ATN/AMHS system in accordance with the requirement adopted by APANPIRG.

4.19 On 16 May 2012 Japan informed that their plan for improving their system was going to be completed by the end of FY2015. In March 2013 at ATNICG/8 meeting, Japan reiterated their earlier stance that their plan to implement their upgraded AMHS system is by November 2015. Testing with other Administrations will commence from 2016 subject to successful testing with USA.

4.20 Japan was urged to develop a possible way to expedite the implementation of their ATN/AMHS system.

Ground to ground data communication between Myanmar and China

4.21 The AFTN circuit between Beijing and Yangon had been out of service since 14 July 2008 due to a faulty board on the VSAT system. During this outage, the AFTN traffic between China and Myanmar was exchanged through an alternate routing via Bangkok. No other alternate routing is available for Myanmar in case the Yangon/Bangkok circuit becomes out of order. There was no immediate plan in place to get the faulty board repaired.

4.22 The circuit is specified in the regional Air Navigation Plan - FASID Table CNS 1A. In addition to the normal AFTN traffic between Myanmar and Z AFS Routing Area, the circuit also plays a critical role as the alternate routing for Bangkok-Yangon circuit.

4.23 The prolonged outage status has to be resolved as soon as possible in order to avoid a situation of single point of failure. A COM coordination meeting in March 2013 developed two action items to rectify the deficiency with target date no later than June 2014.

ATS direct speech circuit between Pakistan and China

4.24 Air Traffic Transfer mistakes reported between Lahore and Urumqi Area Control Centers (ACCs) in 2010 was brought to the notice of Pakistan and China. A special coordination meeting between China and Pakistan was held in Karachi in 2011 with LOA renewed. The ATS direct communication via IDD was observed not stable. In a recent RASMAG meeting, this was identified as one of the issues causing concern that would require further improvements and necessary remedial action.

4.25 In order to resolve the problem, it was considered necessary to establish a direct ATS speech circuit between Lahore and Urumqi as primary means and to keep ISD as secondary means. China had proposed to use new VSAT technology to provide economical and efficient solution to the problem. The meeting therefore recommended Pakistan in coordination with China to take necessary action to establish a dedicated ATS direct speech circuit between Lahore and Urumqi. ICAO APAC Office was also requested to facilitate the coordination for early implementation.

4.26 The updated List of Air Navigation Deficiencies in the CNS field is given in **Appendix C** to the Report on Agenda Item 4.

Deficiencies in the MET field

4.27 The meeting noted the list of Air Navigation Deficiencies in MET field which was reviewed and updated by MET/SG/17.

4.28 MET SG/17 reviewed 20 deficiencies listed in the MET field (against 11 APAC States) in the APANPIRG list of air navigation deficiencies, related to the provision of SIGMET information, WAFS forecasts for flight briefings, aerodrome meteorological observations and volcanic ash/activity information.

4.29 The updated List of Air Navigation Deficiencies in the MET field is given in **Appendix D** to this paper.

Discussion

4.30 Bangladesh, India, and Vietnam reported the action taken by their Administration in relation to some of the deficiencies. The meeting urged States with deficiencies to put in additional resources to resolve the deficiencies and inform the Regional Office the action taken. The Regional Office will update the deficiencies based on written confirmation provided by their respective Administrations.

APANPIRG adopted the following Decision:

Decision 24/59 – ATM/AIS/SAR, AOP, CNS and MET Deficiency List

That, the list of air navigation deficiencies reported and identified in ATM/AIS/SAR, AOP, CNS and MET Deficiency List be updated as detailed in **Appendix A to D** to the Report on Agenda Item 4.

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ATM/AIS/SAR Deficiencies List (Updated 24 May 2013)

Identification		Deficiencies			Corrective Action			
Requirements	**States/ facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action****
WGS-84								
Requirements of Paragraph 3.7.1 of Annex 15	Bhutan	WGS-84 - Not implemented	2/7/1999	Data conversion completed, but not published		Bhutan	TBD	A
	Kiribati	WGS-84 - Not implemented				Kiribati	TBD	A
	Nauru	WGS-84 - Not implemented		Conferring with consultant		Nauru	TBD	A
	Vanuatu	WGS-84 - Implemented at main airports	2/7/1999			Vanuatu	1999	A
Airspace Classification								
Requirements of Paragraph 2.6 of Annex 11	China	Airspace Classification - Not implemented	7/7/99		Difference to Annex 11 is published in AIP, China.	China	APANPIRG/19 updated, implementation planned by end 2010.	A
	Kiribati	Airspace Classification - Not implemented	7/7/99			Kiribati	TBD	A

	Nauru	Airspace Classification - Not implemented	7/7/99			Nauru	TBD	A
	Papua New Guinea	Airspace Classification - Not implemented	7/7/99			Papua New Guinea	Project in place	A
	Solomon Islands	Airspace Classification - Not implemented	7/7/99			Solomon Islands	TBD	A
	~~Viet Nam~~	~~Airspace Classification - Not implemented~~	~~7/7/99~~	~~-~~	~~-~~	~~Viet Nam~~	~~ATM/AIS/SAR/SG/22 Target date for completion: November 2012.~~	~~A~~
<u>AIP Format</u>								
Requirements of Chapter 4 of Annex 15	Cook Islands	AIP Format - Not implemented	7/7/99			Cook Islands	ATM/AIS/SAR/G/16 (June 2006) updated - AIP COOK ISLANDS in new format in progress with assistance of New Zealand	A
	Kiribati	AIP Format - Not implemented	7/7/99			Kiribati	ATM/AIS/SAR/SG/18 (June 2009) was advised AIP in draft stage	A
	Nauru	AIP Format - Not implemented	7/7/99			Nauru	ATM/AIS/SAR/SG/18 (June 2008) was advised work soon to start	A
	Papua New Guinea	AIP Format - Not implemented	7/7/99			Papua New Guinea	TBA	A

SAR capability								
Requirements of Annex 12	Cook Islands	Annex 12 requirements not implemented. No agreements with adjacent States.	31/1/95		Cook Islands - implement Annex 12 requirements and co-ordinate LOA with adjacent States ICAO - assist to develop SAR capability and to co-ordinate with adjacent States	Cook Islands	2009. SAR agreement with New Zealand completed 2007.	U
	Maldives	Annex 12 requirements not implemented. No agreements with adjacent States.	24/4/97	SAR services and facilites provided (details to be confirmed). SAR agreements with neighbouring States under development	Maldives - implement Annex 12 requirements and co-ordinate LOA with adjacent States ICAO - assist to develop SAR capability and to co-ordinate with adjacent States	Maldives	2009	U
Carriage of ACAS II								
Requirement of Chapter 6 of Annex 6	Bhutan	Annex 6 requirement not implemented.	26/8/05		Bhutan - implement Annex 6 as required.	Bhutan	TBD	U
	Cook Islands	Annex 6 requirement not implemented.	26/8/05		Cook Island - implement Annex 6 as required.	Cook Islands	TBD	U

	Kiribati	Annex 6 requirement not implemented.	26/8/05		Kiribati - implement Annex 6 as required.	Kiribati	TBD	U
	Marshall Islands	Annex 6 requirement not implemented.	26/8/05		Marshall Islands - implement Annex 6 as required.	Marshall Islands	TBD	U
	Micronesia	Annex 6 requirement not implemented.	26/8/05		Micronesia - implement Annex 6 as required.	Micronesia	TBD	U
	Nauru	Annex 6 requirement not implemented.	26/8/05		Nauru - implement Annex 6 as required.	Nauru	TBD	U
	Palau	Annex 6 requirement not implemented.	26/8/05		Palau - implement Annex 6 as required.	Palau	TBD	U
	Papua New Guinea	Annex 6 requirement not implemented.	26/8/05		Papua New Guinea - implement Annex 6 as required.	Papua New Guinea	TBD	U
	Solomon Islands	Annex 6 requirement not implemented.	26/8/05		Solomon Islands - implement Annex 6 as required.	Solomon Islands	TBD	U
	Vanuatu	Annex 6 requirement not implemented.	26/8/05	Pressure altitude reporting transponder required in all airspace since 1/1/00.	Vanuatu - implement Annex 6 as required.	Vanuatu	TBD	U

<u>Carriage of Pressure Altitude Reporting Transponder</u>								
Requirement of Chapter 6 of Annex 6	Bhutan	Annex 6 requirement not implemented.	26/8/05		Bhutan - implement Annex 6 as required.	Bhutan	TBD	U
	Cook Islands	Annex 6 requirement not implemented.	26/8/05		Cook Island - implement Annex 6 as required.	Cook Islands	TBD	U
	Kiribati	Annex 6 requirement not implemented.	26/8/05		Kiribati - implement Annex 6 as required.	Kiribati	TBD	U
	Marshall Islands	Annex 6 requirement not implemented.	26/8/05	ACAS II required.	Marshall Islands - implement Annex 6 as required.	Marshall Islands	TBD	U
	Micronesia	Annex 6 requirement not implemented.	26/8/05		Micronesia - implement Annex 6 as required.	Micronesia	TBD	U
	Nauru	Annex 6 requirement not implemented.	26/8/05		Nauru - implement Annex 6 as required.	Nauru	TBD	U
	Palau	Annex 6 requirement not implemented.	26/8/05		Palau - implement Annex 6 as required.	Palau	TBD	U
	Papua New Guinea	Annex 6 requirement not implemented.	26/8/05		Papua New Guinea - implement Annex 6 as required.	Papua New Guinea	TBD	U

	Solomon Islands	Annex 6 requirement not implemented.	26/8/05		Solomon Islands - implement Annex 6 as required.	Solomon Islands	TBD	U
<u>Non Provision of Safety-related Data</u>								
Requirement of Paragraph 3.3.4.1 of Annex 11	Bangladesh	Annex 11 requirement not implemented.	11/9/09		Bangladesh - provide the safety-related data as required. Bangladesh advised ATM/AIS/SAR/SG/20 that the data were submitted to MAAR in 2008 and 2009. Thailand to confirm.	Bangladesh		U
	Lao PDR	Annex 11 requirement not implemented.	11 0		ao PD - provide the safety-related data as required.	ao PD		U
	Papua New Guinea	Annex 11 requirement not implemented.	21/8/06		Papua New Guinea - provide the safety-related data as required.	Papua New Guinea	TBD	U

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirements	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
	Nepal							
Annex 14, Volume I	Katmandu International Airport	Runway/ taxiways	ICAO Mission of February 2008	Provision of RESA in accordance with section 3.5 of ICAO Annex 14, Volume I.	RESA will be provided	Tribhuvan International airport/ CAAN	2015	U
				Insufficient runway strip, refer recommendations given in section 3.4 of Annex 14, Volume I.	Provide runway strip as per ICAO recommendations		Not possible	A

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirements	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
Annex 14, Volume I	**Maldives** **Male International Airport**	**Runway/ Taxiways**	AGA Mission Report April 2008	Insufficient runway strip.	Runway strip will be provided	MACL/CW Unit	Runway strip will be provided as per ICAO requirements by 2014. Exemption granted by State and published in AIP	U
				Provision of RESA in accordance with section 3.5 of ICAO Annex 14, Volume I.	RESA will be provided		RESA will be provided as per ICAO requirements before end 2014. Exemption granted by State and published in AIP.	U
	Gan International airport	**Runway**	**AGA mission Report**	Provision of RESA in accordance with section 3.5 of ICAO Annex 14, Volume I.	RESA will be provided		CAP have been submitted. RESA will be provided as per ICAO requirement by 2013	A

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirements	States/facilities	Description	Date first reported	Remarks	Description	Executing body	Target date of completion	Priority for action**
	India							
Annex 14 Volume I	**Chennai International Airprot**	**Runway**	**AGA mission January 2009**	RESA not provided in accordance with Para 3.5 of Annex 14, Volume I requirements;	RESA will be provided	AAI	December 2012 RESA provided, however desired strength is yet to be provided.	U
				Runway strip is insufficient-300m strip width is not available for the full length of runway 07/25 in accordance with 3.4.3 of Annex 14, Volume I	300m strip width for full length of runway 07/25 will be made available.	AAI	December 2013 Action initiated	A
Annex 14, Volume I	**Mumbai International Airport**	**Runway**	**AGA mission January 2009**	RESA not provided for R/W 09 and R/W 14 in accordance with Para 3.5 of ICAO Annex 14, volume I;	RESA will be provided	MIAL	R/w-09 RESA provided R/w-14- June 2013	U
				Runway strip is insufficient-300m strip width is not available for the full length of runway 09/27 in accordance with 3.4.3 of Annex 14, Volume I	300m strip width for full length of runway 09/27 will be made available	MIAL	R/w 09/27- August 2013 R/w 14/32- June 2013	A

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirements	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
Annex 14 Volume I	**Cambodia** **Phnom Penh International Airport**	**Runway**	**AGA mission of March 2009**	RESA not provided in accordance with Para 3.5 of Annex 14, Volume I.	RESA will be provided	SSCA Cambodia	RESA provided. RESA improvement plan under consideration to satisfy Para's 3.5.7 to 3.5.11 of Annex 14	U
				non frangible signage on runway strip. (5.4.1.3 & 9.9 of Annex 14, volume I)	frangible signs will be provided		Replacement with frangible equipment in progress	A
	Siem Reap International Airport	**Runway**	**AGA mission of March 2009**	RESA not provided as per Para 3.5 of Annex 14, Volume I. ;	RESA will be provided		RESA provided. RESA improvement plan under consideration to satisfy Para's 3.587 to 3.5.10 of Annex 14	U

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirements	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
	Bangladesh							
Annex 14 Volume I	**Zia International Airport, Dhaka**	**Runway/ Taxiway**	**ICAO mission April 2009**	Runway strip width insufficient(300m strip not available for the full length of runway);	runway strip in accordance with Annex 14, volume I will be provided	CAABD	December 2011	A
				RESA not provided in accordance with Section 3.5 of Annex 14, Volume I requirements;	RESA will be provided		December 2011	U
				runway edge lights and taxiway edge lights does not meet frangibility requirements in accordance with 9.9 of Annex 14, Volume I. ;	airfield lighting system satisfying frangibility requirements will be provided		August 2010	A
Annex 14, Volume I	**Shah Amanat International Airport, Chittagong**	**Runway**	**ICAO mission April 2009**	RESA not provided in accordance with Section 3.5 of Annex 14, Volume I requirements;	RESA will be provided		June 2010	U
				Runway strip width insufficient(300m strip not available for the full length of runway;	300m runway strip for full length of runway will be provided		Dec 2010	A

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirements	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
	Thailand							
Annex 14 Volume I	**Chiang Mai**	**Runway**	**AGA mission of July 2009**	300m strip width not available for the full length of precision approach CAT I runway in accordance with the standard 3.4.3, Annex 14, Volume I;	300m strip for full length of runway will be made available	DCA/AOT	Oct 2011	A
				RESA to satisfy Section 3.5 of Annex 14, Volume I requirements; and	RESA will be provided		Oct 2011 RESA of r/w 36 is available. RESA for r/w 18 is in progress	U
Annex 14, Volume I	**Phuket International Airport**	**Runway**	**AGA mission of July 2009**	R ESA to satisfy Section 3.5 of Annex 14, Volume I requirements;	RESA will be provided		Dec 2011-On Going	U
				Runway strip width insufficient(300m runway strip for precision approach runways in accordance with Para 3.4.5 of Annex 14, Volume I;	300m runway strip width for full length of runway will be made available		AOT has submitted risk assessment report to DCA. Additional info requested from operator	A

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirements	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
	Myanmar							
Annex 14 Volume I	Yangon International Airport	**Runway/ Taxiway**	**ICAO mission April 2010**	Runway shoulder higher than adjacent strip	Flush strip with adjacent runway shoulder	Department of Civil Aviation	October 2011	A
				Provision of enhanced taxiway centre line marking in accordance with standard in Para 5.2.8.11 of Annex 14, Volume I.	enhanced taxiway markings will be provided		DCA has planned to implement SMGCS. The system will start in 2012	A
				Provision of RESA in accordance with Section 3.5 of Annex 14, Volume I requirements;	RESA will be provided		March 2011	A
				Provisions of shoulders for taxiways	taxiway shoulders will be provided		Beginning of 2012	B
				Provision of road holding position signs at entrances to active runways	road holding position signs will be provided		October 2011	A
		Bird Hazard		Establishment of a national bird committee in accordance with APANPIRG Conclusion 18/1.	Establish National Bird Committee		DCA will establish National Bird committee.	B

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		**Deficiencies**			**Corrective Action**			
Requirements	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
Annex 14, volume I	**Mandalay Airport**	**Runway/ Taxiway**	**April 2010**	Provision of RESA in accordance with Section 3.5 of Annex 14, Volume I requirements;	RESA will be provided	Department of Civil Aviation	Oct 2011	A
				Provision of enhanced taxiway centre line marking in accordance with standard in Para 5.2.8.11 of Annex 14, Volume I.	enhanced taxiway markings will be provided		DCA is reviewing the requirement for taxiway enhanced centerline marking	A
				Provision of road holding position signs at entrances to active runways	Road holding position signs will be provided		Oct 2011	A
Annex 14 Vol. I Amendment 6 *§ 10.1 § 10.2*				A maintenance programme should be established to maintain facilities in a condition which does not impair safety of air navigation	DCA will establish and implement procedures to aerodrome operators meet national requirements for maintenance program	DCA Myanmar	End of 2011	A

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
Annex 14 Volume I	**Fiji Islands** Nadi international Airport	**Runway/ Taxiway**	**ICAO mission June 2010**	Flush the strip with the adjacent runway shoulder	Flushed strip with adjacent runway shoulder	Civil Aviation Authority of Fiji	4th Quarter 2013	A
				Provision of RESA in accordance with Section 3.5 of Annex 14, Volume I requirements;	RESA will be provided		3rd quarter 2012	A
				Provision of Airfield signage in accordance with ICAO Annex 14, volume I, section 5.4	signage as per ICAO standards will be provided		4th Quarter 2013	A
		Bird Hazard		Establishment of a national bird committee in accordance with APANPIRG Conclusion 18/1.	Established National Bird Committee		May 2012	B
	Nausori International Airport	**Runway/ Taxiway**		Provision of 300m strip width for the full length of precision approach CAT I runway in accordance with the standard 3.4.3, Annex 14, Volume I; remove obstacles from runway strip; flush the strip with the adjacent runway shoulder	runway strip will be provided and strip flushed with adjacent runway shoulder		4th Quarter 2013	A

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		**Deficiencies**			**Corrective Action**			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
Annex 14, volume I	Nausori International Airport	**Runway/ Taxiway**	**June 2010**	Provision of RESA in accordance with Section 3.5 of Annex 14, Volume I requirements;	RESA will be provided	Civil Aviation Authority of Fiji	4^{th} Quarter 2013	A

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirements	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
Annex 14 Volume I	**Sri Lanka** Bandaranaike International Airport	**Runway/ Taxiway**	**ICAO mission April 2010**	Provision of 300m strip width for the full length of precision approach CAT I runway in accordance with the standard 3.4.3, Annex 14, Volume I; remove obstacles from runway strip; flush the strip with the adjacent runway shoulder	runway strip in accordance with Annex 14, volume I will be provided, obstacles from strip will be removed and and flush strip with adjacent runway shoulder	CAASL	AASL has been granted a period of 12 years to cover the drains. Exemption for the period granted has been published in the AIP.	A
				Provision of runway hold position lights in accordance with Para 5.3.19 of ICAO Annex 14, Volume I	runway hold position lights will be provided		Airside safety committee has been formed to study all runway makings, signs and lighting to determine the adequacy of the system in order to prevent runway incursion	A
				Provision of enhanced taxiway centre line marking in accordance with standard in Para 5.2.8.11 of Annex 14, Volume I.	Enhanced taxiway markings will be provided		February 2011	A
				Establishment of a national bird committee in accordance with APANPIRG Conclusion 18/1.	National Bird Committee will be established		July 2010	A

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
	Vietnam							
Annex 14 Volume I	Noi Bai international Airport, Hanoi	**Runway/ Taxiway**	**ICAO mission March 2010**	Runway shoulder higher than adjacent strip and obstacles on strip	Flush strip with adjacent runway shoulder and remove obstacles	Civil Aviation Administration of Vietnam		A
				Provision of enhanced taxiway centre line marking in accordance with standard in Para 5.2.8.11 of Annex 14, Volume I.	Provide enhanced taxiway markings			A
				Provision of RESA in accordance with Section 3.5 of Annex 14, Volume I requirements;	Provide RESA			A
		Bird Hazard		Wildlife strike report submission to ICAO for inclusion in IBIS	Submission of wildlife strike reports to ICAO for inclusion in IBIS			B

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
Annex 14, volume I	Tan Son Nhat International Airport, Ho Chi Minh City	**Runway/ Taxiway**	**March 2010**	Runway shoulder higher than adjacent strip and obstacles on strip	Flush strip with adjacent runway shoulder and remove obstacles	Civil Aviation Administration of Vietnam		A
				Provision of enhanced taxiway centre line marking in accordance with standard in Para 5.2.8.11 of Annex 14, Volume I.	Provide enhanced taxiway markings			A
				Provision of RESA in accordance with Section 3.5 of Annex 14, Volume I requirements;	Provide RESA			A
				Wildlife strike report submission to ICAO for inclusion in IBIS	Submission of wildlife strike reports to ICAO for inclusion in IBIS			B

* Priority for action to remedy the shortcoming is based on the following safety assessments:

"U" priority = Urgent requirements having a direct impact on safety and requiring immediate corrective actions. Urgent requirement consisting of any physical, configuration, material, performance, personnel or procedures specification, the application of which is urgently required for air navigation safety

"A" priority = Top priority requirements necessary for air navigation safety. Top priority requirement consisting of any physical, configuration, material, performance, personnel or procedures specification, the application of which is considered necessary for air navigation safety.

"B" priority = Intermediate requirements necessary for air navigation regularity and efficiency. Intermediate priority requirement consisting of any physical, configuration, material, performance, personnel or procedures specification, the application of which is considered necessary for air navigation regularity and efficiency

AIR NAVIGATION DEFICIENCIES IN AOP FIELD IN THE ASIA/PACIFIC REGION FOR VALIDATION BY STATES

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
Annex 14 Volume I	**Brunei Darussalam** Brunei International Airport	Runway/ vegetation along pavement edges and strip higher than the adjacent runway pavement; uneven earth mounds on strip	ICAO Mission of April 2011					A
		faded centre line and other markings;						A
	Taxiway	non provision of enhanced taxiway centre line marking in accordance with Para 5.2.8 of Annex 14, Volume I						A
		Objects on taxiway strips; vegetation on pavement joints and maintenance of joints.						A
	Apron	non provision of ICAO compliant signage in accordance with section 5.4 Annex 14, Volume I						A
	Rescue and Fire Fighting (RFF):	non provision of direct access for the rescue and fire fighting vehicles from the fire station into the runway;						A
		non provision of road holding position sign at all road entrances to a runway; and						A
	Wildlife Hazards:	Establishing a national bird control committee in accordance with APANPIRG Conclusion 18/1;						B

Identification		Deficiencies			Corrective Action			
Requirement	States/facilities	Description	Date first reported	Remarks	Description	Executing body	Target date of completion	Priority for action**
Annex 14 Volume I	**Lao PDR** Wattay International Airport	**Runway/** Non provision of RESA in accordance with section 3.5 of Annex 14, Volume I	ICAO Mission of March 2011					U
		rubber deposits and faded centre line markings.						A
	Taxiway	Provision of runway hold position lights in accordance with Para 5.3.19 of ICAO Annex 14, Volume I						A
		Provision of enhanced taxiway centre line marking in accordance with Para 5.2.8 of Annex 14, Volume I						
	Rescue and Fire Fighting (RFF):	Provision of road holding position sign at all road entrances to a runway;						A
	Wildlife Hazards:	Establishing a national bird control committee in accordance with APANPIRG conclusion 18/1.						B
	Luang Prabang International Airport	Runway						A
	Taxiway	Provision of enhanced taxiway centre line marking in accordance with standard in Para 5.2.8.11 of Annex 14, Volume I			.			A

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date of completion**	**Priority for action****
		Provision of runway hold position lights in accordance with Para 5.3.19 of ICAO Annex 14, Volume I on new taxiways						A
	Rescue and Fire Fighting (RFF)	Provision of road holding position sign at all road entrances to a runway						A
Annex 14 Volume I	**Mongolia** Ulaan Baatar International Airport	**Runway/** rubber deposits and faded centre line and other faded markings;	ICAO Mission of July 2011					A
		Resealing cracks on pavement surface with sealants to prevent ingress of water and broken edges which could cause FOD issues.						A
	Taxiway	Provision of enhanced taxiway centre line marking in accordance with Para 5.2.8 of Annex 14, Volume I ;						A
		faded taxiway markings						A
		Maintenance of pavement cracks						A
		provision of runway hold position lights in accordance with Para 5.3.19 of ICAO Annex 14,						A
		provision of taxiway hold position signs on all hangar taxiways at entrances to the active taxiways/runway.						A

Identification		Deficiencies			Corrective Action			
Requirement	States/facilities	Description	Date first reported	Remarks	Description	Executing body	Target date of completion	Priority for action**
	Apron	sealing the cracks on the apron surface						
	Airfield signage	Provision of ICAO compliant signage in accordance with section 5.4 Annex 14, Volume I and to cut the vegetation in front of the signs.						A
	Wildlife Hazards	establishing a national bird control committee in accordance with APANPIRG conclusion 18/1; collect wildlife reports and forward to ICAO for inclusion in the ICAO IBIS;						B

* Priority for action to remedy the shortcoming is based on the following safety assessments:

"U" priority = Urgent requirements having a direct impact on safety and requiring immediate corrective actions. Urgent requirement consisting of any physical, configuration, material, performance, personnel or procedures specification, the application of which is urgently required for air navigation safety.

"A" priority = Top priority requirements necessary for air navigation safety. Top priority requirement consisting of any physical, configuration, material, performance, personnel or procedures specification, the application of which is considered necessary for air navigation safety.

"B" priority = Intermediate requirements necessary for air navigation regularity and efficiency. Intermediate priority requirement consisting of any physical, configuration, material, performance, personnel or procedures specification, the application of which is considered necessary for air navigation regularity and efficiency.

REPORTING FORM ON AIR NAVIGATION DEFICIENCIES IN THE CNS FIELD IN THE ASIA/PACIFIC REGION

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action**
Adequate and reliable VHF COM	Myanmar	Quality and reliability of RCAG VHF inadequate and unavailability of required coverage. Improvement has been observed and pilot reports continued to indicate occasional communication difficulties. Further improvement has been observed with occasional communication problems reported. From 2 to 13 April 2012, a survey was conducted by IATA. 129 of 349 aircraft from 11 airlines reported problems of one sort or another (HF, VHF or Data Link) 50 reported no communication had been established. .	1998 Early 2008 June 2011 April 2012	Improvements in the quality of link to RCAG stations and power supply system at some remote stations are required.	An action plan was developed to upgrade equipment at RCAG stations, provide VSAT link at all RCAG stations, to improve power supply system. ICAO missions were conducted. DCA Myanmar has replaced equipments at all 6 RCAG sites with digital VHF system and has provided VSAT links and solar power supply system at all sites. The installation of new high power HF with full associated equipment to be done at Yangon ACC by the end of year 2011; The current VCSS (Voice Control Switching System) has already been upgraded since first quarter 2011 The interface between new ATM system and CSP was upgraded from X.25 to IP in March 2013. The connectivity was stable but ATM/FANS system exhibits some instability. Replacement of new communication equipments such as head set, inter-com system and DSC line configuration have already been completed since the end of May 2011.	DCA Myanmar	Revised target date is end of 2011 This deficiency will be removed from the list upon receipt of official report providing full details of action taken by Myanmar and confirmation by the users. Further improvements need to be taken by the DCA Myanmar including both operational and technical arrangements	A

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action**
Adequate and reliable Navaids and navigation service	Philippines	Un-serviceability of both the ILSs and the DVOR at Manila airport	19 June 2010	A letter from CAAP informed that the ILS system with associated DME had been commissioned in January and April 2011 respectively. Arrangement for continuous DVOR/DME operation was made by temporarily relocating old DVOR/DME facilities from another place.	The significant breakdown of the services was considered a deficiency if remedial action was not taken. The Administration was requested to inform about the remedial action taken to avoid breakdown of power supply. Power supply module has been replaced; For DVOR/DME, a plan to replace temporary aging facilities with new system is in place which was expected to be completed in early 2012	Civil Aviation Authority of the Philippines (CAAP)	2014 The CAAP is invited to notify Regional Office to remove the deficiency from the list once the new DVOR/DME is put into operation.	A
Reliable ground to ground communication as specified in the regional air navigation plan (Doc.9673)	Afghanistan and Pakistan	Unreliability of AFS communication between Afghanistan and Pakistan was brought to the notice of APANPIRG/21. Lack of reliability in the AFS including data communication between Kabul and Karachi and ATS voice communication between Lahore and Kabul was identified.	September 2010	Follow-up letters from ICAO regional offices were sent to Administrations concerned in April 2010 and further follow- up in March 2011 A COM coordination meeting – Afghanistan and Pakistan was held in June 2012 in Karachi, Pakistan. A Remedial action plan was developed.	In March 2012, initial discussion on improvement of AFS communication was held at a special ATS coordination meeting. The COM coordination meeting in June 2012 developed a remedial action plan with three action items: 1. Near-term by end of September 2012, fully utilize the VPN circuit operational since January 2012 for exchange of AFTN traffic, organize users' training if required; 2. Mid-term by end of March 2013, harmonize VSAT terminal equipment and select common network service provider to recover the VSAT Links; (efforts being by PCAA replacing	Ministry of Transport and Civil Aviation Afghanistan and CAA. Pakistan	July 2014	A

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action**
					aging parts of VSAT. However, the same efforts expected from Afghanistan) 3. Long-term by end of June 2014, establish 2 MB dedicated landline connection with multiplexers between Afghanistan and Pakistan to support both data and voice communication between COM centres and ACCs.			
Regional air navigation plan – FASID Table CNS 1A	Myanmar	AFS data circuit between Beijing and Yangon had been out of service since Mid. July 2008.	September 2008	The circuit serves exchanging traffic between Myanmar and Z AFS routing area and also plays a critical role as alternate routing for Bangkok-Yangon circuit.	A COM Coordination meeting in March 2013 developed two action items to rectify the deficiency as soon as possible.	DCA. Myanmar and ATMB	June 2014	A

REPORTING FORM ON AIR NAVIGATION DEFICIENCIES IN THE MET FIELD IN THE ASIA/PAC REGION								
Identification		**Deficiencies**			**Corrective action**			
Requirements	**States/ facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action ***
Meteorological observations and reports. (Annex 3, Chapter 4)	Solomon Is. AP-MET-01	Weather information is inadequate and not provided on a regular basis	1996 Confirmed 2006 SOA	Reported by airlines operating to Solomon I.	Equipment to be upgraded and arrangements to be made for regular observations. TC expert recommendation to replace and/or calibrate MET obs. equipment AGGH – 2008. State made aware of MET Services gaps identified by ICAO TC Project, CAEMSA-SP, in late 2008. CAEMSA-SP Phase II plan for Donors and associated remedies. Activation of WIFS will assist in overcoming deficiency. AWS was installed (2012) at Honiara (Henderson), AGGH, by New Zealand, including training of Solomon Islands technical personnel in the maintenance of the equipment. Responsibility for ongoing system calibration and verification may need to be determined. Secure transmission of weather information to the appropriate RODB may need to be verified (noting that transmission via email to the Australian Bureau of Meteorology may not be appropriate)	Ministry of Transport, Works and Aviation, Solomon I. *Note: OPMET/M TF to carry out survey*	2011	A
Meteorological observations and reports. (Annex 3, Chapter 4)	Kiribati AP-MET-02	METAR from Kiribati not available on regular basis.	1998 Confirmed 2005 SIP	Reported by airlines	State's MET authority to consider urgent action to be taken for providing regular observations and reports. TC expert recommendation to purchase/install AWOS – 2008. ICAO SIP conducted in 2005. State made aware of MET Services gaps identified	Directorate of Civil Aviation, Kiribati. *Note: OPMET/M TF to carry out survey*	2011	A

REPORTING FORM ON AIR NAVIGATION DEFICIENCIES IN THE MET FIELD IN THE ASIA/PAC REGION

Identification		Deficiencies			Corrective action			
Requirements	**States/ facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action ***
					by ICAO TC Project CAEMSA-SP, in late 2008. CAEMSA-SP Phase II plan for Donors and associated remedies. Activation of WIFS will assist in overcoming deficiency.			
Reporting of information on volcanic eruptions to civil aviation units. (Annex 3, 3.6, 4.8)	Indonesia AP-MET-03	Information on volcanic activity not provided regularly to ATS units and MWOs.	1995 Confirmed by ICAO SIP mission Dec 2003	Observed by States concerned. Reported at the WMO/ICAO Workshop on Volcanic Ash Hazards (Darwin, 1995)	Three-party LOA to be signed between the MGA, DGCA and DVGHM. Information exchange between CVGHM & ABA in draft form. VSAT comms installed to improve the monitoring in E Nusa Tenggara – provides direct transfer of data to CVGHM HQ full time. (AusAID-funded project). Bilingual reporting form based on VONA to improve comm. to VAAC in Sulawesi.	DGCA, MGA Indonesia	TBD (no action plan submitted to RO)	A
Reporting of information on volcanic eruptions to civil aviation units. (Annex 3, 3.6, 4.8)	Papua New Guinea AP-MET-04	Information on volcanic activity not provided regularly to ATS units and MWOs.	1995 Confirmed by ICAO SIP mission Dec 2003	Observed by States concerned. Reported at the WMO/ICAO Workshop on Volcanic Ash Hazards (Darwin, 1995)	Procedures to be set up for exchange of data between NWS, ATS and Rabaul Volcano Observatory (RVO) and a LOA to be signed Discussion of an agreement between RVO & PNG CAA to provide volcanic information to aviation through cost recovery is underway.	NWS, ATS Papua New Guinea *Note: ICAO Regional Office to monitor*	TBD (no action plan submitted to RO)	A
Provision of SIGMET for volcanic ash (Annex 3, Chapter 7; ASIA/PAC FASID Table MET 1B)	Indonesia AP-MET-06 Philippines AP-MET-07 Papua New	Requirements for issuance and proper dissemination of SIGMET, including SIGMET for volcanic ash, have not been fully	ICAO SIP mission Dec 2003	a) Reported by airlines b) Noted by Volcanic Ash Advisory Centres	a) ICAO to carry out a Special Implementation Project (SIP) with the primary objective to improve implementation of SIGMET procedures, especially for VA. b) State to take urgent actions to implement the SIGMET procedures.	a) State's Met authorities b) ICAO to implement the SIP. c) ICAO Regional	To be advised	U

REPORTING FORM ON AIR NAVIGATION DEFICIENCIES IN THE MET FIELD IN THE ASIA/PAC REGION								
Identification		**Deficiencies**			**Corrective action**			
Requirements	**States/ facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action ***
	Guinea AP-MET-08	implemented			Note. ICAO SIP carried out in 2003, progress in issuance of SIGMET for VA is noted; the outstanding problems to be resolved within 1-year (progress reported by VAAC Darwin) LOA between ATO, PHIVOCS & PAGASA signed in 2004 to make reporting part of information dissemination practice. LOA is undergoing periodic review (ref. letter of PAGASA dated March 12, 2008) VAAC Darwin trained forecasters in PNG and Philippines to prepare VA SIGMET Participated in VA SIGMET test 17 Nov 2009 SIGMET monitoring over a period of 2 months in August and September 2012 indicated that no SIGMET was received from PNG (MET SG/17, 8.4.3 & 13.9 refers). Indonesia advised (MET SG/17) that procedures were developed for the issuance of SIGMET (WS, WV and WC) compliant with ICAO provisions and that MWO Jakarta (WIII) and MWO Ujung Pandang (WAAF) have issued SIGMET according to the requirements since April 2013. MET SG noted that validation of SIGMET receipt at RODBs and WIFS/SADIS gateways would be necessary and may require additional SIGMET monitoring and participation in SIGMET tests.	Office to co-ordinate and monitor.		
a) Service for operators and flight crew members.	Cambodia AP-MET-09	Briefing and flight documentation not provided as required.	1999	Airlines do not receive the required flight documentation	States to consider urgent action for installation of SADIS VSAT for receiving WAFS products and OPMET information.	State's MET authorities	End 2011	A

REPORTING FORM ON AIR NAVIGATION DEFICIENCIES IN THE MET FIELD IN THE ASIA/PAC REGION

Identification		Deficiencies			Corrective action			
Requirements	**States/ facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action ***
(Annex 3, Chapter 9). b) WAFS products for flight documentation. (ASIA/PAC FASID Table MET 1A).		WAFS products not available		including WAFS forecasts.	Action plan proposed by ICAO MET mission 2003 A TC project proposal submitted to SSCA, Cambodia Cambodia expects to have SADIS FTP operational in 2011 and may require training from a nearby State Cambodia informed MET SG/17 that the Secure SADIS FTP system was installed but further action was required in relation to training of personnel to use the system.			
MWO for Phnom Penh FIR and SIGMET (Annex 3, Chapter 3 & 7; ASIA/PAC FASID Table MET 1B)	Cambodia AP-MET-11	Requirements for meteorological watch office (MWO) to be established at Phnom-Penh international airport have not been met.		MWO not established due to lack of trained personnel and technical facilities. No SIGMET service for Phnom Penh FIR	Establishment of MWO currently not feasible. SIGMET service is provided under bilateral agreement with China to meet requirements. A TC project proposal submitted to SSCA, Cambodia Cambodia is in process of establishing its own MWO with target date end of 2011	SSCA, Cambodia	TBD End 2011	A
Provision of SIGMET information (Annex 3, Chapter 7; ASIA/PAC FASID Table MET 1B)	Lao PDR AP-MET-12	Requirements for issuance and dissemination of SIGMET have not been fully implemented.	2000	SIGMET frequently not available Reported by airlines	State's MET authority to take urgent actions to implement the SIGMET procedures. Lao PDR has established MWO in 2010 and started issuing SIGMET since March 2011. As a result of monitoring by RODB Bangkok, LAO PDR was advised to correct noted formatting problem and to issue SIGMET on a regular basis to meet requirements. Lao PDR is expected to issue SIGMET regularly by the end of 2011. This deficiency can be considered for removal after correcting the above problems.	State's MET authorities	End 2011	A

REPORTING FORM ON AIR NAVIGATION DEFICIENCIES IN THE MET FIELD IN THE ASIA/PAC REGION

Identification		Deficiencies			Corrective action			
Requirements	**States/ facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action ***
					SIGMET monitoring by RODB Bangkok in February 2012 failed to identify the issuance of any SIGMET by Lao PDR, indicating that the deficiency is still to be properly rectified (ROBEX WG/11, 2.1.4 refers).			
Provision of SIGMET information for Kathmandu FIR. (Annex 3, Chapter 7; ASIA/PAC FASID Table MET 1B)	Nepal AP-MET-14	Requirements for issuance and dissemination of SIGMET have not been met.	2000	Not established due to lack of technical facilities. No SIGMET service for Kathmandu FIR	Issuance of SIGMET currently not feasible. Action being taken to have SIGMET service provided under bilateral agreement with a neighboring country to meet immediate requirement. Nepal is also planning to issue its own SIGMET	MET Authority Nepal	End 2011 TBD	A
MWO for Pyongyang FIR and SIGMET (Annex 3, Chapter 3 & 7; ASIA/PAC FASID Table MET 1B)	DPR Korea AP-MET-16	Requirements for meteorological watch office (MWO) to be established at Pyongyang international airport have not been met.	2008	MWO not established due to lack of trained personnel and lack of resources. No SIGMET service for Pyongyang FIR Reported by RO mission	MWO established in February 2009 as reported by State. DPR. Korea is subsequently producing SIGMET on a regular basis and is routing SIGMET to RODB Tokyo. It is required for Sunan MWO to participate the APAC SIGMET test in November 2011. This deficiency can be removed if SIGMET is continued to be issued regularly for another six months. DPRK informed R/O that SIGMET were issued in May 2013; R/O to coordinate confirmation of receipt of SIGMETs at required offices. DPR Korea to submit in writing an official report to the Regional Office providing full details of the action taken to rectify the deficiency; and the Regional Office to validate that the action taken in	General Administration of Civil Aviation (GACA) DPR Korea	Jan 2012	A

REPORTING FORM ON AIR NAVIGATION DEFICIENCIES IN THE MET FIELD IN THE ASIA/PAC REGION

Identification		Deficiencies			Corrective action			
Requirements	**States/ facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action ***
					the report satisfactorily rectifies the deficiency.			
Volcanic activity information to be provided to ATS units, MWOs, and VAAC (Annex 3, 3.6 and 4.8)	Tonga AP-MET-17	Information on volcanic activity not provided regularly to ATS units, MWOs, and VAAC	2008	Reported by TCB CAEMSA-SP technical expert	Agreement drafted for the dissemination of volcanic ash information from MLSNRKT to MTKT for distribution to ACCs, MWOs and VAACs (under consideration) Tonga submitted official report to R/O (10 May 2013) advising that MOU between the Ministry of Infrastructure (MOI) and the Ministry of Lands, Environment, Climate Change and Natural Resources (MLECCNR) signed 9 May 2013 for coordination procedures of the dissemination of detection of volcanic ash information to the appropriate ACC, VAAC and MWO.	Ministry of Transport of the Kingdom of Tonga (MTKT) Ministry of Lands, Survey and Natural Resources of the Kingdom of Tonga (MLSNRKT)	2011	U
Briefing and flight documentation (Annex 3, Chapter 9, Appendix 2 & 8)	Kiribati AP-MET-18 Nauru AP-MET-19 Solomon Islands AP-MET-20	WAFS products not accessed and therefore not available for inclusion in flight briefings and documentation	2008	Reported by TCB CAEMSA-SP Technical Expert	WAFS Internet File Service (WIFS) allows for the retrieval of WAFS forecasts for flight briefings and documentation (versus more expensive satellite dish) – available for operations since May 2010 Will seek donor ship for installation and training on WIFS as part of CAEMSA-SP Phase II	MET Services, TCB, Donor, ISCS Provider State	2012	U
Provision of meteorological observations (Annex 3, 4.3.1, 4.5, 4.6)	Nauru AP-MET-21	No METAR/SPECI observing programme in place (no calibrated and maintained equipment available)	2008	Reported by TCB CAEMSA-SP Technical Expert	Automatic observing station needed as well as maintenance programme Will seek donor for observing system and maintenance contract and/or training as part of CAEMSA-SP Phase II	MET Service, TCB, Donor	2012	U
Provision of SIGMET information	Papua New Guinea AP-MET-22	Lack of SIGMET issued for the Port Moresby, Honiara, and Nauru FIRs.	9/09/2011	IATA emphasized the importance of having hazards reported in this	ICAO: States concerned are urged to take urgent action to seek assistance from a State in a position to do so to provide the service until such time the			U

REPORTING FORM ON AIR NAVIGATION DEFICIENCIES IN THE MET FIELD IN THE ASIA/PAC REGION								
Identification		**Deficiencies**			**Corrective action**			
Requirements	**States/ facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action ***
(Annex 3, Chapter 7)	Solomon Islands AP-MET-23 Nauru AP-MET-24			large sub-regional area that straddles the equator and deemed this situation unsafe and unacceptable to airline operations.	States concerned can provide their own SIGMET. SIGMET monitoring over a period of 2 months in August and September 2012 indicated that no SIGMET was received (MET SG/17, 8.4.3 & 13.9 refers).			

Agenda Item 5: Future Work Programme

Schedule of Future meetings

5.1 The meeting agreed that the tentative schedule of meetings for the rest of 2013, 2014 and 2015 should be as follows (Notes: A decode of acronyms has been included in **Appendix A** to the Report on Agenda Item 5):

2013 – Outstanding Meetings

IRAIDCTF/2	22-26July	Bangkok
ATNWG/12	5-8 August	Seattle
China Special coordination meeting	23-25 September	Beijing
ATFM/SG/2	30 September-4 October	Hong Kong, China
ISTF/3	15-17 October	Seoul
SEA/BOB ADS-B WG/9	12-14 November	TBA
RACPTF/3	26-29 November	TBA
MET/R TF/3 & MET/ATM Seminar	November(TBC)	Bangkok (TBC)
2014		
APSAR/TF/2	January	TBD
SAIOACG/4,	February-March	Bangkok
SEACG/21	February-March	Bangkok
ROBEX WG/12	17-19 March	Bangkok
MET/H TF/4	19-21 March	Bangkok
ATFM/SG/3	March	TBD
ADS-B SITF/13	22-25 April	Hong Kong China
AAITF/9	April	TBD
RACP/TF/4	May	TBD
ACSICG/1	May	Republic of Korea
FIT-Asia/3/ RASMAG/19	May-June	Bangkok
AOP/WG/2	2-4 June	Indonesia
MET/SG/18	2-5 June	Bangkok
APSAR/TF/3	June	TBA
CNS/SG/18	14-18 July	Bangkok
ATM/SG/2	21-25 July	Bangkok
APANPIRG/25	8-11 September	Bangkok
MET/R TF/4	TBD 2014 or 2015	TBD
2015		
APSAR/TF/4	February	TBD
SEACG/22	March	Bangkok
SAIOACG/5	March	Bangkok
ROBEX WG/13	March	Bangkok
MET/H TF/5	March	Bangkok
AAITF/10	April	TBD
ADS-B SITF/14	April	TBD
FIT-Asia/3/ RASMAG/20,	May	Bangkok
ACSICG/2	May	
RACP/TF/4	May	TBD
AOP/WG/3	June	
ATM/SG/3	July	Bangkok
MET/SG/19	July	Bangkok
CNS/SG/19	July	Bangkok
APANPIRG/26	7 -10 September	Bangkok

(Note: Refer Appendix A for Acronyms)

APPENDIX - A

ACRONYMS

AAITF	Aeronautical Information Services – Aeronautical Information Management Implémentations Task Force
ADS-B SITF	ADS-B Study and Implementation Task Force
AOP/WG	Aerodrome Operations and Planning Working Group
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Group
APSAPG	ICAO Asia Pacific Seamless ATM Planning Group
ATM/SG	ATM/ Sub Group
ATN IC G	Aeronautical Telecommunication Network Implementation and Coordination Group
CMRI	China, Mongolia, Russian federation and IATA ATS coordination Meeting
CNS/SG	CNS Sub-Group of APANPIRG
FIT-Asia	FANS Interoperability Team-Asia
GLS Seminar	GNSS Landing System Seminar
IRAIDCTF	ICAO Inter Regional AIDC Task force.
ISTF	Ionospheric Study Task Force
MET/ATM/Seminar	Meteorology/Air Traffic Management Seminar
MET/H TF	Meteorological Hazards Task Force (of the MET SG)
MET/R TF	Meteorological Requirements Task Force (of the MET SG)
MET/SG	Meteorology Sub-Group of APANPIRG
PBN TF	Performance Based Navigation Task force
RACP/TF	Regional ATM Contingency Planning Task Force
RASMAG	Regional Air Space Monitoring Advisory Group of APANPIRG
ROBEX WG	Regional OPMET Bulletins Exchange Working Group (of the MET SG)
SAIOACG	South Asia/Indian Ocean ATM Coordination Group
SEACG	South East Asia ATS Coordination Group
SEA/BOB ADS-B WG	South East Asia and Bay of Bengal Sub-regional ADS-B Implementation Working Group

Agenda Item 6: Any other business

6.1 APANPIRG Future Meetings

6.1.1 Australia, India, New Zealand, Singapore, Thailand, and USA, supported holding the future APANPIRG Meetings in 4 working days as this will provide adequate time for discussion. APANPIRG/24 reached a consensus and decided on 4 working days for its future meetings including the meeting which will be held in Assembly Year.

6.1.2 In relation to delegation of Authority to Sub Groups for adoption of Conclusions and Decisions arising from its Sub Group the meeting decided to make no changes.

6.1.3 In relation to delegation of Authority to Sub Groups for adoption of regional guidance material the Group decided to retain the present structure with no change.

6.2 New Administration

6.2.1 ICAO Secretariat invited reference to Para 6.1, Part III of APANPIRG Procedural Handbook on the term of Chairperson, First and Second Vice Chairperson which shall be for a maximum period of three years. The meeting noted that the term of the current APANPIRG Administration ended in 2013 and invited proposals from the Group.

6.2.2 China, Pakistan, Philippines, India, Singapore, Thailand and Vietnam supported the continuation of Mr. Norman Lo as Chairperson of APANPIRG for another three years. The Group acknowledged the able leadership provided by Mr. Lo since 2011 and recognized his significant contribution and valuable support to the air navigation system in the APAC Region as Chairman of APANPIRG.

6.2.3 The meeting reached a consensus for the continuation of the existing administration comprising of Mr. Norman Lo as Chairperson , Mr. Azharuddin DG Malaysia as First Vice Chair and Mr. Nimalsiri DG & CEO CAA Sri Lanka as second Vice Chairperson.

6.2.4 In thanking the strong support from China and trust from States bestowed on him, Mr. Lo stated that he looked forward to close cooperation and guidance of the Group in carrying out the duties as Chairperson of APANPIRG.

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LIST OF INFORMATION AND WORKING PAPERS

Paper No.	Agenda Item	Title	Presented by
INFORMATION PAPERS			
IP/1	-	Meeting Bulletin	Secretariat
IP/2	2	The Evolution of Electronic Tools and Data: A Strategic Plan for the Creation of a Community-Driven Decision-Support Digital Environment for the Global Aviation Community	Secretariat
IP/3	3.0	Alignment of Air Navigation Plans with the 4th edition of the Global Air Navigation Plan (AN-Conf/12, Recommendation 6/1)	Secretariat
IP/4	3.6	Business Case for NextGen	USA
IP/5	2	Update of RASG-APAC Activities	Secretariat
IP/6	3.6	Integration of Unmanned Aircraft Systems (UAS) into the United States' National Airspace System (NAS)	USA
IP/7	3.5	ICAO Meteorological Information Exchange Model (IWXXM)	USA
IP/8	3.5	Space Weather Services	USA
IP/9	3.4	ICAO Position and Preparations for ITU WRC-2015	Secretariat
IP/10	1.2	Aspects of Space Weather	Secretariat
IP/11	3.6	Traffic Forecasts for Trans-Pacific and Intra-Asia	Secretariat
IP/12	3.2	Second Joint Exercise of Aviation Search and Rescue Services of Mongolia and Russian Federation	Mongolia
IP/13	3.4	Status of ATC Surveillance Activities in Civil Aviation Authority of Mongolia (MCAA)	Mongolia
IP/14	1.2	Progress on Implementation of ATN/AMHS, AIDC, ADS-B, PBN and Up Gradation of ATM	Bangladesh
IP/15	3.4	The Federal Aviation Administration (FAA) System Wide Information Management (SWIM) Program	USA

Paper No.	Agenda Item	Title	Presented by
IP/16	3.4	Harmonization Activities for New CNS/ATM Implementation between Japan and ROK	Japan and ROK
IP/17	3.4	Standardization of COTS Products for CNS/ATM Systems	India
IP/18	3.2	APAC Air Traffic Flow Management Zone	IATA
IP/19	6	The Republic of Korea - ICAO Developing Countries Training Programme	ROK
IP/20	3.2	AIM Implementation Process of Mongolia	Mongolia
IP/21	3.4	Progress on PBN Implementation in Lao PDR	Lao PDR
IP/22	3.2	Report of the Second Meeting of Mekong ATM Coordination Group (MK-ATM/CG/2)	Cambodia, Lao PDR, Myanmar, Thailand and Viet Nam
IP/23	6	Conduct Fourth Trans-Regional Airspace and Supporting ATM Systems Steering Group (TRASAS/4) Meeting	USA
IP/24	3.4	ATS Surveillance Coverage in Ho Chi Minh FIR	Viet Nam
IP/25	3.6	Updates on Air Navigation Activities in Viet Nam	Viet Nam
IP/26	3.6	Seamless ATM Plan Implementation	India
IP/27	3.6	Environmental Benefits Assessment of Aviation System Block Upgrades	Secretariat
IP/28	3.4	Cambodia for Surveillance System	Cambodia
IP/29	3.4	Cambodia for CNS	Cambodia
IP/30	3.5	Updated OPMET Data Availability in Cambodia	Cambodia
IP/31	3.6	Moving towards a Regional and Global Air Traffic Flow Management System in the South China Sea Airspace	China

Paper No.	Agenda Item	Title	Presented by
WORKING PAPERS			
WP/1	-	Adoption of the Provisional Agenda	Secretariat
WP/2	1.1	Review of the Actions of the Air Navigation Commission on the Report of the 23rd Meeting of the ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG/23)	Secretariat
WP/3	1.2	Status of Implementation of APANPIRG/23 Conclusions and Decisions	Secretariat
WP/4	1.3	Status of Implementation of Outstanding APANPIRG Conclusions and Decisions	Secretariat
WP/5 Revision 1	2	Regional and Global Air Navigation Reporting	Secretariat
WP/6	2	Regional Priorities and Targets for Air Navigation	Secretariat
WP/7	2	Follow-up to Recommendations of the Twelfth Air Navigation Conference (AN-Conf/12)	Secretariat
WP/8	2	A Comprehensive Strategy for Air Navigation Revised Global Air Navigation Plan	Secretariat
WP/9	2	Funding of Aviation Infrastructure, Oversight Functions and Aviation Systems	Secretariat
WP/10	3.1	Report on the First Meeting of AOP Working-Group	Chairman of AOPWG
WP/11 Revision 1	6	APANPIRG Future Meetings	Secretariat
WP/12	3.2	ATMSG Outcomes	Secretariat
WP/13	3.3	RASMAG Outcomes	Secretariat
WP/14	3.4	Report on the Seventeenth Meeting of CNS Sub-Group	Chairman of CNS SG
WP/15	3.5	Report on the Seventeenth Meeting of MET Sub-Group	Chairman of MET SG
WP/16	5	APANPIRG Work Programme 2014+	Secretariat

Paper No.	Agenda Item	Title	Presented by
WP/17	4	Status of Air Navigation Deficiencies in the Asia/PAC Region	Secretariat
WP/18	3.6	APASPG Outcomes	Secretariat
WP/19	3.2	Transitioning to RNAV-2 in Enroute Airspace - India	India
WP/20	3.4	Proposed Asia/Pacific Internet Protocol (IP) Virtual Private Network (VPN)	USA
WP/21	2	Bringing the GANP/ASBU Integrated Planning Methodology into the APANPIRG Domain	Australia
WP/22	3.2	Implementation of APAC Seamless Operations	IATA
WP/23	3.3	Collaboration to Support Regional Monitoring Agencies	India
WP/24 Revision 1	3.2	Cost-Benefit Analysis of RNAV 2 Parallel Routes Y711 and Y722	ROK
WP/25	3.6	A Collaborative Decision Making (CDM)/Air Traffic Flow Management (ATFM) Concept through Sub-Regional Cooperation	Hong Kong, China, Singapore and Thailand

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APANPIRG/24 Conclusions/Decisions – Action Plan

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
D 24/1 **A & C**	**Regional Priorities and Targets for Air Navigation**	That APANPIRG a) establish, consistent with Recommendations 6/1 and 6/12 of the AN-Conf/12, priorities and targets for air navigation by May 2014; b) utilize specific interface groups, where required, for addressing the harmonization of air navigation plans in adjacent areas of APANPIRG; and c) coordinate with APAC-RASG to ensure consistency of action and avoid overlap.	APANPIRG	Regional Priorities and Targets established	May 2014
C 24/2 **A & C**	**Establishing Regional Priorities and Targets**	That, following the PIRG- RASG Global Coordination meeting held in March 2013 APANPIRG/24 invited the Chairpersons of ATM, RASMAG, CNS, and MET sub groups to establish regional priorities and targets for the APAC Region in alignment with the GANP and APAC Seamless ATM Plan by December 2013 in order to facilitate submission to ICAO by May 2014	ICAO APAC Office Chairperson of ATM, CNS, RASMAG & MET	State Letter Regional Priorities and Targets established	September 2013 December 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/3 **A & C**	**Regional and Global Air Navigation Reporting**	That States: a. support the plan for an online Regional Performance Dashboard in March 2014 and annual Global Air Navigation Report in April 2014; b. provide requisite information to the ICAO Regional Office, Bangkok to demonstrate operational improvements; and c. establish, if not yet done so, a performance measurement strategy that comprises of data compilation, processing, storage and reporting for the identified regional performance metrics for the air navigation systems.	ICAO APAC Office APAC States	State Letter	November 2013
C 24/4 **A & C**	**Follow-up to AN-Conf/12 Recommendations by States and International Organizations**	That, the States and International Organizations, on the basis of analysis contained in the Appendix A to Report on Agenda Item 2, takes follow-up action as appropriate on the applicable recommendations of the AN-Conf/12	ICAO APAC Office	State Letter	November 2013
D 24/5 **A & C**	**Follow-up to AN-Conf/12 Recommendations by APANPIRG**	That the subgroups of APANPIRG study the recommendations of the AN-Conf/12, initiate appropriate follow-up actions and submit a report on the outcomes of these actions to APANPIRG/25.	ICAO APAC Office APANPIRG Sub Groups	State Letter	August 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/6 A & C	**Airfield Pavement**	That, ICAO be invited to provide the definition of 'unrestricted operations' in the ACN-PCN guidance material and the level of traffic for operation of an aircraft to be considered as overload or normal.	ICAO APAC Office	IOM to HQ	September 2013
C 24/7 A & C	**Establishment of Runway Safety Team at Airports**	That, States in APAC Region establish Runway Safety Teams comprising all the stakeholders at their airports and Runway Safety Programmes should address the mitigation measures in a timely manner taking into RASG activities and report the action taken to Regional Office.	ICAO APAC Office States	State Letter Report establishment of RST	September 2013
C 24/8 A & C	**Minimum Vertical Clearance between Aircraft and an Object on aircraft stands;**	That ICAO be invited to: i) carry out studies based on the best practices followed at airports worldwide and develop guidance for parking low height equipment in-between the aircraft stands; and ii) carry out feasibility studies regarding the provision of guidance for minimum vertical clearances between an aircraft and an object on aircraft stands.	ICAO APAC Office	IOM to HQ	October 2013
C 24/9 A & C	**Review of SARPS on Obstacle Limitation Surfaces (OLS)**	That, recognizing the advancement of air navigation systems and the need for land use optimization around aerodromes, ICAO be invited to review the OLS requirements.	ICAO APAC Office	IOM to HQ	October 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
D 24/10 **A & C**	**AOPWG Task List**	That the AOPWG Task List contained in **Appendix A** to the Report on Agenda item 3.1 be adopted as the current work programme for the AOPWG of APANPIRG.	ICAO APAC Office	State Letter	October 2013
C 24/11 **A & C**	**Reliance on FPL and ATS Message Converters**	That, considering the airspace capacity, efficiency and safety benefits intended by the full implementation of PANS/ATM Amendment 1changes, States are urged to: a) report to the ICAO Asia/Pacific Regional Office the: i. current status of ATM automation and conversion systems; and ii. planned date of implementation of full capability to process NEW format FPL and ATS messages without conversion; and b) where converters are utilized, upgrade ATM Automation and supporting systems to fully support Amendment 1 changes without using converters.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP085/13 (ATM)	July 2013
D 24/12 **A & C**	**Dissolution of the FPL&AM Implementation Task Force**	That, considering the successful implementation of Amendment 1 to the Fifteenth Edition of ICAO Doc 4444 (PANS/ATM), the Asia/Pacific Flight Plan and ATS Messages Implementation Task Force (FPL&AM/TF) be dissolved, and any on-going tasks be delegated to the ATM Sub-Group.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP085/13 (ATM)	July 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/13 **A & C**	**Air Traffic Flow Management Capacity Assessments**	That States be urged to establish capacity assessment and adjustment mechanisms, and regular review for all aerodromes and ATC sectors where traffic demand is expected to reach capacity, or is experiencing traffic congestion, and to report the assessment outcomes to the Asia/Pacific Regional Office prior to 1 May 2014.	1. ICAO APAC Office 2. States	1. State Letter Ref. T 3/10.0 – AP088/13 (ATM) 2. Report Capacity Assessment Outcomes	1. July 2013 2. May 2014
C 24/14 **A & C**	**Air Traffic Flow Management Information Sharing**	That States, where ATFM processes are in place, including within adjacent airspace, be urged to share information, which may include: a) capacity assessment: including factors of interest affecting capacity, such as special use airspace status, runway closures and weather information; b) traffic demand information: which may include flight schedules, flight plan, repetitive flight plan data as well as associated surveillance updates of flight status; and c) ATFM Daily Plan.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP088/13 (ATM)	July 2013
C 24/15 **A & C**	**Asia/Pacific ATFM Steering Group**	That, States participate in, and support the Asia/Pacific ATFM Steering Group to develop a common Regional ATFM framework, which addresses ATFM implementation and ATFM operational issues in the Asia/Pacific region.	1. ICAO APAC Office 2. States	1. State Letter Ref. T3/10.0 AP080/13 (ATM) **2.** Participate at and support ATFM/SG/2	1. July 2013 2. October 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/16 A & C	**South China Sea ATS Facilities**	That the provision of surveillance and communications services in the South China Sea area, where radar, ADS-B and/or VHF voice communications are currently not provided, be reviewed by China, Hong Kong China, Malaysia, Philippines, Singapore and Viet Nam, to consider: a) enhancement of current services; b) delegation or amendment of airspace service volumes; and c) cooperative agreements to exchange communications and surveillance capability.	ICAO APAC Office	State Letter Ref. T 3/10.0–AP082/13 (ATM)	July 2013

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**
C 24/17 A & C	**AIDC Implementation**	Recognizing that States implementing AIDC messaging may be doing so without previous knowledge or experience, and significant safety, ATC capacity and workload benefits arise from implementation of an appropriately selected initial suite of AIDC messages; States should: a) engage as soon as possible in AIDC trials to develop knowledge and address any related ATM or communications system issues; b) implement operational AIDC messaging as a matter of priority, in accordance with APANPIRG Conclusion 19/19; and c) implement as far as practicable, the AIDC messages Advanced Boundary Information (ABI), Coordinate Estimate (EST), Acceptance (ACP), Transfer of Control (TOC) and Assumption of Control (AOC).	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP082/13 (ATM)	July 2013

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**
C 24/18 **A & C**	**ATS Route Catalogue Version 12**	That Version 12 of the Asia and Pacific Region ATS Route Catalogue, appended as **Appendix A** to the Report on Agenda Item 3.2 replace Version 11 on the Asia/Pacific Regional Office's web site.	ICAO APAC Office	State Letter Ref. T 3/10.0–AP084/13 (ATM) Updated ATS Route Catalogue Uploaded V12 to the ICAO APAC web site.	July 2013 (Uploaded)

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/19 A & C	**Electronic AIP**	That, considering that Electronic AIP (eAIP) is part of Phase 2 of the AIS-AIM Transition Roadmap, due for completion by 14 November 2013 to coincide with the publication of Amendment 37 to Annex 15, and that few Asia/Pacific States' internet-accessible eAIP as reported to ICAO Regional Office comply with the Annex 15 requirements for Integrated Aeronautical Information Packages, States are urged to: a) implement internet-accessible electronic AIP (eAIP) as soon as possible; b) ensure the eAIP has the unconditional authority of the State, without disclaimers referring to a separately published paper product; c) permit open access to the eAIP either without the need for registration or, if registration is required, access to eAIP is automatically and immediately available; d) provide the facility to register for an update/amendment notification service; e) ensure the eAIP complies with Annex 15 requirements for content and structure; f) report eAIP implementation and its internet hyperlink to the ICAO Asia/Pacific Regional Office; and g) having implemented internet-accessible eAIP, on receipt of advice from the ICAO Asia/Pacific Regional Office, discontinue the forwarding of paper or CD copies of AIP, AIP SUP, AIC and NOTAM Checklists to the Regional Office.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP081/13 (ATM)	July 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/20 **A & C**	**Basic Air Navigation Plan Amendment Procedure and Guidance for Submission of ATS Route Amendments**	That, to further improve the quality and processing time of proposals to amend ATS route information in the Basic Air Navigation Plan, the Doc 9673 Amendment Procedure provided on the Asia/Pacific website should be replaced with the Amendment Procedure and Guidance for Submission of ATS Route Amendments appended as Appendix E to the Report on Agenda Item 3.2.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP084/13 (ATM) Uploaded Guidance Material amendment to the ICAO APAC web site.	July 2013
C 24/21 **A & C**	**Survey of Differences between States NOTAM Operations and Chapter 3 of the Guidance Manual for AIS in the Asia/Pacific Region - OPADD Edition 3.0**	That, recognizing the potential for inconsistencies in NOTAM format within the Asia Pacific Region, States should complete the OPADD Survey attached at Appendix F to the Report on Agenda Item 3.2 and forward the completed survey to the ICAO Asia/Pacific Office by 31 December 2013.	1. ICAO APAC Office 2. States	1. State Letter Ref. T 3/10.0 – AP081/13 (ATM) 2. Respond to State Survey	1. July 2013 2. December 2013
C 24/22 **A & C**	**Search and Rescue Agreements**	Recognizing the difficulties of enacting Search and Rescue (SAR) Agreements, States should be urged to make arrangements for senior civil and military decision-makers to facilitate the implementation and maintenance of SAR Agreements as early as possible.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP087/13 (ATM)	July 2013
C 24/23 **A & C**	**Asia/Pacific SAR Contact List**	That, States should be urged to provide contact details of SAR managers or senior SAR staff who may respond in a timely manner to aeronautical non-emergency and administrative SAR matters to the Asia/Pacific Regional Office, for incorporation into an Asia/Pacific SAR Contact List.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP087/13 (ATM)	July 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/24 A & C	**ADS/C and CPDLC Problem Reporting and Analysis**	That, FIT-Asia States are requested to: • register on the FIT-Asia website (http://www.ispacg-cra.com), and report their registration to the ICAO Asia/Pacific Regional Office by 31 December 2013; • report problems relating to Automatic Dependent Surveillance-Contract (ADS-C) and Controller Pilot Data-Link Communications (CPDLC) services to the Central Reporting Agency (CRA) for analysis, utilizing the FIT-Asia website; and • ensure the CRA analysis is reported to FIT-Asia.	1. ICAO APAC Office 2. States	1. State Letter Ref. T 3/10.0 – AP086/13 (ATM) 2. Report FIT-Asia Registration to the APAC Office	1. July 2013 2. December 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C24/25 **A & C**	**En-Route Monitoring Agency Role and Tasks**	Considering the requirement for a defined process of monitoring airframe Required Communication Performance (RCP) and Required Surveillance Performance (RSP) compliance, and analysis of data-link performance affecting horizontal separation standards that utilise data-link, Asia/Pacific States should: a) in collaboration with RASMAG, assign an En-Route Monitoring Agency (EMA) for each FIR; and b) support the assigned EMA with the provision of information regarding - i. observed aircraft horizontal navigation performance; and ii. observed non-compliant data-link performance of individual aircraft; and iii. aircraft data-link approvals, and c) recognize the potential benefit of EMAs in providing risk analysis to support horizontal separation implementation.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP086/13 (ATM)	July 2013
C24/26 **A & C**	**Repetitive Non-RVSM Approved Aircraft Operating as RVSM Approved Flights**	That, Asia/Pacific States should, except where a specific non-RVSM operation is authorized, deny entry to operate within RVSM airspace for aircraft that have been confirmed as non-RVSM approved over a significant length of time, or by intensive checking.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP086/13 (ATM)	July 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C24/27 A & C	**Prioritization of AIDC Implementation to Address LHDs**	Considering that ATS Inter-facility Data Communications (AIDC) is an important means of minimizing Large Height Deviations (LHD), Asia/Pacific States should support the expedition of AIDC through collaborative projects at the following significant LHD interface areas: a) Indonesia: between Jakarta and Chennai/Ujung Pandang/Brisbane/Melbourne FIRs; b) India: between Chennai and Kuala Lumpur FIRs; c) Philippines: between Manila and Fukuoka/Taipei/Hong Kong/Ho Chi Minh/Singapore/Kota Kinabalu/ Ujung Pandang FIRs; and d) China: between – i. Urumqi and Lahore FIRs; and ii. Beijing and Ulaan Baatar FIRs.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP086/13 (ATM)	July 2013

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**
C 24/28 A & C	**Timely implementation of ATN/AMHS**	That, a) States/Administrations hosting BBIS hubs be urged to review the feasibility and realize interim ATN connectivity using IDRP prior to complete readiness of all the member States in the Region by 2014/15. This will realize early operational benefits of network resiliency and AMHS operations, particularly in the instances where incompatible versions of AMHS currently preclude AMHS connectivity; b) BBIS and BIS States/Administrations be urged to resolve bilateral issues on urgent basis paving the way for effective use of the network and thereby ensuring utilization of resources and the investment made by the States; and c) States hosting BIS nodes be urged to aggressively take up implementation of ATN/AMHS connectivity as per the Regional Plan to complete regional ATN/AMHS network in the whole APAC region by the end of 2015.	ICAO APAC Office	State Letter	July 2013
C 24/29 A & C	**Interface Control Document for ATN IPS (IP V.4)**	That, the ICD for ATN IPS (IP v.4) as provided in Appendix A to the Report on Agenda Item 3.4 be adopted as the regional guidance material.	ICAO APAC Office	State Letter Published GM on website	July 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/30 A & C	**XML Trial over ATN/AMHS**	That, ICAO be invited to provide guidance on the requirements for end-user product/message in respect of XML coded NOTAM and OPMET messages.	ICAO APAC Office	.IOM to HQ	December 2013
D 24/31 A & C	**Aeronautical Communication Services Implementation Coordination Group – (ACSICG)**	That, a) the name "ATN Implementation Coordination Group" be replaced by "Aeronautical Communication Services Implementation Coordination Group" and b) the revised TOR of ACSICG provided in Appendix B to the Report on Agenda Item 3.4 be adopted.	ICAO APAC Office	State Letter	August 2013
D 24/32 A & C	**Common Regional Virtual Private Network (VPN) Task Force**	That, a Task Force with Subject Matter Experts (SME) be established to study the virtual private network and develop a detailed proposal by 2016. The Task Force reports the outcome of its study to APANPIRG through ACSICG and CNS SG.	ICAO APAC Office	State Letter	November 2013
D 24/33 A & C	**APAC RCP/RSP Implementation Framework**	That, APANPIRG Sub-groups include in their work program and implementation initiatives, consideration of the required communication performance (RCP) and required surveillance performance (RSP) framework.	ICAO APAC Office APANPIRG SGs	State Letter updated work programme of CNS SG and ATNICG	November 2013 July 2014

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/34 A & C	**Conclusion 24/34 – Adoption of Global Operational Data Link Document (GOLD) Edition 2**	That, the Global Operational Data Link Document (GOLD) Edition 2 provided in Appendix D to the Report on Agenda Item 3.4 be adopted.	ICAO APAC Office	State Letter Posted on the APAC website	July 2013
C 24/35 A & C	**Revised regional Aeronautical Mobile Service Strategy**	That, the revised regional AMS strategy provided in Appendix E to the Report on Agenda Item 3.4 be adopted.	ICAO APAC Office	State Letter	August 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/36 A & C	**RNAV Substitution for Conventional Instrument Flight Procedures**	That, considering the intent of US AC 90-108 and issues concerning the application of GNSS capability for aircraft flying conventional instrument flight procedures: a) Asia/Pacific States should publish material that: i) includes approval for authorized operators with the appropriate RNAV capability to include the listing of conventional navigation aids in flight plans, provided the operator has approval for navigation aid substitution and an appropriate, up-to-date database; ii) includes acceptance of navigation substitution approvals of foreign States; and iii) supports ATC separation standards for navigation aid substitution; and b) ICAO HQ be invited to: i) expedite development of global navigation aid substitution provisions; and ii) review the current Flight Plan contents to consider the listing of aircraft navigation capabilities rather than the listing of specific equipment carried (revisions should include the addition of Item 18 PBN codes for navigation specifications not currently included).	ICAO APAC Office	State letter IOM to HQ	September 2013 November 2013 July 2014

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/37 A & C	**New PBN Navigation Specifications**	Considering that the RNP2, RNP0.3 and Advanced RNP Navigation Specifications were to be significantly valuable for future planning, ICAO be urged to: a) expedite standards and guidance associated with these navigation specifications; b) provide adequate training material and courses to enable effective implementation; and c) expedite the development of procedure design standards in Doc 8168 for low RNP value missed approach and departure operations.	ICAO APAC Office	IOM to HQ . Workshop on RNP2, RNP0.3 and Advanced RNP specifications;	December 2013 December 2014
C 24/38 A & C	**PBN Procedures with Vertical Guidance**	That, given the difficulties that some States had with insufficient fleet capability for Baro-VNAV and no Space Based Augmentation System (SBAS), ICAO was urged to consider additional guidelines on alternative provisions to enable compliance so as to better align with the intent of Assembly Resolution A37-11 where practicable.	ICAO APAC Office	IOM to HQ	December 2013
C 24/39 A & C	**Asia/Pacific Regional PBN Implementation Plan Ver. 4**	That, recognizing the need for alignment of PBN Strategies and Guidance Material, as well as development of the Asia/Pacific Seamless ATM Plan, the Asia/Pacific Regional PBN Implementation Plan Version 4.0, provided in Appendix F to the Report on Agenda Item 3.4 be adopted.	ICAO APAC Office	State Letter and posted on the APAC website	July 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
D 24/40 A & C	**Dissolution of the PBN Task Force**	That, the Performance-based Navigation Task Force (PBN/TF) be dissolved.	ICAO APAC Office	State Letter	July 2013
C 24/41 A & C	**Navigation Strategy for the Asia/Pacific Region**	That, the revised navigation strategy provided in Appendix G to the Report on Agenda Item 3.4 be adopted for the Asia/Pacific Region.	ICAO APAC Office	State Letter	August 2013
C 24/42 A & C	**Timeframe for Data-sharing in the Bay of Bengal Sub-region**	That, States concerned be urged to consider the timeframe established for data-sharing in the Bay of Bengal Sub-region as provided in Appendix H to the Report on Agenda Item 3.4.	ICAO APAC Office	State Letter	August 2013
C 24/43 A & C	**Processing altitude information in ADS-B Message**	That, States/Administrations implementing ADS-B based surveillance services be urged to be fully aware of the safety implications and difference between geometric and barometric altitude. Geometric altitude information shall not be displayed on ATC displays used for the provision of air traffic services. States may choose to use geometric altitude in ATM systems for other purposes.	ICAO APAC Office	State Letter	July 2013
C 24/44 A & C	**Amendment to ADS-B Implementation and Operation Guidance Document (AIGD)**	That, the revised AIGD provided in Appendix I to the Report on Agenda Item 3.4 be adopted.	ICAO APAC Office	State Letter and Publish on the website	July 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/45 A & C	**Exchange ADS-B performance monitoring result**	That, States be encouraged to exchange findings/result of their ADS-B performance monitoring including experience gained in conducting the required performance monitoring.	ICAO APAC Office	State Letter	November 2013
C 24/46 A & C	**Need for adequate Logistics and Spares Support for ADS-B service**	That, States consider making maintenance arrangements including requirements for spares pool and/or maintenance contract for all ADS-B system acquisitions and existing systems already in operation if these arrangements do not yet exist.	ICAO APAC Office	State Letter	August 2013
C 24/47 A & C	**Surveillance Strategy for the Asia/Pacific Region**	That, the revised surveillance strategy for the Asia/Pacific Region provided in Appendix J to the Report on Agenda Item 3.4 be adopted.	ICAO APAC Office	State Letter	August 2013
C 24/48 A & C	**Migration to WAFS gridded global forecasts in WMO GRIB Edition 2 code form as soon as possible**	That, in view of the cessation of GRIB1 on 14 November 2013, States be invited to: a) urgently migrate to receiving, decoding and using the WAFS gridded global forecasts in WMO GRIB Edition 2 code form as soon as possible, if they have not already done so; and b) if required, urgently contact their workstation/software providers or consider contacting another State already using the GRIB2 datasets for assistance in migrating to GRIB2. Note: States who feel unable to migrate prior to 14 November 2013 should advise ICAO as soon as possible.	ICAO APAC Office	State letter	July 2013

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
C 24/49 A & C	**Improvements to SIGMET Implementation and Distribution**	That, the ICAO be invited to urge: a) MWOs to improve upon the compliance and availability of SIGMET information; and b) Regional OPMET databanks to ensure that all SIGMET data is forwarded to the SADIS and WIFS Providers in accordance with section 1.2.2 of Appendix 6 to ICAO Annex 3 — Meteorological Service for International Air Navigation.	ICAO APAC Office	State letter	July 2013
C 24/50 A & C	**Use of VONA format**	That, States be invited to consider ways to ensure implementation of the VONA format to report volcanic activities by Volcano Observatories.	ICAO APAC Office	State letter	July 2013
C 24/51 A & C	**Assessment of bilateral agreements for the provision of SIGMET services**	That, in coordination with ICAO, States to investigate and assess the feasibility of implementing effective bilateral agreements for the provision of SIGMET services as a corrective action towards resolution of air navigation deficiencies listed in the MET field.	ICAO APAC Office & States	State Letter and Working paper developed	September 2013 & March 2014
D 24/52 A & C	**Survey on the implementation of meteorological competency**	That, ICAO coordinates a survey on the level of implementation of competency assessment, qualifications and training for meteorological personnel providing service for international air navigation and report the result to the MET SG/18 meeting.	ICAO APAC Office	State Letter and Working paper developed	September 2013 & March 2014

Conclusion/ Decision No --- Strategic Objective*	Title of Conclusion/Decision	Text of Conclusion/Decision	Responsibility	Deliverable	Target date
D 24/53 A & C	**Guidance on QMS, competencies and cost recovery**	That, ICAO investigates opportunities to provide States with guidance information regarding implementation of QMS, competencies and cost recovery within the APAC Region	ICAO APAC Office	State letter	July 2013
C 24/54 A & C	**Asia/Pacific Seamless ATM Plan**	That, the Asia/Pacific Seamless ATM Plan Version 1.0 attached as Appendix B to the Report on Agenda Item 3.6 be endorsed, and made available on the ICAO Asia/Pacific Regional Office web site.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP083/13 (ATM)	July 2013
C24/55 A & C	**State Seamless ATM Planning**	That, given the urgency and priority of Seamless ATM planning for the Asia/Pacific as acknowledged by the 46th Conference of Directors General of Civil Aviation (DGCA, Osaka, Japan, 12-16 October 2009) and APANPIRG/22 (05-09 September 2011), States should be urged to: a) review Version 1.0 of the Asia/Pacific Seamless ATM Plan and utilise the Plan to develop planning for State implementation of applicable Seamless ATM elements; b) ensure relevant decision-makers are briefed on the Seamless ATM Plan; c) submit the first Regional Seamless ATM Reporting Form to the ICAO Regional Office by 01 March 2014; and d) where possible, participate and contribute to Seamless ATM system collaborative training and research initiatives.	1. ICAO APAC Office 2. States	1. State Letter Ref. T 3/10.0 – AP083/13 (ATM) 2. Submit Regional Seamless ATM Reporting Form to the APAC Office	1. July 2013 2. March 2014

Conclusion/ Decision No --- Strategic Objective*	**Title of Conclusion/Decision**	**Text of Conclusion/Decision**	**Responsibility**	**Deliverable**	**Target date**
D 24/56 A & C	**Seamless ATM Seminars/Workshops**	That, ICAO be urged to facilitate Asia/Pacific Seamless ATM Planning and Implementation Seminars/ Workshops for Asia/Pacific and trans-regional States.	ICAO APAC Office	1. State Letter 2. Conduct Seminars/Workshops	1. July 2013 2. March 2014
D 24/57 A & C	**Dissolution of APSAPG**	That, considering the submission of the Draft Seamless ATM Plan to APANPIRG, and subject to the Seamless ATM Plan being approved, the Asia/Pacific Seamless ATM Planning Group (APSAPG) be dissolved, and any on-going tasks be delegated to the appropriate Sub-Group.	ICAO APAC Office	State Letter Ref. T 3/10.0 – AP083/13 (ATM)	July 2013
D 24/58 A & C	**Addition of the APANPIRG Air Navigation Deficiencies for Noncompliance with Annex 14 SARPs**	That, the AOP Air Navigation Deficiencies reported and identified in Appendix B1 to Report on Agenda Item 4 be added to the APANPIRG Air Navigation Deficiencies listed in Appendix B.	ICAO APAC Office	State Letter	December 2013
D 24/59 A & C	**ATM/AIS/SAR, AOP, CNS and MET Deficiency List**	That, the list of air navigation deficiencies reported and identified in ATM/AIS/SAR, AOP, CNS and MET Deficiency List be updated as detailed in Appendix A to D to the Report on Agenda Item 4.	ICAO APAC office	Updated deficiency list	December 2013