INTERNATIONAL CIVIL AVIATION ORGANIZATION

TWENTY SIXTH MEETING OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (APANPIRG/26)

Bangkok, Thailand, 7 – 10 September 2015

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

3.4 **CNS**

REPORT ON THE NINETEENTH MEETING OF CNS SUB-GROUP

(Presented by Chairman of CNS SG)

SUMMARY

This paper presents the report of the Nineteenth Meeting of the CNS Sub-group (CNS SG/19) held at the ICAO Regional Office, Bangkok, Thailand, from 20 – 24 July 2015. The meeting is invited to review the report and adopt the draft Decisions and Conclusions formulated by the Sub-group.

This paper relates to –

Strategic Objectives:

*A: **Safety** – Enhance global civil aviation safety*

*B: **Air Navigation Capacity and Efficiency**—Increase the capacity and improve the efficiency of the global aviation system*

*E **Environmental Protection** — minimize the adverse environment effects of civil aviation activities.*

1. INTRODUCTION

1.1 The Nineteenth Meeting of the CNS Sub-group was held from 20 to 24 July 2015. The meeting was attended by 75 participants from 23 States/Administrations, IATA, IBAC, IFALPA and two Communication Service Providers – SITA and Rockwell Collins. A summary report of the meeting for consideration by APANPIRG/26 is provided in the Attachment to this paper. Full report of the Sub-group was posted on the ICAO APAC Office website and can be accessed at the following webpage:
http://www.icao.int/APAC/Meetings/Pages/2015-CNS-SG19.aspx

2. DISCUSSION

2.1 The meeting considered 27 Working Papers and 23 Information Papers covering its 10 Agenda Items.

2.2 Based on the outcome of discussions on various Agenda Items, the meeting developed 22 Draft Conclusions and a Draft Decision for consideration by APANPIRG/25 Meeting. In addition, the Sub-group made 1 Decision (19/10) relating to the work programme of Ionospheric Study Task Force. List of these outcomes are as follows:

Draft Conclusion 19/1	-	Revised AMHS Naming Plan
Draft Conclusion 19/2	-	Second Iteration of CRV Cost Benefit Analysis (based on RFI)
Draft Conclusion 19/3	-	CRV preliminary Safety Analysis Follow-up
Draft Conclusion 19/4	-	CRV Cost Arrangement Framework
Draft Conclusion 19/5	-	Recommendations for AIDC Implementation
Draft Conclusion 19/6	-	Use of Pan regional ICD for AIDC
Draft Conclusion 19/7	-	PBN in a page
Draft Conclusion 19/8	-	PBN Procedure Safety Assessment Checklist and Record of Hazard Template
Draft Conclusion 19/9	-	Need for ionospheric models in the APAC Region
Draft Conclusion 19/11	-	Standard for exchange and sharing of GNSS data in the APAC Region
Draft Conclusion 19/12	-	Revised Navigation Strategy for the Asia/Pacific Region
Draft Conclusion 19/13	-	Amendment to ADS-B Implementation and Operations Guidance Document (AIGD)
Draft Conclusion 19/14	-	Airworthiness and Filtering Process for ADS-B Avionics Equipage
Draft Conclusion 19/15	-	Template for Promulgation of ADS-B Avionics Equipage Requirements
Draft Conclusion 19/16	-	Guidelines for Airworthiness Approval for ADS-B Avionics Equipage
Draft Conclusion 19/17	-	ADS-B OUT Forward Fit Equipage
Draft Decision 19/18	-	Surveillance Implementation Coordination Group
Draft Conclusion 19/19	-	Inter-regional ADS-C Reporting Interval Task Force
Draft Conclusion 19/20	-	Strategic planning and tactical use of VHF frequencies in the APAC Region from 2015 onwards

Draft Conclusion 19/21 - Transition to the new global database

Draft Conclusion 19/22 - Assignment of back up frequencies in APAC Region

Draft Conclusion 19/23 - Amendment to the APAC frequency allotment plan

Draft Conclusion 19/24 - CNS parts for e-ANP

2.3 In the **Attachment** to this paper, a summary report provides the outcome of the CNS SG/19 Meeting including all Draft Conclusions for consideration by APANPIRG/26 Meeting.

2.4 Appendices used from CNS SG/19 Report in the Summary Report carry the same Appendix numbers as those in the meeting report of CNS SG/19 for easy reference.

2.5 The updated ATN/AMHS and AIDC implementation status and the ADS-B implementation status in the Asia and Pacific Regions are provided in the **Appendix F** and **Appendix J** to the meeting report.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

i) review the summary report on the outcome of CNS SG/19 meeting; and

ii) consider adoption of draft Conclusions and draft Decision developed by the CNS Sub-group.

— — — — — — —

Agenda Item 1: Adoption of agenda

1.1 The tentative agenda items presented in WP/01 was adopted by the meeting.

Agenda Item 2: Review outcome of relevant meetings:

DGCA Conf/51 Outcome (WP/02)

2.1 The meeting reviewed actions items developed by the 51st Conference of Directors General of Civil Aviation (DGCAs), Asia and Pacific Regions (DGCA/51) held in Hong Kong, China in November 2014. The Conference developed in total 29 Action Items, among which 51/2, 51/4, 51/6, 51/7, 51/8, 51.9, 51/13, 5/14 5/15, 5/26 and 15/28 are relevant to CNS SG. The meeting urged States and Administrations to take action on the agreed Action Items and provide feedback on actions taken by Administrations. The meeting also noted the theme topics for DGCA Conf/52 to be held in Philippines from 26 to 30 October 2015.

Report of the CNS SG/18 and APANPIRG/25 Meetings (WP/09)

2.2 The meeting carried out a review of the actions taken by APANPIRG/25 on the Decisions and Conclusions formulated by the Eighteenth Meeting of the CNS Sub-group (CNS SG/18). The meeting noted with satisfaction the actions taken and the progress achieved by States and the Secretariat. The status of the follow-up action as reviewed by the meeting is provided in Attachment 1 to WP/09. Regarding Conclusion 25/30, USA informed the meeting that SITA and USA will be conducting a meeting on the upgrading type A and Type B connection between SITA and ANSPs in Atlanta, USA in the next few months. The meeting also reviewed the list of Outstanding Conclusions up to APANPIRG/23 (2013). The remaining outstanding items in the CNS fields would require further action and are expected to be completed by the mid. of 2016.

Outcome of the Second meeting of RASG/APAC Coordination (WP/04)

2.3 The meeting reviewed the outcome of Second APANPIRG-RASG-APAC Coordination Meeting held on 21 May 2015. The APANPIRG Sub Groups are expected to coordinate with RASG APAC/APRAST on the 10 Regional Air Navigation Priorities endorsed by APANPIRG/25 and determine the ASBU modules where correlation exists so as to avoid duplication of efforts. The meeting observed that the chart in the RASG APAC/3 final report illustrated the correlation between the identified RASG study and the associated ASBUs. In this connection, the meeting proposed suggestions detailed in **Appendix A** to this Report for consideration by RASG/APAC. These suggestions may also be transferred to the ATM SG for further comments at its next meeting scheduled for 3-7 August 2015. The result from both SGs may then be forwarded to the RASG for their consideration.

FIT-ASIA/4 and RASMAG/20 Outcomes (WP/05)

2.4 The meeting noted the outcome of the Fourth Meeting of the Future Air Navigation Systems Interoperability Team-Asia (FIT-Asia/4) and the Twentieth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/20) held in Bangkok in May 2015. The meeting noted a number of draft Conclusions regarding the proposed Data Link Performance Reporting Template and Guidance and the proposed ANS Deficiencies Relating to Data Link Performance Monitoring and Analysis. The meeting also noted the overview of safety assessment result from a regional perspective which CNS Subgroup would have a role to play.

Agenda Item 3: Aeronautical Fixed Service (AFS)

Report of ACSICG/2 meeting (WP/7 and WP/27)

3.1 The meeting reviewed and took action on the report of the Second Meeting of ACSICG held in May 2015: http://www.icao.int/APAC/Meetings/Pages/2015-CRVTF4+ACSICG2.aspx)

3.2 The meeting noted that the VSAT connectivity to a number of Pacific Islands States is planned which will support IP-based AFTN/AMHS connections and voice. The meeting noted that the World Bank had issued a tender which would fund the installation of VSAT connections at a number of locations in the Pacific Region.

3.3 It was encouraging to note that a number of new operational AMHS had been put into operation in the end of 2014 and beginning of 2015 in the Region and more planned implementation will take place in 2016. The meeting noted the updated AMHS implementation planner and the Regional ATN/AMHS implementation Status Table.

Revised AMHS Naming Plan

3.4 The meeting reviewed the revised AMHS Naming Plan which provides planning and technical guidance on the naming convention for AMHS. Based upon the ATN SARPs as published in ICAO Annex 10 and updated ICAO Doc. 9880, naming and addressing plans are required to be developed by ICAO regions concerned. The updated sections in the revised document for the naming assignment conventions for allocating Originator/Recipient (O/R) names were highlighted in the report of ACSICG. Accordingly, the meeting endorsed the following draft Conclusion:

Draft Concluson 19/1 - Revised AMHS Naming Plan

That, the revised AMHS Naming Plan provided in **Appendix B** to the Report be adopted.

3.5 The meeting noted ACSICG had reviewed updated CBA for CRV project and endorsed following draft Conclusion:

Draft Conclusion 19/2 – Second Iteration of CRV Cost Benefit Analysis (based on RFI)

That the second iteration of the CRV Cost Benefit Analysis provided in **Appendix C** (with password to access) be adopted and distributed to States/Administrations for their reference.

3.6 The meeting also endorsed the following draft Conclusion taking into account the preliminary safety analysis material presented through (WP27) by France (New Caledonia):

Draft Conclusion 19/3 - CRV preliminary Safety Analysis Follow-up

That, CRV Participating States/Administrations be urged to consider the CRV safety specified in the CRV Preliminary Safety Analysis v1.0 as a basis for their local safety case, perform their local safety case, and report to APANPIRG through the appropriate body.

Note: to support the local safety case, a template is provided in **Appendix D** to this Report based on WP/27.

3.7 The meeting further noted the proposed cost arrangements between Administrations. In order to facilitate Administrations with negative CBA value to implement CRV project to achieve common benefits, the meeting encourage those Administrations in a position to do so, to work out cost arrangements with their counter parts. In view of the foregoing, the meeting endorsed following Draft Conclusion:

Draft Conclusion 19/4 – CRV Cost Arrangement Framework

That, noting that cost arrangements on current telecommunications exist between some States/Administrations and considering the result of the second iteration of the CRV Cost Benefit Analysis, APAC States/Administrations be advised to:

- make their own local Cost benefit analysis as needed;

- start discussions of possible new or improved cost arrangement frameworks with other ICAO Member State(s)/Administration(s), based on the Request For Information results; and

- endeavor to establish arrangements for mid 2016.

Inter-regional Connection issues

3.8 The meeting noted the need to replace existing International Private Line (IPL) between Air Navigation Service Providers (ANSPs) with common network using standard Internet Protocol (IP) interface. The equipment to support IPL service is obsolete and has been difficult to maintain as spare part inventory is depleting and many parts are no longer manufactured. ANSPs in the Asia/Pacific region who have IPLs with other ICAO regions should consider the following options to replace their existing IPLs:

1) Invite counterparts in other ICAO regions to join CRV; or
2) Join the respective ICAO regional IP network (e.g. PENS) ; or
3) Establish a bi-lateral agreement for a single telecommunication network vendor

3.9 The meeting invited States with inter-regional entry/exit points including Australia, China, India, Japan, Singapore and Thailand to provide addresses and contact points of their counter parts in the other Regions so the potential service providers may be requested to provide quotation on the options for including those circuits in the CRV project proposal.

SWIM Seminar/Workshop in 2016

3.10 To follow up APANPIRG Conclusion 25/43 - Promote understanding of SWIM in APAC Region with focus on both technical and operational aspects for SWIM development, a workshop is scheduled for April-June 2016. States/Administrations were invited to support the event by providing SME. USA, China, Japan and Singapore expressed their willingness to support the event. Australia, Republic of Korea and Thailand were requested to confirm their support. Australia recommended conducting the workshop in conjunction with other associated meeting so approval of travel for participants from States would be justified.

Proposed joint action by the ATFM/SG

3.11 The meeting noted that ATFM/SG/5 made a decision (ATFM/SG/5-1) on the need for an ICD for technical ATFM communications solutions. A small working group comprised of China, Hong Kong China, India, Indonesia, Japan, Singapore, Thailand was established to draft an Operational Requirements document and a technical interface control document (ICD). The meeting noted that ACSICG encouraged member Administrations of the ATFM/IR/SWG to nominate additional telecommunication subject experts in addition to the ATFM expert for joint development of the ICD. ATFM SG was requested to provide the draft ATFM ICD to the ACSICG for review and comments once it is ready.

Report of the First meeting of AIDC Task Force (WP/08)

3.12 The meeting reviewed the report of the first meeting of Asia and Pacific AIDC Task Force (APA TF/1, June 2015 http://www.icao.int/APAC/Meetings/Pages/2015-APA-TF1.aspx) and took following actions.

3.13 The meeting noted the recommendations consolidated by the Task Force which provide implementation guidance to States/Administrations and endorsed the following draft Conclusion:

Draft Conclusion 19/5 –Recommendations for AIDC Implementation

That, a list of recommendations provided in **Appendix E** to this Report be adopted and distributed to States/Administrations for AIDC Implementation guidance.

3.14 Considering that the pan regional ICD for AIDC had been adopted by APANPIRG/25 meeting, the meeting endorsed the following draft Conclusion.

Draft Conclusion 19/6 – Use of Pan regional ICD for AIDC

That, States/Administrations in the Asia/Pacific Regions be encouraged to use the Pan Regional ICD for AIDC for any planned new ATM automated system or updating ATM automated systems for AIDC function.

3.15 The Secretariat highlighted the ATS transfer human errors related safety issues which were identified by RASMAG/18 and RASMAG/20 meetings. Considering that ATS Inter-facility Data Communications (AIDC) is an important means of minimizing Large Height Deviations (LHD), Asia/Pacific States were urged by APANPIRG to 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.

3.16 The meeting noted issue/problems report form developed by the APA TF for use by States/Administrations which is provided in the Appendix B to the Task Force meeting report. States/Administrations had been urged to submit the identified issues using the form to the ICAO Regional Office (A State Letter Ref.: T 8/3.5:AP097/15 (CNS) dated 07 July 2015 refers).

Review of regional specific requirements for APAC e-ANP (Table CNS 1E)

3.17 The meeting endorsed the recommendation to keep AIDC planning table into the regional air navigation plan (new e-ANP) as regional specific requirement. The updated table and draft Conclusion was considered by the meeting under Agenda Item 8 (WP/03).

Development of APAC AIDC Implementation Guidance Material

3.18 The meeting noted that the APA Task Force was tasked to develop additional AIDC implementation guidance material as mandated in the TOR as Task C.

Sharing of experience on AIDC implementation including training and implementation packages

3.19 The meeting noted that a number of papers presented to APA TF/1 meeting by Indonesia, Singapore, Malaysia, Sri Lanka and USA on the AIDC implementation status. The meeting congratulated all States for having achieved the successful conduct of trials and/or implementation of AIDC. The AIDC including ATN/AMHS implementation status in the APAC Region further updated by the meeting is provided in **Appendix F** this Report.

Benefits of AIDC Implementation

3.20 The first meeting of the APA Task Force reconfirmed the benefits brought about by introduction of AIDC such as reduction of controller workload, increasing efficiency and capacity for operators, and enhancing safety to stakeholders. Errors such as large height deviations are eliminated as human errors are minimized with the automated coordination process. Although, some States only use a small message set currently, the benefits of AIDC operations have reap substantial benefits to States as voice coordination is reduced drastically.

Next APA TF Meeting

3.21 The meeting noted that the next meeting of the AIDC Task Force is scheduled for early 2016. A Teleconference for the small working group for development of the guidance material is scheduled for October 2015.

Progress of AIDC Implementation in Singapore (WP/14)

3.22 Singapore presented the progress of AIDC Implementation with ATS units of its adjacent States. States concerned were urged to implement AIDC early in view of its benefits. The detailed implementation was provided to the meeting in a table form.

AIDC implementation status in India (WP/17)

3.23 India presented the implementation status of AIDC in India and with neighboring ATSUs. The major observed implementation issues were also highlighted in the papers such as inconsistent CRC.

3.24 A number of successful trials had been carried out between various ATS units in India including those with different ATM systems. India is having boundaries with adjacent ATSUs of both intra and inter regional States (MID/AFI) and has plans to establish AIDC connections with Bangladesh, Myanmar, Thailand, Pakistan, Nepal, Seychelles, Malaysia, Indonesia, Sri Lanka, Kenya, Oman and Maldives, Mauritius and Somalia. Successful trials have been carried out with adjacent ATSUs of neighboring states in the sub-region between:

- Chennai – Kuala Lumpur (Malaysia)
- Chennai – Male (Maldives)
- Ahmedabad – Karachi (Pakistan)
- Delhi – Karachi (Pakistan) (Successful one way)

COM Coordination meetings (IP/02)

3.25 In order to improve AFS communication between States and address identified air navigation deficiencies in CNS fields, three COM coordination meetings were held since CNS SG/18 meeting including:

- First one was held in at Headquarters of AAI, New Delhi, India from 16 to 17 December 2014. The meeting discussed COM issues between India and Pakistan and between Afghanistan and India and developed an action plan.

- A follow-up meeting was held in the IATA Office, Abu Dhabi, and UAE on 25 - 26 February 2015. The objective of the meeting was to update the remedial action plan for the identified air navigation deficiency between Afghanistan and Pakistan.

- Another meeting between China and Pakistan was held at Headquarters of ATMB in Beijing, China from 7 to 9 May 2015. The meeting discussed about the ground/ground communication issues between Lahore and Urumqi and Air/ground communication around boundary between China and Pakistan from technical and operational aspects through development of a remedial action plan.

System Wide Information Management (SWIM) (IP/3)

3.26 Japan made a presentation on their informaiton managment in CARATS project associated with SWIM concept. JCAB intended to convey the importance to increase common awarenes among concerned members through active discussions. Japan reconfirmed its support and the contact point for the planned SWIM workshop in 2016.

Options to Support SWIM Environment (IP/20)

3.27 USA presented the FAA’s operational and implementation analysis to support SWIM environment between Air Navigation Service Providers (ANSPs) utilizing existing infrastructure. The ATS Message Handling System (AMHS) has been standardized and could be utilized for common access to both existing interface and to SWIM with each individual ANSP’s specific SWIM Gateway.

AFTN messages length and max. number of characters per line

3.28 Hong Kong China brought up for attention by the meeting regarding State letter (AN 7/1.3.104-15/31) on the proposal for amendment to Annex 10, Vol. II relating to the AFTN message length and max characters per line etc. dated 24 April 2015. Hong Kong China highlighted the potential impacts to the region by this proposal considering the tight timeframe and migration to ATN/AMHS and CRV in progress in the region. Japan also shared similar concerns as it would be costly to modify their system to support this function. However, FAA stated that this recommended practice would provide flexibility to those Administrations who have plans to upgrade their system to accommodate new applications. USA also indicated that the amendment may impact those AFTN stations that have a number of AFTN connections with different signal speed. The ICAO urged to States to reply to the State Letter and to express comments by 24 July 2015.

CRV Tender and evaluation Package

3.29 The meeting reviewed the CRV tender package and the evaluation package developed by the CRV Task Force and agreed by 15 CRV Pioneer States/Administrations on 21 and 22 July 2015. The tender package consists of several parts including instructions to Tenderers; Terms of Reference (TOR) and Terms and Conditions. Considering that the tender package needed to be published by ICAO TCB in early August 2015 without further delay, the meeting agreed to publish the package in accordance with the schedule. The meeting encouraged those States/Administrations that are not CRV Pioneer States to indicate their intention to participate in the stage 2 (implementation) as early as possible so that the tender package indicates this intention.

Agenda Item 4: Aeronautical Mobile Service (AMS)

4.1 Under this agenda item, a number of information papers were presented by States:

– IP/07 presented by India highlighting implementation of new state-of-art IP based Voice Communincation Control System (VCCS) to cope with the growth of air traffic. It was one of the major ANS initiatives to enhance safety, efficiency and increasing airports & airspace capacity by networking of systems in implementing Upper Air Space Harmonization in Kolkata FIR.

– IP/13 by Japan informed that a trial operation of DEPARTURE CLEARANCE through DATA-LINK SERVICE (DCL) at Tokyo international airport and Narita international airport had been conducted from 28 June 2012 to 19 August 2015. Then DCL service was expected to be put into operation from 20 August 2015.

– IP/19 – by New Zealand presented a summary of the issues encountered while designing and implementing Digital Clearance delivery (DCL) in the New Zealand domestic FIR. The following key issues were encountered and ways to resolve them were highlighted:

  - CLD message format conflicting with domestic initial clearance content
  - Avionics issues with message format or content
  - Exposure to real request messages during live ‘end-to-end’ testing
  - ED-85A/AIRINC622 non-compliant airspace users who wished to participate

4.2 Republic of Korea informed the ACSICG/2 meeting of VHF DATA LINK System implementation status in Republic of Korea in particular for VDL M2 during the period from Oct. 2014 to Dec. 2015.

4.3 In this connection, the meeting recalled that implementation of data link based application like DCL using industry standard ED-85A and AIRINC622 had been encouraged by APANPIRG. It had been enclosed in the regional aeronautical communication strategy for APAC Region. It may be considered for inclusion into the regional Seamless ATM Plan in its next consolidated amendment in 2016.

Agenda Item 5: Navigation

Performance-based Navigation (PBN) Implementation Coordination Report

5.1 The meeting reviewed reports of the first meeting of Performance Based Navigation Implementation Co-ordination Group (PBNICG/1) and second meeting of the PBNICG as well as the PBN Seminar which preceded the second meeting. The PBNICG developed a document called the 'PBN-in-a-page' to summarise relevant PBN-related information from various ICAO documents into one page to be used as a quick reference material during PBNICG meetings as well as during PBN airspace and route design sessions. The meeting found this document useful and endorsed the following Draft Conclusion as developed by the PBNICG, namely:

Draft Conclusion 19/7 -- PBN in a page

That, the PBN-in-a-page document be adopted as a regional supporting material and be published on the ICAO Regional Office's website after review by relevant Panels and Study Group as well as on ICAO's website.

5.2 Recognising the difficulties of safety assessment of PBN procedures which are required by various ICAO documents, the PBNICG developed a PBN Procedure Safety Assessment Checklist and Hazard Template to facilitate this assessment. The Template can be used to record and analyse the hazards identified as well as document the proposed mitigation measures. The meeting found this Checklist and Template useful and endorsed the following Draft Conclusion:

Draft Conclusion 19/8 - PBN Procedure Safety Assessment Checklist and Record of Hazard Template

That,

a) the PBN Procedure Safety Assessment Checklist and Record of Hazard Template be adopted as regional supporting material; and

b) the checklists and template be published on the ICAO Regional Office's website.

<u>Ionospheric Studies Task Force outcome</u>

5.3 The meeting was briefed on the studies done by the Task Force. In particular, the Task Force had identified the need for local threat model for GBAS for the APAC Region and it formulated the following the Draft Conclusion which the meeting endorsed: -

Draft Conclusion 19/9 - Need for ionospheric models in the APAC region

That, considering that extreme ionospheric gradients were observed in parts of APAC region through data collection, and in Brazil likewise, the need for GBAS threat model is confirmed**.**

5.4 The Task Force reported that these ionospheric threat models would only be available for review at the CNS SG/20 meeting in 2016. The meeting agreed with the Task Force's schedule. The meeting also agreed with the Task Force that these threat models being developed as outcomes of the Task Force should be properties of ICAO. The meeting also agreed that these threat models should be published in both ICAO documents as well as technical journals for public use. The Task Force said that it would develop a framework for maintenance of these models for discussion at the CNS SG/20 meeting

5.5 The meeting was also briefed about the need for guidance material for developing safety case of using SBAS services in the APAC Region, namely how to mitigate operational hazards related to the ionospheric threats. As a result the Task Force developed the following Decision which the meeting endorsed:

Decision 19/10 - Need for SBAS ionospheric safety case model

That, considering the various factors such as variable ground stations network layouts and service levels, guidance material for establishing a SBAS ionospheric safety case model is needed to be developed**.**

5.6 The Task Force also recommended the adoption of two ITU standards for the APAC Region to facilitate exchange and sharing of GNSS data in the study of ionospheric effects on navigation systems. The meeting endorsed the following draft Conclusion:

Draft Conclusion 19/11 – Standard for exchange and sharing of GNSS data in the APAC Region

That, Considering the need for sharing GNSS data to study the ionospheric effects on navigation systems, the SCINTEX and GTEX Formats be adopted as ICAO APAC standard for exchange of GNSS data and these formats be posted on the ICAO APAC Regional Website.

5.7 The meeting was briefed about how airport environment and Localiser antenna selection at the Beijing Capital Airport could impact the ILS signals of Runway 01 and 36L during CAT III operations. The meeting was also briefed that the India's GAGAN had obtained required certifications for RNP 0.1 and APV 1.0 Service over Indian Airspace.

5.8 Japan briefed the meeting about its SARPs validation activities for CAT III GBAS. To do so, Japan had developed a ground experimental prototype and an airborne experimental system, following draft international standards. Successful flight trials were conducted, with and without ionospheric disturbances.

5.9 The meeting was also briefed by Japan regarding its stocking-up of standby equipment, for fast turn-around in times of emergencies.

5.10 China briefed the meeting about status of its BeiDou Navigation Satellite System (BDS) and its SARPs. The BDS had officially been providing Open Service (OS) since 27 December 2012. The BDS will provide global Open Service (OS) after its full deployment in 2020. The development of BDS SARPs was initialized in ICAO in 2011. The approval of BDS SARPs is targeted for 2018, in line with the standardization of the next generation of aviation receivers.

5.11 Australia informed the meeting that Australia was transitioning to a largely satellite-based CNS/ATM structure. This includes publishing mandates for the carriage of GNSS and ADS-B and the subsequent removal of some 200 ground-based navigation aids.

5.12 Major implementation dates are February 2016 for the carriage of GNSS (with TSO C145/6 preferred) and the carriage of ADS-B by February 2017. Australia had already in place a mandate for carriage of ADS-B above FL290 and a very high compliance had been achieved. The PBN transition is planned for 26 May 2016 with the publication of the required charts and associated material in AIP.

5.13 Australia has also deployed a GBAS (GLS) at Sydney airport and the unit provided Category I level approaches to all 6 runways. A unit at Melbourne airport is being installed with Brisbane airport under consideration. The use of the GLS is available to all aircraft that have State of Registry approval for GLS use – that is the aircraft is fitted and the crews are trained and current.

5.14 Australia participated in the Interim Global Tracking Initiative and now has in place the key recommendations from ICAO for most of the Australian Oceanic airspace.

5.15 The meeting reviewed and updated the navigation strategy and formulated the following draft Conclusiong:

Draft Conclusion 19/12 – Revised Navigation Strategy for the Asia/Pacific Region

That, the revised Navigation Strategy for APAC Region provided in **Appendix G** to the Report be adopted.

Agenda Item 6: Surveillance

6.1 Under this agenda, the meeting reviewed the report of the Fourteenth Meeting of the Automatic Dependent Surveillance – Broadcast (ADS-B) Study and Implementation Task Force (ADS-B SITF/14) held in Christchurch, New Zealand in April 2015 including the outcome of the Tenth meeting of SEA/BOB ADS-B Working Group held in Singapore in November 2014.

6.2 The meeting noted that an ADS-B Seminar was held in conjunction with the ADS-B SITF/14 meeting which provided an opportunity for sharing information and experience focused on mandating carriage/operational use of ADS-B from regulators; airframe and avionics manufacturers; air space users' perspective; system/equipment suppliers, and Air Navigation Service Providers.

6.3 The meeting noted that lack of separation minima for using ADS-B/CPDLC and ADS-B/SATCOM Voice (DCPC) was an issue identified by the SEA/BOB Working Group. Considering that the following draft Conclusion formulated the working group and endorsed by ADS-B SITF on the need for separation minima using ADS-B with CPDLC and ADS-B with SATCOM voice in remote airspace outside the VHF coverage was relevant to the operational requirement, Chairman of CNS SG agreed to refer it to ATM SG of APANPIRG for further consideration.

Draft Conclusion xx/xx – Need Guidance on Separation Minima using ADS-B with CPDLC and ADS-B with SATCOM voice.

That, ICAO (SASP) be invited to study the separation minima that can be applied using ADS-B with CPDLC and ADS-B with "DCPC" type (i.e. without operators) of SATCOM voice in remote airspace outside the range of VHF voice communications of the responsible ATC unit.

6.4 Regarding the need to study the space-based ADS-B application, the meeting noted the Decision 14/2 made by the ADS-B Task Force.

Date and venue for the next WG meeting

6.5 The next SEA/BOB ADS-B working group meeting is scheduled for November or early December 2015. The member States/Administrations were invited to coordinate with the Secretariat for hosting the meeting.

Amendment to AIGD

6.6 The meeting identified the need to update the AIGD. The source of amendments was derived from number of papers presented to the Task Force meeting. The consolidated amendment to AIGD is provided in **Appendix H** to the Report. Accordingly, the meeting endorsed the following Draft Conclusion:

Draft Conclusion 19/13 – Amendment to ADS-B Implementation and Operations Guidance Document (AIGD)

That, the consolidated amendment to the AIGD provided in **Appendix H** be adopted.

Operational Approval for Receiving ADS-B Surveillance Service

6.7 APANPIRG/25 held in September 2014 did not adopt the second part of the draft Conclusion formulated by ADS-B SITF/13 meeting i.e. "States in the Asia and Pacific Regions may choose to require or not require an Operations Specification or Operations Approval for ADS-B OUT". The ADS-B SITF/14 meeting further discussed this issue including the outcome of ad hoc working group and SEA/BOB ADS-B WG. As a result of discussion, the ADS-B SITF developed three Draft Conclusions which were endorsed by the CNS SG/19:

Draft Conclusion 19/14 – Airworthiness and Filtering Process for ADS-B Avionics Equipage

That, States:

a) do not require operational approval for the operational use of ADS-B OUT by ATC;

b) note that operational approval may be required for ADS-B IN applications where there is a safety case;

c) monitor ADS-B transmissions from aircraft and take action to ensure compliance with Regional Supplementary Procedure MID/ASIA Section 5.5; and

d) provide capabilities to either:
   - reject ADS-B data from aircraft which are known to transmit misleading ADS-B data until corrective actions have been successfully conducted; or
   - implement procedures to ensure that such aircraft are safely managed.

Draft Conclusion 19/15 – Template for Promulgation of ADS-B Avionics Equipage Requirements

That, based on APANPIRG Conclusion 20/54, States intending to implement ADS-B based surveillance service for a defined airspace and having not published regulations be urged to promulgate mandating rules for ADS-B Avionics Equipage Requirements as soon as possible using the following template:

On and after dd/mm/yyyy, if an aircraft operates on airways (insert routes)…………at or above FLXXX………(or in defined airspace boundaries ……………. at or above FLXXX):

the aircraft must carry serviceable 1090 MHz ES ADS-B transmitting equipment that has been certificated as meeting EASA AMC 20-24, or FAA AC No. 20-165A – Airworthiness Approval of ADS-B, or meets the equipment configuration standards in Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia.

Note: This Conclusion supersedes APANPIRG Conclusion 21/39 (i.e. removes any requirement for operations approval)

Draft Conclusion 19/16 – Guidelines for Airworthiness Approval for ADS-B Avionics Equipage

That, States be advised to use the guidelines provided in **Appendix I** for Airworthiness Approval for ADS-B OUT Avionics Equipage.

Note: This Conclusion supersedes APANPIRG Conclusion 21/40

6.8 In addition, the meeting also agreed to update the AIGD by removal of the reference to operations approval for ATC use of ADS-B OUT.

Enhancing Aviation safety through Establishment of a Regional ADS-B Avionics Problem Report Database (APRD)

6.9 The meeting noted the latest satisfactory progress in establishment of a Regional ADS-B Avionics Problem Reporting Database (APRD) in collaboration with the ICAO Regional Sub-office (RSO). During 51st DGCA Conference held in November 2014, Hong Kong China presented a paper outlining a proposal on the establishment of the Regional APRD for sharing the analysis results with a view to enhancing aviation safety for the Region. The proposal gained support from the Conference. The demonstration made by Hong Kong China at the Task Force meeting included the work flow of problem reporting and phases of processing, and also the roles of the reporting Administration/ANSP, ICAO, verifying and follow-up parties, as well as a prototype of the database and human-machine interface (HMI) design. The APRD will contain useful information on the generic ADS-B avionics performance problem commonly encountered in the Region. The APRD would be posted on an ICAO secure website, with States/Administrations requesting access required to nominate registered points-of-contact, who would be notified whenever there were updates to the APRD.

Regional ADS-B Requirement for New Aircraft

6.10 ADS-B SITF proposed the revised wording for an Asia/Pacific Region ADS-B forward fitment commencing in 2018. It was pointed out that as the lowest cost of fitment of ADS-B was during manufacture, the proposal would allow the avoidance of later retrofit costs, bringing long term savings to the aviation community without any significant cost in the short term. While the Asia/Pacific Region had taken the pragmatic view of ADS-B implementation using DO-260 and DO-260A, implementation of DO-260B would leverage off the Europe (from 2016) and FAA mandates (from 2020 not only for forward fit) and promote global harmonization. Mandates for forward fit would minimize the economic burden on aircraft operators, as it would not apply to existing aircraft.

6.11 Defining a forward fit mandate according to the date of issue of a certificate of airworthiness could result in the mandate being applied to an imported aircraft that is quite old. Mandates determined by date of manufacture were a better option. The meeting noted that the overall purpose was to commence the transition to a DO-260B environment by applying only to newly manufactured aircraft from a defined future date. Accordingly, the meeting endorsed a revised Draft Conclusion as follows:

Draft Conclusion 19/17- ADS-B OUT Forward Fit Equipage

That, States/Administrations in APAC Region be strongly encouraged to mandate that registered aircraft with a maximum certified take-off mass exceeding 5 700 kg or having a maximum cruising true airspeed capability greater than 250 knots, with a date of manufacture on or after 8 June 2018 (two years after the European forward fitment mandate is effective) be equipped with ADS-B avionics compliant with Version 2 ES (equivalent to RTCA DO260B) or later version.

6.12 Status of Implementation issues and experience gained in monitoring performance of aircraft were provided by a number of States/Administrations at ADS-B SITF meeting including Australia, China, Indonesia, Japan, Philippines, Republic of Korea, Singapore and USA. The meeting noted the updated ADS-B implementation status in the APAC region which is provided in the **Appendix J** to this Report.

ADS-B in the South Pacific

6.13 Tonga provided information on the ADS-B implementation plans of the governments of the Republic of Kiribati, Samoa, Tonga and Tuvalu (and potentially Vanuatu) under the Pacific Aviation Investment Program (PAIP), a World Bank initiative. The PAIP included investments in four main components: Aviation Infrastructure Improvements, Aviation Sector Reform, Future Investments for Sustainability and Program Support and Training. The Aviation Infrastructure Improvements included ADS-B implementation and supporting communications. ADS-B equipage was expected to be made mandatory for all resident aircraft.

Future work of ADS-B SITF

6.14 The ADS-B SITF meeting recalled that the Task Force had met 14 times in the past 12 years. A number of guidance materials in particular for the AIGD had been developed and then adopted by APANPIRG from time to time to assist States in the planning and implementation of ADS-B. The Task Force would further discuss outstanding issues/tasks at its next meeting and, depending on the scale of work involved, any uncompleted tasks would be addressed by other contributory bodies of APANPIRG after its next meeting. In addition, the need for guidance on Mode S SSR planning and implementation was identified, as the region was not taking advantage of the technology that was available to improve safety and efficiency outcomes.

6.15 In view of the foregoing, the meeting agreed to the proposal of the Task Force that ADS-B SITF should meet in its present form for one more meeting in 2016 to provide the opportunity to finalize the current outstanding action items where possible, and to arrange for the transfer of action items to new body which would cover broader surveillance technologies including ADS-B, and SSR Mode S and Multilateration applications. The next meeting of the ADS-B SITF would be a back to back meeting with a new surveillance body.

6.16 In this connection, the meeting reviewed and agreed to the draft Terms of Reference for a broader "Surveillance Implementation Coordination Group (SURICG)". Consequently, the meeting formulated following draft Decision:

Draft Decision 19/18 - Surveillance Implementation Coordination Group

That, the Surveillance Implementation Coordination Group (SURICG) be established with Terms of Reference provided in **Appendix K** to this Report.

6.17 It was also suggested that SEA/BOB ADS-B WG which currently reports to ADS-B SITF would report to APANPIRG through SURICG from 2017 onwards.

Australian and New Zealand Use of Downlink Aircraft Parameters DAPs

6.18 The meeting noted that Australia and New Zealand presented information at ADS-B SITF/14 meeting describing the plan to utilize SSR Mode S Downlink Aircraft Parameters (DAPs). Mode S radars had the ability to interrogate 'registers' in Mode S SSR transponders to obtain useful information for ATC. Some ADS-B transmissions included the same information. Information already available from a large number of aircraft included Flight ID, selected vertical intention (pilot or FMS selected level and barometric pressure setting), track and turn report (roll angle, true track angle, groundspeed, track angle rate and true airspeed), heading and speed (magnetic heading, indicated airspeed, Mach no., true airspeed and inertial vertical velocity).

Note of appreciation

6.19 The meeting expressed its appreciation and gratitude to the Civil Aviation Authority of New Zealand and Airways New Zealand for hosting the ADS-B Seminar, the excellent arrangements made for the meeting and all activities arranged. The meeting also thanked CAA Singapore for hosting the Tenth meeting of the ADS-B SEA/BOB WG meeting.

Update on the ADS-B Collaboration Project in the South China Sea (WP/15)

6.20 Singapore presented the paper on the collaborative efforts of States to achieve a seamless ADS-B surveillance coverage over a portion of the South China Sea area with the aim of improving safety, capacity and efficiency. The meeting noted the progress of the collaborative efforts of Indonesia, Singapore and Viet Nam to achieve seamless ADS-B surveillance coverage over a portion of the South China Sea area.

6.21 Singapore and Viet Nam had agreed on a progressive phased approach to reduce longitudinal separation on specified ATS routes to allow airspace users the optimum benefits of ADS-B. From the previous 50 NM longitudinal separation, the minimum separation would be reduced to 20NM over 3 phases commencing in December 2013 and planned to be completed at the end of 2015.

Surveillance Data sharing between India and Myanmar (WP/19, IP/16)

6.22 India and Myanmar provided updates on their ADS-B implementation programme and readiness status for ADS-B data sharing in accordance with guidance of APANPIRG. The meeting congratulated to the States for the progress made and encourage States to overcome the identified issues to realize the data sharing in order to enhance flight safety and coverage of surveillance in the Bay of Bengal area.

6.23 IATA emphasized the importance of collaborative cooperation on surveillance sharing in South China Sea and Bay of Bengal and appreciated the efforts made by States and congratulated for the achievement made.

6.24 Through following information papers, States introduced the latest development of their ADS-B implementation programme and the status of planning and implementation of surveillance systems including information on the global tracking.

- IP/6 - by New Zealand on Airways New Zealand plans for replacement of the current surveillance systems within the NZZC FIR;
- IP/8 - by Australia on the Interim Global Tracking Initiative implemented by Australia;
- IP/9 - by Republic of Korea on their ADS-B implementation plan;

- IP/12 - by Japan on surveillance upgrade plan focusing on ADS-B; and
- IP/22 - by USA providing comprehensive update on their ADS-B implementation activities

Surveillance Strategy Review (WP/25)

6.25 The meeting reviewed the surveillance strategy presented by the Secretariat. There were several proposed changes which had been included in draft of revised surveillance strategy provided in **Appendix L** to this Report.

6.26 New Zealand added that the current strategy does not recognise the need for contingency surveillance systems. This should be a strategic consideration for states and regions when implementing modernised surveillance systems. The strategy makes the statement that the adoption platform based surveillance options will facilitate a reduced reliance on primary radar. The residual reliance on primary radar will be different for each state as the likes of ADS-B technology has system wide implications. New Zealand will take cognisance of the strategy when implementing a modernised surveillance system to meet our specific needs.

Additionally - This meeting has expressed a view that the use MODE S data (especially DAPS) from SSR's is desirable. That being the case then the use of such data has to be applicable to ADS-B ground systems as well. Providing such data to enhance both safety net processing and aircraft trajectory within the ATM needs to be provided by both systems to ensure completeness and consistency.

6.27 IATA recommended that the revised surveillance strategy should also consider the requirement for aircraft tracking as the new SARPs for aircraft tracking would soon become available.

6.28 Considering the proposed new SURICG is likely to meeting in the first half of 2016 if APANPIRG approved its establishment. Therefore, the meeting agreed to refer the surveillance strategy with comments by the meeting to the new SURICG for them to review as it would be one of the deliverables in the proposed draft TOR of the group.

Inter-regional ADS-C Reporting Interval Task Force (WP/16)

6.29 The meeting noted the outcome of the Forty-Fifth Meeting of the North Atlantic Implementation Management Group (NAT IMG/45 Nov. 2014) presented by the Secretariat regarding the need for a study to determine the minimum ADS-C periodic report intervals.

6.30 The NAT IMG noted that the FANS 1/A Interoperability Standard (RTCA DO 258A/EUROCAE ED 100A) specified a minimum ADS-C periodic reporting interval of 64 seconds for each of up to five possible ADS periodic contracts. However, early on, Airbus and Boeing certification testing had identified that system performance would significantly deteriorate, particularly if each ADS-C periodic contract specified such intervals. Any potential issues with using short (i.e. 64 seconds) ADS-C periodic reporting intervals could impact NAT planning and implementation initiatives as well as have global implications. Specifying a short ADS-C periodic reporting interval in one part of the world may affect system performance in other parts of the world.

6.31 The NAT IMG was informed that a new global initiative had arisen out of the loss of MH370 (as well as the older AFR447 accident) addressing the perceived need to constantly track aircraft on a global basis for the purpose, inter alia, of reducing the size of the potential search area should an aircraft be lost. An international meeting convened by ICAO concluded that IATA, with support from ICAO, would investigate solutions to effectively implement global tracking of aircraft. Using ADS-C to report position at one minute (64 second) periodic intervals in abnormal circumstances was currently among the near-term options.

6.32 Taking into account the vast investment that was instigated by aircraft operators and ANSPs in FANS 1/A systems, the NAT IMG considered appropriate to investigate the performance capabilities of the end-to-end FANS 1/A system in order to be able to maximize the benefits that can be derived from the system. Therefore, the NAT IMG agreed to establish an inter-regional task force with the terms of reference as provided at **Appendix M** to determine the technically feasible minimum reporting interval.

6.33 New Zealand provided several comments about paragraph 2.8, observations from APAC Secretariat. Japan, Singapore and New Zealand expressed their interest to join this inter-regional Task Force. As result of the discussion, the meeting agreed to the proposal for such study and encouraged States/ Administration with experience of ADS-C implementation and in a position to do so participate in the Task Force and provide input and contribution to the study. Accordingly, the meeting formulated following draft Conclusion:

Draft Conclusion 19/19 – Inter-regional ADS-C Reporting Interval Task Force

That,

a) the Terms of Reference of the inter-regional ADS-C Reporting Interval Task Force provided by NAT Implementation Management Group at **Appendix M** to the Report be endorsed; and

b) States in Asia/Pacific Regions with experience of ADS-C implementation and in a position to do so, be encouraged to participate in the Task Force to contribute the study.

6.34 IATA commented that users do not want any proposal derived from this study to be mandated for global application, given different regional unique requirements.

Agenda Item 7: Aeronautical electromagnetic spectrum utilization

Updated ICAO Postion for WRC-2015 (WP/26)

7.1 The meeting noted the updated ICAO position for WRC-2015 approved by ICAO Council on 17 June 2015. The updated ICAO Position was distributed to ICAO member States under cover of State letter E 3/5.15-15/52 dated 15 July 2015. The main changes in the ICAO position were highlighted in the paper. Active support from ICAO member States is expected to ensure that the results of the ITU WRC-15 reflect civil aviation's need for spectrum. States were requested to apply the ICAO position to the maximum extent possible when developing/finalizing States' position for WRC-15 and support the ICAO position before and during WRC-15. States were also requested to include aviation experts in the development of national position for WRC-15 and as part of your State's delegation to the regional forum and to the WRC-15.

7.2 The meeting was informed that the same information had also been forwarded to the WRC-15 contact focal points as nominated by States/Administrations. Some states have updated their focal point for WRC-15 during the meeting. The next meeting of regional preparatory forum for WRC-15 i.e. the 5th Meeting of the APT Conference Preparatory Group for WRC-15 (APG15-5) will be held in Seoul, Republic of Korea from 27 July to 1 August 2015 and the World Radiocommunication Conference 2015 (WRC-15) is scheduled from 2 to 27 November 2015 in Geneva, Switzerland. States were urged to support ICAO position at these forums in accordance with APANPIRG Conclusion 23/37 – Preparation for WRC-15.

Outcome of the APT APG2015-4 Meeting (WP/23)

7.3 The meeting noted the outcomes of the fourth meeting of the Asia-Pacific Conference Preparatory Group for WRC-15 (APT APG2015-4) was held from 9 to 15 February 2015 in Bangkok, Thailand presented by the Secretariat. The challenges of the tentative regional position in support of ICAO position for WRC-15 were highlighted.

Outcomes of SRWG/2 Meeting (WP/13)

7.4 The meeting reviewed the outcomes of the 2nd Spectrum Review Working Group meeting held in Bangkok in May 2015 and took following action:

7.5 The SRWG considered possible to keep using the 25 KHz spacing scheme throughout APAC region in the next 5 years. But it was also discussed that such assessment should be revised on an annual basis. It was discussed that a planning mechanism is consistently used by the APAC Region for the future. It was also considered number of method should be considered to reduce the pressure of frequencies congestion including introduction of strategic planning. The meeting endorsed a number of conclusions formulated by the SRWG/2 meeting with slight changes made to the first one on Strategic planning and tactical use of VHF frequencies based on comments from China. The endorsed draft Conclusions are as follows:

Draft Conclusion 19/20 - Strategic planning and tactical use of VHF frequencies in the APAC Region from 2015 onwards

That, considering that the simulations conducted by SRWG on the basis of the needs submitted, showed that congestion in the APAC region for VHF frequencies using a 25 kHz channel spacing was unlikely to happen until 2020, and considering the necessity to continue using 25 kHz channel spacing as long as possible,

1/ All APAC States should contribute to the strategic planning by submitting number of VHF channel required based on the operational requirement (planned use and release) for a 5-years sliding window so as to detect and mitigate any spectrum congestion sufficiently beforehand and optimize the efficiency of the available spectrum, by submitting and updating their operational needs in terms of VHF frequencies (international and national) on a yearly basis to the ICAO Regional Office;

2/ If the frequencies for the channels could be reserved for protection as a result of strategic planning, their effective use should start after tactical assignment coordinated with the ICAO Regional Office;

3/ The tactical coordination of frequencies without any prior strategic planning should be avoided as much as possible in congested areas;

4/ Both strategic planning and tactical assignments should be completed using the ICAO global tool Frequency Finder; and

5/ Strategic planning should be revised on an annual basis; in case of detected congestion within a 3-year timeframe based on the latest simulations made, the decision to move to 8.33 KHz spacing would need to be made by APANPIRG and implemented in a coordinated manner, after due consultation of airspace users.

Transition to the new global database

7.6 As Frequency Finder was considered to be a necessary tool for an efficient frequency management across ICAO regions, the need for securing the resources to maintain the tool and organize a SIP to train States was reinforced. Consequently the meeting adopted the following draft Conclusion:

Draft Conclusion 19/21 – Transition to the new global database

That, considering that Frequency Finder and the global database were a necessary toolkit for efficient frequency management across ICAO regions, and training on using it is needed,

a) ICAO be invited to secure the resources to maintain the tool and organize a seminar/workshop on Frequency Finder in 2016,

b) States secure the attendance of their Subject Matter experts to the Seminar/workshop

Backup frequencies

7.7 Guidance material on the use of backup frequencies based on the practices in the EUR Region presented to the SRWG meeting was noted. Considering that the guidance material would be quite useful to regulate the assignment of back up frequencies, the meeting adopted the following draft Conclusion:

Draft Conclusion 19/22 – Assignment of back up frequencies in APAC Region

That, considering that the assigned number of backup frequencies should be kept to a minimum,

1) the guidance material placed at **Appendix N** be adopted as regional guidance;

2) State/Administration requiring back up frequencies, where operationally feasible:

- shares backup frequencies either between different services (at the same ATC center) or between different facilities (e.g. different aerodromes or different APP/ACC/FIS serves from different ATC centers);

- follows the regional guidance for the backup frequencies to be assigned; and

- re-coordinates the backup frequencies already assigned as necessary.

Emergency Frequency Guard Band

7.8 Regarding the use of additional aeronautical emergency frequency guard band, the meeting endorsed the following draft Conclusion:

Draft Conclusion 19/23 – Amendment to the APAC frequency allotment plan

That, considering the effect of the reduction of the guard band around the frequency 121.500 MHz and the four new channels that can be used for ATC communications and the necessity to map services previously defined in APAC region under ASIA/PAC/3 RAN meeting Recommendation 11/4,

a) the frequency allotment plan for the APAC Region be modified as follows:

Current allotment	**Current frequency band**	**New frequency band**
APP-I	121.100 – 121.400 MHz	121.100 – 121.450 MHz
AS (aerodrome surface)	121.600 – 121.975 MHz	121.550 – 121.975 MHz

b) coordination be undertaken with ICAO HQ to update the ICAO Doc9718 Volume II accordingly.

c) the mapping between the services and designated operational coverages previously defined in APAC Region under ASIA/PAC/3 RAN Meeting Recommendation 11/4 and those defined in the global Database as per **Appendix O** be adopted.

7.9 The meeting also noted the result of survey on regarding national/international allocation and AOC sub-band provided in the attachment to the working paper.

Agenda Item 8: Review and updates

Seamless ATM Reporting Process (WP/11)

8.1. As a follow-up to the Conclusion APANPIRG 25/5 a number of States/Administrations reported on their Seamless ATM implementation progress. The status of the reporting process as per 21 Jul 2015 placed at **Appendix P** showed that 18 States/Administrations have submitted at least one report online. The meeting noted that 3 States/Administrations now update their progress on a regular basis, which is an excellent practice, that 2 States/Administrations had prepared an initial form but had not submitted it yet, and that 24 States/Administrations had not prepared any report yet.

8.2 24 States/Administrations had nominated their seamless points of contact, and 20 had not yet. The meeting noted the matrix of responsibilities as per Conclusion APANPIRG 25/3, and specifically that the CNS Sub Group is responsible for 15 seamless items. Outcomes of the reporting process after its first year are gathered in bar graphs in a regional picture placed at **Appendix Q.** This picture is updated after each new submission from any State/Administration. IATA noted the value of such a picture for the region, which would help steer the changes, detect and solve the issues of implementation.

8.3 Noting that some of the States reported about TCAS v7.1 as not applicable, the meeting stated that this specific item should be always applicable. The Secretariat explained that the quality of the information reported was being continuously improved by interacting with POC and cross checking the information collected with the information available in the ICAO Regional Office. The meeting noted with great interest the first regional picture.

Review outcome of e-ANP WG meeting and regional air navigation tables (WP/03)

8.4 The meeting reviewed draft CNS parts of e-ANP presented by the Secretariast based on contributions by the eANP Working Group established by the CNS SG/18 meeting. The populated templates and tables were further updated through the relevant meetings and feedback from States/Administrations. Some information in these tables was further updated during the meeting. As a result of review, the meeting agreed to those proposed text materials provided in for the CNS text parts of the e-ANP Volumes I (**Appendix R1)** and II (**Appendix R2**) and for Volume III (**Appendix R3**). The meeting also reviewed the draft CNS Tables CNS II-1 through CNS II-7 for e-ANP Vol. II that are provided in **Appendices S1 to S7.** Consequently, the meeting formulated following draft Conclusion:

Draft Conclusion 19/24 - CNS parts for e-ANP

That, the text elements contained in Appendices R1, R2, R3 and CNS Tables provided in Appendices S1, S2, S3, S4, S5, S6 and S7 for CNS Parts of e-ANP be adopted and distributed to States/Administrations through PfA in accordance with the established procedure.

8.5 The meeting noted that the e-ANP working group recommended to drop existing FASID AMHS planning Table and the AMS and AMSS table. The new draft surveillance table was resulted from combination of existing FASID Table 4A and 4B.

8.6 The meeting further clarified that updates to the implementation status in the new draft Radio Navigation Aids table are not subject to formal amendment procedure for e-ANP Vol. II but considered same as dynamic information contained in the Vol. III of e-ANP.

ABSRTF/2 meeting and ToR of CNS SG (IP/5)

8.7 The meeting noted the outcome of the second meeting of the APANPIRG Contributory Bodies Structure Review Task Force (ABSRTF) including the proposed new structure of APANPIRG contributory body (Sub-group level); proposal for empowerment of Sub-groups; promotion of the project management principles. The meeting also noted the draft new TOR of CNS SG.

CNS equipment certification (IP/17)

8.8. Through the information paper, China informed meeting of the procedures of CNS equipment certification and the development of new generation CNS equipment by CAAC.

Agenda Item 9: Review status of CNS deficiencies (APANPIRG Deficiency List)

Updated status of CNS deficiencies (WP/20)

9.1 The related outcome of discussion is consolidated into the working paper on Deficiency and the updated list of air navigation deficiencies in CNS fields is provided in the **Appendix T** to this Report.

Agenda Item 10: Dates of next meeting and any other business

New (cooperative) approach for CNS and ATM service (IP/4)

10.1 Thailand informed the meeting about the new (cooperative) procurement approach for CNS (and ATM automation) systems and provided initial analysis on the new approach that may benefit the ANSPs at inter-organizational or international level.

Presentation from IBAC (IP/23)

10.2 IBAC made a presentation regarding its consideration for their operation in oceanic area. The presentation indicated that IBAC supports Performance-Based approach for COM, NAV & SURV and recognized the need for aircraft system certification and the need for specific ops approvals i.e. RNP AR APCH and also endorse the requirement for Flight Crew Training. The

Secretariat welcome more frequent participation from IBAC at APAC CNS related meeting.

Optimization of airspace and procedures (IP/21)

10.3 The USA presented the Federal Aviation Administration's (FAA) efforts at averaging Performance Based Navigation (PBN) expertise and experience to expedite implementation of optimized airspace and procedure.

General Discussion on Human Factor

10.4 Although there were no papers on the subject of Human Factors, Chairman said that increasingly, there is a need to consider Human Factor engineering as well as other issues such as training in the Research, Acquisition, Operations and Maintenance of CNS/ATM Systems, which come under the purview of this Sub-Group.

10.5 Human Factors being a multidisciplinary effort which takes into account human capabilities and limitations, besides being relevant to Air Traffic Control, will also impact on the safe and efficient operations and maintenance of new state-of –the-art CNS/ATM systems. Air Traffic Controllers' and Pilots' today heavily depend on such systems and safe airspace. Also airports operations cannot be ensured without the reliability, availability, continuity and integrity of the CNS-ATM systems.

10.6 By planning, acquiring, installing, maintaining and operating CNS/ATM and associated systems, Air Traffic Safety Electronics Personnel (ATSEPs) play a critical safety role in ensuring safe Air Navigation Services. Therefore, Human Factors related to Stress, Fatigue, and Health hazards in the Research, Acquisitions, Operations, Maintenance and working environment of ATSEPS have to be given their due consideration as they contribute significantly to the overall Safety Management System of the provision of CNS services.

10.7 Human factors analysis of these roles can improve overall performance, reduce technical risk in system acquisitions/operations/maintenance, lower lifecycle costs of systems and equipment, improve human interfaces with the system and contribute to economic decisions on controller training, as well as providing other benefits.

10.8 In view of the above considerations and after some discussion, the meeting agreed to add an additional agenda item on Human Factor and related issues such as training for agenda of next year meeting (CNS SG/20).

– – – – – – – – – – – – – –

PROPOSED SUGGESTIONS TO THE OUTCOME OF SECOND APANPIRG-RASG-APAC COORDINATION MEETING

Introduction

CNS SG19 WP04 reported the outcomes of the coordination meeting between APANPIRG & RASG APAC held on 21st May 2015. CNS SG was invited to note, discuss and take appropriate action on these outcomes, with the view that the third RASG APANPIRG Regional coordination meeting will be held in April/May 2016 to discuss the progress achieved on the actions suggested in this Report.

Suggestions from CNS SG/19

The RASG APAC/3 Final Report noted three areas under their work programme where the resulting findings would greatly enhance the PIRGs work towards ASBU implementation. These areas include Control Flight into Terrain, Runway Safety and Loss of Control.

Currently the RASG APAC is collecting information and studying the challenges facing the aviation community regarding these three areas. RASG APAC to share the results of these studies related to safety with APANPIRG Sub Groups to improve efficiency and effectiveness.
In this connection, the CNS SG meeting reviewed the input available and proposes the following suggestions.

1. Amend the chart illustrating the correlation between the identified RASG study and the associated ASBUs as follows:

- Add APTA as a safety barrier both for CFIT and RS (protection means, mostly through vertical guidance). Priority 1.
- Add SURF as a safety barrier for RS. Priority 3.
- Delete ASUR as a safety barrier for RS (ASUR does not provide for runway safety as this is a SURF issue).
- Include also regional Seamless ATM items in the chart. If this option is retained then:

    - Add 10 Apron Management (*high density aerodromes should provide an appropriate apron management service in order to regulate entry of aircraft into and coordinate exit of aircraft from the apron*) for RS as a risk control;

    - Add 340 Safety Assessment of Changes (*safety teams comprising multidisciplinary operational staff and managers which review safety performance and assess significant proposals for change to ATM systems*) as a transversal risk prevention mechanism; and

    - Add 350 ATM Operators' Performance (*training for the application of tactical, surveillance-based ATC separation; use of control techniques near minimum ATC separation; responses to ATM contingency operations and safety net alerts; and the importance of an effective safety reporting culture*) should be considered for RS as a major risk prevention and risk factor.

2. As per the RASG APAC Meeting Conclusion 4/4 and 4/23, RASG would endorse the APAC seamless ATM Plan, it is therefore suggested that RASG could propose to APANPIRG to allocate a different priority based on the contribution of the said item to the regional risk.

3. As it was already done for ACAS last year, it is suggested that RASG uses the APAC regional picture reflecting the implementation status of ANS improvements to assess how far and where the barriers are implemented.

A dedicated grouping could be developed in the regional picture that would present the ASBU and regional items of interest to RASG.

Responsibility for Airborne Safety Systems (Seamless item 170)

4. The Responsibility matrix for all Seamless items adopted by APANPIRG/25 shows that for Airborne Safety Systems (seamless item 170) the endorsing body is CNS SG. As the Second RASG–APAC Regional Coordination Meeting identified that RASG was to continue with the lead responsibility for the implementation of ACAS II, it is proposed that RASG replaces CNS SG in the Responsibility matrix for that for Airborne Safety Systems (seamless item 170). However RASG should note that the responsibility is not only with TCAS v7.1 but to implement the Seamless ATM objective:

> *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; and ACAS and Terrain Awareness Warning Systems (TAWS), unless approved by ATC (ASBU Priority 2)*

KPIs and analysis of operational safety

5. *The Key Performance Indicators listed on Page 7 under "Measuring Global Air Navigation" are primarily ATM-oriented and not necessarily appropriate metrics for safety analysis.* The metrics listed on page 8, while more closely aligned to Safety, really provide no baseline by which to do analysis and several do not directly align with safety analysis (i.e. Fleet age by itself is not a safety metric where a comparison of accidents/incidents to fleet age is).

Some operational safety metrics that could provide a more viable analysis could include:

- Runway Incursions and Excursions/total operations and their causal factors
- Airspace Incursions/total operations and their causal factors
- Operational Errors or Deviations/total operations and their causal factors
- Readback/Hearback Errors/total transmissions and correlation to control experience, time on position, etc.
- Communication/Navigation/Surveillance failures/hours of operation and their causal factors
- Automation Failures/hours of operation and their causal factors
- Intra- and Inter-facility coordination errors/total transmission and their causal factors

RASMAG and FIT/Asia data in the analysis of operational safety (specifically navigation accuracy and interfacility coordination issues) are potentially rich far beyond their primary analysis and could be better exploited.

Note: The information above may require going to the ATM/SG for further discussion so it could be essentially a joint submission from the SGs to the RASG.

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC ATS MESSAGE HANDLING SYSTEM (AMHS) NAMING PLAN

FOURTH EDITION - MAY 2015

Table of Content

Abstract

This document is the planning and technical guidance on the naming convention for the transition of ground Aeronautical Fixed Telecommunication Network (AFTN) services to the ATS Message Handling System (AMHS) within the ASIA/PAC Region. Based upon the ATN SARPs as published in ICAO Annex 10 and ICAO Doc. 9880, naming and addressing plans are required to be developed by ICAO regions concerned.

This revised AMHS Naming Plan will provide guidance to States in the assignment and registration of addresses and names to be used for the Aeronautical Telecommunication Network (ATN) with a view to ensure its consistency with the latest EUROCONTROL AMC documentary and database requirements.

Executive Summary

This document provides planning and technical guidance on the naming convention for the transition of ground Aeronautical Fixed Telecommunication Network (AFTN) services to the ATS Message Handling System (AMHS) within the ASIA/PAC Region.

Based upon the ATN SARPs as published in ICAO Annex 10 and ICAO Doc 9880, naming and addressing plans are required to be developed by ICAO regions concerned. These Regional Plans will provide guidance to States in the assignment and registration of addresses and names to be used for the Aeronautical Telecommunication Network (ATN).

The ASIA/PAC ATN AMHS Naming Plan aligns itself with the global AMHS naming scheme. To maintain compatibility within the region, the Common AMHS Addressing Scheme (CAAS) Address format should be adopted where States are about to start their AMHS implementation programmes. This will ensure compatibility with the proposed global AMHS naming scheme.

A formal registration authority is established within ICAO, which will maintain a register for registering all Private Management Domains (PRMDs).

This document was adopted by 12th Meeting of APANPIRG held in 2001 for distribution to States in the ASIA/PAC and adjacent regions. It was further updated in April 2005 to include a comprehensive elaboration on the Common AMHS Addressing Scheme (CAAS), in particular the Private Management Domain Name value for States in the ASIA/PAC region.

As follow-up action of the 1st Meeting of ACSICG, an updated version was accepted by the 2nd Meeting of ACSICG with an aim to ensure compliance of ASIA/PAC of AMHS Naming Plan to latest EUROCONTROL AMC documentary and database requirement.

1. Introduction

This document presents the naming assignment conventions for allocating Originator/Recipient (O/R) names to be used for the ATS Message Handling System (AMHS) in the ASIA/PAC Region.

The information contained in this document was firstly adopted by 12th Meeting of APANPIRG held in 2001 for distribution to States in the ASIA/PAC and adjacent regions. It was further updated in April 2005 to include a comprehensive elaboration on the Common AMHS Addressing Scheme (CAAS), in particular the Private Management Domain Name value for States in the ASIA/PAC region. As follow-up action of the 1st Meeting of ACSICG, an updated version was accepted by the 2nd Meeting of ACSICG with an aim to ensure compliance of ASIA/PAC of AMHS Naming Plan to latest EUROCONTROL AMC documentary and database requirement.

This document has been updated as follow:

a. The references / documents / definitions / abbreviations concerned. (1.3-1.5)
b. AMHS addressing scheme with wildcard (3.2)
c. Defining Organization-name and Organization-unit-name-1 for CAAS (5)
d. Table 1a: PRMD-name values of the AMHS MD in ASIA/PAC region Information from EUROCONTROL AMC Database
e. Table 1b: Suggested PRMD-name values of the AMHS MD in ASIA/PAC region for states/ATSO which have not registered to AMC assuming all States/ATSOs using CAAS

1.1 Objectives

The objective of the document is to provide guidance in the naming convention to be used for the AMHS in the ASIA/PAC Region (Included the present AMHS Address information from EUROCONTROL AMC Database)

1.2 Scope

The scope of the document includes:

- Describing the attributes of the AMHS address format, and
- Recommending the values for the relevant attributes those are to be used in the AMHS address.

The ASIA/PAC Regional ATN/AMHS naming convention presented here will comply with the relevant formats as specified in ICAO Doc 9880.

The ASIA/PAC Regional ATN/AMHS Naming Plan defines the method for assigning values to each of the relevant attributes of the AMHS address. States may choose to assign their AMHS addresses based upon the recommendations made here.

1.3 References

Reference 1	Manual of Technical Provisions for the ATN (Doc 9880-AN/466) First Edition
Reference 2	ICAO Location Indicators – Document 7910
Reference 3	The State Letter T8/2.11, T8/2.13&T8/10.10: AP150/14 (CNS) dated 9 October 2014
Reference 4	The Third Edition of the ASIA/PAC ATN Network Service Access point (NSAP) Addressing Plan
Reference 5	ATNICG 5-WP20: ASIA/PACIFIC ATN NSAP Addressing Plan

Reference 6	The revised EUROCONTROL Convention 27 June 1997
Reference 7	AMC User Manual Edition 10.0 Adopted version (AFSG/18) (10/04/2014)
Reference 8	Appendix E1 AMC Network Inventory Form
Reference 9	Appendix E2 Major Change Form of AMC
Reference 10	Working Paper 9 (WP/9) The sage of Wildcard (**) in AMHS CAAS Address / ATNICG/7

1.4 Definitions

AMC Database	An off-line network management services in support of the ground ATS Messaging network of Air Navigation Service Providers (ANSPs) in Europe. This network integrates the Aeronautical Fixed Telecommunications Network (AFTN), the Common ICAO Data Interchange Network (CIDIN) and the ATS Message Handling System (AMHS) to transparently deliver operational ATS Messages such as flight plans, between users and hosts in ANSPs, airlines, etc. on a global basis.
CAAS-Address (Common AMHS Address Scheme)	A MF-Address of which the organization-name attribute identifying the user within an AMHS Management Domain is selected by the Management Domain itself and shall be supplied to ICAO for publication.
MF-Address (MHS-form address)	The Originator/Recipient name of an AMHS user.
NSAP Address (Network Service Access Point)	A hierarchically organized global address, supporting international, geographical and telephony-oriented formats by way of an address format identifier located within the protocol header. Although the top level of the NSAP address hierarchy is internationally administered by ISO, subordinate address domains are administered by appropriate local organizations.
NSAP Address Prefix	A portion of the NSAP Address used to identify groups of systems that reside in a given routing domain or confederation. An NSAP prefix may have a length that is either smaller than or the same size as the base NSAP Address.
Routing Domain (RD)	A set of End Systems and Intermediate Systems that operate the same routing policy and that are wholly contained within a single administrative domain.
XF-Address (Translated-form address)	A particular MF-Address of which all attributes identifying the user within an AMHS Management Domain may be converted by an algorithmic method to and from an AFTN form address.

1.5 Abbreviations

The following abbreviations are used in this document:

ADMD	Administration Management Domain
AFTN	Aeronautical Fixed Telecommunication Network
AMHS	ATS Message Handling System
AMC	ATS Messaging Management Centre
ATSMHS	ATS Message Handling Service
APANPIRG	Asia Pacific Air Navigation Planning and Implementation Regional Group
ATN	Aeronautical Telecommunication Network
ATNTTF	APANPIRG ATN Transition Task Force
ATS	Air Traffic Service
ATSO	Air Traffic Service Organizations
CAAS	Common AMHS Addressing Scheme
CCITT	Consultative Committee for International Telephony and Telegraphy
ICAO	International Civil Aviation Organization
ITU-T	International Telecommunication Union Telecommunication Standardization Sector
MHS	Message Handling Service
MF	MHS Form
MTA	Message Transfer Agent
O/R	Originator/Recipient
PRMD	Private Management Domain
NSAP	ASIA/PACIFIC ATN Network Service Access Point
SARP	Standards and Recommended Practices
XF	Translated Form

2. AMHS Naming Convention

The ASIA/PAC AMHS naming convention is based on a number of factors that have arisen from the third meeting of the ATN Panel held in Montreal during the 7th to 18th of February 2000 and the results from other AMHS planning activities developed by other regions.

To ensure continuity and compatibility with other AMHS naming conventions, the AMHS naming convention for the ASIA/PAC Region was developed based upon the outcome of the European SPACE[1] Project.

[1] SPACE (Study and Planning of AMHS Communications in Europe) is a project supported by the European Commission and is the combined efforts of the participating countries and organizations from EUROCONTROL, France, Germany, Spain and the United Kingdom.

The attributes of the AMHS address format should be:

- Simplicity
- No prefix
- Not an abbreviation words

2.1 MHS Addressing Scheme

There are 4 types of address form in CCITT X.400 Message Handling System. The addressing scheme of AMHS adopts the mnemonic form address and the attributes contain in this form are described in the table below:

Table 2-1 Mnemonic form address attributes of MHS

Attribute	Notation	Maximum Length	Comment
Country-name	C	3	
ADMD	A	16	
PRMD	P	16	
Organization-name	O	64	
Organizational Unit name	OUn	4 x 32	n = 1 – 4
Common name	CN		
Personal name	S G I GQ	40 16 5 3	Surname Given name Initials Generation Qualifier
Domain-defined-attributes	DDA	Varies	(DDA type) = (DDA Value), up to 4 attributes

2.2 MF-Addressing Scheme in AMHS

Each AMHS user within an AMHS Management Domain is assigned an Originator/Recipient (O/R) name, which is referred to as a MF-address (MHS-form address).

Two types of MF-address in AMHS are defined in Doc9880, namely Common AMHS Addressing Scheme (CAAS) and XF (Translated-form) Addressing Scheme. They differ in the number of attributes being selected from mnemonic form of MHS addressing scheme,

The MF-address of an AMHS user (no matter CAAS or XF) shall comprise:

a) a set of attributes identifying the AMHS Management Domain of which the AMHS user, either direct or indirect, is a service-user; and
b) a set of attributes identifying unique AMHS user within the AMHS Management Domain.

2.3 Naming Convention for CAAS Format

It is recommended that:

a) ICAO register with the ITU-T the ADMD name “ICAO” as an international ADMD under the “XX” country code.
b) ICAO establishes and maintains a register of PRMDs allocated by air traffic service providers according to the “XX” + “ICAO” address structure.

The management of this register would be established and maintained in the same way as the Location Indicators (Doc7910) and Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services (Doc8585).

The Air Navigation Commission on the 1st of June 2000 approved these recommendations. On the basis of these recommendations, the ASIA/PAC Region accepted the format for the allocation of the first two attributes used in the O/R name. It was proposed that a common naming convention be used worldwide to help stream line the addressing scheme and to ensure compatibility and consistency with other neighboring regions. This scheme would be based on the work that has been ongoing in Europe. It was also stressed that if States have not already started their implementation programmed for AMHS that when planning to do so they should adopt the CAAS-Address format and not the XF-Address format.

The ASIA/PAC Region will adopt the proposed worldwide CAAS-Address format, which uses the following attributes to define the O/R name during the transition phase from AFTN to AMHS:

1. Country-name;
2. ADMD;
3. PRMD;
4. Organization-name;
5. Organizational-unit-name 1; and
6. Common Name.

2.3.1 Country Name

The country name is a mandatory requirement and shall consist of the two alphanumeric ISO 3166 Country Code “XX” encoded as a Printable String. The country code “XX” has been adopted, as this is a special code registered by the ITU-T for the purpose of allocation to international organizations, which do not reside within any particular country.

2.3.2 ADMD

The administrative domain is a mandatory requirement and shall consist of the Printable String “ICAO”. ICAO has registered “ICAO” as the ADMD with the ITU-T. By providing the “ICAO” ADMD will allow the addressing schemes to be independent of any constraints that may be imposed by management domains in the global MHS or national regulations that may vary from region to region.

2.3.3 PRMD

The private management domain is an optional requirement as documented in the relevant ITU-T Standards. However, this attribute is mandatory for implementation of AMHS by States in the ASIA/PAC Region as part of the worldwide CAAS-Address format scheme.

The contents of this field can include the ICAO Location Indicator specified in ICAO Doc7910 or the name of the Air Traffic Service Organization (ATSO) that has been registered with ICAO. Where an ATSO has not yet assigned their PRMD then a default value will be allocated, which will use either one or two letters of the ICAO Country Indicator specified in ICAO Doc7910. This has been chosen for its simplistic and non-ambiguous format, which is already managed by ICAO. Hence providing an easier management role for ICAO who will be responsible for maintaining the register of all PRMDs allocated under the ADMD of "ICAO".

2.3.4 Organization Name

The organization name is used to define the local or national geographical routing information. This information is to be assigned by the ATSO (for example can be based on the ICAO location indicator as specified in ICAO Doc7910 or some other value determined by an ATSO and published by ICAO). Figure 2 - 1 provides a pictorial view of how the organization name can be used in relation with the lower attribute structure.

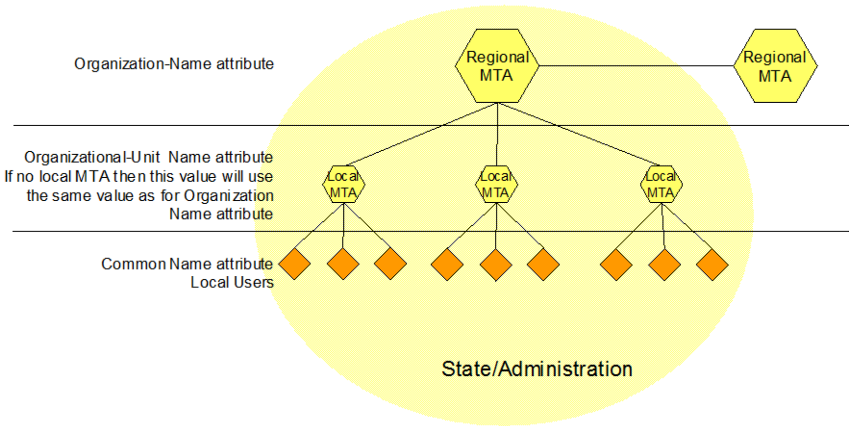


Figure 2 -1 Lower Attribute Structure

2.3.5 Organizational Unit Name OU1

Each State or organization is allocated a unique ATS message organizational name. As all States are familiar with the ICAO four character location indicators defined in ICAO doc7910, it is proposed that the organization unit name 1 use the location indicator to identify the Message Transfer Agent (MTA) site, encoded as a Printable String. Including the reference to the WP/9 - The sage of Wildcard (**) in AMHS CAAS Address / ATNICG/7, wildcard should be used for the purposes of reducing the amount of data in EUROCONTROL AMC Database.

Note: The MTA site may be the MTA name of the server. However there are security issues that need to be addressed to ensure that this arrangement does not cause any unnecessary concerns with service providers that allow the MTA name to be broadcast in this fashion.

2.3.6 Common Name

It is proposed that during the AFTN transition to AMHS that the common name attribute be used to contain the 8-character alphabetical value of the AFTN address indicator of the user, encoded as a Printable String. This shall apply for AFTN users only. Possible example of an O/R address is shown in Table 2-2

Table 2- 2 Example of a CAAS-Address AMHS Naming Convention

Attribute	**Assigned By**	**Value**	**Comment**
Country-name (C)	ITU-T	XX	International Organization
ADMD (A)	ICAO	ICAO	ICAO Responsibility to register
PRMD (P)	ATSO	e.g. THAILAND	ATSO registered private domain with ICAO.
Organization name (O)	ATSO	e.g. VTBB	Local/national geographical information, which can be based on ICAO Location Indicators (Doc7910)
Organizational-Unit name (OU1)	ATSO	e.g. VTBB, VT**	ICAO Location Indicator (Doc7910) Wild card can be used (*)
Common Name (CN)	ATSO	e.g. VTBBYFYX	AFTN address

Note: It is proposed that for a direct AMHS user that an ATSO should be able to assign a suitable name to that user without being restricted to an AFTN address indicator.

2.4 Naming Convention for XF-Address Format

The attributes to be used for the XF-Address format are as described in ICAO Document 9880 and presented below as follows:

Country-name;
ADMD;
PRMD;
Organization-name; and
Organizational-unit-name 1.

2.4.1 Country Name

As proposed in Section 2.3.1

2.4.2 ADMD

As proposed in Section 2.3.2

2.4.3 PRMD

As proposed in Section 2.3.3

2.4.4 Organization Name

This field has already been defined by ICAO Document 9880. The value of this field contains the encoded printable string “AFTN”.

2.5 General Use of X.400 O/R Addresses

The address format of X.400 O/R address attributes for sending general non-operational AMHS traffic is a local matter for States/Administrations to implement if they wish to do so and no further advice is provided in this plan.

3. PRMD-name values and Address Scheme Registration

As it is important to have the proper address developed well before the AMHS implementation in the Region, a comprehensive draft of PRMD value and AMHS Addressing Scheme for each State/ATSO in the ASIA/PAC region are developed in table 1a and table 1b. Examples and tables given would assist State/ATSO to understand XF and CAAS address scheme. States/ATSOs are recommended to follow the proposal and register to deploy CAAS as early as possible.

3.1 XF Addressing Scheme

XF is only intended for transitional arrangement when both AFTN and AMHS systems co-exist during the initial implementation of AMHS. States/ATSOs declare the use of XF could still maintain an AFTN system for routing of messages to and from local and international AFTN users before the sunset date (to be decided by ICAO), whereas messages to and from the ATN are routed through the AFTN/AMHS gateway for format conversion.

The XF Addressing Scheme is simple to implement because the *organization-name* always takes the fixed value "AFTN" and the *organization-unit-name-1* is used to store the AFTN address. Hence, only the *PRMD-name* is required for AFTN to XF address translation and there are not more than 200 of such entries. The ATN SARPs Edition 2 provided the XF addressing requirements. However, the XF scheme does not support the addressing of multiple MTAs within a MD for more operational choice by States/ATSO. For example, having two MTAs as entry/exit points, a MD can serve the purpose of load balancing as well as providing a hot-backup site to enhance the performance and availability of the AMHS service. The drawback on the use of XF is that, unlike the CAAS that allows multiple *organization-name* values, XF supports only one value. Hence an AMHS initially using XF addressing will need to be changed back to CAAS addressing at a later time (when the system will be in operation delivering live traffic). With this in conjunction with the limited value (i.e. for simplicity) of XF addressing, the ATN SARPs Edition 3 encourages the direct use of CAAS addressing right in the beginning of AMHS implementation.

3.2 Common AMHS Addressing Scheme with wildcard

CAAS supports both transitional (AFTN plus AMHS) and pure AMHS environment. In a pure AMHS environment, only CAAS addresses are used and the routing decision rests on the router and/or MTA depending on the MTA routing policy. No address conversion is needed and hence XF address does not play any role here.

The CAAS offers greater flexibility in assigning values to the *organization-unit-name-1 (OU1)* and *common-name (CN)* attributes. It opens up the possibility for the MD to select any desirable values on *OU1* and *CN* after the sunset date and hence give rise to a user-friendly address and more importantly, higher scalable service even down to personal level.

To facilitate smooth migration, *OU1* attribute is initially used to store 4-letter location indicator(s) categorized under *organization* attribute whereas *CN* is deployed to keep the existing AFTN address during the transition period. After the transition period, the values of *OU1* and *CN* could be changed or re-assigned by the respective MDs in accordance with the guidelines to be developed by ICAO.

The CAAS requires each AMHS MD to maintain and update the latest *organization-name* and additional *organization-unit-name-1* values declared by all AMHS MDs. The complexity of maintenance and updating of these values will grow with the size of AMHSs in use globally. To ease the problem on address resolution in CAAS, Directory Service (DIR), which is an Extended AMHS function, should be used. For information, DIR had been included as one of the optional elements in the ATN SARPs.

In this connection, in the AFSG/14 meeting in June 2010, the AFSG Operations Group at EUR proposed in WP/02 "The use of wildcard (*) characters to reduce the number of entry in the CAAS table. The working paper recommended that wild card (*) characters can be used for AMHS Address on the "Organization-unit-name-1" (OU1) attribute, be restricted to the 2nd, 3rd, and 4th position, and be used as trailing characters only. The recommendation has been also proposed in The ATNICG/7-WP/09, The AMC has just announced the use of wild card (*) characters for AMHS ASIA/PAC Addresses on the "Organization-unit-name-1" (OU1) attribute and proposed all AMC users to consider changing their AMHS registry entries to include wild card (*) character.

For example: VTBB used by VT** / VHHH used by VH**

4. PRMD-name value

Values of the *PRMD-name* may take any one of the following three forms: -

(a) Value declared by AMHS MD which is their country name, e.g.

- Hong Kong, China declared the value "HONGKONG" as *PRMD-name.*
- Thailand declared the value "THAILAND" as *PRMD-name.*

(b) Value declared by AMHS MD but follows the Nationality Letter as specified in Doc7910, e.g.

- New Zealand declared the value "NZ" as *PRMD-name.*

(c) Value from the default Nationality Letter assigned by ICAO when the AMHS MD does not respond to the ICAO State Letter, e.g. value "RP" is assigned to Philippine as *PRMD-name* by ICAO.

4.1 PRMD-name value for XF

In the XF Addressing Scheme, the *organization-name* value is fixed as "AFTN" and there is no *common-name* attribute. Therefore, only the *PRMD-name* is required by AMHS MD for AFTN/XF address translation. To streamline the choice of *PRMD-name* value and to simplify the conversion, it would be more convenient and logical to make use of the Nationality Letters in AFTN location indicator as the *PRMD-name* value.

4.2 PRMD-name value for CAAS

In CAAS, the *organization-name* value is not fixed. To minimize the influence of the legacy AFTN address structure on CAAS and to present explicitly the name of the States/ATSOs administering the AMHS MD, it would be advisable to use full name of the States/ATSOs as the *PRMD-name* value.

Table 1a presents the data extracted from EUROCONTROL AMC Database shows the registered PRMD-name values of the AMHS MD in ASIA/PAC region. For States/ATSOs not yet registered at AMC, Table 1b gives suggested *PRMD-name* values of the AMHS MD assuming CAAS addressing scheme is used.

5. Defining *Organization-name* and *Organization-unit-name-1* for CAAS

On top of *PRMD-name*, *organization-name* is also required for AFTN to CAAS address resolution. It may take a value that represents a geographical unit or identifies an organization. The syntax and values are to be defined by the States/ATSOs. States/ATSOs selecting CAAS are required to provide at the same time a group of 4-letter location indicators associated to the selected *organization-name* value. These location indicators constitute the *organization-unit-name-1* values to facilitate address conversion and therefore shall also be provided to ICAO for publication. Examples on CAAS deployment in the ASIA/PAC Region are given below:

Example 1 : CAAS with *organization-name* to identify an organization

State/ATSO: A

PRMD-name	*A*
Organization-name	*x*
Organization-unit-name-1	*[XXXX] / [XX**]*

A= *name of State/ATSO in alphanumeric characters*
x = *name of the organization in alphanumeric characters. The syntax and value are to be defined by the considered State/ATSO.*
[XXXX] = *4-letter AFTN location indicator(s) that is associated with the organization*
*[XX**] =* *4-letter AFTN location indicator(s) that is associated with the organization with wild card (*) characters*

Wildcard (*) characters may be used to reduce the number of entries in Organsiation-unit-name-1 attribute.

e.g. COUNTRYABCD

PRMD-name	*COUNTRYABCD*
Organization-name	*CAA NAME*
Organization-unit-name-1	*VKKK VKKA VKSA VKSP / VK***

Example 2 : CAAS with *organization-name* to represent a geographical unit

State/ATSO: A

PRMD-name	*A*
Organization-name	*[PPPP]*
Organization-unit-name-1	*[XX**]*

[PPPP] = 4-letter AFTN location indicator representing a geographical unit
[XX**] = 4-letter AFTN location indicator(s) that is associated with the organization with wild card (*) characters

e.g. COUNTRYMNPQ

PRMD-name	*COUNTRYMNPQ*
Organization-name	*VZSS*
Organization-unit-name-1	*VZ***

The above examples involve one single MTA. However, it is possible to deploy multiple MTAs within the AMHS MD when the area of the States/ATSOs or the size of the organizations is big enough for consideration of segregation. In this case, more than one *organization-name* value, each associated with a number of location indicators shall be defined and provided to ICAO for publication.

Example 3 : CAAS with *organization-name* to represent a geographical unit and more than one MTA within the MD

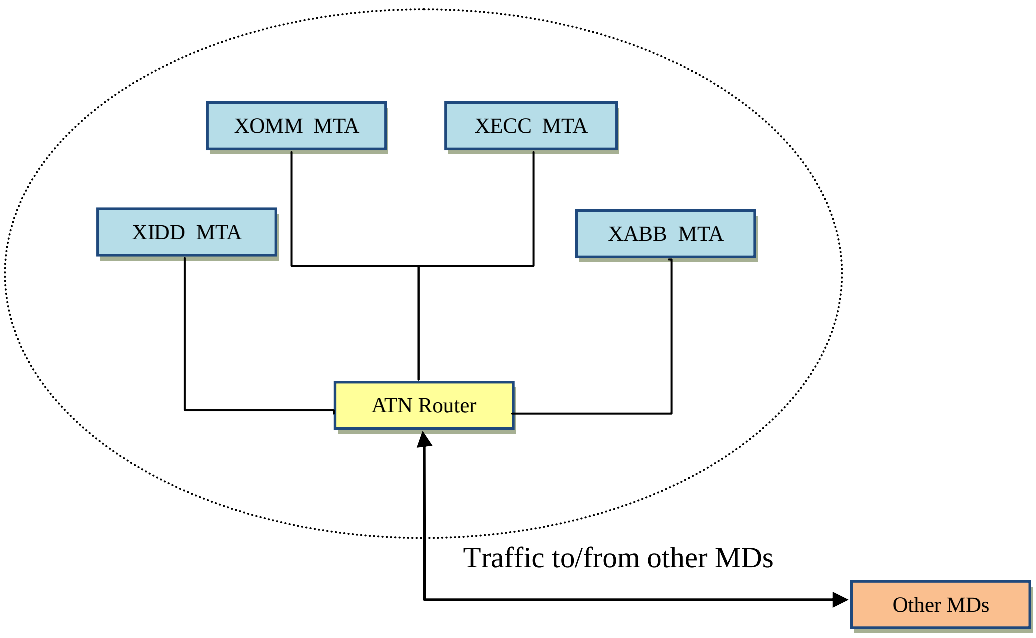
State/ATSO: B

PRMD-name	*B*
Organization-name	*m[PPPP]*
Organization-unit-name-1	*n[XXXX] / n[XX**] per [PPPP] / [PP**]*

m[PPPP] = *m number of 4-letter location indicator each representing different geographical unit*
n[XXXX] = *n number of 4-letter location indicator(s) that are associated with a particular geographical unit*
*n[XX**]* = *4-letter AFTN location indicator(s) that is associated with the organization with wild card (*) characters*

e.g. COUNTRYXYZ

PRMD-name	COUNTRYXYZ			
Organization-name	XECC	XABB	XOMM	XIDD
Organization-unit-name-1	XE**	XA**	XO**	XI**



AMHS MD with multiple MTAs requires CAAS addressing

Note: 1. Each MTA, as an end system, should have its own NSAP address.
2. Traffic between MTAs within the domain is a local matter.

As an example, the registered OU value of Hong Kong in the CAAS table of EUROCONTROL AMC Database shows that wildcard is used.

HONGKONG - XX - ICAO - HONGKONG

AMHS MD Register

MD Common Name	Country-Name	Addressing Scheme	ATN Directory Naming-Context
HONGKONG	XX	CAAS (selected) / XF / Other	c=HK

PRMD-Name	ADMD-Name	Administrative Status	Operational Status	Relation to Doc 7910	ATN ICAO Designator
HONGKONG	ICAO	EXTERNAL	OP	Consistent	

State(s)/ Organization(s)

State(s)/ Organization(s)	Nationality Letters or Designator	Doc 7910 Status
Hong Kong, China	VH	Official

COM Centres

COM Centres	Location	Organization Name
VHHH	HONG KONG/INTERNATIONAL	

HONGKONG - XX - ICAO - HONGKONG

Intra MD Addressing

CAAS Table

Org. (O)	Org. Unit (OU)	7910 Status	Offic. Register Status
HKGCAD	VH**	Official	Registered

User Address Table

User Short Name	AFTN Addr Indicator	O/R Address

****

Table 1a

PRMD-name values of the AMHS MD in ASIA/PAC region
Information from EUROCONTROL AMC Database

	Contracting State	MD Common Name	MTA Name	Addressing Scheme	Country-name	Administration-domain-name	Private-domain-name	Organization name	Organization unit-name-1	COM Centre	Location of COM Centre	Operational Status
				(CAAS/XF)	(C)	(A)	(P)	(O)	(OU1)			
1	**AFGHANISTAN**	OA		XF	XX	ICAO	OA	AFTN	OAKB	OAKB	KABUL	NON OP
2	**AUSTRALIA**	AUSTRALIA		CAAS	XX	ICAO	AUSTRALIA	YBBN	Y***	YBBB	BRISBANE	OP
3	**BANGLADESH**	VG	VGEG-MTA	CAAS	XX	ICAO	BANGLADESH	VGHS	VG**	VGHS	DHAKA	OP
4	**BHUTAN**	VQ		XF	XX	ICAO	VQ	AFTN	VQPR	VQPR	PARO INTL	NON OP
5	**BRUNEI DARUSSALAM**	WBSB		XF	XX	ICAO	WBSB	AFTN	WBSB	WBSB	BRUNEI INTL AP	NON OP
				XF	XX	ICAO	WBSB	AFTN	WBAK	WBAK	BRUNEI INTL AP	NON OP
6	**CAMBODIA**	CAMBODIA	MTA-VDPP-1	CAAS	XX	ICAO	CAMBODIA	VDPP	VD**	VDPP	PHNOM PENH	OP

	Contracting State	MD Common Name	MTA Name	Addressing Scheme	Country-name	Administration-domain-name	Private-domain-name	Organization name	Organization unit-name-1	COM Centre	Location of COM Centre	Operational Status
				(CAAS/XF)	(C)	(A)	(P)	(O)	(OU1)			
7	**CHINA**	CHINA	CHNMTA	CAAS	XX	ICAO	CHINA	CS	ZG**	ZBBB	BEIJING CITY	OP
				CAAS	XX	ICAO	CHINA	CS	ZH**			
				CAAS	XX	ICAO	CHINA	CS	ZJ**			
				CAAS	XX	ICAO	CHINA	EC	ZS**			
				CAAS	XX	ICAO	CHINA	HQ	ZBBB			
				CAAS	XX	ICAO	CHINA	NC	ZB**			
				CAAS	XX	ICAO	CHINA	NE	ZY**			
				CAAS	XX	ICAO	CHINA	NW	ZL**			
				CAAS	XX	ICAO	CHINA	SW	ZP**			
				CAAS	XX	ICAO	CHINA	SW	ZU**			
				CAAS	XX	ICAO	CHINA	XJ	ZW**			
		RC		XF	XX	ICAO	RC	AFTN	RCTP	RCTP	TAIBEI CITY	NON OP
8	**HONG KONG, CHINA**	HONGKONG	HKAMHS	CAAS	XX	ICAO	HONGKONG	HKGCAD	VH**	VHHH	HONGKONG INTL AP	OP
9	**MACAO, CHINA**	MACAO	MCUMTA	CAAS	XX	ICAO	MACAO	VM	VM**	VMMC	MACAO INTL AP	OP

	Contracting State	MD Common Name	MTA Name	Addressing Scheme	Country-name	Administration-domain-name	Private-domain-name	Organization name	Organization unit-name-1	COM Centre	Location of COM Centre	Operational Status
				(CAAS/XF)	(C)	(A)	(P)	(O)	(OU1)			
10	**COOK ISLANDS**	NC		XF	XX	ICAO	NC	AFTN	NCRG	NCRG	RAROTONGA INTL.	NON OP
11	**DPR OF KOREA**	ZK		XF	XX	ICAO	ZK	AFTN	ZKKK	ZKKK	PYONGYANG (CITY)	NON OP
12	**FIJI**	FIJI	NFMTA	CAAS	XX	ICAO	FIJI	NFFN	NF**	NFFN	NADI INTL	OP
13	**FRENCH POLYNESIA**	NT		XF	XX	ICAO	NT	AFTN	NTAA	NTAA	TAHITI FAAA	NON OP
14	**INDIA**	INDIA	BBAMHS	CAAS	XX	ICAO	INDIA	VABB	VA**	VABB	MUMBAI	OP
				CAAS	XX	ICAO	INDIA	VECC	VE**	VECC	KOLKATA	
				CAAS	XX	ICAO	INDIA	VIDD	VI**	VIDD	SAFDARJUNG (DELHI)	
				CAAS	XX	ICAO	INDIA	VOMM	VO**	VOMM	CHENNAI	
15	**INDONESIA**	INDONESIA		CAAS	XX	ICAO	INDONESIA	WIII	WI**	WIII	JAKARTAINTL / SOEKARNO-HATTA	NON OP
				CAAS	XX	ICAO	INDONESIA	WAAA	WA**			
				CAAS	XX	ICAO	INDONESIA	WRRR	WR**			
16	**JAPAN**	RJ	JPAMHS	XF	XX	ICAO	RJ	AFTN	RJJJ	RJJJ	FUKUOKA/JCAB	OP
				XF	XX	ICAO	RO					
17	**KIRIBATI**	NG		XF	XX	ICAO	NG	AFTN	NGTT	NGTT	TARAWA/BETIO	NON OP

	Contracting State	MD Common Name	MTA Name	Addressing Scheme	Country-name	Administration-domain-name	Private-domain-name	Organization name	Organization unit-name-1	COM Centre	Location of COM Centre	Operational Status
				(CAAS/XF)	(C)	(A)	(P)	(O)	(OU1)			
18	**LAO PDR**	LAO	MTA-VLVT-1	CAAS	XX	ICAO	LAO	VLVT	VL**	VLVT	VIENTIANE(WATTAY)	NON OP
19	**MALAYSIA**	MALAYSIA		CAAS	XX	ICAO	WM	WMKK	WM**	WMKK	SEPANG/KL INTL AP	NON OP
				CAAS	XX	ICAO	WB	WBKK	WB**	WBKK	KOTA KINABALU	NON OP
20	**MALDIVES**	VR		XF	XX	ICAO	VR	AFTN	VRMM	VRMM	IBRAHIM NASIR INTL AP	NON OP
21	**MONGOLIA**	ZM		XF	XX	ICAO	ZM	AFTN	ZMUB	ZMUB	ULAANBAATAR	NON OP
22	**MYANMAR**	VY		XF	XX	ICAO	VY	AFTN	VYYY	VYYY	YANGON	NON OP
23	**NAURU**	AN		XF	XX	ICAO	AU	AFTN	ANAU	ANAU	NAURU FIR	NON OP
24	**NEPAL**	VN		XF	XX	ICAO	VN	AFTN	VNKT	VNKT	KATHMANDU	NON OP
25	**NEW CALEDONIA**	NW		XF	XX	ICAO	NW	AFTN	NWWW	NWWW	NOUMEA LA TONTOUTA	NON OP
26	**NEW ZEALAND**	NZ		CAAS	XX	ICAO	NZ	NZCH	NZ**	NZCH	CHRISTCHURCH INTL	NON OP
27	**PAKISTAN**	OP		XF	XX	ICAO	OP	AFTN	OPKC	OPKC	KARACHI	NON OP
28	**PAPUA NEW GUINEA**	AY		XF	XX	ICAO	AY	AFTN	AYPM	AYPM	PORT MORESBY	NON OP
29	**PHILIPPINES**	RP		XF	XX	ICAO	RP	AFTN	RPLL	RPLL	MANILA	NON OP
30	**REPUBLIC OF KOREA**	RK	RKMTA	CAAS	XX	ICAO	RK	RKSS	RK**	RKSS	GIMPO	OP

	Contracting State	MD Common Name	MTA Name	Addressing Scheme	Country-name	Administration-domain-name	Private-domain-name	Organization name	Organization unit-name-1	COM Centre	Location of COM Centre	Operational Status
				(CAAS/ XF)	(C)	(A)	(P)	(O)	(OU1)			
31	**SINGAPORE**	SINGAPORE	SGAMHS	CAAS	XX	ICAO	SINGAPORE	CAASG	WS**	WSSS	SINGAPORE/CHANGI	OP
32	**SOLOMON ISLANDS**	AG		XF	XX	ICAO	AG	AFTN	AGGG	AGGG	HONIARA (FIC)	NON OP
33	**SRI LANKA**	SRILANKA		XF	XX	ICAO	VC	AFTN	VCCC	VCCC	RATMALANA/COLO MBO	NON OP
34	**THAILAND**	THAILAND	MTA-VTBB-1	CAAS	XX	ICAO	THAILAND	VTBB	VT**	VTBB	BANGKOK	OP
35	**TIMOR LESTE**	WP		XF	XX	ICAO	WP	AFTN	WPDL	WPDL	DILI	NON OP
36	**TONGA**	NFT		XF	XX	ICAO	NFT	AFTN	NFTF	NFTF	TONGATAPU	NON OP
37	**TUVALU**	NGF		XF	XX	ICAO	NGF	AFTN	NGFF	NGFF	FUNAFUTI	NON OP
38	**UNITED STATES**	K	KATLMTA	XF	XX	ICAO	K	AFTN	KATL	KATL	HARTSFIELD-JACKSON ATLANTA INTL GA.	OP
			KSLCMTA	XF	XX	ICAO	K	AFTN	KSLC	KSLC	SALT LAKE CITY	OP
39	**VANUATU**	NV		XF	XX	ICAO	NV	AFTN	NVVV	NVVV	PORT VILA/BAUERFIELD	NON OP
40	**VIET NAM**	VV		XF	XX	ICAO	VV	AFTN	VV	VVVV	HANOI	NON OP
41	**WALLIS AND FUTUNA ISLANDS**	NL		XF	XX	ICAO	NL	AFTN	NLWW	NLWW	WALLIS HIHIFO	NON OP

Note: Information from 1. EUR AFTN/CIDIN/AMHS Address Management Implemented On : 30/04/2015 10:15 UTC Created by AMC at EUROCONTROL
2. AMC Operational Data / Network Inventory: AMHS Capabilities OPER 144 Released on 30/04/2015 11:00 UTC
3. Bangladesh Information is the last information received from him (MAR 2015)

Table 1b

Suggested *PRMD-name* values of the AMHS MD in ASIA/PAC region
For states/ATSO which have not registered to AMC
assuming all States/ATSOs using CAAS

	Contracting State	Nationality Letters	Addressing Scheme	Country-name	Administration-domain-name	Private-domain-name (using Nationality Letters)	Private-domain-name (using Name of Country)	Organization name	Organization unit-name-1 (using wildcard)
			(CAAS)	(C)	(A)	(P)	(P)	(O)	(OU1)
1	**AFGHANISTAN**	OA	CAAS	XX	ICAO	OA	AFGHANISTAN	OAKB	OA**
2	**BHUTAN**	VQ	CAAS	XX	ICAO	VQ	BHUTAN	VQPR	VQ**
3	**BRUNEI DARUSSALAM**	WBSB	CAAS	XX	ICAO	WBSB	BRUNEI DARUSSALAM	WBSB	WBS*
4	**COOK ISLANDS**	NC	CAAS	XX	ICAO	NC	RAROTONGA INTL.	NCRG	NC**
5	**DPR OF KOREA**	ZK	CAAS	XX	ICAO	ZK	DPR OF KOREA	ZKKK	ZK**
6	**FRENCH POLYNESIA**	NT	CAAS	XX	ICAO	NT	FRENCH POLYNESIA	NTAA	NT**
7	**KIRIBATI**	NG	CAAS	XX	ICAO	NG	KIRIBATI	NGTT	NG**
8	**MALDIVES**	VR	CAAS	XX	ICAO	VR	MALDIVES	VRMM	VR**
9	**MONGOLIA**	ZM	CAAS	XX	ICAO	ZM	MONGOLIA	ZMUB	ZM**
10	**MYANMAR**	VY	CAAS	XX	ICAO	VY	MYANMAR	VYYY	VY**

	Contracting State	Nationality Letters	Addressing Scheme	Country-name	Administration-domain-name	Private-domain-name (using Nationality Letters)	Private-domain-name (using Name of Country)	Organization name	Organization unit-name-1 (using wildcard)
			(CAAS)	**(C)**	**(A)**	**(P)**	**(P)**	**(O)**	**(OU1)**
11	**NAURU**	AU	CAAS	XX	ICAO	AU	NAURU	AUUU	AU**
12	**NEPAL**	VN	CAAS	XX	ICAO	VN	NEPAL	VNKT	VN**
13	**NEW CALEDONIA**	NW	CAAS	XX	ICAO	NW	NEW CALEDONIA	NWWW	NW**
14	**PAKISTAN**	OP	CAAS	XX	ICAO	OP	KARACHI	OPKC	OP**
15	**PAPUA NEW GUINEA**	AY	CAAS	XX	ICAO	AY	PAPUA NEW GUINEA	AYPM	AY**
16	**PHILIPPINES**	RP	CAAS	XX	ICAO	RP	PHILIPPINES	RPLL	RP**
17	**SOLOMON ISLANDS**	AG	CAAS	XX	ICAO	AG	SOLOMON ISLANDS	AGGG	AG**
18	**SRI LANKA**	VC	CAAS	XX	ICAO	VC	SRI LANKA	VCCC	VC**
19	**TIMOR LESTE**	WP	CAAS	XX	ICAO	WP	TIMOR LESTE	WPDL	WP**
20	**TONGA**	NFT	CAAS	XX	ICAO	NFT	TONGA	NFTF	NFT*
21	**TUVALU**	NGF	CAAS	XX	ICAO	NGF	TUVALU	NGFF	NGF*
22	**VANAUTU**	NV	CAAS	XX	ICAO	NV	VANAUTU	NVVV	NV**
23	**VIET NAM**	VV	CAAS	XX	ICAO	VV	VIET NAM	VVVV	VV**
24	**WALLIS AND FUTUNA ISLANDS**	NL	CAAS	XX	ICAO	NL	WALLIS	NLWW	NL**

INTERNATIONAL CIVIL AVIATION ORGANIZATION

Common Regional Virtual Private Network (CRV)Of Asia/Pacific Air Navigation Planning and implementation Regional Group (APANPIRG)

Cost Benefit Analysis (Second iteration, based on Request for Information, Jan.15)

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA-PACIFIC OFFICE

Document Change Record

Version Number	Date	Reason for Change	Sections Affected
1	29 April 2014	Creation of draft CBA for CRV TF/2 and ACSICG/1 meetings	
2	03 March 2015	Update based on the Request for Information data collected from the market from August 2014 to January 2015	Part II is added
3	28 April 2015	Review by CRV Task Force Chair and ICAO Secretariat	

Table of Contents

Intentionally left blank

I. First iteration (April 2014)

1. Introduction

The First Meeting of the CRV (Common Regional Virtual Private Network) Task Force elaborated a work plan for carrying out the study mandated by the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) under Decision 24/32 Common Regional Virtual Private Network (VPN) Task Force.

It was recognized that such a service could be considered as a multinational service, as per ICAO Document ASIA/PAC BASIC ANP Doc 9673, and that such approach would require a cost benefit analysis to make sure that the project was cost efficient and beneficial for both developing and advanced States. The task was initiated to collect data from various member states as per Appendix 1 template in order to better define the recurring costs and problems associated with the current configurations. Every State or Administration of the Asia/Pacific Region was invited to reply to this Survey to ICAO Asia and Pacific Office (ICAO APAC Survey).

Fifteen organizations including one ANSP and fourteen States, have positively contributed through the ICAO APAC Survey, as per Appendix 2. This Cost Benefit Analysis (CBA) document analyzes the reports based on the Survey of these States and evaluates options that will help APANPIRG and the member states to take a decision for joining the CRV network and plan their budget accordingly.

1.1. Current Status

Currently, Aeronautical Fixed Telecommunication Network (AFTN) and AMHS services in the Asia/Pacific Region are operated over point-to-point international private lines (IPL). This network configuration exhibits a number of limitations, including (but not limited to):

- Half circuit arrangement between States is increasingly difficult to order and time consuming;
- Circuit upgrades between states is also impacted due to variable pricing and bandwidth availability of the half circuit at each State;
- Dynamic routing is not supported due to limited bandwidth and no central administration of the network;
- Incompatible network protocol do not support Extended Service as specified in ‘Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols (ICAO Doc9880)’;

- New features enhancement as recommended by ICAO 12th Air Navigation Conference such as System Wide Information Management (SWIM) is not supported;
- Network security measures cannot be implemented which leads many States to implement their own security measures and policy adding to overall costs; and
- Different budget cycles and priorities between States make the synchronization of upgrades difficult and in turn limit the seamless distribution of Aeronautical Fixed Service (AFS) data.

1.2. Brief introduction to CRV

In an attempt to resolve these issues, the CRV Task Force was formally established in accordance with APANPIRG Decision (24/32), (Bangkok, Thailand, 24-26 June 2013).

It was decided that a dedicated, common network operated by a Communication service provider is a viable approach to be studied to replace the current configuration. Common networks have successfully been deployed in other ICAO regions (e.g. PENS in the EUR Region and MEVA in the CAR Region). Therefore, 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.*

2. Scenario Analysis

The CBA document has studied two scenarios: introducing and not introducing a common aeronautical regional network in the Asia/Pacific region. Cost and benefit analysis was performed for the two scenarios.

2.1. Scenario 1 – Do Nothing

This chapter considers the case of not introducing the CRV.

2.1.1. Benefit Analysis

2.1.1.1. Summarized cost of current link infrastructure from ICAO APAC Survey

From ICAO APAC Survey and analyses on the data provides following

Type of circuits in use:

There are three types of circuits currently used by states, ‘Voice only’, ‘Data only’ and ‘Multiplexed Data + Voice’. Summarizing all usage types, the total number of circuits are 181. Distribution of usage is ‘Data only’: 43%, ‘Voice only’: 43% and ‘Multiplexed Data+ Voice’: 14%. Usage of Multiplexed ‘Voice’ and ‘Data’ remains quite low at 14%, indicating that separate circuits are provided for data and voice in most cases.

Bandwidth in use:

Currently circuits with 64 Kbps bandwidth accounts for the highest number of circuits in use and amount to 39% of all the circuits in use in Asia/Pacific region. 9.6kbps accounts for 12%. Furthermore the slowest bandwidth used is 2.4kbps and highest bandwidth is 2Mbps. There are 8 lines of 2Mbps.

Ratio of Landline to Satellite circuits:

Regarding the use of connection between various states, the ratio of Land Line is 85%, and the ratio of Satellite is quite low at 15%.

In accordance with the result from ICAO APAC Survey, the cost of the communication infrastructure that is currently connected is summarized in the table below:

Figure 1: *Result of ICAO APAC Survey*

	For all Communications	For voice only	For data only	For multiplexed data + voice
Total monthly cost of communications for all States (in US$)	415,647	185,009	162,498	68,140
Total annual cost of communications for all States (in US$)	4,987,764	2,220,110	1,949,976	817,678
Average annual cost by State (in US$)	332,518	148,007	129,998	54,512
Average kbps cost (in US$)	98.7			

Caveats:

- Number of States/Administrations in the Survey is 15 organizations (States/ANSPs).
- All currencies have been converted into US$ based on the March 14 rate
- Costs are a minimal estimate since costs as per use are not included

It may be noted that the 15 organizations (States/ANSPs) that were reported by ICAO APAC Survey are spending a total US$ 5 million per year for international aeronautical ground-to-ground communications (voice and data).

2.1.1.2. Negative impact from doing nothing (can be considered as cost)

Negative impact of non-introduction of the CRV by states based on available data is as follows:

2.1.1.2.1. Inability to support GANP technology roadmap

SWIM is an integral part of the Global Air Navigation Plan (GANP) and relates to a number of Aviation System Block Upgrades (ASBUs) modules. It will offer SWIM technical services based as much as possible on mainstream information technologies (IT) technologies. It will preferably be based on commercial off-the-shelf (COTS) products and services. Typically dedicated, secured IP networks will be applied to the underlying basic ground/ground connectivity. Also a dedicated IP network is an explicit requirement of the technology roadmap to enable SWIM and Voice over IP for inter - centre voice ATM communications. In Asia/Pacific region, IP network that connects between each States is not currently implemented. The CRV if not implemented will be a major stumbling block in realizing the future plan of ICAO.

2.1.1.2.2. Difficult to expand / manage ground-ground communications (lack of scalability and manageability)

The management - and specifically the upgrade - of the present IPL which are based on half circuit agreements between states is becoming increasingly difficult. Setting up and maintaining the circuits require regular coordination between telecommunication service providers and are difficult to manage. The actual implementation of the circuit requires a long lead time as each State has a different contract procedure and is required to pay for its own half circuit thus making it increasingly difficult to order the circuits in several States. Also, there is no common point for management of faults thus requiring each state to individually research into the cause of a circuit failure and thus it takes a lot of time to isolate the fault. Furthermore, whenever an upgrade of circuit is required due to increased bandwidth requirements, the service provider is not able to upgrade and mostly a new circuit is required to be established to cater for higher bandwidth.

2.1.1.2.3. No common interface – different interfaces due to different technologies used such as X.25, VSAT, etc.

The existing regional network has been built up with large number of IPLs between individual States. These circuits use various underlying protocols and physical interfaces such as X.25, X25/IP conversion, or voice/data MUX, making it increasingly difficult to manage for the technical teams. In addition, many interfaces, which were designed to support point-to-point or application-to-application exchanges, have limited flexibility to accommodate new users, additional systems, new content or changed formats use.

2.1.1.2.4. Obsolescence

According to the ICAO APAC Survey, the maintenance of low-speed IPL by the telecommunication service provider is becoming increasingly difficult. The legacy technologies like X.25 or PES/TES VSAT etc. are almost obsolete, requiring lot of effort and increasing costs to maintain and sustain the network. The service providers are therefore reluctant to maintain the legacy technologies. X.25 technology has been taken over by IP based/ MPLS networks which are more efficient and provide higher bandwidths at lower costs. Also, the Voice/Data Multiplexer has become difficult to maintain as the industry has moved to Voice over Internet Protocol (VoIP) standard. In some cases, spare parts can no longer be obtained from industry.

2.1.2. Cost Analysis

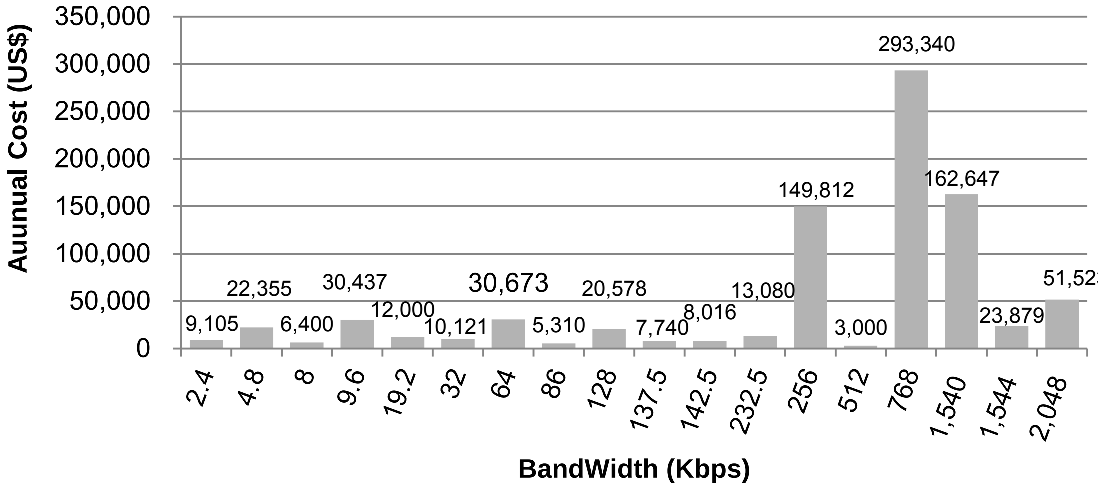
2.1.2.1. Current predictable cost

Currently, the contract method of IPLs is based on half circuit arrangement: the cost is shared by two States for establishing one circuit. In view of difficulty in analyzing each line approach of total cost and average connecting cost in the Asia/Pacific region has been adopted accordance with the purpose.

The analysis of the data based on annual cost per circuit for each bandwidth connection reveals that 64Kbps accounts for 39% of the total circuits and the protocol mainly used is X.25 protocol, and the average cost per circuit is US$ 30,673.

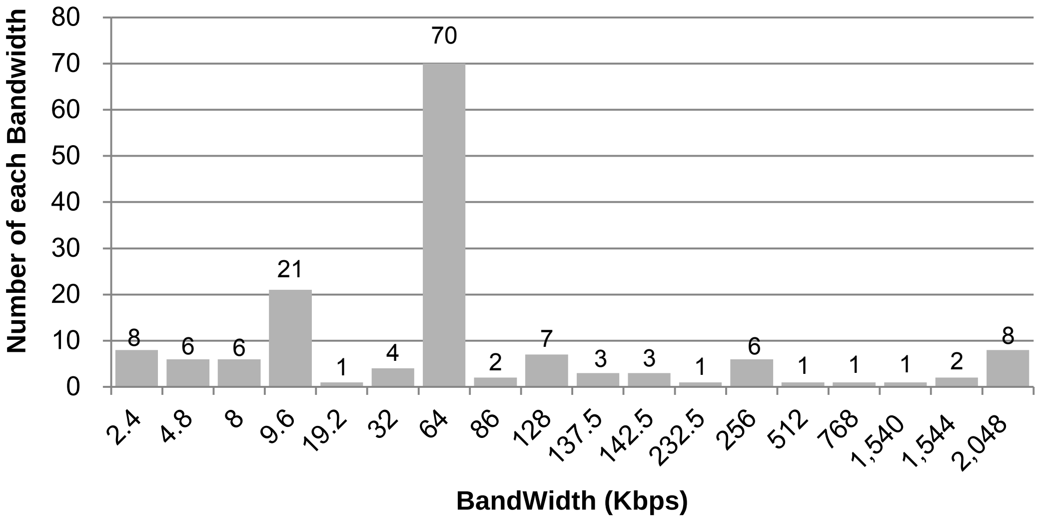
The reason of usage of 64Kbps being so widespread is the use of underlying X.25 protocol which supports 64Kbps as a maximum bandwidth. The cost worked out is per circuit, so total cost for each State depends on the number of connections.

Figure 2: *Annual Cost per Line of each Bandwidth*



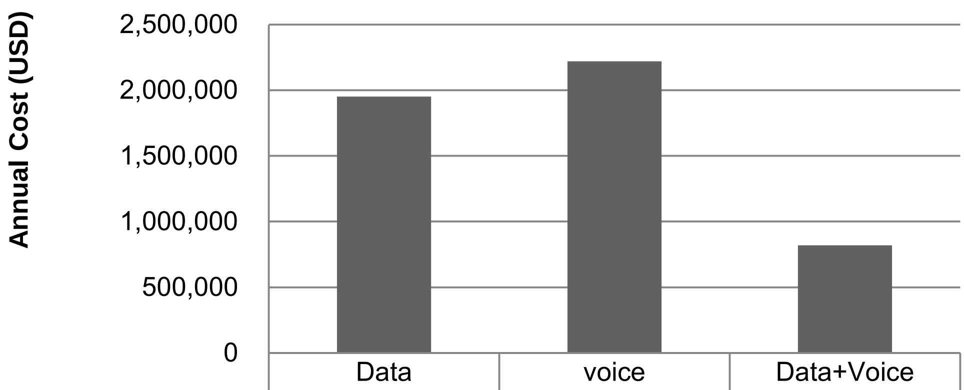
In the future, the need for internet protocol suite (IPS) would increase, requiring faster line speeds. As per the plans AMHS will be used to exchange weather information (WXXM) defined by the XML format, and thus the lines for AMHS will be expected to use IPS for accommodating increased flow of data through XML format.

Figure 3: *The Number of lines per bandwidth*



Furthermore, it may be seen that bandwidth requirements/ new circuits will increase in the short-term to cater for the exchange for AIDC messages with adjacent States.

Figure 4: *Annual Cost of Type*

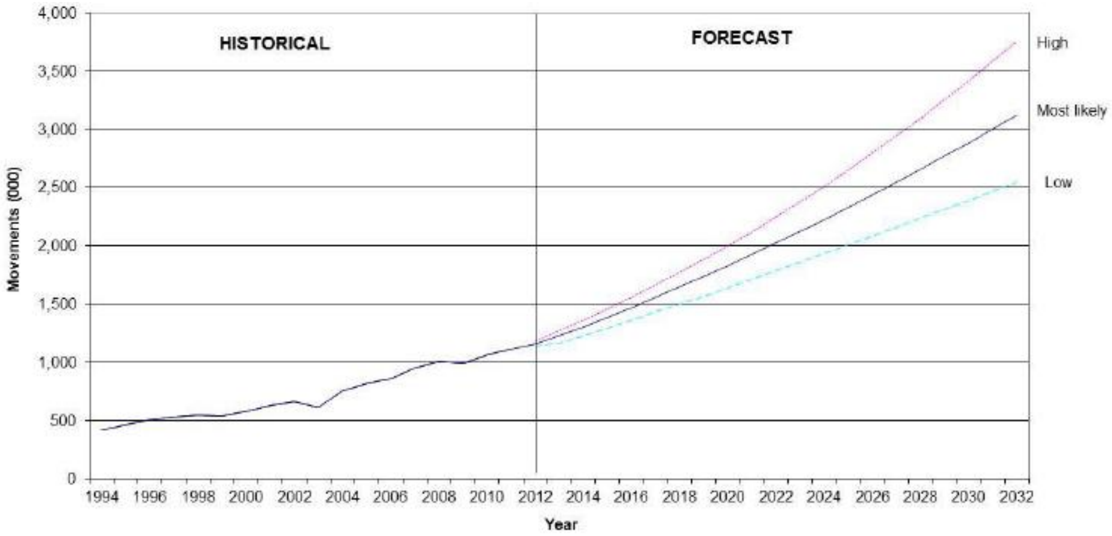


	Data	voice	Data+Voice
Lines	78	77	26
Yearly Cost (USD)	1,949,976	2,220,110	817,678

Also as per ICAO APAC Survey, MUX for Voice and Data cannot be maintained by telecommunication service providers in near future, so it is imperative to look for alternative method or install individual circuits for different services.

In the medium to long term perspective, strong growth of demand is expected toward 2032. The demand for aircraft movement of the Intra-Asia/Pacific is shown in the figure 5 below. To cater to these demands, States will need to achieve the ASBUs in GANP (e.g. SWIM). Therefore, the wider bandwidths supported by a secure IP/ MPLS network will be required by existing and new international aeronautical communication services.

Figure 5: *Intra-Asia/Pacific Aircraft Movement Forecast*



Forecasts of Transpacific and Intra-Asia/Pacific Traffic to the Year 2032

(REPORT OF THE ASIA/PACIFIC AREA TRAFFIC FORECASTING GROUP (APA TFG) SIXTEENTH MEETING MONTREAL, 19 – 21 SEPTEMBER 2012)

Consequently, it may be seen that the present method of constructing the network by IPLs to meet the existing requirements as listed above, the cost to maintain the circuits will continue to upwards from annual US$ 5 million presently being used by 15 States in ICAO APAC Survey.

2.2. Scenario 2 – Move to CRV (15 States)

This chapter considers the case of introducing the CRV network in the Asia/Pacific region.

2.2.1. Benefit Analysis

2.2.1.1. Support Global Air Navigation Plan (GANP) roadmap

'ICAO's Global Air Navigation Plan (GANP) (ICAO Doc 9750)' has introduced the Aviation System Block Upgrade (ASBUs) framework and roadmaps in 2013. As a follow-up to APANPIRG/24 Conclusion 24/2, regarding the establishment of Regional Priorities and Targets, and referring to the ICAO APAC Seamless ATM plan v1.0, the initial regional priorities endorsed by APANPIRG/25 in September 2014 should be:

- ATFM/A-CDM (B0-NOPS);
- AIM (B0-DATM);
- AIDC (B0-FICE);
- FUA (B0-FRTO);
- Surveillance (B0-ASUR); and
- Data-link ADS-C and CPDLC (B0-TBO).

To enable specifically AIDC (B0--FICE) in the initial regional priorities, implementation of a common network internationally is essentially required. According to the ICAO APAC Survey, currently, there are many problems, such as described in 1.1 Current Status to the introduction of IPLs. For catering to the future services, the communication infrastructure is required in an environment that can take advantage of IT technology.

A dedicated, common regional virtual private network operated by a communication service provider will be of utmost importance in the Asia/Pacific region, in order to promote the implementation of the GANP roadmap and is under consideration 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).

2.2.1.2. CRV technology is the enabler for future services:

The CRV network shall be established by using the IP based virtual private network (IP-VPN) service, which will be a closed private IP network via the access line.

Specific service level agreement (SLA) will be put in place between States and a common service provider to guarantee the speed of the circuit, the quality of service (QoS) and other performance and quality parameters.

The usage fee shall be determined based on bandwidth usage or other similar criteria as agreed upon or quoted by a common service provider and is expected to be lower than the one of existing IPL.

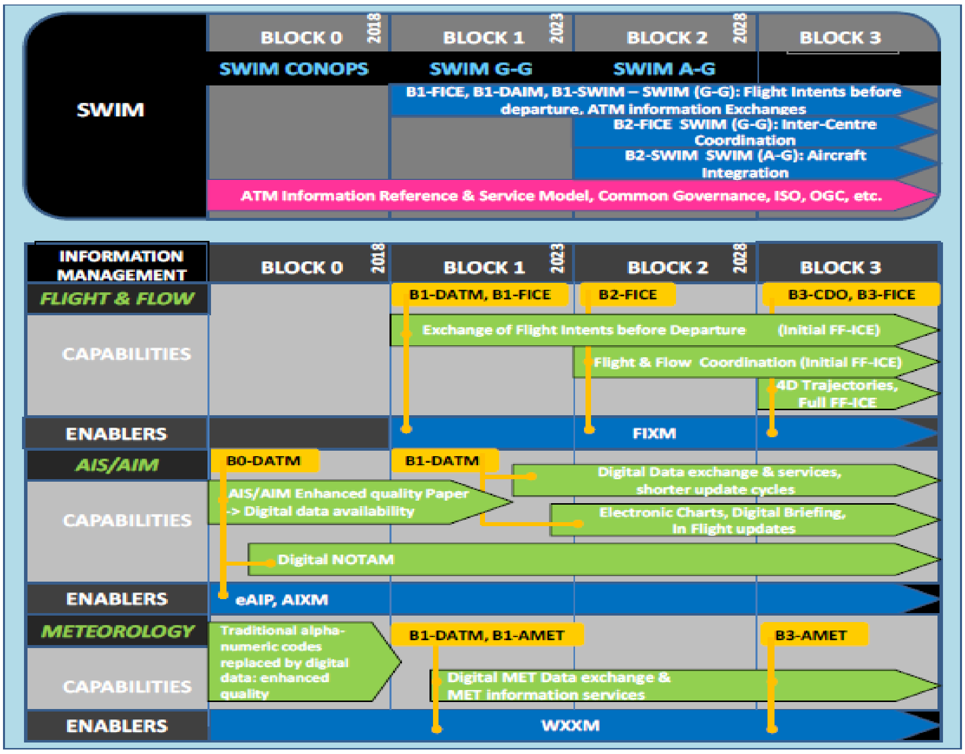
As compared to IPL services, such as wide-area Ethernet or conventional Frame Relay, the IP-VPN is advantageous in terms of low running cost, and easy to construct with a flexible network configuration. In addition, priority control and bandwidth control is also feasible, thereby allowing high speed and large capacity of data flow enabling voice communication as well using VoIP.

Therefore, the CRV is sufficient to meet the technical requirements of demands on future concepts, as applications may be developed using IT technology according to the future concepts.

2.2.1.2.1. SWIM

The SWIM is mainly contained in the ASBUs B1-SWIM and B2-SWIM. In addition, the modules relating to service improvement through digital aeronautical information management and integration (B0-DATM & B1-DATM) as well as modules for improving operational performance through FF-ICE (B1-FICE, B2-FICE, and B3-FICE) are important early components of overall SWIM.

Figure 6: *Roadmap of Global Air Navigation Plan*



As an IP network based on IP-VPN, the CRV network will be the future communication infrastructure to support the SWIM.

2.2.1.2.2. ASBUs – B0-FICE

The ICAO, B0-FICE in ASBUs is required to be implemented during the period Block0 (2013 ~ 2018).

Figure 7: *Summary of Module B0-FICE in ASBUs*

B0-FICE	
Item	Increased Interoperability Efficiency and Capacity through Ground – Ground Integration
Summary	Supports the coordination of ground – ground data communication between ATSU based on ATS Inter-facility Data Communication (AIDC) defined by ICAO Document 9694.
Comment	Increased Interoperability, Efficiency and Capacity though Ground – Ground Integration Improves coordination between air traffic service units (ATSUs) by using ATS inter-facility data communication (AIDC) defined by ICAO's Manual of Air Traffic Services Data Link Applications (Doc9694). The transfer of communication in a data link environment improves the efficiency of this process, particularly for oceanic ATSUs.

It is set as the target in the short term. Therefore, the reduction in lead time to introduce the procedures will greatly contribute to the achievement. The whole process to implement AIDC with adjacent FIR can be expedited by implementing the CRV instead of establishing IPL which will be expensive and difficult to manage.

2.2.1.3. Manageability

The CRV will provide a seamless and homogeneous service in view of better management and service level agreements that will be in place between individual states and the communication service provider. Service provider will be in a better position to manage, report and restore the circuits in case of failure. In addition, dynamic increase in bandwidth of the circuits and network will be possible as per the requirement on short notice. The network will be using the underlying IP protocol and thus COTS products/applications will be easily available. The system of monitoring and the maintenance by service provider will be built in 365 days 24 hours. Fault detection will be easy and fault status and reporting can be determined by point of contact quickly and fault section and report generated end-to-end. Monitoring of communication equipment and the circuits shall be possible remotely (e.g. Ping Monitoring, CPU utilization, Memory usage/rate, Traffic (in/out)). In addition, the country that connects to the CRV will be able to ensure the monitoring environment using the WEB.

2.2.2. Cost Analysis

2.2.2.1. Initial One-off deployment costs

To assess the one-off deployment costs, a survey was carried out on several IP-VPN service providers (KDDI, NTT communications). The results of the survey are as follows.

(1) The one-off deployment does not depend on the bandwidth.

(2) If 21 locations in the 15 States of ICAO APAC Survey introduce IP-VPN, the estimated amounts would be:

A) Large difference occurs in the estimated amount by the situation of the communications infrastructure in each State.

B) From US$ 600 ~ to: US$ 50,000.

Based on the information above, following a conservative approach, the initial one-off deployment costs of introducing the CRV would be assumed to be as follows:

- The one-off deployment costs should be assumed that it will be introduced as the most expensive case to communication facility of 21 locations.
  - 21(locations) x 50,000(US$) = US$ 1,050,000
  - The costs necessary to TCB for CRV introduction is estimated at: US$ 180,000
  - Adapting the current equipment owned by States to interface with the CRV network is assessed as not needed, because the common service provide will deploy and maintain all necessary equipment.
- The costs for States representatives to participate in the CRV task force are estimated as follows:
  - 15(States) x 5,000(US$) x 10(times) = US$ 750,000
- It is required 100 days until operation after application for IP-VPN. In addition, Project management, Design, Safety, Installation and Tests cost for the creation of the network for 15 States (21 locations) for States would be assumed to be US $ 700 per day.
  - 21(locations) x 100(Days) x 700(US $) = US$ 1,470,000

As a result, the initial one-off deployment cost conservative estimative for 15 States (21 locations) amounts to US$ 3,450,000.

2.2.2.2. Total cost of ownership over 10 years

To compare the cost of the two scenarios on a fair basis, the cost of moving to the CRV has to be estimated over the CRV lifecycle, 10 years (initial 5 years contract plus 5 years extension), including the initial one-off deployment costs to implement the CRV network.

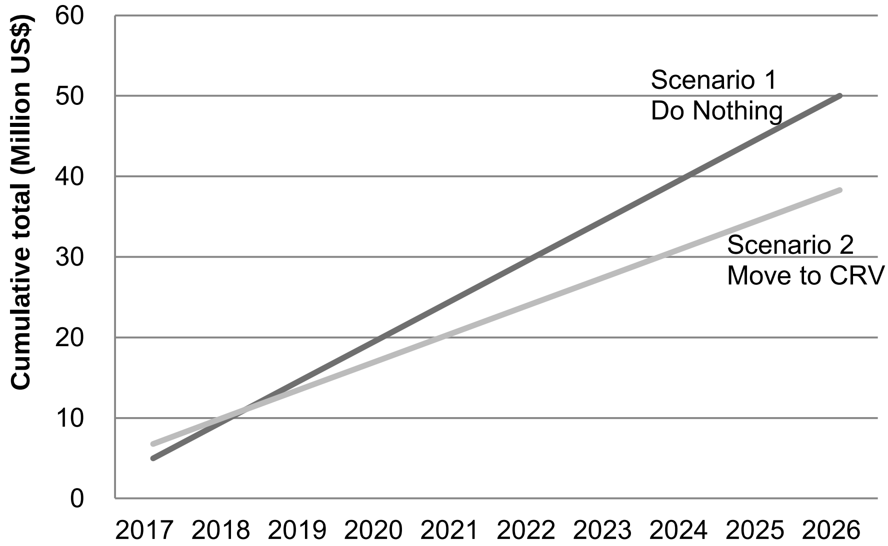
According to *Proposed Asia/Pacific Internet Protocol (IP) Virtual Private Network (VPN) (APANPIRG/24 - WP/20*, using an IP-VPN could result in 30% cost saving and significant additional bandwidth when compared to point-to-point circuits.

The initial one-off deployment costs could be recovered in one or two years, even if it is assumed that the introduction of IP-VPN would only encompass all connected points that were reported in the ICAO APAC Survey (conservative approach).

Figure 8: *Total cost of ownership over 10 years for 15 States, for the 2 scenarios*

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Scenario 1 Do Nothing	One-off costs (15 States)	0	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated), (15 States)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
	Cumulative total	5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
Scenario 2 Move to CRV	One-off costs (15 States)	3.45	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated), (15 States)	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
	Cumulative total	6.95	10.45	13.95	17.45	20.95	24.45	27.95	31.45	34.95	38.45

Figure 9: *Compared total cost of ownership over 10 years for 15 States, for the 2 scenarios*



In reality it is foreseeable that the number of connections will have to be increased in both scenarios as more States opt in.

If the number of connecting points is increased, the IPL network in Scenario 1will need to be further meshed and the service costs will increase accordingly. In the Scenario 2, the IP-VPN network is not sensitive to the increase in the number of connecting points, which will augment the distance between the 2 scenarios, in favour of Scenario 2.

For example, for an IP network of 1Mbytes with 5 connecting points, the cost comparison between IPL and IP-VPN would be estimated by the following modeling approach:

- Current IPL line is composed of domestic access lines and international IPL line. The costs of the global IPL line is assumed to be 100, in addition, total costs of access lines to the end of both on the global IPL is assumed to be 100. In this case, it becomes 200 to carry out 1 line.

- Regarding the IP-VPN access, since the cost of IP-VPN becomes at least 30% reduction compared with the cost of international IPL line, the cost of the global IP-VPN is assumed to be 70. Since there is no difference in the cost of the access line to the global IP-VPN, it is assumed to be 100.

- It should be noted that, if there is no requirement to increase the bandwidth and access lines, it is not necessary to implement one more line even if the number of connecting States has increased.

Figure 10: *The Cost Comparison between IPL and IP-VPN connectivity*

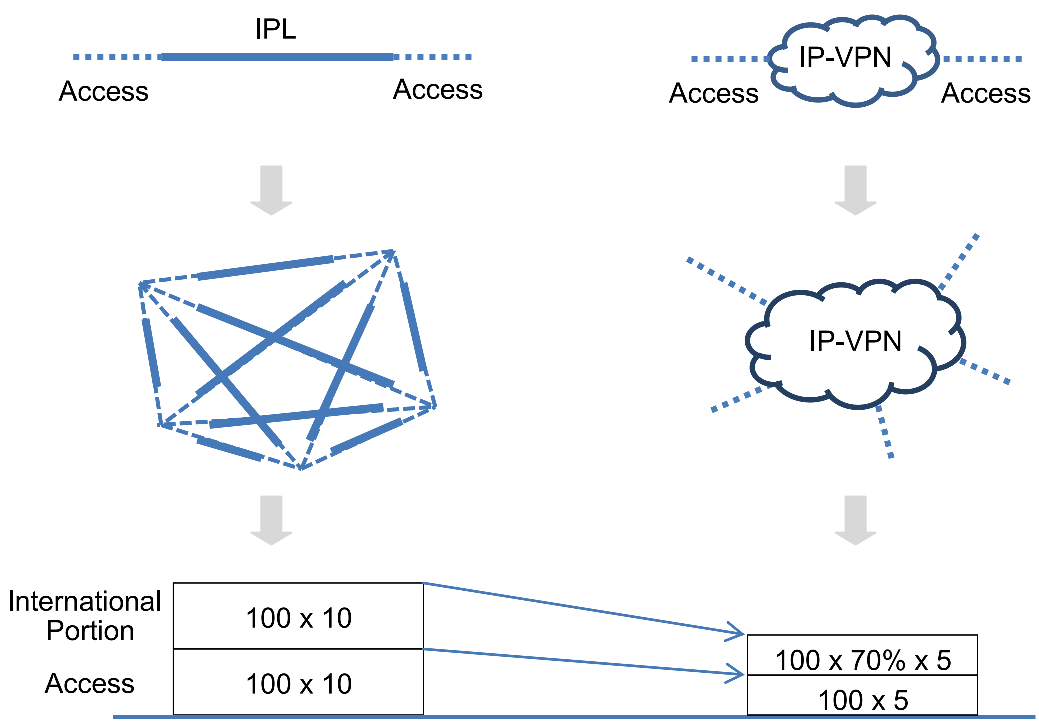
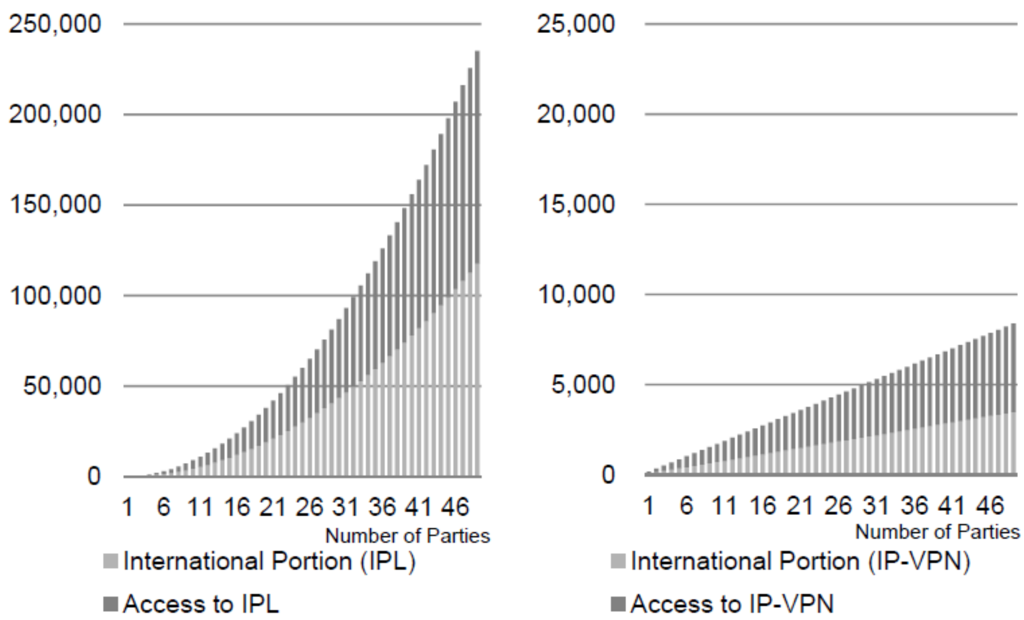


Figure 11: *The Costs increase of IPL and IP-VPN with an increasing number of Parties*



This shows that the distance between the 2 scenarios as regards the total cost of ownership has been estimated in a conservative way. Costs increase induced by greater connectivity is exponential in Scenario 1 and linear in Scenario 2. Any new need of connectivity would favour even more the scenario 2.

2.3. Summary (first iteration, Apr. 14)

Currently, the Aeronautical Fixed Telecommunication Network (AFTN) and Air Traffic Service Message Handling System (AMHS) provide ground to ground message switching functions based on point-to-point IPLs in the Asia/Pacific Region. The protocol in use is mainly X.25 protocol, which is almost obsolete and becoming difficult to maintain.
In the Scenario 1, Do Nothing, the acquisition of new IPL circuits by half circuit arrangement between States will become increasingly difficult and require lot of time to establish. Its sustainability may even be threatened by equipment and technology obsolescence.

The Scenario 2 presents strong advantages. Since the AMHS in BBIS is equipped with a dual-stack ATN router, it corresponds to the IP network. Therefore, the IP network is a strong candidate while considering setting up of a new network to facilitate intra region communication. In addition, to achieve the GANP ROADMAP, when considering the introduction of the SWIM, the IP network is essential as a common communication platform that can be connected by various stakeholders. The implementation of the common IP network in the Asia/Pacific region will solve issues of obsolescent technology and enable the introduction of new applications.

The overall architecture of the CRV will provide use of optimum bandwidth and number of circuits for connecting between Asia/Pacific states thus providing sufficient cost benefits and will be a cost effective solution. In the future, the aircraft movement in Asia/Pacific region is forecasted to grow exponentially. Considering the above issues, the introduction of the CRV network is essential, in particular, to build up a system that can correspond to the introduction of new technology for performing collaborative decision-making.

Figure 12: *Summarized Cost Benefit Analysis for CRV*

	Scenario 1 – Do Nothing (based on ICAO survey)	Scenario 2 – Move to CRV
Quantitative benefits		
Cost	Scenario of reference Costs increase induced by greater connectivity is exponential	Expected reduction of the total cost of ownership by 23% over 10 years for 15 States (same number as for Scenario of reference) Initial one-off deployment efforts paid back in one to two years Costs increase induced by greater connectivity is linear
Performance	Lower performance due to low speed/obsolescent technology and unsuitable design	Better performance based on performance and safety monitoring, and ad hoc design including high speed technology (1~2 Mbps connectivity)
Diversity	Fallback solutions by Operator when available	Solutions available on the market (logical fallback on IP-VPN and physical diversity etc) but shall be required through user requirements and monitored
Reactivity (Delays)	Longer period to implement a new line with poor control of delays (a couple of months) Poor synchronisation in change management between APAC States	Reduced time to coordinate and implement any upgrade following pre-established and homogeneous contractual requirements (a couple of weeks)

Qualitative benefits		
Safety	Lay down by Point to point, secured by physical	Ensured through network design
International commitment	Not possible to meet ICAO GANP objectives	Possible to meet ICAO GANP objectives
Contingency	Manage with coordinating each half-circuit by both Service Providers	Manage a whole network by Service Provider
Upgradeability	Need for new line and facility to upgrade Bandwidth	Easy to upgrade Bandwidth without installing additional facility

II. Second iteration, based on RFI (Jan. 15)

3. Review of the scenarios analysis

The Request for Information (RFI) indicated the actual costs which were estimated by several IP-VPN service providers from August to December 2014 as an outcome of Task 28 “Update CBA for ACSICG/2 from RFI”.

The estimated costs comprise the initial one-off deployment costs (Project management, installation), the recurrent service costs, depending upon whether data and voice are included or not. Among the service providers having responded to the RFI, several service providers introduced the detailed costs to implement CRV for all member states in ICAO Asia/Pacific region.

The CBA in the first iteration was a simplified approach without any market survey. In addition to the update of costs based on estimations provided by the communication service providers during the RFI, this iteration considers other scenarios to take into account the issue of the poorer communication infrastructure available in Pacific islands, and more generally, of the States with a poor communication infrastructure.

3.1. Scenario 3 – Move Data and Voice to CRV and keep external independent back-up for critical services (15 States)

This scenario is based on cost estimations received during the Request For Information, for the same baseline of 15 States having participated initially in the ICAO survey (scenario 1) and the scenario 2.

It consists in moving data and voice to CRV while keeping external independent back-ups for critical services.

3 sub scenarios are considered:

- Scenario 3a: Move data and voice to CRV (MPLS, lower offer): the cost estimations correspond to the **lowest costs** received during the RFI for an **IP MPLS** provision, 2Mbps, 15 states, 23 sites

- Scenario 3b: Move data and voice to CRV (MPLS, higher offer) the cost estimations correspond to the **highest costs** received during the RFI for an **IP MPLS** provision, 2Mbps, 15 states, 23 sites

- Scenario 3c: Move data and voice to CRV - Private VSAT network: the cost estimations correspond to the costs received during the RFI for a **Private VSAT** network 2Mbps, 15 states, 23 sites

For this analysis, the external back-up for critical services costs correspond to the internet based VPN costs which were included in the RFI.

3.2. Scenario 4 – Move Data only to CRV, Current infrastructure kept for voice (15 States)

In this scenario, the infrastructure currently used for voice by APAC States will be kept to maintain the redundancy between data communication and voice communication.

The one-off costs and annual service costs quote the highest costs within the RFI. In addition, the current infrastructure used for voice services costs quote the annual services costs for voice services as per ICAO survey 14th Jan. (Figure 13).

Figure 13: *Total cost of ownership over 10 years for 15 States, for the 4 scenarios*

Scenario	Cost	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Scenario 1 Do Nothing (Current costs as per ICAO Survey Jan.14, extrapolated)	One-off costs (15 States)	0	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated) (15 States)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
	Cumulative total	5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
Scenario 2 Move data and voice to CRV (initial CBA, Apr. 14)	One-off costs (15 States)	3.45	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated) (15 States)	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
	Cumulative total	6.95	10.45	13.95	17.45	20.95	24.45	27.95	31.45	34.95	38.45
Scenario 3a Move data and voice to CRV (MPLS, lower offer) 1) data and voice on CRV 2) independent external back ups for critical services (updated with RFI, Dec.14)	One-off costs (15 States)	0.21	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated) (15 States)	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
	One-off costs **external back-up** (15 States)	0.03	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated), external back-up (15 States)	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
	Cumulative total (Includes external back up for critical services)	2.13	4.03	5.93	7.82	9.72	11.61	13.51	15.41	17.30	19.20
Scenario 3b Move data and voice to CRV (MPLS, higher offer) 1) data and voice on CRV 2) independent external back ups for critical services (updated with RFI, Dec.14)	One-off costs (15 States)	0.00	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated) (15 States)	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38
	One-off costs **external back-up** (15 States)	0.03	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated), external back-up (15 States)	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
	Cumulative total (Includes external back up for critical services)	3.03	6.03	9.02	12.02	15.02	18.02	21.02	24.01	27.01	30.01
Scenario 3c Move data and voice to CRV - Private VSAT network 1) data and voice on CRV 2) independent back ups for critical services (updated with RFI, Dec.14)	One-off costs (15 States)	0.91	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated) (15 States)	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59
	One-off costs **external back-up** (15 States)	0.03	0	0	0	0	0	0	0	0	0
	Annual service costs (extrapolated), external back-up (15 States)	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
	Cumulative total (Current external infrastructure kept for voice)	3.16	5.37	7.59	9.80	12.01	14.23	16.44	18.66	20.87	23.08
Scenario 4 Move data only to CRV 1) data on CRV 2) voice kept on external infrastructure (updated with RFI, Dec.14)	One-off costs (15 States)	0.15	0	0	0	0	0	0	0	0	0
	Annual service costs (voice), as per ICAO survey Jan.14 (15 States)	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22
	Annual service costs (extrapolated) (15 States)	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
	Cumulative total (Current external infrastructure kept for voice)	4.03	7.90	11.78	15.65	19.52	23.40	27.27	31.14	35.02	38.89

3.3. Scenario 5 – Move Pacific States to CRV (6 States)

The first iteration of Cost Benefit Analysis for CRV indicated indeed that the expected cost saving was about 23% for the 15 States, but did not refine the case of the small Pacific island states (for example Fiji, Kiribati, Tuvalu, Vanuatu, Wallis & Futuna and New Caledonia).

The member States of CRV TF mentioned the impact of RFI on Cost Benefit Analysis on smaller Pacific island states by WP/02 in CRV TF/3.

Their current costs (as per Dec. 14) are as follows:

Figure 14: *estimated cost based on current services*

State	Estimated Bandwidth	Estimated Cost US$ (Monthly)	Communication Service
Tuvalu	· PSTN	100	· Voice/Fax
Kiribati	· PSTN	100	· Voice/Fax
Vanuatu	· PSTN · Data(VPN over internet)	150	· Voice · AFTN(via Brisbane AFTN system)
Wallis & Futuna	· PSTN · Data(VPN over internet)	150	· Voice · AFTN(via Tontouta AFTN system)
New Caledonia	· PSTN · 1.0Mbps Data(VPN over internet)	200	· Voice · AFTN
Fiji	· PSTN · 1.5Mbps Data(VPN over internet IPLC)	4,000	· Voice · AFTN/AMHS

(Estimated Costs (Monthly) CRV TF/3-WP/02, Dec.14)

The motive of joining the CRV is mainly the increasing of communication bandwidth, the performance, the expected cost savings and the integration of all States on the same infrastructure.

This working paper referred to the communication infrastructure which is not well developed in the small Pacific islands. For this reason, the service providers would propose VSAT communications, and the cost was expected to be more than the VPN over Internet option but it would provide a more secure and high reliable communication for the current and future services.

The result from RFI is as follows:

Figure 15: *Communication Link Available and estimated cost based on communication service*

State	Estimated Bandwidth	Estimated Cost US$ (Monthly)	Communication Service	Communication Link Available
Tuvalu	· 2.0Mbps IP-VPN	14,XXX	· VOIP, AMHS, ADS-B, SWIM	· Satellite
Kiribati	· 2.0Mbps IP-VPN	21,XXX	· VOIP, AMHS, ADS-B, SWIM	· Satellite
Vanuatu	· 2.0Mbps IP-VPN	13,XXX	· VOIP, AMHS, ADS-B, SWIM	· Satellite
Wallis & Futuna	· 2.0Mbps IP-VPN	12,XXX	· VOIP, AMHS, ADS-B, SWIM	· Satellite
New Caledonia	· 2.0Mbps IP-VPN	7,XXX	· VOIP, AMHS, ADS-B, SWIM	· Satellite
Fiji	· 2.0Mbps IP-VPN	9,XXX	· VOIP, AMHS, ADS-B, SWIM	· Southern Cross Cable · Satellite

(Estimate Cost (Monthly) RFI, Dec.14)

As an outcome, the VSAT costs may prove prohibitive for some States and the benefits expected for other APAC States are not reaped in the case of these islands.

For this reason costs of services were explored with the IP-VPN service providers based on VPN over Internet for the non-critical applications. This would be the cheapest option subject to the secured internet gateway in place. The use of the internet as a means of communication for non-time-critical aeronautical ground-ground applications is mentioned by the document "*Guidelines on the Use of the Public Internet for Aeronautical Applications* (Doc 9855 First Edition-2005)".

The result from RFI is as follows:

The VPN over Internet option has an advantage over Satellite Communications on the cost as shown by figures 16, 17, and 18 and costs are affordable. However the performance cannot be guaranteed as the communications rely on Internet and best effort.

A fourth option (scenario 5-4), consisting of a private VSAT network with guaranteed performance, seems a credible intermediate option:

Figure 17: *Total cost of ownership over 10 years for 6 Pacific Islands States, for the 4 scenarios*

Scenario	Cost type	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Scenario 5-1 Do Nothing (Current estimated costs as per CRV TF/3-WP/02, Dec.14)	One-off costs (6 States)	0	0	0	0	0	0	0	0	0	0
	Yearly service costs (6 States)	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Cumulative total	0.06	0.11	0.17	0.23	0.28	0.34	0.39	0.45	0.51	0.56
Scenario 5-2 Move to CRV - Critical application (Satellite) (updated with RFI, Dec.14)	One-off costs (6 States)	0.53	0	0	0	0	0	0	0	0	0
	Yearly service costs (extrapolated) (6 States)	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	Cumulative total	1.49	2.44	3.40	4.35	5.31	6.27	7.22	8.18	9.13	10.09
Scenario 5-3 Move to CRV - Non-Critical application (VPN over Internet) (updated with RFI, Dec.14)	One-off costs (6 States)	0.13	0	0	0	0	0	0	0	0	0
	Yearly service costs (extrapolated) (6 States)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Cumulative total	0.20	0.27	0.34	0.41	0.48	0.55	0.62	0.69	0.76	0.83
Scenario 5-4 Move to CRV - Critical application (private VSAT network) (updated with RFI, Dec.14)	One-off costs (6 States)	0.19	0	0	0	0	0	0	0	0	0
	Yearly service costs (6 States)	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
	Cumulative total	0.45	0.71	0.97	1.23	1.49	1.75	2.01	2.27	2.53	2.79

3.4. Summary (second iteration, Jan. 15)

3.4.1. States/Administrations with a performant terrestrial connectivity

The table presented in the chapter 2.3 is still valid and gaps are even strengthened in favor of the move to CRV scenario for the States/Administrations with a good terrestrial connectivity:

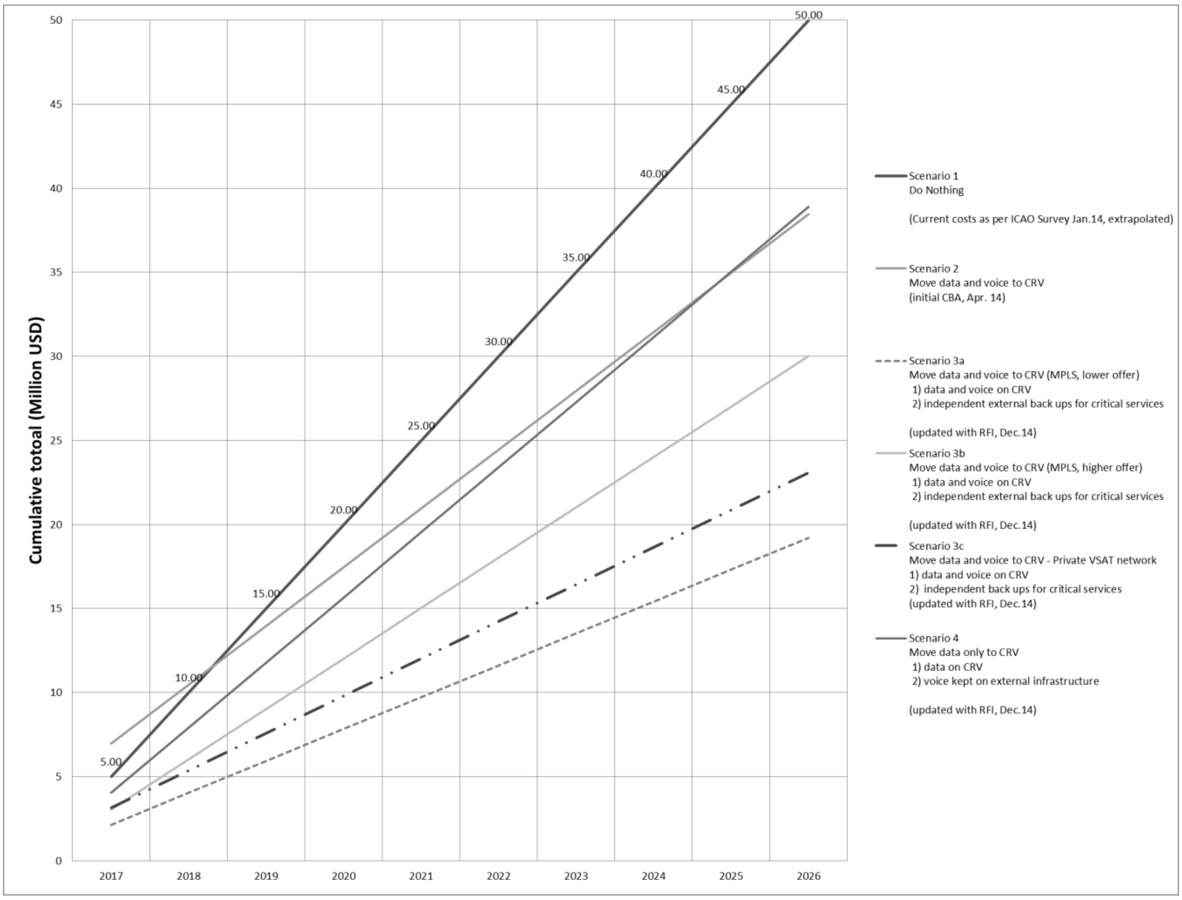
Figure 18: *Compared total cost of services over 10 years for 15 States for a performant (MPLS-based) terrestrial connectivity*

Scenario	Costs are for 15 States and include…	TCO 2017-2026, 15 States, in US million USD	Cost impact 2017-2026
1- Do nothing	*Current costs for data and voice as per ICAO Survey Jan.14, extrapolated over 10 years*	*50*	*Reference scenario See paragraph 2.2.2.2*
2- Move to CRV (initial CBA, Apr. 14)	Move data and voice to CRV (1st iteration, initial CBA, Apr. 14)	38.45	- 23.10% compared to the Reference scenario
3a - Move data and voice to CRV (MPLS, lower offer)	Move data and voice to CRV (MPLS, lower offer) 1) data and voice on CRV 2) independent external back ups for critical services (updated with RFI, Dec.14)	19.20	- 61.6% compared to the Reference scenario
3b - Move data and voice to CRV (MPLS, higher offer)	Move data and voice to CRV (MPLS, higher offer) 1) data and voice on CRV 2) independent external back ups for critical services (updated with RFI, Dec.14)	30.01	- 40% compared to the Reference scenario
3c - Move data and voice to CRV - Private VSAT network	1) data and voice on CRV 2) independent back ups for critical services (updated with RFI, Dec.14)	23.08	- 53.8% compared to the Reference scenario
4 - Move data only to CRV	1) data on CRV 2) voice kept on external infrastructure (updated with RFI, Dec.14)	38.89	- 22.22% compared to the Reference scenario

The overall result shows that the best economical option is to move to CRV, integrate voice and data on CRV as soon as possible, while making sure that all safety requirements are met through potential external and independent redundancies for critical services such as voice or surveillance data exchanges, particularly in high density areas.

The figure 19 illustrates this graphically:

Figure 19: *Compared total cost of ownership over 10 years for 15 States, for the 5 scenarios*



3.4.2. States/Administrations with a poor terrestrial connectivity

Concerning the States with poor terrestrial connectivity (where a MPLS connectivity is not offered), the scenario 5-2 Move to CRV with VSAT is the most expensive, while the scenario Move to CRV with VPN over internet remains comparable with the Do Nothing scenario.

However it should be noted that this scenario 5-2 is based on 2MBps prices obtained during the RFI[1]. Probably those costs would significantly decrease based on 64 or 128 Kbps bandwidth.

[1] Prices for smaller bandwidths were not requested during RFI

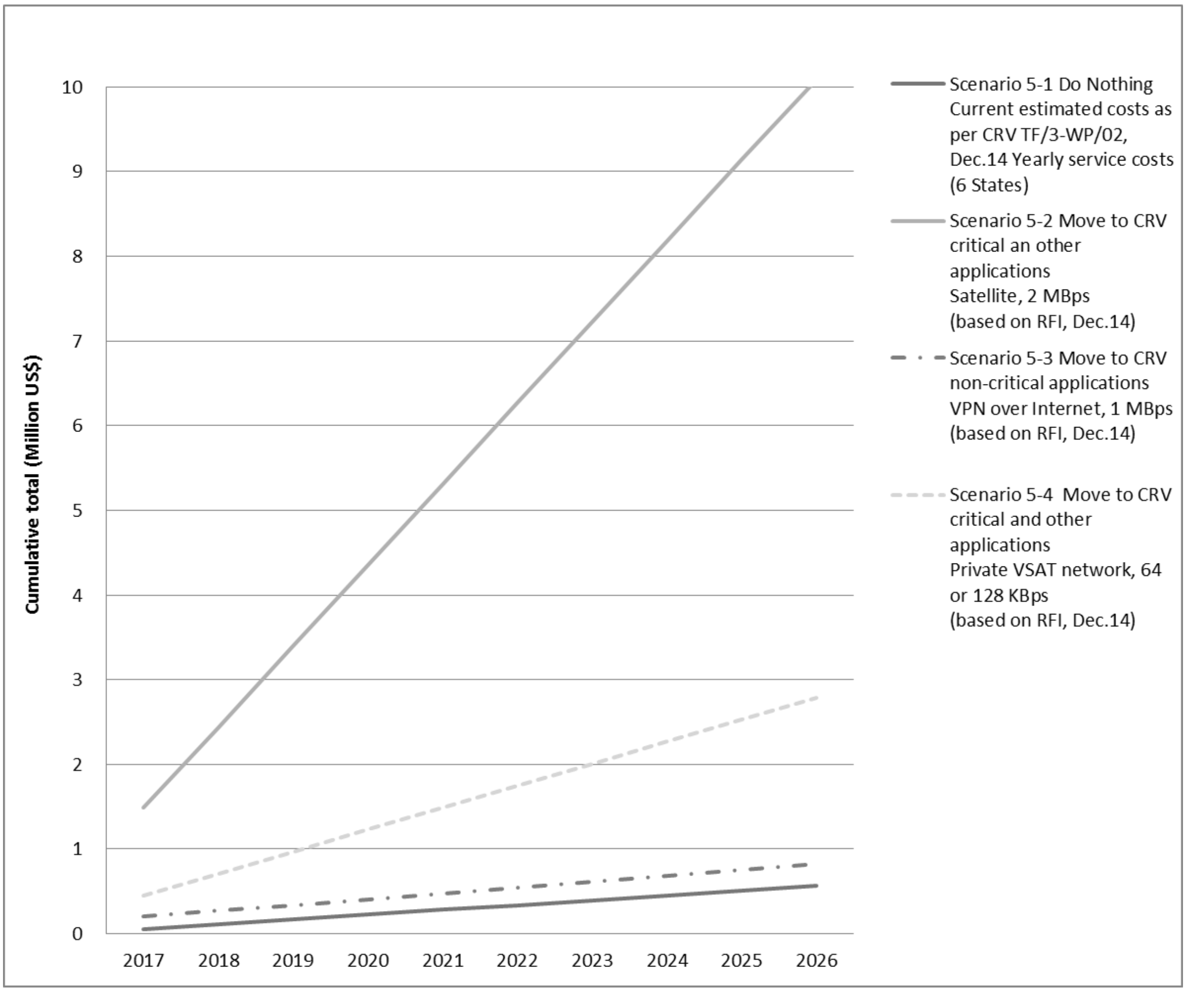
Figure 20: *Compared total cost of ownership over 10 years for 6 Pacific Islands States, for the poorer communication infrastructure*

Scenario	Costs include…	TCO 2017-2026, 6 Island States, in US million USD	Cost impact 2017-2026
5-1 Do nothing	*Current costs extrapolated over 10 years*	*0.56*	*Reference scenario*
5-2 Move to CRV	Move to **CRV critical and other applications** **Satellite, 2 Mbps** (based on RFI, Dec.14)	10.09	+1788.96% compared to the Reference scenario
5-3 Move to CRV	Move to **CRV non-critical applications** **VPN over Internet, 1 Mbps** (based on RFI, Dec. 14)	0.83	+147.16% compared to the Reference scenario
5-4 Move to CRV	Move to **CRV critical and other applications** **Private VSAT network, 64 or 128 Kbps** (based on RFI, Dec.14)	2.79	+494.68% compared to the Reference scenario

However it should not be deduced that the status quo is acceptable. As a matter of fact flight operations are more and more integrated and while the operational context will remain less demanding than in high density traffic areas, a reliable ground-ground communication infrastructure will be necessary for AIDC, SWIM etc. Voice will come as an enabler for a better cost benefit analysis if the infrastructure is performant enough. This means that the scenarios 5-2 and 5-4 have to be chosen if/when critical applications are carried over CRV.

Figure 21: *Compared total cost of ownership over 10 years for 6 Pacific Islands States, for*

the 4 scenarios



However a performant infrastructure may prove not affordable for most Islands.

4. Final recommendations

The final recommendations are as follow:

Recommendation 1: allotment

To make a bid allotment sorting States with a good terrestrial connectivity resulting in an open/competitive offer based on MPLS services (lot A) and those with a poor terrestrial offer (lot B) based on VSAT technology (be it a private or shared VSAT-based network). Tenderers with MPLS and VSAT technology should be invited to bid on the 2 lots.

Based on the ICAO survey in January 2014 and RFI, the proposed list is as follows:

	Lot A - MPLS		Lot B - VSAT		Existing Interregional connectivity
	Site(s)	Bandwidth	Site	Bandwidth	
Afghanistan			1	128	
American Samoa			1	64	
Australia	2	2048			
Bangladesh	1	2048			
Bhutan			1	64	
Brunei Darussalam	1	2048			
Cambodia	1	2048			
China	2	2048			
China, Hong Kong	1	2048			
China, Macau	1	2048			
China, Taipei	1	2048			
Cook Islands			1	64	
Democratic People's Republic of Korea			1	128	
Fiji			1	128	
French Polynesia			1	64	
India	2	2048			
Indonesia			1	128	
Japan	2	2048			
Kiribati			1	64	
Lao People's Democratic Republic			1	64	
Malaysia	2	2048			
Maldives			1	64	
Marshall Islands			1	64	
Micronesia (Federated States of)			1	64	
Mongolia			1	64	EUR (Russia)
Myanmar			1	64	
Nauru			1	64	
Nepal			1	64	
New Caledonia			1	64	
New Zealand	2	2048			
Niue Islands			1	64	
Pakistan	1	2048			
Palau			1	64	

	Lot A - MPLS		Lot B - VSAT		Existing Interregional
Papua New Guinea			1	64	
Philippines	1	2048			
Republic of Korea	1	2048			
Samoa			1	64	
Singapore	2	2048			EUR (UK)
Solomon Islands			1	64	
Sri Lanka	1	2048			
Thailand	2	2048			EUR (Italia)
Timor Leste			1	64	
Tonga			1	64	
Tuvalu			1	64	
United States	2	2048			
Vanuatu			1	64	
Viet Nam	2	2048			
Wallis and Futuna			1	64	

Total Sites **30 sites** **28 sites**

Note: future sites in MID ICAO region may have to be included

The list should be reviewed and agreed by States.

Some States of lot A may also consider to use lot B services for back up purpose instead of their existing solutions.

Recommendation 2: Network services requested

For the lot A, request only offers based on MPLS.

For the lot B, request explicitly two types of services in the sealed tender process as follows:

- VSAT offer operated by telecommunication service providers (shared network); and
- private VSAT network, for 64kbps and 128 kbps bandwidths.

There should be a termination mechanism in the lot B to enable a State to contract with lot A provider.

Recommendation 3: Network integration and performance management

Define clearly an interface between lots A and B. This definition should be stated in lots A and B.

To the lot A provider, request end to end performances between end users of lot A (internally) based on OSED performance profiles and application data carried

To the lot B provider, request end to end performances between end users of lot B (internally) based on OSED performance profiles and application data carried

To the lot A provider, request end to end performances between end users of lot A and interface with lot B based on OSED performance profiles and application data carried

To the lot B provider, request end to end performances between end users of lot B and interface with lot A based on OSED performance profiles and application data carried

A requirement should be added that the engineering (design/validation) should be done cooperatively between lot A and lot B.

Note: the very favorable case may appear that the same provider would bid for the 2 lots (example: a telecom service provider subcontracts the lot B). In that case the Network integration and performance management will be easier.

Recommendation 4: Network integration

Request to the lot B provider to set up and operate a gateway for ensuring the integration between lot A and lot B end users in line with the overall design.

Recommendation 5: cost sharing scheme

If despite the allotment, the costs of lot B are not bearable by small States or not attractive enough for them to join CRV, OOG should be able to manage a cost sharing scheme between States.

The Sealed Tender should embark the necessary requirements in the billing part (example: charge X % of the recurrent costs to the State X and 100- X % to the subsiding State).

Recommendation 6: tracking the migration of aeronautical applications (including voice)

Considering that the migration of voice to the CRV network is highly cost efficient (it would result in a reduction of between 18% and 39.6% of the total cost of services as compared to the existing situation) but that it also requires the implementation of the necessary independent backups, the migration of applications should be monitored by the CRV operations oversight group. It would additionally make sure that the CRV services are used in accordance with the plans. Not doing so may conduct to not reap the expected benefits, and in the worst case scenario, to the abandon of the project.

Recommendation 7: evaluation criteria

In the Sealed Tender evaluation, the scoring of the commercial proposal should be based on a total cost of services (initial and recurrent costs) over 10 years, based on recommendation 1. The lots should be awarded accordingly.

-END-

TEMPLATE AND GUIDANCE FOR CRV LOCAL SAFETY ASSESSMENT

1.1 In the frame of CRV project, a generic safety study using a safety assessment process was performed. However, this generic safety study is not formally recognized by any National Surveillance Authority. This paper suggests a way forward by instantiating the generic safety study, in accordance with the local operational needs.

1.2 During ACSICG second meeting, a draft conclusion was proposed:

Draft Conclusion 2/3 - CRV preliminary Safety Analysis Follow-up

That, CRV Participating States/Administrations be urged to consider the CRV safety requirements specified in the CRV Preliminary Safety Analysis v1.0 as a basis for their local safety case, perform their local safety case, and report to APANPIRG through the appropriate body.

Note: to support the local safety case, a template will be provided, as well as educational material on the safety case.

1.3 This paper proposes the aforementioned template.

1.4 Since there is no harmonized safety assessment process within APAC region, the preliminary safety assessment was conducted in a pragmatic way, as follows :

1) delineation of the services (AFTN, surveillance, voice…) to be conveyed with the CRV;

2) identification of corresponding operational hazards considering several failure modes (loss, corruption of the service) as well as the operational environment categorization;

3) for each hazard, assignment of severity and probability. To do so, a risk classification scheme aligned with ICAO Doc 9859 Safety Management manual principles (5 levels of severity and qualitative probabilities) was enriched with probabilistic figures leading to a Safety Objectives Classification Scheme model (SOCS); and

4) Given a hazard, derivation of safety requirements for both protective and preventive mitigation means. Protective mitigations are means that can reduce the severity of a hazard where preventive mitigation means can reduce the probability of occurrence of a hazard. This process resulted in expressing safety requirements at both CSP and ANSP level for Human/Procedure and Equipment components of the ATM/CNS system. Of course, these requirements were part of the tender package.

1.5 From that standpoint, as there was no visibility on the level of redundancy nor diversity of the CSP regarding the logical and physical implementations, the generic safety study could not figure out to which extent the CSP could satisfy the safety objectives assigned for the hazards. Consequently, for critical services (surveillance, air-voice communication…) mainly, different options were envisioned as were considered key safety topics for the tenders.

1.6 The generic safety **study ended up with generic safety requirements and different options presuming the full or partial ability of the CSP to satisfy the Safety Objectives of the HAZ.**

1.7 Moreover, as there is **no formal recognition** at NSA level of the generic safety assessment process as presently performed, ANSP instantiate should follow up with respect to NSA-recognized safety assessment methodology.

1.8 Hereafter is a proposed way forward to perform this instantiation :

- Select which services are intended to be delivered through the CRV;

- Endorse the severity of the hazards (by assessing the efficiency of the protective mitigation means). Adjust accordingly;

- Endorse the safety objectives. Adjustment may occur at this stage to comply with recognized safety criteria; and

- Demonstrate satisfaction of the safety objectives using CSP contribution. Decide whether or not the CSP contribution is to be completed by CRV-independent mitigation means.

— — — — — — — — — — — —

RECOMMENDATIONS FOR AIDC IMPLEMENTATION

- States/Administrations to share experience on AIDC implementation including sharing of training and implementation packages and visit each other;

- Define operational requirements and specify scope of operational improvements (determine what AIDC messages set is required to be supported) at initial planning stage;

- Engage both technical and operational experts (CNS/ATM) in the process of AIDC implementation from initial stage;

- Define the objectives for trials to avoid any problems during the implementation process;

- Develop a comprehensive and detailed testing plan including testing scripts to evaluate the process of the implementation;

- ATCOs should be trained for using AIDC in a safe and efficient manner before its implementation and before each upgrade (message set, HMI or system). The training syllabus should consist of theory and practice (CBT, simulator, OJT);

- Develop a training plan taking into consideration specific requirements for ATCO, FDO and ATSEP; and

- The Asia and Pacific AIDC TF (APA TF) to maintain the AIDC issues table and to follow up with the action plan to resolve the issue as one of the top priorities.

– – – – – – – – – – – – –

ATN/AMHS/AIDC Implementation Status in the APAC Region

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
AFGHANISTAN					
AUSTRALIA	ATN tests were conducted. BIS Router and Backbone BIS Router and AMHS implemented. 64 kbps IPLC established with Fiji. Basic AMHS circuit will be commissioned in September 2014; Another basic AMHS circuit planned for operational in Feb. 2015. The connectivity will be provided by CAAS's VPN.	COMSOFT	AFTN based AIDC Implemented between Brisbane and Melbourne, Oakland, Nadi and Auckland; Implemented between Melbourne and Johannesburg; AIDC is also in use between Melbourne and Mauritius; Operational trial between Brisbane and Ujung Pandang since May 2013.		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
BANGLADESH	Bangladesh installed ATN/AMHS at Dhaka (with User Agents at Chittagong (VGEG) and Sylhet (VGSY). BIS Router and AMHS installed in Q1/2013 at Dhaka (VGHS). System Commissioning & SAT completed in March 2013.	COMSOFT	Tentative date of implementation of AIDC is Q1 of 2018 with Kolkata and Myanmar.		AMHS connectivity between Dhaka & Chittagong and Dhaka & Sylhet are already established. Dhaka-Mumbai AMHS connectivity is commissioned on 23 March 2015 and the circuit is operational. Dhaka-BKK AMHS connectivity is expected to be commissioned by the end of May2015 and TMC will be signed accordingly. ATC Center up-gradation of Dhaka is expected to be completed by December 2017. As soon as the ATC up-gradation is completed hopefully Bangladesh will be able to implement AIDC with Kolkata and Myanmar (Q1/2018)

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
BHUTAN	ATN BIS Router and UA service planned for 2015.				
BRUNEI DARUSSALAM	ATN BIS Router planned for 2015 and AMHS planned for 2015				
CAMBODIA	BIS Router and AMHS installed. Cambodia (CATS) AMHS connected with Bangkok via VSAT IP link on 10 December 2013	AVITECH	AIDC function and capability made available. Ready for testing with neighbors ATS Facilities starting from 2015-2016.	THALES which supports AIDC ICD Version 1.	
CHINA	ATN Router and AMHS including NCC deployed in 2008 which is being upgraded to support ATN/IPS with target date of completion in December 2013. 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 (2016).	IN-HOUSE (Aero-Info Technologies Co., Ltd)	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 since 8 Feb 2007. AIDC between Qingdao and Incheon planned for 2015; Implemented between: Guangzhou with Nanning/Zhanjiang/Zhuhai;		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	AMHS/ATN technical tests with Macau completed in 2009. Plan for ATN/AMHS implementation with Macau, China (2016). ATN/AMHS circuit with ROK put into operational use since June 2011. ATN/AMHS tests with India started from March 2011 using 64 Kbps landline. ATN and AMHS technical trial with Mongolia is TBD. Connection tests with Thailand is TBD Connection tests with Nepal is TBD		Nanning and Kunming/Guiyang/Zhanjiang in 2011; Zhanjiang/Haikou; Chengdu and Chongqing/Guiyang in 2011; Guiyang and Chongqing/Kunming in 2011; Started negotiation for implementation between Dalian and Incheon and Shanghai/Fukuoka.		
HONG KONG, CHINA	Preliminary ATN/AMHS technical trials with China (Beijing) using VPN over Internet connection in 2006. Operational AMHS and BIS router accepted in July2009. ATN/AMHS circuit with Macao put into operation use in Dec. 2009. ATN/AMHS circuit with Bangkok put into operation use in Sept. 2014 ATN/AMHS interoperability tests with other adjacent communications centres commenced in late 2009, viz Taibei (2009), Japan (Planned Q4/2017), Philippines (Planned Q2/2016) and Viet Nam (Planned 2016)	COMSOFT	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 mid-2016. AIDC technical trial with Taibei conducted in 2010 and completed in 2012 and put into operational use in Nov. 2012	Raytheon ATM system Support AIDC ICD Version 3 from mid 2016	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	Plan for ATN/AMHS implementation with China (Beijing) (2016).				
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.	COMSOFT	(Not applicable for using AIDC, looking into the possible application (some way) between TWR and ACC/APP).		
COOK ISLANDS					
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	The ATN BIS Router and AMHS planned for in 2011.		With neighboring ACCs to be implemented		
FIJI ISLANDS	ATN BIS Router and AMHS implemented	COMSOFT	AFTN based AIDC implemented between Nadi/ Brisbane, Auckland and Oakland.	- Support and implemented AIDC messaging: ABI, EST, CPL, CDN, ACP, TOC, AOC with all three centers - AIDC ICD version 2.0 implemented with Auckland and Oakland. - AIDC ICD Version 1.0 implemented with Brisbane	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
FRANCE ***(French Polynesia Tahiti)***			Implementation of AIDC (based on Version 3) with adjacent centres (Oakland and Auckland) since 2009		
INDIA	Dual stack ATN/lp router and AMHS implemented at Mumbai in 2011	COMSOFT	AIDC planned with Bangladesh, Myanmar, Thailand, Pakistan, Nepal, Seychelles, Malaysia, Indonesia, Sri Lanka, Kenya, Oman and Maldives Mauritius and Somalia. Successful AIDC trials done between Chennai-Kuala Lumpur, Chennai-Male, Ahmedabad-Karachi, Delhi-Karachi (One way towards Delhi)	1) Raytheon at New Delhi, Mumbai and Chennai 2) Selex at Hyderabad and Bengaluru. 3) INDRA at 39 locations	1) Major Indian airports and ATC centres have integrated ATS Automation Systems having AIDC capability. Successful AIDC trials have been carried out amongst major ATSUs within India. 2) AIDC implemented between Chennai and Mumbai. 3) AMHS implemented and working between A. BBIS: Mumbai-Singapore, Bangkok B: BIS: Mumbai, Kathmandu, Dhaka

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
INDONESIA	ATN BIS Router and AMHS planned for trial in 2009. Trial with Singapore planned. ATNBIS Router and AMHS are still ongoing trial with Singapore planned to complete by 2012. (Part D: AMHS Commission)	ELSA	Makasar and Brisbane has been on-going trial AIDC since 2013. Plan for its implementation with Brisbane 4Q2015;	Thales in Makasar which is able to support ICD Version 2.	
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 connection test with each country which is not currently connecting is started after update.	NEC	AIDC implemented between Fukuoka ATMC and Oakland ARTCC in 1998. AIDC implemented between Fukuoka ATMC and Anchorage ARTCC in 2005. AIDC implemented between Tokyo ACC/Fukuoka ACC and Incheon ACC in 2010. Implemented between Fukuoka and Incheon since June 2009. AIDC implemented between Fukuoka ACC/Naha ACC and Taibei ACC implemented .		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			AIDC between Fukuoka ACC and Shanghai ACC under negotiation (2014)		
KIRIBATI					
LAO PDR	ATN BIS Router and AMHS completed, put into operation with Bangkok since 2Q 2015.	THALES	AIDC with Bangkok planned for 2016. Testing with Ha Noi for 2017, with Ho Chi Minh2017, With Cambodia for 2016	THALES which is able support ICD Version 2.	
MALAYSIA	ATN BIS Router completed 2007. AMHS planned for 2015.	FREQUENTIS	AFTN AIDC planned with Bangkok ACC – Middle 2Q2016. AIDC between Kuching and KK FIR already implemented in 2014 via AFTN. Between Kuala Lumpur and Chennai trial successful scheduled for operation from 1Q2016. Plan for trial with Singapore from Mid. November 1Q 2016.	SELEX which is able to support ICD Version 3.	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			Plan for trial with Ho Chi Minh from 1Q 2016 Between Kota Kinabalu and Singapore 4Q2015 Kuching and Singapore for 1Q2016 Kota Kinabalu and Makassar 4Q2015		
MALDIVES	Planned for 2016 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. Implementation with ACC's (Chennai, Colombo, Mumbai, Melbourne and Mauritius) plan for 2017.	SELEX which is able to support ICD Version 3.	
MARSHALL ISLANDS					
MICRONESIA (EDERATED STATES OF)					
Chuuk					
Kosrae					
Pohnpei					

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
Yap					
MONGOLIA	AMHS/AFTN gateway implemented 2012. ATNBIS router implemented in 2014. Coordinating with China using ATN/AMHS connection technical trials conducted in 2014.	COMSOFT	ATM automation system supports both AIDC and OLDI. Coordinating with Russia on OLDI connection in target date 2016. Coordinating with China on AIDC connection technical trial in progress.	INDRA Aircon 2100 supporting AIDC ICD Version 2.	
MYANMAR	AMHS including ATFTN/AMHS gateway implemented in Nov. 2011	THALES	ATM automation system capable to support AIDC in end of 2015. Plan for with Bangkok with target for implementation in 2016.	THALES	
NAURU					
NEPAL	BIS Router and AMHS commissioned with Kathmandu Mumbai circuit on 2 June 2014.	COMSOFT	AIDC between Kathmandu and Beijing and KTM-BBN and KTM-CCU planned for 2016		
NEW CALEDONIA	New router and AMHS planned at the end of 2013 with Nadi				

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
NEW ZEALAND	Some external AMHS connections 2014.	COMSOFT	AIDC implemented between New Zealand, Australia, Fiji, Tahiti, Chile and USA.		
PAKISTAN	ATN/AMHS considered as Phase II implemented since 2010.	COMSOFT	Implemented between Karachi and Lahore ACCs Plan to implement AIDC with Mumbai and Muscat for 2015		Existing Radar system being upgraded.
PAPUA NEW GUINEA	Plans to create a newly duplicated digital communications line connecting with existing and new sites and AMHS system implemented in 4Q2014	COMSOFT	Plan to implement with all neighboring FIRs in 3Q 2016	COMSOFT which is able to support ICD Version 3	
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.	COMSOFT	AFTN based AIDC system (version 2) test plan for Dec. 2014. Plan for implementation with Singapore 4Q2015; 2Q2016 with Taibei, 4Q2016 Hong Kong and 2Q2016Kota Kinabalu; 2017 with Oakland.	THALES which is able to support ICD Version 2.	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
REPUBLIC OF KOREA	ATN/AMHS circuit with China put into operational use in June 2011. ATN/AMHS test with Japan to be conducted	SAMSUNG	AFTN based AIDC implemented between ACC and Fukuoka ATMC. AIDC between Incheon and Dalian under negotiation (2014)		
SINGAPORE	AMHS implemented. ATN/AMHS circuit with India put into operational use in March 2011. ATN/AMHS circuit with UK put into operational use in March 2012. ATN/AMHS circuit with Thailand put into operational use in December 2014. On-going ATN/AMHS trial with Indonesia and Malaysia. Coordinating with Australia and Viet Nam to start ATN/AMHS trial in Q3 2015.	COMSOFT	Operational with Ho Chi Minh implemented July 2014. Technical trials with Malaysia (Kota Kinabalu, Kuching and Kuala Lumpur ATCCs) on going since Dec. 2014. Planned operational implementation from Dec. 2015. Technical trials with Manila ACC ongoing since Dec. 2014. Planned operational implementation in Nov. 2015. Planned technical trial with Indonesia plan from Dec. 2015.	THALES currently support s ICD Version 1 and to be upgraded to Version 3 in 2016	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
SRI LANKA	ATN BIS Router Planned for 2013. AMHS (Domestic) and AMHS/AFTN Gateway implemented by Oct. 2011. - Mumbai testing during Q3/Q4 2014 operational in Nov. 2014; - Singapore testing in Q4 214 operational in Dec. 2014; - Male testing in Q2 2015 operational date TBD.	IDS	Trials with Male' planned for in 2017. Trial with Chennai on-going. Plan for implementation in 3Q2016 and with Melbourne plan for 3Q2015 and implementation for 1Q2017.	INTELCAN which is able to support ICD Version 3.	
THAILAND	BBIS/BIS Routers already implemented. AMHS has been implemented in July 2011. Trial with other BBIS States; Singapore, India, Hong Kong China and Italy are ongoing. Pre-operational test (POT) with India and Singapore in 2013, with Hong Kong China in May 2014, with Italy in August 2014, with Laos PDR and Malaysia over VSAT IP link conducted in 2014. Inter-Operability Test (IOT) with Bangladesh in May 2014, with Beijing China planned for 2014 and with Vietnam and Myanmar planned for 2015. Connected with Cambodia (CATS) AMHS on 10 December 2013 over VSAT IP link; Established new CLNP 64 Kbps link with AAI In June 2013 following successful IOT; Established CLNP 64 Kbps link with CAAS in July 2013 following successful IOT. Operational the AMHS service with target date within Q4 2014; Established CLNP 64Kbps with Hong Kong China CAD in May 2014, POT is scheduled for Q2 2014.	AEROTHAI's AMHS System / Ubitech System	Plan for coordination with neighboring ACCs from 2015. Plan for implementation starting from 2016.	THALES which is being implemented with planned completion in November 2015. AIDC feature is based on APAC AIDC ICD V.3	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
TONGA	AMHS planned for 2008. The provider is linked to the New Zealand AFTN				CPDLC and ADS-C is not considered for lower airspace
UNITED STATES	AMHS implemented. (Salt Lake City & Atlanta). Transition using AMHS when counter parts ready	IN-HOUSE	AFTN based AIDC implemented.	IN-HOUSE which is able to support APAC and NAT ICDs currently Version 2.	
VANUATU					
VIET NAM	BIS Routers planned for 2009. ATN/AMHS trial in 2010 and operation in 2012. ATN BIS Router AMHS in 2013	IN-HOUSE	AFTN based AIDC implemented in 2009. Operational with Singapore in April 2014. Plan for trials with Lao. PDR. Cambodia, Malaysia 1Q 2015.		

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 qualified for ~~approved to conduct~~ PBN operations;

c) GNSS is the primary navigation system for RNP;

d) APV operations may be conducted with either BARO-VNAV or augmented GNSS;

e) Augmented GNSS is available to support Category I, and will be able to support Category II and III operations by 20177~~6~~;

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 and ground 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 operations where it is operationally 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;

vii) ensure civil-military interoperability; and

viii) continue monitoring the development of alternative position, navigation and timing

– – – – – – – – – – – – – –

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ADS-B IMPLEMENTATION AND OPERATIONS GUIDANCE DOCUMENT

Edition ~~7~~8.0 – September 201~~4~~5

Intentionally left blank

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.icao.int/APAC/Pages/edocs.aspx

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

(Intentionally blank)

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 APAC@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 (3^{rd} 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	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
7.0	September 2014	Proposed by ADS-B SITF/13 and adopted by APANPIRG/25	(i) Included guidance materials on monitoring and analysis of ADS-B equipped aircraft (ii) Included guidance materials on synergy between GNSS and ADS-B (iii) Revised ATC Phraseology (iv) Included clarification on Flight Planning
8.0	September 2015	Proposed by ADS-B SITF/14 and adopted by APANPIRG/26	(i) Updated the guidance materials on monitoring and analysis of ADS-B equipped aircraft (ii) Updated the categories of reported ADS-B avionics problems (iii) Updated the guidance materials on ADS-B flight plan (iv) Updated the guidance materials on disabling ADS-B transmissions (v) Remove reference to operational approval for use of ADS-B Out by ATC

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~~ Source 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~~ Source 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.icao.int/APAC/Pages/edocs.aspx" 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.icao.int/APAC/Pages/edocs.aspx 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.icao.int/APAC/Pages/edocs.aspx" 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~~1) 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~~	

4~~5~~	Flight Level	SG, HK, CN : - At or Above FL290 (ADS-B airspace) - Below FL290 (Non-ADS-B airspace) VN to be confirmed	
5~~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)
6~~7~~	Flight Planning	Before 15 Nov 2012, as per AIGD~~DG~~ On or after 15 Nov 2012, as per new flight plan format	
7~~8~~	Aircraft ~~Approval~~Equippage		
7~~8~~a)	Procedures if Aircraft Not ~~Approved~~ Equipped or Aircraft without a Serviceable ADS-B Transmitting Equipment before Flight	SG, HK, CN : FL280 and Below VN to be confirmed	

7~~8~~b)	Aircraft ~~Approved~~ Equipped but Transmitting Bad Data (Blacklisted Aircraft)	For known aircraft, treat as non ADS-B aircraft.	Share blacklisted aircraft among concerned States/Administration
8~~9~~	Contingency Plan		
8~~9~~a)	Systemic Failure such as Ground System / GPS Failure	Revert back to current procedure.	
8~~9~~b)	Avionics Failure or ~~Approved~~ Equipped 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.
9~~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".

Regarding the use of ADS-B in complex airspace (as discussed in ICAO Circular 326), complex airspace may be considered to be airspace with the following characteristics:

- Higher aircraft density
- Higher route crossing point density
- A higher mixture of different aircraft performance levels
- A higher rate of aircraft manoeuvring (as distinct from straight and level flight).

The following recommendations need to be considered:

1. Whether complex or not, States are urged to consider whether the current or required surveillance system performance is better, equivalent or worse than the SASP reference.

2. If the current or required surveillance system used by a State is lower or equivalent in performance than the reference MSSR used in Circular 326 Appendix A, then that State may use the Appendix C performance criteria.

3. If the current or required surveillance system used by a State is higher performance than the reference MSSR used in Circular 326 Appendix A, then the State must ensure that the ADS-B system achieves the more demanding performance.

4. State should undertake, in all cases, a safety assessment that ensures that any additional risks and safety requirements already identified for the airspace where ADSB or MLAT is to be implemented, or any newly identified risks, are effectively controlled and risk is reduced to an acceptable level.

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.icao.int/APAC/Pages/edocs.aspx" 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.

Guidance materials on monitoring and analysis of ADS-B Avionics Performance are given at Appendix 2.

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/Documents/edocs/cns/ADSB_ServicePer.pdf

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 equippage rates of ADS-B avionics. However the equippage 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 equippage 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~~Appendix 3 on the template for ADS-B mandate/regulations ~~on provision of ADS-B based ground surveillance~~for aircraft avionics. Some States listed below have published their ADS-B mandate/regulations on their web sites that could also 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 Publication Supplement No. 13/13 dated 29 October 2013
"http://www.hkatc.gov.hk/HK_AIP/supp/A13-13.pdf"

(c) Civil Aviation Authority of Singapore (CAAS)
Aeronautical Information Publication Supplment No. 254/13 dated 6 November 2013
"http://www.caas.gov.sg/caasWeb2010/export/sites/caas/en/Regulations/Aeronautical_Information/AIP_Supplements/download/AIPSUP254-13.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

States are encouraged to mandate forward fit for newly manufactured aircraft on and after 8th June 2018, having a maximum certified takeoff weight of 5700kg or greater, or having a maximum cruising true airspeed capability of greater than 250 knots, with ADS-B avionics compliant to Version 2 ES (equivalent to RTCA DO-260B) or later version [1].

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 barometric 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 barometric 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

[1] Subject to endorsement by APANPIRG/26 in September 2015

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.icao.int/APAC/Pages/edocs.aspx" 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.

9.3.5 Synergy of ADS-B and GNSS

States intending to implement GNSS/PBN or ADS-B should consider the efficiency of implementing the other technology at the same time due to the inherent efficiencies in doing so. GNSS systems provide navigation solutions to IFR aircraft for the conduct of enroute, terminal and non-precision approaches. The use of GNSS/PBN can provide higher performance and higher safety. Transition to GNSS can avoid significant ground infrastructure costs.

ADS-B systems provide surveillance based upon GNSS position source. ADS-B provides high performance and high update surveillance for both air-air and ATC surveillance. Transition to ADS-B can avoid the costs associated with ground based radar infrastructure. ADS-B system installations rely on acceptable GNSS equipment being installed in the aircraft to provide the position source and integrity.

If the fleet is equipped with ADS-B, they will already have most of the requirements to use GNSS for navigation satisfied. Similarly, if aircraft have suitable GNSS on board, they will have a position source to support ADS-B. It is noted however, that some care is needed to ensure that the requirements of GNSS/PBN and surveillance are both satisfied.

There is significantly less cost for these systems to be installed in an aircraft at the same time. A single installation of GNSS & ADS-B will involve :

– a single design activity instead of two
– a single downtime instead of two
– installation of the connection between GPS and ADS-B transponder
– a single test, certification and aircraft flight test

For the affected aviation community (ANSP, regulator and operator), the lessons learnt and issues faced in both GNSS and ADS-B have significant commonality. This can lead to efficiencies in Industry education and training.

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 use common phraseology for both ADS-B and radar where possible, and should note the requirement for ADS-B specific phraseology in some instances. 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.

Note: For (b) and (c) – the options are not available for aircraft that are not equipped.

TO REQUEST RESELECTION OF AIRCRAFT IDENTIFICATION
REENTER FLIGHT IDENTIFICATION.

Note: For some aircraft, this option is not available in-flight

TERMINATION OF RADAR AND/OR ADS-B SERVICE
IDENTIFICATION LOST [reasons] (instructions).

TO REQUEST THE OPERATION OF THE MODE S OR ADS-B IDENT FEATURE
SQUAWK IDENT.

Note: For some standalone ADS-B equipage affecting General Aviation, the option of "TRANSMIT ADS-B IDENT" may be available

TO REQUEST AIRCRAFT SWITCHING TO OTHER TRANSPONDER OR TERMINATION OF ADS-B TRANSMITTER OPERATION
a) SWITCH TO OTHER TRANSPONDER
b) STOP ADS-B TRANSMISSION. SQUAWK (code) ONLY.

Note:

a) In many cases the ADS-B transmitter cannot be operated independently of the SSR transponder and switching off the ADS-B transmission would also switch off the SSR transponder operation

b) "STOP ADS-B TRANSMISSION" applies only to aircraft that have the facility to switch off the ADS-B transmission, while maintaining SSR operation.

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 will not be possible in many 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.

Very few aircraft provide the capability to turn off ADS-B without turning off TCAS. It is not recommended to switch off ATC transponders (& remove TCAS protection). The only action for most pilots of aircraft transmitting misleading ADS-B data in response to ATC requests is to recycle the transponder, or switch to the alternate transponder as appropriate. Besides, aircraft that do not support ADS-B OFF should have the details included in the flight manual including the undesirability of disabling TCAS.

9.9.2.2 STOP ADSB ALTITUDE TRANSMISSION [WRONG INDICATION or reason] and TRANSMIT ADSB ALTITUDE

Issue: Most aircraft will 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 and/or Mode C altitude – 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.

These are defined in ICAO DOC 4444 as follows:

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

During the ADS-B SITF/13 meeting held in April 2014, clarification of the B1 and B2 descriptors was recommended as follows. This will be progressed for change to ICAO DOC 4444, but may take some time for formal adoption:

B1 ADS-B “out” capability using 1090 MHz extended squitter
B2 ADS-B “out” and “in” capability using 1090 MHz extended squitter

States should consider use of the revised descriptors in AIP.

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, according to ICAO Doc 4444, an appropriate Mode S designator should also be entered in item 10; i.e.: either s

- 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.

During the ADS-B SITF/13 meeting held in April 2014, clarification of the E and L descriptors was recommended as follows. This will be progressed for change to ICAO DOC 4444, but may take some time for formal adoption:

- E Transponder — Mode S, including aircraft identification, pressure-altitude and ADS-B capability, or
- L Transponder — Mode S, including aircraft identification, pressure-altitude, ADS-B and enhanced surveillance capability.

States should consider use of the revised descriptors in AIP.

9.10.2.4 Inconsistency between ADS-B Flight Planning and Surveillance Capability

Inconsistency between flight planning of ADS-B and surveillance capability of an aircraft can impact on ATC planning and situational awareness. States are encouraged to monitor for consistency between flight plan indicators and actual surveillance capability. Where discrepancies are identified, aircraft operators should be contacted and instructed to correct flight plans, or general advice (as appropriate to the operational environment and type of flight planning problems) should be issued to aircraft operators. An example of such advice is provided at Appendix 4~~3~~.

9.10.3 Setting Aircraft Identification (Flight ID) 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 (ACID) 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 Gyroplane 123).

9.11 PROCEDURES TO HANDLE NON-COMPLANT ADS-B AIRCAFT OR MIS-LEADING 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 NAC 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-B; 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 NAC 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-B;

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 NAC or SIL.

Note:

1. It is considered equivalent to deactivation if NUCp or NIC or NAC 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 NUC or NIC or NAC 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.icao.int/APAC/Pages/edocs.aspx" 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.

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _

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

Guidance Materials on Monitoring and Analysis of ADS-B Avionics Performance

1. Introduction

1.1 The APANPIRG has endorsed the following Conclusion during its 24th Meeting to encourage States/Administration to exchange their ADS-B performance monitoring results and experience gained from the process :

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."

1.2 Since the ADS-B mandate for some airspace in the Region became effective in December 2013, monitoring and analysis on avionics performance of ADS-B equipped aircraft has become an increasingly important task for concerned States. The APANPIRG has also requested and the ICAO has agreed to support establishing a centralized database to be hosted by the ICAO Regional Sub-office (RSO) for sharing the monitoring results in order to enhance safety for the Region. The specification for the database and relevant access procedures are being developed by the ADS-B Study and Implementation Task Force, and will be shared with States in due course.

1.3 This document serves to provide guidance materials on monitoring and analysis of avionics performance of ADS-B equipped aircraft, which is based on the experience gained by States.

2. Problem Reporting and Feedback

2.1 For ADS-B avionics problems, it is critical that an appropriate reporting and feedback mechanism be established. It is highly desirable that those discovering the problems should report them to the appropriate parties to take action, such as study and analyse the problems, identify the root causes, and rectify them. Those action parties include :-

(a) Air Navigation Service Providers (ANSPs) – upon detection of any unacceptable ADS-B reports from an aircraft, report the observed problem to the performance monitoring agent(s), if any, and the Aircraft Operators for investigation. In addition, ANSPs should take all actions to avoid using the ADS-B reports from the aircraft until the problem is rectified (e.g. black listing the aircraft), if usage of such reports could compromise safety.
(b) Regulators – to initiate any appropriate regulatory action or enforcement.
(c) Aircraft Operators – to allow avionics specialists to examine the causes and as customers of the avionics manufacturers ensure that corrective action will take place.

(d) Avionics Manufacturers and Aircraft Manufacturers – to provide technical evidence and knowledge about the problem and problem rectification

2.2 Incentives should be received by those parties acting on the problems including :-

(a) Regulations that require deficiencies to be rectified
(b) Regulatory enforcement
(c) Consequences if conduct of operations with problematic equipment (e.g. no access to the airspace requiring healthy equipment)

2.3 When an ADS-B avionics problem is reported, it should come along with adequate details about the problem nature to the action parties. In addition, the problem should be properly categorised, so that appropriate parties could diagnose and rectify them systematically.

3. Problem Categorisation

3.1 Regarding ADS-B avionics, their problems are quite diversified in the Region but can be categorized to ensure they will be examined and tackled systematically.

3.2 Based on the experience gained from States, the common ADS-B avionics problems in the Region are summarized under different categories in Attachment A. It is noted that only a relatively minor portion of the aircraft population exhibits these problems. It must be emphasized that aircraft transmitting incorrect positional data with NUC = 0 or NIC = 0 should not be considered a safety problem. The data transmitted have no integrity and shall not be used by ATC. This situation exists for many aircraft when their GNSS receivers are not connected to the transponders.

4. Managing the Problem

4.1 There are two major approaches to manage the problems :-

(a) Regulatory approach
Regulations which require non-approved avionics to disable ADS-B transmission (or transmit "no integrity"), and the concerned operators to file flight plans to indicate no ADS-B equipage. APANPIRG has endorsed this approach which is reflected in the Regional Supplementary Procedures (Doc 7030).

(b) Blacklist approach
Filtering out ("black listing") any airframes that do not comply with the regulations or transmitting bad data, and advising the regulator of the non-compliance. This approach is temporary which allows the ANSP to protect the system whilst regulatory action is underway.

5. Systematic Monitoring and Analysis of the Problem

~~5.1 For States who have radar coverage, a systematic and efficient means to monitor and analyse the problem could be considered on top of relying on ATC to report the problem / sample checking. This can be achieved by developing a system to automatically compare radar and flight plan information with ADS-B reported position, and examine the ADS-B and Flight Identification (FLTID) contained in the ADS-B reports.~~

~~5.2 The system will intake all recorded information on ADS-B, radar targets and ATS flight plans in an offline manner. For each ADS-B flight, the system will compare it with its corresponding radar and flight plan information, and analyse if the following pre-defined criteria are met :-~~

~~Deviation between ADS-B reported position and independent referenced radar position is greater than 1NM for more than 5% of total number ADS-B updates; or~~

~~NUC of each ADS-B reported position is smaller than 4 for more than 5% of total number of ADS-B updates; or~~

~~FLTID entered via cockpit interface and downlinked in ADS-B data (i.e. I021/170 in Asterix CAT 21) does not match with aircraft callsign in the ATS Flight Plan for more than 5% of total number of ADS-B updates.~~

~~5.3 For (a) above, deviation between ADS-B and radar tracks is set to 1NM in accordance with ICAO Circular 326 defining position integrity (NUC) shall be at least 4 (0.5NM < HPL < 1NM) for 3NM aircraft separation use, on assumption that radar targets are close to actual aircraft position. A threshold of 5% is initially set to exclude aircraft only exhibiting occasional problems during their flight journey. The above criteria should be made configurable to allow fine-turning in future.~~

~~5.4 The system will generate a list of aircraft meeting the above pre-defined criteria showing full details of each occurrence such as date/time of occurrence, Mode S address, screen capture of radar and ADS-B history tracks, graphs of NUC value changes and deviation between radar and ADS-B tracks along the flight journey. A sample screen shot of the system is given at Attachment B for reference.~~States using ADS-B should have in place systematic ways to identify and manage ADS-B deficiencies similar to that described below :-

5.1 Reporting Deficiencies

States using ADS-B should have in place systematic ways to identify ADS-B deficiencies including :-

(a) Systematic capture of ATC reported events and engineering detected events into a database; and

(b) Manual or automatic detection of anomalous avionics behavior independent from controller reports

5.1.1 ATC Reported Deficiencies

ATC procedures should exist that allow services to continue to be provided safety, as well as to capture relevant information for later analysis. This should include :-

(a) ATC request for the pilot to select the alternate transponder; and
(b) ATC to adequately record the circumstances including Flight ID, ICAO Aircraft Address (if readily available) accurate time, Flight plan, and pilot provided information.

5.1.2 Non ATC reported deficiencies

5.1.2.1 Where capability is available, States should also identify non ATC reported deficiencies.

5.1.2.2 Without overlapping radar coverage: ADS-B data may be examined for the following :-

(a) NUC of each ADS-B reported position is smaller than required for service delivery for more than 5% of total number of ADS-B updates;
(b) NIC, NAC, SIL are smaller than required for service delivery for more than 5% of total number of ADS-B updates;
(c) ICAO Aircraft Address (i.e. I021/080) is inconsistent with the flight planned registration (REG) based on each state's ICAO Aircraft Address allocation methodology;
(d) Flight ID entered via cockpit interface and downlinked in ADS-B data (i.e. I021/170 in Asterix CAT 21) is a mismatch[1] with aircraft callsign in the ATS Flight Plan;
(e) Inconsistent vertical rate compared to flight level change; and
(f) Inconsistency of position reports and presence of "jumps.

5.1.2.3 Overlapping radar coverage: For States that have overlapping radar coverage, a systematic means to monitor and analyze ADS-B could be considered in addition to relying on ATC to report the problem, or utilising the evaluation criteria in 5.1.2.2 above. This can be achieved by comparing radar information with ADS-B reported position, velocity, flight level and vertical rate change data as well as examining the ADS-B quality indicators and Flight Identification (FLTID) contained in the ADS-B reports.

For each ADS-B flight, its ADS-B data could be compared with its corresponding radar information. For example, this would allow analysis to determine if the following pre-defined criteria are met :-

(a) Deviation between ADS-B reported position and independent referenced radar position is greater than 1NM[2], with the indication of good positional quality in the

[1] A missing Flight ID, or a Flight ID with only "spaces" should not be considered a mismatch.

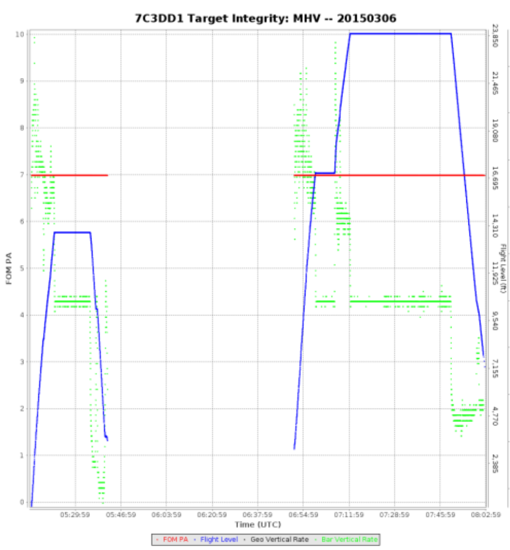
[2] For example, the deviation between ADS-B and radar tracks could be set to 1NM in accordance with ICAO Circular 326 defining position integrity (0.5NM < HPL < 1NM) for 3NM aircraft separation use, on

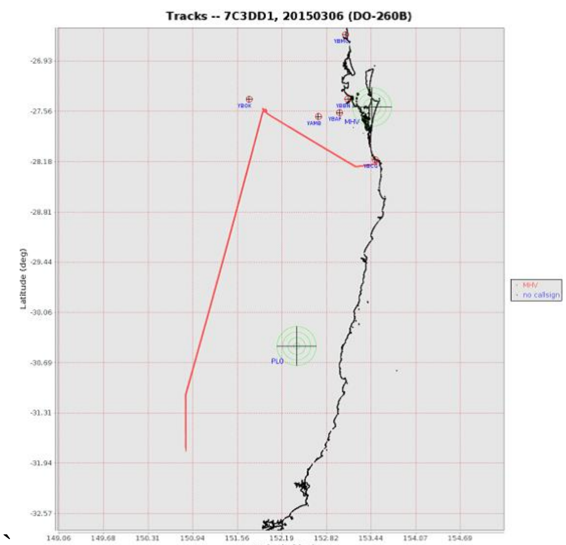
quality indicators for more than 5% of total number ADS-B updates. A sample screen shot of a system performing the analysis automatically is given at Attachment B for reference.

5.2 Managing and Processing Deficiencies

Whether detected by ATC or not, all deficiencies should trigger:

(a) Systematic recording of the details of each occurrence such as date/time of occurrence, ICAO aircraft address and flight plan information should be obtained. Graphical representations such as screen capture of radar and ADS-B history tracks, graphs of NUC/NIC value changes versus time and deviation between radar and ADS-B tracks along the flight journey would be desirable. Examples of typical graphical representations are shown below :-





(b) Systematic technical analysis of each detected issue using ADS-B recorded data, to ensure that all detected issues are examined and addressed. Typically this will need:

- systems to record ADS-B data, replay ADS-B data and analyze ADS-B data
- staff and procedures to analyze each report
- A database system to manage the status of each event and to store the results of each analysis

---

assumption that radar targets are close to actual aircraft position. The values of ADS-B quality indicators (NUC, NAC, SIL, NIC) could be chosen based on the definition in ICAO Circular 326 on Position Accuracy and Position Integrity for 3NM aircraft separation minimum. A threshold of 5% is initially set to exclude aircraft only exhibiting occasional problems during their flight journey. The above criteria should be made configurable to allow fine-turning in future. Evaluation of ADS-B vs radar may alternatively expose radar calibration issues requiring further investigation.

(c) Procedures to support engagement with operators (domestic & foreign), regulators, other ANSPs, Airframe OEMs and avionics vendors to ensure that each issue is investigated adequately and maximize the probability that the root cause of the event is determined. The procedures could include :-

- Data collection procedures;
- Telephone & email contact details; and
- Mechanisms for reporting, as appropriate, to the Asia Pacific ADS-B Avionics Problem Reporting Database (APRD)

* * * * * * * *

Attachment A – List of known ADS-B avionics problems

Ref.	Problem	Cause	Safety Implications to ATC (Yes / No)	Recommendations
1.	Track Jumping problem with Rockwell Collins TPR901 (See Figure1)	Software issue with TPR901 transponder initially only affecting Boeing aircraft. Does not occur in all aircraft with this transponder. Subsequent investigation by Rockwell Collins has found that the particular transponder, common to all of the aircraft where the position jumps had been observed, had an issue when crossing ±180 degrees longitude. On some crossings (10% probability), errors are introduced into the position longitude before encoding. These errors are not self-correcting and can only be removed by a power reset of the transponder. The problem, once triggered can last days, since many transponders are not routinely powered down.	**Yes.** Will present as a few wild/large positional jumps. Nearly all reports are tagged as low quality (NUC=0) and are discarded, however, some occasional non zero reports get through. Problem is very "obvious". Could result in incorrect longitudinal position of Flight Data Record track. Can trigger RAM alerts.	Rockwell Collins has successfully introduced a Service Bulletin that solves the problem in Boeing aircraft. The problem is known to exist on Airbus aircraft. Rockwell has advised that a solution will not be available in the near future because of their commitment to DO260B development. Rockwell Collins may not have a fix for some time. Workaround solutions are being examined by Airbus, Operators and Airservices Australia. The only workaround identified at this time is to power down the transponders before flight to states using ADS-B – after crossing longitude 180. It can be noted that in Airbus aircraft it is not possible to safely power down the transponder in flight. Airbus have prepared a procedure to support power down before flight. Airservices Australia have negotiated with 2 airlines to enact this procedure prior to flights to Australia.

Ref.	Problem	Cause	Safety Implications to ATC (Yes / No)	Recommendations
				An additional partial workaround is : to ensure that procedures exist for ATC to ask the pilot to changeover transponders if the problem is observed. Since there is a 10% chance of the problem occurring on each crossing of ±180 degrees longitude, the chance that both transponders being affected is 1%. There is no complete workaround available for flights that operate across 180 degrees longitude directly to destination without replacing the transponder. Airbus advise that a new TPR901 transponder compliant with DO260B will be available in 2014. This new transponder will not exhibit the problem.
2.	Rockwell Collins TDR94 Old version. The pattern of erroneous positional data is very distinctive of the problem. (See Figure 2)	Old software typically before version -108. The design was completed before the ADS-B standards were established and the message definitions are different to the current DO260. Rockwell has recommended that ADS-B be disabled on these models.	**Yes.** Will present as a few wild positional jumps. Nearly all reports are tagged as low quality (NUC=0) and are discarded, however, some occasional non zero reports get through. Also causes incorrect altitude reports. Problem is very “obvious”.	Problem well known. Particularly affects Gulfstream aircraft which unfortunately leave the factory with ADS-B enabled from this transponder model. Rockwell has issued a service bulletin recommending that ADS-B be disabled for aircraft with this transponder software. See Service Information Letter 1-05 July 19, 2005. It is easy to disable the transmission.

Ref.	Problem	Cause	Safety Implications to ATC (Yes / No)	Recommendations
				If a new case is discovered, an entry needs to be made to the black list until rectification has been effected.
3.	Litton GPS with proper RAIM processing	Litton GNSSU (GPS) Mark 1 design problem. (Does not apply to Litton Mark II). GPS does not output correct messages to transponder.	**No.** Perceived GPS integrity changes seemingly randomly. With the GPS satellite constellation working properly, the position data is good. However the reported integrity is inconsistent and hence the data is sometimes/often discarded by the ATC system. The effected is perceived extremely poor "coverage". The data is not properly "protected" against erroneous satellite ranging signals – although this cannot be "seen" by ATC unless there is a rare satellite problem.	This GPS is installed in some older, typically Airbus, fleets. Data appears "Correct" but integrity value can vary. Performance under "bad" satellite conditions is a problem. Correction involves replacing the GNSSU (GPS) which is expensive. If a new case is discovered, an entry needs to be made to the black list until rectification has been effected.
4.	SIL programming error for DO260A avionics	Installers of ADS-B avionics using the newer DO260A standard mis program "SIL". a) This problem appears for DO260A transponders, with SIL incorrectly set to 0 or 1 (instead of 2 or 3) b) As the aircraft enters	**No.** First report of detection appears good (and is good), all subsequent reports not displayed because the data quality is perceived as "bad" by the ATC system. Operational effect is effectively no ADS-B data. Hence no risk.	Would NOT be included in a "black list". Aircraft with "Dynon avionics" exhibit this behavior. They do not have a certified GPS and hence always set SIL = 0. This is actually correct but hence they do not get treated as ADS-B equipped.

Ref.	Problem	Cause	Safety Implications to ATC (Yes / No)	Recommendations
		coverage, the ADS-B ground station correctly assumes DO260 until it receives the version number. c) The transmitted NIC (DO260A) is interpreted as a good NUC (DO260) value, because no SIL message has yet been received. The data is presented to ATC.		
5.	Garmin "N" Flight ID problem (See Figure 3)	Installers of Garmin transponder incorrectly set "Callsign"/Flight ID. This is caused by poor human factors and design that assumes that GA aircraft are US registered.	**Yes.** Flight ID appears as "N". Inhibits proper coupling.	Can be corrected by installer manipulation of front panel. Does not warrant "black list" activity.
6.	Flight ID corruption issue 1 – trailing "U" Flight ID's received : GT615, T615U ,NEB033, NEB033U, QF7550, QF7550U, QF7583, QF7583U, QF7585, QF7585, QF7585U, QF7594, QFA7521, QFA7531, QFA7531, QFA7531U, QFA7532, QFA7532U, QFA7532W, QFA7550, QFA7552,	TPR901 software problem interfacing with Flight ID source. Results in constantly changing Flight ID with some reports having an extra "U" character.	**Yes.** Flight ID changes during flight inhibits proper coupling or causes decoupling.	Affects mainly B747 aircraft. Boeing SB is available for Rockwell transponders and B744 aircraft. Rockwell Collins have SB 503 which upgrades faulty -003 transponder to -005 standard. If a new case is discovered, an entry needs to be made to the black list until rectification has been effected.

Ref.	Problem	Cause	Safety Implications to ATC (Yes / No)	Recommendations
	QFA7581			
7.	Flight ID corruption issue 2	ACSS software problem results in constantly changing Flight ID. Applies to ACSS XS950 transponder Pn 7517800-110006 and Honeywell FMC (pn 4052508 952). ACSS fix was available in Sept 2007.	**Yes.** Flight ID changes during flight inhibits proper coupling or causes decoupling.	Software upgrade available. If a new case is discovered, an entry needs to be made to the black list until rectification has been effected.
8.	No Flight ID transmitted	Various causes	**No.** Flight ID not available. Inhibits proper coupling.	Aircraft could "fail to couple with Flight Data Record". Not strictly misleading – but could cause controller distraction.
9.	ACSS Transponder 10005/6 without Mod A reports NUC based on HFOM.		**Yes.** Appears good in all respects until there is a satellite constellation problem (not normally detectable by ground systems).	Not approved and hence not compliant with CASA regulations. If known could be added to black list. Configuration is not permitted by regulation.
10.	Occasional small position jump backwards (See Figure 4)	For some older Airbus aircraft, an occasional report may exhibit a small "jump back" of less than 0.1 nm Root cause not known	**No.** Not detectable in ATC due to extrapolation, use of latest data and screen ranges used.	ATC ground system processing can eliminate these.
11.	Older ACSS transponders report integrity too	Design error reports integrity one value worse than reality	**No.**	Can be treated in the same manner as a loss of transponder capability.

Ref.	Problem	Cause	Safety Implications to ATC (Yes / No)	Recommendations
	conservatively		In poor GPS geometry cases the ATC system could discard the data when the data is in fact useable. Will be perceived as loss of ADS-B data.	
12.	Intermittent wiring GPS transponder	ADS-B transmissions switch intermittently between INS position and GPS position.	**Yes.** Normally the integrity data goes to zero when INS is broadcast, but sometimes during transition between INS and GPS, an INS position or two can be broadcast with "good" NUC value. Disturbing small positional jump.	If a new case is discovered, an entry needs to be made to the black list until rectification has been effected.
13.	Wrong 24 bit code	Installation error	**No.** No direct ATC impact unless a rare duplicate is detected.	This is not a direct ADS-B problem, but relates to a Mode S transponder issue that can put TCAS at risk. Cannot be fixed by black list entry. Needs to be passed to regulator for resolution.
14.	Toggling between high and low NUC (See Figure 5)	Faulty GPS receiver/ADS-B transponder	**No.** ATC will see tracks appear and disappear discretely. No safety implications to ATC.	While it is normal for NUC value to switch between a high and low figure based on the geometry of GPS satellites available, it is of the view that more should be done to examine this phenomenon. It is observed that such switching between high and low NUC occurs on certain airframe and

Ref.	Problem	Cause	Safety Implications to ATC (Yes / No)	Recommendations
				not on others. The issue was raised to the airlines so as to get a better understanding. On one occasion, the airline replied that a module on their GPS receiver was faulty. On another occasion, the airline replied that one of the ADS-B transponder was faulty. Good NUC was transmitted when the working transponder was in use and poor NUC was transmitted when the faulty ADS-B transponder was in use.
15.	Consistent Low NUC (See Figure 6)	GNSS receivers are not connected to the ADS-B transponders.	**No.** Data shall be filtered out by the system and not detectable in ATC	Not considered a safety problem but a common phenomenon in the Region – the concerned aircraft will be treated equivalent to “aircraft not equipped with ADS-B”. While it is normal for aircraft to transmit low NUC, it is of the view that “consistent low NUC’ could be due to the avionics problem (e.g. GNSS receiver is not connected to the ADS-B transponder). It is recognised that operators may not be aware that their aircraft are transmitting unexpected low NUC / NIC values, due to equipment malfunction. Hence, it is desirable for States to inform the operators when unexpected low NUC

Ref.	Problem	Cause	Safety Implications to ATC (Yes / No)	Recommendations
				values are transmitted, where practicable. Concerned airline operators are required to take early remedial actions. Otherwise, their aircraft will be treated as if non-ADS-B equipped which will be requested to fly outside the ADS-B airspace after the ADS-B mandate becomes effective.
16.	ADS-B position report with good integrity (i.e. NUC >= "4") but ADS-B position data are actually bad as compared with radar (met criteria 5.2(a))	Faulty ADS-B avionics	**Yes.** As the ground system could not "automatically" discard ADS-B data with good integrity (i.e. NUC value >=4), there could be safety implications to ATC.	The problem should be immediately reported to the concerned CAA/operators for problem diagnosis including digging out the root causes, avionics/GPS types etc., and ensure problem rectification before the ADS-B data could be used by ATC. Consider to "blacklist" the aircraft before the problem is rectified.
17.	FLTID transmitted by ADS-B aircraft does not match with callsign in flight plan (see Figures 7a – 7d)	Human errors	**Yes.** Could lead to screen clutter - two target labels with different IDs (one for radar and another for ADS-B) being displayed, causing potential confusion and safety implications to ATC.	Issue regulations/letters to concerned operators urging them to set FLTID exactly match with callsign in flight plan.
18	B787 position error with	Software issue - surveillance	**Yes.**	Problem identified and fix will be

Ref.	Problem	Cause	Safety Implications to ATC (Yes / No)	Recommendations
	good NUC	system inappropriately "coasts" the position when data received by the transponder is split across multiple messages. System seems to self correct after some time. Can be corrected by surveillance system power off.	Misleading position presentation which is typically detected by ATC observing aircraft "off track" when in fact it is "on-track".	provided by Boeing at the same time as the availability of DO260B upgrade – late 2015.
19	A number of airlines have reported or experienced ADS-B outages for complete flight sectors in A330 aircraft. Appears as low reliability ADS-B and has afflicted both A & B side at same time.	Being actively investigated. One airline has implemented on-board recording which confirms that the MMRs are not providing HIL/HPL to the transponder whilst continuing to provide HFOM, GPS alt etc	**No.** Equivalent to a failed transponder.	Aircraft must be managed procedurally if outside radar coverage.
20	A380 flight ID lost after landing	For the A380 fleet, it has been confirmed that for some seconds after landing, the flight ID is set as invalid by FMS to AESS. Consequently, the current AESS design uses, as per design, the Aircraft Registration Number as a back-up source for A/C flight identification field in ADS-B broadcast messages.	**No.**	The correction to this logic is planned for next AESS standard release; planned for 2017.". Only a problem for arriving aircraft on surface surveillance systems.

Figure 1 - Track Jumping problem with TPR901

Figure 3 - Garmin "N" Flight ID problem

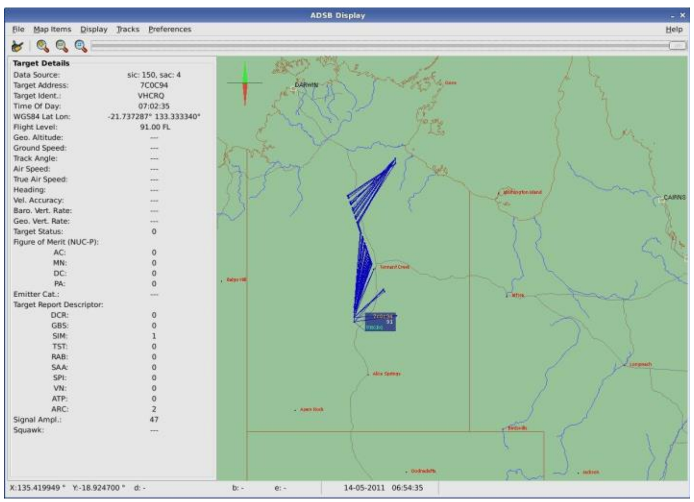


Figure 2 - Rockwell Collins TDR94 Old version. The pattern of erroneous positional data is very distinctive of the problem

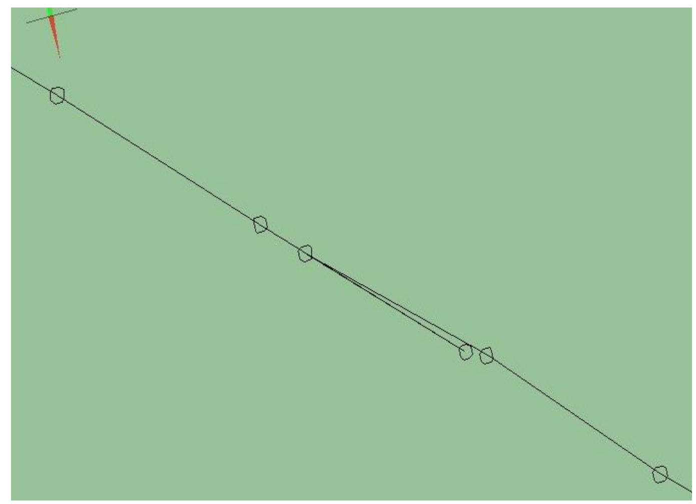


Figure 4 - Occasional small position jump backwards

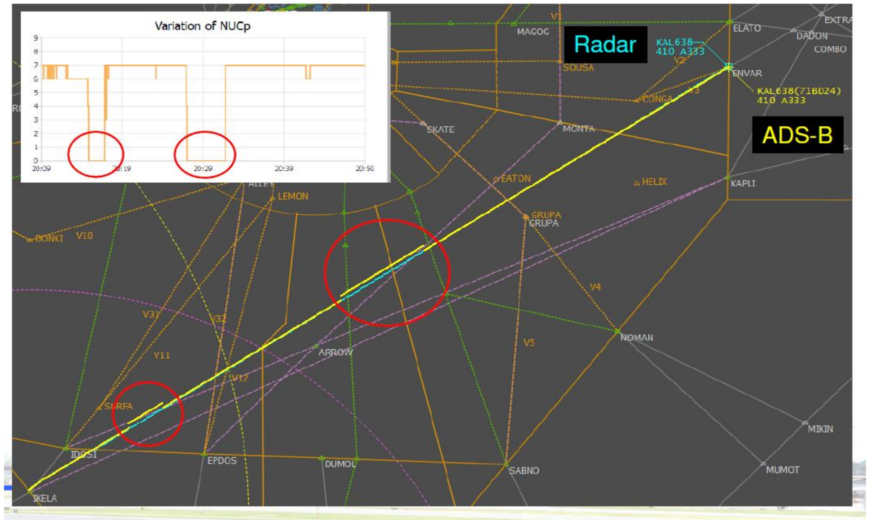


Figure 5 - NUC value toggling

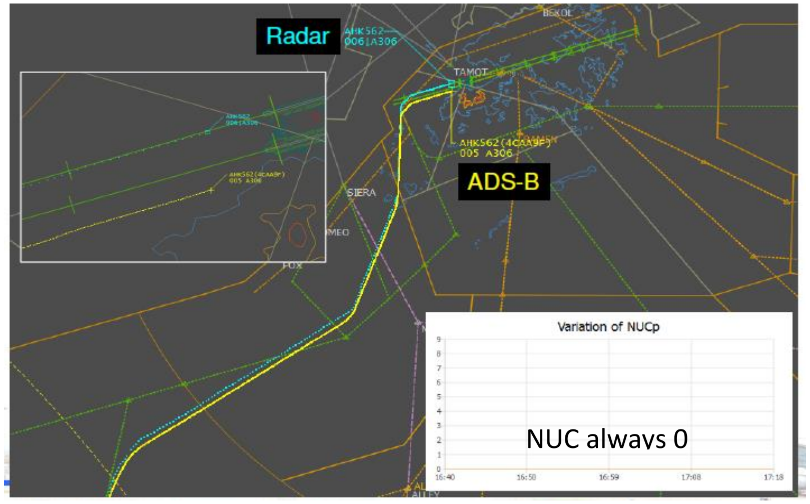


Figure 6 – Consistent low NUC

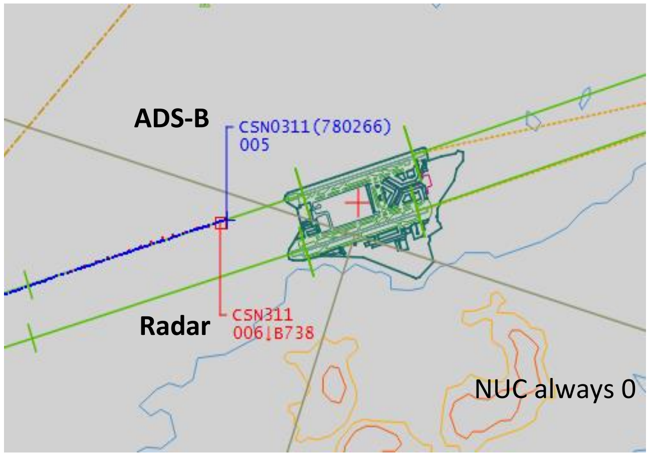


Figure 7a - Additional zero inserted

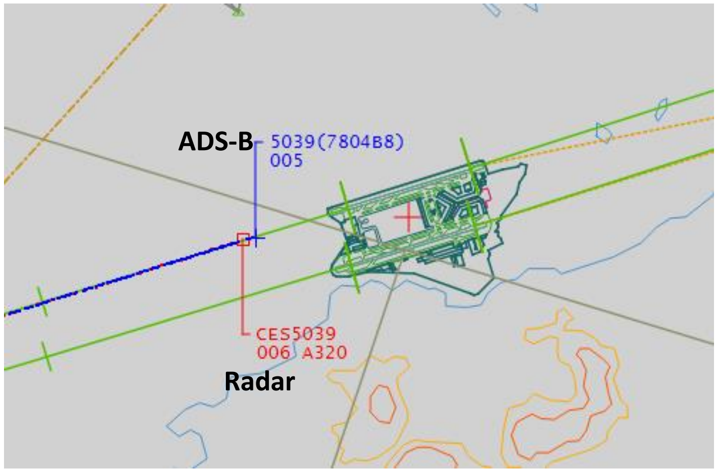


Figure 7b - ICAO Airline Designator Code dropped

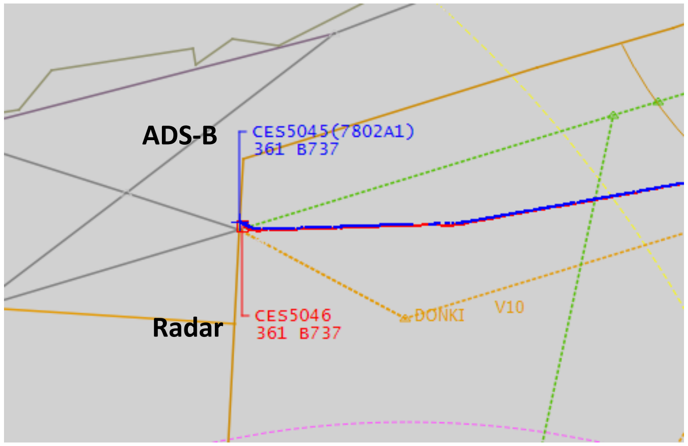


Figure 7c - Wrong numerical codes entered

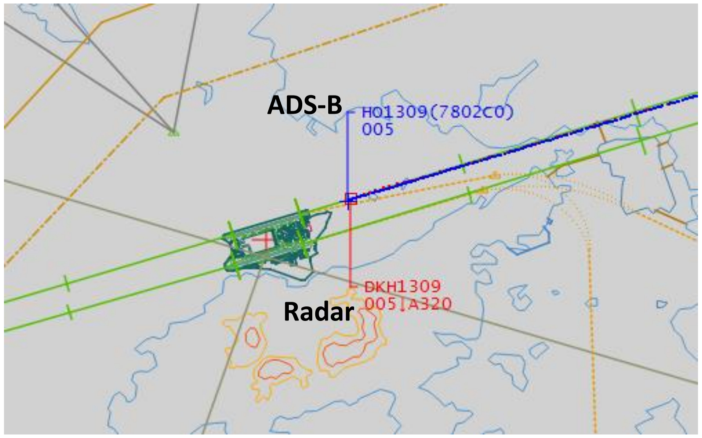
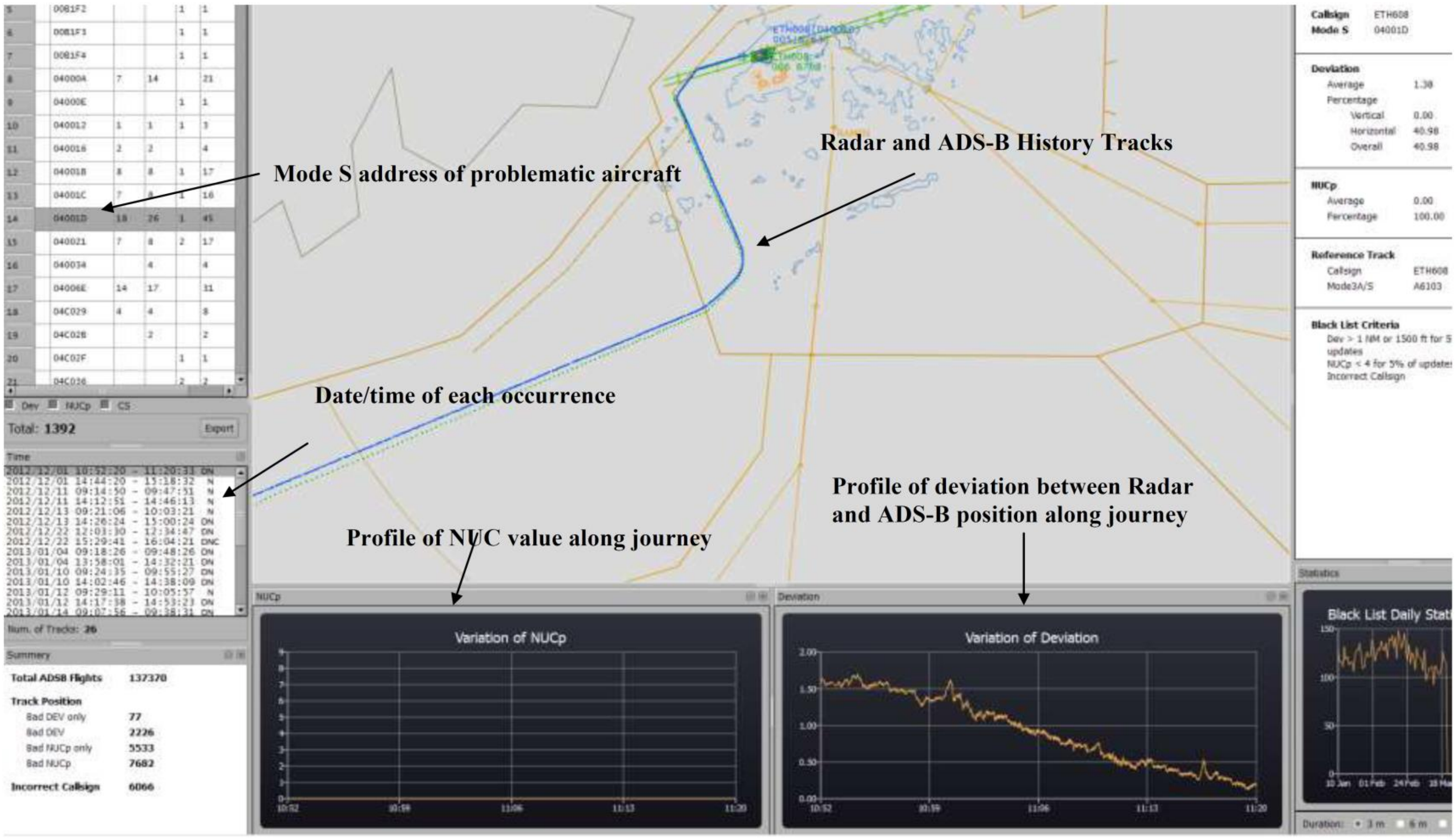


Figure 7d - IATA Airline Designator Code used

Attachment B - Sample screen shot of a system to monitor and analyse performance of ADS-B avionics



A Template for ADS-B Mandate/Regulations for Aircraft Avionics

(1) On and after dd/mm/yyyy, if an aircraft carries 1090MHz extended squitter (1090ES) ADS-B transmitting equipment for operational use in xxxxxxxx territory, the equipment must have been certificated as meeting :-[1]

(a) EASA AMC 20-24; or
(b) the equipment configuration standards in Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia; or
(c) FAA AC No. 20-165A – Airworthiness Approval of ADS-B

(2) On and after dd/mm/yyyy, if an aircraft operates on airways (insert routes)…………at or above FLXXX………(or in defined airspace boundaries ……………. at or above FLXXX):[2]

The aircraft must carry serviceable 1090MHz extended squitter (1090ES) ADS-B transmitting equipment that has been certificated as meeting :-

(a) EASA AMC 20-24; or
(b) the equipment configuration standards in Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia; or
(c) FAA AC No. 20-165A – Airworthiness Approval of ADS-B

(3) An aircraft carrying 1 090 MHz extended squitter (1090ES) ADS-B equipment shall disable ADS-B transmission unless:

(a) the aircraft emits position information of an accuracy and integrity consistent with the transmitted value of the position quality indicator; or
(b) the aircraft always transmits a value of 0 (zero) for one or more of the position quality indicators (NUCp, NIC, NAC or SIL); or
(c) the operator has received an exemption granted by the appropriate ATS authority.

(a) [1] This paragraph ensures all aircraft operating in the airspace, if equipped with ADS-B, are compliant to standards.
(b) [2] This paragraph provides mandate requirements within certain parts of the airspace.

An Example of Advice to Operators Concerning Inconsistency Between ADS-B Flight Planning and Surveillance Capability

1. Background

Newer technologies for aircraft surveillance are now available – such as Mode S and ADS-B – which in many aircraft are installed as replacements for older Mode A/C transponders.

Air Traffic Control makes use of these new capabilities, and uses the Flight Plan information as a decision support tool – to allow the Air Traffic Controller to predict the surveillance capability of a particular aircraft before it enters radar or ADS-B coverage.

Requirements for ADS-B and Mode S (**insert local reference document if applicable**) may mean that if flight planning does not accurately reflect the aircraft capability, services may be withheld (for example if ADS-B is mandatory, but not indicated on the flight plan **– this section to be modified for local requirements**).

2. Flight Planning Requirements for Transponder and ADS-B

The flight planning requirements for aircraft are described in **(local document reference or ICAO DOC 4444 Appendix 2)** and repeated below.

Surveillance Equipment

N if no surveillance equipment for the route to be flown is carried, or the equipment is unserviceable

OR

INSERT one or more of the following descriptors, to a maximum of 20 characters, to describe the serviceable surveillance equipment and/or capabilities on board:

SSR Modes A and C

A Transponder — Mode A (4 digits — 4 096 codes)

C Transponder — Mode A (4 digits — 4 096 codes) and Mode C

SSR Mode S

E Transponder — Mode S, including aircraft identification, pressure-altitude and extended squitter (ADS-B) capability

H Transponder — Mode S, including aircraft identification, pressure-altitude and enhanced surveillance capability

I Transponder — Mode S, including aircraft identification, but no pressure-altitude capability

L Transponder — Mode S, including aircraft identification, pressure-altitude, extended squitter (ADS-B) and enhanced surveillance capability

P Transponder — Mode S, including pressure-altitude, but no aircraft identification capability

S Transponder — Mode S, including both pressure altitude and aircraft identification capability

X Transponder — Mode S with neither aircraft identification nor pressure-altitude capability

Note : Enhanced surveillance capability is the ability of the aircraft to down-link aircraft derived data via a Mode S transponder.

ADS-B

B1 ADS-B with dedicated 1 090 MHz ADS-B “out” capability[1]

B2 ADS-B with dedicated 1 090 MHz ADS-B “out” and “in” capability[1]

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

3. Additional information

The capability of your aircraft transponder, and ADS-B capability, will typically be available in the transponder manual, or in the aircraft flight manual for the aircraft. For General Aviation aircraft, the most common configurations for filing in the flight plan field 10b will be (listed in order of capability).

EB1 – An ADS-B equipped aircraft would typically file this to indicate the Mode S transponder capability with ADS-B out.

S – The majority of Mode S transponders (without ADS-B) will support pressure altitude information and Flight ID transmission.

C – For aircraft with an older Mode A/C transponder – most of which provide pressure altitude capability.

Less common configurations in General Aviation will include:

H, LB1 or LB2 – Enhanced surveillance capability is more usually associated with higher end aircraft. ADS-B IN (B2) is relatively rare at this time, but may be available for some aircraft.

---

[1] Based on current version of ICAO Doc 4444

I, P or X – Most Mode S transponders will support Flight ID and pressure altitude, so these configurations are not common.

A – some low end GA aircraft may not provide pressure altitude information.

U1 or U2 – these ADS-B technologies are only authorized in a limited number of countries in the Asia Pacific Region.

Planning designations not to be used in Asia Pacific:

V1 or V2 – these ADS-B technologies are not authorised for use in Asia Pacific Region.

Remember:

Always flight plan the correct surveillance capability for your aircraft. If in doubt, consult the transponder manual, aircraft flight manual, or your Licenced Aircraft Maintenance Engineer.

**GUIDELINES FOR AIRWORTHINESS APPROVAL FOR
ADS-B AVIONICS EQUIPAGE**

a) The airworthiness compliance of the aircraft under the airframe OEM Type Certificate approval in the Airplane Flight Manual, in an AFM supplement or other appropriate airworthiness documentation is normally accepted by the State of Registry. If the aircraft does not have an existing certification, compliance with Appendix XI of CASA CAO 20.18 specified requirements needs to be established;
http://www.casa.gov.au/wcmswr/_assets/main/download/orders/cao20/2018.pdf

b) The continuing airworthiness of ADS-B system must be assured. Existing established maintenance practices or a proposed maintenance programme for the aircraft needs to be reviewed to ensure that it meets relevant requirements. This is typically a demonstration that ADS-B is included as part of the normal maintenance process in the documentation provided; (NB: most ADS-B systems comprise transponder & GPS systems already the subject of existing maintenance and ongoing airworthiness programs);

c) The Minimum Equipment List needs to reflect the functional requirements of the ADS-B system;

d) Appropriate flight operations training programme and operational procedures are established to ensure that pilots are knowledgeable about their onboard operational equipment. This is typically a demonstration that all used aircraft systems are included in the training process and operational documentation including Flight Dispatch considerations; and

e) In light of the fact that usually there are no ADS-B specific actions that the flight crew can take, and that whilst desirable, ADS-B OUT training has minimal (if any) impact on the safety and efficiency of ADS-B OUT based operations, it is not considered essential that flight crew have been trained explicitly on ADS-B.

\- - - - - - - - - - - - -

ADS-B IMPLEMENTATION STATUS IN THE APAC REGION

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
AFGHANISTAN	ADS-B & Multi Lateration system installed.				subject to safety assessment
AUSTRALIA	A total of 33 ADS-B stations and 28 WAM stations are currently used. ATC system readiness since 2004. 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. Additional 13 ADS-B stations from 2014-2016. OneSKY replacing current ATM system is estimated for full operational around 2020.	2009/effective date of mandating in UAP 12/12/2013. 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.	at/above FL290 UAP from 12/2013 for domestic & foreign aircraft. Mandates for additional flight level are considered for 2015 & 2017. WAM is operating in Tasmania since 2010 delivery 5 Nm separation service. WAM is also operating in Sydney for 3 Nm separation service in TMA and for precision runway monitoring function.	5 NM 3 NM SYDWAN	

State/ Administration	**ADS-B Ground Infrastructure and ATC System readiness or Implementation plan**	**Date of issue/effectiveness date of equipage mandate**	**Mandated Airspace and/or ATS-routes**	**Intended separation criteria to be applied**	**Remarks**
BANGLADESH	Bangladesh has a plan to commission four ADS-B ground stations to be installed at Dhaka, Cox's Bazar, Saidpur and Barisal Airports by 2016. ADS-B data will be integrated with new ATS system at Dhaka.				
CAMBODIA	3 ADS-B ground stations installed at Phnom Penh, Siem Reap and Stung Treng City since 2011 and able to provide full surveillance coverage for Phnom Penh FIR. Cambodia is willing to share data with others.				
CHINA	5 UAT ADS-B sites are used for flight training of CAFUC. 8 ADS-B stations installed by end of 2012. 200 ADS-B stations nationwide will deployed as 1st phase. 1 ADS-B station operational in Sanya FIR since 2008. Sanya ATC system ready since July 2009 to support L642 nd M771. Chengdu-Jiuzhai project finished in 2008 with 2 ADS-B stations and	NOTAM issued on ADS-B trial operation			ADS-B signal alone won't be used for ATC separation

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	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.				
HONG KONG CHINA	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	AIP supplement issued on 29 Oct.2013/12 Dec. 2013 as effective date.	L642/M771 ATS routes.	To be determined.	ADS-B signals being fed to ATC controllers under an operational trial programme. ADS-B operation in Hong Kong FIR re-scheduled for Dec. 2016. An AIP Supplement was issued on 29 Aug. 2014.

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	FL 290 within HK FIR was effective in December 2013 and within HK FIR at or above FL 290 is planned for December 2016. ADS-B ground station infrastructure completed in 2013. ADS-B trial using ADS-B signal provided by Mainland China to cover southern part of Hong Kong FIR commenced in 2010.				
MACAO, CHINA	Mode S MSSR coverage available for monitoring purposes.				
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	ADS-B has been used as back-up surveillance of SSR since 2008.				
FIJI ISLANDS	ADS- B /multilateration ground stations installed. Situations awareness service will be provided in 2013.	ADS-B mandate commencing form 31st December 2013			
FRANCE *(French Polynesia)*	ATM system is ready for ADS-B sensors/Installation of 5 first GS expected at beginning of 2017. 2nd stage with implementation of 7 GS and associated VHF coverage.			5 NM for airspace under coverage.	

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
INDIA	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. ATS systems at 12 ACCs are capable of processing ADS-B data and provide the information on Display. Wide area Multilateration pilot project is being planned in Kolkata TMA to augment the surveillance coverage.	AIP supplement issued on 17th April 2014 with effective date of implementation from 29th May 2014.			ADS-B in India to provide redundancy for radar and filling the surveillance gaps. Currently study the integrity of ADS-B data and evaluating in both Non-radar and radar environment for ATC purposes.
INDONESIA	30 Ground Station successfully installed. Since 2009, ATC Automation in MATSC has capabilities to support ADS-B application.	On 24 July 2014 DGCA published AIRAC AIP Supplement No. 10/14 for using ADS-B for situation awareness effective from 18 Sep. 2014 to 25 June 2015.			ADS-B Task Force Team is considering a mandate in 2016. Mandate for 3 ATS routes: B472, M768, R592

State/ Administration	**ADS-B Ground Infrastructure and ATC System readiness or Implementation plan**	**Date of issue/effectiveness date of equipage mandate**	**Mandated Airspace and/or ATS-routes**	**Intended separation criteria to be applied**	**Remarks**
	ADS-B Task Force team established to develop planning and action concerning ADS-B Implementation within Indonesia FIR ADS-B data sharing with Australia and Singapore.	AIP Supplement on ADS-B Implementation (Tier-1)(mandate) being published with effective date on 25 June 2015.			from 25 June 2015 subject to safety assessment process.
JAPAN	Multilateration Systems for surface monitoring have been implemented at seven airports and are being implemented at another one airport. PRM (WAM) is planned to be implemented at Narita Airport. (Operation will start in 2014). Basic design of en-route WAM system completed in FY2013. Plans to start manufacture in FY2014 and estimated operational in FY2018. Plan to evaluate accuracy of ADS-B information and has intension to introduce ADS-B to the oceanic direction.				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
MALAYSIA	Malaysia planned to start mandate ADS-B requirement in KL FIR in 2018 and full implementation of ADS-B service at specific routes/exclusive airspace by end of 2020. One station at Terrengganu. Plan to install two ADS-B stations at Pulau Langkawi and Genting Highland and new ATM centre being built for KL FIR. The project expected to complete by end of 2019.	Plan to issue mandate with target effective date end of 2018.			
MALDIVES	4 ADS-B stations installed in Nov. 2012 (2 at Male' Ibrahim Nasir Intl Airport, 1 at Kulhudhuffushi Island in the North and 1 at Fuah Mulah Island in the South to cover 95% of the FIR at/above FL290. Maldives' ADS-B is integrated with the ATM system (in November 2013), and under observation prior to commencing trials. Maldives has planned to share ADS-B data with its adjacent FIRs.				Seaplane in Maldives equipped with ADS-B for AOC purpose. These seaplanes have ADS-B IN functions as well.

State/ Administration	**ADS-B Ground Infrastructure and ATC System readiness or Implementation plan**	**Date of issue/effectiveness date of equipage mandate**	**Mandated Airspace and/or ATS-routes**	**Intended separation criteria to be applied**	**Remarks**
MONGOLIA	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.				
MYANMAR	ADS-B ground stations to be installed at Sittwe, Co Co Island by end of 2014 as 1st phase Yango , Lashio and Myeik - 2015 as 2nd phase; Kengteng, Myitkyina in 2016. Completion of integration to Euro Cat. C. in 2014. Agreed to share ADS-B data with India, agreement on sharing being negotiated.				Supplement radar and fill the gaps to improve safety and efficiency. ADS-C/CPDLC integrated in Yangon ACC since 2010.
NEPAL	ADS-B feasibility study conducted in 2007.				
NEW CALEDONIA	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.				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
NEW ZEALAND	MLAT and ADS-B data is being used from the WAM system centered in the Queenstown area to provide surveillance coverage and surveillance separation (5 nm) over the southern half of the South Island of New Zealand. Additionally MLAT data from the Auckland MLAT system is used to provide airport surface movements at NZAA. The New Zealand Navigation and Airspace and Air Navigation Plan "New Southern SKY" issued in May 2014			5 NM Surveillance Separation	
PAKISTAN	Tender for procurement of 5 ADS-B stations issued to be installed at Pasni, Lakpass, Rojhan, Dalbandin and Laram-top. Contract expected to be finalized by end of 2015. These stations will be DO260B compliant and operational by end of 2016.				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
PAPUA NEW GUINEA	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.				
PHILIPPINES	Four (4) ADS-B ground stations (Manila, Palawan, Pangasinan and Ilocos Norte) with target date to complete by end 2016. ATM Center expected to be available in 2016.				
REPUBLIC OF KOREA	ADS-B implemented 2008 for SMC in Incheon International Airport. ROK is developing ADS-B system since 2010 through R&D group. The testbed at Gimpor Airport supporting both 1090ES and UAT, undergoing operational testing (2013-16). At Incheon Intl Airport, promotion of surface surveillance (2014-17) In 2nd phase from 2015 to 2016, ADS-B ground stations will				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	supplement to the radar in the terminal area and fill up the gap between radar coverage. The last phase from 2017 to 2020, ADS-B will be deployed for entire Incheon FIR.				
SINGAPORE	The airport MLAT system was installed in 2007 and “far-range” ADS-B sensor was installed in 2009. ATC system has been processing ADS-B data since 2013.	AIC was issued on 28 December 2010/effective from 12 Dec.2013. AIP supplement published in Nov 2013 to remind operators of ADS-B exclusive airspace implementation. AIP updated in Jan 2015 to remove the need for ops approval and to include the FAA standard as an additional accepted means to meet the equipage requirements.	L642 and M771. At and above FL290. Also affect the following ATS routes N891, M753, L644 & N892	40nm on ATS routes L642, L644, M753, M771, N891 and N892 30nm implemented on 26th June 2014 on ATS routes L642, M753, M771 and N892; 20nm planned for end 2015	Safety case was completed end of November. 2013.
SRI LANKA	ADS-B Trials planned for 2012 and implementation in 2013. 5 ADS-B ground station was planned and willing to share ADS-B data with neighbouring States through a cenral processor which is ready for trial in 4th Quarter 2014.				An AIC on ADS-B services with TMA of Colombo FIR issued on 10 Nov. 2014 (A02/14) with effective 1 Sep. 2015.

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
THAILAND	Multilateration implemented in 2006 at Suvarnbhumi Int'l. Airport. ADS-B Ground Stations (DO260B compliant) installed in Thailand for internal research and development project. ADS-B is planned to be part of future surveillance infrastructure. New ATM System to be operational in 2017 will be capable of processing ADS-B data.				
TONGA	Trial planned for 2017				
UNITED STATES	As of 1 April 2015, the "baseline" set of Service Volumes planned by the FAA in 2007 are operational, using data from 634 radio sites installed by Exelis. Since 2007, FAA has planned and funded activities to activate additional Service Volumes that Exelis will service using and additional 29 radio sites; 9 of these radio sites have been installed by Exelis as of 1 April 2015. As of 1 April 2015, 123 of the 231 U.S. air traffic control facilities are using	The U.S. ADS-B Out rule (14 CFR 91.225 and 14 CFR 91.227) was issued in May 2010 and specifies that the ADS-B Out mandate is effective on 1 January 2020.	Class A, B, and C airspace, plus Class E airspace above 10,000 ft MSL. See 14 CFR 91.225 for details.	The U.S. is using both terminal and en route (5nm) separation criteria, depending on the specific airspace and available surveillance information. Terminal separation includes the following separation criteria: - 3nm - 2.5nm - indepen-	

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	ADS-B for ATC separation; all facilities are planned to be using ADS-B by 2019.			dent parallel approach operations down to 4300 ft centreline separation - dependent parallel approach operations down to 2500 f centreline separation (currently 1.5 nm diagonal distance).	
VIET NAM	Two phases ADS-B implementation plan adopted. Phase 1 implemented in March 2013. Phase 2 for whole lower and upper airspace of Ha Noi and Ho Chi Minh FIR to be completed by 2016.	AIC issued on 20 June 2013/ADS-B mandating effective from 12 December 2013 in Ho Chi Minh FIR.	M771, L642, L625, N892, M765, M768, N500 and L628 At/above FL290.		Operators required to have operational approval from State of aircraft registry.

– – – – – – – – – – – – – –

TERMS OF REFERENCE OF
SURVEILLANCE IMPLEMNTATION COORDINTION GROUP (SURICG)

Consists of objectives and deliverables as follows:

The Objectives of the SURICG are to:

1) *Ensure continuous and coherent development of the Surveillance parts of the Asia/Pacific Regional Air Navigation Plan (APAC ANP) in a manner that is harmonized with adjacent regions, consistent with ICAO SARPs, the Global Air Navigation Plan and the Global Aviation Safety Plan;*

2) *Facilitate the implementation of Surveillance systems and services identified in the Aviation System Block Upgrades (ASBU) modules, APAC ANP, and Asia/Pacific Seamless ATM Plan elements using the project management principles where appropriate; and*

3) *Review, identify and address major issues in technical, operational, safety and regulatory aspects to facilitate the implementation or provision of efficient Surveillance services in the Asia and Pacific Regions.*

<u>Deliverables to meet the Objectives:</u>

1) *Progress report to be submitted to CNS SG addressing the SURICG deliverables (listed in 2 to 11 below);*

2) *Surveillance parts of the APAC ANP to be reviewed and aligned with work programme of States and, as necessary, amendment proposals prepared to update the APAC ANP to reflect changes in the operational and global requirements;*

3) *To review the outcome of the Surveillance Panel, AN-Conf, APANPIRG and CNS SG related to surveillance, revise and update a tasks list and action items for the SURICG and formulate relevant Working Groups to work on those tasks / action items;*

4) *To develop regional targets/metrics for planning, implementation, measurement and monitoring of Surveillance systems and services;*

5) *To review and update the Surveillance Strategy by considering currently available and emerging technologies with respect to concept of operations, relative costing, technical and operational performance and maturity of alternative technology/solutions such as primary, secondary radar including Mode-S, ADS-B, multilateration, ADS-C, multi-static radar;*

6) *To study and identify applicable multilateration applications in the Asia and Pacific Regions considering:*

   - *Concept of use/operation*
   - *Required site and network architecture*
   - *Expected surveillance coverage*
   - *Cost of system*
   - *Recommended separation minimums*

7) *To study and identify applicable Mode S radar applications in the Asia and Pacific Regions considering:*

- *Concept of use/operation*
- *Required site and network architecture*
- *Expected surveillance coverage*
- *Cost of system*
- *Matching functionality required in ATC automation system*

8) *To develop an implementation plan for near term ADS-B applications in the Asia and Pacific Regions including implementation target dates taking into account:*

- *available equipment standards*
- *readiness of airspace users and ATS providers*
- *identifying sub-regional areas (FIRs) where there is a positive cost/benefit for near-term implementation of ADS-B OUT; and*
- *developing a standardised and systematic task-list approach to ADS-B OUT implementation.*
- *the use of Enhanced MODE S data (DAPS) from ADS-B applications including the interrogation of DAPS by ADS-B systems (not Multilateration)*

9) *To 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, EUROCAE, RTCA and Industry;*

10) *To encourage research and development, trials and demonstrations in the field of Surveillance and other relevant areas, and, as necessary, steer for the sharing of this information and expertise between States through organizing educational seminars, providing guidance materials to educate States and airspace users;*

11) *To support the ICAO in making specific recommendations, developing guidance materials, aimed at improving the Surveillance services by the use of existing and/or new procedures, facilities and technologies; and*

12) *Draft Conclusions and Decisions to be formulated relating to matters in the field of Surveillance that come within the scope of the APANPIRG or CNS Sub-group work plan.*

[Note: The Implementation Coordination Group, while undertaking the tasks, should take into account of the work being undertaken by SAS, Surveillance Panels with a view to avoid any duplication.

The Implementation Coordination Group will report to CNS Sub-group and CNS Sub-group will coordinate with ATM Sub-group.]

Membership:

All APAC member States/Administrations providing air navigation services in the Asia and Pacific Regions.

The Implementation Coordination Group shall normally invite representatives of International Organizations recognized by the ICAO Council as representing important civil aviation interests to participate in its work in a consultative capacity.

− − − − − − − − − − − −

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.~~ ~~Block 2 and Block 3.~~

THE SURVEILLANCE STRATEGY FOR THE ASIA/PACIFIC REGION IS TO:

1. Minimize the reliance upon pilot position reporting, particularly voice position reporting, for surveillance of aircraft;

2. Maximize 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, Wide Area Multilateration 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 and feasible. ~~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.

– – – – – – – – – – – –

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).*

TERMS OF REFERENCE OF THE INTER-REGIONAL ADS-C REPORTING INTERVAL TASK FORCE

(paragraph 7.21 refers of NAT IMG meeting report)

Reporting structure

The Task Force would report jointly to the executive bodies of the NAT SPG and APANPIRG.

Purpose

This study will investigate existing FANS 1/A data link implementations to determine the technically feasible minimum ADS-C periodic reporting interval. The study will:

a) Gain a better understanding of the sensitivities to system loading based on ADS-C reporting intervals that are used;

b) Determine minimum ADC C periodic reporting interval that would be technically feasible under specified conditions and without significantly impacting operational performance;

c) Determine benefit to the regions in their planning and implementation of future ATM concepts of operation (e.g. NAT Service Development Roadmap and future 2025 concept of operations); and

d) Support validation of future standards for applying separation minima based on ADS-C, such as 37 km (20 NM) longitudinal separation minimum, currently under development by the Separation and Airspace Safety Panel (SASP);

The primary intent of convening an inter-regional task force is to prepare a report that would support regional planning and implementation initiatives, the development of ICAO manuals, such as *Global Operational Data Link Document* (Doc [GOLD]), and proposed amendments to Annexes and *Procedures for Air Navigation Services (PANS).*

Scope of Work:

The study may include analysis, testing and operational trials and address the following elements:

a) The avionics (up to and including the communications components);
b) The VHF sub-network (the RGS capacity aspect);
c) The ground/ground sub-network (including the ATSU connections);
d) The inter-networking connection;
e) The satellite sub-network (the per satellite/GES aspect);
f) ATS automation systems; and
g) Interaction between intervals and latency, including impact on communicate on performance.

The issue of "minimum technically feasible report interval" has at least three dimensions that will be considered:

a) Single ground-recipient (and thus single contract), single aircraft;
b) Multiple ground-recipients (up to five contracts), single aircraft; and
c) Multiple ground-recipients (up to five contracts with each aircraft), multiple aircraft.

Composition

The Task Force is composed of multidisciplinary experts with relevant knowledge from contributory groups of the NAT SPG, APANPIRG and ICAO Secretariat; OPLINKP, SASP, communications service providers, satellite companies, aircraft manufacturers and aircraft operators. The TF may consult with outside experts, as required.

Conduct of the work and schedule

It is anticipated that the Task Force will conduct its work primarily by teleconferences and other electronic means of communications. The Task Force would only hold any direct meetings as deemed necessary and as agreed by its members.

The tentative completion date for this task would be early 2016 to support regional coordination and provide the final report at NAT SPG/52 and APANPIRG/27.

Deliverables

The Task Force will produce the following:

a) a report on the sensitivities and effects of specifying short ADS-C periodic reporting intervals on system capability and performance;

b) a statement on the economic aspects; and

c) other material, as determined necessary, such as analysis/test plans and results to substantiate the conclusions and any proposed changes Doc [GOLD], or other manuals and regional documents.

– – – – – – – – – – – –

GUIDANCE ON THE IMPLEMENTATION AND USE OF BACKUP FREQUENCIES

1. Assessment for the need for backup frequencies.

1.1 Backup frequencies may be operationally required to provide and alternative air/ground communication channel in cases where an operational radio frequency is not available.

Examples include intentional interference, unintentional interference (e.g. badly designed FM broadcasting stations), stuck microphone, phony air traffic controllers.

1.2 Implementation of backup frequencies should be limited only to the following ATC services:

• Aerodrome Surface communications	AS
• Tower services	TWR
• Approach services	APP-L, APP-I and APP-U
• Area control services	ACC-L, ACC-U
• Meteorological information	VOLMET
• Flight Information services	FIS-L, FIS-U

Other air/ground communication services such as ATIS, AFIS, generic unspecified air-to-air (A/A), generic unspecified air-to-ground (A/G) services, generic unspecified General Purpose (GP) services and aeronautical operational control services (AOC) do not require backup communication channels.

1.3 Backup frequencies should not be provided when communication channels are lost due to malfunctioning of the ground infrastructure. Adequate backup facilities in cases of malfunctioning of the ground infrastructure (or parts the-of) should be in place.
Examples are equipment failure, power loss and loss of ground communication links to remote transmitter / receiver sites.

1.4 The assessment of the required number of backup frequencies should be kept to a minimum. Where possible, it should be based on experience (e.g. number of days per year that a communication channel is not available).

1.5 Where operationally feasible, arrangements should be in place to share backup frequencies either between different services (at the same ATC center) or between different facilities (e.g. different aerodromes or different ACC/FIS serves from different ATC centers).

1.6 In the ICAO COM list, backup frequencies are as such identified.

2. Backup frequency for short distance communications

2.1 Short distance communications that may require backup frequencies include AS, TWR and APP services

2.2 Backup frequencies should only be implemented at aerodromes with a clear operational requirement.

2.3 The number of backup frequencies for the combined services in 2.1 above should not exceed two (with a maximum of one backup frequency for TWR and one backup frequency for APP services).

Note: a single backup frequency can in principle be used to provide for a backup communications channel for both a TWR and an APP service or for a TWR and an AS service.

2.4 Adjacent ATS units are encouraged and where possible, operationally feasible and spectral efficient to make suitable arrangements to share backup frequencies.

3. Backup frequencies for long distance communications

3.1 A study or safety case should be presented to justify the number of backup frequencies required for ACC and FIS services.

3.1 Adjacent ATS units are encouraged and where possible, operationally feasible and spectral efficient to make suitable arrangements to share backup frequencies.

– – – – – – – – – – – – –

1. Mapping

Services / DOC as specified in current APAC COM list 3			Services /DOC as specified in Handbook Volume 2 and used in Global COM list 3		
Service	**Symbol**	**Service Range/Height (NM/feet)**	**Service**	**Symbol**	**Service Range/Height (NM/FL)**
Aerodrome Control	TWR	25/4000	Aerodrome Control Tower	TWR	25/40
			Aerodrome Flight Information Service	AFIS	25/40
			Precision Approach radar	PAR	25/40
Surface Movement Control	SMC	Limit of aerodrome	Aerodrome Surface Communications	AS	5/1
Approach Control (Upper)	APP-U	150/45000	Approach Control Service (Upper)	APP-U	150/450
Approach Control (Intermediate)	APP-I	75/25000	Approach Control Service (Intermediate)	APP-I	75/150
Approach Control (Lower)	APP-L	50/12000	Approach Control Service (Lower)	APP-L	50/120
Area Control or Flight Information Service ((Upper)	ACC-U FIS-U	Specified area + 50 NM; Height 45000	Area Control Centre (Upper)	ACC-U	260/450 or specified area
			Flight Information Service (Upper)	FIS-U	260/450 or specified area
Area Control (Lower)	ACC-L	Specified area + 50 NM; Height 25000	Area Control Service (Lower)	ACC-L	195/250 or specified area
			Flight Information Service (Lower)	FIS-L	185/250 or specified area
Area Control or Flight Information (Extended Range)	ACC-ER FIS-ER	To be specified; Height 45000	Not used; extended range stations are grouped in families of extended range stations and identified in the Global COM list as ER		
VOLMET/ATIS	VOLMET ATIS	Omnidirectional; Height 45000	VOLMET	VOLMET	260/450
			ATIS	ATIS	260/450

Mapping of Service and DOC in current APAC COM List 3 with Service and DOC in Global COM list 3

Note 1: Values for SST (Super Sonic Transport) operations not shown.

Note 2: FL is height in feet divided by 100

Note 3: When for area services the area is not specified the DOC is assumed to extend up to the radio horizon

2. In the Global COM list the specified DOC is preceded with a prefix as follows:

A- (e.g. A-260/250) – The prefix A- indicates that the frequency is for a protected area service for which a geographical area is specified.

B- (e.g. B-260/450) – The prefix B- indicates that the frequency is for a protected aeronautical broadcast service (VOLMET or ATIS) with a circular (omnidirectional) DOC of 260 NM and 45000 ft.

C- (e.g. C-25/40) – The prefix C- indicates that the frequency is for a protected service with a circular (omnidirectional) DOC of 25 NM and 4000 ft.

U- (e.g. U-260/450) The prefix U- indicates that the frequency is for an un-protected service with a circular DOC of 260 NM and 45000 ft.

3. Harmonization of Services

3.1 The current COM list 3 for the APAC Region includes a definition of special functions that apply to the operational use of the frequency. This additional information was added to the field Remarks in the Global COM lsit. When converting the APAC COM list into the ICAO Global COM list, the following actions were taken.

APAC COM list	Global COM list	
Service	**Service**	**Remarks**
ACC	ACC-U	
ACC-CDC	ACC-U	Clearance delivery
TWR/ACC	ACC-U	Also TWR
ACC-ER	ACC-U	Extended range
ACC-I	ACC-I	
ACC-L	ACC-L	
ACC-LU	ACC-U	Also ACC-L
ACC-LU-ER	ACC-U	Also ACC-L; Extended range
ACC-SR	ACC-U	Surveillance radar
ACC-SR-I	ACC-I	Surveillance radar
ACC-SR-L	ACC-L	Surveillance radar
ACC-SR-U	ACC-U	Surveillance radar
ACC-U	ACC-U	
ACC-U-ER	ACC-U	Extended range
ACC/APP	ACC-U	Also APP
ACC/APP/FIS	ACC-U	Also APP and FIS
ACC/DATA	ACC-U	Data
ACC/FIS	FIS-U	Also ACC
ACC-FIS-U	FIS-U	Also ACC
AFIS	AFIS	
AOC	AOC	
ACC/FIS/APP	FIS-U	Also ACC and APP
APP	APP-U	APP-U assumed

APAC COM list	Global COM list	
Service	Service	Remarks
APP-I	APP-I	
APP-L	APP-L	
APP-LU	APP-U	Also APP-L
APP-PAR-I	APP-I	PAR
APP-PR	APP-U	Precision radar
APP-PR-I	APP-I	Precision radar
APP-PR/TWR	APP-U	Precision radar; also TWR
APP-PR+DF	APP-U	Precision radar and DF
APP-R	APP-U	Radar
APP-SR	APP-U	Surveillance radar
APP-SR-I	APP-I	Surveillance radar
APP-SR-I/L	APP-I	Surveillance radar; also APP-L
APP-SR-L	APP-L	Surveillance radar
APP-SR-LU	APP-U	Surveillance radar; also APP-L
APP-SR-U	APP-U	Surveillance radar
APP-SR-U+DF	APP-U	Surveillance radar; direction finding
APP-U	APP-U	
APP/ACC	ACC-U	Also APP
APP/ACC/FIS	FIS-U	Also ACC and APP
APP/DF	APP-U	Direction finding
APP/DF-I	APP-I	Direction finding
APP/FIS	FIS-U	Also APP
APP/L	APP-L	
APP/PR	APP-U	Precision radar
APP/SR-I	APP-I	Surveillance radar
APP/TMA	APP-U	TMA
APP/TWR	APP-L	Also TWR
APP/TWR-PR	APP-L	Precision radar; also TWR
APP/TWR/FIS	FIS-L	Also APP and TWR
APP+DF	APP-U	Direction finding
APP+DF-I	APP-I	Direction finding
APP+DF-L	APP-L	Direction finding
APPI	APP-I	
ATIS	ATIS	
AWIB	TWR	AWIB
CD	APP-L	Clearance delivery
DATA-LINK	AOC	Data Link (VDL)
DATIS	ATIS	D-ATIS
DELIVERY	TWR	Delivery
DEP	TWR	Departure
ENROUTE	ACC-U	En Route
FIS	FIS-U	FIS-U assumed

APAC COM list	Global COM list	
Service	**Service**	**Remarks**
FIS-ER	FIS-U	Extended range
FIS-GP	FIS-U	General purpose
FIS-I	FIS-I	
FIS-L	FIS-L	
FIS-LU	FIS-U	Also FIS-L
FIS-LU/GP	FIS-U	General purpose; also FIS-L
FIS-U	FIS-U	
FIS-U/GP	FIS-U	General purpose
FIS/ACC-ER	ACC-U	Extended range
FIS/ER	FIS-U	Extended range
OP-CTL	AOC	
FLIGHT CHE	FIS-U	Flight checking
RCAG	FIS-U	Remote controlled A-G communications
SAR	SAR	
SITADATA	AOC	SITA DATA
SMC	AS	
SMC/CD	AS	Clearance delivery
SMC/DEP	AS	Departure
SMC/FIRE	AS	Fire
TMA	APP-U	TMA
TWR	TWR	
TWR/APP	APP-L	Also TWR
TWR/APP-I	APP-I	Also TWR
TWR/APP-L	APP-L	Also TWR
TWR/APP/DF	APP-L	Direction finding; also TWR
TWR/APP/FIS	APP-L	Also FIS and TWR
TWR/APP/VDF	APP-L	Direction finding; also TWR
TWR/DF	TWR	Direction finding
TWR/FIS	TWR	Also FIS
TWR/SMC	TWR	Also aerodrome surface
TWR/SMC/FIS	TWR	Also FIS and aerodrome surface
TWR/UNICOM	TWR	UNICOM
TWR+APP	APP-L	Also TWR
TWR+DF	TWR	Direction finding
TWR+PR	TWR	Precision radar
TWR+R	TWR	Radar
VDF/APP	APP-L	Direction finding
A/G LIGHT	A-G	A/G LIGHT
VOLMET	VOLMET	

4. Table of Services and DOC as identified for use in Frequency Finder.

4.1 Frequency Finder has incorporated the following Table, identifying the Services, the Designated Operational Coverage and the Designated Operational Range and Height. Some of these Services are not used in the APAC Region.

Service	DOC	Range	Height
A-A	A-A C-261/450	261	45000
A/G	A-G C-261/450	261	45000
ACC-L	ACC-L C-194/250	194	25000
ACC-U	ACC-U C-261/450	261	45000
AFIS	AFIS C-25/40	25	4000
AOC	AOC U-260/450	260	45000
APP-I	APP-I C-75/250	75	25000
APP-L	APP-L C-50/120	50	12000
APP-U	APP-U C-150/450	150	45000
ATIS	ATIS B-260/450	260	45000
EMERG	EM	0	0
FIS-L	FIS-L C-194/250	194	25000
FIS-U	FIS-U C-261/450	261	45000
GUARD	REG. GUARD C-261/450	0	0
RGA	REGION	25	4000
PAR	PAR C-25/40	25	4000
SAR	SAR	0	0
SMC	SMC C-5/1	10	100
TWR	TWR C-25/40	25	4000
VOLMET	VOLMET B-260/450	260	45000
ACC-I	ACC-I C-194/250	194	25000
ACC	ACC-U C-265/450	261	45000
APP	APP-U C-150/450	150	45000
FIS	FIS-U C-261/450	261	45000
FIS-I	FIS-I C-194/250	194	25000
AS	AS C-5/1	5	100

– – – – – – – – – – – – –

Status of the Seamless ATM reporting process (21 July 2015)

State/Administration	Points of contact nominated	Status	Latest submission
Australia	Yes	Submitted Regular updates	Q 2015-3
Bangladesh	Yes	Submitted	Q 2015-2
Bhutan	Yes	Submitted	Q 2015-2
China	Yes	Submitted	Q 2014-1
Fiji	Yes	Submitted	Q 2015-3
French Polynesia, France	Yes	Submitted	Q 2014-1
Hong Kong, China	Yes	Submitted	Q 2014-1
India	Yes	Submitted Second update in preparation	Q 2014-4
Japan	Yes	Submitted	Q 2014-4
Macao, China	Yes	Submitted	Q 2014-4
Malaysia	Yes	Submitted	Q 2015-2
Maldives	Yes	Submitted	Q 2015-3
New Caledonia, France	Yes	Submitted	Q 2015-2
Philippines	Yes	Submitted	Q 2015-3
Singapore	Yes	Submitted Regular updates	Q 2015-3
Sri Lanka	Yes	Submitted	Q 2014-3
Thailand	Yes	Submitted Regular updates	Q 2014-4
United States	Yes	Submitted	Q 2015-1
New Zealand	Yes	In preparation	-
Republic of Korea	Yes	In preparation	-
Afghanistan	No	No report	-
Brunei Darussalam	No	No report	-
Cambodia	No	No report	-

State/Administration	Points of contact nominated	Status	Latest submission
Cook Islands	No	No report	-
Democratic People's Republic of Korea	No	No report	-
Indonesia	No	No report	-
Kiribati	No	No report	-
Lao People's Democratic Republic	No	No report	-
Marshall Islands	No	No report	-
Micronesia (Federated States of)	No	No report	-
Mongolia	No	No report	-
Myanmar	Yes	No report	-
Nauru	No	No report	-
Nepal	Yes	No report	-
Pakistan	No	No report	-
Palau	No	No report	-
Papua New Guinea	No	No report	-
Samoa	No	No report	-
Solomon Islands	Yes	No report	-
Democratic Republic of Timor-Leste	Yes	No report	-
Tonga	No	No report	-
Vanuatu	No	No report	-
Vietnam	No	No report	-
Wallis and Futuna Islands, France	No	No report	-

ANS implementation in Asia-Pacific: Regional Picture as of 21 July 2015

THE 10 ASIA-PACIFIC REGIONAL PRIORITIES ADOPTED BY APANPIRG/25, 2014

Seamless Item	ASBU	Target
Network Operations	**B0-NOPS**	1. **All High Density FIRs** supporting the busiest Asia/Pacific traffic flows and high-density aerodromes should implement ATFM incorporating CDM using operational ATFM platform/s. *Note: High Density FIRs are defined as:* *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.* *[APANPIRG Conclusion 22/8 and 23/5 refer]*
PBN	**B0-APTA**	2. Approach: Where practicable, **all high- density aerodromes** with instrument runways serving aeroplanes should have precision approaches or APV or LNAV. *Note 1: High density aerodrome is defined by Asia-Pacific Seamless ATM Plan as aerodromes with scheduled operations in excess of 100,000/year.* *Note 2: the Asia/Pacific PBN Plan Version 3 required RNP APCH with Baro-VNAV or APV in 100% of instrument runways by 2016*
Ground Surveillance	**B0-ASUR**	3. 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.
Ground Surveillance	**B0-ASUR**	4. ADS-B or MLAT or radar surveillance systems should be used to provide coverage of all Category S-capable airspace as far as practicable, with data integrated into operational ATC aircraft situation displays.
Trajectory-Based Operations-Data Link En-Route	**B0-TBO**	5. Within Category R airspace, ADS-C surveillance and CPDLC should be enabled to support PBN-based separations.
Flight and Flow Information for a Collaborative Environment	**B0-FICE**	6. All States between ATC units where transfers of control are conducted have implemented the messages ABI, EST, ACP, TOC, AOC as far as practicable.
Aeronautical Information Management	**B0-DATM**	7. ATM systems should be supported by digitally-based AIM systems through implementation of **Phase 1 and 2 of the AIS-AIM Roadmap**.
Civil/Military	**B0-FRTO**	8. Enhanced En-Route Trajectories: All States should ensure that SUA are regularly reviewed by the appropriate Airspace Authority to assess the effect on civil air traffic and the activities affecting the airspace.
Civil/Military	**Strategic Civil Military coordination (Regional)**	9. Enhanced En-Route Trajectories: All States should ensure that a national civil/military body coordinating strategic civil-military activities is established.
Civil/Military	**Tactical Civil Military coordination (Regional)**	10. Enhanced En-Route Trajectories: All States should ensure that formal civil military liaison for tactical response is established.

Nov. 2015

THE 10 ASIA-PACIFIC REGIONAL PRIORITIES (APANPIRG/25, 2014)

		Air Traffic Flow Management/ Collaborative Decision-Making (ATFM/CDM)	Performance-based Navigation (PBN) Approach	Ground-based Surveillance	ATS surveillance with data integrated	ADS-C and CPDLC	ATS Inter-facility Data-link Communications (AIDC)	Aeronautical Information Management	Civil Military use of SUA	Strategic Civil Military coordination	Tactical Civil Military coordination
	Seamless Item	**80**	**110**	**180**	**270**	**280**	**220**	**300**	**360**	**370**	**380**
	ASBU	**B0-NOPS**	**B0-APTA**	**B0-ASUR**	**B0-ASUR**	**B0-TBO**	**B0-FICE**	**B0-DATM**	**B0-FRTO**	**Regional**	**Regional**
Australia	**2015 - 3**	100%	100%	100%	100%	100%	100%	76.9%	100%	100%	100%
Bangladesh	**2015 - 2**	N/A	30%	N/A	30%	N/A	No data	61.5%	No data	No data	100%
Bhutan	**2015 - 2**	N/A	No data	N/A	No data	N/A	No data	0%	N/A	No data	No data
China	**2014 - 1**	77.7%	100%	11.1%	100%	N/A	100%	38.5%	N/A	100%	100%
Fiji	**2015 - 3**	No data	70%	100%	100%	100%	100%	7.7%	N/A	N/A	N/A
French Polynesia, France	**2014 - 1**	N/A	50%	100%	No data	No data	100%	No data	No data	N/A	N/A
Hong Kong, China	**2014 - 1**	100%	100%	0%	No data	N/A	0%	No data	100%	N/A	100%
India	**2014 - 4**	0%	100%	N/A	80%	100%	75%	100%	100%	100%	100%
Japan	**2014 - 4**	100%	0%	0%	100%	100%	100%	No data	100%	100%	100%
Macao, China	**2014 - 4**	N/A	No data	N/A	N/A	N/A	N/A	38.5%	N/A	N/A	N/A
Malaysia	**2015 - 2**	50%	0%	0%	100%	50%	100%	76.9%	100%	100%	100%
Maldives	**2015 - 3**	80%	100%	0%	100%	100%	0%	0%	No data	No data	No data
New Caledonia, France	**2015 - 2**	N/A	0%	N/A	N/A	N/A	N/A	No data	N/A	N/A	N/A
Philippines	**2015 - 3**	No data	100%	0%	50%	100%	0%	46.2%	100%	100%	0%
Singapore	**2015 - 2**	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Sri Lanka	**2014 - 3**	No data	No data	100%	100%	100%	100%	84.6%	100%	100%	100%
Thailand	**2014 - 4**	0%	No data	0%	100%	N/A	0%	0%	100%	100%	100%
United States	**2015 - 1**	50%	N/A	50%	N/A	50%	50%	No data	100%	100%	100%
	Indicator	% of High Density FIRs supporting the busiest Asia/Pacific traffic flows and high density aerodromes using operational ATFM platforms incorporating CDM	% of high density aerodromes with precision approaches or APV or LNAV (High density aerodrome is defined by Asia-Pacific Seamless ATM Plan as aerodromes with scheduled operations in excess of 100,000/year)	% of of FIRs where Category S airspace and Category T airspace supporting high density aerodromes are designated as ADS-B airspace?	% of ACCs with ATS Surveillance using ADS-B, MLAT or radar in Category S airspace, and having data integrated into the ATC system situation display	% of FIRs utilising data link en-route in applicable airspace	% of FIRs within which all applicable ACCs have implemented at least one interface to use AIDC / OLDI with neighbouring ACCs	% of Phase 1 and 2 AIS-AIM elements completed (0-13)	% of FIRs in which FUA is implemented	Have you established a national civil/military body that performs strategic civil-military coordination? (1- yes, 0-no)	Have you established a formal civil military liaison for tactical response? (1- yes, 0-no)

Progress against the 10 APAC Regional Priorities

(Regional Picture 21 Jul 2015)

2 of 7

Nov. 2015

		Air Traffic Flow Management/ Collaborative Decision-Making (ATFM/CDM)	Apron Management	Aerodrome capacity	Safety and Efficiency of Surface Operations	ATM-Aerodrome Coordination	Airport Collaborative Decision-Making (ACDM)	Arrival Manager/Departure Management (AMAN/DMAN)	ATC Horizontal separation	ATC Sector Capacity	Automated Transfer of Control	Optimized wake turbulence separation
	Seamless Item	80	10	30	40	20	70	50	260	60	230	440
	ASBU	B0-NOPS	Regional	Regional	B0-SURF	Regional	B0-ACDM	B0-RSEQ	Regional	Regional	Regional	B0-WAKE
		PRIORITY										
Australia	2015 - 3	100%	100%	100%	100%	100%	100%	0%	100%		100%	
Bangladesh	2015 - 2	N/A	10%	No data	N/A	50%	N/A	N/A	100%		N/A	
Bhutan	2015 - 2	N/A	N/A	N/A	N/A	0%	N/A	N/A	No data		No data	
China	2014 - 1	77.7%	100%	100%	100%	100%	100%	50%	100%		100%	
Fiji	2015 - 3	No data	60%	No data	No data	No data	No data	No data	No data		No data	
French Polynesia, France	2014 - 1	N/A	No data	N/A	N/A	N/A	10%	N/A	100%		No data	
Hong Kong, China	2014 - 1	100%	100%	100%	0%	100%	0%	0%	100%		0%	
India	2014 - 4	0%	100%	100%	100%	100%	50%	50%	100%		100%	
Japan	2014 - 4	100%	100%	40%	50%	100%	0%	0%	100%		100%	
Macao, China	2014 - 4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	
Malaysia	2015 - 2	50%	100%	100%	100%	90%	10%	20%	100%		60%	
Maldives	2015 - 3	No data	No data	No data	No data	No data	No data	N/A	100%		100%	
New Caledonia	2015 - 2	N/A	N/A	N/A	No data	N/A	N/A	N/A	100%		N/A	
Philippines	2015 - 3	No data	100%	100%	No data	100%	0%	0%	100%		30%	
Singapore	2015 - 3	0%	100%	100%	100%	100%	0%	100%	100%		100%	
Sri Lanka	2014 - 3	No data	N/A	N/A	N/A	N/A	N/A	N/A	100%		100%	
Thailand	2014 - 4	0%	0%	100%	50%	100%	0%	0%	100%		0%	
United States	2015 - 1	50.0%	N/A	N/A	N/A	N/A	N/A	N/A	100%		100%	
	Indicator	% of High Density FIRs supporting the busiest Asia/Pacific traffic flows and high density aerodromes using operational ATFM platforms incorporating CDM	% of high density international aerodromes (100,000 scheduled movements per annum or more) providing an appropriate apron management service	% of high density international aerodromes having declared capacity in accordance with the Seamless ATM Plan Phase 1	% of applicable international aerodromes having implemented A-SMGCS Level 2	% of high density international aerodromes having appropriate ATM coordination in accordance with the Seamless ATM Plan	% of applicable international aerodromes having implemented improved airport operations through airport-CDM (applicable=high density)	% of applicable international aerodromes having implemented AMAN / DMAN (applicable = high density)	Does your AIP authorise the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable ? (1- yes, 0-no)		% of ATC sectors with automated hand-off procedures in accordance with Seamless ATM Plan Phase 1	

Nov. 2018

		Air Traffic Flow Management/ Collaborative Decision-Making (ATFM/CDM)	Apron Management	Aerodrome capacity	Safety and Efficiency of Surface Operations	ATM-Aerodrome Coordination	Airport Collaborative Decision-Making (ACDM)	Arrival Manager/Departure Management (AMAN/DMAN)	ATC Horizontal separation	ATC Sector Capacity	Automated Transfer of Control	Optimized wake turbulence separation
Australia	2015 - 3	No data		No data				20%		No data	No data	No data
Bangladesh	2015 - 2	N/A		No data				N/A		N/A	N/A	No data
Bhutan	2015 - 2	N/A		N/A				N/A		No data	No data	N/A
China	2014 - 1	No data		No data				No data		No data	No data	No data
Fiji	2015 - 3	No data		No data				No data		No data	No data	No data
French Polynesia, France	2014 - 1	N/A		N/A				N/A		N/A	No data	No data
Hong Kong, China	2014 - 1	No data		No data				No data		100%	0%	
India	2014 - 4	No data		No data				No data		No data	No data	No data
Japan	2014 - 4	100%		100%				No data		100%	100%	No data
Macao, China	2014 - 4	N/A		N/A				N/A		N/A	N/A	
Malaysia	2015 - 2	100%		No data				100%		100%	90%	No data
Maldives	2015 - 3	No data		No data				N/A		No data	100%	No data
New Caledonia	2015 - 2	N/A		N/A				N/A		N/A	N/A	100%
Philippines	2015 - 3	No data		100%				0%		0%	0%	No data
Singapore	2015 - 3	0%		100%				100%		0%	No data	No data
Sri Lanka	2014 - 3	No data		N/A				N/A		50%	100%	No data
Thailand	2014 - 4	No data		No data				No data		No data	No data	No data
United States	2015 - 1	50%		N/A				N/A		100%	No data	N/A
	Indicator	% of FIRs supporting Major Traffic Flows should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements		% of high density aerodromes having declared capacity in accordance with the Seamless ATM Plan Phase 2				% of applicable international aerodromes having implemented AMAN / DMAN (applicable = high density)		% of ATC sectors with capacity figures in accordance with Seamless ATM Phase 2	% of ATC sectors with automated hand-off procedures in accordance with Seamless ATM Plan Phase 2	% of applicable international aerodromes having implemented increased runway throughput through optimized wake turbulence separation

Meeting the Seamless ATM objectives - Optimal capacity

(Regional Picture 21 Jul 2015)

Nov. 2015

		Performance-based Navigation (PBN) Approach	Performance-based Navigation (PBN) Routes	Performance-based Navigation (PBN) Airspace	Continuous Descent Operations (CDO)	Continuous Climb Operations (CCO)	Standard Instrument Departures/Standard Terminal Arrivals (SID/STAR)	Performance-based Navigation (PBN) Visual Departure and Arrival Procedures	ATM systems enabling optimal PBN/ATC operations	UPR and DARP	In-trail procedures
Seamless Item		110	140	150	90	100	120	130	250	290	450
ASBU		B0-APTA	B0-FRTO	Regional	B0-CDO	B0-CCO	B0-CCO B0-CDO	Regional	B0-APTA	B0-FRTO	B0-OPFL
		PRIORITY									
Australia	2015 - 3	100%	100%	100%	N/A	N/A	100%		90%	100%	
Bangladesh	2015 - 2	30%	10%	N/A	N/A	N/A	0%		No data	N/A	
Bhutan	2015 - 2	No data	0%	No data	N/A	N/A	No data		N/A	N/A	
China	2014 - 1	100%	10%	100%	0%	0%	100%		100%	N/A	
Fiji	2015 - 3	70%	No data	No data	No data	No data	No data		No data	No data	
French Polynesia, France	2014 - 1	50%	80%	N/A	N/A	N/A	80%		No data	100%	
Hong Kong, China	2014 - 1	100%	100%	0%	100%	No data	100%		100%	N/A	
India	2014 - 4	100%	40%	N/A	100%	100%	100%		100%	25%	
Japan	2014 - 4	0%	100%	100%	30%	No data	100%		100%	100%	
Macao, China	2014 - 4	No data	N/A	N/A	N/A	N/A	No data		N/A	N/A	
Malaysia	2015 - 2	0%	40%	100%	100%	100%	100%		100%	N/A	
Maldives	2015 - 3	100%	60%	No data	100%	100%	100%		100%	100%	
New Caledonia	2015 - 2	0%	No data	No data	N/A	N/A	100%		N/A	N/A	
Philippines	2015 - 3	100%	30%	0%	50%	50%	100%		20%	0%	
Singapore	2015 - 3	100%	0%	100%	100%	0%	100%		0%	N/A	
Sri Lanka	2014 - 3	No data	100%	N/A	No data	No data	No data		50%	100%	
Thailand	2014 - 4	No data	0%	0%	0%	0%	50%		100%	N/A	
United States	2015 - 1	N/A	100%	100%	N/A	N/A	N/A		100%	50.0%	
Indicator		% of high density aerodromes with precision approaches or APV or LNAV (High density aerodrome is defined by Asia-Pacific Seamless ATM Plan as aerodromes with scheduled operations in excess of 100,000/year)	% of ATS routes designated as PBN routes in accordance with Seamless ATM Phase 1	Are all your Category R and S upper controlled airspace, and Category T airspace supporting high density aerodromes designated as non-exclusive or exclusive PBN airspace as appropriate.? (1- yes, 0-no)	% of international aerodromes/TMA where CDO is implemented	% of international aerodromes where CCO is implemented	% of international aerodromes / TMAs with PBN STAR implemented		% of ATC units with ATM systems enabling optimal PBN operations	% of FIRs using UPR and DARP within R airspace	

Nov. 2018

		Performance-based Navigation (PBN) Approach	Performance-based Navigation (PBN) Routes	Performance-based Navigation (PBN) Airspace	Continuous Descent Operations (CDO)	Continuous Climb Operations (CCO)	Standard Instrument Departures/Standard Terminal Arrivals (SID/STAR)	Performance-based Navigation (PBN) Visual Departure and Arrival Procedures	ATM systems enabling optimal PBN/ATC operations	UPR and DARP	In-trail procedures
Australia	2015 - 3		100%				No data	No data	No data		No data
Bangladesh	2015 - 2		40%				50%	N/A	0%		No data
Bhutan	2015 - 2		0%				No data	No data	N/A		N/A
China	2014 - 1		No data				No data	No data	No data		N/A
Fiji	2015 - 3		No data				No data	No data	No data		No data
French Polynesia, France	2014 - 1		100%				100%	N/A	No data		100%
Hong Kong, China	2014 - 1		0%				100%	N/A	No data		
India	2014 - 4		No data				No data	No data	No data		No data
Japan	2014 - 4		0%				100%	0%	100%		No data
Macao, China	2014 - 4		N/A				No data	N/A	N/A		
Malaysia	2015 - 2		100%				No data	100%	No data		No data
Maldives	2015 - 3		100%				100%	N/A	100%		No data
New Caledonia	2015 - 2		No data				No data	N/A	N/A		N/A
Philippines	2015 - 3		0%				20%	No data	0%		No data
Singapore	2015 - 3		0%				No data	0%	No data		No data
Sri Lanka	2014 - 3		100%				100%	No data	100%		No data
Thailand	2014 - 4		No data				No data	No data	No data		No data
United States	2015 - 1		No data				N/A	N/A	100%		50.0%
Indicator			% of ATS routes designated as PBN routes in accordance with Seamless ATM Phase 2				% of international aerodromes / TMAs with PBN SID implemented	% of high density aerodromes with PBN procedures that overlay visual arrival and departure procedures	% of ATC units with ATM systems supporting optimal aerodrome capacity and using electronic fight progress strips		% of FIRs having implemented in-trail procedures

Meeting the Seamless ATM objectives - Optimal trajectories

(Regional Picture 21 Jul 2015)

Nov. 2015

		Airspace classification	Flight Level Orientation Schemes (FLOS)	Flight Level Allocation Schemes (FLAS)	Civil Military use of SUA	Strategic Civil Military coordination	Tactical Civil Military coordination	Civil Military system integration	Civil Military navaids joint provision	Civil Military common training	Civil Military common procedures
	Seamless Item	190	200	210	360	370	380	390	400	410	420
	ASBU	Regional	Regional	Regional	B0-FRTO	Regional	Regional	Regional	Regional	Regional	Regional
					PRIORITY	PRIORITY	PRIORITY				
Australia	2015 - 3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Bangladesh	2015 - 2	N/A	100%	N/A	No data	No data	100%	No data	100%	No data	100%
Bhutan	2015 - 2	N/A	No data	N/A	N/A	No data	No data	No data	N/A	No data	No data
China	2014 - 1	N/A	N/A	No data	N/A	100%	100%	N/A	N/A	N/A	N/A
Fiji	2015 - 3	No data	No data	No data	N/A	N/A	N/A	N/A	N/A	N/A	N/A
French Polynesia, France	2014 - 1	100%	100%	N/A	No data	N/A	N/A	N/A	N/A	N/A	100%
Hong Kong, China	2014 - 1	100%	100%	100%	100%	N/A	100%	100%	N/A	N/A	N/A
India	2014 - 4	N/A	100%	100%	100%	100%	100%	0%	N/A	100%	100%
Japan	2014 - 4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Macao, China	2014 - 4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Malaysia	2015 - 2	100%	100%	No data	100%	100%	100%	100%	100%	100%	100%
Maldives	2015 - 3	100%	100%	No data	No data	No data	No data	No data	No data	No data	No data
New Caledonia	2015 - 2	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Philippines	2015 - 3	100%	100%	100%	100%	100%	0%	No data	100%	100%	100%
Singapore	2015 - 3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Sri Lanka	2014 - 3	100%	100%	N/A	100%	100%	100%	N/A	N/A	100%	100%
Thailand	2014 - 4	100%	100%	No data	100%	100%	100%	0%	0%	0%	0%
United States	2015 - 1	N/A	100%	N/A	100.0%	100%	100%	100%	N/A	N/A	N/A
	Indicator	Has your State/Administration harmonized the upper airspace classification 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.? (1- yes, 0-no)	Does your State/Administration use the ICAO Table of Cruising Levels based on feet as contained in Appendix 3a to Annex 2 ? (1- yes, 0-no)	Does your Operations Manual give priority for FLAS level allocations to higher density ATS routes over lower density ATS routes, and a lower priority to any aircraft that does not meet specified equipage ? (1- yes, 0-no)	% of FIRs in which FUA is implemented	Have you established a national civil/military body that performs strategic civil-military coordination? (1- yes, 0-no)	Have you established a formal civil military liaison for tactical response? (1- yes, 0-no)	Are civil ATS and military systems integrated? 1-yes, 0-no	Are there joint civil and military navigation aids? 1-yes, 0-no	Is Civil Military common training conducted in areas of common interest? 1-yes, 0-no	Are there common procedures for Civil Military operations where appropriate? 1-yes, 0-no

Nov. 2018

Australia	2015 - 3										
Bangladesh	2015 - 2										
Bhutan	2015 - 2										
China	2014 - 1										
Fiji	2015 - 3										
French Polynesia, France	2014 - 1										
Hong Kong, China	2014 - 1										
India	2014 - 4										
Japan	2014 - 4										
Macao, China	2014 - 4										
Malaysia	2015 - 2										
Maldives	2015 - 3										
New Caledonia	2015 - 2										
Philippines	2015 - 3										
Singapore	2015 - 3										
Sri Lanka	2014 - 3										
Thailand	2014 - 4										
United States	2015 - 1										
	Indicator										

Meeting the Seamless ATM objectives - Airspace

Meeting the Seamless ATM objectives - Civil/Military integration

(Regional Picture 21 Jul 2015)

		Seamless Item	320	330	340	350	220	280	300	310
			ATM Managers' Performance	ATC simulators performance	Safety assessment of changes	ATM Operators' performance	ATS Inter-facility Data-link Communications (AIDC)	ADS-C and CPDLC	Aeronautical Information Management	Meteorological Information
		ASBU	Regional	Regional	Regional	Regional	B0-FICE	B0-TBO	B0-DATM	B0-AMET
							PRIORITY	PRIORITY	PRIORITY	
Nov. 2015	Australia	2015 - 3	100%	100%	100%	100%	100%	100%	76.9%	100%
	Bangladesh	2015 - 2	No data	N/A	No data	No data	No data	N/A	61.5%	30%
	Bhutan	2015 - 2	No data	N/A	No data	No data	No data	N/A	0%	0%
	China	2014 - 1	100%	100%	No data	100%	100%	N/A	38.5%	80%
	Fiji	2015 - 3	No data	No data	No data	No data	100%	100%	7.7%	No data
	French Polynesia, France	2014 - 1	100%	No data	100%	100%	100%	No data	No data	N/A
	Hong Kong, China	2014 - 1	100%	100%	100%	100%	0%	N/A	No data	100%
	India	2014 - 4	100%	100%	100%	100%	75%	100%	100%	100%
	Japan	2014 - 4	100%	100%	100%	100%	100%	100%	No data	100%
	Macao, China	2014 - 4	0%	0%	0%	100%	N/A	N/A	38.5%	100%
	Malaysia	2015 - 2	100%	100%	100%	100%	100%	50%	76.9%	100%
	Maldives	2015 - 3	0%	100%	100%	0%	0%	100%	0%	No data
	New Caledonia	2015 - 2	100%	100%	100%	100%	N/A	N/A	No data	100%
	Philippines	2015 - 3	No data	100%	100%	100%	0%	100%	46.2%	100%
	Singapore	2015 - 3	100%	100%	100%	100%	100%	100%	100%	100%
	Sri Lanka	2014 - 3	100%	100%	100%	100%	100%	100%	84.6%	N/A
	Thailand	2014 - 4	100%	100%	0%	0%	0%	N/A	0%	0%
	United States	2015 - 1	100%	100%	100%	100%	50.0%	50.0%	No data	100%
		Indicator	Does your Operations Manual require the human performance training for all ANSP managers? (1-yes, 0-no)	Do you have a programme for enhancement and improved application of ATC simulators ? (1- yes, 0-no)	Do you have safety teams comprising multidisciplinary operational staff and managers which review safety performance and assess significant proposals for change to ATM systems? (1-yes, 0-no)	Do you have human performance-based training and procedures for staff providing ATS? (1-yes, 0-no)	% of FIRs within which all applicable ACCs have implemented at least one interface to use AIDC / OLDI with neighbouring ACCs	% of FIRs utilising data link en-route in applicable airspace	% of Phase 1 and 2 AIS-AIM elements completed (0-13)	% of high density aerodromes providing meteorological forecasts, aerodrome warnings and alerts
Nov. 2018	Australia	2015 - 3	No data				No data		No data	
	Bangladesh	2015 - 2	No data				No data		75%	
	Bhutan	2015 - 2	No data				No data		0%	
	China	2014 - 1	No data				No data		No data	
	Fiji	2015 - 3	No data				100%		12.5%	
	French Polynesia, France	2014 - 1	No data				No data		No data	
	Hong Kong, China	2014 - 1	0%				0%		No data	
	India	2014 - 4	No data				No data		No data	
	Japan	2014 - 4	100%				100%		No data	
	Macao, China	2014 - 4	100%				N/A		No data	
	Malaysia	2015 - 2	No data				No data		87.5%	
	Maldives	2015 - 3	0%				0%		0%	
	New Caledonia	2015 - 2	No data				N/A		No data	
	Philippines	2015 - 3	No data				0%		0%	
	Singapore	2015 - 3	No data				No data		No data	
	Sri Lanka	2014 - 3	No data				100%		100%	
	Thailand	2014 - 4	No data				No data		No data	
	United States	2015 - 1	No data				No data		25.0%	
		Indicator	Is the prevention of fatigue systems established to support human performance in the delivery of your ATM services? (1- yes, 0-no)				% of FIRs within which all applicable ACCs have implemented full AIDC messaging, or alternate communication standard		% of Phase 3 AIS-AIM elements completed (0-8)	

Meeting the Seamless ATM objectives - Performing safely

Meeting the Seamless ATM objectives - Communications

Meeting the Seamless ATM objectives - Information management

(Regional Picture 21 Jul 2015)

Nov. 2015

		Ground-based Surveillance	ATS surveillance with data integrated	ATS Surveillance data sharing	Safety Nets	Airborne Safety Systems	Air traffic situational awareness
	Seamless Item	180	270	240	160	170	430
	ASBU	B0-ASUR	B0-ASUR	Regional	B0-SNET	B0-ACAS	B0-ASEP
		PRIORITY	PRIORITY				
Australia	2015 - 3	100%	100%	50%	100%	100%	
Bangladesh	2015 - 2	N/A	No data	N/A	100%	0%	
Bhutan	2015 - 2	N/A	No data	No data	N/A	No data	
China	2014 - 1	11.1%	100%	100%	100%	N/A	
Fiji	2015 - 3	100%	100%	No data	No data	No data	
French Polynesia, France	2014 - 1	100%	No data	No data	100%	N/A	
Hong Kong, China	2014 - 1	0%	No data	100%	0%	0%	
India	2014 - 4	N/A	80%	80%	No data	100%	
Japan	2014 - 4	0%	100%	N/A	No data	100%	
Macao, China	2014 - 4	N/A	N/A	N/A	N/A	N/A	
Malaysia	2015 - 2	0%	100%	0%	100%	100%	
Maldives	2015 - 3	0%	100%	0%	100%	100%	
New Caledonia	2015 - 2	N/A	N/A	N/A	N/A	No data	
Philippines	2015 - 3	0%	50%	0%	100%	No data	
Singapore	2015 - 3	100%	100%	100%	No data	100%	
Sri Lanka	2014 - 3	100%	100%	No data	100%	100%	
Thailand	2014 - 4	0%	100%	0%	N/A	N/A	
United States	2015 - 1	50.0%	N/A	N/A	100%	No data	
	Indicator	% of of FIRs where Category S airspace and Category T airspace supporting high density aerodromes are designated as ADS-B airspace?	% of ACCs with ATS Surveillance using ADS-B, MLAT or radar in Category S airspace, and having data integrated into the ATC system situation display	% of ACCs within high density FIRs (as per the Seamless ATM Plan) sharing ATS surveillance data	Does your State implement ground-based safety-nets (STCA, APW, MSAW, etc.)? (1- yes, 0-no)	Does your State/Administration require the carriage of ACAS (with TCAS 7.1 evolution) ? (1- yes, 0-no)	

Nov. 2018

		Ground-based Surveillance	ATS surveillance with data integrated	ATS Surveillance data sharing	Safety Nets	Airborne Safety Systems	Air traffic situational awareness
Australia	2015 - 3	100%		No data	No data	No data	No data
Bangladesh	2015 - 2	N/A		N/A	10%	No data	No data
Bhutan	2015 - 2	N/A		No data	N/A	No data	No data
China	2014 - 1	No data		No data	No data	N/A	No data
Fiji	2015 - 3	100%		No data	No data	No data	No data
French Polynesia, France	2014 - 1	100%		No data	No data	N/A	100%
Hong Kong, China	2014 - 1	0%		100%	0%	0%	
India	2014 - 4	N/A		No data	No data	No data	No data
Japan	2014 - 4	0%		N/A	0%	100%	No data
Macao, China	2014 - 4	N/A		N/A	N/A	N/A	
Malaysia	2015 - 2	50%		100%	100%	No data	No data
Maldives	2015 - 3	0%		50%	100%	100%	100%
New Caledonia	2015 - 2	N/A		N/A	N/A	No data	100%
Philippines	2015 - 3	0%		0%	0%	No data	No data
Singapore	2015 - 3	100%		No data	0%	100%	No data
Sri Lanka	2014 - 3	No data		100%	100%	100%	100%
Thailand	2014 - 4	No data		No data	N/A	N/A	No data
United States	2015 - 1	0%		N/A	100%	100%	100%
	Indicator	% of of FIRs where Category S airspace and Category T airspace supporting high density aerodromes are designated as ADS-B airspace?		% of ACCs sharing ATS surveillance data	% of ACCs using CPAR in R airspace in accordance with Seamless ATM Phase 2	Does your State/Administration require the carriage of TAWS? (1- yes, 0-no)	Does your State/Administration implement air traffic situational awareness? (1- yes, 0-no)

Meeting the Seamless ATM objectives - Surveillance

(Regional Picture 21 Jul 2015)

ASIA/PAC ANP, VOLUME I

PART III – COMMUNICATIONS, NAVIGATION AND SURVEILLANCE (CNS)

1. INTRODUCTION

1.1 This part of the ASIA/PAC Regional ANP constitutes the agreed regional requirements considered to be the minimum necessary for effective planning and implementation of Communications, Navigation and Surveillance (CNS) facilities and services in the Asia and Pacific regions and complements the provisions of ICAO SARPs related to CNS. It contains stable plan elements related to the assignment of responsibilities to States for the provision of CNS facilities and services within the ICAO Asia and Pacific regions in accordance with Article 28 of the Convention on International Civil Aviation (Doc 7300) and mandatory requirements related to the CNS facilities and services to be implemented by States in accordance with regional air navigation agreements.

1.2 The dynamic plan elements related to the assignment of responsibilities to States for the provision of CNS facilities and services and the mandatory requirements based on regional air navigation agreements related to CNS are contained in the ASIA/PAC ANP Volume II, Part III – CNS.

1.3 The ASIA/PAC ANP Volume III contains dynamic/flexible plan elements related to the implementation of certain air navigation systems, based mainly on the Aviation System Block Upgrades (ASBU) modules aimed at increasing capacity and improving efficiency of the aviation system whilst maintaining or enhancing safety level, and help achieve the necessary harmonization and interoperability at regional and global level. This includes the regionally agreed ASBU modules applicable to the specified ICAO region/sub-region and associated elements/enablers necessary for the monitoring of the status of implementation of these ASBU modules.

1.4 In planning for these elements, economy and efficiency should be taken into account in order to ensure that the requirements for the provision of CNS facilities and services can be kept to a minimum. CNS facilities and services should fulfil multiple functions whenever this is feasible.

Standards, Recommended Practices and Procedures

1.5 The Standards, Recommended Practices and Procedures and related guidance material applicable to the provision of CNS are contained in:

a) Annex 10 – *Aeronautical Telecommunications*, Volumes I, II, III, IV and V;
b) Annex 2 – *Rules of the Air;*
c) Annex 3 – *Meteorological Service for international air navigation*;
d) Annex 6 – *Operation of Aircraft*, Parts I (Chapter 7), II (Chapter 7) and III (Chapter 5);
e) Annex 11 – *Air Traffic Services*;
f) Annex 12 – *Search and Rescue*;
g) Annex 15 – *Aeronautical Information Services*;
h) *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM) (Doc 4444);
i) *Regional Supplementary Procedures* (Doc 7030);
j) *GNSS Manual* (Doc 9849);
k) *Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols* (Doc 9880);

l) *ICAO Aeronautical Telecommunication Network (ATN) Manual for the ATN using IPS Standards and Protocols* (Doc 9896);
m) *Manual of Testing of Radio Navigation Aids* (Doc 8071);
n) *Manual on the Planning and Engineering of the Aeronautical Fixed Telecommunications Network* (Doc 8259);
o) *Manual on Required Communication Performance (RCP)* (Doc 9869);
p) *Training Manual* (Doc 7192);
q) *Performance-based Navigation Manual* (Doc 9613);
r) *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation* (Doc 9718);
s) *ICAO Manual on the Secondary Surveillance Radar (SSR) Systems* (Doc 9684);
t) *Manual on Airborne Surveillance Applications* (Doc 9994); and
u) *Manual of Air Traffic Services Data Link Applications* (Doc 9694).

2. GENERAL REGIONAL REQUIREMENTS

Communications

Aeronautical Fixed Service (AFS)

2.1 The aeronautical fixed service (AFS) should satisfy the communication requirements of ATS, AIS/AIM, MET and SAR, including specific requirements in terms of system reliability, message integrity and transit times, with respect to printed as well as digital data and speech communications. If need be, it should, following agreement between individual States and aircraft operators, satisfy the requirements for airline operational control.

The Aeronautical Telecommunication Network (ATN)

2.2 The ATN of the Region should have sufficient capacity to meet the minimum requirements for data communications for the services mentioned in paragraph 2.1 above.

Aeronautical Mobile Service (AMS)

2.3 Air-ground communications facilities should meet the agreed communication requirements of the air traffic services, as well as all other types of communications which are acceptable on the AMS to the extent that the latter types of communications can be accommodated.

Air-ground communications for ATS

2.4 Air-ground communications for ATS purposes should be so designed to require the least number of frequency and channel changes for aircraft in flight compatible with the provision of the required service. They should also provide for the minimum amount of coordination between ATS units and provide for optimum economy in the frequency spectrum used for this purpose.

Air-ground data link communications

2.5 Air-ground data link communications should be implemented in such a way that they are regionally and globally harmonised and make efficient use of available communication means and ensure optimum economy in frequency spectrum use and system automation.

Navigation

2.6 Planning of aeronautical radio navigation services should be done on a total system basis, taking full account of the navigation capabilities as well as cost effectiveness. The total system composed of station-referenced navigation aids, satellite-based navigation systems and airborne capabilities should meet the performance based navigation (PBN) requirements for all aircraft using the system and should form an adequate basis for the provision of positioning, guidance and air traffic services.

2.7 Account should be taken of the fact that certain aircraft may be able to meet their navigation needs by means of self-contained or satellite-based aids, thus eliminating the need for the provision of station-referenced aids along the ATS routes used by such aircraft, as well as the need to carry on board excessive redundancies.

Surveillance

2.8 Planning of aeronautical surveillance systems should be made based on a system approach concept, where collaboration and sharing of data sources should be considered in support of an efficient use of the airspace.

Frequency Management

2.9 Frequency assignment planning in the Region(s) should be carried out in accordance with the provisions of Annex 10 and *ICAO Handbook on Radio Frequency spectrum for Civil Aviation* (Doc 9718), supplemented, as necessary, by regional recommendations and technical criteria developed for this purpose.

3. SPECIFIC REGIONAL REQUIREMENTS

Communications

AFTN

3.1 The AFTN inter-regional entry/exit points:

a) between ASIA/PAC and AFI should be Brisbane and Mumbai;
b) between ASIA/PAC and EUR should be Bangkok, Singapore and Tokyo;
c) between ASIA/PAC and MID should be Karachi, Mumbai and Singapore;
d) between ASIA/PAC and NAM should be Brisbane, Nadi and Tokyo; and
e) between ASIA/PAC and CAR/SAM should be Brisbane.

[APANPIRG/11, Conc.11/6]

3.2 The trunk circuits interconnecting main AFTN communication centres should be provided to operate at a modulation rate commensurate with operational requirements, and employ International Alphabet Number 5 (IA-5) and character-oriented data link control procedures -system category B, or bit-oriented data link control procedures as defined in Annex 10, Volume Ill, Part I, Chapter 8.

3.3 The circuits connecting tributary AFTN communication centres with main AFTN communication centres, or with other tributary AFTN communication centres, or with AFTN stations should be provided with, a modulation rate commensurate with operational requirements employing IA-5 code and procedures and an appropriately controlled circuit protocol.
[ASIA/PAC AFS RPG/3, Rec. 3/1]

ATN/AMHS implementation

3.4 Considering the inclusion of ATN over IPS SARPs in ICAO Annex 10, Volume 3 and to support global harmonization of ATN implementation, States hosting BBIS should implement ATN over IPS in addition to ATN over OSI and complete this implementation of Dual Stack ATN (ATN/OSI and ATN/IPS) by 2011.
[APANPIRG 19/20]

3.5 States should permit non-backbone States, and States in other regions with connections to ASIA/PAC Region, to connect their Message Transfer Agents (MTAs) to backbone States using either the OSI-based ATN Internet Communications Services (ICS) or the ATN IPS on a bilateral basis.
[APANPIRG 21/20]

HF en-route communications

3.6 States should be urged to coordinate on a national basis with the appropriate national regulators, a programme directed towards achieving the elimination of the interference currently being experienced on some of the frequencies allocated to the Aeronautical Mobile (R) Service in the ASIA/PAC Region. When reviewing methods for developing such a national programme, consideration should be given to the procedures in Article S15 of the ITU Radio Regulations.

Frequency management

3.7 States in the ASIA/PAC Region should coordinate, as necessary, with the ICAO Regional Office all radio frequency assignments for both national and inter-national facilities in the 190--526.50 kHz, 108-117.975 MHZ, 960-1215 MHZ and 117.975-137 MHZ bands.
[ASIA/PAC/3, Conc. 11/4, 11/5 and 12/9]

Navigation

GNSS minimum requirement for RNP

3.8 State aviation authorities, in partnership with other agencies of the State are requested to prohibit malicious and unintentional interference to GNSS and regulate legitimate uses of technology to preserve aviation utility of GNSS.
[APANPIRG/22, Conc. 22/28]

ASIA/PAC ANP, VOLUME II

PART III – COMMUNICATIONS, NAVIGATION AND SURVEILLANCE (CNS)

1. INTRODUCTION

1.1 This part of the ASIA/PAC Regional Air Navigation Plan, Volume II, complements the provisions in Standards, Recommended Practices and Procedures (SARPs) related to communication, navigation and surveillance (CNS). It contains dynamic plan elements related to the assignment of responsibilities to States for the provision of CNS facilities and services within a specified area in accordance with Article 28 of the Convention on International Civil Aviation (Doc 7300); and mandatory requirements related to CNS facilities and services to be implemented by States in accordance with regional air navigation agreements. Such agreement indicates a commitment on the part of the State(s) concerned to implement the requirement(s) specified.

2. GENERAL REGIONAL REQUIREMENTS

Communications

Aeronautical Fixed Service (AFS)

2.1 The aeronautical fixed service should comprise the following systems and applications that are used for ground-ground (i.e. point-to-point and/or point-to-multipoint) communications in the international aeronautical telecommunication service:

a) ATS direct speech circuits and networks;
b) meteorological operational circuits, networks and broadcast systems, including World Area Forecast System – Internet File Service (WIFS) and/or Satellite Distribution; System for Information Relating to Air Navigation (SADIS);
c) the aeronautical fixed telecommunications network (AFTN);
d) the common ICAO data interchange network (CIDIN);
e) the air traffic services (ATS) message handling services (AMHS); and
f) the inter-centre communications (ICC).

2.2 To meet the data communication requirements, a uniform high-grade aeronautical network should be provided, based on the aeronautical telecommunication network (ATN), taking into account the existence and continuation of current networks.

2.3 Contingency procedures should be in place to ensure that, in case of a communication centre breakdown, all the parties concerned are promptly informed of the prevailing situation. All possible arrangements should be made to ensure that, in case of breakdown of a communications centre or circuit, at least high-priority traffic continues to be handled by appropriate means.

2.4 AFS planning should permit flexibility in detailed development and implementation. The required AFTN Stations and Centres are listed in the AFTN Plan in Table CNS II-1.

The Aeronautical Telecommunication Network (ATN)

2.5 The ATN should be able to:

a) support applications carried by the existing networks;
b) support gateways enabling inter-operation with existing networks; and

c) support ground-ground communications traffic associated with air-ground data link applications.

2.6 The ATN should make optimum use of dedicated bilateral/multilateral aeronautical links and other communication means commensurate with the operational Quality of Service (QoS) requirements.

2.7 The implementation of the ATN should take into account the need for cost-effective evolution in terms of network capacity, requirements and time-frame and allow for a progressive transition from existing communication networks and services to a uniform, harmonised and integrated communications infrastructure, capable of supporting the implementation of future aeronautical services such as Flight and Flow Information in a Collaborative Environment (F-FICE), System-Wide Information Management (SWIM) applications, etc.

2.8 In case means other than dedicated bilateral links are used by the ATN, States should ensure that service level agreements (SLA) are met in terms of implementation priority, high availability, priority in restoration of service and appropriate levels of security.

2.9 The ATN should provide for interregional connections to support data exchange and mobile routing within the global ATN.

2.10 In planning the ATN, provisions should be made, where required, for interfacing with other international networks. The Required ATN Infrastructure Routing Plan is described under Table CNS II-2[1B].

Network services

2.11 The Internet Society (ISOC) communications standards for the Internet Protocol Suite (IPS) should be used for the implementation of AMHS.

2.12 The migration from legacy bit-oriented protocols such as X.25 Protocol suite to IPS should be planned.

2.13 The migration of international or sub-regional ground networks to the ATN based on Internet Protocol (IP) to support AFS communication requirements, while reducing costs, should be planned.

2.14 States should ensure that the solutions provided for the implementation of the ATN meet the air traffic management and aeronautical fixed service requirements. Such requirements should consist of:

a) Performance requirements: availability, continuity, integrity, monitoring and alerting criteria per data flow. In the case where a required communication performance (RCP) is globally prescribed, requirements derived from RCP should be stated;
b) Interoperability requirements;
c) Safety and security requirements, duly derived after the identification of operational hazards and threats, and allocation of objectives; and
d) Implementation process requirements (creation, test, migration, upgrades, priority in restoration of service, termination).

Network management

2.15 An ICAO centralised off-line network management service is provided to participating AFTN/ AMHS centres in the ASIA/PAC Region under the ATS Messaging Centre (AMC).

2.16 In the case of integrated communications services procured and shared by several States, organizational provisions should allow for the planning and performing of the management of technical performance, network configuration, fault, security, cost division/allocation, contract, orders and payment.

Specific ATM requirements

2.17 Where ATS speech and data communication links between any two points are provided, the engineering arrangements should be such as to avoid the simultaneous loss of both circuits. The required ATS direct speech circuits plan is detailed under Table CNS II-3[1C].

2.18 Special provisions should be made to ensure a rapid restoration of ATS speech circuits in case of outage, as derived from the performance and safety requirements.

2.19 Data circuits between ATS systems should provide for both high capacity and message integrity.

2.20 The Inter-Centre Communication (ICC), consisting of ATS Inter-facility Data Communication (AIDC) application and the Online Data Interchange (OLDI) application, should be used for automated exchange of flight data between ATS units to enhance the overall safety of the ATM operation and increase airspace capacity.

2.21 Where Voice over IP is planned or implemented between ATS units for voice communications, it should meet the ATS requirements. When data and voice are multiplexed, particular attention should be paid to the achievement of the ATM performance and safety requirements.

Specific MET requirements

2.22 The increasing use of the GRIB and BUFR code forms for the dissemination of the upper wind and temperature and significant weather forecasts and the planned transition to digital form using extensible mark-up language (XML)/geography mark-up language (GML) for the dissemination of OPMET data should be taken into account in the planning process of the ATN.

2.23 In planning the ATN, account should be taken of changes in the current pattern of distribution of meteorological information resulting from the increasing number of long-range direct flights and the trend towards centralized flight planning.

Specific AIM requirements

2.24 The aeronautical fixed service should meet the requirements to support efficient provision of aeronautical information services through appropriate connections to area control centres (ACCs), flight information centres (FICs), aerodromes and heliports at which an information service is established.

Aeronautical Mobile Service (AMS)

2.25 To meet the air-ground data communication requirements, a high-grade aeronautical network should be provided based on the ATN, recognising that other technologies may be used as part of the transition. The network needs to integrate the various data links in a seamless fashion and provide for end-to-end communications between airborne and ground-based facilities.

2.26 Whenever required, use of suitable techniques on VHF or higher frequencies should be made. The required HF Network designators applicable for the ASIA/PAC Region are listed in Table CNS II-4[2B].

2.27 Aerodromes having a significant volume of International General Aviation (IGA) traffic should also be provided with appropriate air-ground communication channels.

Air-Ground Data Link Communications

2.28 A Strategy for the harmonised implementation of the data link communications in the AISA/PAC Region should be developed based on the Global Operational Data Link Document (GOLD) adopted by ICAO Regions and the Aviation System Block Upgrade (ASBU) methodology.

2.29 Where applicable, CPDLC, based on ATN VDL data link Mode 2 (VDL2) and/or FANS-1/A, should be implemented for air-ground data link communications.

2.30 Partial or divergent aircraft data link evolutions that result in excluding messages from aircraft systems should not be pursued. Interim steps or phases toward full implementation of the common technical definition in ground systems should only be pursued on a regional basis, after coordination between all States concerned.

2.31 Harmonization of operational procedures for implementation of the above packages is essential. States, PIRGs and air navigation services providers should adopt common procedures to support seamless ATS provision across FIR boundaries, rather than each State or Region developing and promulgating unique procedures for common functions.

Required Communication Performance (RCP)

2.32 The Required Communication Performance (RCP) concept characterizing the performance required for communication capabilities that support ATM functions without reference to any specific technology should be applied wherever possible.

2.33 The States should determine, prescribe and monitor the implementation of the RCP in line with the provisions laid down in the *ICAO Manual on Required Communication Performance* (Doc 9869).

Navigation

Navigation Infrastructure

2.34 The navigation infrastructure should meet the requirements for all phases of flight from take-off to final approach and landing.

Note: Annex 10 to the Convention on International Civil Aviation—Aeronautical Telecommunications, Volume I— Radio Navigation Aids, Attachment B, provides the strategy for introduction and application of non-visual aids to approach and landing.

2.35 The Asia/Pacific Regional PBN Implementation Plan provides guidance to air navigation service providers, airspace operators and users, regulators, and international organizations, on the expected evolution of the regional air navigation system in order to allow planning of airspace changes, enabling ATM systems and aircraft equipage. It takes due account of the operational environment of the ASIA/PAC Region.

PBN Transition Strategy

2.36 During transition to PBN, sufficient ground infrastructure for conventional navigation systems should remain available. Before existing ground infrastructure is considered for removal, users should be given reasonable transition time to allow them to equip appropriately to attain a performance level equivalent to PBN.. States should approach removal of existing ground infrastructure with caution to ensure that safety is not compromised. This should be guaranteed by conducting safety assessments and consultations with the users.

Use of specific navigation aids

2.37 Where, within a given airspace, specific groups of users have been authorized by the competent authorities to use special aids for navigation. The respective ground facilities should be located and aligned so as to provide for full compatibility of navigational guidance with that derived from the SARPs.

2.38 States should ensure and oversee that service providers take appropriate corrective measures promptly whenever required by a significant degradation in the accuracy of navigation aids (either space based or ground based or both) is detected.

Surveillance

2.39 Aeronautical surveillance systems are required elements of modern air navigation infrastructure required to safely manage increasing levels and complexity of air traffic.

2.40 When operating Mode S radars, States should coordinate with their corresponding Regional ICAO Office the assignment of their corresponding interrogator identifier (II) codes and surveillance identifier (SI) codes, particularly where areas of overlapping coverage will occur.

Frequency Management

Aeronautical Mobile Service (AMS)

2.41 Frequencies should be assigned to all VHF aeronautical mobile service (AMS) facilities in accordance with the principles laid out in Annex 10, Volume V and *ICAO Handbook on Radio Frequency Spectrum Requirements for Civil Aviation* (Doc 9718) Volumes I and II, and take into account:

a) agreed geographical separation criteria based on 25 kHz or 8.33 kHz interleaving between channels;
b) agreed geographical separation criteria for the implementation of VDL services;
c) the need for maximum economy in frequency demands and in radio spectrum utilization; and
d) a deployment of frequencies which ensures that international services are planned to be free of interference from other services using the same band.

2.42 The priority order to be followed in the assignment of frequencies to service is:

a) ATS channels serving international services (ACC, APP, TWR, FIS);
b) ATS channels serving national purposes;
c) channels serving international VOLMET services;
d) channels serving ATIS and PAR; and
e) channels used for other than ATS purposes.

2.43 The criteria used for frequency assignment planning for VHF AMS facilities serving international requirements should, to the extent practicable, also be used to satisfy the need for national VHF AMS facilities.

2.44 Special provisions should be made, by agreement between the States concerned, for the sharing and the application of reduced protection of non-ATS frequencies in the national sub-bands, so as to obtain a more economical use of the available frequency spectrum consistent with operational requirements.

2.45 States should ensure that no air/ground frequency is utilized outside its designated operational coverage and the stated operational requirements for coverage of a given frequency can be met for the transmission sites concerned, taking into account terrain configuration.

Radio navigation aids for Aeronautical Radio Navigation Services (ARNS)

2.46 Frequencies should be assigned to all radio navigation facilities taking into account greed geographical separation criteria to ILS localizer, VOR and GBAS, X and Y channels to DME, in accordance with the principles laid out in Annex 10, Volume V and *ICAO Handbook on Radio Frequency Spectrum Requirements for Civil Aviation* (Doc 9718) Volumes I and II. Also, the need for maximum economy in frequency demands and in radio spectrum utilization and a deployment of frequencies which ensures that international services are planned to be free of interference from other services using the same band, need to be considered.

2.47 The principles used for frequency assignment planning for radio navigation aids serving international requirements should, to the extent possible, also be used to satisfy the needs for national radio aids to navigation.

Support to ICAO Positions for ITU World Radiocommunication Conferences (WRCs)

2.48 Considering the importance and continuous demand of the radio frequency spectrum and for the protection of the current aeronautical spectrum and the allocation of new spectrum for the new services and system to be implemented in civil air navigation, States and international organizations are to support ICAO's position at ITU World Radiocommunication Conferences (WRCs) and in regional and other international activities conducted in preparation for ITU WRCs.

Note: The Handbook on Radio Frequency Spectrum Requirements for Civil Aviation (Doc 9718) Volume I, contains ICAO policy statements relevant to the aviation requirements for radio frequency spectrum. The handbook is intended to assist States and ICAO in preparing for ITU WRCs.

3. SPECIFIC REGIONAL REQUIREMENTS

Communications

AFTN

3.1 States operating AFTN circuits which do not function satisfactorily 97 per cent of the time during which the circuit is scheduled to be in operation, should exchange monthly circuit performance data. Where a circuit consistently achieves 97 per cent reliability, the exchange of performance data may cease. The circuit performance data should be exchanged directly between the correspondent stations, with copies to the administrations concerned and to the ICAO Regional Office. States should also identify the causes for inadequate circuit performance and take necessary remedial measures.
[ASIA/PAC/3, Conc. 10/2]

3.2 States responsible for the operation of AFTN circuits, which do not adequately meet transit time requirements should record transit time statistics on the twenty-third day of each third month (January, April, July and October) of each year, in accordance with the existing practices, for the AFTN circuits and terminals under their jurisdiction which do not meet the specified transit time criteria. The data recorded should be exchanged directly between the correspondent stations, with copies to administrations concerned and to the ICAO Regional Office.
[ASIA/PAC/3, Conc. 10/3]

Common regional network services

3.3 States should consider implementing digital communication networks or circuits in a coordinated manner in order to meet current and future AFS communication requirements for data/voice communications and to facilitate the introduction of ATN.
[APANPIRG/11, Conc. 11/14]

Navigation

3.4 The navigation system to be used in the Asia and Pacific Regions is documented in the Navigation strategy and periodically reviewed by APANPIRG.

3.5 States should continue to provide ICAO with information on their flight inspection activities for inclusion in the ASIA/PAC Catalogue of Flight Inspection Units and circulation to States in the ASIA/PAC Region and to the ASIAIPAC Air Navigation Planning and Implementation Regional Group (APANPIRG).
[ASIA/PAC/3, Conc. 12/8]

3.6 Unless otherwise specified by the APAC navigation strategy, States that have not yet done so should install VHF omnidirectional radio range (VOR) supplemented by distance measuring equipment (DME) as the primary aid for en-route navigation and, except in specified circumstances, delete any parallel requirement for a non-directional radio beacon (NOB) from the ANP.
[ASIA/PAC/3, Rec. 5/22]

3.7 GNSS-enabled area navigation systems for all RNP navigation specifications are adopted as minimum requirement in the ASIA/PAC Region.
[APANPIRG/22, Conc. 22/22]

3.8 State aviation authorities, in partnership with other agencies of the State are requested to prohibit malicious and unintentional interference to GNSS and regulate legitimate uses of technology to preserve aviation utility of GNSS.
[APANPIRG/22, Conc. 22/28]

3.9 In order to reduce the likelihood of CFIT accidents, States should review non-precision approach procedures with LNAV lines of minima to include CDFA profile and include the Baro-VNAV design in the current and new RNP APCH approaches and consequent LNAVNNAV approach minima.
[APANPIRG/19, Conc. 19/28]

Surveillance

ADS-C

3.10 The surveillance system to be used in the Asia and Pacific Regions is documented in the Surveillance strategy and periodically reviewed by APANPIRG.

3.11 The Global Operational Data Link Document (GOLD) edition 2 was adopted as ASIA/PAC regional guidance material for use by States and airspace users as the basis for operating Automatic Dependent Surveillance- Contract (ADS-C) and Controller Pilot Data Link Communications (CPDLC), in conjunction with Annex 10 - Aeronautical Telecommunications Volume 11- Communications Procedures including those with PANS status and the Procedures for Air Navigation Services- Air Traffic Management (PANSATM Doc 4444).
[APANPIRG/20, Conc.20/73 and APANPIRG 24, Conc. 24/34]

ADS-B

3.12 Mode S Extended Squitter (1090 ES) is to be used as the data link for ADS-B radar like services in the ASIA/PAC Region in the near term.
[APANPIRG/14, Conc.14/20]

3.13 States are urged to consider following regional policy on supporting the provision of direct controller pilot communication capability associated with ADS-B data sharing between adjacent FIRs of States:

- in order to provide radar like separation services using ADS-B. It is necessary for the controllers to have direct controller pilot communication (DCPC).

- In some cases, to achieve radar like separation services it may be necessary for the States to provide VHF radio voice communication services for use by adjacent States.

lt is therefore recommended that States capable to do so, support provision of VHF radio voice communication services to adjacent States when this is required to support the delivery of ADS-B based separation services. Cost of such service provision shall be agreed between the States concerned.
[APANPIRG/19, Conc. 19/38]

3.14 States are urged to support provision of VHF radio voice air/ground communication infrastructure for use by adjacent States and States sharing ADS-8 data and providing VHF voice air-ground communication infrastructure to adjacent States should co-ordinate with ICAO Regional Office and their national Telecommunication Regulatory Authority for assignment of specific VHF radio frequencies to be used by the adjacent States.
[APANPIRG/22, Conc. 22/32]

SSR

3.15 In view of low density of SSR interrogator installations in the region, only Interrogator Identifier (not Surveillance Identifier) codes are used for SSRs Mode S in the areas of overlapping coverage.
[APANPIRG/19 Conc.19/40]

3.16 While implementing SSR Mode S, States should take into account following issues while assigning Interrogator Identifier codes for these installations:

- for planning the implementation of SSR Mode S administrations should ensure that the interrogators with overlapping coverage are not operating with the same Interrogator Identifier (11) codes; and

- where, the coverage of the interrogator extends beyond the boundaries of the State, The 11 code and PRF should be worked out in coordination with the ICAO Asia and Pacific Office and the neighboring States.

3.17 Administrations should inform ICAO Asia and Pacific Office about the assigned 11 codes and PRFs for these installations.
[APANPIRG/19, Conc.19/40]

3.18 Recognizing more Mode S Radar ground stations being introduced in the region, States in the Asia and Pacific Regions are urged to have aircraft registered having Mode S transponder, regularly inspected to ensure correct operation of the Mode S transponders.
[APANPIRG17, Conc.17/29]

Frequency Management

3.19 The ICAO Regional Office, based on the information provided for this purpose by the States, will issue Frequency Lists Nos. 1, 2 and 3 at periodic intervals.
[ASIA/PAC/3, Conc. 11/4, 11/5 and 12/9]

3.20 In the case of an unidentified interfering station, States should notify the ICAO Regional Office, utilizing the procedure and report form developed by the Fifth Session of the Communications Division (1954) and updated by the Communications Divisional Meeting (1978). However, in the case of persistent harmful interference to an aeronautical service which may affect safety, it should be immediately reported to ICAO and to the ITU, using the prescribed format, for appropriate action.
[ASIA/PAC/3, Conc. 11/6]

3.21 States, where aeronautical stations are experiencing HF radio interference, should take necessary actions in coordination with respective radio regulators to identify the source of interference and to eliminate the problem.
[APAN PI RG/17, Conc.17 /32]

3.22 The provision of Aeronautical Mobile (R) Service in the Asia and Pacific Regions will be guided by the following strategy:

- The VHF voice service, backed by CPDLC and HF will be the primary communication medium for transcontinental traffic; and a combination of CPDLC and HF voice will be the communication medium for oceanic traffic.

- The requirement for basic voice communication will continue, supplemented by data-link Flight Information Service (DFIS) applications including D-VOLMET, D-ATIS and PDC to significantly reduce pressure on VHF spectrum congestion.
[APANPIRG/18, Conc. 18/29, partly]

ASIA/PAC ANP VOLUME III – PART II

PART II – AIR NAVIGATION SYSTEM IMPLEMENTATION

1. INTRODUCTION

1.1 The planning and implementation of the ICAO Aviation System Block Upgrades (ASBUs) should be undertaken within the framework of the APANPIRG with the participation and support of all stakeholders, including regulatory personnel.

1.2 The ASBU Blocks and Modules adopted by the Asia and Pacific Regions should be followed in accordance with the specific ASBU requirements to ensure global interoperability and harmonization of air traffic management. The APANPIRG should determine the ASBU Block Upgrade Modules, which best proved the needed operational improvements in the ICAO APAC and Pacific Regions.

2. ICAO ASIA/PAC AIR NAVIGATION OBJECTIVES, PRIORITIES AND TARGETS

2.1 In accordance with Recommendation 6/1 of the Twelfth Air Navigation Conference (AN-Conf/12), PIRGs are requested to establish priorities and targets for air navigation, in line with the ASBU methodology.

2.2 The achievement of the intended benefits along such routing or within each affinity is entirely dependent on the coordinated implementation of the required elements by all provider and user stakeholders concerned.

2.3 Considering that some of the block upgrade modules contained in the GANP are specialized packages that may be applied where specific operational requirements or corresponding benefits exist, States and PIRGs should clarify how each Block Upgrade module would fit into the national and regional plans.

2.4 As Block 0 Modules in many cases provide the foundation for future development, all Block 0 modules should be assessed, as appropriate, for early implementation by States in accordance with their operational needs.

2.5 In establishing and updating the ASIA/PAC Air Navigation Plan, the ASIA/PAC States should give due consideration to the safety priorities set out in the Global Aviation Safety Plan (GASP) and RASG.

2.6 States in the Asia and Pacific Regions through the APANPIRG should establish their own air navigation objectives, priorities and targets to meet their individual needs and circumstance in line with the global and regional air navigation objectives, priorities and targets.

2.7 In 2014, APANPIRG/25 adopted the following regional priorities and targets (APANPIRG/25 Conc. 25/2):

Priority	ASBU module or Seamless Element	Targets	Target date (Seamless ATM Phase 1 Plan)	Metric
PBN	B0-APTA	1. <u>Approach</u>: Where practicable, **all high- density aerodromes** with instrument runways serving aeroplanes should have precision approaches or APV or LNAV. *Note 1: High density aerodrome is defined by Asia-Pacific Seamless ATM Plan as aerodromes with scheduled operations in excess of 100,000/year.* *Note 2: the Asia/Pacific PBN Plan Version 3 required RNP APCH with Baro-VNAV or APV in 100% of instrument runways by 2016*	12 November 2015	% of **high density aerodromes** with precision approaches or APV or LNAV.
Network Operations	B0-NOPS	2. **All High Density FIRs** supporting the busiest Asia/Pacific traffic flows and high-density aerodromes should implement ATFM incorporating CDM using operational ATFM platform/s. *Note: **High Density FIRs are defined as:*** *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.* *[APANPIRG Conclusion 22/8 and 23/5 refer]*	12 November 2015	% of **High Density FIRs** supporting the busiest Asia/Pacific traffic flows and high density aerodromes using operational ATFM platforms incorporating CDM
Aeronautical Information Management	B0-DATM	3. ATM systems should be supported by digitally-based AIM systems through implementation of **Phase 1 and 2 of the AIS-AIM Roadmap**	12 November 2015	% of Phase 1 and 2 AIS-AIM elements completed
Flight and Flow Information for a Collaborative Environment (FF-ICE)	B0-FICE	4. All States between ATC units where transfers of control are conducted have implemented the messages ABI, EST, ACP, TOC, AOC as far as practicable.	12 November 2015	% of FIRs within which all applicable ACCs have implemented at least one interface to use AIDC / OLDI with neighbouring ACCs
Civil/Military	B0-FRTO	5. Enhanced En-Route Trajectories: All States should ensure that SUA are regularly reviewed by the appropriate Airspace Authority to assess the effect on civil air traffic and the activities affecting the airspace.	12 November 2015	% of States in which FUA is implemented

Priority	ASBU module or Seamless Element	Targets	Target date (Seamless ATM Phase 1 Plan)	Metric
Civil/Military	Strategic Civil Military coordination (Regional)	6. Enhanced En-Route Trajectories: All States should ensure that a national civil/military body coordinating strategic civil-military activities is established.	12 November 2015	% of States which have established a national civil/military body that performs strategic civil-military coordination
Civil/Military	Tactical Civil Military coordination (Regional)	7. Enhanced En-Route Trajectories: All States should ensure that formal civil military liaison for tactical response is established.	12 November 2015	% of States which have established a formal civil military liaison for tactical response
Ground Surveillance	B0-ASUR	8. 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.	12 November 2015	% of FIRs where Category S airspace and Category T airspace supporting high density aerodromes are designated as ADS-B airspace
Ground Surveillance	B0-ASUR	9. ADS-B or MLAT or radar surveillance systems should be used to provide coverage of all Category S-capable airspace as far as practicable, with data integrated into operational ATC aircraft situation displays.	12 November 2015	% of ACCs with ATS Surveillance using ADS-B, MLAT or radar in Category S airspace, and having data integrated into the ATC system situation display
Trajectory-Based Operations-Data Link En-Route	B0-TBO	10. Within Category R airspace, ADS-C surveillance and CPDLC should be enabled to support PBN-based separations.	12 November 2015	% of FIRs using data link applications to support PBN-based separations in Category R airspace

2.8 All ASIA/PAC objectives, priorities and targets are documented in the following ASIA/PAC Main Planning Table. The ASIA/PAC Main Planning Table is built upon the Seamless ATM plan v1.0 which was adopted by APANPIRG/24:

Objectives							Priorities and targets					Reference
Block	ASBU modules and elements and enablers	Performance Improvement Area	Applicable or not in APAC (yes/no)	Regional planning elements		Enablers	Priority allocated in APAC	Target(s) in APAC		Indicator(s) / Metric(s)		Supporting document (ANRF, other)
								Nov. 2015 (Phase 1)	Nov. 2018 (Phase 2)	Nov. 2015 (Phase 1)	Nov. 2018 (Phase 2)	
0	Regional	1- Airport Operations	Yes	10	Apron Management		3	All high density international aerodromes (100,000 scheduled movements per annum or more) should provide an appropriate apron management service in order to regulate entry of aircraft into and coordinate exit of aircraft from the apron;		% of high density international aerodromes (100,000 scheduled movements per annum or more) providing an appropriate apron management service		Seamless Plan V1R0
0	Regional	1- Airport Operations	Yes	20	ATM-Aerodrome Coordination		3	All high density international aerodromes (100,000 scheduled movements per annum or more) should have appropriate ATM coordination on airport development and maintenance planning; coordination with local authorities regarding environmental, noise abatement, and obstacles; and ATM/PBN procedures for the aerodrome		% of high density international aerodromes having appropriate ATM coordination in accordance with the Seamless ATM Plan		Seamless Plan V1R0
0	Regional	1- Airport Operations	Yes	30	Aerodrome capacity		3	All high density international aerodromes (100,000 scheduled movements per annum or more) should have a declared airport terminal and runway capacity	All high density aerodromes should have a declared airport terminal and runway capacity	% of high density international aerodromes having declared capacity in accordance with the Seamless ATM Plan Phase 1	% of high density aerodromes having declared capacity in accordance with the Seamless ATM Plan Phase 2	Seamless Plan V1R0
0	B0-SURF	1- Airport Operations	Yes	40	Safety and Efficiency of Surface Operations		3	All high density international aerodromes (100,000 scheduled movements per annum or more) should have provide electronic surface movement guidance and control.		% of applicable international aerodromes having implemented A-SMGCS Level 2		ANRF B0-SURF
0	B0-RSEQ	1- Airport Operations	Yes	50	Arrival Manager/Departure Management (AMAN/DMAN)		2	All high density aerodromes should have AMAN/DMAN facilities	All AMAN systems should take into account airport gates for runway selection and other aircraft departures from adjacent gates that may affect arriving aircraft	% of applicable international aerodromes having implemented AMAN / DMAN (applicable = high density)	% of applicable international aerodromes having implemented AMAN / DMAN (applicable = high density)	Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	60	ATC Sector Capacity		2		All all enroute ATC sectors and 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.		% of ATC sectors with capacity figures in accordance with Seamless ATM Phase 2	Seamless Plan V1R0
0	B0-ACDM	1- Airport Operations	Yes	70	Airport Collaborative Decision-Making (ACDM)		2	Airport CDM at all high density aerodromes.		% of applicable international aerodromes having implemented improved airport operations through airport-CDM (applicable=high density)		ANRF B0-CDM
0	B0-NOPS	3- Optimum Capacity and Flexible Flights	Yes	80	Air Traffic Flow Management/Collaborative Decision-Making (ATFM/CDM)		1	All high density FIRs supporting the busiest Asia/Pacific traffic flows and high density aerodromes should implement ATFM incorporating CDM using operational ATFM platform/s.	All FIRs supporting Major Traffic Flows should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements	% of High Density FIRs supporting the busiest Asia/Pacific traffic flows and high density aerodromes using operational ATFM platforms incorporating CDM	% of FIRs supporting Major Traffic Flows should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements	ANRF B0-NOPS
0	B0-CDO	4- Efficient Flight Path	Yes	90	Continuous Descent Operations (CDO)		2	All high density international aerodromes implement CCO and CDO operations where States have assessed it applicable		% of international aerodromes/TMA where CDO is implemented		ANRF B0-APTA - CCO - CDO
0	B0-CCO	4- Efficient Flight Path	Yes	100	Continuous Climb Operations (CCO)		2	All high density international aerodromes implement CCO and CDO operations where States have assessed it applicable		% of international aerodromes where CCO is implemented		ANRF B0-APTA - CCO - CDO
0	B0-APTA	1- Airport Operations	Yes	110	Performance-based Navigation (PBN) Approach		1	Where practicable, all high density aerodromes with instrument runways serving aeroplanes should have precision approaches or APV or LNAV	Where practicable, all aerodromes with instrument runways serving aeroplanes should have precision approaches or APV or LNAV	% of high density aerodromes with precision approaches or APV or LNAV (High density aerodrome is defined by Asia-Pacific Seamless ATM Plan as aerodromes with scheduled operations in excess of 100,000/year)	No input needed here - Measured through the Regional Performance Dashboard: % of international aerodromes having at least one runway end provided with APV Baro-VNAV or LPV procedures	ANRF B0-APTA - CCO - CDO
0	B0-CCO B0-CDO	1- Airport Operations	Yes	120	Standard Instrument Departures/Standard Terminal Arrivals (SID/STAR)		2	All international high density aerodromes should have RNAV 1 (ATS surveillance environment) or RNP 1 (ATS surveillance and non-ATS surveillance environments) SID/STAR	All international aerodromes should have RNAV 1 (ATS surveillance environment) or RNP 1 (ATS surveillance and non-ATS surveillance environments) SID/STAR	% of international aerodromes / TMAs with PBN STAR implemented	% of international aerodromes / TMAs with PBN SID implemented	ANRF B0-APTA - CCO - CDO
0	Regional	4- Efficient Flight Path	Yes	130	Performance-based Navigation (PBN) Visual Departure and Arrival Procedures		3		PBN procedures that overlay visual arrival and departure procedures should be established where this provided an operational advantage		% of high density aerodromes with PBN procedures that overlay visual arrival and departure procedures	Seamless Plan V1R0
0	B0-FRTO	4- Efficient Flight Path	Yes	140	Performance-based Navigation (PBN) Routes		2	All ATS routes should be designated with a navigation performance specification for category R airspace RNP 4 or RNP 10 (RNAV 10) or RNP 2 oceanic; and for Category S airspace RNAV 2 or RNP 2	All ATS routes should be designated with a navigation performance specification RNP 2	% of ATS routes designated as PBN routes in accordance with Seamless ATM Phase 1	% of ATS routes designated as PBN routes in accordance with Seamless ATM Phase 2	ANRF to be developed
0	Regional	4- Efficient Flight Path	Yes	150	Performance-based Navigation (PBN) Airspace		2	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.		Are all your Category R and S upper controlled airspace, and Category T airspace supporting high density aerodromes designated as non-exclusive or exclusive PBN airspace as appropriate.? (1- yes, 0-no)		Seamless Plan V1R0
0	B0-SNET	3- Optimum Capacity and Flexible Flights	Yes	160	Safety Nets		2		ATM systems providing services within Category R airspace should enable appropriate ATC capabilities including CPAR, which is a key enabler for UPR and DARP operations	Does your State implement ground-based safety-nets (STCA, APW, MSAW, etc.)? (1- yes, 0-no)	% of ACCs using CPAR in R airspace in accordance with Seamless ATM Phase 2	ANRF B0-SNET
0	B0-ACAS	3- Optimum Capacity and Flexible Flights	Yes	170	Airborne Safety Systems		2	All Category R and S upper controlled airspace, and Category T airspace supporting high density aerodromes should require the carriage of ACAS and Terrain Awareness Warning Systems (TAWS), unless approved by ATC	All Category R and S upper controlled airspace, and Category T airspace should, unless approved by the State, require the carriage of an operable ACAS and TAWS	% of States/Administrations requiring the carriage of ACAS (with TCAS 7.1 evolution)	% of States/Administrations requiring the carriage of TAWS? (1- yes, 0-no)	ANRF B0-ACAS
0	B0-ASUR	3- Optimum Capacity and Flexible Flights	Yes	180	ATS Surveillance		1	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	All Category S upper controlled airspace and Category T 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. 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	% of of FIRs where Category S airspace and Category T airspace supporting high density aerodromes are designated as ADS-B airspace?	% of of FIRs where Category S airspace and Category T airspace supporting high density aerodromes are designated as ADS-B airspace?	ANRF B0-ASUR

0	Regional	3- Optimum Capacity and Flexible Flights	Yes	190	Airspace classification		2	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.		% of States/Administrations having harmonized the upper airspace classification 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.? (1- yes, 0-no)		Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	200	Flight Level Orientation Schemes (FLOS)		2	The ICAO Table of Cruising Levels based on feet as contained in Appendix 3a to Annex 2 should be used.		% of States/Administrations using the ICAO Table of Cruising Levels based on feet as contained in Appendix 3a to Annex 2 ? (1- yes, 0-no)		Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	210	Flight Level Allocation Schemes (FLAS)		2	Priority for FLAS level allocations should be given to higher density ATS routes over lower density ATS routes. Any aircraft that does not meet specified equipage requirements should		% of States/Administrations having their Operations Manual give priority for FLAS level allocations to higher density ATS routes over lower density ATS routes, and a lower priority to any aircraft that does not meet		Seamless Plan V1R0
0	B0-FICE	2- Globally Interoperable Systems & Data	Yes	220	ATS Inter-facility Data-link Communications (AIDC)		1	ATM systems should enable AIDC between ATC units where transfers of control are conducted. As far as practicable, the AIDC messages types ABI, EST, ACP, TOC, AOC should be implemented.	Implement full AIDC messaging, or alternate communication standard.	% of FIRs within which all applicable ACCs have implemented at least one interface to use AIDC / OLDI with neighbouring ACCs	% of FIRs within which all applicable ACCs have implemented full AIDC messaging, or alternate communication standard	ANRF B0-FICE
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	230	Automated Transfer of Control		2	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	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	% of ATC sectors with automated hand-off procedures in accordance with Seamless ATM Plan Phase 1	% of ATC sectors with automated hand-off procedures in accordance with Seamless ATM Plan Phase 2	Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	240	ATS Surveillance data sharing		2	Subject to appropriate filtering, ATS surveillance data, particularly from ADS-B, should be shared with neighbouring ATC units within high density FIRs	Subject to appropriate filtering, ATS surveillance data, particularly from ADS-B, should be shared with all neighbouring ATC units	% of ACCs within high density FIRs (as per the Seamless ATM Plan) sharing ATS surveillance data	% of ACCs sharing ATS surveillance data	Seamless Plan V1R0
0	B0-APTA	3- Optimum Capacity and Flexible Flights	Yes	250	ATM systems enabling optimal PBN/ATC operations		2	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	ATM system design should be planned and implemented to support optimal aerodrome capacity expectations for the runway(s) concerned. Electronic flight progress strips should be utilised wherever practicable.	% of ATC units with ATM systems enabling optimal PBN operations	% of ATC units with ATM systems supporting optimal aerodrome capacity and using electronic fight progress strips	ANRF B0-APTA - CCO - CDO
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	260	ATC Horizontal separation		2	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,		% of States/Administrationshaving their AIP authorising the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable ? (1- yes, 0-no)		Seamless Plan V1R0
0	B0-ASUR	3- Optimum Capacity and Flexible Flights	Yes	270	ATS surveillance with data integrated		1	ADS-B or MLAT or radar surveillance systems should be used to provide coverage of all Category S-capable airspace as far as practicable, with data integrated into operational ATC aircraft situation displays		% of ACCs with ATS Surveillance using ADS-B, MLAT or radar in Category S airspace, and having data integrated into the ATC system situation display		ANRF B0-ASUR
0	B0-TBO	4- Efficient Flight Path	Yes	280	ADS-C and CPDLC		1	Within Category R airspace (remote en-route airspace within ATS communications and surveillance coverage dependent on a third-party CSP), ADS-C surveillance and CPDLC should be enabled to support PBN-based separations		% of FIRs utilising data link en-route in applicable airspace		ANRF B0-TBO
0	B0-FRTO	4- Efficient Flight Path	Yes	290	UPR and DARP		3	Within Category R airspace, UPR and DARP should be enabled to support PBN-based separations		% of FIRs using UPR and DARP within R airspace		ANRF B0-FRTO
0	B0-DATM	2- Globally Interoperable Systems & Data	Yes	300	Aeronautical Information Management		1	ATM systems should be supported by digitally-based AIM systems through implementation of Phase 1 and 2 of the AIS-AIM Roadmap	ATM systems should be supported by digitally-based AIM systems through implementation of Phase 3 of the AIS-AIM Roadmap	% Phase 1 and 2 AIS-AIM elements completed (0-13)	% of Phase 3 AIS-AIM elements completed (0-8)	ANRF B0-DATM
0	B0-AMET	2- Globally Interoperable Systems & Data	Yes	310	Meteorological Information		2	All high density aerodromes should provide meteorological forecasts, aerodrome warnings and alerts that support efficient terminal operations. ATM systems should be supported by implementation of appropriate meteorological information reporting systems		% of high density aerodromes providing meteorological forecasts, aerodrome warnings and alerts		ANRF to be developed
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	320	ATM Managers' Performance		2	Human performance training for all ANSP managers, including management of risks related to human capabilities and limitations; effective participation in a team and team management, effective safety reporting systems, human	Prevention of fatigue systems should be established to support human performance in the delivery of a Seamless ATM service	% of States/Administrations having their Operations Manual require the human performance training for all ANSP managers	% of States/Administrations having a prevention of fatigue systems established to support human performance in the delivery of your ATM services	Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	330	ATC simulators performance		2	Enhancement and improved application of ATC simulators should be established to support human performance in the delivery of a Seamless ATM service		% of States/Administrations having a programme for enhancement and improved application of ATC simulators		Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	340	Safety assessment of changes		2	Safety teams comprising multidisciplinary operational staff and managers which review safety performance and assess significant proposals for change to ATM systems should be established to support human performance in the delivery of a Seamless ATM service		% of States/Administrations having safety teams comprising multidisciplinary operational staff and managers which review safety performance and assess significant proposals for change to ATM systems		Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	350	ATM Operators' performance		2	Human performance-based training and procedures for staff providing ATS should be established to support human performance in the delivery of a Seamless ATM service		% of States/Administrations having human performance-based training and procedures for staff providing ATS		Seamless Plan V1R0
0	B0-FRTO	3- Optimum Capacity and Flexible Flights	Yes	360	Civil Military use of SUA		1	All States should ensure that SUA are regularly reviewed by the appropriate Airspace Authority to assess the effect on civil air traffic and the activities affecting the airspace		% of FIRs in which FUA is implemented		ANRF B0-FRTO
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	370	Strategic Civil Military coordination		1	All States should ensure that a national civil/military body coordinating strategic civil-military activities is established		% of States/Administrations having established a national civil/military body that performs strategic civil-military coordination		Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	380	Tactical Civil Military coordination		1	All States should ensure that formal civil-military liaison for tactical responses is established		% of States/Administrations having you established a formal civil military liaison for tactical response		Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	390	Civil Military system integration		2	Civil and military ATM systems integrated using joint procurement, and sharing of ATS surveillance data (especially from ADS-B systems) should be provided as far as practicable		% of States/Administrations having their civil ATS and military systems integrated		Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	400	Civil Military navaids joint provision		2	Joint provision of civil/military navigation aids should be encouraged;		% of States/Administrations having their joint civil and military navigation aids		Seamless Plan V1R0

0	Regional	3- Optimum Capacity and Flexible Flights	Yes	410	Civil Military common training		**2**	Common training should be conducted between civil and military ATM units in areas of common interest;		% of States/Administrations having Civil Military common training conducted in areas of common interest		Seamless Plan V1R0
0	Regional	3- Optimum Capacity and Flexible Flights	Yes	420	Civil Military common procedures		**2**	Civil and military ATM units should utilize common procedures as far as practicable		% of States/Administrations having common procedures for Civil Military operations where appropriate		Seamless Plan V1R0
0	B0-ASEP	3- Optimum Capacity and Flexible Flights	No	430	Air traffic situational awareness		**2**		Nil		% of States/Administrations implementing air traffic situational awareness? (1- yes, 0-no)	Nil
0	B0-WAKE	1- Airport Operations	No	440	Optimized wake turbulence separation		**3**		Nil		% of applicable international aerodromes having implemented increased runway throughput through optimized wake turbulence separation	Nil
0	B0-OPFL	3- Optimum Capacity and Flexible Flights	No	450	In-trail procedures		**3**		Nil		% of FIRs having implemented in-trail procedures	Nil

3. Monitoring of ASBU IMPLEMENTATION

3.1 The monitoring of air navigation and its enhancement should be carried out through identification of relevant air navigation Metrics and Indicators as well as the adoption and attainment of air navigation system Targets.

3.2 The monitoring of the regional progress and performance metrics/indicators should be done for all elements by APANPIRG. The monitoring should allow global correlation of status and expectations, appreciation of benefits achieved for the airspace users, as well as corrective actions to be taken by the PIRG on implementation plans.

3.3 The APANPIRG should determine appropriate mechanisms and tools for the monitoring and the collection data at national and regional levels.

Data collection

3.4 ASIA/PAC States/Administrations are urged to report on their Seamless ATM implementation progress at least once a year through the ICAO online reporting process from November 2014 onwards (Conclusion APANPIRG 25/5). The Web-based Seamless ATM Implementation Progress Reporting Process is available here (secured access): https://portal.icao.int/RO_APAC/Reporting/Pages/default.aspx

3.5 The list of Points of Contact for the Reporting Process is available here:
https://portal.icao.int/RO_APAC/Reporting/Lists/Point%20of%20Contact/AllItems.aspx

Monitoring through the regional picture and Regional Performance Dashboards

3.6 The process of ANS implementation against the objectives and targets as set forth in the ASIA/PAC Main Planning Table above is tracked through a series of bar graphs, forming a regional picture that is periodically updated. The latest version is available here:
https://portal.icao.int/RO_APAC/Reporting/Documents/Regional%20Picture.pdf (secured access).

3.7 The Regional Performance Dashboards aim to provide a glance of both Safety and Air Navigation Capacity and Efficiency strategic objectives, using a set of indicators and targets based on the regional implementation of the Global Aviation Safety Plan (GASP) and the Global Air Navigation Plan (GANP). The progress can be checked here: http://www.icao.int/safety/Pages/Regional-Targets.aspx#tabs-2.

Implementation Guidance

3.8 The Seamless ATM implementation guidance was adopted by ASIA/PAC States/Administrations and is maintained by the ICAO Regional Office (Conclusion APANPIRG 25/4). Its latest version is the version 4.3, May 2014 which is available here: http://www.icao.int/APAC/Documents/edocs/Seamless%20ATM%20Implementation%20Guidance%20v4-3.pdf

TABLE CNS II-1 AERONAUTICAL FIXED TELECOMMUNICATIONS NETWORK (AFTN) PLAN

EXPLANATION OF THE TABLE

Column

1 The AFTN Centres/Stations of each State are listed alphabetically. Each circuit appears twice in the table. The categories of these facilities are as follows:

M - Main AFTN COM Centre
T - Tributary AFTN COM Centre
S - AFTN Station

2 Category of circuit:

M - Main trunk circuit connecting Main AFTN communication centres.
T - Tributary circuit connecting Main AFTN communication centre and Tributary AFTN Communications Centre.
S - AFTN circuit connecting an AFTN Station to an AFTN Communication Centre.

3 Type of circuit provided:

LTT/a - Landline teletypewriter, analogue (e.g. cable, microwave)
LTT/d - Landline teletypewriter, digital (e.g. cable, microwave)
LDD/a - Landline data circuit, analogue (e.g. cable, microwave)
LDD/d - Landline data circuit, digital (e.g. cable, microwave)
SAT/a/d - Satellite link, with /a for analogue or /d for digital

4 Circuit signalling speed in bits/s.

5 Circuit protocols

6 Data transfer code (syntax):

ITA-2 - International Telegraph Alphabet No. 2 (5-unit Baudot code).
IA-5 - International Alphabet No. 5 (ICAO 7-unit code).
CBI - Code and Byte Independency (ATN compliant).

7 Remarks

TABLE CNS II – 1 AERONAUTICAL FIXED TELECOMMUNICATIONS NETWORK (AFTN) PLAN

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
AFGHANISTAN						
Kabul/OAKB						
Karachi/OPKC	S	SAT/d	2400 bps	None	IA-5	
Tehran/OIII	S	LDD/d	2400 bps	None	IA-5	
AMERICAN SAMOA						
Pago Pago/NSTU						
Salt Lake City/KSLC	S	LDD/d	2400 bps	IP	IA-5	
AUSTRALIA						
Brisbane/YBBB						
Christchurch/NZCH	T	LDD/d	2400 bps	X.25	IA-5	MPLS VPN AMHS-IPS 2017
Honiara/AGGG	S	LDD/d	N/A	HTTP	IA-5	INTERNET
Jakarta/WIII	S	SAT/d	64 Kbps	AMHS/IPS	IA-5	IP VPN
Makassar/WAAA	S				IA-5	IP VPN for AIDC

State/Station	Category	Requirement				Remarks
		Type	**Signaling Speed**	**Protocol**	**Code**	
1	**2**	**3**	**4**	**5**	**6**	**7**
Nadi/NFFN	M	LDD/d	64 Kbps	AMHS/OSI	IA-5	INTERNET
Nauru/ANAU	S	LDD/d	N/A	HTTP	IA-5	
Port Moresby/AYPM	S	LDD/d	128 Kbps	IP	IA-5	INTERNET
Port Vila/NVVV	S	LDD/d	N/A	HTTP	IA-5	INTERNET
Dili/WPDL	S	LDD/d	N/A	HTTP	IA-5	INTERNET
Singapore/WSSS	M	LDD/d	64 Kbps	X.25	IA-5	AMHS/OSI 2015
United States/KSLC	M	LDD/d	64 Kbps	X.25	IA-5	MPLS/VPN AMHS/IPS 2017
Johannesburg/FAOR	M	LDD/d	64 Kbps	X.25	IA-5	IP VPN
BANGLADESH						
Dhaka/VGHS						
Bangkok/VTBB	S	SAT/d	32 Kbps	None	IA-5	
Kolkata/VECC	S	LDD/d	64 Kbps	X.25	IA-5	
BHUTAN						
Paro/VQPR						
Mumbai/VABB	S	SAT/a	900 baud	None	ITA-2	Plan to upgrade to 64 Kbps 2017 LDD/d using IA5 X.25

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	**2**	**3**	**4**	**5**	**6**	**7**
Bangkok/VTBB	S	SAT/a	900 baud	None	ITA-2	Plan to upgrade to 64 Kbps 2017 LDD/d using IA5 X.25
BRUNEI DARUSSALAM						
Brunei/WBSB						
Singapore/WSSS	S	LDD/d	64 Kbps	X.25	IA-5	
Kuala Lumpur/WMKK	S	LDD/d	9600 bps	X.25	IA-5	
CAMBODIA						
Phnom Penh/VDPP						
Bangkok/VTBB	S	SAT/d	64 Kbps	None	IA-5	
CHINA						
Beijing/ZBBB						
Bangkok/VTBB	M	SAT/da	2400 bps	X.25	IA-5	
Guangzhou/ZGGG	M	LDD/d	64 Kbps	X.25	IA-5	
Karachi/OPKC	M	LDD/d	2400 bps	X.25	IA-5	
Kathmandu/VNKT	S	SAT/d	300 bps	None	IA-5	

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Russian Federation/UHHH	M	LDD/d	64 Kbps	X.25	IA-5	
Pyongyang/ZKKK	S	SAT/d	9600 bps	X.25	IA-5	
Seoul/RKSS	S	SAT/d	9600 bps	X.25	IA-5	
Fukuoka/RJJJ	S	LDD/d	64 Kbps	X.25	IA-5	
Ulaan Baatar/ZMUB	S	LDD/d	64 Kbps	X.25	IA-5	
Yangon/VYYY	S	SAT/d	4800 bps	X.25	IA-5	
Guangzhou/ZGGG						
Beijing/VTBB	M	LDD/d	64 Kbps	X.25	IA-5	
Hanoi/VVNB	S	SAT/d	300 bps	None	IA-5	
Hong Kong/VHHH	M	LDD/d	2400 bps	None	IA-5	
Macao/VMMC	S	LDD/d	2400 bps	None	IA-5	
Haikou/ZJHK	S	LDD/d	9600 bps	None	IA-5	
Haikou/ZJHK						
Guangzhou/ZGGG	S	LDD/d	9600 bps	None	IA-5	
Hong Kong/VHHH	S	LDD/d	2400 bps	None	IA-5	

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Taibei/RCTP						
Hong Kong/VHH	S	LDD/d	4800 bps	X.25	IA-5	
Manila/RPLL	S	LDD/d	300 bps	None	ITA-2	
Fukuoka/RJJJ	S	LDD/d	64 Kbps	X.25	IA-5	
Hong Kong China/VHHH						
Bangkok/VTBB	M	LDD/d	64 Kbps	X.25	IA-5	
Guangzhou/ZGGG	M	LDD/d	2400 bps	None	IA-5	
Ho Chi Minh/VVTS	S	LDD/d	2400 bps	None	IA-5	
Macao/VMMC	S	LDD/d	64 Kbps	X.25	IA-5	
Manila/RPLL	S	LDD/d	9600 bps	X.25	IA-5	
Haikou/ZJHK	S	LDD/d	2400 bps	None	IA-5	
Taibei/RCTP	S	LDD/d	4800 bps	X.25	IA-5	
Fukuoka/RJJJ	M	LDD/d	64 Kbps	X.25	IA-5	
MACAO CHINA						

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Macau/VMMC						
Hong Kong/VHHH	S	LDD/d	64 Kbps	X.25	IA-5	
Guangzhou/ZGGG	S	LDD/d	2400 bps	None	IA-5	
COOK ISLANDS						
Rarotonga/NCRG						
Christchurch/NZCH	S	LDD/d	64 Kbps	IP	IA-5	
DPR KOREA						
Pyongyang/ZKKK						
Beijing/ZBBB	S	LDD/d	2400 bps	X.25	IA-5	
FIJI						
Nadi/NFFN						
Brisbane/YBBB	M	LDD/d	64 Kbps	AMHS/OSI	IA-5	
Funafuti/NGFU	S	SAT/d	Internet	IP	IA-5	VPN over Internet
Noumea/NWWW	S	SAT/d	9600 bps	Asynch.	IA-5	

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Tarawa/NGTT	S	SAT/d	Internet	IP	IA-5	VPN over Internet
United States/KSLC	M	LDD/d	9600 bps	X.25	IA-5	
Wallis Is./NLWW	S	SAT/d	9600 bps	Asynch.	IA-5	Via Noumea
FRENCH POLYNESIA (France)						
Papeetee (NTAA)						
Christchurch/NZCH	S	SAT/d	64 Kbps	IP	IA-5	
INDIA						
Mumbai/VABB						
Bangkok/VTBB	M	LDD/d	64 Kbps	X.25	IA-5	
Kolkata/VECC	S	LDD/d	64 Kbps	X.25	IA-5	
Colombo/VCCC	S	LDD/d	64 Kbps	X.25	IA-5	
Karachi/OPKC	M	SAT/d	2400 bps	None	IA-5	
Kathmandu/VNKT	S	SAT/a	50 bauds	None	ITA-2	
Muscat/OOMS	M	SAT/a	300 bauds	None	ITA-2	
Nairobi/HKNA	M	SAT/a	50 bauds	None	ITA-2	

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Paro/VQPR	S	SAT/a	900 bauds	None	ITA-2	Plan to upgrade to 64 Kbps 2017 LDD/d using IA5 X.25
Singapore/WSSS	M	LDD/d	64 Kbps	X.25	IA-5	
Kolkata/VECC						
Dhaka/VGZR	S	LDD/d	64 Kbps	None	IA-5	
Mumbai	S	LDD/d	64 Kbps	X.25	IA-5	
Delhi/VIDP						
Tashkent/UTTT	S	SAT/a	50 bauds	None	ITA-2	
Chennai/VOMM						
Kuala Lumpur/WMKK	S	LDD/d	64 Kbps	None	IA-5	
INDONESIA						
Jakarta/WIII						
Brisbane/YBBB	S	SAT/d	64 Kbps	AMHS/IPS	IA-5	IP VPN
Singapore/WSSS	S	LDD/d	128 Kbps	X.25	IA-5	

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Makassar/WAAA						
Brisbane/YBBB	S					IP VPN for AIDC
JAPAN						
Fukuoka-M/RJJJ						
Beijing/ZBBB	M	LDD/d	64 Kbps	X.25	IA-5	
Hong Kong/VHHH	M	LDD/d	9600 bps	X.25	IA-5	
Russian Federation/UUUU	M	LTT	64 Kbps	X.25	IA-5	
Seoul/RKSS	S	LDD/d	9600 bps	X.25	IA-5	
Singapore/WSSS	M	LDD/d	9600 bps	X.25	IA-5	
United States/KSLC	M	LDD/d	64 Kbps	X.25	-	
Taibei/RCTP	S	LDD/d	64 Kbps	X.25	IA-5	
KIRIBATI						
Tarawa-S/NGTT						
Nadi/NFFN	S	SAT/d	Internet	IP	IA-5	VPN over Internet

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	**2**	**3**	**4**	**5**	**6**	**7**
LAO PDR						
Vientiane-S/VLVT						
Bangkok/VTBB	S	SAT/d	32 kbps	None	IA-5	
Hanoi/VVNB	S	SAT/d	2400 bps	None	IA-5	
MALASIA						
Kuala Lumpur-S/WMKK						
Bangkok/VTBB	S	SAT/d	64 Kbps	None	IA-5	
Brunei/WBSB	S	LDD/d	9600 bps	X.25	IA-5	
Chennai/VOMM	S	LDD/d	9600 bps	X.25	IA-5	
Singapore/WSSS	S	SAT/d	64 Kbps	X.25	IA-5	
MALDIVES						
Male-S/VRMM						
United States/KSLC	S	SAT/d	9600 bps	X.25	IA-5	
MARSHALL ISLAND						

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Majuro-S/PKMJ						
United States/KSLC	S	Internet	64 Kbps	IP	IA-5	
MICRONESIA						
FEDERATED STATES OF						
Chuuk-S/PTKK						
United States/KSLC	S	Internet	64 Kbps	IP	IA-5	
Kosrae-S/PTSA						
United States/KSLC	S	Internet	64 Kbps	IP	IA-5	
Ponapei-S/PTPN						
United States/KSLC	S	Internet	64 Kbps	IP	IA-5	
YAP-S/PTYA						
YAP-S/PTYA						
United States/KSLC	S	Internet	64 Kbps	IP	IA-5	

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
MONGOLIA						
Ulaanbaatar-S/ZMUB						
Beijing/ZBBB	S	LDD/d	64 Kbps	X.25	IA-5	
Russian Federation/UIII	S	LDD/d	9600 bps	X.25	IA-5	
MYANMAR						
Yangon-S/VYYY						
Bangkok/VTBB	S	SAT/d	48 Kbps	None	IA-5	
Beijing/ZBBB	S	SAT/d	4800 bps	X.25	IA-5	
NAURU						
Nauru-S/ANAU						
Brisbane/YBBB	S	LDD/d	N/A	HTTP	IA-5	Internet
NEPAL						
Katmandu-S/VNKT						

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Beijing/ZBBB	S	SAT/d	300 baud	None	IA-5	
Mumbai/VABB	S	SAT/a	50 baud	None	ITA-2	
NEW CALEDONIA (FRANCE)						
Noumea-S/NWWW						
Nadi/NFFN	S	SAT/d	9600 bps	Asynch.	IA-5	
NEW ZEALAND						
Christchurch-T/NZCH						
Faleolo/NSFA	S	LDD/d	64 Kbps	IP	IA-5	
Brisbane/YBBB	T	LDD/d	2400 bps	X.25	IA-5	MPLS VPN AMHS-IPS 2017
Niue/NIUE	S	E-mail				
Papeetee/NTAA	S	SAT/d	64 Kbps	IP	IA-5	
Rarotonga/NCRG	S	LDD/d	64 Kbps	IP	IA-5	
Tongatapu/NFTF	S	LDD/d	64 Kbps	IP	IA-5	
USA/KSLC	M	LDD/d	9600 bps	X.25	IA-5	

State/Station	Category	Requirement				Remarks
		Type	**Signaling Speed**	**Protocol**	**Code**	
1	**2**	**3**	**4**	**5**	**6**	**7**
NIUE IS						
Niue-S/NIUE						
Christchurch/NZCH	S	E-mail				
PAKISTAN						
Karachi-M/OPKC						
Beijing/ZBBB	M	LDD/d	2400 bps	None	IA-5	
Mumbai/VABB	M	SAT/d	2400 bps	None	IA-5	
Kabul/OAKB	S	SAT/d	2400 bps	None	IA-5	
Kuwait/OKBK	M	LDD/d	2400 bps	None	IA-5	
PALAU						
Koror-S/PTRO						
United States/KSLC	S	Internet	64 Kbps	IP	IA-5	
PAPUA NEW GUINEA						

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Port Moresby-S/AYPM						
Brisbane/YBBB	S	LDD/d	128 Kbps	IP	IA-5	
PHILIPPINES						
Manila-S/RPLL						
Hong Kong/VHHH	S	LDD/d	9600 bps	X.25	IA-5	
Singapore/WSSS	S	LDD/d	64 Kbps	X.25	IA-5	
Taibei/RCTP	S	LDD/d	300 baud	None	ITA-2	
REPUBLIC OF KOREA						
Seoul-S/RKSS						
Beijing/ZBBB	S	SAT/d	9600 bps	X.25	IA-5	
Fukuoka/RJJJ	S	LDD/d	9600 bps	X.25	IA-5	
SAMOA						
Faleolo-S/NSFA						
Christchurch/NZCH	S	LDD/d	64 Kbps	IP	IA-5	

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
SINGAPORE						
Singapore-M/WSSS						
Bahrain/OBBI	M	LTT/d	64 Kbps	X.25	IA-5	
Bangkok/VTBB	M	LDD/d	64 Kbps	X.25	IA-5	
Brisbane/YBBB	M	LDD/d	64 Kbps	X.25	IA-5	AMHS/OSI 2015
Brunei/WBSB	S	LDD/d	64 Kbps	X.25	IA-5	
Colombo/VCCC	S	LDD/d	64 Kbps	X.25	IA-5	
Ho-Chi-Minh/VVTS	S	LDD/d	128 Kbps	X.25	IA-5	
Jakarta/WIII	S	LDD/d	128 Kbps	X.25	IA-5	
Kuala Lumpur/WMKK	S	SAT/d	64 Kbps	X.25	IA-5	
Mumbai/VABB	M	LDD/d	64 Kbps	X.25	IA-5	
London/EGGG	M	LDD/d	128 Kbps	None	IA-5	
Manila/RPLL	S	LDD/d	64 Kbps	X.25	IA-5	
Fukuoka/RJJJ	M	LDD/d	9600 bps	X.25	IA-5	
SOLOMON IS.						
Honiara-S/AGGG						

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	**2**	**3**	**4**	**5**	**6**	**7**
Brisbane/YBBBB	S	LDD/d	N/A	HTTP	IA-5	Internet
SRI LANKA						
Colombo-M/VCCC						
Mumbai/VABB						
Male/VRMM						
Singapore/WSSS						
THAILAND						
Bangkok-M/VTBB						
Beijing/ZBBB	M	SAT/d	2400 bps	X.25	IA-5	
Mumbai/VABB	M	LDD/d	64 Kbps	X.25	IA-5	
Dhaka/VGHS	S	SAT/d	32 Kbps	None	IA-5	
Ho Chi Minh/VVTS	S	SAT/d	2400 bps	X.25	IA-5	
Hong Kong/VHHH	M	LDD/d	64 Kbps	X.25	IA-5	
Kuala Lumpur/WMKK	S	SAT/d	64 Kbps	None	IA-5	
Phnom Penh/VDPP	S	SAT/d	64 Kbps	None	IA-5	

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	**2**	**3**	**4**	**5**	**6**	**7**
Paro/VQPR	S	SAT/a	900 baud	None	ITA-2	Plan to upgrade to 64 Kbps 2017 LDD/d using IA5 X.25
ROME/LIII	M	LDD/d	64 Kbps	X.25	IA-5	
Singapore/WSSS	M	LDD/d	64 Kbps	X.25	IA-5	
Vientiane/VLVT	S	SAT/d	32 Kbps	None	IA-5	
Yangon/VYYY	S	SAT/d	48 Kbps	None	IA-5	
TIMOR LESTE						
Dili/WPDL						
Brisbane/YABB	S	LDD/d	N/A	HTTP	IA-5	Internet
TONGA						
Tongatapu-S/NFTF						
Christchurch/NZCH	S	LDD/d	64 Kbps	IP	IA-5	
TUVALU						
Funafuti-S/NGFU						
Nadi/NFFN	S	SAT/d	Internet	IP	IA-5	VPN over Internet

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
United States/KSLC	M	LDD/d	64 Kbps	X.25	IA-5	MPLS/VPN AMHS/IPS 2017
UNITED STATES						
USA-M/KSLC						
Brisbane/YBBB	M	LDD/d	64 Kbps	X.25	IA-5	MPLS/VPN AMHS/IPS 2017
Christchurch/NZCH	S	LDD/d	9600 bps	X.25	IA-5	
Chuuk/PTKK	S	Internet	64 Kbps	IP	IA-5	
Koror/PTRO	S	Internet	64 Kbps	IP	IA-5	
Kosrae/PTSA	S	Internet	64 Kbps	IP	IA-5	
MajuroPKMJ	S	Internet	64 Kbps	IP	IA-5	
Nadi/NFFN	M	LDD/d	9.6 Kbps	X.25	IA-5	
Pago Pago/NSTU	S	SAT/d	2400 bps	IP	IA-5	
Ponapei/PTPN	S	Internet	64 Kbps	IP	IA-5	
Fukuoka/RJJJ	M	LDD/d	64 Kbps	X.25		
YapPTYA	S	Internet	64 Kbps	IP	IA-5	
VANUATU						

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	**2**	**3**	**4**	**5**	**6**	**7**
Port Vila-S/NVVV						
Brisbane/YBBB	S	LDD/d	N/A	HTTP	IA-5	Internet
VIET NAM						
Hanoi-S/VVNB						
Vientiane/VLVT	S	SAT/d	2400 bps	None	IA-5	
Ho Chi Minh/VVTS	S	SAT/d	9600 bps	None	IA-5	
Guangzhou/ZGGG	S	SAT/d	300 bps	None	IA-5	
Ho Chi Minh-S/VVTS						
Bangkok/VTBB	S	SAT/d	2400 bps	None	IA-5	
Hanoi/VVNB		SAT/d	9600 bps	None	IA-5	
Hong Kong/VHHH	S	LDD/d	2400 bps	None	IA-5	
Singapore/WSSS	S	LDD/d	128 Kbps	X.25	IA-5	
WALLIS IS/ (FRANCE)						
Wallis-S/NLWW						

State/Station	Category	Requirement				Remarks
		Type	Signaling Speed	Protocol	Code	
1	2	3	4	5	6	7
Nadi/NFFN	S	SAT/d	9600 bps	IP	IA-5	Via Noumea

TABLE CNS II-2 - REQUIRED ATN INFRASTRUCTURE ROUTING PLAN

EXPLANATION OF THE TABLE

Column

1 Name of the Administration and Location of the ATN Router

2 Type of Router (in end systems (ES) of the Administration shown in column 1)

3 Type of Interconnection:

Inter-Regional: Connection between different Regions/ domains
Intra-Regional: Connection within a Region/ domain.

4 Connected Router: List of the Administration and location of the ATN routers to be connected with the router shown in column 1)

5 Bandwidth: Link Speed expressed in bits per second (bps)

6 Network Protocol: If Internet Protocol Suite is used, indicate version of IP (IPv4 or IPv6)

7 Via: The media used to implement the interconnection of the routers. (in case of IP service bought from a service provider, indicate VPN)

DDN (public telecomm leased line)
VSAT
VPN

8 Remarks

Table CNS II-2 - Required ATN Infrastructure Routing Plan

Administration and Location	**Type of Router**	**Type of Interconnection**	**Connected Router**	**Bandwidth**	**Network Protocol**	**Via**	**Remark**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Afghanistan Kabul	BIS	Intra-Regional	Pakistan	64000bps	IPS		Intra-domain
	BIS	Inter-Regional	Iran	9600 bps	IPS		
American Samoa Pago Pago			United States				Intra-domain
Australia Brisbane	BBIS	Intra-Regional	Fiji	64000 bps	CLNP/IP-SNDCF (IPv4)	DDN	Implemented
	BIS	Intra-Regional	Indonesia	64000 bps	IPS		Not implemented
	BBIS	Intra-Regional	Japan	64000 bps	IPS/IP-SNDCF	VPN	Not implemented
	BIS	Intra-Regional	New Zealand	64000 bps	IPS	VPN	Not implemented
	BBIS	Intra-Regional	Singapore	64000 bps	CLNP/IP-SNDCF	DDN	ATN/AMHS trial planned to completed by end 2015
	BBIS	Inter-Regional	South Africa	64000 bps	TBD		Not implemented
	BBIS	Inter-Regional	United States	64000 bps	DDN lease line/IPS		
Bangladesh Dhaka	BIS	Intra-Regional	India	64000 bps	IPS		Implemented
	BIS	Intra-Regional	Thailand	32000 bps	IPv4	VSAT	Implemented
Bhutan Paro	BIS	Intra-Regional	India	64000 bps	IPS		TBD. Presently using AFTN via VPN through public internet
Brunei Darussalam Brunei	BIS	Intra-Regional	Malaysia	64000 bps	IPS		
	BIS	Intra-Regional	Singapore	9600 bps	IPv4	DDN	ATN/AMHS trial commence on 2017

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	2	3	4	5	6	7	8
Cambodia Phnom Penh	BIS	Intra-Regional	Thailand	64000 bps	IPv4	VSAT	Implemented
China Beijing	BIS	Intra-Regional	DPR Korea	9600 bps	X.25		Router Implemented
	BBIS	Intra-Regional	Hong Kong, China	64000 bps	X.25	DDN	Router Implemented
	BBIS	Intra-Regional	India	64000 bps	X.25/IPS	DDN	IOT/POT completed. - Migrate to IPS
	BBIS	Intra-Regional	Japan	64000 bps	IPS/SNDCF	VPN	Implement from 2016 onwards
	BBIS	Inter-Regional	Kuwait	64000 bps	X.25		Router Implemented
	BIS	Intra-Regional	Macao, China	64000 bps	X.25		Implemented
	BIS	Intra-Regional	Mongolia	9600 bps	X.25		Router Implemented
	BIS	Intra-Regional	Myanmar	64000 bps	IPS		Implementation on going/Plan Q4/15
	BIS	Intra-Regional	Nepal	9600 bps	X.25		Router Implemented
	BIS	Intra-Regional	Pakistan	64000 bps	X.25		Router Implemented
	BIS	Intra-Regional	Republic of Korea	64000 bps	X.25		Implemented
	BBIS	Inter-Regional	Russian Federation	64000 bps	X.25		Router Implemented
	BBIS	Intra-Regional	Thailand	64000 bps	CLNP/X.25	DDN	
	BIS	Intra-Regional	Vietnam	9600 bps	X.25		
Taibei	BIS	Intra-Regional	Hong Kong, China	64000 bps	X.25	DDN	TBD
	BIS	Intra-Regional	Japan	64000 bps	IPS	VPN	Implement from 2016 onwards Scheduled after CRV

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	2	3	4	5	6	7	8
Hong Kong, China	BBIS	Intra-Regional	China	64000 bps	X.25	DDN	Router Implemented
	BIS	Intra-Regional	Macao, China	64000 bps	X.25	DDN	Implemented
	BBIS	Intra-Regional	Japan	64000 bps	X.25/SNDCF	VPN	Scheduled for Q4/2017
	BIS	Intra-Regional	Philippines	64000 bps	X.25/IPS	DDN	Scheduled for Q4/2016
	BBIS	Intra-Regional	Taibei	64000 bps	X.25	DDN	TBD
	BBIS	Intra-Regional	Thailand	64000 bps	CLNP/X.25	DDN	Implemented
	BIS	Intra-Regional	Viet Nam	64000 bps	X.25	DDN	TBD
Macao, China	BIS	Intra-Regional	China	64000 bps	X.25		Implemented
	BIS	Intra-Regional	Hong Kong, China	64000 bps	X.25	DDN	Implemented
Cook Islands Rarotonga			New Zealand	796 kbps	IPS		Intra-domain
DPR Korea Pyongyang	BIS	Intra-Regional	China	9600 bps	X.25		
Fiji Nadi	BBIS	Intra-Regional	Australia	64000 bps	CLNP/IP-SNDCF (IPv4)	DDN	Implemented
	BIS	Intra-Regional	Kiribati	Internet	IPv4	VPN	Intra-domain (User Agent) - Implementation Q3 2015
	BIS	Intra-Regional	New Caledonia	64000 bps	IPS (IPv4)	DDN	Intra-domain - Implementation 2016 Connect with Wallis
	BIS	Intra-Regional	Tuvalu	Internet	IPv4	VPN	Intra-domain (User Agent) - Implementation Q3 2015

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	2	3	4	5	6	7	8
	BBIS	Inter-Regional	United States	9600 bps	CLNP/X.25-SNDCF	DDN	The protocol will upgrade to IPS/SNDCF in 2016
	BIS	Intra-Regional	Wallis Islands	Internet	IPv4	VPN	Connect with New Caledonia - Implemente in 2016
French Polynesia Papeete			New Zealand	64000 bps	IPS		Intra-domain
India Mumbai	BIS	Intra-Regional	Bangladesh	64000 bps	DDN leased line/IPS		Implemented
	BIS	Intra-Regional	Bhutan	64000 bps	IPS		TBD. Presently using AFTN via VPN through public internet
	BBIS	Intra-Regional	China	64000 bps	X. 25/IPS	DDN	IOT/POT completed. - Migrate to IPS
	BIS	Inter-Regional	Kenya	64000 bps	TBD	TBD	Presently using AFTN via VPN via public internet
	BIS	Intra-Regional	Nepal	64000 bps	IPS		Implemented
	BIS	Inter-Regional	Oman	64000 bps	IPS		IOT completed. POT planned. TMC to be signed
	BIS	Intra-Regional	Pakistan	64000 bps	IPS		IOT/POT completed. TMC to be signed
	BBIS	Intra-Regional	Singapore	64000 bps	X.25	DDN	Implementation Plan Q4/15
	BIS	Intra-Regional	Sri Lanka	64000 bps	IPS	DDN	IOT/POT Ccompleted.
	BBIS	Intra-Regional	Thailand	64000 bps	X. 25	DDN	Implemented
	BBIS	Intra-Regional	Nairobi	64000 bps	IPS		
Indonesia Jakarta	BIS	Intra-Regional	Australia	64000bps	IPS		Not Implemented

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	2	3	4	5	6	7	8
	BIS	Intra-Regional	Singapore	64000 bps	IPv4	VSAT	ATN/AMHS trial to be completed by end 2015. Implementation Plan Q1/16

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	2	3	4	5	6	7	8
Japan Tokyo	BBIS	Intra-Regional	Australia	64000 bps	IPS/IP-SNDCF	VPN	Schedule after CRV
	BBIS	Intra-Regional	China	64000 bps	IPS/IP-SNDCF	VPN	Implement from 2016 onwards Schedule after CRV
	BBIS	Intra-Regional	Hong Kong, China	64000 bps	X.25/SNDCF	VPN	Scheduled for Q4/2017
	BBIS	Inter-Regional	Europe	64000 bps	IP-SNDCF	DDN/ VPN	TBD
	BIS	Intra-Regional	Republic of Korea	64000 bps	IPS(IPv4)	VPN	Implement from 2016 onwards Scheduled after CRV
	BBIS	Inter-Regional	Russia Federation	64000 bps	IP-SNDCF	DDN/ VPN	TBD
	BBIS	Intra-Regional	Singapore	64000 bps	IPS/SNDCF	DDN	Scheduled for Q1/2018
	BIS	Intra-Regional	Taibei	64000 bps	IPS	VPN	Implement from 2016 onwards Scheduled after CRV
	BBIS	Inter-Regional	United States	64000 bps	X.25-SNDCF	DDN/ VPN	Implemented
Kiribati Tarawa	BIS	Intra-Regional	Fiji	Internet	IPv4	VPN	Intra-domain (User Agent) - Implementation Q3 2015
Lao PDR Vientiane	BIS	Intra-Regional	Thailand	32000 bps	IPv4	VSAT	Implemented
	BIS	Intra-Regional	Viet Nam	9600 bps	X.25		
Malaysia Kuala Lumpur	BIS	Intra-Regional	Brunei	64000 bps	IPS		
	BIS	Intra-Regional	Singapore	64000 bps	IPv4	VSAT	Scheduled for Q1/2018
	BIS	Intra-Regional	Thailand	64000 bps	IPv4	VSAT	Implemented

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	2	3	4	5	6	7	8
Maldives Male	BIS	Intra-Regional	Sri Lanka	64000 bps	X.25		

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Marshall Islands Majuro	BIS	Inter-Regional	United States	64000 bps	IP		VPN over Internet Intro-domain
Micronesia Federated State of Chuuk	BIS	Inter-Regional	United States	64000 bps	IP	VPN	VPN over Internet Intra-domain
Kosrae		Inter-Regional	United States	64000 bps	IP	VPN	VPN over Internet/Intra-domain
Ponapei		Inter-Regional	United States	64000 bps	IP	VPN	VPN over Internet/Intra-domain
Yap		Inter-Regional	United States	64000 bps	IP	VPN	VPN over Internet/Intra-domain
Mongolia Ulanbaatar	BIS	Intra-Regional	China	9600 bps	X.25		Router Implemented
Myanmar Yangon	BIS	Intra-Regional	China	64000 bps	IPS		
	BIS	Intra-Regional	Thailand	32000 bps	IPv4	VSAT	Implemented
Nepal Kathmandu	BIS	Intra-Regional	China	9600bps	X.25		Router Implemented
	BIS	Intra-Regional	India	64000 bps	IPS		Implemented
New Caledonia Noumea			Fiji	64000 bps	IPS (IPv4)	DDN	Intra-domain - Implementation 2016 Connect with Wallis

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	2	3	4	5	6	7	8
New Zealand Christchurch	BIS	Intra-Regional	Australia	64000 bps	IPS	VPN	Not Implemented
			Cook Is.	796 kbps	IPS		Intra-domain
			French Polynesia	64000 bps	IPS		Intra-domain
			Samoa	1.1 Mb	IPS		Intra-domain
			Tonga	85000 bps	IPS		Intra-domain
	BIS	Inter-Regional	USA	64000 bps	IPS		
Pakistan Karachi	BIS	Intra-Regional	Afghanistan	64000 bps	IPS		
	BIS	Intra-Regional	China	64000 bps	X.25		
	BIS	Intra-Regional	India	64000 bps	IPS		IOT/POT completed. TMC to be signed
	BIS	Inter-Regional	Oman	64000 bps	-		
	BIS	Inter-Regional	Iran	64000 bps	-		
	BIS	Inter-Regional	Kuwait	64000 bps	-		
Philippines	BIS	Intra-Regional	Hong Kong, China	64000 bps	X.25/IPS	DDN	Scheduled for Q4/2016
	BIS	Intra-Regional	Singapore	64000 bps	IPv4	DDN	2016
		Intra-Regional	United States	64000 bps	IPS		to be implementated in 2016
Republic of Korea Seoul	BIS	Intra-Regional	China	64000 bps	X.25		Implemented
	BIS	Intra-Regional	Japan	64000 bps	IPS(IPv4)	VPN	Implementation from 2016 onwards scheduled after CRV
Samoa Faleolo			New Zealand	1.1 Mb	IPS		Intra-domain

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	2	3	4	5	6	7	8
Singapore Singapore	BBIS	Intra-Regional	Australia	64000 bps	CLNP/IP-SNDCF	DDN	ATN/AMHS trial planned to completed by end 2015
	BBIS	Inter-Regional	Bahrain	64000 bps	IPv4	DDN	
	BIS	Intra-Regional	Brunei	9600 bps	IPv4	DDN	ATN/AMHS trial commence on 2017
	BBIS	Intra-Regional	India	64000 bps	X.25	DDN	Implemented
	BIS	Intra-Regional	Indonesia	64000bps	IPv4	VSAT	ATN/AMHS trial to be completed by end 2015. Implementation Plan Q1/16
	BBIS	Intra-Regional	Japan	64000 bps	IPS/SNDCF	DDN	ATN/AMHS trial commence on 2017 Scheduled for Q1/2018
	BIS	Intra-Regional	Malaysia	64000 bps	IPv4	VSAT	Scheduled for Q1/2018
	BIS	Intra-Regional	Philippines	64000 bps	IPv4	DDN	2016
	BIS	Intra-Regional	Sri Lanka	64000 bps	IPv4	DDN	Implementation Plan Q1/16
	BBIS	Intra-Regional	Thailand	64000 bps	CLNP/X.25	DDN	Implemented
	BBIS	Inter-Regional	United Kingdom	128000 bps	IPv4	VPN	Implemented
	BIS	Intra-Regional	Viet Nam	9600 bps	X.25	DDN	ATN/AMHS trial planned to completed by end 2015
Sri Lanka Colombo	BIS	Intra-Regional	India	64000 bps	IPS	DDN	Implementation Plan Q4/15
	BIS	Intra-Regional	Maldives	64000 bps	X.25		TBD
	BIS	Intra-Regional	Singapore	64000 bps	IPv4	DDN	Implementation Plan Q1/16
Thailand Bangkok	BIS	Intra-Regional	Bangladesh	32000 bps	IPv4	VSAT	Implemented
	BIS	Intra-Regional	Cambodia	64000 bps	IPv4	VSAT	Implemented

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	2	3	4	5	6	7	8
	BBIS	Intra-Regional	China	64000 bps	CLNP/X.25	DDN	

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	BBIS	Intra-Regional	Hong Kong, China	64000 bps	CLNP/X.25	DDN	Implemented
	BBIS	Intra-Regional	India	64000 bps	X.25	DDN	Implemented
	BBIS	Inter-Regional	Italy	64000 bps	IPv4	DDN	
	BIS	Intra-Regional	Lao PDR.	32000 bps	IPv4	VSAT	Implemented
	BIS	Intra-Regional	Malaysia	64000 bps	IPv4	VSAT	Implemented
	BIS	Intra-Regional	Myanmar	32000 bps	IPv4	VSAT	Implemented
	BBIS	Intra-Regional	Singapore	64000 bps	CLNP/X.25	DDN	Implemented
	BIS	Intra-Regional	Viet Nam	64000 bps	IPv4	VSAT	
Tonga Tongatapu	BIS	Intra-Regional	New Zealand	85000 bps	IPS		Intra-domain
Tuvalu Faleolo	BIS	Intra-Regional	Fiji	Internet	IPv4	VPN	Intra-domain (User Agent) - Implementation Q3 2015
United States Salt Lake City	BBIS	Inter-Regional	Australia	64000 bps	IPS		
			American Samoa				Intra-domain
	BBIS	Inter-Regional	Fiji	9600 bps	CLNP/X.25-SNDCF	DDN	The protocol will upgrade to IPS/SNDCF in 2016
	BBIS	Inter-Regional	Japan	64000 bps	X.25-SNDCF	DDN/ VPN	Implemented
		Intra-Regional	Marshall Islands	64000 bps	IP		Intra-domain/Internet
		Intra-Regional	Micronesia, Federated State of	64000 bps	IP		Intra-domain

Administration and Location	Type of Router	Type of Interconnection	Connected Router	Bandwidth	Network Protocol	Via	Remark
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	BIS	Inter-Regional	New Zealand	64000 bps	IPS		Implemented
		Intra-Regional	Philippines	64000 bps	IP		to be implementated in 2016
Viet Nam Ho Chi Minh/Hanoi	BIS	Intra-Regional	China	9600 bps	X.25		
	BIS	Intra-Regional	Hong Kong, China	64000 bps	X.25	DDN	TBD
	BIS	Intra-Regional	Lao PDR.	9600 bps	X.25		
	BIS	Intra-Regional	Singapore	9600 bps	X.25	DDN	ATN/AMHS trial planned to completed by end 2015
	BIS	Intra-Regional	Thailand	64000 bps	IPv4	VSAT	
Wallis Islands	BIS	Intra-Regional	Fiji	Internet	IPv4	VPN	Connect with New Caledonia - Implemente in 2016

Updated: JUN 2015

TABLE CNS III-3 - ATS DIRECT SPEECH CIRCUITS PLAN

EXPLANATION OF THE TABLE

Column

1 and 2	Circuit terminal stations are listed alphabetically by the Terminal I.
3	A — indicates ATS requirement for the establishment of voice communication within 15 seconds D — indicates requirements for instantaneous communications
4	Type of service specified: LTF — landline telephone (landline, cable, UHF, VHF, satellite) RTF — radiotelephone
5	Type of circuits; Direct (DIR) or Switched (SW) DIR — indicates a direct circuit connecting Terminals I and II. SW — indicates that a direct circuit does not exist and that the connection is established via switching at the switching centre(s) indicated in column 6. IDD — International direct dialling by public switch telephone network
6	Location of switching centre(s).
7	Remarks

Note 1.— Number of D and/or S circuits between Terminals I and II are indicated by numerical prefix, i.e. 2 D/S means 2 direct circuits and one switched circuit.

Note 2.— Pending the implementation of proper ATS voice circuits, and provided that aeronautical operational requirements are met, IDD services may be used for the ATS voice communications in low traffic areas.

– – – – – – – – – – –

TABLE CNE II-3 REQUIRED ATN INFRASTRUCUTRE ROUTING PLAN

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	**TERMINAL II**	**TYPE**	**SERVICE**	**DIR/SW**	**TO BE SWITCHED VIA**	
1	**2**	**3**	**4**	**5**	**6**	**7**
AFGHANSITAN						
KABUL ACC	KARACHI	A	LTF	DIR		
	LAHORE	A	LTF	DIR		
AMERICAN SAMOA (United States)						
PAGO PAGO APP	ALOFI	A	LTF	DIR		
	APIA/FALEOLO	A	LTF	DIR		
	NADI	A	LTF	DIR		
AUSTRALIA						
BRISBANE ACC	AUCKLAND	A	LTF	DIR		
	BALI	A	LTF	DIR		
	HONIARA	A	LTF	DIR		
	JAKARTA	A	LTF	DIR		
	NADI	A	LTF	SW	OAKLAND	
	OAKLAND	A	LTF	DIR		
	PORT MORESBY	A	LTF	DIR		
	UJUNG PANDANG	A	LTF	DIR		
MELBOURNE	BRISBANE	A	LTF	DIR	NETWORK OPERATION	
	COLOMBO	A	LTF	DIR		
	DIEGO GARCIA	A	LTF	DIR		
	JAKARTA	A	LTF	SW	BRISBANE	
	JOHANNESBERG	A	LTF	DIR		
	MALE	A	LTF	DIR		
	MAURITIUS	A	LTF	DIR		
	JAKATA ACC	A	LTF	DIR		
	BRISBANE	X	LTF	DIR		
PERTH APP	JAKATA ACC	A	LTF	DIR		
BANGLADESH						
DHAKA ACC	AGARTALA	A	LTF	IDD		
	KOLKATA	A	LTF	DIR		
	GUWAHATI	A	LTF			
	YANGON	A	LTF	SW	BANGKOK	
BRUNEI DARUSSALAM						
BRUNEI ACC	KOTA KINABALU	A	LTF	DIR		
	LABUAN	A	LTF	DIR		
	LIMBANG	A	LTF	DIR		
	MIRI	A	LTF	DIR		
CAMBODIA						
PHNOM PENH ACC	BANGKOK	A	LTF	DIR		
	HO CHI MINH	A	LTF	DIR		
	VIENTIANE	A	LTF	SW	BANGKOK	
CHINA						
BEIJING ACC	DALIAN	A	LTF	DIR		
	HOHHOT	A	LTF	DIR		
	JINAN	A	LTF	DIR		
	SHENYANG	A	LTF	DIR		
	TAIYUAN	A	LTF	DIR		
	ULAANBAATAR	A	LTF	DIR		
	ZHENGZHOU	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	**TERMINAL II**	**TYPE**	**SERVICE**	**DIR/SW**	**TO BE SWITCHED VIA**	
1	**2**	**3**	**4**	**5**	**6**	**7**
	GUANGZHOU	A	LTF	DIR		
	GUILIN	A	LTF	DIR		
	GUIYANG	A	LTF	DIR		
	WUHAN	A	LTF	DIR		
	NANCHANG	A	LTF	DIR		
CHENGDU ACC	GUIYANG	A	LTF	DIR		
	KUNMING	A	LTF	DIR		
	LANZHOU	A	LTF	DIR		
	LHASA	A	LTF	DIR		
	WUHAN	A	LTF	DIR		
	XI'AN	A	LTF	DIR		
DALIAN ACC	BEIJING	A	LTF	DIR		
	PYONGYANG	A	LTF	DIR		
	QINGDAO	A	LTF	DIR		
	INCHEON	A	LTF	DIR		
	SHENYANG	A	LTF	DIR		
GUANGZHOU ACC	CHANGSHA	A	LTF	DIR		
	GUILIN	A	LTF	DIR		
	HAIKOU	A	LTF	DIR		
	HONG KONG	D	LTF	DIR		
	MACAO	A	LTF	DIR		
	NANCHANG	A	LTF	DIR		
	NANNING	A	LTF	DIR		
	SANYA	A	LTF	DIR		
	TAIBEI	A	LTF	DIR		
	XIAMEN	A	LTF	DIR		
GUILIN ACC	CHANGSHA	A	LTF	DIR		
	GUANGZHOU	A	LTF	DIR		
	GUIYANG	A	LTF	DIR		
	NANNING	A	LTF	DIR		
GUIYANG ACC	CHANGHSA	A	LTF	DIR		
	CHENGDU	A	LTF	DIR		
	GUILIN	A	LTF	DIR		
	KUNMING	A	LTF	DIR		
	NANNING	A	LTF	DIR		
HAIKOU ACC	GUANGZHOU	A	LTF	DIR		
	HA NOI	A	LTF	DIR		
	HONG KONG	A	LTF	DIR		
	NANNING	A	LTF	DIR		
	SANYA	A	LTF	DIR		
HAILAR ACC	CHITA	A	LTF	DIR		
	HARBIN	A	LTF	DIR		
	SHENYANG	A	LTF	DIR		
HARBIN ACC	KHABAROVSK	A	LTF	DIR		
	HAILAR	A	LTF	DIR		
	SHENYANG	A	LTF	DIR		
	VLADIVOSTOK	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			
TERMINAL I	**TERMINAL II**	**TYPE**	**SERVICE**	**DIR/SW**	**TO BE SWITCHED VIA**	**REMARKS**
1	**2**	**3**	**4**	**5**	**6**	**7**
HEFEI ACC	JINAN	A	LTF	DIR		
	NANCHANG	A	LTF	DIR		
	SHANGHAI	A	LTF	DIR		
	ZHENGZHOU	A	LTF	DIR		
	WUHAN	A	LTF	DIR		
HOHHOT ACC	BEIJING	A	LTF	DIR		
	LANZHOU	A	LTF	DIR		
	TAIYUAN	A	LTF	DIR		
	ULAANBAATAR	A	LTF	DIR		
JINAN ACC	BEIJING	A	LTF	DIR		
	HEFEI	A	LTF	DIR		
	QINGDAO	A	LTF	DIR		
	SHANGHAI	A	LTF	DIR		
	TAIYUAN	A	LTF	DIR		
	ZHENGZHOU	A	LTF	DIR		
KUNMING ACC	CHENGDU	A	LTF	DIR		
	GUIYANG	A	LTF	DIR		
	HANOI	A	LTF	DIR		
	NANNING	A	LTF	DIR		
	VIENTIANE	A	LTF	DIR		
	YANGON	A	LTF	SW	BANGKOK	
LANZHOU ACC	CHENGDU	A	LTF	DIR		
	HOHHOT	A	LTF	DIR		
	LHASA	A	LTF	DIR		
	ULAANBAATAR	A	LTF	DIR		
	URUMQI	A	LTF	DIR		
	XI'AN	A	LTF	DIR		
LHASA	CHENGDU	A	LTF	DIR		
	KATHMANDU	A	LTF	DIR		
	LANZHOU	A	LTF	DIR		
	URUMQI	A	LTF	DIR		
NANCHANG ACC	CHANGSHA	A	LTF	DIR		
	GUANGZHOU	A	LTF	DIR		
	HEFEI	A	LTF	DIR		
	WUHAN	A	LTF	DIR		
	XIAMEN	A	LTF	DIR		
NANNING	GUANGZHOU	A	LTF	DIR		
	GUILIN	A	LTF	DIR		
	GUIYANG	A	LTF	DIR		
	HAIKOU	A	LTF	DIR		
	HA NOI	A	LTF	DIR		
	KUNMING	A	LTF	DIR		
QINGDAO ACC	DALIAN	A	LTF	DIR		
	JINAN	A	LTF	DIR		
	SHANGHAI	A	LTF	DIR		
	INCHEON	A	LTF	DIR		
SANYA ACC	GUANGZHOU	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	TERMINAL II	TYPE	SERVICE	DIR/SW	TO BE SWITCHED VIA	
1	2	3	4	5	6	7
	HAIKOU	A	LTF	DIR		
	HA NOI	A	LTF	DIR		
	HO CHI MINH	A	LTF	DIR		
	HONG KONG	A	LTF	DIR		
	MANILA	A	LTF	DIR		
SHANGHAI ACC	FUKUOKA	A	LTF	DIR		
	HEFEI	A	LTF	DIR		
	JINAN	A	LTF	DIR		
	NAHA	A	LTF	DIR		
SHENYANG ACC	BEIJING	A	LTF	DIR		
	DALIAN	A	LTF	DIR		
	HAILAR	A	LTF	DIR		
	HARBIN	A	LTF	DIR		
	PYONGYANG	A	LTF	DIR		
	VLADIVOSTOK	A	LTF	DIR		
SHENZHEN	MACAO	A	LTF	DIR		
TAIBEI ACC	GUANGZHOU	A	LTF	DIR		
	HONG KONG	D	LTF	DIR		
	MANILA	A	LTF	DIR		
	NAHA	D	LTF	DIR		
	SHANGHAI	A	LTF	DIR		
	INCHEON	A	LTF	DIR		
	XIAMEN	A	LTF	DIR		
TAIYUAN ACC	BEIJING	A	LTF	DIR		
	HOHHOT	A	LTF	DIR		
	JINAN	A	LTF	DIR		
	XI'AN	A	LTF	DIR		
	ZHENGZHOU	A	LTF	DIR		
URUMQI ACC	ALMA-ATA	A	RTF	DIR		
	BARNUAL	A	RTF	DIR		
	BISHEKEK	A	RTF	DIR		
	KHOVD	A	RTF	DIR		
	LAHORE	A	LTF	DIR		
	LANZHOU	A	LTF	DIR		
	RAWALPIND	A	LTF	DIR		
	ULAANBAATAR	A	LTF	DIR		
WUHAN ACC	CHANGSHA	A	LTF	DIR		
	CHENGDU	A	LTF	DIR		
	HEFEI	A	LTF	DIR		
	NANCHANG	A	LTF	DIR		
	ZHENGZHOU	A	LTF	DIR		
XIAMEN ACC	GUANGZHOU	A	LTF	DIR		
	NANCHANG	A	LTF	DIR		
	SHANGHAI	A	LTF	DIR		
	TAIBEI	A	LTF	DIR		
XI'AN ACC	CHENGDU	A	LTF	DIR		
	LANZHOU	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	TERMINAL II	TYPE	SERVICE	DIR/SW	TO BE SWITCHED VIA	
1	2	3	4	5	6	7
	TAIYUAN	A	LTF	DIR		
	ZHENGZHOU	A	LTF	DIR		
ZHANJIANG	HONG KONG	A	LTF	DIR		
ZHENGZHOU ACC	BEIJING	A	LTF	DIR		
	JINAN	A	LTF	DIR		
	TAIYUAN	A	LTF	DIR		
	WUHAN	A	LTF	DIR		
	XI'AN	A	LTF	DIR		
ZHUHAI APP	HONG KONG	A	LTF	DIR		
	MACAO	D	LTF	DIR		
HONG KONG, China						
HONG KONG ACC	GUANGZHOU	D	LTF	DIR		
	MACAO	D	LTF	DIR		
	MANILA	A	LTF	DIR		
	SANYA	A	LTF	DIR		
	SHANTOU	A	LTF	DIR		
	ZHANJIANG	A	LTF	DIR		
	TAIBEI	D	LTF	DIR		
	ZHUHAI	A	LTF	DIR		
MACAO, China						
MACAO TOWER	SHENZHEN	A	LTF	DIR		
	HONG KONG	D	LTF	DIR		
	ZHUHAI	D	LTF	DIR		
COOK IS.						
RAROTONGA	AUCKLAND	A	LTF	DIR		
	TAHITI/PAPEETE	A	LTF	DIR		
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA						
PYONGYANG ACC	DALIAN	A	LTF	DIR		
	SHENYANG	A	LTF	DIR		
	INCHEON	A	LTF	DIR		
	VLADIVOSTOK	A	LTF	DIR		
FIJI						
NADI ACC	ALOFI	A	LTF	DIR		
	APIA	A	LTF	DIR		
	AUCKLAND	A	LTF	DIR		
	BRISBANE	A	LTF	SW	AUCKLAND	
	HONIARA	A	LTF	SW	SYDNEY	
	NOUMEA	A	LTF	DIR		
	OAKLAND	A	LTF	DIR		
	PAGO PAGO	A	LTF	DIR		
	PORT VILA	A	LTF	DIR		
	VAVA'U	A	LTF	DIR		
	WALLIS	A	LTF	DIR		Via IDD
FRENCH POLYNESIA (France)						
TAHITI/PAPEETE ACC	AUCKLAND	A	LTF	IDD		
	ISLA DE PASCUA	A	LTF	DIR		
	OAKLAND	A	LTF	DIR		
	RAROTONGA	A	LTF	DIR		
GUAM (United States)						
GUAM I.	MOEN	A	LTF	DIR		
	YAP	A	LTF	DIR		
INDIA						

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			
TERMINAL I	TERMINAL II	TYPE	SERVICE	DIR/SW	TO BE SWITCHED VIA	REMARKS
1	2	3	4	5	6	7
AGARTALA APP	KOLKATA	A	LTF	DIR		
	DHAKA	A	LTF	IDD		
AHMEDABAD APP	MUMBAI	A	LTF	DIR		
	KARACHI	A	LTF	DIR	MUMBAI	D/S
AMRITSAR APP	DELHI	A	LTF	DIR		
	LAHORE	A	LTF	DIR		
KOLKATA ACC	AGARTALA	A	LTF	DIR		
	MUMBAI	A	LTF	DIR		
	DHAKA	A	LTF	DIR		
	DELHI	A	LTF	DIR		
	GUWAHATI	A	LTF	DIR		
	KATHMANDU	A	LTF	DIR		
	CHENNAI	A	LTF	DIR		
	NAGPUR	A	LTF	DIR		
	VARANASI	A	LTF	DIR		
	YANGON	A	LTF	DIR		
CHENNAI ACC	MUMBAI	A	LTF	DIR		
	KOLKATA	A	LTF	DIR		
	COLOMBO	A	LTF	DIR		
	KUALA LUMPUR	A	LTF	DIR		
	MEDAN	A	LTF	DIR		
	TIRUCHCHIRAPPA LLI	A	LTF	DIR		
	TRIVANDRUM	A	LTF	DIR		
	YANGON	A	LTF	IDD		
DELHI ACC	AMRITSAR	A	LTF	DIR		
	MUMBAI	A	LTF	DIR		
	KOLKATA	A	LTF	DIR		
	KARACHI	A	LTF	DIR		D/S
	KATHMANDU	A	LTF	IDD		
	LAHORE	A	LTF	DIR		
	VARANASI	A	LTF	DIR		2D
GUWAHATI	KOLKATA		LTF	DIR		
	DHAKA		LTF	IDD		
MUMBAI ACC	AHMEDABAD	A	LTF	DIR		
	KOLKATA	A	LTF	DIR		
	DELHI	A	LTF	DIR		
	KARACHI	A	LTF	DIR		2D
	CHENNAI	A	LTF	DIR		
	MALE	A	LTF	IDD		
	MAURITIUS	A	LTF	IDD		
	MOGADISHU	A	LTF	IDD		
	MUSCAT/SEEB	A	LTF	DIR		
	NAGPUR	A	LTF	DIR		
	SEYCHELLES	A	LTF	DIR		
NAGPUR APP	MUMBAI	A	LTF	DIR		
	KOLKATA	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	TERMINAL II	TYPE	SERVICE	DIR/SW	TO BE SWITCHED VIA	
1	2	3	4	5	6	7
TIRUCHCHIRAPPALLI APP	CHENNAI	A	LTF	DIR		
TRIVANDRUM ACC	CALICUT	A	LTF	DIR		
	COLOMBO	A	LTF	IDD		
	CHENNAI	A	LTF	DIR		
	MALE	A	LTF	DIR		
VARANASI ACC	KOLKATA	A	LTF	DIR		
	DELHI	A	LTF	DIR		
	KATHMANDU	A	LTF	DIR		
INDONESIA						
BALI ACC	BRISBANE	A	LTF	DIR		
	JAKARTA	A	LTF	DIR		
	KUPANG	A	LTF	DIR		
	MANADO	A	LTF	DIR		
	SURABAYA	A	LTF	DIR		
	UJUNG PANDANG	A	LTF	DIR		
BATAM TWR	JAKARTA	A	LTF	DIR		
	SINGAPORE	D	LTF	DIR		
	TANJUNG PINANG	D	LTF	DIR		
BIAK APP	DARWIN	A	LTF	DIR		
	JAYAPURA	A	LTF	DIR		
	MANILA	A	LTF	DIR		
	OAKLAND	A	LTF	DIR		
	UJUNG PANDANG	A	LTF	DIR		
JAKARTA ACC	BALI	A	LTF	DIR		
	BATAM	A	LTF	DIR		
	KOTA KINABALU	A	LTF	SW	SINGAPORE	
	KUALA LUMPUR	A	LTF	SW	SINGAPORE	
	MANILA	A	LTF	DIR		
	MEDAN	A	LTF	DIR		
	PADANG	A	LTF	DIR		
	PEKAN BARU	X	LTF	DIR		
	PERTH	A	LTF	DIR		
	PONTIANAK	A	LTF	DIR		
	RANAI	A	LTF	DIR		
	SINGAPORE	A	LTF	DIR		
	SYDNEY	X	LTF	DIR		
	TANJUNG PINANG	A	LTF	DIR		
	UJUNG PANDANG	A	LTF	DIR		
JAYAPURA APP	BIAK	A	LTF	DIR		
	PORT MORESBY	A	LTF	DIR		
	VANIMO	A	LTF	DIR		
KUPANG APP	BALI	A	LTF	DIR		
	DARWIN	A	LTF	DIR		
MANADO	BALI	A	LTF	DIR		
	UJUNG PANDANG	A	LTF	DIR		
MEDAN ACC	COLOMBO	A	LTF	DIR		
	JAKARTA	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	TERMINAL II	TYPE	SERVICE	DIR/SW	TO BE SWITCHED VIA	
1	2	3	4	5	6	7
	KUALA LUMPUR	A	LTF	DIR		
	CHENNAI	A	LTF	DIR		
	PADANG	A	LTF	DIR		
	SINGAPORE	A	LTF	SW	JAKARTA	
PADANG	JAKARTA	A	LTF	DIR		
	MEDAN	A	LTF	DIR		
	PEKAN BARU	A	LTF	DIR		
PEKAN BARU APP	JAKARTA	X	LTF	DIR		
	KUALA LUMPUR	A	LTF	DIR		
	MALACCA	A	LTF	DIR		
	MEDAN	A	LTF	DIR		
	SINGAPORE	A	LTF	DIR		
PONTIANAK TWR	JAKARTA	A	LTF	DIR		
	KUCHING	A	RTF	DIR		
	RANAI	A	LTF	DIR		
	SINGAPORE	A	LTF	DIR		
	TANJUNG PINANG	A	LTF	DIR		
RANAI	JAKARTA	A	LTF	DIR		
	KUCHING	A	LTF	DIR		
	PONTIANAK	A	LTF	DIR		
SURABAYA	BALI	A	LTF	DIR		
TANJUNG PINANG	BATAM	D	LTF	DIR		
	JAKARTA	A	LTF	DIR		
	PONTIANAK	A	LTF	DIR		
	SINGAPORE	D	LTF	DIR		
UJUNG PANDANG	BALI	D	LTF	DIR		
	BIAK	A	LTF	DIR		
	BRISBANE	A	LTF	DIR		
	JAKARTA	A	LTF	DIR		
	KOTA KINBALU	A	LTF	DIR		
	MANADO	A	LTF	DIR		
	MANILA	A	LTF	SW	JAKARTA	
	PORT MORESBY	A	LTF	SW	JAKARTA, SYDNEY	
	OAKLAND	A	LTF	DIR		
JAPAN						
FUKUOKA ACC	INCHEON	A	LTF	DIR		
	SHANGHAI	A	LTF	DIR		
NAHA ACC	MANILA	A	LTF	DIR		
	OAKLAND	A	LTF	DIR		
	SHANGHAI	A	LTF	DIR		
	INCHEON	A	LTF	DIR		
	TAIBEI	A	LTF	DIR		
SAPPORO ACC	KHABAROVSK	D	LTF	DIR		
	VLADIVOSTOK	A	LTF	DIR		
	YUZHNO SAKHALINSK	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	TERMINAL II	TYPE	SERVICE	DIR/SW	TO BE SWITCHED VIA	
1	2	3	4	5	6	7
TOKYO ACC	ANCHORAGE	A	LTF	SW		
	ANCHORAGE	D	LTF	DIR		
	OAKLAND	A	LTF	DIR		
	INCHEON	A	LTF	DIR		
JOHNSTON I. (United States)						
JOHNSTON I. TWR	OAKLAND	A	LTF	DIR		
KIRIBATI						
TARAWA	OAKLAND	A	LTF	DIR		
KIRITIMATI I.	OAKLAND	A	LTF	DIR		
LAO PEOPLE'S DEMOCRATIC REPUBLIC						
VIENTIANE FIC	BANGKOK	A	LTF	DIR		
	HA NOI	A	LTF	DIR		
	HO CHI MINH	A	LTF	DIR		
	KUNMING	A	LTF	DIR		
	PHNOM PENH	A	LTF	SW	BANGKOK	
	YANGON	A	LTF	SW	BANGKOK	
MALAYSIA						
JOHOR BAHRU APP	SINGAPORE	D	LTF	DIR		
	KUALA LUMPUR	A	LTF	DIR		
KOTA KINABALU ACC	BRUNEI	A	LTF	DIR		
	JAKARTA	A	LTF	SW	SINGAPORE	
	KUALA LUMPUR	A	LTF	DIR		
	KUCHING	A	LTF	DIR		
	MANILA	A	LTF	DIR		
	MIRI	A	LTF	DIR		
	SINGAPORE	A	LTF	DIR		
	TAWAU	A	LTF	DIR		
	UJUNG PANDANG	A	LTF	DIR		
KUALA LUMPUR ACC	BANGKOK	A	LTF	DIR		
	HO CHI MINH	A	LTF	DIR		
	JAKARTA	A	LTF	SW	SINGAPORE	
	JOHOR BAHRU	A	LTF	DIR		
	KUANTAN	A	LTF	DIR		
	KOTA KINABALU	A	LTF	DIR		
	CHENNAI	A	LTF	DIR		
	MALACCA	A	LTF	DIR		
	MEDAN	A	LTF	DIR		
	PEKAN BARU	A	LTF	DIR		
	SINGAPORE	D	LTF	DIR		
KUANTAN APP	SINGAPORE	A	LTF	DIR		
	KUALA LUMPUR	A	LTF	DIR		
KUCHING APP	KOTA KINABALU	A	LTF	DIR		
	PONTIANAK	A	LTF	DIR		
	RANAI	A	LTF	DIR		
	SINGAPORE	A	LTF	DIR		
LABUAN	BRUNEI	A	LTF	DIR		
LIMBANG	BRUNEI	A	LTF	DIR		
MALACCA APP	KUALA LUMPUR	A	LTF	DIR		
	PEKAN BARU	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	**TERMINAL II**	**TYPE**	**SERVICE**	**DIR/SW**	**TO BE SWITCHED VIA**	
1	**2**	**3**	**4**	**5**	**6**	**7**
MIRI	BRUNEI	A	LTF	DIR		
	KOTA KINABALU	D	LTF	DIR		
TAWAU APP	KOTA KINABALU	A	LTF	DIR		
MALDIVES						
MALE FIC	COLOMBO	A	LTF	IDD		
	MUMBAI	A	LTF	IDD		
	CHENNAI	A	LTF	IDD		
	MAURITIUS	A	LTF	IDD		
	MELBOURNE	A	LTF	IDD		
	TRIVANDRUM	A	LTF	IDD		
MARSHALL IS.						
MAJURO APP	OAKLAND	A	LTF	DIR		
KWAJALEIN APP	OAKLAND	A	LTF	DIR		
MICRONESIA, FEDERATED STATES OF						
KOSRAE APP	OAKLAND	A	LTF	DIR		
MOEN APP	GUAM I.	A	LTF	DIR		
	OAKLAND	A	LTF	DIR		
POHNPEI APP	OAKLAND	A	LTF	DIR		
YAP APP	GUAM I.	A	LTF	DIR		
	OAKLAND	A	LTF	DIR		
MONGOLIA						
ULAANBAATAR ACC	ABAKAN	A	LTF	DIR		
	BARNAUL	A	LTF	DIR		
	BEIJING	A	LTF	DIR		
	HUHHOT	A	LTF	DIR		
	IRKUTSK	A	LTF	DIR		
	KYZYL	A	LTF	DIR		
	LANZHOU	A	LTF	DIR		
	MUREN	A	LTF	DIR		
	URUMQI	A	LTF	DIR		
MYANMAR						
YANGON ACC	BANGKOK	A	LTF	DIR		
	KOLKATA	A	LTF	DIR		
	DHAKA	A	LTF	SW	BANGKOK	
	KUNMING	A	LTF	SW	BANGKOK	
	CHENNAI	A	LTF	IDD		
	VIENTIANE	A	LTF	SW	BANGKOK	
NAURU						
NAURU FIC	HONIARA	A	LTF	SW	SYDNEY	
	NADI	A	LTF	DIR		
	PORT MORESBY	A	LTF	SW	SYDNEY	
NEPAL						
KATHMANDU	KOLKATA	A	LTF	DIR		
	DELHI	A	LTF	IDD		
	LASHA	A	LTF	DIR		
	VARANASI	A	LTF	DIR		
NEW CALEDONIA (France)						
NOUMEA/LA TONTOUTA APP	HONIARA	A	LTF	SW	SYDNEY, NADI	
	NADI	A	LTF	DIR		
	PORT VILA	A	LTF	SW	NADI	

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			
TERMINAL I	**TERMINAL II**	**TYPE**	**SERVICE**	**DIR/SW**	**TO BE SWITCHED VIA**	**REMARKS**
1	**2**	**3**	**4**	**5**	**6**	**7**
NEW ZEALAND						
AUCKLAND	ALOFI	A	LTF	IDD		
	CHRISTCHURCH	A	LTF	DIR		
	ISLA DE PASCUA	A	LTF	IDD		
	NADI	A	LTF	DIR		
	OAKLAND	A	LTF	IDD		
	RAROTONGA	A	LTF	IDD		
	BRISBANE	A	LTF	DIR		
	TAHITI/PAPEETE	A	LTF	IDD		
NIUE (New Zealand)						
ALOFI APP	AUCKLAND	A	LTF	IDD		
	NADI	A	LTF	DIR		
	PAGO PAGO	A	LTF	DIR		
NORTHERN MARIANA IS. (United States)						
SAIPAN APP	OAKLAND	A	LTF	DIR		
PAKISTAN						
KARACHI ACC	AHMEDABAD	A	LTF	SW	MUMBAI	D/S
	MUMBAI	A	LTF	DIR		2D
	DELHI	A	LTF	DIR		D/S
	KABUL	A	LTF	DIR		
	MUSCAT	A	LTF	DIR		2D
	TEHRAN	A	LTF	DIR		2D
LAHORE ACC	AMRITSAR	A	LTF	DIR		
	DELHI	A	LTF	DIR		2D
	DUSHANBE	A	LTF	DIR		(Planned)
	KABUL	A	LTF	DIR		
	URUMQI	A	LTF	DIR		
PAPUA NEW GUINEA						
PORT MORESBY ACC	BRISBANE	A	LTF	DIR		
	CAIRNS	A	LTF	DIR		
	HONIARA	A	LTF	DIR		
	JAYAPURA	A	LTF	DIR		
	OAKLAND	A	LTF	DIR		
	UJUNG PANDANG	A	LTF	SW	SYDNEY, JAKARTA	
PHILIPPINES						
DAVAO APP	MACTAN	A	LTF	DIR		
	MANILA					NC
LAOAG APP	MANILA	A	LTF	DIR		
MACTAN APP	DAVAO	A	LTF	DIR		
	MANILA	A	LTF	DIR		
	ZAMBOANGA	A	LTF	DIR		
	TAGBILARAN TOWER	A	LTF	DIR		
MACTAN ACC	BACOLOD APP	A	LTF	DIR		
	LAGUINDINGAN APP	A	LTF	DIR		
BACOLOD APP	ILOILO TOWER	A	LTF	DIR		
KALIBO APP	ROXAS TOWER	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	TERMINAL II	TYPE	SERVICE	DIR/SW	TO BE SWITCHED VIA	
1	2	3	4	5	6	7
	CATICLAN TOWER	A	LTF	DIR		
MANILA ACC	BIAK					NC
	DAVAO					NC
	HO CHI MINH	A	LTF	DIR		
	HONG KONG	A	LTF	DIR		
	KOTA KINABALU	A	LTF	DIR		
	JAKARTA					NC
	LAOAG	A	LTF	DIR		
	MACTAN	A	LTF	DIR		
	NAHA	A	LTF	DIR		
	FUKUOKA	A	LTF	DIR		
	OAKLAND	D	LTF	DIR		
	SANYA	A	LTF	IDD		
	SINGAPORE	A	LTF	DIR		
	SUBIC BAY	A	LTF	DIR		
	TAIBEI	A	LTF	DIR		
	UJUNG PANDANG	A	LTF	DIR		
	CLARK	A	LTF	DIR		
	LEGASPI	A	LTF	DIR		
	KALIBO	A	LTF	DIR		
	PUERTO PRINCESA	A	LTF	DIR		
SUBIC BAY APP	MANILA	A	LTF	DIR		
REPUBLIC OF KOREA						
INCHEON ACC	DALIAN	A	LTF	DIR		
	FUKUOKA	D	LTF	DIR		
	PYONGYANG	A	LTF	DIR		
	NAHA	A	LTF	DIR		
	QINGDAO	A	LTF	DIR		
	SHANGHAI	A	LTF	DIR		
	TAIBEI	A	LTF	DIR		
	TOKYO	A	LTF	DIR		
SAMOA						
APIA/FALEOLO	AUCKLAND	A	LTF	DIR		
	PAGO PAGO	A	LTF	DIR		
	NADI	A	LTF	DIR		
	TONGATAPU	A	LTF	DIR		
SINGAPORE						
SINGAPORE ACC	BATAM	D	LTF	DIR		
	HO CHI MINH	A	LTF	DIR		
	JAKARTA	A	LTF	DIR		
	JOHOR BAHRU	D	LTF	DIR		
	KOTA KINABALU	A	LTF	DIR		
	KUALA LUMPUR	D	LTF	DIR		
	KUANTAN	A	LTF	DIR		
	KUCHING	A	LTF	DIR		
	MANILA	A	LTF	DIR		
	MEDAN	A	LTF	SW	JAKARTA	
	PEKAN BARU	A	LTF	DIR		
	PONTIANAK	A	LTF	DIR		
	TANJUNG PINANG	D	LTF	DIR		
SOLOMON IS.						
HONIARA ACC	BRISBANE	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	**TERMINAL II**	**TYPE**	**SERVICE**	**DIR/SW**	**TO BE SWITCHED VIA**	
1	**2**	**3**	**4**	**5**	**6**	**7**
	NADI	A	LTF	SW	SYDNEY	
	NAURU	A	LTF	SW	SYDNEY	
	NOUMEA	A	LTF	SW	SYDNEY, NADI	
	OAKLAND	A	LTF	SW		
	PORT MORESBY	A	LTF	DIR		
SRI LANKA						
COLOMBO ACC	BRISBANE	A	LTF	DIR		
	CHENNAI	A	LTF	DIR		
	MALE	A	LTF	DIR		
	MEDAN	A	LTF	DIR		
	TRIVANDRUM	A	LTF	DIR		
THAILAND						
BANGKOK ACC	HO CHI MINH	A	LTF	DIR		
	KUALA LUMPUR	A	LTF	DIR		
	PHNOM PENH	A	LTF	DIR		
	VIENTIANE	A	LTF	DIR		
	YANGON	A	LTF	DIR		
TONGA						
TONGATAFU APP	AUCKLAND	A	LTF	DIR		
	NADI	A	LTF	DIR		
VAVA'U	NADI	A	LTF	DIR		
TUVALU						
FUNAFUTI APP	NADI					
UNITED STATES						
ANCHORAGE ACC	ANADYR	A	LTF	DIR		
	MAGADAN	A	LTF	DIR		
	OAKLAND	A	LTF	DIR		
	TOKYO	A	LTF	SW	OAKLAND	
	TOKYO	D	LTF	DIR		
	VANCOUVER	A	LTF	DIR		
	PETROPAVLOVSK -KAMCHATSKY	A	LTF	DIR		
	VANCOUVER	D	LTF	DIR		
OAKLAND	AUCKLAND	A	LTF	IDD		
	BIAK	A	LTF	DIR		
	BRISBANE	A	LTF	DIR		
	KIRITIMATI I. TWR	A	LTF	DIR		
	GUAM I.	A	LTF	DIR		
	HONIARA	A	LTF	DIR		
	JOHNSTON I. TWR	A	LTF	DIR		
	KOROR	A	LTF	DIR		
	KOSRAE	A	LTF	DIR		
	KAWJALEIN	A	LTF	DIR		
	MAJURO ATOLL	A	LTF	DIR		
	MANILA	D	LTF	DIR		
	MOEN	A	LTF	DIR		
	NADI	A	LTF	DIR		
	NAHA	A	LTF	DIR		
	NAURU	A	LTF	DIR		
	PAGO PAGO APP	A	LTF	DIR		
	POHNPEI	A	LTF	DIR		
	PORT MORESBY	A	LTF	DIR		

ATS REQUIREMENTS FOR SPEECH COMMUNICATIONS			CIRCUIT			REMARKS
TERMINAL I	TERMINAL II	TYPE	SERVICE	DIR/SW	TO BE SWITCHED VIA	
1	2	3	4	5	6	7
	SAIPAN	A	LTF	DIR		
	SAPPORO	A	LTF	DIR		
	TAHITI	A	LTF	DIR		
	TARAWA TWR	A	LTF	DIR		
	TOKYO	A	LTF	DIR		
	UJUNG PANDANG	A	LTF	DIR		
	VANCOUVER	D	LTF	DIR		
	YAP	A	LTF	DIR		
VANUATU						
PORT VILA	NADI	A	LTF	DIR		
	NOUMEA	A	LTF	SW		
VIET NAM						
HA NOI ACC	NANNING	A	LTF	DIR		
	HO CHI MINH	A	LTF	DIR		
	KUNMING	A	LTF	DIR		
	SANYA	A	LTF	DIR		
	VIENTIANE	A	LTF	DIR		
HO CHI MINH ACC	BANGKOK	A	LTF	DIR		
	HA NOI	A	LTF	DIR		
	HONG KONG	A	LTF	DIR		
	KUALA LUMPUR	A	LTF	DIR		
	MANILA	A	LTF	DIR		
	PHNOM PENH	A	LTF	DIR		
	SANYA	A	LTF	DIR		
	SINGAPORE	A	LTF	DIR		
	VIENTIANE	A	LTF	DIR		
WALLIS AND FUTUNA IS. (France)						
WALLIS	NADI	A	LTF	DIR		Via IDD

TABLE CNS II-4 HF NETWORK DESIGNATORS

EXPLANATION OF THE TABLE

Column

1 Name of station, preceded by its location indicator.

2 Network designators assigned to the facility providing HF radiotelephony en-route aeronautical communications (selected from the provisions of the allotment plan in Appendix S27 to the ITU Radio Regulations).

NOTES

- *The ICAO designators for HF MWARA and VOLMET networks in the Asia and Pacific regions are derived from the ITU allotment area abbreviations as contained in Appendix S27 to the ITU Radio Regulations. The additionally sectorised sub-networks in accordance with provision 27/21 of the ITU Radio Regulation Appendix 27 were agreed and allocated by ASIA/PAC/3 RAN Meeting and consequential APANPIRG meetings.*

ITU allotment area:

- *Two- and three-letter alpha entries indicate major world air route areas (MWARA) and Four-letter alpha entries indicate VOLMET areas. Few frequencies selected from RDARA network are also included for en-route aeronautical communication.*

Location Indicator and Name of Location		HF Voice	Remarks
1		2	3
AFGHANISTAN			
OAKB	Kabul	MID 2	
AUSTRALIA			
YBBN	Brisbane	VASIA	
YBBB	Brisbane		
YPXM	Christmas Is	SEA	
YPDN	Darwin	SEA	
YMMM	Melbourne		
YPPM	Perth	SW, NW, INO1 and SEA3	
BANGLADESH			
VGFR	Dhaka		
BHUTAN			
VGFR	PARO/Paro	SEA 1A	
CAMBODIA			
VDPP	Phnom-Penh	SEA 2	
CHINA			
ZBPE	Beijing	NP, EA 1, VASIA	
ZGZU	Guangzhou	EA 1, SEA 1A, VASIA	
ZPKM	Kunming	EA 1, SEA 1A	
ZGSY	Sanya	EA , SEA	
ZSHA	Shanghai	CWP, EA 1, NP	
ZYSH	Shenyang	EA 1	

Location Indicator and Name of Location		HF Voice	Remarks
1		2	3
RCSS	Taibei	CWP	
ZWUQ	Urumqi	MID 2, EA 1	
HONG KONG, CHINA			
VHHK	Hong Kong	CWP, SEA 2, VPAC	
COOK ISLANDS			
NCRG	Avarua/Rorotonga	SP, RDARA 9	
DEMOCRATIC PEOPLE'S REPUBLIC			
OF KOREA			
ZKKK	Pyongyang	CWP, EA 1, EA 2, NCA 3	
FIJI			
NFFN	Nadi	SP, RDARA 9	
FRENCH POLYNESIA			
NTTT	Tahiti	SP	
INDIA			
VOMF	Chennai	SEA 1B	
VIDF	Delhi	MID 2	
VECF	Kolkata	SEA 1A, VASIA	
VABF	Mumbai (FIC)	MID 2, INO, VASIA	
INDONESIA			
WADZ	Bali	SEA 3	
WIIZ	Jakarta	SEA 3	
WIMZ	Medan	SEA 1B	

Location Indicator and Name of Location		HF Voice	Remarks
1		2	3
WAAZ	Ujungpandang	SEA 3	
JAPAN			
RORG	Naha	CWP	
RJDG	Fukuoka	CWP, NP	
RJTG	Tokyo	CWP, NP, VPAC	
KIRIBATI			
NGTA	Tarawa/Bonriki Int'l.	SP, RDARA 9	
LAO PEOPLE'S DEMOCRATIC REPUBLIC			
VLVT	Vientiane	SEA 2	
MALAYSIA			
WBFC	Johor Bahru	SEA 1	
WMFC	Kuala Lumpur	SEA 1B, SEA 2	
MALDVIES (REPUBLIC OF)			
VRMM	Male		
MONGOLIA			
ZMUB	Ulaan Baatar	NCA 3, EA 1, EA 2	
MYANMAR			
VYYY	Yangon	SEA 1A	
NAURU			
ANAU	Nauru	CWP, RDARA 9	
NEPAL			
VNSM	Kathmandu	SEA 1A, MID 2	
NEW ZEALAND			
NZZO	Auckland	SP, VPAC	

Location Indicator and Name of Location		HF Voice	Remarks
1		2	3
NIUE			
NIUE		RDARA 9	
PAKISTAN			
OPKR	Karachi	MID 2, VASIA	
OPLR	Lahore	MID 2	
PAPUA NEW GUINEA			
AYPY	Port Moresby	CWP	
PHILIPPINES			
RPHI	Manila	CWP, SEA 2	
REPUBLIC OF KOREA			
RKRR	Incheon	NCA 3, CWP	
SAMOA			
NSFA	Faleolo	SP, RDARA 9	
SINGAPORE			
WSJC	Singapore	SEA 2, SEA 3, VASIA	
SOLOMON ISLANDS			
AGGH	Honiara	RDARA 9	
SRI LANKA			
VCCC	Colombo	SEA 1B, INO	
THAILAND			
VTBB	Bangkok	VASIA	
TONGA			
NFTF	Fua'amotu Int'l.	SP, RDARA 9	
TUVALU			
NGFU	Funafuti Int'l.	SP, RDARA 9	

Location Indicator and Name of Location		HF Voice	Remarks
1		2	3
UNITED STATES OF AMERICA			
PHZH	Honolulu	SP, NP, CEP, CWP, VPAC	
VANUATU			
NVVV	Port Vila	RDARA 9	
VIET NAM			
VVNB	Ha Noi	SEA 2	
VVTS	Ho Chi Minh	SEA 2	
WALLIS & FUTUNA IS. (France)			
NLWW	Wallis/Hihifo	RDARA 9	

FREQUENCY ALLOTMENT PLAN FOR HF EN-ROUTE RADIOTELEPHONY NETWORKS - MWARA AND VOLMET

(in numerical order of frequencies)

Frequency (kHz)	ITU allotment area	CEP-1	CEP-2	CWP-1	CWP-2	EA-1	EA-2	INO-1	MID-2	NCA-3	NP	RDARA-9	SEA-1A	SEA-1B	SEA-2	SEA-3	SP	VASIA	VPAC	Remarks
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
2 863	V PAC																		X	
2 869	CEP		X																	
2 932	NP										X									
2 947	9											X								
2 965	V ASIA																	X		
2 998	CWP				X															
3 004	NCA									X										
3 016	EA					X														
3 413	CEP	X																		
3 425	9B											X								
3 455	CWP			X																
3 458	V ASIA																		X	
3 467	MID, SP								X								X			
3 470	SEA													X		X				
3 473	MID (1)																			
3 476	INO							X												
3 485	EA, SEA						X								X					
3 491	SEA												X							
4 657	CEP	X	X																	
4 666	CWP				X															
5 547	CEP		X																	
5 559	SP																X			
5 574	CEP	X																		
5 628	NP											X								
5 634	INO							X												
5 643	SP																X			
5 649	SEA														X					
5 652	CWP																			
5 655	EA, SEA						X								X					
5 658	MID								X											
5 661	CWP																			
5 664	NCA									X										
5 670	EA (3)													X						
5 673	V ASIA																	X		
6 532	CWP			X																
6 553	9											X								
6 556	SEA												X			X				
6 562	CWP																			
6 571	EA					X														
6 625	MID (1)																			
6 655	NP										X									
6 661	NP										(1)									
6 673	CEP		X																	
6 676	V ASIA																	X		
6 679	V PAC																		X	

Frequency (kHz)	ITU allotment area	CEP-1	CEP-2	CWP-1	CWP-2	EA-1	EA-2	INO-1	MID-2	NCA-3	NP	RDARA-9	SEA-1A	SEA-1B	SEA-2	SEA-3	SP	VASIA	VPAC	Remarks
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
8 828	V PAC																		X	
8 843	CEP	X																		
8 846	9											X								
8 849	V ASIA																	X		
8 867	SP																X			
8 879	INO							X									X			
8 897	EA					X														
8 903	CWP			X	X															
8 942	SEA														X					
8 951	(3)										X									
10 018	MID								X											
10 039	RDARA 3B, C(3)									X										
10 042	EA					X														
10 048	NP										X									
10 057	CEP	X																		
10 066	SEA												X							
10 081	CWP			X	X															
10 084	SP																(1)			
11 282	CEP		X																	
11 285	SEA													X						
11 297	(3)														X					
11 327	SP																(1)			
11 330	NP										X									
11 339	9											X								
11 384	CWP				X															
11 387	V ASIA																	X		
11 396	EA, SEA						X								X	X				
13 261	(3)																X			
13 273	(3)										X									
13 282	V PAC																		X	
13 285	V ASIA																	X		
13 288	MID, (3)		X						X											
13 297	EA					X														
13 300	CWP			X	X															
13 303	EA, NCA									X										
13 306	NCA, (1) INO							X												
13 309	EA, SEA						X								X					
13 318	SEA													X		X				
13 354	(3)	X																		
17 904	(4)	X	X	X	X						X						X			
17 907	EA, SEA						X							X	X	X				
17 958	NCA									X										
17 961	INO							X												

TABLE CNS II-5

ATS INTER-FACILITY DATA COMMUNICATION (AIDC) IMPLEMENTATION PLAN

EXPLANATION OF THE TABLE

Column

1 State/Administration – the name of the State/Administration;

2 Location of AIDC end system – the location of the AIDC end system under the supervision of State/Administration identified in column 1;

3 AIDC Pair – the correspondent AIDC end system;

Location – location of the correspondent AIDC end system

State/Administration – the name of the State/Administration responsible for management of the correspondent AIDC end system

A "/" is placed between the location and State/Administration

4 Transmission Means – the transmission means used for the AIDC messages exchanged between the corresponding AIDC pair, AFTN, AFTN/AMHS;

5 Target Date of Implementation – date of implementation of the AIDC end system in the form of xQyyyy or yyyy (quarter year);

6 Remarks – any additional information describing the AIDC end system or the AIDC service between the corresponding AIDC pair.

State/Administration	Location of AIDC System ATSU1	AIDC System Pair ATSU2 /Correspondent State – Administration	Transmission Means	Target date of Implementation xQyyyy	Remarks
1	2	3	4	5	6
AFGHANISTAN	Kabul ACC	Kabul ACC /Afghanistan	AFTN/AMHS		
AUSTRALIA	Brisbane ACC	Oakland ARTCC /USA	AFTN	Implemented	
			AFTN/AMHS		
		Auckland ACC /New Zealand	AFTN	Implemented	
			AFTN/AMHS		
		Melbourne ACC /Australia	AFTN	Implemented	
			AFTN/AMHS		
		Makassar ACC /Indonesia	AFTN	4Q2015	
			AFTN/AMHS		
		Nadi ACC /Fiji	AFTN	Implemented	
			AFTN/AMHS	Implemented	
		Port Moresby/PNG	AFTN		
			AFTN/AMHS	3Q2016	
	Melbourne ACC	Brisbane ACC /Australia	AFTN	Implemented	
			AFTN/AMHS		
		Jakarta ACC /Indonesia	AFTN		
			AFTN/AMHS		
		Mauritius ACC /Mauritius	AFTN	Implemented	
			AFTN/AMHS		
BANGLADESH	Dhaka ACC	Kolkata ACC /India	AFTN/AMHS	2017	
		Yangon ACC /Myanmar	AFTN/AMHS	2017	
BHUTAN					
BRUNEI DARUSSALAM					
CAMBODIA	Phnom Penh ACC	Bangkok ACC /Thailand	AMHS	2016	
		Vientiane ACC/Laos PDR	AMHS	2016	
		Ho Chi Minh ACC/Viet Nam	AFTN/AMHS	2016	
CHINA	Beijing ACC	Incheon ACC /Republic of Korea	AFTN		
		Ulaanbaatar ACC/Mongolia	AFTN	2016	
	Sanya ACC	Hong Kong ACC /Hong Kong, China	AFTN	Implemented	
		Ho Chi Minh ACC /Vietnam	AFTN		
	Kunming ACC	Yangon ACC /Myanmar	AFTN	2016	
	Guangzhou ACC	Hong Kong ACC /HK China	AFTN		

State/Administration	Location of AIDC System ATSU1	AIDC System Pair ATSU2 /Correspondent State – Administration	Transmission Means	Target date of Implementation xQyyyy	Remarks
1	2	3	4	5	6
	Taibei ACC	Hong Kong ACC /HK China	AFTN	Implemented	
	Urumqi ACC	Lahore ACC /Pakistan			
	Dalian ACC	Incheon ACC /Republic of Korea	AFTN	2015	
	Shanghai ACC	Fukuoka ATMC /Japan	AFTN		
HONG KONG, CHINA	Hong Kong ACC	Guangzhou ACC /China	AFTN		
		Sanya ACC /China	AFTN	Implemented	
		Manila ACC /Philippines	AMHS		
		Taibei ACC /China	AFTN	Implemented	
MACAO, CHINA	Macao ATZ				Automatic transfer of control with adjacant ATC units is applicable instead of AIDC
COOK ISLANDS					
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA					
FIJI	Nadi ACC	Auckland ACC /New Zealand	AFTN	Implemented	ICD V.1.0
		Brisbane ACC /Australia			ICD V. 1.0
			AFTN/AMHS	Implemented	
		Oakland ARTCC /USA			ICD V.1.0
			AFTN/AMHS	Implemented	
FRANCE ***FRENCH POLYNESIA*** ***NEW CALEDONIA***	Papeete ACC				
		Auckland ACC /New Zealand	AFTN	Implemented	ICD V. 2.0
		Oakland ARTCC /USA	AFTN	Implemented	
INDIA	Ahmedabad ACC	Karachi ACC /Pakistan	AFTN	3Q2016	
	Chennai ACC	Colombo ACC / Sri Lanka	AFTN	3Q2016	
		Jakarta ACC /Indonesia	AFTN		
		Kuala Lumpur ACC / Malaysia	AFTN	1Q2016	
		Male ACC /Maldives	AFTN	2017	
		Yangon ACC /Myanmar	AFTN	2017	
	Delhi ACC	Karachi ACC /Pakistan	AFTN		
		Lahore ACC /Pakistan	AFTN		
	Kolkata ACC	Dhaka ACC /Bangladesh	AFTN	2017	

State/Administration	Location of AIDC System ATSU1	AIDC System Pair ATSU2 /Correspondent State – Administration	Transmission Means	Target date of Implementation xQyyyy	Remarks
1	2	3	4	5	6
		Yangon ACC /Myanmar	AFTN	2016	
		Kathmandu ACC /Nepal	AFTN		
	Mumbai ACC	Karachi ACC /Pakistan	AFTN/AMHS		
		Male ACC /Maldives	AFTN	2017	
		Muscat ACC /Oman	AFTN		
		Seychelles ACC / Mauritius	AFTN		
	Varanasi ACC	Kathmandu ACC /Nepal	AFTN		
INDONESIA	Jakarta ACC	Melbourne /Australia	AFTN/AMHS		
		Colombo ACC / Sri Lanka	AFTN		
		Singapore ACC /Singapore	AFTN		
		Kuala Lumpur ACC / Malaysia	AFTN		
		Kota Kinabalu ACC /Malaysia	AFTN		
		Chennai ACC /India	AFTN		
	Makassar ACC	Brisbane ACC /Australia	AFTN	4Q2015	
			AFTN/AMHS		
JAPAN	Fukuoka ATMC	Port Moresby ACC/ PNG	AFTN		
		Kota Kinabalu ACC / Malaysia	AFTN		
		Manila ACC /Philippines	AFTN		
		Anchorage ACC /USA	AFTN	Implemented	ICD V.2.0
		Incheon ACC /Republic of Korea	AFTN	Implemented	ICD V.1.0
		Oakland ARTCC /USA	AFTN	Implemented	ICD V.2.0
		Shanghai ACC /China	AFTN		
		Taibei ACC /Taibei, China	AFTN	Implemented	ICD V.3.0
KIRIBATI					
LAO PEOPLE'S DEMOCRATIC REPUBLIC	Vientiane ACC	Bangkok ACC /Thailand	AMHS	2Q2015	
		Hanoi ACC /Veitnam	AFTN	2017	
		Phnom Penh ACC /Cambodia	AMHS	2016	
		Yangoon/ Myanmar	AFTN	2016	
		Ho Chi Minh/ Vietnam	AFTN	2017	
		Bangkok ACC /Thailand	AFTN	2Q2016	ICD V.3.0
		Singapore ACC /Singapore	AFTN	1Q2016	ICD V.3.0

State/Administration	Location of AIDC System ATSU1	AIDC System Pair ATSU2 /Correspondent State – Administration	Transmission Means	Target date of Implementation xQyyyy	Remarks
1	2	3	4	5	6
MALAYSIA	Kuala Lumpur ACC	Chennai ACC /India	AFTN	1Q2016	ICD V.3.0
		Ho Chi Minh ACC /Vietnam	AFTN	1Q2016	ICD V.3.0
		Jakarta ACC /Indonesia	AFTN		ICD V.3.0
		Singapore ACC /Singapore	AFTN	4Q2015	ICD V.3.0
		Jakarta ACC /Indonesia	AFTN		
	Kota Kinabalu ACC	Makassar ACC /Indonesia Manila ACC /Philippines	AFTN AFTN	4Q2015 2Q2016	 ICD V.3.0
	Kuching ACC	Singapore ACC /Singapore Colombo ACC/ Sri Lanka Melborne ACC /Australia	AFTN AFTN AFTN	1Q2016 2017 2017	ICD V.3.0
MALDIVES	Male ACC	Mumbai ACC / India	AFTN	2017	
		Chennai ACC /India	AFTN	2017	
		Mauritius ACC/Mauritius	AFTN	2017	
MARSHALL ISLANDS					
MICRONESIA (FEDERATED STATE OF)					
MONGOLIA		Beijing ACC/ China	AFTN	2016	
MYANMAR	Yangon ACC	Bangkok ACC /Thailand	AFTN	2016	ICD V.2.0
		Kolkata ACC /India	AFTN	2016	
		Chennai ACC /India	AFTN	2017	
		Kunming ACC /China	AFTN	2016	
		Vientianne ACC /Lao PDR	AFTN	2016	
		Dhaka ACC /Bangladesh	AFTN	2017	
NEPAL	Kathmandu ACC	Kolkata ACC /India	AFTN		
		Lhasa ACC /China	AFTN		
		Nadi ACC /Fiji	AFTN	Implemented	ICD V.1.0
		Port Moresy ACC/ PNG	AFTN	3Q2016	
NEW ZEALAND	Auckland ACC	Brisbane ACC /Australia	AFTN	Implemented	ICD V.1.0
		Nadi ACC /Fiji	AFTN	Implemented	ICD V.1.0
		Oakland ARTCC /USA	AFTN	Implemented	ICD V.2.0
		Papeete ACC /French Polynesia	AFTN	Implemented	ICD V.2.0
			AFTN/AMHS		

State/Administration	Location of AIDC System ATSU1	AIDC System Pair ATSU2 /Correspondent State – Administration	Transmission Means	Target date of Implementation xQyyyy	Remarks
1	2	3	4	5	6
PAKISTAN	Karachi	Mumbai ACC /India	AFTN		
		Muscat ACC /Oman	AFTN		
		Tehran ACC /Iran	AFTN		
		Delhi ACC /India	AFTN		
		Ahmadabad ACC /India	AFTN	3Q2016	
		Kabul ACC /Afghanistan	AFTN		
	Lahore ACC	Delhi ACC /India	AFTN		
		Urumqui ACC /China	AFTN/AMHS		
		Tajakistan ACC /Tajakistan	AFTN		
PALAU					
PHILIPPINES	Manila ACC	Hong Kong ACC /Hong Kong, China	AFTN	4Q2016	
			AFTN/AMHS		
		Singapore ACC /Singapore	AFTN	4Q2015	
			AFTN/AMHS		
		Taibei ACC/Taibei, China	AFTN	2Q2016	
			AFTN/AMHS		
		Kota Kinabalu ACC /Malaysia	AFTN	2Q2016	
			AFTN/AMHS		
		Ho Chi Minh ACC /Viet Nam	AFTN		
			AFTN/AMHS		
		Oakland ARTCC /USA	AFTN	1Q2017	
			AFTN/AMHS		
		Fukoka ATMC /Japan	AFTN		
			AFTN/AMHS		
		Makasar ACC /Indonesia	AFTN		
			AFTN/AMHS		
REPUBLIC OF KOREA	Incheon ACC	Fukoka ATMC /Japan	AFTN	Implemented	ICD V.1.0
		Dalian ACC /China	AFTN	2015	
SAMOA					

State/Administration	Location of AIDC System ATSU1	AIDC System Pair ATSU2 /Correspondent State – Administration	Transmission Means	Target date of Implementation xQyyyy	Remarks
1	**2**	**3**	**4**	**5**	**6**
SINGAPORE	Singapore ACC	Ho Chi Minh ACC /Vietnam	AFTN/AMHS	Implemented	
		Manila ACC /Philippines	AFTN/AMHS	4Q2015	
		Jakarta ACC /Indonesia	AFTN/AMHS		
		Kuala Lumpur ACC /Malaysia	AFTN/AMHS	1Q2016	
		Kota Kinabalu ACC /Malaysia	AFTN/AMHS	4Q2015	
		Kuching /Malaysia	AFTN/AMHS	1Q2016	
SOLOMON ISLANDS		Nadi ACC /Fiji			
		Port Moresby ACC/PNG			
		Brisbane ATSC /Australia			
SRI LANKA	Colombo ACC	Male ACC /Maldives	AFTN/AMHS	2017	
		Jakarta ACC / Indonesia	AFTN/AMHS		
		Chennai ACC /India	AFTN/AMHS	3Q2016	
		Melbourne ACC /Australia	AFTN/AMHS	1Q2017	
TIMOR LASTE					
THAILAND		Kuala Lumpur ACC /Malaysia	AFTN	2Q2016	
		Phnom Penh ACC /Cambodia	AMHS	2016	
		Vientiane ACC /Lao PDR	AMHS	2Q2015	
		Yangon ACC /Myanmar	AFTN	2016	
TONGA					
UNITED STATES	Oakland ARTCC	Auckland OAC /New Zealand	AFTN	Implemented	ICD V.2.0
		Fukuoka ATMC /Japan	AFTN	Implemented	ICD V.2.0
		Nadi ATMC /Fiji	AFTN	Implemented	ICD V.2.0
		Brisbane ACC /Australia	AFTN	Implemented	ICD V.2.0
		Tahiti ACC /Tahiti	AFTN	Implemented	ICD V 2.0
		Port Moresby/PNG	AFTN	3Q2016	
		Manila /Philippines	AFTN	1Q2017	
	Anchorage ARTCC	Anchorage ARTCC /United States	AFTN	Implemented	ICD V 2.0
		Fukuoka ATMC /Japan	AFTN	Implemented	ICD V.2.0
		Oakland ARTCC /United States	AFTN	Implemented	ICD V.2.0

State/Administration	Location of AIDC System ATSU1	AIDC System Pair ATSU2 /Correspondent State – Administration	Transmission Means	Target date of Implementation xQyyyy	Remarks
1	2	3	4	5	6
VIET NAM	Ho Chi Minh ACC	Sanya ACC /China	AFTN		
			AFTN/AMHS		
		Phnom Penh ACC /Cambodia	AFTN/AMHS	2016	
		Vientiane ACC /Lao PDR	AFTN/AMHS	2017	
		Singapore ACC /Singapore	AFTN/AMHS	Implemented	ICD V.3.0
		Manila /Philippines	AFTN		
		Kuala Lumpur /Malaysia	AFTN	1Q2016	

TABLE CNS II-6

RADIO NAVIGATION AIDS

EXPLANATION OF THE TABLE

Column

1 Name of the State and city (and aerodrome if different name than the city) or, for en-route aids, the location of the facility.

2 The designator number and runway type:

NINST — Visual flight runway
NPA — Non-precision approach runway
PA1 — Precision approach runway, Category I
PA2 — Precision approach runway, Category II
PA3 — Precision approach runway, Category III

and functions:

T — Terminal
E — En route

Note.— Precision approach category refers to the standard of facility performance to be achieved and maintained in accordance with the relevant Annex 10 specifications and not to the specifications of the ILS equipment itself, which are not necessarily the same.

3 ILS — Instrument landing system

4 L — Locator, either associated with an ILS or for use as an approach aid at an aerodrome.

5 DME — Distance measuring equipment. Aligned with the ILS shown in column 3 when the DME is required to serve as a substitute for a marker beacon. When aligned with VOR in column 6, indicates the DME to be collocated with the VOR.

6 VOR — VHF omnidirectional radio range.

7 Blank

8 Implementation Status for ILS

9 Implementation status for Locator

10 Implementation status for DME

11 Implementation status for VOR

Column

12 Remarks

Note.— Columns 3 to 6 *use the following symbols:*

R – Required

Blank Entry would mean no requirement.

Note.— Columns 8 to 11 *use the following symbols:*

I — Implemented.

X — Implementation status undetermined. (in red)

N — Not implemented. (in red)

P --- Planned (need to fill up Remarks column with planned implementation date in MM/YY format)

– – – – – – – – – – – – –

	Requirements						Implementation Status (July 15)				
State City/location (aerodrome)	Runway Function	ILS	L	DME	VOR		ILS	L	DME	VOR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
AMERICAN SAMOA (United States)											
PAGO PAGO	05 PA1	R	R	R	R		X	X	X	X	
	T			R	R				X	X	
	E			R	R				X	X	
AUSTRALIA											
Adelaide	PA1	R		R	R						
	T			R	R		I		I	I	
	E			R	R				I	I	
Albany	PA1	R		R							NDB
	T			R			I		I		NDB
Albury	NPA			R	R						
	T			R	R				I	I	
	E			R	R				I	I	
Alice Springs	PA1	R		R	R						
	T			R	R		I		I	I	
	E			R	R				I	I	
Amberly	PA1	R					I				DoD
Armidale	NPA			R							NDB
	T			R					I		NDB
	E			R					I		NDB
Avalon	PA1	R		R	R				I		
	T			R	R		I		I	I	
	E			R	R				I	I	
Ayers Rock	NPA			R					I		NDB
	T			R					I		NDB
	E			R					I		NDB
Beermullah	PA1	R					I				DoD
Brisbane	01 PA1	R		R	R		I		I	I	
	19PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
Broken Hill	NPA			R	R				I	I	
	T			R	R				I	I	
	E			R	R				I	I	
Broome	NPA			R					I		NDB
	T			R					I		NDB
	E			R					I		NDB
Cairns	15PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
Canberra	35PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
Carnarvon	NPA			R	R				I	I	
	T			R	R				I	I	
	E			R	R				I	I	
Christmas Island	NPA			R	R				I	I	
	T			R	R				I	I	
	E			R	R				I	I	
Cocos Island	NPA			R	R				I	I	
	T			R	R				I	I	
	E			R	R				I	I	
Coffs Harbour	NPA			R	R				I	I	
	T			R	R				I	I	
	E			R	R				I	I	

Cooma	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Cunnamulla	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Curtin	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Darwin	29PA1	R	R	R		I	I	I	
	T		R	R			I	I	
	E		R	R			I	I	
East Sale	22PA1	R	R			I	I		DoD
	T	R	R			I	I		DoD
Edinburgh	18PA1	R				I			DoD
Esperance	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Essendon	16PA1	R				I			
	T	R				I			
Geralton	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Gladstone	10PA1	R	R	R		I	I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Gold Coast	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Gove	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Groote Eylandt	NPA		R				I		NDB
	T		R				I		NDB
	E		R				I		NDB
Hamilton Island	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Hobart	12PA1	R	R	R		I	I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Kalgoorie	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Karratha	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Kununurra	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Launceston	32PA1	R	R	R		I	I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Learmonth	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Lord Howe Island	NPA		R				I		NDB
	T		R				I		NDB
	E		R				I		NDB
Mackay	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	

Managalore	NPA			R				I	
	E			R				I	
Meekatharra	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Melbourne	16PA3	R	R	R		I	I	I	
	27PA1	R	R	R		I	I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Merimbula	NPA		R				I		NDB
	T		R				I		NDB
	E		R				I		NDB
Mildura	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Moomba	NPA		R				I		NDB
	T		R				I		NDB
	E		R				I		NDB
Mount Gambier	NPA			R				I	
	T			R				I	
	E			R				I	
Mount Isa	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Newman	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Norfolk Island	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Nowra	21PA1	R	R			I	I		DoD
	T		R				I		DoD
	E		R				I		DoD
Oakey	14PA1	R	R	R		I	I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Paraburdoo	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Parkes	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Pearce	36PA1	R				I			DoD
	18PA1	R				I			DoD
Perth	03PA1	R	R	R		I	I	I	
	21PA1	R	R	R		I	I	I	
	24PA1	R	R	R		I	I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Port Headland	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Proserpine	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Richmond	28PA1	R				I			DoD
Rock Hampton	NPA		R	R			I	I	
	T		R	R			I	I	
	E		R	R			I	I	
Sydney	34R PA1	R	R	R		I	I	I	
	34L PA2	R	R	R		I	I	I	
	16R PA2	R	R	R		I	I	I	

	16L PA1	R		R	R	I		I	I	
	25PA1	R		R	R	I		I	I	
	7PA1	R		R	R	I		I	I	
	T			R	R			I	I	
	E			R	R			I	I	
Tamworth	30R PA1	R	R	R	R	I	I	I	I	
	T			R	R			I	I	
	E			R	R			I	I	
Tennant Creek	NPA			R	R			I	I	
	T			R	R			I	I	
	E			R	R			I	I	
Tindal	14PA1	R			R	I			I	DoD
	T				R				I	
	E				R				I	
Townsville	01PA1	R		R	R	I		I	I	
	T			R	R			I	I	
	E			R	R			I	I	
Wagga Wagga	23PA1	R		R	R	I		I	I	
	T			R	R			I	I	
	E			R	R			I	I	
Weipa	NPA			R	R			I	I	
	T			R	R			I	I	
	E			R	R			I	I	
Williamsdale	E				R				I	
Williamstown	12PA1	R				I				DoD
Yarrowee	E				R				I	
BANGLADESH										
CHITTAGONG	NPA		R	R	R		X	X	X	
	T			R	R			X	X	
	E			R	R			X	X	
COMILLA	E				R				X	
DHAKA (Zia intl)	14 PA1	R	R	R	R	X	X	X	X	
	T			R	R			X	X	
	E			R	R			X	X	
RAJSHAHI	E				R				X	
SAIDPUR	E				R				X	
BHUTAN										
PARO	NPA		R		R		X		X	
	T		R		R		I		X	
	E				R				X	
BRUNEI DARUSSALAM										
BRUNEI	21 PA1	R	R	R	R	I	I	I	I	
	T			R	R			I	I	
	E			R	R			I	I	
CAMBODIA										
PHNOM PENH	23 PA1	R	R	R	R	X	X	I	I	
	T			R	R			X	X	
	E			R	R			X	X	
SIEM REAP (Ankor)	NPA		R	R	R		X	I	I	

	T			R	R			X	X
	E			R	R			X	X
CHINA									
ALTAY	E			R	R			I	I
ANDONG	E			R	R			I	I
BAIHESI	E			R	R			I	I
BOSE	E			R	R			I	I
BAOTOU	E/T			R	R			I	I
BEIJING (Capital)	18R PA1	R	R	R		I	I	I	
	36L PA1	R	R			I	I		
	18L PA1	R	R			I	I		
	36R PA2	R	R	R	R	I	I	I	I
	01 PA2	R	R			I	I	I	
	19 PA1	R	R			I	I	I	
CENCUN	E			R	R			I	I
CHA'AN	E			R	R			I	I
CHANGCHUN/Longjia	06 PA1	R	R	R		I	I	I	
	24 PA1	R	R	R		I	I	I	
CHANGHAI	E			R	R			I	I
CHANGSHA/Huanghua	18 PA1	R	R	R	R	I	I	I	I
	36PA1	R	R	R		I		I	
CHANGSHENGQIAO	E			R	R			I	I
CHANGZHOU	E/T			R	R			I	I
CHANGZHOU/Benniu	11 PA1	R	R	R	R	I	I	I	I
	29 PA1	R	R			I	I	I	
CHAOSHAN	E			R	R			I	I
CHAOYANG	E/T			R	R			I	I
CHENGDU/Shuangliu	20R PA1	R	R	R	R	I	I	I	I
	02L PA2	R	R			I	I		
	02R PA3	R	R			I	I	I	
	20L PA1	R	R			I	I	I	
CHENGHAI	E			R	R			I	I
CHONGQING/Jiangbei	02L PA1	R	R	R	R	I	I	I	I
	20R PA1	R	R			I	I	I	
	02R PA1	R	R			I	I	I	
	20L PA1	R	R			I	I	I	
CHONGZHOU	E			R	R			I	I
CONGHUA	E			R	R			I	I
DAGUSHAN	E								

DAHUSHAN	E			R	R			I	I
DALI	E/T			R	R			I	I
DALIAN/Zhoushuizi	28 PA1	R	R	R	R	I	I	I	I
	10 PA1	R	R			I	I		
	E			R	R			I	I
DANDONG	E/T			R	R			I	I
DANGSHAN	E			R	R			I	I
DAWANGZHUANG	E			R	R			I	I
DENGKOU	E			R	R			I	I
DONGLIHU	E			R	R			I	I
DONGMULANTOU	E			R	R			I	I
DONGSHAN	E			R	R			I	I
DONGYING	E/T			R	R			I	I
DUNHUANG	E/T			R	R			I	I
EJINAQI	E			R	R			I	I
ENSHI	E			R	R			I	I
EREN	E			R	R			I	I
ERENHOT	E/T			R	R			I	I
FENGHUO	E			R	R			I	I
FUJIACHANG	E			R	R			I	I
FUKANG	E			R	R			I	I
FULING	E			R	R			I	I
FUQING	E			R	R			I	I
FUYANG	E			R	R			I	I
FUYU	E			R	R			I	I
FUZHOU/Changle	03 PA1	R	R	R	R	I	I	I	I
	21 PA1	R	R			I	I		
	E			R	R			I	I
GANLANBA	E			R	R			I	I
GAOYAO	E			R	R			I	I
GENGMA	E			R	R			I	I
GUANGZHOU (Baiyun)	02L PA1	R	R	R	R	I	I	I	
	20R PA1	R	R	R		I	I	I	
	01 PA1	R	R	R		I	I	I	

	19 PA1	R	R	R		I	I	I	
	02R PA1	R	R	R		I	I	I	
	20L PA1	R	R	R		I	I	I	
GUILIN/Liangjiang	01 PA1	R	R	R	R	I	I	I	I
	19 PA1	R	R	R		I	I	I	
GUANLAN	E			R	R			I	I
GUANZHUANG	E			R	R			I	I
GUIYANG	E/T			R	R			I	I
GUIYANG/Longdongbao	01 PA1	R	R	R	R	I	I	I	I
	19 PA1	R	R	R		I	I	I	
HAIKOU/Meilan	09 PA1	R	R	R	R	I	I	I	I
	19 PA1	R	R	R		I	I	I	
HAILAR	E			R	R			I	I
HAMI	E/T			R	R			I	I
HANGZHOU (Xiaoshan)	07 PA1	R	R	R	R	I	I	I	I
	25 PA1	R	R			I	I		
	06 PA1	R	R			I	I	I	
	24 PA1	R	R			I	I	I	
HARBIN (Taiping)	23 PA1	R	R	R	R	I	I	I	I
	05 PA1	R	R			I	I		
HEFEI (Xinqiao)	15 PA1	R	R	R	R	I	I	I	I
	33 PA1	R	R			I	I	I	
	E			R	R			I	I
HEIHE	E/T			R	R			I	I
HEDONG	E			R	R			I	I
HENGSHA	E			R	R			I	I
HEKOU	E			R	R			I	I
HOHHOT/Baita	08 PA1	R	R	R	R	I	I	I	I
	26 PA1	R	R			I	I	I	
	E			R	R			I	I
HOTAN/Hotan	11 PA1	R	R	R	R	I	I	I	I
	29 PA 1	R	R			I	I	I	
	E			R	R			I	I
HUAIAN	E/T			R	R			I	I
HUAIAN/Lianshui	04 PA1	R	R	R	R	I	I	I	I
	22 PA1	R	R			I	I	I	
	E			R	R			I	I
HUANGCHENG	E			R	R			I	I
HUANGHUA	E/T			R	R			I	I
HUANGPING	E			R	R			I	I

HUANGSHAN/Tunxi	13 PA1	R	R	R	R	I	I	I	I
	E			R	R			I	I
HUAIROU	E			R	R			I	I
HUAYUAN	E			R	R			I	I
HULUNBEIER/Hailar	27 PA1	R	R	R	R	I	I	I	I
	E			R	R			I	I
JIAYUGUAN	E/T			R	R			I	I
JIEYANG/Chaoshan	04 PA1	R	R	R	R	I	I	I	I
	22 PA1	R	R			I	I	I	
	E			R	R			I	I
JINAN (Yaoqiang)	01 PA1	R	R	R	R	I	I	I	I
	19 PA1	R	R			I	I	I	
	E			R	R			I	I
JINGNING	E			R	R			I	I
JINGTAI	E			R	R			I	I
JINNING	E			R	R			I	I
JINTANG	E			R	R			I	I
JIUTING	E			R	R			I	I
JINZHOU	E			R	R			I	I
KAIYUAN	E			R	R			I	I
KASHI/Kashi	08 PA1	R	R	R	R	I	I	I	I
	26 PA1	R	R	R		I	I	I	
	E			R	R			I	I
KOULING	E			R	R			I	I
KUNMING (Changshui)	03 PA1	R	R	R	R	I	I	I	I
	21 PA1	R	R	R		I	I	I	
	04 PA1	R	R	R		I	I	I	
	22 PA1	R	R	R		I	I	I	
	E			R	R			I	I
KUQA	E/T			R	R			I	I
LAIBIN	E			R	R			I	I
LANZHOU (Zhongchuan)	36 PA1	R	R	R	R	I	I	I	I
	18 PA1	R	R	R					
	E			R	R			I	I
LAOLIANGCANG	E			R	R			I	I
LEDU	E			R	R			I	I
LHASA/Gonggar	09L PA1	R	R	R	R	I	I	I	I
	27R PA1	R	R	R		I	I	I	
	E			R	R			I	I

LIANJIANG	E			R	R			I	I
LIANSHENGWEI	E			R	R			I	I
LIBO	E/T			R	R			I	I
LIJIANG/Sanyi	02 PA1	R	R	R	R	I	I	I	I
	20 PA1	R	R	R		I	I	I	
	E			R	R			I	I
LILING	E			R	R			I	I
LINLI	E			R	R			I	I
LIUPANSHUI	E/T			R	R			I	I
LIUZAO	R			R	R			I	I
LONGKOU	E			R	R			I	I
LONGMEN	E			R	R			I	I
LONGZAOCUN	E			R	R			I	I
LONGZHOU	E			R	R			I	I
LUANXIAN	E			R	R			I	I
LUOGANG	E			R	R			I	I
LUXI	E			R	R			I	I
MALONG	E			R	R			I	I
MANZHOULI/Xijiao	12 PA1	R	R	R	R	I	I	I	I
	30 PA1	R	R	R		I	I	I	
	E			R	R			I	I
MIZI	E			R	R			I	I
MOLING	E			R	R			I	I
MUDANJIANG/Hailang	22 PA1	R	R	R	R	I	I	I	I
	E			R	R			I	I
NALATI	E/T			R	R			I	I
NANCHANG/Changbei	03 PA1	R	R	R	R	I	I	I	I
	21 PA1	R	R	R		I	I	I	
	E			R	R			I	I
NANCHONG	E/T			R	R			I	I
NANJING (Lukou)	06 PA1	R	R	R	R	I	I	I	I
	24 PA1	R	R	R		I	I	I	
	07 PA1	R	R	R		I	I	I	
	25 PA1	R	R	R		I	I	I	
	E			R	R			I	I
NANKANG	E			R	R			I	I

NANLANG	E			R	R			I	I
NANNING (Wuxu)	05 PA1	R	R	R	R	I	I	I	I
	23 PA 1	R	R	R		I	I	I	
	E			R	R			I	I
NANTONG	E			R	R			I	I
NANXIONG	E								
NANXUN	E			R	R			I	I
NANYINGBINDAO	E			R	R			I	I
NINGBO/Lishe	13 PA1	R	R	R	R	I	I	I	I
	31 PA1	R	R	R		I	I	I	
	E			R	R			I	I
NINGSHAN	E			R	R			I	I
NIULING	E			R	R			I	I
PANLONG	E			R	R			I	I
PENGLAI	E			R	R			I	I
PINGZHOU	E			R	R			I	I
PIXIAN	E			R	R			I	I
POTOU	E			R	R			I	I
QIANXI	E			R	R			I	I
QIEMO	E			R	R			I	I
QIJIANG	E			R	R			I	I
QINGDAO/Liuting	17 PA1	R	R	R	R	I	I	I	I
	35 PA1	R	R	R		I	I	I	
	E			R	R			I	I
QINGYANG	E/T			R	R			I	I
QIQIHAR/Sanjiazi	17 PA1	R	R	R	R	I	I	I	I
	E			R	R			I	I
QITAI	E			R	R			I	I
QUANZHOU/Jinjiang	03 PA1	R	R	R	R	I	I	I	I
	21 PA1	R	R	R		I	I	I	
	E			R	R			I	I
RIKAZE	E/T			R	R			I	I
SANJIANG	E			R	R			I	I
SANXIA	E/T			R	R			I	I
SANYA/Phoenix	08 PA1	R	R	R	R	I	I	I	I
	26 PA1	R	R	R		I	I	I	
	E			R	R			I	I

SHACHE	E			R	R			I	I
SHANGHAI (Hongqiao)	18L PA1	R	R	R	R	I	I	I	I
	36R PA1	R	R	R		I	I	I	
	18R PA1	R	R	R		I	I	I	
	36L PA1	R	R	R		I	I	I	
	E			R	R			I	I
SHANGHAI (Pudong)	17L PA3	R	R	R	R	I	I	I	I
	35R PA2	R	R	R		I	I	I	
	16R PA1	R	R	R		I	I	I	
	34L PA1	R	R	R		I	I	I	
	17R PA1	R	R	R		I	I	I	
	35L PA1	R	R	R		I	I	I	
	16L PA1	R	R	R		I	I	I	
	34R PA1	R	R	R		I	I	I	
	E			R	R			I	I
SHANGRAO	E			R	R			I	I
SHANTOU	E			R	R			I	I
SHAZIYING	E			R	R			I	I
SHEKOU	E			R	R			I	I
SHENGZHOU	E			R	R			I	I
SHENYANG (Taoxian)	06 PA1	R	R	R	R	I	I	I	I
	24 PA1	R	R	R		I	I	I	
	E							I	I
SHENZHEN/Baoan	33 PA1	R	R	R	R	I	I	I	I
	15 PA1	R	R	R		I	I	I	
	16 PA1	R	R	R		I	I	I	
	34 PA1	R	R	R		I	I	I	
SHILONG	E			R	R			I	I
SHIQIU	E			R	R			I	I
SHUYUAN	E			R	R			I	I
SHUOFANG	E/T			R	R			I	I
TACHENG	E			R	R			I	I
TAIYUAN/Wusu	31 PA1	R	R		R	I	I		I
	13 PA1	R	R			I	I		
	E			R	R			I	I
TAOHUA	E			R	R			I	I
TIANJIN (Binhai)	34l PA1	R	R	R	R	I	I	I	I
	16R PA1	R	R	R		I	I	I	
	34R PA2	R	R	R		I	I	I	
	16L PA2	R	R	R		I	I	I	
	E			R	R			I	I
TIANMEN	E			R	R			I	I

TIANZHEN	E			R	R			I	I
TONGLIAO	E/T			R	R			I	I
TONGLU	E			R	R			I	I
TUMURTAI	E			R	R			I	I
URUMQI (Diwopu)	25 PA1	R	R	R	R	I	I	I	I
	07 PA1	R	R			I	I		
	E			R	R			I	I
WANCHANG	E			R	R			I	I
WANGQING	E			R	R			I	I
WEIHAI/Dashuipo	02 PA1	R	R	R	R	I	I	I	I
	20 PA1	R	R			I	I		
	E			R	R			I	I
WEIXIAN	E			R	R			I	I
WENZHOU/Longwan	03 PA1	R	R	R	R	I	I	I	I
	21 PA1	R	R			I	I		
	E			R	R			I	I
WONGYUAN	E			R	R			I	I
WUFENGXI	E			R	R			I	I
WUHAN/Tianhe	04 PA1	R	R	R	R	I	I	I	I
	22 PA1	R	R	R		I	I	I	
	E			R	R			I	I
WUXI	E			R	R			I	I
WUXI/Shoufang	03 PA1	R	R	R	R	I	I	I	I
	21 PA1	R	R	R		I	I	I	
	E			R	R			I	I
WUZHONG	E			R	R			I	I
XIAMEN (Gaoqi)	05 PA1	R	R	R	R	I	I	I	I
	23 PA1	R	R	R		I	I	I	
	E			R	R			I	I
XI'AN (Xianyang)	05L PA1	R	R	R	R	I	I	I	I
	23R PA1	R	R	R		I	I	I	
	05R PA2	R	R	R		I	I	I	
	23L PA1	R	R	R		I	I	I	
	E			R	R			I	I
XIANGTANG	E			R	R			I	I
XICHANG (Qingshan)	36 PA1	R	R	R	R	I	I	I	I
	E			R	R			I	I
XINGLIN	E								
XINGTANG	E								

XILINHOT	E			R	R			I	I
XINGLIN	E			R	R			I	I
XINING/Caojiapu	11 PA1	R	R	R	R	I	I	I	I
	29 PA1	R	R	R		I	I	I	
	E			R	R			I	I
XINQIAO	E			R	R			I	I
XINZHENG	E/T			R	R			I	I
XISHAN	E			R	R			I	I
XISHUANGBANNA/Gasa	16 PA1	R	R	R	R	I	I	I	I
	34 PA1	R	R	R		I	I	I	
	E			R	R			I	I
XISHUI	E			R	R			I	I
XUEJIADAO	E			R	R			I	I
XUYONG	E			R	R			I	I
XUZHOU/Guanyin	09 PA1	R	R	R	R	I	I	I	I
	27 PA1	R	R			I	I		
	E			R	R			I	I
YABRAI	E			R	R			I	I
YAN'AN	E/T			R	R			I	I
YANCHENG/Nanyang	04 PA1	R	R	R		I	I	I	I
	22 PA1	R	R			I	I		
	E			R	R			I	I
YANJI/Chaoyangchuan	09 PA1	R	R	R	R	I	I	I	I
	23 PA1	R	R			II	I		
	E			R	R			I	I
YANTAI/Penglai	05 PA1	R	R	R	R	I	I	I	I
	23 PA1	R	R			I	I		
	E			R	R			I	I
YIBIN	E			R	R			I	I
YINCHUAN	E/T			R	R			I	I
YINCHUAN/Hedung	03 PA1	R	R	R	R	I	I	I	I
	21 PA1	R	R			I	I		
	E			R	R				I I
YIWU	02 PA1	R	R			I	I		
	E			R	R			I	I
YINGDE	E			R	R			I	I
YUANTAN	E			R	R			I	I
YUNCHENG	E/T			R	R			I	I
ZHANGJIAJIE/Hehua	08 PA1	R	R	R	R	I	I	I	I

	26 PA1	R	R			I	I		
	E			R	R			I	I
ZHAOTONG	E/T			R	R			I	I
ZHENGZHOU/Xinzheng	02 PA1	R	R	R	R	I	I	I	I
	30 PA1	R	R	R		I	I	I	
	E			R	R			I	I
ZHOUKOU	E			R	R			I	I
ZHOUSHAN	E/T			R	R			I	I
ZIYANG	E			R	R			I	I
ZU'AN	E			R	R			I	I
COOK IS.									
RAROTONGA	NPA		R	R	R		X	X	X
	T			R	R			X	X
	E			R	R			X	X
DEMOCRATIC PEOPLE'S REP. OF KOREA									
PYONGYANG	NPA		R	R	R		I	X	X
	35 PA1	R	R			I	I		
	01 PA1	R	R			I	I		
	19 PA1	R	R			I	I		
	T			R	R			I	I
	E			R	R			I	I
FIJI									
NADI	02 PA1	R	R			I	I		
	T			R	R			I	I
	E			R	R			I	I
SUVA (Nausori)	NPA		R	R	R		I	I	I
	T			R	R			I	I
	E			R	R			I	I
FRENCH POLYNESIA (France)									
RANGIROA	NPA		R	R	R		I	I	I
	T			R	R			I	I
	E				R				I
TAHITI (Faaa)	04 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
GUAM (United States)									
GUAM I.	06L PA1	R	R	R	R	X	X	X	X
	T			R	R			X	X
	E			R	R			X	X
GUAM I. (Anderson AFB)	06R PA1	R		R	R	X		X	X
	T			R	R			X	X
	E			R	R			X	X

HONG KONG, China									
HONG KONG	07R PA2	R		R	R	I		I	I
	25L PA2	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
	E			R	R			I	I
	07L PA2	R		R	R	I		I	I
	25R PA3	R		R	R	I		I	I
INDIA									
AHMEDABAD	23 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
AMRITSAR	34 PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
BAGDOGRA	E			R	R			X	X
BELGAUM	E			R	R			I	I
BHUBANESHWAR	E			R	R			I	I
CALICUT	NPA		R	R	R		X	I	I
CHENNAI	07 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
COIMBATORE	E			R	R			I	I
DELHI (Indira Ghandi)	28 PA2	R	R	R	R	I	I	I	I
	27 PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
GUWAHATI	E			R	R			X	X
IMPHAL	E			R	R			X	X
KOLKATA	19L PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
LUCKNOW	27 PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
MADURAI	E				R				I
MUMBAI (Chhatrapati Shiviji Intl)	27 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
NAGPUR	32 PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
PATNA	25 PA1	R		R	R	I		I	I

	T			R	R			I	I
	E			R	R			I	I
PORT BLAIR	E			R	R			I	I
PRATAPGARH	E			R	R			I	I
SILCHAR	E			R	R			X	X
TIRUCHCHIRAPPALLI	27 PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
TRIVANDRUM	32 PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
VARANASI	27 PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
VISHAKHAPATNAM	E			R	R			I	I
INDONESIA									
AMBON (Patimura)	22 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
BALI (Ngurah Rai)	27 PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
BALIKPAPAN (Sepinggan)	25 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
BANJARMASIN (Syamsudin Noor)	10 PA1	R	R	R	R	I	I	I	I
	E			R	R			I	I
	T			R	R			I	I
BATAM (Hang Nadmn)	04 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
BIAK (Frans Kaisiepo)	11 PA1	R	R	R	R	X	X	I	I
	T			R	R			I	I
	E			R	R			I	I
JAKARTA (Halim Perdanakusuma)	24 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
JAKARTA (Soekarno Hattal)	07R PA1	R	R	R	R	I	I	I	I
	07L PA1	R	R	R	R	N	I	I	I
	T		R	R	R		I	I	I
	E		R	R	R		I	I	I
JAYAPURA (Sentani)	30 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I

KETAPANG	34 PA1	R		R	R	N		N	N
	T			R	R			N	N
	E			R	R			N	N
KUPANG (El Tari)	25 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
MANADO (Sam Ratulangi)	18 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
MEDAN (Polonia)	05 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
MERAUKE (Mopah)	NPA		R	R	R		I	I	I
	T			R	R			I	I
	E			R	R			I	I
PADANG (Tabing)	NPA		R	R	R		I	I	I
	T			R	R			I	I
	E			R	R			I	I
PALEMBANG (Sultan Mahmud Badaruddin II)	27 NPA	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
PANGKALPINANG	NPA			R	R			I	I
	T			R	R			I	I
	E			R	R			I	I
PEKANBARU	36 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
PONTIANAK (Supadio)	15 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
SURABAYA (Juanda)	10 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
TANJUNG PINANG (Kijang)	NPA		R	R	R		I	I	I
	T			R	R			I	I
	E			R	R			I	I
TARAKAN	NPA		R	R	R		I	I	I
	T			R	R			I	I
	E			R	R			I	I
TIMIKA(Tembagapura)	NPA		R	R	R		X	X	X
	T			R	R			X	X
	E			R	R			X	X
UJUNG PANDANG (Hasanuddin)	13 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
JAPAN									

ASAHIKAWA	E			R	R			I	I
DAIGO	E			R				I	
ERABU	E			R	R			I	I
FUKUE	E			R	R			I	I
FUKUOKA	16 PA1	R	R	R	R	I	I	I	I
	34 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
GOBOH	E			R				I	
HAKODATE	12 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
HIROSHIMA	10 PA3	R	R	R	R	I	I	I	I
	NPA		R	R	R		I	I	I
	T			R	R			I	I
	E			R	R			I	I
IKI	E			R	R			I	I
IWAKI	E			R	R			I	I
KAGOSHIMA	34 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
KANSAI	06L PA2	R	R	R	R	I	I	I	I
	06R PA2	R	R	R	R	I	I	I	I
	24L PA2	R	R	R	R	I	I	I	I
	24R PA2	R	R	R	R	I	I	I	I
	T			R	R			I	I
KOMATSU	E			R	R			I	I
KOWA	E			R				I	
KUGA	E			R	R			I	I
KUMAMOTO	07 PA3	R	R	R	R	I	I	I	I

	07 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
KUSHIMOTO	E			R	R			I	I
MIHO	E			R	R			I	I
MINAMI DAITO	E			R	R			I	I
MIYAKE JIMA	E			R	R			I	I
MIYAZU	E			R	R			I	I
NAGASAKI	32 PA2	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
NAGOYA	18 PA2	R	R	R	R	I	I	I	I
	36 PA3	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
NAHA	36 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
NARITA	34L PA1	R	R	R	R	I	I	I	I
	34R PA1	R	R	R	R	I	I	I	I
	16L PA1	R	R	R	R	I	I	I	I
	16R PA3	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
NIIGATA	28 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
OITA	01 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
OKAYAMA	07 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I

ONJUKU	E			R				I	
OSAKA	32L PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
OSHIMA	E			R	R			I	I
OTSU	E			R	R			I	I
SAPPORO (New Chitose)	01L PA1	R	R	R	R	I	I	I	I
	01R PA1	R	R	R	R	I	I	I	I
	19R PA3	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
SENDAI	27 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
SHIMIZU	E			R	R			I	I
SHINODA	E			R	R			I	I
TAKAMATSU	26 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
TATEYAMA	E			R				I	
TOKYO (Haneda)	22 PA1	R	R	R	R	I	I	I	I
	23 PA1	R	R	R	R	I	I	I	I
	34L PA1	R	R	R	R	I	I	I	I
	34R PA3	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
JOHNSTON I (United States)									
JOHNSTON ATOLL (Johnston I.)	NPA								
	T								
	E								
KIRIBATI									
KIRITIMATI I.	NPA			R	R			X	X

	T			R	R				X	X
	E			R	R				X	X
TARAWA (Bonriki Intl)	NPA		R	R	R			X	X	X
	T			R	R				X	X
	E			R	R				X	X
LAO PEOPLE'S DEMOCRATIC REPUBLIC										
PAKSE	E				R					X
VIENTIANE (Wattay)	14 PA1	R	R	R	R		X	X	X	X
	T			R	R				X	X
	E			R	R				X	X
MACAO, China										
MACAO	34 PA2	R		R	R		I		I	I
	16 IGS									
	T			R	R				I	I
	E			R	R				I	I
MALAYSIA										
ALOR SETAR (Sultan Abdul Halim)										
	NPA		R	R	R			I	I	I
	T			R	R				I	I
	E			R	R				I	I
IPOH (Sultan Azian Shah)										
	PA-I 04	R	R	R	R		I	I	I	I
	T			R	R				I	I
	E			R	R				I	I
JOHOR BAHRU	16 PA1	R	R	R	R		I	I	I	I
	T			R	R				I	I
	E			R	R				I	I
KERTEH	NPA			R	R				I	I
	T			R	R				I	I
	E			R	R				I	I
KOTA BHARU (Sultan Ismail Petra)	NPA		R	R	R			I	I	I
	T			R	R				I	I
	E			R	R				I	I
KOTA KINABALU	02 PA1	R	R	R	R		I	I	I	I
	T			R	R				I	I
	E			R	R				I	I
KUALA TERENGGANU (Sultan Mahmud)	NPA		R	R	R			I	I	I
	T			R	R				I	I
	E			R	R				I	I
KUANTAN	18 PA1	R	R	R	R		I	I	I	I
	T			R	R				I	I
	E			R	R				I	I
KUCHING	25 PA1	R	R	R	R		I	I	I	I
	T			R	R				I	I

	E			R	R			I	I
LABUAN	NPA	R	R	R	R	X	I	I	I
	T			R	R			I	I
	E			R	R			I	I
MALACCA	NPA		R	R	R		I	I	I
	T			R	R			I	I
	E			R	R			I	I
MERSING	E			R	R			I	I
MIRI	02 PA1 02	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
PENANG	04 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
PULAU LANGKAWI	03 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
PULAU TIOMAN	NPA			R	R			X	X
	T			R	R			X	X
	E			R	R			X	X
SANDAKAN	08 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
SIBU	13 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
SEPANG (KL Intl)	32R PA1	R		R	R	I		I	I
	14L PA1	R		R	R	I		I	I
	32L PA1	R		R	R	I		I	I
	14R PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
SUBANG (Sultan Abdul Aziz Shah)	33 PA1	R	R	R	R	I	I	I	I
	15 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
TAWAU	NPA	R	R	R	R	X	I	I	I
	T			R	R			I	I
	E			R	R			I	I
MALDIVES									
DHARAVANDHOO	NPA					X	X	X	X
FUVAHMULAH	NPA					X	X	X	X
GAN	NPA			R	R	X	X	I	I
HANIMADHOO	NPA					X	X	X	X

KAADEDHOO	NPA					X	X	X	X
KADHDHOO	NPA					X	X	X	X
KOODDOO	NPA					X	X	X	X
MAAMIGILI	NPA					X	X	X	X
MALE	36 PA1	R		R	R	I	X	I	I
	T			R	R			I	I
	E			R	R			I	I
THIMARAFUSHI	NINST					X	X	X	X
MARSHALL IS.									
MAJURO ATOLL (Marshall Is. Intl)	NPA			R	R			X	X
	T			R	R			X	X
	E			R	R			X	X
MICRONESIA (FEDERATED STATES OF)									
KOSRAE	NPA		R	R			X	X	
	T			R	R			X	X
	E			R	R			X	X
POHNAPEI	NPA			R	R			X	X
	T			R	R			X	X
	E			R	R			X	X
WENO I. (FM Chuuk Intl)	NPA		R	R			X	X	
	T			R	R			X	X
	E			R	R			X	X
YAP	NPA		R		R		X		X
	T			R	R			X	X
	E			R	R			X	X
MONGOLIA									
ULAANBAATAR	14 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
MYANMAR									
BAGO	E			R	R			I	I
CHANMYATHAZI	E				R			I	I
	T				R			I	I
DAWEI	E			R	R			I	I
	T			R	R			I	I
HEHO	T			R	R			I	I
HLEGU	T			R	R			I	I
LASHIO	E			R	R			I	I
	T			R	R			I	I
MANDALAY	17PA1	R		R	R	I		I	I
	T								
MYEIK	18PA1	R				X			

MYITKYINA	T			R	R			I	I	
NAYPYITAW	16PA1	R		R	R	I		I	I	
	T									
NYAUNG U	T			R	R			I	I	
PATHEIN	E			R	R			I	I	
	T			R	R			I	I	
SITTWE	T			R	R			I	I	Not Yet Commissioned
TACHILEIK	T			R	R			I	I	
THANDWE	T			R	R			I	I	
YANGON	21PA1	R				I				Use of Hlegu VOR/DME
	T			R	R			I	I	
NAURU										
NAURU I.	NPA		R	R	R		X	X	X	
	T			R	R			X	X	
	E			R	R			X	X	
NEPAL										
BHAIRAHAWA	E			R	R			X	X	
BIRATNAGAR	E			R	R			X	X	
JANAKPUR	E				R				X	
KATHMANDU	NPA		R	R	R		X	X	X	
	T			R	R			X	X	
	E			R	R			X	X	
NEPALGUNJ	E			R	R			X	X	
SIMARA	E			R	R			X	X	
NEW CALEDONIA (France)										
NOUMEA (La Tontouta)	11 PA1	R	R	R	R	I	I	I	I	
	T			R	R			I	I	
	E			R	R			I	I	
NEW ZEALAND										
AUCKLAND	05 PA1	R	R	R	R	I	I	I	I	
	23 PA1	R	R			I	I			
	T			R	R			I	I	
	E			R	R			I	I	
CHRISTCHURCH	02 PA1	R	R	R	R	I	I	I	I	
	20 PA1	R	R			I	I			
	T			R	R			I	I	
	E			R	R			I	I	
HOKITIKA	E			R				I		
WELLINGTON	NPA		R	R	R		I	I	I	
	T			R	R			I	I	

	E			R	R			I	I
NORTHERN MARIANA IS. (United States)									
OBYAN (Saipan Intl)	07 PA1	R			R	X			X
	T				R				X
	E				R				X
NIUE (New Zealand)									
NIUE	NPA		R				X		
	T			R				X	
	E			R				X	
PAKISTAN									
BINDO	E				R				I
CAPE MONZE	E								
CHORE	E								
GWADAR	NPA								
	T								
HANGU	E								
ISLAMABAD (Chaklala)	30 PA2	R	R	R	R	I	X	I	I
	T			R	R			I	I
	E			R	R			I	I
JIWANI	E			R	R			I	I
	E								
KALAT	E								
KARACHI (Jinnah)	25R PA2	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
LAHORE	36R PA2	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
MULTAN	E			R	R			I	I
NAWABSHAH	NPA		R	R	R		I	I	I
	T			R	R			I	I
	E			R	R			I	I
PANJGUR	E			R	R			I	I
PESHAWAR	NPA			R	R			I	I
	T			R	R			I	I
	E			R	R			I	I
RAHIM YAR KHAN	E			R	R			I	I
ZHOB	E			R	R			I	I
PALAU									

KOROR	NPA		R	R	R		X	X	X
	T			R				X	
PAPUA NEW GUINEA									
KIETA				R	R			X	X
MADANG	E			R	R			X	X
MOUNT HAGEN	NINST			R				X	
NADZAB				R	R			X	X
PORT MORESBY	14L PA1	R	R	R	R	X	X	X	X
	32R PA1	R		R	R	X		X	X
	T			R	R			X	X
	E			R	R			X	X
VANIMO	NINST			R				X	
WEWAK	E			R	R			X	X
PHILIPPINES									
BACOLOD-SILAY	03PA1	R		R	R	I		I	I
	T								
	E								
BASCO	T			R				I	
BUTUAN	T			R	R			I	I
	E								
CABANATUAN	E			R	R			I	I
CAGAYAN DE ORO	E			R	R			I	I
CATICLAN	T			R				I	
CAUAYAN	NPA			R	R			I	I
	T								
	E								
CLARK	02PA1	R		R	R	I		I	I
	20PA1								
	T								
	E								
COTABATO	NPA			R	R			I	I
	T								
	E								
DAVAO	05 PA1	R		R	R	I		I	I
	23 PA1								
	T								
	E								
DUMAGUETE	NPA				R				I
	T								
ILOILO	02PA1	R		R	R	I		I	I
	20PA1								
	T								

	E									
JOMALIG	E			R	R				I	I
KALIBO	NPA T E			R	R				I	I
LAOAG	NPA T E			R	R				I	I
LEGASPI	NPA T E			R	R				I	I
LIPA	E				R					I
LUBANG	E			R	R				I	I
MACTAN	04 PA1 22 PA1 T E	R		R	R		I		I	I
MANILA	06 PA1 24 PA1 T E	R		R	R		I		I	I
NAGA	NPA T E			R	R				I	I
PUERTA PRINCESA	NPA T E			R	R				I	I
ROXAS	NPA T E			R	R				I	I
SAN FERNANDO	E				R					I
SAN JOSE	NPA			R	R				I	I
SUBIC	T			R	R				I	I
TACLOBAN	NPA T E			R	R				I	I
TAMBLER	17PA1 T E	R		R	R		I		I	I
TUGUEGARAO	NPA T				R					I
ZAMBOANGA	09PA1 T	R		R	R		I		I	I

	E								
REPUBLIC OF KOREA									
ANGYANG	E				R				I
BUSAN	E				R				I
CHEONGJU	24R PA1	R			R	I			I
	24R NPA				R				I
	T				R				I
DAEGU	31L PA1	R			R	I			I
	31L NPA				R				I
	T				R				I
DALSUNG	E				R				I
GANGWON	E			R	R			I	I
GIMHAE	36L NPA			R	R			I	I
	36R PA1	R		R		I		I	
	36L PA1	R		R		I		I	
	36R NPA			R	R			I	I
	T			R	R			I	I
GIMPO	14R PA2	R		R		I		I	
	14L PA1	R	R	R		I	I	I	
	32R PA1	R	R	R		I	I	I	
	32R NPA			R	R			I	I
	32L PA1			R				I	
	32L NPA	R		R	R	I		I	I
	T			R	R			I	I
INCHEON	15R PA3	R		R		I		I	
	15L NPA			R	R			I	I
	33L PAI	R		R		I		I	
	33L NPA			R	R			I	I
	15L PA3	R		R		I		I	
	33R PA3	R		R		I		I	
	33R NPA			R	R			I	I
	T			R	R			I	I
JEJU	06 PA1	R		R		I		I	
	24 PA1	R		R		I		I	
	06 NPA			R				I	
	24 NPA			R	R			I	I
	T			R	R			I	I
	E			R	R			I	I
YANGYANG	33 PA1	R		R		I		I	
	33 NPA			R	R			I	I
	T			R	R			I	I
YANGJU	E			R	R			I	I
SAMOA									
FALEOLO (Faleolo Intl)	NPA		R	R	R		X	X	X
	T			R	R			X	X
	E			R	R			X	X
SINGAPORE									

PAYA LEBAR	NPA				R				I
	T				R				I
SELETAR	NINST								
SINGAPORE (Changi)	02L PA2	R		R		I		I	
	20R PA1	R		R		I		I	
	02C PA1	R		R	R	I		I	I
	20C PA2	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
SOLOMON IS.									
HONIARA (Henderson)	NPA		R	R	R		X	X	X
	T			R	R			X	X
	E			R	R			X	X
SRI LANKA									
COLOMBO (Bandaranaike)	04 PA1	R	R	R	R	N	I	I	I
	22 PA1	R	R	R	R	I	I	I	I
	T			R	R			I	I
	E			R	R			I	I
HIGURAKGODA (Mineriya)	25 PA1	R		R	R	N		N	N
	T			R	R			N	N
	E			R	R			N	N
THAILAND									
BANGKOK / Don Mueang INTL	21LPA1	R		R	R	I		I	I
	21RPA2	R		R	R	I		I	I
	03LPA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
BANGKOK / Suvarnabhumi INTL	19LPA2	R		R	R	I		I	I
	19RPA2	R		R	R	I		I	I
	01LPA2	R		R	R	I		I	I
	01RPA2	R		R	R	I		I	I
	T			R	R			I	I
	E								
CHIANG MAI / INTL	36PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
CHIANG RAI / Mae Fah Luang - Chiang Rai INTL	03PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
CHUMPHON	24PA1	R		R	R	I		I	I
	T			R	R			I	I
	E			R	R			I	I
KHON KAEN	NPA			R	R			I	I
	T			R	R			I	I
	E			R	R			I	I
KRABI	32PA1	R		R	R	I		I	I
	T			R	R			I	I

	E			R	R				I	I	
MAE HONG SON	NPA			R	R				I	I	
	T			R	R				I	I	
	E			R	R				I	I	
NAKHON PHANOM	15PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
NAKHON RATCHASIMA	06PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
NAKHON SI THAMMARAT	19PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
NAN	02PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
NARATHIWAT	02PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
PHITSANULOK	32PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
PHUKET / INTL	27PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
PRACHUAP KHIRI KHAN / Hua Hin	NPA			R	R				I	I	
	T			R	R				I	I	
	E			R	R				I	I	
RANONG	02PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
RAYONG / U-Tapao Pattaya INTL	18PA1	R	R	R	R		I	I	I	I	
	T			R	R				I	I	
	E			R	R				I	I	
SONGKHLA / Hat Yai INTL	26PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
SUKHOTHAI	36PA1	R		R			I		I		
	T			R					I		DME collocated with NDB
	E			R					I		
SURAT THANI	22PA1	R		R	R		I		I	I	
	T			R	R				I	I	
	E			R	R				I	I	
SURAT THANI / Samui	NPA			R	R				I	I	
	T			R	R				I	I	
	E			R	R				I	I	

TAK / Mae Sot	NPA			R	R			I	I	
	T			R	R			I	I	
	E			R	R			I	I	
TRANG	08PA1	R		R	R	I		I	I	
	T			R	R			I	I	
	E			R	R			I	I	
TRAT	NPA			R				I		DME Collocated with NDB
	T			R				I		
	E			R				I		
UBON RATCHATHANI	23PA1	R		R	R	I		I	I	
	T			R	R			I	I	
	E			R	R			I	I	
UDON THANI	30PA1	R		R	R	I		I	I	
	T			R	R			I	I	
	E			R	R			I	I	
TONGA										
FUA'AMOTU	NPA		R	R	R		X	X	X	
	T			R	R			X	X	
	E			R	R			X	X	
VAVA'U	NPA									
	T									
	E									
TUVALU										
FUNAFUTI	NPA									
	T									
	E									
UNITED STATES										
HONOLULU	08L PA1	R	R	R	R	X	X	X	X	
	04R PA1	R	R	R	R	X	X	X	X	
	T			R	R			X	X	
	E			R	R			X	X	
KAHULUI	02 PA1	R		R	R	X		X	X	
	T			R	R			X	X	
	E			R	R			X	X	
VANUATU										
PORT VILA (Bauerfield)	NPA			R	R			X	X	
	T			R	R			X	X	
	E			R	R			X	X	
SANTO (Pekoa)	NPA									
	T									
	E									
VIET NAM										
DA NANG	35R PA1	R	R	R	R	X	X	X	X	
	T			R	R			X	X	

	E			R	R			X	X	
HA NOI (Noi Bai)	11 PA1	R	R	R	R	X	X	X	X	
	T			R	R			X	X	
	E			R	R			X	X	
HO CHI MINH (Tan Son Nhut)	25R PA1	R	R	R	R	X	X	X	X	
	T			R	R			X	X	
	E			R	R			X	X	
WALLIS AND FUTUNA IS. (France)										
WALLIS (Hihifo)	NPA		R	R	R		I	I	I	02/15
	T			R	R			I	I	02/15
	E			R	R			I	I	02/15

TABLE CNS II-7

SURVEILLANCE

EXPLANATION OF THE TABLE

Column

1 ATS Units to consider are ACC units and Approach units responsible for International airports and alternate aerodromes, International airports and alternate aerodromes.

2 The category may be: R, S, T or AD. Categories R,S, T are defined in the Seamless ATM plan. AD means Aerodrome.

3 Indicate Yes if part(s) of the airspace referred to in Column 2 is (are) not covered by surveillance listed in column 6, and in column remarks when such gaps are planned to be bridged

4 Indicate Yes or No.

Indicate No in case of standalone displays of ATS surveillance data (should not be used operationally)

5 Indicate Yes or No

6 List all types of surveillance used:

PSR
SSRmS
SSRmAC
ADS-B
ADS-C
MLAT
WAM
PRM

7 According to the definition in Doc 9830 Appendix B

8 Remarks

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
AFGHANISTAN							
AUSTRALIA							
International Airports							
Adelaide	**C**						Adelaide, Summertown
TCU			YES	YES	PSR+SSRmS+SSRmAC		
APP			YES	YES	PSR+SSRmS+SSRmAC		
TWR			YES	YES	PSR+SSRmS+SSRmAC		
Cairns	**C**						Redden Creek, Hanns Tableland
TCU			YES	YES	PSR+SSRmS+SSRmAC		
APP			YES	YES	PSR+SSRmS+SSRmAC		
TWR			YES	YES	PSR+SSRmS+SSRmAC		
Brisbane	**C**						Mt Hardgrave, Brisbane, Mt Sommerville
EC			YES	YES	PSR+SSRmAC+SSRmS+ADS-B		
APP			YES	YES	PSR+SSRmAC+SSRmS+		
ACC			YES	YES	PSR+SSRmAC+SSRmS+ADS-B		
TWR			YES	YES	PSR+SSRmAC+SSRmS+A-SMGCS+SMR	2	
Gold Coast	C						Mt Sommerville, Mt Hardgrave
APP			YES	YES	PSR+SSRmS+SSRmAC		
TWR			YES	YES	PSR+SSRmS+SSRmAC		
Melbourne	**C**						Gelliebrand Hill, Mt Macedon
EC			YES	YES	PSR+SSRmAC+SSRmS+ADS-B+		
APP			YES	YES	PSR+SSRmAC+SSRmS		
ACC			YES	YES	PSR+SSRmAC+SSRmS+ADS-B		
TWR			YES	YES	PSR+SSRmAC+SSRmS+ADS-B+A-SMGCS+SMR	2	
Perth	**C**						Perth, Kalamunda, Eclipse Hill
TCU			YES	YES	PSR+SSRmAC+SSRmS		
APP			YES	YES	PSR+SSRmAC+SSRmS		
TWR			YES	YES	PSR+SSRmAC+SSRmS+A-SMGCS+SMR	2	
Sydney	**C**						Sydney, Mt Boyce, Cecil Park
TCU			YES	YES	PSR+SSRmS+SSRmAC+WAM+MLAT		
APP			YES	YES	PSR+SSRmS+SSRmAC+WAM+MLAT		
TWR			YES	YES	PSR+SSRmS+SSRmAC+A-SMGCS+WAM+MLAT+SMR	2	
Darwin	**C**						Darwin, Knuckeys Lagoon
APP			YES	YES	PSR+SSRmS+SSRmAC		
TWR			YES	YES	PSR+SSRmS+SSRmAC		
Hobart	**D**						Hobart
APP			YES	YES	WAM+ADS-B		
TWR			YES	YES	WAM+ADS-B		
Karratha	**D**						Karratha
APP			YES	YES	ADS-B		
TWR			YES	YES	ADS-B		
Alternate aerodromes							
Alice Springs	**D**						Alice Springs

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
APP			YES	YES	ADS-B		
TWR			YES	YES	ADS-B		
Avalon	**D**						Gellibrand Hill, Mt Macedon
APP			YES	YES	PSR+ SSRm(S)+SSRm(A/C)		
TWR			YES	YES	PSR+ SSRm(S)+SSRm(A/C)		
Canberra	**C**						Mt Majura, Mt Bobbara
APP			YES	YES	PSR+ SSRm(S)+SSRm(A/C)		
TWR			YES	YES	PSR+ SSRm(S)+SSRm(A/C)		
Coffs Harbour	**D**						The Round Mountain, Point Lookout
APP			YES	YES	SSRm(S)+SSRm(A/C)+ADS-B		
TWR			YES	YES	SSRm(S)+SSRm(A/C)+ADS-B		
Kalgoorlie	**G**	Over aerodrome	YES	YES	-		
Launceston	**D**						Launceston
APP			YES	YES	WAM+ ADS-B		
TWR			YES	YES	WAM+ ADS-B		
Learmonth	**G**		YES	YES	ADS-B		Learmonth
Port Hedland	**G**	Over aerodrome	YES	YES	-		
Rock Hampton	**D**						Mt Alma
APP			YES	YES	SSRm(S)+SSRm(A/C)		
TWR			YES	YES	SSRm(S)+SSRm(A/C)		
Tindal	**C**						Tindal
APP			YES	YES	PSR+SSRm(A/C)		
TWR			YES	YES	PSR+SSRm(A/C)		
Townsville	**C**						Townsville, Tabletop
APP			YES	YES	PSR+ SSRm(S)+SSRm(A/C)		
TWR			YES	YES	PSR+ SSRm(S)+SSRm(A/C)		
Other aerodromes							
Broome	D		YES	YES	ADS-B		Broome
Albury	D		YES	YES	Higher level SSR coverage		Mt Bobbara
Tamworth	D		YES	YES	?		The Round Mountain
Mackay	D		YES	YES	SSRm(A/C)		Swampy Ridge
Hamilton Island	D		YES	YES	SSRm(A/C)		Swampy Ridge
BANGLADESH Dhaka APP					SSRmAC		
BHUTAN							
BRUNEI DARUSALAM Brunei APP					PSR + SSRmAC		

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
CAMBODIA					SSRmAC		
CHINA							
Beijing ACC					PSR + SSRmAC		
Beijing APP					PSR + SSRmAC		
Beijing TWR					PSR + SSRmAC		
Tianjin APP							
Tianjin TWR					SSRmAC		
Shijiazhuang APP							
Shijiazhuang TWR					SSRmAC		
Taiyuan ACC					PSR + SSRmAC		
Taiyuan APP							
Taiyuan TWR					PSR + SSRmAC		
Hohhot ACC					SSRmAC		
Hohhot APP							
Hohhot TWR					SSRmAC		
Guangzhou ACC					PSR + SSRmAC		
Guangzhou APP					PSR + SSRmAC		
Guangzhou TWR					PSR + SSRmAC		
Shenzhen APP							
Shenzhen TWR					PSR + SSRmAC		
Zhuhai ACC					PSR + SSRmAC		
Zhuhai APP					PSR + SSRmAC		
Zhuhai TWR					PSR + SSRmAC		
Sanya ACC					PSR + SSRmAC		
Sanya APP					PSR + SSRmAC		
Sanya TWR					PSR + SSRmAC		
Haikou ACC					PSR + SSRmAC		
Haikou APP							
Haikou TWR					PSR + SSRmAC		
Changsha ACC					PSR + SSRmAC		
Changsha APP							
Changsha TWR					PSR + SSRmAC		
Enshi TWR					SSRmAC		
Wuhan ACC					PSR + SSRmAC		
Wuhan APP							
Wuhan TWR					PSR + SSRmAC		

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
Zhengzhou ACC					PSR + SSRmAC		
Zhengzhou APP							
Zhengzhou TWR					PSR + SSRmAC		
Guilin ACC					PSR + SSRmAC		
Guilin APP							
Guilin TWR					PSR + SSRmAC		
Nanning ACC					SSRmAC		
Nanning TWR					SSRmAC		
Zhanjiang ACC					SSRmAC		
Zhanjiang APP							
Zhanjiang TWR					SSRmAC		
Shantou ACC					PSR + SSRmAC		
Shantou APP							
Shantou TWR					PSR + SSRmAC		
Kunming ACC					PSR + SSRmAC + AC		
Kunming APP							
Kunming TWR					PSR + SSRmAC		
Chengdu ACC					PSR + SSRmAC + ADS-C		
Chengdu APP							
Chengdu TWR					PSR + SSRmAC		
Guiyang ACC					PSR + SSRmAC		
Guiyang APP							
Guiyang TWR					PSR + SSRmAC		
Chongqing ACC					PSR + SSRmAC		
Chongqing APP							
Chongqing TWR					PSR + SSRmAC		
Shanghai ACC					PSR + SSRmAC		
Shanghai APP					PSR + SSRmAC		
Shanghai TWR					PSR + SSRmAC		

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
Jinan ACC					SSRmAC		
Jinan APP							
Jinan TWR					SSRmAC		
Qingdao ACC					SSRmAC		
Qingdao APP							
Qingdao TWR					SSRmAC		
Hefei ACC					PSR + SSRmAC		
Hefei APP							
Hefei TWR					PSR + SSRmAC		
Nanjing ACC					PSR + SSRmAC		
Nanjing APP							
Nanjing TWR					PSR + SSRmAC		
Lianyungang ACC					SSRmAC		
Lianyungang APP							
Lianyungang TWR					SSRmAC		
Xuzhou TWR					SSRmAC		
Hangzhou ACC					PSR + SSRmAC		
Hangzhou APP							
Hangzhou TWR					PSR + SSRmAC		
Nanchang ACC					PSR + SSRmAC		
Nanchang APP							
Nanchang TWR					PSR + SSRmAC		
Fuzhou ACC					PSR + SSRmAC		
Fuzhou APP							
Fuzhou TWR					PSR + SSRmAC		
Wenzou TWR					SSRmAC		
Xiamen ACC					PSR + SSRmAC		
Xiamen APP							
Xiamen TWR					PSR + SSRmAC		
Shenyang ACC					PSR + SSRmAC		
Shenyang APP							
Shenyang TWR					PSR + SSRmAC		

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
Dalian ACC					PSR + SSRmAC		
Dalian APP							
Dalian TWR					PSR + SSRmAC		
Harbin ACC					PSR + SSRmAC		
Harbin APP							
Harbin TWR					PSR + SSRmAC		
Xi'an ACC					PSR + SSRmAC		
Xi'an APP							
Xi'an TWR					PSR + SSRmAC		
Lanzhou ACC					SSRmAC + AC		
Lanzhou APP							
Lanzhou TWR					SSRmAC		
Urumqi ACC					PSR + SSRmAC + AC		
Urumqi APP							
Urumqi TWR					PSR + SSRmAC		
HONG KONG, CHINA							
Hong Kong ACC	S				PSR + SSRmAC + ADS-B		
Hong Kong APP	T		Yes	Yes	PSR + SSRmAC		
Hong Kong TWR	AD				PSR + SSRmAC + MLAT	2	SMR, A-SMGCS
MACAO, CHINA							
Macao TWR	AD		Yes	Yes	SSRmS+SSRmAC		SMR
COOK ISLANDS							
DPR KOREA							
Pyongyang							
Pyongyang ACC					SSRmAC		
Pyongyang APP					PSR + SSRmAC		PAR
Pyongyang TWR							
FIJI							
Naid ACC					ADS-B + ADS-C		
Nadi APP					ADS-B		
FRENCH POLYNESIA							
Tahiti ACC					SSRmAC + ADS-B + ADS-C		
Tahiti APP					SSRmAC		
Tahiti TWR							

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
INDIA							
Chennai ACC					PSR + ADS-C		MI
Chennai APP					PSR + ADS-C		MI
Chennai TWR					PSR + ADS-C		A-SMGCS
Delhi ACC					PSR + ADS-C		MI
Delhi APP					PSR + ADS-C		MI
Delhi TWR					PSR + ADS-C		A-SMGCS
Kolkata ACC					PSR + ADS-C		MI
Kolkata APP					PSR + ADS-C		MI
Kolkata TWR					PSR + ADS-C		A-SMGCS
Mumbai ACC					PSR + ADS-C		MI
Mumbai APP					PSR + ADS-C		MI
Mumbai TWR					PSR + ADS-C		A-SMGCS
Bangalore APP					PSR		MI
Bangalore TWR					PSR		MI
Shamshabad ACC					PSR		MI
Shamshabad APP					PSR		MI
Shamshabad TWR					PSR		MI
INDONESIA							
Jakarta ACC					PSR + SSRmAC + ADS-B		ADS-B Trial
Jakarta APP					PSR + SSRmAC + ADS-B		ADS-C Trial, A-SMGCS
Medan ACC					PSR + SSRmAC + ADS-B		
Medan APP					PSR + ADS-B		
Tanjung Pinang APP					SSRmAC		
Pontianak APP					ADS-B		
Pekanbaru APP					PSR + SSRmAC + ADS-B		
Palembang APP					PSR + SSRmAC + ADS-B		
Ujung Pandang ACC					PSR + SSRmAC + ADS-B		
Ujung Pandang APP					PSR + SSRmAC + ADS-B		ADS-C Trial, A-SMGCS
Banjarmasin APP					SSRmAC + ADS-B		
Balikpapan APP					PSR + SSRmAC + ADS-B		
Yogyakarta APP					PSR		
Surabaya APP					PSR		A-SMGCS

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
Bali ACC							
Bali APP					ADS-B		A-SMGCS
Biak APP					SSRmAC + ADS-B		
Jayapura ACC					PSR		
Jayapura APP					PSR		
Kupang ACC					ADS-B		
Kupang APP					ADS-B		
Tarakan ACC					PSR + ADS-B		
Batam ACC					SSRmS		
Batam APP					SSRmS + ADS-B		
Sorong ACC					SSRmS + ADS-B		
JAPAN							
Fukuoka ATMC					ADS-C		
Narita APP					PSR + SSRmAC + SSRmS		
Narita TWR					MLAT, PSRMLAT		SMR
Haneda TWR					MLAT		SMR
Chubu APP					PSR + SSRmAC + SSRmS		
Chubu TWR					MLAT		SMR
Osaka APP					PSR + SSRmAC + SSRmS		
Osaka TWR					MLAT		SMR
Kansai APP					PSR + SSRmAC + SSRmS		
Kansai TWR					MLAT		SMR
Fukuoka ACC					PSR + SSRmAC + SSRmS		
Fukuoka APP					PSR + SSRmAC + SSRmS		
Fukuoka TWR					MLAT		SMR
Naha ACC					PSR + SSRmAC + SSRmS		
Naha APP					PSR + SSRmAC + SSRmS		
Naha TWR					MLAT		SMR
Hakodate APP					PSR + SSRmAC		
Sendai APP					PSR + SSRmAC		
Tokyo ACC					PSR + SSRmAC + SSRmS		
Tokyo APP					PSR + SSRmAC + SSRmS		

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
Niigata APP					PSR + SSRmAC		
Chubu APP					PSR + SSRmAC + SSRmS		
Hiroshima APP					PSR + SSRmAC		
Takamatsu APP					PSR + SSRmAC		
Kochi APP					PSR + SSRmAC		
Matsuyama TWR					SSRmAC		
Kitakyusyu TWR					SSRmAC		
Nagasaki APP					PSR + SSRmAC		
Oita APP					PSR + SSRmAC		
Kumamoto APP					PSR + SSRmAC		
Miyazaki APP					PSR + SSRmAC		
Kagoshima APP					PSR + SSRmAC		
Shimojishima APP					PSR + SSRmAC		
Ishigaki APP					PSR + SSRmAC		
Sapporo ACC					PSR + SSRmAC + SSRmS		
KIRIBATI							
LAO PDR							
Vientiane ACC					SSRmAC + SSRmS		
Vientiane APP					PSR		

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
MALAYSIA							
Langkawi APP					PSR + SSRmAC		
Kuala Lumpur ACC					PSR + SSRmAC + SSRmS		
Lumpur APP					PSR + SSRmAC + ADS-C		
Johor Bharu APP					PSR + SSRmS		
Kota Bharu APP					PSR + SSRmS		
K. Kinabalu ACC					PSR + SSRmAC		
K. Kinabalu APP					PSR + SSRmAC		
Kuching ACC					PSR + SSRmAC		
Kuching APP							
Kuching TWR					PSR + SSRmAC		
Miri APP					PSR + SSRmAC		
MALDIVES							
MARSHALL ISLANDS							
MICRONESIA (FEDERATED STATE OF)							
MONGOLIA							
Ulaanbaatar ACC					ADS-C		
Ulaanbaatar APP					ADS-C		
MYANMAR							
Yangon ACC					SSRmAC + SSRmS + ADS-C		
Yangon APP					SSRmAC + SSRmS + ADS-C		
Mandalay APP					PSR + SSRmAC + SSRmS		
NAURU							
NEPAL							
Kathmandu APP					PSR + SSRmAC		
NEW CALEDONIA							
Tontouta ACC	A, D	Yes	Yes	Not applicable	ADS-B	Not applicable	ADS-B Tier 3 implemented, Tier 2 in progress
Tontouta APP	G						
NEW ZEALAND							
Chrischurch ACC					PSR + SSRmAC + SSRmS		
Christchurch TWR							

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
Auckland ACC					SSRmAC + SSRmS		
Auckland TWR							Auckland A-SMGCS has no SMR
Wellington TWR							
Queenstown TWR							Wide Area MDS planned for Queenstown in 2010
PAKISTAN							
Karachi ACC					PSR + SSRmAC		
Karachi APP			Yes	Yes	PSR + SSRmAC	Nil	
Karachi TWR					PSR + SSRmAC		
Lahore ACC					PSR + SSRmAC		
Lahore APP			Yes	Yes	PSR + SSRmAC	Nil	
Lahore TWR					PSR + SSRmAC		
Islamabad APP			Yes	No	PSR + SSRmAC	Nil	
Islamabad TWR					PSR + SSRmAC		
PAPUA NEW GUINEA							
Jacksons APP					PSR + SSRmAC		
Moresby ACC					PSR + SSRmAC		
PHILIPPINES							
Manila ATM Center					SSRmAC + SSRmS + ADS-B		Planned implementation on Dec. 16
Manila ACC					SSRmAC + SSRmS		
Manila APP					PSR + SSRmAC + SSRmS		
Clark APP					PSR + SSRmAC		
Mactan APP					PSR + SSRmAC		
Kalibo/Caticlan APP					PSR + SSRmAC + SSRmS		Planned implementation on Dec. 16
Bacolod APP					PSR + SSRmAC + SSRmS		Planned implementation on Dec. 16
Davao APP					PSR + SSRmAC + SSRmS		Planned implementation on Dec. 16

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
REPUBLIC OF KOREA							
Jeju APP					PSR + SSRmAC		
Jeju TWR							SMR
CheongjuTWR							
Seoul ACC					PSR + SSRmAC		
Seoul APP					PSR + SSRmAC		
Incheon TWR							SMR, A-SMGCS
Yangyang TWR							
Gimhae APP					PSR + SSRmAC		
Gimhae TWR							
Daegu APP					PSR + SSRmAC		
Jungwon APP					PSR + SSRmAC		
Gimpo ACC					PSR + SSRmAC		SMR
Gimpo APP					PSR + SSRmAC		SMR
Gimpo TWR							SMR, A-SMGCS
SINGAPORE							
Singapore ACC	S		Yes	Yes	PSR + SSRmS + ADS-B + ADS-C		
Singapore APP	T		Yes	Yes	PSR + SSRmS+SSRmAC		
Singapore TWR	AD		Yes	Yes	PSR+ADS-B+MLAT	2	
SOLOMON ISLANDS							
SRI LANKA							
Colombo ACC					SSRmAC + ADS-B + ADS-C		ADS-C Trial
Colombo APP					PSR		
THAILAND							
Bangkok ACC					PSR + SSRmAC + SSRmS		
Bangkok APP					PSR + SSRmAC + SSRmS		
Bangkok TWR						2	SMR, MLAT, A-SMGCS
SVB TWR							
Chiang Mai APP					SSRmAC		
Chiang Mai TWR							
Hat Yai APP					SSRmAC + SSRmS		
Hat Yai TWR							
Phuket APP					SSRmAC + SSRmS		
Phuket TWR							
Phitsanulok APP					PSR		

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
Phitsanulok TWR							
Hua Hin APP					PSR		
Hua Hin TWR							
U Taphao					SSRmAC		
TONGA					ADS-B		
UNITED STATES							
Alaska ACC					ADS-B + ADS-C		
Hilo, Hawaii ACC					SSRmAC		
Hilo, Hawaii APP					PSR		
Hilo, Hawaii TWR							
Honolulu, Hawaii ACC					SSRmS		
Honolulu, Hawaii APP					PSR		
Honolulu, Hawaii TWR							
Kahului, Hawaii APP					PSR + SSRmAC		
Kahului, Hawaii TWR							
Kokee, Hawaii ACC					PSR		
Lihue, Hawaii APP					PSR + SSRmAC		
Lihue, Hawaii TWR							
Mount Kaala, Hawaii ACC					PSR + SSRmAC		
Pahoa, Hawaii ACC					SSRmAC		
Kunianiau, Hawaii ACC					SSRmAC		
Guam ACC					PSR + SSRmAC		
Mount Santa Rosa, Guam ACC					PSR + SSRmS		
Mount Santa Rosa, Guam APP					PSR + SSRmAC		
Mount Santa Rosa, Guam TWR							
Kona, Hawaii ACC					SSRmAC		
VANUATU							
VIET NAM							
Hanoi ACC					PSR + SSRmAC + ADS-B		
Noibai APP					SSRmAC		
Noibai TWR							SMR, A-SMGCS

ATS Units Served	Category of airspace	Surveillance Gaps	Integration of Surveillance Information into ATC Situation Display	Multi-Surveillance Data Processing Capability	Surveillance Used	Level of A-SMGCS Implemented	Remarks
1	2	3	4	5	6	7	8
Ho Chi Minh ACC					PSR + SSRmAC + ADS-B +ADS-C		
Danang APP					PSR		
Honoi ACC							
Tansan Nhat APP					PSR		
Tansan Nhat TWR							SMR, A-SMGCS

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. In Flight Broadcast Procedure (IFBP) currently still in place	1998 Early 2008 June 2011 April 2012 July 2014	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, replace VSAT stations at 5 VSAT location for the relay link to RCAG sites, to improve power supply system. Latest update refer IP/15 from Myanmar to CNS SG/19 meeting 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. Further improvements need to be taken by the DCA Myanmar including both operational and technical arrangements	DCA Myanmar	December 2015 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. IATA conduct a visit and decide conducting a survey from its member airlines for the air/ground communication status in Yangon FIR by October 2015,	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~~ REMOVED	~~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)~~	Letter received from CAAP that this deficiency had been removed since November 2014. (successful installation of the new VOR/DME at NAIA having been commissioned through flight calibration since November 2014 after new ILS serving both runway 06 and 24 put into operation in early 2011)	~~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. Further follow-up	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 which was further updated in February 2015. 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; (status quo) 2. Mid-term by end of May 2015, 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	December 2015	A

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action**
				was made in end of 2014 and early 2015. A Remedial action plan was updated. New proposal for using landline has also proposed to be established between two States.	aging parts of VSAT. Afghanistan has successfully changed the service provider in February 2015. Site visit by expert from Afghanistan side is expected to Pakistan. 3. Long-term by end of end of 2015, establish a dedicated landline connection with multiplexers between Afghanistan and Pakistan to support both data and voice communication between COM centres and ACCs. A proposal has been received from Pakistan. PCAA recommended in July 2015 to use landline to recover both the AFTN and ATS voice communication through a service provider.			
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 February 2014 developed an action item to rectify the deficiency as soon as possible. End of 2014, an E1 (2Mbytes) circuit was ordered by both States. the terminating equipment also purchased and under configuration and testing	DCA. Myanmar and ATMB	October 2015	A
Regional air navigation plan – FASID Table CNS 1D	China & Pakistan	Improvement of ATS Direct Speech circuit performance and A/G communication and surveillance coverage between China and Pakistan	May 2014 RASMAG/19	The ATS direct speech circuit via IDD between Urumuqi and Lahore was observed not stable. Issues reported were in 2013	Remedial action plan was developed in May 2015 by both States through a COM coordination meeting. A VSAT is planned to be installed at Lahore for connection with Urumqi ACC and additional VHF station with VSAT link will be installed to cover the VHF gap at PURPA crossing point.	China ATMB and CAA. Pakistan	December 2015	A