INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

REPORT OF THE THIRTEEN MEETING OF COMMUNICATIONS, NAVIGATION AND SURVEILLANCE/ METEOROLOGY SUB-GROUP (CNS/MET SG/13) OF APANPIRG

BANGKOK, THAILAND 20 - 24 JULY 2009

The views expressed in this Report should be taken as those of the Sub-group and not for the Organization. This Report will be submitted to the APANPIRG/20 Meeting and any formal action taken will be published in due course as a Supplement to the Report of the APANPIRG Meeting.

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1. Introduction

1.1 The Thirteenth Meeting of the Communications, Navigation and Surveillance/Meteorology Sub-group (CNS/MET SG/13) of Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) was held at the ICAO Asia and Pacific Regional Office, Bangkok, Thailand, from 20 to 24 July 2009.

2. Attendance

2.1 The meeting was attended by 99 experts from 22 States and 3 International Organizations (WMO, IATA and IFALPA). A list of participants is at **Attachment 1.**

3. Opening of the Meeting

3.1 Mr. Mokhtar A. Awan, ICAO Regional Director, while welcoming the participants, highlighted the challenges the air transport industry is currently facing and a momentum expected in 2010 when air traffic is expected to bounce up, particularly from low cost carrier, privatization and de-regulation. Therefore, investment in CNS/ATM infrastructure will be required. He mentioned that ICAO has adopted the Performance Based Approach and the regional operational objectives are going to be developed which will have a salutary effect. He urged States to continue their support for ICAO position for next ITU World Radio Communications Conference (WRC) scheduled for early 2012, at national, regional and global levels. He also informed the meeting that the ICAO Asia and Pacific Office celebrated 60th anniversary of its establishment just before this meeting. While highlighting importance of cooperation among all members of the civil aviation community for the successful implementation of a seamless air navigation system, Mr. Awan commended highly of the mutual cooperation displayed by China and Cambodia in meeting users' needs of essential information on aviation weather hazards by providing SIGMET service for Phnom Penh FIR of Cambodia by Kunming Meteorological Watch Office of China commencing 1 June 2009.

3.2 In his opening remarks, Mr. Jeffrey Bollard, Chairman of the CNS/MET Sub-group, welcomed the participants and thanked the Regional Director for his opening remarks and guidance. He was pleased to note that a large number of participants attended the meeting. He identified some challenging issues to be addressed and highlighted working methodology of the Sub Group. He encouraged the participants to actively contribute to the deliberations during the meeting.

3.3 Dr. Olli Turpeinen, Chief MET/AIM Section of ICAO Headquarters emphasized the need for officers from Headquarters to support regional implementation activities. He highlighted the significance of business plan and stated how the plan has helped in the integration of resources amongst Regional Offices and Headquarters. He stated that only one common work programme has been developed both for the Headquarters and Regional Offices where implementation aspects need to be addressed by the both Regional Offices and Headquarters. He appreciated contribution made by the region and wished the Group for a very successful meeting.

4. Officers and Secretariat

4.1 Mr. Jeffrey Bollard, Chairman of the Sub-group, presided over the meeting. The two Vice Chairmen of the Group, Mr. Lo Weng Kee from Singapore and Mr. Shun Chi-ming, from Hong Kong, China chaired separate meetings of CNS ad hoc Working Group and the MET Working Group of the Sub-group.

4.2 Mr, Li Peng and Mr. Sujan Saraswati Regional Officers, CNS and Mr. Christopher F. Keohan, Regional Officer, MET, acted as the Secretaries of the meeting.

4.3 The meeting was also assisted by Olli Turpeinen, Chief of MET/AIM Section, Mr. Zhang Nan, Technical Officer and Mr. Robert Witzen, Communication Expert, CNS/AIRS Section, ANB ICAO Headquarters.

5. Organization, Working Arrangement, Language and Documentation

5.1 The working language was English inclusive of all documentation and this report. The Sub-group met as a single body on 20, 23 and 24 July 2009 to deal with the subjects of common interest in both CNS and MET fields. On other days the CNS and MET Working Groups met separately to deal with specific tasks.

5.2 A list of Working Papers and Information Papers presented at the meeting is placed at **Attachment 2.**

6. Terms of Reference of the CNS/MET Sub-Group

1) Ensure the continuing and coherent development of the ASIA/PAC Regional Air Navigation Plan in the CNS/MET fields in accordance with the Global Air Navigation Plan.

2) Review and identify deficiencies that impede the implementation or provision of efficient CNS/MET services in the ASIA/PAC Region.

3) Monitor CNS/ATM systems research and development, trials and demonstrations in the fields of CNS/MET and facilitate the transfer of this information and expertise between States.

4) Make specific recommendations aimed at improving CNS/MET services by the use of existing procedures and facilities and/or through the evolutionary implementation of CNS/ATM systems.

5) Review and identify inter-regional co-ordination issues in the fields of CNS/MET and recommend actions to address those issues.

7. Conclusions and Decisions - Definition

7.1 The Sub-groups of APANPIRG record their actions in the form of Draft Conclusions, Draft Decisions and Decisions with the following significance:

a) Draft Conclusions deal with matters, which, in accordance with the Sub-group's Terms of Reference, require the attention of States or actions by ICAO in accordance with established procedures;

b) Draft Decisions relate solely to matters dealing with the internal working arrangements of APANPIRG and its contributory bodies; and

c) Decisions relate solely to matters dealing with internal working arrangement of the Sub-group only.

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Draft Decision 13/1	-	Revision of Subject/Tasks List of ATNICG	7
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Draft Conclusion 13/38	-	Replace FASID Tables MET 4A and 4B by the ROBEX Handbook	46
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Draft Conclusion 13/40	-	Cost Recovery by Volcano Observatories	50
Draft Conclusion 13/41	-	Expanded WV SIGMET Test Development	53
Draft Conclusion 13/42	-	Implementation of SIGMET on Radioactive Clouds and Aerodrome Warnings on Tsunami	56
Draft Conclusion 13/43	-	Training on QMS	59

Reference		Subject	Page
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Draft Conclusion 13/45	-	Performance Framework Workshop/Seminar	62
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Draft Conclusion 13/47	-	Removal of the APANPIRG Air Navigation Deficiency AP- MET-16	65
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Agenda Item 1: Adoption of agenda

1.1 The agenda adopted by the meeting was as follows:

Agenda Item 1: Adoption of agenda

Agenda Item 2: Review:

1) follow-up action on reports of the CNS/MET SG/12 and APANPIRG/19 Meetings
2) relevant action items of 45th DGCA Conference
3) outcome of meetings of other related groups of APANPIRG

Agenda Item 3: Aeronautical Fixed Service (AFS):

1) review report of the Fourth Meeting of the ATN Implementation Coordination Group (ATNICG/4)
2) discuss other AFS related issues

Agenda Item 4: Aeronautical Mobile Service (AMS):

1) discuss satellite data-link communication continuity issues
2) discuss satellite voice communication
3) DFIS and other AMS related issues

Agenda Item 5: Navigation:

1) review reports of the Performance Based Navigation (PBN) Task Force
2) review navigation strategy
3) other radio navigation issues

Agenda Item 6: Surveillance:

1) review reports of the Eighth Meeting of ADS-B Study and Implementation Task Force
2) review strategy for the surveillance systems
3) discuss other surveillance related issues

Agenda Item 7: Aeronautical electromagnetic spectrum utilization:

1) review preliminary ICAO position for WRC-2011
2) review result of the Second APT Regional Preparatory Group Meeting

Agenda Item 8: Implementation of the World Area Forecast System (WAFS):

1) review WAFSOPSG and SADISOPSG issues
2) review the status of implementation of ISCS and SADIS
3) review the status of implementation and utilization of the WAFS products

Agenda Item 9: Implementation of observation, forecast and OPMET exchange:

1) review AMOFSG and OPMET/M TF issues
2) review regional requirements for OPMET information (FASID Tables)
3) review the status of implementation of 30-h TAF and VOLMET broadcast

Agenda Item 10: ICAO advisory & warning systems:

1) review METWSG issues
2) review the status of implementation of International Airways Volcano Watch (IAVW)
3) review the status of implementation of SIGMET and warnings

Agenda Item 11: MET/ATM coordination

1) review METATM TF issues
2) MET support for operations at aerodromes and terminal areas

Agenda Item 12: Other MET issues

1) implementation of Amendment 75 to Annex 3
2) review the status of implementation of quality management system

Agenda Item 13: Review Regional Performance Framework Objectives and forms:

1) CNS related Performance Framework Forms
2) MET related Performance Framework Forms
3) review and update CNS/ATM Implementation Planning Matrix

Agenda Item 14: Review of deficiencies in the CNS and MET fields:

1) status of CNS deficiencies (APANPIRG Deficiency List)
2) status of MET deficiencies (APANPIRG Deficiency List)

Agenda Item 15: Future Work Programme

Agenda Item 16: Any other business

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Agenda Item 2: Review:

1) follow-up action on reports of CNS/MET SG/12 and APANPIRG/19 Meetings
2) relevant action items of 45th DGCA Conference
3) outcome of meetings of other related groups of APANPIRG

Report of the CNS/MET SG/12 and APANPIRG/19 Meetings

2.1 The meeting carried out a review of the actions taken by APANPIRG/19 on Decisions and Conclusions formulated by the Twelfth Meeting of the CNS/MET Sub-group held in Bangkok from 21 to 25 July 2008. The meeting noted with satisfaction, actions taken and the significant progress achieved by the States and the Secretariat. It was noted that action on 90% of the Conclusions and Decisions of the APANPIRG/19 were complete. The status of the follow-up action as reviewed by the meeting is provided in **Appendix A** to the Report.

Action taken by Air Navigation Commission

2.2 The meeting noted the outcome and specific actions taken by the Air Navigation Commission (ANC) on the APANPIRG/19 Report with respect to the CNS/MET matters. ANC reviewed on 26 February 2009 the APANPIRG/19 report, as presented by the ANC Working Group on Regional Plans (WG/RPL) in AN-WP/8368. It was further noted that in accordance with the revised established practice (C-DEC 177/14 dated 20 March 2006 refers) PIRG reports will not be presented to the Council unless the Commission deems it necessary for the Council to take action on any of the conclusions. In the case of APANPIRG/19 Report, there were no specific items that required Council action, and hence it was not submitted to the Council. ANC noted 6 Conclusions and took actions on 13 actions items adopted by the APANPIRG/19 meeting.

Outstanding Conclusions

2.3 The meeting reviewed the list of Outstanding Conclusions up to APANPIRG/18 (2007), which is provided in **Appendix B** to the Report. The meeting noted that of the 8 outstanding Conclusions, action on 4 Conclusions had either been completed or the item had been closed. The remaining 4 on-going items would require further action, which is expected to be completed by May 2010.

Relevant Action Items of the 45th DGCA Conference

2.4 The 45th Conference of Directors General of Civil Aviation (DGCAs), Asia and Pacific Regions (DGCA/45) was held in Kuala Lumpur, Malaysia from 24-28 November 2008. A total of 228 delegates from 34 States/administrations and 5 international organizations attended the Conference. The meeting noted the theme subjects for 45th and 46th DGCA Conference and the action items agreed by the Conference. Action Items relating to the Work Programme of the CNS/MET Sub-group were as follows:

- Action Item 45/2 –Aviation environmental protection;
- Action Item 45/3 –Harmonized regulations of ADS-B systems on aircraft;
- Action Item 45/5 – Technical Cooperation Projects for civil aviation development;
- Action Item 45/9 - Human resource development –Training Director Seminar

2.5 The meeting noted that Items 45/3 and 44/5 were already covered by the work program of the CNS/MET Sub-group and APANPIRG. While recognizing that harmonized regulation is a global issue and ICAO technical provision focuses on signal in the air, the meeting noted that the

ADS-B SITF supported Action Item 45/3 formulated by the 45th DGCA Conference and reconfirmed the need for the Task Force to take follow-up action to contribute towards the development of the required guidance material which has been included in the subject/tasks list of the Task Force and regional Performance Framework Form (PFF). The meeting encouraged States to follow up the recommendations of the 45th DGCA Conference.

2.6 Japan informed the meeting about their preparations for hosting the 46th DGCA Conference in Kansai, Osaka from 12 to 16 October 2009. Japan invited all the participants to lend their support.

Review outcome of the ATM/AIS/SAR/SG/19

2.7 The meeting noted following outcome of ATM/AIS/SAR/SG/19 meeting which was held from 22 to 26 June 2009. ATM/AIS/SAR SG developed 17 Draft Decisions and Conclusions for consideration by APANPIRG/20. The details of the draft Decisions and Conclusions on the following subjects of relevance to the CNS/MET/SG were reviewed by the meting.

- Developed ATM/AIS/SAR related regional performance objectives taking into account existing APANPIRG Key Priorities, Task List of the Sub-group and user expectations
- Suggestions to discontinue the Key Priorities list
- Recommendation for adoption of APAC regional metrics and relevant data collection
- Developed draft interim strategy for implementation of New Flight Plan Format
- Draft Global Data Link Document (GOLD Version .4.3) developed by GOLD Ad Hoc Working Group. Participants were invited to review the draft GOLD from technical perspective and to provide feedback to the Regional Office for compilation and relay to the Working Group before end of August 2009
- Assistance to States in the implementation of eTOD
- SAR guidance on 121.5 MHz Search Planning
- Support for Global ICD for AFTN AIDC
- ATFM survey

2.7.1 Secretariat informed the meeting about the AIDC Workshop being planned for end of 2009 and appealed the meeting for its support.

2.7.2 With respect to need to include WMO participation to ensure a harmonized and consistent development of key mutual components of AIS and MET data model, the meeting was of the view that the influence of NextGen and SESAR on future work should be reflected in the Asia/Pacific Regional planning and implementation of related systems.

Review outcome of the RASMAG

2.8 The meeting noted following updates on the activities of the Regional Airspace Safety Monitoring Advisory Group (RASMAG) presented by the Secretariat:

- reviewed the work of Asia/Pacific Regional Monitoring Agencies (RMAs) and En-route Monitoring Agencies (EMAs) in relation to ongoing safety assessments for vertical and horizontal operations;

- recommended formal adoption by APANPIRG of the RVSM Minimum Monitoring Requirements (MMRs) that had been in use regionally for some years;

- continued preparation of the *Asia/Pacific Regional Impact Statement – RVSM Global Long Term Height Monitoring Requirements Effective from November 2010* for consideration by APANPIRG/20 for adoption as regional guidance material;

- noted the persistence of high numbers of errors in ATC unit to ATC Unit coordination resulting in LHD occurrences in regional RVSM operations and recognized the benefits of automated messaging (including AIDC) in managing this type of problem;

- concluded that the 100 feet misalignment between the feet based flight level orientation scheme and the metric scheme adopted in China did not influence (positively or negatively) RVSM safety performance and should not be reported as LHD;

- noted the promising results from the ongoing work in relation to using ADS-B data as a methodology for the monitoring of Altimetry System Error (ASE) in RVSM operations;

- reviewed and commended the technical assistance provided by China RMA to DPRK for the October 2009 RVSM implementation in Pyongyang FIR, noting that the pre-implementation safety assessment satisfied the TLS and the preparations were well advanced for this implementation;

- recommended that APANPIRG adopt the terminology En-route Monitoring Agency (EMA) in preference to Safety Monitoring Agency (SMA) for horizontal plane assessment and not adopt a formal approvals process for EMAs, instead let RASMAG continue to assess EMA competency;

- reviewed the follow up safety assessment for the implementation of 50 NM lateral and longitudinal separation on ATS routes L642 & M771 in the South China Sea and noted that safety performance was satisfying the regional TLS in the lateral and longitudinal dimensions;

- continued preparation of the *Asia/Pacific En-route Monitoring Agency Handbook*, noting that a final version would be presented to APANPIRG/20 in September 2009 for adoption as regional guidance material; and

- strongly supported the near term intentions of the United States to proceed with an operational trial of ADS-B In Trail Procedures in the South Pacific.

2.8.1 The meeting also noted the draft Conclusions formulated by RASMAG for consideration by APANPIRG.

2.8.2 The meeting took note of the comments from ATM/AIS/SAR Sub-group and RASMAG into considerations when dealing with related issues.

Follow-up action on APANPIRG Conclusion 18/23

2.9 The meeting was reminded about APANPIRG Conclusion C 18/23 recommending discontinuation of the *Regional Plan for New CNS/ATM Systems* and inviting ICAO to develop detailed proposal for incorporating the useful information contained in the discontinued Plan into Asia Pacific Air Navigation Plan (Doc 9673). Secretariat through its Information Paper informed the meeting that to meet the requirement of APANPIRG Conclusion the concerned sections in the Regional Office were advised to review the discontinued Regional Plan and provide their comments. The meeting endorsed the following comments as the result of review by the Secretariat.

Air Traffic Management

2.10 It has been observed that most of the ATM related information has either been overtaken by events, incorporated into other documents including BANP or is otherwise out of date/not relevant.

2.11 It was recommended that only 'Figure 2-1 General Transition Issues (Page 2-2 and 2-3) and 'Table 10-2 Generic Table for En-route Operations' (Page 10-5 to 10-9) be considered for retention. If retained, both Figure 2-1 and Table 10-2 would need to be updated.

Meteorology

2.12 It was recommended that the relevant information provided in the Regional Plan be retained in Regional Guidance Material in consultation with Headquarters.

CNS Systems

2.13 Information provided in Chapters 7, 8 and 9 of the Asia/Pacific Regional Plan for new CNS/ATM system, in addition to being quite outdated is also available in many other documents also. The information provided in the Tables in the chapters mentioned above is also quite outdated and in any case most of this information is already available in the FASID Tables. So no information provided in Chapters 7, 8 and 9 of Asia/Pacific Regional Plan for new CNS/ATM system is considered to be transferred to any other document.

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Agenda Item 3: Aeronautical Fixed Service (AFS)

1) review report of the Fourth Meeting of the ATN Implementation Coordination Group (ATNICG/4)
2) discuss other AFS related issues

Review Report of Fourth Meeting of ATNICG

3.1 The Fourth Meeting of ATNICG, hosted by Civil Aviation Authority of Singapore was held at Singapore Aviation Academy from 4 to 8 May 2009. The Meeting was attended by 74 participants from 20 States and 5 industry partners. The Meeting considered seventeen working papers and twenty two information papers and formulated 10 Draft Decision/Conclusions.

3.2 CNS/MET SG/13 reviewed the Terms of Reference of ATNICG and did not consider it necessary to amend it. After discussing the tasks proposed by ATNICG/4 for inclusion in the Tasks List and reviewing the status of completion of the assigned Tasks, the meeting recommended the updated Tasks List for adoption by APANPIRG/20 through following Draft Conclusion.

Draft Decision 13/1 - Revision of Subject/Tasks List of ATNICG

That, the revised Subject/Tasks List of ATNICG provided in **Appendix C** to the Report be adopted.

IDRP Routing Policy

3.3 The meeting agreed that Version 2.0, the current version of the Asia/Pacific IDRP Routing Policy does not provide for an optimal routing of CLNP PDUs for some sites which have multiple connections into Asia Pacific Region, for example Salt Lake City in USA, Moscow, Russian Federation etc. In addition, it was identified that in case of a backbone link failure, a non-backbone alternative path might be selected by the IDRP. To overcome these problems, the meeting recommended adoption of the revised version, Version 3.1 of the Asia/Pacific IDRP Routing Policy developed by ATNICG/4.

AMHS/ATN Network Management Operational Procedure Guidelines

3.4 To satisfy the requirements of Conclusion 15/15 adopted by APANPIRG, AMHS/ATN Network Management Operational Procedure Guidelines were presented to the meeting. It was noted that the presented document covered areas deemed necessary for efficient and effective operation of regional and global AMHS, the system used for distributing critical and necessary information used to facilitate efficient movement of aircraft in the global environment. It was clarified that the document does not include any information about performance requirements or performance specifications; the document covers only the operational procedure issues.

AMHS Conformance Testing Document (AMHS Manual)

3.5 The meeting was informed that with the release of EUR AMHS Manual Version 3.0 in April 2008, it had become necessary to revise Asia Pacific guidance document on AMHS Conformance Testing (AMHS Manual) accordingly. Revised Manual, recommended for adoption by ATNICG/4 was reviewed by the meeting and recommended for adoption by APANPIRG.

Security Requirements

3.6 Telecommunication Network Security Checklist was presented to the meeting for its consideration. The Checklist is intended to support the Asia/Pacific ATN Security Policy adopted by

APANPIRG/19. The meeting was informed that the Checklist may be used as the basis of an organization's verification that their implemented system includes appropriate security measures. ATNICG recommended that the system may be placed into operation after the Designated Approval Authority has ensured that the recommended Checklist is completed.

Guidance Materials for ATN/AMHS Implementation

3.7 In view of the foregoing, the meeting formulated following Draft Conclusion recommending adoption of the above guidance materials for ATN/AMHS Implementation by APANPIRG.

Draft Conclusion 13/2 - ATN/AMHS Guidance Material

That, the following guidance materials for ATN/AMHS Implementation be adopted and published.

- Version 3.1 of the Asia/Pacific IDRP Routing Policy provided in **Appendix D;**
- AMHS/ATN Network Management Operational Procedure Guidelines provided in **Appendix E**;
- Amended AMHS Conformance Testing (AMHS Manual provided in **Appendix F;**
- Aeronautical Telecommunication Network Security Checklist provided in **Appendix G**.

Short term procedure for Global AMHS address coordination

3.8 Meeting was reminded about the procedure prescribed by ICAO through State Letter dated 14 April 2009 for the purpose of AMHS address coordination through EU AMC. The State Letter mentions that the AMC implemented by EUROCONTROL under the aegis of the ICAO EUR Office (Paris) for all operational purposes and the ICAO AMHS MD Register loaded with AMC data to ensure consistency will only be used as the systems for the short-term address management.

3.9 The State Letter also advises that the States should register their nominated users and these users need to be trained before they are actually allowed to enter data into AMC. ATNICG/4 took up this issue of address management for discussion and arrived at an opinion that for the Asia/Pacific Region all the data going into the AMC database should be submitted through Aeronautical Radio of Thailand (the agency designated in Asia/Pacific Region for coordinating with EUROCONTROL AMC on matters related to AMHS). ATNICG urged Aeronautical Radio of Thailand (Aerothai) to coordinate with EUROCONTROL to ascertain if it could be designated by States as the AMC user on their behalf. Procedure to be adopted for submitting AMC data through Aerothai will be notified by ICAO Asia/Pacific Office through a State Letter.

3.10 ATNICG also proposed that a copy of the information submitted by the States to the AMC database should be provided to ICAO Asia Pacific Office. Meeting reviewed the recommendation made by ATNICG and formulated following Draft Conclusion recommending adoption of the procedure developed by ATNICG. Since Aerothai is the agency identified in Thailand to coordinate with EUROCONTROL, it was agreed that the word 'Thailand' should be replaced with Aerothai in the Draft Conclusion developed by ATNICG/4.

Draft Conclusion 13/3 - Short-term procedure for Global AMHS address Coordination

That, ICAO request States to register their AMHS address with EUROCONTROL AMC through Aeronautical Radio of Thailand (Aerothai) and provide a copy of this information to ICAO Asia/Pacific Office.

AMHS Addressing Scheme

3.11 The meeting was explained the AMHS address management domain in terms of Country (C), Administrative Domain (ADMD or A) and the Private Domain (PRMD or P) attributes. The two address schemes XF and CAAS were also explained in terms of these attributes. It was informed that a Regional AMHS Naming Register had been created to record the addressing schemes adopted by different States. Meeting urged the States to update information in respect of their administration in the Naming Register. Meeting also agreed that BBIS hubs should be equipped to process messages both with the XF and CAAS addressing schemes to ensure interoperability. After discussions, meeting formulated following Draft Conclusion.

Draft Conclusion 13/4 - AMHS Addressing Scheme

That,

a) States be urged to update information in respect of their administrations in the regional AMHS Naming Register circulated by State Letter T 8/9.1:AP0051/06 (CNS) dated 16 June 2006 latest by 2010; and

b) States hosting BBIS hubs are required to process both the XF and CAAS addressing schemes.

FASID Tables CNS-1B, CNS-1C and CNS-1E

3.12 Meeting reviewed FASID Tables CNS-1B for ATN Router Plan, CNS-1C for AMHS Routing Plan and CNS-1E for the AIDC Routing Plan. These tables had been updated by ATNICG in its Fourth Meeting based on the information provided by the States. It was mentioned that the information provided in the Tables had been further updated on the basis of the information provided in the Communication Co-ordination Meeting, which took place in Shenyang China from 3 to 5 June 2009. After reviewing the Tables, meeting decided to formulate the following Draft Conclusion.

Draft Conclusion 13/5 - Revision of FASID Tables CNS-1B, CNS-1C and CNS-1E

That, FASID Tables CNS-1B, 1C and 1E for ATN Router Plan, AMHS Routing Plan and AIDC Routing Plan be replaced with the revised CNS Tables provided in **Appendices H, I and J**

Performance Based Approach

3.13 Meeting was informed that the concept of Performance Based Approach had been adopted in the implementation plan for ATN/AMHS also. It was informed that ATNICG had reviewed the Performance Framework Form (PFF) prepared for the implementation of ATN in the Asia Pacific Region. It was also informed that ATNICG had appreciated the concept and had agreed to support it.

3.14 Meeting appreciated the progress made in the implementation of ATN in the region and appreciated the contribution made by ATNICG. Meeting also placed on record its appreciation for Civil Aviation Authority of Singapore for hosting the ATNICG meeting in Singapore Aviation Academy.

COM Coordination Meeting

3.15 The Secretariat, through an Information Paper reported result of the Communication Co-ordination Meeting, hosted by ATMB, China from 3 to 5 June 2009 in Shenyang China. The meeting was conducted to discuss issues related to communication between China, Democratic People's Republic of Korea and Republic of Korea. Meeting discussed issues related to the AFS network and adopted five action items to improve the performance of the AFTN/ATS Direct Speech Circuits and AIDC between the three States. Asia Pacific Regions Regional Air Navigation Plan for AFS was reviewed and FASID tables were updated based on the information received. Status of implementation of specific bilateral circuits and difficulties faced in the implementation were also taken up for discussion. Republic of Korea informed the meeting about the status of implementation of Qingdao/Incheon and Shanghai/ Incheon direct speech circuits. China informed the meeting that the trials for the circuits will be conducted next week and operations are expected to start in July 2009.

Telecommunications Evolution

3.16 The United States, through an Information Paper informed the meeting about the evolutions that are being undertaken to the ATC telecommunication infrastructure. It was informed that AFTN is gradually being replaced with AMHS, a system designed to distribute the flight plans globally, distribute meteorological data and support systems like Ocean Tracking System (OTS), ATS Inter-facility Data Communications (AIDC), Search and International Rescue etc. The paper highlighted the emerging technologies that are being adopted and implemented by various regions. It traced the history of AFTN and subsequent transition to AMHS. Structures adopted for the implementation of ATN in different regions were discussed in the paper. Objective of the paper was to present the evolution of the Aeronautical Telecommunication Service for use in the Air Traffic Management and bring out the variances between the systems adopted in different regions.

3.17 Issues of harmonized and coordinated implementation were raised in the meeting and it was suggested that ATNICG should develop a Working Paper on regional coordinated approach. It was recognized that implementation of security measures and operational compatibility in the structure adopted by different regions was difficult

3.18 On the issue of X.25/IPv4 heading for obsolescence, it was clarified that ICAO has adopted to migrate to IPv6 and the other arrangements like X.25 or IPv4 are only transitional arrangements. Issues related to integrating web-based services with the current arrangements, particularly the security issues were also pointed out.

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Agenda Item 4: Aeronautical Mobile Service (AMS):

1) discuss satellite data-link communication continuity issues
2) dicusss satellite voice communication
3) DFIS and other AMS related issues

Use of SATCOM Voice for ATS Communication

4.1 The meeting discussed a proposal by Australia for ICAO to develop proper standards for use of SATCOM Voice. The paper highlighted the reason why SCV was not recommended by APANPIRG for routine ATS communication and this included lack of message delivery standards (in both directions), lack of ATC infrastructure to support the operation and cost, reliability and security concerns etc. It was recommended to develop standards to allow SCV use for ATS purpose.

4.2 While discussing the proposal, the meeting reviewed the background information presented by the secretariat on the position of APANPIRG on the SATCOM Voice i.e. using SCV for emergency and non-routine ATS communication in addition to its AOC and public communication. The meeting also noted the relevant discussions at the twenty third meeting of the Informal south Pacific Air Traffic Service Coordinating Group (ISPACG/23) held from 26 to 27 March 2009 and outcome of discussions on the SCV at the forty-fifth meeting of North Atlantic Systems Planning Group (NAT SPG) held from 23 to 26 June 2009. The meeting noted the NAT SPG Conclusion 45/28 on the amendment to the NAT Regional Supplementary Procedures (SUPPs) regarding the use of SATCOM voice for Air Traffic Service (ATS) Communication. The amendment proposal to allow aircraft with installed avionics capable of SCV, as approved by the State of Operator or the State of Registry may use such equipment for ATS communications as an additional means to HF voice communications.

4.3 While some participants supported the proposal made by Australia. Views were expressed that current HF in some States does not have problem of congestion and there is no need to have secondary voice for HF. It was also indicated that use of SCV for ATS purposes would increase the workload of the controllers.

4.4 The secretariat clarified that required technical SARPs for using AMSS including SCV have already been included in the relevant provisions. No further technical standard in terms of signal in air would be required to be developed for use of SCV for ATS purposes. It was further informed that the development of guidance material and/or implementation guidelines to further progress the use of satellite voice communications are on the work programme of OPLINKP.

4.5 The meeting noted the information on the use of SATCOM voice systems in lieu of a second HF as presented by New Zealand. The weight of HF systems, the requirement for structural modifications of the aircraft and the difficulty of achieving good performance from independent wire antennae made the usage of SCV beneficial. The paper recommended that the system should meet the technical and operational requirements like amendment of Minimum Equipment List etc. It was clarified that the SATCOM voice system in use is the same as the commercially available one and is used in lieu of the second HF. Anecdotal information suggests that the controllers preferred to use SATCOM voice because of its voice quality. The criteria used by New Zealand for the approval of SCV System and granting the exemption for the second independent HF is provided in the **Appendix K** to the Report.

4.6 Comments received from the NZ ANSP (Airways Corporation) during the meeting were as follows:

Call setup can be variable but is usually a three stage process:

1) dial access number (Inmarsat or Iridium);

2) input your PIN; and

3) input aircraft call number (usually done by software for security reasons) from ground to air calls, it can be anywhere between 20-50 seconds before the aircraft answers.

4.7 From an ATS perspective, Auckland Oceanic Control has only one line so if we are talking to an aircraft, anybody else calling us is going to get a busy tone. Some work is being done in this area to get additional lines.

4.8 It was also informed that an agenda item on SCV has been included in the tentative agenda for the SATCOM Continuity Meeting scheduled for end of August 2009.

4.9 In conclusion, the meeting was of the view to include this issue as task for the Sub Group as well as an Agenda Item for the next CNS/MET Sub Group meeting scheduled for 2010.

Development of ICAO web-based aeronautical frequency management

4.10 The meeting noted progress in the development of a computer based system for aeronautical VHF (air/ground) frequency assignment planning and management by the Secretariat. This program, that will be made available to States through the ICAO web, is based on a global frequency list that comprises of the currently separately managed and developed Regional frequency lists (Frequency List No.3). As a result, it was felt necessary to harmonize Regional differences between these frequency lists. Current differences are of an editorial and technical nature.

4.10.1 With regard to the editorial aspects of the format of the frequency list proposed by the Secretariat, the meeting offered following observations:

a) the service identifications, as currently contained in the APAC frequency list 3 should preferably be maintained;

b) the meeting agreed to the format of the COM frequency list as suggested by the Secretariat with the understanding that the final format will be developed by the Secretariat in due course with the view to meet any specific requirement from all Regional Offices.

c) the buffer of 50 NM, currently being used for areas services (ACC, FIS) could be removed;

d) reference to SST operations, requiring a DOC of up to 65000 ft could be deleted (maximum altitude to protect ACC/U. APP/U and FIS/U would be 45000 ft.;

e) a flexible structure to identify DOC could be implemented, while keeping the current DOC range/height combination for DOC's as preferred.

Frequency assignment planning criteria

4.11 The meeting noted a proposal for introducing a matrix defining separation distances between different services. This proposal is provided in **Appendix L.** The meeting agreed that it would be preferred if this proposal could be reviewed on a global basis by an appropriate ICAO body, such as the Aeronautical Communications Panel. The Secretariat was invited to initialize this review. After review and approval of the planning criteria on a global level, the CNS/MET SG would consider adoption of these frequency assignment planning criteria for use in the APAC Region. It was noted that similar steps are expected to be taken in other ICAO Regions.

Frequency assignment planning criteria for VDL

4.12. The meeting reviewed frequency planning criteria for VDL (VDL Modes 2 and 4) that were approved by the Aeronautical Communications Panel. The meeting agreed to these planning criteria and requested the Secretariat to incorporate them into the planning criteria currently applicable to frequency list 3. These planning criteria are provided in **Appendix M** to the Report.

Demonstration of the VHF air ground communication frequency planning tool

4.13 The meeting received a detailed presentation and demonstration on the functions of the program for VHF air-ground communications frequency planning in the frequency band 117.975 – 137 MHz.

4.13.1 This program, that in its final form is expected to be available to States through the ICAO web, offers regular database functionalities such as querying the (global) data base of frequency assignments, sorting (e.g. in frequency order or country order), exporting the data base in Excel and PDF format. In addition, the program offers specific functionality to calculate and assess compatibility between current frequency assignments as well as for new (or modified) frequency assignments. One special feature in the program is the capability to plot coverage and interference contours on a map. This would enable on a geospatial basis assessment of frequency assignments. It also offers the opportunity to overlay on the map operational information (such as air routes, ACC and FIR sectors together with the technical requirements for COM systems frequencies and may assist States when developing airspace infrastructure.

4.13.2 The meeting noted that the program, in its full version would need the availability of FileMaker Pro 10 Advanced by each user. A runtime version, that offers somewhat limited functionality, will be made available by ICAO. The program is intended to be distributed free of charge to the contracting States. Users themselves need to install on their computer Google Earth.

4.13.3 The meeting was informed that a similar program for NAV (ILS, VOR, DME, GBAS and NDB) systems is being developed. Considerations are given to also include the possibility to assess potential interference from FM broadcasting stations, operating in the band below 108 MHz.

4.13.4 Concerning the availability of the program (and in particular the global database of frequency assignments) the meeting expressed as its opinion that the information should not be made available on an open web-site (i.e. it should not be made available for access by the general public. Specific attention should be given by the secretariat to secure the integrity of the data base and to protect it from interference in particular from malicious users.

4.13.5 The meeting wished to put on record its appreciation for the work performed on this project (as well as the project on SSR Mode S II code assignment planning) by the Secretariat and the close and productive cooperation between CNS/AIRS (Montreal) and the CNS section in the APAC Office which assisted in improving efficiency in the coordination of frequency assignments while maintaining the central coordinating role of the ICAO Regional Office.

4.14 A number of participants expressed their willingness and interest in taking part in the testing of the current version of the programme, in close cooperation with the Secretariat.

4.15 It is expected that eventually the final (web-based) version of the programme will be available by 2010.

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Agenda Item 5: Navigation:

1) review reports of the Performance Based Navigation (PBN) Task Force
2) review navigation strategy
3) other radio navigation issues

Review report of the Performance Based Navigation (PBN) Task Force

5.1 The meeting reviewed the outcomes of the work accomplished by the PBNTF over the course of two meetings. The work of the Task Force (TF) that was accomplished prior to the meetings of RASMAG/11 and ATM/ASIA/SAR/SG/19 was coordinated with those bodies and their input was taken into consideration for the work programme of PBN TF. The Fourth meeting of the Performance Based Navigation Task Force (PBN TF) was held in Osaka, Japan from 4-6 March 2009 in conjunction with a successful PBN Seminar held on 2 and 3 March. The Fifth meeting of the Performance Based Navigation Task Force (PBN TF) was held in Bangkok, Thailand from 15 to 17 July 2009 at the ICAO APAC Office and was attended by 74 participants from 21 States and 3 International Organizations.

Asia Pacific Flight Procedure Programme

5.2 The meeting noted that Flight Procedure Programme (FPP) Office for the Asia-Pacific region will be located in Beijing, China. On March 26, 2009 ICAO signed a letter of intent with the CAAC regarding the establishment of the FPP Office in Beijing. ICAO State Letter T 613.1 1.2 - AP089109 (FS), dated 26 June 2009, invited the States in the region to indicate their intent to participate in the Flight Procedure Programme. At the PBN TF Meeting practically all States informally indicated their intention to participate in the FPP. After consideration of the FPP in APANPIRG and the State letter, the intention is that the States will sign the FPP documentation at the next Directors General of Civil Aviation (DGCA) Conference to be held from 12-16 Oct in Japan. Initial FPP activities will include a PANS OPS initial course to be held 23 November to 18 December 2009, and a PBN Procedure Design Course to be held from 1 to 12 February 2010. Both these courses are to be held at the Civil Aviation Flying University of China (CAFUC), Chengdu, China.

Review of ICAO Directives /Guidelines on APVs

5.3 The meeting was informed about the outcomes of the commercial study undertaken by Australia to review alternative technologies available for APV implementation. The study recommended using Baro-VNAV but at the same time noted that many aircraft were unlikely to be equipped for Baro-VNAV operations in near future and hence it will be difficult to meet the time schedule prescribed by ICAO Assembly. Based on the outcome of the study and recommendation of PBN TF, meeting decided to endorse following Draft Conclusion for adoption by APANPIRG.

Draft Conclusion 13/6 - APV Implementation Resolution

That, ICAO note that the objective of Assembly Resolution A 36-23 on APV implementation will not be achieved in the timeframe of the resolution because many of the aircraft in the Region are not equipped to use Baro-VNAV Procedures and without SBAS, no APV alternatives are available.

5.4 In response to the Task Force proposal to conduct a feasibility of establishing a regional SBAS capability, IATA conveyed that it did not support SBAS development and other options like ABAS, DME/DME etc. could also be considered. Hong Kong China informed the meeting that it had a plan for GBAS instead of SBAS provision in the FIR. The meeting was informed that achieving the Assembly requirement through Baro-VNAV was not achievable since most of the older airline, middle level and general aviation aircraft are not suitably equipped with a certified

Baro-VNAV capability and enhance capabilities of multi-constellation systems are likely to take a lot of time and hence there is no way to fully implement APV operations. Clarifying on the issue of the requirement for additional of SBAS systems the Chairman PBN TF mentioned that the proposal was for a feasibility study only and the outcome may be to extend the service areas of existing or developing systems rather than develop new SBAS systems. The meeting on the basis of discussion and clarifications provided, decided to endorse following Decision.

Decision 13/7 - Feasibility of establishing a regional SBAS capability

That, CNS/MET SG conduct study on the need for and feasibility of establishing a regional SBAS capability**.**

Review of PBN Manual

5.5 The meeting was reminded that GPS prediction service was a necessary part of GNSS approvals to allow for the fluctuations in service availability. Concern was also raised over the United States Government Accountability Office (GAO) *Global Positioning System: Significant Challenges in Sustaining and Upgrading Widely Used Capabilities* report on GPS availability and note was taken of USAF response that GPS service would not fall below that guaranteed by the specification (SPS). This concern was further addressed in the Information Paper presented by US on the same subject. It was expressed that guidance materials are necessary to address the requirement of GNSS reporting and prediction.

Guidance Material for PBN Implementation

5.6 In addition the meeting noted that many States had significant number of aircraft that are GNSS (GPS) IFR approved. Though GPS systems, in general terms supports RNP 0.3 operations, the actual installations in the aircraft vary considerably, predominantly depending upon the installation antiquity. It was therefore necessary to have guidance for translating the GPS IFR approvals to corresponding PBN capability.

5.7 Meeting also agreed with the requirement of guidance material on PBN specific aspects of en-route safety assessment to facilitate implementation of PBN.

5.8 Following discussion on the requirements expressed for GNSS reporting and prediction, the need to assess the GPS IFR aircraft in terms of their PBN capability and for PBN-specific aspects of en-route safety assessment proposal of the PBN TF recommending development of guidance materials was endorsed by the meeting. In light of the foregoing, the meeting endorsed the following Draft Conclusion:

Draft Conclusion 13/8 - Guidance material for PBN Implementation

That, ICAO (PBNSG) be invited to develop guidance materials on:

a) establishing common implementation rules and technical standards for GNSS reporting and prediction requirements;

b) assigning PBN capability to GPS IFR aircraft in the first instance without the need for recertification; and

c) PBN-specific aspects of en-route safety assessment

5.9 To further facilitate implementation of homogeneous PBN system in the Region, the meeting considered the PBN TF proposal to conduct a feasibility study on establishing a regional RAIM prediction system and endorsed its following Draft Decision.

Draft Decision 13/9 - Regional RAIM prediction System

That, PBNTF be tasked to examine the feasibility of establishing a regional RAIM prediction system.

RNAV Human Factors and Systems Safety

5.10 Meeting was informed about Cranfield University RNAV operations safety review report, which highlights a number of significant safety issues associated with RNAV operations. Significant points on human factors of RNAV systems design, RNAV systems installation in aircraft and flight crew conducting RNAV operations have been included in the report. The report identifies a number of human factor issues that need to be considered for the conduct of RNAV operations. The meeting was of the opinion that the information provided in the report will be of immense value for the States implementing RNAV operations and hence endorsed following Draft Conclusion recommending circulation of the safety message placed in **Appendix N.** The Secretariat was also requested to facilitate to have RNAV safety message published in the ICAO Journal.

Draft Conclusion 13/10 - RNAV Human Factor

That, RNAV safety message provided in **Appendix N** to the Report be distributed to the States for further distribution to all operators involved in RNAV operations in order to apply the lessons learnt.

PBN Implementation Progress Report Template

5.11 Meeting reviewed the template developed by PBN TF for reporting progress and agreed that this common template will help in harmonizing the reporting process. In view of the above, meeting endorsed following Draft Conclusion recommending adoption of the template developed by the PBN Task Force.

Draft Conclusion 13/11 - PBN Implementation Progress Report Template

That, States be urged to use the PBN Implementation Progress Report Template provided in **Appendix O** to the Report for all future reporting of their status of PBN implementation. The Report should be submitted at each of the future PBN Task Force Meeting.

5.12 The meeting noted that the PBN Task Force meeting requested the Secretariat to urge States to submit their PBN Implementation Progress Report by 15 August 2009 for submission to APANPIRG/20 meeting scheduled for 7-11 September 2009.

PBN Implementation Plan

5.13 Interim Edition Version 0.3 of the Asia/Pacific Regional PBN Implementation Plan, updated by PBN TF incorporating RASMAG and ATM/AIS/SAR SG comments was presented to the meeting. The Meeting, after reviewing the updated plan, agreed to endorse it for adoption by APANPIRG as Version 1.0 through following Draft Conclusion.

Draft Conclusion 13/12 - Asia/Pacific Regional PBN Implementation Plan

That, the Asia/Pacific Regional PBN Implementation Plan provided in **Appendix P** to the Report be adopted as Version 1.0

Presentation – Implementation of Region Wide Performance Based Navigation

5.14 PBN TF, while taking note of ATM/AIS/SAR Sub Group Decision 19/1 relating to establishment of Southeast Asia Route Review Task Force (SEA RR/TF) came to a conclusion that most practical way of implementing PBN in the region was to create a dedicated project to design PBN based Regional Air Route. Without such a project, the regional implementation of PBN based routes between States was unlikely to proceed. Japan expressed concern on the establishment of a PBN Office or a dedicated project because the demarcation between the PBN TF/RRTF has not been clarified. Japan pointed out that the necessity if establishing PBN Office/dedicated Project in addition to the two TFs should be clarified. It was recognised that the proposed project would need to be resourced by the States. The Meeting, after discussing the issue at length following Draft Decision.

Draft Decision 13/13 - PBN based Regional Air Routes Design

That, in conjunction with the proposal to establish a SEA Route Review Task Force, a dedicated project be established to design PBN based Regional Air Routes to facilitate their adoption by States.

Presentation on RNP AR Flight Operational Safety Assessment (FOSA)

5.15 Requirement of having information on PBN safety assessments was noted by the meeting. After a brief discussion on the subject, meeting agreed with the proposal of PBN TF to include presentation(s) on safety assessment as part of the agenda for the PBN Implementation Seminar to be held in Hong Kong in February 2010. The meeting also agreed with the recommendation made by PBN TF requesting ICAO to assist in addressing the PBN safety assessment training needs in the region and endorsed following Draft Conclusion.

Draft Conclusion 13/14 - PBN Safety Assessment Training

That, ICAO be requested to assist in addressing the PBN safety assessment training needs in the region.

RNP AR Approach Procedures

5.16 While discussing the issue of deciding on the implementation of RNP AR Approach procedures safety concerns were noted if States were to proceed directly to PBN AR implementation without firstly considering public RNP approaches and then undertaking adequate training and assessment. The meeting came to a conclusion that the States should carry out a safety and cost benefit analysis for such implementation before a decision is taken in this regard and agreed to endorse the following Draft Conclusion formulated by PBN TF.

Draft Conclusion 13/15 – RNP AR Approach Implementation

That, States be urged to give detailed considerations to the operational need, safety and cost benefits prior to deciding on RNP AR Approach implementation.

5.17 It was agreed that to achieve efficiency and to increase the level of safety, there is a need to focus on integrated PBN development, connecting the en-route phase of flight with the final approach utilizing gate-to-gate concept. It was also agreed that focus of the Task Force should now shift from development of implementation plan to developing applications to facilitate achievement of the mentioned gate-to-gate concept. In addition, the PBN TF needed to continue its education and training role plus identify issues to be considered by the PBNSG. In pursuance of these objectives, meeting endorsed following Draft Decision formulated by PBN TF.

Draft Decision 13/16 - PBN Task Force Activities

That, the PBN Task Force continues with the current TORs for two additional meetings in 2010 to complete the remaining.

Sharing of information

5.18 Sharing of information is considered essential for uniform and homogeneous development. Appreciating the benefits of disseminating information on the activities of various ICAO Panels and Study Groups, the meeting agreed with the following PBN TF Draft Conclusion and decided to endorse it.

Draft Conclusion 13/17 – Sharing Information on ICAO Panels/SGs

That, ICAO be requested to consider sharing information on ICAO Panels and Study Groups activities/outcome regularly with regional planning/implementation regional groups**.**

Review of Asia Pacific Flight Procedure Program Document

5.19 Considerable support for the FPP program amongst the PBN Task Force members was reported to the meeting. In response to a query, it was explained that the quantum of contribution will predominantly depend on the number of States deciding to participate in the program. The meeting was informed that ICAO would follow up its State Letter dated 26 June 2009, inviting the States in the Region to respond to the letter dated 15 August 2009 requesting them to convey their intent to participate in the Flight Procedure Program.

Time and venue of next meeting

5.20 PBN Implementation Seminar is scheduled for 1- 2 February 2010. The seminar will be followed by PBN TF/6 meeting on 3-5 February 2010. Both, the seminar and the meeting will be hosted by Hong Kong China.

Review Navigation Strategy

5.21 The meeting reviewed the Navigation Strategy for the Asia/Pacific Region that was produced last year by the integration of two separate strategies. Additional clarification on the need to transition from an interim state to the final end was discussed. Current activity to define RNP2 was noted and it was considered appropriate to add RNP2 to the end state configurations for continental en-route. The meeting was cautioned that appropriate implementation of high performance capabilities requires training, experience and demonstration of competence for safe implementation. The meeting taking these considerations into account revised the strategy and proposed the adoption of the revised documented with the following Draft Conclusion.

Draft Conclusion 13/18 - Revision of the Strategy for the Provision of Navigation Services in the Asia/Pacific Region

That, the updated Strategy for the provision of navigation services provided in **Appendix Q** to the Report on Agenda Item 5 be adopted and published.

Other Radio Navigation Issues

Characterization of the Ionosphere

5.22 Australia proposed the characterisation of the ionosphere throughout the Asia and Pacific Region as a useful step in the implementation of GNSS applications including GBAS and SBAS augmentations. The proposal noted that the ionosphere was a dynamically changing phenomenon that directly affects the performance of satellite navigation systems by introducing varying propagation delays and therefore errors and inaccuracies in the end user solution. Augmentation system such as GBAS and SBAS enhances the user performance of the system by providing corrections for ionospheric delays and other core satellite error source. The augmentation systems also provide integrity warning when errors are unable to be corrected. Variation of the ionosphere is induced by solar activity is coupled to the 11-year solar cycle. Solar activity such as flares and coronal mass ejections cause ionosphere anomalies (ionospheric storms) which are characterised by speed, gradient and width. Augmentation systems achieve integrity by design choices based on the worst case anomaly conditions for the service area of the system. An overly conservative model can result in reduced system availability whilst an inadequate model can result in un-alerted integrity failures. An augmentation system certified against an ionospheric characterisation for one geographic area may not be suitable for certification in another geographic area. The characterisation of the ionosphere can be achieved by the review of archival observations collected over an extended period. The observations may have been completed by a State's geoscience, meteorology or research for other purposes and can be re-evaluated to establish a characterisation suitable for evaluation of aeronautical augmentation systems.

5.23 The proposal had the objective of establishing an ionosphere characterisation methodology and to have States or a cooperation of States process available data to characterise the ionosphere. The established model would then be available for certification and tuning of augmentation systems.

5.24 The meeting discussed the proposal and identified options of ICAO undertaking the characterisation of ionosphere on a global basis. It was noted that similar activities are already occurring within States in the Asia Pacific region as well as similar activities in North and Central America and Europe.

5.25 The value of undertaking the activity was recognised by the meeting however States were unwilling to commit to participation in the proposed task force without further consideration of the proposition. Positive bilateral discussion occurred with some States engaging in cooperative arrangements with the possibility of extending the activity to a regional activity in the future.

GPS Performance Commitment

5.26 The United States provided information on the current status of the Global Positioning System (GPS) and emphasized the commitment to maintain the function at or above published levels of performance. Improved performance is expected as more modernized satellites replace older-generation satellites. The GPS Standard Positioning Service (SPS) Performance Standard (PS), dated September 2008, includes the following commitments:

- 95% probability of 24 operational satellites (averaged over any day);
- At least 21 out of 24 orbital slots will be occupied either by a satellite broadcasting a healthy SPS Signal-In-Space in the baseline slot configuration (or by a pair of satellites each broadcasting a healthy SPS Signal-In-Space in the expanded slot configuration) with a probability no less than 98 percent (normalized annually); and

- A new commitment that at least 20 out of the 24 slots will be occupied by a satellite broadcasting a healthy SPS Signal-In-Space with a probability no less than 99.999 percent (normalized annually).

GBAS Update

5.27 The meeting was informed that the United States Federal Aviation Administration (FAA) is continuing to pursue research and development of GBAS technology and is supporting applicant request(s) for GBAS system design approval within the National Airspace (NAS). The FAA is in the final stages of approval for the first Category-I GBAS (Honeywell SLS-4000). This approval will allow private entities to procure and install this system for use throughout the U.S. National Airspace. Memphis International airport is the first to apply for installation and approval for use in Category-I precision approach operations. Research and development efforts continue to focus on the development and validation of proposed Annex 10 standards to support Category-III autoland operations. These draft standards are available to support demonstrations and development by both manufacturers and service providers.

5.28 The FAA is continuing to support international development of GNSS augmentations including GBAS. The FAA has signed Memorandums of Cooperation (MOC) with Australia, Brazil, Spain, Germany, Chile for GBAS development and implementation. The FAA continues to co-chair with EUROCONTROL the International GBAS Working Group (IGWG). The goal of the IGWG is to provide a forum for the exchange of technical and operational topics and coordination of research and implementation activities that will help the implementation of GBAS capability worldwide.

5.29 As part of the FAA's NextGen initiative the FAA is working with the international community to develop standards to support Category-III operations and validate those standards. The FAA will leverage Category-I experience to further refine the Category III requirements. The ICAO Navigation Systems Panel (NSP) is currently generating a baseline draft of Annex 10 standards to assist in Industry and Air Navigation Service Provider (ANSP) research and development activities. Once complete, these standards will be used to develop prototype equipment and provide the basis for aircraft and ground equipment development and certification programs. These standards are currently scheduled to be frozen by March 2010 and will be submitted as formal amendments at the conclusion of the first operational certification. This approach will allow lessons learned from the first approvals to be fed back into the standards further stabilizing those requirements.

5.30 The RTCA has published Minimum Operating Performance Standards (MOPS) DO253C to compliment the ICAO standards and support avionics development for near term validation and GLS operations.

Seminar on Testing Of Navigation and Surveillance Facilities and Validation of Flight Procedures

5.31 The meeting was informed that in accordance with APANPIRG Conclusion 19/32 a seminar on 'Testing of Navigation and Surveillance Facilities' will be held at the Regional Office, Bangkok from 5 to 7 August 2009 jointly with Aeronautical Radio of Thailand (Aerothai). The seminar will address requirements of ground/flight testing of navigation/surveillance facilities and validation of flight procedures. Guidance provided in various ICAO Manuals on the extent of testing and inspection required will also be discussed.

5.32 As of 15 July 2009, 35 participants from 10 States (Australia, Bangladesh, China PR, Macau China, Germany, Japan, New Zealand, Philippines, Singapore and USA) have already registered for participation.

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Agenda Item 6: Surveillance:

1) review reports of the Eighth Meeting of ADS-B Study and Implementation Task Force
2) review strategy for the surveillance systems
3) discuss other surveillance related issues

Review Report of the Eighth Meeting of ADS-B Study and Implementation Task Force

6.1 The meeting reviewed the outcome of the Eighth Meeting of ADS-B Study and Implementation Task Force. An ADS-B Seminar and the Eighth Meeting of Automatic Dependent Surveillance – Broadcast (ADS-B) Study and Implementation Task Force (ADS-B SITF/8), both hosted by CAAV and VANSCORP Viet Nam, were held in Ha Noi, Viet Nam from 18 to 22 May 2009.

6.2 The objective of the ADS-B Seminar was to provide information to the participants on ADS-B planning and implementation and to facilitate discussions at the meeting. The Seminar covered a comprehensive list of topics on the ADS-B implementation and was well received by the participants.

Terms of Reference and Subject/Tasks List

6.3 The meeting noted that no changes to the TOR was proposed and agreed with the Subject/Tasks List updated by the ADS-B SITF and endorsed the following Draft Decision.

Draft Decision 13/19 - Subject/Tasks List of ADS-B Study and Implementation Task Force

That, the Subject/Tasks List for ADS-B Study and Implementation Task Force provided in **Appendix R** to the Report be adopted.

6.4 The meeting considered it essential to develop common understanding for the regulators to publish equipage requirement for ADS-B OUT based service. This would get all the regulators concerned to work in the same path. The meeting supported to organize a regulators workshop on ADS-B OUT equipage requirement before the end of 2009 as recommended by the Task Force. Australia and USA reconfirmed to support the Workshop through coordinating and providing experts for the Workshop. Accordingly, the meeting endorsed the following draft Conclusion:

Draft Conclusion 13/20 – Workshop on ADS-B OUT equipage requirement

That, ICAO be invited to organize a workshop on ADS-B OUT equipage requirement by the end of 2009 with the assistance from Australia and USA.

6.4.1 The meeting considered necessary to invite aircraft manufacturers including Airbus and Boeing and other OEM providers for the workshop. It was agreed that Australia would facilitate the invitation to the manufacturers.

Updates on ADS-B Planning and Implementation

6.5 The meeting noted the following implementation status updated by States at the Task Force meeting and some issues observed during the trials and implementation.

Australia

6.6 Several papers presented by Australia provided explanation and analysis on requirements for TSO 145/6 GPS receiver that includes FDE and SA Aware capabilities and examined ADS-B NUC values for various GPR MMR and transponders. Australia encouraged other states to perform similar analysis to further confirm or refute Australian findings with respect to SA ON avionics ADS-B service reliability.

6.6.1 The meeting noted that a PC based ADS-B Filter is being developed by Australia to control the exchange of ADS-B data between Australia and its neighbors. It is called Foreign ADS-B Filter (FAF). The development of FAF is expected to be completed in 2009. The functional and system requirement was provided for consideration by other States who wish to share ADS-B derived data. Regarding location of the filter, the meeting felt that the FAF could be installed at either site or at both the sites which should be specified in the data sharing agreement. The reliability and redundancy of FAF should also be taken into account when a PC based system is used.

Australian Wide Area Multilateration (WAM)

6.7 The meeting noted the experience gained and lessons learnt in deploying Wide Area Multilateration in Tasmania, Australia. The project started in May 2006 and the Site Acceptance testing commenced in May 2008. A number of flight tests have been conducted as part of Site Acceptance testing. Final flight test and conclusion of SAT is expected in MID 2009.

China

6.8 China provided the result of the Trial & Evaluation Project conducted in South Western part of China to support ADS-B implementation. Several issues including analysis of the invalid data were identified. The meeting discussed and analyzed some issues resulting from the ADS-B evaluation project including velocity and heading evaluation, low updates rate, etc. The issues and finding observed in the real flight testing were considered very useful.

Hong Kong, China

6.9 It was noted that Hong Kong, China plans to:

a) mandate ADS-B carriage, by end 2013, for aircraft flying over L642/M771;

b) mandate ADS-B carriage, by end 2014, for all aircraft flying within the Hong Kong FIR; and

c) mandate ADS-B carriage, after 2015 (TBC), for low flying aircraft, including general aviation aircraft and helicopters.

New Caledonia

6.10 Three ground stations will be installed at the existing VHF sites in New Caledonia by March 2009. Technical testing will be conducted during October to December 2009 and operational testing will start from end of 2009 and complete mid 2010.

Pakistan

6.11 The meeting noted that most of the Pakistan air space currently is already under radar surveillance, some gaps in the west, northern mountain regions and some portion in the south and southwest airspace need to be brought under positive visibility/surveillance. PCAA considers ADS-B, a potential option to fill up the gaps in radar surveillance and also considers using ADS-B to provide partial back up to the existing radar. One ADS-B station was installed at Karachi ACC on trial basis for a period of one year.

The Philippines

6.12 The Civil Aviation Authority of the Philippines (CAAP) installed a new Mode S SSR capable of processing ADS-B reports based on 1090ES. This enables the monitoring of ADS-B equipped aircraft in the 100NM radius from the radar station. The ADS-B function of the radar will be used to observe and evaluate population of aircrafts equipped with ADS-B within 100 NM. The CAAP has planned to install two stand alone ADS-B stations in Manila and Puerto Princesa by 2012. The CAAP also intends to include the ADS-B function in all other Mode S SSR stations that will be installed in 2012.

Viet Nam

6.13 Viet Nam has been participating in South East Asia's program on ADS-B installation and has committed to share ADS-B data with its neighboring States. Viet Nam also considers to share VHF communication capabilities with neighboring FIR when ADS-B control is applied. Viet Nam had preliminary discussion with stakeholders on upgrading ATM system in Ho Chi Minh AACC to process ADS-B data and sharing of ADS-B data with Singapore.

ADS-B Data Sharing

6.14 Australia and Indonesia agreed to further progress the ADS-B data sharing project and the funding has been allocated by each party for phase 1A only. Australia and Indonesia hope that data sharing will be operational in the 2nd Quarter 2010. This phase will use single data communications infrastructure to support situational awareness and safety nets. It is proposed to use an existing satellite data communications link between Australia and Indonesia. The phase 1A will include: Data sharing from existing ADS-B sites:

- Thursday Island (installed)
- Gove (to be installed in 2009)
- Merauke (installed)
- Saumlaki (installed)

6.15 The meeting noted that Indonesia offered to share its ADS-B data from Banda Aceh ground station with Malaysia during the fourth South-East Asia sub-regional ADS-B implementation working group meeting. It was noted that the ADS-B data from Banda Aceh station is expected to enhance Malaysia surveillance capability within its AOR in the Bay of Bengal Area. The meeting further noted that the current Kuala Lumpur ATCC ADS-C/Radar integrated workstation for oceanic (Bay of Bengal) Sector is capable of processing and integrating ADS-B data.

6.16 Indonesia confirmed that the ADS-B ground station has been installed with data format ASTERIX 21 version .23. Indonesia is ready to further discuss with Malaysia the data sharing arrangements. It was encouraging to note the initiatives being taken by Malaysia and Indonesia for ADS-B data sharing in the Bay of Bengal area. States concerned were encouraged to consider sharing VHF communication capability wherever they are applicable.

FASID Tables on Surveillance Systems

6.17 The meeting noted that the Tables CNS 4A and 4B of the Asia and Pacific Regions Air Navigation Plan, Volume II, FASID, Doc 9673 were reviewed and updated by the Task Force meeting. Table CNS 4 was renamed as Table CNS 4A – Surveillance Systems in 2006 and Table CNS 4B - ATS Automation Systems was renamed from the Table ATS 3. The FASID Table CNS 4A specifies the requirements for Surveillance Systems and Table CNS-4B specifies the requirements for ATC automation systems in the Asia and Pacific Regions. The meeting further updated the tables based on the information provided during the meeting and endorsed the following draft conclusion.

Draft Conclusion 13/21 – Table CNS 4A and Table CNS 4B

That, the FASID Table CNS 4A and Table CNS 4B be replaced with Updated Tables provided in **Appendix S** and **Appendix T** to the Report in accordance with the established procedure.

SEA ADS-B Working Group

6.18 The meeting noted the outcome of the fourth meeting of the Southeast Asia ADS-B Working group meeting hosted by Airservices Australia in Melbourne on 9-10 February 2009. The meeting agreed with the following to expedite ADS-B implementation in South China Sea area:

i) Complete installation of ADS-B stations at Natuna and Matak Islands, Singapore and Con Son Island by 2010;

ii) sharing of ADS-B data and DCPC capability between DGCA Indonesia, CAAS and VANSCORP to facilitate application of radar-like separation standards;

iii) commence ADS-B operational trials in 2010 along air routes L642 and M771; and

iv) The earliest operational trial will be conducted approximately at the end of 2010 depending on new ATC automation system capabilities in the states. It was envisaged that an ADS-B mandate for some flight levels could come into effect in 2013.

Cost benefit study for South China Sea area

6.19 The meeting noted the cost benefit study for the initial phase of ADS-B implementation in the South China Sea area by CANSO. The study was undertaken jointly with IATA with assistance from CANSO members, in particular the FAA which is helping in the analysis, and CAAS which is helping with the collection of operational and technical data. The meeting appreciated the study conducted. The meeting noted the positive business case of the project and possibility of greater benefits if ADS-B were implemented over a wider area regionally. The meeting also noted that CANSO and IATA were requested to assist in an extension of the South China Sea project cost benefit study to include the Philippines. Singapore and USA agreed to provide the necessary support assuming that the Philippines is willing to provide the appropriate data.

Guidelines for Development of ADS-B Implementation plan

6.20 The meeting recalled the "Guidelines for development of ADS-B Implementation plan by States" adopted by APANPIRG/19 meeting under Conclusion 19/35. The meeting endorsed a proposal by Viet Nam and agreed by the Task Force to revise the guidelines with additional information and formulated the following draft Conclusion.

Draft Conclusion 13/22 - Revised Guidelines for Development of ADS-B Implementation Plan by States

That, the revised guidelines for Development of ADS-B Implementation Plan by States provided in **Appendix U** to the Report be adopted.

Australian ADS-B aircraft mandate

6.21 Australia informed the meeting (IP13)that in March 2009, the Civil Aviation Safety Authority (CASA) issued legislation for an ADS-B aircraft equipment mandate for aircraft flight in the upper airspace (at and above FL290) of Australian territorial airspace, with a compliance date on

and from 12 December 2013. It is applicable to Australian aircraft and also to foreign registered aircraft when operating in Australia. A copy of the text of the mandate is available on the following CASA webpage: http://www.casa.gov.au/newrules/airspace/jcp/nfrm_jcp_annexb.pdf In the subsequent IATA stated that they and their members have been early supporters of ADS-B and recognized that Australia has been leading the world in many developments. IATA continues to support the intent of the Australian ADS-B mandate.

6.22 IATA expressed two prime concerns which need to be quickly resolved. Firstly the issue of SA Aware as required by the TSO-145/146 mandate for June 2012. IATA stated that this timeframe was not achievable and even with slippage until late 2013, would be difficult to achieve. Neither of the major manufacturers are producing any aircraft with TSO-145/146 GPS and upgrades to enable the alternative SA OFF were limited in availability and are extremely costly to airlines. European AMC 20-24 does not require these capabilities and most existing GPS installation meet this standard. IATA also mentioned its concern about the requirement to have a separate dedicated switch to disable ADS-B transmission in the flight deck. This issue will need to be resolved on a global basis as it has safety and operational considerations as well as the availability of an acceptable design to meet other regulatory requirements. IFALPA also expressed concern about activation and de-activation and wished to be involved in the development of a solution.

6.23 Australia responded that the extensive theoretical studies and results from two 3 month studies of actual performance has convinced Australia of the need for FDE and SA Aware capabilities to ensure adequate Availability and Continuity of position data. It was also observed that these results are for the current 28 to 30 healthy GPS Satellites available. Many GPS satellites are old and their replacement is behind schedule; it is expected that the number of available satellites will decline reducing Availability and Continuity of position data for ADS-B. The USA guarantees 24 satellites 95% of the time and 21 Satellites 99.99% of the time (refer IP 42). For these reasons Australia does not accept AMC 20-24. Australia also indicated that two of the three GPS/MMR manufactures have product and/or upgrades available. Solutions for the remaining aircraft were being explored.

Options for states to establish Aircraft ADS-B avionics mandate

AMC20-24

6.24 The meeting noted the considerations of third meeting of South East Asia ADS-B WG in July 2008 on AMC20-24 published on 25 April 2008 by the European Aviation Safety Agency (EASA) which defines acceptable means of compliance for the airworthiness and operational approval of the “Enhanced Air Traffic Services in Non-Radar Areas using ADS-B Surveillance” The working group meeting agreed that AMC20-24 with proposed changes serves as baseline document for further consideration. The AMC20-24 with proposed changes by SEA ADS-B WG is provided in the Appendix J to the Report of the ADS-B SITF/8.

ADS-B OUT Equipage Standards - IATA

6.25 The meeting noted the proposal for ADS-B OUT Equipage Standards proposed by IATA for the APAC Region. It was stated that both the Australian approval method and AMC 20-24 are suitable standards for Asia Pacific. EASA AMC20-24 is better recognized as a global benchmark detailing an acceptable means of compliance for operation in non-radar areas. AMC 20-24 should eventually be adopted as the equipage standard for Asia and Pacific. Forward fit aircraft should comply from commencement of operations while retrofit aircraft must comply by 2013.

6.25.1 Regarding approval process for ADS-B OUT, IATA expressed that it should be no different for any other avionics equipment. The contracting States shall recognize as valid an air operator certificate issued by another Contracting State. Australia informed the meeting that a possible way is to endorse the list of CASA approved aircraft that can be provided by CASA on request.

Regional ADS-B Equipage Requirement

6.26 The meeting noted the information of options for states to establish harmonized Aircraft ADS-B avionics mandates including Australian ADS-B mandate for upper airspace from 12 December 2013, AMC20-24 published on 25 April 2008 by the European Aviation Safety Agency (EASA) which defines acceptable means of compliance for the airworthiness and operational approval of the "Enhanced Air Traffic Services in Non-Radar Areas using ADS-B Surveillance" and IATA' proposal. The meeting also noted the current state of development of the regulations in Canada and USA.

6.26.1 The meeting agreed that the Australian approval method and AMC20-24 are suitable standards for APAC Region. However, it was also recognized that some aircraft configurations are currently unable to obtain AMC 20-24 certification without upgrade despite being in compliance with the current Australian standard. In the interim, these aircraft can and should be authorized to operate ADS-B in the APAC Region. At the same time, the benefits of SA aware avionics and FDE were recognized and it is recommended that new aircraft should be fitted with these capabilities. Therefore, States are recommended to identify these capabilities as forward fit requirements as soon as reasonable.

6.26.2 IATA presented a paper to clarify the intent of a draft conclusion formulated by the ADS-SITF on regional ADS-B Equipage Requirement. The intent is for states to introduce appropriate regulations that allow any of the stated requirements. The meeting agreed with the proposal.

In view of the foregoing, the meeting endorsed following two draft Conclusions.

Draft Conclusion 13/23 - Regional ADS-B Equipage Requirement

That, States be urged to issue ADS-B authorizations for the interim period 2010-2020 (or until requirements can be harmonized globally) in NRA airspace based on:

- AMC20-24 certification or
- Approval by CASA Australia or
- The requirements of the CASA Civil Aviation Order 20.18 Amendment (No. 1) 2009 and Advisory Circular AC21-45

Note: States that have not yet published regulations should implement necessary regulations that recognize that any one of the above requirements is acceptable and not specify an individual requirement

Draft Conclusion 13/24 – Forward Fitment Requirements for SA Aware and FDE functionality

That, ICAO recommend States concerned to adopt forward fitment requirements which include SA aware and FDE functionality as soon as reasonable.

6.27 USA informed the meeting of USA's position on mandating ADS-B. USA will mandate DO260B effective from 2020. The United States will not provide ADS-B based separation service for aircraft equipped with DO260 equipment. The USA also identified the need for coordination with military authorities in the air space where ADS-B based surveillance is provided or ADS-B data is shared.

6.28 The meeting noted that there were many existing carriers equipped with ADS-B transponders compliant with DO-260, and states should certify such aircraft for early implementation of ADS-B OUT in their FIR in line with the regional strategy.

Sub-regional ADS-B implementation projects

6.29 The meeting noted the outcome of the discussion by the three ad hoc working groups established during the Task Force meeting to further develop proposals for sub-regional implementation plans for South East Asia, Bay of Bengal and South Asia and Pacific. The outcome is provided in Appendix K to the report of ADS-B SITF/8.

Note of appreciation

6.30 The meeting appreciated the efforts and progress made by the ADS-B SITF and the SEA ADS-B WG. The meeting expressed its appreciation and gratitude to the Civil Aviation Authority of Viet Nam and VANSCORP for hosting the ADS-B Seminar and the Task Force meeting. The meeting also expressed appreciation to Airservices, Australia for hosting the fourth meeting of the SEA ADS-B Working Group.

Time and Venue of Next Meeting

6.31 The fifth meeting of SEA ADS-B Working Group is scheduled in the end of 2009 or early 2010 in Indonesia and the next meeting of ADS-B Study and Implementation Task Force is scheduled for April or May 2010.

6.32 Australia informed the meeting (IP12) that following formal consultation with industry the government agencies have decided not to proceed with the Australia plan for the rapid transition to GPS Primary means Navigation and ADS-B surveillance; a more gradual transition strategy has been adopted. The first step is the mandatory carriage of ADS-B Out for aircraft operating at or above FL290. Area specific implementations of GPS navigation and ADS-B are currently being considered. The slower transition requires renewal of the en route radar network and most of the ground Navigation Aids; this has commenced. The meeting noted that Australia remains committed to the use of ADS-B technology despite the decision to no longer proceed with the cross-industry funding proposals.

Regional Surveillance Strategy for Asia/Pacific Region

6.33 The meeting reviewed the surveillance strategy for Asia and Pacific Regions adopted by APANPIRG/19. The meeting did not identify the need to amend the Strategy.

SSR Mode S II Code Coordination Activities

6.34 Japan provided a progress report on the SSR Mode S II code coordination with neighboring States. Japan has commenced discussion and meetings to establish frameworks to solve the recognized problem. It was noted that Japan had been operating some SSR Mode S stations for a few years and has plans to replace current SSRs (Mode A/C) with SSRs Mode S. Japan had coordinated with Republic of Korea and relevant ANSP and SSR operators such as United States Air Force in Japan (USFJ and Japan Self Defense Force (JSDF). Japan also has plans to coordinate with China on the Mode S II code assignment. Coordination with military is necessary because of overlap pins coverage of civil and military SSR Modes station. The difficulty to get related information from military on the SSR Mode S station parameters was brought up.

SSR Mode S International Identifier (II) Code

6.35 The meeting recalled that SSR Mode S interrogator Identifier Code are used to reduce garble and to improve performance in the overlapping coverage of SSRs. ICAO SARPs provided for a 4 bit Interrogator Identifier (II) code, which permits 16 code combinations to be available for operational use. In 1998, Annex 10, Volume IV was amended to provide SARPs for additional 63 Surveillance Identifier (SI) codes, in addition to Interrogator Identifier (II) codes, to meet the requirement of SSR interrogators in the areas of high density of installations. In Asia and Pacific Regions, the density of interrogator installations does not warrant the use of Surveillance Identifier

(SI) and hence CNS/MET SG/12 agreed that only Interrogator Identifier be used, till such time the density increases to the extent that 16 Interrogator Identifier codes are found inadequate to provide unique codes for all the interrogators with the overlapping coverage. The meeting was informed that among the 4 bit Interrogator Identifiers, the code 0 (zero) is reserved and not generically available for II code assignment.

6.35.1 The meeting reviewed a proposal from the Secretariat on the coordination and management of SSR Mode S Interrogator Identifier codes and was informed on the progress made by ICAO to develop a (tool to assist States and the Regional Offices in coordinating and maintaining a database on SSR Mode S II code assignments.

6.35.2 The meeting agreed, noting Conclusion 19/40 of the APANPIRG, to develop a Table on SSR Mode S Interrogator Identifier (II) codes that have been coordinated and assigned to SSR Mode S stations. The Table needs to include essential characteristics of the SSR Mode S stations to enable an interference free Mode S II code assignment, such as the geographical coordinates, Designated Operational Coverage (DOC) of the Mode S station and the height above MSL.

6.35.3 The meeting agreed that, until a flexible modification procedure for Table CNS 4A (Surveillance systems) in the Air Navigation Plan (FASID) would be in place, coordinated Mode S II code assignments would be maintained in a separate Table. The coordination procedure needs to secure that the ICAO Regional Office is the focal point in making Mode S II code assignments. Pre-coordination of II code assignments between neighbouring States is however encouraged.

6.35.4 The format of the Table for Mode S II code assignments is in **Appendix V** to the Report. The meeting requested the Secretariat to invite ICAO contracting States to provide the relevant information with regard to their Mode S stations. The meeting stressed the coordinating role of ICAO in the Mode S II code assignments.

Following the discussions on this matter, the meeting formulated the following Conclusion.

Draft Conclusion 13/25 - Information for coordination for SSR MODE S II

That,

a) the TABLE on SSR MODE S Interrogator Identifier Codes as provided in **Appendix V** to the CNS/MET SG/13 Report be adopted; and

b) States be advised to provide the required information as specified in the Table on SSR MODE S Interrogator Identifier Codes to the ICAO Regional Office for coordination and registration.

Planning criteria for Mode S II code assignments.

6.36 Planning criteria for SSR Mode S II codes, as presented by the Secretariat, were supported by the meeting. The planning criteria, essential for developing a Regional SSR Mode S II code assignment plan, are contained in the **Appendix W** to the Report. It was noted however that these planning criteria may require future review.

6.36.1 In connection to the activities above, the meeting was presented with the program, developed by ICAO HQ (CNS/AIRS) that manages and calculates Mode SS II code assignments. The meeting concurred with the functions provided in this program. It was noted with concern that test runs of this program have shown that in some limited areas of the APAC Region not all requirements for II codes could be met with the 15 codes available. The meeting agreed that in these cases, further coordination would be required noting that the SSR Mode S system offers methodologies to make a more efficient use of Mode S II codes that was assumed in the test runs. This matter requires further attention by the APAC countries.

In view of the foregoing, the meeting developed the following Draft Conclusion.

Draft Conclusion 13/26 – Planning criteria for SSR Mode S II assignment

That, the Planning criteria for SSR Mode S II coordination and assignment as provided in **Appendix W** to the CNS/MET SG/13 Report be adopted as a provisional guidance for use in the APAC Region.

6.36.2 The meeting requested the Secretariat to expand the planning criteria with background information on the use of II code 0 (zero).

6.36.3 The meeting could not agree to a suggestion to reserve II code 15 for airborne Mode S interrogator platforms and agreed that this matter would be considered after a full assessment of the required II codes in the APAC Region has been completed.

6.36.4 In view the observation as stated in the paragraph 6.38, the meeting invited the ICAO to conduct further study on introduction of SI code in the Asia and Pacific Region and formulated the following Decision.

Decision 13/27 – Study of using SSR Mode S SI code

That, Study on the need for introduction of SSR Mode S SI code for future use in the Asia and Pacific region be included in the Subject and Tasks List of CNS/MET SG.

6.36.5 The meeting appreciated for efforts made by the Secretariat in developing the SSR Mode S management tool and procedure for coordination.

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Agenda Item 7: Aeronautical electromagnetic spectrum utilization

1) Review preliminary ICAO position for World Radiocommunicaiton Conference -2011 (WRC-2011)
2) Review result of the Second APT Regional Preparatory Group Meeting

7.1 The meeting was informed by the Secretariat that the draft ICAO Position on WRC-2011 Agenda Items of critical interest for Civil Aviation was circulated through a State Letter in November 2008. Comments received from Administrations in response to the State Letter were incorporated and the final position incorporating the comments was approved by ICAO Council in June 2009. A copy of the State Letter E 3/5-09/61 dated 30 June 2009, provided in **Appendix X** informing the States ICAO Position on WRC-2011 Agenda Items of interest for Civil Aviation was also presented to the meeting. The meeting was reminded about ICAO Assembly Resolution A36-25, through which the States and International Organizations were urged to provide full support for ICAO Position in their State and regional views for presentation to WRC-2011. Meeting after reviewing the Position presented on WRC-2011 Agenda Items, urged the States for their support through the following Draft Conclusion.

Draft Conclusion 13/28 - ICAO Position for WRC-11 Agenda Items

That, States be urged to:

a) integrate ICAO Position on WRC-11 Agenda Items into their State Position presented to the regional telecommunication forum (APG) involved in the preparation of joint regional position on the Agenda Items;

b) include ICAO Position on WRC-11 Agenda Items into the State Position to the extent possible;

i) undertake to provide experts from their civil aviation authorities to participate in the development of State and regional positions; and

ii) ensure to the extent possible, State delegation to regional conferences, ITU Study Groups and WRC should include experts from Civil Aviation authorities.

7.2 The meeting was also presented the outcome of Second Meeting of the APT Conference Preparatory Group for WRC-2011 (APG 2011-2) by the Secretariat. APG 2011-2 hosted by Ministry of Transport and Information Technology, PR China was held in Hangzhou China from 22 to 26 June 2009. The meeting was attended by 285 participants from 24 Member States, affiliate members including industrial organizations, international organizations and other relevant organizations. Representation of national civil aviation organizations was low at eight only. ICAO Asia Pacific Office participated in the meeting as an observer. Agenda Items were assigned to six Working Parties, which in turn appointed Drafting Groups for developing and recording the views on individual agenda items. The views developed were subsequently discussed at the level of Working Party and then in the plenary session. ICAO Position on WRC-11 Agenda Items of critical interest for civil aviation was presented through an Information Paper. Drafting Groups, while recording the preliminary views took into account ICAO Position also on almost all the relevant agenda items.

7.3 Meeting was informed that ITU Council has rescheduled the meeting from 23 January to 17 February 2012. The meeting will be preceded by the Radiocommunication Assembly meeting scheduled from 16 to 20 January 2012. APG members reported their dissatisfaction with the dates and adopted a resolution requesting APT Secretary General to write to the States requesting them to take up with ITU the reconsideration of the meeting dates.

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Agenda Item 8: Implementation of the World Area Forecast Systems (WAFS):

1) review WAFSOPSG and SADISOPSG issues
2) review the status of implementation of ISCS and SADIS
3) review the status of implementation and utilization of the WAFS products

8.1 Review WAFSOPSG and SADISOPSG issues

8.1.1 The meeting noted the executive summaries of the 4th Meeting of the WAFSOPSG held at the ICAO Regional Office, Cairo, Egypt from 26 to 28 February 2008 (full report is available on the WAFSOPSG website http://www.icao.int/anb/wafsopsg), and the 14th meeting of the SADISOPSG held in Bangkok, Thailand from 15 to 17 July 2009 (full report available on SADISOPSG website http://www.icao.int/anb/sadisopsg). The meeting was informed of the executive summary and highlights of the summary provided such as the implementation of SADIS FTP Service enhancements which were implemented in April 2009. The second phase of enhancements known as SADIS FTP Secure Service planned for implementation by November 2010, which would coincide with the applicability date of Amendment 75 to Annex 3. GRIB 2 data trials revealed 2-hour transmission time in retrieving uncompressed data of forecast products. The increase in time from the GRIB 1 transmission time of 30 minutes was due to the increased spatial and temporal resolution. The transmission of compressed GRIB 2 data was expected to be one hour. Despite the expected drop of users associated with the implementation of SADIS 2G, membership had since increased to a record high of 99 States.

WAFS developments

8.1.2 A follow-up of Conclusions of the WAFSOPSG/4 meeting was presented to the meeting as reference material for use by the group in that two papers to be presented in the meeting (IP/6 and WP/15) were related to WAFSOPSG/4 Conclusions. Specifically, arising from WAFSOPSG Conclusions 4/19, 4/11 and 4/20, the progress with interpolation of concatenated WAFS forecasts, global output performance indices of wind and temperature, and web based interface for provision of a minimum set of WAFC charts was noted by the meeting. The WAFS developments presented to the meeting are included in **Appendix Y** to the Report and will be distributed to States by the Regional Office.

8.2 Review the status of implementation of SADIS and ISCS

SADIS Strategic Assessment Tables

8.2.1 The meeting reviewed the draft SADIS Strategic Assessment Tables for Asia, 2009-2013 prepared by the SADIS Strategic Assessment Team were used to help guide the SADIS Provider State in future developments necessary for SADIS. The process of formulating the regional SADIS Strategic Assessment Tables was addressed in SADISOPSG Conclusion 14/15 calling for the SADIS Provider State to take note of the completed SADIS Strategic Assessment Tables to form the basis for the future development of the SADIS and to forward the SADIS Strategic Assessment Tables to the MET sub-groups of the PIRGs concerned for update in respect of future requirements. With the aforementioned, the ASIA region SADIS strategic assessment tables for 2009-2013 were reviewed. The meeting noted that the expected increase in FC TAF would be related to non-AOP aerodromes and not from AOP aerodromes which no longer should disseminate FC TAF in the Region per regional air navigation agreement. The levels of SIGMET transmission further addressed in agenda item 10 would be updated to reflect the expected increase in SIGMET availability in the Region. For forwarding of the tables to the SADISOPSG, the meeting formulated the following Decision.

Decision 13/29 – SADIS Strategic Assessment Tables

That, the Asia region SADIS strategic assessment tables, as given in **Appendix Z** to the Report, be adopted and forwarded to the SADISOPSG for planning the future SADIS bandwidth requirements.

Replacement of 2nd Generation ISCS (ISCS-2G)

8.2.2 The meeting was informed of the updated situation with regards to the current contract for leasing the satellite broadcast capability for the distribution of World Area Forecast (WAFS) products on ISCS. It was reported at the CNS/MET SG/12 meeting that the contract with Verizon (MCI) that provided ISCS satellite broadcast services would expire on 31 December 2009; however, since then the contract had been extended to 30 June 2010 and negotiations to further this contract until 30 June 2012 were underway in order to give States time to plan on acquiring the reception system needed when the contract expired. The meeting was informed that the ISCS Provider State would no longer be in a position to provide any components of the reception system (whether it be VSAT SGS, work station or necessary software) free-of-charge to the ISCS user States.

8.2.3 The meeting was informed that the ISCS Provider State may replace the existing ISCS-G2 satellite broadcast service with ISCS-G3 service which would likely involve reception system modifications (possibly VSAT SGS, work station and software). In this scenario, the WIFS is planned to be a parallel service to the satellite broadcast. Nevertheless, the decision had not yet been made by the ISCS Provider State resulting in a delay to the implementation plan of ISCS-G3.

8.2.4 Irrespective of whether or not the ISCS-G2 service would expire on 30 June 2010 or 2012, all WAFS forecasts and OPMET data currently available on the ISCS satellite broadcast would be available for download via a WAFS Internet File Server (WIFS) accessible via public Internet. WIFS was expected to be available for operational use by March 2010. Users would be responsible for arranging their own access to the public Internet, and also for any required modifications to WAFS workstation software necessary to download WAFS products off the WIFS. Guidance would be provided in the ISCS User Guide. There would also be unrestricted user access for an interim period of time in early 2010 for test evaluation by the users. Increased costs to the users for accessing the WIFS WAFS products were uncertain, but believed to be minimal to States and covered under existing maintenance contracts. The ISCS User Guide is expected to be updated to provide information for accessing the WIFS.

8.2.5 One significant factor in making the decision to provide WAFS products via the Internet or via satellite broadcast was whether or not the Internet guidelines, *Guidelines on the use of the Public Internet for Aeronautical Applications* (Doc 9855), should be changed to accommodate the use of the Internet for time-critical data or that the classification of time critical be removed as currently stipulated in Doc 9855 and in ICAO Annexes. A risk had been identified to the Public Internet in that a number of States did not have reliable Internet Service and AFTN circuits should be used for time-critical data. It was pointed out that these same States in the Region were likely to have unreliable AFTN circuits. Another point made for the Internet distribution of all WAFS products was that the time-critical categorization was derived from older technology relating to the slow speed of AFS circuits. Nevertheless, with the current guidelines, SIGMET would also be distributed via AFS in addition to the Internet. The meeting was also made aware that MET data provided by WAFCs were intended for flight planning and deemed non-time critical, which would enable the development of WIFS in this context. With the aforementioned, the following draft Decision was formulated.

Draft Decision 13/30 – Use of the public Internet to access OPMET data and WAFS forecasts

That, OPMET data and WAFS forecasts currently distributed through the ISCS, if only used for flight planning, can be considered non-time critical and therefore, can be accessed through the public Internet.

Note: Relevant ICAO guidance will be updated accordingly, subject to consideration of a similar decision by the WAFSOPSG/5 Meeting and subsequent endorsement by ANC.

8.2.6 The meeting was aware of the significant impact to ISCS users in the South Pacific in that Internet access was not reliable or available everywhere. This point should be considered in the assessment of future dissemination method(s) which would replace ISCS-G2 broadcast. The meeting was of the view that there was no ideal solution since higher costs were expected stemming from the hardware upgrade associated with an ISCS-G3 broadcast. A survey to States through the Regional Office was considered necessary in determining the impact to States given the choice of continued satellite broadcast (ISCS-G3) versus distribution of WAFS forecasts and OPMET data via the web (WIFS). The pros and cons of each option by the ISCS Provider State was regarded desirable by the meeting. The final decision by the ISCS Provider State was considered time critical by the group. Given the above discussion on the means of delivering WAFS products to the users under the footprint of the ISCS, the following draft Conclusions were formulated.

Draft Conclusion 13/31 – Extension of the ISCS-G2 and the implementation of the WAFS Internet file server (WIFS)

That, WAFC Washington Provider State advise the ISCS user States about its intentions to:

a) continue to work on extending the current ISCS-G2 service through 30 June 2012 to allow users sufficient time for transition to replacement services; and

b) provide an operational WAFS Internet File Server (WIFS) by March 2010.

Draft Conclusion 13/32 – Replacement of ISCS-G2

That,

a) the ICAO Regional Office, in coordination with the ISCS Provider State, prepare a survey to be circulated to the ISCS user States and focal points on their intentions as to the future reception of OPMET data and WAFS forecasts, i.e. ISCS-G3 vs. WIFS; and

Note: the survey would include pros and cons of the two systems, together with the associated cost estimates, to be provided by the ISCS Provider State and seek information about the States' capability to assume these costs in view of establishing possible funding arrangements.

Note: the Secretariat request States to revalidate their respective focal point to further promote coordination between the ISCS Provider State and the user States in the Asia/Pacific Region.

b) after completion of action under a) above by 1 December 2009, the ISCS Provider State inform the ISCS user States concerning their plans for the replacement of the ISCS-G2; and

Note: the ISCS Provider State is expected to indicate its future plans concerning ISCS-G3 and the WIFS

c) the WAFSOPSG be invited to consider preparing an amendment to all ICAO regional procedures in the ANP/FASID to render WIFS and SADIS FTP Service as an alternative to the respective satellite broadcasts as the primary means of obtaining WAFS forecasts and OPMET data for flight planning purposes.

Note: WAFS user States are responsible for the procurement of the necessary tools to access WAFS forecasts and OPMET data provided by the WAFCs.

Note: The adoption of this Conclusion reinstates the APANPIRG Conclusion 19/45, Transition to ISCS 3rd Generation.

ISCS and SADIS Harmonization of OPMET data

8.2.7 The latest efforts to harmonize ISCS and SADIS were presented to the meeting by the ISCS Provider State. In September 2008 the ISCS Provider State no longer rebuilds bulletins under the CCCC of KWBC which is in alignment with SADIS. In addition, the SUG Annex 1 is used as the requirements for U.S. OPMET data collectives. Two more changes were expected by the end of 2009 that further harmonize ISCS with SADIS: (1) to become ICAO compliant by not using METAR identifiers with numbers and (2) creating bulletins under 1800 characters long which will use the optional code RRx in accordance with WMO GTS Manual on Codes (No. 386). The significant amount of data issued would be distinguished with the proximity in time to reconstruct a multi-bulletin. **Appendix A1** lists the aerodromes for the new scheme. States were invited to identify collectives that were missing on the broadcast. If a non-AOP aerodrome was missing from the broadcast, the information should be forwarded to the ICAO Headquarters for removal from Annex 1 to the SUG. If an AOP aerodrome was missing from the broadcast, the information should be forwarded to the Regional Office for consultation with the States concerned about the requirements in the respective FASID Table MET 1A. If a State determined an aerodrome status should change from AOP to non-AOP, the State should notify the Regional Office of the status change for removal from the Basic ANP and FASID Table MET 1A. The meeting was notified of a plan by the United States of the removal of air force bases from the list of AOP aerodromes that would affect the Regional Air Navigation Plans (RANP) of the North American Region (NAM) and the Asia/Pacific (ASIA/PAC) Region RANP.

8.3 Review the status of implementation and utilization of the WAFS products

WAFS gridded forecasts of icing, turbulence and cumulonimbus clouds

8.3.1 The meeting was presented with further observations by Hong Kong, China on the WAFS trial gridded forecasts of icing, turbulence and cumulonimbus clouds since the CNS/MET SG/12 meeting which are reproduced in **Appendix A2**. These observations indicated the following issues: (a) compatibility of forecasts of the two WAFCs; (b) quality issues in seasonal aspects, CB diurnal variation and CB associated with tropical cyclones.

8.3.1.1 Furthermore, based on the information presented at the 2009 WAFS Science Coordination Meeting, the following additional issues with the quality, verification and calibration WAFS trial gridded forecasts were identified:

(a) **In-cloud turbulence** – until such time systematic verification for the related products was done, it would appear that the quality of the in-cloud turbulence gridded products was doubtful for acceptance for operational flight planning applications, in particular noting that the algorithms for in-cloud turbulence are not as well developed (mature) as those for clear-air turbulence;

(b) **Icing** – unlike the CAT products which were verified using flight data as ground truth, the icing products at different thresholds were verified using another icing potential product (CLIP), with the "trace icing" criterion, derived from satellite cloud classification data and numerical model temperature forecast. It was not sure if the "trace icing" criterion for CLIP represented a level considered significant by the aviation users and whether or not an appropriate balance had been struck between maximizing the Probability of Detection (POD) while minimizing the False Alarm Rate (FAR) at the same time. There was an apparent need for: (i) the WAFCs to justify the use of the verification method for icing, viz. to verify the WAFS icing potential products based on another icing potential product which by itself was subject to verification against pilot reports; (ii) the WAFSOPSG to systematically develop and agree on the WAFS output performance indicators for verifying the gridded forecasts, and (iii) the WAFCs to calibrate the relevant thresholds of the algorithms so that the gridded forecasts would be compatible with the user's expectation/perception formed in using the existing SIGWX forecasts;

(c) **CAT** – similar to the above comments on icing, it is noted that numerous thresholds were considered in verifying the CAT products, and in particular, the verification was performed with reference to the criterion DEVG >= 2 m/s based on aircraft data. An immediate question on the use of this criterion was whether or not there was any correspondence with the moderate/severe or EDR thresholds for significant turbulence adopted by ICAO. Points (ii) and (iii) in item (b) above were apparently relevant and needed to be addressed;

(d) **CB** – due to the apparent lack of information on the verification scheme for the CB products, it was rather difficult to provide specific comments but points (i)-(iii) in item (b) above should be relevant and need to be addressed for the systematic verification of the CB products.

8.3.2 IFALPA informed the meeting of the need for accurate, yet simple, visualization charts for flight planning given the short 15 minutes of planning for long flights by pilots. IFALPA drew the meetings attention to a draft policy on SIGWX charts that cite the need for surface fronts and other SIGWX features that were eliminated in Amendment 74 to Annex 3. In response to the concern of readiness of the new gridded forecasts raised by Hong Kong, China, the meeting realized that the enabling clauses proposed for Amendment 75 to Annex 3 with regards to the new gridded forecasts of icing, turbulence and cumulonimbus were for experimental and development purposes only and that States would be advised not to use these products for operational purposes until 2013 or later. With that, it may be expected that a note will be provided in Annex 3 for clarity that the new gridded products would remain as trial products and not for operational use prior 2013. The meeting agreed that the identified issues should be directly referred to the WAFSOPSG/5 meeting. In addition, WAFC London and Washington confirmed that efforts addressing the above issue were ongoing and biases of products were being identified for future corrections.

8.3.3 Based on the above discussions, the meeting considered that it was important that, the identified issues in the compatibility, quality, verification, calibration and visualization of the gridded forecasts of the two WAFCs should be satisfactorily addressed before these trial products are suitable for operational use. In this regard, the meeting was pleased to note that the WAFSOPSG was developing WAFS output performance indicators which would be used for verifying the WAFS gridded forecasts. Furthermore, the WAFCs would convene a workshop targeted to aviation users related to the visualization of gridded WAFS forecasts in September 2009. This workshop was expected to contribute towards the calibration and fine tuning of forecast algorithms rendering them compatible with user's expectation. Moreover, the WAFSOPSG would consider the inclusion of SIGWX features (including TC and VA) in the future visualization models for the gridded forecasts. Hong Kong, China will present these issues in a paper for consideration by the WAFSOPSG/5 meeting.

Concatenated products for GRIB 2 forecasts

8.3.4 The meeting was informed that a study of the interpolation of concatenated WAFS forecasts in particular for long-haul flights conducted by an ad hoc group of the WAFSOPSG could similarly be applied to the gridded forecasts of cumulonimbus clouds, icing and turbulence conducted. A proposal would be reported to the WAFSOPSG/5 meeting. ICAO in coordination with WMO would develop Annex 3 provisions for applicability in 2013 to enable the provision of concatenated route specific wind/temperature forecasts generated preferably from interpolating data from consecutive forecast times. Hong Kong, China informed the meeting through an information paper about the results of a study of various visualization schemes for the WAFS trial gridded forecasts on cumulonimbus clouds, icing and turbulence. Emphasis was placed on the generation of time-interpolated route-specific vertical cross-sectional high "at-a-glance" charts. Use of simplified monochrome presentation (dotted/continuous/thick lines, grey shades or hatched areas) versus colour was proposed. Further simplification by removing in-cloud turbulence and icing within CB would be plausible. An example of a route-specific horizontal strip chart generated for the forecast of wind and temperature at a particular flight level, in a form similar to those generated for the trial gridded forecasts, was also presented. The necessary information for flight planning could be obtained using these simple "at-a-glance" presentations. It was noted that the depiction of tropical cyclone and volcanic ash have not yet been addressed, but the users will be consulted on the development of the standards for visualization of the gridded forecasts.

Regional progress

8.3.5 The meeting noted the cessation of SADIS 1G on 5 January 2009. In particular, 95% of States have now migrated to SADIS 2G. Changes to the WAFS related work programme are in **Appendix A3**.

WAFS implementation plan

8.3.6 In the light of the above discussions, in particular noting the significant number of WAFS developments planned in the next year, the meeting updated the ASIA/PAC WAFS Implementation Plan and Procedures, Work Programme and composition of the WAFS/I TF. Given the aforementioned, the meeting formulated the following Decision.

Decision 13/33 – ASIA/PAC WAFS Implementation Plan and WAFS Implementation Task Force

That,

a) the ASIA/PAC WAFS Implementation Plan and Procedures be amended as shown in **Appendix A4** to this report;

b) the work programme and composition of the WAFS Implementation Task Force be amended as given in **Appendix A3** to this the report.

8.3.7 Australia suggested that, for clarity, the ICAO Regional Office should display the task force terms of reference, work programme, and composition of each task force under the CNS/MET SG on the ICAO Regional Office website similar to that provided for the Study Groups at ICAO Headquarters.

ISCS Help Desk, Operation Statistics, Operational Efficacy

8.3.8 The meeting was presented with information on the ISCS 24-hour help desk operated by the U.S. National Weather Service (NWS) Telecommunications Operations Center (TOC). Eleven sites utilized this help desk this past year with most problems related to the workstation software and referenced to the appropriate vendor. Information on reporting problems and installation related with the reception of WAFS can be found at http://www.weather.gov/iscs/trouble.htm. In addition, the ISCS help desk can be reached at +1 301 713 0902 or by fax at +1 301 587 1773.

8.3.9 During the 12 months from April 2008 through April 2009, ISCS was available over 99.99% of the time, exceeding the 99.9% requirement every month except June 2008. ICAO Annex 3 requirements were met for GRIB-1 products by being available within 6 hours before the initial synoptic time and BUFR SIGWX products by being available no later than 12 hours before their validity time.

8.3.10 The results from 12 of 26 States of the Asia/Pacific Survey on ISCS Operational Efficacy of ISCS/2 broadcast from 1 May 2008 to 31 June 2009 were presented to the meeting and reproduced below.

- 82% of States considered that the service administrative messages were acceptable;
- 83% of States reported acceptable availability of upper-air data in the GRIB code form;
- 83% of States reported acceptable availability of SIGWX data in the BUFR code form;
- 91% of States reported acceptable availability of OPMET messages;
- 83% of States reported that they are able to produce WAFS SIGWX charts from the BUFR code form;
- 91% of States reported acceptable VSAT signal quality;
- 91% of States reported an acceptable overall assessment of the VSAT;

- 53% of States reported they used the Internet, either through the UK MET Office or the US NWS

8.3.11 The meeting was informed that the future surveys are expected to be on the ISCS web page to provide more continuous feedback on the ISCS service. In response to a query by Laos about the equipment needed and associated cost to upgrade to SADIS 2G the meeting noted that the SADIS Provider State and WMO was the contributor to a WAFS Trust Fund of the WMO; however, future funding is uncertain due to the depletion of this fund.

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Agenda Item 9: Implementation of observation, forecast and OPMET exchange:

1) review AMOFSG and OPMET/M TF issues
2) review regional requirements for OPMET information (FASID Tables)
3) review the status of implementation of 30-h TAF and VOLMET broadcast

9.1 Review AMOFSG and OPMET/M TF issues

9.1.1 The meeting noted the follow-up actions agreed at the Seventh Meeting of the Aerodrome Meteorological Observation and Forecast Study Group (AMOFSG/7), which were made available for information purpose only.

9.1.2 The meeting was informed about the major outcome of the Seventh Meeting of the ASIA/PAC OPMET Management Task Force (OPMET/M TF/7) held in Bangkok, Thailand, from 2 to 4 June 2009. The meeting was attended by 27 experts from Australia, Cambodia (observer), China, Hong Kong China, India, Japan, Malaysia, Singapore, Thailand, Viet Nam, IATA and ICAO. The full meeting report was available on the ICAO Asia/Pacific web site at http://www.bangkok.icao.int/meetings/2009/opmet_tf7/index.html. The status of deficiencies addressed by the OPMET/M TF/7 meeting was presented in Agenda Item 14(2). In addition, performance framework forms were presented in Agenda Item 13(2). Lastly, SIGMET test for tropical cyclone, volcanic ash and other weather phenomena was presented in Agenda Item 10(3).

Review of Terms of Reference (TOR)

9.1.3 The OPMET/M TF/7 meeting reviewed its Terms of Reference (TOR) which was last adopted by the CNS/MET SG/12 meeting (July 2008). In view of the fact that XML might be used in the exchange of OPMET contingent on a pilot project being conducted by WMO in close coordination with ICAO and endorsement by the ANC in 2010, continuous monitoring of the progress of XML would be needed. In view of the status of new format for the exchange of OPMET, the following decision was adopted by the group with regard to the revised TOR and Work Programme of the OPMET/M TF.

Decision 13/34 – Revised TOR and Work Programme of the OPMET/M TF

That, the revised TOR and Work Programme for the OPMET/M TF as shown in the **Appendix A5** to the Report be adopted.

Current status of OPMET exchange in the Region (RODB/3 and OPMET/M TF/7 meetings)

Third RODB Meeting

9.1.4 The group was informed of the outcome of the third RODB Coordination Meeting hosted by the Bureau of Meteorology (BoM) from 29 to 30 January 2009 in Melbourne, Australia. The RODB coordination meeting reviewed tasks in preparation for the OPMET/M TF/7 meeting detailed in an action item list that included inquiries on specific OPMET requests, RODB backup tests, update of regional guidance material, improvement and expansion of WV SIGMET test procedures and providing specific OPMET deficiencies to the Regional Office for use in State letters.

OPMET/M TF/7 meeting

9.1.5 The OPMET/M TF/7 meeting reviewed the status of Regional OPMET data banks and in particular activities such as RODB backup test, OPMET monitoring of multi-part bulletins,

SIGMET, compliance with Amendment 74 to Annex 3, and a comparison of performance indices amongst three RODBs. A brief description of activities is included in **Appendix A6.**

IATA OPMET monitoring

9.1.6 The meeting noted IATA's monitoring of the timeliness and regularity of OPMET data received from the Asia/Pacific Region for the period 18 March 2009 to 07 April 2009. Data were received through SADIS, ISCS, DWD, AFTN and SITA. With reference to ICAO Annex 3, Appendix 10 (paragraph 1.1 and 2.1.2) the time between observation and reception should be 15 minutes or less for METAR/SPECI and Trend Forecasts. IATA observed that METAR and/or TAF were sometimes received before the indicated observation or issuance time, which can vary from day to day. While the requirement for issuance of TAF is at least one hour before the commencement of the period of validity as per FASID Table MET 1A, TAF in some cases was received more than one hour after the issuance time or after the commencement of the period of validity time. As a result, automated alerting system for missed OPMET data was not always effective.

9.1.7 Suggested steps on addressing the observation, completion and transmission times for METAR were presented by IATA and reproduced as follows:

- State determines how often per hour a METAR is issued (hourly, half hourly or less)
- State determines what time (minutes of hour) the observation on which METAR is based is made (and be consistent for all hours and all days)
- METAR is prepared using the observation time in the METAR report
- METAR is compiled no later than 5 minutes after observation time (the compilation time in the bulletin header should be equal or later than the observation time)
- METAR is issued no later than 10 minutes after observation time through agreed communication links

9.1.8 Suggested steps on addressing the completion and transmission times for TAF were presented by IATA and reproduced as follows:

- State determines what time the four scheduled TAFs (FT) per day are issued (and be consistent for all days)
- TAF is issued 1 hour before the TAF is effective (FASID Table MET 1A)
- TAF issuance time is used in the TAF
- TAF is compiled no later than 20 minutes of issuance time (compilation time in bulletin is equal or later than the issuance time)
- TAF is made available no later than 25 minutes after issuance time through agreed communication links

9.1.9 The United States prefers a near immediate time of TAF issuance by providing TAF near the start period of validity time. IATA informed the meeting the need for an hour lead time of issuing TAF before the period of validity in the time needed to coordinate the dissemination of new TAF to aircraft in flight. This was also in agreement with the Asia/Pacific ANP. IATA noted that the buffer time within the hour lead time was preferred to be in the order of 10-20 minutes in response to the MET service logistics of issuing multiple TAF posed by Australia. The meeting agreed that these issues warrant further discussion at the AMOFSG whose work programme includes this issue. Furthermore, the CNS/MET SG will revisit this issue in 2010 when reviewing the regional procedures in the Asia/Pacific ANP. As a short term measure, the meeting agreed that guidance in the ROBEX Handbook should be expanded. Given the above discussion, the meeting formulated the following draft Conclusion.

Draft Conclusion 13/35 — Harmonization of procedures for OPMET data issuance

That, ICAO Regional Office be invited to

a) Include examples of correct methods of issuing OPMET data for inclusion in the ROBEX Handbook;

b) After completion of a) above request States in the Asia/Pacific Region to implement these methods as a matter of priority; and

c) Consult the RODBs to monitor the progress of OPMET data issuance in compliance with the Regional Air Navigation Plan for reporting at the OPMET/M TF/8 Meeting

9.1.10 IATA also monitored OPMET data received from the Asia/Pacific Region from SADIS for the period from 10 March to 11 May 2009. METAR and TAF issued and received for AOP and non-AOP aerodromes in the SADIS Users' Guide Annex 1 dated January 2009 were analyzed. Only 61.7% and 86% of AOP aerodromes issued METAR and TAF while 66.1% and 67.7% of non-AOP aerodromes issued METAR and TAF. The aerodromes that did not provide METAR and/or TAF are listed in **Appendix A7**, which includes a summary of missing OPMET data on SADIS by State. The meeting was reminded that States were obliged to issue METAR, and TAF subject to RAN agreement, for AOP aerodromes unless the State notified ICAO that no OPMET data were issued for that certain AOP aerodrome or that partial service was available at specific aerodromes. In addition, in support to en-route alternates and ETOPS operations, IATA formulated the general requirement that all OPMET data currently available should be distributed internationally (without changing the status of an aerodrome) at the IATA METTF/14 Meeting. IATA set a goal of 95% and 90% of OPMET (METAR and TAF) availability for AOP and non-AOP aerodromes.

9.1.11 New Caledonia noted that aerodromes in French Polynesia should not be included in the list of unavailable OPMET data as they should be treated as non-AOP aerodromes. The meeting noted that the aerodrome concerned was an AOP aerodrome and included as a formal requirement. Therefore, the State concerned should inform the Regional Office that the OPMET requirements (or the status of the aerodrome) should be changed. New Caledonia also noted that their respective TAF is available on the ISCS, but not available on the SADIS. The ISCS Provider State will coordinate with the SADIS Provider State in providing these TAF to SADIS. This revealed further harmonization between ISCS and SADIS would be needed before consulting States on unavailable OPMET data. With the aforementioned on methods to improve the availability of OPMET data, the meeting formulated the following draft Conclusions.

Draft Conclusion 13/36 — Improvement of OPMET data availability for AOP aerodromes

That, after the next round of harmonization of OPMET data between SADIS and ISCS Provider States,

a) IATA be invited to monitor the availability of OPMET data for AOP aerodromes; and

b) ICAO Regional Office, based on the results of the monitoring in a) above, remind States concerned of unavailability of OPMET data.

Note: the aim will be an availability of 95% of all OPMET data (METAR and TAF) from AOP aerodromes on SADIS and ISCS.

Draft Conclusion 13/37 — Improvement of OPMET data availability for non-AOP aerodromes

That, after the next round of harmonization of OPMET data between SADIS and ISCS Provider States,

a) IATA be invited to monitor the availability of OPMET data for non-AOP aerodromes; and

b) ICAO Regional Office, based on the results of the monitoring in a) above, approach States concerned to confirm their agreement to continue providing OPMET data

Note: the aim will be an availability of 90% of all OPMET data (METAR and TAF) from non-AOP aerodromes on SADIS and ISCS

9.1.12 Analysis of the monitoring for the 9-week period based on the day of the week for all the aerodromes in SUG Annex 1 broadcasted on SADIS. The type of rejected OPMET data was categorized as communication or format. TAFs issued by some States (AY, AP, VA, VE, VI, VO) had many rejects and the format was the main cause. The meeting considered that determining the reject type helped develop guidance for States on corrective actions needed.

Responsibility of true to magnetic wind reporting for ATS

9.1.13 The meeting was presented with a proposal to amend Annex 3, paragraph 4.6.1.1 in order to use degrees magnetic for measuring and reporting the surface wind direction. The proposal was based on the use of degree true and degree magnetic in reporting wind direction in various ICAO documents as follows: Annex 3, 4.6.1.1 (true); Annex 11, 4.3.6.1g (implied true as wind was extracted from local meteorological routine or special report which would change to magnetic following Amendment 75 to Annex 3 and responsible entity to make conversion was not specified). Para. 5.2.9 of Doc 9377 specified conversion of true to magnetic for ATS display, but did not specify responsible entity to make the conversion. It was noted that many States did not convert wind direction from true to magnetic for ATS displays, which was a safety issue where the magnetic deviation is significant. Clarity is desired by either specifying the responsible entity to convert reported wind direction from true to magnetic in Annex 11 with regards to the wind in the ATIS or amending Annex 3 to measure and report the wind in magnetic and avoid conversions. Given the fact that aerodromes operate in magnetic direction and that confusion to those who use METAR/SYNOP could be rectified by education if the magnetic direction were used.

9.1.14 The meeting recalled that all runway oriented information was in magnetic because the runway orientation was given in magnetic and that METAR and TAF represent conditions at and around the aerodrome, not only at the runway, explaining why they are in degrees true while the ATS display of wind is in degrees magnetic. In this context, it was noted that in the replies to the State letter related to draft Amendment 75 to Annex 3 the need for guidance related to the responsibility of the conversion from the true to magnetic wind speed had been raised and that it could be expected that the Secretariat would issue this guidance in time for the applicability of Amendment 75. Since the meeting considered that current ICAO Annex provisions were clear and need not be amended, the development of this guidance would sufficiently address the responsibility issue raised by China.

9.2 Review regional requirements for OPMET information (FASID Tables)

Implementation of Amendment 74 to Annex 3 – new TAF provisions

9.2.1 The meeting was reminded of the changes associated with Amendment 74 to Annex 3 and regional requirements in relation to the issuance of TAF, that is, (a) the TAF format included the day in the time elements, (b) only one TAF was required at an aerodrome at any given time, (c) 9-hour TAF was no longer issued internationally in the ASIA/PAC Region, and (d) the requirements for the period of validity of TAF was increased to 30 hours at some aerodromes to support ultra-long haul flights and 24 hours for all other AOP aerodromes in the ASIA/PAC Region.

9.2.2 IATA through continuous monitoring from 9 June to 9 July 2009 presented the meeting with a list of 43 aerodromes in the Asia/Pacific Region where two TAFs were still valid at any given time, which relate to the provisions listed in (b) and (c) in the previous paragraph. The aerodromes are located in 5 States (Bangladesh (1), India (36), Mongolia (1), Pakistan (3), Sri Lanka (1)) and one Territory (French Polynesia (1)) and reproduced in **Appendix A8**. Therefore, 13% (5/38) of contracting States are noncompliant with the provision of one valid TAF at an aerodrome at any given time.

9.2.3 IATA presented the meeting with format error types associated with the day in the time element, which were related to the provision listed in (a) of 9.2.1. The format error types provided included:

- time in change group missing
- incorrect time format in change group
- change group time is outside of the forecast period of validity time period
- period of validity of TAF is greater than 30 hours
- new and old time formats are mixed in the same TAF and validity begins more than 12 hours in the future

These problems resulted in manual intervention to automated systems that process OPMET data, which resulted in an added resource cost. States were encouraged to implement Annex 3 provisions and develop quality control procedures to limit the number of errors in the OPMET bulletins.

9.2.4 IATA also noted that incorrect format of Tropical Cyclone Advisories (TCAs) issued by the Tropical Cyclone Advisory Centre (TCAC) New Dehli. In particular,

- Forecasts greater than 6 hours was not given
- The use of GUSTING is noncompliant with Annex 3, Appendix 2
- MAX WIND +6HR needs the term FCST before it

Based on the discussion above, the meeting agreed that the Regional Office issues a State letter to TCAC Delhi requesting compliance in the issuance of TC Advisories as per Annex 3, Appendix 2 using the example provided by IATA.

9.2.5 Viet Nam informed the meeting that 24-hour TAF would replace 18-hour TAF at three international aerodromes (VVNB, VVDN, VVPB (VVPB would also include a trend forecast)) and that 30-hour TAF would be implemented for VVTS on 01 September 2009. The 30-hour TAF to be provided at VVTS would allow airlines to utilize this aerodrome in alternate flight planning and fuel saving. Moreover, the 30-hour TAF would support future ultra-long haul flights to Viet Nam. The issuance of TAF would be four times a day and one hour before the start period of validity of 0000, 0600, 1200, and 1800 UTC. The meeting commended Viet Nam as it would be compliant with the Regional ANP with regard to TAF on 01 September 2009. IATA was also commended for conveying the reason for the requirements for VVTS. IATA reaffirmed that the FASID Table MET 1A proposed

by Viet Nam was in compliance to IATA requirements and any changes would be included in the current amendment proposal (APAC09/7-MET), which was being process by the ICAO Regional Office.

9.2.6 The meeting was presented with information on the U.S. implementation of TAF verification through a web based program called Stats on Demand (SOD) which would be a component of the NWS/FAA Quality Management System planned to be implemented in 2010. TAF forecast verification allowed individual forecasters to realize their strength and weaknesses and forecast offices to target training to common weaknesses, saving resources on unnecessary training. In recent years, training and verification had led to lower false alarm scores for IFR Ceiling/Visibility while maintaining the probability of detection of TAF. Examples of SOD are provided and States encouraged utilizing this program to improve TAF and utilize limited training resources on targeted areas. This verification process was commended by IATA in providing more accurate TAF. Coordination on retrieving this program could be done through the Regional Office. In addition, placing the software on the WMO web site that housed useful software for Members' free-of-charge access was deemed viable.

Regional Guidance Material

9.2.7 The meeting noted the work done by the OPMET/M TF to amend the Regional Guidance material; mainly ROBEX tables for METAR and TAF, Appendix H to the SIGMET Guide and RODB updates to their respective appendices to the Asia/Pacific ICD.

ROBEX Handbook

9.2.8 The meeting was reminded by the Secretariat of the recent amendments to the ROBEX Handbook with regard to the new TAF provisions associated with Amendment 74 to Annex 3. In particular, the long TAF bulletins in Table B were amended in November and December 2008. A new amendment in June 2009 included the period of validity of TAF requirement if the TAF issued was different from the requirement for implementation tracking. A short list of changes included the new FTAE33 TAF bulletin for Thailand effective 1 August 2009, updates received from States and the OPMET/M TF/7 meeting with regard to METAR exchange in Table A, hours of operation of some bulletins in Table A to assist in the OPMET monitoring process, and adding RODBs to some METAR and TAF bulletins for a wider distribution of OPMET data. The full list of changes associated with the June 2009 amendment to the ROBEX Handbook is given in **Appendix A9** to this Report. The June 2009 amendment to the ROBEX Handbook is posted on the Asia/Pacific website at http://www.bangkok.icao.int/edocs/robex2004_e12.pdf.

ASIA/PAC ICD

9.2.9 The meeting was informed of updates to the Asia/Pacific OPMET data banks interface control document (ICD) to reflect the non-issuance of FC TAF in the Asia/Pacific Region and to change the definition of FT TAF to be with a period of validity of at least 12 hours. In addition, the Bangkok, Brisbane, Singapore and Tokyo RODBs updated their respective appendices A, B, D and E to the ICD. A full list of changes associated with the June 2009 amendment to the ASIA/PAC ICD is given in **Appendix A10** to this Report. The June 2009 amendment to the ASIA/PAC ICD is posted on the Asia/Pacific website at http://www.bangkok.icao.int/edocs/OPMET_DataBanksICD2004.pdf.

SIGMET Guide

9.2.10 The meeting was informed of the updates to the ASIA/PAC Region SIGMET Guide that resulted from its review of incorrect WMO SIGMET headings used in the SIGMET tests. Most changes to the SIGMET Guide were associated with Appendix H, WMO SIGMET headings, but also

included adding a note to the introduction to the WS SIGMET test be initiated by the MWO in Appendix J to the SIGMET Guide. The full list of changes to the ASIA/PAC Region SIGMET Guide is located in **Appendix A11** to this Report. The June 2009 amendment to the ASIA/PAC Region SIGMET Guide is posted on the Asia/Pacific website at http://www.bangkok.icao.int/edocs/sigmet_guide4.pdf.

FASID Tables

9.2.11 The Secretariat reminded the meeting that FASID Tables MET 1A, 1B, 3A, 3B, 3C, 5, 6, and 7 were recently updated. An active amendment proposal (origin IATA) to FASID Table MET 1A added a 24-hour TAF requirement for seven aerodromes. Furthermore, States were invited to provide updated information with regards to FASID Table MET 2A (in particular, OPMET for non-AOP aerodromes). Information provided for FASID Table MET 2A does not go through the nominal amendment proposal procedures and information would simply be gathered and sent to headquarters to input into the database system that produced the ASIA/PAC FASID Table MET 2A (a regional subset of the global database in SUG Annex 1).

9.2.12 The meeting was informed of the proposal forwarded by the OPMET/M TF/7 meeting to replace FASID Tables MET 4A and 4B with the ROBEX Handbook when referencing the ROBEX Scheme in the Basic ANP as shown in **Appendix A12** to this Report. This proposal is in view of current practices by RODBs and States in terms of referencing OPMET exchange information. The OPMET/M TF/7 meeting also agreed with the subsequent proposal of removing the FASID Tables MET 4A and 4B from Part VI Meteorology (MET) – FASID as shown in **Appendix A13** to this Report. **(**The CNS/MET SG/13 meeting agreed with these proposals and formulated the following draft Conclusion.

Draft Conclusion 13/38 — Replace FASID Tables MET 4A and 4B by the ROBEX Handbook

That, the FASID Tables MET 4A and 4B be replaced with the ROBEX Handbook when referencing the ROBEX Scheme in the Basic ANP and FASID in accordance to **Appendices A12** and **A13**. Subsequently, FASID Tables MET 4A and 4B will be removed from the FASID.

9.2.13 The meeting was informed of the proposal made by the OPMET/M TF/7 meeting to replace FASID Table MET 4C with the Asia/Pacific regional OPMET data banks interface control document when referencing the responsibilities of the ASIA/PAC OPMET data banks for collection and dissemination of OPMET bulletins to support the ROBEX Scheme of the Basic ANP as shown in **Appendix A12**. This proposal was in view of current practices by RODBs in terms of referencing OPMET exchange information in support to the ROBEX Scheme in the Basic ANP. The OPMET/M TF/7 meeting also agreed with the subsequent proposal of removing the FASID Table MET 4C from Part VI Meteorology (MET) – FASID as shown in **Appendix A13**. The CNS/MET SG/13 meeting agreed with the proposals by the OPMET/M TF/7 meeting with regard to referencing the collection and dissemination of OPMET bulletins to support the ROBEX Scheme in the Basic ANP and FASID and formulated the following draft Conclusion.

Draft Conclusion 13/39 — Replace FASID Table MET 4C by the Asia/Pacific regional OPMET data banks interface control document

That, the FASID Tables MET 4C be replaced with the Asia/Pacific regional OPMET data banks interface control document when referencing the responsibilities of the ASIA/PAC OPMET data banks for collection and dissemination of OPMET bulletins

to support the ROBEX Scheme in the Basic ANP and FASID in accordance to **Appendices A12** and **A13**. Subsequently, FASID Table MET 4C will be removed from the FASID.

9.2.14 The meeting was briefed on the assignment of the ICAO location indicator for distributing TAF if different from the responsible MET office that generated the TAF as indicated by columns 5 and 4 in the FASID Table MET 1A. Specifically, the U.S. responded to amendment proposal APAC 09/1-MET in that the location indicator used for distributing TAF was assigned KWBC (column 5) which represented the National Weather Service Telecommunications Gateway (NWSTG) while maintaining the responsible MET office name that generated the TAF (column 4) for a particular aerodrome (column 2).

9.2.15 The meeting was presented with information on a program that uses climatology in the creation and quality management of TAF in the United States. Specifically, the Aviation Forecast Prep Software (AVNFPS) used by NWS forecasters in preparing and monitoring TAF utilized conditional climatology. That is, when marginal or poor visibility (<5 SM) and ceiling (<400 feet) conditions existed, conditional climatology assisted the forecaster in trends that have occurred given similar conditions in the past. This could be particularly useful for now casting ceiling and visibility conditions from 1-6 hours from observation time in the conditions mentioned. The climatology database included ceiling, visibility, wind speed and direction, and weather for every day and hour for the past 30 years was available for most locations. The AVNFPS software application could be accessed (http://www.nws.noaa.gov/mdl/pgb/AvnFPS/OB9/html/index.html) and downloaded at no cost to States and modified accordingly.

9.2.16 The meeting agreed that future CNS/MET Sub-group meetings would include a discussion on the Regional Air Navigation (RAN) Plan by examining the Basic ANP and associated FASID Tables MET. Inputs provided at the meetings could be used in formulating amendment proposals that provided regional requirements and clarity.

9.3 Review the status of implementation of 30-h TAF and VOLMET broadcast

9.3.1 The meeting was informed that 32% of the aerodromes required to issue 30-hour TAF had implemented the new requirements as indicated in **Appendix A14** to this Report. The low implementation rate was due to the operational impact to the MET Services providing TAF. Ease of monitoring TAF with the same period of validity in addition to the fact that some aerodromes did not contain ultra-long haul flights were reasons cited by States for not implementing the 30-hour TAF. IATA reminded States that some aerodromes listed in the requirements to have a 30-hour TAF were used for alternate aerodrome planning and airline fuel saving. IATA suggested that States could choose to issue 30-hour TAF for all the aerodromes with international operations (even if some aerodromes were not required to have a 30-hour TAF) for the ease of monitoring TAF of the same duration, since the cost incurred was considered minimal. IATA might consider informing States (through the Regional Office) the benefits to the State for issuing 30-hour TAF at the required aerodromes. Japan informed the meeting that it would comply with the 30-hour TAF requirement for their respective aerodromes in the future. Hong Kong, China informed the meeting about some pilot's feedback that the introduction of the 30-hour TAF decreased the precision of the forecast compared with the 24-hour TAF and this was regarded as a deterioration of the aeronautical meteorological service for international air navigation.

9.3.2 The meeting was made aware of the desire by the user to have two minimum temperatures in a 30-hour TAF in that it was more important in flight planning when the temperatures get near or below freezing according to the users polled in Hong Kong, China. The meeting noted that this issue was pursued by the Aerodrome Meteorological Observing and Forecast Study Group (AMOFSG). Based on the user response at Hong Kong, China, the meeting was informed of a proposal to limit the number of maxima/minima in TAF to keep the length of TAF to a minimum for

effective operational use while better reflecting the temperature variations in the forecast period. Clarity in the inclusion of multiple minimum/maximum temperature was desired by those airline dispatchers polled. Flexibility in choosing either 2 maximum or 2 minimum temperatures was proposed, i.e. limited to a total of three temperature forecasts in TAF.

9.3.3 IATA inclined not to limit the number of minimum and maximum temperatures that could occur in a 30-hour period and cited the importance of having the forecast temperatures to flight planning calculations needed for takeoff and landing. It was noted that the temperature group was optional, subject to Regional Air Navigation agreement. The meeting concurred that for consistency the maximum number of minimum and maximum temperatures provided should be reflected in the templates of Annex 3.

9.3.4 As not to conflict with current AMOFSG work, the meeting noted that the ANC supported the request and called upon the Secretary General to address issues in APANPIRG Conclusion 19/50, with the assistance of the AMOFSG.

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Agenda Item 10: ICAO advisory & warning systems

1) review METWSG issues
2) review the status of implementation of International Airways Volcano Watch (IAVW)
3) review the status of implementation of SIGMET and warnings

10.1 Review METWSG issues

10.1.1 The meeting was informed that the action items agreed at the Second Meeting of the Meteorological Warnings Study Group (METWSG/2) were available for information purposes only. Particular attention was drawn to the first (regional issuance of SIGMET) and fourth (description of geographical areas of phenomena in SIGMET and AIRMET) action items which were related to papers for this meeting. The Chairman drew the attention of the meeting to the first action item agreed by the recent METWSG/2 meeting pertaining to the ad hoc group task of conducting a feasibility study on the issuance of SIGMET advisory information from selected regional centre(s).

10.2 Review the status of implementation of International Airways Volcano Watch (IAVW)

Asia/Pac VA/TC Implementation TF

10.2.1 The meeting agreed on updating the Asia/Pac Task Force on the Implementation of Volcanic Ash and Tropical Cyclone Advisories and SIGMET (VA/TC Implementation TF) which is provided in **Appendix A15** to this Report. Specifically, the new task assigned was changed from "conduct" to "coordinate" regular regional SIGMET tests. The meeting also agreed to consider the expansion of tasks to include aerodrome and other meteorological warnings at the next CNS/MET SG meeting.

Information on the operations of VAAC Darwin

10.2.2 The meeting noted that a record total of 1583 (326 in last report) Volcanic Ash Advisories (VAAs) were issued by the Darwin VAAC over the 12 months 1 July 2008 – 12 June 2009. The significant increase in advisories could be contributed to the improvement in ground-based monitoring and reporting of volcanic activity, in particular for low-level eruptions, and more regular reporting from volcanological authorities. In fact, the vast majority of advisories were for low-level eruptions where the Rabaul Volcano contributed to 44% of advisories which had an impact at the nearby Tokua airport.

10.2.3 Despite the improvements made, challenges still existed in the issuance of associated SIGMETs, NOTAMs, and AIREPs. An example of such a case involved the Soputan Volcano in Sulawesi, Indonesia on 6 October 2008 and despite the notification of the first eruption by the Centre of Volcanology and Geological Hazard Mitigation (CVGHM), a secondary eruption that extended to 43,000 feet was detected by the VAAC, but no SIGMET was issued by the responsible MWO. A miscommunication was also noted between CVGHM and the Darwin VAAC for the eruption of Semeru in Java, Indonesia on 6 March 2009. Two high-level eruptions occurred at Soputan volcano during the year resulting in a significant impact to aviation. A lack of SIGMET issuance and forwarding of AIREPs to the VAAC were cited. The location of this eruption was a concern to airlines due to the proximity to air routes.

10.2.4 The meeting also noted that 5 of 13 MWOs that did not issue test volcanic ash SIGMET were from those most vulnerable to volcanic eruptions. In addition, only one SIGMET was returned to the VAAC from the test and AFTN addressing was part of the cause. The lack of SIGMET test notification was relayed to the Darwin VAAC by Indonesia and Papua New Guinea

giving more credibility to also send notification to the MWOs after obtaining an MWO email address list.

10.2.5 To further improve communications between Indonesia and the Darwin VAAC, communication tests were planned with the Indonesian Climatological and Geophysical Agency (BMKG). In addition, the AusAID-funded collaborative project with the CVGHM to improve the monitoring in East Nusa Tenggara, Indonesia had been completed by using VSAT communications for a direct transfer of data to CVGHM headquarters and around the clock operations centre. To improve the communication of volcanic activity of the Rabaul Volcano Observatory (RVO) in PNG, the Darwin VAAC was assisting the RVO in exploring cost recovery methods for the reporting service provided to aviation. The U.S. efforts in the Sulawesi Region included the development of bilingual reporting form based on the ICAO Volcano Observatory Notice for Aviation (VONA) which would aid in the communication to the VAAC.

10.2.6 Internal improvements include the completion of the volcanic ash chapter of the Australian Bureau of Meteorology's Aeronautical Forecasters Handbook that included satellite analysis techniques for volcanic ash detection which was used for training sessions within the VAAC and was available on the WMO CAeM website. A facility for the global collection of Volcanic Ash Report forms for dissemination to the Smithsonian and relevant VAACs was being established and promoted by IATA and IFALPA. SO_2 detection efforts continued by the planned implementation of S-Watch and procurement of an X-band satellite receiver near Darwin that would receive high-resolution MODIS, AIRS and related imagery useful for detecting volcanic ash and SO_2. Lastly, Darwin VAAC planned to be ISO 9001:2000 accredited this coming year.

Cost Recovery by Volcano Observatories

10.2.7 A proposal to test the cost recovery for State Volcano Observatories was presented to the meeting. Given the role of State Volcano Observatories detailed in Annex 3, paragraph 3.6 and associated resources (human, monitoring, communications and implementation of Volcano Observatory Notice for Aviation (VONA)) to meet this role, cost recovery was enabled in guidance material provided by the Handbook on International Airways Volcano Watch. Specifically, "*the State concerned, may, if it so wishes, recover reasonable costs related to the transmission of such information"*, through a Letter of Agreement (LOA) between the parties involved (CAA, MET, vulcanological agency). The enabling revision to the *Manual on Air Navigation Services Economics* (Doc 9161) in accordance to IAVWOPSG C4/9 would not be available for up to five years. Given the known economic impact of not providing timely volcanic activity information to aviation (3 million US Dollars cited by one airline associated with the Manam eruptions over a four-month period) and that many States did not have an LOA to recover costs that would help improve the infrastructure needed for timely volcanic activity reporting, there was a need to provide examples of cost recovery for State Volcano Observatories.

10.2.8 IATA noted concerns related to the cost recovery which would be required to assist States in developing the infrastructure needed for the proper communication between the Volcano Observatories and the VAAC, in view of the importance of the information for safe flight. It was suggested that the issue might be best tabled for the IAVWOPSG; however, the meeting concluded that this matter was an implementation issue and formulated the following draft Conclusion.

Draft Conclusion 13/40 — Cost Recovery by Volcano Observatories

That, the ICAO CNS/MET Sub-group VA/TC Implementation Task Force, in coordination with the VAAC Provider States and the ICAO Secretariat, be invited to investigate examples of agreements between State volcanic observatories and the civil aviation authorities that may be used by other States in considering the recovery of the cost in accordance with ICAO provisions.

Developments on volcanic ash warnings on the eastern coast of the Russian Federation

10.2.9 The meeting noted the status of volcanic ash warning systems on the eastern coast of the Russian Federation. The importance of volcanic ash warnings in the Kurile Islands and Kamchatka Peninsular was due to the potentially active volcanoes (more than 65) combined with the busy air routes of the Northern Pacific (NOPAC). As a result, two teams monitor the region, Volcanic Eruption Response Team (KVERT) for the Kamchatka Peninsular and northern Kurile Islands and Sakhalin Volcanic Eruption Response Team (SVERT) for most of the Kurile Islands. Both teams coordinated warning messages with appropriate meteorological and aviation authorities in Japan, Russia, and the U.S. which were successful in that no damaging encounters with volcanic ash had been recorded in this region. Several challenges were detailed in a paper, *Russian eruption warning systems for aviation*, that was related to communication and dedication of resources. Such challenges included equipment and methodologies to validate eruption onset and determine ash-cloud heights utilizing pressure sensors, radar, and calibrated web-cameras. The language difference between the Russian Federation, Japan and the United States was also cited as a challenge in communication. Therefore, there was a continued need for improved coordination and capacity among volcanological, meteorological, and aviation authorities amongst these States. This information would be presented at the next IAVWOPSG meeting.

10.2.10 The meeting noted a summary of the effects on aviation operations of recent eruptions on three volcanoes in the North Pacific region: Kasatochi in Alaska, USA in August 2008; Redoubt in Alaska, USA in March to April 2009; Sarychev in the Kurile Islands, Russia, in June 2009. All three eruptions had a significant impact to aviation in the cancellation of flights that stranded 6,000 passengers with the Kasatochi eruption, 20,000 passengers associated with nearly 300 flights cancelled with the Redoubt eruption and an unknown number of passangers associated with dozens of flights cancelled and one airline reported 700k USD loss from re-routes associated with the Sarychev eruption. The importance of ground monitoring was noted in that an early warning of potential volcanic activity was issued nearly 2 months prior the Redoubt eruption, which allowed for proper planning by the activation of a regional Unified Response Group by the FAA several weeks before the eruption. Also observed was the difference between the dispersion modelling by the Montréal VAAC which indicated a much larger ash cloud than that detected by the thermal infrared brightness-temperature-differencing (BTD) remote sensing method for the Kasatochi eruption. As the cloud became mostly aerosols versus ash, an encounter into the sulphur dioxide cloud did not result in significant damage where it was noted that a correlation of sulphur dioxide cloud and damage was not well established. Procedures for flying into sulphur dioxide cloud would need to be established based on historical data. The use of the Volcano Observatory Notice for Aviation (VONA) by the Anchorage VAAC was received positively by the user and an example was provided to remind other States of the use volcanic activity information in the form provide succinct, clear information on volcanic activity that is understood by ACCs and MWOs for subsequent action.

10.2.11 The meeting discussed airline policies of flying into or below volcanic ash clouds and noted that airlines and Civil Aviation Authorities had specific policies that explained why some airlines allow the penetration into volcanic ash clouds and while others do not. The common theme amongst airlines and States was that risk assessment with different risk thresholds was relevant. Regardless of the different policies, the meeting noted the importance of observations received from aircraft that flew into or below ash clouds in further development of policies based on sound data. The balance of minimizing false alarms and maximizing safety had not been fully achieved and data received from aircraft, including null reports, would help achieve this balance. IATA supported the efforts of the IAVW in that the risk of flying into ash had been significantly reduced as a result of the IAVW efforts.

10.3 Review the status of implementation of SIGMET and warnings

SIGMET tests for volcanic ash and tropical cyclones

10.3.1 The Rapporteur of the Task Force on the Implementation of Volcanic Ash and Tropical Cyclone advisories and warnings (VA/TC/I TF) informed the meeting of the on-going activities on monitoring the issuance of VA and TC SIGMET in the ASIA/PAC States. A TC SIGMET test was conducted on 10 February and a VA SIGMET test on 17 February 2009. The meeting noted that the level of participation in these tests was improved in that the number of MWOs that were expected to issue WC and WV SIGMET increased to 77 % (27/35) and 76% (25/33) up from 54 and 65% the previous years, but still under the goal of 95%. Note that the expected results were based on Appendix H to the SIGMET Guide, where errors were identified and corrected in the June 2009 amendment to the SIGMET Guide which would provide an improved truth set for the next SIGMET test. The United States and Japan would confer on the lack of VA and TC SIGMET issuance for United States territories in the west Pacific under the jurisdiction of the Honolulu MWO. Other highlights of the testing included the fact that all 7 of 7 Tropical Cyclone Advisory Centres participated in the test by issuing tropical cyclone advisories, an increase in test message reception at the RODBs, and Russian MWOs' participation with the Tokyo VAAC. Improvements need to be made in correctly formatting WMO headers, use of priority, issuance of SIGMET to the VAACs (only one received at the Darwin VAAC) and to avoid double counting in that only FV and FK messages by AFTN be included in the reception statistics, which was reflected in the June 2009 amendment to the SIGMET Guide. The Secretariat would inform States and MWOs to include VAAC, (TCAC) and RODB AFTN addresses for dissemination of VA (TC) SIGMET. IATA indicated that all SIGMETs received during a short monitoring period did exactly meet the format requirements and expressed appreciation on the improvements in SIGMET issuance in the Region. It was suggested that these encouraging results should be reported to the METWSG by the members from the Asia/Pacific Region.

10.3.2 As per the OPMET/M TF/7 meeting, Japan provided an expanded WV SIGMET test procedure as a simplified case study of volcanic ash simulation exercise as detailed in **Appendix A16** to this Report. The procedure involved a simulated volcanic eruption that straddles three VAACs (Tokyo, Washington, and Darwin): the simulated Mt. Canlaon volcano is first identified by satellite at 0200 UTC resulting in a volcanic ash advisory by the Tokyo and Darwin VAACs. From 0200-0210 UTC, MWOs receiving advisories issue a WV SIGMET providing there are no other advisories or severe weather in the region and the WV SIGMET messages sent to the RODBs. The test continues until 0400 UTC at which time the VAAC Tokyo and Darwin issue a test VAA for VA dissipation. Cancellation of the test SIGMET is omitted in the plan. Involvement of ATS units is desirable, but not part of the plan. Lastly, test NOTAMs are issued 1 hour before the test and at the end of the test.

10.3.3 The meeting agreed that the expanded WV SIGMET test first be tested at a national level involving one MWO and one FIR and associated users utilizing templates that reduce the risk of the test. Once this test had been proven successful at the national level, other States would be invited to conduct a prototype test and report the findings to the OPMET/M TF and CNS/MET SG for further planning on a coordinated test amongst States possibly as early as 2011. The first of such tests would be conducted in Japan by way of the Fukuoka MWO and FIR and associated users. Consultation with VAAC Darwin on developing the test procedures was offered by Australia. Given the aforementioned, the meeting formulated the following draft Conclusion.

Draft Conclusion 13/41 — Expanded WV SIGMET Test Development

That,

a) Japan be invited to further develop an expanded WV SIGMET Test utilizing automated templates in consultation with the Darwin VAAC; and

b) upon completion of a) above, Japan conducts the expanded WV SIGMET Test and produce an analysis to the OPMET/M TF/8 meeting for further review and subsequent reporting to the CNS/MET SG/14 meeting to determine the next phase of the test.

Regional WS SIGMET tests

10.3.4 The meeting was informed of the results of the fourth regional WS SIGMET test conducted on 24 February 2009. The test results showed a decrease in State participation which was against the previous trend of gradual improvement, i.e. excluding the 9 States listed without an associated active MWO, 60% (12/20) of States participated in the WS SIGMET test. Of the twelve States that did take part, 97% of the MWOs within those States issued a test WS SIGMET. A mismatch between WMO headers used in the SIGMET test and those listed in Appendix H to the SIGMET Guide were identified, which resulted in many changes to Appendix H that were included in the June 2009 amendment to the SIGMET Guide.

Comparison of four WS SIGMET tests

10.3.5 The OPMET/M TF/7 meeting reviewed results of a comparison of the four WS SIGMET tests conducted from 2006-2009. Excluding States with non-active MWOs, the participation rate for each year was 62, 60, 70 and 60%. As indicated, the level of participation had not greatly changed in four years and remains between 60 and 70%. Focus therefore would be made to involve States who had not participated in the past tests whose FIRs were indicated in **Appendix A17** to this Report. In addition, States with non-active MWOs were encouraged to have services be provided by a neighboring State and make progress in establishing a MWO for the provision of SIGMET. Laos informed the meeting that the issuance of SIGMET was expected for the Vientiane FIR by the end of 2009.

10.3.6 As noted, recent steps had been taken to remind MWOs that the WS SIGMET test was not initiated by an advisory as with WC and WV SIGMET tests. This clarification was placed in the June 2009 amendment to the SIGMET Guide. The OPMET/M TF/7 meeting recommended communications with MWOs be established by obtaining contact information and subsequently providing the SIGMET test information directly to the MWOs in addition to the SIGMET point of contact if different. The CNS/MET SG/13 meeting agreed that a MWO contact list be developed for those States that had not participated in the test during the last 4 years since maintaining such a list for States that had been active in the tests would be unnecessary. Therefore, a State letter would be issued to the targeted States requesting MWO contact information in addition to the SIGMET focal point for which contacts on both lists would be informed of SIGMET test plans.

10.3.7 The meeting also re-addressed an issue raised at the CNS/MET SG/12 meeting. That is, the inclusion of States on the APANPIRG list of deficiencies for States who had not routinely participated in the SIGMET tests. On reflection, the meeting did not endorse this concept because testing was not a requirement. The meeting agreed that focus be placed on those States not issuing real-time SIGMET when deemed necessary and systematic absence of real-time SIGMET be considered for inclusion of deficiencies at the next CNS/MET SG meeting. Finally, the meeting

agreed that the Fiji RODB be strongly encouraged to report the SIGMET test reception to Australia for inclusion in the report.

10.3.8 The tests still proved fruitful in that the RODB reception of test messages had improved significantly. The RODB reception of test messages had almost doubled at the Bangkok RODB between the first and fourth test, which achieved an 86% reception of test messages in test 4. The Brisbane and Tokyo RODBs reception rate was above 90% while the Singapore RODB had achieved 100% reception of test messages for two years in a row. With these improvements to RODB reception, the tests had yielded benefits to the users by making SIGMET messages available. The meeting noted that the next round of WC, WV and WS SIGMET tests would be conducted on 10, 17 and 24 November 2009.

Regional issuance of SIGMET

10.3.9 The meeting was informed by New Zealand that the regional issuance of SIGMET through a regional centre was a viable solution to the long standing problems of the issuance of SIGMET by MWOs identified in every region. The problems identified with the issuance of SIGMET by MWOs included inconsistencies observed at the FIR boundaries, format errors, and non-issuance of SIGMET for States without designated MWOs. The demand for accurate, timely hazardous information served the purpose of safety and importantly efficiency at a time when airlines needed to increase efficiency of operations. In addition, a centralized location would mitigate these current problems and address the modernization of operational needs such as graphics and gridded data. Legalities were cited as not being an obstruction to developing regional centres for the provision of SIGMET.

10.3.10 IATA endorsed the endeavours of the METWSG in the feasibility study of regional SIGMET advisory centre(s). With regards to implementation, the meeting noted that the establishment of the regional SIGMET advisory centre(s) would be subject to endorsement by the conjoint WMO/ICAO meeting in 2013 or 2014 and that short-term solutions such as the LOA between China and Cambodia be considered by States not able to provide SIGMET in the short term. This point was further expanded on by WMO in that the provision of SIGMET through an LOA would satisfy the establishment of Quality Management Systems which was required in Amendment 75 to Annex 3 applicable in November 2008.

Expression of SIGMET box

10.3.11 The meeting noted that aircraft operators preferred locations such as recognized navigation aid names or abbreviations, published way points, ICAO location indicators, and geographic features well known internationally when describing the area bounded by a SIGMET. Annex 3 was more limited than the list given by the aircraft operators and flexibility needed in defining the SIGMET area allowed for a more accurate depiction of hazardous weather and results in less restricted airspace. For example, a crude SIGMET box (i.e. region orthogonal to the line not given for N OF Nnn(nn) or the limited number (3-5) of points for WI) indicating severe icing reduced or eliminated options for turboprop aircraft not equipped to fly into severe icing conditions and overcompensating reroutes, delays and cancellations, which significantly impacted the regional airlines. It was recalled that the METWSG/2 meeting (May 2009, Montréal) had considered the removal of well-known geographical features from SIGMET/AIRMET template in Annex 3, and an increase in the maximum number of coordinates permissible, which had been endorsed by IATA, when describing location within a SIGMET and AIRMET. The meeting agreed that graphical SIGMET which would be most suitable for user automated systems be developed in harmony with SIGMET text messages. However, these issues were global in nature and would continue to be addressed by the METWSG.

Further SIGMET developments by States

10.3.12 Japan presented the meeting with improvements in the issuance of SIGMET by utilizing application products and grid point value (GPV) from new techniques in numerical weather prediction (NWP) that produce indices in icing, cumulonimbus clouds and turbulence provided by the Japan Meteorological Agency (JMA). Specifically, JMA utilized new icing models based on the frequency of aircraft reports and temperature-dewpoint spread known as the Kudo icing index. This technique had been utilized since December 2008. Adjustments to parameters derived by Kudo in the KF scheme had improved the forecasts of CB. Lastly, the forecast of clear air turbulence had improved utilizing turbulent kinetic energy which would be available for JMA in the near future.

10.3.13 The issuance of SIGMET for the Phnom Penh (VDPP) FIR by the Kunming (ZPPP) MWO on behalf of Cambodia was described by China as per the Letter of Agreement between the Air Traffic Management Bureau (ATMB) of the Civil Aviation Administration of China (CAAC) and the Flight Operation and Safety Department (FOSD) of the State Secretariat of Civil Aviation of Cambodia (SSCA) effective 1 June 2009. Particular attention was given to the ICAO location indicator, CCCC, in the WMO header (ZPPP – communication centre disseminating the message), first and second entries in the first line of SIGMET (VDPP – ATS unit serving FIR and ZPPP – issuing MWO) and second line of SIGMET (VDPP – FIR the SIGMET serves). In addition, SIGMET bulletins (WSKP31, WCKP31, WVKP31) were sent by the Kunming MWO to the Regional OPMET Data Banks (RODB)s via AFTN and confirmation of receipt of SIGMET verified by the Singapore RODB. China requested confirmation of the receipt of SIGMET bulletins by the other RODBs (Bangkok, Brisbane, Nadi, and Tokyo). The meeting commended on the efforts made by China, Cambodia and Secretariat for overcoming an urgent deficiency in the Region, and strongly encouraged other States should use this as a model for resolution of similar deficiencies.

10.3.14 Other miscellaneous issues on the issuance of SIGMET with relation to this LOA were discussed. The meeting was pleased to note the reception of SIGMET for the Phnom Penh FIR by the SADIS Provider State. The Secretariat would update the FASID Table MET 1B on the provision of SIGMET, in due course.

10.3.15 The meeting reviewed the development of two satellite products for automatic identification and categorization of deep convection by the Hong Kong Observatory. Utilizing distinct characteristics of different observational channels of frequent observations provided by geostationary satellites, deep convection could be identified. Specifically, less than a degree Kelvin difference between Infrared channels 1 and 3 identified deep convection which was well correlated with lightning data. To provide useful information of deep convection for the generation of SIGMET, which were categorized by spatial area for FRQ (>75%), OCNL (50-75%), and ISOL (<50%), an automatic spatial categorization process was developed where the search size was optimized to correlate with SIGWX forecasts in order to reflect user needs. The size of search area of 2.5 by 2.5 degrees was used for FRQ and OCNL CBs while the search area was reduced to 1 by 1 degree for ISOL CB (using a minimum threshold of 5% since it was not specified in Annex 3). Further user input was being processed based on trials conducted in the Asia/Pacific Region in late 2007 and early 2009 via the web-based Aviation Meteorological Information Dissemination System (AMIDS). Fine tuning the search area would be performed if deemed necessary. Developing a product for nowcasting and uplinking these satellite based weather products to the cockpit would be considered.

Radioactive cloud SIGMET

10.3.16 The meeting noted implementation issues of SIGMET for the accidental release of radioactive material into the atmosphere encountered by the United States. In order to provide transmission guidance on radioactive material that entailed the responsibilities of the sender and receiver of information was considered necessary. Existing platforms should be utilized, such as WMO Regional Specialized Meteorological Centres (RSMC) for providing forecasts of radioactive

cloud using trajectory models (as with VAAC and TCAC) and disseminating the information in a standard form (as with VONA for VAAC) to designated MWO(s) for each State (as documented in FASID Tables MET 3A and 3B for roles and responsibilities for obtaining information on tropical cyclone and volcanic ash) for the indentifying those responsible for the subsequent issuance of SIGMET. Clarity in Annex 3, Table A6-1 was also considered necessary for forecast position in that it currently only applied to volcanic ash and tropical cyclones, but Annex 3 section 3.4.1 g) required forecast trajectories of the radioactive cloud if known.

10.3.17 The meeting noted that at present time the radioactive cloud information was sent by the International Atomic Energy Agency in Vienna to 1) VAAC London for further dissemination to ACCs and 2) to WMO RSMCs for further distribution to MWOs (through national meteorological centres). The notification of ACCs would be applicable in 2010. The role of MWOs was to thus issue SIGMET of radioactive cloud in a highly simplified form in order to ensure their timely dissemination. The meeting nevertheless felt that there was merit to consider developing ICAO provisions related to SIGMET on radioactive clouds. Furthermore, the issuance of Aerodrome Warnings on Tsunami was considered difficult based on the current provisions. Given the above implementation issues, the meeting formulated the following draft Conclusion.

Draft Conclusion 13/42 — Implementation of SIGMET on Radioactive Clouds and Aerodrome Warnings on Tsunami

That, in view of clarifying existing Annex 3 provisions,

a) the IAVWOPSG consider developing Annex 3 provisions and guidance material, as necessary, related to the issuance of SIGMET on radioactive clouds; and

b) ICAO consider developing Annex 3 provisions and guidance material as necessary related to the issuance of aerodrome warnings on Tsunami

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Agenda Item 11: MET/ATM coordination

1) review MET/ATM TF issues
2) MET support for operations at aerodromes and terminal areas

11.1 Review METATM TF issues

Report of MET/ATM Task Force and preparation of a regional survey on ATM requirements for MET

11.1.1 The meeting was informed of the planned MET/ATM Task Force meeting during the 4th quarter of 2009 with dates not yet confirmed. The current Terms of Reference of the MET/ATM Task Force was updated to include the membership on the page, in which China and New Zealand were added to the membership list as noted in **Appendix A18** to this Report. The meeting also agreed that the task force considered the inclusion of other user representation such as IFALPA, IFATCA and the Airport Council International at the next meeting. The agenda of the next MET/ATM meeting would also include the nomination of a Rapporteur or chairperson of the task force. Lastly, the meeting requested the ICAO Regional Office to solicit MET/ATM Task Force membership from States.

11.1.2 The meeting also noted the Air Traffic Management Flow Survey questionnaire in Appendix D to the ATM/AIS/SAR/SG/19 Report on Agenda Item 5. With regards to meteorological questions in the survey, the meeting agreed that inputs be sent to the ICAO Regional Office by 10 August 2009 for consideration by ATM in formulating the associated paper for the APANPIRG/20 meeting. The meeting noted that aeronautical MET services should be included in section 10 of the questionnaire.

11.2 MET support for operations at aerodromes and terminal areas

National Operations Centre Meteorological Support Unit

11.2.1 The meeting noted that the Meteorological Support Unit established in the Airservices Australia's National Operations Centre had become an integral part in collaborative decision making with all stakeholders. Specifically, tailored presentations of meteorological information to the users included regular scheduled weather briefings to Airservices, airlines and airport operators that contributed to optimizing aerodrome capacity, utilization of winds in flex tracks which saved time and fuel, using weather information in off-line analysis to improve future operations, and learning Airservices' operations which resulted in recommendations of future tailored products. IATA acknowledged the coordination efforts made between MET and ATM in Australia.

Establishment of Air Traffic Meteorology Centre

11.2.2 The meeting noted that the Air Traffic Meteorology Center (ATMetC) had been established in October 2005 for the purpose of supporting the Air Traffic Management Center (ATMC) of the Japan Civil Aviation Bureau (JCAB). The ATMetC services for the advanced Collaborative Decision Making (CDM) included: regular and extra briefings to ATMC on weather impacts to air traffic (i.e. change in approach procedures); METAR and TAF for aerodromes in adjacent countries in support to international air traffic flow management; tailored 6-hour forecasts essentially every hour that included the probability of weather impacts to air traffic flow; a summary of weather information (significant weather forecasted, numerical weather prediction, radar graphic, forecaster comments, text of impacts on air traffic, time series forecasts) every 3 hours valid for up to 6 hours. The products provided were shared through CDM amongst ATMC, ATMetC and the Ministry of Defense in order to make collaborative air traffic management decisions. As a trial, an improvement to the shared knowledge process included video conferences with ATMC, ATMetC,

ATC Centers, and two Japanese airline operation control centers. The result of the conferences was an ATM Operations Plan (OP) issued by ATMC that included capacity constraints due to weather impacts, which were available to other stakeholders not mentioned. Increasing membership of CDM and holding extraordinary meetings that produced extraordinary Ops would be considered for the future. The meeting noted that the OP issued by ATMC was available to authorized users, which could be obtained upon request from the Civil Aviation Bureau.

Wind shear and turbulence parameters from aircraft data

11.2.3 The meeting noted information regarding the implementation of a post-processing software for the computation of windshear and turbulence parameters from Quick Access Recorder (QAR) data of commercial jets by the Hong Kong Observatory. The use of QAR data served two purposes: (1) to validate wind shear detection algorithms and (2) aid in the development and verification of turbulence detection algorithms, which both were derived from a suite of sensors: anemometers, weather buoys, radar wind profilers, Terminal Doppler Weather Radar (TDWR), and LIght Detection and Ranging (LIDAR). The Hong Kong Observatory in collaboration with an established aerospace laboratory had developed a software package called WINDSTURB to process QAR data using different aircraft types in the calculation of the F-factor for wind shear verification and EDR for turbulence verification. Thus far, LIDAR calculations of F-factor and EDR correlated well with those derived from QAR. This gave credence to utilizing the LIDAR in producing wind shear hazard factor and turbulence products. The EDR estimation software could be utilized in detecting turbulence on aircraft. Hong Kong, China informed the meeting that details of the wind shear algorithms (i.e. for the LIDAR) were available in several papers and would be provided to those interested.

Thunderstorm nowcasting in support of ATM

11.2.4 The meeting was apprised of the latest developments with regards to aviation thunderstorm nowcasting products in support to ATM and airline users in Hong Kong, China. Developments since the CNS/MET SG/12 meeting included utilizing technology derived nowcasting techniques used for the Beijing Olympics in 2008. Specifically, technology from the Short-range Warnings of Intense Rainstorm in Localized System (SWIRLS) was tailored for aviation based on user feedback of the prototype system at Hong Kong International Airport (HKIA). In addition to the 1-hour forecast of radar reflectivity at specific altitudes within 120 km of HKIA reported last year, current and forecast elements of cloud-top heights, vertically integrated liquid water, and reflectivity were superimposed on Google Map / Geographical Information System (GIS) that included the option of displaying way-points and obtain readings of the meteorological elements described at any particular point. A trial website had been developed for evaluation by users and was expected to become operational in mid-2010. To address storm growth and dissipation, utilizing nowcasting information with high-resolution numerical weather prediction (NWP) products might be considered. In the future, nowcasting products might be up-linked to the cockpit and adapted to specific flight routes relevant to the user.

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Agenda Item 12: Other MET issues

1) implementation of Amendment 75 to Annex 3
2) review the status of implementation of quality management system

12.1 Implementation of Amendment 75 to Annex 3

12.1.1 The meeting noted that draft Amendment 75 to Annex 3 had been circulated to States for comment due 24 April 2009. Final review by the ANC was expected in November 2009. Adoption of the Amendment 75 by the Council was expected in February or March 2010. The applicability date of Amendment 75 to Annex 3 would be 8 November 2010. Implementation issues related to Amendment 75 would be tabled for discussion at the next CNS/MET SG meeting in July 2010.

12.2 Review the status of implementation of quality management system

12.2.1 The meeting noted that the provisions related to mandatory quality management system (QMS) for aeronautical meteorology would become applicable in 2010. In order to assist States in the Region to implement QMS it was considered important that WMO be invited to organize a seminar/workshop on QMS, in close coordination with ICAO. In this regard, the meeting formulated the following draft Conclusion.

Draft Conclusion 13/43 — Training on QMS

That, WMO, in coordination with ICAO, be invited to organize a seminar/workshop on QMS related to aeronautical meteorological services during the first half of 2010.

Other MET issues

12.2.2 The meeting noted that the Australian Bureau of Meteorology was establishing aerodrome climatological summaries for selected aerodromes in Australia that were consistent with ICAO Annex 3, Chapter 8, Section 8.3 and Appendix 7, Section 3.2, and WMO Publication No 49, Technical Regulations Volume II, C.3.2 and Attachment to C.3.2. These climatological summaries would assist the aviation industry in strategic and operational planning in that aerodrome forecasts and warnings were expected to improve. Climatological summaries of the frequency of threshold weather elements at given times of the day for a particular month were given for visibility and cloud-base height combination, visibility, cloud-base height, surface temperature range, and concurrent wind direction and speed (the last not given with relation to time of day). An aerodrome climatological study was given of selected meteorological elements (i.e. Hail) in number of days per month with an annual sum for a period of eighty years was also given.

12.2.3 IATA requested the climatological information used for long-term planning (not pre-flight or in-flight planning) be available to the user via a datastream. Australia could currently assist by providing climatological information in pdf on a website. WMO drew the meeting's attention that the third World Climate Conference would address climate services which would provide seasonal and long-term outlooks useful to airlines long-term planning.

12.2.4 The meeting took note of the Universal Safety Oversight Audit Programme (USOAP) conducted by ICAO in 2008 for the Aviation Meteorological Service (AMS) in Korea. Preparation for the audit between the Korea Meteorological Administration (KMA) and the Civil Aviation Safety Authority (CASA) proved fruitful in that the results revealed the Republic of Korea was very successful in the audit. Preparation for the audit included: development of a task force team, identified and remedied MET service gaps, consultation with the ICAO Regional Office for audit details, and coordination with other units such as ATS, ACC, CASA, and SAR with particular attention to developing an agreement between CASA and KMA on the provision of MET supplied by AMS.

Furthermore, KMA developed an inspectorate program, national regulations, and training records for AMS.

12.2.5 The meeting took note of the ASEAN-RoK Training Workshop on Aviation Meteorology held in Seoul, Republic of Korea from 9-15 November 2008 hosted by the Korea Meteorological Administration (KMA). This workshop was in response to the request of the ASEAN Secretariat at the 28th ASEAN Sub-Committee on Meteorology and Geophysics (SCMG) Meeting, which was held from 17 to 23 September 2006 in Myanmar. Fifteen participants from ASEAN Member Countries and 3 lecturers from WMO, ICAO and New Zealand and participants from KMA attended the workshop that included lectures to improve basic knowledge of the aviation meteorological services and application of meteorological data to the operational works related to aviation meteorology. WMO encouraged further activities of this nature hosted by Member Countries.

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Agenda Item 13: Review Regional Performance Framework Objectives and forms:

1) CNS related Performance Framework Forms
2) MET related Performance Framework Forms
3) review and update CNS/ATM Implementation Planning Matrix

Performance Base Approach Metrics

13.1 Working Paper identifying four Asia/Pacific Regional Performance Metrics was presented by the Secretariat. It was stated that one of the key aspects of the performance based approach is the development of regional performance objectives with measurable outcomes and associated metrics. It was also informed that ATM/AIS/SAR Sub Group of APANPIRG, in its Nineteenth Meeting (June 2009) had adopted Draft Conclusion SG 19/3 which recommends adoption of the four metrics as air navigation system performance indicators for the Asia and Pacific Region.

13.2 The paper explained the key attributes of Performance Based Approach and stressed the importance of consensus on the desired outcomes in terms of performance results to be achieved. Assessment of achievement will be periodically checked through performance reviews, which in turn will be based on the performance measurements. Metrics described are proposed to be used as performance indicators for the performance measurement in the region.

13.3 The meeting discussed the proposed metrics in particular APAC Efficiency-3 and considered it necessary to further develop the harmonized methodology for measurement once the Metrics are adopted by APANPIRG because the delay could be because of various reasons.

13.4 As result of discussion, the meeting endorsed Metrics recommended by ATM/AIS/SAR/SG/19 and the following Draft Conclusion.

Draft Conclusion 13/44 - Asia/Pacific Performance Metrics

That, following Performance Metrics be adopted as Asia/Pacific Regional Performance Metrics.

Safety

APAC Safety-1:	Percentage of RMA sub-regions meeting the regional Target Level of Safety (TLS) for RVSM operations, referenced as of end April each year

Efficiency

APAC Efficiency-1	Percentage of instrument runway ends with an approach procedure with vertical guidance (APV), (BARO-VNAV and/or augmented GNSS) either as the primary approach or as a back-up for precision approaches
APAC Efficiency-2	Percentage of en-route and terminal PBN routes implemented on a sub-regional basis in accordance with the regional PBN plan
APAC Efficiency-3	Average delay for departures at State's primary international airports for the busiest hour on a weekly basis

Workshop on the Development of Performance Framework

13.5 The meeting was informed that a five day workshop on the development of national performance framework to achieve a global ATM system was conducted within the framework of Special Implementation Projects (SIPs) from 9 to 13 March 2009 at ICAO Regional Office Bangkok.

The objective was to provide States in the Asia/Pacific Regions, with a better understanding of developing national performance framework for air navigation system. The workshop was attended by a total of 58 participants from 18 States/Administrations and 1 international organization.

13.5.1 The workshop developed the following recommendations, which are to be addressed by ICAO and States, as appropriate:

1) **States** collect and provide the required data to the regional office that meets the regional metrics to be developed by the APANPIRG for efficiency which includes capacity, cost effectiveness, GHG emissions and fuel burn.

2) **States** adopt a performance based approach in developing the air navigation infrastructure on the basis of ICAO guidance material and ensure their alignment with the regional performance objectives. The performance framework should include identification of national performance objectives and completion of national performance framework forms;

3) **ICAO** continues enhancing the ongoing intra and interregional coordination for planning, implementation and harmonization of a Global ATM system; and

4) **ICAO** assists States in the development of performance based planning for air navigation systems.

13.6 Recognizing that very few participants for the CNS/MET SG had participated in the workshop and noting wide spread adoption of Performance Based Approach by the agencies engaged in civil aviation and also recognizing the significance of these forms in this whole concept, meeting agreed that more number of workshops of kind conducted from 9 to 13 March 2008 in Bangkok should be organized.

13.7 The meeting invited ICAO to organize more such workshop/seminars on the performance based planning and development of harmonized performance framework in the CNS/MET fields. Accordingly the meeting formulated the following Draft Conclusion.

Draft Conclusion 13/45 - Performance Framework Workshop/Seminar

That, ICAO be invited to conduct workshop(s)/Seminars on Performance Framework to provide guidance to the States in developing their Performance Framework

Review APANPIRG Key Priorities

13.8 The meeting reviewed the *List of Key Priorities for the CNS/ATM Implementation in the Asia/Pacific Region* noted by the APANPIRG/19 meeting and agreed that relevant matters from the List should be incorporated into the regional performance objectives. This would mean that there was no need to duplicate them on the List of Key Priorities. In comparing the PFFs against the Key Priorities List, the meeting considered that the CNS and MET related aspects of Key Priorities 2 had also been included in APAC CNS 2, Key Priority 3 and 4 had been included in the work programme for CNS/MET SG reflected in Subject/Task List of the Sub-group as the training and preparation for WRC are the on going tasks. Priority 5 had been reflected in APAC MET X, Key Priority 6 had been included in APAC CNS 3 and Key Priority 11 had been reflected in APAC CNS 1. Regarding Key Priority 8 on DFIS which has been included in the long term task of the Sub-group, a Seminar on DFIS was conducted in November 2008.

13.9 Accordingly, the meeting considered that most of CNS and MET related aspects of the Key Priorities List had been sufficiently incorporated into the PFFs and could be removed from the Key Priorities List. Therefore, the meeting agreed that the Key Priorities List be discontinued which was also suggested by the ATM/AIS/SAR SG/19.

Performance Framework Forms

13.10 The meeting was introduced to the regional performance framework adopted by APANPIRG/19 through Conclusion 19/1 – Regional performance framework. The ICAO planning objective is to achieve a performance based global air traffic management system through the implementation of air navigation systems and procedures in a progressive, cost-effective and cooperative manner. Regional performance objectives that take into consideration user expectations which are mapped against current work through regional performance framework forms. The meeting reviewed the proposed performance framework forms shown in **Appendix A19** with subtitles:

APAC CNS 1 – Implementation of ATN for Ground-Ground Network

APAC CNS 2 – Enhanced Communication and Surveillance in Oceanic Area

APAC CNS 3 – Implementation of ADS-B Air to Ground Surveillance

APAC CNS 4 – Implementation of ATS Inter-Facility DataCommunication (AIDC) in Asia/Pacific Region

APAC MET 1 – Implement International Airways Volcano Watch (IAVW), International Tropical Cyclone Watch (ITCW) and SIGMETs

APAC MET 2 – Implement WAFS and associated developments

APAC MET 3 – Develop regional MET requirements to support ATM

APAC MET 4 – Improve OPMET exchange efficiency

13.11 The meeting provided input to APAC MET 2 in that the references include ASIA/PAC Implementation Plan and Procedures document. In addition, the new terminal forecast efforts being developed by WMO and ICAO was included in APAC-MET 3.

13.12 After discussing the information provided in each column of the PFFs, meeting agreed to endorse them for adoption by APANPIRG and following Draft Conclusion was formulated.

Draft Conclusion 13/46 – Asia Pacific Regional Performance Objectives in the CNS and MET fields

That, the Asia Pacific Regional Performance Objectives and associated performance framework forms as contained in **Appendix A19** to the CNS/MET SG/13 Report be adopted.

13.13 Meeting was explained the importance of these forms in the overall concept of Performance Based Approach and it was reminded that ATS/AIS/SAR Sub Group of APANPIRG had adopted a Draft Conclusion recommending discontinuation of Key Priorities in view their introduction. The meeting agreed and recommended that these forms for all components of Air Navigation Services should be included in a single list and should be numbered continuously.

Review of CNS/ATM Implementation and Planning Matrix

13.14 Secretariat presented the matrix reflecting implementation status of new CNS/ATM systems in the Asia/Pacific Regions. It was noted that the CNS/ATM Implementation Planning Matrix was developed in accordance with the Conclusion 11/37 of APANPIRG and the Matrix has since been regularly updated. CNS/ATM Implementation Matrix reflects the status of implementation of major CNS/ATM elements in the region which includes ATN, AIDC, CPDLC, GNSS, ADS-C and

ADS-B. The meeting was informed that the Matrix was updated by Eighth meeting of ADS-B Study and Implementation Task Force, the Fourth meeting of ATN Implementation Coordination Group and a COM Coordination Meeting.

13.15 The meeting further reviewed and updated the Matrix. The updated Matrix is provided in **Appendix A20** to the Report.

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Agenda Item 14: Review of deficiencies in the CNS and MET fields:

1) status of CNS deficiencies (APANPIRG Deficiency List)
2) status of MET deficiencies (APANPIRG Deficiency List)

14.1 **Status of CNS deficiencies**

14.1.1 Presenting the status of deficiencies reviewed by APANPIRG/19, the meeting observed that resolving safety related deficiencies was one of the most important tasks of PIRGs. The meeting reviewed the deficiencies listed in the Deficiency List in the CNS fields.

Air-ground communication in Yangon FIR

14.1.2 Status of operation of the RCAG stations operating in Lashio, Mandalay, Sittwe, Myeik and Pathein in addition to the local VHF station at Yangon was reviewed. It was reported that interruption of power supply at remote stations still continue to be an issue and Myanmar had planned to upgrade the solar power supply systems at two remote stations. It was informed that IATA, in its report provided in February 2009, had reported some improvement of performance. Review of the report revealed that 70% of the reports indicated normal operations. Myanmar had requested IATA and the airspace users to provide the feedback timely and should include following information as minimum.

- Time of occurrence and position of occurrence added in the report template;
- ATS Route No. and the closest waypoint when problem experienced;
- Flight level which is important to analyze the coverage of RCAG; and
- Report required to be forwarded to DCA Myanmar as soon as possible preferable within 1 to 2 days of occurrence.

ATIS function at Kathmandu and Dhaka airports

14.1.3 The meeting was informed that the ATIS function at Kathmandu had been implemented and official notification to this effect had been received from Nepal. The meeting agreed with the recommendation to remove this item from the Deficiencies List for CNS facilities.

14.1.4 It was reported that no updates for the operational status of ATIS at Dhaka Airport had been received. Operational implications of this deficiency were explained to the meeting. Participants from Bangladesh were requested to provide an update to the status of this deficiency.

Manila-Hong Kong AFTN and ATS Direct Speech Circuits

14.1.5 Information on the status of operation of the two circuits was provided to the meeting. Meeting appreciated the efforts put in by both Philippines and Hong Kong China in restoring operation on both these circuits. Hong Kong China updated the outage status for both the circuits for the month of June and July 2009 and urged the CAA. Philippines to take active action to rectify the problem with the service provider and improve the performance of the circuits. The Philippines assured the meeting early restoration of the circuits in close coordination with Hong Kong China.

HF Communication problem in Mumbai FIR

14.1.6 The meeting was informed about the concerns on HF air-ground communications in Mumbai FIR. It was reported that follow-up actions were taken by the Airport Authority of India and the communications had improved to an extent. FANS 1/A based ADS/CPDLC service is also provided in Mumbai FIR. However, negative contacts on the route B459 have been reported by an operator in June 2009. The matter was being investigated by the ANSP. India, further clarified that a

detailed study had been undertaken and some steps had been taken to improve the operations. India was of the opinion that the problem will be completely mitigated once all the actions are completed. The meeting was assured that the actions will be completed in four to six months. The updated List of Air Navigation Deficiencies in the CNS field is in **Appendix A21** to this Report.

14.2 Status of MET deficiencies (APANPIRG deficiency list)

14.2.1 The meeting noted the establishment of a Meteorological Watch Office (MWO) at the Pyongyang International Airport that serves the Pyongyang FIR as of February 2009 as reported by DPR Korea. The issuance of SIGMET for the Pyongyang FIR needs to be verified by a RODB during the active convective months of July and August 2009. Therefore, deficiency AP-MET-16 for the establishment of MWO and provision of SIGMET is proposed to be removed from the APANPIRG list of deficiencies contingent upon the issuance of SIGMET validation and the absence of validated airline reports indicating SIGMET deficiencies. Given the aforementioned, the following draft Conclusion was agreed upon by the meeting.

Draft Conclusion 13/47 – Removal of the APANPIRG Air Navigation Deficiency AP-MET-16

That, the air navigation deficiency AP-MET-16 be removed from the APANPIRG air navigation deficiencies list.

Note: This draft Conclusion is contingent upon the validation of the issuance of SIGMET during July and August 2009 by a Regional OPMET Data Bank in addition to the absence of validated airline reports indicating any SIGMET deficiencies.

14.2.2 The meeting noted a bilateral agreement between the Air Traffic Management Bureau (ATMB) of the Civil Aviation Administration of China (CAAC) for the provision of SIGMET by the Kunming (ZPPP) MWO for the Phnom Penh (VDPP) FIR on behalf of the Flight Operation and Safety Department (FOSD) of the State Secretariat of Civil Aviation of Cambodia (SSCA) that became effective 1 June 2009. The agreement is renewable automatically each year providing there is no disagreement before 30 days of the renewal date 1 June. SIGMET issued by the Kunming MWO for the Phnom Penh FIR are received at the Singapore RODB as verified during the week of the OPMET/M TF/7 meeting. Therefore, the deficiency AP-MET-15, the provision of SIGMET for the Phnom Penh FIR, is proposed to be removed from the APANPIRG list of deficiencies in the following draft Conclusion.

Draft Conclusion 13/48 – Removal of the APANPIRG Air Navigation Deficiency AP-MET-15

That, the air navigation deficiency AP-MET-15 be removed from the APANPIRG air navigation deficiencies list.

14.2.3 The meeting agreed that the deficiency AP-MET-11 for the establishment of a MWO for the Phnom Penh FIR remain on the list of APANPIRG air navigation deficiencies since other duties such as the dissemination of information on a radioactive material release as referenced in Annex 3, 3.4 are duties of a MWO in addition to the provision of SIGMET.

14.2.4 The meeting acknowledged the recent progress in Myanmar with regards to AP-MET-10, pre-flight documentation, and AP-MET-13, provision of SIGMET. Specifically, Myanmar plans to implement the regular retrieval of WAFS products as it is already an approved SADIS FTP user. In addition, Myanmar will improve the access to meteorological information via a separate internet line provided by the World Meteorological Organization. The Singapore RODB verified the reception of SIGMET by the Yangon (VYYY) MWO during the 13 to 30 June 2009 monitoring

period. The meeting agreed that this deficiency should be considered for future removal from the list after satisfactory verification from the airlines in addition to consultation with the State.

14.2.5 The meeting noted the deficiencies identified for the States in the South-West Pacific that were reported by the ICAO Technical Cooperation Project *Cooperative Agreement for Enhancement of the Meteorological Service for Aviation in the South Pacific (CAEMSA-SP)* which was conducted from August to December 2009. Eight Pacific Island States, Cook Islands, Fiji, Kingdom of Tonga, Kiribati, Nauru, Samoa, Solomon Islands, and Vanuatu participated in the CAEMSA-SP. The ICAO TCB Technical Expert visited six of the eight States and developed a list of action items associated with identified gaps given in **Appendix A22** to this Report. The actions performed with identified gaps and associated target dates would achieve compliance to Annex 3 and improve the State's ability to meet the next round of USOAP audits in relation to meteorology Services to Aviation. The meeting noted that gaps associated with lack of or outdated documents can be overcome by the distribution of current WMO and ICAO documents, specifically if the missing or outdated documents are known.

14.2.6 The meeting further noted that a total of 10 deficiencies were recommended by the ICAO TCB Technical Expert, but two of these (AP-MET-01 and AP-MET-02) were already APANPIRG deficiencies. The remaining 8 proposed deficiencies were presented to the OPMET/M TF/7 meeting (2-4 June 2009, Bangkok) where it was decided by the meeting that 5 of the 8 deficiencies indicated in **Appendix A23** to this Report be presented to the CNS/MET SG/13 meeting for further scrutiny and formulate a proposed list with associated deficiency type (urgent or top priority) to the APANPIRG/20 meeting.

14.2.7 The meeting referenced the process of assigning a deficiency status. That is, U (urgent) status is reserved for an ICAO standard and A (top priority) status is reserved for recommended practices. Therefore, the lack of METAR data, WAFS forecasts for pre-flight planning and volcanic ash monitoring would be tagged with the U status. In view of the discussion above, the meeting formulated the following draft Conclusion with regards to proposed air navigation deficiencies in the South Pacific.

Draft Conclusion 13/49 – MET deficiencies to be added to the APANPIRG list of Air Navigation Deficiencies

That, the list of proposed air navigation deficiencies in **Appendix A23** obtained by the ICAO TCB CAEMSA-SP draft reports be added to the list of APANPIRG air navigation deficiencies list tagged with the U status.

14.2.8 The meeting further discussed the difficulties associated in mitigating the gaps in MET service in the South Pacific in that cost recovery is not sufficient to cover the costs of meeting Annex 3 requirements. Bhutan drew a parallel to the cost recovery difficulty in that only a handful of flights utilize their international aerodrome each day. The meeting noted that a viable solution would be to consolidate MET Services and broaden the area influenced by one MET Service Provider to retrieve costs comparable to the service required. With that, the meeting agreed that a proposal be introduced in a future meeting that would invite ICAO to provide guidance in retrieving cost recovery for such States where the aerodromes are mainly used for alternate aerodromes in flight planning.

14.2.9 The meeting noted that in the meantime, significant resources are necessary to fulfill the MET requirements for those States, which requires ongoing effort by States, ICAO, WMO and donor States. Given the scope of gaps and deficiencies identified, the continuation of CAEMSA-SP in coordination with the ICAO Regional Office, the Pacific Aviation Safety Office (PASO), WMO and signatory States was considered necessary to execute the actions detailed in **Appendix A22**. With the continuation of CAEMSA-SP, the risk to airline safety would be reduced and airlines would be enabled to carry less fuel utilizing vitally located alternate aerodromes in the South Pacific. With that,

the meeting agreed that resources and donations were needed to produce the safety and efficiency required by airlines operating in the South Pacific. Given the aforementioned, the meeting formulated the following draft Conclusion.

Draft Conclusion 13/50 – Continuation of CAEMSA-SP

That, the DGCA/46 conference considers funding and resources be allotted by donor States, WMO, and ICAO for the continuation of the CAEMSA-SP in order to meet international requirements in the provision of meteorological services which would achieve the necessary safety and efficiency levels for airlines operating in the South Pacific.

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Agenda Item 15: Future Work Prorgramme

TOR and Subject/Tasks List of CNS/MET Sub-group

15.1 The Nineteenth Meeting of APANPIRG held in September 2008 reviewed the Subject/Tasks List of the CNS/MET Sub-Group. The meeting in its Decision 19/55 adopted the updated Subject/Tasks List as the Work Programme for CNS/MET Sub-Group.

15.2 The meeting reviewed the Terms of Reference of the Sub Group and agreed to amend the Terms of Reference to include development of guidance material and identification of intra-regional issues based on a proposal made by Viet Nam. The meeting also reviewed the Subject/Tasks List. The new tasks included in the list include comprehensive updating several FASID tables and feasibility study for establishing a regional SBAS capability. The status of on-going tasks was also updated as necessary. The meeting considered necessary to take into account the Performance Framework Form being developed when the Subject/Task List is updated in the future.

15.3 Accordingly the meeting and formulated the following Draft Decision for adoption by APANPIRG.

Draft Decision 13/51 - Updated Terms of Reference and Subject/Tasks List of the CNS/MET Sub-group

That, the revised Terms of Reference and Subject/Tasks List of the CNS/MET Sub-group provided in **Appendices A24** and **A25** to the Report be adopted.

Next Meeting

15.4 It was agreed that the Fourteenth Meeting of the CNS/MET Sub Group should be scheduled tentatively for 19 to 23 July 2010 at the Regional Office, Bangkok. The dates are to be confirmed by the APANPIRG/20 meeting.

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Agenda Item 16: Any other business

US Next Generation Air Transportation System

16.1 The United States provided an information paper on the Next Generation Air Transport System (NextGen) vision for 2025 which is being founded upon an underlying set of principles and enabled by a series of key capabilities that will free the US of many current system constrains, support a wider range of operations and deliver an overall system capacity up to three times greater than that of current operating level. The paper briefly described the key NextGen capabilities. NextGen Transformation Program outlined in 2009, includes Automatic Dependent Surveillance – Broadcast (ADS-B), System Wide Information Management (SWIM), NextGen Network Enabled Weather (NNEW), NAS Voice Switch (NVS), and Data Communication (Data Comm.). In 2010, the list will grow to six Transformation Programs with addition of Collaborative Air Traffic Management – Technology (CATM-T). The paper invited all interested States to learn more about NextGen and assess as to how this process can assist other States in the development of their future air transportation system.

16.2 IATA supported the development of NextGen by USA and urged the States to consider using information provided in the Information Paper for developing similar systems.

Global Air Traffic Management Forum on Civil/Military Cooperation

16.3 The meeting was informed that ICAO in partnership with ATCA, CANSO, Eurocontrol, IATA, NATO and UVS is preparing "Global Air Traffic Management Forum on Civil/Military Cooperation" which will be held in Montreal 19-21 October 2009. The Forum will provide an opportunity for States civilian and military authorities, civilian and military airspace users, ANSPs and industry to discuss on the need to improve civil/military cooperation and coordination in support of optimum use of airspace to effectively meet operational requirements of air transportation, national defense and environmental conservation.

16.4 The meeting was advised that New Zealand was preparing a paper for APANPIRG/20 proposing to split the CNS/MET SG to separate Sub Groups.

Record of Appreciation

16.5 The meeting noted that a letter of appreciation from ICAO Regional Office was sent to Cambodia and China for the cooperation for providing SIGMET service by Kunming (ZPPP) MWO for Phnom Penh (VDPP) FIR. This agreement between the Air Traffic Management Bureau (ATMB) of the Civil Aviation Administration of China (CAAC) and the Flight Operation and Safety Department (FOSD) of Civil Aviation of Cambodia (SSCA) became effective 1 June 2009. The meeting congratulated and recorded appreciation for the first cooperation between States in the region in meeting SIGMET requirements.

16.6 The meeting noted that Mr. Shun Chi-ming, Assistant Director (Aviation Weather Services) from Observatory Hong Kong, China would not be able to continue serving as the vice Chairman of the Sub-group next year due to another important commitment. The meeting recorded its appreciation and gratitude to Mr. Shun for his dedication and achievements

16.7 The meeting also recorded its appreciation and gratitude to Mr. Jeffrey Bollard, Chairman of the Sub-group for dedicated efforts and valuable contributions to the APANPIRG objectives since 1993. Mr. Bollard has been serving as chairpersons for various taskforce, working groups, and sub-groups and he has been recognized as “Dean” of Chairmen of APANPIRG contributory bodies.

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Follow-up to APANPIRG/19 Conclusions/Decisions – Action Plan

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/1 **D**	**Regional Performance Framework**	That, a regional performance framework be adopted on the basis of ICAO guidance material and aligned with the Global Air Navigation Plan and the Global ATM Operational Concept. The performance framework should include identification of regional performance objectives taking into consideration user expectations (to be mapped against current work) and completion of regional performance framework forms based on the sample shown in **Appendix A** to the Report on Agenda Item 3.	Develop performance framework	ICAO APAC Office Sub Groups APANPIRG	Regional Performance objectives; Performance Framework Forms	Jun 2009	Revised target date July 2009. [ATM/AIS/SAR/ SG scheduled June 09, and CNS/MET SG meeting is scheduled July 09. ANC action: Noted and that APANPIRG is requested to take action into account the user expectations in the development of performance framework forms.

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/2 **D**	**National Performance Framework**	That, States be invited to adopt a national performance framework on the basis of ICAO guidance material and aligned with the regional performance objectives, the regional air navigation plan and the Global ATM Operational Concept. The performance framework should include identification of national performance objectives taking into consideration user expectations (to be mapped against current work) and completion of national performance framework forms based on the sample shown in **Appendix A** to the Report on Agenda Item 3.	Notify States	ICAO APAC Office States	State Letter National Performance objectives; Performance Framework Forms	Feb 2009 TBD	**COMPLETED** State letter dated 15 January ICAO Special Implementation Project − Workshop On the development of national performance framework to achieve a global ATM system was conducted in BKK from 9-13 March 2009. ANC action: Noted and that states of Asia/Pacific Regions were requested to take action into account the user expectations in the development of performance framework forms.

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
D 19/4 **A D**	**Dissolution of the Regional Performance Framework Task Force (RPF/TF)**	That, recognizing the performance based planning process utilizing "Performance Framework Forms (PFF)" promulgated by ICAO during 2008 had overtaken the Terms of Reference of the Regional Performance Framework Task Force (RPF/TF), the RPF/TF be dissolved. .					**COMPLETED**
C19/7 **A D**	**RNP 4 capability for operators**	That, recognizing the significant benefits expected from the implementation of 30 NM longitudinal separation based on RNP 4, operators of Pacific fleets be urged to equip with RNP 4 avionics for oceanic airspace operations and obtain approval from the States of Registry/Operators as early as possible, but no later than 2012.	Notify States and air space users	ICAO APAC Office	State Letter	Dec 2008	**COMPLETED** State Letter Ref.:T3/10 AP-ATM 0063 dated 20 February 2009.
D 19/16 **D**	**Revision to the Subject/Tasks List of ATNICG**	That, the Revised Subject/Tasks List of the ATNICG provided in **Appendix A** to the Report on Agenda Item 3.4 be adopted.	Notify ATNICG	ICAO APAC Office	ATNICG informed. Paper prepared.	May 2009	COMPLETED ATNICG/4 in Singapore in May 2009

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/17 **D**	**Asia/Pacific Aeronautical Telecommunication Network System Security Policy**	That, the updated "Asia/Pacific Aeronautical Telecommunication Network System Integrity Policy" provided in **Appendix B** to the Report on Agenda Item 3.4 be adopted as "Asia/Pacific Aeronautical Telecommunication Network System Security Policy".	Publish on website	ICAO APAC Office	Published on website. States notified	Oct 2008	**COMPLETED**. State letter dated 14/10/08
C 19/18 **A D**	**ATS Message Management Center (AMC) Software**	That, to facilitate implementation and management of ATN in Asia/Pacific Region, ICAO be urged to facilitate transfer of Eurocontrol AMC Software to Aerothai and to allow Aerothai to modify the Software to suit the requirements of Asia/Pacific Region.	Coordinate with parties concerned. Prepare Issue Form	ICAO HQ ICAO APAC Office	MOU signed and AMC software transferred. Sent to HQ	May 2009. Revised June 2009. Dec 2008	Coordination being carried out with HQ and Aerothai. ANC: Noted that the secretariat is reviewing the feasibility. **COMPLETED**
C 19/19 **A D**	**Implementation of AIDC in Asia and Pacific Regions**	That, States be urged to expedite implementation of AIDC between neighboring ATS facilities in accordance with the Regional Air Navigation Plan and the Asia/Pacific AIDC ICD.	Notify States	ICAO APAC Office	State Letter	Dec. 2008	**COMPLETED** 10/12/08

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/20 **D**	**Adoption of ATN over IPS in addition to ATN over OSI**	That, considering the inclusion of ATN over IPS SARPs in ICAO Annex 10, Volume 3 and to support global harmonization of ATN implementations, States hosting BBIS be urged to 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.	Notify States hosting BBIS.	ICAO APAC Office States	State Letter ATN over IPS	Dec. 2008 2011	**COMPLETED.** **ANC- Noted**
C 19/21 **D**	**Amendment to Asia/Pacific Regional AMHS MTA Routing Policy**	That, the revised Asia/Pacific AMHS MTA Routing Policy placed at **Appendix C** to the Report on Agenda Item 3.4 be adopted.	Publish on website	ICAO APAC Office	Published on website	Mar. 2009	**COMPLETED**
C 19/22 **D**	**Amendment to FASID Tables CNS – 1B and CNS – 1C**	That, FASID Tables CNS – 1B ATN Router Plan and Table CNS – 1C AMHS Routing Plan, be amended by replacing them with the Tables provided in **Appendices D and E** to the Report on Agenda Item 3.4 in accordance with the established procedure.	Prepare amendment proposal	ICAO APAC Office	Amendment proposal processed	Mar 2009	**COMPLETED** amendment proposal processed 27/01/09
C 19/23 **D**	**Amendment to Asia/Pacific AMHS Manual.**	That, Annex E and Annex F provided in **Appendix F** to the Report on Agenda Item 3.4 be adopted as Annexes to the Guidance Document for AMHS Conformance Testing (AMHS Manual).	Publish on website	ICAO APAC Office	Published on website and States notified	Nov. 2008	**COMPLETED 19/11/08**

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/24 **A D E**	**Satellite Communications Service Performance**	That, a) States and International Organizations be requested to liaise with satellite service providers to establish a mechanism to maintain and modernize the satellite communication infrastructure; and b) ICAO be invited to organize a meeting by the end 2008 for stakeholders to review the performance and provision of satellite data link communications in the Asia/Pacific Region and find a solution.	a) Notify States and Intl' Organizations b) To organize a meeting	ICAO APAC Office ICAO APAC Office	State Letter Meeting conducted	Feb 2009 Dec 2008 Revised target date- August 2009	**COMPLETED** 16/02/09 Meeting postponed Dec 2008 Meeting was deferred due airports closure in Thailand, will be held in August 2009 ANC: noting the similar developments in different Regions. Requested the secretariat to address the subject of ensuring availability of SATCOM in a comprehensive manner.

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/25 **D**	**ASIA/PAC PBN Implementation Plan**	That, the Asia/Pacific PBN Implementation Plan as provided in **Appendix G** to the Report on Agenda Item 3.4 be adopted and published as the interim Edition based on which, States be urged to developed their national PBN implementation plan and provide feedback to the ICAO Regional Office.	Notify States Publish on website	ICAO APAC Office	State letter. Published on website and States notified	Nov. 2008	**COMPLETED** 19/11/08 ANC: Noted
C 19/26 **A D**	**Investigation DME based RNAV**	That, in the interest of efficiency, States with DME coverage extending beyond their FIRs be requested to consider allowing neighboring States to develop PBN procedures utilizing these DMEs.	Notify States with extended DME coverage	ICAO APAC Office	State Letter	Feb 2009	**COMPLETED** 24/03/09

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/27 **D**	**Flight Procedure Design Office**	That, ICAO continues to develop the concept of a Flight Procedure Design Office taking into account proposals submitted by the States with emphasis on the role, responsibility and financial mechanisms.	Prepare Issue Form	ICAO APAC Office ICAO HQ	Issue form sent to HQ Establishment of FPO	Dec 2008 May 2009	**COMPLETED** China selected to host FPP ANC Action: noted that the Secretariat is on the task of studying the proposals received and would take into account the concerns expressed by the ANC in this regard.
C 19/28 **A D**	**Continuous Descent Final Approach (CDFA) and Baro-VNAV**	That, in order to reduce the likelihood of CFIT accidents, States be urged to a) review non-precision approach procedures with LNAV lines of minima to include CDFA profile; and b) include the Baro-VNAV design in the current and new RNP APCH approaches and consequent LNAV/VNAV approach minima.	Notify States	ICAO APAC Office	State Letter	Oct 2008	**COMPLETED** State letter dated 14/10/08 ANC: Noted

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/29 **D**	**Separation Standards for PBN**	That, ICAO be invited to expedite development and publication of separation standards for use in implementation of the PBN RNAV 5, RNAV 2, RNAV 1 and Basic-RNP 1 navigation specifications.	Prepare Issue Form	ICAO APAC Office ICAO HQ	Issue Form sent to HQ development of separation standards for use in implementation of the PBN RNAV 5, RNAV 2, RNAV 1 and Basic-RNP	Dec 2008 2010	**COMPLETED** ANC action: noted that the task has already been taken up by SASP and is developing SARPs on the basis of obstacle clearance criteria for separation of aircraft in terminal airspace with a target date of 2010.
D 19/30 **D**	**Revision to the Terms of Reference of the PBN Task Force**	That, the Revised Terms of Reference of the PBN Task Force provided in **Appendix I** to the Report on Agenda Item 3.4 be adopted.	Notify PBN Task Force	ICAO APAC Office	Paper prepared	Mar 2009	**COMPLETED** TF reviewed and proposed to amend TOR
C 19/31 **D**	**Revision of the Strategy for the Provision of Navigation Services in the Asia/Pacific Region**	That, the revised Strategy for the provision of navigation services provided in **Appendix J** to the Report on Agenda Item 3.4 be adopted and provided to States	Publish on website	ICAO APAC Office	Published on Website and States notified	Feb 2009	**COMPLETED** 18/02/09. ANC- Noted

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/32 **D**	**Testing of Navigation and Surveillance facilities Seminar**	That, ICAO be invited to organize a seminar on 'Testing of Navigation and Surveillance facilities' in 2009 to address issues related to ground and flight inspection/validation.	Organize a Seminar	ICAO APAC Office	Seminar	Sep 2009	COMPLETED The Seminar was conducted on 5-7 August 2009.
D 19/33 **D**	**Subject/Tasks List of ADS-B Study and Implementation Task Force**	That, the Subject/Tasks List for ADS-B Study and Implementation Task Force provided in **Appendix L** to the Report on Agenda Item 3.4 be adopted.	Notify ADS-B Study and Implementation Task Force	ICAO APAC Office	ADS-B S & I TF informed and paper prepared.	Apr 2009. revised May 2009	COMPLETED Notified the TF at ADS-B SITF/8 20-22 May Hanoi
C 19/34 **D**	**Guidance Materials on Implementation of ADS-B**	That, the following Guidance Materials on implementation of ADS-B Out Services be adopted for use by States in the Asia and Pacific Regions: - Reporting Probability of ADS-B update as shown in **Appendix M;** - Reporting ADS-B Avionics fitment as shown in **Appendix N**; - the performance criteria for multi-sensor fusion as shown in the **Appendix O**.	Publish on website and inform States	ICAO APAC Office	Published on website and States notified	Jan 2009	**COMPLETED**

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/35 **D**	**Guidelines for the development of ADS-B Implementation**	That, States be advised to use the following guidelines for the development of ADS-B implementation plan. a) minimize capital and operating costs of ADS-B data facilities; b) give priority to provide coverage over major traffic flows; c) provide ADS-B coverage in areas within 150 NM from FIR boundaries; d) suitable sites with power, shelter, access routes and data communication links shall be preferred; and e) overlapping of ADS-B coverage is preferred.	Notify States	ICAO APAC Office	State Letter	Feb 2009	**COMPLETED**
C 19/36 **D**	**Sample Agreement for ADS-B Data Sharing**	That, the sample Agreement for ADS-B Data Sharing and the cost apportionment framework provided in the **Appendices P and Q** respectively to the Report on Agenda Item 3.4 be adopted as the regional guidance material.	Notify States	ICAO APAC Office	State Letter	Feb 2009	**COMPLETED** 14/01/09

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/37 **D**	**Revised Mandate Regional ADS-B Out Implementation**	States intending to implement ADS-B based surveillance service, be urged to a) determine ADS-B OUT equipage mandates based upon the ability to provide ADS-B OUT separation services; b) expedite the implementation of ADS-B OUT in accordance with the Regional Air Navigation Plan and the provision of separation services based on ADS-B OUT; c) publish their equipage mandates as soon as possible, with a target publication date of no later than 2010 so that operators can plan ahead their forward purchasing and retrofit; d) choose a date after mid 2012 on which the ADS-B out equipage mandate will become effective in airspace served by ADS-B ground stations with sufficient transition period to enable fleet equipage. *Note: The implementation would require aircraft equipped with avionics compliant with either;*	Notify States States States	ICAO APAC Office	State Letter publish their ADS-B OUT equipage mandate ADS-B out equipage mandate will become effective in airspace served by ADS-B ground stations	Nov 2008 2010 After mid 2012	**COMPLETED.** **ANC action- Noted**

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
		1) *Version 0 ES as specified in Annex 10, Volume IV, Chapter 3, Paragraph 3.1.2.8.6 (up to and including Amendment 82 to Annex 10) and Chapter 2 of the Technical Provisions for Mode S Services and Extended Squitter (ICAO Doc 9871) (Equivalent to DO260) to be used till at least 2020. or* 2) Version 1 ES as specified in Chapter 3 of the Technical Provisions for Mode S Services and Extended Squitter (ICAO Doc 9871) (Equivalent to DO260A)					

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/38 **A D**	**Support provision of VHF radio voice communication associated with ADS-B data sharing between adjacent States**	That, States be urged to consider following regional policy on supporting 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. It 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."	Notify States	ICAO APAC Office	State letter	Mar 2009	**COMPLETED**

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/39 **D**	**Regional Surveillance Strategy for Asia/Pacific Region**	That, the revised Regional Surveillance Strategy for Asia/Pacific Region provided in the **Appendix R** to the Report on Agenda Item 3.4 be adopted.	Publish on the web site.	ICAO APAC Office	Published on website and States notified.	Jan/Feb 2009	**COMPLETED ANC- Noted**
C 19/40 **A D**	**Coordination for SSR Mode S Interrogator Identifier Code**	That, a) in view of low density of SSR interrogator installations in the region, only Interrogator Identifier (and not Surveillance Identifiers) codes be used for SSRs Mode S in areas of overlapping coverage b) 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 interrogators, administrations should ensure that the interrogators with overlapping coverage are not operating with the same Interrogator Identifier (II) codes. - where, the coverage of the interrogator extends beyond the boundaries of the State, The II code and PRF should be worked out in coordination with the ICAO	Notify States	ICAO APAC Office	State letter	Mar 2009	**COMPLETED.** State Letter dated 24 March 09

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
		Asia and Pacific Office and the neighboring States, and - administrations should inform the ICAO Asia and Pacific Office about the assigned II codes and PRFs for these installations.					
C 19/41 **A D E**	**Contact Person for WRC-11 and active participation by the States in WRC-11 related national and regional activities**	That, States be urged to a) nominate a Contact Person responsible for the preparation for WRC-11 in their administration and inform ICAO Asia and Pacific Office about the contact details of the nominated Contact Person; and b) actively participate in all the national and regional level activities related to the preparation for WRC-11.	Notify States	ICAO APAC Office	State Letter	Jan 2009	**COMPLETED**

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/42 **A D**	**Providing ASIA/PAC States with information on recent and forthcoming developments to WAFS**	That, in order to increase the regional awareness on the planned developments of the WAFS, SADIS and International Satellite Communication System (ISCS), the information provided by the WAFCs, as shown in **Appendix S** to the Report on Agenda Item 3.4 be circulated by the ICAO Regional Office to the States in the ASIA/PAC Region.	Notify States	ICAO APAC Office	State Letter	Oct 2008	**COMPLETED** T 8/4.1: AP148/08(MET) 28 Oct 2008

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/43 **D**	**Training for the new WAFS gridded forecasts**	That, in order to facilitate the implementation by the States of the new WAFS gridded forecasts, a) WAFC Provider States, in coordination with ICAO and WMO, be invited to organize training on the use of the new WAFS gridded forecasts for icing, turbulence and cumulonimbus clouds; and b) WAFSOPSG be invited to consider, in addition to the planned regional training seminars, developing alternative methods for provision of training to the States on the new gridded forecasts for icing, turbulence and cumulonimbus clouds in order to ensure that a maximum number of WAFS users in the States will have access to the training in the most efficient way. *Note: The alternative training methods include computer based training products distributed to States and web-based training.*	a) Organize training b)Develop alternative methods for provision of training to the States on the new gridded forecasts for icing, turbulence and cumulonimbus clouds	ICAO HQ ICAO HQ	conduct training programme Alternative training methods	Dec 2010 Dec 2010	Revised target date Dec 2010. ANC action-Noted and invited the Secretary General to invite WAFC provider States in coordination with ICAO and WMO to organize the required training.

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/44 **D**	**Use of administrative messages for errors in the WAFS SIGWX forecasts**	That, a) WAFSOPSG be requested to develop as soon as possible the procedures for the issuance of administrative messages by the WAFCs drawing attention to errors identified in the current WAFS SIGWX forecasts (in the BUFR code and PNG chart forms); and b) ICAO be invited to develop guidance for the meteorological offices and aviation users on the use of the above administrative messages.	Prepare Issue Form Development of procedures develop guidance on the use of the above administrative messages.	ICAO APAC Office ICAO HQ ICAO HQ	Issue Form sent to HQ The procedures for the issuance of administrative messages by the WAFCs Guidance	Dec 2008 2010 2010	**COMPLETED**
C 19/45 **A D**	**Transition to ISCS 3rd Generation**	That, in view of the plans by the ISCS Provider State to upgrade the ISCS broadcast to a new 3rd Generation service (ISCS 3G) by the end of 2009: a) the ISCS Provider State be urged to provide timely information to the ISCS user States on the planned changes including specifications of the hardware and software changes, transition timeline and expected cost implications for the users if any; and	Provide specifications Notify ISCS user States	ISCS provider State ICAO APAC Office	Specification information available State Letter	Mar 2009 Apr 2009	State Letter sent T 4/8.1:AP-MET 0019/09 dated 27 Feb 2009. Response awaited.

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
		b) the ISCS user States be urged to keep abreast of the planned developments through the established channels of communication with the ISCS Provider State and plan well in advance any resources required for the transition to the ISCS 3G; *Notes:* *1) The ISCS Provider State will use the established network of ISCS focal points as its basis for keeping States informed.* *2) The Secretariat will undertake the task to keep the list of ISCS focal points up-to-date to ensure efficient communication between the ISCS Provider State and the ISCS user States in the ASIA/PAC Region.* *3) All information on the planned transition will be available on: http://www.weather.gov/iscs*					

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/46 **D**	**Amendment proposal to TAF-related provisions in the ASIA/PAC Basic ANP and FASID (Doc 9673)**	That, a) the amendment proposal to the ASIA/PAC Basic ANP, as presented in **Appendix V** to the Report on Agenda Item 3.4 , be processed according to the established procedure; and b) the new format of FASID Table MET 1A, as presented in **Appendix U** to the Report on Agenda Item 3.4, be adopted and the ASIA/PAC States be invited to provide the necessary data to the Regional Office in order to issue an amendment proposal.	prepare amendment proposal Notify States	ICAO APAC Office ICAO APAC Office	amendment proposal to HQ State Letter	Sep 2008 Nov 2008	**COMPLETED** Amendment Proposal (APAC 08/29-MET:AP 123/08 (MET) 17 Sep 2008 (approved –SL 11 Mar. 2009) **COMPLETED** Amendment Proposal (APAC 08/31 :AP133/08(MET) 1 Oct 2008 (approved-SL 13Jan 2009)

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/47 **D**	**Regional preparedness for timely implementation of the new TAF provisions**	That, a) the Regional implementation plan for the new TAF provision presented in **Appendix W** to the Report on Agenda Item 3.4 be circulated to all ASIA/PAC States; and b) States be informed that the new TAF format should be used for all TAFs issued after 00 UTC on 5 November 2008.	Notify States Notify States	ICAO APAC Office ICAO APAC Office	State Letter State Letter	Sep 2008 Sep 2008	**COMPLETED** T 4/8.3.2: AP127/08(MET) 23 Sep 2008 **COMPLETED** T 4/8.3.2: AP129/08(MET) 29 Sep 2008
C 19/48 **D**	**Test website for the transition to the new TAF format**	That, States in the ASIA/PAC Region be invited to use the special website established by the U.S. NWS to facilitate the transition to the new TAF format and test their procedures for issuance of 30-hour TAF. *Note: The 30-hour TAF test website is accessed on: http://www.weather.gov/os/aviation/taf_testbed.shtml*	Notify States	ICAO APAC Office	State Letter	Sep 2008	**COMPLETED** T 4/8.3.2: AP129/08(MET) 29 Sep 2008

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/49 **D**	**Guidance on the period of validity of TAF included in the HF VOLMET broadcasts**	That, ICAO: a) be invited to urgently review the concerns expressed with regard to the non-suitability of 30-hour TAF for HF VOLMET broadcasts as described in detail in the report of CNS/MET SG/12 meeting; and b) provide urgent guidance to the States concerned taking into consideration the user requirements expressed by IATA and IFALPA, before the implementation date of the new TAF provisions.	Prepare Issue Form review guidance to the States	ICAO APAC Office ICAO HQ ICAO HQ	Issue form sent to HQ Review required guidance	Dec 2008	**COMPLETED** **COMPLETED** **COMPLETED** T 4/6.1.1: AP124/08(MET) 17 Sep. 2008

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/50 **D**	**Issues related to TAF code**	That, ICAO, in coordination with WMO be invited to consider the following issues related to TAF: a) providing explicit definition of the geographical area that the TAF covers with consistency between this definition for the TAF and METAR; b) establishment of amendment criteria for the temperature group in the TAF; and c) establishment of provision for multiple occurrences of operationally significant maximum or minimum temperatures in a 30-hour TAF.	Prepare Issue Form Review the issues concerning TAF	ICAO APAC Office ICAO HQ	Issue Form sent to HQ Amendment criteria to be included in Amendment 76 to Annex 3 as necessary; and guidance	Dec 2008 2011	**COMPLETED** ANC action-supported the request and called upon the Sec Gen to address the issues in Conclusion 19/50 with the assistance of AMOFSG

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/51 **D**	**Coordination and Implementation of the Volcanic Ash Notification for Aviation**	That States listed in FASID Table MET 3C be encouraged to implement the format VONA developed by the International Airways Volcano Watch Operations Group (IAVWOPSG) in order to: a) improve communication of information on volcanic activity to ACC, VAAC, and MWO; and b) provide feedback on the utility of the VONA and refinements that should be considered by the IAVWOPSG *VONA = Volcano Observatory Notice for Aviation*	Notify States	ICAO APAC Office	State Letter	Nov 2008	**COMPLETED** T 4/9.1 : AP171/08(MET) 28 Nov 2008
C 19/52 **D**	**Update of ASIA/PAC Regional SIGMET Guide**	That, the new SIGMET examples developed by Hong Kong, China and Australia given in **Appendix Y** to the Report on Agenda Item 3.4 be included in the new edition of the ASIA/PAC Regional SIGMET Guide.	Notify States	ICAO APAC Office	State Letter	Dec 2008	**COMPLETED** T 4/8.3.2 : AP185/08(MET) 17 Dec 2008

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
C 19/53 **D**	**Convening MET/ATM TF meeting and organizing MET/ATM seminar**	That, a meeting of MET/ATM Task Force be convened in 2009 to review and update the Work Programme of the group and prepare a programme for the second ASIA/PAC MET/ATM Seminar to be held in 2010. *Note: Coordination with the ATM/AIS/SAR Sub-group is essential for the planned meeting of the MET/ATM TF.*	Organize meeting	ICAO APAC Office	Meeting convened	Dec 2009	
C 19/54 **D**	**Improvements to aeronautical climatological information provision**	That, ICAO, in coordination with WMO and IATA, be invited to: a) study the evolving user requirements for the provision of aeronautical climatological information, in view of the increasing importance of climatological data in the decision making process and strategic planning of airline operations; b) based on the results of the study, consider developing proposal for improvements to aeronautical climatological information provision.	Prepare Issue Form proposals for improvements to aeronautical climatological information.	ICAO APAC Office ICAO HQ	Issue form sent to HQ Appropriate provisions	Dec 2008 TBD	**COMPLETED** ANC action- In view of the important scope of this issue no action should be taken until the need for the provision of improved aeronautical climatological information be assessed by a conjoint ICAO/WMO meeting

Conclusion/ Decision No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status as on 30 March 2009
D 19/55 **D**	**Updated Subject/Tasks List of the CNS/MET Sub-group**	That, the Subject/Tasks List of the CNS/MET Sub-group provided in Appendix A2 to the Report on Agenda Item 3.4 be adopted.	Notify CNS/MET SG	ICAO APAC Office	CNS/MET SG informed with paper prepared	Jul 2009	COMPLETED Updated CNS/MET was presented to CNS/MET/SG/13.
C 19/56 **C,D**	**Common methodology for environmental benefits**	That, ICAO be invited to establish and maintain a simple and cost effective common methodology to assess and document environmental benefits to airspace and CNS/ATM planning initiatives.	Prepare Issue Form Common methodology	ICAO APAC Office ICAO HQ	Issue Form sent to HQ Appropriate guidance	Dec 2008 2010	**COMPLETED** ANC action- Noted that the task of developing a common methodology to assess environmental benefits of CNS/ATM systems is already included in the work program of CAEP.

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

Status of outstanding APANPIRG/18 Conclusions/Decisions – Action Plan

Concl/ Dec No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 18/4 **A D**	**Consequences of Global RVSM Long Term Height Monitoring**	That, the Regional Office draw to the attention of the RVSM airspace safety monitoring agencies within the Asia Pacific Region the provisional global RVSM long-term height monitoring requirements recently proposed by the ICAO Separation and Airspace Safety Panel (ICAO SASP), and request that those agencies prepare a regional impact statement summarizing the estimated consequences for the Region, including consideration of numbers of airframes required to be monitored, for initial review by RASMAG/8 in late 2007.	Inform RMAs of long term height monitoring requirements and request they prepare impact statements	ICAO APAC Office	Report to RASAMAG	June 09	**ONGOING** RASMAG/8 (Dec 07) addressed these issues in detail and raised 6 Long Term Height Monitoring Actions Items. State letter issued on 31/1/08. RASMAG/11 (June 09) will finalize this work.
C 18/7 **D**	**Conduct Regional ATFM Seminar**	That, noting the provisions of GPI- 6 *Air Traffic Flow Management* and the increasing numbers of actual and planned ATFM implementations occurring in the Asia/Pacific Region, the ICAO Asia/Pacific Regional Office conduct, with assistance from States experienced in ATFM, a 3-day Air Traffic Flow Management Seminar during 2008.	Conduct seminar	ICAO APAC Office/States with the experience of ATFM	Seminar	October 2008	**COMPLETED** ATFM Workshop conducted in Fukuoka, Japan from 7-9 October 2008

TBD = To be determined

Concl/ Dec No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 18/12 **D**	**Assistance to States to improve AIS capability**	That, in follow up to the comprehensive survey on AIS conducted in the Asia/Pacific Region in 2006/2007, ICAO undertake a special implementation project during the second half of 2008 for a workshop/seminar to be held on AIS automation	Establish SIP Conduct SIP	ICAO HQ Regional Office assisted by States	SIP approval SIP completed	2009.	**COMPLETED** Council has approved -a Seminar, to be scheduled for late 2008 **COMPLETED** AIS Automation/ eTOD Seminar/ Workshop conducted in Japan, 23&24 Feb 09, followed by AAITF/4

TBD = To be determined

Concl/ Dec No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 18/15 **D**	**Strategies to implement eTOD**	That, in light of the experiences encountered by States attempting to implement Annex 15 provisions on eTOD, ICAO be invited to: a) hold an eTOD Workshop in the Asia and Pacific Region during 2008;	conduct workshop	ICAO APAC Office	SIP Approval Workshop	Feb 2009	**COMPLETED** AIS Automation/ eTOD Seminar/ Workshop conducted in Japan, 23&24 Feb 09, followed by AAITF/4
		b) make available the *Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information* (Doc 9881), as soon as possible; and	circulate guidelines to states	ICAO ~~APAC Office~~ HQ	HQ State letter	2010	**CLOSED.** ICAO HQ is finalizing Doc 9881, will transmit by State letter in due course
		c) provide specific guidance on cost recovery and property rights of eTOD material	establish and provide guidelines	ICAO HQ	Specific guidelines		**CLOSED**- World Wide symposium conducted in June 08 addressed this issue.

TBD = To be determined

Concl/ Dec No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 18/23 **D**	**Discontinuation of Asia/Pacific Regional Plan for New CNS/ATM Systems**	That a) in order to harmonize planning process with the Global Air Navigation Plan, Regional Plan for New CNS/ATM Systems be discontinued; and b) ICAO be invited to develop detailed proposals for incorporating the useful information contained in the Regional Plan for the CNS/ATM Systems into the Asia Pacific Regional Air Navigation Plan (Doc 9763) and completed by 2009.	Notify states Establish proposals	ICAO APAC Office ICAO APAC Office	State letter Proposal for the consideration at APANPIRG 20 in September 2009	Oct 2007 2009	**COMPLETED**. State Letter AP0112/07 (CNS) issued on 16 Oct. 07 **ON GOING** Task in b) to be undertaken in coordination with HQ
C 18/53 **D**	**Development of State PBN Implementation Plans**	That, the Regional Office encourage States to begin development of their State PBN implementation plans in harmony with the development of the Asia/Pacific Regional PBN implementation plan being coordinated by the Asia/Pacific PBN Task Force for submission to APANPIRG/19 (2008).	Encourage States to develop State PBN implementation plan by 2009	ICAO APAC Office	State Letter based on regional PBN implementation plan to be developed by PBN task force	2009	**ONGOING** Interim Regional PBN plan adopted by APANPIRG/19 has been further updated by TF for consideration by APAPNIRG/20; PBN/TF is developing models for such plans.

TBD = To be determined

Concl/ Dec No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 18/59 **D**	**Resolution of ATM and OPS Deficiencies in the South West Pacific Small Island Developing States (SIDS)**	That, in recognizing the safety implications of the long-standing ATM and OPS deficiencies in the South-West Pacific SIDS included in the APANPIRG Deficiency Data Base, ICAO, in coordination with the international organizations and regional bodies concerned, considers providing urgent assistance to these States in order to build their capacity to provide the required services in a sustainable and cost-efficient manner	Assist in establishment of TC project	ICAO HQ	TC Project	2008	**ON GOING** State letter to SIDS circulated on 22 January 08 to update the status of deficiencies identified. Additional follow up by Regional Office and through PASO. Response still awaited from States.

TBD = To be determined

Concl/ Dec No. --- Strategic Objective*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable	Target date	Status
C 15/15	**Asia Pacific Regional ATN Implementation System Management Operational Procedures**	That, the Asia/Pacific regional ATN Implementation System Management Operational Procedures be published to assist States in implementation of the ATN ground infrastructure in the Asia/Pacific region			Considered premature due to lack of experience in operational aspect to develop a manual procedure. This task can be addressed only after gaining sufficient operational experience of AMHS. Asia/Pacific Regional ATN Implementation System Management Operational Procedures containing initial direction and guidance was published in August 2004.	2009	**COMPLETED** The basic guidance material on procedures was developed in 2004. Further updates are expected by ATNICG based on sufficient experience gained in 2009. Updated guidance material has been developed by the ATNICG/4 meeting for consideration by APANPIRG through CNS/MET SG.

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

TBD = To be determined

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/4 Update
1	ATN Implementation Coordination	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Review of implementation problems and develop co-ordinated solutions (2) Coordinate/compile the regional implementation schedule	Expedite implementation activities, ensure system compatibility through out the region	(1) Co-ordination Report (2) Waterfall schedule	(1)Ongoing/Semi-annually until (2010)- (2) Schedule 09/2009	Kapoor (India)	All members	(1)Updated the information in the ATN Router and AMHS planning tables and the implementation status.(2) Waterfall schedule relivered by September 2009
2	ATN Operational Procedures	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Development of Interim Database for Directory Services	Make available real time and quality assurance addresses for ATN message delivery	(1) Interim Database	(1) (2007)	Robert Hallman (USA)	Thailand, Hong Kong China, Japan	The database was demonstrated. Aerothai will maintain the database on behalf of the regional ICAO Office. Aerothai will serve as POC for AMC coordination between Asia/Pac States and Eurocontrol. ATN Operational Procedures is completed and forward for adoption.
				(2) Develop the operational database management procedures		(2) Operational Procedures	(2) (2007)			Completed.
3	ATN Certification & Validation Process	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Develop conformance procedures and checklist for AMHS and ATN routers	Expedite implementation activities, ensure global system compatibility	(1) Checklist	(1) (2007)	Sin Hie Sng (Singapore)	China, Hong Kong China, Indonesia,ROK,USA,	Completed

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/4 Update
				(2) Develop validation process document		(2) Conformance Document	(2) 2007			Completed and forward to CNS/MET SG and APANPIRG/20 for review and adoption
						(3) Update to Conformance Document	(3) Ongoing until 2010			Document need to be kept up-to-date to reflect defect report from States
4	(1) ATN Documentation (2) Review all documents adopted by ATNICG and ATNTTF	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Study DIR objects/attributes proposed in ACP and follow development within other groups (2) Update document tree/establish tracking table for suspended dates (3) Standardized Report form and Guidance Material	Expedite implementation activities, ensure global system compatibility	(1) Directory Report (2) Tracking table/Updated documentation tree (3) AMC report (4)Report Form and Report Guidance	(1) Annually until (2010) (3) Periodically (4) 2010	Chonlawit B. (Thailand)	USA	Update the database.
				(2) Development AIDC documentation (including ICD) and follow development within other groups		(2) AFTN AIDC/ATN Gateway Specification ATN AIDC ICD	(2) 2008 (ACP-dependent)	(Thailand)	Thailand	Postpone development of ATN-based AIDC ICD. Awaiting new format developed by OPMET Panel
				(3) Update of AMHS ICD to comply with SARPs 3rd Edition		(3) Updated AMHS ICD	(3) (2007)		Japan	Provided to ATNICG/2 for endorsement. Adopted by APANPIRG/18. Completed

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/4 Update
5	ATN Performance	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Develop/establish/adapt/monitor/identify/analyse performance indicators	Assure QOS, service continuity, timely delivery of services	(1) AMHS performance report	(1) Annually until (2010)	Japan	Republic of Korea, India	Review and update at ATNICG WG/6
6	ATN Service Enhancements	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Review the impact of the implementation of Directory Services in the Region	Enhancing the service	(1) Report on directory	(1) Annually until (2010)	Fiji	USA, Thailand, New Zealand, Japan, Australia	Complete. AMC has been adopted by ICAO. Aerothai has been designed as POC for Asia/Pac region
				(2) Development of profiles for the directory access and exchange protocols (Ref. Decision 7/9)	Enhancing the operation	(2) Report on profiles	(2) (2011)	Fiji		
				(3a) Study IPv4 vs. IPv6 implementation, operational and transition impacts (3b) Investigation 9880 standard	Inbter-regional network compatibility	(3) Report (4) Report	(3) 2011 (4) 2009/2010 (WG/6 and ATNICG/5)	Singapore	Australia, China, India, Fiji, HongKong, China, Japan, and USA	(4) USA will draft report
				(4) Study for transition to BUFR code	Enhancing the service	(4) Report on the impact of BUFR code to ATN	(4) (2007)	Japan	New Zealand, USA,	Closed. BUFR code is no longer considered. Awaiting OPMET Panel for Meteorological message format.

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/4 Update
				(5) Study for transition of AFTN-based AIDC as an alternative to ATN based AIDC to ATN environment	Improving the service and lowering the operating cost	(5) Report on the impact of transition of AFTN-AIDC to ATN-AIDC AFTN AIDC/ATN Gateway Specification	(5) (2008)	Thailand	India, Indonesia, New Zealand, USA,	A Draft specification of AFTN AIDC/ATN Gateway was presented.
		D. Efficiency	GPI-17, GPI-19, GPI-22	Analyze Common Address Prefix Proposal	Improving the service and routing efficiency	Report on common prefix based analysis conduced	End of 2008	Mark Brown (Japan)	Australia, Fiji, HongKong China, New Zealand and USA	Action Items developed at ATNICG/2 for follow-up at WG meetings.
7	Security	B. Security	GPI-17, GPI-19, GPI-22	(1) Develop ATN System Security policy	Safe and Secure Inter and Intra Regional Communication and service infrastructure	(1) Policy Document	(1) Annually until (2010)	Vidyut Patel (USA)	Australia, Hong Kong China	Adopted by APANPIRG/19
				(2) Develop ATN System Security Guidance		(2) Guidance Document	(2) (2008)			On-Going review and update
				(3) Develop ATN System Security Solution for Initial and Enhanced Services		(3) Security, Technical, Management and Operational Control	(3) (2008)			On-Going review and update

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/4 Update
				(4) Co-ordinate and monitor ACP working group and other regions including Directory Service, PDRs		**(4) Report**	**(4) Semi-Annually until (2010)**		**Thailand**	**On-Going review and update**

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/4 Update
				(5) Develop ATN System Security Check List based on Security Control and Regional Incident Response Plan and Contingency Plan		(5) Check List, Regional Incident Response Plan and Contingency Plan	(5) (2009)			Forward to CNS.MET SG and APANPIRG for review and adoption
8	ATN Service Enhancements (supporting amended ICAO Flight Plan and ATS Message Formats)	D - Efficiency	GPI - 17, GPI - 19, GPI - 22	1) Review the impact of the impleemntation of Amendment 1 to 15th Edition of Doc. 4444 effective 15 Nov. 2012 (PANS ATM Chapter 4 and Appendix 3 relating to the ICAO Flight Plan and associated ATS Message formats to the AFS	Enhancing the service	1) Report on capability of existing and planned AFS systems to the revised ICAO Flight Plan and ATS Message Format	1) Annually until 2011	USA	Fiji India Hong Kong New Zealand Singapore USA	Pending result from ICAO Flight Plan and ATS Message TF
				2) Indentify the new requirements for AMHS/AFTN to support new message format	Enhancing the operation	2) Report on impact of New ATS message format in AMHS	2) 2010	Thailand	Fiji India Hong Kong New Zealand Singapore USA	On-going task-Report at ATNICG/4
				3) Identify the link control procedure using the AMHS to support the revised ATS message format to the ATC automation system	Enhancing the service	3) Report whether special link control procedure is required	3) 2010	Thailand	Fiji India Hong Kong New Zealand Singapore USA	On-going task

The ATN PERFORMANCE OBJECTIVE

The APAC ATN ground-to-ground infrastructure will be fully operational 53 percent at 23 locations by December 2007.

(GPI-22) COMMUNICATION NETWORK INFRASTRUCTURE

Related ATM objectives: AMSS; HF data; VHF data; SSR Mode S; ATN

Scope: To evolve the aeronautical mobile and fixed communication infrastructure, supporting both voice and data communications, accommodating new functions as well as providing the adequate capacity and quality of service to support ATM requirements.

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/4 Update
(GPI-19) METEOROLOGICAL SYSTEMS **Objective:** To improve the availability of meteorological information in support of a seamless global ATM system. **(GPI-17) IMPLEMENTATION OF DATA LINK APPLICATIONS** **Scope:** Increase the use of data link applications **Related ATM objectives:** Application of data link; Functional integration of ground systems; with airborne systems; ATS inter-facility data communication (AIDC)										

Asia /Pacific
ATN IDRP Routing Policy
Version 3.1

SUMMARY

This paper is the version 3.1 of the ATN IDRP Routing Policy for the Asia and Pacific region. It maintains the approach developed at the ATNICG/2 meeting in Hong Kong in May 2007. This document however defines a combined ASIA/PAC regional prefix rather than a combined ASIA/PAC/NAM region.

Singapore

4 – 8 May 2009

Asia /Pacific ATN IDRP Routing Policy

Draft Version 3.1

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This document provides global policy for Aeronautical Telecommunication Network (ATN) routers operating in the Asia and Pacific Region in support of Air Traffic Services Message Handling Services (ATSMHS) and other ATN services.

Background

The ATN Transition Task Force (ATNTTF) has been assigned a number of tasks to prepare the region for the introduction of the ATN. At the third meeting of the ATNTTF Working Group B meeting held in Bangkok, Thailand on 27 through 30 August 2001, a specific action item was identified to develop documentation on Routing Policy. This document is in response to that action.

Overview

This document presents relevant background information on routing and provides a general discussion of policy-based routing. With this background, policy for routing to ground systems is specified for ATN ground-ground routers in support of inter-regional, intra-regional and local connectivity. This document additionally provides a set of recommended policies for routing to airborne systems. These policies are subject to further development in future versions of this document as the Asia/Pacific ATN Routing architecture evolves to include air-ground routers.

1. INTRODUCTION

The Aeronautical Telecommunication Network Transition Task Force is preparing a series of documents which will govern the introduction of the ATN into the Asia and Pacific region. This document is to be the basis of ATN routing policy for the region.

1.1 OBJECTIVES

The objective of this document is to specify global policy for Aeronautical Telecommunication Network (ATN) routers operating in the Asia and Pacific Region in support of Traffic Service Communications (ATSC) and Aeronautical Industry Service Communications (AINSC).

1.2 SCOPE

The scope of the document includes:

- An introduction to relevant routing concepts;
- An overview of the Inter-domain Routing Protocol (IDRP) and the rational for its use in the ATN
- Routing policy requirements for ATN routers in the Asia and Pacific Region.

1.3 REFERENCES

Reference 1 Manual of Technical Provisions for the ATN (ICAO Doc 9705-AN/956)

Reference 2 Asia/Pacific ATN Routing Architecture

Reference 3 ISO/IEC TR 9575, Information technology – Telecommunications and information exchange between systems – OSI Routeing Framework

Reference 4 ISO/IEC 10747, Information technology – Telecommunications and information exchange between systems – Protocol for Exchange of Inter-domain routeing Information among Intermediate Systems to Support Forwarding of ISO 8473 PDUs.

Reference 5 Asia/Pacific ATN Addressing Plan

1.4 TERMS USED

Backbone Router – A backbone router (in the Asia and Pacific region) is a Class 4 Ground/Ground ATN router which has been designated by the operating state/organization to provide an appropriate level of performance and support the routing policies for inter-regional and intra-regional connectivity, and whose operation as a backbone router has been approved by the ICAO regional office as agreed-to by all other member states/organizations.

Network Addressing Domain – A subset of the global addressing domain consisting of all the NSAP addresses allocated by one or more addressing authorities.

Network Entity (NE) – A functional portion of an internetwork router or host computer that is responsible for the operation of internetwork data transfer, routing information exchange and network layer management protocols.

Network Entity Title (NET) – The global address of a network entity.

Network Service Access Point (NSAP) – Point within the ISO protocol architecture at which global end users may be uniquely addressed on an end-to-end basis.

Network Service Access Point (NSAP) Address – 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.

Routing Domain Confederation (RDC) – A set of routing domains and/or routing domain confederations that have agreed to join together. The formation of a routing domain confederation is done by private arrangement between its members without any need for global coordination.

1.4 ROUTING CONCEPTS

In this document the primary concern is routing through the ATN at the network layer. In order to establish a common framework, certain fundamental concepts are described. See Reference 3 for more detailed information.

The routing process in any network involves a forwarding function and a route maintenance function. Forwarding refers to those actions which result in the actual relaying of network protocol data units (NPDUs) through nodes in the network. From a simplified perspective, forwarding is the process of accepting an incoming NPDU, accessing a routing database to determine the next network node or locally attached system, and sending the NDPU on to that node or system. Route maintenance refers to the update of the routing database. Route maintenance may be static, in which case it is performed through management operations in either an on-line or off-line mode, or it may be dynamic (also known as adaptive routing). Dynamic route maintenance involves the exchange of routing protocol data units (RPDUs). RPDUs may be received from a single source such as a Network Control Center, in which case routing is said to be centralized. Alternatively, RPDUs may be exchanged among the nodes in a network, in which case routing is said to be distributed. See Figure 2-1. In the ATN a distributed adaptive routing procedure is adopted.

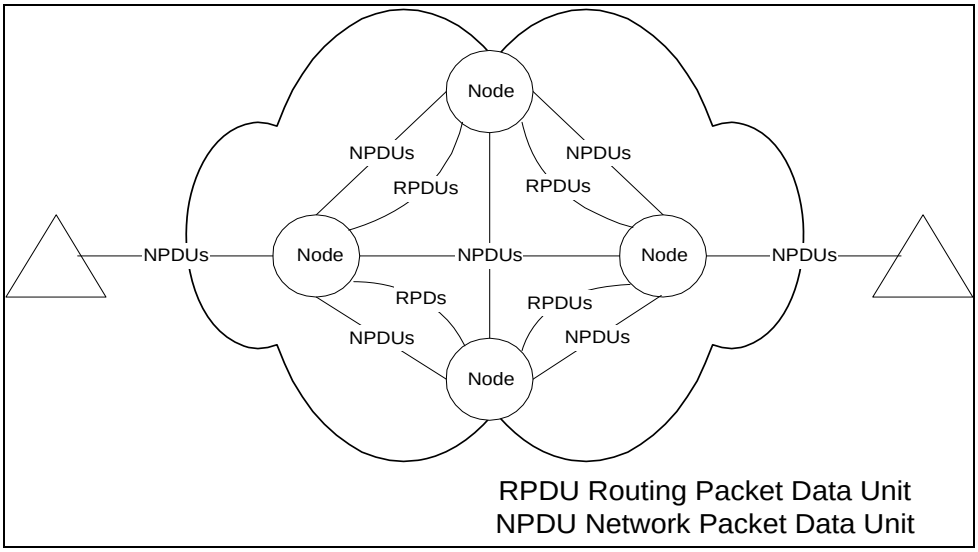

Figure 2-1. Exchange of NPDUs and RPDUs in Generic Network Environment

The route maintenance and forwarding functions under a distributed adaptive routing procedure are depicted generically in Figure 2-2. The routing database is partitioned into a Routing Information Base (RIB), which is the primary concern of the Route Maintenance Function, and a Forwarding Information Base (FIB), which is the primary concern of the Forwarding Function. The Route Maintenance and Forwarding Functions are conceptually connected through a Decision Process. The Decision Process determines:

1. Which routes are accepted into the Routing Information Base,
2. Which routes are placed into the Forwarding Information Base in support of the forwarding function, and
3. Which routes are to be advertised to other nodes in the network.

As will be described in more detail below, the decision process is affected by policy.

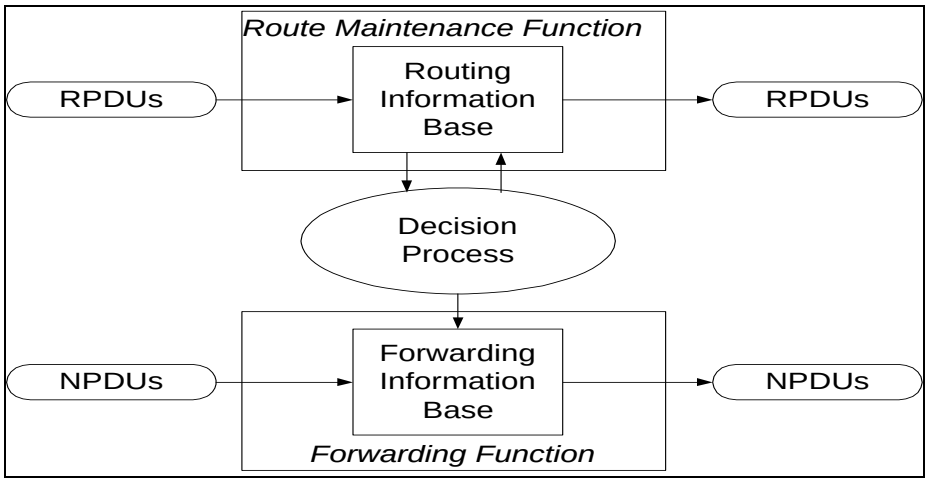

Figure 2-2 Generic Routing Functions

1.5 INTER-DOMAIN ROUTING PROTOCOL (IDRP)

In this section the rational for the use of IDRP in the ATN is summarized. The three general reasons for using IDRP are support for mobility, support for policy-based routing, and support for the secure exchange of routing information.

1.5.1 SUPPORT FOR MOBILITY

A fundamental objective of the ATN is to maintain connectivity from ground-based ATSC and AINSC end systems to their airborne counterparts. This is to be accomplished over multiple subnetworks; that is, over the various VHF Digital Links, over Mode S and over AMSS (Aeronautical Mobile Satellite Service). This objective is essentially a routing problem. If we consider the general approaches to routing, it is immediately obvious that static routing would not work. This is because routes to an aircraft are inherently dynamic; that is, aircraft traverse multiple subnetworks and within each subnetwork they traverse multiple ground stations. Thus we are left with some type of adaptive routing. A centralized approach to adaptive routing has the problem that the central control center where changes would be reported becomes a bottleneck, especially in a global environment. Even if enough capacity could be provided, there are associated timing considerations; that is, a reported change in an aircraft's location must be available to communicating ground systems in real time. There are also administrative considerations with centralized adaptive routing. These considerations include determining which administration (a particular Civil Aviation Authority (CAA), service provider, etc.) would operate the central control center and what the liabilities associated with such an operation would be. Accordingly, since neither static routing nor centralized adaptive routing would be appropriate, we are led to some type of distributed adaptive routing approach as the solution to mobility.

There are two general approaches to distributed adaptive routing. The first is called *link state* routing and the second is called *distance vector* routing. Under link state routing, each change in the network topology (in connectivity to an aircraft in the context of support for mobility) is broadcast to every other node in the network. Upon receipt of each change message, each node updates its image of the network topology and calculates the complete (shortest) path to the destination in the change message. The main problem with this approach is that the number of messages required to report changes in network topology becomes quite large in a global environment. Thus we arrive at a distance vector approach to distributed adaptive routing approach in the ATN. Under distance vector routing, a change in connectivity is propagated (i.e., advertised) to affected ATN routers throughout the network. The RPDU consists of a vector containing a destination prefix and a distance metric, which is generically a measure of the cost associated with the path being advertised to a particular destination.[1] The difference

[1] In the context of the OSI Routeing Framework (Reference 3) IDRP would be classified as a distance vector routing protocol. However, in the technical literature, IDRP is often called *path vector* routing protocol. This is because IDRP can advertise multiple metrics called path attributes associated with a

however (from link state routing) is that not all routers need be affected. In other words, not every router needs to know about every change. Particular changes need only be propagated to a point where a choice of routes is to be made. Beyond that point either an aggregate route may be advertised to other routers or these routers may be configured with a default path to that point. For example, a service provider with a ground-ground router connected to a CAA's ATN router on one side and with connections to multiple service provider air-ground routers on the other side may not need to advertise a new route each time an aircraft connects to a new air-ground router. The service provider ground-ground router may rather only advertise an aggregate route to the ATN router when the aircraft connects with the first air-ground router and withdraw the aggregate route when the aircraft is no longer connected to any air-ground router. At the same time, non-backbone routers belonging to the CAA need not receive routes to individual aircraft but rather may be configured to forward all aircraft NPDUs to the backbone router.

1.5.2 SUPPORT FOR POLICY-BASED ROUTING

1.5.2.1 IDRP Model of Operation

ATN routers execute a particular distributed adaptive routing protocol for route maintenance. The protocol is called IDRP, which stands for Inter-domain Routing Protocol (Reference 4). Figure 2-3 depicts a simplified model of IDRP route maintenance and CLNP forwarding.[2]

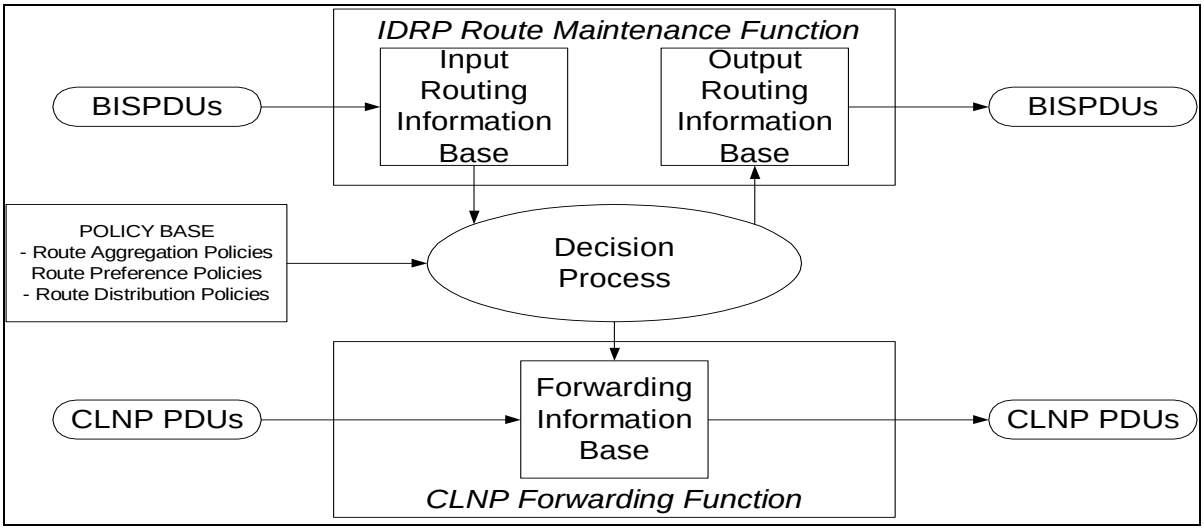

Figure 2-3. IDRP Route Maintenance and CLNP Forwarding

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particular route to a destination rather than a single distance metric.

[2] The model of routing components in this document is a simplified form of the IDRP model. The IDRP specification (Reference 4) contains a more detailed model involving the concept of a multiple local RIBs for combinations of path attributes.

In the context of IDRP, an ATN router is a Boundary Intermediate System (BIS), and accordingly the routing PDUs exchanged are called BISPDUs. Similarly, in the context of CLNP (Connectionless Network Protocol: the network protocol used by ATN), the forwarded NPDUs are called CLNP PDUs. As depicted in the figure and described in the following section, the IDRP decision process is conditioned by a policy base.

1.5.2.2 Types of Policy

The IDRP decision process (and thus ATN routing policy) is conditioned by three types of policy concerns.

- *Route Aggregation* policies permit ATN routers to reduce the amount of routing information propagated throughout the ATN.
- *Route Preference* policies determine which routes received in BISBPUs will be installed in the Forwarding Information Base. Route preference policies thus determine which path an ATN router will select to forward CLNP NPDUs on.
- *Route Distribution* policies determine which routes an ATN router will advertise to other ATN routers. Route distribution policies are a key aspect of a domain's transit policy in that they determine which routes will be permitted in a domain. An ATN router will not propagate a route, which it does not wish to support. By selective advertisement of routing information ATN routers control the use of their own resources since other routers cannot choose a route they do not know about.

1.5.3 SUPPORT FOR SECURE EXCHANGE OF ROUTING INFORMATION

A final general advantage of using IDRP in the ATN is that it has a mechanism for the secure exchange of routing information. The mechanism takes advantage of a transport protocol built in to IDRP operation. When an IDRP connection is established (through the exchange of OPEN BISPDUs), the type of security to be applied to subsequent BISPDUs is signaled. In Edition 3 of ICAO Doc. 9705, procedures for performing *Type 2* authentication are specified. With type 2 authentication each ATN router can be assured that the routing updates it receives are from a peer ATN router whose identity has been confirmed using strong (cryptographic) authentication.

2. GENERAL FRAMEWORK FOR ATN IDRP ROUTING POLICY

2.1 ROUTING POLICY GOAL FOR ATN ROUTERS

The ATN infrastructure and each region of the infrastructure must support a consistent set of routing policies to provide paths to ground systems at an inter-regional, intra-regional and local level and paths to airborne systems without an inordinate number of routing protocol updates. Accordingly, the detailed policy requirements and recommendations specified in section 4 are derived from the following general routing policy goal:

a. Asia and Pacific region ATN routers will provide global shortest path connectivity with a minimal exchange of routing information.

This general policy goal is intended to meet the objective of minimizing the delay to PDUs traversing the network while ensuring that the exchange of routing information does not significantly degrade the performance of the network for delivery of PDUs.

2.2 NETWORK ORGANIZATION FOR ROUTING TO GROUND SYSTEMS

For ground ATSC and AINSC applications the ATN infrastructure may be partitioned into various levels of organization. See Figure 2-1, which depicts routing domains for three states in the Asia/Pacific region.. Routing domains at the highest level are associated with a particular ICAO region or a group of regions called a “combined region”. The Asia/Pacific region is a combined region with an NSAP prefix of 4700278191. Within a region, routing domains are next associated with a particular state or organization. Figure 2-1 depicts three arbitrary states (s1, s2, and s3). Note that in accordance with the regional addressing plan s1, s2, and s3 would actually be a two-byte field with the two ASCII characters assigned to the state or organization. Finally, within a particular state or organization there may be multiple local routing domains. Figure 2-1 depicts one routing domain in states s1 and s2 and three routing domains in state s2. Within this framework ATN ground routers may be characterized and their policy requirements specified according to the type of connectivity they have to adjacent ATN ground routers.

- ATN routers connecting to adjacent routers in another region are said to have “inter-regional” connectivity.
- ATN routers connecting to adjacent routers in another state or organization within a particular region are said to have “intra-regional” connectivity.
- ATN routers connecting to adjacent routers within a particular state or organization are said to have “local” connectivity, i.e. intra-state or intra-organizational connectivity.

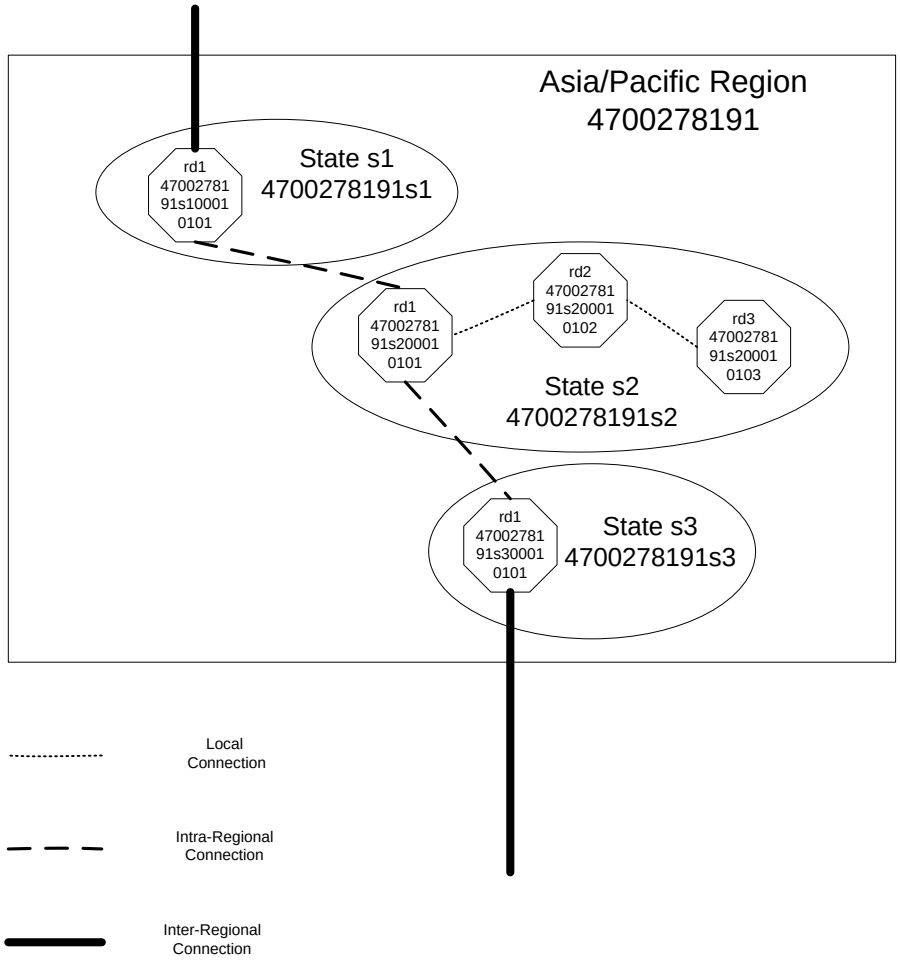

Figure 2-1. Connectivity of Ground Routing Domains

2.3 NETWORK ORGANIZATION FOR ROUTING TO AIRBORNE SYSTEMS

For air-ground ATSC and AINSC applications in the ATN it is useful to distinguish ground state domains from air-ground domains or subnetworks, which may operated by Service Provider organizations. See Figure 2-2. This figure depicts two distinct Air-Ground subnetworks, which are connected to the regional backbone. Note that a state may operate its own Air-Ground subnetwork, in which case the concepts that apply to Service Providers apply to the state-operated subnetwork.

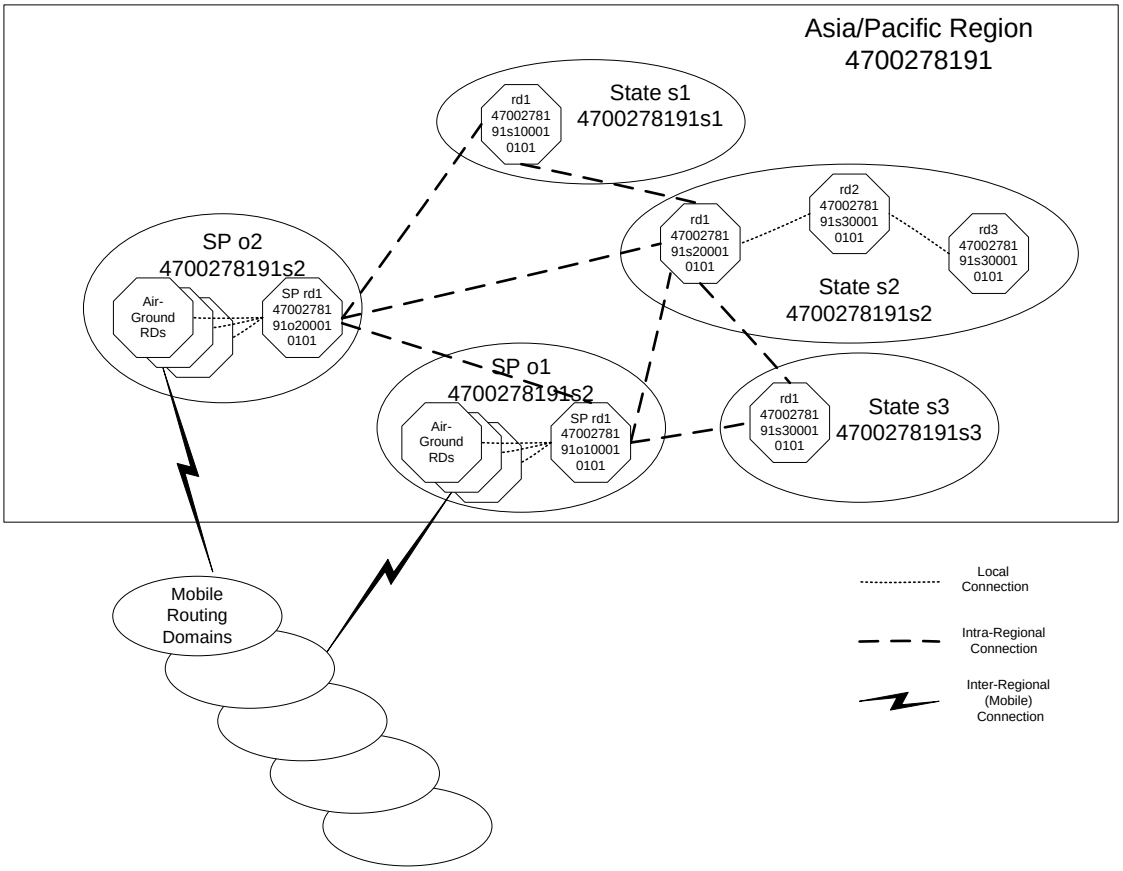

Figure 2-2. Connectivity of Air-Ground Service Providers to Regional Backbone

3. POLICY FOR ROUTES TO GROUND SYSTEMS

The policy requirements for ATN routers in the Asia and Pacific region for routes to ground (i.e., fixed) systems are specified in this section 3. Section 3.1 specifies the general policy for routes to ground systems. Policy requirements are next partitioned into policy for inter-regional routes (section 3.2), policy for intra-regional routes (section 3.3), and policy for local routes (section 3.4) according to the organizational framework described in section 2.2. Within these second-level sections policy requirements are partitioned at a third level according to the types of policy concerns identified in section 1.5.2, that is, policy requirements are partitioned at a third level into aggregation policies, preference policies, and distribution policies. Section 3.5 notes that additional state/organizational local routing policies are permitted.

Note 1. – This section specifies routing policy requirements for backbone routers in the Asia/Pacific region. A backbone router is a Class 4 Ground/Ground ATN router which has been designated by the operating state/organization to provide an appropriate level of performance and support the routing policies for inter-regional and intra-regional connectivity, and whose operation as a backbone router has been approved by the ICAO regional office as agreed-to by all other member states/organizations. This section also contains a number of recommended policies non-backbone routers.

Note 2. – This document and companion documents specify requirements for ATN routers in the "Asia and Pacific region"; however, in order to facilitate shortest path routing across inter-domain boundaries, the Asia and Pacific regions are combined under a single region identifier. See Appendix B for more information on the combined "Asia/Pac region".

3.1 GENERAL POLICY

a) If a backbone router receives multiple routes to an aggregate or specific destination, the route with the shortest path (i.e., lowest value of RD Hop Count) shall be selected.

b) All ATN routers in the Asia and Pacific shall authenticate the identity of peer ATN routers.

Note. – Authentication may be accomplished via IDRP Type 2 Authentication as specified in Edition 3 of ICAO Doc 9705 or via local means via Bilateral Agreement between the responsible organizations.

3.2 POLICY FOR INTER-REGIONAL AGGREGATE ROUTES TO GROUND SYSTEMS

Inter-regional route aggregation permits advertisement of a single aggregate route which identifies all systems in an ICAO region. Aggregation at an inter-regional level refers to aggregating NLRI fields to an NSAP prefix up through the first octet of the ADM field. (Reference 5)

Note. – Although this section specifies policy for inter-regional aggregate routes, the strategy for the Asia and Pacific regions is to combine them under a single region identifier. Therefore, the policy specified in this section will not apply between the Asia and Pacific regions See Appendix B for more information on the combined "Asia/Pac region". Although the Asia/Pac strategy will result in not advertising inter-regional routes among these regions, this inter-regional policy is still specified since the actual interface to other regions has not yet been determined.

3.2.1 ROUTE AGGREGATION POLICIES FOR INTER-REGIONAL ROUTES

a) Backbone routers with inter-regional connectivity shall be configured with aggregate routes to ground systems for ATSC and AINSC applications at an inter-regional level.

3.2.2 ROUTE PREFERENCE POLICIES FOR INTER-REGIONAL AGGREGATE ROUTES

a) Backbone routers with inter-regional connectivity shall accept inter-regional aggregate routes to ground systems for ATSC and AINSC applications from adjacent ATN routers.

b) **Recommendation. -** Backbone routers with inter-regional connectivity should only accept inter-regional aggregate routes on these connections.

Note 1. - A simple method is to not accept routes with an NSAP prefix longer than the first octet of the ADM field. An alternative is to only accept inter-regional aggregate routes which have been pre-configured (using a so-called access control list).

Note 2. – This policy statement is a recommendation since in the future other routes such as routes to an airline's "administrative" routing domain may need to be supported.

c) Backbone routers with intra-regional connectivity shall accept inter-regional aggregate routes to ground systems for ATSC and AINSC applications from adjacent ATN routers.

d) Routers with local connectivity (i.e., intra-state or intra-organization) shall accept inter-regional aggregate routes to ground systems for ATSC and AINSC applications from adjacent ATN routers.

3.2.3 ROUTE DISTRIBUTION POLICIES FOR INTER-REGIONAL AGGREGATE ROUTES

a) Backbone routers with inter-regional connectivity shall distribute inter-regional aggregate routes to ground systems for ATSC and AINSC applications to adjacent ATN routers.

b) Backbone routers with intra-regional connectivity shall distribute inter-regional aggregate routes to ground systems for ATSC and AINSC applications to adjacent ATN routers.

c) Routers with local connectivity shall distribute inter-regional aggregate routes to ground systems for ATSC and AINSC applications to adjacent ATN routers.

3.3 POLICY FOR INTRA-REGIONAL AGGREGATE ROUTES TO GROUND SYSTEMS

Intra-regional route aggregation permits advertisement of a single aggregate route which identifies all systems in a particular state or organization of an ICAO region. Aggregation at an intra-regional level refers to aggregating NLRI fields to an NSAP prefix up through the complete ADM field. (Reference 5)

3.3.1 INTRA-REGIONAL ROUTE AGGREGATION POLICIES

a) Backbone routers with intra-regional connectivity shall be configured with aggregate routes to ground systems for ATSC and AINSC applications at an intra-regional level.

3.3.2 INTRA-REGIONAL ROUTE PREFERENCE POLICIES

a) Backbone routers with intra-regional connectivity shall accept intra-regional aggregate routes to ground systems for ATSC and AINSC applications from adjacent ATN routers.

b) **Recommendation.** Backbone routers with intra-regional connectivity should only accept inter-regional or intra-regional aggregate routes on these connections.

c) Routers with local connectivity shall accept intra-regional aggregate routes to ground systems for ATSC and AINSC applications from adjacent ATN routers.

d) **Recommendation.** Non-Backbone routers with local connectivity may accept intra-regional aggregate routes to ground systems for ATSC and AINSC applications from adjacent ATN routers.

Note. – Non-backbone routers that accept intra-regional routes must provide an appropriate level of performance to support the routing policies for intra-regional connectivity. Other alternatives for Non-Backbone transit routers are described in Appendix C.

3.3.3 INTRA-REGIONAL ROUTE DISTRIBUTION POLICIES

a) Backbone routers with intra-regional connectivity shall distribute intra-regional aggregate routes to ground systems for ATSC and AINSC applications to adjacent ATN routers.

b) Routers with local connectivity shall distribute intra-regional aggregate routes to ground systems for ATSC and AINSC applications to adjacent ATN routers.

c) **Recommendation.** Non-Backbone routers with local connectivity may distribute intra-regional aggregate routes to ground systems for ATSC and AINSC applications to adjacent ATN routers.

Note. – Non-backbone routers that distribute intra-regional routes must provide an appropriate level of performance to support the routing policies for intra-regional connectivity. Other alternatives for Non-Backbone transit routers are described in Appendix C.

3.4 POLICY FOR AGGREGATE ROUTES TO GROUND SYSTEMS FOR DISTINCT ROUTING DOMAINS WITHIN A STATE/ ORGANIZATION

Distinct Routing Domain-level aggregation permits advertisement of a single aggregate route which identifies all systems in a specific routing domain of a particular state or organization of an ICAO region. Aggregation at this level refers to aggregating NLRI fields to an NSAP prefix up through the complete ARS field. (Reference 5) ATN routers connecting to adjacent routers within a particular state or organization, i.e., with intra-state or intra-organizational connectivity, are said to have “local” connectivity.

3.4.1 DISTINCT ROUTING DOMAIN ROUTE AGGREGATION POLICIES

a) **Recommendation.** ATN routers serving individual routing domains should be configured with aggregate routes to all ground systems for ATSC and AINSC applications.

3.4.2 DISTINCT ROUTING DOMAIN ROUTE PREFERENCE POLICIES

a) **Recommendation.** ATN routers with local connectivity should accept state/organizational-level aggregate routes to ground systems for ATSC and AINSC applications from adjacent ATN routers within the same state or organization.

3.4.3 DISTINCT ROUTING DOMAIN ROUTE DISTRIBUTION POLICIES

a) **Recommendation.** ATN routers with local connectivity should distribute state/organizational-level aggregate routes to ground systems for ATSC and AINSC applications to adjacent ATN routers within the same state or organization.

3.5 LOCAL STATE/ORGANIZATIONAL ROUTING POLICIES

Individual states/organizations may have additional routing policies consistent with the above policies for routes to ground systems. Such policies may include various local preferences or Quality of Service based routing, for example, routing based on line error rates, expense, delay, capacity, and priority.

3.6 CONFIGURATION OF ROUTES TO END ROUTING DOMAINS

The routing policies in sections 3.1 through 3.5 apply to transit routing domains, i.e, routers which connect to two or more other routers. However there are several end routing domains in the Asia/Pacific region where routers are connected to only one other router. In this case the routes may be statically configured in both routers rather than using IDRP dynamic routing procedures. Note however that the router in the transit routing domain must still distribute a route to the end routing domain to other routers. Note further that the distributed route must reflect the actual reachability of the end routing domain. Thus if IDRP is not used to determine reachability to the end routing domain some other local means must be used, for example, detecting whether or not there is an X.25 connection.

4. POLICY FOR ROUTES TO AIRBORNE SYSTEMS

The policy requirements for ATN routers in the Asia and Pacific region for routes to airborne (i.e., mobile) systems are specified in this section 4. Policy requirements are next partitioned according to the types of policy concerns identified in section 1.5.2; that is, policy requirements are partitioned into aggregation policies, preference policies, and distribution policies.

Note 1. – This initial baseline document only contains recommended policies. This is primarily because the architecture for air-ground ATN routers has not yet been developed. Once more concrete plans for the implementation of airborne applications in the Asia and Pacific region are developed, additional requirements and/or recommendations may be added in future versions of this document.

4.1 POLICY FOR AGGREGATE ROUTES TO AIRBORNE SYSTEMS

Aggregation of routes to airborne (i.e. mobile) systems permits advertisement of aggregate routes to airborne systems rather than advertisement of individual routes to every airborne system. Aggregation of routes to mobile systems may occur at a coarse level to "all mobile" or may occur at an "administrative domain" level of all aircraft belonging to an airline or the General Aviation aircraft of a given country of registration. Aggregation to "all mobile" refers to aggregating NLRI fields to an NSAP prefix up through the VER field where the value of the VER field may be "41" for Mobile AINSC routes or "C1" for Mobile ATSC routes. Aggregation at an administrative domain" level refers to aggregating the NLRI fields to an NSAP prefix up through the ADM field.

4.1.1 ROUTE AGGREGATION POLICIES FOR ROUTES TO AIRBORNE SYSTEMS

b) **Recommendation. -** ATN routers in an Air-Ground subnetwork (e.g., backbone routers for an Air-Ground Service Provider) with intra-regional connectivity (to the regional backbone routers) should be configured with aggregate routes to airborne systems for ATSC and AINSC applications at an "administrative domain" level.

Note –The basic assumption of this recommendation is there may be multiple service providers operating in a region and that an airline will contract with one service provider as the primary provider of air-ground service and optionally contract with a second service provider for back-up service.

c) **Recommendation. -** ATN routers in the regional backbone with local connectivity should be configured with aggregate routes to airborne systems for ATSC and AINSC applications at an "all mobile" level.

4.1.2 ROUTE PREFERENCE POLICIES FOR ROUTES TO AIRBORNE SYSTEMS

a) **Recommendation. -** ATN ground routers in the regional backbone with intra-

regional connectivity to ATN routers in an Air-Ground subnetwork should accept aggregate routes to airborne systems for ATSC and AINSC applications from adjacent ATN routers at an "administrative domain" level.

b) **Recommendation. -** ATN ground routers in the regional backbone with intra-regional connectivity to ATN routers in an Air-Ground subnetwork should accept routes to airborne systems for ATSC and AINSC applications from adjacent ATN routers at a "mobile routing domain" level, i.e., accept routes to individual aircraft.

Note. – This policy permits advertisement of routes to individual aircraft for cases where there are multiple Air-Ground subnetworks. It permits routing to the Air-Ground subnetwork with actual connectivity to an aircraft.

c) **Recommendation. -** ATN ground routers with local connectivity to ATN routers should accept aggregate routes to airborne end systems for ATSC and AINSC applications from adjacent ATN routers at an "all mobile" level.

Note. – Non-backbone routers accept routes at an "all mobile" level from backbone routers and from other non-backbone routers.

4.1.3 ROUTE DISTRIBUTION POLICIES FOR ROUTES TO AIRBORNE SYSTEMS

a) **Recommendation. -** ATN ground routers with intra-regional connectivity to ATN routers should distribute aggregate routes to airborne systems for ATSC and AINSC applications at an "administrative domain" level to adjacent ATN ground routers.

b) **Recommendation. -** ATN ground routers with intra-regional connectivity to ATN routers should distribute routes to airborne systems for ATSC and AINSC applications at a "mobile routing domain" level to adjacent ATN ground routers.

c) **Recommendation.** ATN ground routers with local connectivity to ATN routers should distribute aggregate routes to airborne systems for ATSC and AINSC applications at an "all mobile" level to adjacent ATN ground routers.

Appendix A – Scenarios for Distribution of Routes to Ground Systems

This appendix contains example scenarios which illustrate distribution of inter-regional, intra-regional, and routing domain level routes in accordance with the Asia Pacific routing policy. Note that in these examples the Asia and Pacific regions are defined as distinct regions. This is to illustrate the concept of hierarchical distribution of routing information. In practice, the Asia and Pacific regions are grouped together as a combined region with a single address prefix. See Appendix B. Note also that although the scenarios are for ATSC applications, the principles apply also to AINSC applications.**Scenario A-1 Inter-Regional Route Distribution**

Figure A-1 depicts routing policy operation for distribution of inter-regional routes for ATSC applications in the Asia Region.

STEP 1.

Ground-Ground Router A (GG A) in State S1 of the Pacific Region is a backbone router with inter-regional connectivity to the Asia Region. In accordance with 3.1.2.1.a GG A is configured with an aggregate route to ground systems for ATSC applications.

STEP 2.

In accordance with 3.1.2.3.a GG A distributes the aggregate route to adjacent Ground-Ground Router B (GG B) in State S3 of the Asia Region. In accordance with 3.1.2.2.a GG B accepts this route and installs it in its routing database.

STEP 3.

In accordance with 3.1.2.3.b GG B distributes the aggregate route to adjacent Ground-Ground Router C (GG C) in State S2 of the Asia Region. In accordance with 3.1.2.2.c GG B accepts this route and installs it in its routing database.

STEP 4.

In accordance with 3.1.2.3.b GG C distributes the aggregate route to adjacent Ground-Ground Router F (GG F) in State S1 of the Asia Region. In accordance with 3.1.2.2.c GG F accepts this route and installs it in its routing database. In accordance with 3.1.2.3.c GG C distributes the aggregate route to adjacent Ground-Ground Router D (GG D) also in State S2 of the Asia Region. In accordance with 3.1.2.2.d GG D accepts this route and installs it in its routing database.

STEP 5.

In accordance with 3.1.2.3.c GG D distributes the aggregate route to adjacent Ground-Ground Router E (GG E) also in State S2 of the Asia Region. In accordance with 3.1.2.2.d GG E accepts this route and installs it in its routing database.

STEP 6.

In accordance with 3.1.2.3.a GG F distributes the aggregate route to an (unidentified) adjacent Ground-Ground Router in an adjacent Region.

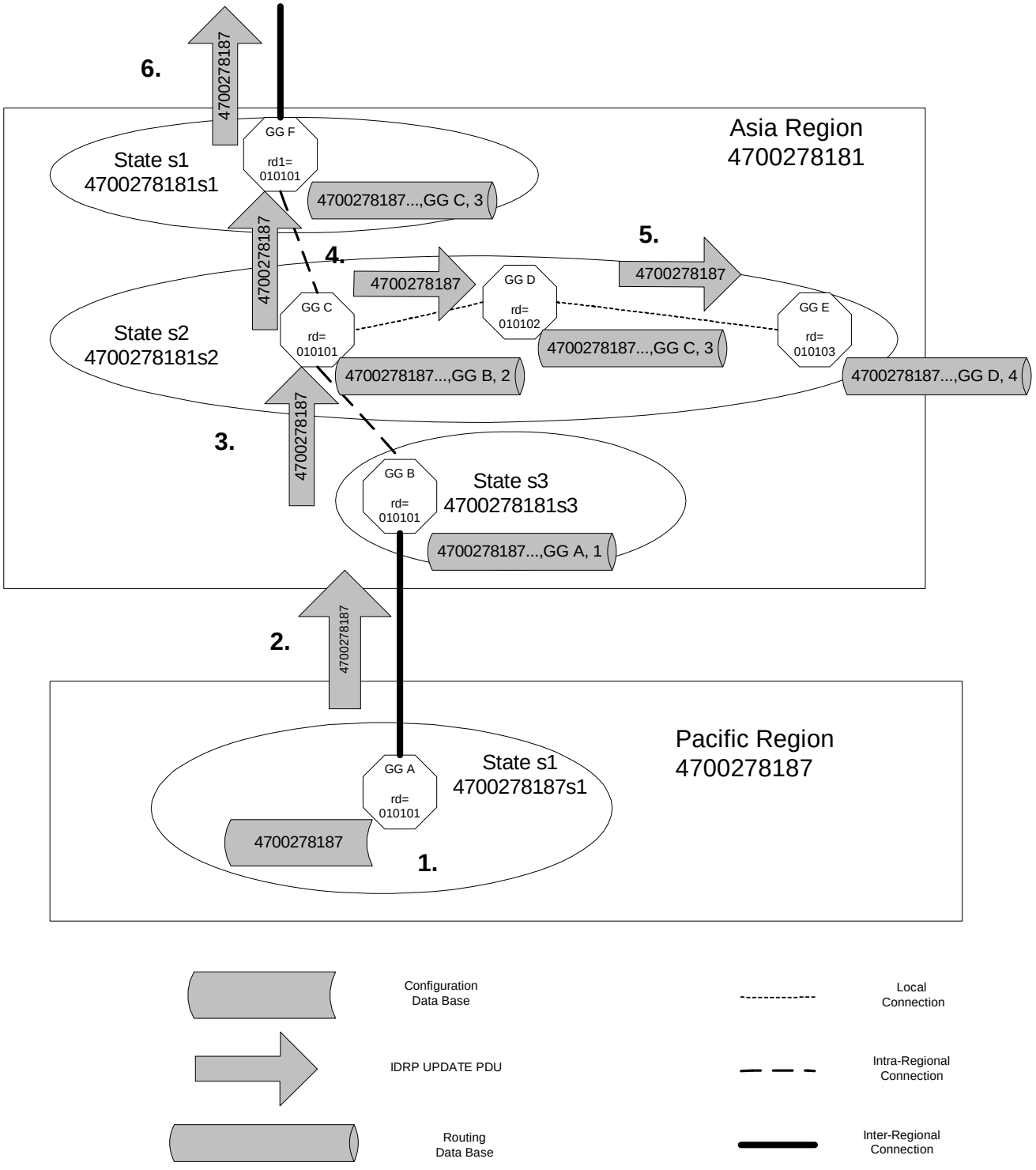

Figure A-1 Inter-Regional Route Distribution

Scenario A-2 Intra-Regional Route Distribution

Figure A-2 depicts routing policy operation for distribution of intra-regional routes for ATSC applications in the Asia Region.

STEP 1.

Ground-Ground Router B (GG B) in State S3 is a backbone router with intra-regional connectivity in the Asia Region. In accordance with 3.1.3.1.a GG B is configured with an aggregate route to ground systems for ATSC applications.

STEP 2.

In accordance with 3.1.3.3.a GG B distributes the aggregate route to adjacent Ground-Ground Router C (GG C) in State S2 of the Asia Region. In accordance with 3.1.3.2.a GG C accepts this route and installs it in its routing database.

STEP 3.

In accordance with 3.1.3.3.a GG C distributes the aggregate route to adjacent Ground-Ground Router F (GG F) in State S1 of the Asia Region. In accordance with 3.1.3.2.a GG B accepts this route and installs it in its routing database. In accordance with 3.1.3.3.b GG C distributes the aggregate route to adjacent Ground-Ground Router D (GG D) also in State S2 of the Asia Region. In accordance with 3.1.3.2.c GG D accepts this route and installs it in its routing database.

STEP 4.

In accordance with 3.1.3.3.b GG D distributes the aggregate route to adjacent Ground-Ground Router D (GG E) also in State S2 of the Asia Region. In accordance with 3.1.3.2.c GG E accepts this route and installs it in its routing database.

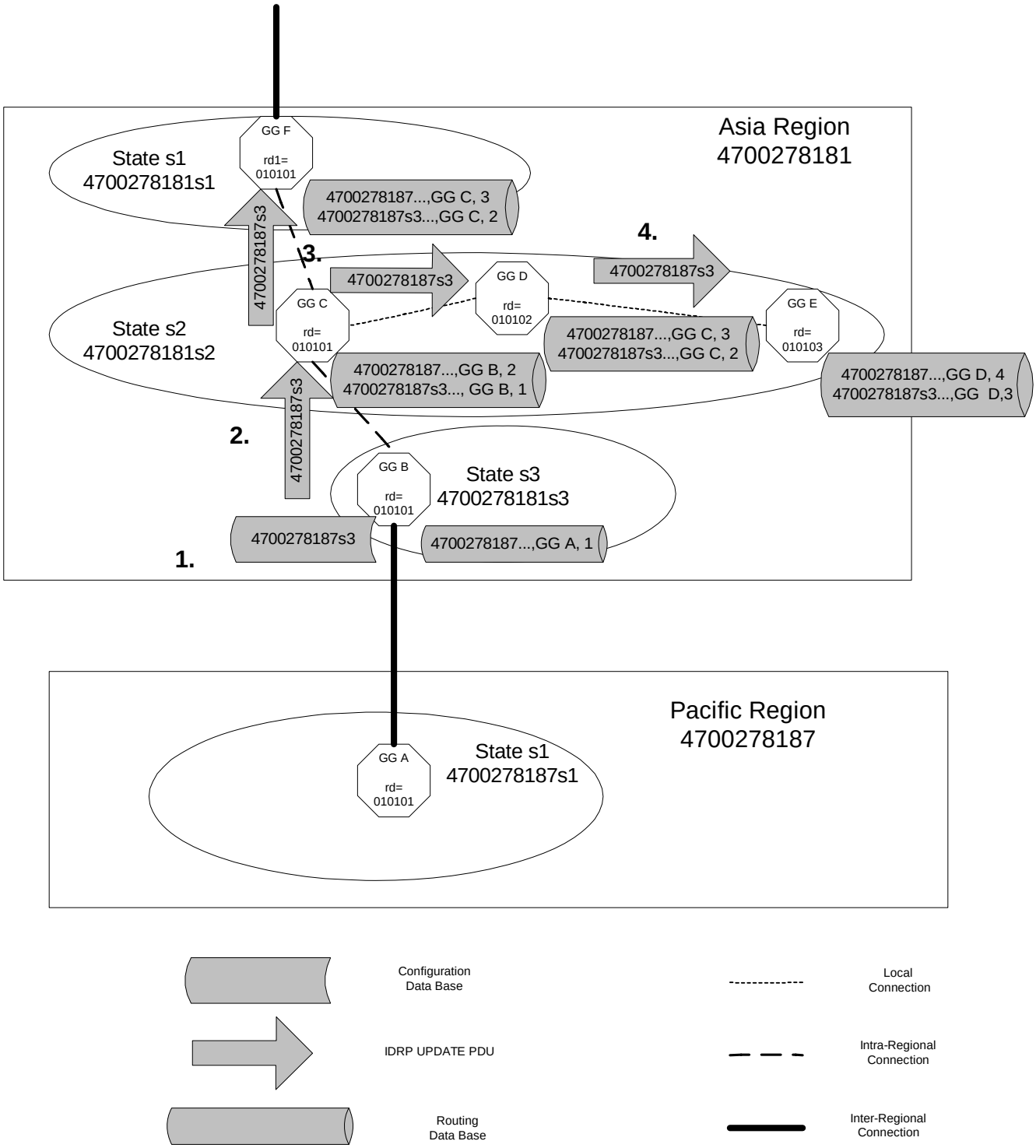

Figure A-2 Intra-Regional Route Distribution

Scenario A-3 Routing Domain Route Distribution

Figure A-3 depicts routing policy operation for distribution of routing domain routes for ATSC applications in the Asia Region.

STEP 1.

Ground-Ground Router E (GG E) in State S2 is a (non-backbone) routing domain level router with local connectivity in the Asia Region. In accordance with 3.1.4.1.a GG E is configured with an aggregate route to ground systems for ATSC applications.

STEP 2.

In accordance with 3.1.4.3.a GG E distributes the aggregate route to adjacent Ground-Ground Router D (GG D) also in State S2 of the Asia Region. In accordance with 3.1.4.2.a GG D accepts this route and installs it in its routing database.

STEP 3.

In accordance with 3.1.4.3.a GG D distributes the aggregate route to adjacent Ground-Ground Router C (GG C) also in State S2 of the Asia Region. In accordance with 3.1.4.2.a GG C accepts this route and installs it in its routing database.

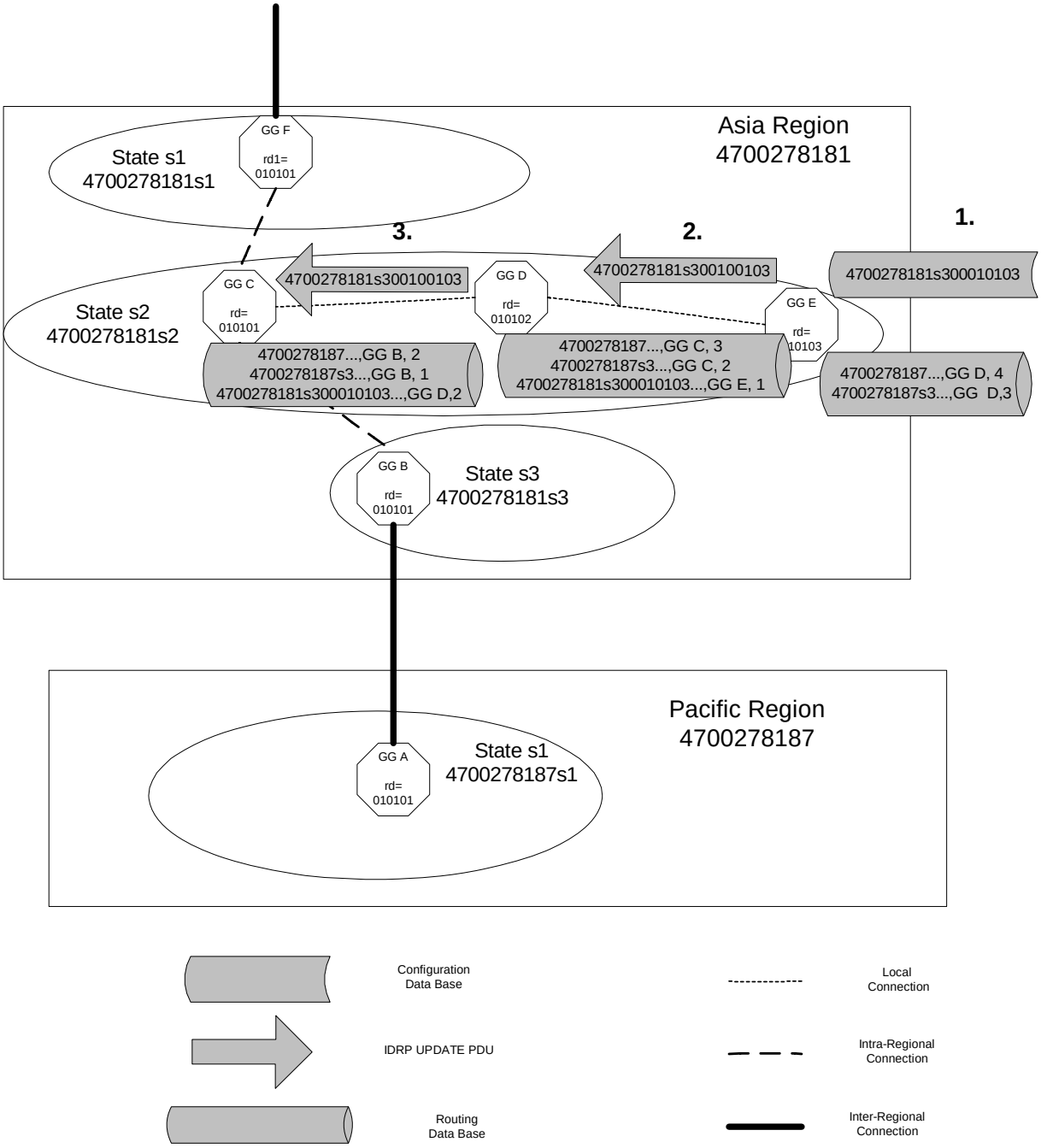

Figure A-3 Routing Domain Route Distribution

APPENDIX B

Routing with a Common Address Prefix for the Asia and Pacific Regions

B-1. Asia/Pacific ATN Routing Policy Goal

Section 2.1 of this document has specified an IDRP Routing policy with the following general routing policy goal:

- Asia and Pacific region ATN routers will provide global shortest path connectivity with a minimal exchange of routing information.

B.2. ATN Hierarchical Address Structure and Routing Prefixes

The ATN uses a hierarchical address structure to reduce the amount of routing information advertises on an inter- and intra-regional basis. The general ATN address structure is depicted in Figure B-1.

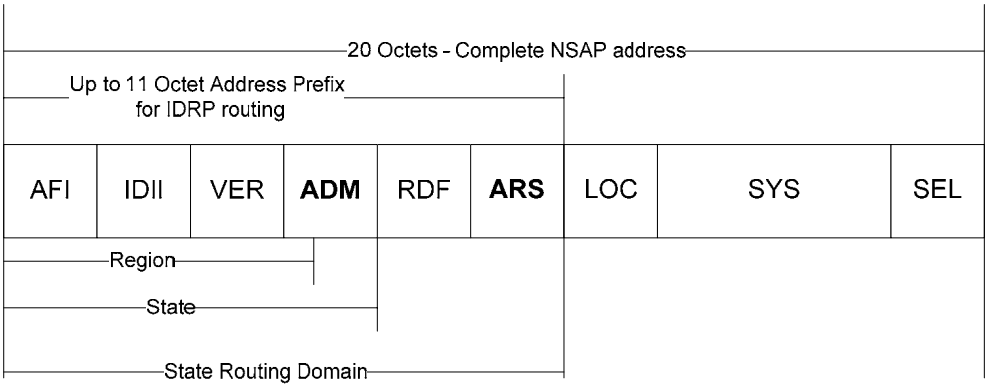

Figure B-1 – ATN NSAP Address Structure

The Asia/Pacific Region the NSAP addressing plan uses the first 5 octets of an NSAP address (up to the 1st octet of the ADM field) to designate an ICAO Region. The first 7 octets of an NSAP address (including the second two octets of the ADM field) designate a states or organizations within a Region. The first 11 octets (including the ARS field) designate individual routing domains within a state or organization.

Given the above generic address allocation the following address prefixes will be advertised in accordance with the Asia/Pacific Routing Policy.

- Routers with inter-regional connectivity will advertise a regional prefix of 5 octets on the inter-regional interface to indicate they can reach all systems in the region,
- Routers with intra-regional connectivity will advertise a prefix of 7 octets on the intra-regional interface to indicate they can reach all systems within the state or organization, and
- Routers with local connectivity will advertise a prefix of 11 octets for individual routing domains in the state or region.

B.3. Consequence of Aggregation on Inter-regional boundaries

Because systems are aggregated under a single address prefix, a router receiving multiple advertisements may not always choose the shortest path.

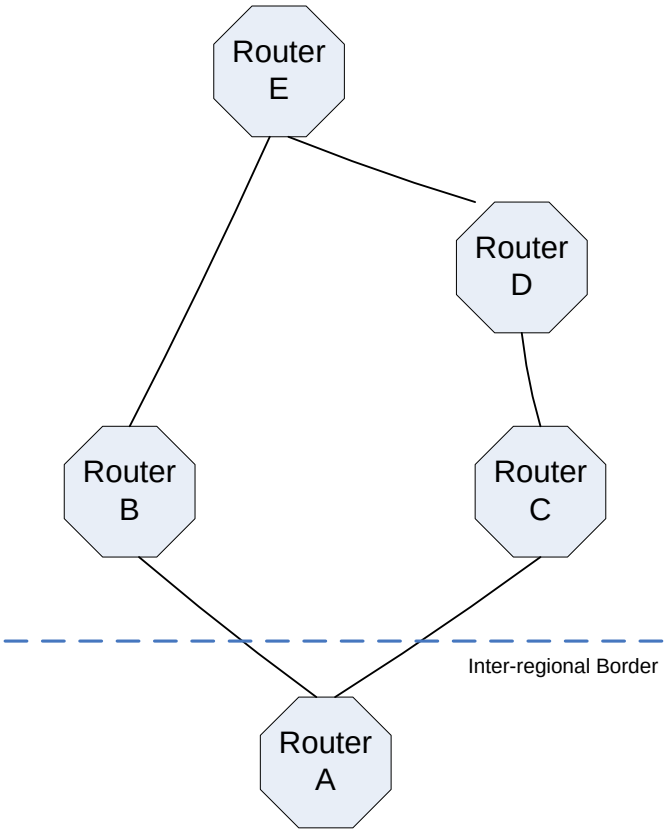

Figure B-2 – Routers with Inter-Regional Connectivity

Figure B-2 depicts Router A connected to two routers (B and C) across an inter-regional boundary. In accordance with the routing policy, routers B and C will advertise the same regional 5 octet prefix indicating that they can reach all systems in the region. In addition Routers B and C will advertise a hop count of 1 since they are one hop away from A. Given two paths of equal length to the same prefix, Router A will select the Router which happens to have the lowest address. However, in order to reach Router D via the shortest path, Router A should select the path via Router C. Similarly to reach Router E via the shortest path, Router A should select the path via Router B.

B.3. General Recommendation to eliminate inter-regional borders

In order to achieve shortest path routing, it is proposed that the inter-regional border be eliminated whenever possible such that Router A belongs to the same region as the other routers. In this case, following the policy, Router A will receive a 7 octet prefix for Routers D and E from both Router B and

Router C but the hop count will be different. Using the hop count Router A can select the shortest path.

B.4. Eliminating Inter-regional borders in the Asia/Pacific Region

Figure B-3 depicts Asia/Pacific Routing topology. The dotted lines are cases where there is inter-regional connectivity in accordance with the NSAP Addressing Plan.

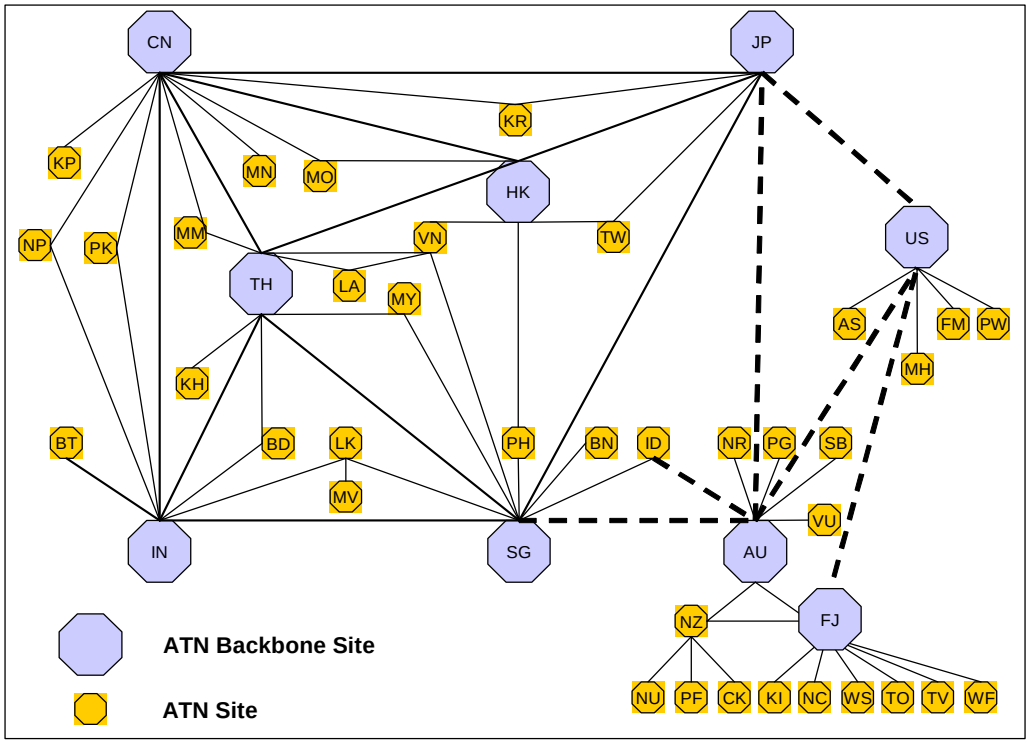

Figure B-3 – Asia, Pacific, and NAM Inter-Regional Connectivity

B.4.1 Eliminating the Asia/Pacific Border

As an example we may consider the case of Australia (AU). From the diagram it can be seen that Autralia (AU) will receive aggregate prefixes from Japan (JP) and Singapore (SG). And so for example to reach China (CN) the desired path would be via Japan (JP) but to reach India the desired path would be via Singapore (SG). This can be accomplished by combining the Asia and Pacific regions into a single "combined region". The effect will generally be that shortest path routing will be achieved across the two regions.

B.4.2 Eliminating the Asia/Pacific to NAM border

If the Asia and Pacific regions are combined but the connections to the US are still inter-regional, then the US will receive the same aggregate prefix from Japan, Australia, and Fiji Consequently, the US may not select the shortest path to routers beyond the interfacing router. In order to avoid this situation, the inter-regional border to the US may also be eliminated by making the US part of a combined Asia and Pacific region for routing purposes. The routing prefix uses the hexadecimal value of '91' in the first octet of the ADM field to signal the combined Asia/Pac region.

APPENDIX C

Non-Backbone Transit Routers

C-1. Introduction

The routing policy in this document distinguishes between backbone and non-backbone routers. See Figure C-1. In the event of a failure of a connection between two backbone routers (A and C), the next shortest path between these routers will be selected. This may result in a path through a non-backbone router being selected.

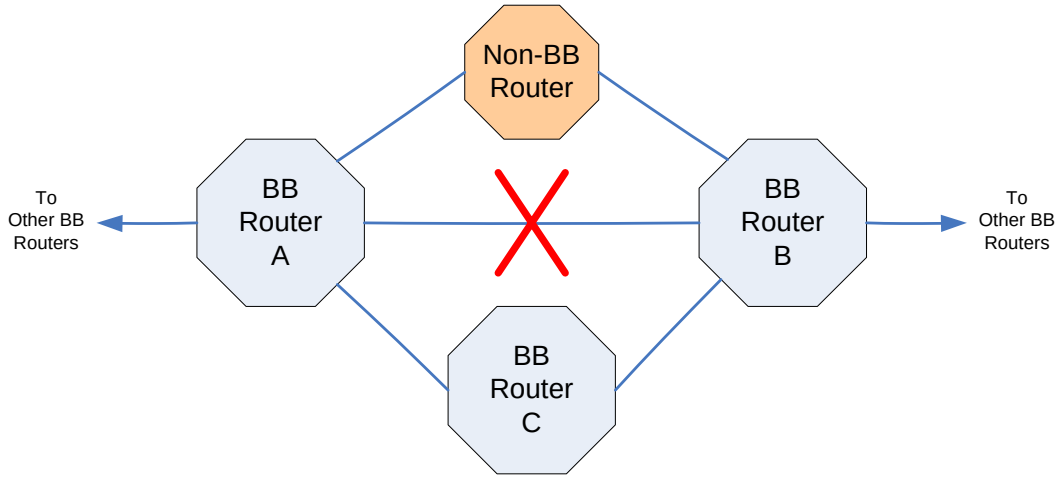

FIGURE C-1: ALTERNATE PATH VIA BACKBONE OR NON-BACKBONE ROUTER

This may occur even if there is an equal hop path through backbone routers (i.e, through router C). This can happen becaue of the way IDRP selects paths. If there is more than one path with the same lowest hop count, IDRP will compare the NET addresses of the adjacent routers on each path as integers and select the "lowest". In the Asia/Pac region this can occur in several situations. From Figure B-3 it can be seen that the following non-backbone routes could be selected.

Failed Connection	Alternate Path
Japan–Hong Kong	alternate path via Taiwan instead of Beijing
Japan–China	alternate path via Republic of Korea instead of Hong Kong
China–India	alternate path via Pakistan instead of Thailand
Thailand–India	alternate path via Bangladesh instead of Beijing or Singapore
India–Singapore	alternate path via Sri Lanka instead of Thailand

In general non-backbone transit routers are not required to to handle intra-domain traffic but they are not precluded from doing so. Recommendation 3.3.3.c specifies that "Non-Backbone routers with local connectivity may distribute intra-regional aggregate routes to ground systems for ATSC and AINSC applications to adjacent ATN routers." This recommendation has an important caveat however. Non-backbone routers that distribute intra-regional routes must provide an appropriate level of performance to support the routing policies for intra-regional connectivity. If a non-backbone router does not have the appropriate level of performance there are several alternatives which may be selected.

C-3. Alternatives

Alternative 1 – Preference for alternate routes via Backbone Routers

When the connection between two backbone routers fails and there are multiple alternate paths available as depicted in Figure C-1, preference should be given to the backbone path, i.e., via backbone router C. If a backbone path is not available and there are multiple non-backbone paths then the link with the greatest capacity (speed) should be selected. This local policy may be summarized as follows:

> *If there are multiple paths with the same lowest hop count, PDUs should be forwarded on the ATN backbone path, if available, otherwise on the link with the greatest speed.*

Alternative 2 – Operate as Transit Router only for directly connected Backbone Routers

A non-backbone transit router may accept routes for the directly connected backbone routers and for other routers in the network; however, it could have a more restrictive policy regarding which routes it will advertise. Specifically a non-backbone transit router could be configured to only distribute routes for directly connected routers. For example, the non-backbone router in Figure C-1 would distribute a route for router A to router B but not other intra-regional routes received from router A. In the other direction, the non-backbone router in Figure C-1 would distribute a route for router B to router A but not other intra-regional routes received from router B. The net result of this approach is that the non-backbone router could be an alternate path only for traffic between the adjacent backbone routers. How this is accomplished is a local matter. One possible method would be to statically configure these routes in the non-backbone router.

AMHS/ATN Network Management Operational Procedure Guidelines

SECTION 1 –GENERAL

1.0 Introduction:

The **Aeronautical Message Handling System (AMHS)** is a global telecommunications message handling service that requires support and cooperation from multiple organizations and states regionally and around the globe. Personnel from the states, industry, and various private commercial organizations have met for many years to define a structure and guidance for the service.

Because of the basic principle of equal status among all States operating Communications Centers, no provision has been made for unique or special functions, including network management to be performed at any single specific place in the network: any function which is performed at one Center would or should be performed at all Centers. The existing and former situation Aeronautical Fixed Telecommunications Network (AFTN) does not contain or even allow the presence of a non-distributed, i.e. centralized network management function. It must, however, be recognized that one of the reasons for the permanence and robustness of the AFTN is the distribution of operational responsibility. Any introduction of non-distributed functions has to consider carefully the possibility of keeping distributed operational functions for stability reasons.

The current setting of AFTN operation is based on equal distributed function with the fixed centers with dedicated circuit network to support adjacent Flight Information Regions (IFRs) flight exchange. If any disruptions of service occur, the impacted center will coordinate with its adjacent center for backup and traffic diversion.

In the AMHS environment, either using ATN over X.25 subnet or TCP/IP network, the traffic is expected to be diverted automatically. This means, some centers will receive direct traffic that they never encountered in AFTN environment.

Furthermore, the introduction of AMHS with two addressing schemes along with many different network protocols such as ATN over X.25subnet, ATN over IP Subnet, and IPv4 and IPv6 over a TCP/IP network will significantly increase the possibility of the rejection of messages.

Sustaining service is critical during operations and implementation and is required to ensure that AFTN and AMHS will co-exist operationally for a long period of transition. This will make Communication Centers a very important part of transitional and operational activities to quickly resolve any message rejection or processing of unknown delivery problems.

In most all cases the maintenance and operation of Communication Centers is a local matter. However, to maintain a high level of operational reliability and performance there are critical items, procedures, and methods that must be coordinated and shared between and among network centers. Communications Centers must assure conformance to message delivery and format standards as well as accepted telecommunications and network protocols identified for use by the AMHS in ICAO documentation.

Therefore, the introduction of centralized processes and procedures into the Communication Centers will provide for a logical centralized network operation in a decentralized physical network structure.

1.1 Purpose

The AMHS will serve to replace the existing AFTN system. This document provides guidance in the regional, global, and local operation of the AMHS systems located in and associated with Communication's Centers operating AMHS systems or user agents.

1.2 Scope:

This document covers areas deemed necessary for the efficient and effective operation of regional and global AMHS message handling systems distributing critical and necessary information used to facilitate the efficient movement of aircraft in the global environment.

1.3 Application:

Policies and processes applied by this document are published and available in ICAO regional or global documentation relating to ATN, AMHS, Standards and Recommended Practices as well as relative technical guidance.

SECTION 2 AMHS OVERVIEW

2.0 Introduction

The AMHS is a message handling system that is owned and operated by ICAO member States or their agents and provides high-speed data communication and message exchange between other AMHS locations in a global or regional network environment.

2.1 AMHS:

The AMHS is comprised of Message Transfer Agents (MTAs), Message Stores (MSs), User Agents (UAs), Access Units (AUs) and Directory User Agents (DUAs). Routers and telecommunication backbones connect AMHS communication center locations and User Agents to facilitate data exchange and transmission between users and suppliers. The AMHS employs the X.400 suite of recommendations for message handling and delivery.

2.2 AMHS Message Communication Standard

The AMHS, employed by or contracted by member states or their agents, will conform to ICAO standards for message format and message types. Any deviation from the standards must be approved by ICAO and coordinated with member States.

2.3 AMHS Data Telecommunication Standard

AMHS network center participants and providers will utilize the most efficient telecommunications circuits that comprise the backbone circuits between AMHS routing and message transfer agent locations. AMHS participants will conform to and utilize data telecommunications protocols and methods identified and approved in applicable ICAO documentation.

SECTION 3 ORGANIZATIONAL RESPONSIBILITIES

3.0 Introduction

This section provides information on the management approach that will be used for AMHS and the responsibilities of organizations that own, operate, and support AMHS systems.

3.1 AMHS Management Approach

The AMHS will employ a matrix management approach to provide technical systems and services under the guidance of network management policies.

3.2 Management Functions

AMHS network management will be comprised of 5 basic functions and modeled after the OSI network management standard. The 5 functions are:

1. Configuration Management,
2. Fault Management,
3. Performance Management,
4. Security Management,
5. User Access Management.

3.3 Organizations and Roles:

It is the basic responsibility of all AMHS providers and users to supply the following basic information to other providers and users that they normally coordinate and communicate with in the daily operation of the AMHS.

1. Points of contact and telephone numbers for:
    a. Network operations desk.
    b. Communication Center Management, first and second levels
    c. Engineering and planning
2. Maintenance and restoration activities
3. System changes and configuration changes
4. Modifications

All network activities modifications and corrective actions will be coordinated through these points of contact, beginning at the lowest and most practical level.

SECTION 4 CONFIGURATION MANAGEMENT

4.0 Introduction

It will be the responsibility of AMHS managers to provide an initial operational baseline configuration of the functional and physical configuration of their systems. This information will be shared and accessible to other AMHS participants. Changes to this baseline will be shared, tested, and, coordinated for implementation before they become operational.

The importance of strict configuration management is a paramount element of a global network such as the AMHS. Modifications can have far reaching global effects greater than those encountered today when implementation and change failures occur in the current AFTN network.

4.1 Operational Baseline

The initial operational baseline will not be modified without proper regional and global coordination. This is to assure that the addition or modifications of elements in the AMHS have passed proper conformance and implementation testing before being deployed. This activity will provide a foundation to limit and mitigate the risks associated with changes.

4.2 Configuration Control

While the procurement and operation of AMHS is mostly a local matter it is important that elements of software and hardware used in these systems conform to the standards identified by ICAO. Additionally participants cannot act unilaterally with modifications and changes to their AMHS without the assurance to other participants that their changes with not adversely impact the system locally, regionally, or globally.

Any changes will be coordinated and advertised globally and shall not be implemented until a reasonable comment period has expired. This comment period will be 30 days from the initial announcement of the proposed change. The change will be considered approved, without further comment, and be implemented within 7 days of the comment period expiration.

It is recommended that configuration control measures be initiated in all regions with global coordination between the regions managed by ICAO.

4.3 Routine Modifications and Configuration Changes

Any modifications that occur as a result of software, hardware, informational updates, and the implementation and installation of modified or new hardware, shall be fully coordinated for fault and risk mitigation.

4.3.1 Address changes

Address changes will be closely coordinated among Communication Centers to avoid the problems associated with Non Deliverable Reports (NDR.) The changes can then be applied and propagated during a predetermined and scheduled Aeronautical Information and Regulation Cycle (AIRAC) period

4.3.2. Routing, software, and hardware modifications

Routing, software, and hardware modifications not associated with restoration will only be initiated when regional and global databases have been modified, and comment and notification periods have been observed. The changes can then be applied and propagated during a predetermined and scheduled Aeronautical Information and Regulation Cycle (AIRAC) period

SECTION 5 FAULT MANAGEMENT

5.0 Introduction

System component failures and degradations in network service are usually noted first by operations personnel via alarms, reports and monitoring systems or by individual network users who notify the Communication Center. Therefore fault management functions start at the Communication Centers.

5.1 Elements of Fault Management
5.1.1. Monitoring
5.1.2. Detection
5.1.3. Notification
5.1.4. Restoration
5.1.5. Tracking

5.1 Organizational Functions for Fault management
5.1.1 Communication Center

The primary focus for fault management of the AMHS rests with the Communication Center personnel who perform the five basic elements of fault management as an integral function of their daily activities. The Communication Center maintains the latest versions of software and configurations for reloading elements in the event of a failure.

5.2.2 Engineering and second level support

These organizations assist in the resolution of system faults that require engineering expertise. These organizations will normally be alerted by the Communication Center who will provide a detailed description of the fault.

5.2.3. Telecommunications

It is the responsibility of all Communications centers to contact telecommunications vendors and providers in the event of reduced service or circuit failures.

5.2.3.1. Bi-lateral circuits

It is recommended that in the case of bi-laterally provisioned circuits between states or Communication Centers, the Center with the Eastern most geographic location be the primary point-of-contact for testing and restoration coordination activities. This does not reduce the responsibility of the associated facility to monitor and participate in fault location and restoration.

SECTION 6 SAFETY MANAGEMENT

6.0. Introduction

In order to provide continual and safe services when changes, modifications, policy amendments, and routine maintenance activities are conducted AMHS users and providers must practice Safety Management System (SMS) activities. AMHS participants practice safety management by

conducting and performing risk assessment and analysis and using the results to make decisions. The risk assessment and analysis must be predetermined, documented in a plan which must include the criteria for acceptable risk The plan must be published and approved internally and with other affected AMHS Communication Centers and users. Guidance related to Safety Management can be found in ICAO Doc.9859 Safety Management System (SMS) Manual.

6.1. Risk Management Plan

Risk assessment and analysis must be predetermined, documented in a plan which must include the criteria for acceptable risk

6.2. Hazard Identification

The hazard analyses and assessments required in the plan must identify the safety risks associated with the system or operations under evaluation, modification or maintenance.

6.3. Risk Assessment

The risk assessment of the hazards examined must be compared to the acceptability criteria specified in the plan and the results provided in a manner and method easily adapted for decision making

6.4. Risk Mitigation

The risk management decision must include the safety risk assessment and the risk assessments may be used to compare and contrast options. The implementation of the plan will facilitate the mitigation of failures and incidents incurred as a result of system modifications, replacement and improvements.

SECTION 7 PERFORMANCE MANAGEMENT

7.0 Introduction

Performance management is the function that keeps the network and services operating efficiently when unexpected patterns or failures would otherwise cause network congestion and failed or delayed message delivery. Performance management uses control processes to anticipate network delivery problems and respond to them. This involves collecting and accessing network data, and determining whether changes, repair or corrective action is necessary. Performance management is akin to a long term monitoring function as opposed to “real time” fault and operational management functions.

7.1 Performance Management Concept

The concept used by Communication Center’s is a simple 4 step approach to performance management:

1. Identify performance parameters
2. Set performance objectives
3. Access conformance
4. Take control action to insure performance objectives are obtained

7.2 Performance parameters

Basic performance parameters and application of performance parameters are identified in ASIA/PACIFIC ATN/AMHS regional transition and planning documentation in the system management sections.

SECTION 8 SECURITY MANAGEMENT

8.0 Introduction

The implementation of security policy will be applied to all network resources and users to prevent unauthorized access to AMHS and computers connected to the AMHS and the applications running on those computers.

8.1. Policy

Users and providers will adhere to published regional and global ICAO security guidelines.

SECTION 9 USER ACCESS MANAGEMENT

9.0 Introduction

User access management compliments security and network performance and is fundamental to the efficient operation of the network.

9.1 User conformance and interface testing

All new users and user modifications will be tested to assure compliance with ICAO prescribed standards, tolerances and interface control documentation. Testing performed and documented shall be in compliance with ICAO prescribed Conformance documents and Interface Control documents. No system shall be considered operational until formal operational testing has been performed in a live environment.

SECTION 10 VALIDATION TESTING

10.0 Introduction

Testing is essential to the operation of the network and provides verification that the introduction of new hardware, software or the modifications of hardware or software are accomplished with minimal impact on the operational network.

10.1 System changes, modifications and new hardware or software

All changes whether hardware or software will be thoroughly tested in off-line systems prior to implementation in the operational environment. Testing will strictly adhere to good fault mitigation practices and safety management guidelines as outline in related ICAO documentation.

10.1 . Security testing

Testing will include tests associated with security vulnerabilities and the possible introduction of weaknesses into the operational network with the introduction of new or modified hardware or software.

SECTION 11 RECOMMENDED BEST PRACTICES

11. Introduction

Best Practices consolidate the elements of network and communication center management and focus on the procedures that are most productive and effective in a real time environment. In the AMHS environment Communications Centers will be more dependent on networks they do not own or control. In order to be effective they will need to be able to look through these networks to End Users and on to other Communication Centers, and ascertain the viability of the network and user elements. This ability will enable the Communication Center to make sound and swift decisions to increase the availability times of the entire AMHS infrastructure.

11.1. Availability

First and foremost base most monitoring on availability, and second monitor performance. While availability and performance go hand-in-hand they primary real time responsibility of the communication center is to assure the delivery of messages in an efficient manner and the availability of systems and networks is the most important operational element in when serving users. Rapid identification and replacement of failed elements of the AMHS or its supporting network are the primary concern.

11.2. Early detection

Strive for early detection of problems. Use monitoring tools that identify availability issues first. Rely more on real-time measurements and assessments rather than trend analysis. Use measurements that

screen problems to determine priority and establish priorities that reflect the return to availability as the highest priority.

11.3. Performance

Measuring performance is important but not key to operational management availability in operational management is primary. However performance statistics and measurements must be made to accomplish important trend analysis and data gathering. Ensure that monitoring tools used make these measurements and gather this information during periods of relatively low network activity.

11.3 Focus

Operational management should be focused on the availability of the AMHS to the users and communication centers. Centers should respond rapidly to failures and deploy swift measures to resume system and network availability. While trend analysis is import, in the operational environment it is more important to use tools, equipment, methods, and practices that facilitate a return-to-service at the earliest possible time.

11.4 Availability Keys

a. End-User response times
b. Message Queue size
c. Transmission times (latency)
d. Non-deliverable reports.
e. Application Response times

SECTION 11 DOCUMENT REFERENCES

(1) ICAO doc9739 ATN Manual
(2) ICAO doc9896 Manual for the ATN using IPS Standards and Protocols
(3) ICAO doc9880 ATN Technical provisions
(4) ICAO doc9705 ATN Technical provisions
(5) ICAO ATN SARP Annex 10 Volume III amendment 83
(6) ICAO ASIA/PACIFIC ATN Regional Transition Documentation
(7) ITU-T, ISO, IETF X.400
(8) IETF RFC 1649
(9) IETF RFC 2126
(10) IETF RFC 1006
(11) ICAO Doc 9859 Safety Management System (SMS) Manual
(12) AMC Users Manual EuroControl, OneSky
(13) ICAO Europe AMHS Manual version 3.1
(14) ICAO Asia Pacific AMHS Regional Transition Documentation Guidelines Performance
(15) ICAO Asia Pacific AMHS Regional Transition Documentation Guidelines Management

International Civil Aviation Organization
Asia and Pacific Office

The Guidance Document for AMHS Conformance Testing (AMHS Manual)

Version 2.0 – September 2008

Scope of the Document

This document has been developed by ATN ICG in order to present a comprehensive collection of test and checklist required to ensure conformance and compatibility pertaining to the implementation of AMHS facilities in the Asia and the Pacific Region.

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Document Control Log

Edition	Date	Comments	section/pages affected
0.11	30/03/2007	Creation of the document.	all
1.0	September 2007	Document is endorsed by APANPIRG/18	all
2.0	22/09/2008	Editorial updates to the document	all 1.2, 2.1.3, 2.2.1, 3.2.8.5, 5.4.3.2, 6.1.1, 6.1.2, 6.1.6, 7.1, 8

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1 Structure of the Asia and the Pacific AMHS Conformance Manual

1.1. The Asia and the Pacific AMHS Manual consists of 2 parts. The "Main Part" and the Appendices.

The main part will introduce and provide general guidance and detailed information on requirements concerning AMHS implementation in the Asia and the Pacific Region. They consist of:

1. Structure of the Asia and the Pacific AMHS Conformance Manual
2. Introduction
3. Asia and the Pacific AMHS Requirements
4. System implementation - Guidelines for system requirements
5. Tests and validation of systems
6. Miscellaneous

For better presentation and management, detailed documents, which have been produced on particular subjects initially addressed in the main body of the Manual, have been included as Appendices to the Manual.

1.2. The following Annexes to the Asia and the Pacific AMHS Manual have been produced:

- Annex A: Guidelines on Quality of Service (QOS)
- Annex B: AMHS Conformance Tests
- Annex C: ATN Router
- Annex D: AMHS Testing Requirements
- Annex E: AMHS Inter-Operability Tests
- Annex F: AMHS Pre-Operational Tests

2 Introduction

2.1 Background Information

2.1.1 AFS

The Aeronautical Fixed Service provides, among other things, for the exchange of messages pertaining to the safety of air navigation and the regular, efficient and economical operation of air services.

The following categories of message are handled by the AFS:

- distress and urgency messages
- flight safety messages
- meteorological messages
- flight regularity messages
- aeronautical information services messages
- administrative messages
- service messages

The principal users of messages in the above categories are ATS and the AIS, ATFM, MET and SAR Services which support and complement the ATS.

2.1.2 AFTN/X.25

Initially, the operational requirements for such an information exchange were met by the development of the Aeronautical Fixed Telecommunications Network. The AFTN provides a store-and-forward messaging service for the conveyance of text messages in ITA-2 or IA-5 format, using character-oriented procedures. Although AFTN served its purpose well for many years, AFTN technology has become outdated due to the fact that is remains bound to its telex/telegraphic origins.

The X.25 network provides a common transport service for the conveyance of binary or text application messages in an expeditious and reliable manner.

In the Asia and the Pacific Region, the X.25 provides the reliable backbone data communications infrastructure for the AFTN and a general data communications service to non-AFTN applications such as OPMET.

2.1.3 AMHS

The most recent development with regard to messaging in the ATS environment is the AMHS. The AMHS is a natural evolution from AFTN/X.25, replacing the telegraphic style of working with a modern Message Handling System based on international Standards.

It is presumed that the ATSMHS, being an ATN application, utilizes the infrastructure of the ATN inter-network. However this is not a prerequisite for the initial deployment of the ATSMHS.

There are several advantages of AMHS over AFTN/X.25 including:

- increased speed, capacity and throughput
- enhanced reliability
- extended functionality
- interoperability with other global messaging services
- security capabilities
- use of COTS equipment and services

The provisions pertaining to ATSMHS, such as SARPs and general guidance material, are contained in the following ICAO documents, which constitute the main references for this Manual.

- Annex 10, Volume II, Chapter 4 [1]
- Annex 10, Volume III, Part I, Chapter 3 [1]
- Doc 9705 Sub-Volume III [2]
- Doc 9739 Part III, Chapter 6 [3]
- ICAO Asia and Pacific Regions BASIC ANP [6]
- ICAO Asia and Pacific Regions ANP (FASID) [7]

2.2 ATSMHS Overview

2.2.1 General

The ATN SARPs for the Air Traffic Services Message-Handling Service (ATSMHS) define the ICAO store and forward messaging service used to exchange ATS messages between users over the ATN internet.

The set of computing and communication resources implemented by ATS organizations to provide the ATS Message Handling Service is commonly referred to as AMHS (ATS Message Handling System). The ATS Message Handling System SARPs are compliant with mature message handling systems standards such as ISO/IEC 10021 [10] and ITU-T X.400.

2.2.2 Functional Components

In terms of functionality, the ATSMHS comprises the following components:

(a) the Message Transfer Agent (MTA) which performs the function of the Message switch,

(b) the User Agent (UA) which performs the user access to the MTA and provides an appropriate user interface,

(c) the Message Store (MS) which provides the intermediary storage between MTA and UA and is usually co-located with the MTA, and

(d) the Access Unit (AU) which provides for intercommunication with other Messaging Systems.

(e) the ATN router (Optional)

2.2.3 End systems

Three categories of ATN end systems are defined for the support of the ATS Message Handling Service:

- the ATS message server
- the ATS message user agent
- the AFTN/AMHS gateway

Together, these systems provide connectivity between users at ATN end systems and users at AFTN Stations in three different end-to-end configurations:

a) from an AFTN/X.25 Station to another AFTN Station over the ATN

b) from an AFTN/X.25 Station to an ATN End System, and vice versa

c) from an ATN End System to another ATN End System with ATN routers

2.2.4 Levels of service

Two levels of service are defined within the ATS Message Handling Service:

a) The Basic ATS Message Handling Service

b) The Extended ATS Message Handling Service

The Basic ATS Message Handling Service meets the basic requirements of the MHS Profiles published by ISO as International Standardized Profiles (ISPs), and it incorporates additional features to support the service offered by the AFTN.

Compared to the service of the AFTN, the Basic ATS Message Handling Service offers some significant improvements such as:

- practically unlimited message length
- virtually no limit on the number of addressees of a message
- provision of non-delivery reports
- indication of the subject of a message

The Extended ATS Message Handling Service provides functionality in addition to those of the Basic ATS Message Handling Service such as the introduction of directory services and security mechanisms. Furthermore, in addition to IA-5 text, the extended service allows for the transfer of binary coded data, files etc.

The Extended ATS Message Handling Service is backwards compatible with the Basic ATS Message Handling Service.

2.2.5 Inter-operability

During the transition phase from the AFTN or the X.25 network to the AMHS the inter-perability between systems is achieved by the use of the AFTN/AMHS and X.25/AMHS gateways respectively.

The SARPs for the AFTN/AMHS gateways have been defined by ICAO.

3 AMHS Requirements

3.1 Quality of Service Requirements

The purpose of this section is to define quality of service (QoS) requirements and set target performance objectives for the AMHS. The performance requirements dealt with in this section are the common understanding on what the applications will get in terms of performance and what level of performance the network has to provide. The performance parameters are therefore necessary for designing applications as well as the network itself.

It is also a very subjective matter. So the detail of this section is only included in the appendix for reference. It is not a requirement but just a guideline for those who interests.

3.2 AMHS Addressing

3.2.1 Introduction

This section aims at the production of the AMHS Addressing Plan for all the Potential AMHS users in the Asia and the Pacific Region. This Plan should define the AMHS users addressing in an intuitive way and it should be comprehensible and meaningful to the human user and independent of the use (or not) of any type of Directory service such as X.500.

The Addressing Plan should also provide the rules to extend the addressing defined to other ATSOs (or not yet identified users).

3.2.2 Requirements

The AMHS addressing scheme should meet all of the following requirements:

- The addressing scheme should be as uniform as possible across all AMHS implementations in different Regions (as it is currently the case for AFTN addresses);
- The same addressing scheme should be maintained when indirect AMHS users (i.e. AFTN users or X.25 network users) migrate to AMHS. This implies that the AMHS addressing scheme is pre-defined and published before actual operation of the newly implemented AMHS;
- The addressing scheme should be independent of any constraints that may be imposed by Management Domains (MDs) in the Global MHS (i.e. the non-AMHS services operating globally as commercial services) or by national regulations that may vary from Region to Region; and
- The addressing scheme should allow for the interchange messages with MDs in the Global MHS.

3.2.3 MHS Addressing Structure

Each MHS address consists of a set of MHS standard components referred to as address attributes.

3.2.3.1 High Level MHS Address Attributes

The high level MHS attributes identify an MHS Management Domain as specified in ISO/IEC 10021-2, Section 18.3 [9]. They are determined by the structuring of Management Domains of the MHS Region / organization to which the address belongs. Each attribute must be registered with an appropriate registration authority to ensure that all addresses remain unambiguous. They are as follows:

- **Country (C) Name:**
  This is mandatory, and the possible range of values of the attribute is drawn from the ISO 3166 register of country names. The register contains a special value 'XX', allocated for the purposes of international organizations (i.e. those that are established by international treaty) which do not 'reside' within any particular country;

- **Administrative Management Domain (ADMD) Name:**
  This is mandatory, and its value is the name of an MHS Service provider in the context of a particular country. ADMD Names must be registered by a national registration authority. ADMDs registered under the 'XX' country must obtain that registration from the Telecommunication Standardization Sector of the International Telecommunication Union (ITU-T).

- **Private Management Domain (PRMD) Name:**
  This is optional, and its value is the name of an MHS service usually operated by a private organization. PRMD names must be registered either with their respective ADMDs, or with a national register of PRMDs.

3.2.3.2 Low Level MHS Address Attributes

They are as follows:

- **Organization name:**
  The organization name is the most significant naming attribute of the O/R address. Many organizations will operate as sub-naming authorities, allocating name space below their organization name attribute. The function of the domain names, both Administrative and Private, is to provide a relaying mechanism for delivery of the message to the intended destination. Relaying to the intended destination is made easier by the combination of a unique Organization Name within a unique PRMD

- **Organizational unit name:**
  The organizational unit (OU) names are used within the context of a hierarchical addressing structure as identified by the organization name attribute, and should be used to identify meaningful subdivisions of that namespace. The X.400 O/R address allows for up to 4 specified, each up to 32 characters in length, in descending order of significance within the organizational hierarchy.

  The other *OU name* (*OU2-4*) attributes can be used to further subdivide the namespace represented by the *OU1* attribute if necessary. Subordinate OU names should only be used if all superior OU names are in use.

- **Common Name:**
  The common name attribute is the preferred way of Identifying distribution lists and computer applications, avoiding the (mis)use of the personal name attribute. The common name attribute can be up to 64 characters in length.

3.2.3.3 List of Attributes

A complete list of attributes with different information concerning on the Maximum length and type of allowed characters for each attribute type is provided in the following Table:

MNEMONIC FORM ADDRESS ATTRIBUTE	CHARACTERISTICS
Country name	2 alpha or 3 numeric
ADMD name	24 Printable String
PRMD name	24 Printable String
Organization name	64 Printable String
Organizational unit name	32 Printable String
Common name	64 Printable String

Table 1: Mnemonic O/R address attributes maximum length and types

3.2.4 AMHS Addressing Schemes

3.2.4.1 XF-Addressing Scheme

The AMHS SARPs describe a potential AMHS addressing scheme, the XF-Address (translated), composed of the following:

a) an AMHS Management Domain Identifier;

b) an organization-name attribute:

(1) as specified in ISO/IEC 10021-2, Section 18.3,

(2) taking the 4-character value “AFTN”, and

(3) encoded as a Printable String;

c) an organizational-unit-names attribute:

(1) as specified in ISO/IEC 10021-2, Section 18.3,

(2) comprising a sequence of one single element, which takes the 8-character Alphabetical value of the AF-Address (AFTN-form address) of the user; and

(3) encoded as a Printable String.

Note 1. – An XF-Address is a particular MF-Address whose attributes identifying the User within an AMHS Management Domain (i.e. those attributes other than country-name, administration-domain-name and private-domain-name) may be converted by an algorithmic method to and from an AF-Address. The algorithmic method requires the additional use of look-up tables which are limited, i.e. which include only a list of AMHS Management Domains rather than a list of individual users, to determine the full MF-address of the user.

Note 2. – An MF-Address (MHS-form address) is the address of an AMHS user.

A summary of XF-Addressing Scheme can be found in the following table:

Attribute	Attribute value	Remarks
Country-name (C)	C = "XX", as already obtained by ICAO from ITU-T	
ADMD-name (A)	A = "ICAO", as already registered by ICAO at ITU-T	
PRMD-name (P)	P = private-domain-name, taking the value of the one or two-letter ICAO Nationality Letters as specified in Document 7910.	Default value will be used to ensure that the attribute value is always defined (see [8]).
Organization name (O)	O = "AFTN", taking the 4-character value "AFTN" encoded as a Printable String	
Organizational unit-Name (OU1)	OU1 = the 8-letter AF-address (or AFTN indicator) of the considered user	

Table 2: XF-Addressing Scheme

3.2.4.2 CAAS Addressing Scheme

(a) High-level attributes

The following preferred high-level MD and address structure that meets all of the requirements outlined in paragraph 3.2.1 above:

• Country Name = 'XX';

• ADMD Name = 'ICAO';

• PRMD Name = preferred operating name assigned by each ATSO or group of ATSOs.

In this way, ICAO creates an international ADMD without addressing constraints Imposed from outside ICAO and its members.

This scheme has placed two requirements on ICAO:

- To obtain from the ITU-T the registration of the name 'ICAO' (or some other suitable acronym agreed between ICAO/ANC and ITU-T); and

- To establish and maintain a register of PRMDs established by ATSOs that operate using the 'XX' + 'ICAO' address structure, in a way similar to Doc. 7910 [4]and Doc 8585 [5].

  *Note. – This scheme does **not** require ICAO itself to operate the ADMD systems since this should be delegated to the participating ATSOs.*

This registration will enable the establishment of regional AMHS services and their later interconnection, and it will provide ATSOs with a good deal of stability within which they can develop their AMHS plans.

(b) Low-level attributes

The CAAS addressing scheme includes the following attributes:

- Organization name (O) = Region,
- Organizational unit 1 (OU1) = Location,
- Common name (CN) = User

Consequences:

- Each ATSO will define the values for the Organization-Name attribute (O) in its Management Domain. The character set to be used for this attribute will be the set of characters allowed by the ASN.1 type "Printable String".
- Organizational Unit 1 (OU1) will be the 4-character ICAO location indicator (as specified in ICAO Doc 7910 [4]) of the user.
- Common Name (CN) will either include the 8-character AFTN address for AFTN users, or the X.25 users (OPMET, AFTN Operator messages). It should be noted that this is partly redundant with the definition of OU1, however it is considered as unavoidable due to the evolutionary nature of the move from AFTN to AMHS.

3.2.5 Asia and the Pacific AMHS Addressing Plan

3.2.5.1 Asia and the Pacific AMHS Addressing Scheme

Major concepts of this AMHS Addressing Plan are shown as follows:

Attribute	Attribute value	Remarks
Country-name (C)	C = “XX”, as already obtained by ICAO from ITU-T	
ADMD-name (A)	A = “ICAO”, as already registered by ICAO at ITU-T	
PRMD-name (P)	P = a name to be defined by each ATSO and registered by ICAO. Such a name will identify a State, an Organization or an organization within a State. .	In the absence of such a name being registered by the ATSO at ICAO, a default value will be used to ensure that the attribute value is always defined. This default value is the ICAO two letter State/territory identifier, as may be found in Doc 7910.
Organization-name (O)	O = a value corresponding to local/national geographical information, e.g. a region or a geographical area within a State where the user is located.	The syntax and value are to be defined by the considered ATSO. The table associating such an organization-name to each ICAO location indicator (4 characters) needs to be registered and published by ICAO.

Organizational-unit-name (OU1)	OU1 = the ICAO location indicator (4 characters) of the considered user;
Common-name (CN)	CN = the 8-letter AF-address (or AFTN indicator) of the considered user, irrespective of whether it is a direct or indirect user.

Table 3: AMHS Addressing Plan

Example: MF AMHS Address of Singapore Com center:
/C=XX/A=ICAO/P=Singapore/O=CAASG/OU=WSSS/CN=WSSSYFYX

3.2.5.2 Distribution lists

The scheme to be used for the identification of AMHS Distribution Lists is the same as for potential AMHS users. The O and OU attributes would then represent the expansion point of the Distribution list.

3.2.6 Guidelines on PRMD Name assignment

3.2.6.1 Purpose

A PRMD-name attribute shall be formulated and assigned by each ATSO in order to uniquely identify the AMHS Management Domain of which the considered ATSO is in charge. Practically, the PRMD-name attribute identifies that part of the AMHS for which an ATSO is responsible.

3.2.6.2 Assignment rules

When assigning a value to the PRMD-name attribute the following rules should be considered:

1) It should be representative of the whole AMHS Management Domain for which the ATSO is responsible;

2) It should be as short as possible, an acronym would be sufficient;

Note. – The use of the two-letter ISO 3166 country codes (e.g. SG for Singapore, AU for Australia, US for the United States, etc.) is not advisable, as these codes are used as values of the Country-name attribute and not the PRMD-name attribute. This may confuse the operators.

3) It should be stable and not subject to changes unless there are duly justified technical and/or operational reasons;

4) It should be unique and unambiguous;

Note. – Care should be taken not to use a name or an acronym such as "civil aviation", "ATSO", "DGAC".

5) A default value has been reserved in order to ensure that this attribute value is always defined. This default value is the ICAO two letter State/territory identifier, as may be found in Doc 7910 [4].

6) It should only comprise standard characters, e.g. no accented letters or letters that are only used in specific geographical areas;

7) The use of figures is not advisable.

3.2.6.3 Registration

Once assigned by the concerned ATSO, the PRMD-name value(s) shall be registered and published by ICAO after checking its uniqueness, as described in paragraph 3.2.6.2.

Note. – ICAO being the naming authority for AMHS addresses, there is no requirement to register the PRMD-name value(s) with a national authority.

3.2.7 Guidelines on Organization Name assignment

3.2.7.1 Purpose

The purpose of the Organization-name attribute is to allow each ATSO to split, if needed, the AMHS Management Domain (MD) for which it is responsible in distinct geographical areas.

Within a given AMHS Management Domain (identified by the "C", "A" and "P" attributes) two potential AMHS network architectures are possible:

a) Centralised architecture, with one single ATS message server; and

b) Geographically distributed architecture, with several regional ATS message servers.

It is to be noted that architectural aspects and addressing aspects are not completely linked together; in effect the agreed addressing scheme does not place any constraints on the AMHS network deployment plan.

3.2.7.2 Assignment rules

Before assigning a value to the Organization-name attribute, each ATSO should follow the following 3-step process:

1) Develop the general architecture of the AMHS to be implemented;

2) Define the location and the number of sites at which ATS Message Server could be installed within a foreseeable time frame (e.g. 5, 10 or 15 years); and

3) Chose and assign a name to each one of these sites.

A specific case is the situation where a single ATS Message Server is implemented in an AMHS MD, providing services to AMHS users that are all directly attached to this server (centralized architecture). For simplification, it was suggested that a single organization name (O) value be allocated to all location indicators in the AMHS MD.

Potential criteria for the selection of sites include:

- Geographic divisions, such as: North, South, East, West, etc.;
- Administrative divisions of the concerned ATSO, such as ATS, Meteorological, etc.;
- Operational divisions centred around the ACCs (if more than one ACCs exist);
- Operational divisions centred around the main airports;
- Mapping of the AMHS architecture on the existing AFTN / architecture;
- A mixture of the above criteria; and
- Other.

Note. – Care should be taken not to define too many geographical areas within a given AMHS MD as this may lead to less efficient message routing.

When assigning a value to the Organization-name attribute, the following rules should be considered:

1. It should be as short as possible;
2. It should only comprise standard characters, i.e. no accented letters or letters only used in specific geographical areas;
3. The use of figures is not advisable.

Note. – An ATSO should define different values for the Organization-name attribute only if it plans to implement a distributed AMHS architecture in the short, medium or long term future. ATSOs not planning to implement a distributed AMHS architecture should allocate a single value for this attribute.

3.2.7.3 Registration

Once assigned by the concerned ATSO, the Organization-name values shall be registered and published by ICAO, as described in paragraph 3.2.8.3.

Note. – ICAO being the registration authority for AMHS addresses, there is no requirement to register the Organization-name value(s) with a national authority.

3.2.8 Address conversion

3.2.8.1 Addressing Plans requirements

The selected address conversion strategy must take into account the following principles:

- The selected address conversion solution shall be able to support any X.400 addressing plan making use of any address form.
- The AFTN address of an AFTN or AMHS user is unambiguous, internationally recognized and shall not be replaced by another value.

The addresses to be considered are: AFTN, XF-form, CAAS and MF (non- CAAS). It can be concluded that:

- All Asia and the Pacific AFTN/AMHS gateways shall implement the conversions AFTN<=>XF;

- All Asia and the Pacific AFTN/AMHS gateways shall implement the conversions AFTN<=>ATSOs;

- All Asia and the Pacific ATSOs gateways should implement the conversions AFTN<=>ATSOs, together with an ATSOs address space within their remit (SARPs recommendation);

- To deal with the arrival of spurious XF addresses at the Asia and the Pacific ATSOs MDs from the global AMHS, the redirection XF=> ATSOs could be supported by all ATSOs;

- If an ATSO defined an MF (non-ATSO) address space, then all gateways would have to support the conversion AFTN<=> MF (non-ATSO). This is an undesirable alternative since a global and common CAAS has been recommended by ICAO.

3.2.8.2 Address Conversion Scenarios and Criteria

The identified scenarios are the following: single conversion, AMHS transit conversion, AFTN transit conversion and multiple transit conversion.

Once the scenarios have been established, the following considerations for the address conversion have to be performed:

- The result of the address conversion performed in an AFTN/AMHS gateway shall depend only on the pre-defined pair of unambiguously associated AFTN and AMHS addresses, and not on the gateway itself, according to the form published by ICAO and defined by the delivering MD.

- It is recommended that each gateway performing address conversion should have access to the minimal necessary information to perform mappings between AFTN addresses and AMHS addresses and vice-versa. The complete mappings between AFTN addresses and their AMHS equivalents should be published (in electronic form) and made available to all gateways that support address translations.

- The conversion process shall be easy to use and manage, and efficient.

As a conclusion, a compromise solution combining the use of algorithmic tables and X.500 directory is preferred for the address conversion.

3.2.8.3 General model for address distribution and gateway address conversion

A model of address distribution and gateway address conversion is depicted in Figure 1 below. The figure represents information exchanges between ICAO and three ATSOs implementing AMHS Gateways, concerning address conversion. ATSO1 and ATSO2 implement a distributed address publishing service (APS), e.g. by means of ATN X.500 Directory Services. This allows electronic distribution. ATSO3 provides this information to ICAO for manual collation and distribution (e.g. on paper, electronic database), and does not support a directory.

The dotted arrows represent exchanges that are performed in a non-electronic way, e.g. through "paper" procedural exchanges. The full arrows represent exchanges that are performed electronically using appropriate communication protocols.

The model identifies a number of components that are necessary for address conversion:

(1) Collection and distribution of the basic addressing information that establishes equivalence between the different addresses identifying each MHS/AFTN/X.25 user; the content of this information **must** be standardized and made available to all AMHS/AFTN/X.25 Gateways;

(2) Access to, and/or import of the basic addressing information into AFTN/AMHS gateways. This depends on the particular gateway implementation;

(3) Re-structuring the basic addressing information into a format suitable for use by each gateway's internal address conversion procedures (AMI). This is again Gateway implementation specific;

(4) The internal procedures and data structures of the gateway (AMP and AMT) that make use of the re-structured addressing information. This is gateway implementation specific.

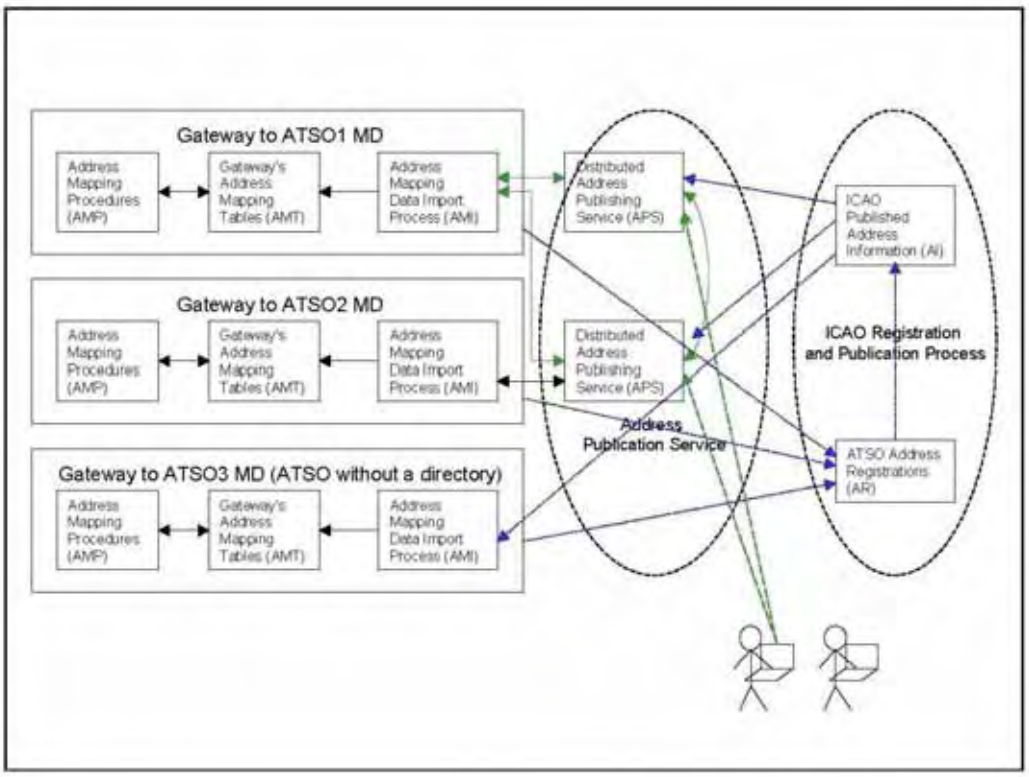

Figure 1: General model for gateway address conversion

The address mapping information content held in AMT and distributed through APS is identical in nature.

The structure of APS must be compatible with many different systems (e.g Different ATSO's Gateways), and must therefore be standardized. There are a number of possibilities for structuring APS:

- As an X.500 Directory Information Tree, thereby enabling implementation of a Distributed APS;
- By some other electronic means (e.g. CSV files);
- On paper.

3.2.8.4 The impact of different paths through the AFTN and AMHS

There is also a potential need for messages to undergo multiple address conversions. In order to minimize message rejection and to regulate the responsibilities for conversions, the following rules should apply:

- Originating MDs (for originator's addresses) shall generate addresses according to the form published by ICAO and defined by the delivering MD (for recipient addresses);
- Delivering MDs shall be authorized to reject messages received with recipient addresses which do not comply with the address form published by ICAO and defined by the delivering MD.
- Delivering MDs should have the capability of redirecting potential internal XF addresses to the corresponding MF(S) form addresses for use within their delivering MD, for a transition period of at least 6 months after publication of the appropriate ICAO documentation.
- Transit domains should not attempt to perform any AMHS <-> AMHS Mapping unless a specific bilateral agreement has been established with the delivering MD (for recipient's addresses) or the originating MD (for originator addresses). Transit MD should only use the attributes C, A, P (which are invariant and predetermined for all AMHS address forms in the ATS) in selecting a message route.

3.2.8.5 Recommended AMHS Address Conversion Strategy

The recommended AMHS address conversion strategy is the means by which the general model represented in Figure 2 should be realized by States in the Asia and the Pacific Region. It is also applicable on a worldwide basis and has been presented and adopted by the ICAO ATNP as the general AMHS address conversion strategy[1]. This strategy is made of the following elements:

a) the establishment, by an appropriate ICAO body or entity, of an ICAO Registration and Publication process as a set of procedures for collecting and publishing AMHS address conversion information on a periodic basis (e.g. twice yearly). This will include:

[1] This will result in the corresponding guidance material being included in Edition 2 of ICAO Document 9739 (Comprehensive ATN Manual).

i) the MD information included in the ICAO Registry of AMHS Management Domains, i.e. the MD identifier and the corresponding ICAO State/territory two letter identifier, together with the specification of the type of implemented addressing scheme (XF or CAAS).

ii) for those MDs having implemented the CAAS, the mapping information providing the organization-name address attribute for each ICAO location indicator;

b) A Distributed Address Publishing Service (APS), based on ATN Directory Services, that allows publication of real-time AMHS address conversion information. This is to be implemented at the earliest opportunity upon ATSOs initiative, with the following principles:

i) use of the directory scheme;

ii) initial population of the Directory Information Base with the information distributed through the ICAO Registration and Publication process;

iii) implementation of a single Directory System Agent (DSA) per ATSO to hold the MD Registry sub-tree, the world-wide ATSO information distributed through the ICAO Registration and Publication process, and the local AMHS MD address conversion information sub-tree; and

c) in co-existence with the use of Address Mapping Tables (AMT) directly derived from the information published through the ICAO Registration and Publication process, for ATSOs that choose to defer the implementation of ATN Directory Services.

As a local implementation matter, ATSOs that envisage implementation of Directory Services for the purpose of the Distributed address publication service (APS) at the same time as they implement AMHS, should also consider the use of directory solutions as a technical option for the gateway's Address Mapping Tables (AMT).

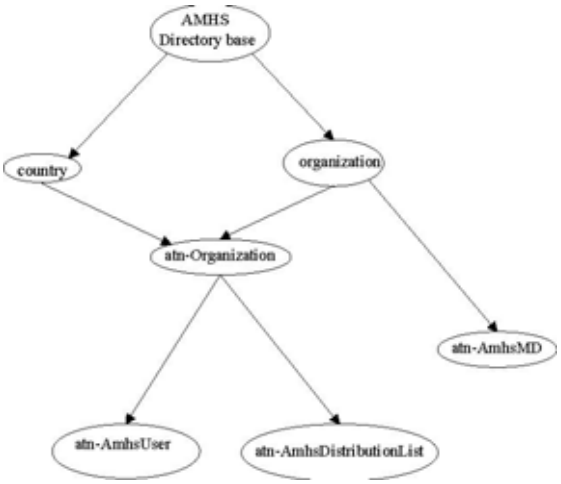

Figure 2: DIT structure for AMHS address conversion

3.2.8.6 Regional Provisions

The strategy above is complemented by the following transitional provisions which may apply regionally.

In case the first element in the above strategy is not implemented by ICAO in a timeframe compatible with early AMHS implementations, an equivalent process may be set up on an ad-hoc basis among ATSOs forming an AMHS island. This is particularly applicable to any countries ATSOs being early AMHS implementers.

In case of ATSOs implementing the second element in the above strategy that initially prefer to group together for the implementation of a single ICAO Regional DSA, the following should apply:

- the MD Registry sub-tree,
- a local AMHS MD ATSOs information sub-tree for each of the ATSOs in the group; and
- the world-wide ATSOs information distributed through the ICAO Registration and Publication process.

The Regional DSA thereby becomes an aggregation of the local DSAs envisaged in the principle strategy.

In the Asia and the Pacific Region, the creation of an Offline Management Centre is recommended to consolidate, co-ordinate and distribute AMHS user address changes across the Region. This Offline Management Centre should implement such a Regional DSA in support of its address management activities.

3.3 AMHS router topology

3.3.1 OSI Model for ATN Router

This section addresses the lower three layers of the OSI seven-layer model for the ATN Ground-Ground (G/G) routers in the Asia/Pacific regional ATN network. The three layers are Network, Data Link and Physical layer.

The ATN uses the ISO/IEC8473 Connectionless Network Protocol (CLNP) as the network protocol. Data are transferred in the CLNP Protocol Data Units (PDUs) over sub-networks such as ISO/IEC 8802 Local Area Network (LAN) and ISO/IEC 8208 (“X.25”) point-to-point connections or packet switched networks. ATN routers bridge these sub-networks together to form an integrated ATN network, relaying data packets between LAN and WAN, and WAN and WAN.

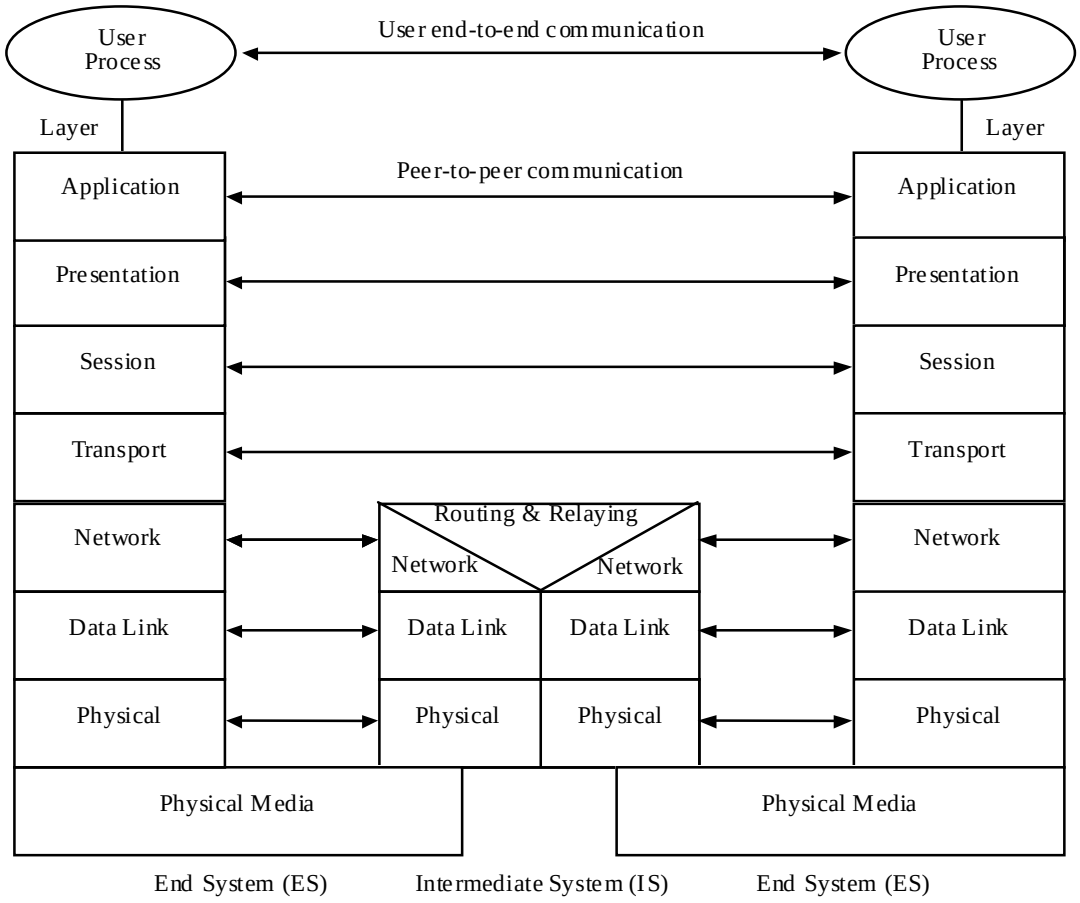

Figure 3: Open System Interconnection reference model

a. Network Layer

The network layer includes three sub-layers:

Sub-network Independent Function (SNICF)

The SNICF **shall** include the following routing and routed protocol:
1. ISO/IEC 10747 — the Inter-Domain Routing Protocol (IDRP); and
2. ISO/IEC 8473-1 — the Connectionless Network Protocol (CLNP).

The SNICF may support the following two optional routing protocols:
1. ISO/IEC 9542 — the End-System to Intermediate-System (ES-IS) protocol; and
2. ISO/IEC 10589 — the Intermediate-System to Intermediate-System (IS-IS) Intra-domain routing information exchange protocol.

Sub-network Dependent Convergence Function (SNDCF)

The proper SNDCF **shall** be implemented for underlying sub-network(s). The most commonly implemented SNDCFs are the following:

1. ISO/IEC 8473-2 — Sub-network Dependent Convergence Function (SNDCF) for Local Area Network (LAN); and
2. ISO/IEC 8473-3 — Sub-network Dependent Convergence Function (SNDCF) for X.25 network.

Sub-network Sub-layer

The sub-network sub-layer is determined by the underlying sub-network. When the data are communicated over X.25 sub-network, the sub-network **shall** include X.25 Packet Layer Protocol (PLP) as specified in ISO/IEC 8208.

b. Data Link Layer

The ATN G/G router Data Link Layer for use within States is a local matter and could be X.25, LAN, etc.

The Data Link Layer used between States is subject to bilateral agreement. To ensure regional interoperability, however, the data link layer requirements for ATN routers that connect to the Asia/Pacific ATN regional network are specified in the Asia/Pacific regional ATN router ICD.

c. Physical Layer

The ATN G/G router Physical Layer is a local or bilateral matter and could use the Physical Layer of X.25, LAN, etc.

3.3.2 Routing and Routed Protocols

Class 4 routers support dynamic routing using the following routing protocols:

1) End system to Intermediate System (ES-IS) routing protocol;

According to ICAO Doc 9705, the ES-IS routing protocol is an optional protocol for ATN G/G routers. However, if ES-IS is supported, it is recommended that to ensure interoperability with End Systems, ATN G/G routers **should** comply with the requirements of ISO/IEC 9542 (ES-IS).

2) Intermediate System to Intermediate System (IS-IS) routing protocol; and

According to ICAO Doc 9705, the IS-IS routing protocol is an optional protocol for ATN G/G routers. However, if IS-IS is supported, it is recommended that to ensure interoperability with IS routers. ATN G/G routers should comply with the requirements of ISO/IEC 10589 (IS-IS).

3) Inter-domain Routing Protocol (IDRP).

The ATN G/G router shall comply with the requirements in ISO/IEC 10747 (IDRP), section 5.8.3 of ICAO Doc 9705, and the IDRP APRLs specified in the Asia/Pacific regional Ground/Ground router ICD.

4) Connectionless Network Protocol (CLNP)

The ATN G/G router shall comply with the requirements in ISO/IEC 8374-1, sections 5.6.2 and 5.6.3 of ICAO Doc 9705, and the CLNP APRLs specified in the Asia/Pacific regional Ground/Ground router ICD.

4 AMHS Protocol Scenarios

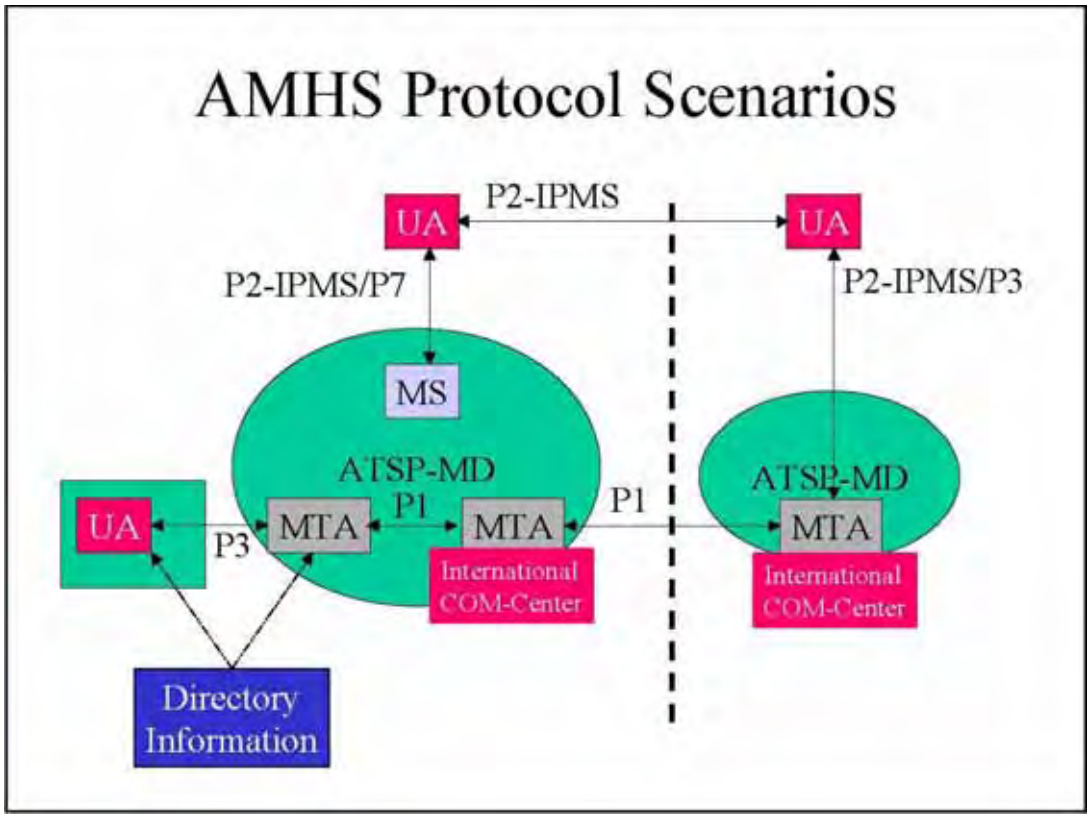

Figure 4: AMHS Systems and interconnecting Protocols

4.1 Applicable Profile

The Profile applies to the following AMHS system components:

a) UA - User Agents

b) MTA - Message Transfer Agents

c) MS - Message Stores

The Profile applies to the following AMHS protocols:

a) P1 - Message Transfer

b) P2 - IPM Content

c) P3 - Message Submission/Delivery

d) P7 - Message Retrieval

The Profile specifies a profile of ATS Message Handling Service conformance called the Asia and the Pacific-AMHS Profile. It is based on the requirements of following:

a) The Basic ATS Message Handling Service (Bas), introduced in the Doc. 9705 Ed. 3, para. 3.1.1 Note 2;

b) A number of further Functional Groups and options selected from the Extended ATS Message Handling Service (Ext), introduced in the Doc. 9705 Ed.3, para 3.1.1 Note 2;

The resulting scope is sufficient to ensure inter-State message interchange using AMHS according to the Basic AMHS requirements stated in Doc. 9705, which covers Basic Message Transfer Capabilities, Distribution Lists, appropriate message size capability and Legal Recording.

Security requirements are not a mandatory part of the Asia and the Pacific-ATSMHS Profile. However, the Profile mandates IP address validation and the protocol includes system identification following transport connection establishment. It must be pointed out that certain Messaging Application Security functions are also mandated in the MHS.

4.2 Use of the Directory

Use of Directory is not mandated in the Profile due to the following reasons:

- There are other ways to implement the distribution of the necessary directory information which are viable at least in the early phases of AMHS implementation;

- Some States will not implement the directory (nor access it) in the first Implementation of AMHS. Some of the reasons for this are that they want to implement AMHS first before taking the next step to the Directory. Also, some currently available AMHS products do not support access to the Directory;

- Some States foresee that Directory Access as specified in Doc. 9705 using X.500 DAP is too costly in terms of software purchase, and they would like to be able to use LDAP (a more cost effective RFC-based equivalent). However, there are no currently available LDAP schema standards covering some of the ATN Directory-specific requirements (and some aspects of X.400 support). There are also no suitable standard LDAP products available;

- In some cases, it is not quite clear what elements of the ATN-Directory Schema are required to support different AMHS functions (e.g. in terms of directory information). These issues need to be resolved by further guidance material on the use of the ATN/AMHS Directory by the ACP. Currently, work is ongoing to fulfill this requirement.

5 System implementation -Guidelines for system requirements

5.1 Introduction

5.1.1. This section is intended to deal with technical and operational requirements for a COM system replacing the AFTN/X.25 system by an AMHS or adding the ATSMHS capability. As indicated by its title, this section covers guidelines for requirements not specified in the AMHS SARPs, but considered by the Group important enough for being included in a Call For Tender for the procurement of an AMHS system.

5.1.2. The main input of this section was a subset of the specifications of an actual Call For Tender issued by one of the Group members, adapted and modified in order to have a 'template' able to be used by any ATSO who intends to procure an AMHS system.

5.1.3. The section covers technical and operational requirements like:

- General facilities
- Addressing - mapping table facilities
- Queue management facilities
- Message repetition facilities
- Tracing facilities
- Sizing
- Availability and reliability

5.1.4. For such a COM system in the following paragraphs the term "**AMHS System**" will be used.

5.1.5. Due to the character of this section (as guidelines for system requirements) the Term "**should**" is used. In a specific Call For Tender this term can be replaced by shall.

5.2 General requirements

5.2.1. The AMHS System should implement the ATSMHS and AFTN/AMHS Gateway facilities in accordance to the specifications defined in the latest approved ATN SARPs for Basic Services, but supporting AFTN messages with a message length up to 64 Kbytes.

Note. – This requirement is not covered by the SARPs, which mandate support of Standard AFTN message length only.

5.2.2. The AMHS System should support several simultaneous associations with an MTA partner (at least, up to 5).

5.2.3. The AMHS System should support simultaneous associations with several MTA partners (one or several associations with each MTA partner) with the same or different “transport” protocols (e.g. TCP/IP to be used within EUR, ATN between ICAO Regions).

5.2.4. The AMHS System should support the total number of simultaneous Associations (sum of all associations) without any restrictions caused by inherent limitations of the system (memory, interfaces, etc).

5.2.5. The AMHS System should allow control of establishment of associations with MTA partners via on-line operator commands; i.e., it should be able to:

- Prevent/allow the establishment of associations with a given MTA partner by AMHS System (local MTA), by MTA partner only or by both partners.
- Prevent/allow the establishment of associations with all configured MTA partners by AMHS System (local MTA), by all MTA partners only or by all partners.
- Force the termination of associations already established with a given MTA partner.
- Force the termination of associations already established with all configured MTA partners.

Note. – The number of actual simultaneous associations to be supported will depend on:

- *the target 'logical' AMHS network topology: for example each centre establishes direct associations with all the other centres or each centres establishes associations with adjacent centres only (as in AFTN);*
- *whether permanent or dynamic connections will be established. Such distinction is only applicable in case there is no requirement for continuous traffic exchange.*

5.2.6. The AMHS System should implement MTA queues. These queues will keep the AMHS messages that:

a) either are pending to be sent; or

b) have been transmitted but for which a delivery report is expected.

Note 1. – The queue referred to in " item a" should be implemented in the MTA.

Note 2. – The queue of messages for which a DR is expected should be implemented in the User Agents and MTCUs of the AFTN/AMHS gateways. The reaction of an AMHS System in case of loss of a DR should be fixed (implementation matter): E.g., would it have to resend the message after timeout? How many attempts to resend the message should be made? A DR or NDR is addressed to the originator of the message, therefore it should be left to the originator to react upon non-arrival of a DR as it is his task to react upon reception of a NDR. If the originator is an indirect (AFTN) user, the AFTN/AMHS gateway has to perform this task on his behalf. Furthermore, a report may take another route than the message it refers to, that means it does not necessarily pass through the same MTAs as the original message.

5.2.7. There should be a logical MTA queue per configured MTA partner. Management of these queues is specified in section 5.4).

5.2.8. The configuration of an MTA partner (via on-line commands) should provide flexibility for each of its parameters. For example:

a) It should be possible to configure the "transport" protocol (e.g. ATN, TCP/IP, TP0/X.25, TP4/X.25) to be used per each MTA partner.

b) In case of selection of TP4/X.25, it should be allowed to configure at least two local X.25 attachments to be used for the connections, several calling – called addresses to be used for initiating a call or acceptance of an incoming call, etc.

c) It should be possible to configure the maximum number of simultaneous associations with each MTA partner.

d) It should be possible to configure whether the associations have to be left permanently established or whether they have to be established and closed depending on traffic.

5.2.9. The AMHS System should allow configuration of all profile items if possible.

5.2.10. The AMHS System should allow configuration of the following profile items, at least:

a) Mapping between AFTN priorities and AMHS Message Transfer Envelope priorities.

b) Values of "rn" and "rnr" in the notification-requests element in the recipient fields in the IPM heading. These values should depend on the value of the AFTN priority.

Note 1. – Both functions should be implemented in the UAs and MTCUs of the AFTN/AMHS gateway since the MTA does not deal with the ATS Message Priority (or AFTN priority) which is contained in the ATS Message Header as part of the IPM body.

Note 2. – The SARPs specify the values of these profile items. It is considered that the implementation should allow the possibility to change them just by configuration in case operational experience recommended other settings. The processing is implementation matter.

5.3 Addressing – mapping tables requirements

5.3.1. The AMHS System should support the CAAS (see section 3.2)

5.3.2. The AMHS System should process and manage AMHS messages received with the O/R name in the XF Addressing Scheme also, even if the ATSO has chosen the CAAS for its internal users.

5.3.3. The AMHS System should provide mechanisms to import mapping tables needed in the AFTN/AMHS Gateway. The tables to be imported will be downloadable from the AMC system.

5.3.4. The implemented facilities in the AFTN/AMHS Gateway which map an AFTN address to an O/R name should be flexible enough to accommodate different O/R structures (Addressing Schemes) and use the minimum number of configuration / lookup tables with the minimum number of entries. As an example for the implementation of the mapping of an AFTN address to an O/R name, the following information should be entered in configuration tables:

i) Attributes and associated values that are fixed for each State. e.g. in the case of States using the address scheme described in section 3.2 the attributes and associated values to be entered should be Country, ADMD and PRMD. Each entry will be indexed by the ICAO routing area or State/territory identifying letters (1 or 2 first characters of the AFTN address).

ii) Attributes whose values can be determined directly from the AFTN address. e.g. in the case of States using the CAAS described in section 3.2, the Organization Unit 1 attribute (first to fourth characters in the AFTN address) and the Common Name (all characters in the AFTN address) should be declared here for them.

iii) Attributes whose values depend on a mapping table. For each such attribute for each State, the following should be specified: the name of the mapping table and the subset of the AFTN address (e.g. one to four first characters, the complete AFTN address, wild characters could be used to define the subset...) that gives the index to the mapping table. The mapping table itself should also be provided. e.g. in the case of countries using the CAAS address scheme described in section 3.2.4.2, the value for the Organization attribute should be defined this way.

5.3.5. The possibility to use a directory should also be contemplated, even if this is not part of the Basic Services.

5.4 Queue management requirements

5.4.1. The AMHS System should provide, in addition to a pure diversion facility of outgoing queues, a reprocessing of messages in X.400 (outgoing) queues in case of longer outages of adjacent MTAs (non-reachability).

Note. – Such reprocessing facilities will be very important during the time period when both AMHS and AFTN/X.25 centres coexist in the Asia and the Pacific Region.

5.4.2. Two types of reprocessing should be envisaged at:

a) the pure X.400 level

b) the AFTN level (in the case of AFTN/AMHS Gateways)

5.4.3. Reprocessing at the pure X.400 level

5.4.3.1. The reprocessing at pure X.400 level should allow :

a) to extract messages waiting in an X.400 queue from this queue,

b) to process these messages again by the X.400 routing software and

c) to route according to possible new or temporarily modified X.400 routing tables.

5.4.3.2. Such a mechanism would allow to extract the messages from the queue associated to a non reachable MTA. The messages could be routed through another centre (MTA) and forwarded through the alternate route only for those recipient addresses for which alternate routes have been activated. For all other recipients addresses the messages remain in the

queue. This kind of processing prevents a general forwarding of messages to other centres (MTAs) containing recipient addresses for which rerouting is not intended.

5.4.3.3. The reprocessing at the pure X.400 level should be present in the ATS Message Servers, in AFTN/AMHS Gateways.

5.4.4. Reprocessing at the AFTN level

5.4.4.1. The reprocessing at AFTN level should allow:

a) to extract messages waiting in an X.400 queue,

b) to re-process them by the AFTN layer, and

c) to route them according to the current AFTN, X.25 and X.400 routing tables respecting the updated route availability information (predefined alternate routing).

This reprocessing would solve the problem of non-reachability due to outages, in a heterogeneous AFTN/ X.25/AMHS environment.

5.4.4.2. An X.400 queue can contain messages, reports and probes. The AFTN reprocessing function should only concern the messages. These messages can be of different 'types,

e.g. i) messages from AFTN/AMHS gateways,
ii) messages from X.25-OPMET/AMHS gateways,
iii) 'pure' UA to UA exchanges, etc.

All these messages will be IPM messages, so there is no way to distinguish them at the X.400 (envelope) protocol level.

5.4.4.3. The reprocessing should be restricted to messages generated by an AFTN/AMHS gateway.

5.5 Message repetition requirements

5.5.1. The AMHS System should provide powerful message repetition facilities in the AFTN, X.25 and AMHS subsystems implementation.

5.5.2. The repetition facilities should be able to repeat messages as they were originally transmitted i.e. sent to all recipients following the same transmission paths.

5.5.3. Additionally, the repetition facilities should be able to specify (with the use of wildcards) 'detailed' or 'generic' destinations. Such destinations can be an AFTN address, an O/R name, all AFTN addresses mapped to a given Ax, all O/R names of a given PRMD, etc.

5.5.4. The AMHS System should find all the messages that were transmitted to such specified 'generic' destinations within a specified time interval and retransmit them only to pending destinations and following the current routing. To avoid a transmission to other destinations originally contained in the message the addresses not matched by the 'generic' destination should be suppressed (address stripping).

5.6 Tracing facilities requirements

5.6.1. The AMHS System should provide a facility to allow generation of X.400 probes.

5.6.2. The user interface of the facility should allow entering of the priority, the O/R name of the originator / destinations and the message length.

5.6.3. The AMHS System should send the reports regarding the probes (delivery, non-delivery) to a configurable instance (e.g. the rejection queue).

Note. – This requirement relates to a user interface requirement. The user should get some notification when the delivery report related to the probe has been received. It is an implementation matter to decide whether this is performed just by allocating a fixed originator O/R name to one of the queues of the system or by another way.

The contents of such reports should be decoded and presented in a 'human' readable and understandable format.

5.6.4. The AMHS System should provide association-tracing facilities to monitor in real time the establishment, interruption and finalization of associations related to adjacent MTAs.

5.7 Sizing requirements

The sizing of the AMHS System operational platform should support the traffic during peak hour situations with:

a) Average peak hour total CPU usage at 30% maximum.

b) Communication adapters loaded at a maximum 30% of their real bandwidth capacity (not the theoretical one) and excluding the redundancy needs.

Note. – The previous values have to be reconsidered by each ATSO depending on the expected lifetime of the AMHS System. As e.g., if the lifetime is expected to be 10 years and the traffic estimates for the peak hour relate to the end of the lifetime, the usage requirements for the CPU and the communication adapters should be greater than 30% (if not, the purchased system will be oversized during quite a number of years)

c) Processing time of a message (High QoS flow type class, see section 3.1) at least less than 1.5 seconds. The processing time is defined as the difference between the moment the latest character of the message enters into the AMHS System and the moment the first character of the message is sent out. This applies for all implemented in / out protocol combinations. For messages of other flow types, the processing time should be less than 3 seconds.

Note. – This value, especially for AMHS, has significant implications in the platform sizing and total network transit time. If the value is too low, a very powerful platform is required; If the value is too high, it could introduce a significant delay in the overall message transmission (specially if the other centres also have high values).

d) Response time to configuration / management on-line commands less than 3 seconds. This response time is related to request from a management position for actions which do not require a query / browsing of a log (e.g. close a PVC, create an Ax, etc).

e) At least sufficient disk space remaining available after:

1. all the standard and specific developed software versions (including the possibility of more than one software versions and two configurations per version) are present on disk,

2. all logs and archive folders corresponding to the number of days to be kept on-line in the system are present on disk.

Note.1 – The precise number of days will depend on the particular policy of each ATSO to comply with the ICAO Legal Requirements

If its policy indicates that all the data has to be kept on the AMHS System, the system should support at least 30 days. If the policy indicates that the data are saved for such purpose somewhere else (e.g. in another system, in an external media like CD-ROM, DAT, cartridge, etc), data concerning fewer days needs to be kept on-line (e.g. three days, one week, etc.).

Note.2 – As for the CPU and communication adapter usage, the value for disk Space shall be reconsidered by each ATSO depending on the expected lifetime of the AMHS System and the traffic estimates related to.

5.8 Availability and reliability requirements

5.8.1. The AMHS System should operate 24 hours per day and 365 days per year.

Note. – The values provided below should be considered as 'minimum' requirements. Each ATSO should reconsider them according to its own policy and internal SLAs with its internal users.

5.8.2. Interruptions for system maintenance and installation should be limited to the Strict minimum and should be less than 60 minutes.

5.8.3. After power is switched on, the AMHS System should be fully operational after a maximum of 15 minutes.

5.8.4. The AMHS System should auto monitor:

- the state of its application processes.
- the state of its system processes.
- the state of its system components (hardware).

5.8.5. The AMHS System should generate an SNMP MIB of the states monitored (see above).

5.8.6. The AMHS System should automatically try to recover from failure conditions in its application processes. If it is not possible to recover without impacting the service, the AMHS System should terminate all its application processes in an orderly manner and restart them afterwards automatically.

5.8.7. The AMHS System should allow an operator to:

a) Stop the AMHS application gracefully (with automatic restart).

b) Stop the AMHS application gracefully (with no automatic restart).

c) Force the AMHS application to stop (with no automatic restart).

d) Start the AMHS application with message recovery (messages that were in queue when the system was stopped are processed and forwarded).

e) Start the AMHS application without message recovery (messages that were in queue when the system was stopped are discarded).

5.8.8. The AMHS System should lose no message that has been acknowledged by it (according to the respective messaging protocol), unless an operator explicitly requests to drop the messages.

5.8.9. The AMHS System should lose no message because of its load.

5.8.10. In case of a switchover (cluster, master/standby) configuration, the following requirements apply:

a) After detection of failure of the primary system unit or after an operator command, the switchover process should last less than five minutes. The duration of the switchover is counted as the time from the failure detection (or operator command) until the time the AMHS restarts forwarding messages again (assuming there are messages in queue or there are new incoming messages).

b) The time needed for the standby unit to detect failure of the primary one should be less than three minutes.

c) The switchover process should be completely automatically without requiring any plugging / unplugging of any type of cables (communications, disks ...). A matrix switch action (if a matrix switch is proposed) is not considered as a cable plug / unplug.

5.8.11. Any period of time longer than one minute, during which the AMHS System does not perform message switching (in a total or partial manner) due to software or hardware problems, should be considered as an interruption of service.

5.8.12. An interruption of service of a AMHS System should be less than 10 minutes when the recovery is automatic. The duration of an interruption is calculated as the time from the moment the last received message was forwarded until the moment the AMHS System starts forwarding messages again (assuming there are messages in queue or there are new incoming messages).

5.8.13. There should be no more than one interruption of service without automatic recovery in a sliding window of six months.

5.8.14. There should be no more than one interruption of service with automatic recovery per day.

5.8.15. There should be no more than two interruptions of service with automatic recovery per month.

5.8.16. There should be no more than three interruptions of service with automatic recovery in a sliding window of three months.

5.8.17. The MTBF of the AMHS System hardware should be higher than 52 weeks.

6 Requirements for statistics

6.1.1 The AMHS System should monitor and produce statistics per direct MTA partner as follows, where the term "data messages" includes all X.400 P1 information objects, i.e. messages, probes and reports:

a) Number of data messages transmitted
b) Average size of the data messages transmitted
c) Maximum size of the data messages transmitted
d) Average number of destination addresses per message transmitted
e) Number of data messages received
f) Average size of the data messages received
g) Maximum size of the data messages received
h) Average transfer time
i) Number of delivery reports transmitted (a subset of item a)
j) Number of non-delivery reports transmitted (a subset of item a)
k) Number of delivery reports received (a subset of item e)
l) Number of non-delivery reports received (a subset of item e)
m) Minimum size of data messages received
n) Minimum size of data messages transmitted
o) Maximum, mean and minimum response time
p) Number of recipients processed
q) Number of messages deferred (the criterion for a deferred message should be specified by a configurable system parameter)
r) Number of messages redirected
s) Number of messages rejected
t) Number of loops detected

6.1.2 The AMHS System and its management tools should be enable to monitor and produce statistics per direct MTA partner, related to traffic volume and quality of service at an overall system level, as follows:

a) Overall traffic volume

b) Maximum outage duration of association between MTAs (if any)

c) Cumulated outage duration of association between MTAs (if any)

6.1.3 Additionally the AMHS System should produce the information specified in 6.1.1 and 6.1.2 for all partner MTAs as a total.

6.1.4 The AMHS System should be able to generate the above statistics in at least the following intervals: 1 day interval, 1 hour interval, 30 minutes interval or better.

6.1.5 The AMHS System should be flexible in configuring other intervals for application statistics generation.

6.1.6 The AMHS System should be flexible in generating statistics at a more detailed level, as e.g., MTA route entries, particular O/R attributes, individual O/R names (to be discussed).

Note. – Each ATSO may consider what requirements on statistics are put on the AMHS System in accordance with its requirements (national and international) and its policy for statistics production. e.g., there can be ATSOs which transfer the traffic logs to another system which will produce all required statistics; in such a case, the AMHS System may be

relieved of too many statistics requirements. If an ATSO does not have such other system, the AMHS System should produce all statistics needed

The AMHS System should be able to export specific statistic files on a monthly basis. Such a statistic file should contain daily as well as peak hour statistical data in a standard format, covering certain items in 6.1.1 and 6.1.2, because of their specific international relevance.

7 Tests and validation of AMHS systems

7.1 Objective

Experience has shown that, although it is claimed that systems have been implemented according to the one set of protocol specifications, they are often not capable of inter-working. This is due to errors in implementation or to different interpretations of the specifications (SARPs). Testing and validation of systems according to the same set of principles, aims at the detection of such errors and the prevention of incompatibility instances.

The primary objective of this chapter is to formulate recommendations for testing the ability of a given AMHS implementation to function as required at the level of an International Communication Centre within the AFTN/ X.25/AMHS network environment.

This chapter provides general information on the AMHS testing concept. The actual testing methodologies, configurations and procedures are defined in Annex B, Annex C, Annex D, Annex E and Annex F. In these Annexes, tests are described in sufficient detail to give an appreciation of the variety of functions that are covered, the facilities required and the expected results.

7.2 General Principles

The creation of standards for testing is subject to consideration by a number of standardization bodies concerned with open systems (e.g. ISO, ITU-T).

In these standards, *conformance testing* is prescribed for testing a protocol implementation (IUT) with respect to its specification.

If conformance testing could be done in a complete and correct manner, then two different implementations that passed the conformance test would be interoperable. In practice, conformance testing does not necessarily reach the intended point of completeness and correctness. Consequently, conformance testing may be followed by *interoperability testing* to determine whether two or more implementations will produce the expected behaviour under actual operating conditions.

In a more detailed analysis of the objectives of conformance and interoperability testing the following distinctions can be made:

a) The primary objective of interoperability testing is to confirm the end-to-end interoperability of two systems, which have both been developed to a common specification. Performance and load testing are possible, at least in principle.

b) Conformance testing can be defined as the exhaustive testing of an IUT against the functions and procedures defined in an agreed standard. Performance and load testing are not usually part of conformance testing which is restricted to the “logic” of the protocol implementation.

Furthermore, two essential practical differences between conformance and interoperability testing should be pointed out:

a) Incorrect protocol behavior. – Conformance testing allows "provoking" of the IUT, through incorrect protocol behavior, in order to study its stability.

b) Interoperability testing provides only limited possibilities due to (normally) correct protocol implementations in real systems.

c) Distribution of test locations. – Conformance testing can be performed locally between IUT and a conformance testing equipment. Interoperability testing is normally distributed over at least two remote locations, therefore requiring more coordination effort.

Figure 5, below depicts the principal differences in test arrangements for interoperability and conformance testing.

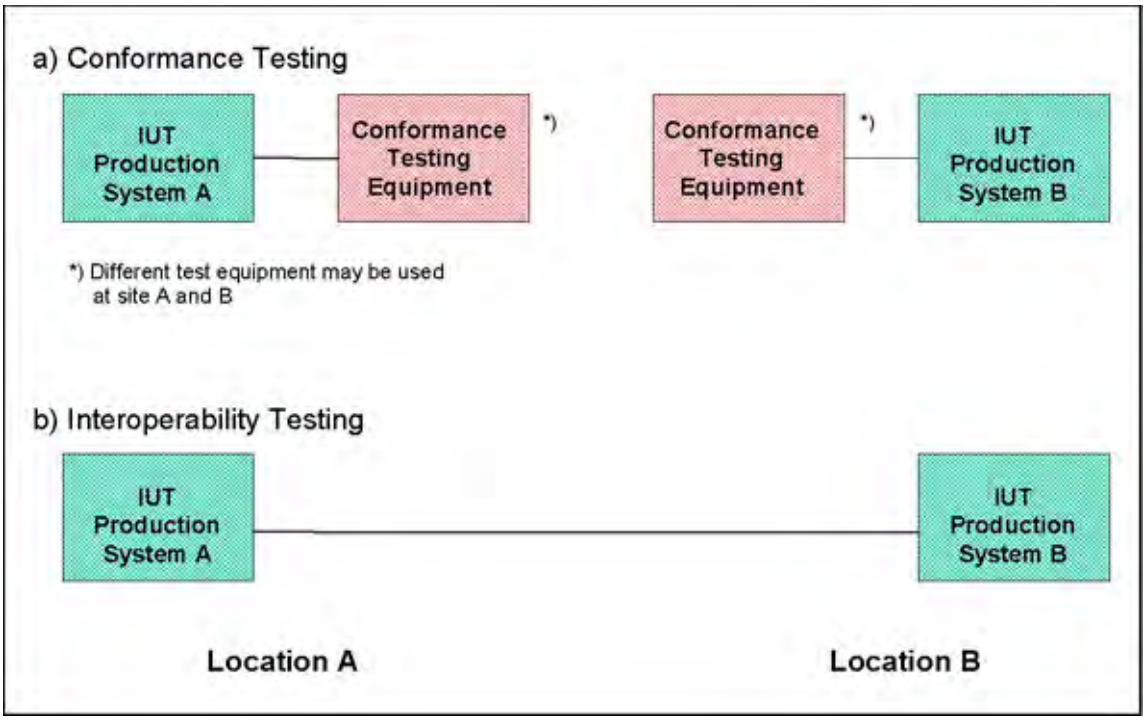

Figure 5: Principal test arrangements for conformance and interoperability testing

7.3 AMHS testing concept

7.3.1 Testing strategy

AMHS system implementations consist of protocol layers according to the principles of the Reference Model for Open Systems Interconnection. The AMHS functions to be tested reside in the application layer of the ISO/OSI reference model. The underlying layers provide supporting communication services, however they are not primarily subject to testing.

Figure 6 provides a generic functional presentation of an AMHS implementation under test.

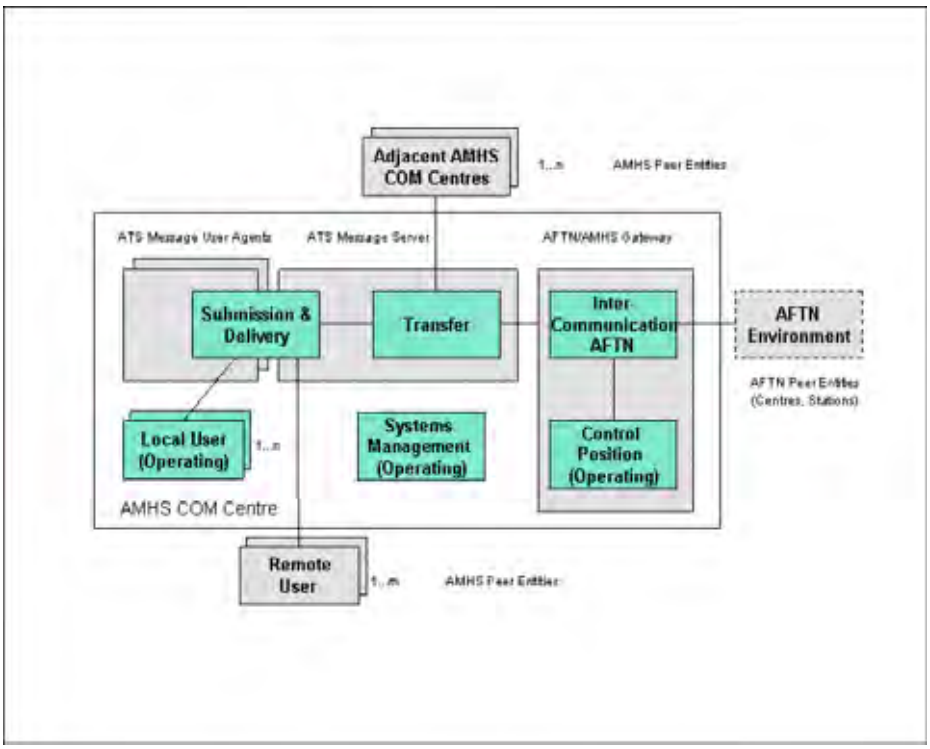

Figure 6: Functional view of an AMHS IUT

7.3.2 AMHS testing phases

7.3.2.1 AMHS Conformance testing

For the purposes of AMHS, *conformance testing* is considered mandatory and shall be performed in parallel with or after the acceptance testing of a new system.

The new system is tested as a *black box*, meaning that that required features are verified by observation of the external *behavior* of the IUT upon stimulation with well defined input events.

A *conformance testing equipment*, called the *AMHS test tool*, is used typically for the production of such input events and the monitoring of the resulting outputs from the IUT. In case such an AMHS test tool or reference implementation is *not* available, a test environment could be configured by using functional components of the IUT itself. Testing in such an environment may be seen as consistency testing rather than conformance testing.

The main AMHS functional areas covered by conformance testing are:

- Transfer of messages probes and reports
- Submission of messages and probes / delivery of messages and reports
- Intercommunication with AFTN
- Naming and addressing
- Parameters
- System management functions.

7.3.2.2 AMHS Interoperability testing

After successful completion of conformance testing, *interoperability testing* is recommended, particularly between AMHS implementations of different manufacturers.

As a first step to interoperability testing the interconnection between pairs of systems should be established and checked.

Then, at the bilateral level, the following functional areas should be covered:

- Submission, Transfer and Delivery Operations (AMHS to AMHS)
- Gateway operations (AFTN to AMHS)
- Gateway operations (AMHS to AFTN)
- Gateway operations (AFTN to AMHS to AFTN)
- Gateway operations – special case scenarios
- Stress traffic situations
- Submission/Transfer/Delivery and Relay operations
- Test of special situations

At the multilateral level, interoperability testing involves more than two organizations, interchanging normal and exception messages and generating specific reactions of their systems.

7.3.2.3 AMHS Pre-operational testing

Before going into operation, pre-operational testing should be carried out between the AMHS systems concerned, within the operational network environment and using duplicated operational traffic.

The configuration details and the actual sub-sets of traffic to be used, have to be co-ordinated between the test partners. In any case, the operational traffic selected for this purpose should be traffic under the responsibility of the Communication Centres under test.

The AMHS relation between the two systems is considered operational, if the exchange of the total of operational traffic between them (or a subset of that), is performed by means of AMHS only. For this operational traffic no other transmission means (AFTN or X.25) is used.

8 References

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ANNEX A

Guidelines to QOS (Quality of Service)

ANNEX A

of

AMHS Manual

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1 Scope

The purpose of this section is to define quality of service (QoS) requirements and set target performance objectives for the ASIAPAC AMHS. To this end, the properties of the AMHS are considered from the outside of the network, i.e. at its boundary, without taking into account the way in which the service, as defined on its boundary, is provided from within the network.

The performance requirements dealt with in this section are the common understanding on what the applications will get in terms of performance and what level of performance the network has to provide. The performance parameters are therefore necessary for designing applications as well as the network itself.

Numerical values for performance parameters are defined using the following input:

- anticipated location of message servers and gateways;
- analysis of existing and projected message flows in the ASIAPAC area based on presently available information;
- general design principles;
- user expertise.

As in most cases, in order to arrive at concrete values for the performance parameters, a number of assumptions and restrictions are made:

- QoS is not dependent on traffic volumes;
- QoS is measured between originator-recipient pairs;
- QoS is not geographically dependent;
- QoS is not dependent on time;
- QoS represents worst case performance;
- the underlying network should be sized to accommodate QoS;
- degree of corruption is not relevant to the Corruption QoS parameter;
- corruption is not dependent on message size;
- non reachability due to network causes is typically of the order of a few minutes (60per year);
- the bit error rate of an HDLC link is of the order 10^{-11}.

In dimensioning the AMHS only complete messages should be considered for the Following reasons:

- the message is the basic unit of data at the user interface;
- whole messages are stored and forwarded by MTAs in the network;

- in formulating performance requirements, transport or sub-network performance is not taken into account.

Of course, in dimensioning the network, it will be necessary to consider performance aspects of lower level infrastructure as well, but as a result of the user requirements formulated in this document and their impact on MTA performance.

Further, it is important to note that the specification of performance requirements is based on individual messages, independently of all other messages.

When considering message size, only the volume of user information is relevant since the user has no control (or only very limited control) over the data overhead involved in message handling.

Formulating performance requirements of a given user, taking into account the simultaneous use of the network by other users, does not appear to be feasible. However, it has to be recognised that, in a real world situation, the performance of the network for a given message certainly does depend on the presence of other messages currently being processed. The performance requirements specified here represent minimum or worst-case performance under the load conditions (Traffic Volume Requirements).

Types of performance parameters

There are two distinct groups of performance parameters to be considered in connection with the AMHS. Parameters not dependent on message volumes: These parameters describe the quality of service (QoS), which is available to each individual message considered by itself, e.g. transit time. They can be measured, i.e. they are the quantitative results of the way in which messages are handled by the network.

Message volumes: These parameters describe the volumes of messages, message sizes and their distribution geographically, as they could be generated by users of the network. The parameters could be measured in the user end systems but it is not realistic to measure them in the network.

QoS per individual message

QoS requirements have to be satisfied under worst possible/allowable traffic volumes and most unfavourable originator/recipient pairs within a specific network configuration. Consequently, QoS is formulated for each individual message, independently of other messages being handled by the network.

This choice has been made for the following reasons:

- it is difficult to imagine that users would accept a QoS which is dependent on the demands which other users place on the network at the same time;

- the network has to be dimensioned to handle the maximum message volumes, while performing sufficiently well;

- the QoS requirements represent "worst case" performance when maximum degradation through interaction with other traffic occurs.

It must be pointed out, that AMHS provides the facilities to send messages many orders of magnitude greater than AFTN, with attachments measured in Mb. Clearly transfer times for such messages will be considerably longer than for the short text messages exchanged in AFTN. It is, thus, necessary to qualify the statement that QoS is independent of message size by adding 'for messages containing similar information to that carried over the AFTN'. If a quantitative limit is required, this will be between 4Kb and 6Kb, being the equivalent size of an AFTN message including the AMHS header.

Independence of QoS on location and time

QoS for an originator/recipient pair is most likely dependent on the relative locations of the two end systems, i.e. whether messages are transmitted with more or less hops through MHS systems (MTAs etc.). However, for simplicity reasons and since QoS requirements are "worst case" requirements, they are stated independently of the location of a message server.

Furthermore, QoS requirements remain constant at all times and are not dependent on date and time of day.

The AMHS performance requirements for the AFTN/AMHS Gateways, could, by agreement, be deemed to apply to interfaces between AMHS functions and AFTN functions in Gateways, e.g. a boundary point consisting of an interface between an internal Message Store and an AFTN handler within a Gateway.

Dependence of QoS on the AMHS service used

It may be necessary to specify different QoS levels for the AMHS corresponding to different sets of services used, i.e. there may be different classes of messages with respect to QoS. The number of QoS levels should be kept small for simplicity and the way in which service parameters map a message to a QoS level must be simple.

The values of QoS provided by the AMHS are useful to the application designer in deciding which services to use and how they are used. For example, the degree of certainty that a message will reach its destination will determine whether AMHS acknowledgement services are used and in what way. Furthermore, the values of QoS are useful in designing higher-level protocols.

2 Specification of performance requirements

The specification and meaningful application of performance requirements is not a simple task. This sub-section outlines some of the difficulties involved and principles to be adopted.

Statistical significance

The way in which performance parameters are formulated is necessarily statistical in nature. This is due to the large number of factors, which affect the performance of the network, such as:

- the current network configuration;
- the current overall load of the network, i.e. the behaviour of all users considered as a whole; and
- the dynamic properties of network nodes and transmission systems.

The need for measurement

For the specification and application of performance requirements to be meaningful, there has to be a framework for measuring performance with respect to the performance parameters. Aspects of a measurement framework which have to be considered are:

- because of the non-deterministic nature of network performance, measurements need to involve large samples of messages, as described in the previous section;
- measurements must be made at different locations simultaneously;
- consistent decisions have to be made as to where measurements are performed, e.g. at service interfaces in MTAs, UAs etc.

Network aspects relevant to performance

The following list contains factors which can affect message handling performance:

- processing speed, limits the capacity due to the store and forward nature of message handling;
- the finite transmission capacity (line speed) of links between nodes, limits the network throughput;
- the transmission times across links, affects the message transit time since complete messages are stored and forwarded a number of times between originator and recipient;
- the efficiency of message queues;
- transmission line failures and errors are obvious sources of degraded performance;
- table configuration errors can have major negative effects on network performance;
- software failures, which are difficult to treat quantitatively.

In designing the network, the performance requirements (amongst other things) have to be translated into properties of individual network components such that overall requirements are satisfied. Of course other considerations such as policy, expandability, ease of maintenance etc. enter into the network design as well.

AMHS Quality of Service Requirements

For reasons of completeness, simplicity and relevance, a minimal set of parameters was selected out of the large range of possibilities for expressing performance properties, to form a suitable "frame of reference" for discussing the dynamic properties of the AISAPAC AMHS:

These parameters defined and described in the following sub-sections in more detail, are:

- Destination Non-Reachability;
- Maximum Transit Time;
- Message Corruption**.**

The selection of these three parameters has been made for the sake of:

- Completeness: all relevant performance aspects of AMHS are covered;
- Simplicity: the formulation of requirements is intentionally kept simple; and
- Relevance: no aspects are included which are not considered to be relevant.

If the performance of the AMHS is such that these parameters are exceeded, then the service is deemed to be of poor quality.

Destination Non-Reachability

Destination Non-Reachability is expressed with respect to pairs of addresses (originator / recipient). It is the probability that a message sent by the originator will not reach the recipient within the Maximum Transit Delay (as defined below).

The above definition shows that the parameters Destination Non-Reachability and maximum Transit Time (see below) are not independent of each other: their definitions are coupled. This is intentional. The philosophy behind this definition is that the value of a message to a person or an application receiving it is dependent on its timely receipt. It is assumed, for a given flow type, that all messages belonging to it have the same value of this parameter.

The definition of Destination Non-Reachability is independent of whether the long (or infinite) transit time for a message is reported to its originator or not. It is also independent of whether acknowledgement procedures within the AMHS or on an application level detect the long (or infinite) transit time or not.

Destination Non-Reachability includes the cases in which messages are “lost”, i.e. do not reach their destination in finite time. The probability of message loss must be negligible and this probability is included in the total probability of Destination Non-Reachability. However, there remains a need (for procurement purposes) to place a separate figure on this probability.

In keeping with the above rationale, it is required that the probability of message loss is, at most, one tenth of the probability of Destination Non-Reachability.

Maximum Transit Delay

The Maximum Transit Delay is the time within which a single message has to be transmitted through the network end-to-end so that its transmission is of value to the applications (users).

If this time is exceeded, the receipt of the message is, in principle, of no value to the application. If the non-receipt within this time is known to the application, then, presumably, error procedures, such as message retransmission, will be initiated.

The transit delay is the time taken by the network to make the message available to the Message Store associated with the message recipient (UA). Therefore the boundary points of the network may, in this context, be considered to be the MTAs connected to the UAs serving the originators/recipients. The boundary points can also be the MTA functionality within AFTN/AMHS Gateways.

It must be borne in mind, that the parameters Maximum Transit Delay and destination Non-Reachability only have significance when they are taken together.

Message Corruption

The third Quality of Service Parameter concerns message integrity and is called "Message Corruption". It is the probability that each 1,000 octet content block of a message which arrives at its destination, has been corrupted in any way. The definition of Message Corruption applies only to messages which reach their recipients within the Maximum Transit Delay.

"Corruption" means a deviation, end-to-end, of the content of the received message from the content of the original message. The "content" is also deemed to include parameters, such as originator address, which are delivered together with the message. Corruption can also result from unauthorised changes to a message.

Since the volume unit for defining Message Corruption is large (1,000 octets), the requirement is almost independent of the size of (current) messages. This simplification is based on the assumption that corruption is due to unforeseen system malfunctioning, e.g. faulty software.

The corruption of messages due to such causes is not likely to be dependent on the size of messages. (This is true today, but the upcoming use of ADEXP messages-with message lengths up to 10koctets-has to be mentioned, as well as the potential forthcoming applications interchanging messages with binary body parts).

The probability of corruption due to other parameters such as system load, queue sizes, transmission errors etc. is almost negligible.

It is estimated, that the volume dependent non-detected bit error probability for a 1000 octet message traversing the AMHS and involving 5 links and 5 different systems (MTAs, UAs, MSs) is of the order of one bit in 10^5 or less. This justifies the (almost) volume-independent character of the Message Corruption parameter.

QoS Flow Type Classes

Different types of information exchange, called Flow Types here, place different QoS requirements on the AMHS.

In principle, each Flow Type might need to be associated with its own specific values of the three QoS parameters. However, taking into account the large number of possible Flow Types, this would result in a very complex analysis. A suitable approach to reducing this complexity is the introduction of “QoS Flow Type Classes” as follows:

Define a number of "QoS Flow Type Classes" and associate a set of fixed values of the three QoS parameters with each class. Depending on the properties and needs of applications using specific Flow Types, assign these to the QoS Flow Type Classes.

When engineering the network, message traffic volumes of each class need to be taken into account rather than individual Message Flow Types.

Three QoS Flow Type Classes

The approach outlined above is simple and practical provided the number of classes is small. In addition, there is a requirement that the QoS Flow Type Class to which a message belongs, can be coded in some way in the message itself. This requirement comes from the fact that all AMHS components, e.g. MTAs, must be able, at least in principle, to adapt their processing to the QoS Flow Type Class. The means for this coding must come from standard MHS protocol elements, since development specific to AMHS has to be avoided and the possibility of using third-party-service must be kept open. This rules out, for example, the representation of QoS Flow Type Classes by specific User Parts.

The use of the MHS message priority parameter with three values, "urgent", "normal" and "non urgent", belonging to the P1 protocol handled by MTAs, is currently also not suitable for this purpose. The association of values to messages originating from and destined for the AFTN is fixed by SARPs, since such messages traverse an AFTN/AMHS Gateway. This means that values of the MHS priority parameter cannot be freely assigned to message types which are currently handled by the AFTN.

There is no short-term solution to this problem. However, in the long-term, when the majority of messages handled by the AMHS are originated by and destined for native users, the priority parameter may become available for this purpose, keeping in mind, nevertheless, that various practical issues may need to be resolved. In keeping with the three possible values of the MHS message priority parameter, three corresponding QoS Flow Type Classes are defined:

(a) The "High QoS" Flow Type Class
Properties of this QoS Flow Type Class are:

- message transmissions are part of procedures, i.e. the sending and receipt of messages necessarily lead to actions or processing. Without receipt of the message, these actions or processing would not take place, or
- any corrupt information in messages could have serious consequences. This possibility has to be negligible.

(b) The "Medium QoS" Flow Type Class

This class has similar properties to the High QoS Flow Type Class, however the maximum Transit Time requirement can be somewhat less stringent. This distinction is important, because it can be expected that the Maximum Transit Time requirement will have a sensitive effect on network dimensioning.

Properties of this QoS Flow Type Class are:

- message transmissions tend to be of the nature of "information distribution" or "broadcast", possibly based on distribution lists rather than being parts of operational procedures. They are normally not acknowledged. Transit time and reachability constraints are not critical. In the case of non-delivery of messages, this may be noticed by users, in which case backup activities could be initiated; or

- message corruption could have serious consequences and needs to be as low as for the previous class.

(c) The "Low QoS" Flow Type Class

This class has similar properties to the Medium QoS Flow Type Class, however the Destination Non-Reachability and Message Corruption requirements can be somewhat less stringent. This is due to a certain amount of redundancy in the message contents and/or the regular updating and transmission of messages with similar content.

3 Numerical requirements

Guidelines for system requirements.

	High QoS Flow Type Class	Medium QoS Flow Type Class	Low QoS Flow Type Class
Destination Non-Reachability (probability)	$< 10^{-4}$	$< 10^{-4}$	$< 10^{-3}$
Maximum Transit Delay	< 10 seconds	< 5 minutes	< 5 minutes
Message Corruption (probability)	$< 10^{-6}$	$< 10^{-6}$	$< 10^{-5}$

Table 1: Numerical values of SPACE QoS performance requirements

It must be noted that the above numerical values:

- could be adopted as possible quantitative and qualitative characteristics for setting up the ASIAPAC AMHS network;
- will be reviewed on the basis of compiled AMHS operational experience.

4 Application of performance requirements

The QoS parameters are obviously of importance to the network operators, users and application designers.

The QoS requirements along with the volume requirements for each of the Flow Type Classes at the boundary of the network (servers and gateways) are used, in conjunction with a set of well defined design principles (see 3.3 AMHS topology), in order to:

- determine the local performance of servers and gateways, thus dimensioning their configuration,
- determine the throughput of MTAs and capacity of links,
- draft possible network configurations and select the “optimum” network design, and measure actual network performance.

5 Measurement

The specification of numerical values for Performance Requirements is meaningless unless provision is foreseen for measurement of network performance. Such measurement is needed:

- when implementing and enforcing Service Level Agreements between AMHS service providers and users;
- for acceptance testing of network components;
- to determine network capacity;
- to gain experience in network operation (e.g. testing of various routing strategies, etc.).
- to manage the network efficiently.

Technically, network performance measurement involves, among other things:

- generation of large message/data volumes;
- automation of measurement;
- time-stamping of messages;
- use of statistical analysis.

-End-

ANNEX B

AMHS Conformance and Compatibility Test

ANNEX B

of

AMHS Manual

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1.0	11/04/2007	Creation of the document.	all
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1 Introduction

1.1 Purpose of the Document

The purpose of the document is to define the functional tests for an AMHS Conformance Test, which allows checking an AMHS implementation against the AMHS SARPs as a first step to ensure the interoperability between compliant systems.

1.2 Document Structure

Chapter 2 presents the test environment used for AMHS conformance testing.

Chapter 3 defines the addressing plan implemented in the test environment.

Chapter 4 contains the test procedures with subsections for each AMHS functional area.

Each test procedure is presented in a structured way consisting of
- defined test criteria
- a (brief) scenario description
- reference to the relevant part of the standard specification (SARPS section),
- reference to test classes (N, E_n)

1.3 Test Identification Scheme

Each test procedure has an identifier in the form

CT*xnn*

where CT is an acronym for Conformance Test, *x* is a number identifying the test group[2] and *nn* is a consecutive number identifying the individual test procedure.

Test procedures are presented in six groups:
- test of submission operations (x=1)
- test of delivery operations (x=2)
- test of transfer operations (x=3)
- test of gateway operations converting a user message from AMHS to AFTN (x=4)
- test of gateway operations converting a user message from AFTN to AMHS (x=5)
- tests with special focus on naming and addressing, e.g. address translations between AMHS and AFTN domains (x=6)

[2] Test groups for AMHS conformance tests are identified in Annex D.

2 AMHS Conformance Test Environment

The AMHS Implementation Under Test (IUT) is embedded in a simulated operational environment formed by the AMHS test tool with three MTA instances (representing three adjacent ATS Message Servers or three neighbour PRMDs) and one AFTN/X.25 source/sink (representing an adjacent AFTN/X.25 environment).

The IUT has an AMHS user agent (UA) attached, which is used in submission and delivery tests. Gateway tests involve either the AFTN/X.25 test application or the AFTN user terminal. It is also possible to make use of the IUT's associated Monitor & Control Position – if available - to observe outcomes of the conversion process, especially in error situations.

The AMHS test tool implements three MTA test applications (MTA-1, -2 and -3) to send and receive AMHS messages (IPM, IPN), reports and probes to and from three directions. The test tool generates AMHS data at the X.400/P1 level. It uses the AFTN/X.25 test application or the AFTN user terminal to send and receive AFTN user messages and AFTN service messages.

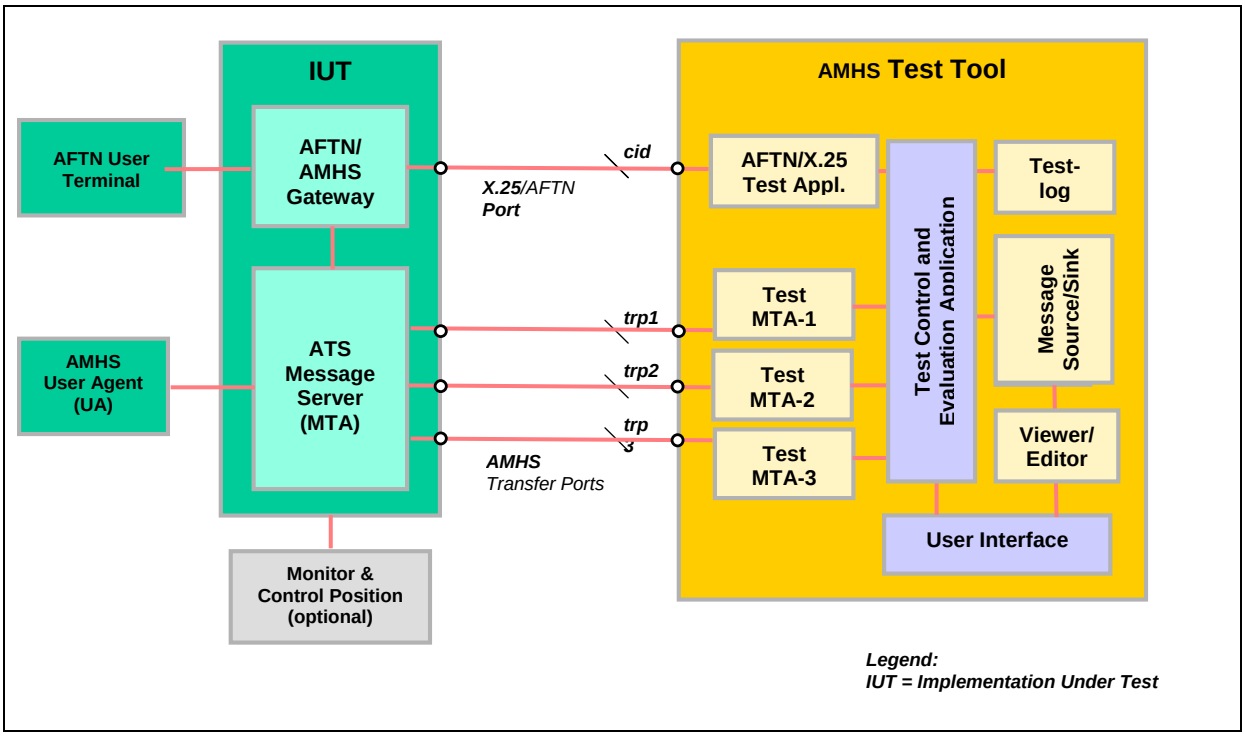


Figure 1: AMHS Conformance Test Environment

Figure 1 shows the test environment used for AMHS conformance tests (setup for the tests CT*xxx* in Part 3, where *xxx* refers to the test case number) and the components of the AMHS Test Tool. The AMHS Test Tool will be interconnected with the IUT's (standardized) external interfaces, i.e.

- three AMHS transfer ports (trp1, trp2, trp3) supporting the X.400/P1 protocol over a TCP/IP/LAN[3], and
- a AFTN/X.25 port (cid).

[3] Optionally, an ATN stack can be supported instead of the TCP/IP interface to support the AMHS X.400/P1 protocol.

All test applications can be controlled independently via user interface through the Test Control and Evaluation Application. The Test Control and Evaluation Application:

- maintains test samples in a repository (message source)
- executes test scripts,
- verifies the received messages (message sink),
- evaluates each performed test step,
- stores every test step result in a test log, and
- keeps record of all sent and received messages during a test run.

Test scenarios involve the test components as depicted in Figure 1 in the following way:

Submission operation tests:

AMHS User Agent	=>	IUT (ATS Message Server)	=>	MTA-1

Transfer operation tests:

MTA-1	=>	IUT (ATS Message Server)	=>	MTA-2 (and for distribution tests also MTA-3)

Delivery operation tests:

MTA-1	=>	IUT (ATS Message Server)	=>	AMHS User Agent

AMHS to AFTN gateway tests:

MTA-1	=>	IUT (ATS Message Server and Gateway)	=>	AFTN/X.25 Test Application or AFTN User Terminal

AFTN to AMHS gateway tests:

AFTN/X.25 Test Application or AFTN User Terminal	=>	IUT (Gateway and ATS Message Server)	=>	MTA-1

3 Addressing Plan for AMHS Conformance Testing

To meet the scope of testing, the test-address space used by AMHS Conformance Testing should include AMHS addresses placed in different AMHS PRMDs (Private Management Domain) and AFTN addresses located in different countries.

As a minimum, there is a need of three generic PRMDs and three generic AFTN countries which may be called: AMHSLAND-1, AMHSLAND-2, AMHSLAND-3, AFTNLAND-1, AFTNLAND-2 and AFTNLAND-3. If required, an extension of the address space should follow the same principles.

This allows covering of all cases of selected addressing schemes, including:

- CAAS (Common AMHS Addressing Scheme) with one single organisation-name value for all location indicators within the PRMD

- CAAS with multiple organisation-name values for different sets of location indicators within the PRMD
- XF (Translated-Form Addressing).

The Nationality Letters AA, AB, AC, BA, BB and BC have been reserved for the purpose of AMHS testing. The PRMD names and addressing schemes used for AMHS Conformance testing are indicated in Table 1:

Nationality Letter	C	ADMD	PRMD	Addressing Scheme
AA	**XX**	**ICAO**	**AMHSLAND-1**	**CAAS**
AB	**XX**	**ICAO**	**AMHSLAND-2**	**CAAS**
AC	**XX**	**ICAO**	**AMHSLAND-3**	**XF**
BA	**XX**	**ICAO**	**AFTNLAND-1**	**CAAS**
BB	**XX**	**ICAO**	**AFTNLAND-2**	**CAAS**
BC	**XX**	**ICAO**	**AFTNLAND-3**	**XF**

Table 1: PRMD names and addressing schemes

The user addresses of AMHSLAND-1 (Addressing scheme: CAAS – single "O" value)

C=**XX** A*DMD*=**ICAO** *PRMD*=**AMHSLAND-1**
O=**AA-REGION** *OU1*=**AAAA** → *CN*=**AAAAMHAA** till **AAAAMHAZ**
and
CN=**AAAAMHBA** till **AAAAMHBZ**

The user addresses of AMHSLAND-2 (Addressing scheme: CAAS – multiple "O" value)

C=**XX** A*DMD*=**ICAO** *PRMD*=**AMHSLAND-2**

O=**AB-REGION1**	*OU1*=**ABAA**	→ *CN*=**ABAAMHAA** till **ABAAMHAZ**
O=**AB-REGION1**	*OU1*=**ABAB**	→ *CN*=**ABABMHAA** till **ABABMHAZ**
O=**AB-REGION2**	*OU1*=**ABBA**	→ *CN*=**ABBAMHAA** till **ABBAMHAZ**
O=**AB-REGION2**	*OU1*=**ABBB**	→ *CN*=**ABBBMHAA** till **ABBBMHAZ**
O=**AB-REGION3**	*OU1*=**ABCA**	→ *CN*=**ABCAMHAA** till **ABCAMHAZ**
O=**AB-REGION3**	*OU1*=**ABCB**	→ *CN*=**ABCBMHAA** till **ABCBMHAZ**

Table 2: AMHSLAND-2

The user addresses of AMHSLAND-3 (Addressing scheme: XF)

C=**XX** A*DMD*=**ICAO** *PRMD*=**AMHSLAND-3**
O=**AFTN** *OU1*=**ACCCMHAA** till **ACCCMHAZ** and
OU1=**ACCCMHBA** till **ACCCMHBZ**

The user addresses of AFTNLAND-1 (Addressing scheme: CAAS – single "O" value)

C=**XX** A*DMD*=**ICAO** *PRMD*=**AFTNLAND-1**
O=**BA-REGION** *OU1*=**BAAA** → *CN*=**BAAAFTAA** till **BAAAFTZZ**

The user addresses of AFTNLAND-2 (Addressing scheme: CAAS – multiple "O" value)

C=**XX** A*DMD*=**ICAO** *PRMD*=**AFTNLAND-2**

O=**BB-REGION1**	*OU1*=**BBAA**	→ *CN*=**BBAAFTAA** till **BBAAFTAZ**
O=**BB-REGION1**	*OU1*=**BBAB**	→ *CN*=**BBABFTAA** till **BBABFTAZ**
O=**BB-REGION2**	*OU1*=**BBBA**	→ *CN*=**BBBAFTAA** till **BBBAFTAZ**
O=**BB-REGION2**	*OU1*=**BBBB**	→ *CN*=**BBBBFTAA** till **BBBBFTAZ**
O=**BB-REGION3**	*OU1*=**BBCA**	→ *CN*=**BBCAFTAA** till **BBCAFTAZ**
O=**BB-REGION3**	*OU1*=**BBCB**	→ *CN*=**BBCBFTAA** till **BBCBFTAZ**

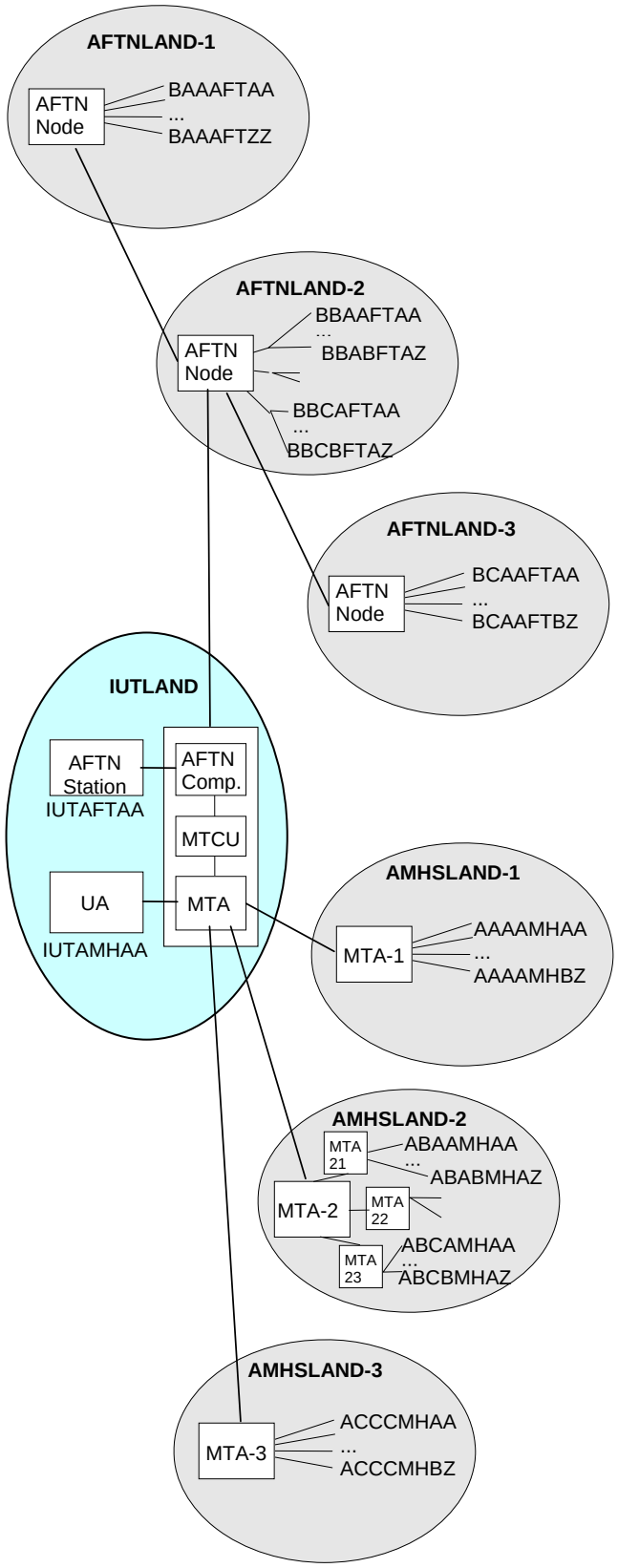
Table 3: AFTNLAND-2

The user addresses of AFTNLAND-3 (Addressing scheme: XF)

C=**XX** A*DMD*=**ICAO** *PRMD*=**AFTNLAND-3**

O=**AFTN**	*OU1*=**BCAAFTAA**	till	**BCAAFTAZ**	and
	OU1=**BCAAFTBA**	till	**BCAAFTBZ**	

[The portion left empty]



AFTNLAND-1 (Addressing scheme: CAAS)

```
   C = XX
ADMD = ICAO
PRMD = AFTNLAND-1

e.g.  O = BA-REGION
     OU1 = BAAA
      CN = BAAAFTAA
```

AFTNLAND-2 (Addressing scheme: CAAS)

```
   C = XX
ADMD = ICAO
PRMD = AFTNLAND-2

e.g.  O = BB-REGION3
     OU1 = BBCB
      CN = BBCBFTAA
```

AFTNLAND-3 (Addressing scheme: XF)

```
   C = XX
ADMD = ICAO
PRMD = AFTNLAND-3

e.g.  O = AFTN
     OU1 = BCAAFTBZ
```

AMHSLAND-1 (Addressing scheme: CAAS)

```
   C = XX
ADMD = ICAO
PRMD = AMHSLAND-1

e.g.  O = AA-REGION
     OU1 = AAAA
      CN = AAAAMHAA
```

AMHSLAND-2 (Addressing scheme: CAAS)

```
   C = XX
ADMD = ICAO
PRMD = AMHSLAND-2

e.g.  O = AB-REGION3
     OU1 = ABCA
      CN = ABCAMHAA
```

AMHSLAND-3 (Addressing scheme: XF)

```
   C = XX
ADMD = ICAO
PRMD = AMHSLAND-3

e.g.  O = AFTN
     OU1 = ACCCMHBZ
```

Figure 2: Addressing Plan

For the IUT itself as test addresses could be used alternatively:

The original, operational AMHS and AFTN addresses assigned to the COM Centre or a generic address space taken from the fictitious PRMD/AFTN country IUTLAND including the generic user addresses IUTAFTAA and IUTAMHAA (or a more comprehensive set of addresses in case of CAAS with multiple "O" values) which may be mapped either onto the CAAS (preferred) or XF addressing scheme. The following table shows the generic address space assigned to the IUT.

CAAS (preferred) – single "O"	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**IUT-REGION** *OU1*=**IUTA** *CN*=**IUTAFTAA** *C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**IUT-REGION** *OU1*=**IUTA** *CN*=**IUTAMHAA**
CAAS (preferred) – multiple "O"	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**IUT-REGION1** *OU1*=**IUTA** *CN*=**IUTAFTAA ...** *C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**IUT-REGION1** *OU1*=**IUTA** *CN*=**IUTAMHAA** *C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**IUT REGION2** *OU1*=**IUTB** *CN*=**IUTBFTAA ...** *C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**IUT REGION2** *OU1*=**IUTB** *CN*=**IUTBMHAA** *C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**IUT-REGION3** *OU1*=**IUTC** *CN*=**IUTCFTAA ...** *C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**IUT-REGION3** *OU1*=**IUTC** *CN*=**IUTCMHAA**
XF	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**AFTN** *OU1*=**IUTAFTAA** *C*=**XX** *ADMD*=**ICAO** *PRMD*=**IUTLAND** *O*=**AFTN** *OU1*=**IUTAMHAA**

Table 4: Generic address spaces of the IUT

3.1 "Unknown" addresses used for "negative testing"

Some conformance tests use addresses, which are "unknown" for the IUT and provoke specific reaction, e.g. return of a NDR. Several cases must be distinguished:

a) The AMHS component (MTA) of the IUT is not able to route the message, neither to an AMHS domain, nor to the AMHS/AFTN gateway (MTCU). For example, this occurs, when the global domain identifier does not match any X.400 routing entry (Table 5).

b) The AMHS/AFTN gateway component (MTCU) of the IUT is not able to translate the originator or recipient address from AMHS to AFTN (Table 6).

c) The AFTN/AMHS gateway component (MTCU) of the IUT is not able to translate the originator or destination address from AFTN to AMHS (Table 7).

d) The AFTN component of the IUT is not able to route an AFTN message.

Note that AFTN routing is not subject of AMHS conformance tests, and therefore no requirement exists for "unknown" AFTN addresses that do not match a routing indicator in the AFTN routing table.

The following "unknown" addresses may be used in the conformance tests:

"Unknown" AMHS addresses used to test MTA routing
C=XX ADMD=ICAO PRMD=UNKNOWN O=AA-REGION OU1=AAAA CN=AAAAMHAA ... CN=AAAAMHBZ
C=XX ADMD=ICAO PRMD=UNKNOWN O=AB-REGION1 OU1=ABAA CN=ABAAMHAA ... CN=ABAAMHBZ
C=XX ADMD=ICAO PRMD=UNKNOWN O=AFTN OU1=ACCCMHAA ... OU1=ACCCMHBZ

Table 5: "Unknown" address space for MTA routing tests

"Unknown" AMHS addresses used to test MTCU mappings from AMHS to AFTN
C=XX ADMD=ICAO PRMD=AFTNLAND-1 O=BA-REGION OU1=BAAA CN=BAAAFTABC C=XX ADMD=ICAO PRMD=AFTNLAND-1 O=BA-REGION OU1=BAAA CN=BAAAFT C=XX ADMD=ICAO PRMD=AFTNLAND-1 O=BA-REGION OU1=BAAA CN= C=XX ADMD=ICAO PRMD=AFTNLAND-1 O=BA-REGION OU1= CN=BAAAFTAA C=XX ADMD=ICAO PRMD=AFTNLAND-1 O=BA-REGION OU1=BAAX CN=BAAAFTAA C=XX ADMD=ICAO PRMD=AFTNLAND-1 O= OU1=BAAA CN=BAAAFTAA
C=XX ADMD=ICAO PRMD=AMHSLAND-1 O=AA-REGION OU1=AAAA CN=AAAAMHABC C=XX ADMD=ICAO PRMD=AMHSLAND-1 O=AA-REGION OU1=AAAA CN=AAAAMH C=XX ADMD=ICAO PRMD=AMHSLAND-1 O=AA-REGION OU1=AAAA CN= C=XX ADMD=ICAO PRMD=AMHSLAND-1 O=AA-REGION OU1= CN=AAAAMHAA C=XX ADMD=ICAO PRMD=AMHSLAND-1 O=AA-REGION OU1=AAAX CN=AAAAMHAA C=XX ADMD=ICAO PRMD=AMHSLAND-1 O= OU1=AAAA CN=AAAAMHAA

"Unknown" AMHS addresses used to test MTCU mappings from AMHS to AFTN
C=XX ADMD=ICAO PRMD=AFTNLAND-1 O=BA-REGION OU1=BAAAFTAA
C=XX ADMD=ICAO PRMD=AFTNLAND-3 O=AFTN OU1=BCAAFTABC
C=XX ADMD=ICAO PRMD=AFTNLAND-3 O=AFTN OU1=BCAAFT
C=XX ADMD=ICAO PRMD=AFTNLAND-3 O=AFTN OU1=
C=XX ADMD=ICAO PRMD=AFTNLAND-3 O= OU1=BCAAFTAA
C=XX ADMD=ICAO PRMD=AFTNLAND-3 O=ATFM OU1=BCAAFTAA
C=XX ADMD=ICAO PRMD=AMHSLAND-1 O=UNKNOWN OU1=AAAAMHAA
C=XX ADMD=ICAO PRMD=AMHSLAND-3 O=AFTN OU1=ACCCMHABC
C=XX ADMD=ICAO PRMD=AMHSLAND-3 O=AFTN OU1=ACCCMH
C=XX ADMD=ICAO PRMD=AMHSLAND-3 O=AFTN OU1=
C=XX ADMD=ICAO PRMD=AMHSLAND-3 O= OU1=ACCCMHAA
C=XX ADMD=ICAO PRMD=AFTNLAND-3 O=UNKNOWN OU1=ACCCMHAA

Remark: This table contains example of "unknown" O/R addresses which cannot be converted into AF-addresses.

Table 6: "Unknown" AMHS addresses for MTCU mapping tests

"Unknown" AFTN addresses used to test MTCU mappings from AFTN to AMHS
AAXXXXXX, AAAXXXXX, AAABXXXX,
ABXXXXXX, ABAXXXXX, ABBXXXXX, ABCXXXXX, ABACXXXX, ABABXXXX
ACXXXXXX, ACCXXXXX, ACAAXXXX, ACBAXXXX
BAXXXXXX, BBXXXXXX, BCXXXXXX

Remark: These addresses match a routing indicator in the AFTN routing table, but not any entry of the MD Look-up Table (Table 8).

Table 7: "Unknown" AFTN addresses for MTCU mapping tests

AFTN/AMHS gateway settings

To fulfil the requirements of the "unknown" addresses following setting of the MD Lookup/CAAS Tables of the AFTN/AMHS gateway (IUT) is requested:

Nationality Letter, Location Indicator	Mapped to	Used addressing scheme
AAAA	*C=***XX** *ADMD=***ICAO** *PRMD=***AMHSLAND-1**	CAAS
ABAA	*C=***XX** *ADMD=***ICAO** *PRMD=***AMHSLAND-2**	CAAS
ABBA	*C=***XX** *ADMD=***ICAO** *PRMD=***AMHSLAND-2**	CAAS
ABCA	*C=***XX** *ADMD=***ICAO** *PRMD=***AMHSLAND-2**	CAAS
ACCC	*C=***XX** *ADMD=***ICAO** *PRMD=***AMHSLAND-3**	XF
BAAA	*C=***XX** *ADMD=***ICAO** *PRMD=***AFTNLAND-1**	CAAS
BBAA	*C=***XX** *ADMD=***ICAO** *PRMD=***AFTNLAND-2**	CAAS
BBBA	*C=***XX** *ADMD=***ICAO** *PRMD=***AFTNLAND-2**	CAAS
BBCA	*C=***XX** *ADMD=***ICAO** *PRMD=***AFTNLAND-2**	CAAS
BCAA	*C=***XX** *ADMD=***ICAO** *PRMD=***AFTNLAND-3**	XF
IUTA	*C=***XX** *ADMD=***ICAO** *PRMD=***IUTLAND**	CAAS

Table 8: MD Lookup Table of the AFTN/AMHS gateway

country-name	ADMD-name	PRMD-name	organization-name	organizational-unit-name
*C=***XX**	*ADMD=***ICAO**	*PRMD=***AMHSLAND-1**	*O=***AA-REGION**	*OU1=***AAAA**
*C=***XX**	*ADMD=***ICAO**	*PRMD=***AMHSLAND-2**	*O=***AB-REGION1**	*OU1=***ABAA**
*C=***XX**	*ADMD=***ICAO**	*PRMD=***AMHSLAND-2**	*O=***AB-REGION2**	*OU1=***ABBA**
*C=***XX**	*ADMD=***ICAO**	*PRMD=***AMHSLAND-2**	*O=***AB-REGION3**	*OU1=***ABCA**
*C=***XX**	*ADMD=***ICAO**	*PRMD=***AFTNLAND-1**	*O=***BA-REGION**	*OU1=***BAAA**
*C=***XX**	*ADMD=***ICAO**	*PRMD=***AFTNLAND-2**	*O=***BB-REGION1**	*OU1=***BBAA**
*C=***XX**	*ADMD=***ICAO**	*PRMD=***AFTNLAND-2**	*O=***BB-REGION2**	*OU1=***BBBA**
*C=***XX**	*ADMD=***ICAO**	*PRMD=***AFTNLAND-2**	*O=***BB-REGION3**	*OU1=***BBCA**
*C=***XX**	*ADMD=***ICAO**	*PRMD=***IUTLAND**	*O=***IUT-REGION**	*OU1=***IUTA**

Table 9: CAAS Table settings of the AFTN/AMHS gateway

3.2 AMHS O/R address used for asymmetric re-conversion tests

Within the AMHS/AFTN address conversion tests for the following AMHS addresses are used to demonstrate the robustness of the address conversion of the IUT introduced by the PDR M7100001[4]. The AFTN addresses will be extracted from the original O/R (Originator/Recipient) address, but the re-conversions do not result in the same AMHS addresses. These AMHS addresses, the AFTN addresses resulting from conversion and the re-converted AMHS addresses are listed in the following table:

	Used AMHS Address	**Converted AFTN Address**	**Re-converted AMHS Address**
(1)	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AFTNLAND-1** *O*=**BA-REGION** *OU1*=**BBAA** *CN*=**BBAAFTAA**	BBAAFTAA	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AFTNLAND-2** *O*=**BB-REGION1** *OU1*=**BBAA** *CN*=**BBAAFTAA**
(2)	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AFTNLAND-2** *O*=**AFTN** *OU1*=**BCAAFTAA**	BBAAFTAA	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AFTNLAND-3** *O*=**AFTN** *OU1*=**BCAAFTAA**
(3)	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AFTNLAND-3** *O*=**AFTN** *OU1*=**BCAA** *CN*=**BCAAFTAA**	BCAAFTAA	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AFTNLAND-3** *O*=**AFTN** *OU1*=**BCAAFTAA**
(4)	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AFTNLAND-1** *O*=**AFTN** *OU1*=**BAAAFTAA**	BAAAFTAA	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AFTNLAND-1** *O*=**BA-REGION** *OU1*=**BAAA** *CN*=**BAAAFTAA**
(5)	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AMHSLAND-1** *O*=**AA-REGION** *OU1*=**ABAA** *CN*=**ABAAMHAA**	ABAAMHAA	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AMHSLAND-2** *O*=**AB-REGION1** *OU1*=**ABAA** *CN*=**ABAAMHAA**
(6)	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AMHSLAND-1** *O*=**AFTN** *OU1*=**ACCCMHAA**	ACCCMHAA	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AMHSLAND-3** *O*=**AFTN** *OU1*=**ACCCMHAA**
(7)	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AMHSLAND-3** *O*=**AFTN** *OU1*=**ACCC** *CN*=**ACCCMHAA**	ACCCMHAA	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AMHSLAND-3** *O*=**AFTN** *OU1*=**ACCCMHAA**
(8)	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AMHSLAND-1** *O*=**AFTN** *OU1*=**AAAAMHAA**	AAAAMHAA	*C*=**XX** *ADMD*=**ICAO** *PRMD*=**AMHSLAND-1** *O*=**AA-REGION** *OU1*=**AAAA** *CN*=**AAAAMHAA**

Table 10: AMHS addresses used for asymmetric re-conversion tests

[4] To reduce message rejections due to non-symmetrical address conversion, it is necessary to:
a) detect such situations by checking the result of backward conversion of the address and report the error situations,
b) convert the message to AFTN and transfer it, despite the detected non-symmetry.

4 Test Procedures

4.1 Submission Operations

CT101 - Forward a submitted IPM

CT101	**Forward a submitted IPM**
Test criteria	This test is successful, if the IUT forwards a submitted ATS message (IPM) to a peer MTA correctly.
Scenario description	From the UA send a sequence of five ATS messages (IPMs) to the IUT addressing a remote AMHS user reachable via AMHS transfer port *trp1*. • Message 1 (CT101M01) shall have ATS-message-priority KK. • Message 2 (CT101M02) shall have ATS-message-priority GG. • Message 3 (CT101M03) shall have ATS-message-priority FF. • Message 4 (CT101M04) shall have ATS-message-priority DD. • Message 5 (CT101M05) shall have ATS-message-priority SS. Each message shall have different ATS-filing-time and ATS-message-text. The *optional-heading-information* element shall be empty. Verify the messages received by the test tool at the AMHS interface. Check the format and contents of MTE, IPM heading and body. In particular, verify the priority value contained in the MTE and the following elements contained in the IPM body: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.
AMHS SARPs reference	3.1.2.2.1 (ATS Message User Agent), 3.1.2.2.2 (ATS Message Server), 3.1.2.2.3.2.3.1 (ATS-Message-Header)
Test class	Normal AMHS communications

4.2 Delivery Operations

CT201 – Deliver an IPM to a local AMHS user

CT201	**Deliver an IPM to a local AMHS user**
Test criteria	This test is successful, if the IUT correctly delivers an ATS message (IPM) received from a peer MTA to its local AMHS user.
Scenario description	From the AMHS Test Tool send a sequence of five ATS messages (IPMs) to the IUT addressing a local UA. • The first ATS message shall have ATS-message-priority KK. • The second ATS message shall have ATS-message-priority GG. • The third ATS message shall have ATS-message-priority FF. • The fourth ATS message shall have ATS-message-priority DD. • The fifth ATS message shall have ATS-message-priority SS. Each message shall have different ATS-filing-time and ATS-message-text. The optional-heading-information element shall be empty. Verify the messages received at the AMHS user agent. In particular, verify the following elements displayed at the AMHS user agent: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.
AMHS SARPs reference	3.1.2.1.6 (AMHS routing)
Test class	Normal AMHS communications

CT202 – Deliver an IPM containing erroneous ATS-message-header or ATS-message text format

CT202	**Deliver an IPM containing erroneous ATS-message-header or ATS-message-text format**
Test criteria	This test is successful, if the IUT, when receiving an IPM containing erroneous ATS-message-header or ATS-message-text from a peer MTA: • delivers this message to its local AMHS user regardless of the contained error, or • indicates the error situation, or • returns a non-receipt notification or NDR.
Scenario description	From the AMHS Test Tool send a sequence of six messages (IPMs) to the IUT addressed to a local UA. • The first message (IPM) shall contain an empty ATS-message-priority. • The second message (IPM) shall contain an invalid ATS-message-priority • The third message (IPM) shall contain an empty ATS-message-filing-time. • The fourth message (IPM) shall contain an invalid ATS-message-filing-time. • The fifth message (IPM) shall contain an OHI text longer than 53 characters. • The sixth message (IPM) shall contain an empty ATS-message-header. • The seventh message (IPM) shall contain an empty ATS-message-text. Verify that the messages are delivered to the UA. Analyse the IUT's log files with respect to delivered messages and reported errors, if any. Check the contents of the received ATS message and verify the ATS-message-priority, ATS-message-filing-time and ATS-message-text displayed at the UA[5].
AMHS SARPs reference	3.1.2.2.3.2 (IPM text)
Test class	Erroneous AMHS parameters

[5] The displayed message depends on the UA capabilities

CT203 – Deliver an IPM containing empty or invalid IPM heading fields

CT203	**Deliver an IPM containing empty or invalid IPM heading fields**
Test criteria	This test is successful, if the IUT when receiving an ATS message (IPM) from a peer MTA containing empty or invalid IPM heading fields: • delivers this message to its local AMHS user regardless of the empty or invalid IPM heading fields, or • indicates the error situation, or • returns a non-receipt notification or NDR.
Scenario description	From the AMHS Test Tool send a sequence of messages (IPMs) to the IUT addressing a local UA. The Message Transfer Envelope (MTE) shall be correctly formatted while the IPM heading contains empty or invalid values. • The first message shall contain an empty originator field in the IPM heading. • The second message shall contain neither primary nor copy nor blind copy recipient addresses in the IPM heading. • The third message shall contain a primary recipient with an invalid combination of the notification-request flag (rn bit = true and nrn bit = false). Check the IUT's log files with respect to delivered messages and reported errors, if any. Check any messages received and displayed at the UA[6].
AMHS SARPs reference	3.1.2.2.1 (ATS Message User Agent – AMH21)
Test class	Erroneous IPMS information objects

[6] The displayed message depends on the UA capabilities.

4.3 Transfer Operations

CT301 – Transfer messages (IPMs and IPNs)

CT301	**Transfer messages (IPMs and IPNs)**
Test criteria	This test is successful, if the IUT transfers (forwards) messages (IPMs, IPNs) correctly.
Scenario description	From the AMHS Test Tool send a sequence of messages to the IUT's transfer port *trp1*. All envelopes shall contain a remote recipient address reachable via transfer port *trp2*. All messages shall have the *originator-report-request* flag and the *originating-MTA-report-request* flag set to "non-delivery-report". The sequence of messages shall consist of: • an IPM with ia-5-text body part, • an IPM with general-text body part, • an IPN containing a RN, • an IPN containing a NRN. Monitor the outcome of IUT transfer ports *trp1, trp2* and *trp3*. Verify that: • all messages are routed correctly via transfer port *trp2*, and there is no message misrouted, i.e. no output from the IUT at transfer port *trp1* or *trp3*, • there is no NDR returned via *trp1*, • the content of the forwarded message has not changed, but is identical to the original content, • trace information is added in the message transfer envelope (MTE).
AMHS SARPs reference	3.1.2.2.2 (ATS message server), 3.1.2.1.2.2 (AMHS information model)
Test class	Normal AMHS communications

CT302 – Transfer a report

CT302	**Transfer a report**
Test criteria	This test is successful, if the IUT transfers (forwards) reports correctly.
Scenario description	From the AMHS Test Tool send two manually prepared reports (a DR and a NDR) to the IUT's transfer port *trp1*. The report transfer envelope shall contain a remote recipient address reachable via transfer port *trp2*. The reports shall contain fictitious values for those fields, which are normally automatically generated from the related subject message, for example, the subject-MTS-identifier and originally intended recipients. Monitor the outcome of IUT transfer ports *trp1, trp2* and *trp3*. Verify that: • all reports are routed correctly via transfer port *trp2*, and there is no report misrouted, i.e. no output from the IUT at transfer port *trp1* or *trp3*, • the content of the forwarded report has not changed, but is identical to the original report content, • trace information is added in the report transfer envelope (RTE).
AMHS SARPs reference	3.1.2.2.2 (ATS message server), 3.1.2.1.2.2 (AMHS information model)
Test class	Normal AMHS communications

CT303 – Transfer a probe

CT303	**Transfer a probe**
Test criteria	This test is successful, if the IUT transfers (forwards) a probe testing the reachability of a remote AMHS user correctly and returns a NDR, if the probe contains a content-length value which exceeds the length supported by the IUT's MTA component.
Scenario description	From the AMHS Test Tool send two probes to the IUT's transfer port *trp1*. The probe (envelope) shall contain an intended recipient address reachable via transfer port *trp2*. • The first probe shall contain a content length value of 1.048.576 (octets), which is a length, which must be supported by the IUT's MTA component. • The second probe shall contain a content length value of 2.147.483.647 (octets), which is the maximum length in octets specified in X.411:06/1999. It equals the largest integer in 32 bits. Monitor the outcome of IUT transfer ports *trp1*, *trp2* and *trp3*. Verify that: • the first probe is routed correctly via transfer port *trp2*, and there is not any NDR returned from the IUT, • the second probe is either routed correctly via transfer port *trp2* or rejected, if such a length is not supported by the IUT's transfer capabilities. Check, if either a forwarded probe or a NDR is received from the IUT. *Note. – The AMHS Test Tool shall respond with a DR, if it receives a valid probe for a user residing in the test tool's domain.*
AMHS SARPs reference	3.1.2.2.2 (ATS message server), 3.1.2.1.2.2 (AMHS information model)
Test class	Normal AMHS communications

CT304– Reject a message, if DL expansion is prohibited

CT304	**Reject a message, if DL expansion is prohibited**
Test criteria	This test is successful, if the IUT distributes a received IPM addressing a distribution list (DL) only, if the *dl-expansion-prohibited* flag is set to "false" and rejects the message, if the *dl-expansion-prohibited* flag is set to "true". In the latter case, the IUT shall return a NDR.
Scenario description	From the AMHS Test Tool send two IPMs to the IUT's transfer port *trp1*. The recipient in the message transfer envelope (MTE) shall address a distribution list. The distribution list, in turn, shall address three remote AMHS users, one reachable via transfer port *trp1*, one reachable via *trp2* and one via *trp3*. The first message shall have the *dl-expansion-prohibited* flag set to "false" and the second to "true". Monitor the outcome of transfer ports *trp1, trp2* and *trp3*. Verify that: • only the first message is distributed by the IUT and three messages are received at the AMHS Test Tool, • a NDR is returned to trp1 for the second message.
AMHS SARPs reference	3.1.2.2.2.1.1 (DL functional group)
Test class	Normal AMHS communications

CT305– Loop detection

CT305	**Loop detection**
Test criteria	This test is successful, if the IUT detects that the received message, IPN, report and probe have traversed a loop.
Scenario description	Create a temporary routing loop, i.e. modify the routing table in MTA-2 to forward all messages addressed to AMHSLAND-2 to MTA-1, which in turn forwards those messages to the IUT. Configure the loop detection mechanism in the AMHS Test Tool (MTA-1 and MTA-2) to allow a message to run through the loop 32 times. From the AMHS Test Tool send an AMHS message (IPM) to the IUT addressing an AMHS user in AMHSLAND-2. Verify that: • the IUT detects the loop, • discards the message and • sends a NDR (before the test tool detects that the message has traversed the loop 32 times). Repeat the test for an IPN, a report and a probe. The IUT shall detect the loop in all cases and return a NDR for the IPN and the probe (but not for the report).
AMHS SARPs reference	3.1.1, Note 2a (ISO/IEC 10021), *See also ITU-T Rec. X.411 clause 14.3.1 and clause 12.3.1.*
Test class	MHS procedural errors

CT306– Generate a NDR, if transfer fails

CT306	**Generate a NDR, if transfer fails**
Test criteria	This test is successful, if the IUT correctly generates a NDR, if it can not transfer the received IPM towards the specified recipient.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) to the IUT's transfer port *trp1*. All messages shall contain an unknown primary recipient address and have different combinations of settings for the *originator-report-request* flag and the *originating-mta-report-request* flag according to Table 11. Verify that in all cases the IUT returns a NDR. Verify that the report is always addressed to the originator of the message. Verify that the *originator-report-request* flag setting in the per-recipient-fields of the generated NDR is equal to the setting in the subject message.
AMHS SARPs reference	3.1.2.2.2.1.1 (AMH22/AMH11)
Test class	Normal AMHS communications

ATS Message	**Value of the originator-report-request element**	**Value of the originating-MTA-report-request element**	**Expected result**
1	no-report(0)	report(2)	IUT returns a NDR with the *originator-report-request* flag set to no-report(0).
2	non-delivery-report(1)	report(2)	IUT returns a NDR with the *originator-report-request* flag set to non-delivery-report(1).
3	report(2)	report(2)	IUT returns a NDR with the *originator-report-request* flag set to report(2).

Table 11: CT306 report request settings[7]

[7] Note that the originating-MTA-report-request argument shall specify at least the level specified in the originator-report=request (see ITU-T recommendation X.411, clause 1.2.2.1.1.1.8)

4.4 Gateway Operations (AMHS to AFTN)

CT401 – Convert an incoming IPM to AFTN format

CT401	**Convert an incoming IPM to AFTN format**
Test criteria	This test is successful, if the IUT converts an IPM into AFTN format correctly.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp1* to the IUT addressing an AFTN user. • The first ATS message shall have ATS-message-priority KK. • The second ATS message shall have ATS-message-priority GG. • The third ATS message shall have ATS-message-priority FF. • The fourth ATS message shall have ATS-message-priority DD. • The fifth ATS message shall have ATS-message-priority SS. Each message shall have different ATS-filing-time and ATS-message-text and address an AFTN user reachable via the AFTN/X.25 port *cid1*. The optional-heading-information element shall be empty[8]. The implicit-conversion-prohibited attribute of the AMHS message must be set to "false". Verify the messages received at the AFTN/X.25 interface of the AMHS Test Tool. Check the correct format of the AFTN message. Verify the AFTN priority and filing time for each received message. Compare the AFTN message text with the original ATS-message-text.
AMHS SARPs reference	3.1.2.3.5.2 (AMHS IPM conversion)
Test class	Normal AMHS communications

[8] There is a separate test case specified, that will test the conversion of the optional-heading-information element.

CT402 – Convert an IPM containing optional-heading-information in the ATS-message-header

CT402	**Convert an IPM containing optional-heading-information in the ATS-message-header**
Test criteria	This test is successful, if the IUT converts an IPM containing optional-heading-information (OHI) in the ATS-message-header correctly into AFTN format and returns a non-delivery report, if it cannot convert the message, because the OHI text is too long.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over the AMHS transfer port to the IUT. The sequence of IPMs shall address a remote AFTN user. • The first ATS message shall have FF priority and contain OHI text of less than 53 characters[9]. • The second ATS message shall have FF priority and contain OHI text of exactly 53 characters. • The third ATS message shall have FF priority and contain OHI text of more than 53 characters. • The fourth ATS message shall have SS priority and contain OHI text of less than 48 characters[10]. • The fifth ATS message shall have SS priority and contain OHI text of exactly 48 characters. • The sixth ATS message shall have SS priority and contain OHI text of more than 48 characters. Check the AFTN messages received at the X.25/AFTN port and verify the AFTN format. In particular, check the format and contents of the OHI. Verify that the IUT returns a NDR for the third and sixth ATS message containing the following elements (as specified in the AMHS SARPs, section 3.1.2.3.5.2.1.5-b): • "unable-to-transfer" for the *non-delivery-reason-code*, • "content-syntax-error" for the *non-delivery-diagnostic-code*, and • "unable to convert to AFTN due to ATS-Message-Header or Heading Fields syntax error" for the supplementary-information.

[9] OHI text of 53 characters is the maximum length for non-SS messages, if the total maximum line length is 69. (Total line length = OHI text + space + 6 digit filing time + space + 8 characters originator indicator.)
[10] OHI text of 48 characters is the maximum length for SS messages, if the total maximum line length is 69. (Total line length = OHI text + space + 6 digit filing time + 8 characters originator indicator + 5 character priority alarm.)

AMHS SARPs reference	3.1.2.3.5.2.2.8 (OHI) 3.1.2.2.3.2.3.4 (ATS Message Optional Heading Info) PDR M4100001
Test class	Normal AMHS communications

CT403 – Generate a DR for a successfully translated IPM

CT403	**Generate a DR for a successfully translated IPM**
Test criteria	This test is successful, if the IUT returns a DR for a successfully translated ATS message (IPM), if a report was requested by the originator or the originating MTA.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) to the IUT addressing an AFTN user. The IPMs shall have ATS-Message-Priority "FF" and different combinations of settings for the *originator-report-request* flag and the *originating-mta-report-request* flag according to Table 12. The IUT shall convert all ATS messages into AFTN format and forward them via the AFTN/X.25 port *cid1* to the AMHS Test Tool. Check the messages received at the AMHS interface and verify that the IUT sends a DR for every ATS message, if: a) the *originator-report-request* element is set to "report", or b) the originating-mta-report-request element is set to "report" or "audited-report". (see Table 12).
AMHS SARPs reference	3.1.2.3.5.6.1.3 (generation of AMHS reports)
Test class	Normal AMHS communications

ATS Message	**Value of the originator-report-request element**	**Value of the originating-MTA-report-request element**	**Expected result for conformance test CT403**
1	no-report(0)	non-delivery-report(1)	IUT does not return a report
2	no-report(0)	report(2)	IUT returns a DR
3	no-report(0)	audited-report(3)	IUT returns a DR
4	non-delivery-report(1)	non-delivery-report(1)	IUT does not return a report
5	non-delivery-report(1)	report(2)	IUT returns a DR
6	non-delivery-report(1)	audited-report(3)	IUT returns a DR
7	report(2)	report(2)	IUT returns a DR
8	report(2)	audited-report(3)	IUT returns a DR

Table 12: CT403 report request settings[11]

[11] Note that the originating-MTA-report-request argument shall specify at least the level specified in the originator-report-request (see ITU-T recommendation X.411, clause 12.2.1.1.1.8)

CT404 – Generate a NDR, if implicit conversion is prohibited

CT404	**Generate a NDR, if implicit conversion is prohibited**
Test criteria	This test is successful, if the IUT rejects a received IPM addressed to an AFTN user, if the *implicit-conversion-prohibited* attribute is set to "true" and generates a NDR.
Scenario description	From the AMHS Test Tool send two ATS messages (IPMs) to the IUT transfer port *trp1*. The IPMs shall have both the *originator-report-request* and the *originating-MTA-report-request* flag set to "non-delivery-report" and contain the recipient address of an AFTN user reachable via the AFTN/X.25 port *cid1*. The first message shall have the argument *implicit-conversion-prohibited* set to "false" and the second message set to "true". Verify that only the first message is transferred over the AFTN/X.25 test interface to the AMHS Test Tool, and a NDR is generated for the second message and received by the AMHS Test Tool via the transfer port *trp1*. Verify that this NDR contains the following elements (as specified in the AMHS SARPs 3.1.2.3.5.2.1.2): • "conversion-not-performed" for the *non-delivery-reason-code*, • "implicit-conversion-prohibited" for the *non-delivery-diagnostic-code*, and • "unable to convert to AFTN" for the *supplementary-information*.
AMHS SARPs reference	3.1.2.3.5.2.1.2
Test class	Normal AMHS communications

CT405 – Generate a NDR, if the ATS-message-header has a syntax error

CT405	**Generate a NDR, if the ATS-message-header has a syntax error**
Test criteria	This test is successful, if the IUT generates a NDR, if it receives an IPM addressed to an AFTN user containing erroneous ATS-message-header or ATS-message-text.
Scenario description	From the AMHS Test Tool send a sequence of seven messages (IPMs) to the IUT addressed to an AFTN user reachable via the IUT's gateway. • The first message (IPM) shall contain an empty ATS-message-priority. • The second message (IPM) shall contain an invalid ATS-message-priority • The third message (IPM) shall contain an empty ATS-message-filing-time. • The fourth message (IPM) shall contain an invalid ATS-message-filing-time. • The fifth message (IPM) shall contain OHI text longer than 53 characters. • The sixth message (IPM) shall contain an empty ATS-message-header. • The seventh message (IPM) shall contain an empty ATS-message-text. Check the messages received at the AMHS- and X.25/AFTN-interfaces of the AMHS Test Tool. Verify that the IUT - except for the seventh message[12] - does not convert the received AMHS messages into AFTN, but returns a NDR for each message via its transfer port *trp1*. Verify that all NDRs contains the following elements (as specified in the AMHS SARPs, section 3.1.2.3.5.2.1.5-b): • "unable-to-transfer" for the *non-delivery-reason-code*, • "content-syntax-error" for the *non-delivery-diagnostic-code*, and • "unable to convert to AFTN due to ATS-Message-Header or Heading Fields syntax error" for the supplementary-information.
AMHS SARPs reference	3.1.2.3.5.2.1.5-b), 3.1.2.2.3.2.3 (ATS Message Header)
Test class	Erroneous AMHS parameters

[12] The AMHS SARPS (3.1.2.2.3.2.4) do not exclude an IPM containing empty ATS-message-text.

CT406 – Convert or reject an IPM, if the ATS-message-text contains more than 1800 characters

CT406	**Convert or reject an IPM, if the ATS-message-text contains more than 1800 characters**
Test criteria	This test is successful, if the IUT, when it receives an ATS message with long ATS-message-text of more than 1800 characters, a) rejects the message and returns a NDR, or b) splits the received IPM into several messages and converts the resulting messages into AFTN format as specified in ICAO Annex 10, Attm. B (changed from D to B with Amendment 78) . *Note:– The AMHS SARPS (3.1.2.3.5.2.1.7) specify that the message can be rejected (case a) or split into several messages (case b).*
Scenario description	From the AMHS Test Tool send an ATS message (IPM) to the IUT containing ATS-message-text of 4500 characters to an AFTN user recipient. *If case a) is implemented:* Verify that the IUT does not convert the IPM into AFTN format, but returns a NDR. Check the NDR contents received at the TSMS-AMHS interface. Verify that the NDR contains the following elements: • "unable-to-transfer" for the *non-delivery-reason-code*; • "content-too-long" for the *non-delivery-diagnostic-code*; and • "unable to convert to AFTN due to message text length" for the *supplementary-information*. *If case b) is implemented:* Verify that (at least) three AFTN messages are received at the AFTN/X.25 test interface. Check the correct format of the AFTN messages. Check the text field of all received AFTN messages. Verify that the text is complete and unchanged, i.e. compare the received data with the *ATS-message-text* provided in the original IPM.
AMHS SARPs reference	3.1.2.3.5.2.1.7
Test class	Normal AMHS communications

CT407 – Convert or reject an IPM, if the ATS-message-text contains lines with more than 69 characters

CT407	**Convert or reject an IPM, if the ATS-message-text contains lines with more than 69 characters**
Test criteria	This test is successful, if the IUT converts a received IPM containing an ATS-messages-text with lines of more than 69 characters, if *conversion-with-loss-prohibited* is set to "false". Otherwise the IUT shall reject the message and generate a NDR.
Scenario description	From the AMHS Test Tool send two ATS messages (IPMs) to the IUT transfer port. The messages shall have both the *originator-report-request* and the *originating-MTA-report-request* flag set to "non-delivery-report" and contain the recipient address of an AFTN user reachable via the AFTN/X.25 port *cid1*. The IPM body shall contain ATS-message-text with lines exceeding 69 characters. In the first message the argument *conversion-with-loss-prohibited* shall be set to "false" and in the second message to the value "true". Verify that only messages are received at the AFTN/X.25 test interface of the AMHS Test Tool, if the *conversion-with-loss-prohibited* was set to "false". Check the correct format of the AFTN message. Verify that an additional line feed has been inserted for every text line exceeding 69 characters. In case of message rejection, verify that a NDR is generated and received by AMHS Test Tool via the transfer port *trp1* with the following values: • "conversion-not-performed" for the *non-delivery-reason-code*, and • "line-too-long" for the diagnostic code.
AMHS SARPs reference	3.1.2.3.5.2.1.6 a)
Test class	Normal AMHS communications

CT408 – Convert or reject an IPM, if the ATS-message-text contains characters not allowed by ICAO Annex 10

CT408	**Convert or reject an IPM, if the ATS-message-text contains characters not allowed by ICAO Annex 10**
Test criteria	This test is successful, if the IUT converts a received IPM containing an ATS-messages-text with characters not allowed by ICAO Annex 10, if *conversion-with-loss-prohibited* is set to "false". Otherwise the IUT shall reject the message and generate a NDR.
Scenario description	From the AMHS Test Tool send two ATS messages (IPMs) to the IUT transfer port *trp1*. The messages shall have both the *originator-report-request* and the *originating-MTA-report-request* flag set to "non-delivery-report" and contain the recipient address of an AFTN user reachable via the AFTN/X.25 port *cid1*. • In the first message the ATS-Message-Text shall contain one or more IA-5 characters that are not allowed by ICAO Annex 10, e.g. the punctuation symbol ";" and have the *conversion-with-loss-prohibited* argument set to "false", • The second message shall contain equal ATS-Message-Text, but have the *conversion-with-loss-prohibited* argument set to "true", Verify that only messages are received at the AFTN/X.25 test interface of the AMHS Test Tool, if the *conversion-with-loss-prohibited* was set to "false". In such a case, check the converted AFTN message format. In case of message rejection, verify that a NDR is generated and received by AMHS Test Tool via the transfer port *trp1* with the following values: • "conversion-not-performed" for the *non-delivery-reason-code*, and • "punctuation-symbol-loss" for the diagnostic code.
AMHS SARPs reference	3.1.2.3.5.2.1.6 c), d) and e)
Test class	Normal AMHS communications

CT409 – Reject an IPM with multiple body part

CT409	**Reject an IPM with multiple body part**
Test criteria	This test is successful, if the IUT generates a NDR, if it receives an IPM addressed to an AFTN user containing multiple body parts.
Scenario description	From the AMHS Test Tool send an ATS message (IPM) to the IUT transfer port *trp1*. The message shall contain two (or more) IA5-text body parts. Verify that a NDR is generated and received by AMHS Test Tool via the transfer port *trp1* with the following elements: • "unable-to-transfer" for the *non-delivery-reason-code*, • "content-syntax-error" for the *non-delivery-diagnostic-code*, and • "unable to convert to AFTN due to multiple body parts" for the *supplementary-information*.
AMHS SARPs reference	3.1.2.3.5.2.1.3
Test class	Erroneous AMHS parameters

CT410 – Distribute an IPM to AMHS and AFTN users

CT410	**Distribute an IPM to AMHS and AFTN users**
Test criteria	This test is successful, if the IUT distributes an IPM addressing both an AMHS and an AFTN user correctly.
Scenario description	From the AMHS Test Tool send two ATS messages (IPMs) addressing both AMHS and AFTN users to the IUT via transfer port *trp1*. • The IPM Heading of the first message shall contain two primary recipients, which are one AMHS and one AFTN user and two copy recipients, which are also one AMHS and one AFTN user. • The IPM Heading of the second message shall contain two primary recipients, which are one AMHS and one AFTN user and two blind copy recipients, which are also one AMHS and one AFTN user. The message shall have the *originator-report-request* flag set to "non-delivery-report". Verify that both messages (IPMs) are: • relayed to AMHS transfer port *trp2*, and • relayed and converted to AFTN format and transferred via the AFTN/X.25 port *cid1*. Check the messages received at the AMHS-interface. Verify that: • both messages contain an MTE with all AMHS recipient addresses and an IPM heading with all AMHS and AFTN recipients. Check the messages received at the AFTN/X.25 port. Verify that: • both messages contain the addresses of both AFTN users.
AMHS SARPs reference	3.1.2.2.1 (ATS message user agent), 3.1.2.2.2 (ATS message server), 3.1.2.3.5.2 (IPM conversion)
Test class	Normal AMHS communications

CT411 – Expand a DL addressing both AMHS and AFTN users

CT411	**Expand a DL addressing both AMHS and AFTN users**
Test criteria	This test is successful, if the IUT distributes an IPM addressing AMHS and AFTN users in a distribution list correctly.
Scenario description	From the AMHS Test Tool send two ATS messages (IPM) to the IUT transfer port *trp1*. The recipient contained in the MTE, shall address a distribution list, for which the IUT is responsible. The distribution list shall address one AMHS user and two AFTN users. The AMHS user is reachable via the AMHS transfer port *trp2* and the AFTN users are reachable via the X.25/AFTN port *cid1*. The first message shall have the *dl-expansion-prohibited* flag set to "false" and the second to "true". Check the messages received at the AMHS and X.25/AFTN interfaces of the AMHS Test Tool. Verify that only the first IPM is: • transferred via AMHS transfer port *trp2*, and • converted to AFTN format and transferred via the X.25/AFTN port *cid1*. Verify for the first IPM that: • one message is received at the AMHS-interface *trp2* containing (only) the AMHS recipient address in the MTE and the DL recipient address in the IPM heading • one AFTN message is received at the X.25/AFTN-interface containing the addresses of both AFTN users Verify for the second message that: • a NDR is returned to *trp1*.
AMHS SARPs reference	3.1.2.2.2.1.1 (DL functional group), 3.1.2.3.5.2 (IPM conversion)
Test class	Normal AMHS communications

CT412 –Split or reject an incoming IPM addressing more than 21 AFTN users

CT412	**Split or reject an incoming IPM addressing more than 21 AFTN users**
Test criteria	This test is successful, if the IUT receives an ATS message (IPM) addressing more than 21 AFTN users and a) splits the received IPM into several messages, each addressing 21 or less AFTN users if no more than 512 AFTN users are addressed, or b) rejects the received IPM and returns a NDR if more than 512 AFTN users are addressed. *Note: – With the resolution of PDR M4050004 a message with more than 21, but no more than 512 recipient addresses must not be rejected by the gateway.*
Scenario description	From the AMHS Test Tool send two ATS messages (IPM) to the IUT transfer port *trp1*. The message shall have the *originator-report-request* flag set to "non-delivery-report". • Send one IPM with 512 recipients. Verify that this message is split into 25 AFTN messages, each of the first 24 messages containing 21 addresses, the last one containing 8 addresses. • Send one IPM with 513 recipients. Verify that the IUT does <u>not</u> convert the AMHS message into AFTN format, but returns a NDR via its transfer port *trp1* with the following elements: • "unable-to-transfer" for the *non-delivery-reason-code*, • "too-many-recipients" for the *non-delivery-diagnostic-code*, and • "unable to convert to AFTN due to number of recipients" for the *supplementary-information.*
AMHS SARPs reference	3.1.2.3.5.2.1.8, PDR M4050004
Test class	Normal AMHS communications

CT413 – Remove an unknown address before conversion into AFTN format

CT413	**Remove an unknown address before conversion into AFTN format**
Test criteria	This test is successful, if the IUT that receives an ATS message (IPM) addressed to multiple AFTN users removes any unknown address before conversion.
Scenario description	From the AMHS Test Tool send an ATS message (IPM) to the IUT via AMHS transfer port *trp1*. The message shall have two (primary) recipients addressing two AFTN users. Only the AMHS address of the first AFTN user can be translated by the MTCU into a valid AFTN addressee indicator, the AMHS address of the second AFTN user is unknown and the MTCU can not find a match in its address look-up table. Check the messages received at the AMHS- and X.25/AFTN-interfaces of the AMHS Test Tool. Verify that the IUT: • converts the received AMHS message into AFTN format, removes the unknown address and sends it via the X.25/AFTN-interfaces *cid1*, • returns a NDR via transfer port *trp1* for the unknown recipient. Verify that the NDR contains the following elements (as specified in the AMHS SARPs, section 3.1.2.3.5.2.2.6.2 d): • "unable-to-transfer" for the *non-delivery-reason-code*, and • "unrecognised-OR-name" for the *non-delivery-diagnostic-code*
AMHS SARPs reference	3.1.2.3.5.2.2.6.2
Test class	Normal AMHS communications

CT414 – Convert an incoming AFTN acknowledgement

CT414	**Convert an incoming AFTN acknowledgement**
Test criteria	This test is successful, if the IUT converts an AFTN acknowledgement (SS ACK message) to a receipt notification correctly.
Scenario description	From the AMHS Test Tool send an ATS message (IPM) via AMHS test interface *trp1* to the IUT addressing a remote AFTN user reachable via the AFTN/X.25 test interface *cid1*. The IPM shall have the *receipt-notification* request flag activated and the *ATS-message-priority* shall have the value "SS". The IUT shall convert the AMHS message to an AFTN message with priority indicator "SS" and send it via the AFTN/X.25 test interface *cid1* to the AMHS Test Tool. Upon receipt of the AFTN message, the AMHS Test Tool shall return an AFTN acknowledgement to the IUT (via the AFTN/X.25 test interface *cid1*). The subject message shall refer to the received AFTN user message. The IUT shall convert this AFTN acknowledgement to an AMHS receipt notification and send it via the AMHS test interface *trp1*. Verify that the AMHS Test Tool receives a receipt notification. In particular, verify that: • the originator indicator contained in the AFTN acknowledgement is translated to the *ipn-originator* (IPN) and the *originator-name* (MTE), • the *receipt-time* of the IPN is generated from the *filing time* of the AFTN acknowledgement, • the value of the *priority* element in the MTE is set to "urgent", • the values of *subject-ipm* and *recipient-name* are inserted correctly from log entries.
AMHS SARPs reference	3.1.2.3.4.3 (conversion AFTN ACK)
Test class	Normal AMHS communications

CT415 – Incoming AFTN acknowledgement with unknown AFTN originator

CT415	**Incoming AFTN acknowledgement with unknown AFTN originator**
Test criteria	This test is successful, if the IUT informs its control position, when the AFTN acknowledgement (SS ACK message) can not be converted because the AFTN originator is unknown.
Scenario description	From the AMHS Test Tool send an ATS message (IPM) via AMHS test interface *trp1* to the IUT addressing a remote AFTN user reachable via the AFTN/X.25 test interface *cid1*. The IPM shall have the *receipt-notification* request flag activated and the *ATS-message-priority* shall have the value "SS". The IUT shall convert the AMHS message to an AFTN message with priority indicator "SS" and send it via the AFTN/X.25 test interface *cid1* to the AMHS Test Tool. Upon receipt of the AFTN message, the AMHS Test Tool shall return an AFTN acknowledgement (SS ACK) to the IUT (via the AFTN/X.25 test interface *cid1*). The subject message shall refer to the received AFTN user message, but the originator of the AFTN acknowledgement (SS ACK) message shall be unknown to the IUT, i.e. not contained in any of the IUT's conversion or address mapping tables. Check the output of the IUT at the AMHS test interfaces and the control position. Verify that the IUT does not send any IPM nor IPN via the AMHS transfer port, but reports the error situation to the control position.
AMHS SARPs reference	3.1.2.3.4.3.2.3
Test class	Erroneous AMHS parameters

CT416 – Incoming AFTN acknowledgement relating to a subject message without receipt-notification request

CT416	**Incoming AFTN acknowledgement relating to a subject message without receipt-notification request**
Test criteria	This test is successful, if the IUT encapsulates a received AFTN acknowledgement (SS ACK message) into an IPM, if the subject message did not have the receipt notification flag set.
Scenario description	From the AMHS Test Tool send an ATS message (IPM) via AMHS test interface *trp1* to the IUT addressing a remote AFTN user reachable via the AFTN/X.25 test interface *cid1*. The message shall have the *ATS-message-priority* set to "SS", however, the *receipt-notification-request* shall be deactivated. The IUT shall convert the AMHS message into an AFTN message with priority indicator "SS" and send it over the AFTN/X.25 test interface *cid1* to the AMHS Test Tool. Upon receipt of the AFTN user message the AMHS Test Tool shall return an AFTN SS acknowledgement to the IUT with the subject message relating to the previously received AFTN user message. Since the initial ATS message (IPM) did not have the *receipt-notification-request* activated, the IUT shall not convert the AFTN acknowledgement into a RN, but encapsulate the AFTN acknowledgement into an IPM, instead. Check the output of the IUT at the AMHS test interface *trp1* and the control position. Verify that the IUT sends an ATS message (IPM) with the addressed AMHS user as recipient. Verify that the message contains the original AFTN acknowledgement in the ATS-message-text of the IPM body.
AMHS SARPs reference	3.1.2.3.4.3.1.2
Test class	MHS procedural errors, Erroneous IPMS information objects

CT417 – Incoming AFTN acknowledgement without related subject message

CT417	**Incoming AFTN acknowledgement without related subject message**
Test criteria	This test is successful, if the IUT encapsulates a received AFTN acknowledgement (SS ACK message) into an IPM, if the subject message did not pass the gateway before.
Scenario description	From the AMHS Test Tool send an AFTN acknowledgement (SS ACK message) via the AFTN/X.25 test interface *cid1* to the IUT addressing an AMHS user. The AFTN acknowledgement shall have a fictitious origin subject message in the message text. Check the output of the IUT at the AMHS transfer port and the control position. Verify that the IUT sends an IPM with the addressed AMHS user as recipient. Verify that the IPM contains the original AFTN acknowledgement in the ATS-message-text of the IPM body.
AMHS SARPs reference	3.1.2.3.4.3.1.1
Test class	MHS procedural errors , Erroneous IPMS information objects

CT418 – Convert an AFTN SVC "Unknown Addressee Indicator" to a NDR

CT418	**Convert an AFTN SVC "Unknown Addressee Indicator" to a NDR**
Test criteria	This test is successful, if the IUT converts a received AFTN service message (SVC) of type "Unknown Addressee Indicator" to a NDR correctly.
Scenario description	From the AMHS Test Tool send an ATS message (IPM) via AMHS test interface *trp1* to the IUT addressing a remote AFTN user reachable via the AFTN/X.25 test interface *cid1*. The IUT shall convert the IPM to an AFTN user message and send it over AFTN/X.25 test interface *cid1* to the AMHS Test Tool. Upon receipt of the AFTN user message the AMHS Test Tool shall return an AFTN service message of type "Unknown Addressee Indicator" to the IUT that relates to the formerly received message. The IUT shall convert this AFTN service message to a NDR. Verify that a NDR is generated (as specified in the AMHS SARPs, section 3.1.2.3.4.4) and received by AMHS Test Tool via the AMHS test interface *trp1* with the following elements: • for the report-destination-name the *originator-name* of the subject AMHS message, for the subject-identifier the *message-identifier* of the subject AMHS message, for the actual-recipient-name the *unknown addressee indicator* reported with the SVC, "unable-to-transfer" for the *non-delivery-reason-code*, and • "unrecognised-OR-name" for the *non-delivery-diagnostic-code*.
AMHS SARPs reference	3.1.2.3.4.4 (conversion AFTN SVC unknown)
Test class	Normal AMHS communications

CT419 – Incoming AFTN SVC "Unknown Addressee Indicator" without related subject message

CT419	**Incoming AFTN SVC "Unknown Addressee Indicator" without related subject message**
Test criteria	This test is successful, if the IUT encapsulates a received AFTN service message (SVC) of type "Unknown Addressee Indicator" into an IPM, if the subject message did not pass the gateway before.
Scenario description	From the AMHS Test Tool send an AFTN service message of type "Unknown Addressee Indicator" to the IUT addressing an AMHS user. The AFTN service message shall have a fictitious origin subject message in the message text. Check the output of the IUT at the AMHS transfer port. Verify that the IUT sends an IPM with the addressed AMHS user as recipient. Verify that the IPM contains the original AFTN SVC in the IPM body (ATS-message-text).
AMHS SARPs reference	3.1.2.3.4.4.1.1 b)
Test class	Normal AMHS communications

CT420 – Processing of an incoming SVC QTA RPT Message

CT420	**Processing of an incoming SVC QTA RPT Message**
Test criteria	This test is successful, if the IUT sends an AFTN user message a second time, if it receives an SVC QTA RPT message.
Scenario description	From the AMHS Test Tool send an ATS message (IPM) to the IUT addressing an AFTN user. The IUT shall convert the message into AFTN format and send it over the AFTN/X.25 test interface to the AMHS Test Tool. Upon receipt of the AFTN user message the AMHS Test Tool shall return an AFTN service message of type QTA RPT related to the previously received AFTN message. Verify that the IUT does not translate the AFTN service message into an IPM, but processes the QTA RPT so that the previous message is sent to the AFTN user (automatically or by operator intervention) a second time.
AMHS SARPs reference	3.1.2.3.2.1.12
Test class	Normal AMHS communications

CT421 – Probe Conveyance Test

CT421	**Probe Conveyance Test**
Test criteria	This test is successful, if the IUT (receiving a probe with an AFTN user as intended recipient) generates a DR, if conversion to AFTN is possible or an NDR, if conversion to AFTN is not possible.
Scenario description	From the AMHS Test Tool send a sequence of AMHS probes to the IUT. • Probe 1 shall specify a content-length of 1800 and address an AFTN user recipient reachable via the AMHS/AFTN gateway. • Probe 2 shall specify a content-length of 1800 and address an AFTN user recipient, which is routed by the IUT via the gateway (MTCU), but which can not be mapped onto a valid AFTN address by the MTCU. • Probe 3 shall specify a content-length of 1800 and address two AFTN user recipients, one which can be mapped and one which can not be mapped onto a valid AFTN address. • Probe 4 shall specify a content-length of 10.000 and address an AFTN user recipient reachable via the AFTN/AMHS gateway. • Probe 5 shall specify a content-length of 100.000 and address an AFTN user recipient reachable via the AFTN/MHS gateway. • Probe 6 shall have a recipient argument addressing 512 AFTN users. • Probe 7 shall have a recipient argument addressing more than 512 AFTN users. Check the messages received at the AMHS Test Tool-AMHS interface. Verify that the IUT returns a report for each probe. Check the report contents and determine if it is a DR, NDR or combined report: • A DR shall be returned in response to probe 1. • A NDR shall be returned in response to probe 2. • A DR and NDR (one combined report or two reports) shall be returned in response to probe 3. • Depending on the gateway's capabilities, a DR or NDR shall be returned for probe 4 and 5. • A DR shall be returned for Probe 6. • A NDR shall be returned for Probe 7.
AMHS SARPs reference	3.1.2.3.5.5 (reception of AMHS probe), PDR M4050004, PDR M601003
Test class	Normal AMHS communications

CT422 – Reject an IPM with unsupported content-type

CT422	**Reject an IPM with unsupported content-type**
Test criteria	This test is successful, if the IUT's gateway component rejects an incoming message of content-type other than IPM 88 and generates a NDR.
Scenario description	From the AMHS Test Tool send a sequence of messages to the IUT via transfer port *trp1* addressed to an AFTN user recipient. The messages shall have different values for the content-type contained in the MTE. • The 1st message shall contain a *built-in content-type* value "interpersonal-messaging-1988(22)". • The 2nd message shall contain a *built-in content-type* value "interpersonal-messaging-1984(2)". • The 3rd message shall contain a *built-in content-type* value "edi-messaging(35)". • The 4th message shall contain a *built-in content-type* value "unidentified(0)". All messages shall contain an IPM body with ATS-message-header and ATS-message-text.[13] Verify that the IUT accepts and converts the 1st message, but rejects 2nd, the 3rd and 4th message. Verify that the IUT returns a NDR for the 2nd, 3rd and 4th message containing: • "unable-to-transfer" for the *non-delivery-reason-code*, and • "content-type-not-supported" for the *non-delivery-diagnostic-code*.
AMHS SARPs reference	3.1.2.3.5.1.1
Test class	Normal AMHS communications, Erroneous AMHS parameters

[13] It is assumed that MTAs on the relay path do not verify the specified content-type against the contained body part(s) and transfer all type of messages towards the gateway (MTCU).

CT423 – Processing of the original-encoded-information-types (EIT)

CT423	**Processing of the original-encoded-information-types (EIT)**
Test criteria	This test is successful, if the IUT's gateway component evaluates the original-encoded-information-types contained in the incoming ATS message and: • accepts (and converts) the message, if it contains one of those values specified in section 3.1.2.3.5.2.1.1 of the AMHS SARPs, or • rejects the message, if it does not contain any of those values and generates a NDR.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp1* to the IUT addressing an AFTN user. The messages shall have the following values for the *original-encoded-information-types* (EIT) contained in the Message Transfer Envelope (MTE) • The 1st message shall contain *built-in-encoded-information-types* with value "IA5-text(2)". • The 2nd message shall contain *built-in-encoded-information-types* with value "unknown(0)". • The 3rd message shall contain *extended-encoded-information-types* with OID "2.6.3.4.2" for IA5-text information types. • The 4th message shall contain *extended-encoded-information-types* with OID "2.6.3.4.0" for unknown information types. • The 5th message shall contain *extended-encoded-information-types* with OID {id-cs-eit-authority 1}. • The 6th message shall contain *extended-encoded-information-types* with OID {id-cs-eit-authority 1} and OID {id-cs-eit-authority 6}. • The 7th message shall contain *extended-encoded-information-types* with OID {id-cs-eit-authority 1}, OID {id-cs-eit-authority 6} and OID {id-cs-eit-authority 100}. • The 8th message shall contain *extended-encoded-information-types* with (invalid) OID {id-cs-eit-authority 3}. • The 9th message shall contain *extended-encoded-information-types* with OID {id-cs-eit-authority 1}, OID {id-cs-eit-authority 6} and (invalid) OID {id-cs-eit-authority 7}. • The 10th message shall contain *built-in-encoded-information-types* with value "IA5-text(2)" and *extended-encoded-information-types* with OID "2.6.3.4.2" for IA5-text as well as OID {id-cs-eit-authority 1} and OID {id-cs-eit-authority 6}.

	The messages shall contain a body part corresponding to the (first valid) *original-encoded-information-types* value. Verify that all messages with valid EIT argument are accepted by the IUT's gateway component, converted to AFTN format and received at the AFTN/X.25 test interface of the AMHS Test Tool. Verify that all messages with any invalid EIT argument are rejected by the IUT and a NDR is returned via transfer port *trp1* with the following elements: • "unable-to-transfer" for the *non-delivery-reason-code*, and • "encoded-information-types-unsupported" for the *non-delivery-diagnostic-code.*
AMHS SARPs reference	3.1.2.3.5.2.1.1
Test class	Normal AMHS communications and Erroneous AMHS parameters

CT 424 – Incoming IPM with extended body part of type "IA5-text-body-part"

CT424	**Incoming IPM with extended body part of type "IA5-text-body-part"**
Test criteria	This test is successful, if the IUT's gateway component accepts a received ATS message (IPM) with extended body part of type "IA5-text-body-part" and converts the IPM into AFTN format correctly.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp1* to the IUT addressing an AFTN user. • The first message shall contain an extended body part of type "IA5-text-body-part", which includes an ATS-message-header and ATS-message-text with IA5-text characters. The *original-encoded-information-types* attribute shall contain *extended-encoded-information-types* with OID "2.6.3.4.2" (IA5-text). • The second message shall be equal except for the *original-encoded-information-types*, which has a built-in value for IA5-text(2)[14]. • The third message shall be equal to the first, but the *repertoire* argument in the body shall be different from IA5(5). • The fourth message shall be equal to the first, but the body part data shall contain characters different from IA5String, e.g. special characters of local language – as in German "ä", "ö" and "ü" or in French "é". Verify that the first and second message are accepted by the IUT's gateway component, converted to AFTN format and received at the AFTN/X.25 test interface of the AMHS Test Tool. Check whether the other messages are converted into AFTN format or rejected by the IUT. In case of rejection, verify that an NDR is returned via transfer port *trp1* with the following elements: • "unable-to-transfer" for the *non-delivery-reason-code,* • "content-syntax-error" for the *non-delivery-diagnostic-code,* and • "unable to convert to AFTN due to unsupported body part type" for the *supplementary-information.*
AMHS SARPs reference	3.1.2.3.5.2.1.4 a) 2)
Test class	Normal AMHS communications

[14] It is assumed that an extended IA5-text-body-part can be associated with either a built-in EIT or extended EIT value for IA5-text.

CT425 – Incoming IPM with extended body part type "general-text-body-part" and ISO 646 repertoire

CT425	**Incoming IPM with extended body part type "general-text-body-part" and ISO 646 repertoire**
Test criteria	This test is successful, if the IUT's gateway component accepts a received ATS message (IPM) with extended body part type "general-text-body-part" of which the repertoire set description is Basic (ISO 646) and converts the IPM into AFTN format correctly.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp1* to the IUT addressing an AFTN user recipient. All messages shall contain an extended body part of type "general-text-body-part", which includes an ATS-message-header and ATS-message-text with general-text data. The *original-encoded-information-types* shall be set to *extended-encoded-information-types* with OID {id-cs-eit-authority 1} and OID {id-cs-eit-authority 6}. The message text (data part) shall include ISO 646 (US-ASCII) characters, only. The parameter argument in the IPM body part shall specify the following character sets: • The 1st message shall contain character set registration numbers 1 and 6, which specify the Basic ISO 646 repertoire. • The 2nd message shall contain character set registration numbers 1 and 5. • The 3rd message shall contain character set registration numbers 2 and 5. • The 4th message shall contain an empty set of character registration. The message text (data part) shall include ISO 646 (US-ASCII – see Table 13) characters, only. Verify that only the first message is accepted by the IUT's gateway component, converted to AFTN format and received at the X.25/AFTN interface of the AMHS Test Tool. Analyze the received AFTN messages with respect to the AFTN message text. Verify that all other messages are rejected by the IUT and an NDR is returned via transfer port *trp1* with the following elements: • "unable-to-transfer" for the *non-delivery-reason-code,* • "content-syntax-error" for the *non-delivery-diagnostic-code,* and • "unable to convert to AFTN due to unsupported body part type" for the *supplementary-information.*
AMHS SARPs reference	3.1.2.3.5.2.1.4 a) 3)
Test class	Normal AMHS communications and Erroneous AMHS parameters

20	21 !	22 "	23 #	24 $	25 %	26 &	27 '	28 (	29)	2A *	2B +	2C ,	2D -	2E .	2F /
30 0	31 1	32 2	33 3	34 4	35 5	36 6	37 7	38 8	39 9	3A :	3B ;	3C <	3D =	3E >	3F ?
40 @	41 A	42 B	43 C	44 D	45 E	46 F	47 G	48 H	49 I	4A J	4B K	4C L	4D M	4E N	4F O
50 P	51 Q	52 R	53 S	54 T	55 U	56 V	57 W	58 X	59 Y	5A Z	5B [	5C \	5D]	5E ^	5F _
60 `	61 a	62 b	63 c	64 d	65 e	66 f	67 g	68 h	69 i	6A j	6B k	6C l	6D m	6E n	6F o
70 p	71 q	72 r	73 s	74 t	75 u	76 v	77 w	78 x	79 y	7A z	7B {	7C |	7D }	7E ~	

Table 13: The ISO 646 (US-ASCII) character set

CT426 – Incoming IPM with extended body part type "general-text-body-part" and ISO 8859-1 repertoire

CT426	**Incoming IPM with extended body part type "general-text-body-part" and ISO 8859-1 repertoire**
Test criteria	This test is successful, if the IUT's gateway component processes a received ATS message (IPM) with extended body part type "general-text-body-part" of which the repertoire set description is Basic-1 (ISO 8859-1) according to its local AMHS Management Domain policy. *Note. – Depending on the local policy of the AMHS Management Domain a received message with extended body part type "general-text-body-part" of which the repertoire set description is Basic-1 (ISO 8859-1) can be converted or rejected.*
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp1* to the IUT addressing an AFTN user recipient. All messages shall contain an extended body part of type "general-text-body-part", which includes an ATS-message-header and ATS-message-text with general-text data. The *original-encoded-information-types* shall be set to *extended-encoded-information-types* with OID {id-cs-eit-authority 1}, OID {id-cs-eit-authority 6} and OID {id-cs-eit-authority 100}. The message text (data part) shall include ISO 8859-1 characters (Latin-1, Western Europe – see Table 14). The parameter argument in the IPM body part shall specify the following character sets: • The 1st message shall contain character set registration numbers 1, 6 and 100 which specify the ISO 8859-1 repertoire. • The 2nd message shall contain character set registration numbers 1 and 6, which specify the Basic ISO 646 repertoire. • The 3rd message shall contain an empty set of character registration. The characters used in the message text (data part) shall be equal for all messages. Check, if the messages are converted or rejected by the IUT according to its local policy. In case of conversion, analyze the received AFTN messages with respect to the characters contained in the AFTN message text. In case of message rejection, check, if the NDR returned via transfer port *trp1* contains the following elements: • "unable-to-transfer" for the *non-delivery-reason-code*, • "content-syntax-error" for the *non-delivery-diagnostic-code*, and • "unable to convert to AFTN due to unsupported body part type" for the *supplementary-information*.

AMHS SARPs reference	3.1.2.3.5.2.1.4 a) 4) 3.1.2.3.5.2.1.4 b)
Test class	Normal AMHS communications and Erroneous AMHS parameters

A0	A1 ¡	A2 ¢	A3 £	A4 ¤	A5 ¥	A6 ¦	A7 §	A8 ¨	A9 ©	AA ª	AB «	AC ¬	AD	AE ®	AF ¯
B0 °	B1 ±	B2 ²	B3 ³	B4 ´	B5 µ	B6 ¶	B7 ·	B8 ¸	B9 ¹	BA º	BB »	BC ¼	BD ½	BE ¾	BF ¿
C0 À	C1 Á	C2 Â	C3 Ã	C4 Ä	C5 Å	C6 Æ	C7 Ç	C8 È	C9 É	CA Ê	CB Ë	CC Ì	CD Í	CE Î	CF Ï
D0 Ð	D1 Ñ	D2 Ò	D3 Ó	D4 Ô	D5 Õ	D6 Ö	D7 ×	D8 Ø	D9 Ù	DA Ú	DB Û	DC Ü	DD Ý	DE Þ	DF ß
E0 à	E1 á	E2 â	E3 ã	E4 ä	E5 å	E6 æ	E7 ç	E8 è	E9 é	EA ê	EB ë	EC ì	ED í	EE î	EF ï
F0 ð	F1 ñ	F2 ò	F3 ó	F4 ô	F5 õ	F6 ö	F7 ÷	F8 ø	F9 ù	FA ú	FB û	FC ü	FD ý	FE þ	FF ÿ

Table 14: The ISO 8859-1 character set

4.5 Gateway Operations (AFTN to AMHS)

CT501 – Convert an AFTN user message to AMHS format

CT501	**Convert an AFTN user message to AMHS format**
Test criteria	This test is successful, if the IUT converts an AFTN user message to an AMHS message (IPM) correctly.
Scenario description	From the AMHS Test Tool send a sequence of AFTN user messages over the AFTN/X.25 test interface to the IUT. The sequence of AFTN user messages shall address a remote AMHS user and consist of five messages, one for each AFTN priority, i.e. SS, DD, FF, GG, KK. The filing time shall be different for each message and the OHI field shall be empty for all messages[15]. Check the IPMs that the AMHS Test Tool receives from the IUT via the AMHS transfer port. Verify that the IUT has converted the messages correctly according to Table 3.1.2-8 of the AMHS SARPs – see section 3.1.2.3.4.2. Check message envelopes and contents. In particular, verify that: • the *ATS-message-header* and *ATS-message-text* in the IPM body part has the correct format, • the AFTN message text is correctly inserted in the *ATS-message-text* field, • the AFTN message priority is correctly inserted in the *ATS-message-priority* field, • that the IUT has translated the AFTN priority indicator and inserted the correct priority in the message transfer envelope (MTE) – see • Table 15, • the addressee indicator is correctly translated in the corresponding AMHS OR address and entered as *primary-recipient* in the IPM heading and as *recipient-name* in the MTE, • the AFTN originator is translated in the AMHS OR address which was registered for identification of the AFTN originator in the AMHS and allocated to the elements *originator* (MTE), *originator-name* and the sub-component user of the element *this-IPM* (IPM heading), • the filing time is correctly inserted in the *ATS-message-header*.
AMHS SARPs reference	3.1.2.3.4.2
Test class	Normal AMHS communications

[15] Conversion of the optional-heading-information element is subject to another test.

AFTN Priority Indicator	AMHS MTE priority	AMHS ATS-Message-Priority priority-indicator
SS	Urgent	SS
DD	Normal	DD
FF	Normal	FF
GG	non-urgent	GG
KK	non-urgent	KK

Table 15: Mapping of AFTN Priority Indicator for the Basic ATS Message Handling Service[16]

[16] The mapping of the AFTN priority indicator is specified in table 3.1.2-7 of the AMHS SARPs

CT502 – Convert an AFTN user message containing optional heading information

CT502	**Convert an AFTN user message containing optional heading information**
Test criteria	This test is successful, if the IUT converts an AFTN user message containing optional heading information (OHI) correctly into an AMHS message (IPM).
Scenario description	From the AMHS Test Tool send a sequence of AFTN user messages over the AFTN/X.25 test interface to the IUT. The sequence of AFTN user messages shall address a remote AMHS user and consist of • a normal (non-SS) priority AFTN message containing (short) OHI text, • a normal (non-SS) priority AFTN message containing OHI filling the originator line, • an SS priority AFTN message containing (short) OHI text, • an SS priority AFTN message containing OHI filling the originator line. Check the IPMs transferred via the AMHS transfer port. Verify that the IUT has converted the messages correctly. Check envelopes and contents. In particular, verify the correct format of the ATS-message-header.
AMHS SARPs reference	3.1.2.3.4.2.1.6
Test class	Normal AMHS communications

CT503 – Generate an AFTN service message of the type "Unknown Addressee Indicator"

CT503	**Generate an AFTN service message of the type "Unknown Addressee Indicator"**
Test criteria	This test is successful, if the IUT returns an AFTN service message of the type "Unknown Addressee Indicator", if the translation of addressee indicator fails.
Scenario description	From the AMHS Test Tool send an AFTN messages over the AFTN/X.25 test interface to the IUT. The AFTN message shall contain an addressee indicator which can not be mapped by the IUT. Verify that the IUT does not convert the received AFTN message into an AMHS message (IPM), but returns an AFTN service message of the type "Unknown Addressee Indicator" over the AFTN/X.25 test interface.
AMHS SARPs reference	3.1.2.3.5.4 (NDR conversion)
Test class	Normal AMHS communications

CT504 – Incoming AFTN user message with unknown originator indicator

CT504	**Incoming AFTN message with unknown originator indicator**
Test criteria	This test is successful, if the IUT informs its control position, if during the conversion process the translation of the originator indicator fails.
Scenario description	From the AMHS Test Tool send an AFTN messages over the AFTN/X.25 test interface to the IUT. The AFTN message shall contain an originator indicator which is unknown in the IUT. Verify that the IUT does not send any message via the X.25/AFTN or AMHS interface but informs its control position that the gateway is not able to translate the originator indicator.
AMHS SARPs reference	3.1.2.3.4.2.1.4.1
Test class	Erroneous AMHS parameters

CT505 – Convert a receipt notification

CT505	**Convert a receipt notification**
Test criteria	This test is successful, if the IUT converts a received IPN containing a receipt notification (RN) to an AFTN acknowledgement correctly.
Scenario description	From the AMHS Test Tool send an AFTN user message with priority "SS" via the AFTN/X.25 test interface to the IUT. The message shall address an AMHS user and be converted by the IUT into AMHS format and sent as an IPM to the AMHS Test Tool via transfer port *trp1*. Upon receipt of the IPM the AMHS Test Tool returns a RN. Verify that the IUT converts the received RN correctly into an AFTN acknowledgement. In particular, verify that: • the *originator-name* is translated into the *Originator Indicator* of the AFTN acknowledgement, the *receipt-time* forms the *Filing Time* of the AFTN acknowledgment, logged elements of the previously handled *subject AFTN message* are used and inserted correctly into the AFTN acknowledgment.
AMHS SARPs reference	3.1.2.3.5.3 (RN conversion),
Test class	Normal AMHS communications

CT506 – Incoming non-receipt notification

CT506	**Incoming non-receipt notification**
Test criteria	This test is successful, if the IUT reports to its control position and stores the message, if it receives an IPN containing a NRN addressed to an AFTN user.
Scenario description	From the AMHS Test Tool send an AFTN message with priority "SS" via the AFTN/X.25 test interface to the IUT. The message shall address an AMHS user and be converted by the IUT into AMHS format and sent to the AMHS Test Tool via transfer port *trp1*. Upon receipt of the AMHS message the AMHS Test Tool returns a NRN. Verify that the IUT behaves as specified in the AMHS SARPs, section 3.1.2.3.5.1.2, i.e. • logs the error situation and reports to a control position, and • stores the message for appropriate processing at the control position.
AMHS SARPs reference	3.1.2.3.5.1.2 c) (processing of NRN)
Test class	Erroneous AMHS parameters

CT507 – Generate a NDR as a result of misrouted RN

CT507	**Generate a NDR as a result of misrouted RN**
Test criteria	This test is successful, if the IUT rejects a misrouted IPN containing a receipt notification (RN) and returns a NDR.
Scenario description	From the AMHS Test Tool send a RN to the IUT via transfer port trp1 addressed to an AFTN user. The RN contains a fictitious value for the subject-ipm (subject AFTN message) and is not related to any message that had previously passed the IUT. Verify that the IUT does not transfer any AFTN acknowledgement over the AFTN/X.25 test interface to the AMHS Test Tool, but generates a NDR and sends it via the transfer port *trp1* to the AMHS Test Tool. Verify that the NDR contains the following elements as specified in the AMHS SARPS, section 3.1.2.3.5.3.1.1: • "unable-to-transfer" for the *non-delivery-reason-code*; • "invalid-arguments" for the *non-delivery-diagnostic-code*; and • "unable to convert RN to AFTN ACK service message due to misrouted RN" for the *supplementary-information*.
AMHS SARPs reference	3.1.2.3.5.3.1.1
Test class	MHS procedural errors

CT508 – Convert a non-delivery report (NDR)

CT508	**Convert a non-delivery report (NDR)**
Test criteria	This test is successful, if the IUT converts a received NDR with a *non-delivery-diagnostic-code* of the value “unrecognised-OR-name” to an AFTN service message (SVC) of the type “Unknown Addressee”.
Scenario description	From the AMHS Test Tool send an AFTN message via the AFTN/X.25 test interface to the IUT. The message shall address an AMHS user and be converted by the IUT into AMHS format and sent to the AMHS Test Tool via transfer port *trp1*. The AMHS Test Tool shall return a NDR related to the received message and with a *non-delivery-diagnostic-code* of the value “unrecognised-OR-name”. Verify that the IUT converts the received NDR into an AFTN service message (SVC) and sends it over the AFTN/X.25 test interface to the AMHS Test Tool. In particular, verify that: • the *actual-recipient-name* elements (provided with the *per-recipient-fields* in the Report Transfer Content) are converted into AFTN addresses which form the *unknown-addressee-indicators* in the text of the AFTN SVC, priority indicator, addressee indicator, origin and the first-address-line of the subject message are taken from log entries made for the handled subject message, and the filing time is generated correctly by the gateway component of the IUT. • the originator indicator of the service message is the AFTN Address of the AFTN Component of the AFTN/AMHS Gateway
AMHS SARPs reference	3.1.2.3.5.4 (NDR conversion), 3.1.2.3.5.4.2.7
Test class	Normal AMHS communications

CT509 – NDR conversion process failures

CT509	**NDR conversion process failures**
Test criteria	This test is successful, if the IUT reports to its control position, whenever an error occurs in the NDR conversion process.
Scenario description	From the AMHS Test Tool send three AFTN messages via the X.25/AFTN interface to the IUT. The messages shall address an AMHS user and be converted by the IUT into AMHS format and sent to the AMHS Test Tool via transfer port *trp1*. The AMHS Test Tool shall return a NDR for each received message. • The 1st NDR shall contain a *non-delivery-diagnostic-code* different from "unrecognised-OR-name".The 2nd NDR shall contain an unknown address in the *actual-recipient-name* element. • The 3rd NDR shall refer to a fictitious subject message that did not pass the gateway before. Check the output of the IUT at the control position. Verify that for each NDR the IUT behaves as specified in the relevant sections of the AMHS SARPs, i.e. • logs the non-delivery situation and reports to a control position, and • stores the non-delivery report for appropriate processing at the control position.
AMHS SARPs reference	3.1.2.3.5.4.1.1, 3.1.2.3.5.4.1.3
Test class	Erroneous AMHS parameters

4.6 Naming and Addressing

CT601 – Address conversion from AMHS CAAS- and XF-addresses to AFTN addresses

CT601	**Address conversion from AMHS CAAS- and XF-addresses to AFTN addresses**
Test criteria	This test is successful, if the IUT when converting an AMHS message (IPM) to an AFTN message translates the originator and recipient addresses to the AFTN originator indicator and addressee indicators correctly. Conversion shall be correct for both types, i.e. CAAS and XF-addresses. *Note:- The test cases in which the address conversion AMHS-AFTN-AMHS leads to asymmetric results are covered in CT607.*
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer ports *trp1*, *trp2* and *trp3* to the IUT, addressing different AFTN users reachable via the AFTN/X.25 port *cid1*. • The 1st ATS message shall be sent via MTA-1 with originator from AMHSLAND-1 addressing an AFTN user in AFTNLAND-1. Note that both PRMDs (AMHSLAND-1 and AFTNLAND-1) implement the CAAS with one single organisation-name value for all location indicators within the PRMD. • The 2nd ATS message shall be sent via MTA-2 with originator from AMHSLAND-2 addressing an AFTN user in AFTNLAND-2. Note that both PRMDs (AMHSLAND-2 and AFTNLAND-2) implement the CAAS with multiple organisation-name values for different sets of location indicators within the PRMD. • The 3rd ATS message shall be sent via MTA-3 with originator from AMHSLAND-3 addressing an AFTN user in AFTNLAND-3. Note that both PRMDs (AMHSLAND-3 and AFTNLAND-3) implement the XF addressing scheme. • The 4th ATS message shall be sent via MTA-1 with originator from AMHSLAND-1 addressing three AFTN users, one in AFTNLAND-1, one in AFTNLAND-2 and one in AFTNLAND-3. All messages shall have an IA5-text body part with ATS-message-header. The implicit-conversion-prohibited attribute in the MTE shall be set to “false”. Originator and recipient addresses in the IPM heading shall be equal to those in the MTE or empty[17]. Check the messages received at the X.25/AFTN interface. Verify that the IUT was able to map all AMHS O/R addresses to AFTN addresses. Verify the correct AFTN originator indicator and addressee indicator in the received AFTN messages.

[17] Originator and recipient addresses in the IPM heading may be empty. According to SARPs 3.1.2.3.5.2.3 “Use of IPM elements” those addresses are discarded by the MTCU.

AMHS SARPs reference	3.1.2.1.5 (Naming and Addressing Principles) 3.1.2.3.5.2.2.6.1 (Generation of the AFTN originator indicator) 3.1.2.3.5.2.2.6.2 (Generation of the AFTN addressee indicator)
Test class	Normal AMHS communications

CT602 – Address conversion from AFTN addresses to AMHS CAAS- and XF-addresses

CT602	**Address conversion from AFTN addresses to AMHS CAAS- and XF-addresses**
Test criteria	This test is successful, if the IUT that converts an AFTN user message to AMHS translates the AFTN originator indicator and all addressee indicators into correct AMHS addresses, which may be either XF- or CAAS addresses.
Scenario description	From the AMHS Test Tool send a sequence of AFTN user messages over the AFTN/X.25 port *cid1* to the IUT addressing different AMHS users reachable via the AMHS transfer ports *trp1, trp2* and *trp3*. • The 1st AFTN user message shall be sent with originator from AFTNLAND-1 addressing an AMHS user in AMHSLAND-1. Note that both PRMDs (AFTNLAND-1 and AMHSLAND-1) implement the CAAS with one single organisation-name value for all location indicators within the PRMD. • The 2nd AFTN user message shall be sent with originator from AFTNLAND-2 addressing an AMHS user in AMHSLAND-2. Note that both PRMDs (AFTNLAND-2 and AMHSLAND-2) implement the CAAS with multiple organisation-name values for different sets of location indicators within the PRMD. • The 3rd AFTN user message shall be sent with originator from AFTNLAND-3 addressing an AMHS user in AMHSLAND-3. Note that both PRMDs (AFTNLAND-3 and AMHSLAND-3) implement the XF addressing scheme. • The 4th AFTN user message shall be sent with originator from AFTNLAND-1 addressing three AMHS users, one in AMHSLAND-1, one in AMHSLAND-2 and one in AMHSLAND-3. Check the messages received at AMHS transfer ports *trp1, trp2* and *trp3*. Verify that the IUT was able to map all AFTN originator and addressee indicators to AMHS O/R addresses. Verify the correct AMHS O/R addresses in the originator and recipient fields of both MTE and IPM headings.
AMHS SARPs reference	3.1.2.1.5 (Naming and Addressing Principles) 3.1.2.3.4.2.1.4.1 (Translation of the AFTN originator indicator) 3.1.2.3.4.2.1.4.2 (Translation of the AFTN addressee indicator)
Test class	Normal AMHS communications

CT603 – Reject an IPM with invalid recipient address (CAAS)

CT603	**Reject an IPM with invalid recipient address (CAAS)**
Test criteria	This test is successful, if the IUT generates a NDR, when it receives an ATS message (IPM) that contains a recipient address of type CAAS which can not be mapped to a valid AFTN addressee indicator.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp1* to the IUT addressing an AFTN user in the PRMD "AFTNLAND-1" that implements the CAAS. All messages shall have a valid originator address and an erroneous recipient address in the MTE. Originator and recipient addresses in the IPM heading shall be equal to those in the MTE or empty[18]. • The 1st ATS message shall contain a recipient address with an invalid *common-name* attribute, that contains 9 letters, e.g. "BAAAFTABC". • The 2nd ATS message shall contain a recipient address with an invalid *common-name* attribute, that contains only 6 letters, e.g. "BAAAFT". • The 3rd ATS message shall contain a recipient address with a valid *organizational-unit-names* attribute "BAAA", but an empty *common-name* attribute. • The 4th ATS message shall contain a recipient address with a valid *common-name* attribute "BAAAFTAA", but an empty *organizational-unit-names* attribute. • The 5th ATS message shall contain a recipient address with a valid *common-name* attribute "BAAAFTAA", but an *organizational-unit-names* attribute that is different from the first 4 letters of the *common-name* attribute, e.g. "BAAX". • The 6th ATS message shall contain a recipient address with a valid *common-name* attribute "BAAAFTAA", and correct *organizational-unit-names* attribute "BAAA" but an empty *organization-name* attribute. Verify that for each message a NDR is generated by the IUT with the following elements: • "unable-to-transfer" for the *non-delivery-reason-code*, and • "unrecognised-OR-name" for the non-delivery-diagnostic-code.
AMHS SARPs reference	3.1.2.3.5.2.2.6.1 (Generation of the AFTN originator indicator) 3.1.2.3.5.2.2.6.2 (Generation of the AFTN addressee indicator)
Test class	Erroneous AMHS parameters

[18] Originator and recipient addresses in the IPM heading may be empty. According to SARPs 3.1.2.3.5.2.3 "Use of IPM elements" those addresses are discarded by the MTCU.

CT604 – Reject an IPM with invalid recipient address (XF like)

CT604	**Reject an IPM with invalid recipient address (XF like)**
Test criteria	This test is successful, if the IUT generates a NDR, when it receives an ATS message (IPM) that contains a recipient address of type XF which can not be mapped to a valid AFTN addressee indicator.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp1* to the IUT addressing an AFTN user in the PRMD "AFTNLAND-3" that implements the XF addressing scheme. All messages shall have a valid originator address and an erroneous recipient address in the MTE. Originator and recipient addresses in the IPM heading shall be equal to those in the MTE or empty[19]. • The 1st ATS message shall contain a recipient address with the value "AFTN" in the *organization-name* attribute, but an invalid *organizational-unit-names* attribute, e.g. value "BCAAFTABC". • The 2nd ATS message shall contain a recipient address with the value "AFTN" in the *organization-name* attribute, but an invalid *organizational-unit-names* attribute, e.g. value "BCAAFT". • The 3rd ATS message shall contain a recipient address with the value "AFTN" in the *organization-name* attribute, but an empty *organizational-unit-names* attribute. • The 4th ATS message shall contain an originator address with an empty *organizational-name* attribute and a valid *organizational-unit-names* attribute, e.g. "BCAAFTAA". • The 5th ATS message shall contain an originator address with an invalid organization-name attribute, e.g. "ATFM" and a valid organizational-unit-names attribute, e.g. value "BCAAFTAA" Verify that for each message a NDR is generated by the IUT with the following elements: • "unable-to-transfer" for the *non-delivery-reason-code*, and • "unrecognised-OR-name" for the *non-delivery-diagnostic-code*.
AMHS SARPs reference	3.1.2.3.5.2.2.6.1 (Generation of the AFTN originator indicator) 3.1.2.3.5.2.2.6.2 (Generation of the AFTN addressee indicator)
Test class	Erroneous AMHS parameters

[19] Originator and recipient addresses in the IPM heading may be empty. According to SARPs 3.1.2.3.5.2.3 "Use of IPM elements" those addresses are discarded by the MTCU.

CT605 – Reject an IPM with invalid originator address (CAAS like)

CT605	**Reject an IPM with invalid originator address (CAAS like)**
Test criteria	This test is successful, if the IUT generates a NDR, when it receives an ATS message (IPM) that contains an originator address of type CAAS which can not be mapped to a valid AFTN originator indicator.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp1* to the IUT addressing an AFTN user reachable via the AFTN/X.25 port *cid1*. All messages shall be originated from the PRMD "AMHSLAND-1" which implements the CAAS. They shall have a valid recipient address for the PRMD "AFTNLAND-1", but an erroneous originator address in the MTE. Originator and recipient addresses in the IPM heading shall be equal to those in the MTE or empty[20]. • The 1st ATS message shall contain an originator address with an invalid *common-name* attribute, e.g. "AAAAMHABC". • The 2nd ATS message shall contain an originator address with an invalid *common-name* attribute that contains only 6 letters, e.g. "AAAAMH". • The 3rd ATS message shall contain an originator address with a valid *organizational-unit-names* attribute "AAAA", but an empty *common-name* attribute. • The 4th ATS message shall contain an originator address with a valid *common-name* attribute "AAAAMHAA", but an empty *organizational-unit-names* attribute. • The 5th ATS message shall contain an originator address with a valid *common-name* attribute "AAAAMHAA", but an *organizational-unit-names* attribute that is different from the first 4 letters of the *common-name* attribute, e.g. "AAAX". • The 6th ATS message shall contain an originator address with a valid common-name attribute "AAAAMHAA" and correct organizational-unit-names attribute "AAAA", but an empty *organization-name* attribute. Verify that for each message a NDR is generated by the IUT with the following elements: • "unable-to-transfer" for the *non-delivery-reason-code*, • "invalid-arguments" for the *non-delivery-diagnostic-code*, and • "unable to convert to AFTN due to unrecognized originator O/R address" for the *supplementary-information*.

[20] Originator and recipient addresses in the IPM heading may be empty. According to SARPs 3.1.2.3.5.2.3 "Use of IPM elements" those addresses are discarded by the MTCU.

AMHS SARPs reference	3.1.2.3.5.2.2.6.1 (Generation of the AFTN originator indicator) 3.1.2.3.5.2.2.6.2 (Generation of the AFTN addressee indicator)
Test class	Erroneous AMHS parameters

CT606 – Reject an IPM with invalid originator address (XF like)

CT606	**Reject an IPM with invalid originator address (XF like)**
Test criteria	This test is successful, if the IUT generates a NDR, when it receives an ATS message (IPM) that contains an originator address of type XF which can not be mapped to a valid AFTN originator indicator.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp3* to the IUT addressing an AFTN user reachable via the AFTN/X.25 port *cid1*. All messages shall be originated from the PRMD "AMHSLAND-3" which implements the XF addressing scheme. They shall have a valid recipient address for the PRMD "AFTNLAND-3", but an erroneous originator address in the MTE. Originator and recipient addresses in the IPM heading shall be equal to those in the MTE or empty[21]. • The 1st ATS message shall contain an originator address with the value "AFTN" in the *organization-name* attribute, but an invalid *organizational-unit-names* attribute, e.g. value "ACCCMHABC". • The 2nd ATS message shall contain an originator address with the value "AFTN" in the *organization-name* attribute, but an invalid *organizational-unit-names* attribute, e.g. value "ACCCMH". • The 3rd ATS message shall contain an originator address with the value "AFTN" in the *organization-name* attribute, but an empty *organizational-unit-names* attribute. • The 4th ATS message shall contain an originator address with an *empty organization-name attribute* and a valid organizational-unit-names attribute, e.g. value "ACCCMHAA". • The 5th ATS message shall contain an originator address with an invalid organization-name attribute, e.g. "UNKNOWN" and a valid organizational-unit-names attribute, e.g. value "ACCCMHAA".
AMHS SARPs reference	3.1.2.3.5.2.2.6.1 (Generation of the AFTN originator indicator) 3.1.2.3.5.2.2.6.2 (Generation of the AFTN addressee indicator)
Test class	Erroneous AMHS parameters

[21] Originator and recipient addresses in the IPM heading may be empty. According to SARPs 3.1.2.3.5.2.3 "Use of IPM elements" those addresses are discarded by the MTCU.

CT607 – Asymmetric address conversion from AMHS CAAS- and XF- recipient addresses to AFTN addresses

CT607	**Asymmetric address conversion from AMHS CAAS- and XF-recipient addresses to AFTN addresses**
Test criteria	This test is successful, if the IUT when converting an AMHS message (IPM) to an AFTN message translates the originator and recipient addresses to the AFTN originator indicator and addressee indicators although the re-conversion of the AFTN addressee indicators lead to O/R addressees different from the original recipient O/R addresses (asymmetric). The asymmetric recipient address conversion shall be logged and reported to the Control Position.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer port *trp1* to the IUT, addressing different AFTN users reachable via the AFTN/X.25 port *cid*. • The 1st ATS message shall be sent via MTA-1 with correct originator from AMHSLAND-1 containing CAAS and XF recipient addresses which are translated into AFTN addresses of which the retranslations do not deliver the same AMHS addresses[22]: (1) /C=XX/ADMD=ICAO/PRMD=AFTNLAND-1 /O=BA-REGION/OU1=BBAA/CN=BBAAFTAA, (2) /C=XX/ADMD=ICAO/PRMD=AFTNLAND-2 /O=AFTN/OU1=BCAAFTAA • The 2nd ATS message shall be sent via MTA-1 with correct originator from AMHSLAND-1 containing a CAAS recipient address with a PRMD value of an MD which has implemented the XF addressing scheme and a valid XF recipient address with a PRMD value of an MD which has implemented the CAAS addressing scheme: (3) /C=XX/ADMD=ICAO/PRMD=AFTNLAND-3 /O=AFTN/OU1=BCAA/CN=BCAAFTAA, (4) /C=XX/ADMD=ICAO/PRMD=AFTNLAND-1 /O=AFTN/OU1=BAAAFTAA All messages shall have an IA5-text body with ATS-message-header. The implicit-conversion-prohibited attribute in the MTE shall be set to “false”. Originator and recipient addresses in the IPM heading shall be equal to those in the MTE or empty[23].

[22] The AMHS addresses are listed in Table 10.

[23] Originator and recipient addresses in the IPM heading may be empty. According to SARPs 3.1.2.3.5.2.3 “Use of IPM elements” those addresses are discarded by the MTCU.

	Check the messages received at the AFTN/X.25 interface. Verify that the IUT was able to convert all AMHS O/R addresses to AFTN addresses. Verify the correct AFTN originator indicator and addressee indicator in the received AFTN messages. Check that conversion asymmetries of the recipient addresses are logged and reported to the Control Position.
AMHS SARPs reference	3.1.2.1.5 (Naming and Addressing Principles) 3.1.2.3.5.2.2.6.1 (Generation of the AFTN originator indicator) 3.1.2.3.5.2.2.6.2 (Generation of the AFTN addressee indicator) PDR M7100001
Test class	Normal AMHS communications

CT608 – Asymmetric address conversion from AMHS CAAS- and XF- originator addresses to AFTN addresses

CT608	**Asymmetric address conversion from AMHS CAAS- and XF-originator addresses to AFTN addresses**
Test criteria	This test is successful, if the IUT, when converting an AMHS message (IPM) to an AFTN message, translates the originator and recipient addresses to the AFTN originator indicator and addressee indicators, although the re-conversion of the AFTN originator indicator leads to an originator O/R address different from the original O/R address (asymmetric). The asymmetric originator address conversion shall be logged and reported to the Control Position.
Scenario description	From the AMHS Test Tool send a sequence of ATS messages (IPMs) over AMHS transfer ports *trp1* and *trp3* to the IUT, addressing different AFTN users reachable via the AFTN/X.25 port *cid1*. • The 1st ATS message shall be sent via MTA-1 with a CAAS originator address which is translated into an AFTN address of which the retranslation does not deliver the same AMHS address[24]: (1) /C=XX/ADMD=ICAO/PRMD=AMHSLAND-1 /O=AA-REGION/OU1=ABAA/CN=ABAAMHAA The recipient shall be an AFTN user in AFTNLAND-1. • The 2nd ATS message shall be sent via MTA-1 with a XF originator address which is translated into an AFTN address of which the retranslation does not deliver the same AMHS address: (2) /C=XX/ADMD=ICAO/PRMD=AMHSLAND-1 /O=AFTN/OU1=ACCCMHAA The recipient shall be an AFTN user in AFTNLAND-1. • The 3rd ATS message shall be sent via MTA-3 with a CAAS originator address with a PRMD value of an MD which has implemented the XF addressing scheme:: (3) /C=XX/ADMD=ICAO/PRMD=AMHSLAND-3 /O=AFTN/OU1=ACCC/CN=ACCCMHAA The recipient shall be an AFTN user in AFTNLAND-1.

[24] Originator and recipient addresses in the IPM heading may be empty. According to SARPs 3.1.2.3.5.2.3 “Use of IPM elements” those addresses are discarded by the MTCU.

	• The 4th ATS message shall be sent via MTA-1 with a XF originator address with a PRMD value of an MD which has implemented the CAAS addressing scheme:: (4) /C=XX/ADMD=ICAO/PRMD=AMHSLAND-1 /O=AFTN/OU1=AAAAMHAA The recipient shall be an AFTN user in AFTNLAND-1. All messages shall have an IA5-text body part with ATS-message-header. The implicit-conversion-prohibited attribute in the MTE shall be set to "false". Originator and recipient addresses in the IPM heading shall be equal to those in the MTE or empty. Check the messages received at the AFTN/X.25 interface. Verify that the IUT was able to convert all AMHS O/R addresses[25] to AFTN addresses. Verify the correct AFTN originator indicator and addressee indicator in the received AFTN messages. Check that the conversion asymmetries of the originator addresses are logged and reported to the Control Position.
AMHS SARPs reference	3.1.2.1.5 (Naming and Addressing Principles) 3.1.2.3.5.2.2.6.1 (Generation of the AFTN originator indicator) 3.1.2.3.5.2.2.6.2 (Generation of the AFTN addressee indicator) PDR M7100001
Test class	Normal AMHS communications

[25]The AMHS addresses are listed in Table 10.

4.7 Transfer, delivery and handling of Non-Delivery Reports (NDR)

CT701 – Transfer a non-delivery report (NDR)

CT701	**Transfer a non-delivery report (NDR)**
Test criteria	This test is successful, if the IUT transfers (forwards) non-delivery reports containing the standardized reason and diagnostic codes correctly.
Scenario description	From the AMHS Test Tool send a set of non-delivery reports to the IUT transfer port *trp1* to be forwarded to another domain. The set of NDRs shall cover the full scope of reason and diagnostic codes standardized in ISO/IEC 10021-4 (ITU-T Rec. X.411), section 8.3.1.2.1.11 and section 8.3.1.2.1.12, respectively (see Table 16 below). The report transfer envelope shall contain a remote recipient address (Report Destination) reachable via transfer port *trp2*. The reports may contain fictitious values for those fields which are normally related to a subject message, like subject-MTS-identifier and encoded-information types and originally intended recipients. Monitor the outcome of IUT transfer port *trp2*. Verify that: • all reports are routed correctly via transfer port *trp2*, and • the reason and diagnostic codes of the forwarded report are identical to those contained in the original report.
AMHS SARPs reference	
Test class	Normal AMHS communications

AMHS Report ID	**number of Per-Recipient-Fields**	**reason code**	**diagnostic codes (range)**
CT701M01	*16*	0	0 – 15
CT701M02	*31*	0	0 – 30
CT701M03	*31*	1	0 – 30
CT701M04	*5*	1	46 – 50
CT701M05	*3*	2	8 – 10
CT701M06	*7*	2	19 – 25
CT701M07	*1*	3	31
CT701M08	*14*	4	32 – 45
CT701M09	*1*	5	not used
CT701M10	*1*	6	not used

AMHS Report ID	number of Per-Recipient-Fields	reason code	diagnostic codes (range)
CT701M11	*1*	7	not used
CT701M12	*28*	8	51 – 78

Table 16: AMHS non-delivery-reason-codes and non-delivery-diagnostic-codes used in test messages of CT701 – CT703[26]

Note 1:- The non-delivery-diagnostic-code is an optional element and, for example, not contained in test messages CT701M09, CT701M10 and CT701M11.

Note 2:- Depending on the level of service implemented by the IUT the range of valid non-delivery-reason-codes as well as non-delivery-diagnostic-codes could be different:

Level of Service	ISO/IEC Version	Reason Code Range	Diagnostic Code Range
Basic	ISO/IEC 10021-4:1990	0 – 7	1 – 49
Extended	ISO/IEC 10021-4:1999	0 – 8	1 – 78

[26] Every standardized reason code (0 … 8) and every standardized diagnostic code (0 … 78) is contained at least once in the test messages.

CT702 – Transfer a non-delivery report (NDR) to an AMHS user

CT702	**Transfer a non-delivery report (NDR) to an AMHS user**
Test criteria	This test is successful, if the IUT delivers non-delivery reports containing the standardized reason and diagnostic codes to an AMHS user correctly
Scenario description	From the AMHS Test Tool send a set of non-delivery reports to the IUT transfer port *trp1* to be forwarded to a directly attached AMHS user. The set of NDRs shall cover the full scope of reason and diagnostic codes standardized in ISO/IEC 10021-4 (ITU-T Rec. X.411), section 8.3.1.2.1.11 and section 8.3.1.2.1.12, respectively (see Table 16). The report transfer envelope shall contain the recipient address of an AMHS user connected to the IUT. The reports may contain fictitious values for those fields which are normally related to a subject message, like subject-MTS-identifier and encoded-information types and originally intended recipients. Monitor the reports received at the AMHS user agent. Verify that: • all reports are delivered to the AMHS user agent, and • the reason and diagnostic codes of the delivered reports are identical to those contained in the reports sent from the AMHS test tool.
AMHS SARPs reference	
Test class	Normal AMHS communications

Note:- Note 2 of CT701 applies also to CT702.

CT703 – Handling of received non-delivery report (NDR) in the AFTN/AMHS gateway

CT703	**Handling of received non-delivery report (NDR) in the AFTN/AMHS gateway**
Test criteria	This test is successful, if the IUT upon reception by the MTCU of an AMHS non-delivery report logs the error situation and reports to the control position, if the report does not refer to any previously generated subject message or contains a *non-delivery-diagnostic-code* value other than "unrecognised-OR-name(0)".
Scenario description	From the AMHS Test Tool send a set of non-delivery reports to the IUT addressed to an AFTN user reachable via the AFTN/AMHS gateway. The set of NDRs shall cover the full scope of reason and diagnostic codes standardized in ISO/IEC 10021-4 (ITU-T Rec. X.411), section 8.3.1.2.1.11 and section 8.3.1.2.1.12, respectively (see Table 16). The report transfer envelope shall contain the recipient address of an AFTN user reachable via the IUT's AFTN/AMHS gateway. The reports relate to fictitious subject messages that have never been generated by the MTCU. Monitor the events at the Control Position. Verify that the IUT logs the error situation and reports to the control position for every received NDR.
AMHS SARPs reference	
Test class	Normal AMHS communications

Note:- Note 2 of CT701 applies also to CT703.

CT704 – Transfer a NDR containing non-standard reason or diagnostic codes

CT704	**Transfer a NDR containing non-standard reason or diagnostic codes**
Test criteria	This test is successful, if the IUT transfers non-delivery reports containing reason and diagnostic codes which are syntactically correct, but different from those defined in section 8.3.1.2.1.11 and section 8.3.1.2.1.12 of ISO/IEC 10021-4 (ITU-T Rec. X.411).
Scenario description	From the AMHS Test Tool send several NDRs to the IUT transfer port *trp1* to be forwarded to a recipient address reachable via transfer port *trp2*. The NDRs may contain fictitious values for those fields which are normally related to a subject message. Six NDRs shall be sent containing the following reason and diagnostic codes: • CT704M01 contains "9" for the *non-delivery-reason-code* and "invalid-arguments" for the *non-delivery-diagnostic-code*. • CT704M02 contains "255" for the *non-delivery-reason-code* and "invalid-arguments" for the *non-delivery-diagnostic-code*. • CT704M03 contains "32767" for the *non-delivery-reason-code* and "invalid-arguments" for the *non-delivery-diagnostic-code*. • CT704M04 contains "unable-to-transfer" for the *non-delivery-reason-code* and "79" for the *non-delivery-diagnostic-code*. • CT704M05 contains "unable-to-transfer" for the *non-delivery-reason-code* and "255" for the *non-delivery-diagnostic-code*. • CT704M06 contains "unable-to-transfer" for the *non-delivery-reason-code* and "32767" for the *non-delivery-diagnostic-code*. Monitor the outcome of IUT transfer port *trp2*. Verify that: • all reports are routed correctly via transfer port *trp2*, and • the reason and diagnostic codes of the forwarded report are identical to those contained in the original report.
AMHS SARPs reference	
Test class	Erroneous AMHS parameters

CT705 – Deliver a NDR containing non-standard reason or diagnostic codes to an AMHS user agent

CT704	**Deliver a NDR containing non-standard reason or diagnostic codes to an AMHS user agent**
Test criteria	This test is successful, if the IUT delivers non-delivery reports containing reason and diagnostic codes which are syntactically correct, but different from those defined in section 8.3.1.2.1.11 and section 8.3.1.2.1.12 of ISO/IEC 10021-4 (ITU-T Rec. X.411) to an AMHS user agent.
Scenario description	From the AMHS Test Tool send several NDRs to the IUT transfer port *trp1* to be forwarded to a directly attached AMHS user. The NDRs may contain fictitious values for those fields which are normally related to a subject message. Six NDRs shall be sent containing the following reason and diagnostic codes: • CT705M01 contains “9” for the *non-delivery-reason-code* and “invalid-arguments” for the *non-delivery-diagnostic-code*. • CT705M02 contains “255” for the *non-delivery-reason-code* and “invalid-arguments” for the *non-delivery-diagnostic-code*. • CT705M03 contains “32767” for the *non-delivery-reason-code* and “invalid-arguments” for the *non-delivery-diagnostic-code*. • CT705M04 contains “unable-to-transfer” for the *non-delivery-reason-code* and “79” for the *non-delivery-diagnostic-code*. • CT705M05 contains “unable-to-transfer” for the *non-delivery-reason-code* and “255” for the *non-delivery-diagnostic-code*. • CT705M06 contains “unable-to-transfer” for the *non-delivery-reason-code* and “32767” for the *non-delivery-diagnostic-code*. Verify that all NDRs are delivered to the AMHS user agent. Check the contained reason and diagnostic codes (if any). Verify that no misleading information is presented to the AMHS user.
AMHS SARPs reference	
Test class	Erroneous AMHS parameters

CT706 – Handling of NDR containing non-standard reason or diagnostic codes in the AFTN/AMHS gateway

CT706	**Handling of NDR containing non-standard reason or diagnostic codes in the AFTN/AMHS gateway**
Test criteria	This test is successful, if the IUT upon reception by the MTCU of an AMHS non-delivery report logs the error situation and reports to the control position, if the NDR contains non-standard reason or diagnostic codes.
Scenario description	From the AMHS Test Tool send several AMHS non-delivery reports to the IUT addressed to an AFTN user reachable via the AFTN/AMHS gateway. The NDRs may contain fictitious values for those fields which are normally related to a subject message. Six NDRs shall be sent containing the following reason and diagnostic codes: • CT706M01 contains "9" for the *non-delivery-reason-code* and "invalid-arguments" for the *non-delivery-diagnostic-code*. • CT706M02 contains "255" for the *non-delivery-reason-code* and "invalid-arguments" for the *non-delivery-diagnostic-code*. • CT706M03 contains "32767" for the *non-delivery-reason-code* and "invalid-arguments" for the *non-delivery-diagnostic-code*. • CT706M04 contains "unable-to-transfer" for the *non-delivery-reason-code* and "79" for the *non-delivery-diagnostic-code*. • CT706M05 contains "unable-to-transfer" for the *non-delivery-reason-code* and "255" for the *non-delivery-diagnostic-code*. • CT706M06 contains "unable-to-transfer" for the *non-delivery-reason-code* and "32767" for the *non-delivery-diagnostic-code*. Monitor the events at the Control Position. Verify that the IUT logs the error situation and reports to the control position for every received NDR.
AMHS SARPs reference	
Test class	Erroneous AMHS parameters

--- END ---

ANNEX C

Test Procedure
for
ATN Router Connection Test

ANNEX C

of

AMHS Manual

Document Control Log

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1 Introduction

1.1 This document describes the test procedure for the Ground-Ground (G/G) Aeronautical Telecommunication Network (ATN) router connection, up to 3 ATN router interconnections.

2 References

[1] Asia/Pacific Regional ATN G/G Router ICD for ISO/IEC 8202 Sub-Network.

[2] ASIA/PAC Interface Control Document (ICD) for ATN G/G Router

[3] Test Plan for AMHS Technical Trial between Hong Kong, China and Japan.

[4] "Technical Memorandum of Cooperation between Engineering & Systems Division, Civil Aviation Department, Hong Kong China and Operations and Flight Inspection Division, Civil Aviation Bureau, Ministry of Land, Infrastructure and Transport, Japan: AMHS Trials and Service between Japan and Hong Kong, China", February 2003. (Amended 24 August 2004)

3 Test Overview and Scope

3.1 A joint ATN Router Connection Test between AMHSLAND1 and AMHSLAND2 using a 9.6kbps X.25 PSDN (packet-switched data network) circuit.

3.2 An ATN Router Connection Test is scheduled to verify the connectivity, interoperability, data relaying/routing and redundancy capabilities (where applicable) of the ATN Ground-Ground routers in AMHSLAND1 and AMHSLAND2.

3.3 The ATN Router Connection Test will also confirm that the functions of the AMHSLAND1 and AMHSLAND2 ATN routers were configured in preparation for more than 2 routers tests.

3.4 The system configuration for the test is shown in

Figure 3. Routers in AMHSLAND1 and AMHSLAND2 are linked by an X.25 virtual circuit (VC) over a leased line connection (e.g.64 kbps).

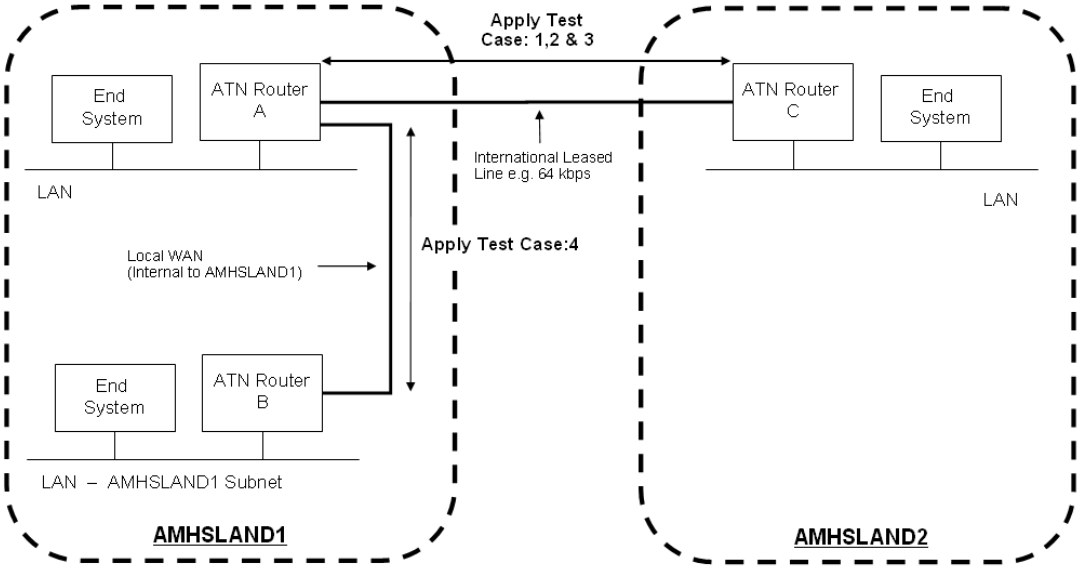


Figure 3 ATN Router Connection Test Configuration

3.5 To test data relay and routing functions, CLNP Echo Request (ERQ) Network Protocol Data Units (NPDU) will be generated by the routers and End Systems. To support these tests, all Intermediate Systems shall be capable of generating CLNP ERQ PDUs, and all Intermediate Systems and End Systems shall be capable of transmitting CLNP Echo Response (ERP) PDUs in response to the receipt of ERQ PDUs. Further, it is desirable that End Systems be capable of generating CLNP ERQ PDUs. Execution of some test items is contingent on End Systems' capabilities.

3.6 Since both AMHSLAND1 and AMHSLAND2 are ATN backbone sites, the proper updating of their routing tables should be tested in detail. This will ensure that the router could relay the data received from its counterpart to another router either within or outside its own domain/ATN site.

3.7 A summary of test items for the ATN Router Connection Test is shown in Table 17.

Table 17 Summary of Test Items for ATN Router Connection Test

No.	Test Item	Details
1	Router Connection Establishment and Maintenance	Establish LAPB, X.25 VC and IDRP connections between routers. Exchange of KEEPALIVE PDUs to maintain IDRP connection.
2	NPDU Relay	Tests to confirm CLNP Echo function of routers, correct NPDU relay, and validation of handling of PDUs with invalid security option parameter.
3	Router end-to-end tests	IDRP route addition/deletion, carrier medium failure/restoration and router failure/recovery.
4	ATN router environment tests	Multiple router route addition/deletion, carrier medium failure/restoration and router failure/recovery in three-domain configurations.

4 Communication Parameters

4.1 The proposed communication parameters for the connection between the routers of AMHSLAND1 and AMHSLAND2 are listed in Table 18.

4.2 The proposed CLNP communication parameters for the End Systems are listed in Table 19. It is proposed to use the NSAP addresses of the AMHS systems that will be used in actual operation for the ES NSAP addresses.

5 Schedule and Test Item Overview

5.1 The test items and planned schedule are shown in Table 20.

Table 18Router Communication Parameters

Protocol	Item No.	Item	Parameter		Note
			Router (AMHSLAND1)	**Router (AMHSLAND2)**	
	1.1	NSAP/NET	ROUTER A: 47.0027.81.81524A.00.010101.0302.000000000000.00 ROUTER B: 47.0027.81.854b00.00.010101.0302.000000000000.00	ROUTER C: 47.0027.81.815648.00.010101.0202.0202.012A.0100.00	1
CLNP (RPDU)	2.1	Priority	14	14	2
IDRP	3.1	NLRI	ROUTER A: 47.0027.81.81524A.00.010101 ROUTER B: 47.0027.81.854b00.00.010101	ROUTER C: 47.0027.81.815648.00.010101	
	3.2	RDI	ROUTER A: 47.0027.81.81524A.00.010101 ROUTER B: 47.0027.81.854b00.00.010101	ROUTER C: 47.0027.81.815648.00.010101	
	3.3	SecurityRegistrationID	06 04 2B 1B 00 00	06 04 2B 1B 00 00	2
	3.4	Tag Set Name	07 (ATSC Class Security Tag Set)	07 (ATSC Class Security Tag Set)	2
	3.5	ATSC Class	Class C	Class C	2
	3.6	Holding Time	180 sec	180 sec	2
	3.7	KEEPALIVE Send Timer	60 sec	60 sec	2, 3
	3.8	OPEN PDU Transmission	ROUTER A: AMHSLAND1-AMHSLAND2 : OPEN-PDU send ROUTER A: local circuit: OPEN-PDU send ROUTER B: OPEN-PDU receive	ROUTER C: AMHSLAND2 -AMHSLAND1: OPEN-PDU receive ROUTER C: local circuit: OPEN-PDU send	

Note 1: Compliant with Asia/Pacific ATN addressing plan.

Note 2: For all routers used in tests.

Note 3: The value of the KEEPALIVE send timer is the holding timer value divided by 3.

Table 19Router Communication Parameters (continued)

Protocol	Item No.	Item	Parameter		Note
			Router (AMHSLAND1)	**Router (AMHSLAND2)**	
X.25	4.1	DTE Address	ROUTER A AMHSLAND1-AMHSLAND2 : 44442000023903 ROUTER A local circuit: 44442000023903 ROUTER B local circuit: 44440110110202	ROUTER C AMHSLAND1-AMHSLAND2 : 48404701021800 ROUTER C local circuit: local matter	
	4.2	LCGN	0	0	4
	4.3	LCN	10	10	4
	4.4	Packet Size	1024	1024	4
	4.5	Window Size	7	7	4
	4.6	Window Size Negotiation	Yes	Yes	4
	4.7	CR Packet Transmission	ROUTER A AMHSLAND1-AMHSLAND2 : Caller (CR send) ROUTER A local circuit: Caller (CR send) ROUTER B local circuit: Called (CR receive)	ROUTER C AMHSLAND1-AMHSLAND2 : Called (CR receive) ROUTER C local circuit: Caller (CR send)	
	4.8	Use of SQ	Yes	Yes	4
	4.9	Packet Sequence	Modulo 8	Modulo 8	4
	4.10	Packet Negotiation	Yes	Yes	4
	4.11	D Bit	OFF	OFF	4
	4.12	M Bit	Yes	Yes	4
	4.13	Restart Request Retransmission Count (R20)	1	1	4
	4.14	Reset Request Retransmission (R22)	1	1	4
	4.15	Clear Request Retransmission Count (R23)	1	1	4
	4.16	Restart Request Timer (T20)	180 sec	180 sec	4
	4.17	DTE Call Request timer (T21)	200 sec	200 sec	4
	4.18	Reset Confirmation Timer (T22)	180 sec	180 sec	4
	4.19	DTE Clear Confirmation Timer (T23)	180 sec	180 sec	4

Note 4: For AMHSLAND1-AMHSLAND2 circuit. Parameters for local circuits used in more than 2 routers tests are a local matter.

Table 20Router Communication Parameter (continued)

Protocol	Item No.	Item	Parameter		Note
			Router (AMHSLAND1)	**Router (AMHSLAND2)**	
LAPB	5.1	Address	ROUTER A AMHSLAND1-AMHSLAND2 : 03 ROUTER A local circuit: 03 ROUTER B local circuit: 01	ROUTER C AMHSLAND1-AMHSLAND2 : 01 ROUTER C local circuit: local matter	
	5.2	Max Outstanding Number	7	7	5
	5.3	Idle Channel State Timer (T3)	60 sec	60 sec	5, 6
	5.4	ACK Receipt Timer (T1)	3 sec	3 sec	5, 7
	5.5	Frame Retransmission Count	5	5	5
	5.6	Maximum Number of bits in I-Frame (N1)	8248	8248	5, 8
	5.7	Frame Sequence	Modulo 8	Modulo 8	5
Physical	6.1	Interface	X.21/V.11 (Line Speed: 64 kbps)	V.11 (Line Speed: 64 kbps)	5
	6.2	Clock	Local Matter	Local Matter	5

Note 5: For AMHSLAND1-AMHSLAND2 circuit. Parameters for local circuits used in more than 2 routers tests are a local matter.

Note 6: APAC ROUTER ICD (ref. [1]) specifies router A: 18–60 seconds, router B: 12–60 seconds.

Note 7: APAC ROUTER ICD (ref. [1]) specifies 6 sec, based on 9,600bps line speed and 256 byte packets.

Note 8: Value depends on the max. X.25 packet size. N1 = packet header size (3) + packet size (bytes) + LAPB address part (1) + LAPB control part (1) + LAPB FCS part (2) in BITS. So if the packet size is 1024 bytes, then N1 is (3 + 1024 + 1 + 1 + 2) * 8 = 8248 bits.

Table 21 End System CLNP Communication Parameters

Protocol	Item No.	Item	Parameter	
			Router (AMHSLAND1)	**Router (AMHSLAND2)**
	7.1	NSAP	AMHSLAND1 ES: 470027.81.81524a.00.010101.0302.128001091001.01 Third domain ES: 470027.81.854b00.00.010101.0302.000000010051.01	AMHSLAND2 ES: 47.0027.81.815648.00.010101.0202.0202.8002.0100.01
CLNP	7.1	Traffic Type	1 (ATSC/No Traffic Type Policy Preference)	1 (ATSC/No Traffic Type Policy Preference)
	7.2	Security Class	1 (Unclassified)	1 (Unclassified)
	7.3	Priority	8	8
	7.4	Partial Route Recording	No	No

Table 22 Test Items and Schedule

Schedule (UTC)		Test Item No.			Description
Day	**Time**				
		1			**Router Connection Establishment and Maintenance**
			1	1 ~ 2	Data link establishment
			2	1 ~ 4	X.25 VC establishment
			3	1 ~ 2	IDRP connection establishment
			4	1 ~ 2	Exchange of routing information (UPDATE PDU transmission)
			5	1 ~ 2	Maintenance of IDRP connection (KEEPALIVE PDU transmission)
		2			**NPDU Relay**
			1	1 ~ 3	ERQ/ERP NPDU transmission /reply from AMHSLAND1 router to AMHSLAND2 router
			2	1 ~ 3	ERQ/ERP NPDU transmission /reply from AMHSLAND2 router to AMHSLAND1 router
			3	1 ~ 3	ERQ/ERP NPDU transmission/reply from AMHSLAND1 ES to valid destination in AMHSLAND2 domain
			4	1 ~ 3	ERQ/ERP NPDU transmission from AMHSLAND2 ES to valid destination in AMHSLAND1 domain (Subject to AMHSLAND2 ES ERQ NDU transmission capability.)
			5	1 ~ 2	ERQ NPDU transmission from AMHSLAND1 ES to unreachable ES in AMHSLAND2 domain
			6	1 ~ 2	ERQ NPDU transmission from AMHSLAND2 ES to unreachable ES in AMHSLAND1 domain (Subject to AMHSLAND2 ES ERQ NDU transmission capability.)
			7	1 ~ 2	Routing process in AMHSLAND1 router for NPDU with invalid security option parameter
			8	1 ~ 2	Routing process in AMHSLAND2 router for NPDU with invalid security option parameter (Subject to AMHSLAND2 ES ERQ NDU transmission capability.)
		3			**Router end-to-end tests**
			1	1 ~ 5	Manual router disconnection at AMHSLAND1 router and route deletion
			2	1	Route activation from AMHSLAND1 router
			3	1 ~ 5	Manual router disconnection at AMHSLAND2 router and route deletion
			4	1	Route activation from AMHSLAND2 router
			5	1 ~ 3	Carrier medium failure and route deletion at AMHSLAND1 router
			6	1	Carrier medium restoration and route addition at AMHSLAND1 router

Schedule (UTC)		Test Item No.			Description
Day	**Time**				
			7	1 ~ 3	Carrier medium failure and route deletion at AMHSLAND2 router
			8	1	Carrier medium restoration and route addition at AMHSLAND2 router
			9	1 ~ 2	Failure and recovery of AMHSLAND1 router (redundant configuration)
			10	1 ~ 2	Failure and recovery of AMHSLAND2 router
		4			**ATN Router Tests: Third Domain connected to AMHSLAND1**
			1	1 ~ 5	Router connection of ROUTER B to ROUTER A (ROUTER A–ROUTER C connection already established)
			2	1 ~ 5	Manual router disconnection at ROUTER A of ROUTER A–ROUTER B route
			3	1 ~ 4	Re-activation at ROUTER A of ROUTER A-ROUTER B route
			4	1 ~ 5	Manual router disconnection at ROUTER B of ROUTER A-ROUTER B route
			5	1 ~ 4	Re-activation at ROUTER B of ROUTER A–ROUTER B route
			6	1 ~ 5	Router connection of ROUTER C to ROUTER A (ROUTER A-ROUTER B connection already established)
			7	1 ~ 5	Manual router disconnection at ROUTER C of ROUTER C–ROUTER A route
			8	1 ~ 4	Re-activation at ROUTER C of ROUTER C-ROUTER A route
			9	1 ~ 5	Manual router disconnection at ROUTER A of ROUTER C–ROUTER A route
			10	1 ~ 4	Re-activation at ROUTER A of ROUTER C–ROUTER A route
			11	1 ~ 3	Carrier medium failure of ROUTER A–ROUTER B circuit
			12	1 ~ 4	Carrier medium recovery of ROUTER A–ROUTER B circuit
			13	1 ~ 3	Carrier medium failure of ROUTER C–ROUTER A circuit
			14	1 ~ 4	Carrier medium recovery of ROUTER C–ROUTER A circuit
			15	1 ~ 2	Failure and recovery of ROUTER C
			16	1 ~ 2	Failure and recovery of ROUTER A
			17	1 ~ 2	Failure and recovery of ROUTER B
			18	1 ~ 6	End-to-End CLNP Echo Test between end systems in ROUTER C and ROUTER B domains (Subject to AMHSLAND2 ES ERQ NDU transmission capability.)

6 Test Cases

The table below shows the protocol abbreviations used in sequence diagrams.

Table 23 Protocol Abbreviations

Abbreviation	Protocol	Name
SABM	LAPB	Set Asynchronous Balanced Mode
UA	LAPB	Acknowledgement frame
SQ	X.25	Restart Request
SI	X.25	Restart Indication
SF	X.25	Restart Confirmation
CR	X.25	Call Request
CC	X.25	Call Connected
CQ	X.25	Clear Request
CF	X.25	Clear Confirmation
OPEN PDU	IDRP	OPEN Protocol Data Unit
UPDATE PDU	IDRP	UPDATE Protocol Data Unit
KEEPALIVE PDU	IDRP	KEEPALIVE Protocol Data Unit
CEASE PDU	IDRP	CEASE Protocol Data Unit
ERQ NPDU	CLNP	Echo request Network PDU
ERP NPDU	CLNP	Echo response Network PDU
ER NPDU	CLNP	Error report Network PDU

6.1 Test Case 1: Router Connection Establishment and Maintenance

a) **Objective**

This test is to verify the establishment of LAPB data link, X.25 Virtual Circuit and IDRP connections between the AMHSLAND2 and AMHSLAND1 routers, the exchange of routing information by UPDATE PDUs, and the maintenance of the IDRP connection by the periodic exchange of KEEPALIVE PDUs. The test configuration is shown in Figure 4.

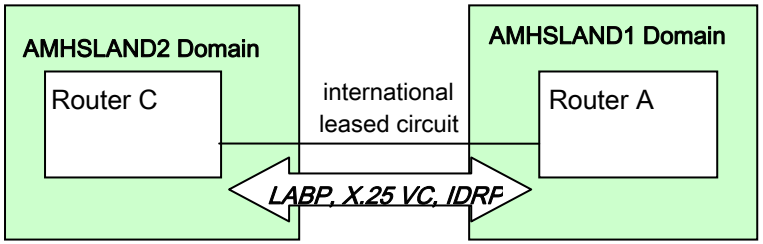


Figure 4 Configuration for router Connection & Maintenance Test

b) **Test Items**

- 1-1: Data link (LAPB) establishment
- 1-2: X.25 Virtual Circuit establishment
- 1-3: IDRP connection establishment (exchange of OPEN PDUs)
- 1-4: Exchange of routing information (exchange of UPDATE PDUs)
- 1-5: Maintenance of IDRP connection (exchange of KEEPALIVE PDUs)

Table 24 Router Connection Establishment & Maintenance Test Procedure

1. Router Connection Establishment & Maintenance		**Test Item**	**Procedure**	**Result**	**Date/Time**
Data link establishment	SABM transmission	1-1-1	Send SABM frame (address: 01) from ROUTER A and confirm ROUTER C receives it.	OK / NG	/ /
	UA transmission	1-1-2	Send UA frame (address: 03) from ROUTER C and confirm ROUTER A receives it and data link is established.	OK / NG	/ /
VC establishment	SQ transmission	1-2-1	Confirm ROUTER A sends SQ packet and ROUTER C receives it. (ROUTER C may send SQ packet, depending on the situation.)	OK / NG	/ /
	SI transmission	1-2-2	After receiving SQ packet from ROUTER A, confirm ROUTER C sends SI packet and ROUTER A receives it. (ROUTER C may send SQ packet, depending on the situation.)	OK / NG	/ /
	CR transmission	1-2-3	Confirm ROUTER A sends CR packet (packet size: 1024, LCGN: 0, LCN: 10, calling DTE address: ROUTER A DTE address, called DTE address: ROUTER C DTE address). Confirm ROUTER C receives it.	OK / NG	/ /
	CC transmission	1-2-4	Confirm ROUTER C sends CC packet (packet size: 1024, LCGN: 0, LCN: 10, calling DTE address: ROUTER A DTE address, called DTE address: ROUTER C DTE address). Confirm ROUTER A receives it, and VC is established.	OK / NG	/ /
IDRP connection establishment	OPEN PDU transmission from ROUTER A	1-3-1	After VC establishment, confirm ROUTER A sends an OPEN PDU. Confirm ROUTER C receives it.	OK / NG	/ /
	OPEN PDU transmission from ROUTER C	1-3-2	After receiving OPEN PDU from ROUTER A, confirm ROUTER C sends an OPEN PDU. Confirm that ROUTER A receives it, and IDRP connection is established.	OK / NG	/ /

1. Router Connection Establishment & Maintenance		**Test Item**	**Procedure**	**Result**	**Date/Time**
UPDATE PDU transmission	UPDATE PDU transmission from ROUTER A	1-4-1	After IDRP connection established, confirm ROUTER A sends an UPDATE PDU (security registration ID: 06042B1B0000, tag set name: 07, ATSC Class: ATSC Class C, holding timer: 180 sec) to ROUTER C. At ROUTER C, confirm UPDATE PDU is received, and routing information for ROUTER A is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C	1-4-2	After IDRP connection established, confirm ROUTER C sends an UPDATE PDU (security registration ID: 06042B1B0000, tag set name: 07, ATSC Class: ATSC Class C, holding timer: 180 sec) to ROUTER A. At ROUTER A, confirm UPDATE PDU is received, and routing information for ROUTER C is added.	OK / NG	/ /
IDRP connection maintenance	KEEPALIVE PDU transmission from ROUTER A	1-5-1	After IDRP connection established, confirm ROUTER A sends a KEEPALIVE PDU to ROUTER C every 60 seconds. At ROUTER C, confirm routing information received from ROUTER A is not deleted by receiving KEEPALIVE PDU continuously.	OK / NG	/ /
	KEEPALIVE PDU transmission from ROUTER C	1-5-2	After IDRP connection established, confirm ROUTER C sends a KEEPALIVE PDU to ROUTER A every 60 seconds. At ROUTER A, confirm routing information received from ROUTER C is not deleted by receiving KEEPALIVE PDU continuously.	OK / NG	/ /

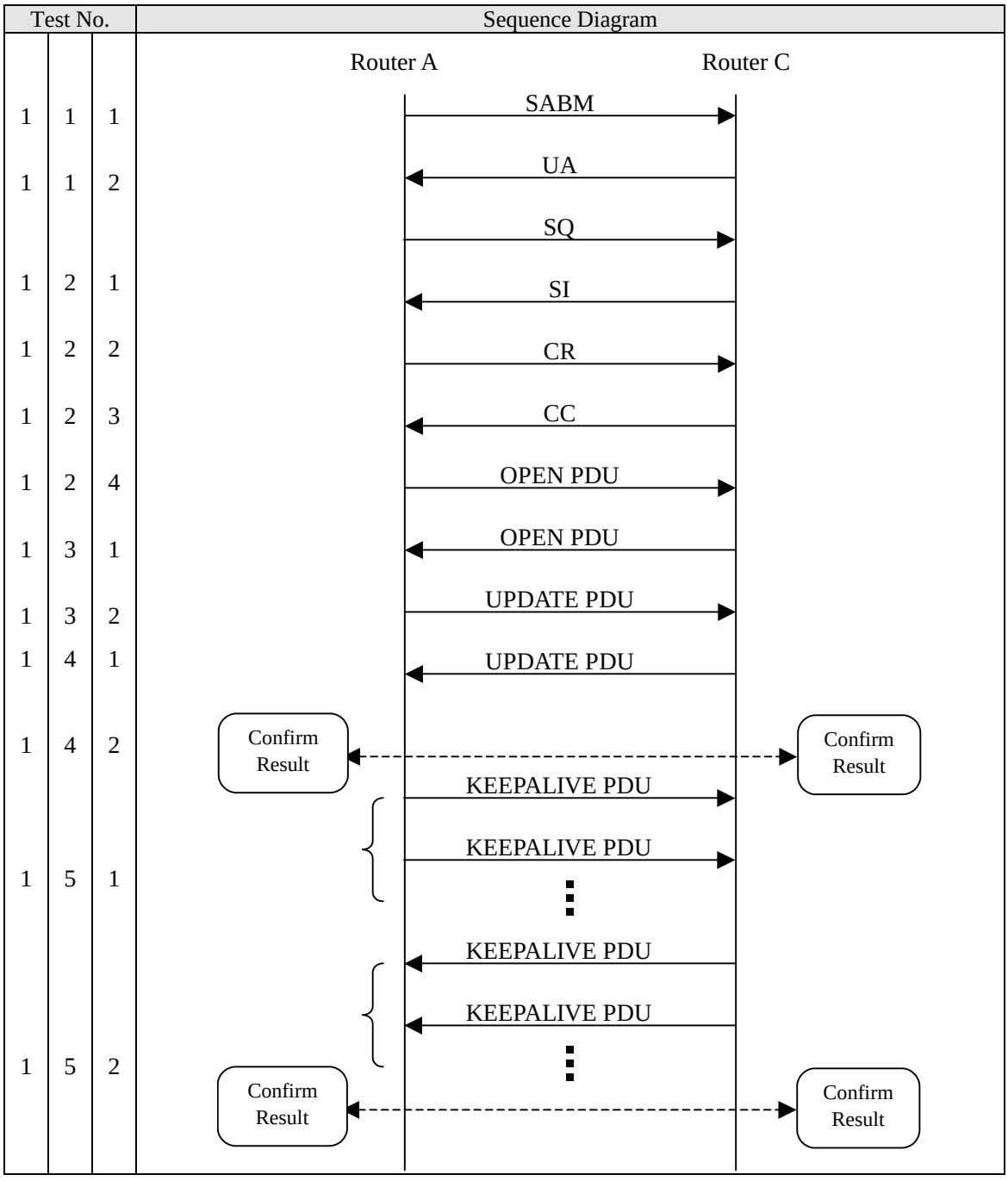


Figure 5 Sequence: Router Connection Establishment and Maintenance

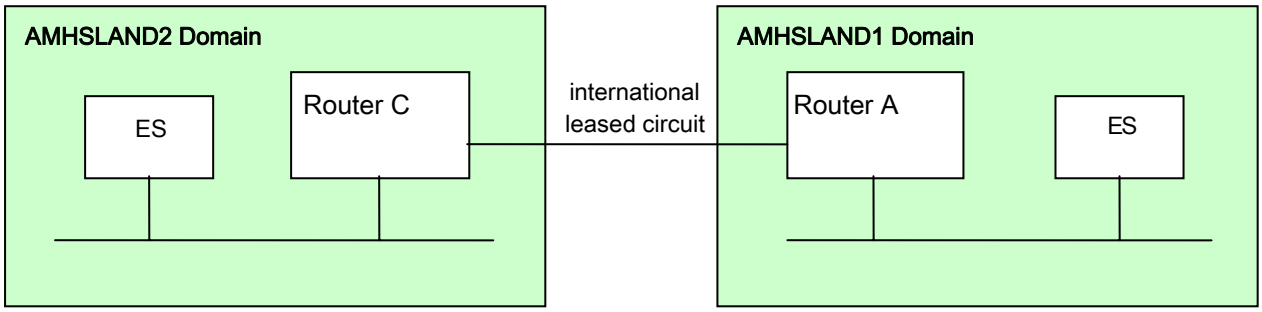
6.2 Test Case 2 : NPDU Relay

a) **Overview**

This test uses the CLNP Echo function to test correct relay and routing of CLNP NPDUs by the AMHSLAND2 and AMHSLAND1 routers. End Systems in both domains are used to verify end-to-end transmission of CLNP PDUs via the routers. The test configuration is shown in Figure 4. The test verifies the following:

(i) CLNP Echo Request/Echo Response function of both routers.
(ii) Relay of CLNP NPDUs by routers to the peer domain.
(iii) ER-PDU returned by peer router when sending a CLNP NPDU to an unknown address in the peer domain.
(iv) Non-relay of CLNP PDUs with incorrect security parameter by own domain router.

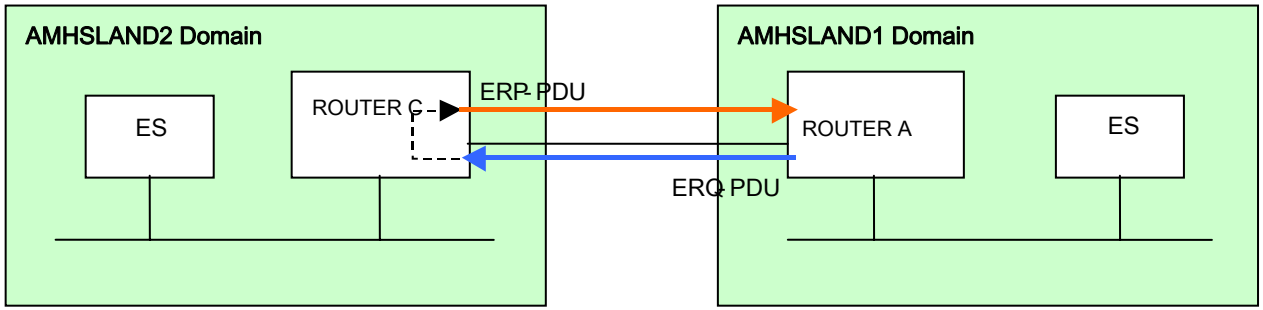
Figure 6 NPDU Transmission and Relay Test Configuration



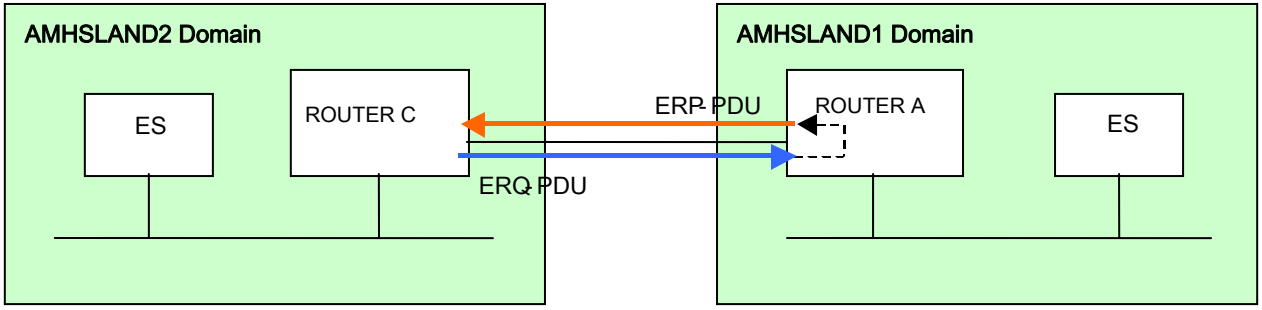
b) **Test Items**

Note: Some of these test items may not be carried out, depending on the capability of End Systems in each domain in to transmit ERQ-PDUs.

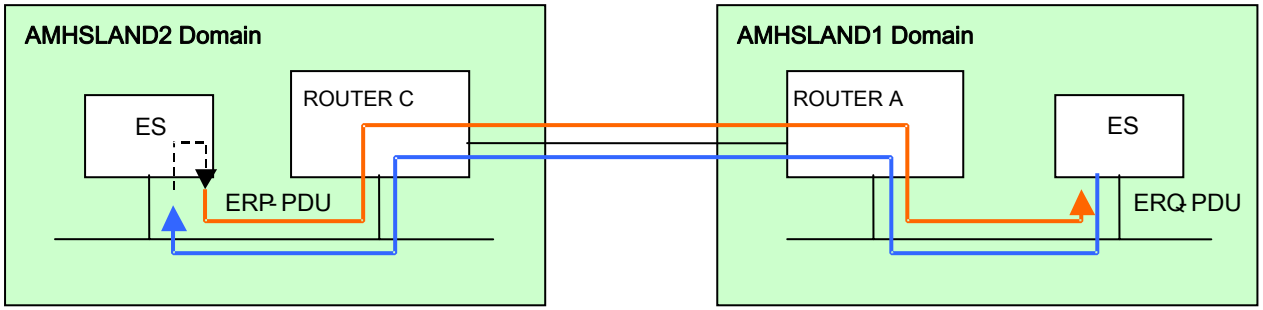
- 2-1: CLNP Echo from AMHSLAND1 router to AMHSLAND2 router.



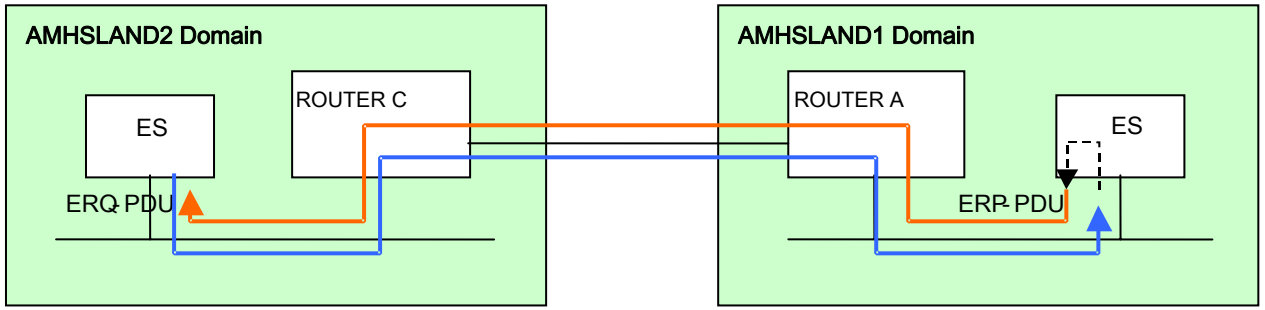
- 2-2: CLNP Echo from AMHSLAND2 router to AMHSLAND1 router.



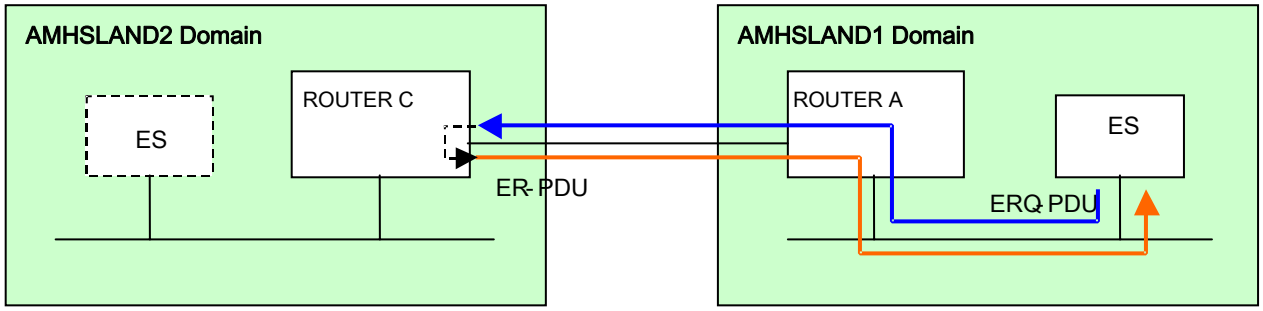
- 2-3: CLNP Echo from AMHSLAND1 End System to valid destination at AMHSLAND2.



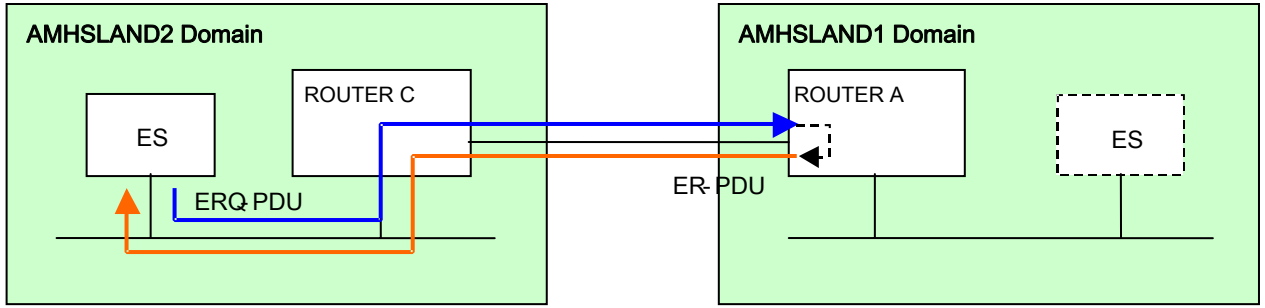
- 2-4: CLNP Echo from AMHSLAND2 End System to valid destination at AMHSLAND1.



- 2-5: CLNP Echo from AMHSLAND1 End System to unreachable AMHSLAND2 End System.

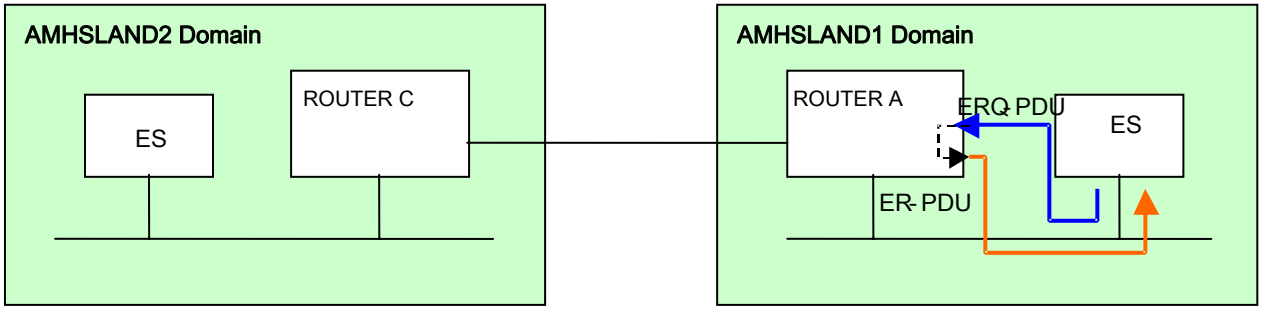


- 2-6: CLNP Echo from AMHSLAND2 End System to unreachable AMHSLAND1 End System.



- 2-7: Routing process in AMHSLAND1 router for NPDU with invalid security parameter.

Note: Transmission of ER NPDU depends on a value in the ERQ NPDU header.



- 2-8: Routing process in AMHSLAND2 router for NPDU with invalid security parameter.

Note: Transmission of ER NPDU depends on a value in the ERQ NPDU header.

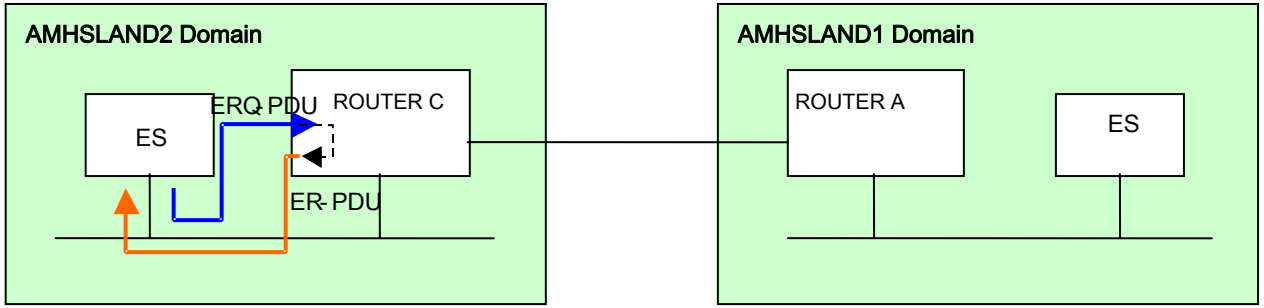


Table 25 NPDU Relay Test Procedure

2. NPDU Relay		**Test Item**	**Procedure**	**Result**	**Date/Time**
ERQ NPDU transmission from AMHSLAND1 router	ERQ NPDU transmission	2-1-1	Send ERQ NPDU from ROUTER A to ROUTER C. Confirm ROUTER C receives it.	OK / NG	/ /
	ERP NPDU transmission	2-1-2	After receiving ERQ NPDU, ROUTER C sends ERP NPDU to ROUTER A. Confirm ROUTER A receives it.	OK / NG	/ /
	Continuous ERQ/ERP NPDU transmission	2-1-3	Repeat from 2-1-1 to 2-1-2 ten times and confirm there is no problem with ERQ/ERP transmission.	OK / NG	/ /
ERQ NPDU transmission from AMHSLAND2 router	ERQ NPDU transmission	2-2-1	Send ERQ NPDU from ROUTER C to ROUTER A. Confirm ROUTER A receives it.	OK / NG	/ /
	ERP NPDU transmission	2-2-2	After receiving ERQ NPDU, ROUTER A sends an ERP NPDU to ROUTER C. Confirm ROUTER C receives it.	OK / NG	/ /
	Continuous ERQ/ERP NPDU transmission	2-2-3	Repeat from 2-2-1 to 2-2-2 ten times and confirm there is no problem with ERQ/ERP transmission.	OK / NG	/ /
ERQ NPDU transmission from AMHSLAND1 ES	ERQ NPDU transmission	2-3-1	Send ERQ NPDU from AMHSLAND1 ES to AMHSLAND2 ES. Confirm the AMHSLAND2 ES receives it.	OK / NG	/ /
	ERP NPDU transmission	2-3-2	After receiving ERQ NPDU, the AMHSLAND2 ES sends an ERP NPDU to the AMHSLAND1 ES. Confirm the AMHSLAND1 ES receives it.	OK / NG	/ /
	Continuous ERQ/ERP transmission	2-3-3	Repeat from 2-3-1 to 2-3-2 ten times and confirm there is no problem with ERQ/ERP transmission.	OK / NG	/ /
ERQ NPDU transmission from AMHSLAND2 ES	ERQ NPDU transmission	2-4-1	Send ERQ NPDU from the AMHSLAND2 ES to the AMHSLAND1 ES. Confirm the AMHSLAND1 ES receives it.	OK / NG	/ /
	ERP NPDU transmission	2-4-2	After receiving ERQ NPDU, the AMHSLAND1 ES sends an ERP NPDU to the AMHSLAND2 ES. Confirm the AMHSLAND2 ES receives it.	OK / NG	/ /
	Continuous ERQ/ERP transmission	2-4-3	Repeat from 2-4-1 to 2-4-2 ten times and confirm there is no problem with ERQ/ERP transmission.	OK / NG	/ /

2. NPDU Relay		**Test Item**	**Procedure**	**Result**	**Date/Time**
ERQ NPDU transmission from AMHSLAND1 ES to unreachable system in AMHSLAND2 domain	ERQ NPDU transmission from AMHSLAND1 ES	2-5-1	AMHSLAND1 ES sends an ERQ NPDU with destination NSAP address set to an unreachable address in AMHSLAND2 domain. Confirm ROUTER C receives it.	OK / NG	/ /
	ERQ NPDU handling in AMHSLAND2 router	2-5-2	Confirm that ROUTER C discards the ERQ NPDU from AMHSLAND1 ES. Confirm that ROUTER C sends an ER NPDU to the AMHSLAND1 ES, and that the AMHSLAND1 ES receives it.	OK / NG	/ /
ERQ NPDU transmission from AMHSLAND2 ES to unreachable system in AMHSLAND1 domain	ERQ NPDU transmission from AMHSLAND2 ES	2-6-1	AMHSLAND2 ES sends an ERQ NPDU with destination NSAP address set to an unreachable address in AMHSLAND1 domain. Confirm ROUTER A receives it.	OK / NG	/ /
	ERQ NPDU handling in AMHSLAND1 router	2-6-2	Confirm that ROUTER A discards the ERQ NPDU. Confirm that ROUTER A sends an ER NPDU to the AMHSLAND2 ES, and that the AMHSLAND2 ES receives it.	OK / NG	/ /
Routing process in AMHSLAND1 router for NPDU with invalid security option parameter	ERQ NPDU transmission from AMHSLAND1 ES	2-7-1	AMHSLAND1 ES sends an ERQ NPDU with an invalid security option parameter (ATN Systems Management Communications/No Traffic Policy Preference) addressed to the AMHSLAND2 ES. Confirm ROUTER A receives it.	OK / NG	/ /
	ERQ NPDU processing in AMHSLAND1 router	2-7-2	Confirm ROUTER A discards ERQ NPDU and sends an ER NPDU to AMHSLAND1 ES. Confirm the AMHSLAND1 ES receives the ER NPDU.	OK / NG	/ /

2. NPDU Relay		**Test Item**	**Procedure**	**Result**	**Date/Time**
Routing process in AMHSLAND2 router for NPDU with invalid security option parameter	ERQ NPDU transmission from AMHSLAND2 ES	2-8-1	AMHSLAND2 ES sends ERQ NPDU with an invalid security option parameter (ATN Systems Management Communications/No Traffic Policy Preference) addressed to the AMHSLAND1 ES. Confirm ROUTER C receives it.	OK / NG	/ /
	ERQ NPDU processing in AMHSLAND2 router	2-8-2	Confirm ROUTER C discards ERQ NPDU and ROUTER C sends an ER NPDU to the AMHSLAND2 ES. Confirm the AMHSLAND2 ES receives the ER NPDU.	OK / NG	/ /

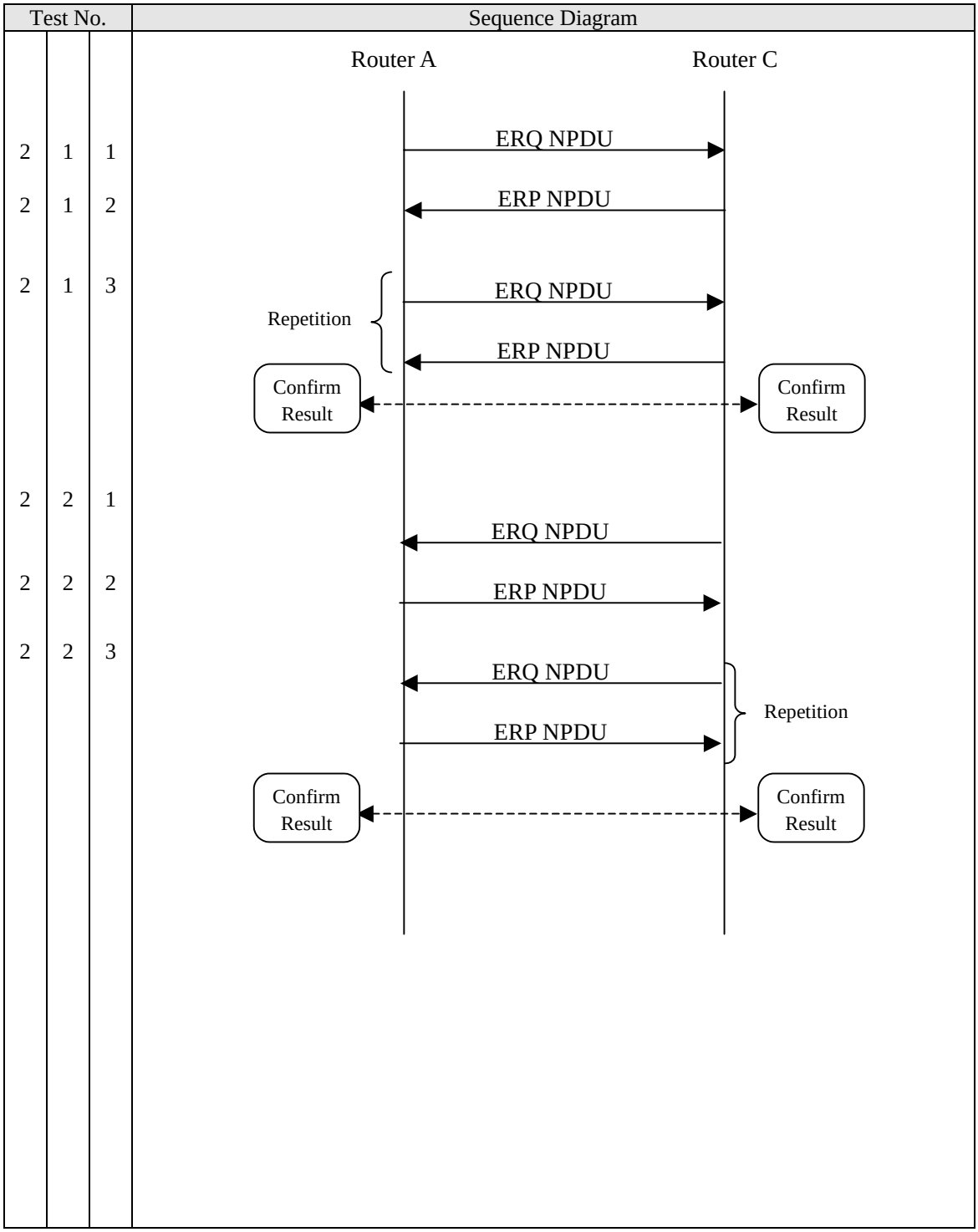


Figure 7 Sequence: NPDU Transmission between Routers

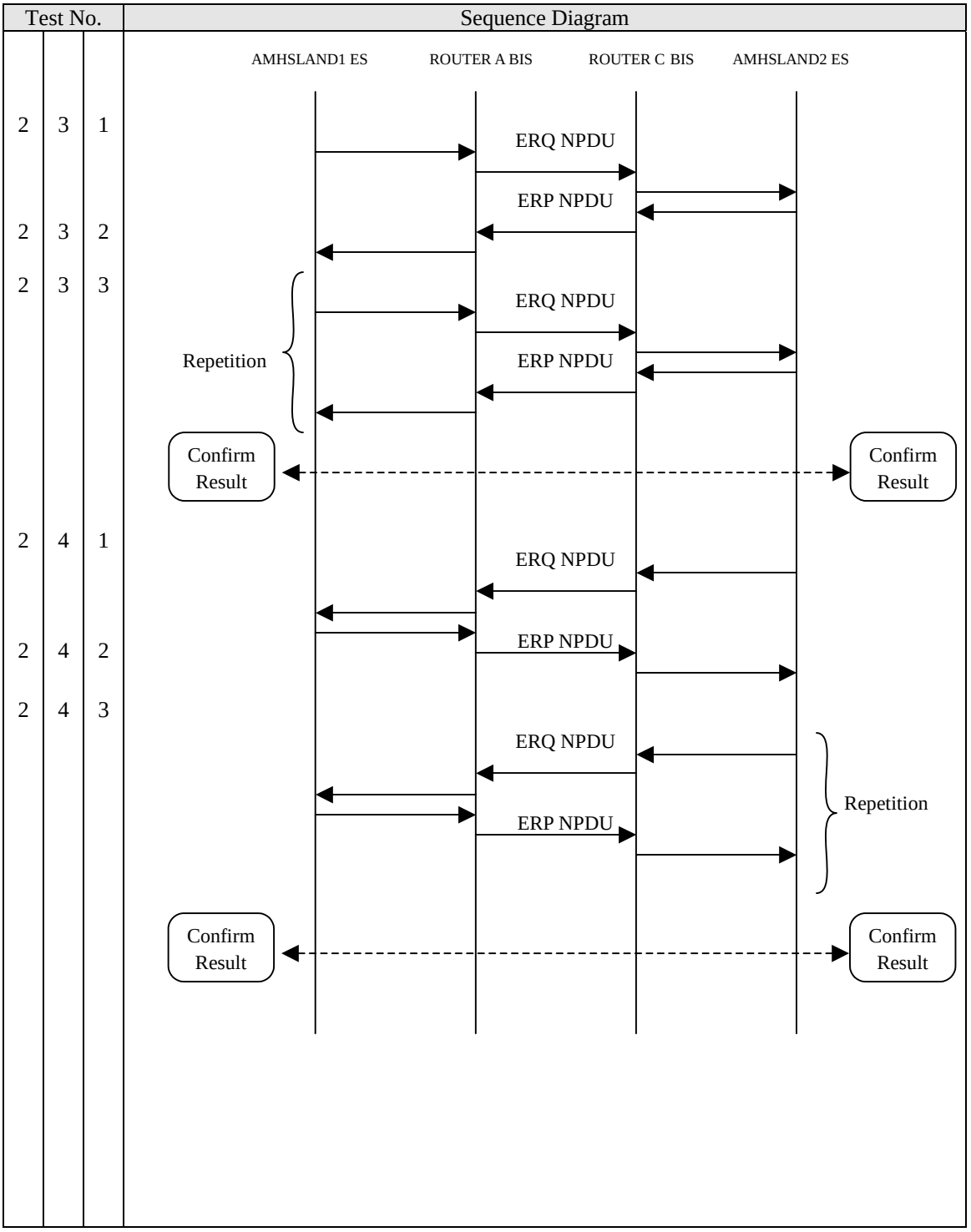


Figure 8 Sequence: NPDU Transmission between End Systems

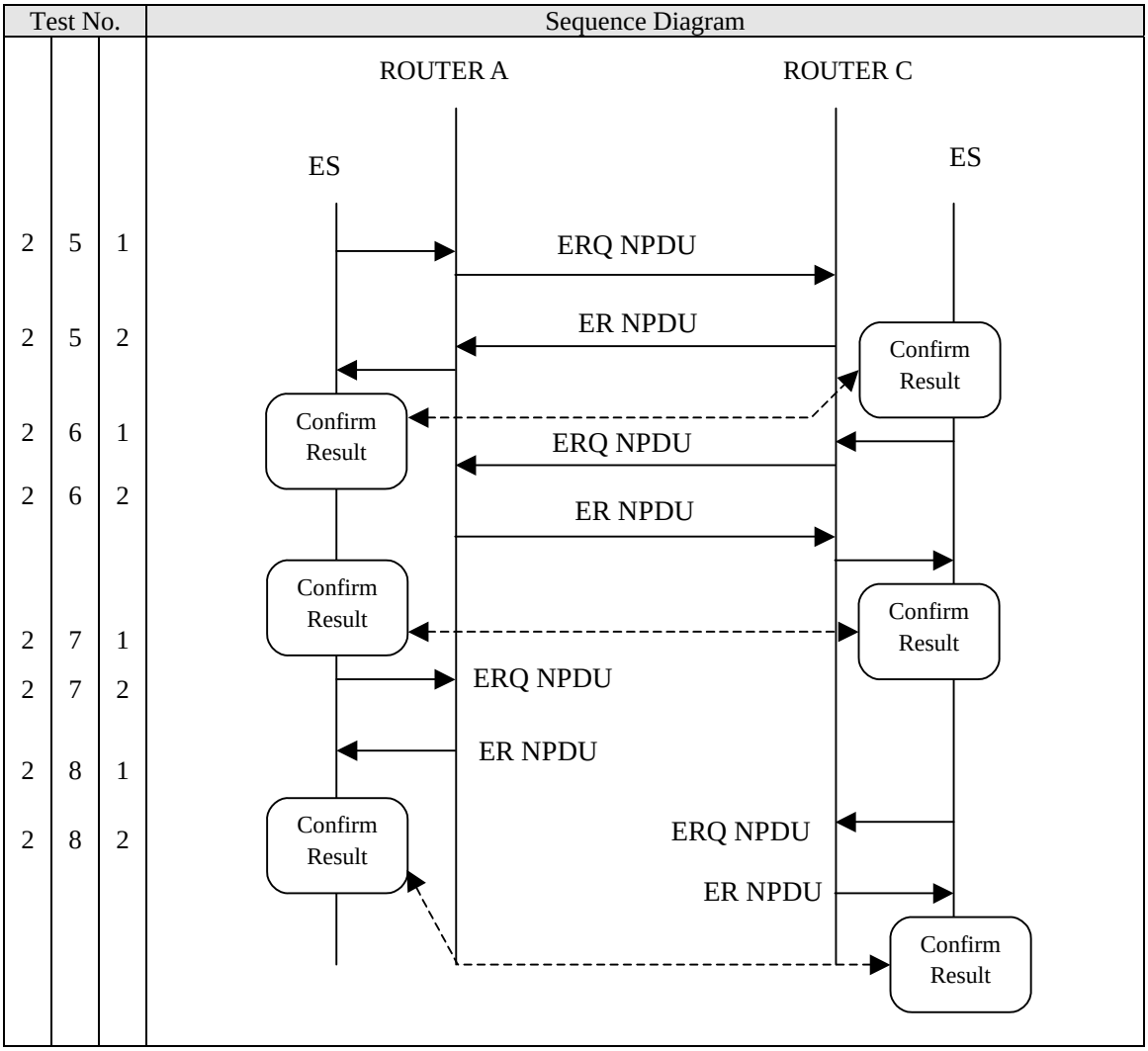


Figure 9 Sequence: NPDU Transmission to Unreachable ES and Handling of NPDU with Invalid Security Parameter

6.3 Test Case 3: Router End-to-End Tests

a) **Objective**

Technical trial to verify the automatic updating of routing tables in the ATN routers through IDRP protocol with routers connecting in end-to-end configuration between AMHSLAND1 and AMHSLAND2.

b) **Test Configuration**

The configuration for this test is shown in Figure 8.

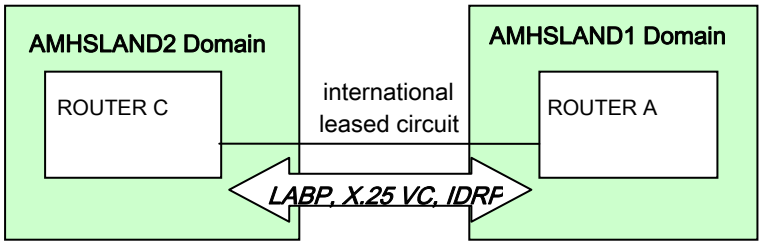


Figure 10 Router End-to-End Test Configuration

c) **Test Item Overview**

3-1: Manual router disconnection at AMHSLAND1 router and route deletion
3-2: Route addition (re-activation of connection) from AMHSLAND1 router
3-3: Manual router disconnection at AMHSLAND2 router and route deletion
3-4: Route addition (re-activation of connection) from AMHSLAND2 router
3-5: Carrier medium failure and route deletion at AMHSLAND1 router
3-6: Carrier medium restoration and route addition at AMHSLAND1 router
3-7: Carrier medium failure and route deletion at AMHSLAND2 router
3-8: Carrier medium restoration and route addition at AMHSLAND2 router
3-9: Failure and recovery of AMHSLAND1 router (redundant configuration)
3-10: Failure and recovery of AMHSLAND2 router

Note:
A detailed test of normal router connection (LAPB, X.25 VC and IDRP) is carried out in Test Items 1-1 through 1-5, and so is not repeated here.

Table 26 Router End-to-End Tests Test Procedure

3. Router End-to-End Tests		Test Item	Procedure	Result	Date/Time
Manual router disconnection at AMHSLAND1 router and route deletion	CEASE PDU transmission from AMHSLAND1 router	3-1-1	At ROUTER A, manually close the router connection to ROUTER C. Confirm ROUTER A sends CEASE PDU.	OK / NG	/ /
	CEASE PDU transmission from AMHSLAND2 router and route deletion	3-1-2	Confirm ROUTER C receives CEASE PDU. After receiving CEASE PDU, confirm that ROUTER C sends CEASE PDU to ROUTER A, and that routing information for ROUTER A is deleted.	OK / NG	/ /
	Route deletion at AMHSLAND1 router	3-1-3	Confirm that ROUTER A receives CEASE PDU from ROUTER C, and that routing information for ROUTER C is deleted.	OK / NG	/ /
	CQ transmission	3-1-4	After IDRP disconnected, confirm ROUTER A sends CQ packet to ROUTER C. Confirm ROUTER C receives it.	OK / NG	/ /
	CF transmission	3-1-5	After receiving CQ packet, confirm ROUTER C sends CF packet to ROUTER A. Confirm ROUTER A receives CF packet, and VC is closed.	OK / NG	/ /
Route addition (re-activation of connection) from AMHSLAND1 router	Router connection restoration after disconnection	3-2-1	At ROUTER A, manually initiate router connection with ROUTER C. (VC call: originate, OPEN PDU: send.) Confirm the router connection is re-established.	OK / NG	/ /

3. Router End-to-End Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Manual router disconnection at AMHSLAND2 router and route deletion	CEASE PDU transmission from AMHSLAND2 router	3-3-1	At ROUTER C, manually close the router connection to ROUTER A. Confirm ROUTER C sends CEASE PDU.	OK / NG	/ /
	CEASE PDU transmission from AMHSLAND1 router and route deletion	3-3-2	Confirm ROUTER A receives CEASE PDU. After receiving CEASE PDU, confirm that ROUTER A sends CEASE PDU to ROUTER C, and that routing information for ROUTER C is deleted.	OK / NG	/ /
	Route deletion at AMHSLAND2 router	3-3-3	Confirm that ROUTER C receives CEASE PDU from ROUTER A, and that routing information for ROUTER A is deleted.	OK / NG	/ /
	CQ transmission	3-3-4	After IDRP disconnected, confirm ROUTER C sends CQ packet to ROUTER A. Confirm ROUTER A receives it.	OK / NG	/ /
	CF transmission	3-3-5	After receiving CQ packet, confirm ROUTER A sends CF packet to ROUTER C. Confirm ROUTER C receives CF packet, and VC is closed.	OK / NG	/ /
Route addition (re-activation of connection) from AMHSLAND2 router	Router connection restoration after disconnection	3-4-1	At ROUTER C, manually initiate router connection to ROUTER A. (VC call: receive, OPEN PDU: receive.) Confirm the router connection is re-established.	OK / NG	/ /
Carrier medium failure and route deletion at AMHSLAND1 router	Data link and VC disconnection	3-5-1	At ROUTER A, simulate a circuit failure by physically disconnecting ROUTER A from the DSU/modem. Confirm that the data link and VC are disconnected between ROUTER A and ROUTER C.	OK / NG	/ /
	IDRP disconnection at AMHSLAND1	3-5-2	After circuit failure, confirm IDRP connection at ROUTER A is closed.	OK / NG	/ /
	IDRP disconnection at AMHSLAND2	3-5-3	After circuit failure, confirm IDRP connection at ROUTER C is closed when the IDRP holding timer expires.	OK / NG	/ /

3. Router End-to-End Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Carrier medium restoration and route addition at AMHSLAND1 router	Data link, VC, and router connection re-establishment	3-6-1	At ROUTER A, restore the circuit by re-connecting ROUTER A to the DSU/modem. Confirm router connection is re-established between ROUTER A and ROUTER C.	OK / NG	/ /
Carrier medium failure and route deletion at AMHSLAND2 router	Data link and VC disconnection	3-7-1	At ROUTER C, simulate a circuit failure by disconnecting the leased line circuit from the modem. Confirm data link and VC are disconnected between ROUTER A and ROUTER C.	OK / NG	/ /
	IDRP disconnection at AMHSLAND2	3-7-2	After circuit failure, confirm IDRP connection at ROUTER C is closed when the IDRP holding timer expires.	OK / NG	/ /
	IDRP disconnection at AMHSLAND1	3-7-3	After circuit failure, confirm IDRP connection at ROUTER A is closed.	OK / NG	/ /
Carrier medium restoration and route addition at AMHSLAND2 router	Data link, VC, and router connection re-establishment	3-8-1	At ROUTER C, restore circuit. Confirm the router connection is re-established between ROUTER A and ROUTER C.	OK / NG	/ /
Failure and recovery of AMHSLAND1 router	Failover from active to standby node	3-9-1	At ROUTER A, force failover from active node (#1) to standby node (#2) by rebooting active node. At ROUTER A, confirm WAN line switches from active to standby node. Confirm that router connection is closed and then re-established.	OK / NG	/ /
	Failover back to previous active node	3-9-2	At ROUTER A, force failover from active node (#2) to standby node (#1) by rebooting active node. At ROUTER A, confirm WAN line switches from active to standby node. Confirm that router connection is closed and then re-established.	OK / NG	/ /

3. Router End-to-End Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Failure and recovery of AMHSLAND2 router	Failover from active to standby node	3-10-1	At ROUTER C, force failover from active node (#1) to standby node (#2). At ROUTER C, confirm WAN line switches from active to standby node. Confirm that router connection is closed and then re-established.	OK / NG	/ /
	Failover back to previous active node	3-10-2	At ROUTER C, force failover from active node (#2) to standby node (#1). At ROUTER C, confirm WAN line switches from active to standby node. Confirm that router connection is closed and then re-established.	OK / NG	/ /

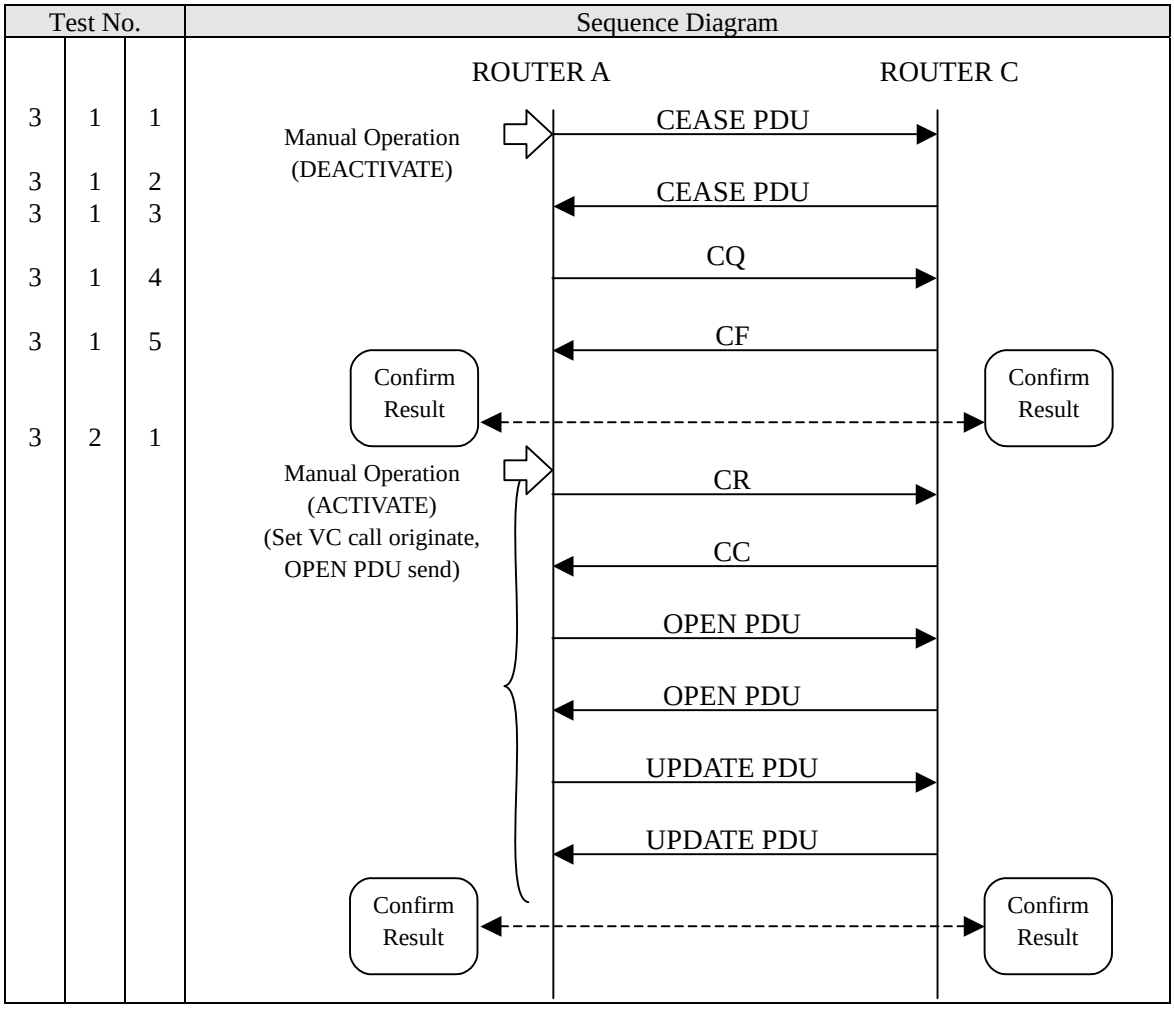


Figure 11 Sequence: Manual router Disconnection and Re-connection at AMHSLAND1 router

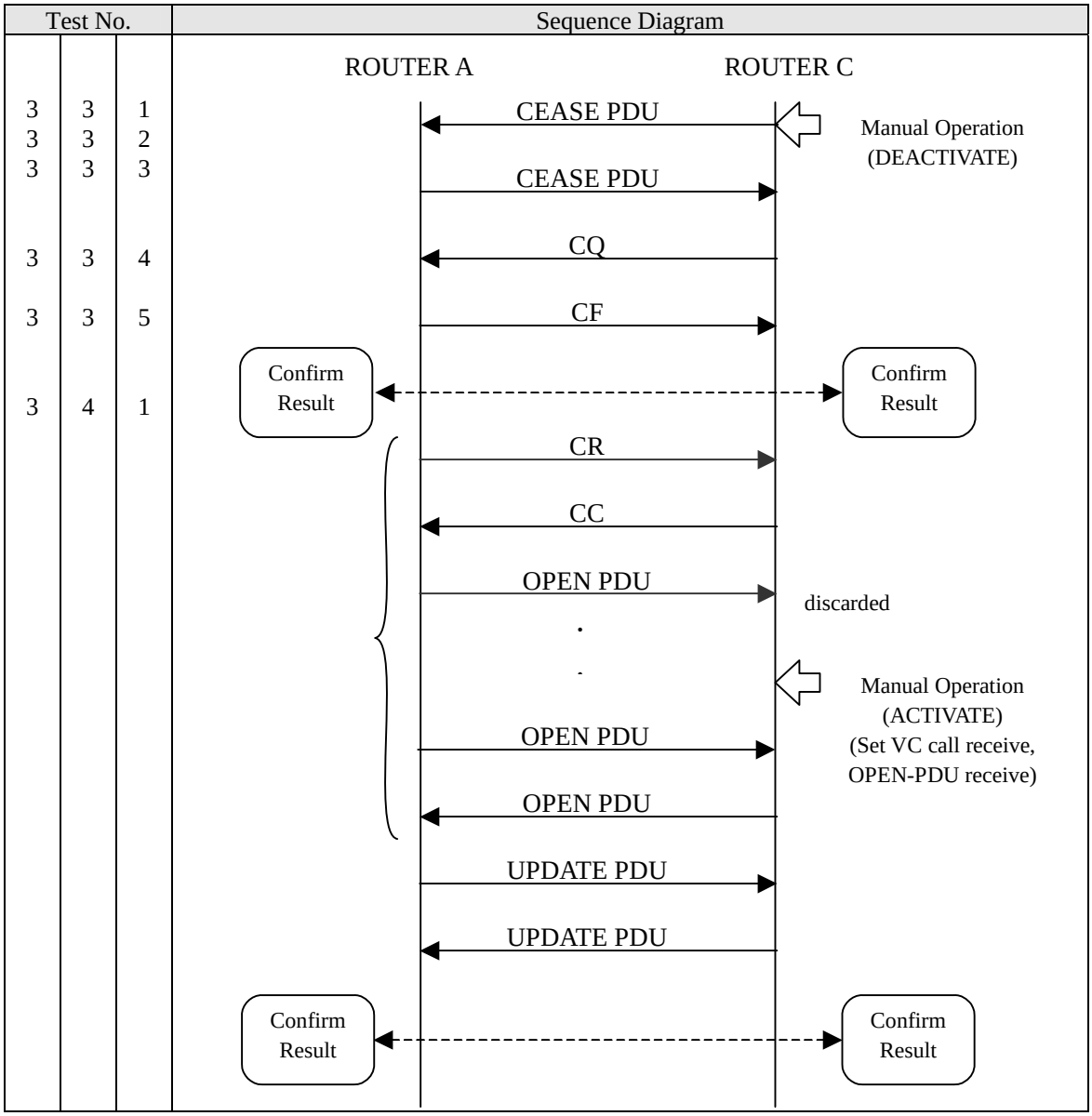


Figure 12 Sequence: Manual router Disconnection and Re-connection at AMHSLAND2 router

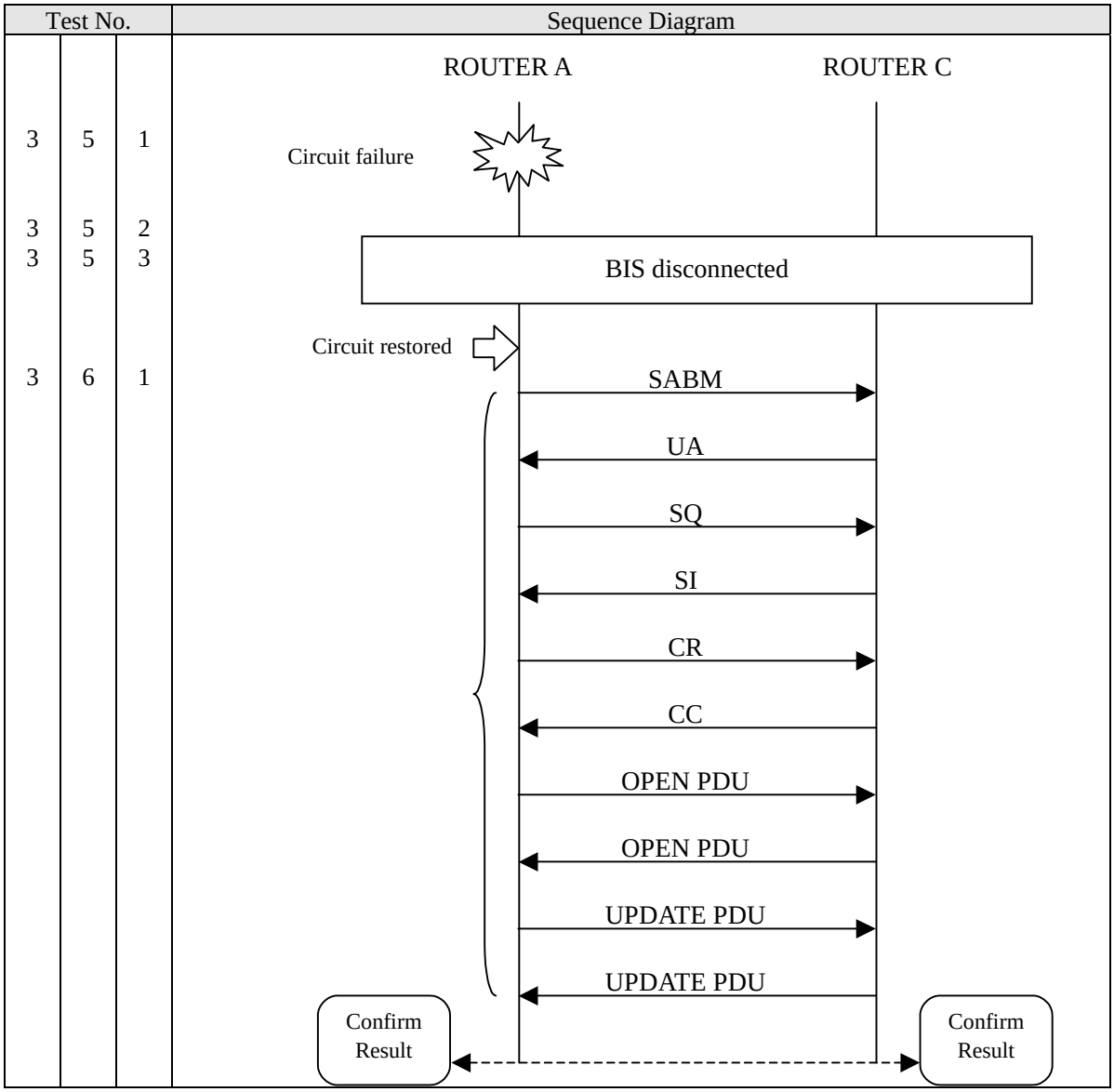


Figure 13 Sequence: Carrier medium failure and recovery at AMHSLAND1 router

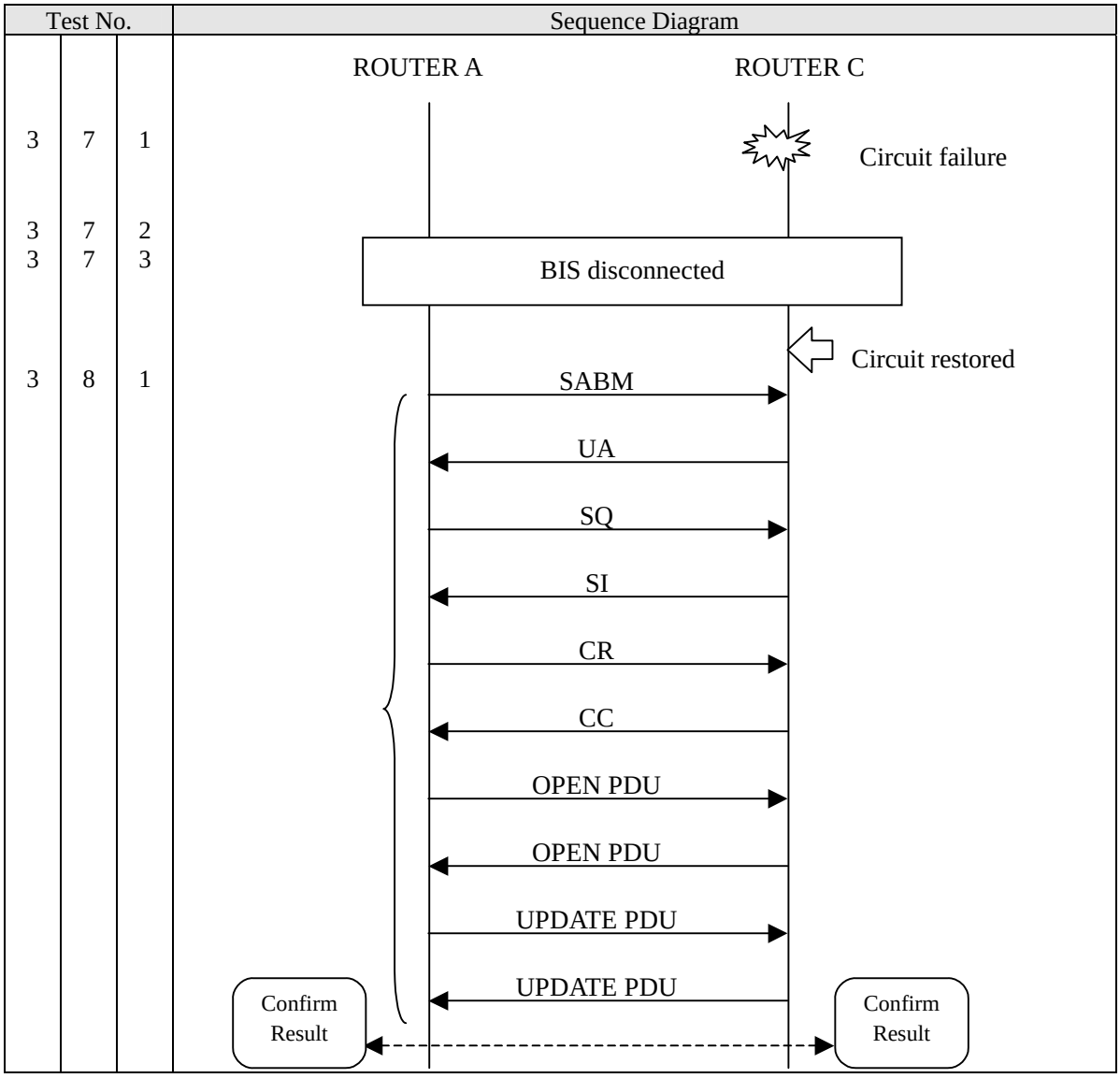


Figure 14 Sequence: Carrier medium failure and recovery at AMHSLAND2 router

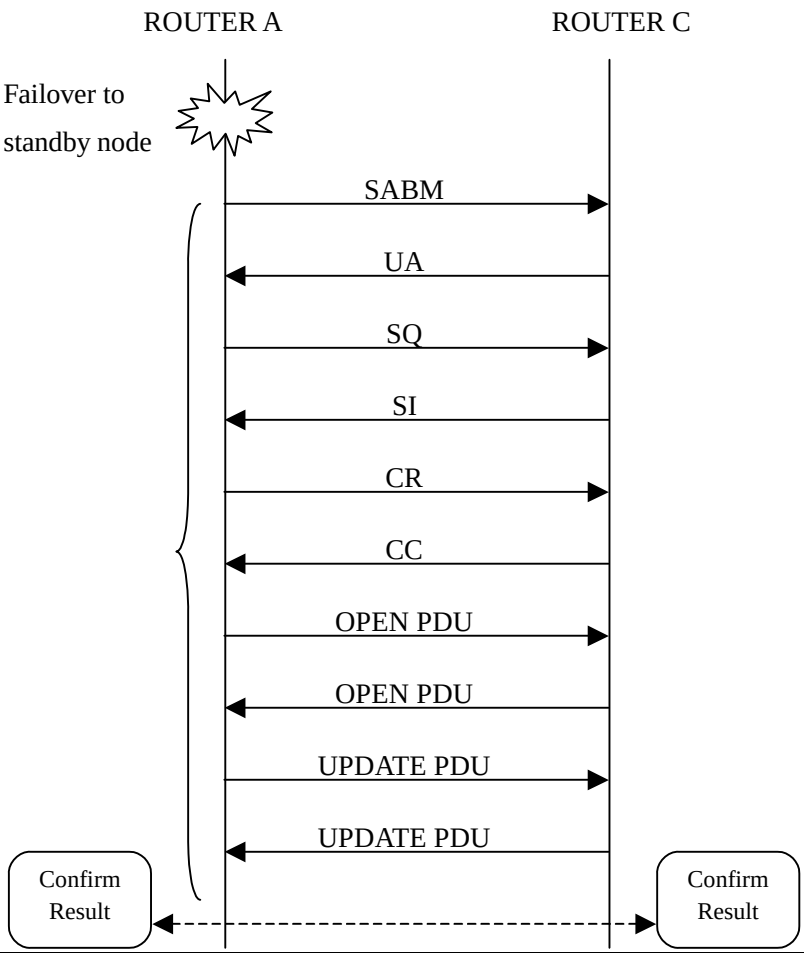
Test No.			Sequence Diagram
33	99	12	

Figure 15 Sequence: AMHSLAND1 router Failure and Recovery

Test No.			Sequence Diagram
3	10	1	
3	10	2	

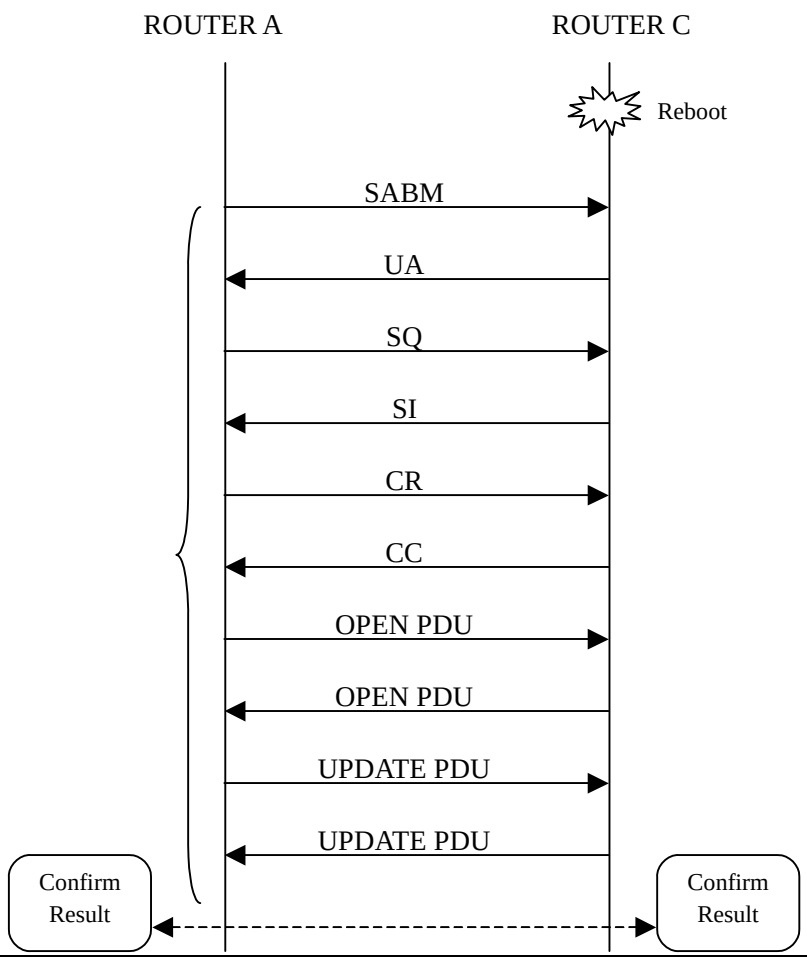


Figure 16 Sequence: AMHSLAND2 router Failure and Recovery

6.4 Test Case 4: ATN Router Tests (This cover additional tests for subnetwork)

a) **Objective**

Technical trial to verify the automatic updating of routing tables in ATN routers through the IDRP protocol with routers connected in 3routers configurations between AMHSLAND1, AMHSLAND2 and simulated third domains connected to AMHSLAND1 and AMHSLAND2. The test configurations are shown below.

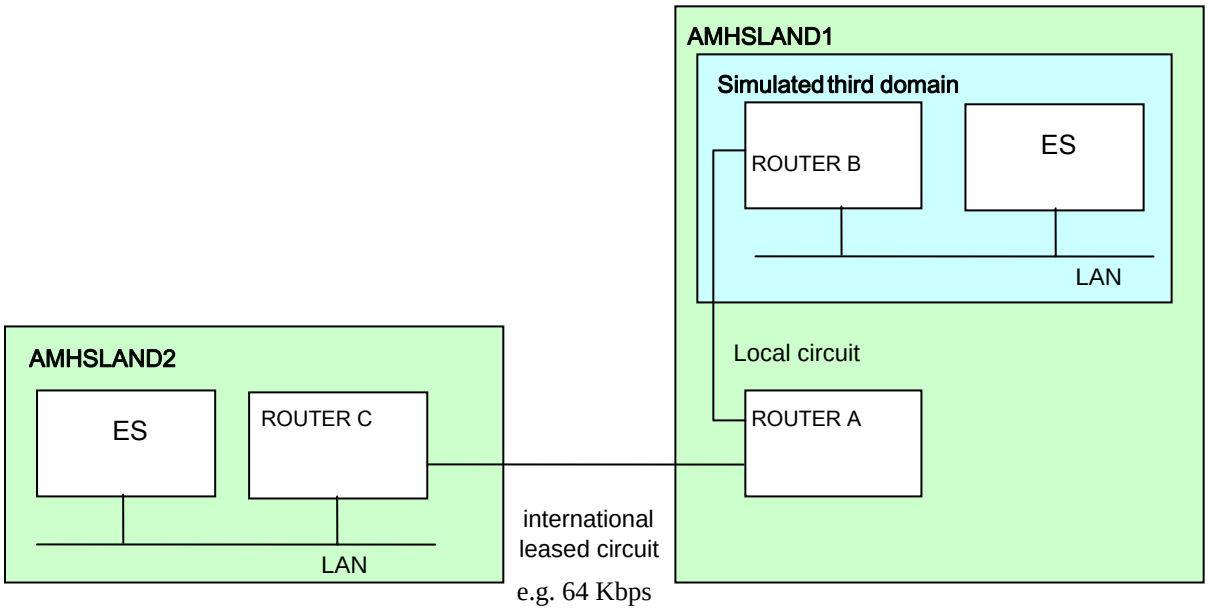


Figure 17 Test Configuration: Simulated Third Domain connected to AMHSLAND1

b) **Test Overview**

(i) Simulated third domain connected to AMHSLAND1.

ROUTER CONNECTION, DISCONNECTION AND RE-ACTIVATION

4-1: Router connection of ROUTER B to ROUTER A (ROUTER A-ROUTER C already established).
4-2, 4-3: Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route and re-activation.
4-4, 4-5: Manual router disconnection at ROUTER B of ROUTER A-ROUTER B route and re-activation.
4-6: Router connection of ROUTER C to ROUTER A (ROUTER B-ROUTER A already established).
4-7, 4-8: Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route and re-activation.
4-9, 4-10: Manual router disconnection at ROUTER A of ROUTER C-ROUTER A route and re-activation.

COMMUNICATION CIRCUIT FAILURE AND RECOVERY

4-11, 4-12: Failure and recovery of ROUTER A-ROUTER B circuit.
4-13, 4-14: Failure and recovery of ROUTER C-ROUTER A circuit.

ROUTER FAILURE AND RECOVERY

4-15: Failure and recovery of ROUTER C.
4-16: Failure and recovery of ROUTER A.
4-17: Failure and recovery of ROUTER B.

END-TO-END DATA RELAY

4-18: End-to-End CLNP Echo Test between End Systems in ROUTER C and ROUTER B domains.
(Subject to End System ERQ-PDU transmission capabilities.)

Table 27 Router Connection, Disconnection and Re-activation Test Procedure: Router A – Router B

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Router connection of ROUTER B to ROUTER A	Data link establishment between ROUTER A and ROUTER B	4-1-1	With VC and IDRP connections established between ROUTER C and ROUTER A, switch on ROUTER B to initiate router connection. Check and confirm data link and VC are established between ROUTER A and ROUTER B.	OK / NG	/ /
	IDRP connection establishment between ROUTER A and ROUTER B	4-1-2	After VC establishment, check and confirm IDRP connection established between ROUTER A and ROUTER B by exchange of OPEN PDUs. (First OPEN PDU sent by ROUTER A.)	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	4-1-3	After IDRP connection established, confirm ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, after receiving UPDATE PDU from ROUTER A, check that route information on ROUTER A and ROUTER C are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B to ROUTER A	4-1-4	After IDRP connection established, confirm ROUTER B sends an UPDATE PDU to ROUTER A. At ROUTER A, after receiving UPDATE PDU from ROUTER B, check and confirm route information of ROUTER B is updated correctly.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C	4-1-5	At ROUTER A, after receiving UPDATE PDU from ROUTER B, confirm ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm that UPDATE PDU is received, and that route information of ROUTER B is added.	OK / NG	/ /
Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route	CEASE PDU transmission from ROUTER A	4-2-1	At ROUTER A, manually close the router connection to ROUTER B. Confirm ROUTER A sends a CEASE PDU to ROUTER B.	OK / NG	/ /
	CEASE PDU transmission from ROUTER B and route deletion	4-2-2	At ROUTER B, confirm receipt of CEASE PDU from ROUTER A. Confirm ROUTER B sends a CEASE PDU to ROUTER A, and that route information for ROUTER A and ROUTER C are deleted.	OK / NG	/ /
	Route deletion at ROUTER A	4-2-3	At ROUTER A, confirm receipt of CEASE PDU from ROUTER B, and that route information for ROUTER B is deleted.	OK / NG	/ /

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
	VC disconnection between ROUTER A and ROUTER B	4-2-4	Confirm that the VC between ROUTER A and ROUTER B is closed normally.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C, and route deletion	4-2-5	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm that UPDATE PDU is received from ROUTER A, and that route information for ROUTER B is deleted.	OK / NG	/ /
Route re-activation from ROUTER A	Router connection re-activation from ROUTER A	4-3-1	At ROUTER A, manually initiate router connection to ROUTER B (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	4-3-2	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, check that route information to ROUTER A and ROUTER C are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B to ROUTER A	4-3-3	Confirm that ROUTER B sends an UPDATE PDU to ROUTER A. At ROUTER A, check that route information to ROUTER B is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C and route addition	4-3-4	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, check that route information to ROUTER B is added.	OK / NG	/ /
Manual router disconnection at ROUTER B of ROUTER A-ROUTER B route	CEASE PDU transmission from ROUTER B	4-4-1	At ROUTER B, manually close the router connection to ROUTER A. Confirm ROUTER B sends a CEASE PDU to ROUTER A.	OK / NG	/ /
	CEASE PDU transmission from ROUTER A and route deletion	4-4-2	At ROUTER A, confirm receipt of CEASE PDU from ROUTER B. Confirm ROUTER A sends CEASE PDU to ROUTER B, and that route information for ROUTER B is deleted.	OK / NG	/ /

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
	Route deletion at ROUTER B	4-4-3	At ROUTER B, confirm receipt of CEASE PDU from ROUTER A, and that route information for ROUTER A and ROUTER C are deleted.	OK / NG	/ /
	VC disconnection between ROUTER A and ROUTER B	4-4-4	Confirm that the VC between ROUTER A and ROUTER B is closed normally.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C, and route deletion	4-4-5	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm that an UPDATE PDU is received from ROUTER A, and that route information for ROUTER B is deleted.	OK / NG	/ /
Route re-activation from ROUTER B	Router connection re-activation from ROUTER B	4-5-1	At ROUTER B, manually initiate router connection to ROUTER A (VC call: called, OPEN PDU: receive). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	4-5-2	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm UPDATE PDU is received, and that route information to ROUTER A and ROUTER C are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B to ROUTER A	4-5-3	Confirm that ROUTER B sends an UPDATE PDU to ROUTER A. At ROUTER A, confirm UPDATE PDU is received, and that route information to ROUTER B is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C and route addition	4-5-4	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm UPDATE PDU is received, and that route information to ROUTER B is added.	OK / NG	/ /

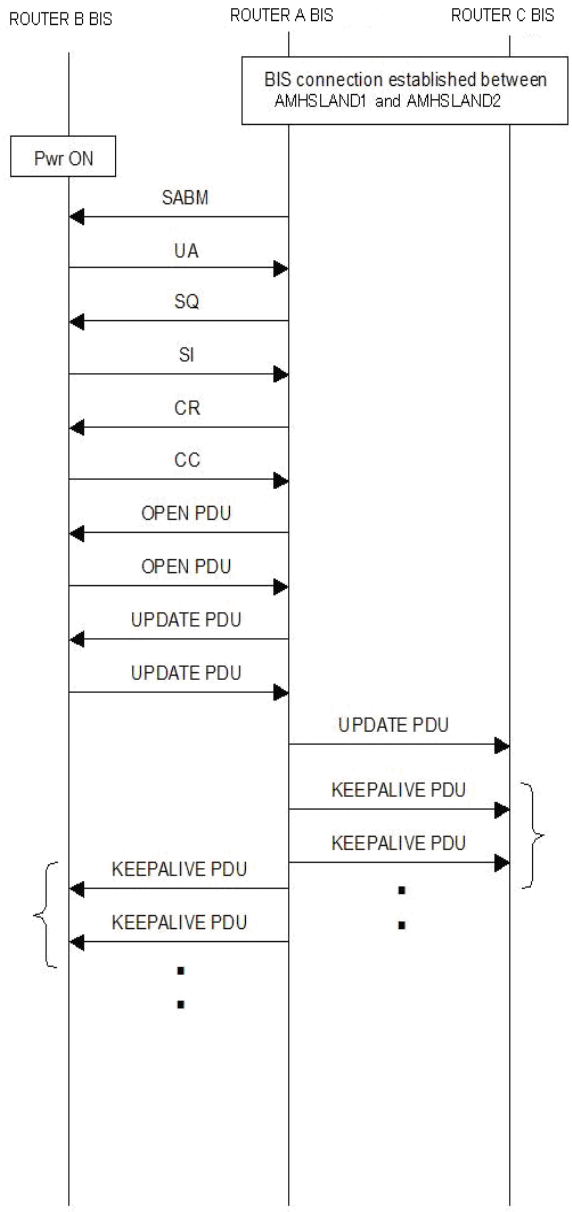
Test No.			Sequence Diagram
4	1	1	
4	1	2	
4	1	3	
4	1	4	
4	1	5	

Figure 18 Sequence: router connection of ROUTER B to ROUTER A (ROUTER A-ROUTER C already established)

Test No.			Sequence Diagram
4	2	1	
4	2	2	
4	2	3	
4	2	4	
4	2	5	
4	3	1	
4	3	2	
4	3	3	
4	3	4	

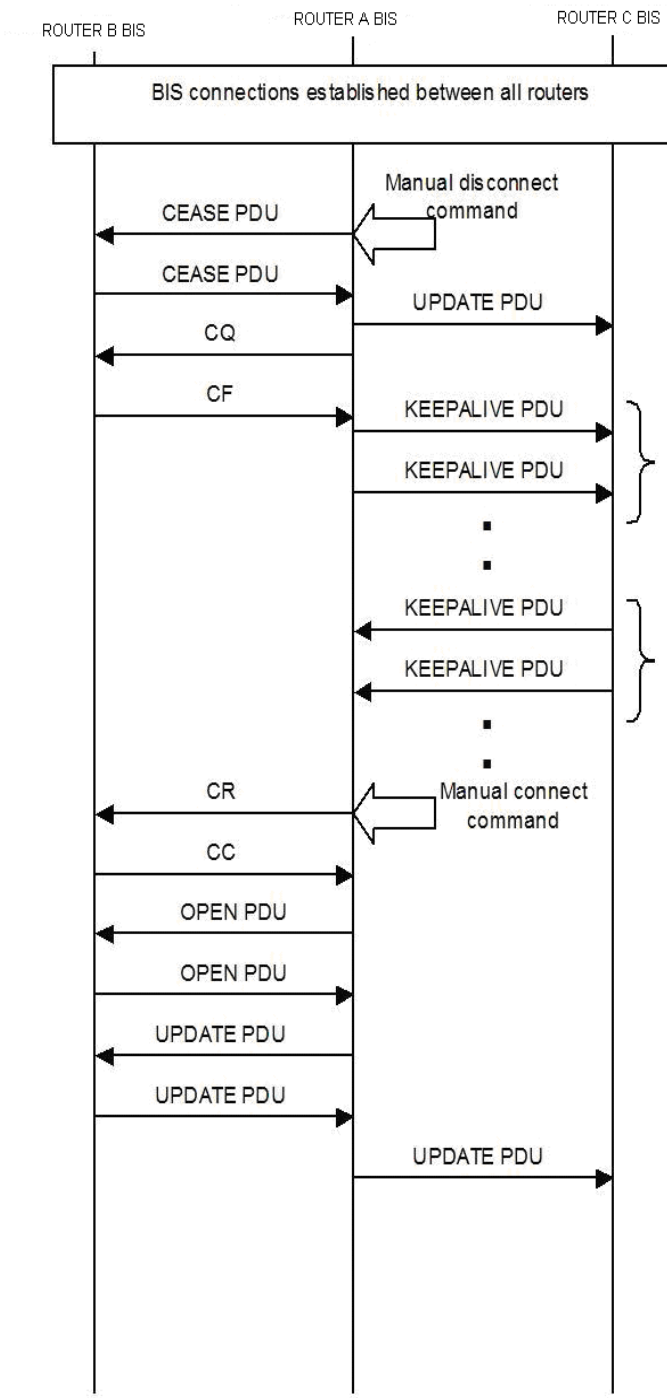


Figure 19 Sequence: Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route and re-activation.

Test No.			Sequence Diagram
4	4	1	Manual disconnect command
4	4	2	CEASE PDU
4	4	3	CEASE PDU
4	4	4	UPDATE PDU
4	4	5	CQ
			CF
			KEEPALIVE PDU
			KEEPALIVE PDU
			CR
			CC
			KEEPALIVE PDU
			OPEN PDU (discarded)
			KEEPALIVE PDU
4	5	1	Manual connect command
			CR
			CC
			OPEN PDU
4	5	2	OPEN PDU
4	5	3	UPDATE PDU
4	5	4	UPDATE PDU
			UPDATE PDU

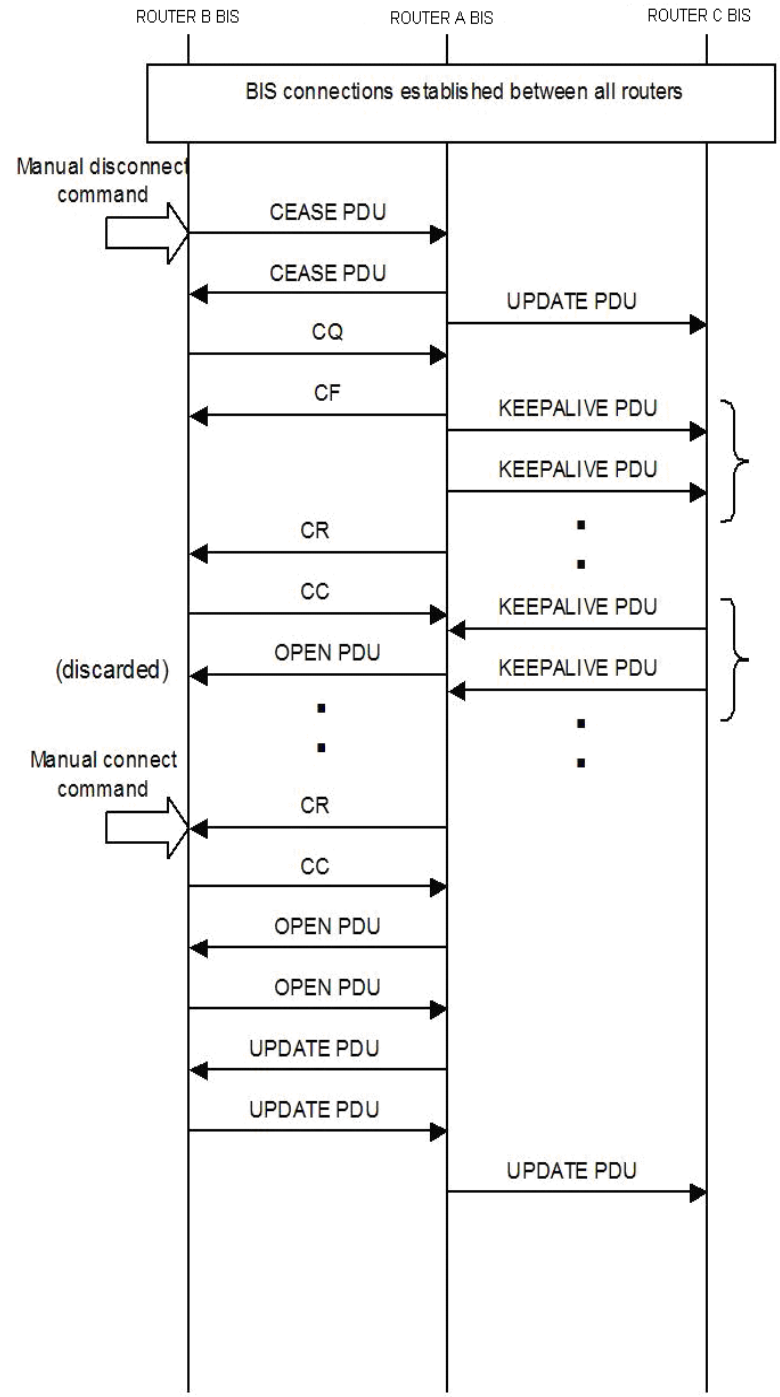


Figure 20 Sequence: Manual router disconnection at ROUTER B of ROUTER A-ROUTER B route and re-activation.

Table 28 Router Connection, Disconnection and Re-activation Test Procedure: ROUTER C-ROUTER A

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Router connection of ROUTER C to ROUTER A	Data link establishment between ROUTER C and ROUTER A	4-6-1	With VC and IDRP connections established between ROUTER A and ROUTER B, at ROUTER A, initiate router connection to ROUTER C. Check and confirm data link and VC are established between ROUTER C and ROUTER A.	OK / NG	/ /
	IDRP connection establishment between ROUTER C and ROUTER A	4-6-2	After VC establishment, check and confirm IDRP connection established between ROUTER C and ROUTER A by exchange of OPEN PDUs. (First OPEN PDU sent by ROUTER A.)	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C	4-6-3	After IDRP connection established, confirm ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, after receiving UPDATE PDU from ROUTER A, check that route information on ROUTER A and ROUTER B are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C to ROUTER A	4-6-4	After IDRP connection established, confirm ROUTER C sends an UPDATE PDU to ROUTER A. At ROUTER A, after receiving UPDATE PDU from ROUTER C, confirm route information of ROUTER C is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	4-6-5	At ROUTER A, after receiving UPDATE PDU from ROUTER C, confirm ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, after receiving UPDATE PDU from ROUTER A, confirm that route information of ROUTER C is added.	OK / NG	/ /
Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route	CEASE PDU transmission from ROUTER C	4-7-1	At ROUTER C, manually close the router connection to ROUTER A. Confirm ROUTER C sends a CEASE PDU to ROUTER A.	OK / NG	/ /
	CEASE PDU transmission from ROUTER A and route deletion	4-7-2	At ROUTER A, confirm receipt of CEASE PDU from ROUTER C. Confirm ROUTER A sends CEASE PDU to ROUTER C, and that route information for ROUTER C is deleted.	OK / NG	/ /

4. ATN Router Tests		Test Item	Procedure	Result	Date/Time
	Route deletion at ROUTER C	4-7-3	At ROUTER C, confirm receipt of CEASE PDU from ROUTER A, and that route information for ROUTER A and ROUTER B are deleted.	OK / NG	/ /
	VC disconnection between ROUTER C and ROUTER A	4-7-4	Confirm that the VC between ROUTER C and ROUTER A is closed normally.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B, and route deletion	4-7-5	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm that UPDATE PDU is received from ROUTER A, and that route information for ROUTER C is deleted.	OK / NG	/ /
Route re-activation from ROUTER C	Router connection re-activation from ROUTER C	4-8-1	At ROUTER C, manually initiate router connection to ROUTER A (VC call: called, OPEN PDU: receive). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C	4-8-2	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm UPDATE PDU is received, and that route information to ROUTER A and ROUTER B are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C to ROUTER A	4-8-3	Confirm that ROUTER C sends an UPDATE PDU to ROUTER A. At ROUTER A, confirm UPDATE PDU is received, and that route information to ROUTER C is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B and route addition	4-8-4	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm that UPDATE PDU is received, and that route information to ROUTER C is added.	OK / NG	/ /
Manual router disconnection at ROUTER A of ROUTER C-ROUTER A route	CEASE PDU transmission from ROUTER A	4-9-1	At ROUTER A, manually close the router connection to ROUTER C. Confirm ROUTER A sends a CEASE PDU to ROUTER C.	OK / NG	/ /

4. ATN Router Tests		Test Item	Procedure	Result	Date/Time
	CEASE PDU transmission from ROUTER C and route deletion	4-9-2	At ROUTER C, confirm receipt of CEASE PDU from ROUTER A, and that route information for ROUTER A and ROUTER B are deleted.	OK / NG	/ /
	Route deletion at ROUTER A	4-9-3	At ROUTER A, confirm receipt of CEASE PDU from ROUTER C, and that route information for ROUTER C is deleted.	OK / NG	/ /
	VC disconnection between ROUTER C and ROUTER A	4-9-4	Confirm that the VC between ROUTER C and ROUTER A is closed normally.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B, and route deletion	4-9-5	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm UPDATE PDU is received from ROUTER A, and that route information for ROUTER C is deleted.	OK / NG	/ /
Route re-activation from ROUTER A	Router connection re-activation from ROUTER A	4-10-1	At ROUTER A, manually initiate router connection to ROUTER C (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C	4-10-2	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm UPDATE PDU is received, and that route information to ROUTER A and ROUTER B are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C to ROUTER A	4-10-3	Confirm that ROUTER C sends an UPDATE PDU to ROUTER A. At ROUTER A, confirm UPDATE PDU is received, and that route information to ROUTER C is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B and route addition	4-10-4	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm UPDATE PDU is received, and that route information to ROUTER C is added.	OK / NG	/ /

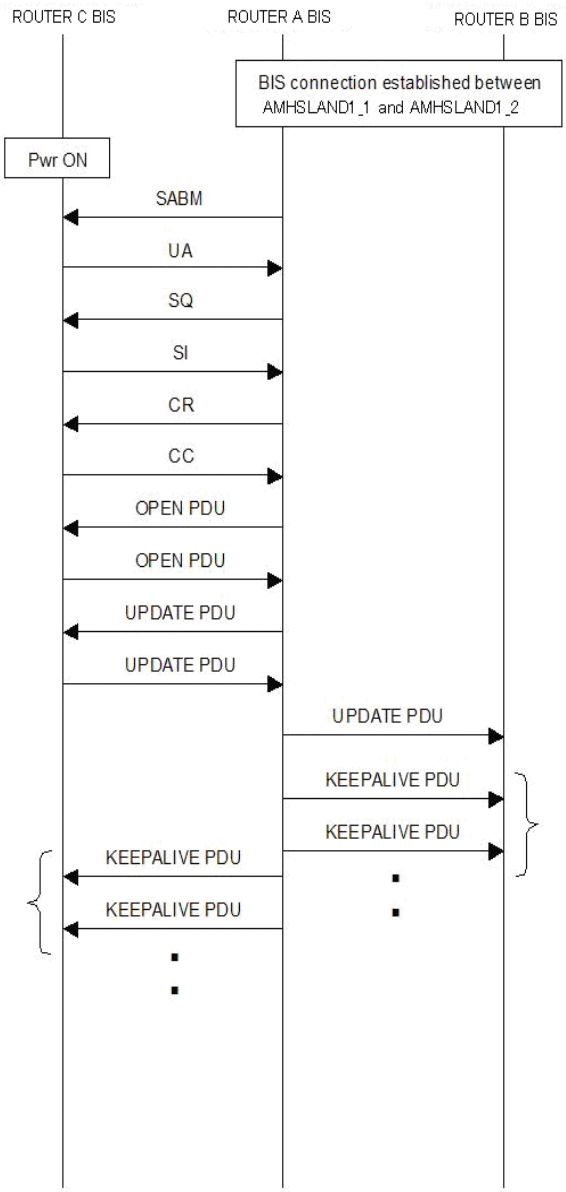
Test No.			Sequence Diagram
			
4	6	1	
4	6	2	
4	6	3	
4	6	4	
4	6	5	

Figure 21 Sequence: Router connection of ROUTER C to ROUTER A (ROUTER B-ROUTER A already established)

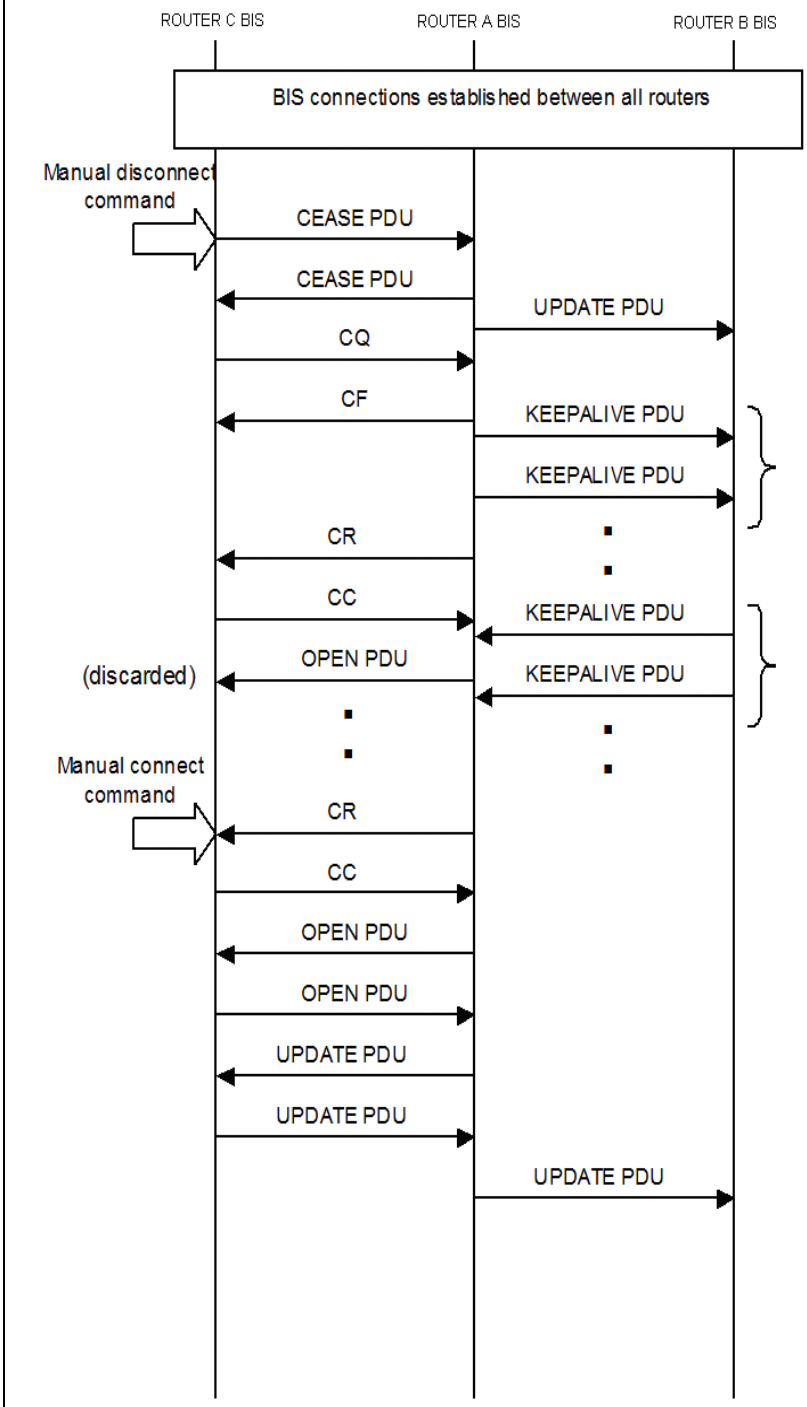
Test No.			Sequence Diagram
4	7	1	
4	7	2	
4	7	3	
4	7	4	
4	7	5	
4	8	1	
4	8	2	
4	8	3	
4	8	4	

Figure 22 Sequence: Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route and re-activation

Test No.			Sequence Diagram
4	9	1	
4	9	2	
4	9	3	
4	9	4	
4	9	5	
4	10	1	
4	10	2	
4	10	3	
4	10	4	

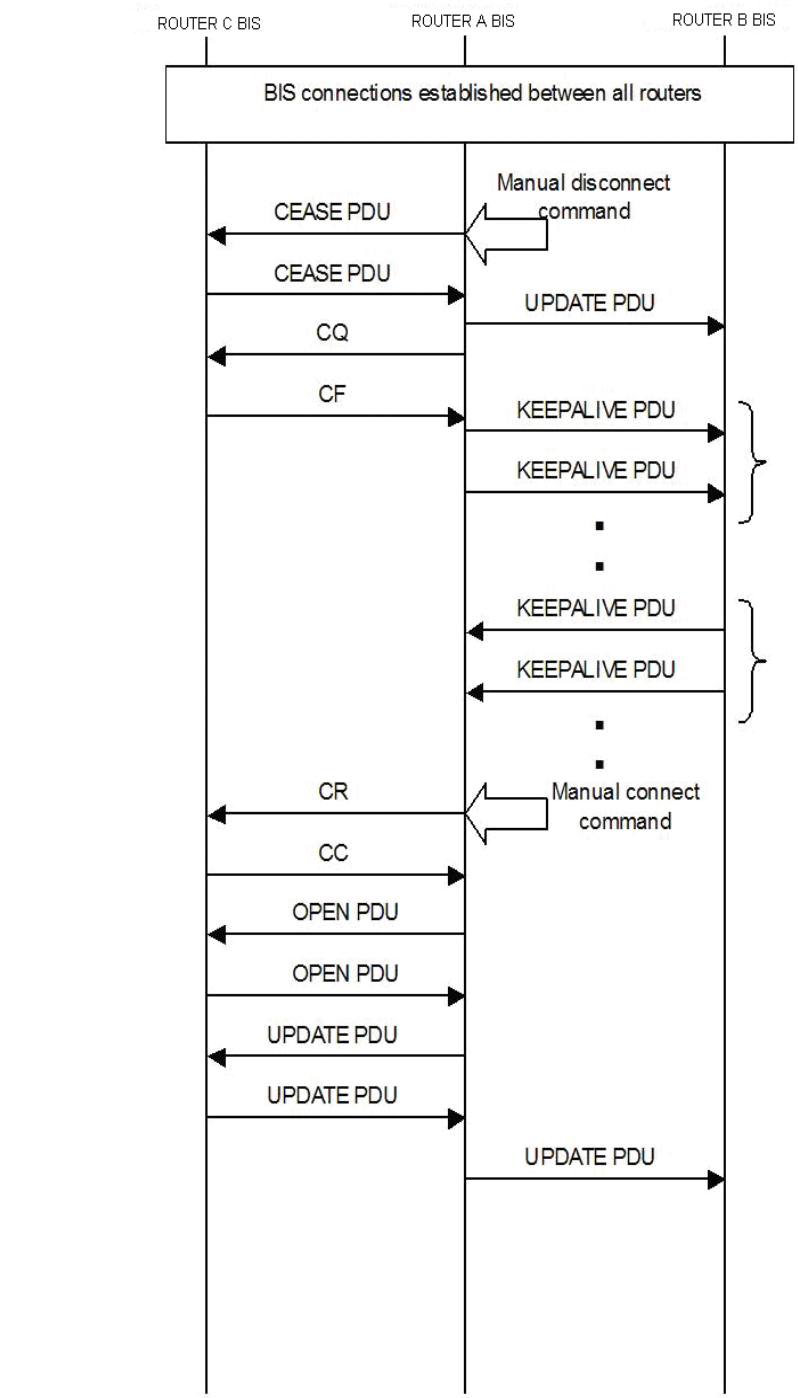


Figure 23 Sequence: Manual router disconnection at ROUTER A of ROUTER C-ROUTER A route and re-activation

Table 29 Communication Circuit Failure and Recovery Test Procedure: Third Domain connected to AMHSLAND1

4. ATN Router Tests		Test Item	Procedure	Result	Date/Time
Carrier media failure of ROUTER A-ROUTER B circuit and route deletion	Data link and VC disconnection	4-11-1	Simulate carrier medium failure between ROUTER A and ROUTER B by disconnecting WAN cable from ROUTER B. Check and confirm data link and VC are disconnected between ROUTER A and ROUTER B.	OK / NG	/ /
	IDRP disconnection and route update	4-11-2	Check and confirm that IDRP connection between ROUTER A and ROUTER B is closed. At ROUTER A, check that route information for ROUTER B is deleted. At ROUTER B, check that route information for ROUTER A and ROUTER C is deleted.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A and route update	4-11-3	Check that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, check UPDATE PDU is received from ROUTER A, and that route information for ROUTER B is deleted.	OK / NG	/ /
Carrier media restoration of ROUTER A-ROUTER B circuit and route addition	Data link, VC, and router connection re-establishment	4-12-1	Restore the ROUTER A-ROUTER B router connection. Confirm router connection is re-established between ROUTER A and ROUTER B.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A	4-12-2	After IDRP connection is established, confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, check that an UPDATE PDU is received from ROUTER A, and that route information for ROUTER A and ROUTER C are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B	4-12-3	After receiving UPDATE PDU from ROUTER A, check that ROUTER B sends an UPDATE PDU to ROUTER A. At ROUTER A, after receiving UPDATE PDU from ROUTER B, check that route information is added for ROUTER B.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A	4-12-4	Check that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, check that an UPDATE PDU is received from ROUTER A, and that route information is added for ROUTER B.	OK / NG	/ /

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Carrier media failure of ROUTER C-ROUTER A circuit and route deletion	Data link and VC disconnection	4-13-1	Simulate carrier medium failure between ROUTER C and ROUTER A by disconnecting WAN cable from ROUTER C. Check and confirm data link and VC are disconnected between ROUTER C and ROUTER A.	OK / NG	/ /
	IDRP disconnection and route update	4-13-2	Check and confirm that IDRP connection between ROUTER C and ROUTER A is closed. At ROUTER C, check that route information for ROUTER A and ROUTER B are deleted. At ROUTER A, check that route information for ROUTER C is deleted.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A and route update	4-13-3	Check that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, check that UPDATE PDU is received from ROUTER A, and that route information for ROUTER C is deleted.	OK / NG	/ /
Carrier media restoration of ROUTER C-ROUTER A circuit and route addition	Data link, VC, and Router connection re-establishment	4-14-1	Restore the ROUTER C-ROUTER A router connection. Confirm router connection is re-established between ROUTER C and ROUTER A.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A	4-14-2	After IDRP connection is established, confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, check that an UPDATE PDU is received from ROUTER A, and that route information for ROUTER A and ROUTER B are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C	4-14-3	After receiving UPDATE PDU from ROUTER A, check that ROUTER C sends an UPDATE PDU to ROUTER A. At ROUTER A, after receiving UPDATE PDU from ROUTER C, check that route information is added for ROUTER C.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A	4-14-4	Check that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, check that an UPDATE PDU is received from ROUTER A, and that route information is added for ROUTER C.	OK / NG	/ /

Test No.			Sequence Diagram
4	11	1	
4	11	2	
4	11	3	
4	12	1	
4	12	2	
4	12	3	
4	12	4	

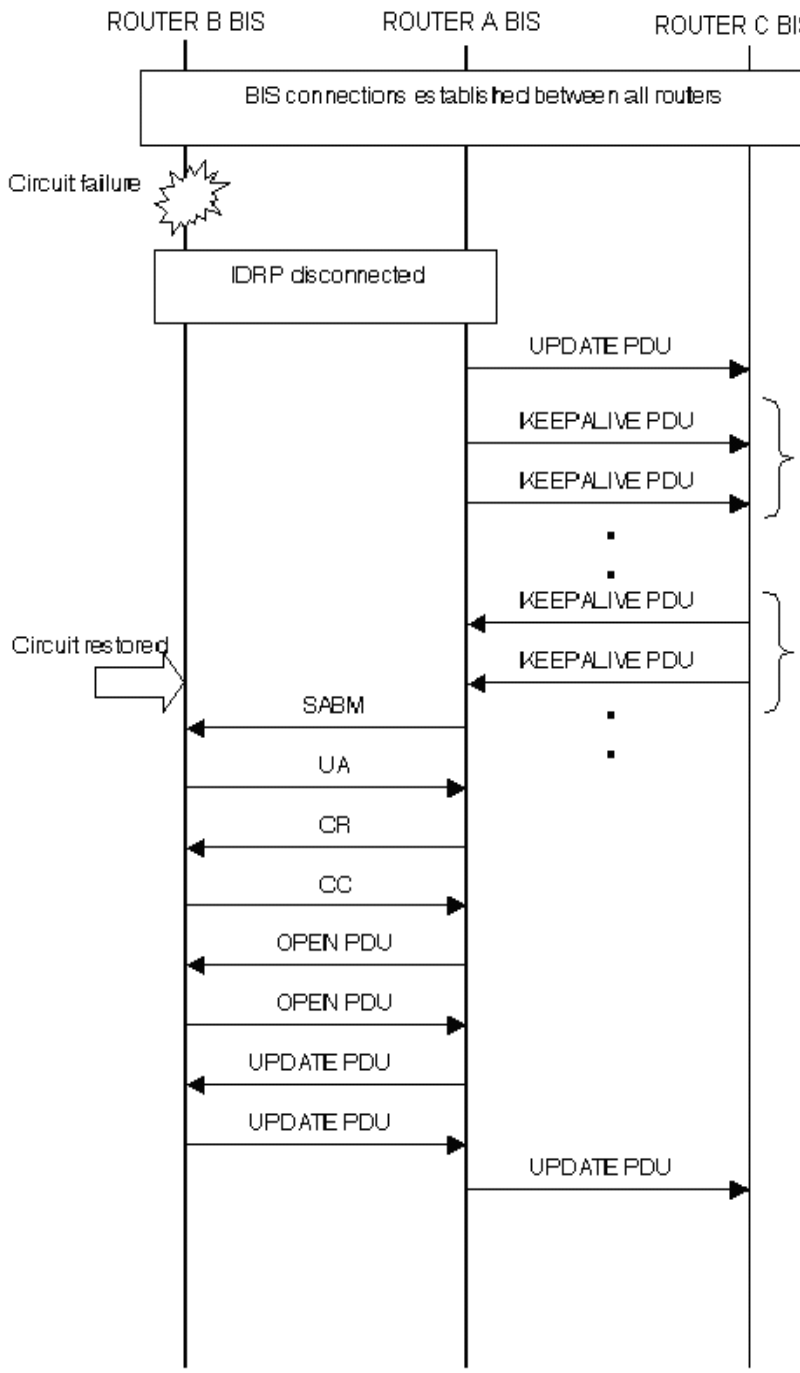


Figure 24 Sequence: Failure and recovery of ROUTER B-ROUTER A circuit

Test No.			Sequence Diagram
4	13	1	
4	13	2	
4	13	3	
4	14	1	
4	14	2	
4	14	3	
4	14	4	

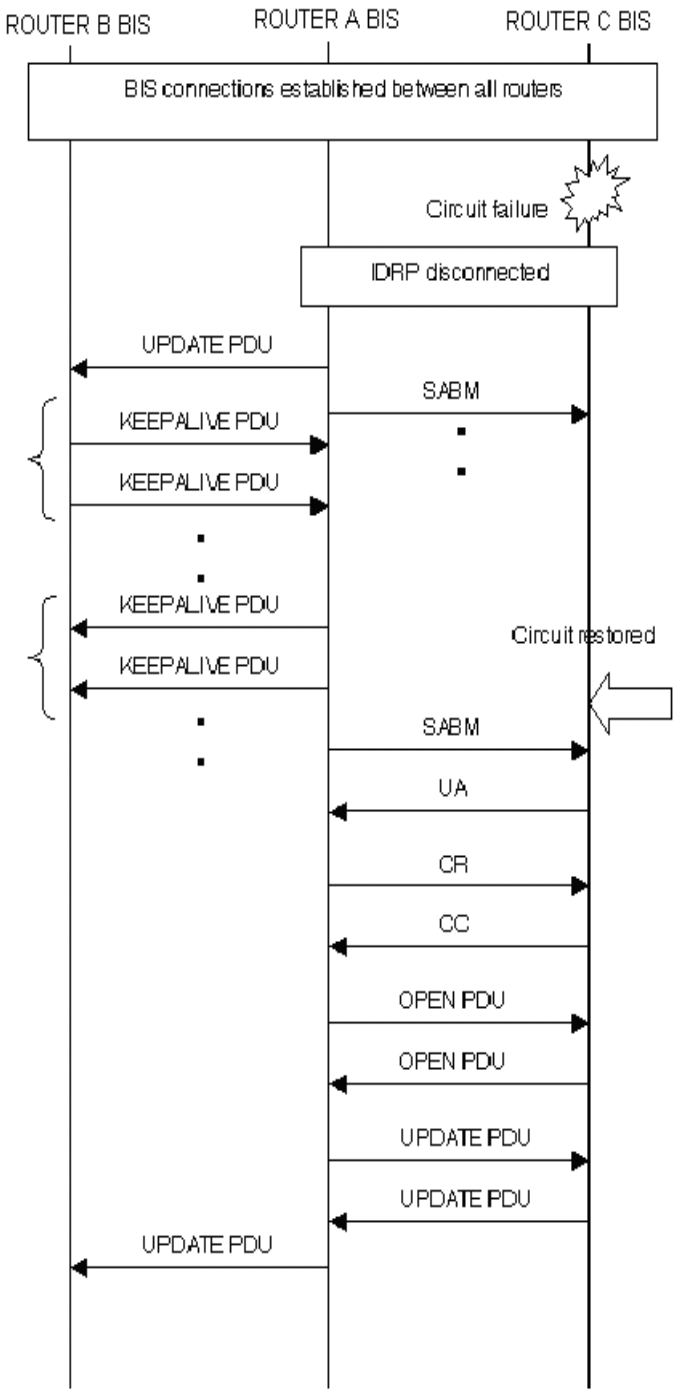


Figure 25 Sequence: Failure and recovery of ROUTER C-ROUTER A circuit

Table 30 Router Failure and Recovery Test Procedure

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Failure and recovery of ROUTER C	Failure of ROUTER C	4-15-1	Simulate failure and recovery of ROUTER C by rebooting the router. At failure: ・ At ROUTER A, check that routing information for ROUTER C is deleted. ・ At ROUTER B, check that routing information for ROUTER C is deleted.	OK / NG	/ /
	Recovery of ROUTER C	4-15-2	Check that the ROUTER C-ROUTER A router connection is automatically re-established after ROUTER C recovers. After recovery: ・ At ROUTER A, check that routing information for ROUTER C is added. ・ At ROUTER B, check that routing information for ROUTER C is added.	OK / NG	/ /
Failure and recovery of ROUTER A	Failure of ROUTER A	4-16-1	Simulate failure and recovery of ROUTER A by forcing failover. At failure: ・ At ROUTER B, check that routing information for ROUTER A and ROUTER C are deleted ・ At ROUTER C, check that routing information for ROUTER A and ROUTER B are deleted.	OK / NG	/ /

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
	Recovery of ROUTER A	4-16-2	Check that the ROUTER C-ROUTER A and ROUTER A-ROUTER B router connections are automatically re-established after ROUTER A recovers. After recovery: ・ At ROUTER A, check that routing information is added for ROUTER C and ROUTER B. ・ At ROUTER B, check that routing information for ROUTER C and ROUTER A are added. ・ At ROUTER C, check that routing information for ROUTER A and ROUTER B are added.	OK / NG	/ /
Failure and recovery of ROUTER B	Failure of ROUTER B	4-17-1	Simulate failure and recovery of ROUTER B by rebooting the router. At failure: ・ At ROUTER A, check that routing information for ROUTER B is deleted. ・ At ROUTER C, check that routing information for ROUTER B is deleted.	OK / NG	/ /
	Recovery of ROUTER B	4-17-2	Check that the ROUTER A-ROUTER B router connection is automatically re-established after ROUTER B recovers. After recovery: ・ At ROUTER A, check that routing information for ROUTER B is added. ・ At ROUTER C, check that routing information for ROUTER B is added. ・ At ROUTER B, check that routing information for ROUTER A and ROUTER C are added.	OK / NG	/ /

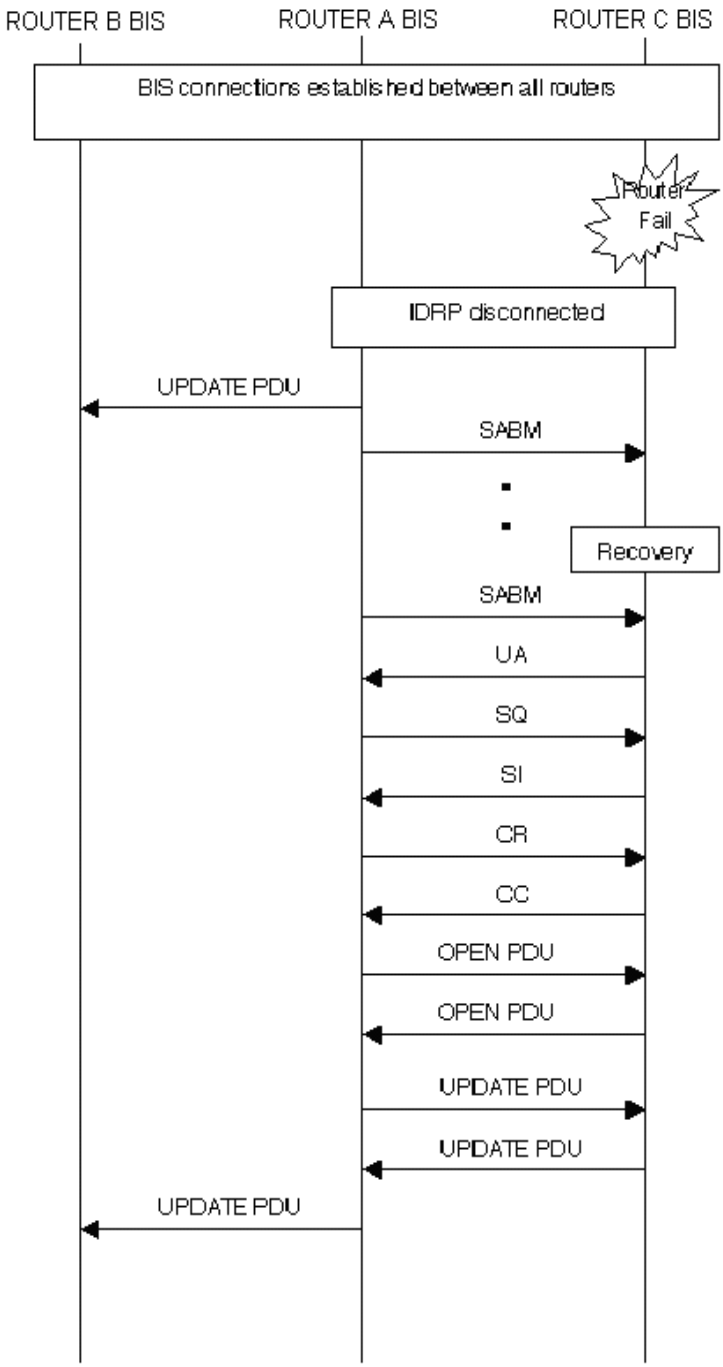
Test No.			Sequence Diagram
4	15	1	
4	15	2	

Figure 26 Sequence: Failure and Recovery of ROUTER C

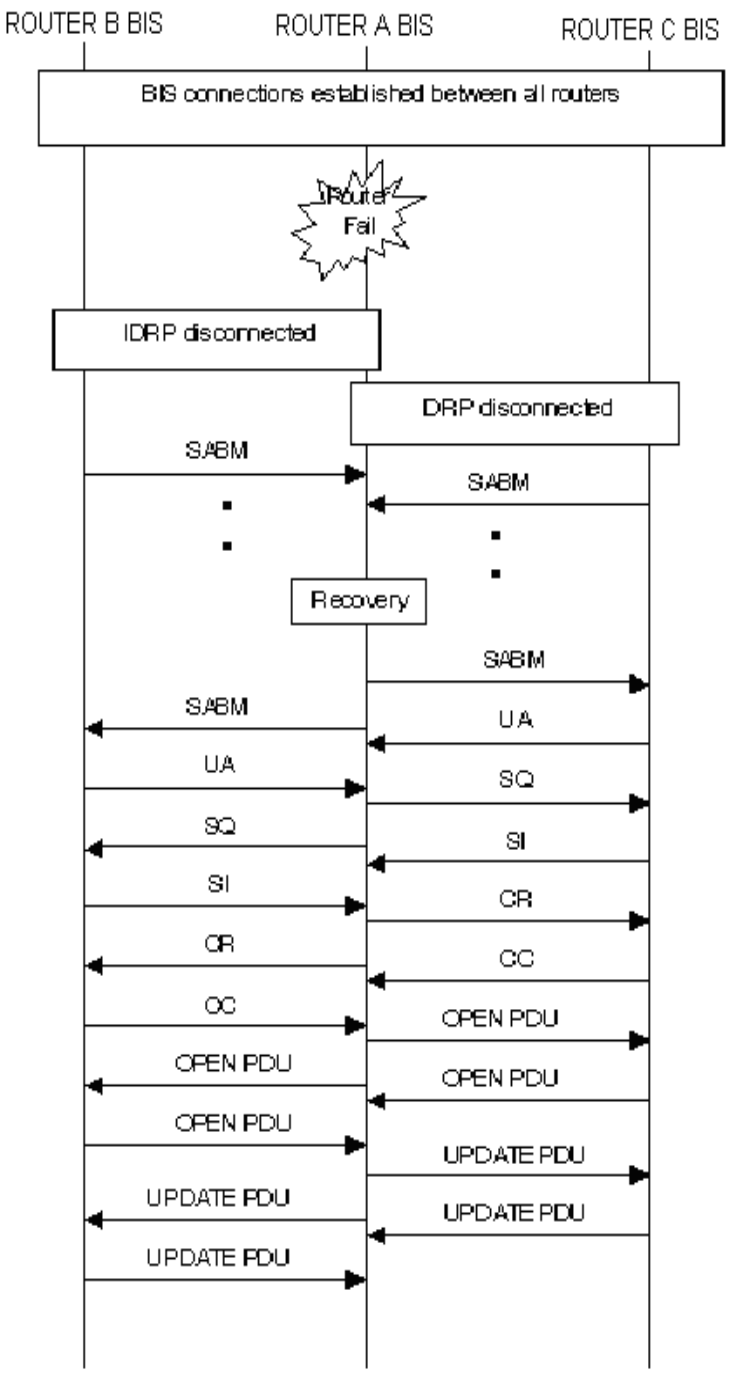
Test No.			Sequence Diagram
4	16	1	
4	16	2	

Figure 27 Sequence: Failure and Recovery of ROUTER A

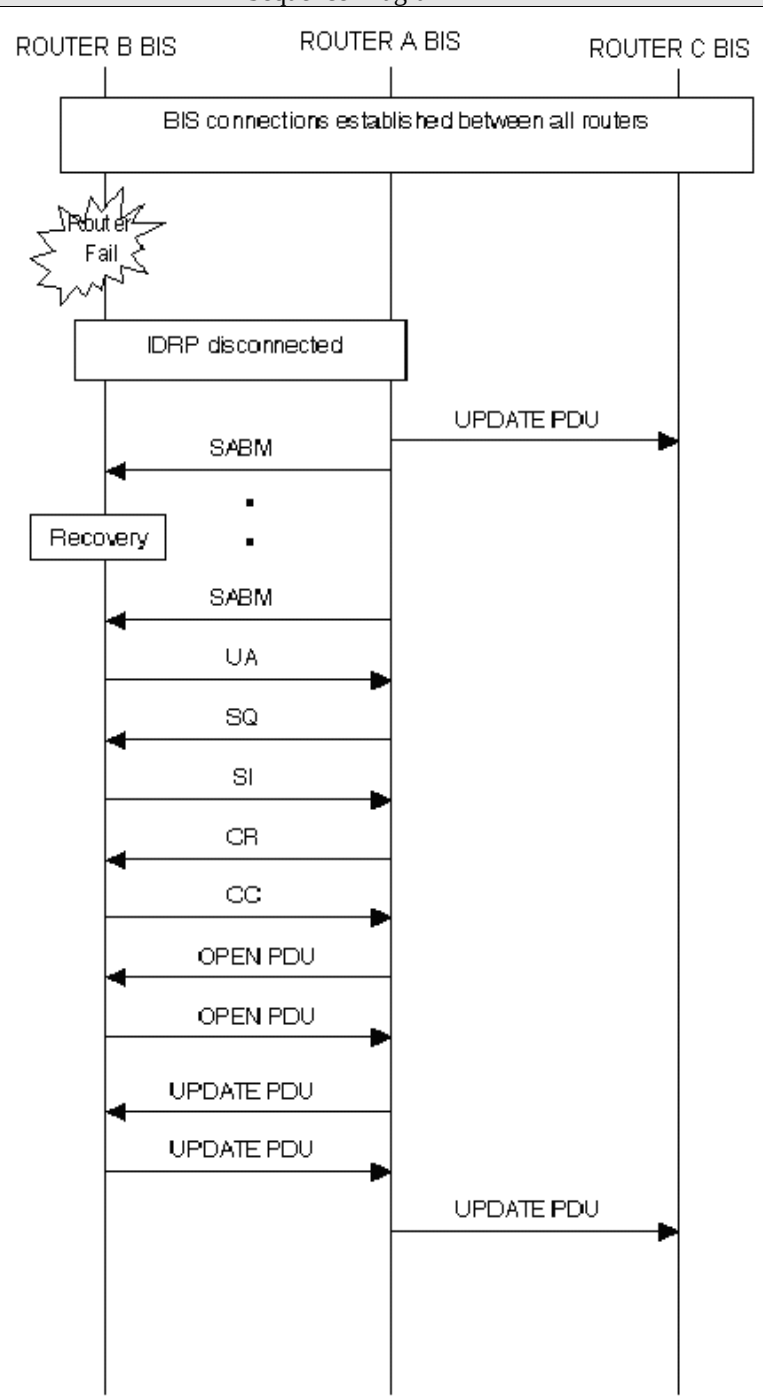
Test No.			Sequence Diagram
4	17	1	
4	17	2	

Figure 28 Sequence: Failure and Recovery of ROUTER B

Table 31 End-to-End CLNP Echo Test Procedure

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
End-to-End CLNP Echo Test between end systems in ROUTER C domain and ROUTER B domain	ERQ transmission	4-18-1	Send ERQ PDU from ES in ROUTER C domain to ES in ROUTER B domain. Confirm receipt of ERQ PDU at ES in ROUTER B domain.	OK / NG	/ /
	ERP transmission	4-18-2	Send ERP PDU from ES in ROUTER B domain to ES in ROUTER C domain. Confirm receipt of ERP PDU at ES in ROUTER C domain.	OK / NG	/ /
	Continuous ERQ/ERP transmission	4-18-3	Repeat 4-18-1 to 4-18-2 ten times to confirm that there is no problem with ERQ/ERP transmission and relay through the ROUTER A.	OK / NG	/ /
	ERQ transmission	4-18-4	Send ERQ PDU from ES in ROUTER B domain to ES in ROUTER C domain. Confirm receipt of ERQ PDU at ES in ROUTER C domain.	OK / NG	/ /
	ERP transmission	4-18-5	Send ERP PDU from ES in ROUTER B domain to ES in ROUTER C domain. Confirm receipt of ERP PDU at ES in ROUTER C domain.	OK / NG	/ /
	Continuous ERQ/ERP transmission	4-18-6	Repeat 4-18-4 to 4-18-6 ten times to confirm that there is no problem with ERQ/ERP transmission and relay through the ROUTER A.	OK / NG	/ /

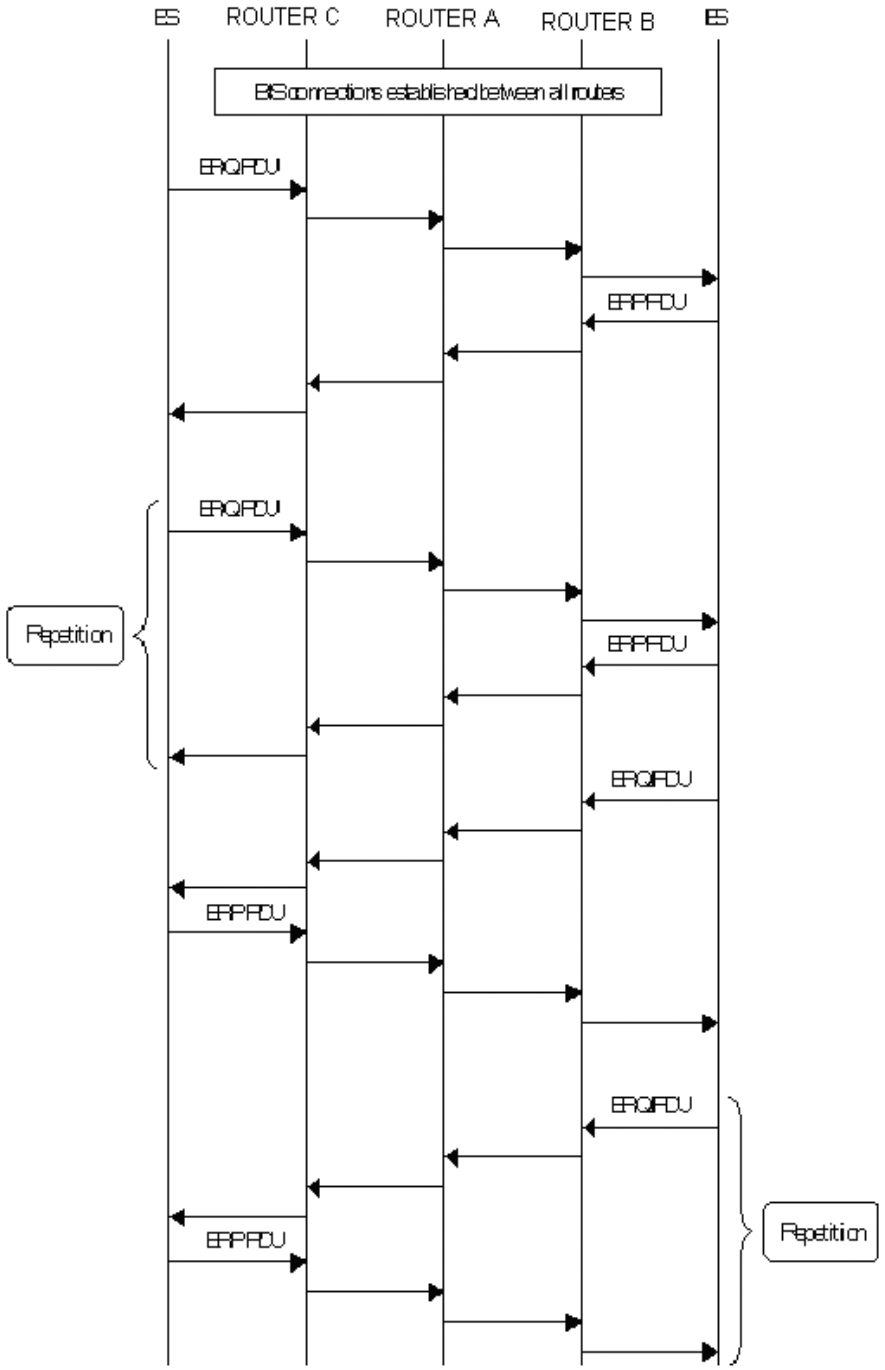
Test No.			Sequence Diagram
4	18	1	
4	18	2	
4	18	3	
4	18	4	
4	18	5	
4	18	6	

Figure 29 Sequence: End-to-End CLNP Echo Tests

- END -

ANNEX D

AMHS Testing Requirements

ANNEX D

of

AMHS Manual

Document Control Log

Edition	Date	Comments	Section/pages affected
1.0	22/06/2007	Creation of the document.	all
1.0	September 2007	Document is endorsed by APANPIRG/18	all
2.0	22/09/2008	Editorial updates – change of document version number	all

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1 Introduction

1.1 Purpose of the Document

The purpose of the document is to define the functional requirements for AMHS testing procedures.

1.2 Scope of the Document

Based on known principles of testing and general assumptions on an AMHS test scenario, the scope of testing for an "AMHS Conformance Test" is specified. Elements of the specifications are generic test groups and related test configurations. Special attention is given to the “provocation” of an AMHS implementation with incorrect protocol behavior (“negative testing”) to analyze its stability (robustness) in out-of-line situations.

Further requirements are specified in terms of configuration parameters (as number of ATS Message Servers and AMHS users represented by test equipment) and the components of AMHS and AFTN information objects to be handled.

In principle, these groups are also valid for interoperability tests. But especially the test groups dealing with “negative testing” cannot be performed by real systems due to the nature of an implementation to avoid such exception situations.

1.3 Document Structure

Chapter 2 is concerned with general aspects of conformance testing and identifies the principal differences to interoperability testing. Key elements of the envisaged test methodology are identified which form high-level requirements for an AMHS conformance testing equipment. References are made to ISO/IEC 9646 which provides a general concept of conformance testing and to deliverables of the ACCESS study concerning AMHS testing.

Chapter 3 deals with the scope of AMHS functions to be tested and identifies reference points at AMHS implementations which should be accessible for testing. In addition, the used transport service for AMHS communications is identified and the interface with AFTN at the implemented AFTN/AMHS Gateway is detailed.

Chapter 4 defines AMHS test groups for comprehensive conformance testing of AMHS native communications and gateway operations with the AFTN. Related test configurations are added with explanations on sequences of exchanged AMHS and AFTN information objects. In addition, principles for definitions of test cases are set up including the consideration of so-called “negative testing”.

Chapter 5 specifies the range of parameters values supported in test configurations which place quantitative requirements on the testing equipment as the number of represented adjacent ATS Message Servers and handled AMHS and AFTN users.

Finally, *chapter* 6 identifies the used AMHS and AFTN test data. In particular, the elements of AMHS information objects and their sub-components (as message and message transfer envelope) to be supported are specified in detail.

1.4 References

[1] ICAO DOC 9705-AN/956: The Manual of technical provisions for the ATN, Sub-volume III, Section 3.1 –Edition 3 (2002) – Referred to as AMHS SARPs

[2] ICAO Annex 10 – Aeronautical Telecommunications, Volume II: Communication Procedures

[3] ISO/IEC 10021-2 – Information technology, Text communication – Message-oriented Text Interchange Systems – Part 2: Overall architecture

[4] ISO/IEC 10021-4 – Information technology, Text communication – Message-oriented Text Interchange Systems – Part 4: Message Transfer System: Abstract service definition and procedures

[5] ISO/IEC 10021-7 – Information technology, Text communication – Message-oriented Text Interchange Systems – Part 7: Interpersonal Messaging System

[6] ISO/IEC ISP 10611-3 – International standardized profile AMH1n – Message Handling Systems – Common Messaging –AMH11: Message transfer (P1)

[7] ISO/IEC ISP 12062-2 – International standardized profile AMH2n – Message Handling Systems – Interpersonal Messaging –AMH21: IPM content

[8] ISO/IEC ISP 12062-3 – International standardized profile AMH2n – Message Handling Systems – Interpersonal Messaging –AMH22: IPM requirements for message transfer (P1)

[9] ISO/IEC 9646-1 – Conformance testing methodology and framework – Part 1: General concept (1994)

2 Conformance Testing

The chapter provides an introduction to general aspects of conformance testing and identifies the principal differences to interoperability testing. Elements of the envisaged test methodology are identified which form high-level requirements for an AMHS conformance testing equipment.
References are made to ISO/IEC 9646.

2.1 Objectives

Generally, conformance testing attempts to determine whether a given implementation matches a specification. The implementation to be tested is referred to as the *implementation under test (IUT).* A tester provides the IUT with defined inputs and observes the resulting outputs. – ISO/IEC 9646-1 provides a general concept of OSI conformance testing and definitions of related key terms.

Note. – According to ISO 9646-1, the term Implementation Under Test (IUT) refers to an implementation of one or more OSI protocols, being part of a real open system which is to be studied. The System Under Test (SUT) is the real open system in which the IUT resides. – In the following, the term IUT is used when referring to the AMHS implementation to be tested in consideration that only the AMHS aspects within an given (real) ATS communication system are addressed.

ISO/IEC 9646-1 distinguishes three types of standardised conformance testing:

- *Basic interconnection tests*, that is to determine whether or not there is sufficient conformance to the relevant protocols for interconnection to be possible without trying to perform thorough testing.

  .
- *Capability tests*, which are used to verify the existence of one or more claimed capabilities of an IUT (*static* conformance requirements).

  .
- *Behaviour tests* deal with *dynamic* conformance requirements, which specify the observable behaviour of an implementation. Behaviour tests include tests for valid behaviour of the IUT for both valid and invalid inputs by the tester.

The AMHS testing requirements specified in this document focus on *behaviour tests*, i.e. test exercises address implemented AMHS functions in a way as they should be used. *Basic interconnection tests* are an appropriate means to check the correctness of a test configuration before starting detailed test exercises.

The discussed AMHS conformance testing relates to that scope of functions which is typically implemented in an *International Communication Centre*, i.e.

1) AMHS message transfer,
2) AMHS submission and delivery operations with attached AMHS user terminals and
3) Intercommunication with the AFTN/X.25 by means of the AFTN/AMHS Gateway.
   The interface to the AFTN (X.25) is only taken into account in the extent as specified in the AMHS SARPs. For example, the AMHS SARPs do not assume AFTN routing by the gateway. – The Basic ATS Message Handling Service is assumed as the service level supported by the IUT.
   The conformance testing equipment acting as peer system of the AMHS IUT is referred to the *AMHS Test Tool*. The AMHS Test Tool provides the IUT with inputs, records and evaluates responses of the IUT.
   The specified testing requirements refer to an initial functionality of the AMHS Test Tool. Potential future extensions are indicated in the context of the specified sub-items of the test tool.

2.2 Specific aspects of AMHS testing

The AMHS (MHS) functions to be tested reside in the *application layer* of the ISO/OSI reference model. The underlying layers provide supporting communication services, however, are not primary subject of testing.

The context of AMHS conformance testing:

.

(a) the testing of complete systems ("black boxes") and

.

(b) the testing of individual protocol layers, in particular the application layer.

In case (a) only external interfaces which are part of the IUT are used by the conformance testing equipment. In case (b), on the other hand, the IUT has to be "opened up", providing the layer to be tested. For this purpose special software modules have to be provided within the IUT for control and observation of the lower and upper service boundary at the layer under test (see ISO/IEC 9646-1).

Recommendations for AMHS conformance testing are:

- the individual components and protocol layers of the IUT not be visible to the conformance testing equipment;
- access to the IUT by the test equipment is only via standard interfaces; and

.

- human readable terminal interfaces (as the Control Position of an AMHS gateway) are not accessed by the test equipment.

This recommended testing approach forms the baseline for the functional requirements placed on the AMHS Test Tool, as follows:

- The AMHS Test Tool will be interconnected with the IUT's external interfaces as far as they are standardised by the AMHS SARPs. Such standardised interfaces are the *AMHS transfer ports* and the *AFTN/X.25 interface*. The IUT is treated as a *black box*.
- Originations and receptions at user terminals have to be performed and observed by an operator who is familiar with the implemented HMI. From that follows that conformance testing needs certain operator assistance at the IUT. (The made assumptions on interfaces which are available at individual IUTs will be outlined by means of an IUT model.)

3 Assumed Test Scenario

3.1 AMHS Functionality of the IUT

3.1.1 AMHS SARPs provisions

The assumption is made that the IUT to be tested provides completely or partially the AMHS functionality as specified by the SARPs in support of the *Basic* ATS Message Handling Service. Figure 1 identifies the key elements of the AMHS which are addressed by SARPs. The figure shall also indicate that the majority of the AMHS functionality is specified by references to the MHS standard series ISO/IEC 10021 and the related profile documentation ISO/IEC ISP 10611 (Common Messaging) and ISP 12063 (Interpersonal Messaging).

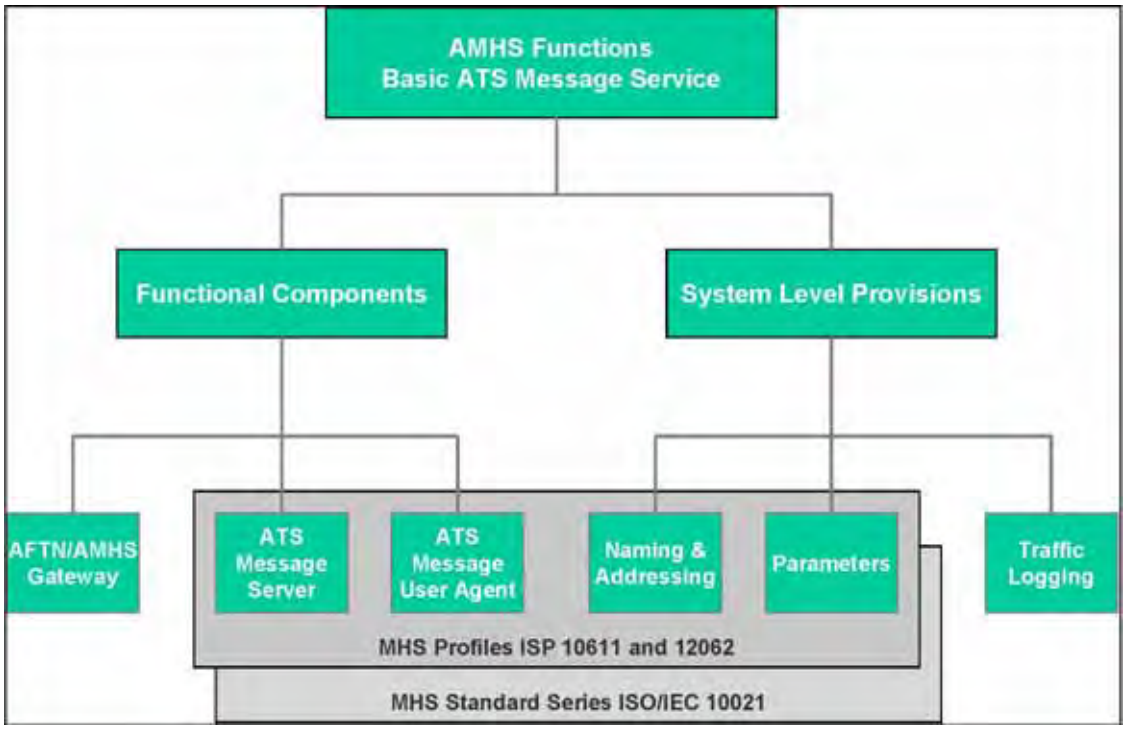

Figure 30: AMHS functionality specified by SARPs

The nucleus of the AMHS is formed by its three functional components:

- *ATS Message Server* performing *transfer* operations with adjacent ATS Message Servers (and AMHS gateways) by means of its inherent (MHS) Message Transfer Agent (MTA). In addition, *submission* and *delivery* operations are performed with one or more attached ATS Message User Agents. Optional (MHS) Message Stores (MS) may provide retrieval services for ATS Message User Agents in connection with message delivery.

- *ATS Message User Agents* each including a (MHS) User Agent (UA) as key component. An ATS Message User Agent interacts on one side with a (local) AMHS user interface and accesses on the other side the transfer level of the AMHS by performing *submission* and *delivery* operations with the superordinated ATS Message Server. Communications between ATS Message User Agents (via ATS Message Servers) are end-to-end and have to comply with the IPM content as specified for the (MHS) Interpersonal Messaging System (IPMS).

- *AFTN/AMHS Gateway* supporting interworking between users of the AMHS and AFTN. The gateway includes for operations with the transfer level of the AMHS and MTA. The mapping functions of the gateway reside in the Message Transfer and Control Unit (MTCU). The operations with AFTN are performed with the AFTN components. Exception handling which needs operator assistance is moved to the Control Position.

The above listed functional components are typically implemented in International Communication Centres performing AMHS message transfers, AMHS message submission and delivery operations with attached AMHS user terminals and intercommunications with the AFTN. However, an AFTN/AMHS Gateway may be also implemented as stand-alone facility allowing existing AFTN communication facilities access to the AMHS.
In addition, the AMHS SARPs address some aspects relating to the system level of an AMHS environment. The key ingredients at the system level of the AMHS are:

- *Naming and addressing* relating to the unambiguously identification of AMHS users and entities at upper layers protocols as needed for communications between AMHS systems. The specifications are based on MHS O/R addressing and ISO/OSI upper layer conventions. Examples are: the Common AMHS Addressing Scheme, Application Process Titles and Transport/Session/Presentation addresses.

  .
- *Parameters* define specific AMHS conventions in the framework of the MHS standard. Examples are: The limitation of Receipt Notifications for IPMs with the *importance* value “high” and the definition of the ATS-Message-Header in the IPM body part.

  .
- *Traffic logging* in functional components in support of message tracking across the AMHS.

The manner of implementation of the above identified AMHS functionality in the IUT is irrelevant for testing (*black-box* view). The above functional outline is used just as reference for the scope of conformance testing to be supported by the AMHS Test Tool.

3.1.2 Implementation specific AMHS features

Typically, an AMHS implementation includes features which are either beyond the scope of the SARPs or seen as local issue. Examples are: User interfaces (HMI) for local submissions and deliveries, proprietary MTS access protocol and provisions for systems management (including statistics and diagnostic means).
Such features will not be subject of conformance testing, however, may be used in support of conformance testing. Example: IPM submission at local user terminals for verification of correct generation of the related P1 message.

3.2 Modelling of the test environment

Figure 2 illustrates the intended operational environment of the IUT at the level of messaging: Via Transfer Ports of the IUT (logical) connections are established to *n* adjacent ATS Message Servers which in turn provide connectivity to *m* distant ATS Message User Agents. Local access to the AMHS is offered by *p* AMHS User Terminals attached to the IUT. Via the AFTN/AMHS Gateway there is a connection to an adjacent AFTN Communication Centre which in turn provides connectivity to *s* AFTN stations. – The figures *m*, *n*, *p* and *s* are seen as configuration parameters of the test configuration (see Section 5).

Note 1. – The specification of the AFTN/AMHS Gateway assumes an AFTN link to only one adjacent AFTN centre to minimise the AFTN functionality in the gateway. However, in typical implementations, the AFTN/AMHS Gateway is collocated with AFTN centre functions supporting connections to a number of adjacent centres. This aspect of multiple AFTN connections is not considered for conformance testing against the AMHS SARPs.

Note 2. – In the AISAPAC Region, AFTN communications make use of the X.25 transport service. This is taken into account for conformance testing, however, with the limitation, that only one X.25/AFTN link is established between the test tool and the IUT (see Figure 2).

Note 3. – In-depth testing of AFTN and X.25 capabilities of the IUT is not seen as subject of AMHS conformance testing.

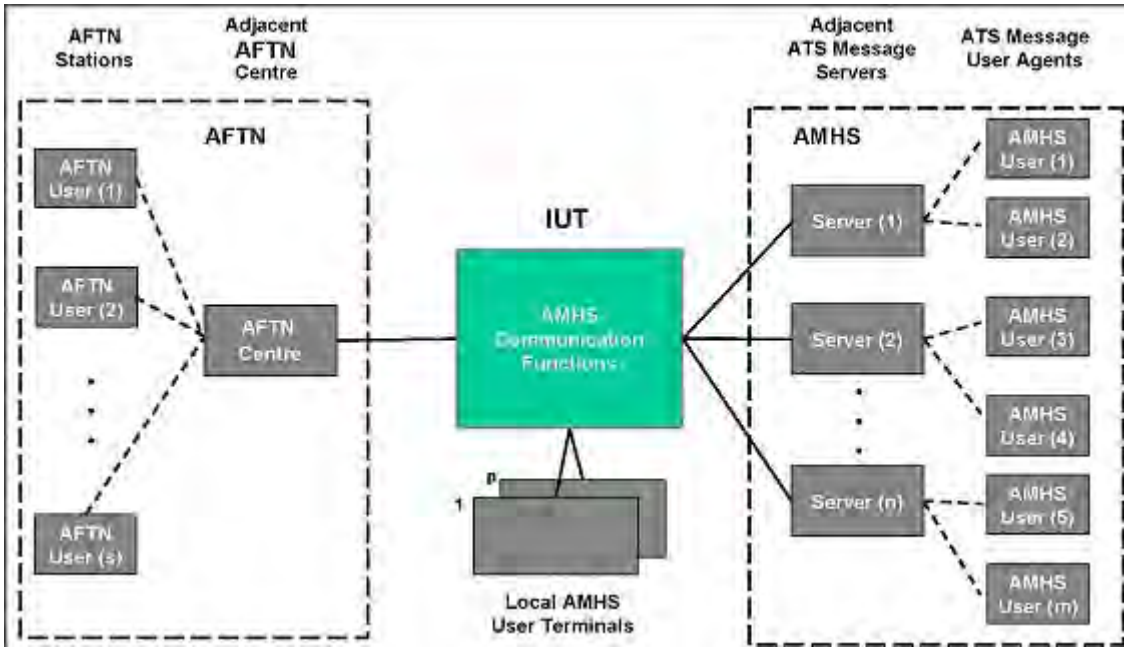

Figure 31: Assumed operational environment of the IUT

The AMHS Test Tool simulates an operational environment for the IUT as depicted in Figure 2. Figure 3 shows the corresponding model of the test configuration. The *COM Interfaces* of the test tool include *n* MTA instances representing the *n* adjacent ATS Message Servers of the IUT and an AFTN/X.25 source/sink representing the AFTN/X.25 environment. Other major functional components of the test tool are the *Test Repository* (containing predefined test scripts and associated test data), *Test Script Editor* (providing an HMI for specifications of test scripts and test data), *Test Log* (containing all the exchanged information objects) and *Test Evaluation* (performing test evaluations based on the test log against various criteria). The *Test Driver* controls the execution of test scripts and enters exchanged information objects in the test log. Finally, the component *Test Management* is tasked with the overall management and administration of the test tool.

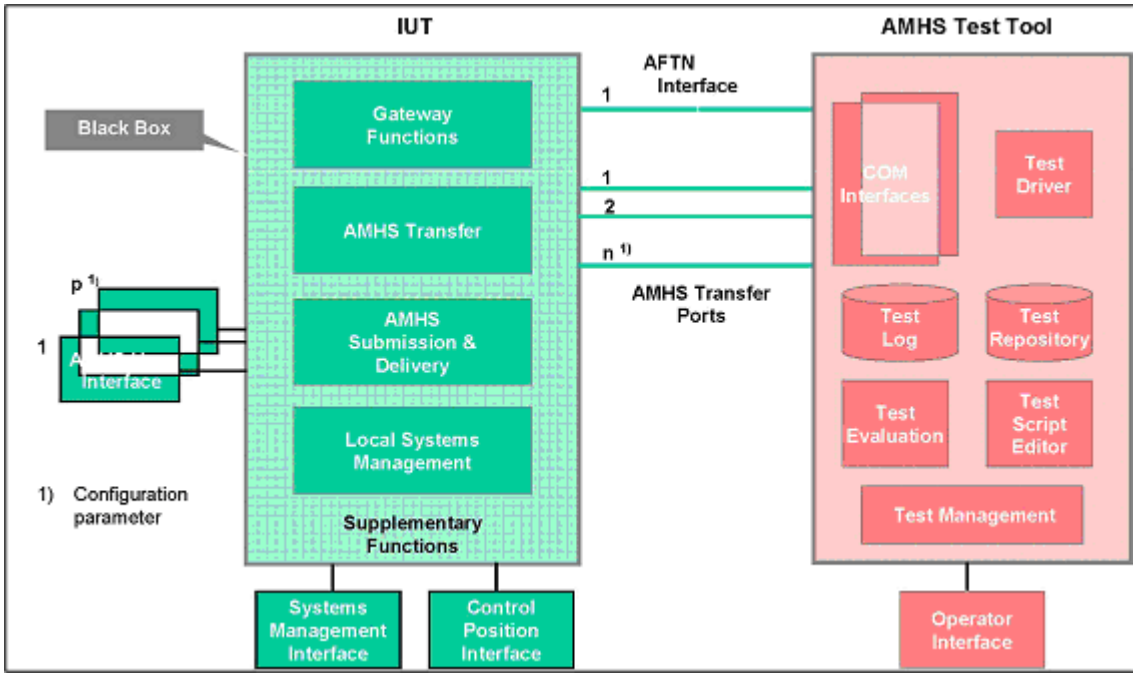

Figure 32: Model of the test environment

The IUT is represented in the modelled test configuration (*Figure 3*) by its functional components which will be subject of testing, i.e. AMHS transfer, AMHS submission/delivery and AMHS gateway functions (cf. Section 3.1). The inclusion of other indicated components of the IUT (as Systems Management Interface) will be addressed in subsequent sections.
The *n* MTA names, the addresses of the *m* ATS Message User Agents, *s* AFTN stations and *p* AMHS User Terminals are considered as configuration parameters which are jointly set up in the IUT and AMHS Test Tool.

Note. – The above outlined functional model includes an abstract, logical view on the AMHS Test Tool for the purpose of understanding the intended testing approach. The real design of the test tool is subject of separate documentation.

3.3 Used Transport Service for AMHS

According to the AMHS SARPs AMHS communications make use of the *ATN Internet Communications Service* (Layer 4). The ISO Transport Service of the class TP0 will be provided over a TCP/IP stack by using the convergence function defined with RFC 1006. The AMHS communications in the test configuration follow this approach.

Note. – Further extensions of the AMHS Test Tool may also support the ATN internet communications Service (aspect of inter-Regional or boundary centres) and TP0 over X.25.

3.4 Communication with the AFTN

The AMHS SARPs specify for the AFTN/AMHS Gateway an AFTN interface by referring to Annex 10, Volume II, i.e. the (asynchronous) *AFTN Teletypewriter Procedures* apply.

Note. – Extensions of the AMHS Test Tool may also support AFTN asynchronous communications and/or AFTN over X.25.

3.5 Points of Reference for testing

With the black-box view at the IUT, the verification of implemented functionality is limited to test inputs and examinations of resulting responses at external (open) interfaces of the IUT. Standardised interfaces of the IUT are directly interfaced by the AMHS Test Tool. At nonstandardised (proprietary) user interfaces of the IUT observations of operator inputs and displayed information are needed. Example: Origination of IPMs to be submitted or presentations of delivered IPMs at local AMHS user interfaces.
Such interfaces of the IUT which are used for conformance testing are referred to as *points of reference*. In the following, these points of reference will be detailed with reference to Figure 3.

3.5.1 Standardised points of reference

3.5.1.1 AMHS Communications

The IUT shall offer *Transfer Ports* for P1 communication with *n* adjacent ATS Message Servers. The lower protocol layers (layers 1 to 4) shall be configured as indicated below:

Layer 4	Layer 3	Layer 2	Layer 1
ISO TP0 RFC 1006 TCP	IPv4	ISO LLC1	10/100 Base T (Ethernet)

Table 32: Lower protocol layers (AMHS communications)

The Transfer Ports of the IUT and AMHS Test Tool shall be physically interconnected via a LAN (Ethernet).

3.5.1.2 AFTN/X.25 Communications

The IUT should offer a X.25/AFTN interface. That means, the IUT conveys AFTN-formatted messages by using the X.25 transport service.
Note. – If the IUT supports only AFTN asynchronous communications or AFTN over X.25 the "Extensions" of the AMHS Test Tool has to be used. The conformance testing is independent from the physical connection used.

3.5.2 Proprietary points of reference

The scope of conformance testing includes submission and delivery operations with local *AMHS user interfaces* of the IUT. Notifications for specified out-of-line situations shall be sent to the *Control Position* of the AFTN/AMHS Gateway. Further, traffic logs generated by the IUT during test exercises have to be verified against the AMHS SARPs by means of retrieval services provided at the IUT's *Operator Positions*.
The style of input and presentation of test data at the above identified three working positions is seen as a local implementation matter and is, therefore, out of scope of conformance testing. The inclusion of these working positions in testing is limited to observation and interpretation of test data.

Next, the handling of the three types of working positions will be discussed in more detail.

3.5.2.1 AMHS user interface

AMHS user interfaces provided at the IUT allow submission of IPMs and Probes and in the opposite direction delivered IPMs, IPNs and Reports have to be brought to the attention of AMHS users. The style of origination and presentation of the mentioned AMHS information objects is seen as subject of implementation. The inclusion of submission and delivery operations in conformance testing requires observations of operator interaction during test exercises.

Note. – Although the MTS access is seen as an implementation matter when supporting only the Basic ATS Message Handling Service, conformance testing shall verify the correct mapping of originated information objects onto P1 information objects; vice versa delivery operations have to map P1 information objects onto displayed objects in a correct manner.

3.5.2.2 Control Position

There is an AMHS SARPs requirement to notify the Control Position of the AFTN/AMHS gateway on specified deviations from the gateway's normal operations. Notifications may be issued for the operator information only or may require operator assistance for recovery from an occurred communication problem. How the Control Position is implemented is out of scope of the AMHS SARPs. However, the correct presentation of notifications at the IUT's Control Position is seen as subject of conformance testing. Appropriate observations have to accompany certain exercises.

3.5.2.3 Access to systems management functions

Access to IUT's systems management functions by means of a related working position shall be possible for:
Preparation of the IUT for the test configuration, and • verification of traffic logs generated by the IUT during test exercises.

4 Supported Scope of Conformance Testing

4.1 General aspects

The scope of testing covers the (native) AMHS communications and interoperations with the AFTN/X.25 by means of the AFTN/AMHS Gateway. The AFTN/X.25 interface is tested for verification of the gateway's capability to intercommunicate with AFTN/X.25, however, is not subject of dedicated conformance testing.
Communication services at lower communication layers (as TCP/IP, X.25, LAN) support the interconnection between the AMHS system and the AMHS Test Tool. In this way, lower communication layers will be included in the test tool, however, there is no intention performing lower layer protocol testing.

The following aspects of conformance testing shall be taken into account:

- *Protocol testing*, encompassing intra-AMHS communications (MTS, IPMS) and AMHS to AFTN/X.25 mappings (and vice versa).

- *Functionality testing*, to ensure the appropriate implementation of AMHS functionality and services (as message submission, transfer, delivery) including the correct mappings between AMHS information objects and user data made visible at users' working positions.

- *Resilience testing*, particularly with regard to the stability of an AMHS implementation against external communication failures.

The reference specification for AMHS testing is the *Basic ATS Message Handling Service* as specified in the AMHS SARPs.

Note. – The incorporation of the Extended ATS Message Handling Service shall be conceptually taken into account in a later extension of the AMHS testing requirements.
Below, the scope of conformance testing will be specified by definitions of generic *test groups* and related *test cases*. These definitions should be seen as a base (minimum) set which do not exclude testing using other equivalent or extended test arrangements.

4.2 Generic test configuration

The scope of AMHS functions expected from the IUT is defined firstly by the implemented AMHS *functional components*, i.e. ATS Message Server, AFTN/AMHS Gateway and ATS Message User Agent and secondly by supplementing *system level provisions* as AMHS naming/addressing, AMHS parameters and AMHS traffic logging (see Section 3.1).
Figure 4 places the above three functional components in a fictitious AMHS communication scenario with flows of AMHS information objects between two (*direct*) AMHS users. In addition, an AFTN/AMHS Gateway supports intercommunications with AFTN users (i.e. *indirect* users of the AMHS). The position of the gateway in Figure 4 should be seen just as an example.

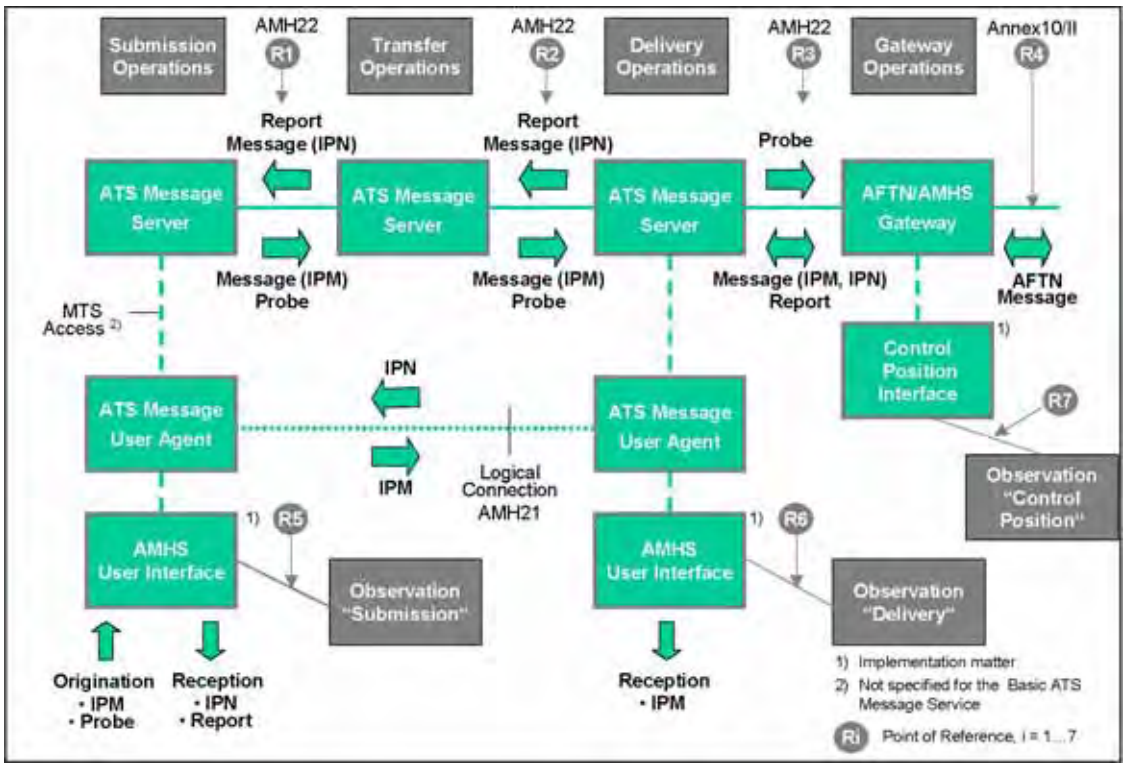

Figure 33: Generic AMHS communication scenario and used Points of Reference for conformance testing

The points of references *R1* to *R7* (in Figure 4) are allocated to the communication scenario according to the principles which have been stated in Section 3.5. The points *R1* to *R3* correspond to communication interfaces which are addressed by the MHS profiles AMH11 or AMH22, respectively [6], [8]. The exchange of IPMs and IPNs between the pair of ATS Message User Agents is subject of the MHS profile AMH21 [7]. Communications at the point *R4* follow the procedures laid down in Annex 10, Volume II, as far as applicable for the AFTN/AMHS Gateway.

The IUT is required to provide the communication functions of the ATS Message Server, ATS Message User Agent and AFTN/AMHS Gateway in any of their positions indicated in Figure 4. For related conformance testing the IUT is placed in various positions of the communication scenario (Figure 4) and the AMHS Test Tool performs the functions of the corresponding AMHS peer entity (entities). The resulting generic test configuration is depicted in Figure 5. The allocated points of reference *R1* to *R7* correspond to them of Figure 4. The reference point R8 is added for identification of the IUT's systems management interface (see Section 3.5.2.3).

Note. – In consideration of testing implementations of the Basic ATS Message Handling Service no point of reference is allocated to the MTS access.

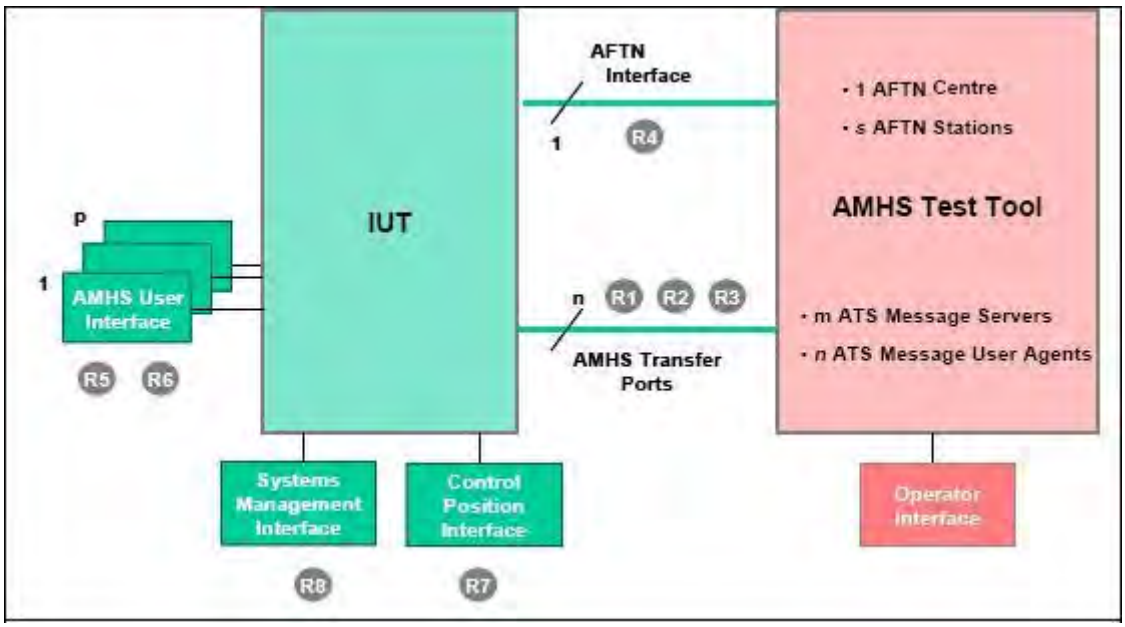

Figure 34: Generic test configuration with points of reference

Note. – In Figure 5 no AFTN user interface is forming part of the IUT. Such interfaces are outside of the scope of the specified AMHS functionality and are placed, therefore, in the IUT's test environment surrounding the IUT (see Figure 2). When testing AFTN/AMHS Gateway functions of the IUT the AFTN peer entities are always represented by the AMHS Test Tool. The AFTN related user actions should be performed by the AMHS Test Tool itself.

4.3 Definition of test groups

Generally, *test groups* provide a logical high-level ordering in test specifications (ISO 96462). Typically, a single test group addresses a particular functional area for which an IUT claims conformance. In the following, AMHS test groups are defined for the purpose of specification of high-level requirements placed on an AMHS Test Tool.

Figure 4 identifies four types of AMHS functional areas to be supported by the IUT: *Submission, Transfer, Delivery* and *Gateway* Operations. These types of AMHS operations will be constitute a first set of test groups. A second set of test groups is formed by the provisions at the AMHS system level as referred to in Section 3.1.1, i.e. *Naming & Addressing*, *Parameters* and *Traffic Logging*.

The defined test groups reflect the external view at the IUT's functionality and are independent of the chosen implementation model. Below, the defined test groups are handled in detail.

For each of the handled test groups the correspondent test configuration is indicated. These test configurations are of generic nature. In practice, test configurations may be combined for study of local interworking between functional areas in an IUT. Example: Combined test exercises for message submission and local gateway functions.

4.3.1 Submission operations

Subject of the test group *Submission* operations is the origination of *IPMs* and *Probes* at AMHS user interfaces at the IUT and the related generation of *P1 information objects* for transfer to adjacent ATS Message Servers; returned *Reports* and *IPNs* have to be displayed at the IUT in an appropriate manner (see Figure 4).

Figure 6 depicts the test configuration for verification of the *Submission* operations. The test configuration follows from Figure 4 and Figure 5.

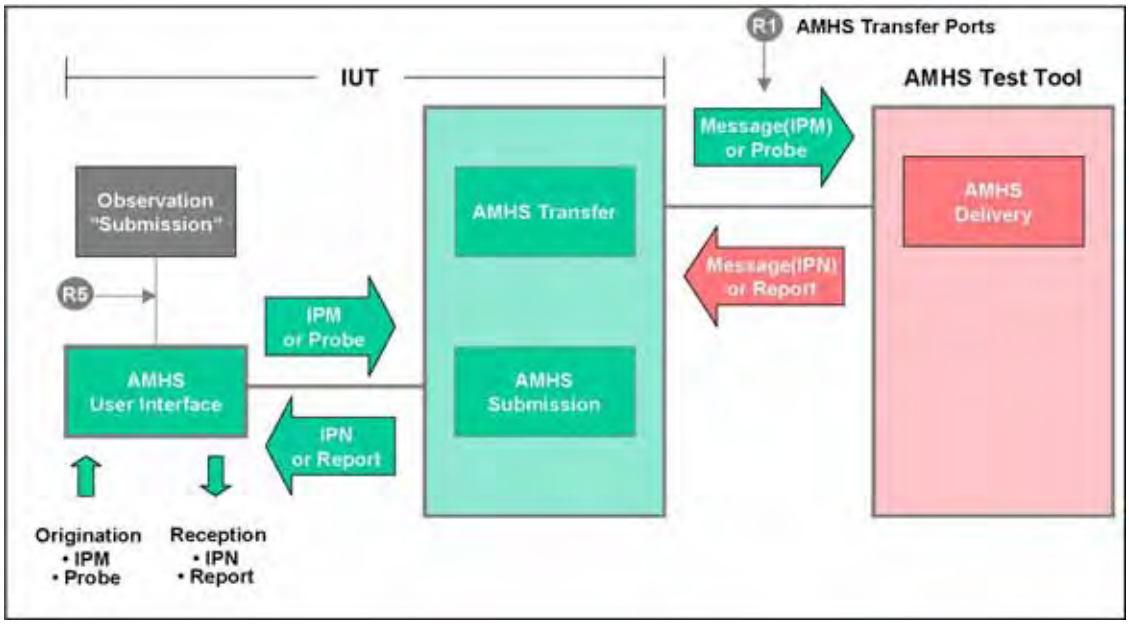

Figure 35: Test configuration "Submission"

For testing of the *Submission* operations the following actions may be performed:

- At an AMHS user interface of the IUT (reference point *R5* in Figure 6) predefined IPMs and Probes are originated for intended recipients. The AMHS Test Tool at the transfer ports of the IUT (*R1*) verifies the correct generation of the related Messages (IPMs) and Probes.

- In the opposite direction, the AMHS Test Tool responds at the transfer ports of the IUT (*R1*) with valid and invalid Messages containing IPNs (upon IPMs) and Reports (upon IPMs and Probes). The presentation of valid IPNs and Reports is observed at the originator's AMHS user interface (*R5*). Invalid responses may effect error notifications at an operator position of the IUT (fault management).

Note. – The local rejection of erroneous originations of IPMs and Probes at IUT's user interfaces is seen as a local implementation matter and is, therefore, out of the scope of conformance testing.

4.3.2 Transfer operations

Subject of the test group *Transfer* operations is the transfer of P1 information objects (i.e. Message, Report, Probe) by the IUT. Rejected transfers of messages and probes have to be indicated by returning of Non-Delivery Reports (NDR). The test group includes handling of multiple recipient addresses (multiple dissemination) and the expansion of Distribution Lists (DLs).

Figure 7 depicts the test configuration for verification of the *Transfer* operations. The test configuration follows from Figure 4 and Figure 5.

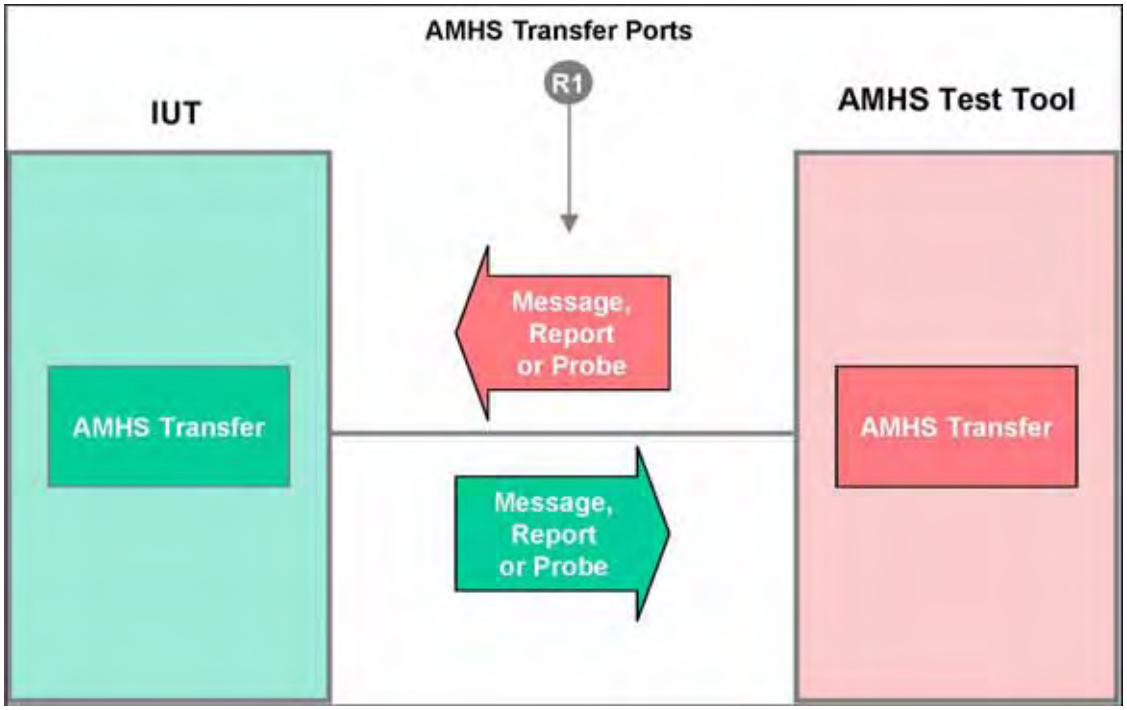

Figure 36: Test configuration "Transfer"

For testing of the *Transfer* operations the following actions may be performed:

- The AMHS Test Tool provides the IUT at its transfer ports (reference point *R1* in Figure 7) with valid and invalid Messages (containing IPMs or IPNs), Reports and Probes with recipient addresses which are *not* local to the IUT.

- The IUT responds at its transfer ports (*R1*) with the output of one or more Messages, (due multiple dissemination and/or DL resolution), one or more Probes (multiple dissemination) or just the received Reports. The AMHS Test Tool verifies the expected IUT behaviour. Invalid information objects generated by the AMHS Test Tool may effect error notifications at an operator position of the IUT (fault management).

4.3.3 Delivery operations

Subject of the test group *Delivery* operations is the display of received Messages (IPMs) at AMHS user interfaces of the IUT. In addition, the IUT shall generate Reports (DR, NDR) and/or IPNs (RN, NRN) according to the requests contained in the received Messages and Probes.

Figure 8 depicts the test configuration for verification of the *delivery* operations. The test configuration follows from Figure 4 and Figure 5.

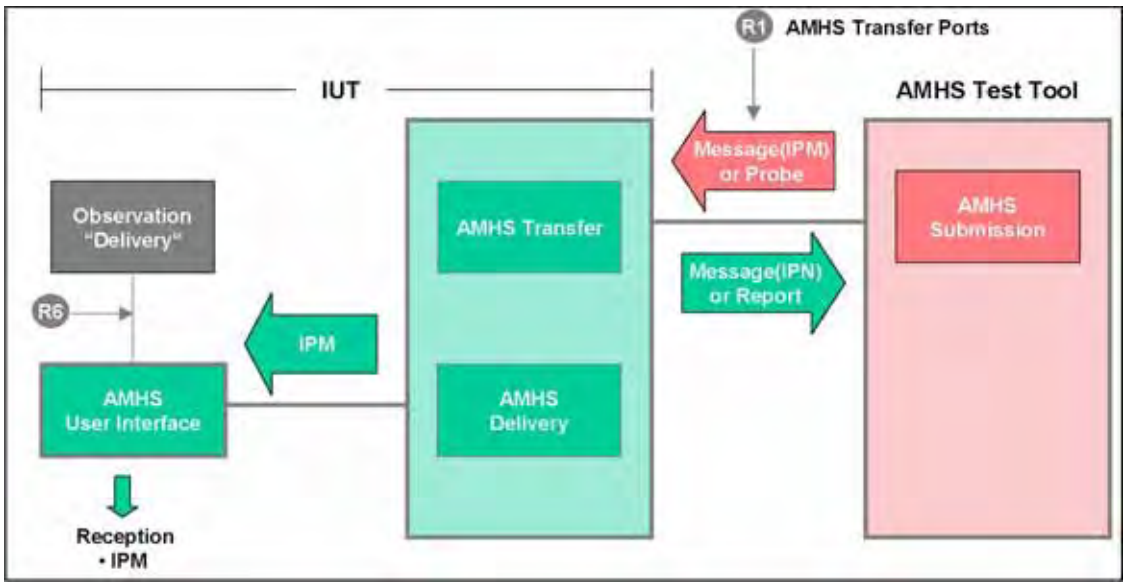

Figure 37: Test configuration "Delivery"

For testing of the *Delivery* operations the following actions may be performed:

- The AMHS Test Tool provides the IUT at its transfer ports (reference point *R1* in Figure 8) with valid and invalid Messages (containing IPMs) and Probes, both with recipient addresses which are local to the IUT.

- The IUT may respond with one or more of the following actions:

  - Display the received IPM at the appropriate AMHS user interface (*R6*),
  - Returning a Message (IPN) at its transfer Port (*R1*) according to the given *receipt notification request* in the subject IPM,
  - Returning a Report (DR or NDR) at its transfer ports (*R1*) according to the given *report request* in the subject Message or Probe.

4.3.4 Gateway operations

Subject of the test group *Gateway* operations is the bi-directional conversion between AMHS and AFTN user messages and the handling of accompanying service information, i.e. AFTN service messages (SVC), AFTN SS acknowledgements (SS ACK), AMHS Reports and AMHS Receipt Notifications. – Cf. AMHS SARPs [1] para. 3.1.2.3.2.1.4.
Considering the functional complexity of the AFTN/AMHS Gateway, the test group is logically subdivided in three sub-groups: 1) Flow of user message from AMHS to AFTN, 2) Flow of user message from AFTN to AMHS and 3) Handling of Probes. The sub-groups 1) and 2) include the handling of accompanying service information.

4.3.4.1 User Message from AMHS to AFTN

Figure 9 depicts the test configuration for verification of the *Gateway* operations for the flow of a user message from AMHS to AFTN. The test configuration follows from the Figure 4 and Figure 5.

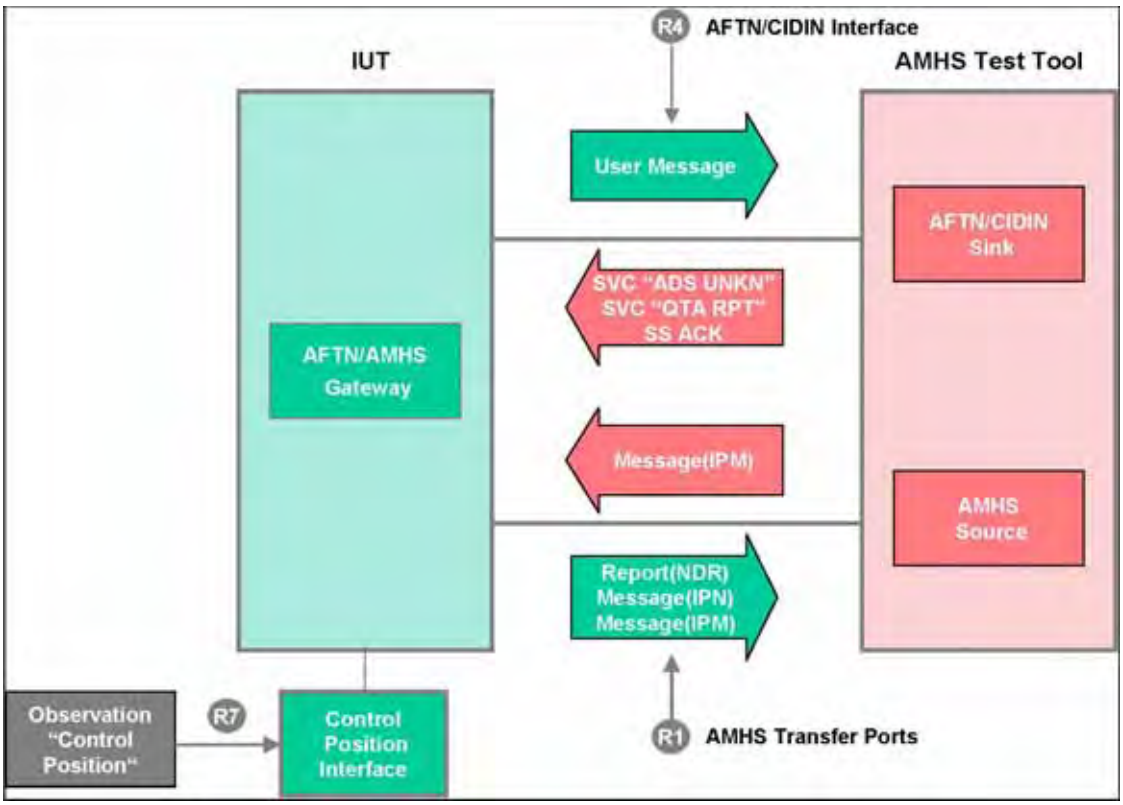

Figure 38: Test configuration "Gateway" – User message from AMHS to AFTN

The following actions may be performed with the Gateway test configuration depicted in Figure 9:

- The AMHS Test Tool provides the IUT at its transfer ports (reference point *R1* in Figure 9) with valid and invalid AMHS Messages containing IPMs. The IUT converts valid AMHS Messages in AFTN user messages which leave the IUT at its AFTN/X.25 interface (*R4*), invalid AMHS Messages are rejected by the IUT with Non-Delivery Reports (NDR) which are returned to the AMHS Test Tool using the IUT's transfer ports (*R1*).

- The AMHS Test Tool provides the IUT at its AFTN/X.25 interface (*R4*) with an AFTN SVC "ADS UNKNOWN" simulating the detection of an unknown destination address within the AFTN. The IUT converts the SVC "ADS UNKNOWN" in a Non-Delivery Report (NDR). In exceptional situation, the SVC "ADS UNKNOWN" is encapsulated by the IUT in an IPM. The NDR or IPM, respectively, is forwarded to the AMHS Test Tool via the IUT's transfer ports (*R1*).

- The AMHS Test Tool provides the IUT at its AFTN/X.25 interface (*R4*) with an SS ACK. The IUT converts the SS ACK in an IPN of the type Receipt Notification (RN). In exceptional situation, the SS ACK is encapsulated by the IUT in an IPM. The IPN or IPM, respectively, is forwarded to the AMHS Test Tool via the IUT's transfer ports (*R1*).

The AMHS Test Tool provides the IUT at its AFTN/X.25 interface (*R4*) with an SVC "QTA RPT" requesting the repetition of an AFTN message sent before to a specified AFTN addressee. The IUT retransmits the respective AFTN message via its AFTN/AMHS interface (*R4).*

.

For certain out-of-line situations, which may occur during conversions in the AFTN/AMHS Gateway, the AMHS SARPs [1] specify error notifications to be forwarded to the gateway's Control Position. Such notifications have to be observed during test exercises at the reference point *R7* in Figure 9.

4.3.4.2 User message from AFTN to AMHS

Figure 10 depicts the test configuration for verification of the Gateway operations for the flow of a user message from AFTN to AMHS. The test configuration follows from Figure 4 and Figure 5.

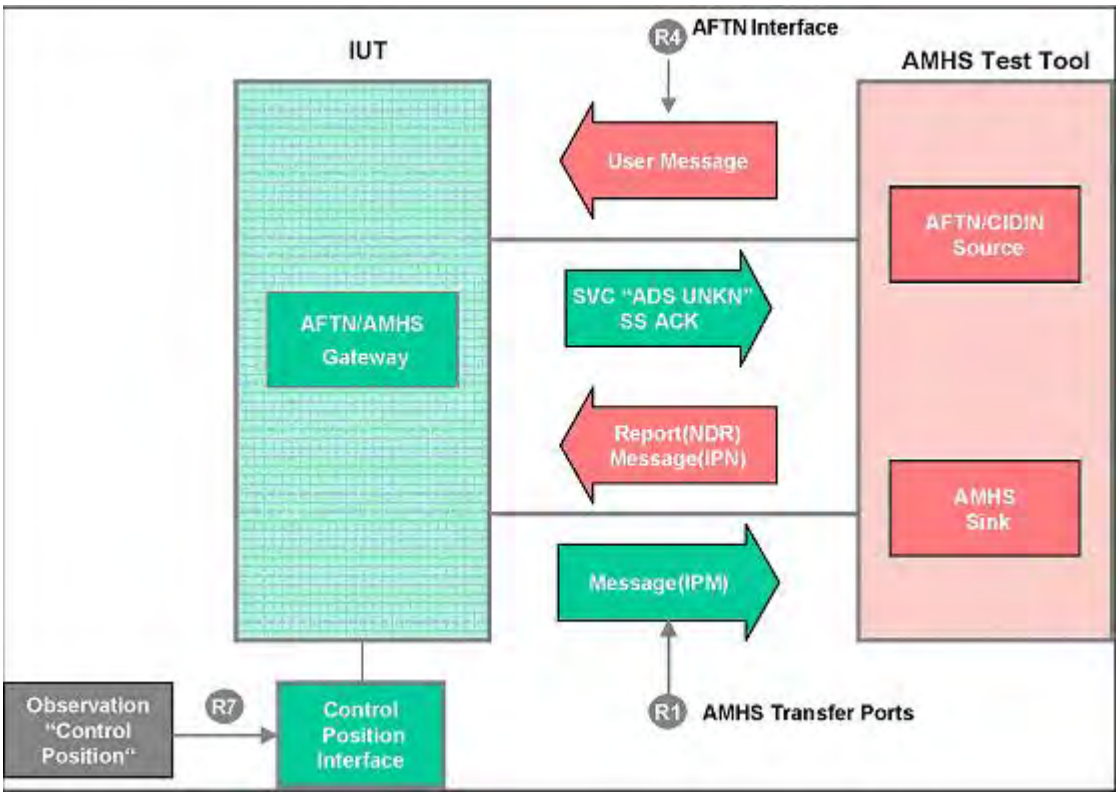

Figure 39: Test configuration "Gateway" – User message from AFTN to AMHS

The following actions may be performed with the Gateway test configuration depicted in Figure 10:

- The AMHS Test Tool provides the IUT at its AFTN/X.25 interface (reference point *R4* in Figure 10) with valid and invalid AFTN user messages. The IUT converts valid AFTN user messages in AMHS messages containing IPMs which leave the IUT at its transfer ports (*R1*), invalid AFTN user messages are handled according to locally implemented procedures. When the conversion of AFTN addressee indictors fails, the IUT returns AFTN service messages of the type SVC "ADS UNKNOWN" to the AFTN (AMHS Test Tool) via its AFTN/X.25 interface (R4).

- The AMHS Test Tool provides the IUT at its transfer ports (*R1*) with a Non-Delivery Report (NDR) simulating the detection of an unknown recipient address within the AMHS. The IUT converts the NDR in an AFTN service message of the type SVC "ADS UNKNOWN" which leaves the IUT via its AFTN/X.25 interface (*R4*).

The AMHS Test Tool provides the IUT at its transfer ports (*R1*) with an AMHS message containing a Receipt Notification (RN) indicating the reception of a SS-priority message at a specified AMHS recipient. The IUT converts the RN in a SS ACK which leaves the IUT via its AFTN/X.25 interface (R4).

For certain out-of-line situations which may occur during conversions in the AFTN/AMHS Gateway, the AMHS SARPs [1] specify error notifications to be forwarded to the gateway's Control Position. Such notifications have to be observed during test exercises at the reference point *R7* in Figure 10.

4.3.4.3 Handling of Probes

Figure 11 depicts the test configuration for verification of the Gateway operations when receiving a Probe. The test configuration follows from Figure 4 and Figure 5.

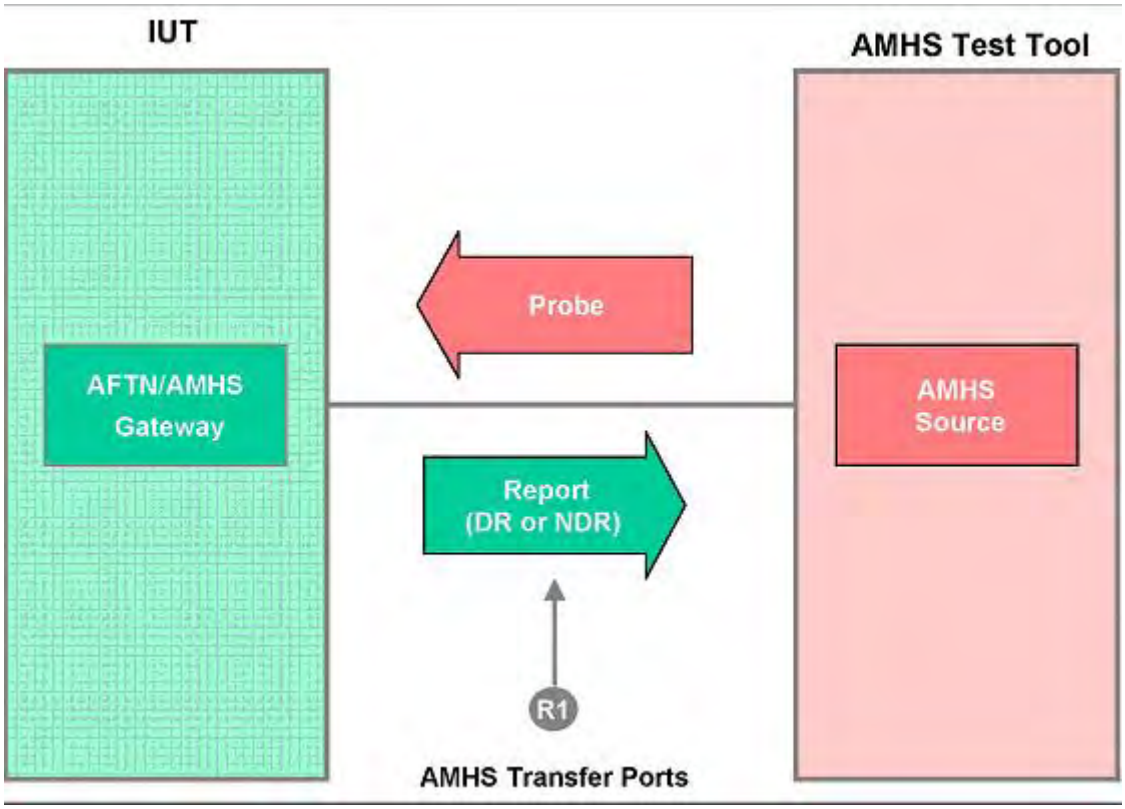

Figure 40: Test configuration "Gateway" – Handling of Probes

The following actions may be performed with the Gateway test configuration depicted in Figure 11:

- The AMHS Test Tool provides the IUT at its transfer ports (reference point *R1* in Figure 11) with valid and invalid Probes.

The IUT verifies whether it could have effected translation in an AFTN user message by comparing certain parameters in the Probe with the capability of its gateway function. The IUT generates in dependence on the result of the verification either a Delivery Report (DR) or a Non-Delivery Report (NDR) which is returned to the AMHS Test Tool via a transfer port (R1).

4.3.5 Naming and addressing

Naming and addressing in the AMHS context relates to the unambiguously identification of 1) users to a global AMHS and 2) communication entities residing in the upper layers of the AMHS communication stack. Focus of conformance testing is the IUT's capability to handle AMHS addressing schemes for identification of users. The second aspect is covered by setting up of configuration parameters in the test configuration (see Section 5).

The AMHS SARPs specify two user addressing schemes which are collectively referred to as MF-addressing schemes: the *XF-addressing scheme* and the *Common AMHS Addressing Scheme (CAAS)*. Preference should be given to the latter. In addition, the SARPs allow to implement within an AMHS Management Domain *locally defined* schemes. The AMHS Test Tool supports the XF-addressing scheme and the CAAS. (Support of other addressing schemes may be subject of further extensions.)

The use of *directory names* is seen as a local matter when supporting the *Basic* ATS Message Handling Service (AMHS SARPs). Their support by the AMHS Test Tool may be subject of further extensions meeting the requirements of the *Extended* ATS Message Handling Service.

An IUT's capability to handle MF-addressing schemes is already implicitly verified with the operations related test groups as defined in Sections 4.3.1 to 4.3.4. However, for in-depth testing of implemented addressing features the establishment of a dedicated test group may be a suitable approach. Depending on the test purpose an appropriate test configuration may be selected from them depicted in Figure 6 to Figure 10.

Note. – The aspect of a dedicated test groups for in-depth testing of system level provisions applies also to the two remaining test groups defined below.

4.3.6 AMHS parameters

The AMHS SARPs [1] 3.1.2.2.3 specify a number of operational conventions which have the nature of parameters from the MHS point of view. These parameters relate to:

- Use of MF-addresses (see Section 4.3.5)
- User data conventions
    - Only single body part in IPMs
    - Ia-5 text body (Basic ATS Message Handling Service)
- Use of ATS-Message-Header in the body part of IPMs (Basic ATS Message Handling Service)
- Restriction of Notification Requests (IPMS) for SS-priority messages. In-depth testing of the AMHS parameters may be performed by means of a dedicated test group. Depending on the test purpose an appropriate test configuration may be selected from them depicted in Figure 6 to Figure 10.

4.3.7 Traffic logging

The AMHS SARPs specify long-term (30 days) logging requirements for the various types of functional components of the AMHS. The requirements make it possible to perform message tracing through the AMHS, in particular when an investigation is needed. The query of the logged information is seen as a local implementation detail.

Logging requirements are placed on the following functional components of the AMHS:

- ATS Message User Agent
- ATS Message Server
- AFTN/AMHS Gateway concerning its sub-components

  - ATN component – [1] Section 3.1.2.3.2.2.6
  - Message Transfer and Control Unit (MTCU) – [1] Section 3.1.2.3.3.1
  - AFTN component – [1] Section 3.1.2.3.21.8-11.

In-depth testing of the traffic logging may be performed by means of a dedicated test group. Depending on the test purpose an appropriate test configuration may be selected from them depicted in Figure 6 to Figure 10. Verification of the logged information will make use of the local query and tracing provisions. Access is typically provided at the system management interface of the IUT (cf. reference point *R8* in Figure 5).

4.4 Definition of test cases

According to ISO 9646-2 a *test case* comprises the actions to achieve a specific test purpose. Each test case normally has a single test purpose, such as that of verifying that the IUT has a certain required capability (e.g. the capability to support certain message lengths) or exhibits a certain required behaviour when a particular event occurs (e.g. transfer of submitted messages). Typically, a set of test cases aiming at a common functional area of an IUT are arranged to a *test group* (see Section 4.3).

There may be many criteria for methodical definitions of test cases (within a test group) to achieve an envisaged confidence in a particular functional area of the IUT. Figure 12 depicts proposed two levels of high-order criteria for definitions of AMHS related test cases. The AMHS Test Tool should support conformance testing in a scope as outlined in Figure 12.

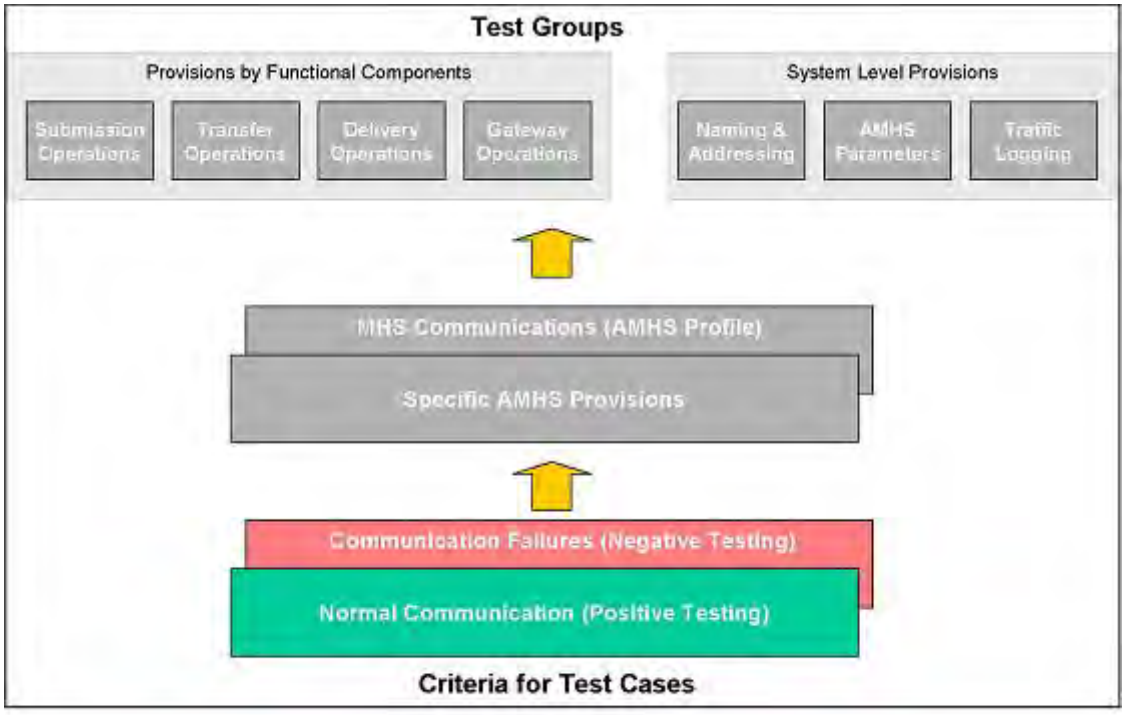

Figure 41: Approach for definition of Test Cases

In Figure 12 a distinction is made between communication requirements which are of general nature in MHS environments and such which are specific to AMHS. The first category of requirements is addressed in the AMHS SARPs just by references to the MHS standard (ISO/IEC 10021) and related profile documentation (ISPs). No further details of MHS procedures are provided with the AMHS SARPs .

In addition, the AMHS SARPs include a number of provisions which are specific for AMHS. Such provisions may relate to supplementary functional components (as AMHS gateways) or specify conventions for which MHS implementations are transparent (e.g. limited use of notification requests). The AMHS SARPs specify the AMHS specific provisions in a “standalone” manner.

Note. – An example of the above made distinction between specific AMHS requirements and underlying MHS features are the AMHS traffic logging requirements: The traffic logging requirements at an ATS Message Server refer to the last element of the trace-information (AMHS SARPs). The trace-information itself (forming part of the message-transfer-envelope) is specified in ISO/IEC 10021-4, 12.3.1. – It is up to the organisation which will operate an AMHS system to limit conformance testing to the SARPs specific elements or to extend testing to the referenced trace-information as defined with the MHS standard.

As second level criteria for definition of test cases a distinction is made between normal MHS/AMHS communications (*positive* testing) and enforcing fault situations (*negative* testing). Figure 13 details this further logical ordering of testing.

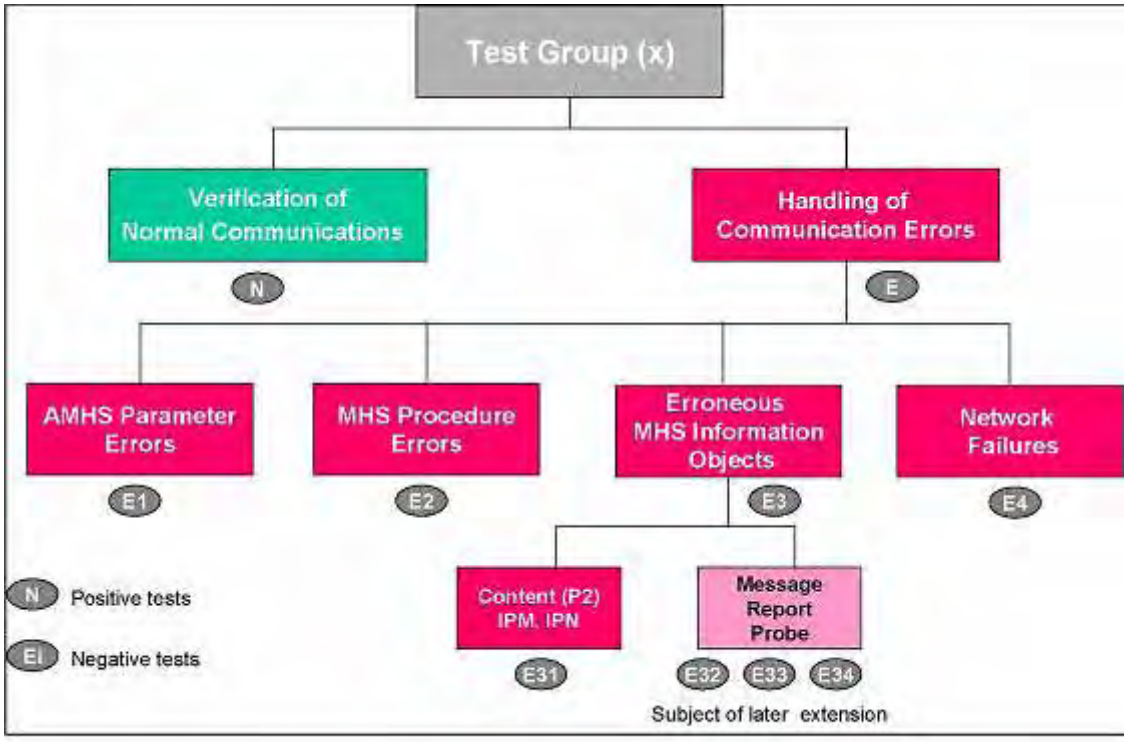

Figure 42: Classes of "Negative Tests"

The test categories indicated in Figure 13 are based on the following definitions:

Normal communications (N). – The AMHS Test Tool provides the IUT with correct inputs and the related responses (behaviour) of the IUT should be in compliance with the AMHS SARPs. It should be noted that a correct response of the IUT not always equals to a successful transmission of an AMHS information object. Example: If the service element *DL-expansion-prohibited* has been set then a DL expansion will not occur.

Erroneous AMHS parameters (E1). – The AMHS SARPs, Parameters, specify a number of specific AMHS conventions as use of MF-addresses, ATS-Message-Header, notification requests and single body part IPMs. It should be noted that violations of such AMHS conventions are not equal with faults in the MHS communication.

MHS procedural errors (E2). – The AMHS Test Tool does not act in compliance with the MHS procedures or the arrangements made in the test configuration. Examples:

1) The IUT is requested to send a message with a Report request, however, the AMHS Test Tool does not return any Report.
2) 2) The AMHS Test Tool uses a recipient address which is unknown in the test configuration.

Erroneous MHS information objects (E3). – That means arguments have not allowed values or information objects are corrupted. A distinction is made between the levels of IPMS and MTS:

- IPMS (E31). – IPMs and IPNs sent to the IUT are not correctly encoded (syntax or semantic errors). Example: Mandatory arguments in the IPM heading are missing or there is no IPM body attached to the IPM heading.

- MTS (E32), (E33), (E34). – Messages, Reports and Probes sent to the IUT are not correctly encoded. Example: In a Report the *Report Transfer Content* is missing.

Network failures (E4). – Transient interruptions of network connections during transmission of AMHS information objects. The AMHS Test Tool supports negative testing of the categories E1, E2 and E31 and E4 (Figure 13).

Note. – Negative testing of the categories E32, E33 and E34 may be subject of further extensions of the testing requirements if experience leads to this need.

A given test group may be transparent for one or more classes of "negative tests". For example, transfer operations are transparent for AMHS parameter errors (E1) and Content (IPMS) failures (E31). Table 3 indicates in a form of a matrix the valid interrelations between defined test groups and classes of negative tests. Such a testing matrix may be helpful to demonstrate the reached coverage of testing for a given set of test cases.

	Submission Ops	**Transfer Ops**	**Delivery Ops**	**Gateway Ops**	**Naming & Addressing**	**AMHS Parameters**	**Traffic Logging**
N	X	X	X	X	X	X	X
E1	X	n/a	X	X	X	X	n/a
E2	X	X	X	X	n/a	n/a	n/a
E31	X	n/a	X	X	n/a	n/a	n/a
E32 – E34	X	X	X	X	n/a	n/a	n/a
E4	X	X	X	X	n/a	n/a	n/a

X = valid interrelation; n/a = not applicable

Table 33: Applicability of negative testing for test groups (testing matrix)

5 Configuration Parameters

The generic test configuration depicted in Figure 5 needs a number of quantitative adjustments before AMHS Test Tool and IUT are in a position to communicate with each other. The subjects of such adjustments are the values of *configuration parameters* which are inherent in the test configuration. Configuration parameters relate to the number of established communication links, number of simulated AMHS and AFTN users as well as to addresses associated with the various layers of communications. Below the configuration parameters are specified in the categories of AMHS and X.25/AFTN communications.

5.1 AMHS communication

5.1.1 AMHS application

- Number of transfer ports: 3
- Number of AMHS users: 30

Reference: Section 3.2, Figure 2 and Figure 3.

5.2 Layer Addresses

No.	Address Type	AMHS SARPs	Value	
			IUT	AMHS Test Tool
1	Application Process Title	3.1.2.1.5.2.1 4.3.2.2		
2	AE-Qualifier	3.1.2.1.5.2.2	ATS Message Server: AMS(7)	
			AFTN/AMHS Gateway: GWB(8)	
3	Presentation Selector	3.1.2.1.5.2.3	tbd	tbd
4	Session Selector	3.1.2.1.5.2.3	tbd	tbd
5	TSAP	3.1.2.1.5.2.3	tbd	tbd
6	TCP Port	n/a	102	
7	IP Address	n/a	tbd	MTA(1): tbd
				MTA(2): tbd
				MTA(3): tbd
8	MAC Address	n/a	tbd	MTA(1): tbd
				MTA(2): tbd
				MTA(3): tbd

Reference: Sections 3.3 and 3.5.1.1.

Table 34: Layer addresses (AMHS communications)

5.3 AFTN/X.25 communication

5.3.1 AFTN application

- Number of links: 1
- Number of AFTN users: 30

Reference: Section 3.2, Figure 2 and Figure 3.

5.4 Layer addresses

No.	Address Type	Reference	Value	
			IUT	AMHS Test Tool
1	X.25 Entry (Ae)	[3] 6.1.2.1.4.5	*tbd*	*tbd*
	X.25 Exit (Ax)	[3] 5.1.2.7	*tbd*	*tbd*
2	X.25 DTE	[3] 4.2.1.7	*tbd*	*tbd*

Reference: Sections 3.4 and 3.5.1.2

Table 35**: **Layer addresses (X.25 communications)

5.5 Test Data

The test data generated and evaluated in conformance testing environments with the AMHS Test Tool comprise (cf. Figure 5):

(1) AMHS and AFTN information objects exchanged between the AMHS Test Tool and IUT. These information objects are well defined by the AMHS SARPs and Annex 10, Vol. II [2], respectively.

(2) AMHS information objects entered and presented at AMHS user interfaces of the IUT. Even if these information objects are substantially specified by the AMHS SARPs their appearance at AMHS user interfaces is specific to a given IUT. In addition, when entering AMHS information objects certain parameters may be handled by the IUT as defaults and do not appear at user interfaces at all.

(3) The AMHS SARPs specify events to be reported to the Control Position of an AFTN/AMHS Gateway. However, the style of reporting is an implementation matter.

(4) Traffic log data to be maintained by the IUT are specified in the AMHS SARPs, however, their handling and presentation is specific for each IUT.

Note:
The correct interpretation of test data of the types (2) to (4) needs insight into the IUT's User Manual.

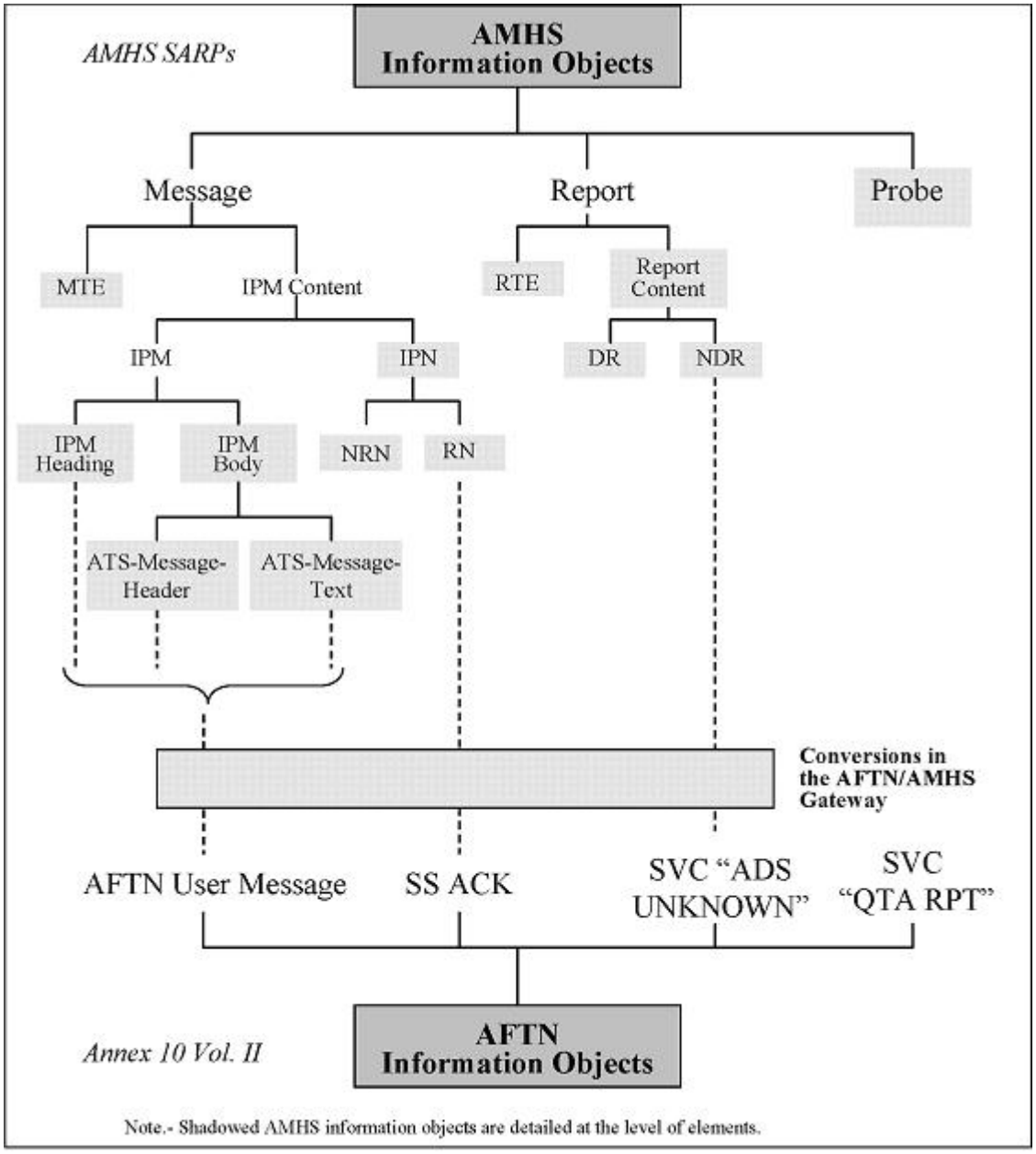

Figure 43 : Information objects supported by the AMHS Test Tool

6 Recommended default values for international MTA names and passwords

6.1 Introduction

6.1.1 AMHS implementation requires the setting of the MTA names and passwords for each communication partner (MTA) connected. In a future fully meshed AMHS Network, unique identification of the MTAs would be required. Additionally, the naming should respect the knowledge and experiences of the operator staff, in order to avoid any unnecessary complications in the transition to AMHS.

6.1.2 One way to achieve this is to use a scheme, in which MTA names and passwords contain keywords which uniquely identify the MTA and facilitate recognition.

6.2 Default values for international MTA names

6.2.1 The recommended scheme of MTA names consists of:

- the term "MTA"
- the Location Indicator of the MTA location and
- a number (for future extensions if required)

6.2.2. All items are separated by a hyphen (hexadecimal 2D). The result is a printable string which can be exchanged in a message without difficulties.

Example: In accordance with this scheme the name of the MTA in Singapore, should be: MTA-WSSS -1.

6.2.3 This scheme could be used for the national MTA naming as well.

6.3 Default values for international MTA passwords

6.3.1 Password complications arise because manufacturers deviate in the interpretation of an "empty" password. Some implementations await "nothing", some hexadecimal 00, others a single "space" character. To avoid misinterpretations during establishment of association(s) all tests could be performed with a common (known) password. Individual secure passwords could be established later, in order to ensure the necessary security of operational AMHS facilities.

6.3.2 The recommended scheme of the default password consists of:

- the term "ICAO"
- the Location Indicator of the MTA location and
- the specific number of the MTA

6.3.3 All items are separated by a hyphen (hexadecimal 2D). The result is a printable string which can be exchanged in a message without difficulties.

Example: In accordance with this scheme the default password of the MTA in Singapore should be: ICAO-WSSS-1.

6.3.4 By following this scheme, the default passwords of future MTAs can be determined at any time. If there are no other security requirements such a scheme can simplify the integration of new MTAs in a fully meshed AMHS Network topology.

- END -

ANNEX E

AMHS Inter-Operability Tests

ANNEX E

of

AMHS Manual

Document Control Log

Edition	Date	Comments	Section/pages affected
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References

[1] ICAO Annex 10 – Aeronautical Telecommunications, Volume II: Communication Procedures
[2] ICAO DOC 9705-AN/956: The Manual of technical provisions for the ATN, Sub-volume III, Section 3.1 –Edition 3 (2002) – Referred to as AMHS SARPs
[3] ASIAPAC AMHS Manual, Main Part
[4] ASIAPAC AMHS Manual, Annex D, AMHS Testing Requirements

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1 Introduction

1.1 Purpose of the Document

The purpose of the document is to define the functional tests for AMHS Interoperability in order to ensure the end-to-end interoperability between AMHS systems under test. These tests are performed after the successful completion of AMHS conformance testing, through which the compliance of all systems under test to the AMHS SARPs has been demonstrated.

For this reason the data used in the interoperability tests are generated either:

- manually; or,
- using records obtained by copy (duplication) and storage of some real traffic occurred among users in service; or
- using parallel duplicated traffic.

Implementations tested in this phase will not be operational systems, but test beds in order to neither disturb the real traffic nor cause potential outages in the operational systems.

As a summary, the correct performance of the interoperability tests included in this document is the previous step to progress the IUT towards a future operational system; this will be done by means of a transition plan to real traffic in the future operational environment.

1.2 Document Structure

Chapter 2 presents the test environment used for AMHS interoperability testing.

Chapter 3 defines the addressing plan implemented in the test environment.

Chapters 4 and 5 contain the general description of the bilateral and trilateral test procedures with subsections for each AMHS functional area. Each test procedure is presented in a structured way consisting of

- defined test criteria,
- a (brief) scenario description,
- reference to the relevant part of the standard specification (SARPs section),

Chapters 6 and 7 contain the detailed test-case descriptions for the bilateral and trilateral test procedures.

Chapter 8 contains the templates for the test messages.

1.3 Test Identification Scheme

Each Interoperability Test procedure has an identifier in the form

ITxnn where:

IT is an acronym for Interoperability Test, *x* is a number identifying the test group[1] and *nn* is a consecutive number identifying the individual test procedure.

Test procedures are classified in two blocks: Bilateral Tests and Trilateral Tests.

The bilateral test groups consist of tests using messages specifically generated by IUTs for trials. The following six groups have been identified:

- testing of submission, transfer and delivery operations (x = 1),

- testing of gateway operations converting a user message from AFTN to AMHS (x=2),
- testing of gateway operations converting a user message from AMHS to AFTN (x=3),
- testing of gateway operations converting a user message from AFTN to AMHS and back to AFTN (x=4),
- testing of gateway operations – special cases (x=5)and
- testing of stress traffic situations (x=6)

The two trilateral test groups are:

- testing of transfer (relay) operations (x=7),
- testing of special situations (alternate routing, traffic loop) (x=8). [1]

[1] Test groups for AMHS conformance tests have been identified in [4].

2 AMHS Interoperability Test Environment

2.1 Application infrastructure

Both AMHS Implementations Under Test (IUTs) are complete systems constituted by AFTN, AMHS and AFTN/AMHS gateway components, with corresponding AFTN and AMHS user terminals and supervision positions, as decided locally by the corresponding organization.

In each IUT, an AMHS User Agent is used in submission and delivery tests. Gateway tests involve an AFTN user terminal. The use of the Monitor & Control Position is required in order to observe the outcome of the conversion processes, especially in out-of-line situations.

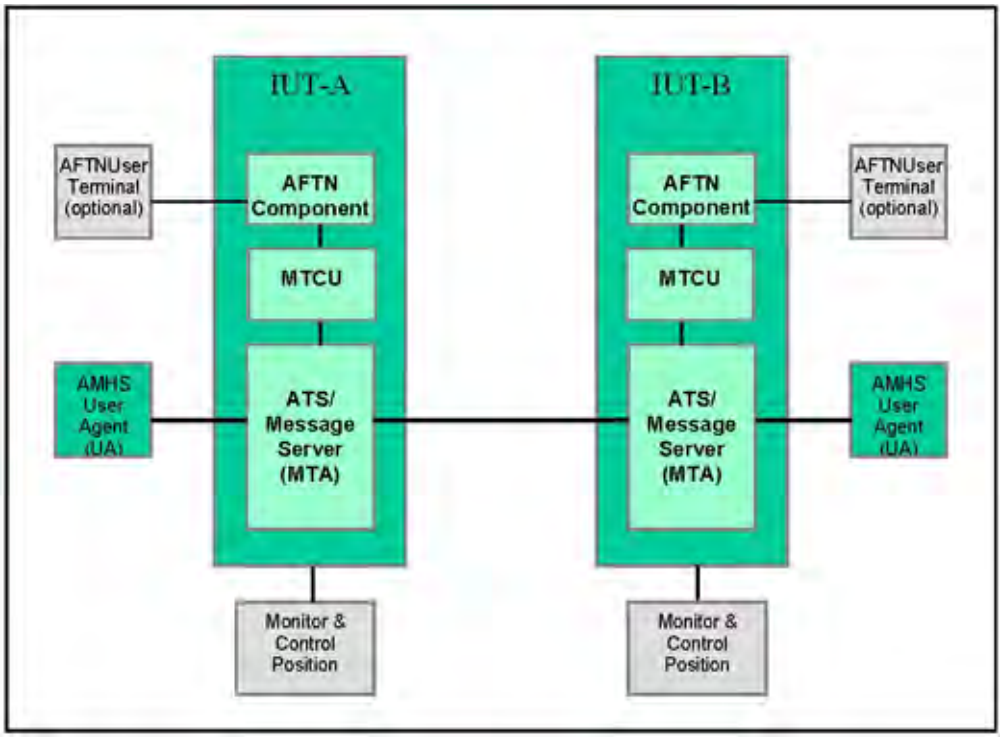

Figure E- 1: AMHS Inter-operability Test Environment

Figure E-1 shows the test environment used for AMHS interoperability tests. Both IUTs will be interconnected via AMHS transfer ports supporting the X.400/P1 protocol over a TCP/IP/LAN.

Note. – In Figure E-1 the AFTN Terminal is directly connected to the AFTN Component in an abstract way. There may exist different implementations with an AFTN component only connected to an AFTN switch or integrated AFTN/AMHS switches. For the interoperability tests it does not matter whether the AFTN Terminal *is connected directly or indirectly.*

The components of the test environment as depicted in Figure 1 are involved in the test procedures in following way:

Submission, Transfer and Delivery operation tests (AMHS => AMHS) (x=1):
AMHS User Agent => ATS Message Server => ATS Message Server => AMHS User Agent

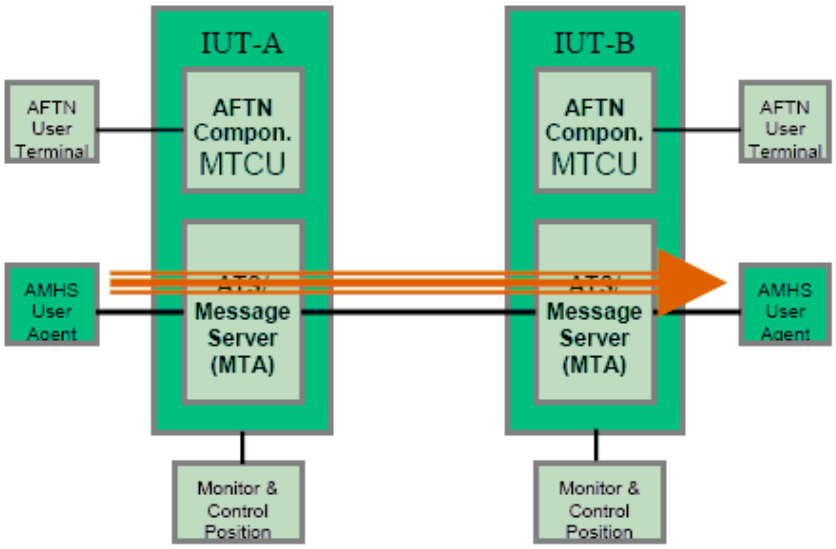

Figure E- 2: UA to UA (IUT-A to IUT-B)

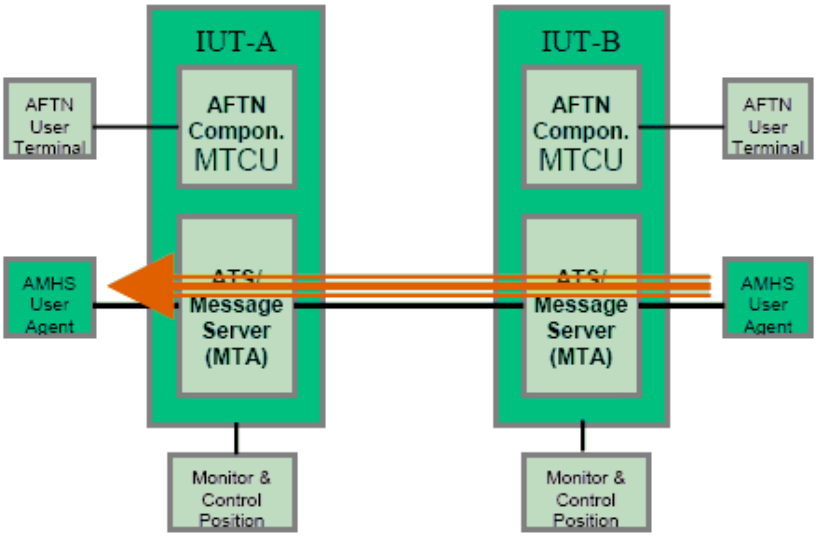

Figure E- 3: UA to UA (IUT-B to IUT-A)

AMHS / AFTN gateway tests (AFTN => AMHS) (x=2):
AFTN Terminal => Gateway and ATS Message Server => UA

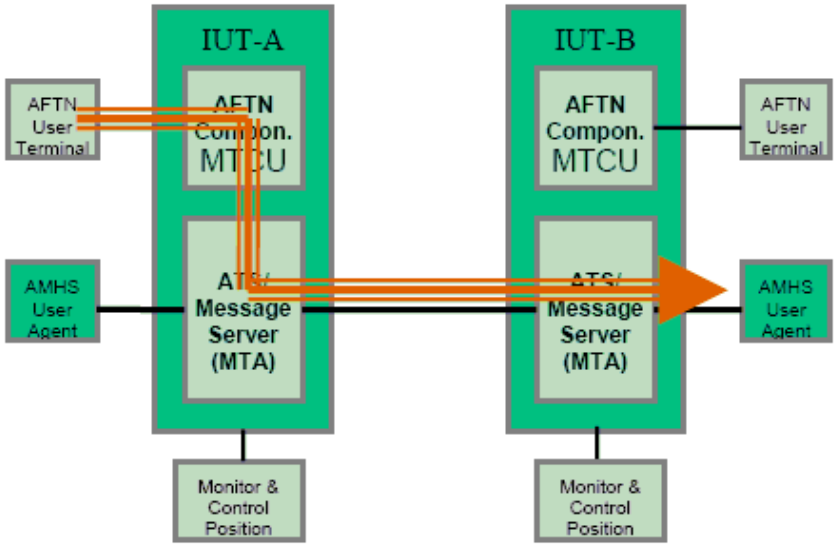

Figure E- 4: AFTN Terminal to UA (IUT-A to IUT-B)

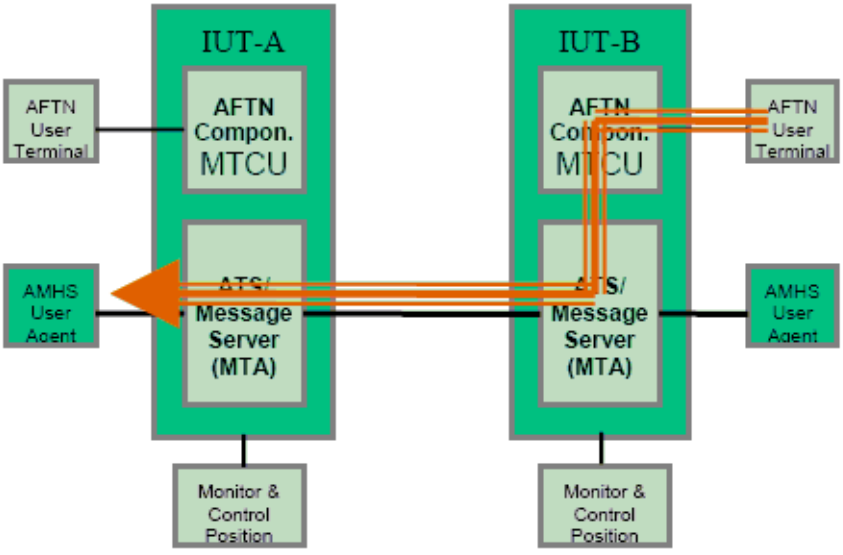

Figure E- 5: AFTN Terminal to UA (IUT-B to IUT-A)

AMHS / AFTN gateway tests (AMHS => AFTN) (x=3):
UA => ATS Message Server and Gateway => AFTN Terminal

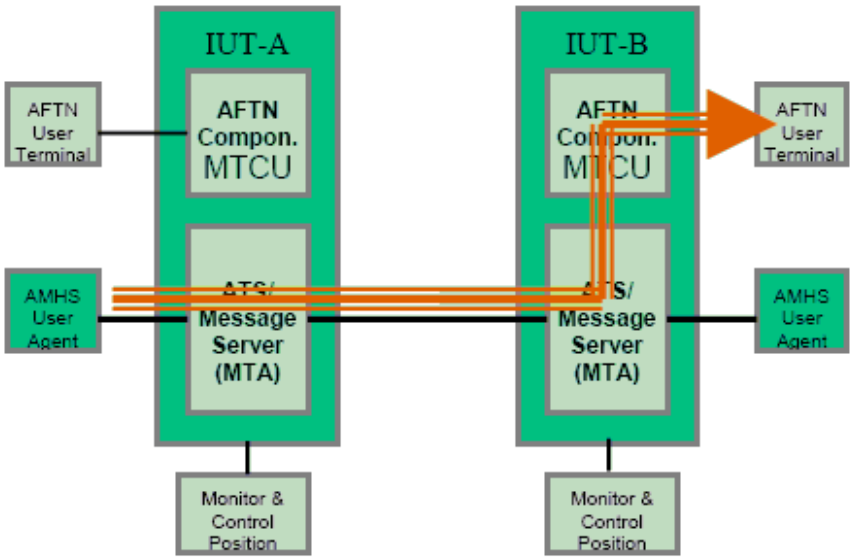

Figure E- 6: UA to AFTN Terminal (IUT-A to IUT-B)

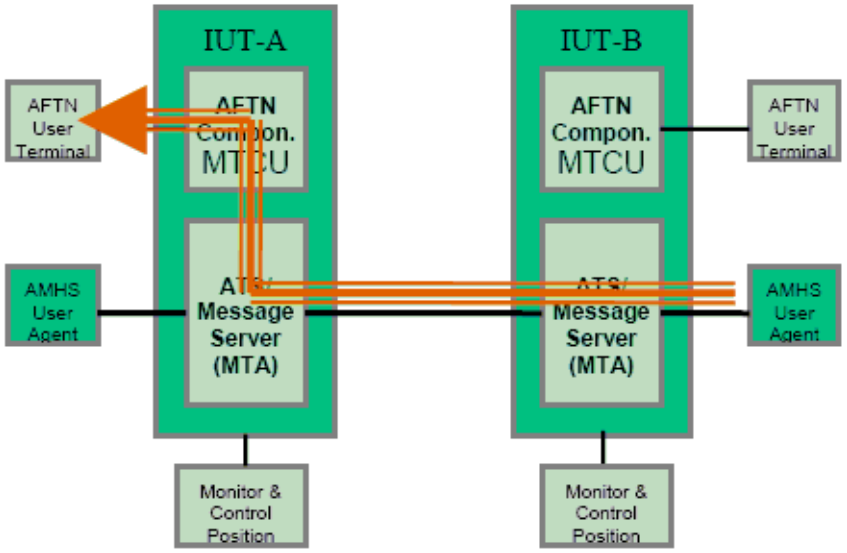

Figure E- 7: UA to AFTN Terminal (IUT-B to IUT-A)

AMHS / AFTN gateway tests (AFTN => AMHS => AFTN) (x=4):

AFTN Terminal => Gateway => ATS Message Servers => Gateway => AFTN Terminal

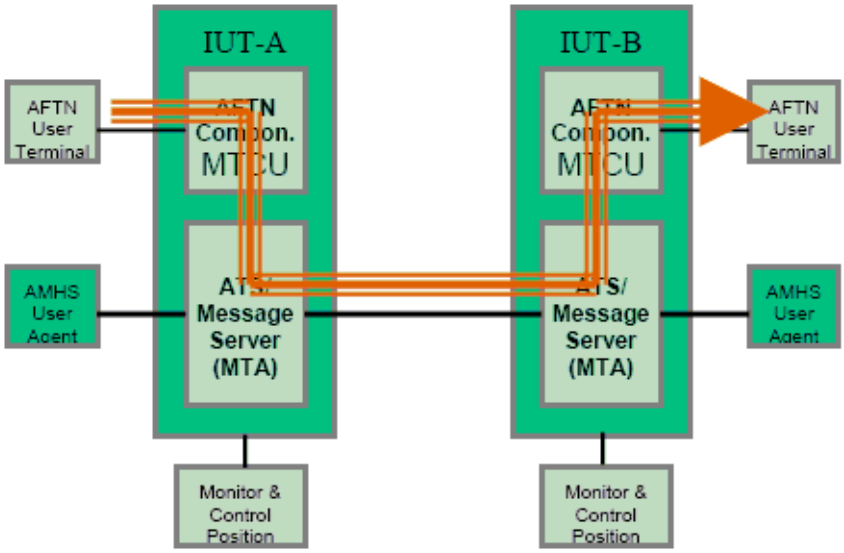

Figure E- 8: AFTN Terminal to AFTN Terminal (IUT-A to IUT-B)

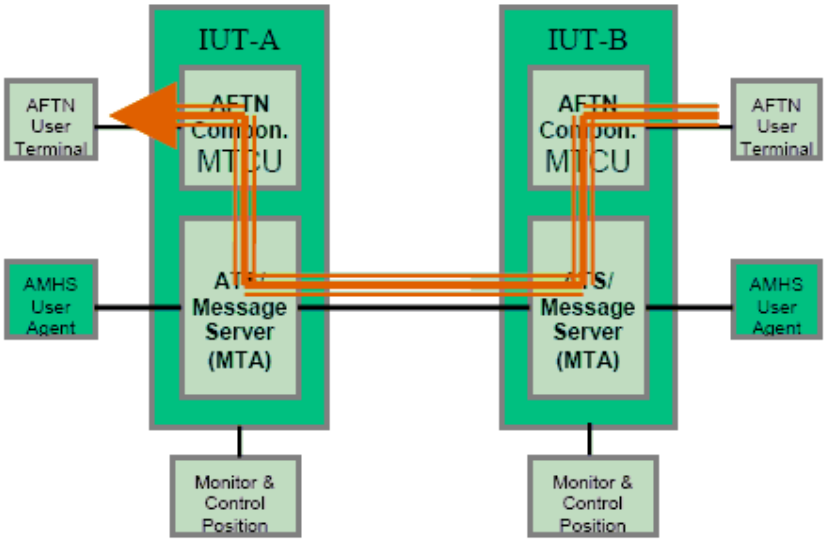

Figure E- 9: AFTN Terminal to AFTN Terminal (IUT-B to IUT-A)

Gateway Operations – special case scenarios (x=5)

For the special case scenarios different combinations of the flows shown above are used.

Stress traffic situations (x=6)

Depending on the stress scenario chosen combinations of the flows shown above are used.

"Relay" operation tests (x=7) – (optional - additional test partner required – IUT-C)

Peer IUT => IUT (ATS Message Server) => peer IUT

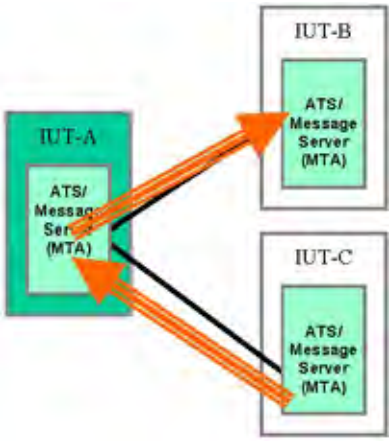

Figure E- 10: "Relay" operation tests

Testing of special situations (x=8) – (optional - additional test partner required – IUT-C and – additional connectivity required IUT-B - IUT-C)

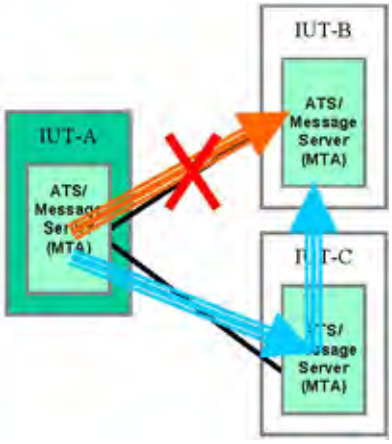

Figure E- 11: Alternate MTA routing

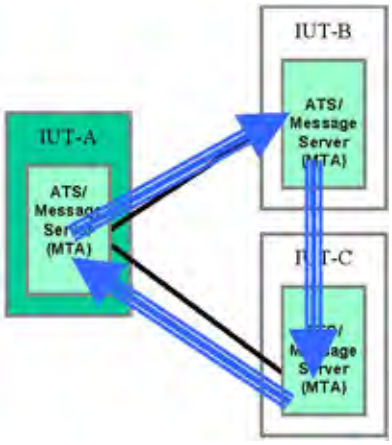

Figure E- 12: Traffic loop test

2.2 Transport infrastructure

To perform the bilateral interoperability tests, an underlying infrastructure for message transport between the two IUTs has to be agreed. In case of multilateral tests an underlying infrastructure for message transport between the involved IUTs (minimum three) has to be agreed. Other "non-standard" solutions may be used for testing. Those refer to the actual network environment or other means offered by communications suppliers, such as ADSL, public internet; in this case, agreement among the parties is necessary due to the potential impact of this solution on the configuration of the timers of the systems concerned, as compared to the standard solution.

2.3 General parameters to be agreed

The following entries and/or parameter shall be agreed between the test partners. Preferred the default values should be used.

2.3.1 Default MTA names and passwords

IUT	MTA name	Remarks
IUT-A	MTA-IUTA-1	
IUT-B	MTA-IUTB-1	
IUT-C	MTA-IUTC-1	

Table 36: Default MTA names

IUT	password	Remarks
IUT-A	ICAO-IUTA-1	
IUT-B	ICAO-IUTB-1	
IUT-C	ICAO-IUTC-1	

Table 37: Default passwords

2.3.2 TSAP addresses

IUT	TSAP address	Remarks
IUT-A	to be agreed bilaterally	
IUT-B	to be agreed bilaterally	
IUT-C	to be agreed	

Table 38: TSAP addresses

2.3.3 IP addresses

IUT	IP address	Remarks
IUT-A	to be agreed bilaterally	
IUT-B	to be agreed bilaterally	
IUT-C	to be agreed	

Table 39: IP addresses

2.3.4 Type and number of associations

IUT	Type of associations	Number of associations	Remarks
IUT-A	monologue	5	
IUT-B	monologue	5	
IUT-C	monologue	5	

Table 40: Default type and number of associations

3 Addressing Plan for AMHS Interoperability Testing

3.1 User addresses

To meet the scope of testing, the test-address space used by AMHS Interoperability Testing should include, for each IUT, the respective AFTN and AMHS addresses and the corresponding AMHS PRMD.

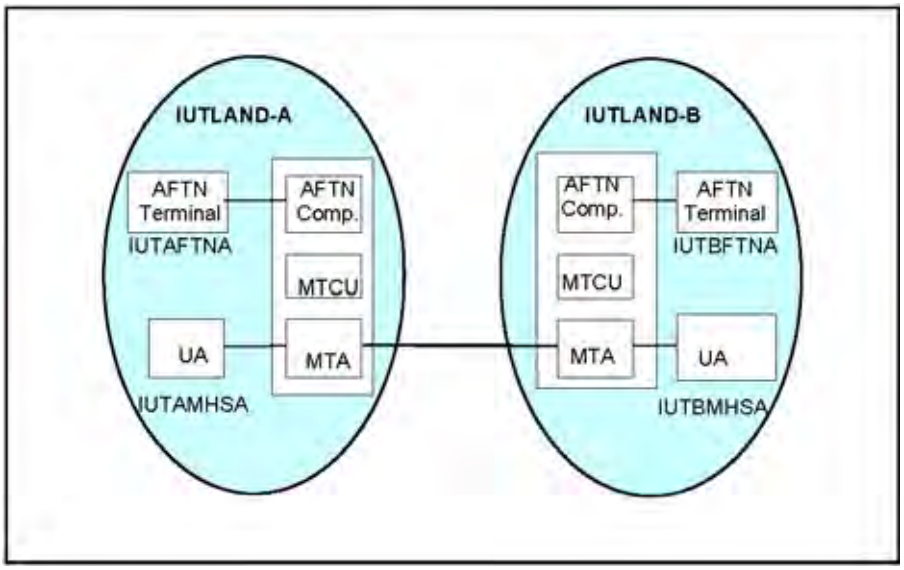

Figure E- 13: Addressing Plan

The original, operational AMHS and AFTN addresses assigned to the COM Centre could be used as test addresses for each IUT. To distinguish between operational and test addresses it is recommended to use alternatively, a generic address space taken from fictitious PRMD/AFTN countries IUTLAND-A and IUTLAND-B.

This includes generic user addresses IUTAFTNA and IUTAMHSA for IUTLAND-A as well as IUTBFTNA and IUTBMHSA for IUTLAND-B, which may be mapped either according to the CAAS (preferred, or a more comprehensive set of addresses in case of CAAS with multiple "O" values) or the XF addressing scheme.

The following tables show the generic address space assigned to the two IUTs and a third IUT if trilateral network tests are performed.

CAAS (preferred) – single "O"	CAAS – multiple "O"	XF
C = XX ADMD = ICAO PRMD = IUTLAND-A O = A-REGION OU1 = IUTA CN = IUTAFTNA ... IUTAMHSA	C = XX ADMD = ICAO PRMD = IUTLAND-A O = A-REGION1 OU1 = IUTA CN = IUTAFTNA ... IUTAMHSA O = A-REGION2 OU1 = IUAA CN = IUAAFTNA ... IUAAMHSA	C = XX ADMD = ICAO PRMD = IUTLAND-A O = AFTN OU1 = IUTAFTNA ... IUTAMHSA

Table 41: Generic address spaces of IUTLAND-A

CAAS (preferred) – single "O"	CAAS – multiple "O"	XF
C = XX ADMD = ICAO PRMD = IUTLAND-B O = B-REGION OU1 = IUTB CN = IUTBFTNA ... IUTBMHSA	C = XX ADMD = ICAO PRMD = IUTLAND-B O = B-REGION1 OU1 = IUTB CN = IUTBFTNA ... IUTBMHSA O = B-REGION2 OU1 = IUBB CN = IUBBFTNA ... IUBBMHSA	C = XX ADMD = ICAO PRMD = IUTLAND-B O = AFTN OU1 = IUTBFTNA ... IUTBMHSA

Table 42: Generic address spaces of IUTLAND-B

CAAS (preferred) – single "O"	CAAS – multiple "O"	XF
C = XX ADMD = ICAO PRMD = IUTLAND-C O = C-REGION OU1 = IUTC CN = IUTCFTNA ... IUTCMHSA	C = XX ADMD = ICAO PRMD = IUTLAND-C O = B-REGION1 OU1 = IUTC CN = IUTCFTNA ... IUTCMHSA O = B-REGION2 OU1 = IUCC CN = IUCCFTNA ... IUCCMHSA	C = XX ADMD = ICAO PRMD = IUTLAND-C O = AFTN OU1 = IUTCFTNA ... IUTCMHSA

Table 43: Generic address spaces of IUTLAND-C

3.2 DL addresses

Distribution List name	Addresses included in the DL	Remarks
IUTADLLO	IUTBFTNA IUTBFTNB IUTBMHSA	
IUTADLRE	IUTAFTNA IUTAFTNB IUTAMHSA	

Table 44: DL addresses of IUT-A

Distribution List name	Addresses included in the DL	Remarks
IUTBDLLO	IUTAFTNA IUTAFTNB IUTAMHSA	
IUTBDLRE	IUTBFTNA IUTBFTNB IUTBMHSA	

Table 45: DL addresses of IUT-B

3.3 AFTN and X.400 Routing Tables

3.3.1 AFTN and X.400 Routing Tables of IUT-A

AFTN Routing Indicator	Routing direction	Remarks
IUTAFT*	AFTN Terminal	
IUTA*	MTCU	
IUTB*	MTCU	
IUTC*	MTCU	

Table 46: AFTN Routing Table of IUT-A X.400

Routing Indicator X.400 Routing Indicator	Routing direction	Remarks
/C=XX/A=ICAO/P=IUTLAND-A /O=A-REGION/OU1=IUTA/CN=IUTAMHSA/	UA IUT-A	If CAAS “single “O” type
/C=XX/A=ICAO/P=IUTLAND-A /O=A-REGION/OU1=IUTA/CN=IUTAMHSB/	UA IUT-A	If CAAS “single “O” type
/C=XX/A=ICAO/P=IUTLAND-A /O=A-REGION/OU1=IUTA/CN=IUTAMHSC/	UA IUT-A	If CAAS “single “O” type
/C=XX/A=ICAO/P=IUTLAND-A /O=AFTN/OU1=IUTAMHSA/	UA IUT-A	If “XF” type
/C=XX/A=ICAO/P=IUTLAND-A /O=AFTN/OU1=IUTAMHSB/	UA IUT-A	If “XF” type
/C=XX/A=ICAO/P=IUTLAND-A /O=AFTN/OU1=IUTAMHSC/	UA IUT-A	If “XF” type
/C=XX/A=ICAO/P=IUTLAND-A	MTCU	
/C=XX/A=ICAO/P=IUTLAND-B	MTA-IUTB-1	
/C=XX/A=ICAO/P=IUTLAND-C	MTA-IUTC-1	
/C=XX/A=ICAO/P=IUTLAND-X	MTA-IUTB-1	

Table 47: X.400 Routing Table of IUT-A

3.3.2 AFTN and X.400 Routing Tables of IUT-B

AFTN Routing Indicator	Routing direction	Remarks
IUTBFT*	AFTN Terminal	
IUTA*	MTCU	
IUTB*	MTCU	
IUTC*	MTCU	

Table 48: AFTN Routing Table of IUT-B

X.400 Routing Indicator	Routing direction	Remarks
/C=XX/A=ICAO/P=IUTLAND-B /O=B-REGION/OU1=IUTB/CN=IUTBMHSA/	UA IUT-B	If CAAS “single “O” type
/C=XX/A=ICAO/P=IUTLAND-B /O=B-REGION/OU1=IUTB/CN=IUTBMHSB/	UA IUT-B	If CAAS “single “O” type
/C=XX/A=ICAO/P=IUTLAND-B /O=B-REGION/OU1=IUTB/CN=IUTBMHSC/	UA IUT-B	If CAAS “single “O” type
/C=XX/A=ICAO/P=IUTLAND-B /O=AFTN/OU1=IUTBMHSA/	UA IUT-B	If “XF” type
/C=XX/A=ICAO/P=IUTLAND-B /O=AFTN/OU1=IUTBMHSB/	UA IUT-B	If “XF” type

X.400 Routing Indicator	Routing direction	Remarks
/C=XX/A=ICAO/P=IUTLAND-B /O=AFTN/OU1=IUTBMHSC/	UA IUT-B	If "XF" type
/C=XX/A=ICAO/P=IUTLAND-B	MTCU	
/C=XX/A=ICAO/P=IUTLAND-A	MTA-IUTA-1	
/C=XX/A=ICAO/P=IUTLAND-C	MTA-IUTC-1	
/C=XX/A=ICAO/P=IUTLAND-X	MTA-IUTC-1	

Table 49: X.400 Routing Table of IUT-B

3.3.3 AFTN and X.400 Routing Tables of IUT-C

AFTN Routing Indicator	Routing direction	Remarks
IUTCFT*	AFTN Terminal	
IUTA*	MTCU	
IUTB*	MTCU	
IUTC*	MTCU	

Table 50: AFTN Routing Table of IUT-C

X.400 Routing Indicator	Routing direction	Remarks
/C=XX/A=ICAO/P=IUTLAND-C /O=C-REGION/OU1=IUTC/CN=IUTCMHSA/	UA IUT-C	If CAAS "single "O" type
/C=XX/A=ICAO/P=IUTLAND-C /O=C-REGION/OU1=IUTC/CN=IUTCMHSB/	UA IUT-C	If CAAS "single "O" type
/C=XX/A=ICAO/P=IUTLAND-C /O=C-REGION/OU1=IUTC/CN=IUTCMHSC/	UA IUT-C	If CAAS "single "O" type
/C=XX/A=ICAO/P=IUTLAND-C /O=AFTN/OU1=IUTCMHSA/	UA IUT-C	If "XF" type
/C=XX/A=ICAO/P=IUTLAND-C /O=AFTN/OU1=IUTCMHSB/	UA IUT-C	If "XF" type
/C=XX/A=ICAO/P=IUTLAND-C /O=AFTN/OU1=IUTCMHSC/	UA IUT-C	If "XF" type
/C=XX/A=ICAO/P=IUTLAND-C	MTCU	
/C=XX/A=ICAO/P=IUTLAND-A	MTA-IUTA-1	
/C=XX/A=ICAO/P=IUTLAND-B	MTA-IUTB-1	
/C=XX/A=ICAO/P=IUTLAND-X	MTA-IUTA-1	

Table 51: X.400 Routing Table of IUT-C

3.4 Look-up Table

3.4.1 Generic look-up Table for all Implementations Under Test (IUT) (CAAS single "O" type)

AFTN address	O/R Address (CAAS single "O" type)
IUTAFTN*	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/
IUTAFTA*	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/
IUTAFTU*	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/ ***Note. – This address has to be unknown and not defined in IUT-A***
IUTAMHSA	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAMHSA/
IUTAMHSB	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAMHSB/
IUTAMHSC	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAMHSC/
IUTADLLO	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTADLLO/
IUTADLRE	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTADLRE/
IUTBFTN*	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/
IUTBFTA*	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/
IUTBFTU*	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/ Note. – This address has to be unknown and not defined in IUT-B
IUTBMHSA	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBMHSA/
IUTBMHSB	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBMHSB/
IUTBMHSC	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBMHSC/
IUTBDLLO	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBDLLO/
IUTBDLRE	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBDLRE/
IUTCFTNC	/C=XX/A=ICAO/P=IUTLAND-C/O=C-REGION/OU1=IUTC/CN=IUTCFTNA/
IUTCMHSA	/C=XX/A=ICAO/P=IUTLAND-C/O=C-REGION/OU1=IUTC/CN=IUTCMHSA/
IUTXLOOP	/C=XX/A=ICAO/P=IUTLAND-X/O=X-REGION/OU1=IUTX/CN=IUTXLOOP/

Table 52: Generic look-up table (CAAS single "O" type)

3.4.2 Generic look-up Table for all Implementations Under Test (IUT) ("XF" type)

AFTN address	O/R Address ("XF" type)
IUTAFTN*	/C=XX/A=ICAO/P=IUTLAND-A/
IUTAFTA*	/C=XX/A=ICAO/P=IUTLAND-A/
IUTAFTU*	/C=XX/A=ICAO/P=IUTLAND-A/ ***Note. – This address has to be unknown and not defined in IUT-A***
IUTAMHSA	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAMHSA/
IUTAMHSB	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAMHSB/
IUTAMHSC	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAMHSC/
IUTADLLO	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTADLLO/
IUTADLRE	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTADLRE/
IUTBFTN*	/C=XX/A=ICAO/P=IUTLAND-B/
IUTBFTA*	/C=XX/A=ICAO/P=IUTLAND-B/
IUTBFTU*	/C=XX/A=ICAO/P=IUTLAND-B/ Note. – This address has to be unknown and not defined in IUT-B
IUTBMHSA	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBMHSA/
IUTBMHSB	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBMHSB/
IUTBMHSC	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBMHSC/
IUTBDLLO	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBDLLO/
IUTBDLRE	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBDLRE/
IUTCFTNC	/C=XX/A=ICAO/P=IUTLAND-C/O=AFTN/OU1=IUTCFTNA/
IUTCMHSA	/C=XX/A=ICAO/P=IUTLAND-C/O=AFTN/OU1=IUTCMHSA/
IUTXLOOP	/C=XX/A=ICAO/P=IUTLAND-X/O=AFTN/OU1=IUTXLOOP/

Table 53: Generic look-up table ("XF" type)

Note. – There are further possibilities: IUT-A could have XF addressing scheme whilst IUT-B has CAAS, or vice-versa. In such a case, the corresponding table entries should be selected. To simplify matters it is recommended to use CAAS single "O" type or "XF" type only.

3.5 Local AMHS User address book

3.5.1 Local AMHS User address book for UA of all Implementations Under Test (IUT) (CAAS single "O" type)

Nick name	O/R Address (CAAS single "O" type)
IUTAFTNA	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNA/
IUTAFTNB	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNB/
IUTAFTNC	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNC/
IUTAFTND	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTND/
IUTAFTNE	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNE/
IUTAFTNF	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNF/
IUTAFTNG	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNG/
IUTAFTNH	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNH/
IUTAFTNI	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNI/
IUTAFTNJ	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNJ/
IUTAFTNK	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNK/
IUTAFTNL	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNL/
IUTAFTNM	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNM/
IUTAFTNN	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNN/
IUTAFTNO	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNO/
IUTAFTNP	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNP/
IUTAFTNQ	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNQ/
IUTAFTNR	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNR/
IUTAFTNS	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNS/
IUTAFTNT	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNT/
IUTAFTNU	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNU/
IUTAFTNV	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNV/
IUTAFTNW	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNW/
IUTAFTNX	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNX/
IUTAFTNY	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTNY/
IUTAFTAA	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAA/
IUTAFTAB	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAB/
IUTAFTAC	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAC/
IUTAFTAD	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAD/
IUTAFTAE	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAE/
IUTAFTAF	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAF/
IUTAFTAG	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAG/
IUTAFTAH	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAH/
IUTAFTAI	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAI/
IUTAFTAJ	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAJ/

IUTAFTAK	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAK/
IUTAFTAL	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAL/
IUTAFTAM	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAM/
IUTAFTAN	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAN/
IUTAFTAO	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAO/
IUTAFTAP	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAP/
IUTAFTAQ	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAQ/
IUTAFTAR	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAR/
IUTAFTAS	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAS/
IUTAFTAT	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAT/
IUTAFTAU	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAU/
IUTAFTAV	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAV/
IUTAFTAW	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAW/
IUTAFTAX	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAX/
IUTAFTAY	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTAY/
IUTAFTUU	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAFTUU/
IUTAMHSA	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAMHSA/
IUTAMHSB	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAMHSB/
IUTAMHSC	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTAMHSC/
IUTADLLO	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTADLLO/
IUTADLRE	/C=XX/A=ICAO/P=IUTLAND-A/O=A-REGION/OU1=IUTA/CN=IUTADLRE/
IUTBFTNA	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBFTNA/
IUTBFTNB	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBFTNB/
IUTBFTNC	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBFTNC/
till	**To be continued till**
IUTBFTNY	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBFTNY/
IUTBFTAA	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBFTAA/
till	**To be continued till**
IUTBFTAY	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBFTAY/
IUTBFTUU	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBFTUU/
IUTBMHSA	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBMHSA/
IUTBMHSB	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBMHSB/
IUTBMHSC	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBMHSC/
IUTBDLLO	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBDLLO/
IUTBDLRE	/C=XX/A=ICAO/P=IUTLAND-B/O=B-REGION/OU1=IUTB/CN=IUTBDLRE/
IUTCFTNC	/C=XX/A=ICAO/P=IUTLAND-C/O=C-REGION/OU1=IUTC/CN=IUTCFTNA/
IUTCMHSA	/C=XX/A=ICAO/P=IUTLAND-C/O=C-REGION/OU1=IUTC/CN=IUTCMHSA/
IUTXLOOP	/C=XX/A=ICAO/P=IUTLAND-X/O=X-REGION/OU1=IUTX/CN=IUTXLOOP/

Table 54: Local AMHS User address book (CAAS single "O" type)

3.5.2 Local AMHS User address book for UA of all Implementations Under Test (IUT) ("XF" type)

Nick name	O/R Address ("XF" type)
IUTAFTNA	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAFTNA/
IUTAFTNB	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAFTNB/
IUTAFTNC	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAFTNC/
till	**To be continued till**
IUTAFTNY	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAFTNY/
IUTAFTAA	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAFTAA/
till	**To be continued till**
IUTAFTAY	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAFTAY/
IUTAFTUU	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAFTUU/
IUTAMHSA	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAMHSA/
IUTAMHSB	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAMHSB/
IUTAMHSC	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTAMHSC/
IUTADLLO	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTADLLO/
IUTADLRE	/C=XX/A=ICAO/P=IUTLAND-A/O=AFTN/OU1=IUTADLRE/
IUTBFTNA	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBFTNA/
IUTBFTNB	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBFTNB/
IUTBFTNC	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBFTNC/
till	**To be continued till**
IUTBFTNY	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBFTNY/
IUTBFTAA	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBFTAA/
till	**To be continued till**
IUTBFTAY	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBFTAY/
IUTBFTUU	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBFTUU/
IUTBMHSA	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBMHSA/
IUTBMHSB	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBMHSB/
IUTBMHSC	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBMHSC/
IUTBDLLO	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBDLLO/
IUTBDLRE	/C=XX/A=ICAO/P=IUTLAND-B/O=AFTN/OU1=IUTBDLRE/
IUTCFTNC	/C=XX/A=ICAO/P=IUTLAND-C/O=AFTN/OU1=IUTCFTNA/
IUTCMHSA	/C=XX/A=ICAO/P=IUTLAND-C/O=AFTN/OU1=IUTCMHSA/
IUTXLOOP	/C=XX/A=ICAO/P=IUTLAND-X/O=AFTN/OU1=IUTXLOOP/

Table 55: Local AMHS User address book ("XF" type)

4 Bilateral Test Procedures

4.1 Submission, Transfer and Delivery Operation (AMHS to AMHS)

4.1.1 IT101 – Submit, transfer and deliver an IPM (UA IUT-A to UA IUT-B)

IT101	**Submit, transfer and deliver an IPM (UA IUT-A to UA IUT-B)**
Test criteria	This test is successful, if the MTA of the sending IUT transfers the submitted ATS messages (IPM) correctly to a peer MTA which delivers the ATS messages (IPM) to the UA of the receiving IUT.
Scenario description	From the UA of IUT-A send a sequence of five ATS messages (IPMs) to the IUT addressing a remote AMHS user in the peer IUT, via AMHS. • Message 1 (IT101M01) shall have ATS-message-priority KK. • Message 2 (IT101M02) shall have ATS-message-priority GG. • Message 3 (IT101M03) shall have ATS-message-priority FF. • Message 4 (IT101M04) shall have ATS-message-priority DD. • Message 5 (IT101M05) shall have ATS-message-priority SS. Each message shall have different ATS-filing-time and ATS-message-text. The *optional-heading-information* element shall be empty. Verify the messages received by the remote UA. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.
AMHS SARPs reference	3.1.2.2.1 (ATS Message User Agent), 3.1.2.2.2 (ATS Message Server), 3.1.2.2.3.2.3 (ATS-Message-Header)
Test class	Normal AMHS communications (N)

4.1.2 IT102 – Submit, transfer and deliver an IPM (UA IUT-B to UA IUT-A)

IT102	**Submit, transfer and deliver an IPM (UA IUT-B to UA IUT-A)**
Test criteria	This test is successful, if the MTA of the sending IUT transfers the submitted ATS messages (IPM) correctly to a peer MTA which delivers the ATS messages (IPM) to the UA of the receiving IUT.
Scenario description	From the UA of IUT-B send a sequence of five ATS messages (IPMs) to the IUT addressing a remote AMHS user in the peer IUT, via AMHS. • Message 1 (IT102M01) shall have ATS-message-priority KK. • Message 2 (IT102M02) shall have ATS-message-priority GG. • Message 3 (IT102M03) shall have ATS-message-priority FF. • Message 4 (IT102M04) shall have ATS-message-priority DD. • Message 5 (IT102M05) shall have ATS-message-priority SS. Each message shall have different ATS-filing-time and ATS-message-text. The *optional-heading-information* element shall be empty. Verify the messages received by the remote UA. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.
AMHS SARPs reference	3.1.2.2.1 (ATS Message User Agent), 3.1.2.2.2 (ATS Message Server), 3.1.2.2.3.2.3 (ATS-Message-Header)
Test class	Normal AMHS communications (N)

4.2 Gateway Operations (AFTN to AMHS)

4.2.1 IT201 – Convert an AFTN message to AMHS format (IUT-A)

IT201	**Convert an AFTN message to AMHS format (IUT-A)**
Test criteria	This test is successful, if the sending IUT converts AFTN messages correctly to AMHS messages (IPM).
Scenario description	From the sending IUT send a sequence of AFTN messages addressing a remote AMHS user, consisting of five messages: • AFTN message 1 (IT201M01) shall have priority KK. • AFTN message 2 (IT201M02) shall have priority GG. • AFTN message 3 (IT201M03) shall have priority FF. • AFTN message 4 (IT201M04) shall have priority DD. • AFTN message 5 (IT201M05) shall have priority SS. The filing time shall be different in each message and the OHI field of each message shall be empty. Check the IPMs that the AMHS user receives in the receiving IUT. Verify that the IUT has converted the messages correctly according to Table 3.1.2-8 of the AMHS SARPs – see section 3.1.2.3.4.2. In particular: • verify that each message has different ATS-filing-time; • verify that the optional-heading-information element is empty; • check the correct format of the ATS message; • verify the ATS-message-priority and the related message transfer priority for each received message; • compare the ATS-message-text with the original AFTN message text.
AMHS SARPs reference	3.1.2.3.4.2
Test class	Normal AMHS communications (N)

4.2.2 IT202 – Convert an AFTN message to AMHS format (IUT-B)

IT202	**Convert an AFTN message to AMHS format (IUT-B)**
Test criteria	This test is successful, if the sending IUT converts AFTN messages correctly to AMHS messages (IPM).
Scenario description	From the sending IUT send a sequence of AFTN messages addressing a remote AMHS user, consisting of five messages: • AFTN message 1 (IT202M01) shall have priority KK. • AFTN message 2 (IT202M02) shall have priority GG. • AFTN message 3 (IT202M03) shall have priority FF. • AFTN message 4 (IT202M04) shall have priority DD. • AFTN message 5 (IT202M05) shall have priority SS. The filing time shall be different in each message and the OHI field of each message shall be empty. Check the IPMs that the AMHS user receives in the receiving IUT. Verify that the IUT has converted the messages correctly according to Table 3.1.2-8 of the AMHS SARPs – see section 3.1.2.3.4.2. In particular: • verify that each message has different ATS-filing-time; • verify that the optional-heading-information element is empty; • check the correct format of the ATS message; • verify the ATS-message-priority and the related message transfer priority for each received message; • compare the ATS-message-text with the original AFTN message text.
AMHS SARPs reference	3.1.2.3.4.2
Test class	Normal AMHS communications (N)

4.3 Gateway Operations (AMHS to AFTN)

4.3.1 IT301 – Convert an IPM generated by the UA of IUT-A to AFTN format

IT301	**Convert an IPM to AFTN format (IUT-B)**
Test criteria	This test is successful, if the receiving IUT converts IPMs correctly into AFTN format.
Scenario description	Send from IUT-A (UA) a sequence of ATS messages (IPMs) to the IUT-B, addressing an AFTN terminal. • Message 1 (IT301M01) shall have ATS-message-priority KK. • Message 2 (IT301M02) shall have ATS-message-priority GG. • Message 3 (IT301M03) shall have ATS-message-priority FF. • Message 4 (IT301M04) shall have ATS-message-priority DD. • Message 5 (IT301M05) shall have ATS-message-priority SS. Each message shall have different ATS-filing-time and ATS-message-text. The *optional-heading-information* element shall be empty. The implicit-conversion-prohibited attribute of the AMHS message must be set to “false”. Check the correct format of the AFTN message. Verify the AFTN priority and filing time for each received message. Compare the AFTN message text with the original ATS-message-text.
AMHS SARPs reference	3.1.2.3.5.2 (AMHS IPM conversion)
Test class	Normal AMHS communications (N)

4.4 Gateway Operations (AFTN to AMHS to AFTN)

4.4.1 IT401 – Convert an AFTN message to AMHS and back to AFTN format

IT401	**Convert an AFTN message to AMHS and back to AFTN format**
Test criteria	This test is successful, if the sending IUT-A converts AFTN user messages correctly to AMHS messages (IPM) and the IPMs are converted back to AFTN in IUT-B.
Scenario description	From IUT-A send a sequence of AFTN messages addressing a remote AFTN user in IUT-B, consisting of five messages: • AFTN message 1 (IT401M01) shall have priority KK. • AFTN message 2 (IT401M02) shall have priority GG. • AFTN message 3 (IT401M03) shall have priority FF. • AFTN message 4 (IT401M04) shall have priority DD. • AFTN message 5 (IT401M05) shall have priority SS. The filing time shall be different in each message and the OHI field of each message shall be empty. Check the AFTN message received by the AFTN user in the IUT-B. • Check the correct format of the AFTN message. • Each AFTN message shall have original filing time. • Each message shall have an empty OHI. • Verify the AFTN priority for each received message. • Compare the AFTN message text with the original AFTN message text.
AMHS SARPs reference	3.1.2.3.4.2, 3.1.2.3.5.2
Test class	Normal AMHS communications (N)

4.4.2 IT402 – Convert an AFTN message to AMHS and back to AFTN format

IT402	**Convert an AFTN message to AMHS and back to AFTN format**
Test criteria	This test is successful, if the sending IUT-B converts AFTN user messages correctly to AMHS messages (IPM) and the IPMs are converted back to AFTN in IUT-A.
Scenario description	From IUT-B send a sequence of AFTN messages addressing a remote AFTN user in IUT-A, consisting of five messages: • AFTN message 1 (IT402M01) shall have priority KK. • AFTN message 2 (IT402M02) shall have priority GG. • AFTN message 3 (IT402M03) shall have priority FF. • AFTN message 4 (IT402M04) shall have priority DD. • AFTN message 5 (IT402M05) shall have priority SS. The filing time shall be different in each message and the OHI field of each message shall be empty. Check the AFTN message received by the AFTN user in the IUT-A. • Check the correct format of the AFTN message. • Each AFTN message shall have original filing time. • Each message shall have an empty OHI. • Verify the AFTN priority for each received message. • Compare the AFTN message text with the original AFTN message text.
AMHS SARPs reference	3.1.2.3.4.2, 3.1.2.3.5.2
Test class	Normal AMHS communications (N)

4.5 Gateway Operations – special case scenarios

Note – The following special case scenarios are symmetric. That means, all test-cases have to be performed by IUT-A as well as IUT-B.

4.5.1 IT501 – Distribute an IPM to AMHS and AFTN users

IT501	**Distribute an IPM to AMHS and AFTN users**
Test criteria	This test is successful, if the receiving IUT distributes an IPM addressing both an AMHS and an AFTN user correctly.
Scenario description	From the sending IUT send an ATS message (IPM), addressing both AMHS and AFTN users, at the receiving IUT. The IPM Heading of the message shall contain two primary recipients, which are one AMHS and one AFTN user. The IPM Heading of the next message shall contain additionally, two copy recipients, which are also one AMHS and one AFTN user. Finally the IPM Heading of the last message shall contain additionally two blind copy recipients, which are also one AMHS and one AFTN user. Verify that all the users, whose addresses have been included in the IPM, receive the message correctly.
AMHS SARPs reference	3.1.2.2.1 (ATS message user agent), 3.1.2.2.2 (ATS message server), 3.1.2.3.5.2 (IPM conversion)
Test class	Normal AMHS communications (N)

4.5.2 IT502 – Expand a DL addressing both AMHS and AFTN users

IT502	**Expand a DL addressing both AMHS and AFTN users**
Test criteria	This test is successful, if the receiving IUT distributes an IPM, addressing AMHS and AFTN users in a distribution list, correctly.
Scenario description	From the sending IUT send an ATS message (IPM) to the receiving IUT. The recipient contained in the MTE addresses a distribution list, for which the receiving IUT is responsible. The distribution list shall have the addresses of one AMHS user and two AFTN users as members. The message shall have the *dl-expansion-prohibited* attribute set to "false". Check the messages received in each AFTN user address verifying that each one contains its corresponding address.
AMHS SARPs reference	3.1.2.2.2.1.1 (DL functional group), 3.1.2.3.5.2 (IPM conversion)
Test class	Normal AMHS communications (N)

4.5.3 IT503 – Convert an IPM, if the ATS-message-text contains more than 1800 characters

IT503	**Convert or reject an IPM, if the ATS-message-text contains more than 1800 characters**
Test criteria	This test is successful, if the IUT, when it receives an ATS message with ATS-message-text longer than 1800 characters, a) rejects the message and returns a NDR, or b) splits the received IPM into several messages and converts the resulting messages into AFTN format as specified in ICAO Annex 10, Attn. B [1], or c) converts the received IPM into a "long" AFTN message. Note. – The AMHS SARPs (3.1.2.3.5.2.1.7) specify that the message can be rejected (case a) or split into several messages (case b).

Scenario description	From the sending IUT send an ATS message (IPM) containing ATS-message-text of 4500 characters to an AFTN recipient of the receiving IUT. If case a is implemented*:* Verify that the receiving IUT does not convert the IPM into AFTN format, but returns a NDR. Check the NDR contents received at the sending User Agent. Verify that the NDR contains the following elements: • "unable-to-transfer" for the non-delivery-reason-code; • "content-too-long" for the non-delivery-diagnostic-code; and • "unable to convert to AFTN due to message text length" for the supplementary-information. If case b is implemented: Verify that (at least) three AFTN messages are received by the AFTN recipient. Check the correct format of the AFTN messages. Check the text field of all received AFTN messages. Verify that the text is complete and unchanged, i.e. compare the received data with the *ATS-message-text* provided in the original IPM. Verify that the received messages contain the sequence indicators as specified in Attm. B of ICAO Annex 10, Vol. II [1]. If case c is implemented: Verify that the AFTN message is received by the AFTN recipient. Check the correct format of the received AFTN message. Verify that the text is complete and unchanged, i.e. compare the received data with the *ATS-message-text* provided in the original IPM.
AMHS SARPs reference	3.1.2.3.5.2.1.7
Test class	Normal AMHS communications (N)

4.5.4 IT504 – Split an incoming IPM addressing more than 21 AFTN users

IT504	**Split an incoming IPM addressing more than 21 AFTN users**
Test criteria	This test is successful, if the receiving IUT receives an ATS message (IPM) addressing more than 21 AFTN users and splits the received IPM into several messages each addressing 21 or less AFTN users. *Note. – PDR M4050004 (Title: AMHS - Too Many Recipients) is resolved. Therefore the message shall be split into several messages.*
Scenario description	From the sending IUT send an ATS message (IPM) to the receiving IUT. The message shall address 50 (primary) recipients. Verify that the receiving IUT converts the IPM into AFTN format and sends three AFTN messages to its AFTN component. Check the addressee indicators contained in the AFTN messages. Verify that no AFTN recipient is lost and the total number of AFTN addressee indicators contained in all three messages is 50. For example • the first AFTN message contains addressee indicators for the first 21 recipients, • the second AFTN message contains addressee indicators for the next 21 recipients, and • the third AFTN message contains addressee indicators for the remaining 8 recipients.
AMHS SARPs reference	3.1.2.3.5.2.1.8
Test class	Normal AMHS communications (N)

4.5.5 IT505 – Probe Conveyance Test

IT505	**Probe Conveyance Test**
Test criteria	This test is successful, if the receiving IUT generates a report (DR or NDR), when it receives a probe with AFTN users as intended recipients.
Scenario description	From the sending IUT, send AMHS probes to the receiving IUT: a) addressing two AFTN recipients and one AMHS recipient, b) addressing two AFTN recipients, one of which can be mapped and one of which cannot be mapped onto a valid AFTN address. Verify that the receiving IUT returns a. one DR with 2 AFTN recipients from the MTCU and one DR with one recipient from the MTA b. a combined DR and NDR or one DR and one NDR in response to the probe received. Verify in all cases that the DRs reporting about the AFTN addresses which could be translated contains the supplementary information “This report only indicates successful (potential) conversion to AFTN, not delivery to a recipient”.
AMHS SARPs reference	3.1.2.3.5.5 (reception of AMHS probe), 3.1.2.3.5.6.2.27
Test class	Normal AMHS communications (N)

4.6 Stress traffic situations

4.6.1 IT601 – Stress load

IT601	Stress load
Test criteria	This test is successful, if both IUTs perform AMHS traffic interchange correctly for a number of messages queued in advance.
Scenario description	Defined numbers of messages (beginning with100, 200, till 400 messages) have to be selected from the data base or generated by the UA or the AFTN terminal. These messages need to be queued (in MTAs) in both IUTs, preferably by disabling the physical connector used to send information to the underlying network in one of the IUTs. When reconnecting, the messages queued in both IUTs will be sent simultaneously from the two sites, the rate being defined by the line speed of the interconnection, as well as the process followed by each system. No errors due to malfunction of the IUTs should be observed during the interchange period. The time from sending the first till receiving the last message has to be measured and analysed in both IUTs.
AMHS SARPs reference	None
Test class	Normal (forced) AMHS communications (N)

5 Trilateral Test procedures - optional

5.1 Submission/Transfer/Delivery and Relay operations

5.1.1 IT701 – Submission /Transfer/Delivery between the partner MTAs

IT701	**Submission / Transfer / Delivery between the partner MTAs**
Test criteria	This test is successful, if the messages from all UAs are received by the corresponding UAs of the other the IUTs.
Scenario description	Create "normal" X.400 routing: (see 3.3, AFTN and X.400 Routing Tables) From the UA send an ATS message (IPM) with ATS-message-priority FF addressed to the UA of the other IUTs. • Message 1 (IT701M01) from UA IUT-A to UAs of IUT-B and IUT-C • Message 2 (IT701M02) from UA IUT-B to UAs of IUT-A and IUT-C. • Message 3 (IT701M03) from UA IUT-C to UAs of IUT-A and IUT-B. Each message shall have different ATS-filing-time and ATS-message-text. The *optional-heading-information* element shall be empty. Verify the messages received by both remote UAs. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.
AMHS SARPs reference	None
Test class	Normal AMHS communications (N)

5.1.2 IT702 – Relay operations

IT702	**Relay operations**
Test criteria	This test is successful, if the message from the sending UA is routed by the IUT in between and received by the addressed UA.
Scenario description	Create a "transfer" X.400 routing: The X.400 routing table of IUT-A routes PRMD=IUTLAND-B and PRMD=IUTLAND-C to IUT-B. The X.400 routing table of IUT-B routes PRMD=IUTLAND-A and PRMD=IUTLAND-C to IUT-C. The X.400 routing table of IUT-C routes PRMD=IUTLAND-A and PRMD=IUTLAND-B to IUT-A. From the UA send an ATS message (IPM) with ATS-message-priority FF to one UA of another IUT. • Message 1 (IT702M01) from UA IUT-A to UA of IUT-C • Message 2 (IT702M02) from UA IUT-B to UA of IUT-A. • Message 3 (IT702M03) from UA IUT-C to UA of IUT-B. Each message shall have different ATS-filing-time and ATS-message-text. The *optional-heading-information* element shall be empty. Verify the messages received by the remote UA and passed the IUT in between. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.
AMHS SARPs reference	None
Test class	Normal AMHS communications (N)

5.2 Test of special situations

5.2.1 IT801 – Alternate MTA routing

IT801	**Alternate MTA routing**
Test criteria	This test is successful, if the message from the sending UA is received by the addressed UA
Scenario description	Create a "normal" X.400 routing: (see 3.3, AFTN and X.400 Routing Tables) Cut the direct connection to the IUT to which you intend to send a message. From the UA send an ATS message (IPM) with ATS-message-priority FF to the UA of the IUT concerned. • Message 1 (IT801M01) from UA IUT-A to UA of IUT-B • Message 2 (IT801M02) from UA IUT-B to UAs of IUT-C. • Message 3 (IT801M03) from UA IUT-C to UAs of IUT-A. Each message shall have different ATS-filing-time and ATS-message-text. The *optional-heading-information* element shall be empty. If alternate MTA routing functionality is implemented and configured the message will be forwarded automatically via the "other" connection;otherwise the queued message should be forced to follow the alternate routing by the adequate means (manually). Verify the messages received by the remote UA and passed the IUT in between. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.
AMHS SARPs reference	None
Test class	Normal AMHS communications (N)

5.2.2 IT802– Loop detection

IT802	**Loop detection**
Test criteria	This test is successful; if the one of the IUT detects that the message has traversed a loop.
Scenario description	Create a temporary routing loop. The X.400 routing table of IUT-A routes PRMD=IUTLAND-X to IUT-B.The X.400 routing table of IUT-B routes PRMD=IUTLAND-X to IUT-C.The X.400 routing table of IUT-C routes PRMD=IUTLAND-X to IUT-A. Send a message addressed to PRMD=IUTLAND-X which will be routed by the IUT to the other IUT so that finally the message is performing a loop. Verify that: • the one of the IUTs detects the loop, • this IUT discards the message and • generates a NDR Verify that the sending IUT receives the NDR Repeat the test with all IUTs, so that all sending IUTs have received the NDR.
AMHS SARPs reference	3.1.1, Note 2a (ISO/IEC 10021), 3.1.2.1.6 (AMHS routing), *See also ITU-T Rec. X.411 clause 14.3.1 and clause 12.3.1.*
Test class	MHS procedural errors (E2)

6 Bilateral Test Procedures – Test Scenarios

6.1 Introduction

The following tables contain the scenarios for the different Interoperability Tests (IT) described in the previous chapters.

The test scenarios consist of several test-cases. The test-case reference is as follows:

ITxxx/TCzz

Test scenario: Txxx where xxx is the scenario number

Test-case: Czz where zz is the number of test-case.

6.2 Submission, Transfer and Delivery Operation (AMHS to AMHS)

IT101	**Submit, transfer and deliver an IPM (UA IUT-A to UA IUT-B)**		
Test-case id: **IT101/TC01**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities A KK priority message will be submitted from the UA of IUT-A and delivered to the UA of IUT-B.		
Test description:	From the User Agent IUTAMHSA send the following message to the UA IUTBMHSA: PRI: KK FT: <FT> OHI: TEST IT101/TC01 Get the message with IUTBMHSA (UA-terminal of IUT-B).		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: KK - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT101	**Submit, transfer and deliver an IPM (UA IUT-A to UA IUT-B)**		
Test-case id: **IT101/TC02**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities A GG priority message will be submitted from the UA of IUT-A and delivered to the UA of IUT-B.		
Test description:	From the User Agent IUTAMHSA send the following message to the UA IUTBMHSA: PRI: GG FT: <FT> OHI: TEST IT101/TC02 Get the message with IUTBMHSA (UA-terminal of IUT-B).		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: GG - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT101	**Submit, transfer and deliver an IPM (UA IUT-A to UA IUT-B)**		
Test-case id: **IT101/TC03**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities An FF priority message will be submitted from the UA of IUT-A and delivered to the UA of IUT-B.		
Test description:	From the User Agent IUTAMHSA send the following message to the UA IUTBMHSA: PRI: FF FT: <FT> OHI: TEST IT101/TC03 Get the message with IUTBMHSA (UA-terminal of IUT-B).		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: FF - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT101	**Submit, transfer and deliver an IPM (UA IUT-A to UA IUT-B)**		
Test-case id: **IT101/TC04**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities A DD priority message will be submitted from the UA of IUT-A and delivered to the UA of IUT-B.		
Test description:	From the User Agent IUTAMHSA send the following message to the UA IUTBMHSA: PRI: DD FT: <FT> OHI: TEST IT101/TC04 Get the message with IUTBMHSA (UA-terminal of IUT-B).		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: DD - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT101	**Submit, transfer and deliver an IPM (UA IUT-A to UA IUT-B)**		
Test-case id: **IT101/TC05**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities An SS priority message will be submitted from the UA of IUT-A and delivered to the UA of IUT-B.		
Test description:	From the User Agent IUTAMHSA send the following message to the UA IUTBMHSA: PRI: SS FT: <FT> OHI: TEST IT101/TC05 Get the message with IUTBMHSA (UA-terminal of IUT-B). A RN is submitted when the message is displayed. Note. – Depending on UA implementation the user might be requested to send the RN.		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: SS - the ATS-message-filing-time and - the ATS-message-text Check the reception of a RN on the UA IUTAMHSA of the IUT-A system.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT102	**Submit, transfer and deliver an IPM (UA IUT-B to UA IUT-A)**		
Test-case id: **IT102/TC01**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities A KK priority message will be submitted from the UA of IUT-B and delivered to the UA of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the UA IUTAMHSA: PRI: KK FT: <FT> OHI: TEST IT102/TC01 Get the message with IUTAMHSA (UA-terminal of IUT-A).		
Test control:	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: KK - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT102	**Submit, transfer and deliver an IPM (UA IUT-B to UA IUT-A)**		
Test-case id: **IT102/TC02**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities A GG priority message will be submitted from the UA of IUT-B and delivered to the UA of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the UA IUTAMHSA: PRI: GG FT: <FT> OHI: TEST IT102/TC02 Get the message with IUTAMHSA (UA-terminal of IUT-A).		
Test control:	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: GG - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT102	**Submit, transfer and deliver an IPM (UA IUT-B to UA IUT-A)**		
Test-case id: **IT102/TC03**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities An FF priority message will be submitted from the UA of IUT-B and delivered to the UA of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the UA IUTAMHSA: PRI: FF FT: <FT> OHI: TEST IT102/TC03 Get the message with IUTAMHSA (UA-terminal of IUT-A).		
Test control:	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: FF - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT102	**Submit, transfer and deliver an IPM (UA IUT-B to UA IUT-A)**		
Test-case id: **IT102/TC04**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities A DD priority message will be submitted from the UA of IUT-B and delivered to the UA of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the UA IUTAMHSA: PRI: DD FT: <FT> OHI: TEST IT102/TC04 Get the message with IUTAMHSA (UA-terminal of IUT-A)		
Test control:	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: DD - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT102	**Submit, transfer and deliver an IPM (UA IUT-B to UA IUT-A)**		
Test-case id: **IT102/TC05**	Tested functionality: Submission, transfer and delivery of messages with different ATS-message-priorities An SS priority message will be submitted from the UA of IUT-B and delivered to the UA of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the UA IUTAMHSA: PRI: SS FT: <FT> OHI: TEST IT102/TC05 Get the message with IUTAMHSA (UA-terminal of IUT-A). A RN is submitted when the message is displayed. *Note. – Depending on UA implementation the user might be requested to send the RN.*		
Test control:	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: SS - the ATS-message-filing-time and - the ATS-message-text Check the reception of a RN on the UA IUTBMHSA of the IUT-B system.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

6.3 Gateway Operations (AFTN to AMHS)

IT201	**Convert an AFTN message to AMHS format (IUT-A)**		
Test-case id: **IT201/TC01**	Tested functionality: Conversion of messages with different AFTN priorities A KK priority message will be sent from the AFTN terminal of IUT-A, converted to AMHS and received at the UA of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA of IUT-A send the following message to the User Agent (UA) of IUT-B: KK IUTBMHSA <FT> IUTAFTNA TEST IT201/TC01 The message is converted from AFTN into AMHS format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: KK - the message transfer priority: NON URGENT - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT201	**Convert an AFTN message to AMHS format (IUT-A)**		
Test-case id: **IT201/TC02**	Tested functionality: Conversion of messages with different AFTN priorities A GG priority message will be sent from the AFTN terminal of IUT-A, converted to AMHS and received at the UA of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA of IUT-A send the following message to the User Agent (UA) of IUT-B: GG IUTBMHSA <FT> IUTAFTNA TEST IT201/TC02 The message is converted from AFTN into AMHS format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: GG - the message transfer priority: NON URGENT - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT201	**Convert an AFTN message to AMHS format (IUT-A)**		
Test-case id: **IT201/TC03**	Tested functionality: Conversion of messages with different AFTN priorities An FF priority message will be sent from the AFTN terminal of IUT-A, converted to AMHS and received at the UA of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA of IUT-A send the following message to the User Agent (UA) of IUT-B: FF IUTBMHSA <FT> IUTAFTNA TEST IT201/TC03 The message is converted from AFTN into AMHS format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: FF - the message transfer priority: NORMAL - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT201	**Convert an AFTN message to AMHS format (IUT-A)**		
Test-case id: **IT201/TC04**	Tested functionality: Conversion of messages with different AFTN priorities A DD priority message will be sent from the AFTN terminal of IUT-A, converted to AMHS and received at the UA of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA of IUT-A send the following message to the User Agent (UA) of IUT-B: DD IUTBMHSA <FT> IUTAFTNA TEST IT201/TC04 The message is converted from AFTN into AMHS format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: DD - the message transfer priority: NORMAL - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT201	**Convert an AFTN message to AMHS format (IUT-A)**		
Test-case id: **IT201/TC05**	Tested functionality: Conversion of messages with different AFTN priorities An SS priority message will be sent from the AFTN terminal of IUT-A, converted to AMHS and received at the UA of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA of IUT-A send the following message to the User Agent (UA) of IUT-B: SS IUTBMHSA <FT> IUTAFTNA TEST IT201/TC05 The message is converted from AFTN into AMHS format in the MTCU of IUT-A. *Optional:* *Generate a RN at the receiving UA IUTBMHSA of ITU-B.*		
Test control:	Check the correct reception of the message at the UA IUTBMHSA of the IUT-B system. Check - the ATS-message-priority: PRI: SS - the message transfer priority: URGENT - the ATS-message-filing-time and - the ATS-message-text *Optional:* If a RN is replied from the UA IUTBMHSA of ITU-B, the MTCU of IUT-A converts it into an SS Ack message which is sent to the AFTN terminal of IUT-A. Check the reception of the SS Ack message at the AFTN terminal IUTAFTNA of IUT-A. .Its originator indicator shall be the AFTN address IUTBMHSA, and its text shall be "R <FT> IUTAFTNA", where <FT> denotes the filing time of the subject AFTN message.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT202	**Convert an AFTN message to AMHS format (IUT-B)**		
Test-case id: **IT202/TC01**	Tested functionality: Conversion of messages with different AFTN priorities A KK priority message will be sent from the AFTN terminal of IUT-B, converted to AMHS and received at the UA of IUT-A.		
Test description:	From the AFTN terminal IUTBFTNA of IUT-B send the following message to the User Agent (UA) of IUT-A: KK IUTAMHSA <FT> IUTBFTNA TEST IT202/TC01 The message is converted from AFTN into AMHS format in the MTCU of IUT-B.		
Test control:	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: KK - the message transfer priority: NON URGENT - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT202	**Convert an AFTN message to AMHS format (IUT-B)**		
Test-case id: **IT202/TC02**	Tested functionality: Conversion of messages with different AFTN priorities A GG priority message will be sent from the AFTN terminal of IUT-B, converted to AMHS and received at the UA of IUT-A.		
Test description:	From the AFTN terminal IUTBFTNA of IUT-B send the following message to the User Agent (UA) of IUT-A: GG IUTAMHSA <FT> IUTBFTNA TEST IT202/TC02 The message is converted from AFTN into AMHS format in the MTCU of IUT-B.		
Test control:	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: GG - the message transfer priority: NON URGENT - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT202	**Convert an AFTN message to AMHS format (IUT-B)**		
Test-case id: **IT202/TC03**	Tested functionality: Conversion of messages with different AFTN priorities An FF priority message will be sent from the AFTN terminal of IUT-B, converted to AMHS and received at the UA of IUT-A.		
Test description:	From the AFTN terminal IUTBFTNA of IUT-B send the following message to the User Agent (UA) of IUT-A: FF IUTAMHSA <FT> IUTBFTNA TEST IT202/TC03 The message is converted from AFTN into AMHS format in the MTCU of IUT-B.		
Test control:	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: FF - the message transfer priority: NORMAL - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT202	**Convert an AFTN message to AMHS format (IUT-B)**		
Test-case id: **IT202/TC04**	Tested functionality: Conversion of messages with different AFTN priorities A DD priority message will be sent from the AFTN terminal of IUT-B, converted to AMHS and received at the UA of IUT-A.		
Test description:	From the AFTN terminal IUTBFTNA of IUT-B send the following message to the User Agent (UA) of IUT-A: DD IUTAMHSA Test message ID: IT202M04 <FT> IUTBFTNA DD IUTAMHSA TEST IT202/TC04 <FT> IUTBFTNA TEST IT202/TC04 The message is converted from AFTN into AMHS format in the MTCU of IUT-B. Test message ID: IT202M05		
Test control: <FT> IUTBFTNA TEST IT202/TC05	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: DD - the message transfer priority: NORMAL - the ATS-message-filing-time and - the ATS-message-text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

Test-case id: **IT202/TC05**	Tested functionality: Conversion of messages with different AFTN priorities An SS priority message will be sent from the AFTN terminal of IUT-B, converted to AMHS and received at the UA of IUT-A.		
Test description:	From the AFTN terminal IUTBFTNA of IUT-B send the following message to the User Agent (UA) of IUT-A: SS IUTAMHSA <FT> IUTBFTNA TEST IT202/TC05 The message is converted from AFTN into AMHS format in the MTCU of IUT-B. Optional: Generate a RN at the receiving UA IUTAMHSA of ITU-A.		
Test control:	Check the correct reception of the message at the UA IUTAMHSA of the IUT-A system. Check - the ATS-message-priority: PRI: SS - the message transfer priority: URGENT - the ATS-message-filing-time and - the ATS-message-text Optional: If a RN is replied from the UA IUTAMHSA of ITU-A, the MTCU of IUT-B converts it into an SS Ack message which is sent to the AFTN terminal of IUT-B. Check the reception of the SS Ack message at the AFTN terminal IUTBFTNA of IUT-B. Its originator indicator shall be the AFTN address IUTAMHSA, and its text shall be "R <FT> IUTBFTNA", where <FT> denotes the filing time of the subject AFTN message.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

6.4 Gateway Operations (AMHS to AFTN)

IT301	**Convert an IPM to AFTN format (IUT-B)**		
Test-case id: **IT301/TC01**	Tested functionality: Conversion of messages with different ATS-message-priorities A KK priority message will be submitted from the UA of IUT-A, converted to AFTN in IUT-B and received at the AFTN terminal of IUT-B.		
Test description:	From the User Agent IUTAMHSA send the following message to the AFTN terminal IUTBFTNA of IUT-B: PRI: KK FT: <FT> OHI: TEST IT301/TC01 The message is converted from AMHS into AFTN format in the MTCU of IUT-B.		
Test control:	Check the correct reception of the message at the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: KK - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT301	**Convert an IPM to AFTN format (IUT-B)**		
Test-case id: **IT301/TC02**	Tested functionality: Conversion of messages with different ATS-message-priorities A GG priority message will be submitted from the UA of IUT-A, converted to AFTN in IUT-B and received at the AFTN terminal of IUT-B.		
Test description:	From the User Agent IUTAMHSA send the following message to the AFTN terminal IUTBFTNA of IUT-B: PRI: GG FT: <FT> OHI: TEST IT301/TC02 The message is converted from AMHS into AFTN format in the MTCU of IUT-B.		
Test control:	Check the correct reception of the message at the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: GG - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT301	**Convert an IPM to AFTN format (IUT-B)**		
Test-case id: **IT301/TC03**	Tested functionality: Conversion of messages with different ATS-message-priorities An FF priority message will be submitted from the UA of IUT-A, converted to AFTN in IUT-B and received at the AFTN terminal of IUT-B.		
Test description:	From the User Agent IUTAMHSA send the following message to the AFTN terminal IUTBFTNA of IUT-B: PRI: FF FT: <FT> OHI: TEST IT301/TC03 The message is converted from AMHS into AFTN format in the MTCU of IUT-B.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: FF - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT301	**Convert an IPM to AFTN format (IUT-B)**		
Test-case id: **IT301/TC04**	Tested functionality: Conversion of messages with different ATS-message-priorities A DD priority message will be submitted from the UA of IUT-A, converted to AFTN in IUT-B and received at the AFTN terminal of IUT-B.		
Test description:	From the User Agent IUTAMHSA send the following message to the AFTN terminal IUTBFTNA of IUT-B: PRI: DD FT: <FT> OHI: TEST IT301/TC04 The message is converted from AMHS into AFTN format in the MTCU of IUT-B.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: DD - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT301	**Convert an IPM to AFTN format (IUT-B)**		
Test-case id: **IT301/TC05**	Tested functionality: Conversion of messages with different ATS-message-priorities An SS priority message will be submitted from the UA of IUT-A, converted to AFTN in IUT-B and received at the AFTN terminal of IUT-B		
Test description:	From the User Agent IUTAMHSA send the following message to the AFTN terminal IUTBFTNA of IUT-B: PRI: SS FT: <FT> OHI: TEST IT301/TC05 The message is converted from AMHS into AFTN format in the MTCU of IUT-B. *Optional:* *Send an SS Acknowledgement message from the receiving AFTN terminal.*		
Test control:	Check the correct reception of the message on the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: SS - the AFTN filing time and - the AFTN message text *Optional:* *When the SS Ack message is replied, the MTCU of IUT-B converts it into a RN.* *Check the reception of the RN at the UA IUTAMHSA of ITU-A.*		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT302	**Convert an IPM to AFTN format (IUT-A)**		
Test-case id: **IT302/TC01**	Tested functionality: Conversion of messages with different ATS-message-priorities A KK priority message will be submitted from the UA of IUT-B, converted to AFTN in IUT-A and received at the AFTN terminal of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the AFTN terminal IUTAFTNA of IUT-A: PRI: KK FT: <FT> OHI: TEST IT302/TC01 The message is converted from AMHS into AFTN format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: KK - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT302	**Convert an IPM to AFTN format (IUT-A)**		
Test-case id: **IT302/TC02**	Tested functionality: Conversion of messages with different ATS-message-priorities A GG priority message will be submitted from the UA of IUT-B, converted to AFTN in IUT-A and received at the AFTN terminal of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the AFTN terminal IUTAFTNA of IUT-A: PRI: GG FT: <FT> OHI: TEST IT302/TC02 The message is converted from AMHS into AFTN format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: GG - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT302	**Convert an IPM to AFTN format (IUT-A)**		
Test-case id: **IT302/TC03**	Tested functionality: Conversion of messages with different ATS-message-priorities An FF priority message will be submitted from the UA of IUT-B, converted to AFTN in IUT-A and received at the AFTN terminal of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the AFTN terminal IUTAFTNA of IUT-A: PRI: FF FT: <FT> OHI: TEST IT302/TC03 The message is converted from AMHS into AFTN format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: FF - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT302	**Convert an IPM to AFTN format (IUT-A)**		
Test-case id: **IT302/TC04**	Tested functionality: Conversion of messages with different ATS-message-priorities A DD priority message will be submitted from the UA of IUT-B, converted to AFTN in IUT-A and received at the AFTN terminal of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the AFTN terminal IUTAFTNA of IUT-A: PRI: DD FT: <FT> OHI: TEST IT302/TC04 The message is converted from AMHS into AFTN format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: DD - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT302	**Convert an IPM to AFTN format (IUT-A)**		
Test-case id: **IT302/TC05**	Tested functionality: Conversion of messages with different ATS-message-priorities An SS priority message will be submitted from the UA of IUT-B, converted to AFTN in IUT-A and received at the AFTN terminal of IUT-A.		
Test description:	From the User Agent IUTBMHSA send the following message to the AFTN terminal IUTAFTNA of IUT-A: PRI: SS FT: <FT> OHI: TEST IT302/TC05 The message is converted from AMHS into AFTN format in the MTCU of IUT-A. *Optional:* *Send an SS Acknowledgement message from the receiving AFTN terminal.*		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: SS - the AFTN filing time and - the AFTN message text *Optional:* *When the SS Ack message is replied, the MTCU of IUT-A converts it into a RN.* *Check the reception of the RN at the UA IUTBMHSA of ITU-B.*		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

6.5 Gateway Operations (AFTN to AMHS to AFTN)

IT401	**Convert an AFTN message to an IPM and back to AFTN format (IUT-A to IUT-B)**		
Test-case id: **IT401/TC01**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with KK priority will be sent from the AFTN terminal of IUT-A to the AFTN terminal of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA send the following message to the AFTN terminal IUTBFTNA of IUT-B: KK IUTBFTNA <FT> IUTAFTNA TEST IT401/TC01 The message is - converted from AFTN into AMHS format in the MTCU of IUT-A, - transferred via the MTA of IUT A to the MTA of IUT-B, - routed to the MTCU of IUT-B and - converted from AMHS into AFTN format in the MTCU of IUT-B. .		
Test control:	Check the correct reception of the message on the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: KK - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT401	**Convert an AFTN message to an IPM and back to AFTN format (IUT-A to IUT-B)**		
Test-case id: **IT401/TC02**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with GG priority will be sent from the AFTN terminal of IUT-A to the AFTN terminal of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA send the following message to the AFTN terminal IUTBFTNA of IUT-B: GG IUTBFTNA <FT> IUTAFTNA TEST IT401/TC02 The message is - converted from AFTN into AMHS format in the MTCU of IUT-A, - transferred via the MTA of IUT A to the MTA of IUT-B, - routed to the MTCU of IUT-B and - converted from AMHS into AFTN format in the MTCU of IUT-B.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: GG - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT401	**Convert an AFTN message to an IPM and back to AFTN format (IUT-A to IUT-B)**		
Test-case id: **IT401/TC03**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with FF priority will be sent from the AFTN terminal of IUT-A to the AFTN terminal of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA send the following message to the AFTN terminal IUTBFTNA of IUT-B: FF IUTBFTNA <FT> IUTAFTNA TEST IT401/TC03 The message is - converted from AFTN into AMHS format in the MTCU of IUT-A, - transferred via the MTA of IUT A to the MTA of IUT-B, - routed to the MTCU of IUT-B and - converted from AMHS into AFTN format in the MTCU of IUT-B. .		
Test control:	Check the correct reception of the message on the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: FF - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT401	**Convert an AFTN message to an IPM and back to AFTN format (IUT-A to IUT-B)**		
Test-case id: **IT401/TC04**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with DD priority will be sent from the AFTN terminal of IUT-A to the AFTN terminal of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA send the following message to the AFTN terminal IUTBFTNA of IUT-B: DD IUTBFTNA <FT> IUTAFTNA TEST IT401/TC04 The message is - converted from AFTN into AMHS format in the MTCU of IUT-A, - transferred via the MTA of IUT A to the MTA of IUT-B, - routed to the MTCU of IUT-B and - converted from AMHS into AFTN format in the MTCU of IUT-B. .		
Test control:	Check the correct reception of the message on the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: DD - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT401	**Convert an AFTN message to an IPM and back to AFTN format (IUT-A to IUT-B)**		
Test-case id: **IT401/TC05**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with SS priority will be sent from the AFTN terminal of IUT-A to the AFTN terminal of IUT-B.		
Test description:	From the AFTN terminal IUTAFTNA send the following message to the AFTN terminal IUTBFTNA of IUT-B: SS IUTBFTNA <FT> IUTAFTNA TEST IT401/TC05 The message is - converted from AFTN into AMHS format in the MTCU of IUT-A, - transferred via the MTA of IUT A to the MTA of IUT-B, - routed to the MTCU of IUT-B and - converted from AMHS into AFTN format in the MTCU of IUT-B. *Optional:* *Send an SS Acknowledgement message from the receiving AFTN terminal.*		
Test control:	Check the correct reception of the message on the AFTN terminal IUTBFTNA of the IUT-B system. Check - the AFTN priority: SS - the AFTN filing time and - the AFTN message text *Optional:* *When the SS Ack message is replied, the MTCU of IUT-B converts it into a RN, the RN is re-converted to an SS Acknowledgement message in the MTCU of IUT-A.* *Check the reception of the SS Acknowledgement at the AFTN terminal IUTAFTNA of ITU-A.*		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT402	**Convert an AFTN message to an IPM and back to AFTN format (IUT-B to IUT-A)**		
Test-case id: **IT402/TC01**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with KK priority will be sent from the AFTN terminal of IUT-B to the AFTN terminal of IUT-A.		
Test description:	From the AFTN terminal IUTBFTNA send the following message to the AFTN terminal IUTAFTNA of IUT-A: KK IUTAFTNA <FT> IUTBFTNA TEST IT402/TC01 The message is - converted from AFTN into AMHS format in the MTCU of IUT-B, - transferred via the MTA of IUT B to the MTA of IUT-A, - routed to the MTCU of IUT-A and - converted from AMHS into AFTN format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: KK - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT402	**Convert an AFTN message to an IPM and back to AFTN format (IUT-B to IUT-A)**		
Test-case id: **IT402/TC02**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with GG priority will be sent from IUT-B to the AFTN terminal of IUT-A.		
Test description:	From the AFTN terminal IUTBFTNA send the following message to the AFTN terminal IUTAFTNA of IUT-A: GG IUTAFTNA <FT> IUTBFTNA TEST IT402/TC02 The message is - converted from AFTN into AMHS format in the MTCU of IUT-B, - transferred via the MTA of IUT B to the MTA of IUT-A, - routed to the MTCU of IUT-A and - converted from AMHS into AFTN format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: GG - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT402	**Convert an AFTN message to an IPM and back to AFTN format (IUT-B to IUT-A)**		
Test-case id: **IT402/TC03**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with FF priority will be sent from the AFTN terminal of IUT-B to the AFTN terminal of IUT-A.		
Test description:	From the AFTN terminal IUTBFTNA send the following message to the AFTN terminal IUTAFTNA of IUT-A: FF IUTAFTNA <FT> IUTBFTNA TEST IT402/TC03 The message is - converted from AFTN into AMHS format in the MTCU of IUT-B, - transferred via the MTA of IUT B to the MTA of IUT-A, - routed to the MTCU of IUT-A and - converted from AMHS into AFTN format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: FF - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT402	**Convert an AFTN message to an IPM and back to AFTN format (IUT-B to IUT-A)**		
Test-case id: **IT402/TC04**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with DD priority will be sent from the AFTN terminal of IUT-B to the AFTN terminal of IUT-A.		
Test description:	From the AFTN terminal IUTBFTNA send the following message to the AFTN terminal IUTAFTNA of IUT-A: DD IUTAFTNA <FT> IUTBFTNA TEST IT402/TC04 The message is - converted from AFTN into AMHS format in the MTCU of IUT-B, - transferred via the MTA of IUT B to the MTA of IUT-A, - routed to the MTCU of IUT-A and - converted from AMHS into AFTN format in the MTCU of IUT-A.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: DD - the AFTN filing time and - the AFTN message text		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT402	**Convert an AFTN message to an IPM and back to AFTN format (IUT-B to IUT-A)**		
Test-case id: **IT402/TC05**	Tested functionality: Conversion of messages with different AFTN priorities An AFTN message with SS priority will be sent from the AFTN terminal of IUT-B to the AFTN terminal of IUT-A.		
Test description:	From the AFTN terminal of IUTBFTNA send the following message to the AFTN terminal IUTAFTNA of IUT-A: SS IUTAFTNA <FT> IUTBFTNA TEST IT402/TC05 The message is - converted from AFTN into AMHS format in the MTCU of IUT-B, - transferred via the MTA of IUT B to the MTA of IUT-A, - routed to the MTCU of IUT-A and - converted from AMHS into AFTN format in the MTCU of IUT-A. Optional: Send an SS Acknowledgement message from the receiving AFTN terminal.		
Test control:	Check the correct reception of the message on the AFTN terminal IUTAFTNA of the IUT-A system. Check - the AFTN priority: SS - the AFTN filing time and - the AFTN message text Optional: When the SS Ack message is replied, the MTCU of IUT-A converts it into a RN, the RN is re-converted to an SS Acknowledgement message in the MTCU of IUT-B. Check the reception of the SS Acknowledgement at the AFTN terminal IUTBFTNA of ITU-B.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

6.6 Gateway Operations – special cases

IT501	**Distribute an IPM to AMHS and AFTN users**		
Test-case id: **IT501/TC01**	Tested functionality: Distribution of IPM A message will be sent from a UA on IUT-A to IUT-B with Primary Recipients addressing an AFTN terminal and a UA in IUT-B.		
Test description:	From IUTAMHSA send the following message to: Primary Recipients: IUTBMHSA and IUTBFTNA PRI: FF FT: <FT> TEST IT501/TC01 Get the message at the UA- and AFTN terminals of IUT-B.		
Test control:	Check the correct reception of the message by IUTBFTNA and IUTBMHSA in the IUT-B configuration.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT501	**Distribute an IPM to AMHS and AFTN users**		
Test-case id: **IT501/TC02**	Tested functionality: Distribution of IPM A message will be sent from a UA on IUT-B to IUT-A with Primary Recipients addressing an AFTN terminal and a UA in IUT-A.		
Test description:	From IUTBMHSA send the following message to: Primary Recipients: IUTAMHSA and IUTAFTNA PRI: FF FT: <FT> TEST IT501/TC02 Get the message at the UA- and AFTN terminals of IUT-A.		
Test control:	Check the correct reception of the message by IUTAFTNA and IUTAMHSA in the IUT-A configuration.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT501	**Distribute an IPM to AMHS and AFTN users**		
Test-case id: **IT501/TC03**	Tested functionality: Distribution of IPM A message will be sent from a UA on IUT-A to IUT-B with Primary Recipients and Copy Recipients, addressing AFTN terminals and UAs in IUT-B.		
Test description:	From IUTAMHSA send the following message to: Primary Recipients: IUTBMHSA and IUTBFTNA Copy Recipients: IUTBMHSB and IUTBFTNB PRI: FF FT: <FT> TEST IT501/TC03 Get the message at the UA- and AFTN terminals of IUT-B.		
Test control:	Check the correct reception of the message by IUTBFTNA, IUTBFTNB and IUTBMHSA, IUTBMHSB in the IUT-B configuration.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT501	**Distribute an IPM to AMHS and AFTN users**		
Test-case id: **IT501/TC04**	Tested functionality: Distribution of IPM A message will be sent from a UA on IUT-B to IUT-A with Primary Recipients and Copy Recipients, addressing AFTN terminals and UAs in IUT-A.		
Test description:	From IUTBMHSA send the following message to: Primary Recipients: IUTAMHSA and IUTAFTNA Copy Recipients: IUTAMHSB and IUTAFTNB PRI: FF FT: <FT> TEST IT501/TC04 Get the message at the UA- and AFTN terminals of IUT-A.		
Test control:	Check the correct reception of the message by IUTAFTNA, IUTAFTNB and IUTAMHSA, IUTAMHSB in the IUT-A configuration.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT501	**Distribute an IPM to AMHS and AFTN users**		
Test-case id: **IT501/TC05**	Tested functionality: Distribution of IPM A message will be sent from a UA on IUT-A to IUT-B with Primary Recipients, Copy Recipients and Blind Copy Recipients, addressing AFTN terminals and UAs in IUT-B.		
Test description:	From IUTAMHSA send the following message to: Primary Recipients: IUTBMHSA and IUTBFTNA Copy Recipients: IUTBMHSB and IUTBFTNB Blind Copy Recipients: IUTBMHSC and IUTBFTNC PRI: FF FT: <FT> TEST IT501/TC05 Get the message at the UA- and AFTN terminals of IUT-B.		
Test control:	Check that at the AFTN Station of IUT-B one message with addresses IUTBFTNA, IUTBFTNB and another message with the address IUTBFTNC is received. Check that at the UA IUTBMHSA one IPM is received which contains the Primary Recipients IUTBMHSA, IUTBFTNA and the Copy Recipients IUTBMHSB, IUTBFTNB, but no Blind Copy Recipients. Check that at the UA IUTBMHSC one IPM is received which contains the Primary Recipients IUTBMHSA, IUTBFTNA, the Copy Recipients IUTBMHSB, IUTBFTNB and one Blind Copy Recipient IUTBMHSC.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT501	**Distribute an IPM to AMHS and AFTN users**		
Test-case id: **IT501/TC06**	Tested functionality: Distribution of IPM A message will be sent from a UA on IUT-B to IUT-A with Primary Recipients, Copy Recipients and Blind Copy Recipients, addressing AFTN terminals and UAs in IUT-A.		
Test description:	From IUTBMHSA send the following message to: Primary Recipients: IUTAMHSA and IUTAFTNA Copy Recipients: IUTAMHSB and IUTAFTNB Blind Copy Recipients: IUTAMHSC and IUTAFTNC PRI: FF FT: <FT> TEST IT501/TC06 Get the message at the UA- and AFTN terminals of IUT-A.		
Test control:	Check that at the AFTN Station of IUT-A one message with addresses IUTAFTNA, IUTAFTNB and another message with the address IUTAFTNC is received. Check that at the UA IUTAMHSA one IPM is received which contains the Primary Recipients IUTAMHSA, IUTAFTNA and the Copy Recipients IUTAMHSB, IUTAFTNB, but no Blind Copy Recipients. Check that at the UA IUTAMHSC one IPM is received which contains the Primary Recipients IUTAMHSA, IUTAFTNA, the Copy Recipients IUTAMHSB, IUTAFTNB and one Blind Copy Recipient IUTAMHSC.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT502	**Expand a DL addressing both AMHS and AFTN users**		
Test-case id: **IT502/TC01**	Tested functionality: Expanding of Distribution list The message will be sent from a UA on IUT-A addressing a local DL which contains addresses of AFTN terminals and the UA in IUT-B.		
Test description:	IUTADLLO must be configured as a local DL entry in IUT-A containing the addresses IUTBFTNA IUTBFTNB and IUTBMHSA. From IUTAMHSA send the following message to IUTADLLO: PRI: FF FT: <FT> TEST IT502/TC01 Get the message at the UA and AFTN terminals of IUT-B.		
Test control:	Check the correct reception of the message by AFTN terminals IUTBFTNA, IUTBFTNB and UA IUTBMHSA in the IUT-B configuration.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT502	**Expand a DL addressing both AMHS and AFTN users**		
Test-case id: **IT502/TC02**	Tested functionality: Expanding of Distribution list The message will be sent from a UA on IUT-B addressing a local DL which contains addresses of AFTN terminals and the UA in IUT-A.		
Test description:	IUTBDLLO must be configured as a local DL entry in IUT-A containing the addresses IUTAFTNA, IUTAFTNB and IUTAMHSA. From IUTBMHSA send the following message to IUTBDLLO: PRI: FF FT: <FT> TEST IT502/TC02 Get the message at the UA and AFTN terminals of IUT-A.		
Test control:	Check the correct reception of the message by AFTN terminals IUTAFTNA, IUTAFTNB and UA IUTAMHSA in the IUT-A configuration.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT502	**Expand a DL addressing both AMHS and AFTN users**		
Test-case id: **IT502/TC03**	Tested functionality: Expanding of Distribution list The message will be sent from a UA on IUT-A addressing a remote DL in IUT-B which contains addresses of AFTN terminals and the UA in IUT-B		
Test description:	IUTBDLRE must be configured as a local DL entry in IUT-B containing the addresses IUTBFTNA, IUTBFTNB and IUTBMHSA. From IUTAMHSA send the following message to IUTBDLRE: PRI: FF FT: <FT> TEST IT502/TC03 Get the message at the UA and AFTN terminals of IUT-B.		
Test control:	Check the correct reception of the message by AFTN terminals IUTBFTNA, IUTBFTNB and UA IUTBMHSA in the IUT-B configuration.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT502	**Expand a DL addressing both AMHS and AFTN users**		
Test-case id: **IT502/TC04**	Tested functionality: Expanding of Distribution list The message will be sent from a UA on IUT-B addressing a remote DL in IUT-A which contains addresses of AFTN terminals and the UA in IUT-A		
Test description:	IUTADLRE must be configured as a local DL entry in IUT-A containing the addresses IUTAFTNA, IUTAFTNB and IUTAMHSA. From IUTBMHSA send the following message to IUTADLRE: PRI: FF FT: <FT> TEST IT502/TC04 Get the message at the UA- and AFTN terminals of IUT-B.		
Test control:	Check the correct reception of the message by AFTN terminals IUTAFTNA, IUTAFTNB and UA IUTAMHSA in the IUT-A configuration.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT503	**Convert or reject an IPM, if the ATS-message-text contains more than 1800 characters**		
Test-case id: **IT503/TC01**	Tested functionality: Conversion of “long” messages A message with normal priority and length of about 4500 characters is sent from the IUT-A to the IUT-B		
Test description:	From UA IUTAMHSA of IUT-A send the following message to the AFTN terminal IUTBFTNA: PRI: FF FT: <FT> OHI: TEST IT503/TC01 TEXT 4500 CHARACTERS 12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789 12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789 12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789 … 12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789 END		
Test control:	The SARPs (3.1.2.3.5.2.1.7) specify that the message can be rejected (case a) or split into several messages (case b). If the system provides “long AFTN message” capability the message will be converted (case c). <u>If case a is implemented:</u> The message is not conveyed to the AFTN component. Check the Report received at the User Agent position IUTAMHSA Verify the following Per-Recipient-Report Non-Delivery information: - Actual-recipient-name: MF-form address of IUTBFTNA - reason code 1 signifies "unable-to-transfer" - diagnostic code 7 signifies "content-too-long". - supplementary information: "unable to convert to AFTN due to message text length". <u>If case b is implemented:</u> Check that IUTBFTNA receives several messages. <u>If case c is implemented:</u> Check that IUTBFTNA receives one message.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**
	a / b / c		

IT503	**Convert or reject an IPM, if the ATS-message-text contains more than 1800 characters**		
Test-case id: **IT503/TC02**	Tested functionality: Conversion of “long” messages A message with normal priority and length of about 4500 characters is sent from the IUT-B to the IUT-A		
Test description:	From UA IUTBMHSA of IUT-B send the following message to the AFTN terminal IUTAFTNA: PRI: FF FT: <FT> OHI: TEST IT503/TC02 TEXT 4500 CHARACTERS 12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789 12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789 12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789 … 12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789 END		
Test control:	The SARPs (3.1.2.3.5.2.1.7) specify that the message can be rejected (case a) or split into several messages (case b). If the system provides “long AFTN message” capability the message will be converted (case c). If case a is implemented: The message is not conveyed to the AFTN component. Check the Report received at the User Agent position IUTBMHSA Verify the following Per-Recipient-Report Non-Delivery information: - Actual-recipient-name: MF-form address of IUTAFTNA - reason code 1 signifies "unable-to-transfer" - diagnostic code 7 signifies "content-too-long". - supplementary information: "unable to convert to AFTN due to message text length". If case b is implemented: Check that IUTAFTNA receives several messages. If case c is implemented: Check that IUTAFTNA receives one message.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**
	a / b / c		

IT504	**Split an incoming IPM addressing more than 21 AFTN users**		
Test-case id: **IT504/TC01**	Tested functionality: Conversion of messages with more than 21 addresses A message with normal priority containing 50 recipients is sent from the IUT-A to the IUT-B.		
Test description:	From IUTAMHSA send the following message to the following addressees (all recipients in the corresponding MF-Form): IUTBFTNA, IUTBFTNB, IUTBFTNC, IUTBFTND, IUTBFTNE, IUTBFTNF, IUTBFTNG, IUTBFTNH, IUTBFTNI, IUTBFTNJ, IUTBFTNK, IUTBFTNL, IUTBFTNM, IUTBFTNN, IUTBFTNO, IUTBFTNP, IUTBFTNQ, IUTBFTNR, IUTBFTNS, IUTBFTNT, IUTBFTNU, IUTBFTNV, IUTBFTNW, IUTBFTNX, IUTBFTNY, IUTBFTAA, IUTBFTAB, IUTBFTAC, IUTBFTAD, IUTBFTAE, IUTBFTAF, IUTBFTAG, IUTBFTAH, IUTBFTAI, IUTBFTAJ, IUTBFTAK, IUTBFTAL, IUTBFTAM, IUTBFTAN, IUTBFTAO, IUTBFTAP, IUTBFTAQ, IUTBFTAR, IUTBFTAS, IUTBFTAT, IUTBFTAU, IUTBFTAV, IUTBFTAW, IUTBFTAX, IUTBFTAY PRI: FF FT: <FT> OHI: TEST IT504/TC01		
Test control:	PDR M4050004 (Title: AMHS - Too Many Recipients) is resolved. Therefore the message shall be split into several messages. The message is split into 3 copies, each conveyed to the AFTN component. The first copy is addressed to 21 of the 50 addressee indicators. The second copy is addressed to further 21 addressee indicators. The third copy is addressed to the remaining 8 of the 50 addressee indicators. Check the correct reception of the messages on the AFTN terminal of IUT-B.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT504	**Split an incoming IPM addressing more than 21 AFTN users**		
Test-case id: **IT504/TC02**	Tested functionality: Conversion of messages with more than 21 addresses A message with normal priority containing 50 recipients is sent from the IUT-B to the IUT-A.		
Test description:	From IUTBMHSA send the following message to the following addressees (all recipients in the corresponding MF-Form): IUTAFTNA, IUTAFTNB, IUTAFTNC, IUTAFTND, IUTAFTNE, IUTAFTNF, IUTAFTNG, IUTAFTNH, IUTAFTNI, IUTAFTNJ, IUTAFTNK, IUTAFTNL, IUTAFTNM, IUTAFTNN, IUTAFTNO, IUTAFTNP, IUTAFTNQ, IUTAFTNR, IUTAFTNS, IUTAFTNT, IUTAFTNU, IUTAFTNV, IUTAFTNW, IUTAFTNX, IUTAFTNY, IUTAFTAA, IUTAFTAB, IUTAFTAC, IUTAFTAD, IUTAFTAE, IUTAFTAF, IUTAFTAG, IUTAFTAH, IUTAFTAI, IUTAFTAJ, IUTAFTAK, IUTAFTAL, IUTAFTAM, IUTAFTAN, IUTAFTAO, IUTAFTAP, IUTAFTAQ, IUTAFTAR, IUTAFTAS, IUTAFTAT, IUTAFTAU, IUTAFTAV, IUTAFTAW, IUTAFTAX, IUTAFTAY PRI: FF FT: <FT> OHI: TEST IT504/TC02		
Test control:	PDR M4050004 (Title: AMHS - Too Many Recipients) is resolved. Therefore the message shall be split into several messages. The message is split into 3 copies, each conveyed to the AFTN component. The first copy is addressed to 21 of the 50 addressee indicators. The second copy is addressed to further 21 addressee indicators. The third copy is addressed to the remaining 8 of the 50 addressee indicators. Check the correct reception of the messages on the AFTN terminal of IUT-A.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT505	**Probe Conveyance Test**		
Test-case id: **IT505/TC01**	Tested functionality: Processing of Probe Messages by UA and MTCU. The messages will be sent from a UA on IUT-A to IUT-B, addressing AFTN terminals and UAs in IUT-B.		
Test description:	From IUTAMHSA send a probe to IUTBFTNA, IUTBFTNB, IUTBMHSA.		
Test control:	On IUT-A UA IUTAMHSA: One Delivery Report (DR) with 2 AFTN recipients from the MTCU and one DR with one recipient from the MTA Verify that the DR reporting about the AFTN addresses contains the supplementary information “This report only indicates successful (potential) conversion to AFTN, not delivery to a recipient”.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT505	**Probe Conveyance Test**		
Test-case id: **IT505/TC02**	Tested functionality: Processing of Probe Messages by UA and MTCU. The messages will be sent from a UA on IUT-B to IUT-A, addressing AFTN terminals and UAs in IUT-A.		
Test description:	From IUTBMHSA send a probe to IUTAFTNA, IUTAFTNB, IUTAMHSA.		
Test control:	On IUT-B UA IUTBMHSA: One Delivery Report (DR) with 2 AFTN recipients from the MTCU and one DR with one recipient from the MTA Verify that the DR reporting about the AFTN addresses contains the supplementary information “This report only indicates successful (potential) conversion to AFTN, not delivery to a recipient”.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT505	**Probe Conveyance Test**		
Test-case id: **IT505/TC03**	Tested functionality: Processing of Probe Messages by UA and MTCU. The messages will be sent from a UA on IUT-A to IUT-B, containing the address of an AFTN terminal of IUT-B and an MF address which cannot be translated by the MTCU of IUT-B.		
Test description:	From IUTAMHSA send a probe to IUTBFTNA, IUTBFTUU (address is not provided in the look-up table of IUT-B).		
Test control:	Verify that at UA IUTAMHSA: A Delivery Report, containing the reported recipient IUTBFTNA and a NDR, containing the reported recipient IUTBFTUU, with: - non-delivery-reason-code set to “unable-to-transfer”, - non-delivery-diagnostic-code set to “unrecognized-OR-name” are received. Verify that the DR reporting about the address which could be translated contains the supplementary information “This report only indicates successful (potential) conversion to AFTN, not delivery to a recipient”.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT505	**Probe Conveyance Test**		
Test-case id: **IT505/TC04**	Tested functionality: Processing of Probe Messages by UA and MTCU. The messages will be sent from a UA on IUT-B to IUT-A, containing the address of an AFTN terminal of IUT-A and an MF address which cannot be translated by the MTCU of IUT-A.		
Test description:	From IUTBMHSA send a probe to IUTAFTNA, IUTAFTUU (address is not provided in the look-up table of IUT-A)		
Test control:	Verify that at UA IUTBMHSA: A Delivery Report, containing the reported recipient IUTAFTNA and a NDR, containing the reported recipient IUTAFTUU, with: - non-delivery-reason-code set to “unable-to-transfer”, - non-delivery-diagnostic-code set to “unrecognized-OR-name” are received. Verify that the DR reporting about the address which could be translated contains the supplementary information “This report only indicates successful (potential) conversion to AFTN, not delivery to a recipient”.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

6.7 Stress traffic situations

IT601	**Stress load**		
Test-case id: **IT601/TC01**	Tested functionality: AMHS traffic interchange after queuing of an amount of messages After queuing of an amount of messages both IUTs start sending a burst of messages		
Test description:	Interrupt the connection between IUT-A and IUT-B by disabling the physical connector used to send information to the underlying network in one of the IUTs. Select from the data base or generated by the UA and/or the AFTN terminal 100 messages in both IUTs. For example, from IUTAFTNA send 100 messages to IUTBFTNA, IUTBMHSA. and from IUTBFTNA send 100 messages to IUTAFTNA, IUTAMHSA, In the result on IUT-A and IUT-B there are 100 messages queued in direction to the peer IUT. Re-establish the connection between IUT-A and IUT-B. The queued messages will be sent simultaneously from both IUTs. Measure the time: from re-establishing the connection till sending the first message and from sending the first till sending the last message. Measure the time: from re-establishing the connection till receiving the first message and from receiving the first message till receiving the last message.		
Test control:	Check that all 100 messages are received at the addressed terminals. Check that no errors or malfunction are reported or observed at the IUTs during the interchange period. Analyse the measured time. Calculate at both sides the amount of time needed to flush the queues. Unacceptable delays shall be treated as "FAILED".		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

The following table can be used to make notes of the Test Control Result.

Test Control	**Result IT601/TC01**	**Result IT601/TC02**	**Result IT601/TC03**
1. Notice the time of re-establishing the connection sending direction.			
2. Notice the time of sending the first message.			
3. Notice the time of sending the last message.			
4. Notice the time of re-establishing the connection receiving direction.			
5. Notice the time of receiving the first message.			
6. Notice the time of receiving the last message.			
7. Notice the number of messages received (shall be equal to the number of messages expected.)			
8. Check the event logging of the system for abnormalities in the area of AMHS / X.400 / AFTN/AMHS Gateway.			
9. Check the event logging / traffic traces for NDRs. (No NDRs are awaited.)			
10. Check for Control Position events. (No related events are awaited.)			
11. Check the X.400 / AMHS diagnostics, check the number of associations used (in particular possible hanging/unused associations).			
12. Monitor the underlying network infrastructure (network specialist).			
13. At both sides note the amount of time needed to flush the queues. (Unacceptable delays shall be treated as “FAILED”)			

IT601	**Stress load**		
Test-case id: **IT601/TC02**	Tested functionality: AMHS traffic interchange after queuing of an amount of messages After queuing of an amount of messages both IUTs start sending a burst of messages		
Test description:	Interrupt the connection between IUT-A and IUT-B by disabling the physical connector used to send information to the underlying network in one of the IUTs. Select from the data base or generated by the UA and/or the AFTN terminal 200 messages in both IUTs. For example, from IUTAFTNA send 200 messages to IUTBFTNA, IUTBMHSA. and from IUTBFTNA send 200 messages to IUTAFTNA, IUTAMHSA, In the result on IUT-A and IUT-B there are 200 messages queued in direction to the peer IUT. Re-establish the connection between IUT-A and IUT-B. The queued messages will be sent simultaneously from both IUTs. Measure the time: • from re-establishing the connection till sending the first message and • from sending the first till sending the last message. Measure the time: • from re-establishing the connection till receiving the first message and • from receiving the first message till receiving the last message.		
Test control:	Check that all 200 messages are received at the addressed terminals. Check that no errors or malfunction are reported or observed at the IUTs during the interchange period. Analyse the measured time. Calculate at both sides the amount of time needed to flush the queues. Unacceptable delays shall be treated as “FAILED”.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT601	**Stress load**		
Test-case id: **IT601/TC03**	Tested functionality: AMHS traffic interchange after queuing of an amount of messages After queuing of an amount of messages both IUTs start sending a burst of messages		
Test description:	Interrupt the connection between IUT-A and IUT-B by disabling the physical connector used to send information to the underlying network in one of the IUTs. Select from the data base or generated by the UA and/or the AFTN terminal 400 messages in both IUTs. For example, from IUTAFTNA send 400 messages to IUTBFTNA, IUTBMHSA. and from IUTBFTNA send 400 messages to IUTAFTNA, IUTAMHSA, In the result on IUT-A and IUT-B there are 400 messages queued in direction to the peer IUT. Re-establish the connection between IUT-A and IUT-B. The queued messages will be sent simultaneously from both IUTs. Measure the time: • from re-establishing the connection till sending the first message and • from sending the first till sending the last message. Measure the time: • from re-establishing the connection till receiving the first message and • from receiving the first message till receiving the last message.		
Test control:	Check that all 400 messages are received at the addressed terminals. Check that no errors or malfunction are reported or observed at the IUTs during the interchange period. Analyse the measured time. Calculate at both sides the amount of time needed to flush the queues. Unacceptable delays shall be treated as “FAILED”.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

7 Trilateral Test procedures - optional

7.1 Submission/Transfer/Delivery and Relay operations

IT701	**Submission / Transfer / Delivery**		
Test-case id: **IT701/TC01**	Tested functionality: Submission, transfer and delivery of messages to different IUTs An IPM submitted in IUT-A is transferred to IUT-B, IUT-C and delivered to the UAs of IUT-B, IUT-C.		
Test description:	Verify that the X.400 routing tables are configured according section 3.3, thus: The X.400 routing table of IUT-A routes PRMD=IUTLAND-B to IUT-B and PRMD=IUTLAND-C to IUT-C. From UA IUTAMHSA send an ATS message (IPM) to UA IUTBMHSA and IUTCMHSA: PRI: FF FT: <FT> OHI: TEST IT701/TC01		
Test control:	Verify that the message is received by both remote UAs in IUT-B and IUT-C. In particular, verify: • ATS-message-priority FF, • ATS-message-filing-time, • ATS-message-text.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT701	**Submission / Transfer / Delivery**		
Test-case id: **IT701/TC02**	Tested functionality: Submission, transfer and delivery of messages to different IUTs An IPM submitted in IUT-B is transferred to IUT-C, IUT-A and delivered to the UAs of IUT-C, IUT-A.		
Test description:	Verify that the X.400 routing tables are configured according section 3.3, thus: The X.400 routing table of IUT-B routes PRMD=IUTLAND-C to IUT-C and PRMD=IUTLAND-A to IUT-A. From the UA IUTBMHSA send an ATS message (IPM) to UA IUTAMHSA and IUTCMHSA. PRI: FF FT: <FT> OHI: TEST IT701/TC02		
Test control:	Verify that the message is received by both remote UAs in IUT-A and IUT-C. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT701	**Submission / Transfer / Delivery between the partner MTAs**		
Test-case id: **IT701/TC03**	Tested functionality: Submission, transfer and delivery of messages to different IUTs An IPM submitted in IUT-C is transferred to IUT-A, IUT-B and delivered to the UA of IUT-A, IUT-B.		
Test description:	Verify that the X.400 routing tables are configured according section 3.3, thus: The X.400 routing table of IUT-C routes PRMD=IUTLAND-A to IUT-A and PRMD=IUTLAND-B to IUT-B. From the UA IUTCMHSA send an ATS message (IPM) to UA IUTAMHSA and IUTBMHSA. PRI: FF FT: <FT> OHI: TEST IT701/TC03		
Test control:	Verify that the messages is received by both remote UAs in IUT-A and IUT-B. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT702	**Relay operations**		
Test-case id: **IT702/TC01**	Tested functionality: Transfer of messages by an IUT in between An IPM is routed via an intermediate MTA and transferred from one IUT to another IUT via a “relay” IUT.		
Test description:	Modify the X.400 routing as follows: The X.400 routing table of IUT-A routes PRMD=IUTLAND-B and PRMD=IUTLAND-C to IUT-B. The X.400 routing table of IUT-B routes PRMD=IUTLAND-C to IUT-C. Hence, IUT-B is the “relay” IUT. From the UA IUTAMHSA send an ATS message (IPM) to the UA IUTCMHSA. PRI: FF FT: <FT> OHI: TEST IT702/TC01		
Test control:	Verify that the message has passed the IUT-B in between (if possible). Verify that the message is received by the UA IUTCMHSA. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT702	**Relay operations**		
Test-case id: **IT702/TC02**	Tested functionality: Transfer of messages by an IUT in between An IPM is routed via an intermediate MTA and transferred from one IUT to another IUT via a “relay” IUT.		
Test description:	Modify the X.400 routing as follows: The X.400 routing table of IUT-B routes PRMD=IUTLAND-A and PRMD=IUTLAND-C to IUT-C. The X.400 routing table of IUT-C routes PRMD=IUTLAND-A to IUT-A. Hence, IUT-C is the “relay” IUT. From the UA IUTBMHSA send an ATS message (IPM) to the UA IUTAMHSA. PRI: FF FT: <FT> OHI: TEST IT702/TC02		
Test control:	Verify that the message has passed the IUT-C in between (if possible). Verify that the message is received by the UA IUTAMHSA. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT702	**Relay operations**		
Test-case id: **IT702/TC03**	Tested functionality: Transfer of messages by an IUT in between An IPM is routed via an intermediate MTA and transferred from one IUT to another IUT via a “relay” IUT.		
Test description:	Modify the X.400 routing as follows: The X.400 routing table of IUT-C routes PRMD=IUTLAND-A and PRMD=IUTLAND-B to IUT-A. The X.400 routing table of IUT-A routes PRMD=IUTLAND-B to IUT-B. Hence, IUT-A is the “relay” IUT. From the UA IUTCMHSA send an ATS message (IPM) to the UA IUTBMHSA. PRI: FF FT: <FT> OHI: TEST IT702/TC03		
Test control:	Verify that the message has passed the IUT-A in between (if possible). Verify that the message is received by the UA IUTBMHSA. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

7.2 Test of special situations

IT801	**Alternate MTA routing**		
Test-case id: **IT801/TC01**	Tested functionality: Alternate routing capability An ATS message (IPM) queued due to outage of the primary X.400 routing path is routed via an alternate MTA (IUT).		
Test description:	Verify that the X.400 routing tables are configured according section 3.3, thus: The X.400 routing table of IUT-A routes PRMD=IUTLAND-B to IUT-B and PRMD=IUTLAND-C to IUT-C. The X.400 routing table of IUT-C routes PRMD=IUTLAND-A to IUT-A and PRMD=IUTLAND-B to IUT-B. Cut the direct connection from IUT-A to IUT-B. From the UA IUTAMHSA send an ATS message (IPM) to the UA IUTBMHSA. If alternate MTA routing functionality is implemented and configured in IUT-A, the message will be transferred automatically via the "alternate" connection. Otherwise: Reroute the queued message manually (an operational procedure for should exist).		
Test control:	Verify that the messages had passed the IUT-C in between (if possible). Verify the message received by the UA IUTBMHSA. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT801	**Alternate MTA routing**		
Test-case id: **IT801/TC02**	Tested functionality: Alternate routing capability An ATS message (IPM) queued due to outage of the primary X.400 routing path is routed via an alternate MTA (IUT).		
Test description:	Verify that the X.400 routing tables are configured according section 3.3, thus: The X.400 routing table of IUT-A routes PRMD=IUTLAND-B to IUT-B and PRMD=IUTLAND-C to IUT-C. The X.400 routing table of IUT-B routes PRMD=IUTLAND-A to IUT-A and PRMD=IUTLAND-C to IUT-C. Cut the direct connection from IUT-B to IUT-C. From the UA IUTBMHSA send an ATS message (IPM) to the UA IUTCMHSA. If alternate MTA routing functionality is implemented and configured in IUT-B, the message will be transferred automatically via the "alternate" connection. Otherwise: Reroute the queued message manually (an operational procedure for should exist).		
Test control:	Verify that the message had passed the IUT-A in between (if possible). Verify the message received by the UA of IUTCMHSA. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT801	**Alternate MTA routing**		
Test-case id: **IT801/TC03**	Tested functionality: Alternate routing capability An ATS message (IPM) queued due to outage of the primary X.400 routing path is routed via an alternate MTA (IUT).		
Test description:	Verify that the X.400 routing tables are configured according section 3.3, thus: The X.400 routing table of IUT-B routes PRMD=IUTLAND-A to IUT-A and PRMD=IUTLAND-C to IUT-C. The X.400 routing table of IUT-C routes PRMD=IUTLAND-A to IUT-A and PRMD=IUTLAND-B to IUT-B. Cut the direct connection from IUT-C to IUT-A. From the UA IUTCMHSA send an ATS message (IPM) to the UA IUTAMHSA. If alternate MTA routing functionality is implemented and configured in IUT-C, the message will be transferred automatically via the "alternate" connection. Otherwise: Reroute the queued message manually (an operational procedure for should exist).		
Test control:	Verify that the message had passed the IUT-B in between (if possible). Verify the message received by the UA of IUTAMHSA. In particular, verify: • ATS-message-priority, • ATS-message-filing-time, • ATS-message-text.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT802	**Loop detection**		
Test-case id: **IT802/TC01**	Tested functionality: A message traversing a loop is detected by an IUT.		
Test description:	Create a temporary routing loop. The X.400 routing table of IUT-A routes PRMD=IUTLAND-X to IUT-B.The X.400 routing table of IUT-B routes PRMD=IUTLAND-X to IUT-C.The X.400 routing table of IUT-C routes PRMD=IUTLAND-X to IUT-A. From UA IUTAMHSA send a message (IT802/M01) addressed to IUTXLOOP. This message will be routed cyclically so that it is finally performing a loop. One IUT detects the looping message, stops the further transfer and non-delivers the message.		
Test control:	Verify that: • the message is discarded • at UA IUTAMHSA a Non-Delivery-Report is received with non-delivery-reason “transfer-failure” and non-delivery-diagnostic-code “loop detected”.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT802	**Loop detection**		
Test-case id: **IT802/TC02**	Tested functionality: A message traversing a loop is detected by an IUT.		
Test description:	Create a temporary routing loop. The X.400 routing table of IUT-A routes PRMD=IUTLAND-X to IUT-B.The X.400 routing table of IUT-B routes PRMD=IUTLAND-X to IUT-C.The X.400 routing table of IUT-C routes PRMD=IUTLAND-X to IUT-A. From UA IUTBMHSA send a message (IT802/M02) addressed to IUTXLOOP. This message will be routed cyclically so that it is finally performing a loop. One IUT detects the looping message, stops the further transfer and non-delivers the message.		
Test control:	Verify that: • the message is discarded • at UA IUTBMHSA a Non-Delivery-Report is received with non-delivery-reason “transfer-failure” and non-delivery-diagnostic-code “loop detected”.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

IT802	**Loop detection**		
Test-case id: **IT802/TC03**	Tested functionality: A message traversing a loop is detected by an IUT.		
Test description:	Create a temporary routing loop. The X.400 routing table of IUT-A routes PRMD=IUTLAND-X to IUT-B.The X.400 routing table of IUT-B routes PRMD=IUTLAND-X to IUT-C.The X.400 routing table of IUT-C routes PRMD=IUTLAND-X to IUT-A. From UA IUTCMHSA send a message (IT802/M03) addressed to IUTXLOOP. The message will be routed cyclically so that it is finally performing a loop. One IUT detects the looping message, stops the further transfer and non-delivers the message.		
Test control:	Verify that: • the message is discarded • at UA IUTCMHSA a Non-Delivery-Report is received with non-delivery-reason “transfer-failure” and non-delivery-diagnostic-code “loop detected”.		
Test result:	**PASS**	**FAILED**	**INCONCLUSIVE**

8 Test message templates

8.1 Test message templates for IUT-A

8.1.1 Input device User Agent (UA): IUTAMHSA

From UA IUTAMHSA	**to UA IUTBMHSA**
Test message ID: IT101M01	PRI: KK FT: <FT> OHI: TEST IT101/TC01
Test message ID: IT101M02	PRI: GG FT: <FT> OHI: TEST IT101/TC02
Test message ID: IT101M03	PRI: FF FT: <FT> OHI: TEST IT101/TC03
Test message ID: IT101M04	PRI: DD FT: <FT> OHI: TEST IT101/TC04
Test message ID: IT101M05	PRI: SS FT: <FT> OHI: TEST IT101/TC05

From UA IUTAMHSA	**to UA IUTBFTNA**
Test message ID: IT301M01	PRI: KK FT: <FT> OHI: TEST IT301/TC01
Test message ID: IT301M02	PRI: GG FT: <FT> OHI: TEST IT301/TC02
Test message ID: IT301M03	PRI: FF FT: <FT> OHI: TEST IT301/TC03
Test message ID: IT301M04	PRI: DD FT: <FT> OHI: TEST IT301/TC04
Test message ID: IT301M05	PRI: SS FT: <FT> OHI: TEST IT301/TC05

From UA IUTAMHSA Test message ID: IT501M01	To Primary Recipients: IUTBMHSA and IUTBFTNA PRI: FF FT: <FT> OHI: TEST IT501/TC01
Test message ID: IT501M03	To Primary Recipients: IUTBMHSA and IUTBFTNA To Copy Recipients: IUTBMHSB and IUTBFTNB PRI: FF FT: <FT> OHI: TEST IT501/TC03
Test message ID: IT501M05	To Primary Recipients: IUTBMHSA and IUTBFTNA To Copy Recipients: IUTBMHSB and IUTBFTNB To Blind Copy Recipients: IUTBMHSC and IUTBFTNC PRI: FF FT: <FT> OHI: TEST IT501/TC05

From UA IUTAMHSA Test message ID: IT502M01	To: IUTADLLO PRI: FF FT: <FT> OHI: TEST IT502/TC01
Test message ID: IT502M03	To: IUTBDLRE PRI: FF FT: <FT> OHI: TEST IT502/TC03
From UA IUTAMHSA Test message ID: IT503M01	To: AFTN terminal IUTBFTNA PRI: FF FT: <FT> OHI: TEST IT503/TC01 TEXT 4500 CHARACTERS 123456789012345678901234567890123456789012345678901234567890123456789 123456789012345678901234567890123456789012345678901234567890123456789 123456789012345678901234567890123456789012345678901234567890123456789 … <63 figure lines 1234567890 … 123456789> 123456789012345678901234567890123456789012345678901234567890123456789 END
From UA IUTAMHSA Test message ID: IT504M01	To IUTBFTNA, IUTBFTNB, IUTBFTNC, IUTBFTND, IUTBFTNE, IUTBFTNF, IUTBFTNG, IUTBFTNH, IUTBFTNI, IUTBFTNJ, IUTBFTNK, IUTBFTNL, IUTBFTNM, IUTBFTNN, IUTBFTNO, IUTBFTNP, IUTBFTNQ, IUTBFTNR, IUTBFTNS, IUTBFTNT, IUTBFTNU, IUTBFTNV, IUTBFTNW, IUTBFTNX, IUTBFTNY, IUTBFTAA, IUTBFTAB, IUTBFTAC, IUTBFTAD, IUTBFTAE, IUTBFTAF, IUTBFTAG, IUTBFTAH, IUTBFTAI, IUTBFTAJ, IUTBFTAK, IUTBFTAL, IUTBFTAM, IUTBFTAN, IUTBFTAO, IUTBFTAP, IUTBFTAQ, IUTBFTAR, IUTBFTAS, IUTBFTAT, IUTBFTAU, IUTBFTAV, IUTBFTAW, IUTBFTAX, IUTBFTAY PRI: FF FT: <FT> OHI: TEST IT504/TC01

8.1.2 Input device AFTN Terminal: IUTAFTNA

From AFTN Terminal IUTAFTNA	**To UA IUTBMHSA**
Test message ID: IT201M01	KK IUTBMHSA <FT> IUTAFTNA TEST IT201/TC01
Test message ID: IT201M02	GG IUTBMHSA <FT> IUTAFTNA TEST IT201/TC02
Test message ID: IT201M03	FF IUTBMHSA <FT> IUTAFTNA TEST IT201/TC03
Test message ID: IT201M04	DD IUTBMHSA <FT> IUTAFTNA TEST IT201/TC04
Test message ID: IT201M05	SS IUTBMHSA <FT> IUTAFTNA TEST IT201/TC05

From AFTN Terminal IUTAFTNA	**to AFTN Terminal IUTBFTNA**
Test message ID: IT401M01	KK IUTBFTNA <FT> IUTAFTNA TEST IT401/TC01
Test message ID: IT401M02	GG IUTBFTNA <FT> IUTAFTNA TEST IT401/TC02
Test message ID: IT401M03	FF IUTBFTNA <FT> IUTAFTNA TEST IT401/TC03
Test message ID: IT401M04	DD IUTBFTNA <FT> IUTAFTNA TEST IT401/TC04
Test message ID: IT401M05	SS IUTBFTNA <FT> IUTAFTNA TEST IT401/TC05

8.2 Test message templates for IUT-B

8.2.1 Input device User Agent (UA): IUTBMHSA

From UA IUTBMHSA	**to UA IUTAMHSA**
Test message ID: IT102M01	PRI: KK FT: <FT> OHI: TEST IT102/TC01
Test message ID: IT102M02	PRI: GG FT: <FT> OHI: TEST IT102/TC02
Test message ID: IT102M03	PRI: FF FT: <FT> OHI: TEST IT102/TC03
Test message ID: IT102M04	PRI: DD FT: <FT> OHI: TEST IT102/TC04
Test message ID: IT102M05	PRI: SS FT: <FT> OHI: TEST IT102/TC05

From UA IUTBMHSA	**to AFTN Terminal IUTAFTNA**
Test message ID: IT302M01	PRI: KK FT: <FT> OHI: TEST IT302/TC01
Test message ID: IT302M02	PRI: GG FT: <FT> OHI: TEST IT302/TC02
Test message ID: IT302M03	PRI: FF FT: <FT> OHI: TEST IT302/TC03
Test message ID: IT302M04	PRI: DD FT: <FT> OHI: TEST IT302/TC04
Test message ID: IT302M05	PRI: SS FT: <FT> OHI: TEST IT302/TC05

From UA IUTBMHSA Test message ID: IT501M02	To Primary Recipients: IUTAMHSA and IUTAFTNA PRI: FF FT: <FT> OHI: TEST IT501/TC02
Test message ID: IT501M04	To Primary Recipients: IUTAMHSA and IUTAFTNA To Copy Recipients: IUTAMHSB and IUTAFTNB PRI: FF FT: <FT> OHI: TEST IT501/TC04
Test message ID: IT501M06	To Primary Recipients: IUTAMHSA and IUTAFTNA To Copy Recipients: IUTAMHSB and IUTAFTNB To Blind Copy Recipients: IUTAMHSC and IUTAFTNC PRI: FF FT: <FT> OHI: TEST IT501/TC06
From UA IUTBMHSA Test message ID: IT502M02	To: IUTBDLLO PRI: FF FT: <FT> OHI: TEST IT502/TC02
Test message ID: IT502M04	To: IUTADLRE PRI: FF FT: <FT> OHI: TEST IT502/TC04
From UA IUTBMHSA Test message ID: IT503M02	To: AFTN Terminal IUTAFTNA PRI: FF FT: <FT> OHI: TEST IT503/TC02 TEXT 4500 CHARACTERS 123456789012345678901234567890123456789012345678901234567890123456789 123456789012345678901234567890123456789012345678901234567890123456789 123456789012345678901234567890123456789012345678901234567890123456789 … <63 figure lines 1234567890 … 123456789> 123456789012345678901234567890123456789012345678901234567890123456789 END

From UA IUTBMHSA Test message ID: IT504M02	To: IUTAFTNA, IUTAFTNB, IUTAFTNC, IUTAFTND, IUTAFTNE, IUTAFTNF, IUTAFTNG, IUTAFTNH, IUTAFTNI, IUTAFTNJ, IUTAFTNK, IUTAFTNL, IUTAFTNM, IUTAFTNN, IUTAFTNO, IUTAFTNP, IUTAFTNQ, IUTAFTNR, IUTAFTNS, IUTAFTNT, IUTAFTNU, IUTAFTNV, IUTAFTNW, IUTAFTNX, IUTAFTNY, IUTAFTAA, IUTAFTAB, IUTAFTAC, IUTAFTAD, IUTAFTAE, IUTAFTAF, IUTAFTAG, IUTAFTAH, IUTAFTAI, IUTAFTAJ, IUTAFTAK, IUTAFTAL, IUTAFTAM, IUTAFTAN, IUTAFTAO, IUTAFTAP, IUTAFTAQ, IUTAFTAR, IUTAFTAS, IUTAFTAT, IUTAFTAU, IUTAFTAV, IUTAFTAW, IUTAFTAX, IUTAFTAY PRI: FF FT: <FT> OHI: TEST IT504/TC02

8.3 Input device AFTN Terminal: IUTBFTNA

From AFTN Terminal IUTBFTNA	**to UA IUTAMHSA**
Test message ID: IT202M01	KK IUTAMHSA <FT> IUTBFTNA TEST IT202/TC01
Test message ID: IT202M02	GG IUTAMHSA <FT> IUTBFTNA TEST IT202/TC02
Test message ID: IT202M03	FF IUTAMHSA <FT> IUTBFTNA TEST IT202/TC03
Test message ID: IT202M04	DD IUTAMHSA <FT> IUTBFTNA TEST IT202/TC04
Test message ID: IT202M05	SS IUTAMHSA <FT> IUTBFTNA TEST IT202/TC05

From AFTN Terminal IUTBFTNA	**to UA IUTAMHSA**
Test message ID: IT402M01	KK IUTAFTNA <FT> IUTBFTNA TEST IT402/TC01
Test message ID: IT402M02	GG IUTAFTNA <FT> IUTBFTNA TEST IT402/TC02
Test message ID: IT402M03	FF IUTAFTNA <FT> IUTBFTNA TEST IT402/TC03
Test message ID: IT402M04	DD IUTAFTNA <FT> IUTBFTNA TEST IT402/TC04
Test message ID: IT402M05	SS IUTAFTNA <FT> IUTBFTNA TEST IT402/TC05

8.4 Test message templates for multilateral tests

From UA IUTAMHSA Test message ID: IT701M01	To: IUTBMHSA and IUTCMHSA PRI: FF FT: <FT> OHI: TEST IT701/TC01
From UA IUTBMHSA Test message ID: IT701M02	To: IUTAMHSA and IUTCMHSA PRI: FF FT: <FT> OHI: TEST IT701/TC02
From UA IUTCMHSA Test message ID: IT701M03	To: IUTAMHSA and IUTBMHSA PRI: FF FT: <FT> OHI: TEST IT701/TC03

From UA IUTAMHSA Test message ID: IT702M01	To: IUTCMHSA PRI: FF FT: <FT> OHI: TEST IT702/TC01
From UA IUTBMHSA Test message ID: IT702M02	To: IUTAMHSA PRI: FF FT: <FT> OHI: TEST IT702/TC02
From UA IUTCMHSA Test message ID: IT702M03	To: IUTBMHSA PRI: FF FT: <FT> OHI: TEST IT702/TC03

From UA IUTAMHSA Test message ID: IT801M01	To: IUTBMHSA PRI: FF FT: <FT> OHI: TEST IT801/TC01
From UA IUTBMHSA Test message ID: IT801M02	To: IUTCMHSA PRI: FF FT: <FT> OHI: TEST IT801/TC02
From UA IUTCMHSA Test message ID: IT801M03	To: IUTAMHSA PRI: FF FT: <FT> OHI: TEST IT801/TC03

From UA IUTAMHSA Test message ID: IT802M01	To: IUTXMHSA PRI: FF FT: <FT> OHI: TEST IT802/TC01
From UA IUTBMHSA Test message ID: IT802M02	To: IUTXMHSA PRI: FF FT: <FT> OHI: TEST IT802/TC02
From UA IUTCMHSA Test message ID: IT802M03	To: IUTXMHSA PRI: FF FT: <FT> OHI: TEST IT802/TC03

- END -

ANNEX F

AMHS Pre-Operational Tests

ANNEX F

of

AMHS Manual

Document Control Log

Edition	Date	Comments	Section/pages affected
1.0	15/06/2007	Creation of the document.	all
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References

[1] ICAO Annex 10 – Aeronautical Telecommunications, Volume II: Communication Procedures
[2] ICAO DOC 9705-AN/956: The Manual of technical provisions for the ATN, Sub-volume III, Section 3.1 –Edition 3 (2002) – Referred to as AMHS SARPs
[3] ASIAPAC AMHS Manual, Main Part
[4] ASIAPAC AMHS Manual, Appendix C, AMHS Testing Requirements
[5] ASIAPAC AMHS Manual, Appendix D, AMHS Conformance Tests
[6] ASIAPAC AMHS Manual, Appendix E, AMHS Interoperability Tests

1 Introduction

1.1 Purpose of the Document

The purpose of the document is to define AMHS Pre-operational Tests in order to ensure the interoperability between AMHS systems prepared for going into operation. The document defines the objectives and prerequisites as well as the tests themselves.

The AMHS Pre-operational Tests are interoperability type tests. They are the last tests between Operational Systems and should be performed within the operational network environment before the “AMHS cut-over”.

After "AMHS cut-over" the AMHS relation between the two systems is operational. That means: the exchange of the complete operational traffic (or a part of that) is performed by means of AMHS only. For this traffic no other means (AFTN or X.25) are used.

1.2 Objectives of the Pre-operational Tests

The objectives of the AMHS Pre-operational Tests are:

1. To test the interoperability between the AMHS systems in an operational environment.

2. To test the integrity of the messages exchanged.

3. To test the message exchange after a disturbance (e.g. queued messages).

The prerequisites of the AMHS Pre-operational Tests are:

- Successful performance of AMHS Conformance Tests as specified in [5], through which the compliance of all systems under test to the [2] has been demonstrated, and
- Successful performance of AMHS Interoperability Tests as specified in [6], through which the interoperability of these AMHS systems in a test (bed) environment has been demonstrated, and
- Successful performance of Underlying Network Tests, through which is demonstrated that the underlying (IP) network is available and stable, and
- System configuration on both systems (The agreed set is loaded and established.)

The messages used in the AMHS Pre-operational Tests are generated either:

- manually, or
- using parallel duplicated traffic;

1.3 Test Overview

The following tests have to be performed:

1. Go-NoGo Test: A simple test which checks that the configuration and underlying network functions are operating correctly. It is a prerequisite for the subsequent tests.

2. Traffic duplication and verification: For selected AFTN addressee indicators all traffic[1] will be duplicated to corresponding AMHS recipient addresses on the remote system. On the remote system the AFTN message received will be compared with the copy received by the AMHS user.

3. Stress test: The outgoing AMHS traffic recorded in one day within the previous test is repeated from one to the other system and vice versa. To simulate an outage between the involved systems the LAN connection can be disabled; in consequence the messages are queued. If enough messages are queued the LAN connection will be enabled.

4. (Optional) Selected test cases from the AMHS Interoperability Tests: Due to the fact that in the pre-operational test phase the operational system with the complete operational setup is used, a selection of interoperability tests may be repeated.

The estimated duration of the AMHS Pre-operational Tests is 4 days and calculated as follows:

Test ID	Duration	Remark
PRE001 and PRE002	1 hour	inclusive set-up / co-ordination
PRE003	3 days	
PRE003	0.5 day	
optional (selected Interoperability Tests)	1 hour	

Table F- 1: Estimated duration of the AMHS Pre-operational Tests

[1] Traffic consisting of the locally originated AFTN flow and the incoming AFTN flow; *Locally originated AFTN flow*: national AFTN traffic received by the COM Centre addressed to international (or national) communication partners; *Incoming AFTN flow*: international AFTN traffic received by the COM Centre addressed to international (or national) communication partners.

[2] Where aaaa = the location indicator of the MTA location of the Test partner 1.

[3] Where dddd = the location indicator of the MTA location of the Test partner 2.

1.4 Document Structure

Chapter 1 presents the purpose, objectives and test overview.
Chapter 2 presents the test environment used for AMHS Pre-operational Testing.
Chapter 3 defines the set-up and configuration of the AMHS systems.
Chapter 4 defines the addressing plan for AMHS Pre-operational Testing.
Chapter 5 contains the description of the Pre-operational Tests.

2 AMHS Pre-operational Test Environment

2.1 Application infrastructure

The AMHS systems prepared for going into operation are interconnected by means of the operational infrastructure (cf. Figure F-1).

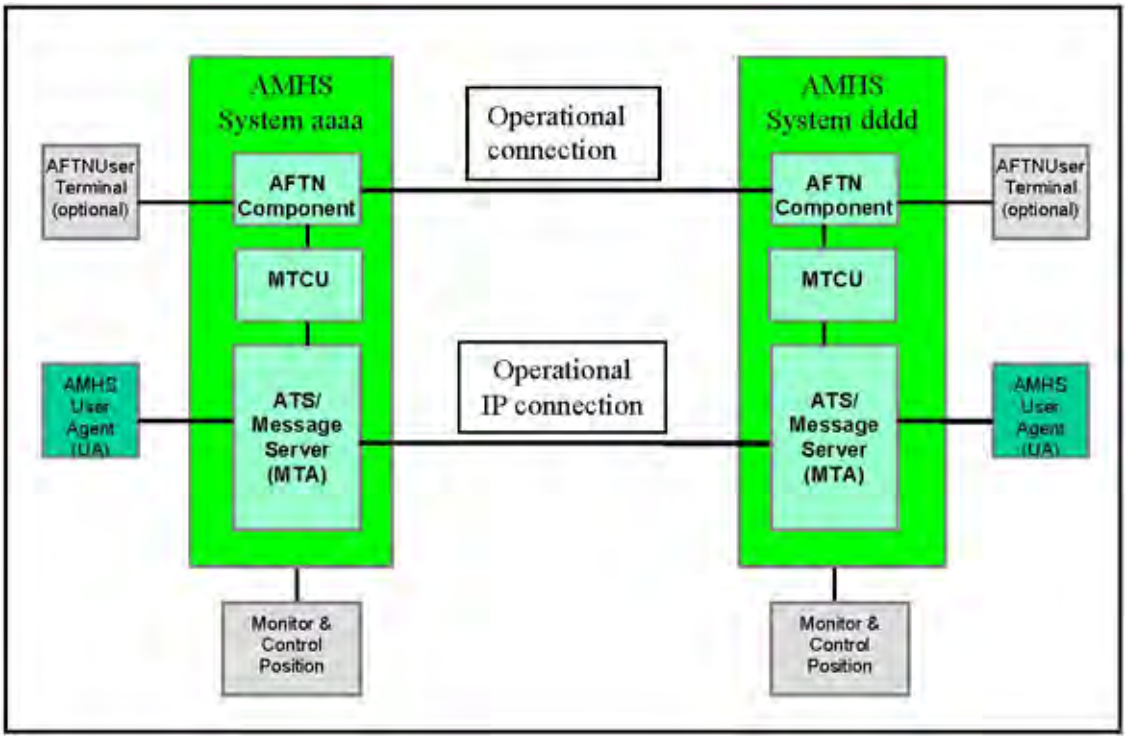

Figure F- 1: AMHS Pre-operational Test Environment

2.2 Transport infrastructure

One of the recommended infrastructures was TCP/IP protocol (IPv4/IPv6). In line with existing recommendations, the operational IP connection should utilize IPv6 at the international level and should provide a redundant connectivity. The redundancy concept of the network ensures the reach ability in any case between the MTAs, while the MTA uses single IP addresses only.

3 Operational system setup - Configuration

The AMHS Systems involved in the pre-operational tests are expected to be configured “as close” to the Operational Systems as possible (with respect to routing tables and look-up tables).

Special addresses needed for testing are listed in this document.

MTA names etc. shall follow the recommendations laid down in [3]. For completeness they are listed hereafter.

3.1 Configuration Lower Layers

Item	Test partner 1	Test partner 2	Recommended values
TSAP	TBD	TBD	e.g. '544350' (“TCP”) or '4D4853' (“MHS”)
IPv6 Address	TBD	TBD	
IP Port	TBD	TBD	102

Table F- 2: Configuration Lower Layers

3.2 Configuration Upper Layers

Item Item	Test partner 1	Test partner 2	Recommended values
MTA Name	MTA-aaaa2-1	MTA-dddd3-1	cf. [3] section 8.2
Password	ICAO-aaaa-1	ICAO-dddd-1	cf. [3] section 8.2
PSAP	not used	not used	not used
SSAP	not used	not used	not used
Number of incoming associations	TBD	TBD	5, should be equal to the outgoing number
Number of outgoing associations	TBD	TBD	5, should be equal to the incoming number
Protocol type	X.400/1988	X.400/1988	cf. PDR M6080001 Phasing out of IPM 1984
Dialogue mode	Monologue	Monologue	

Table F- 3: Configuration Upper Layers

4 Addressing Plan for AMHS Pre-operational Testing

4.1 User addresses

To meet the scope of testing, the test-address space used by AMHS Pre-operational Testing should include for each test partner as minimum one AMHS user.

4.1.1 AMHS Users for Test partner 1

User Name	MF-address	Remarks
aaaaAMHA	/C=XX/A=ICAO/P=bbbb/O=cccc/OU1=aaaa /CN=aaaaAMHA	or other than AMHA

Table F- 4: Registered AMHS Users (Test partner 1)

Example:

User Name	MF-address	Remarks
LEEEAMHA	/C=XX/A=ICAO/P=AENA/O=LECM/OU1=LEEE /CN=LEEEAMHA	

4.1.2 AMHS Users for Test partner 2

User Name	MF-address	Remarks
ddddAMHA	/C=XX/A=ICAO/P=eeee/O=ffff/OU1=dddd /CN=ddddAMHA	or other than AMHA

Table F- 5: Registered AMHS Users (Test partner 2)

Example:

User Name	MF-address	Remarks
EDDDYFYA	/C=XX/A=ICAO/P=GERMANY/O=EDDD/OU1= EDDD /CN=EDDDYFYA	

4.2 Addresses for Traffic Duplication

Due to the fact that the Pre-operational tests will be performed in an operational environment the addresses selected for duplication cannot be pre-determined in this document. The following tables show two different possibilities how to define these addresses. The test partners have all freedom in definition and selection.

It is recommended to select those addresses for duplication to which a moderate number of messages are usually transmitted.

4.2.1 AFTN Addresses selected for Traffic Duplication -Test partner 1 to Test partner 2

AF Address	O/R address	Remarks
ddaaCOPY	/C=XX/A=ICAO/P=eeee/O=ffff/OU1=ddaa /CN=ddaaCOPY	Copy of a real ddaa address
ddbbCOPY	/C=XX/A=ICAO/P=eeee/O=ffff /OU1=ddbb /CN=ddbbCOPY	Copy of a real ddbb address
ddccCOPY	/C=XX/A=ICAO/P=eeee/O=ffff /OU1=ddcc /CN=ddccCOPY	Copy of a real ddcc address

Table F- 6: AFTN addresses -Test partner 1 to Test partner 2

Example:

AF Address	O/R address	Remarks
LEEECOPY	/C=XX/A=ICAO/P=AENA/O=LECM/OU1=LEEE /CN=LEEECOPY	real address: LEEEYNYX
LEEACOPY	/C=XX/A=ICAO/P=AENA/O=LECM/OU1=LEEA /CN=LEEACOPY	real address: LEMMYMYX
LECMCOPY	/C=XX/A=ICAO/P=AENA/O=LECM/OU1=LECM /CN=LECMCOPY	real address: LECMZAZX

4.2.2 AFTN Addresses selected for Traffic Duplication -Test partner 2 to Test partner 1

AF Address	O/R address	Remarks
aaaaAMHA	/C=XX/A=ICAO/P=bbbb/O=cccc/OU1=aaaa /CN=aaaaAMHA	Copy of a real aaaa address
aaaaAMHB	/C=XX/A=ICAO/P=bbbb/O=cccc/OU1=aaaa /CN=aaaaAMHB	Copy of another real aaaa address
aaccAMHC	/C=XX/A=ICAO/P=bbbb/O=cccc/OU1=aacc /CN=aaccAMHC	Copy of a real aacc address

Table F- 7: AFTN addresses -Test partner 2 to Test partner 1

Example:

AF Address	O/R address	Remarks
EDDDAMHA	/C=XX/A=ICAO/P=GERMANY/O=EDDD/OU1=EDDD /CN=EDDDAMHA	real address: EDDDYNYX
EDDDAMHB	/C=XX/A=ICAO/P=GERMANY/O=EDDD/OU1=EDDD /CN=EDDDAMHB	real address: EDZOYMYX
EDZZAMHC	/C=XX/A=ICAO/P=GERMANY/O=EDDD/OU1=EDZZ /CN=EDZZAMHC	real address: EDZZNAXX

4.3 DL addresses

It is recommended to use for DLs specific Common Names (CN) to make it transparent for the users that this special O/R address is related to a Distribution list. The CN of a DL O/R address should in line with the definition for PDAI in [1].

4.4 AFTN and X.400 Routing Tables

It is recommended that the systems involved in the Pre-operational Tests are configured with the latest valid **AFTN Routing Table** available in the AMC system including the minor changes needed for the Pre-operational Tests themselves.

Only for the selected traffic (bilaterally agreed addresses) shall AFTN routing paths through the MTCU be set up.

Furthermore it is recommended that the systems are configured with the **complete X.400**.

Routing Table covering all existing PRMD names. For all PRMD names which are not involved in the Pre-operational Tests, a default routing to a "Dummy MTA direction" shall be defined in order to handle exceptional situations within the Pre-operational Tests as well as for future operations.

Only for the selected traffic (bilaterally agreed addresses) shall respective X.400 routing paths through the MTCU or to the adjacent MTA be set up.

The recommended complete setup of the X.400 Routing table allows the responsible international COM Centre to ensure that each message entered into an international Network (AFTN, X.25 as well as AMHS) is correct in format and addressing. When using a reduced X.400 routing table, (use of general default routing entries), such checking of addressing cannot be performed, especially if domestic UAs are connected. Only with the full set of PRMD routing entries, is a minimum checking of address validity possible.

4.5 Look-up Tables

4.5.1 Generic look-up Tables

It is recommended that the systems are configured with the complete set of information required for the address translation.

The tables needed are reflected in [8] or in the Intra MD Addressing function of the ATS Messaging Management Centre (AMC). From the AMC the complete **MD Look-up Table** (AMHS MD Register Export. csv) and the complete **CAAS Look-up Tables** (CAAS Table .csv) can be downloaded.

Loading of the complete tables is recommended to ensure that the AMHS application is able to handle the extensive content of the tables covering the address translation of all existing AFTN addresses into AMHS O/R addresses (XF as well as CAAS) and vice versa.

4.5.2 User address look-up Table

It is recommended to start Pre-operational tests and operations with empty **User address look-up tables**.

This kind of functionality should be foreseen for exceptional users and situations. Each entry in this table shall be coordinated with the AMC for the Regional and world-wide use.

5 Test Description

5.1 Test Scenarios

The tests are described in the following test scenarios:

PRExxx where xxx is the scenario number.

The following table contains an overview of the test scenarios:

Test-case id	Test function
PRE001	Go-NoGo test Test partner 1 to Test partner 2
PRE002	Go-NoGo test Test partner 2 to Test partner 1
PRE003	Exchange of duplicated Operational messages, check of integrity.
PRE004	Stress / Load Test (queued data)

Table F- 8: Test Scenario overview

5.2 Pre-operational AMHS Tests

This section contains the test-cases. Each test-case is written on a test sheet, which should be completed during testing.

The top of test-sheet contains the **test-case id** and a description of the **tested functionality**.

The **Test description** contains the instructions for the tester, the addresses used and the test message used.

The **Test control** contains the expected reaction/observation of the Systems under Test (SUTs).

The section **Test result** is used to log the test results.

5.2.1 Go-NoGo test (Partner 1 to Test Partner 2)

Test Reference	Tested Functionality
PRE001	This is a simple test with the purpose to check that the configuration and underlying network work correctly. It is a prerequisite for subsequent tests. An FF priority message is sent from Test partner 1 to Test partner2.

Test description:

From aaaaAMHA send the following FF priority message to ddddAMHA:

```
PRE001
1234567890123456789012345678901234567890123456789012345678901234567890123456789
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

(and so on till)

ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ
```

Check the correct reception at ddddAMHA and send the following acknowledgement if the message is received correctly.

From ddddAMHA send the following message to aaaaAMHA:

ACK001 PLS CONTINUE WITH PRE002

Test control:

Check the correct reception of the message at ddddAMHA. No difference must exist between the message as defined above and the received message.

Test result:

PASS	FAILED	INCONCLUSIVE

5.2.2 Go-NoGo test Test partner 2 to Test partner 1

Test Reference	Tested Functionality
PRE002	This is a simple test with the purpose to check that the configuration and underlying network work correctly. It is a prerequisite for subsequent tests. An FF priority message is sent from Test partner 2 to Test partner1.

Test description:

From ddddAMHA send the following message to aaaaAMHA:

```
PRE002
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

(and so on till)

ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ
```

Check the correct reception at aaaaAMHA and send the following acknowledgement if the message is received correctly.

From aaaaAMHA send the following message to ddddAMHA:

```
ACK002 PLS CONTINUE WITH PRE003
```

Test control:

Check the correct reception of the message at aaaaAMHA. No difference must exist between the message as defined above and the received message.

Test result:

PASS	FAILED	INCONCLUSIVE

5.2.3 Duplicated message exchange

Test Reference	Tested Functionality
PRE003	For selected AFTN destination addresses all traffic will be duplicated to corresponding AMHS recipient addresses at the remote system. At the remote system the AFTN messages received will be compared with the copies transmitted via AMHS.

Test description:

- On the system of Test partner 1 enable the duplication of Operational traffic for the agreed AFTN addressee indicators:

  The duplication shall remain active for 3 days.

- On the system of Test partner 2 enable the duplication of Operational traffic for agreed AFTN addressee indicators:

  The duplication shall remain active for 3 days.

Test control:

Note: Not all details of test control can be defined since two different systems are involved. Therefore the control is done in a general form. The main purpose of this test is to prove the integrity of the message exchange. At the same time, it is possible to detect problems which have not been spotted during previous tests.

1. Compare the number of messages received at the AFTN addresses with the number of messages received as copies at the corresponding AMHS addresses (check if all duplicated messages are received).

2. Compare the contents of the messages received for one randomly selected hour of traffic per day. The method of comparison is a local matter. Some options are:

   a) the messages can be displayed on two screens and compared one by one,

   b) the traffic log can be exported and compared (partly) electronically/in an automated way.

3. Check the event logging of the system for abnormalities in the area of AMHS/X.400/AFTN/AMHS Gateway.

4. Check the event logging / traffic traces for NDRs.

5. Check for Control Position events.

6. Check the X.400/AMHS Diagnostics; check the number of associations used (in particular possible hanging/unused associations).

7. Monitor the underlying network infrastructure (network specialist).

The following table can be used to make notes of the Test Control result:

Test Control	Result
1. Compare the number of messages received as AFTN copy with the number of messages received as AMHS copy.	
2. Compare the contents of the messages.	
3. The messages can be displayed on two screens and compared one by one.	
4. The traffic log can be exported and compared (partly) electronically/in an automated way.	
5. Check the event logging of the system for abnormalities in the area of AMHS / X.400 / AFTN/AMHS Gateway.	
6. Check whether NDRs have been received or transmitted.	
7. Check for events at the Control Position.	
8. X.400 / AMHS diagnostics, check the number of associations used (in particular possible hanging/unused associations).	
9. Monitor the underlying network infrastructure (network specialist).	

The test is failed if messages are lost, duplicated or corrupted. The other observations have to be forwarded to each other in the form of a test log and discussed in a test review.

Test result:

PASS	FAILED	INCONCLUSIVE

5.2.4 Stress / Load Test

Test Reference	Tested Functionality
PRE004	This test is performed to observe the behaviour of both systems during a load/stress situation. The traffic exchanged in test PRE003 is repeated in a burst fashion.

Test description:

1. Disable the duplication of traffic on both sides.
2. Three tests should be run. The amount of messages shall be:
   - 100 for the first test
   - 200 for the second test
   - 400 for the third test
3. Both sides shall retrieve the outgoing AMHS traffic exchanged in PRE003 for an agreed day.
4. Both sides shall inform each other about the amount of messages to be expected.
5. At **Test partner 2** (or 1) interrupt the LAN connection to **Test partner 1** (or 2) by an adequate command (should be agreed between the Test partners).
6. At **Test partner 1** and **Test partner 2** "repeat" the messages retrieved in step 2 and observe a queue with a length as communicated in step 3.
7. The moment to re-connect the LAN is co-ordinated by telephone. Note down the time it takes from re-connecting the LAN till the moment the queues are empty.
8. At **Test partner 2** (or 1) re-establish the LAN connection by adequate means (commands).
9. Observe and notice the incoming and outgoing message flow.

Test control:

1. The number of messages received shall be equal to the number of messages expected.
2. Check the event logging of the system for abnormalities in the area of AMHS / X.400 / AFTN/AMHS Gateway.
3. Check the event logging / traffic traces for NDRs.

4. Check for Control Position events.

5. Check the X.400 / AMHS diagnostics, check the number of associations used (in particular possible hanging/unused associations).

6. Monitor the underlying network infrastructure (network specialist).

7. At both sides note the amount of time needed to flush the queues.

The following table can be used to make notes of the Test Control result.

Test Control	**Result**		
	100	**200**	**400**
1. The number of messages received shall be equal to the number of messages expected.			
2. Check the event logging of the system for abnormalities in the area of AMHS / X.400 / AFTN/AMHS Gateway.			
3. Check the event logging / traffic traces for NDRs.			
4. Check for events at the Control Position.			
5. Check the X.400 / AMHS diagnostics, check the number of associations used (in particular possible hanging/unused associations).			
6. Monitor the underlying network infrastructure (network specialist).			
7. At both sides note the amount of time needed to flush the queues.			

Note: The test is failed if messages are lost, duplicated or corrupted. The other observations have to be forwarded to each other in the form of a test log and discussed in a test review.

Test result:

PASS	**FAILED**	**INCONCLUSIVE**

5.2.5 Additional selected and agreed Interoperability Tests

Here the selected and bilaterally agreed Test cases should be listed.

- END -

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ASIA and PACIFIC OFFICE

Aeronautical Telecommunication Network
Implementation Coordination Group
(ATNICG)

Recommended Security Checklist

4 May 2009

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Document Revision History

Release	Date	Comment
Draft 1	21 April 2008	Controls from NIST SP 800-53 Identified
Draft 2	25 September 2008	Controls in checklist format
Version 1	4 May 2009	Checklist reduced to policy and essential check item(s) in each control family

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1 Introduction

1.1 Motivation

The Asia/Pacific Region is implementing the Aeronautical Telecommunication Network (ATN) infrastructure in support of the ATN Message Handling Service (AMHS). In order to ensure that security measures are implemented throughout the Asia/Pac ATN, a comprehensive checklist is needed. The ATNICG Security Sub-Group decided at the first sub-group meeting in April 2008 to base the checklist on the list of security controls in National Institute of Standards and Technology (NIST) Special Publication (SP) 800-53 (SP800-53) [1].

This paper aims to provide a set of security controls in the form of a checklist. The goal is to describe each security control in a fashion suitable for an organization to verify that a set of controls sufficient for their operating environment has been implemented in accordance with the Asia/Pacific System Security Policy [2]. This checklist may be used as the basis of an organization's *verification* that their system is implemented with appropriate security measures. With this checklist filled in the organization's Designated Approving Authority (DAA) can provide *authorization* that the system may be placed into operation.

1.2 References

The following documents were used in the preparation of this paper.

[1] National Institute of Standards and Technology. Special Publication 800-53. Recommended Security Controls for Federal Systems. February 2005. Currently available from: http://csrc.nist.gov/publications/nistpubs/index.html.

[2] Asia/Pacific ATN System Security Policy, 2nd Edition, May 2008

2 Security Control Overview

Table 2-1 is a summary list of the control classes and families. Each control family is classified as a Management, Operational, or Technical Control.

Table 2-1. Security Control Classes and Families

Class	Family	Identifier
Management	Risk Assessment	RA
Management	Planning	PL
Management	System and Services Acquisition	SA
Management	Certification, Accreditation, and Security Assessments	CA
Operational	Personnel Security	PS
Operational	Physical and Environmental Protection	PE
Operational	Contingency Planning	CP
Operational	Configuration Management	CM
Operational	Maintenance	MA
Operational	System and Information Integrity	SI
Operational	Media Protection	MP
Operational	Incident Response	IR
Operational	Awareness and Training	AT
Technical	Identification and Authentication	IA
Technical	Access Control	AC
Technical	Audit and Accountability	AU
Technical	System and Communications Protection	SC

Each family comprises one or more security controls. Each security control is sequentially numbered within the family. The following subsections describe the structure of the security controls and the organization of the security controls into baselines.

3 Catalogue of Security Control Requirements

Table 3-1 identifies the developed security checklist.

The ID column provides the security checklist identifier. It can be used to trace the security checklist item back to its control family. To enable traceability to the security controls, each security checklist item is assigned an identifier based on the identifier of the security control family.

The Security Checklist Text column contains the language for each checklist item.

The Implemented column is where an organization may indicate compliance with the checklist item.

The Comment column provides any additional information noted during the assessment of the particular item.

Table 3-1. Security Checklist

ID	Security Checklist Text	Implemented (Yes/No)	Comment
	ACCESS CONTROL (AC)		CLASS: TECHNICAL
	ACCESS CONTROL POLICY		
AC.1	Does the organization have a formal, documented, access control policy?		
	ACCOUNT MANAGEMENT		
AC.2	Does the organization manage system accounts, including establishing, activating, modifying, reviewing, disabling, and removing accounts?		
	ACCESS ENFORCEMENT		
AC.3	Does the system enforce assigned authorizations for controlling access to the system in accordance with applicable policy?		
	SUPERVISION AND REVIEW — ACCESS CONTROL		
AC.4	Does the organization review the activities of users with respect to the enforcement and usage of system access controls?		
	REMOTE ACCESS		
AC.5	Does the organization document, monitor, and control all methods of remote access (e.g., dial-up, Internet) to the system?		
	AWARENESS AND TRAINING (AT)		CLASS: OPERATIONAL
	SECURITY AWARENESS AND TRAINING POLICY		
AT.1	Does the organization have a formal, documented, security awareness and training policy?		
	SECURITY TRAINING		
AT.2	Does the organization provide basic security awareness training to all users?		
	AUDIT AND ACCOUNTABILITY (AU)		CLASS: TECHNICAL
	AUDIT AND ACCOUNTABILITY POLICY		
AU.1	Does the organization have a formal, documented, audit and accountability policy?		
	AUDITABLE EVENTS		
AU.2	Does the system generate audit records for the significant security events?		
	AUDIT MONITORING, ANALYSIS, AND REPORTING		

ID	Security Checklist Text	Implemented (Yes/No)	Comment
AU.3	Does the organization regularly review/analyze audit records for indications of inappropriate or unusual activity?		
	CERTIFICATION, ACCREDITATION, AND SECURITY ASSESSMENTS (CA)		CLASS: MANAGEMENT
	CERTIFICATION, ACCREDITATION, AND SECURITY ASSESSMENT POLICY		
CA.1	Does the organization have a formal, documented, security assessment and verification and accreditation policy?		
	SECURITY CERTIFICATION		
CA.2	Does the organization conduct an assessment of the security controls in the system to determine the extent to which the controls are implemented correctly, operating as intended, and producing the desired outcome with respect to meeting the security requirements for the system?		
	SECURITY ACCREDITATION		
CA.3	Does the organization authorize (i.e., accredit) the system for processing before operations?		
	CONFIGURATION MANAGEMENT (CM)		CLASS: OPERATIONAL
	CONFIGURATION MANAGEMENT POLICY		
CM.1	Does the organization have a formal, documented configuration management policy?		
	CONFIGURATION CHANGE CONTROL		
CM.2	Does the organization control changes to the system?		
	CONTINGENCY PLANNING (CP)		CLASS: OPERATIONAL
	CONTINGENCY PLANNING POLICY		
CP.1	Does the organization have a formal, documented contingency planning policy?		
	CONTINGENCY PLAN		
CP.2	Does the organization develop a contingency plan?		
	SYSTEM BACKUP		
CP.3	Does the organization conduct backups of user-level and system-level information?		

ID	Security Checklist Text	Implemented (Yes/No)	Comment
	IDENTIFICATION AND AUTHENTICATION (IA)		CLASS: TECHNICAL
	IDENTIFICATION AND AUTHENTICATION POLICY		
IA.1	Does the organization have a formal, documented identification and authentication policy?		
	USER IDENTIFICATION AND AUTHENTICATION		
IA.2	Does the system uniquely identify users (or processes acting on behalf of users)?		
IA.3	Does the system authenticate users (or processes acting on behalf of users)?		
	DEVICE IDENTIFICATION AND AUTHENTICATION		
IA.4	Does the system identify specific devices before establishing a connection?		
IA.5	Does the system authenticate specific devices before establishing a connection?		
	INCIDENT RESPONSE (IR)		CLASS: OPERATIONAL
	INCIDENT RESPONSE POLICY		
IR.1	Does the organization have a formal, documented incident response policy?		
	INCIDENT HANDLING		
IR.2	Does the organization implement an incident handling capability for security incidents that includes preparation, detection and analysis, containment, eradication, and recovery?		
	MAINTENANCE (MA)		CLASS: OPERATIONAL
	SYSTEM MAINTENANCE POLICY		
MA.1	Does the organization have a formal, documented system maintenance policy?		
	CONTROLLED MAINTENANCE		
MA.2	Does the organization perform routine preventative and regular maintenance on the components of the system?		
	MEDIA PROTECTION (MP)		CLASS: OPERATIONAL
	MEDIA PROTECTION POLICY		
MP.1	Does the organization have a formal, documented media protection policy?		

ID	Security Checklist Text	Implemented (Yes/No)	Comment
	MEDIA ACCESS		
MP.2	Does the organization restrict access to system media to authorized individuals?		
	MEDIA STORAGE		
MP.3	Does the organization physically control system media within controlled areas?		
	PHYSICAL AND ENVIRONMENTAL PROTECTION (PE)		CLASS: OPERATIONAL
	PHYSICAL AND ENVIRONMENTAL PROTECTION POLICY		
PE.1	Does the organization have a formal, documented physical and environmental protection policy?		
	PHYSICAL ACCESS CONTROL		
PE.2	Does the organization control all physical access points to facilities containing systems?		
	EMERGENCY POWER		
PE.3	Does the organization provide a short-term uninterruptible power supply to facilitate an orderly shutdown of the system in the event of a primary power source loss?		
	FIRE PROTECTION		
PE.4	Does the organization employ and maintain fire suppression and detection devices/systems that can be activated in the event of a fire?		
	PLANNING (PL)		CLASS: MANAGEMENT
	SECURITY PLANNING POLICY		
PL.1	Does the organization have a formal, documented security planning policy?		
	SYSTEM SECURITY PLAN		
PL.2	Does the organization develop and implement a security plan for the system?		
	PERSONNEL SECURITY (PS)		CLASS: OPERATIONAL
	PERSONNEL SECURITY POLICY		
PS.1	Does the organization have a formal, documented personnel security policy?		
	PERSONNEL SCREENING		

ID	Security Checklist Text	Implemented (Yes/No)	Comment
PS.2	Does the organization screen individuals requiring access to organizational information and systems?		
	RISK ASSESSMENT (RA)		CLASS: MANAGEMENT
	RISK ASSESSMENT POLICY		
RA.1	Does the organization have a formal, documented risk assessment policy?		
	RISK ASSESSMENT		
RA.2	Does the organization conduct assessments of the risk and magnitude of harm that could result from the unauthorized access, use, disclosure, disruption, modification, or destruction of information and systems that support the operations and assets of the organization?		
	VULNERABILITY SCANNING		
RA.3	Does the organization scan for vulnerabilities in the system?		
	SYSTEM AND SERVICES ACQUISITION (SA)		CLASS: MANAGEMENT
	SYSTEM AND SERVICES ACQUISITION POLICY		
SA.1	Does the organization have a formal, documented system and services acquisition policy?		
	ALLOCATION OF RESOURCES		
SA.2	Does the organization determine, document, and allocate as part of its capital planning and investment control process the resources required to adequately protect the system?		
	SYSTEM AND COMMUNICATIONS PROTECTION (SC)		CLASS: TECHNICAL
	SYSTEM AND COMMUNICATIONS PROTECTION POLICY		
SC.1	Does the organization have a formal, documented system and communications protection policy?		
	DENIAL OF SERVICE PROTECTION		
SC.2	Does the system protect against or limit the effects of denial of service attacks?		
	BOUNDARY PROTECTION		
SC.3	Does the system monitor and control communications at the external boundary of the system and at key internal boundaries within the system?		
	TRANSMISSION INTEGRITY		

ID	Security Checklist Text	Implemented (Yes/No)	Comment
SC.4	Does the system protect the integrity of transmitted information?		
	TRANSMISSION CONFIDENTIALITY		
SC.5	Does the system protect the confidentiality of transmitted information?		
	CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT		
SC.6	Does the system employ automated mechanisms with supporting procedures or manual procedures for cryptographic key establishment and key management?		
	PUBLIC KEY INFRASTRUCTURE CERTIFICATES		
SC.7	Does the organization develop and implement a certificate policy and certification practice statement for the issuance of public key certificates used in the system?		
	SESSION AUTENTICITY		
SC.8	Does the system provide mechanisms to protect the authenticity of communications sessions?		
	SYSTEM AND INFORMATION INTEGRITY (SI)		CLASS: OPERATIONAL
	SYSTEM AND INFORMATION INTEGRITY POLICY		
SI.1	Does the organization have a formal, documented system and information integrity policy?		
	FLAW REMEDIATION		
SI.2	Does the organization identify, report, and correct system flaws?		
	MALICIOUS CODE PROTECTION		
SI.3	Does the system implement malicious code protection that includes a capability for automatic updates?		
	SYSTEM MONITORING TOOLS AND TECHNIQUES		
SI.4	Does the organization employ tools and techniques to monitor events on the system, detect attacks, and provide identification of unauthorized use of the system?		
	SECURITY ALERTS AND ADVISORIES		
SI.5	Does the organization receive system security alerts/advisories on a regular basis, issue alerts/advisories to appropriate personnel, and take appropriate actions in response?		
	SOFTWARE AND INFORMATION INTEGRITY		

ID	Security Checklist Text	Implemented (Yes/No)	Comment
SI.6	Does the system detect and protect against unauthorized changes to software and information?		
	SPAM AND SPYWARE PROTECTION		
SI.7	Does the system implement spam and spyware protection?		

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Table CNS 1B

AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) ROUTER PLAN

EXPLANATION OF THE TABLE

Column

1 Administration – the name of the Administration, State or Organization responsible for management of the router

2 Location of Router

3 Type of Router:

BBIS - Backbone Boundary Intermediate System
BIS - Boundary Intermediate System

4 Type of Interconnection:
Inter – Regional
Intra – Regional
Sub – Regional

5 Interconnection, Connected to router of: name of the location of the correspondent router

6 Link Speed – Speed requirements of the interconnecting link

7 Link Protocol – Protocol requirements for the interconnecting link

8 Target Date of Implementation – date of implementation of the router

TBD- To be determined

9 Remarks

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Appendix H to the Report

Administration	Location of Router	Type of Router	Type of Interconnection	Interconnection, Connected to router of:	Link Speed	Link Protocol	Target date of Implementation	Remarks
1	2	3	4	5	6	7	8	9
American Samoa	Pago Pago			United States				Intra-domain
Australia	Brisbane			Timor Leste				Intra-domain
		BBIS	Sub-Regional	Fiji	64000 bps	TDB	2010	Not Implemented
		BIS	Sub-Regional	Indonesia	TDB	TDB	TDB	Not Implemented
		BBIS	Intra-Regional	Japan	64000 bps	TDB	2010	Not implemented
				Nauru				Intra-domain
		BIS	Sub-Regional	New Zealand	TDB	TDB	TDB	Not implemented
				Papua New Guinea				Intra-domain
		BBIS	Inter-Regional	South Africa	TDB	TDB	TBD	Not implemented
				Solomon Islands				Intra-domain
				Vanuatu				Intra-domain
	Melbourne	BBIS	Intra-Regional	Singapore	64000 bps	IP SNCDF	2009	Not implemented
		BBIS	Inter-Regional	United States	64000 bps	TDB	2010	Not implemented
Bangladesh	Dhaka	BIS	Sub-Regional	India	9600 bps	X.25	2010-2011	(India)
		BIS	Sub-Regional	Thailand	9600 bps	X.25	2010-2011	(Thailand)
Bhutan	Paro	BIS	Sub-Regional	India	9600 bps	X.25	TBD	(India)
Brunei Darussalam	Brunei	BIS	Sub-Regional	Malaysia	64000 bps	X.25	2010	(Malaysia)
		BIS	Sub-Regional	Singapore	9600 bps	X.25	2010	(Singapore)
Cambodia	Phnom Penh	BIS	Sub-Regional	Thailand	9600 bps	X.25	2009-2010	(Thailand)

Administration	Location of Router	Type of Router	Type of Interconnection	Interconnection, Connected to router of:	Link Speed	Link Protocol	Target date of Implementation	Remarks
1	2	3	4	5	6	7	8	9
China	Beijing	BIS	Sub-Regional	DPR Korea	9600 bps	X.25	2010	ATN Router Implemented
		BBIS	Intra-Regional	Hong Kong, China	64000 bps	X.25	2009	ATN Router Implemented
		BBIS	Intra-Regional	India	64000 bps	X.25	2009	ATM Router Implemented
		BBIS	Intra-Regional	Japan	64000 bps	X.25	2010	ATN Router Implemented
		BBIS	Inter-Regional	Kuwait	64000 bps	X.25	TBD	ATN Router Implemented
		BIS	Sub-Regional	Macau, China	9600 bps	X.25	2009	ATN Router Implemented
		BIS	Sub-Regional	Mongolia	9600 bps	X.25	2010	ATN Router Implemented
		BIS	Sub-Regional	Myanmar	9600 bps	X.25	2010	ATN Router Implemented
		BIS	Sub-Regional	Nepal	9600 bps	X.25	2010	ATN Router Implemented
		BIS	Sub-Regional	Pakistan	9600 bps	X.25	2010	ATN Router Implemented
		BIS	Sub-Regional	Republic of Korea	64000 bps	X.25	2011	ATN Router Implemented
		BBIS	Inter-Regional	Russian Federation	19200 bps	X.25	TBD	ATN Router Implemented
		BBIS	Intra-Regional	Thailand	64000 bps	X.25	2009	ATN Router Implemented
		BIS	Sub-Regional	Vietnam			TBD	(Vietnam)
	Taibei	BIS	Sub-Regional	Hong Kong, China	9600 bps	X.25	2009	
		BIS	Sub-Regional	Japan	9600 bps	X.25	2009	
Hong Kong, China	Hong Kong	BBIS	Intra-Regional	China	64000 bps	X.25	2009	
		BIS	Sub-Regional	Macau, China	9600 bps	X.25	2009	
		BBIS	Intra-Regional	Japan	64000 bps	X.25	2010	
		BIS	Sub-Regional	Philippines	9600 bps	X.25	2009	
		BIS	Sub-Regional	Taibei	9600 bps	X.25	2009	
		BBIS	Intra-Regional	Thailand	64000 bps	X.25	Implemented	

Administration	Location of Router	Type of Router	Type of Interconnection	Interconnection, Connected to router of:	Link Speed	Link Protocol	Target date of Implementation	Remarks
1	2	3	4	5	6	7	8	9
		BIS	Sub-Regional	Viet Nam	9600 bps	X.25	2010	
Macau, China	Macau	BIS	Sub-Regional	China	9600 bps	X.25	2009	
		BIS	Sub-Regional	Hong Kong, China	9600 bps	X.25	2009	
Cook Islands	Rarotonga			New Zealand	9600 bps	X.25		Intra-domain
DPR Korea	Pyongyang	BIS	Sub-Regional	China	9600 bps	X.25	2010	(China)
Fiji	Nadi	BBIS	Intra-Regional	Australia	64000 bps	X.25	2010	Circuit implemented
				Kiribati		VPN	2011	Intra-domain
		BIS	Sub-Regional	New Caledonia		TBD	TBD	Intra-domain
				Tuvalu		VPN	2011	Intra-domain
		BBIS	Inter-Regional	United States	64000 bps	X.25	2010	Circuit implemented
				Wallis Islands		TBD	TBD	Intra-domain
French Polynesia	Papeete			New Zealand			TBD	Intra-domain
India	Mumbai	BIS	Sub-Regional	Bangladesh	9600 bps	X.25	TBD	
		BIS	Sub-Regional	Bhutan	9600 bps	X.25	TBD	
		BBIS	Intra-Regional	China	64000 bps	X.25	2010	
		BIS	Inter-Regional	Kenya	19200 bps	X.25	TBD	
		BIS	Sub-Regional	Nepal	9600 bps	X.25	TBD	
		BIS	Inter-Regional	Oman	19200 bps	X.25	TBD	
		BIS	Sub-Regional	Pakistan	9600 bps	X.25	TBD	

Administration	Location of Router	Type of Router	Type of Interconnection	Interconnection, Connected to router of:	Link Speed	Link Protocol	Target date of Implementation	Remarks
1	2	3	4	5	6	7	8	9
		BBIS	Intra-Regional	Singapore	64000 bps	X.25	2010	
		BIS	Sub-Regional	Sri Lanka	9600 bps	X.25	TBD	
		BBIS	Intra-Regional	Thailand	64000 bps	X.25	2010	
Indonesia	Jakarta	BIS	Sub-Regional	Australia	9600 bps	X.25	2010	
		BIS	Sub-Regional	Singapore	9600 bps	X.25	2009	
Japan	Tokyo	BBIS	Intra-Regional	Australia	64000 bps	X.25	2010	
		BBIS	Intra-Regional	China	64000 bps	X.25	2010	
		BBIS	Intra-Regional	Hong Kong, China	64000 bps	X.25	2010	
		BBIS	Inter-Regional	Europe	64000 bps	X.25	TBD	
		BIS	Sub-Regional	Republic of Korea	64000 bps	X.25	2011	
		BBIS	Inter-Regional	Russia Federation	64000 bps	X.25	TBD	
		BBIS	Intra-Regional	Singapore	64000 bps	X.25	2010	
		BIS	Sub-Regional	Taibei	64000 bps	X.25	2008	Circuit Implemented
		BBIS	Inter-Regional	United States	64000 bps	X.25	Implemented	
Kiribati	Tarawa	BIS	Sub-Regional	Fiji	9600 bps	X.25	TBD	Intra-domain
Lao PDR	Vientiane	BIS	Sub-Regional	Thailand	9600 bps	X.25	2009-2010	(Thailand)
		BIS	Sub-Regional	Viet Nam	9600 bps	X.25	2010	(Vietnam)
Malaysia	Kuala Lumpur	BIS	Sub-Regional	Brunei	64000 bps	X.25	TBD	
		BIS	Sub-Regional	Singapore	64000 bps	X.25	2007	Implemented
		BIS	Sub-Regional	Thailand	64000 bps	X.25	2009	

Administration	Location of Router	Type of Router	Type of Interconnection	Interconnection, Connected to router of:	Link Speed	Link Protocol	Target date of Implementation	Remarks
1	2	3	4	5	6	7	8	9
Micronesia Federated State of	Chuuk			United States				Intra-domain
	Kosrae			United States				Intra-domain
	Ponapei			United States				Intra-domain
	Yap			United States				Intra-domain
Mongolia	Ulaanbaatar	BIS	Sub-Regional	China	9600 bps	X.25	2010	(China)
Myanmar	Yangon	BIS	Sub-Regional	China	9600 bps	X.25	2010	(China)
		BIS	Sub-Regional	Thailand	9600 bps	X.25	2009-2010	(Thailand)
Nauru	Nauru			Australia				Intra-domain
Nepal	Kathmandu	BIS	Sub-Regional	China	9600bps	X.25	2010	(China)
		BIS	Sub-Regional	India	9600bps	X.25	TBD	(India)
New Caledonia	Noumea			Fiji			TBD	Intra-domain
New Zealand	Christchurch	BIS	Sub-Regional	Australia	9600 bps	X.25	2011	
				Cook Is				Intra-domain
				French Polynesia	9600 bps	X.25	TBD	Intra-domain
				Niue	9600 bps	X.25		Intra-domain
				Samoa	9600 bps	X.25		Intra-domain
				Tonga	9600 bps	X.25		Intra-domain
		BIS	Inter-Regional	USA	9600 bps	X.25	2011	
Niue Islands	Niue			New Zealand	9600 bps	X.25		Intra-domain

Administration	Location of Router	Type of Router	Type of Interconnection	Interconnection, Connected to router of:	Link Speed	Link Protocol	Target date of Implementation	Remarks
1	2	3	4	5	6	7	8	9
Pakistan	Karachi	BIS	Sub-Regional	China	9600 bps	X.25	2010	(China)
		BIS	Sub-Regional	India	9600 bps	X.25	TBD	(India)
Papua New Guinea	Port Moresby			Australia				Intra-domain
Philippines	Manila	BIS	Sub-Regional	Hong Kong, China	9600 bps	X.25	2009	Circuit Implemented
		BIS	Sub-Regional	Singapore	32000 bps	X.25	2009	Circuit Implemented
Republic of Korea	Seoul	BIS	Sub-Regional	China	64000 bps	X.25	2011	
		BIS	Sub-Regional	Japan	64000 bps	X.25	2011	
Samoa	Faleolo			New Zealand				Intra-domain
Singapore	Singapore	BBIS	Intra-Regional	Australia	64000 bps	X.25	2009	Circuit Implemented
		BIS	Inter-Regional	Bahrain	64000 bps	X.25	TBD	Circuit Implemented
		BIS	Sub-Regional	Brunei	9600 bps	X.25	TBD	Circuit Implemented
		BBIS	Intra-Regional	India	64000 bps	X.25	2009	Circuit being implemented
		BIS	Sub-Regional	Indonesia	9600 bps	X.25	2008-2009	Circuit Implemented
		BBIS	Intra-Regional	Japan	64000 bps	X.25	2010	Circuit Implemented
		BIS	Sub-Regional	Malaysia	64000 bps	X.25	2007	Circuit Implemented
		BIS	Sub-Regional	Philippines	32000 bps	X.25	2009-1010	Circuit Implemented
		BIS	Sub-Regional	Sri Lanka	64000 bps	X.25	2010	Circuit Implemented
		BBIS	Intra-Regional	Thailand	64000 bps	X.25	2009-2010	Circuit Implemented
		BBIS	Inter-Regional	United Kingdom	64000 bps	X.25	2009	Circuit Implemented
		BIS	Sub-Regional	Viet Nam	9600 bps	X.25	2010-2011	Circuit Implemented

Administration	Location of Router	Type of Router	Type of Interconnection	Interconnection, Connected to router of:	Link Speed	Link Protocol	Target date of Implementation	Remarks
1	2	3	4	5	6	7	8	9
Solomon Islands	Honiara			Australia	VPN		2008	(Australia) Intra-Domain
Sri Lanka	Colombo	BIS	Sub-Regional	India	64000 bps	X.25	2010	
		BIS	Sub-Regional	Maldives	64000bps	X.25	2010	
		BIS	Sub-Regional	Singapore	64000 bps	X.25	2010	
Thailand	Bangkok	BIS	Sub-Regional	Bangladesh	9600 bps	X.25	2009-2010	
		BIS	Sub-Regional	Cambodia	9600 bps	X.25	2009-2010	
		BBIS	Intra-Regional	China	64000 bps	X.25	2009	
		BBIS	Intra-Regional	Hong Kong, China	64000 bps	X.25	Implemented	
		BBIS	Intra-Regional	India	64000 bps	X.25	2009-2010	Circuit Implemented
		BBIS	Inter-Regional	Italy	64000 bps	X.25	TBD	Circuit Implemented
		BIS	Sub-Regional	Lao PDR	9600 bps	X.25	2009-2010	
		BIS	Sub-Regional	Malaysia	64000 bps	X.25	2009-2010	
		BIS	Sub-Regional	Myanmar	9600 bps	X.25	2009-2010	
		BBIS	Intra-Regional	Singapore	64000 bps	X.25	2009-2010	Circuit Implemented
		BIS	Sub-Regional	Viet Nam	9600 bps	X.25	2009-2010	
Timor Leste	Dili			Australia				Intra-domain
Tonga	Tongatapu			New Zealand	9600 bps	X.25		Intra-domain
Tuvalu	Funafuti			Fiji			TBD	Intra-domain
United States	Salt Lake City	BBIS	Inter-Regional	Australia American Samoa	64000 bps	X.25	2010	Circuit Implemented Intra-domain

Administration	Location of Router	Type of Router	Type of Interconnection	Interconnection, Connected to router of:	Link Speed	Link Protocol	Target date of Implementation	Remarks
1	2	3	4	5	6	7	8	9
		BBIS	Inter-Regional	Fiji	19200 bps	X.25	2010	Circuit Implemented
		BBIS	Inter-Regional	Japan	64000 bps	X.25	2006	Circuit Implemented
				Marshall Islands				Intra-domain
				Micronesia, Federated State of				Intra-domain
		BIS	Inter-Regional	New Zealand	9600 bps	X.25	2010	Circuit Implemented
				Palau	9600 bps	X.25	2010	Intra-domain
Vanuatu	Port Vila			Australia	VPN		2008	Intra-domain (Australia)
Viet Nam	Ho Chin Minh/Hanoi	BIS	Sub-Regional	China			TBD	
		BIS	Sub-Regional	Hong Kong, China	9600bps	X.25	2010	
		BIS	Sub-Regional	Lao PDR	9600bps	X.25	2010	
		BIS	Sub-Regional	Singapore	9600bps	X.25	2010	
		BIS	Sub-Regional	Thailand	9600bps	X.25	2010	
Wallis Islands	Wallis			Fiji		X.25	TBD	Intra-domain

IV-CNS 1C-1

Table CNS 1C

AMHS ROUTING PLAN

EXPLANATION OF THE TABLE

Column

1	Administration – the name of the Administration, State or Organization responsible for management of the facility
2	Location of Facility
3	Facility Type: AMHS UA (Location of AMHS)
4	Target Date of Implementation – date of implementation of the ATSMHS TBD – To be determined
5	Remarks

Note. - AMHS – ATS Message Handling System which may include Message Transfer Agents and AFTN/AMHS gateways services.

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Appendix I to the Report

Administration	Location of Facility	Facility Type	Target Date of Implementation	Remarks
American Samoa	Pago Pago	UA (Salt Lake City)	2010	
Australia	Brisbane	AMHS	2006	
Bangladesh	Dhaka	AMHS	2011	
Bhutan	Paro	UA (Mumbai)	2010	
Brunei Darussalam	Brunei	AMHS	2010	
Cambodia	Phnom Penh	AMHS	2010	
China	Beijing	AMHS	2010	Implemented
	Taibei	AMHS	2010	
Hong Kong, China	Hong Kong	AMHS	2009	
Macau, China	Macau	AMHS	2009	Implemented
Cook Island	Rarotonga	UA (Christchurch)	2010	
DPR Korea	Pyongyang	AMHS	2010	
Fiji	Nadi	AMHS	2010	
French Polynesia	Papeete	AMHS	TBD	
India	Mumbai	AMHS	2010	
Indonesia	Jakarta	AMHS	2009	
	Ujung Pandang	AMHS	2010	
Japan	Fukoka	AMHS	Implemented	
Kiribati	Tarawa	UA (Nadi)	2011	
Lao PDR	Vientiane	AMHS	2010	
Malaysia	Kuala Lumpur	AMHS	2011	
Maldives	Male	AMHS	2010	

Administration	Location of Facility	Facility Type	Target Date of Implementation	Remarks
Marshall Island	Majuro	UA (Salt Lake City)	2010	
Micronesia Federated State of	Chuuk	UA (Salt Lake City)	2010	
	Kosrai	UA (Salt Lake City)	2010	
	Ponapei	UA (Salt Lake City)	2010	
	Yap	UA (Salt Lake City)	2010	
Mongolia	Ulaanbaatar	AMHS	2010	
Myanmar	Yangon	AMHS	2010	
Nauru	Nauru	UA (Brisbane)	2010	
Nepal	Kathmandu	AMHS	2010	
New Caledonia	Noumea	AMHS	TBD	
New Zealand	Christchurch	AMHS	2011	
Niue Is	Niue	UA (Christchurch)	2010	
Pakistan	Karachi	AMHS	2010	
Palau	Koror	UA (Salt Lake City)	2010	
Papua New Guinea	Port Moresby	UA (Brisbane)	2010	
Philippines	Manila	AMHS	2010	Implemented
Republic of Korea	Seoul	AMHS	2011	
Samoa	Faleolo	UA (Christchurch)	2010	
Singapore	Singapore	AMHS	2010	Implemented
Solomon Is	Honiara	UA (Brisbane)	2010	
Sri Lanka	Colombo	AMHS	2010	
Thailand	Bangkok	AMHS	2010	
Timor Leste	Dili	UA (Brisbane)	2010	

Administration	Location of Facility	Facility Type	Target Date of Implementation	Remarks
Tonga	Tongatapu	UA (Christchurch)	2010	
Tuvalu	Funafuti	UA (Nadi)	2011	
United States	Salt Lake City	AMHS	Implemented	
Vanuatu	Port Vila	UA (Brisbane)	2010	
Viet Nam	Ho Chi Minh	AMHS	2012	2010 for Test, 2012 for deployment
Wallis Is.	Wallis	AMHS	TBD	

ASIA/PAC FASID **4-1E-1**

TABLE CNS 1E

**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

4 AIDC standard used – the AIDC standard adopted for the AIDC connection between the corresponding AIDC pair, AFTN, AFTN/AMHS or ATN;

5 Target Date of Implementation – date of implementation of the AIDC end system;

6 Remarks – any additional information describing the AIDC end system or the AIDC service between the corresponding AIDC pair.

TABLE CNS 1E
ATS INTERFACILITY DATA COMMUNICATION (AIDC) ROUTING PLAN

State/Administration	Location of AIDC end system	AIDC Pair		AIDC standard used	Target date of Implementation	Remarks
		Correspondent location	Correspondent State/Administration			
1	2	3		4	5	6
AUSTRALIA	Brisbane ACC	Oakland ARTCC	USA	AFTN	Implemented	ICD V.2.0
				AFTN/AMHS	TBD	
		Auckland ACC	New Zealand	AFTN	Implemented	ICD V.2.0
				AFTN/AMHS	TBD	
		Melbourne	Australia	AFTN	Implemented	ICD V.2.0
				AFTN/AMHS	TBD	
		Makassar ACC	Indonesia	AFTN	2010	ICD V.2.0
				AFTN/AMHS	TBD	
		Nadi ACC	Fiji	AFTN	Implemented	ICD V.2.0
				AFTN/AMHS	TBD	
	Melbourne ACC	Brisbane ACC	Australia	AFTN	Implemented	ICD V.2.0
				AFTN/AMHS	TBD	
		Jakarta ACC	Indonesia	AFTN	TBD	ICD V.2.0
				AFTN/AMHS	TBD	
		Mauritius ACC	Mauritius	AFTN	Implemented	ICD V.2.0
				AFTN/AMHS	TBD	
BANGLADESH	Dhaka ACC	Kolkata ACC	India	AFTN/AMHS	TBD	
		Yangon ACC	Myanmar	AFTN/AMHS	2011	Subject to concurrence with Myanmar
BHUTAN						
BRUNEI DARUSSALAM			Not Required			
CAMBODIA	Phnom Penh ACC	Bangkok ACC	Thailand	AFTN	2010	
CHINA	Beijing ACC	Incheon ACC	Republic of Korea	AFTN	TBD	
	Sanya ACC	Hong Kong ACC	Hong Kong, China	AFTN	Implemented	
		Ho Chi Minh ACC	Vietnam	AFTN	TBD	
	Guangzhou ACC	Hong Kong ACC	Hong Kong, China	AFTN	TBD	
	Taibei ACC	Hong Kong ACC	China	TBD	2012	
	Shanghai ACC	Fukuoka ATMC	Japan	TBD	TBD	

TABLE CNS 1E
ATS INTERFACILITY DATA COMMUNICATION (AIDC) ROUTING PLAN

State/Administration	Location of AIDC end system	AIDC Pair		AIDC standard used	Target date of Implementation	Remarks
		Correspondent location	Correspondent State/Administration			
1	2	3		4	5	6
HONG KONG, CHINA	Hong Kong ACC	Guangzhou ACC	China	AFTN	TBD	
		Sanya ACC	China	AFTN	Implemented	
		Manila ACC	Philippines	AMHS	TBD	
		Taibei ACC	China	TBD	2012	
MACAO, CHINA						
COOK ISLANDS						
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA						
FIJI	Nadi ACC	Auckland ACC	New Zealand	AFTN	Implemented	ICD V.1.0
				AFTN/AMHS	2010	
		Brisbane ACC	Australia	AFTN	Implemented	ICD V. 1.0
				AFTN/AMHS	2010	
		Oakland ARTCC	USA	AFTN	Implemented	ICD V.1.0
				AFTN/AMHS	2010	
FRANCE						
French Polynesia	Papeete ACC	Auckland ACC	New Zealand	AFTN	Implemented	ICD V. 2.0
New Caledonia						
INDIA	Kolkata ACC	Dhaka ACC	Bangladesh	AFTN	TBD	
	Mumbai ACC	Karachi ACC	Pakistan	AFTN	TBD	Subject to co-ordination between Administrations
				AFTN/AMHS	TBD	
INDONESIA	Jakarta ACC	Melbourne	Australia	AFTN/AMHS	TBD	
	Makassar ACC	Brisbane ACC	Australia	AFTN	2010	ICD V.1.0
				AFTN/AMHS	TBD	

TABLE CNS 1E
ATS INTERFACILITY DATA COMMUNICATION (AIDC) ROUTING PLAN

State/Administration	Location of AIDC end system	AIDC Pair		AIDC standard used	Target date of Implementation	Remarks
		Correspondent location	Correspondent State/Administration			
1	2	3		4	5	6
JAPAN	Fukuoka ATMC	Anchorage ACC	USA	AFTN	Implemented	ICD V.1.0
		Incheon ACC	Republic of Korea	AFTN	2009	
		Oakland ARTCC	USA	AFTN	Implemented	
		Taibei ACC	Taibei, China	AFTN	2012	ICD V.3.0
KIRIBATI						
LAO PEOPLE'S DEMOCRATIC	Vientiane ACC	Bangkok ACC	Thailand	AFTN	2010	
MALAYSIA	Kuala Lumpur ACC	Bangkok ACC	Thailand	AFTN	2010	TBD
		Singapore	Singapore	AFTN	2011	
		Kota Kinabalu	Manila	AFTN	2011	
		Kota Kinabalu	Ujung Padang	AFTN	2011	
MALDIVES	Male ACC	Colombo ACC	Sri Lanka	AFTN	2010	
MARSHALL ISLANDS						
MICRONESIA (FEDERATED STATE OF)						
MONGOLIA						
MYANMAR	Yangon ACC	Bangkok ACC	Thailand	AFTN	2010	ICD V.1.0
		Dhaka ACC	Bangladesh	AFTN	2011	
NEPAL	Kathmandu ACC	Kolkata ACC	India	AFTN	2010	
				AFTN/AMHS		
		Banaras ACC	India	AFTN	2010	
				AFTN/AMHS		
		Lhasa ACC	China	AFTN	2010	
				AFTN/AMHS		

TABLE CNS 1E
ATS INTERFACILITY DATA COMMUNICATION (AIDC) ROUTING PLAN

State/Administration	Location of AIDC end system	AIDC Pair		AIDC standard used	Target date of Implementation	Remarks
		Correspondent location	Correspondent State/Administration			
1	2	3		4	5	6
NAURU	Brisbane ACC	Oakland ARTCC	USA	AFTN	Implemented	ICD V.1.0
				AFTN/AMHS	TBD	
		Nadi ACC	Fiji	AFTN	Implemented	ICD V.1.0
				AFTN/AMHS	2010	
NEW ZEALAND	Auckland ACC	Brisbane ACC	Australia	AFTN	Implemented	ICD V.1.0
				AFTN/AMHS	2010	
		Nadi ACC	Fiji	AFTN	Implemented	ICD V.1.0
				AFTN/AMHS	2010	
		Oakland ARTCC	USA	AFTN	Implemented	ICD V.2.0
				AFTN/AMHS	2010	
		Papeete ACC	French Polynesia	AFTN	Implemented	ICD V.2.0
PAKISTAN	Karachi	Kuwait	Kuwait	AFTN	TBD	Subject to concurrence of Kuwait
				AFTN/AMHS	TBD	
		Mumbai	India	AFTN	TBD	
				AFTN/AMHS	TBD	
PALAU						
PAPUA NEW GUINEA						
PHILIPPINES	Manila ACC	Hong Kong ACC	Hong Kong, China	AMHS	TBD	
		Singapore ACC	Singapore	AMHS	2011	
		Taibei	Taibei, China	AMHS	2011	
		Makassar A CC	Indonesia	TBD	2011	
		Ho Chi Minh ACC	Viet Nam	TBD	2011	
		Oakland ARTCC	USA	TBD	2011	

TABLE CNS 1E
ATS INTERFACILITY DATA COMMUNICATION (AIDC) ROUTING PLAN

State/Administration	Location of AIDC end system	AIDC Pair		AIDC standard used	Target date of Implementation	Remarks
		Correspondent location	Correspondent State/Administration			
1	2	3		4	5	6
REPUBLIC OF KOREA	Incheon ACC	Fukoka ATMC	Japan	AFTN	2009	ICD V.1.0
		Beijing	China	AFTN	TBD	
SAMOA						
SINGAPORE	Singapore ACC	Ho Chi Minh ACC	Vietnam	AFTN/AMHS	2011	ICD Version 3.0 Subject to concurrence from States
				ATN	2012	
		Manila ACC	Philippines	AFTN/AMHS	2011	
				ATN	2012	
		Jakarta ACC	Indonesia	AFTN/AMHS	2011	
				ATN	2012	
		Kuala Lumpur ACC	Malaysia	AFTN/AMHS	2011	
				ATN	2012	
		Kota Kinabalu ACC	Malaysia	AFTN/AMHS	2011	
				ATN	2012	
SOLOM ISLANDS						
SRI LANKA	Colombo ACC	Male ACC	Maldives	AFTN	2010	
TIMOR LASTE						
THAILAND	Bangkok ACC	Hochiminh ACC	Viet Nam	AFTN	2010	
		Kuala Lumpur ACC	Malaysia	AFTN	2010	
		Phnom Penh ACC	Cambodia	AFTN	2010	
		Vientiane ACC	Lao PDR	AFTN	2010	
		Yangon ACC	Myanmar	AFTN	2010	

TABLE CNS 1E
ATS INTERFACILITY DATA COMMUNICATION (AIDC) ROUTING PLAN

State/Administration	Location of AIDC end system	AIDC Pair		AIDC standard used	Target date of Implementation	Remarks
		Correspondent location	Correspondent State/Administration			
1	2	3		4	5	6
TONGA						
UNITED STATES	Oakland ARTCC	Auckland ACC	New Zealand	AFTN	Implemented	ICD V.2.0
		Fukuoka ATMC	Japan	AFTN	Implemented	ICD V.1.0
		Nadi ACC	Fiji	AFTN	Implemented	ICD V.1.0
		Brisbane ACC	Australia	AFTN	Implemented	ICD V.1.0
	Anchorage ARTCC	Fukuoka ATMC	Japan	AFTN	Implemented	ICD V.1.0
VIET NAM	Ho Chi Minh ACC	Sanya ACC	China	AFTN/AMHS	TBD	
		Pnom Penh ACC	Cambodia	AFTN/AMHS	TBD	Subject to Concurrence from Cambodia
		Vientiane ACC	Lao PDR	AFTN/AMHS	TBD	Subject to Concurrence from Lao PDR
	Ho Chi Minh ACC	Singapore ACC	Singapore	AFTN/AMHS	2011	Subject to concurrence from Singapore
		Manila	Philippines	TBD	2011	Subject to concurrence from Philippines
		Bangkok ACC	Thailand	AFTN	2010	

New Zealand' Criteria for SCV Approval and Second HF Exemption Process and Procedure

1.1 The process through which the approval of SCV is accomplished through the Exemption process where the operator petitions for the grant of an exemption from the applicable operating rules that require dual independent communications systems. Granting the exemption requires the applicant (operator) to show that the SCV installation will provide an equivalent level of safety to the second HF communications system. The criteria below must be met.

1.2 As all exemptions must be approved by the Director of Civil Aviation, the technical staff ensures that all the criteria are met before recommending that the exemption be granted.

2. AIRCRAFT INSTALLATION

2.1 The basis of the aircraft installation requirements is FAA Advisory Circular 20-150, however, this AC is written around an Inmarsat SCV system whereas we are almost always now dealing with Iridium systems. To be acceptable, the installation must:

a. The SCV must be an approved installation e.g. STC or approved modification. The installation testing must be such that the SCV can be operated in all phases of flight (no take-off or landing limitations).

b. Be shown to be independent of the primary HF communications systems; there must be no common mode failures. To establish independence usually requires the operator to provide the Electrical Load Analysis for the aircraft to show that the SCV is connected to a bus that is unlikely to be shed in the event of an electrical power generation failure.

c. The system must be fully integrated into the aircraft communications audio system.

d. There must audible call annunciation with visual annunciators within the normal forward field of view.

e. When applicable, the system must be integrated with the Cockpit Voice Recorder and Flight Data Recorder systems.

f. The equipment must be suitable for the intended purpose. This is generally accepted to be that the equipment has been tested and shown to meet the normal RTCA DO-160 environmental qualification requirements for avionics systems.

g. A Flight Manual Supplement must be provided.

h. The calling numbers for the ATS units that need to be contacted on the intended route must be stored in the SCV system; free dialing is not permitted.

i. The operator must have an active software configuration management system in practice so that there is configuration control over the operator data stored in the system.

3. OPERATOR REQUIREMENTS

3.1 To support the petition for exemption, the operator must provide the following data:

a. Airworthiness data to show that the installation meets the requirements specified above.

b. Minimum Equipment List revision. This revision must specify that both the HF and SCV must be operating normally for dispatch and include a reference to the operator's route guide for the SCV operating procedures.

c. For Auckland Oceanic, a copy of the operating agreement between the operator and Airways Corporation. This normally specifies operating requirements.

d. Route Guide Procedures revision. This revision specifies the procedures to be used when the SCV system is being used as a back-up to the primary HF system. Of particular significance are the pre-departure procedures.

e. The operator's flight operations group must have a defined procedure for providing and updating the ATS unit calling numbers stored in the SCV. This involves the maintenance organisation and is part of the software configuration management system.

3.2 The pre-departure procedures are a significant element of ensuring that the SCV provides an equivalent level of safety to the HF communications system. Prior to departure, the operator is required to:

a. Identify all ATS units along the intended route (including alternates) that need to be contacted and verify that all are willing to accept SCV in lieu of HF in the event of an HF failure.

b. Verify that each ATS unit has the phone number for the aircraft; this is also included on the flight plan.

c. Verify that the calling number of each ATS unit is stored in the SCV equipment.

d. Prior take-off, the aircraft must call each of the ATS units to verify system operation.

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Frequency assignment planning criteria

Note: frequency assignment planning criteria and other relevant material used in the APAC Region are contained in the foreword to APAC Frequency List No. 3

1 Frequency assignment planning criteria for co-channel VHF assignments for use in the ASIA/PACIFIC Region have been developed at the 3rd ASIA/PACIFIC Regional Air Navigation Meeting (1993). These planning criteria include a (predetermined) set of Designated Operational Coverage areas (DOC) and provide for co-channel separation distances. The separation distances used are the distance between the transmitter sites for circular services like TWR or APP. For area services (ACC and FIS) separation distance are given relative to the distance between limits of service area (or DOC). The separation distances are based upon a desired to undesired (D/U) signal ratio of 20 dB, which requires that the interfering (or undesired) station is located beyond the radio horizon of the interfered (or desired) station. The minimum co-channel separation distance between transmitter/receiver locations can be calculated by adding the relevant distances (DOC-range) to the radio horizon (DOC-altitude) of the two frequency assignments (see Figure 2). These criteria are incorporated in the computer for VHF COM frequency assignment planning. The program however introduces also the option to test a new frequency assignment against adjacent channel interference.

1.1 With regard to frequency assignment planning for area services, ICAO is working on introducing the concept of area service planning. This is work in progress and will hopefully be introduced soon. This method is consistent with the current protection requirements and may result in more efficient frequency assignment planning.

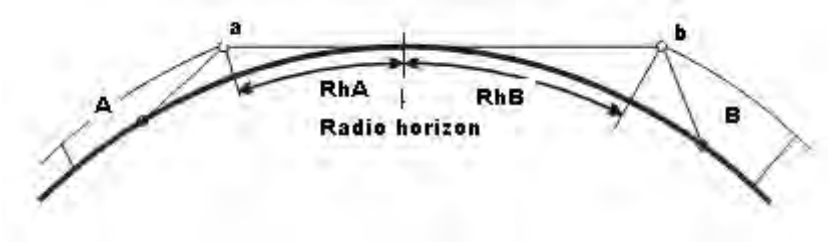

Figure 2

2 Applying the methodology as described in paragraph 3.1, separation distances between the edges of the DOC have been calculated and, using the distance to the radio horizon as in Table 2A, been summarized in Table 2B.

Symbol	Service range (NM)	Service height	Radio horizon
TWR	25 NM / 46km	4000 ft /1200 m	78 NM
AFIS	25 NM / 46km	4000 ft /1200 m	78 NM
AS	Limits of aerodrome	Surface	N/A
APP-U	150 NM / 280 km	45000 ft/ 13700 m	260 NM
APP-I	75 NM / 140 km	25000 ft / 7600 m	195 NM
APP-L	50 NM / 93 km	12000 ft /3650 m	134 NM
ACC-U	Specified area	45000 ft /13700 m	260 NM
ACC-L	Specified area	25000 ft / 7600 m	195 NM
FIS-U	Specified area	45000 ft /13700 m	260 NM
FIS-L	Specified area	25000 ft / 7600 m	195 NM
VOLMET	260 NM / 480 km	45000 ft / 13700m	260 NM
ATIS	150 NM / 280 km	45000 ft /13700 m	260 NM

Table 2A – distance to radio horizon with aircraft at maximum altitude

Note: Radio horizon of the aircraft from the edge of DOC.

2.1 Automatic Terminal Information Service, or ATIS, is a continuous broadcast of recorded information in busier terminal (i.e. airport) areas. ATIS broadcasts contain essential information, such as weather information, which runways are active, available approaches, and any other information required by the pilots, such as important NOTAMs.

As a terminal service, ATIS may not require a DOC greater than APP/U.

Service	TWR	AFIS	SMC	APP-U	APP- I	APP-L	ACC-U	ACC-L	FIS-U	FIS- L	VOLMET	ATIS
TWR	156 (206)	156 (206)	103 (128)	338 (513)	273 (373)	212 (287)	338 *	273 *	338 *	273 *	338 (623)	338 (623)
AFIS	156 (206)	156 (206)	103 (128)	338 (513)	273 (373)	212 (287)	338 *	273 *	338 *	273 *	338 (623)	338 (623)
AS	103 (128)	103 (128)	50	285 (435)	220 (295)	159 (209)	285 *	220 *	285 *	220 *	285 (310)	285 (310)
APP-U	338 (513)	338 (513)	285 (435)	520 (820)	455 (680)	394 (594)	520 *	455 *	520 *	455 *	520 (930)	520 (820)
APP-I	273 (373)	273 (373)	220 (295)	455 (680)	390 (540)	329 (454)	455 *	390 *	455 *	390 *	455 (790)	455 (680)
APP-L	212 (287)	212 (287)	159 (209)	394 (594)	329 (454)	268 (368)	394 *	329 *	394 *	329 *	394 (704)	394 (594)
ACC-U*	338	338	285	520	455	394	520	455	520	455	520	520
ACC-L*	273	273	220	455	390	329	455	390	455	390	455	455
FIS-U*	338	338	285	520	455	394	520	455	520	455	520	520
FIS-L*	273	273	220	455	390	329	455	390	455	390	455	455
VOLMET	338 (623)	338 (623)	285 (545)	520 (930)	455 (790)	394 (704)	520 *	455 *	520 *	455 *	13 (533)	10 (413)
ATIS	338 (513)	338 (513)	285 (435)	520 (820)	455 (680)	394 (594)	520 *	455 *	520 *	455 *	10 (413)	13 (313)

Table 2B – Minimum geographical co-channel separation distances **between limits of DOC**
Note: All distances are in NM; values in brackets are separation distances between facilities for (circular) services
* Area services; only distances between limits of DOC are given.

3 VOLMET and ATIS are one-way transmissions from a ground transmitter to the aircraft. Since the VOLMET DOC has been calculated upon the maximum coverage that can be obtained at 45000 ft (260 NM), protection between VOLMET stations can be secured if the separation distance between these service volumes is 13 NM, assuming a VOLMET transmitter height of 100ft. This distance would also be sufficient for the protection of ATIS from VOLMET transmissions.

4 AS (aerodrome surface movement control) separation distances are calculated with an antenna height of 30 m (100ft). At 100 ft the radio horizon is 12.3 NM to which a buffer (12.7 NM) has been added (total 25 NM). Co-channel operation between AS assignments is 50 NM. Should the difference in height between the two aerodromes be significantly different, additional margins need to be added. Separation distances (between facilities) with airborne services have been calculated as the sum of 25 NM (AS) plus radio horizon plus DOC-range (or the airborne service). In case the airborne service is an area service (ACC or FIS), only the distance of the radio horizon to the nearest limit of the airborne service has been provided (25 NM plus range airborne service). Sharing with airborne services however is unlikely to occur since an (exclusive) sub-band has been allotted by ICAO for AS communication (121.600-121.975 MHz).

5 Adjacent channel utilization.

5.1 The geographical separation between two aircraft operating on the first adjacent 25 kHz channel is 10 NM throughout the service area. This implies that the first adjacent 25 kHz channel cannot be deployed in the same DOC plus 10 NM.

5.2 In cases where DSB-AM equipment is being in use with 50 kHz channel spacing, the first adjacent channel geographical separation between a 50 kHz frequency assignment and a 25 kHz assignment is 100 NM throughout the coverage areas. The first adjacent channel separation between two 50 kHz assignments is 10 NM. Should such protection be required (currently frequency assignment planning throughout the ASIA/PACIFIC Region is based on 25 kHz channel spacing for all frequency assignments) relevant information needs to be included in the COM list and the program be amended accordingly.

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Frequency planning for VDL

1 Frequency assignment planning criteria for VDL Mode s 2 and 4 have already been agreed in the Aeronautical Communications Panel. (Re. Report ACP WG M 12 http://www.icao.int/anb/panels/acp/wgdoclist.cfm?MeetingID=242)

2 The following material is proposed to be added to the frequency assignment planning criteria in the APAC Region for the VHF COM band for VDL frequency assignment planning.

3 Co-channel separation.

3.1 Co-channel separation between VDL and DSB-AM assignments as well as between VDL Mode 4 and VDL Mode 4 is based on a desired to undesired signal protection ratio of 20 dB (line of sight).

3.2 Adjacent channel separation between VDL and DSB-AM systems in the same geographical area is in accordance with the following table:

Vs.		Interference source		
		DSB-AM	VDL 2	VDL 4
Victim	DSB-AM		1	2
	VDL 2	1	1	1
	VDL 4	2	1	1

Table 4. 25 kHz guard channels between DSB-AM, VDL mode 2 and VDL mode 4

Note: The number in Table 4 are guard channels. The next channel that can be used without and frequency planning constrain is 1 higher (e.g. a desired DSB-AM station that is interfered by a VDL Mode 2 aircraft station requires one 25 kHz guard band channel. The next channel, 50 kHz away can be used in the same designated operational coverage without any frequency assignment planning constraint.

3.3. Attention is drawn to the possibility of interference between DSB-AM and VDL Mode 2/4 when these systems are used on the surface of an airport. Interference can occur if the channel separation (guard band) is four or less. In this case interference between aircraft stations can be prevented through securing that the minimum field strength of these systems is 70 dBm at the antenna. Any interference that may be caused in ground based receiving stations (i.e. not aircraft stations) can be mitigated through using cavity filters that block in these receivers the reception of unwanted signals from transmissions from aircraft operating on the surface of an airport.

RNAV HUMAN FACTORS AND SYSTEMS SAFETY

(Cranfield University Human Factors Report)

SUMMARY

In late 2008, a New Zealand operator commissioned Cranfield University to carry out an RNAV operational safety assessment. The report of the assessment identified a number of safety issues; some of the findings are specific to the aircraft type in the study but many are generic to RNAV systems and operations. This paper summarises the study findings and the significant lessons learned.

1. INTRODUCTION

1.1 The Cranfield University was commissioned to carry out an RNAV operations safety assessment by a New Zealand operator flying a fleet of medium weight turboprop aircraft. The assessment carried out surveys and interviews with crews, observed operations in the cockpit and carried out simulator exercises. As a result of the observations made and the simulator exercises, a number of safety significant findings were made; this paper presents a summary of the findings since there are lessons for all in the study.

1.2 A few of the items identified in the report have been known for a long time but have slipped out of view; this report is a reminder that lessons learned long ago are still valid. The report makes a pertinent observation about accident theories such as the Domino theory and James Reason's Swiss Cheese analogy; both of these are extensions of Murphy's Law – if it can happen, it will happen.

1.3 Dr Steve Jarvis is the author of the Cranfield University Human Factors report upon which this paper is based.

2. DISCUSSION

2.1 The study carried out focused on the human factors aspects of RNAV operations. To this extent the report identifies issues that are related directly to the crew and to aircraft installation issues that affect crew performance. The principal findings are reviewed below.

3. AIRCRAFT INSTALLATIONS

3.1 FMS usability raised a number of issues in that the architecture of the system means that errors are likely to be made. A point is made about the method of selecting an arrival runway where the crew have to enter a number to make the selection rather than selecting the required runway with a line select key. Entering codes to make selection requires the crew to verbalise the code to transfer it to the keypad. This creates a high risk that an error will be made because of other cockpit activity. FMS operations and the method of making selections is a human factors problem that needs to be addressed with the manufacturers.

3.2 The location of the FMS CDU came in for a lot of comment. In the aircraft, the FMS CDU is located in the forward left centre pedestal. This location gives rise to a number of issues, particularly for First Officers (FO).

3.3 To access the FMS CDU, the large angles involved make operating the system difficult through parallax, dexterity, and the angle of force transfer to the keypad. This out of normal reach installation makes operating errors more likely. A further problem is the likelihood of unintentional operation of the power levers.

3.4 Reading the FMS display could be very difficult, particularly in bright sunlight. In bright sunlight the display was often unreadable; Figure 1 shows the FMS as it often appeared to the FO. The result of this is that the monitoring task becomes difficult and is discouraged. When the FO is the pilot flying, it is very difficult to monitor the FMS.

Figure 1: FMS Display in Sunlight.

3.5 The location of the FMS CDU discouraged FOs from using the system since it was not located in their personal space, resulting in a lack of practice. When the FMS CDU is located in the crew member's personal space, they will be more relaxed so are more likely to work more methodically and practice with the unit and take their time. If a mistake is made, they will go back and try again. Routine use significantly improves the competence and confidence of the crew in operating the system.

3.6 Further, the location of the FMS CDU led to FOs asking the Captain to operate the FMS when they were pilot flying. This increased the workload of the pilot monitoring and distracted him / her from the monitoring task.

3.7 The report also criticises the FMS Message system. The most significant problem with the message system was that there was no priority indication for messages. In the simulator exercise, important messages were either missed or ignored since there was no indication as to the importance of the message. When the Message light illuminated, there were indications that crews assumed it was an expected routine message so gave it a low priority. Within the system, there is a need for message priority indications so that crew respond to those of high priority.

3.8 When the autopilot was disconnected, the alert tone was the same as when the autopilot self disconnected. Since the disconnect tone is commonly heard in the cockpit, when the autopilot self disconnects and the tone sounds routine, there is no incentive for the crew to check that it is a pilot who has disconnected it. The recommendation is that the pilot disconnect tone for the autopilot should be different to an automatic disconnect (drop-out) by the autopilot system.

4. CREW FINDINGS

4.1 Many of the crew findings are the result of the simulator exercises carried out. In the simulator, a crew workload measurement system was installed to measure the workload of the crew. This was accomplished by a light on the glare-shield illuminating and requiring the crew to select one of five buttons indicating the perceived workload at the time. For most of the simulator exercises, the average crew workload perceptions were in the normal to busy range but during the go around with the failed FMS, the workload perceptions were in the heavy to extreme (incapacitated) range. There was a general correlation between the Captain / Fist officer and Pilot flying and pilot monitoring i.e. the trends for both were similar.

4.2 The simulator details consisted of flying a sector from Wellington to Blenheim (Woodbourne) twice in IMC. On one sector there were no failures induced but a weather related go around was required; this sector was a control for the experiment. On the other sector flight, faults were induced. For the RNAV portion of the flight, the fault induced was to illuminate the GPS Integrity light during final approach to Woodbourne but before the MAP. The control sector was swapped with the experimental sector to mitigate any ‘practice’ effects. The number of crews who undertook the simulator exercises were sufficient for the results to be statistically reliable.

4.3 At Woodbourne, the RNAV (GNSS) missed approach procedure requires the aircraft to cross the MAP and then make a right turn, as shown in Figure 2. The VOR missed approach requires the aircraft to fly straight ahead and then make a left turn to go back across the VOR, as shown in Figure 3.

4.4 During the sector with the induced GPS Integrity fault, approximately 75 % of crews made significant errors. In terms of handling the aircraft, there were several significant failures such as altitude busts, exceeding speed limitations (fast and slow) and failing to raise the flaps.

4.5 In considering the navigation aspects of the exercise, there were numerous errors. The most significant error was that about 25 % of crews flew the procedure with the Integrity light on; this highlighted considerable misunderstanding of the meaning of the light and the actions that needed to be taken. In one case, the crew attempted to fly the RNAV missed approach procedure using the VOR.

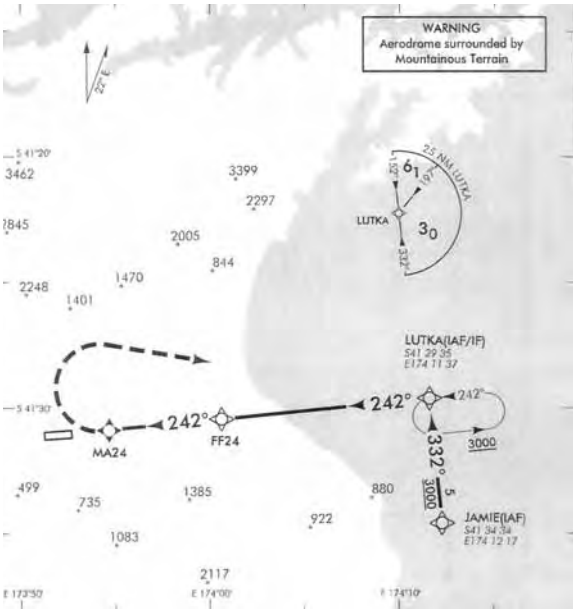

Figure 2: Woodbourne RNAV Procedure.

Figure 3: Woodbourne VOR Procedure.

4.6 The report found that some crews did not activate the Go Around mode. The implication of this to the system being that the there is no missed approach information supplied and therefore no flight guidance is provided to the crew. There are no indications that the system is not in the go around mode other than LNAV and VNAV are still being displayed on the annunciators. A major contributing factor to crews not selecting the Go Around mode was the location of the GA button on the power levers and the action need to activate it; in some cases, learned actions from flying other types was also a factor.

4.7 The GA button problem could be resolved with training but it also highlights a control design human factors issue. While the actual design is common in many aircraft, the human factors associated with control design and how they are actually used by pilots is an important consideration – putting a button in and expecting a pilot to use it is not always the answer.

4.8 As an additional experiment, some crews were asked to fly an RNAV track with the FMS turned off. This proved to be extremely difficult for all crews with most crews falling back to dead reckoning with headings that they thought would work. A significant finding for this exercise was that it is very difficult for crews to maintain situational awareness in an RNAV environment by reference to conventional means of navigation.

4.9 The report concluded that some of the errors during the missed approach probably stemmed from a breakdown of normal monitoring because of the high workload and crews choosing to prioritise something else over the basic monitoring task. There was clear evidence of attention capture. The report recommends that more non-normal situations are trained for and practiced in the simulator, particularly the more challenging situations.

4.10 The most likely failure mode of RNAV systems is a system failure; the loss of signal GNSS failure mode is considered to be less likely than a system failure. By having dual RNAV systems that are fully integrated into the aircraft flight instruments and autopilot, in the event of a system failure, the source of flight guidance is transferred to the second RNAV system. This removes most of the problems associated with a FMS failure in a single system installation.

4.11 In interviews, many pilots did not appreciate the reliability issues with single systems; few addressed the failure issue .Many of the pilots had come through general aviation where FMS's are rare; they appeared to be impressed by it and not understand its weaknesses. Many confused the multiple inputs and system accuracy with reliability. In the interviews and exercises it was apparent that crews treated the FMS as a primary navigation source and were failing to monitor the secondary system. The analysis work showed that the redundant systems are not actually redundant because there is a low probability that a failure in the primary navigation system will be detected by the crew.

4.12 In view of the Cranfield findings, the CAA is of the view that there is a strong safety case to require dual RNAV installations for commercial operations. In the unlikely event all RNAV navigation is lost, the crew should initiate a go around, execute a DR extraction procedure and then transition to an alternate means of navigation. Attempting to carry out a go around and transition to an alternate means of navigation is creating a situation where there is a risk that significant errors will be made. The DR extraction procedure for each approach should be part of the operator's route guide.

4.13 The near simultaneous loss of navigation with dual RNAV systems is most likely to occur if there is a GNSS loss of signal failure. Multi sensor systems are less susceptible to simultaneous failures and will be required when guided missed approaches or extractions are needed. Where aircraft are fitted with GNSS only RNAV systems, the simultaneous failure case should be planned for.

4.14 The report is critical of the design of charts being used in that data is not presented on charts in the best possible way. The charts used had terrain marked as spot heights; this makes it difficult for the crew to build a spatial mental picture of the local terrain.

4.15 The RNAV charts have been 'de-cluttered' with the conventional aids being removed. Most crews do not have the alternate charts with the additional information on hand. The result is that the additional information is being held in the pilot's head where it is vulnerable under arousal or high workload conditions i.e. the time when the information is needed most. The report makes a strong and clear finding that procedure and chart designers had accomplished their roles of making approved components but had fallen short in terms of producing a user centred design.

4.16 In conducting the research for the report, disparities between pilots on their understanding of system operation and the significance of items e.g. the GPS Integrity light and Flight Director modes and mode changes, was quite apparent. This suggests that training may not be as effective as anticipated even though there were competent instructors using suitable training material

and methods; there were indications that different learning styles were present in the crews who participated in the review. Training effectiveness therefore needs to be monitored to ensure that learning objectives are attained and demonstrated in the operating environment rather than just in the classroom or simulator.

4.17 A final comment in the report noted that while all the individual elements for RNAV operations were complied with by the operator, there was no clear oversight responsibility for the whole system (aircraft, procedures, charts, training, currency, operations, and oversight). The approval process was exhaustive in terms of individual components but was fragmented in terms of the overall system. The conclusion drawn was that the overall working system had never really been approved.

5. CONCLUSIONS

5.1 The principal conclusions drawn from the report are:

a. RNAV systems need to be installed in locations where they are readily visible and accessible to the crew under virtually all lighting conditions. Given that with single systems it is difficult to maintain situational awareness sufficiently to detect system malfunctions using conventional systems, RNAV systems should be dual systems fully integrated for redundancy.

b. The architecture and operation of FMS systems is often not human centric so that there are many opportunities for crew to make operating errors.

c. First and foremost, the crew must fly the aircraft. The old aviation adage of “Aviate, Navigate, Communicate” is still just as valid in the modern cockpit as it was generations ago.

d. Chart design is a significant issue; charts needs to be user oriented and provide information useful to the crew in a manner that is easily understood by the crew. For example, distances should be read directly rather than having to be calculated; spot heights should be replaced by terrain shading so that the chart, a TAWS display and the actual terrain (the view out the window) all correlate.

e. Training effectiveness needs to be actively monitored to ensure operational performance objectives are met.

f. There needs to be organisational oversight of the whole system rather than the fragmented approach where only individual components are addressed.

5.2 CAANZ considers that the report to be good and timely work that raises important points that need to be heeded with the implementation of more RNAV operations, be they PBN or GNSS. In future rulemaking, it is proposed that the shortcomings identified in the report will be addressed by appropriate means. As part of the PBN implementation project, consideration will be given to:

a. Requiring aircraft carrying out RNAV commercial operations to be fitted with dual RNAV systems fully integrated into the flight instrument systems and autopilot;

b. Requiring systems architecture and installations to be user oriented with installations being assessed for adverse human factors conditions.

c. Reviewing charting standards to address the points raised and ensure user orientation;

d. Requiring operators to have DR extraction procedures for all procedures (that do not require precision extraction guidance) included in their route guides, particularly for aircraft with GNSS only systems fitted;

e. Training programmes being required to address the training effectiveness and human factors issues raised by the report; and

f. Revising RNAV operations oversight requirements.

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PBN IMPLEMENTATION PROGRESS REPORT

State: (Name of State) Date: (DD/MM/YY)

Designation of PBN Focal Point

Reference: APANPIRG Conclusion 18/55 –Designation of Contact Person for PBN Implementation

*"That, by31 December 2007, States designate a focal contact person responsible for performance based navigation implementation and provide details of the contact person to ICAO Asia/Pacific Regional Office accordingly.***"**

Status: (Nominated/ To be Nominated)

Focal Point: (Name, Designation, Mailing Address, Email, Phone, Fax)

State PBN Implementation Plan

Reference: APANPIRG Conclusion 18/53 – Development of State PBN Implementation Plans

"That, the Regional Office encourages States to begin development of their State PBN implementation plans in harmony with the development of the Asia/Pacific Regional PBN implementation plan being coordinated by the Asia/Pacific PBN Task Force for submission to APANPIRG/19."

Status: (Adopted / To be adopted) by (name of a national body) and (Reviewed / To be reviewed) by ICAO APAC PBN TF

Note(s): (States may include information on publication date and location for State PBN Implementation Plan and other relevant information.)

Approach Operations

Reference: ICAO Assembly Resolution A36-23

"States and planning and implementation regional groups (PIRGs) complete a PBN implementation plan by 2009 to achieve: implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS) for all instrument runway ends, either as the primary approach or as back up for precision approaches by 2016 with intermediate milestones as follows: 30 percent by 2010, 70 percent by 2014."

Status:

Implementation Targets (# of RWY Ends)			**Completed** (# of RWY Ends)		**On Progress** (# of RWY Ends)	
Y2010	Y2014	Y2016	LNAV	LNAV/VNAV	LNAV	LNAV/VNAV

Note(s): (States may include information on recent publications of new PBN approach procedures.)

Arrival and Departure Operations

Reference: 1) ICAO Assembly Resolution A36-23

"States and planning and implementation regional groups (PIRGs) complete a PBN implementation plan by 2009 to achieve: implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones."

2) Interim Asia/Pacific PBN Regional Implementation Plan

"Short-term Implementation Targets: RNAV 1 SID/STAR for 50% of international airports by 2010 and 75% by 2012 and priority should be given to airports with RNP Approach."

"Medium-term Implementation Targets: RNAV 1 or RNP 1 SID/STAR for 100% of international airports by 2016. RNAV 1 or RNP 1 SID/STAR for 70% of busy domestic airports where there are operational benefits."

Implementation Targets (# of Int'l Airports)			**Completed** (# of Int'l Airports)		**On Progress** (# of Int'l Airports)	
Y2010	Y2014	Y2016	Arrival	Departure	Arrival	Departure

Note(s): (States may include information on recent publications with new PBN arrival/departure procedures.)

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INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC REGIONAL PERFORMANCE-BASED NAVIGATION IMPLEMENTATION PLAN

Interim Edition

VERSION 0.3

PBN TF/5
15-17 July 2009

RECORD OF AMENDMENT

Version	Activity	Date
0	Adopted by APANPIRG/19 as Interim Edition	September 2008
0.1	RASMAG Proposal	December 2008
0.2	Amended/Finalized by PBN/TF/4	March 2009
0.3	Amended/Finalized by PBN/TF/5	July 2009

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ASIA/PACIFIC REGIONAL PERFORMANCE-BASED NAVIGATION IMPLEMENTATION PLAN

1. Executive Summary

1.1 This Asia/Pacific Regional PBN Implementation Plan has been produced in line with Resolution A 36/23 adopted by ICAO Assembly in its 36th Session held in September 2007 and Conclusion 18/52 adopted by APANPIRG/18. The Regional PBN Plan addresses the strategic objectives for PBN implementation based on clearly established operational requirements, avoiding equipage of multiple on-board or ground based equipment, avoidance of multiple airworthiness and operational approvals and explains in detail contents relating to potential navigation applications. The Plan envisages the conduct of pre- and post-implementation safety assessments and continued availability of conventional air navigation procedures during transition. The Plan also discusses issues related to implementation which include traffic forecasts, aircraft fleet readiness, adequacy of ground-based CNS infrastructure etc. Implementation targets for various categories of airspace for the short term (2008 – 2012) and for the medium term (2013 – 2016) have been projected in tabular forms to facilitate easy reference. For the long term (2016 and beyond) it has been envisaged that GNSS will be the primary navigation infrastructure. It is also expected that precision approach capability using GNSS and its augmentation system will become available in the long term.

2. Explanation of Terms

2.1 The drafting and explanation of this document is based on the understanding of some particular terms and expressions that are described below:

2.1.1 **Asia/Pacific Regional PBN Implementation Plan.** A document adopted by APANPIRG, often referred to as the "Regional PBN Plan", offering appropriate guidance for air navigation service providers, airspace operators and users, regulating agencies, and international organizations on the evolution of navigation capabilities as one of the key systems supporting air traffic management, and which describes the RNAV and RNP navigation applications that should be implemented in the short, medium and long term in the APAC Region.

2.1.2 **Performance Based Navigation** Performance based navigation specifies RNAV and RNP system performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in an airspace.

2.1.3 **Performance requirements.** Performance requirements are defined in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept. Performance requirements are identified in navigation specifications which also identify which navigation sensors and equipment may be used to meet the performance requirement.

3. Acronyms

3.1 The acronyms used in this document along with their expansions are given in the following list

ABAS	Aircraft-Based Augmentation System
AIS	Aeronautical Information Services
APAC	Asia and Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APCH	Approach
APV	Approach Procedures with Vertical Guidance
ATC	Air Traffic Control
Baro VNAV	Barometric Vertical Navigation
CNS/ATM	Communication Navigation Surveillance/Air Traffic Management

CPDLC	Controller Pilot Data Link Communications
DME	Distance Measuring Equipment
EMA	En-route Monitoring Agency
FASID	Facilities and Services Implementation Document
FIR	Flight Information Region
FMS	Flight Management System
GBAS	Ground-Based Augmentation System
GNSS	Global Navigation Satellite System
GRAS	Ground-based Regional Augmentation System
IATA	International Air Transport Association
IFALPA	International Federation of Air Line Pilots' Associations
INS	Inertial Navigation System
IRU	Inertial Reference Unit
PANS	Procedures for Air Navigation Services
PBN	Performance Based Navigation
PIRG	Planning and Implementation Regional Group
RASMAG	Regional Airspace Safety Monitoring Advisory Group
RCP	Required Communication Performance
RNAV	Area Navigation
RNP	Required Navigation Performance
SARP	Standards and Recommended Practices
SBAS	Satellite-Based Augmentation System
SID	Standard Instrument Departure
STAR	Standard Instrument Arrival
TMA	Terminal Control Area
VOR	VHF Omni-directional Radio-range
WGS	World Geodetic System

4. Introduction

Need for the regional PBN Implementation Plan

4.1 The Thirty-sixth Session of the ICAO Assembly held in Montreal in September 2007 adopted a Resolution to resolve that States and PIRGs complete a regional PBN implementation plan by 2009.

4.2 Recognizing that the PBN concept is now established, States should ensure that all RNAV and RNP operations and procedures are in accordance with the PBN concept as detailed in State letter AN 11/45-07/22 and the ICAO Doc 9613: PBN Manual for ensuring a globally harmonized and coordinated transition of PBN.

4.3 In view of the need for detailed navigation planning, it is advisable to develop a Regional PBN Plan to provide proper guidance to air navigation service providers, airspace operators and users, regulating agencies, and international organizations, on the evolution of navigation capabilities as one of the key systems supporting air traffic management, and which describes the RNAV and RNP navigation applications that should be implemented in the short and medium term in the APAC Region.

4.4 Furthermore, the Asia/Pacific Regional PBN Implementation Plan will contain the basic material serving as guidance for regional projects for the implementation of air navigation infrastructure, such as ABAS, SBAS, GBAS, GRAS, etc., as well as for the development of national implementation plans.

Roles of Navigation in supporting ATM operations

4.5 An "airspace concept" may be viewed as a general vision or master plan for a particular airspace. Based on particular principles, an airspace concept is geared towards specific objectives. Strategic objectives drive the general vision of the airspace concept. These objectives are usually identified by

airspace users, air traffic management (ATM), airports as well as environmental and government policy. It is the function of the airspace concept and the concept of operations to respond to these requirements. The strategic objectives which most commonly drive airspace concept are safety, capacity, efficiency, access, and the environment.

4.6 Navigation is one of several enablers of an airspace concept. Communications, ATS Surveillance and ATM are also essential elements of an airspace concept.

4.7 The PBN–concept specifies RNAV and RNP system performance requirements in terms of accuracy, integrity, availability, continuity and functionality needed for the proposed operations in the context of a particular Airspace Concept, when supported by the appropriate navigation infrastructure. In that context, the PBN concept represents a shift from sensor-based to performance-based navigation. Performance requirements are identified in navigation specifications which also identify the choice of navigation sensors and equipment that may be used to meet the performance requirements. These navigation specifications are defined at a sufficient level of detail to facilitate global harmonization by providing specific implementation guidance for States and operators.

4.8 Under the PBN concept, the generic navigation requirements are defined based on operational requirements. Thus, users may evaluate the available options. To ensure synchronization of investment and interoperability of the airborne and ground systems, the selection of the solution should be in consultation with aviation stakeholders, including international and domestic airline operators, air navigation service providers, and regulators. The solution selected should also be the most cost-effective one.

4.9 The development of the PBN concept recognized that advanced aircraft RNAV systems are achieving an enhanced and predictable level of navigation performance accuracy which, together with an appropriate level of functionality, allows a more efficient use of available airspace to be realized. It also takes account of the fact that RNAV systems have developed over a 40-year period and as a result there were a large variety of differing implementations globally. Identifying navigation requirements rather than on the means of meeting the requirements will allow use of all RNAV systems meeting these requirements irrespective of the means by which these are met.

Benefits of Performance-Based Navigation

4.10 The main benefits derived from the implementation of PBN are:

a) Increased airspace safety through the implementation of continuous and stabilized descent procedures using vertical guidance;
b) Reduced aircraft flight time due to the implementation of optimal flight paths, with the resulting savings in fuel, noise reduction, and enhanced environmental protection;
c) Use of the RNAV and/or RNP capabilities that already exist in a significant percentage of the aircraft fleet flying in APAC airspace;
d) Improved airport and airspace arrival paths in all weather conditions, and the possibility of meeting critical obstacle clearance and environmental requirements through the application of optimized RNAV or RNP paths;
e) Implementation of more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows;
f) Reduced delays in high-density airspaces and airports through the implementation of additional parallel routes and additional arrival and departure points in terminal areas;
g) Reduction of lateral and longitudinal separation between aircraft to accommodate more traffic;
h) Decrease ATC and pilot workload by utilizing RNAV/RNP procedures and airborne capability and reduce the needs for ATC-Pilot communications and radar vectoring;
i) Increase of predictability of the flight path.

Goals & Objectives of PBN Implementation

4.11 APANPIRG, in its Eighteenth meeting (September 2007), discussed various issues related to an early implementation of PBN in the region. To facilitate coordination between States, a PBN Task Force was formed under Conclusion 18/52 and tasked to develop a harmonized regional PBN implementation plan.

4.12 The Asia/Pacific Regional PBN Implementation Plan has the following strategic objectives:

a) To ensure that the implementation of the navigation item of the CNS/ATM system is based on clearly established operational requirements.
b) To avoid undue equipage of multiple on board equipment and/or ground-based systems.
c) To avoid the need for multiple airworthiness and operational approvals for intra- and inter-regional operations.
d) To explain in detail the contents of the Regional Air Navigation Plan, relating to potential navigation applications.

4.13 Furthermore, the Asia/Pacific Regional PBN Implementation Plan will provide a high-level strategy for the evolution of the navigation applications to be implemented in the APAC Region in the short term (2008-2012) and medium term (2013-2016). This strategy is based on the concepts of Area Navigation (RNAV) and Required Navigation Performance (RNP) in accordance with ICAO Doc. 9613: *Performance Based Navigation Manual*, and will be applied to aircraft operations involving instrument approaches, standard departure (SID) routes, standard arrival (STAR) routes, and ATS routes in oceanic and continental areas.

4.14 The Regional PBN Plan was developed by the APAC States together with the international organizations concerned (including IATA and IFALPA)~~,~~ and is intended to assist the main stakeholders of the aviation community plan a gradual transition to the RNAV and RNP concepts. The main stakeholders of the aviation community that benefit from this Regional Plan are:

- Airspace operators and users.
- Air navigation service providers.
- Regulating agencies.
- International organizations.

4.15 The Regional PBN Plan is intended to assist the main stakeholders of the aviation community plan the future transition and their investment strategies. For example, airlines and operators can use this Plan to derive future equipage and additional navigation capability investments; air navigation service providers can plan a gradual transition for the evolving ground infrastructure. Regulating agencies will be able to anticipate and plan for the criteria that will be needed in the future.

4.16 Recognizing the safety benefits of PBN, the thirty-sixth session of the ICAO Assembly held in Montreal, September 2007 adopted a Resolution to resolve that States and PIRGs prepare ~~a~~ PBN implementation plans by 2009 to achieve:

a) Implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones; and
b) Implementation of APV (Baro-VNAV and/or augmented GNSS) for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014.

The ICAO Assembly also urges that States include in their PBN implementation plan provisions for implementation of APV to all runway ends serving aircraft with a maximum certificated take-off mass of 5700 kg or more, according to established timelines and intermediate milestones.

Planning Principles

4.17 Planning for the implementation of PBN in the APAC Region shall be based on the following principles:

a) Pre- and post-implementation safety assessments will be conducted in accordance with ICAO provisions to ensure the application and maintenance of the established target levels of safety.
b) Continued application of conventional air navigation procedures during the transition period, to guarantee the operations by users that are not RNAV and/or RNP equipped.
c) The first regional PBN implementation plan should address the short term (2008-2012) and medium term (2013-2016) and take into account long term global planning issues.
d) Target date for preparation of the first regional PBN implementation plan is APANPIRG/19 (September 2007).

5. PBN Operational Requirements & Implementation Strategy

5.1 Introduction of PBN should be consistent with the Global Air Navigation Plan. Moreover, PBN implementation shall be in full compliance with ICAO SARPs and PANS and support relevant ICAO Global Plan Initiatives.

5.2 The ICAO Council accepted the second amendment to the Global Air Navigation Plan for the CNS/ATM System in November 2006. The approved plan has been renamed as Global Air Navigation Plan (Doc 9750). The relevant Global Plan Initiatives including implementation of performance based navigation (PBN) and navigation system have been included in the Global Plan. The introduction of PBN must be supported by an appropriate navigation infrastructure consisting of an appropriate combination of Global Navigation Satellite System (GNSS), self-contained navigation system (inertial navigation system) and conventional ground-based navigation aids.

5.3 The consolidated *Navigation Strategy for the Asia/Pacific Region was* reviewed and updated by the Twelfth meeting of CNS/MET Sub Group of APANPIRG in July 2008. The updated strategy was reviewed and adopted by APANPIRG in its Nineteen meeting held in September, 2008 under Conclusion 19/31.

Route Operations

5.4 As the routes structure and en-route operation are extensive and complicated in APAC - region, it is difficult to restructure and include the whole airspace in a single implementation plan for en-route operations.

5.5 Considering the traffic characteristics and CNS/ATM capability, en-route operations can be classified as Oceanic, Remote continental, and Continental en-route.

5.6 In principle, each classification of en-route operation (paragraph 5.5 above) should adopt, but not be limited to, a single RNAV or RNP navigation specification. This implementation strategy should be applied by implementing States in coordination with airspace users.

5.7 APANPIRG established the PBN Task Force to develop a PBN implementation plan for the Asia/Pacific Region and to address related regional PBN implementation issues. Accordingly, States are encouraged to work cooperatively bilaterally, multilaterally and with the PBN Task Force to ensure regional and sub-regional harmonization of en-route PBN implementation.

5.8 In areas where operational benefits can be achieved and appropriate CNS/ATM capability exists or can be provided for a more accurate navigation specification than that specified in this plan, States are

encouraged to introduce the more accurate navigation specification on the basis of coordination with stakeholders and affected States.

5.9 Similarly, in circumstances where affected States are agreeable to completing an implementation in advance of the timelines specified in this plan, early implementation is encouraged on the basis of coordination between affected States and airspace users.

TMA Operations

5.10 TMA operations have their own characteristics, taking into account the applicable separation minima between aircraft and between aircraft and obstacles. TMA operations also involve the diversity of aircraft, including low-performance aircraft flying in the lower airspace and conducting arrival and departure procedures on the same path or close to the paths of high-performance aircraft.

5.11 In this sense and as called for under APANPIRG Conclusion 18/53, States shall develop their own national plans for the implementation of PBN in sovereign TMAs. Such national plans should be based on the Asia/Pacific Regional PBN Implementation Plan, seek the harmonization of the application of PBN and avoid the need for multiple operational approvals for intra- and inter-regional operations. Applicable aircraft separation criteria should also be considered.

Instrument Approaches

5.12 States are encouraged to introduce PBN approaches that provide Vertical Guidance to enhance safety. Conventional approach procedures and conventional navigation aids should be maintained to support non-equipped aircraft during the transitional period.

5.13 During early implementation of PBN, IFR Approaches based on PBN should be designed to accommodate a mixed-equipage (PBN and non-PBN) environment. ATC workload should be taken into account while developing approach procedures. One possible way to accomplish this is to co-locate the Initial Approach Waypoint for both PBN and conventional approaches

6. Current Status & Forecast

APAC traffic forecast

6.1 Traffic forecasts have a special role to play in the planning and implementation processes; they represent the demand for future ATM. Global Air Navigation Plan (Doc 9750) requires that the Planning and Implementation Regional Groups (PIRGs) base their work on well developed traffic density forecasts. Guidance on the preparation of traffic forecasts is provided in *Manual on Air Traffic Forecasting* (Doc 8991). At the Asia/Pacific regional level, the traffic forecasting activities were started with the formation of ICAO Pacific Area Traffic Forecasting Group formed in 1991. The scope of the group was subsequently broadened to include Intra-Asia/Pacific traffic also and the group was renamed as Asia/Pacific Area Traffic Forecasting Group (APA TFG).

6.2 Report of the Fourteenth meeting of Asia/Pacific Area Traffic Forecasting Group (APA TFG/14) has been published as Doc 9915. Report includes medium term forecasts of air traffic in the Transpacific area and for selected Transpacific and Asia/Pacific city pair markets through 2012. Report also contains a long term forecast with a horizon to the year 2025 and the short term forecast for the period 2008 – 2010 and intermediate forecasts for each of the years 2015 and 2020. Forecasts are provided for total passenger traffic and aircraft movements and in the case of the aggregate transpacific market also for peak hour movements on selected groups for the year 2012.

6.3 The February 2008 forecast prepared by IATA for APAC traffic in respect of passenger, cargo, aircraft movements and new aircraft deliveries in the Regions is also provided in the Appendix B to this plan as reference.

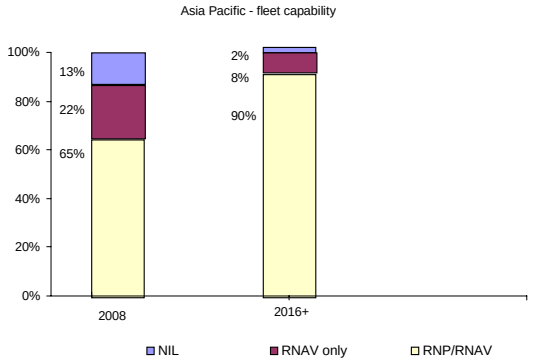
Aircraft fleet readiness status

6.4 2007 was a record year for Asia/Pacific airlines with 418 new aircraft deliveries and more than 1,000 new orders. The overall number of deliveries to Asia/Pacific based airlines in 2008 is expected to total 430 aircraft.

6.5 All major commercial aircraft manufacturers since the 1980's have included RNAV capabilities. The commercial aircraft currently produced incorporate an RNP capability.

6.6 One significant issue for PBN implementation today is directly related to the multitude of FMS installations and varying degrees of capabilities associated with the current fleet of RNAV aircraft. Specifically, there are numerous FMS systems installed in today's fleets, all with varying capabilities.

6.7 The diagram below displays a high level analysis based on fleet numbers from Ascend Online Fleets database March 2008 and RNAV/RNP classification by IATA.



CNS Infrastructure

Navigation infrastructure

Global Navigation Satellite System (GNSS)

6.8 Global Navigation Satellite System (GNSS) is a satellite-based navigation system utilizing satellite signals, such as Global Positioning System (GPS), for providing accurate and reliable position, navigation, and time services to airspace users. In 1996, the International Civil Aviation Organization (ICAO) endorsed the development and use of GNSS as a primary source of future navigation for civil aviation. ICAO noted the increased flight safety, route flexibility and operational efficiencies that could be realized from the move to space-based navigation.

6.9 GNSS supports both RNAV and RNP operations. Through the use of appropriate GNSS augmentations, GNSS navigation provides sufficient accuracy, integrity, availability and continuity to support en-route, terminal area, and approach operations. Approval of RNP operations with appropriate certified avionics provides on-board performance monitoring and alerting capability enhancing the integrity of aircraft navigation.

6.10 GNSS augmentations include Aircraft-Based Augmentation System (ABAS), Satellite-Based Augmentation System (SBAS), Ground-Based Augmentation System (GBAS), and Ground-based Regional Augmentation System (GRAS).

Other PBN navigation infrastructure

6.11 Other navigation infrastructure includes INS, VOR/DME, DME/DME, and DME/DME/IRU. These navigation infrastructures may satisfy the requirements of RNAV navigation specifications, but not those of RNP.

6.12 INS may be used to support PBN en-route operations with RNAV 10 and RNAV 5 navigation specifications.

6.13 VOR/DME may be used to support PBN en-route and STAR operations based on the RNAV 5 navigation specification.

6.14 Uses of DME/DME and DME/DME/IRU may support PBN en-route and terminal area operations based on RNAV 5, RNAV 2 or RNAV 1 navigation specifications. Validation of DME/DME coverage area and appropriate DME/DME geometry should be conducted to identify possible DME/DME gaps, including identification of critical DMEs, and to ensure proper DME/DME service coverage.

Surveillance infrastructure

6.15 For RNAV operations, States should ensure that sufficient surveillance coverage is provided to assure the safety of the operations. For RNP operations, surveillance coverage may not be required. Details on the surveillance requirements for PBN implementation can be found in the ICAO PBN Manual and ICAO PANS-ATM (Doc 4444), and information on the current existing surveillance infrastructure in APAC can be found in ICAO FASID tables.

Communication infrastructure

6.16 Implementation of RNAV/RNP routes includes communication requirements. Details on the communication requirements for PBN implementation can be found in ICAO PANS-ATM (Doc 4444), ICAO RCP Manual (Doc 9869), and ICAO Annex 10. Information on the current existing communication infrastructure in APAC can also be found in ICAO FASID tables.

7. Implementation Plan for Performance Based Navigation

ATM Operational Requirements

7.1 The Global ATM Operational Concept (Doc 9854) makes it necessary to adopt an airspace concept able to provide an operational scenario that includes route networks, minimum separation standards, assessment of obstacle clearance, and a CNS infrastructure that satisfies specific strategic objectives, including safety, access, capacity, efficiency, and environment.

7.2 In this regard, the following programmes will be developed:

a) traffic and cost benefit analyses
b) necessary updates on automation
c) operational simulations in different scenarios
d) ATC personnel training
e) Flight plan processing
f) Flight procedure design training to include PBN concepts and ARINC-424 coding standard
g) Enhanced electronic data and processes to ensure appropriate level of AIS data accuracy, integrity and timeliness
h) WGS-84 implementation in accordance with ICAO Annex 15
i) iuniform classification of adjacent and regional airspaces, where practicable
j) RNAV/RNP applications for SIDs and STARs

k) Coordinated RNAV/RNP routes implementation
l) RNP approach with vertical guidance

Short Term Implementation Plan

Route Operations

7.3 During the planning phase of any implementation of PBN routes, States should gather inputs from all aviation stakeholders to obtain operational needs and requirements. These needs and requirements should then be used to derive airspace concepts and to select appropriate PBN navigation specification.

7.4 In this phase, the application of RNAV 10 and RNP 4 navigation specifications is expected for Oceanic and Remote continental routes. Prior to implementation of RNP 4, States should consider air traffic demands, ATC workload, surveillance and communication capabilities and fleet readiness statistics, and consult all stakeholders.

7.5 For Continental routes, the application of RNAV 5 and RNAV 2 navigation specifications is expected. In the continental en-route areas of operation, States may choose to implement RNAV 2 routes to enhance efficiency of airspace usage and support closer route spacing, noting that appropriate communication and surveillance coverage must be provided. The RNAV 2 navigation specification can also be used in airspace~~,~~ where sufficient CNS capability is provided and there are operational benefits.

TMA Operations

7.6 In selected TMAs, the application of RNAV 1 in a radar environment can be supported though the use of GNSS or ground navigation infrastructure, such as DME/DME and DME/DME/IRU. In this phase, mixed operations (equipped and non-equipped) will be permitted.

7.7 In a non-radar environment and/or in an environment without adequate ground navigation infrastructure, the SID/STAR application of Basic-RNP1 is expected in selected TMAs with exclusive application of GNSS. In this phase, mixed operations (equipped and non-equipped) will be permitted.

Instrument Approaches

7.8 The application of RNP APCH with Baro-VNAV procedures is expected to be implemented in the maximum possible number of airports, commencing primarily with international airports. To facilitate transitional period, conventional approach procedures and conventional navigation aids should be maintained for non-equipped aircraft.

7.9 States should promote the use of APV operations (Baro-VNAV or augmented GNSS) to enhance safety and accessibility of RNP approaches.

7.10 The application of RNP AR APCH procedures should be considered in selected airports, where obvious operational benefits can be obtained due to the existence of significant obstacles.

Summary table & Implementation targets

Short Term (2008-2012)*		
Airspace	**Preferred Nav. Specifications**	**Acceptable Nav. Specifications**
Route – Oceanic	RNP 4	RNAV 10
Route – Remote continental	RNP 4	RNAV 10
Route – Continental en-route	RNAV 2, RNAV 5	
TMA – Arrival	RNAV 1 in radar environment and with adequate navigation infrastructure. Basic-RNP 1 in non-radar environment	
TMA – Departure	RNAV 1 in radar environment and with adequate navigation infrastructure. Basic-RNP 1 in non-radar environment	
Approach	RNP APCH with Baro-VNAV in most possible airports RNP AR APCH in airport where there are obvious operational benefits.	

Implementation Targets

- RNP APCH (with Baro-VNAV) in 30% of instrument runways by 2010 and 50% by 2012 and priority should be given to airports with operational benefits
- RNAV 1 SID/STAR for 50% of international airports by 2010 and 75% by 2012 and priority should be given to airports with RNP Approach
- Re-defining existing RNAV/RNP routes into PBN navigation specification by 2012
- Implementation of additional RNAV/RNP routes

*** Note:** Early completion of an implementation is encouraged within the timeframe on the basis of coordination between affected States and airspace users.

Medium Term Implementation Plan

Route Operations

7.11 Noting the current development of route spacing standards for RNAV 1, RNAV 2, RNP 2, in this phase, it is expected that the implementations of all existing RNAV/RNP routes are consistent with PBN standards. States are encouraged~~,~~ to harmonize their RNAV/RNP routes based on consistent PBN navigation specifications and separation standards. Implementations of additional RNAV/RNP routes are also encouraged.

7.12 With the utilization of ADS and CPDLC, the application of RNP routes in the Oceanic and Remote continental airspace in the APAC Region is expected. This will permit the use of smaller lateral and longitudinal separation, such as 30 NM based on the RNP 4 navigation specification. States should also consider the fleet readiness status during their planning.

7.13 Noting the current development of RNP 2 navigation specification, in this phase, the application of RNP 2 is expected for the continental en-route airspace with high air traffic density. Depending on the sufficiency of DME/DME coverage or GNSS availability, States may consider the use of RNAV 2 navigation specification.

7.14 In this phase, the establishment of a backup system in case of GNSS failure or the development of contingency procedures will be necessary.

TMA Operations

7.15 Noting the current development of Advanced RNP 1 navigation specification, in this phase, it is expected that the application of RNAV 1 or RNP 1 will be expanded in selected TMAs. The application of RNAV 1/RNP 1 will also depend on DME/DME infrastructure, GNSS availability and aircraft navigation capability. In TMAs of high air traffic complexity and movement, the use of RNAV 1 or RNP 1 equipments will be mandatory. In TMAs of less air traffic complexity, mixed operations will be permitted (equipped or non-equipped).

Instrument Approaches

7.16 In this phase, the extended application of RNP APCH with Baro-VNAV or APV in most airports is expected. These applications may also serve as a back-up to precision approaches and provide vertical guided approaches for the runways without precision approach capability.

7.17 The extended application of RNP AR Approaches is expected for airports where there are operational benefits.

7.18 The introduction of application of landing capability using GNSS and its augmentations is expected to guarantee a smooth transition toward high-performance approach and landing capability.

Summary table & Implementation targets

Medium Term (2013-2016)*		
Airspace	**Preferred Nav. Specification**	**Acceptable Nav. Specification**
Route – Oceanic	RNP 2**, RNP 4	RNAV 10
Route – Remote continental	RNP 2	RNAV 2, RNP 4, RNAV 10
Route – Continental en-route	RNAV 1, RNP 2	RNAV 2, RNAV 5
TMA – Arrival	Expand RNAV 1 or RNP 1 application Mandate RNAV 1 or RNP 1 approval for aircraft operating in higher air traffic density TMAs	
TMA – Departure	Expand RNAV 1 or RNP 1 application Mandate RNAV 1 or RNP 1 approval for aircraft operating in higher air traffic density TMAs	
Approach	Expansion of RNP APCH (with Baro-VNAV) and APV Expansion of RNP AR APCH where there are operational benefits Introduction of landing capability using GNSS and its augmentations	
Implementation Targets • RNP APCH with Baro-VNAV or APV in 100% of instrument runways by 2016 • RNAV 1 or RNP 1 SID/STAR for 100% of international airports by 2016 • RNAV 1 or RNP 1 SID/STAR for 70% of busy domestic airports where there are operational benefits • Implementation of additional RNAV/RNP routes		

*** Note 1:** In circumstances where affected States are agreeable to completing an implementation in advance of the timeline, early implementation is encouraged on the basis of coordination between affected States and airspace users.

** **Note 2:** Related CNS requirements and operational procedures for RNP 2 application in Oceanic Airspace are yet to be determined.

Long Term Implementation Strategies (2016 and beyond)

7.19 In this phase, GNSS is expected to be a primary navigation infrastructure for PBN implementation. States should work co-operatively on a multinational basis to implement GNSS in order to facilitate seamless and inter-operable systems and undertake coordinated research and development programmes on GNSS implementation and operation.

7.20 Moreover, during this phase, States are encouraged to consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance.

7.21 With the expectation that precision approach capability using GNSS and its augmentation systems will become available, States are encouraged to explore the use of such capability where there are operational and financial benefits.

8. Transitional Strategies

8.1 During transition to PBN, sufficient ground infrastructure for conventional navigation systems must remain available to serve non-equipped flights. Before existing ground infrastructure is considered for removal, users should be given reasonable transition time to allow them to equip appropriately to attain equivalent PBN-based navigation performance. States should approach removal of existing ground infrastructure with caution to ensure that safety is not compromised. Performance of safety assessments and consultation with users through regional air navigation planning processes will be necessary.

8.2 States should coordinate to ensure that harmonized separation standards and procedures are developed and introduced concurrently in all flight information regions along major traffic flows to allow for a seamless transition towards PBN.

8.3 States should cooperate on a multinational basis to implement PBN in order to facilitate seamless and inter-operable systems and undertake coordinated research and development programmes on PBN implementation and operation.

8.4 States are encouraged to consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance**,** taking due consideration of the needs of State aircraft.

8.5 States should encourage operators and other airspace users to equip with PBN-capable avionics. This can be achieved through early introductions of RNP approaches, preferably those with vertical guidance.

8.6 ICAO Asia-Pacific Regional Office should provide leadership supporting implementation and transition towards PBN.

9. Safety Assessment & Monitoring Requirements

Need for a safety assessment

9.1 To ensure that the introduction of PBN applications within the Asia/Pacific Region is undertaken in a safe manner, in accordance with relevant ICAO provisions implementation shall only take place following conduct of a safety assessment by the implementing State or group of States that demonstrates that an acceptable level of safety will be met. This assessment may also need to demonstrate that residual levels of risk associated with specific PBN implementations are acceptable. Additionally, after implementation ongoing periodic safety reviews shall be undertaken by the implementing State or group of States, where required, in order to establish that operations continue to meet acceptable levels of safety.

En-route safety assessment and monitoring

9.2 When considering en-route PBN implementations, the ICAO *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444, Chapter 5, Section 5.4) contains procedures and RNAV procedural separation minima for use in the separation of aircraft in the en-route phase. In some cases, these separation minima require specific RNP capabilities and are based on collision risk modelling which determines communications and surveillance requirements. However, this modelling does not include all operational and technical aspects and is dependent upon parameter values that may vary depending on the particular airspace where the separation minimum will be applied. Therefore, prior

to implementation, a system verification of sufficient duration and integrity must be performed to assess such parameters and conditions including weather deviations or other contingency events for the airspace concerned and to demonstrate that operational and technical requirements will be met.

9.3 APANPIRG has established the Regional Airspace Safety Monitoring Advisory Group (RASMAG) to facilitate the airspace safety monitoring aspects for implementations of reduced separation minima and CNS/ATM applications within the Asia and Pacific Regions. RASMAG has adopted the term En-route Monitoring Agency (EMA) to describe an organization providing airspace safety assessment, monitoring and implementation services for international airspace in the Asia/Pacific region to assist the implementation and operation of reduced horizontal (lateral and longitudinal) separation minima. To ensure regional harmonization of en-route safety assessment requirements and methodologies, implementing States are encouraged to work cooperatively with RASMAG who will provide guidance and technical assistance to States to support their en-route PBN implementations.

Undertaking a safety assessment

9.4 The implementing State or group of States shall ensure that a safety assessment and, where required, ongoing monitoring of PBN implementations are conducted. The implementing State or group of States may have the capability to undertake such activities or, in the case of en-route implementations, may seek assistance from an En-route Monitoring Agency. The latter course of action is preferred as an EMA can establish the necessary monitoring and data collection activity in an effective manner for the international airspaces in which the EMA holds responsibility.

9.5 In undertaking a safety assessment to enable en-route implementation of PBN, a State authority or EMA shall:

1) Establish and maintain a database of PBN approvals;
2) Pre-implementation - conduct safety and readiness assessments and, for international implementations, report results to RASMAG;
3) Post-implementation - maintain awareness of data link performance and monitor aircraft horizontal-plane navigation performance and the occurrence of large navigation errors (lateral and longitudinal), implement remedial actions as necessary and, for international implementations, report results to RASMAG;
4) Monitor operator compliance with State approval requirements after PBN implementation;
5) Initiate necessary remedial actions in any instances where PBN requirements are not met.

9.6 Detailed information relating to the international airspace jurisdiction, roles and responsibilities of regional EMAs is contained in the *Asia/Pacific En-route Monitoring Agency Handbook*, which is available from the ICAO Asia/Pacific Regional Office.

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Appendix A – CHANGES TO THE ASIA/PACIFIC REGIONAL PBN IMPLEMENTATION PLAN

Whenever a need is identified for a change to this document, the Request for Change (RFC) Form (see below) should be completed and submitted to the ICAO Asia and Pacific Regional Office. The Regional Office will collate RFCs for consideration by the Performance Based Navigation Task Force (CNS/MET Sub-group of APANPIRG).

When an amendment has been agreed by a meeting of the Performance Based Navigation Task Force then a new version of the PBN Regional Plan will be prepared, with the changes marked by an "|" in the margin, and an endnote indicating the relevant RFC, so a reader can see the origin of the change. If the change is in a table cell, the outside edges of the table will be highlighted; e.g.:

Final approval for publication of an amendment to the PBN Regional Plan will be the responsibility of APANPIRG.

PBN Regional Plan REQUEST FOR CHANGE FORM

RFC Nr:	

Please use this form when requesting a change to any part of this PBN Regional Plan. This form may be photocopied as required, emailed, faxed or e-mailed to ICAO Asia and Pacific Regional Office +66 (2) 537-8199 or icao_apac@bangkok.icao.int

1. SUBJECT:		
2. REASON FOR CHANGE:		
3. DESCRIPTION OF PROPOSAL: [expand / attach additional pages if necessary]		
4. REFERENCE(S):		
5. PERSON INITIATING:		**DATE:**
ORGANISATION:		
TEL/FA/X/E-MAIL:		

6. CONSULTATION		**RESPONSE DUE BY DATE:**	
Organization	**Name**	**Agree/Disagree**	**Date**

7. ACTION REQUIRE :	
8. PBN REGIONAL PLAN EDITOR	**DATE REC'D :**
9. FEEDBACK PASSED	**DATE :**

AMENDMENT RECORD

Amendment Number	Date	Amended by	Comments

Appendix B – IATA Traffic Forecast

"By 2010 Asia will be the largest single market for aviation" - IATA 27th Feb 2008. Globally predicted passenger traffic will rise by 4.9 per cent per year between 2007 and 2026, almost trebling in two decades as jet planes got bigger and more people flew on them. Meanwhile airfreight will rise by 5.8 per cent annually in the same period.The greatest demand will come from the Asia-Pacific region, where airlines will take delivery of 31 per cent of new planes in the next 20 years, compared with 24 per cent for Europe and 27 per cent for North America.

Passenger
Asia Pacific airlines saw a marginal drop in demand growth from 6.2 per cent in December 2007 to 5.7 per cent in January 2008. Currently, airlines in the region benefited from increased competitiveness due to the strong Euro and the booming economies of both India and China.

Cargo
Steady year-on-year airfreight growth of 4.5 per cent was recorded in January 2008. In the larger freight markets there is continued strength. Asia Pacific airlines saw demand increase 6.5 per cent, up from 6 per cent in December 2007, boosted by the booming economies in China and India.

For the period 2002-2020 aircraft movements are expected to increase at an annual growth rate of 5.4 per cent, to reach almost 294 thousand aircraft movements by the year 2020. Average annual growth rates of 6.5, 5.7 and 5.2 per cent are forecast for the periods 2005 - 2010, 2010-2015 and 2015 - 2020, respectively.

TRANSPACIFIC PASSENGER FORECAST			
Average Annual Percentage Growth Rates			
	Low	Medium	High
2005-2010	5.3	6.5	7.8
2010-2015	4.5	5.7	7.0
2015-2020	4.0	5.2	6.5
2002-2020	4.1	5.4	6.7

The Intra-Asia/Pacific passenger aircraft movements are expected to increase at an average annual growth rate of 4.6 per cent to the year 2020. The growth rates for the intermediate periods of 2005-2010, 2010-2015 and 2015-2020 are 5.0, 4.3 and 4.2 per cent, respectively.

INTRA ASIA /PACIFIC AIRCRAFT MOVEMENT FORECAST			
Average Annual Percentage Growth Rates			
	Low	Medium	High
2005-2010	3.6	5.0	5.5
2010-2015	3.1	4.3	5.2
2015-2020	3.1	4.2	5.2
2002-2020	3.3	4.6	5.6

New Aircraft Deliveries by Region
Record new aircraft orders were placed by the airline industry in 2005 – 2007. The large numbers of new orders represent strong confidence in the future prospects of the global airline industry. In its

latest forecast of aviation growth, European aircraft maker Airbus said the world's fleet of large passenger jets (of more than 100 seats) would double in the next 20 years to nearly 33,000. The greatest demand will come from the Asia-Pacific region, where airlines will take delivery of 31 per cent of new planes in the next 20 years, compared with 24 per cent for Europe and 27 per cent for North America.

New Aircraft Deliveries by Region	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012+**
	Existing						
Africa	**665**	**26**	**15**	**20**	**16**	**13**	**28**
Asia Pacific	**3,578**	**329**	**428**	**407**	**344**	**267**	**440**
Europe	**5,301**	**292**	**348**	**364**	**251**	**153**	**297**
Latin America/Caribbean	**1,031**	**93**	**91**	**45**	**66**	**43**	**65**
Middle East	**626**	**41**	**57**	**44**	**36**	**27**	**164**
North America	**6,987**	**240**	**293**	**309**	**222**	**163**	**412**
Total	**18,188**	**1,026**	**1,237**	**1,208**	**944**	**679**	**1,551**
Increase in Global aircraft fleet (%)	**4.2**	**4.9**	**4.6**	**4.9**	**3.4**	**2.4**	**2.4**

Appendix C - Reference documentation for developing operational and airworthiness approval

- *General Guidelines for Obtaining Airworthiness and Operational Approvals for PBN Navigation Specifications, Version 1.0*, **International Air Transport Association**, August 2008. (URL - http://www2.icao.int/en/pbn/ICAO%20Documentation/State%20and%20International%20Organization%20Publications/IATA%20Guidelines%20for%20PBN%20Operational%20Approval.pdf**)**

Appendix D – Practical Example of tangible benefits

Practical examples of tangible benefits derived from the implementation of PBN are:

- Increased airspace safety through the implementation of continuous and stabilized descent procedures using vertical guidance;
- Provision of runway-aligned final approach path which may not be possible from conventional navigation
- Reduced aircraft flight time due to the implementation of optimal flight paths, with the resulting savings in fuel, noise reduction, and enhanced environmental protection;
- Improved airport and airspace arrival paths in all weather conditions, and the possibility of meeting critical obstacle clearance and environmental requirements through the application of optimized RNAV or RNP paths;
- Implementation of more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows;
- Reduced delays in high-density airspaces and airports through the implementation of additional parallel routes and additional arrival and departure points in terminal areas;
- Reduction of lateral and longitudinal separation between aircraft to accommodate more traffic;
- Decrease ATC and pilot workload by utilizing RNAV/RNP procedures and airborne capability and reduce the needs for ATC-Pilot communications and radar vectoring;
- Increase of predictability of the flight path.
- Reduction of maintenance and flight inspection costs associated with conventional navigation aids

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 will equip aircraft to support PBN operations;

c) GNSS will be the predominant navigation sensor;

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

e) Augmented GNSS will support Category I operations by end 2009 and Category II and III operations by 2015;

f) in the Asia/Pacific Region, ILS is capable of meeting the majority of requirements for precision approach and landing;

g) MLS CAT III is operational;

h) the need to maintain aircraft interoperability both within the Region and between the Asia/Pacific Region and other ICAO regions and to provide flexibility for future aircraft equipage.

Strategy

a) transit to PBN operations as follows :-

i) RNP10/RNP4 for Oceanic and Remote Continental routes;
ii) RNAV5/RNAV2 for Continental En-route;
iii) RNAV1, RNAV2 and Basic RNP1 based arrivals and departure;
iv) APV **;
v) Precision approaches at selected runways.

with respective end states as follows:

vi) RNP4 for Oceanic and Remote Continental routes;
vii) RNP1/RNP2 for Continental En-route;
viii) RNP1 and RNP0.3 based arrivals and departure;
ix) APV **;
x) Precision approaches at selected runways.

Note: Ideally, e~~E~~nd-state should follow the above process but may be achieved directly without transitting through the immediate phases (i.e. (i) to (v)), if considered safe to do so.

b) retain ILS as an ICAO standard system for as long as it is operationally acceptable & economically beneficial;

c) implement GNSS with augmentation as required for APV and precision approach operations where operationally required and economically beneficial;

d) implement the use of APV operation in accordance with ICAO's requirement;

** APV includes BARO-VNAV, RNP, RNP-AR, APV 1 & 2

e) protect all the Aeronautical Radio Navigation Service (ARNS) frequencies; and

f) ensure civil-military interoperability.

** APV includes BARO-VNAV, RNP, RNP-AR, APV 1 & 2

UPDATED ADS-B SUBJECT/TASKS LIST

No.	Subject/Tasks List	Associated with Strategic Objective	Associated GPI	Deliverables	Target Date	Action to be taken and led by
1	Conduct study and present a paper on a study for the use of ADS-B technology in airspace in the North Asia.	D. Efficiency	GPI01/02/05/06/07/09/ 14/16/17/21/22	Report of study for the use of ADS-B in North Asia area	Completed (04/2008)	IATA
2	Report Organizational Policy on ADS-B data sharing with neighbors.	A. Safety D. Efficiency	GPI01/02/05/06/07/09/ 10/11/14/16/17/21/22	Status report	Completed (04/2008)	All Members
3	Each State report on the number of airframes fitted and transmitting with good NUC/NIC.	D. Efficiency	GPI01/05/06/09/14/16/ 17/21/22	Report on statistics conducted	10/2009	All Members with Ground Stations
4	Develop draft comparison of surveillance technologies document including required site and network architecture, expected surveillance coverage, cost of system.	D. Efficiency	GPI01/02/05/06/07/09/ 14/16/17/21/22	A regional guidance material for implementation	Completed (4/2007)	Greg Dunstone
5	Develop draft update to AIGD to incorporate multilateration.	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	The second amendment to the AIGD	Completed (4/2007)	Nick King, Chainan Chaisompong & Howard Anderson
6	Provide a paper with an update on available equipment standards: (ARINC, Eurocae, RTCA, ICAO, TSO)	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	An information document for implementation	10/2009	USA- seek updates from Home
7	Develop a table detailing readiness of Airspace users & ATS providers.	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Report of a survey conducted	Completed (4/2007)	Singapore
8	Provide details of potential areas (FIRs) that where there is a positive cost/benefit for near term implementation of ADS-B Out	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Report of result of studies	Completed (4/2008)	All -Corner meetings

No.	Subject/Tasks List	Associated with Strategic Objective	Associated GPI	Deliverables	Target Date	Action to be taken and led by
9	Develop a paper on how Probability of detection should be reported for ADS-B so that it can be compared to radar probability of detection	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Guidance material for implementation	Completed (4/2008)	
10	Develop guidelines on how ADS-B equipage should be reported in future, especially the definition of "equipped".	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Guidelines for implementation	Completed (4/2008)	Greg Dunstone
11	Develop outline of the performance criteria and identify issues to be considered when introducing ADS-B into an Air Traffic Control multi-sensor fusion process	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Guidance material for implementation	Completed (4/2008)	Rick Castaldo, Greg Dunstone Michel G. Procoudine
12	Deveop brief guidance paper on security issues associated with ADS-B	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Guidance material for implementation	Completed (4/2008)	Patrick Souchu, Greg Dunstone, Mike Gahan
13	Exam the feasibiity of the use of ADS-B for height monitoring	A. Safety	GPI01/05/06/09/ 14/16/17/21/22	Result of feasibility study - Advice on ADS-B capability to RVSM Groups.	Completed the advice material (4/2008)	TBD
14	Guidance material on how to build safety case for delivery of separation services.	Safety	GPI01/05/06/09/ 14/16/17/21/22	Guidance material for implementation	Apr-10	Australia
15	Guidance material on display of ADS_B tracks on displays.	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Guidelines for implementation	Apr-10	Australia
16	Sample mandate material defining ADS-B avionics including the positional data source including task by 45th DGCA Conference.	A. Safety	GPI01/05/06/09/ 14/16/17/21/22	Guidance material for implementation	Apr-10	Australia
17	Guidance on legal liability issues for ADS-B data sharing.	A.Safety	GPI01/05/06/09/ 14/16/17/21/22	Guidance material for implementation	Apr-10	U.S.A.
18	Develop and implement regional collaboration project for ADS-B Out operational use including data sharing in SEA and report on implementation progress	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Sub-regional ADS-B collaboration project has been .	Jul-08/ Dec-10	SEA WG

No.	Subject/Tasks List	Associated with Strategic Objective	Associated GPI	Deliverables	Target Date	Action to be taken and led by
19	Develop and implement regional collaboration project for ADS-B out operational use including data sharing in South Pacific and report on implementation progress	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Develop and implement sub-regional ADS-B collaboration project.	Apr-09/ Dec-11	South Pacific States
20	Develop common compliance procedures for regulatory surveillance of ADS-B avionics installations and operation.	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Sample document	Completed (5/2009)	Australia
21	Study application of ADS-B and multilat for precision runway monitoring.	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Guidance material for implementation	Apr-10	All Members
22	Perform data collection and data analyis of ADS-B messages to examine GPS performance in different geographic areas.	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Report of data collected and analyzied - continous	Apr-10	All Members
23	Provide feedback to the proposed amendment to sample service agreement for datasharing	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Comments	April-10	All Members
24	Develop and implement regional collaboration project for ADS-B out operational use including data sharing in Bay of Bengal area and report on implementation progress	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Develop and implement sub-regional ADS-B collaboration project	Apr-09/ Dec-11	Bay of Bengal States
25	Working Paper for CNS/MET/SG/13 on the need for global harmonized equipage requirements for ADS-B surveillance service in NRA	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Working Paper	June-09	member from USA
26	Provide feedback to the proposed amendment and template for datasharing based on experience gained by Indonesia and Signapore (Appendix H to the report)	D. Efficiency	GPI01/05/06/09/ 14/16/17/21/22	Comments	April-10	All Members

ASIA/PAC FASID **4A-4-1**

TABLE CNS-4 A – SURVEILLANCE SYSTEMS

Explanation of the Table

Column

1	Name of country and location of the facility or FIR
2	Air Traffic Services Unit served by the facility
3	PSR – Primary Surveillance Radar
4	Coverage of Primary Surveillance Radar in nautical miles
5	SSR – Secondary Surveillance Radar and Modes implemented will be indicated within Brackets, namely Mode A, C & S
6	Coverage of Secondary Surveillance Radar and/or ADS-B in nautical miles
7	ADS-B Automatic Dependent Surveillance Broadcast
8	ADS-C Automatic Dependent Surveillance Contract
9	SMR – Surface Movement Radar
10	A-SMGCS – Advanced Surface Movement Guidance and Control System
11	PAR – Precision Approach Radar
12	Remarks

Note:

The following codes are used in columns 3, 5, 7, 8, 9, 10, 11 and 12

I - required and implemented
for column 5, I - stands for implementation using conventional SSR while
MI - stands for implementation using Monopulse SSR
X - required but not implemented status not determined
N - required but not implemented
A - existing facility provided to supplement or substitute the requirement
F - future Plan
< - year planned commissioning year to be used as appropriate in conjunction with ‘F’ & ‘N’
> - year planned decommissioning year to be used as appropriate in conjunction with ‘A’ & ‘I’

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
AUSTRALIA											
Hans Tableland	Cairns ~~ACC~~ TUC ~~Cairns APP~~ ~~Cairns TWR~~ Brisbane EC			MI(A/C)>14 MI (ACS) F<14	250	250 F<10					
Redden Creek	CairnsACC Cairns APP Cairns TWR	I	50	MI(A/C)>08 MF(A/C/S)F<10	250	250F<12					
Tabletop	Brisbane ACC			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Swampy Ridge	Brisbane ACC			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Mount Alma	Brisbane ACC			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Mount Hardgrave	Brisbane ACC Coolangatta APP Coolangatta TWR			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Brisbane Airport	Brisbane APP Brisbane TWR	I	50	MI(A/C)>08 MF(A/C/S)<10	250	250 F<12					
Mount Sommerville	Coolangatta APP Coolangatta TWR	I	50	MI(A/C/S	250	250 F<12					
Round Mountain	Brisbane ACC Sydney APP			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Mount Boyce	Melbourne ACC Sydney APP Brisbane ACC Melbourne ACC			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Sydney Airport	Sydney APP Sydney TWR	I	50	MI(A/C)>08 MF(A/C/S)<10	250	250F<12		I			

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Mount Majura	Canberra APP Canberra TWR	I	50	MI(A/C)>08 MF(A/C/S)F<10	250	250F<12					in Melbourne
Mount Bobbara	Melbourne ACC (in Melbourne) Canberra APP Canberra TWR			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Mount Macedon	Melbourne ACC Melbourne APP Melbourne TWR			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Gellibrand Hill	Melbourne ACC Melbourne APP Melbourne TWR	I	50	MI(A/C/S)	250	250F<12					
Summertown	Adelaide ACC Adelaide APP Adelaide TWR Melbourne ACC			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Adelaide Airport	Adelaide ACC Adelaide APP Adelaide TWR	I	50	MI(A/C)>08 MF(A/C/S)F<10	250	250 F<12					
Kalamunda	Perth ACC Perth APP Perth TWR			MI(A/C)>14 MI(ACS)F<14	250	250 F<10					
Perth Airport	Perth ACC Perth APP Perth TWR	I	50	MI(A/C)>08 MF(A/C/S)F<10	250	250F<12					
Darwin (military ATC facility)	Brisbane ACC			MI(A/C)	160						SSR data only
Tindal (military ATC facility)	Brisbane ACC			MI(A/C)	250						SSR data only

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Oakey (military ATC facility)	Brisbane ACC			MI(A/C)	250						SSR data only
East sale (military ATC facility)	Melbourne ACC			MI(A/C)	250						SSR data only
Darwin	Brisbane ACC			MI(A/C)>14 MI(ACS) F<14	250	250 F<10					
Bundaberg	Brisbane ACC				250	I					
Balgo Hill	Brisbane ACC				250	FF<2009					
Caiguna	Melbourne ACC				250	I					
Doongan	Brisbane ACC				250	FF<2009					
Esperance	Melbourne ACC				250	I					
Jackson	Brisbane ACC				250	FF<2009					
Thursday Island	Brisbane ACC				250	I					
Ayers Rock AP	Melbourne ACC				250	FF<2009					
Birdsville	Melbourne ACC				250	FF<2009					
Broken Hill	Melbourne ACC				250	I					
Mornington Island	Brisbane ACC				250	FF<2009					
West Gap (Alice Springs)	Brisbane ACC				250	I					
Warburton	Melbourne ACC				250	FF<2009					
Broome	Brisbane ACC				250	FF<2009					
Leonora	Brisbane ACC				250	I					
Longreach	Brisbane ACC				250	I					
Telfer	Brisbane ACC				250	I					
Meekatharra	Brisbane ACC				250	I					
~~Mount Barrow~~	~~Melbourne ACC~~				~~250~~	~~F<2006~~					

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Mount Isa (DCA Hill)	Brisbane ACC				250	FF<2009					
Newman	Brisbane ACC				250	I					
Oodnadatta	Brisbane ACC				250	FF<2009					
Tennant Creek	Brisbane ACC				250	I					
Karratha	Brisbane ACC				250	I					
Billabong	Melbourne ACC				250	I					
Gove	Melbourne ACC				250	FF<2009					
~~Mount Oxley~~	~~Melbourne ACC~~				~~250~~	~~F<2006~~					
~~Mount Rumney~~	~~Melbourne ACC~~				~~250~~	~~F<2006~~					~~Near Hobart in Tasmania~~
Bourke	Melbourne ACC				250	I					
Nullabor	Melbourne ACC				250	FF<2009					
Woomera	Melbourne ACC				250	I					
TAS WAM Multilat	Melbourne ACC				100	FF<2009					MLAT F<2010
Sydney Airport	Sydney TCU				40	F<2010				I	MLAT F<2010
BANGLADESH Dhaka	Dhaka APP			I(A/C)	200						
BHUTAN											
BRUNEI DARUSALAM Brunei Airport	Brunei APP	I	80	I(A/C)	250						
CAMBODIA				I(A/C)	250						VDPP 2011, VDSV 2010
CHINA Beijing-1	Beijing TWR Beijing APP			MI(A/C)	200						Mode S when required

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Beijing-2	Beijing ACC Beijing TWR Beijing APP Beijing ACC	I	60	MI(A/C)	200						
Beijing-3	Beijing TWR Beijing APP Beijing ACC	I	200	MI(A/C)	250						
Tianjin	Tianjin TWR			MI(A/C)	200						
Shijiazhuang	Shijiazhuang TWR Beijing ACC			MI(A/C)	200						
Taiyuan	Taiyuan TWR Taiyuan ACC	I	60	MI(A/C)	200						
Hohhot	Hohhot TWR, ACC			MI(A/C)	200						
Manbanshan	Hohhot ACC			MI(A/C)	200						
Sunite	Hohhot ACC			MI(A/C)	200						
Guangzhou-1	Guangzhou TWR Guangzhou APP Guangzhou ACC	I	60	MI(A/C)	200						
Guangzhou-2	Guangzhou TWR Guangzhou APP Guangzhou ACC	I	60	MI(A/C)	200						
Guangzhou-3	Guangzhou TWR Guangzhou APP Guangzhou ACC			MI(A/C)	200						
Shenzhen	Shenzhen TWR Guangzhou APP Guangzhou ACC	I	60	MI(A/C)	200						
Shaoguan	Guangzhou ACC			MI(A/C)	200						
Zhuhai	Zhuhai TWR Zhuhai APP Zhuhai ACC	I	60	MI(A/C)	200						

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Sanya	Sanya TWR Sanya APP Sanya ACC	I	150	MI(A/C)	250						
Sanya-2	Sanya TWR,APP,ACC			MI(A/C)	250						
Haikou	Haikou TWR Haikou ACC	I	60	MI(A/C)	200						
Changsha	Changsha TWR Changsha ACC	I	60	MI(A/C)	200						
Changsha-2	Changsha TWR, ACC			MI(A/C)	200						
Enshi	Enshi TWR Wuhan ACC			MI(A/C)	200						
Wuhan	Wuhan TWR Wuhan ACC	I	60	MI(A/C)	200						
Wuhan-2	Wuhan TWR , ACC			MI(A/C)	200						
Zhengzhou-1	Zhengzhou TWR Zhengzhou ACC	I	60	I(A/C)	200						
Zhengzhou-2	Zhengzhou TWR Zhengzhou ACC	I	60	MI(A/C)	200						
Zhoukou	Zhengzhou ACC			MI(A/C)	200						
Guilin -1	Guilin TWR Guilin ACC			I(A/C)	200						
Guilin - 2	Guilin TWR Guilin ACC	I	60	MI(A/C)	200						
Nanning	Nanning TWR Nanning ACC			MI(A/C)	200						
Zhanjiang	Zhanjiang TWR Zhanjiang ACC			I (A/C)	200						
Shantou	Shantou TWR Shantou ACC	I	60	MI(A/C)	200						

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Jieyang	Shantou TWR Shantou ACC			MI(A/C)	200						
Kunming	Kunming TWR Kunming ACC	I	60	I(A/C)	200		 I				
Chengdu	Chengdu TWR Chengdu ACC	I	60	I(A/C)	200		 I				
Guiyang - 1	Guiyang TWR Guiyang ACC			I(A/C)	200						
Guiyang - 2	Guiyang TWR Guiyang ACC	I	60	MI(A/C)	200						
Chongqing	Chongqing TWR Chongqing ACC	I	60	MI(A/C)	200						
Shanghai-1	Shanghai TWR Shanghai APP Shanghai ACC	I	60	MI(A/C)	200						
Shanghai-2	Shanghai TWR Shanghai APP Shanghai ACC	I	60	I(A/C)	200						
Jinan	Jinan TWR, ACC			MI(A/C)	200						
Jinan-2	Jinan TWR, ACC			MI(A/C)	200						
Qingdao	Qingdao TWR Qingdao ACC			MI(A/C)	200						
Hefei	Hefei TWR Hefei ACC	I	60	MI(A/C)	200						
Nanjing	Nanjing TWR Nanjing ACC	I	60	MI(A/C)	200						
Lianyungang	Lianyungang TWR Lianyungang ACC			MI(A/C)	200						
Xuzhou	Xuzhou TWR			MI(A/C)	200						
Hangzhou	Hangzhou TWR Hangzhou ACC	I	60	MI(A/C)	200						

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Nanchang	Nanchang TWR Nanchang ACC	I	60	I(A/C)	200						
Nanchang-2	Nanchang TWR, ACC			I(A/C)	200						
Ganzhou	Nanchang ACC			MI(A/C)	200						
Shangrao	Nanchang ACC			MI(A/C)	200						
Fuzhou	Fuzhou TWR Fuzhou ACC	I	60	MI(A/C)	200						
Wenzhou	Wenzou TWR			MI(A/C)	200						
Xiamen	Xiamen TWR Xiamen ACC	I	60	MI(A/C)	200						
Xiamen	Xiamen TWR, ACC			MI(A/C)	200						
Shenyang	Shenyang TWR Shenyang ACC	I	60	MI(A/C)	200						
Shenyang-2	Shenyang TWR Shenyang ACC	I	60	MI(A/C)	200						
Dalian	Dalian TWR Dalian ACC	I	60	I(A/C)	200						
Dalian-2	Dalian TWR, ACC			MI(A/C)	200						
Harbin	Harbin TWR Harbin ACC	I	60	MI(A/C)	200						
Xi'an	Xi'an TWR Xi'an ACC	F<2000	60	I(A/C)	200						
Lanzhou	Lanzhou TWR Lanzhou ACC			MI(A/C)	200		I				
Urumqi	Urumqi TWR Urumqi ACC	I	60	MI(A/C)	200		I				
HONG KONG, CHINA Beacon Hill	Hong Kong ACC Hong Kong APP			MI(A/C)	250	~~F<2008~~					

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
	Hong Kong TWR								~~10~~		
Mount Parker	Hong Kong ACC Hong Kong APP Hong Kong TWR	I	200	MI(A/C)	250						
Tai Mo Shan	Hong Kong ACC Hong Kong APP Hong Kong TWR	I	140	MI(A/C)	250						
Sha Chau	Hong Kong APP Hong Kong TWR	I	80	MI(A/C)	250						
Hong Kong Int'l Airport	Hong Kong APP Hong Kong ACC Hong Kong TWR					F<2013		I	I		PRM I in 2000
MACAO, CHINA Macao	Macao TWR			MI(A/C)	200			F<2010			
COOK ISLANDS											
DPR KOREA **Pyongyang**	Pyongyang ACC Pyongyang APP Pyongyang TWR	I	60	MI(A/C) MI(A/C)	200 200					I	
FIJI											
	Naid ACC Nadi APP					F<2010 F<2010	I				
FRENCH POLYNESIA	Tahiti ACC Tahiti APP			N<2008(A/C) N<2008(A/C)	250	F<2012	I				
INDIA Ahmadabad		I	60	MI	256						
Trivandrum		I	60	MI	256						
Hyderabad		I	60	MI	256						
Guwahati		I	60	MI	256						
Kolkata		I	60	MI	256		I				
Chennai		I	60	MI	256		I				

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Delhi		I	60/220	MI	256		I				RSR=220NM
Mumbai		I	60/220	MI	256		I	F			"
Mangalore				MI	256						
Berhampur				MI	256						
Varanasi				MI	256						
Nagpur				MI	256						
INDONESIA											
Banda Aceh	Medan ACC			I(A/C)	240	I 2008					
	Jakarta ACC			MI (A/C)	240						
Medan	Medan APP	I	90	~~MI(A/C)~~	~~240~~	I <2008					
	~~Medan ACC~~										
	Jakarta ACC			MI(A/C)	240						Pre-operation, ADS-B not integrated to ATC system
Natuna	Jakarta ACC			I(A/C)	240						
Tanjung Pinang	Tanjung Pinang APP	~~I~~	~~90~~	I(A/C)	240	I<2008					
	Jakarta ACC	I	90								
Pontianak	Pontianak APP	~~I~~	~~90~~	~~I(A/C)~~	~~240~~	I<2008					
	Jakarta ACC	I	90	I(A/C)	240						
Pekanbaru	Pekanbaru APP	~~I~~	~~90~~								
	Medan ACC	I	90	I(A/C)	240	I<2008					
	Jakarta ACC										
Palembang	Palembang APP	I	90	MI(A/C)	240	I 2008					
	Jakarta ACC			~~MI(A/C)~~	~~240~~						
Jakarta/Cengkareng	Jakarta APP	I	90	I(A/C)	240	I 2008			F 2010		ADS-C Trial
	Jakarta ACC			MI(A/C)	240						
	Jakarta FIR					F<2007	X				ADS-B Trial
Jakarta/Halim	Jakarta ACC			~~I(A/C)~~	~~240~~	F<2007					

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Semarang	Ujung Pandang ACC Jarkata ACC			I(A/C)	240	I<2009					
Banjarmasin	Banjarmasin APP Ujung Pandang ACC			MI (A/C) ~~I(A/C)~~	240 ~~240~~	I<2009					
Balikpapan	Balikpapan APP Ujung Pandang ACC	I	90	MI(A/C) ~~MI(A/C)~~	240 ~~240~~	I<2009					
Yogyakarta	Yogyakarta APP Ujung Pandang ACC Jakarta ACC	I	90	MI(A/C)	240						
Surabaya	Surabaya APP Ujung Pandang ACC Jakarta ACC	I	90	MI(A/C)	240	I<2009			F 2011		
Bali	Bali APP Ujung Pandang ACC	~~I~~ I	~~90~~ 90	~~MI(A/C)~~ MI(A/C)	~~240~~ 240	I<2009			F 2011		
Waingapu	Ujung Pandang ACC			I(A/C)	240	I<2008					
Ujung Pandang	Ujung Pandang APP Ujung Pandang ACC Ujung Pandang FIR	I	90	I(A/C) I(A/C)	240 240	I<2008 F<2007	 X		F 2011		ADS-C Trial ADS-B Trial
Manado	Ujung Pandang ACC			I(A/C)	240	I<2010					
Ambon	Ujung Pandang ACC			I(A/C)	240	I<2008					
Kendari	Ujung Pandang ACC			I(A/C)	240	I<2010					
Biak	Biak APP Ujung Pandang ACC			I(A/C)	~~200~~ 240	I<2010					
Jayapura	~~Jayapura~~ APP ~~Jayapura~~ ACC	~~F<~~2009		~~F<2009~~	~~F(S)<2009~~ 240						
Kupang	~~Kupang~~ APP ~~kupang~~ ACC	~~F<2009~~		~~F<2009~~	~~F(S)<2009~~	I<2010					
~~Toli-Toli~~	~~Toli-Toli ACC~~			~~F<2009~~	~~F(S)<2009~~						
Tarakan	~~Tarakan~~ ACC	F<2010		~~F<2009~~	~~F(S)<2009~~	I<2009					

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Batam	~~Batam~~ APP ~~Batam~~ ACC			~~F<2009~~	F(S)<2009 F(S)<2009	I<2009					
Sorong	~~Sorong~~ ACC			~~F<2009~~	F(S)<2009	I<2008					
JAPAN											
Narita Airport	Narita TWR					F<2009		I			
Haneda Airport	Haneda TWR							I			
Nagoya Airport	Nagoya TWR							I			
Osaka Airport	Osaka TWR							I			
Kansai Airport	Kansai TWR							I			
Naha Airport	Naha TWR Naha APP	I	60	I(A/C)	60			I			
Hakodate Airport	Hakodate APP	I	60	I(A/C)	60						
Sendai Airport	Sendai APP	I	60	I(A/C)	60						
Narita Airport - 1	Narita APP	I	60	I(A/C)	60						
Narita Airport - 2	Narita APP	I	60	I(A/C)	60						
Handeda Airport - 1	Tokyo APP	I	60	I(A/C)	60						
Handeda Airport - 2	Tokyo APP	I	60	I(A/C)	60						
Niigata Airport	Niigata APP	I	60	I(A/C)	60						
Nagoya Airport - 1	Nagoya APP	I	60	I(A/C)	60						
Nagoya Airport - 2	Nagoya APP	I	60	I(A/C)	60						
Chubu Airport - 1	Chubu APP	I	80	I(A/C)	80						
Chubu Airport - 2	Chubu APP	I	80	I(A/C)	80						
Osaka Airport - 1	Osaka APP	I	80	I(A/C)	80						
Osaka Airport - 2	Osaka APP	I	80	I(A/C)	80						
Kansai Airport - 1	Kansai APP	I	80	I(A/C)	80						

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Kansai Airport - 2	Kansai APP	I	80	I(A/C)	80						
Hiroshima Airport	Hiroshima APP	I	60	I(A/C)	60						
Takamatsu Airport	Takamatsu APP	I	60	I(A/C)	60						
Kouchi Airport	Kouchi APP	I	60	I(A/C)	60						
Fukuoka Airport - 1	Fukuoka APP	I	60	I(A/C)	60						
Fukuoka Airport - 2	Fukuoka APP	I	60	I(A/C)	60						
Nagasaki Airport	Nagasaki APP	I	60	I(A/C)	60						
Oita Airport	Oita APP	I	60	I(A/C)	60						
Kumamoto Airport	Kumamoto APP	I	60	I(A/C)	60						
Miyazaki Airprot	Miyazaki APP	I	60	I(A/C)	60						
Kagoshima Airport - 1	Kagoshima APP	I	60	I(A/C)	60						
Kagoshima Airport - 2	Kagoshima APP	I	60	I(A/C)	60						
Naha Airport	Naha APP	I	60	I(A/C)	60						
Shimojishima Airport	Shimojishima APP	I	60	I(A/C)	60						
Kushiro	Sapporo ACC		200	I(A/C)	200						
Yokotsudake	Sapporo ACC	I	200	MI(A/C)	200						
Hachinohe	Sapporo ACC	I	200	I(A/C)	200						
Jobonzan	Sapporo ACC Tokyo ACC	I	200	I(A/C)	200						
Oginojo	Sapporo ACC Tokyo ACC	I	200	MI(A/C)	250						
Yamada	Tokyo ACC	I	200	I(A/C)	200						
Hakone	Tokyo ACC	I	200	I(A/C)	200						

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Mikawa	Tokyo ACC	I	200	I(A/C)	200						
Mikuniyama	Tokyo ACC	I	200	I(A/C)	200						
Hirata	Tokyo ACC Fukuoka ACC	I	200	I(A/C)	200						
Imanoyama	Tokyo ACC Fukuoka ACC	I	200	I(A/C) MI(A/C)	200 F(250)						
Kaseda	Fukuoka ACC Naha ACC	I	200	I(A/C)	200						
Sangunzan	Fukuoka ACC	I	200	I(A/C)	200						
Amami	Fukuoka ACC Naha ACC	I	200	I(A/C) MI(A/C)	200 F(250)						
Miyakojima	Naha ACC	I	200	I(A/C)	200						
Yaedake	Naha ACC	I	200	I(A/C) MI(A/C)	200 F(250)						
Iwaki	Tokyo ACC			MI(A/C)	250						
Hachijo	Tokyo ACC			MI(A/C)	250						
Fukue	Fukuoka ACC			MI(A/C)	250						
Nihonkai	TBD			MI(A/C)	F(250)						
KIRIBATI											
LAO PDR											
Vientiane	Vientiane APP	I	80								
Vientiane	Vientiane ACC			MI(A/C)	250						
Savannakhet	Vientiane ACC			MI(A/C)	250						
Xieng Kuang	Vientiane ACC			MI(A/C/S)	250	F<2015					
MALAYSIA											
Langkawi	Langkawi APP Kuala Lumpur ACC	I	60	MI (A/C)	200						

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Subang	Lumpur APP Kuala Lumpur ACC	I	60	MI (A/C)	200		F<2007				
Genting Highlands	Kuala Lumpur ACC			MI(A/C)	200						
Kulala Lumpur (KLIA)	Lumpur APP Kuala Lumpur ACC	I	60	MI(A/C)	200			I			
Johor	Johor Bharu APP Kuala Lumpur ACC	I	60	MI (S)	200						
Kota Bharu	Kota Bharu APP Kuala Lumpur ACC	I I	60 60	MI (S)	200						
Kota Kinabalu	K. Kinabalu APP K. Kinabalu ACC	I	60	MI(A/C)	200						
Kuching	Kuching APP K. Kinabalu ACC	I	60	MI(A/C)	200						
Miri	Miri APP K. Kinabalu ACC Kuching ACC	I	60	MI (A/C)	200						
MALDIVES											
MARSHALL ISLANDS											
MICRONESIA (FEDERATED STATE OF)											
MONGOLIA	Ulaanbaatar ACC Ulaanbaatar APP					<2008 <2008	I I				
MYANMAR Yangon	Yangon APP Yangon ACC			MI(A/C)	200						
Mandalay	Mandalay APP	I	60	MI(A/C)	200						
NAURU											

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
NEPAL											
Kathmandu	Kathmandu APP	I	60	I (A/C)	200						
NEW CALEDONIA											
	Tontouta ACC					TBD					
	Tontouta APP					TBD					
NEW ZEALAND											
Auckland	Chrischurch ACC	I	80								
Auckland OCA	Auckland ACC						I				
Auckland TWR	Auckland TWR							F<2009			
Ballance	Chrischurch ACC			I	250						
Cass Peak	Chrischurch ACC			I/A/C/S	250						
Chrischurch	Chrischurch ACC	I	80								MDS Trial 2-8/06
Hawkins Hill	Chrischurch ACC	I	80	I	250						
Mount Robertson	Chrischurch ACC			I	250						
											Wide Area MDS planned for Queenstown in 2007
Queenstown	Chrischurch ACC										
	Queenstown TWR										
Ruao Tewhenua	Auckland ACC			I	250						
	Chrischurch ACC										
Teweraiti	Chrischurch ACC			I	250						
PAKISTAN											
Karachi Airport	Karachi ACC	I	98	MI(A/C)	200						
	Karachi APP										
	Karachi TWR										
Pasni	Karachi ACC			MI(A/C)	200						
Lak Pass	Karachi ACC			MI(A/C)	200						
	Lahore ACC										

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Rojhan	Karachi ACC Lahore ACC			MI(A/C)	200						
Lahore Airport	Lahore ACC Lahore APP Lahore TWR	I	98	MI(A/C)	200						
Islamabad Airport	Lahore ACC Islamabad APP Islamabad TWR	I	98	MI(A/C)	200						
PAPUA NEW GUINEA											
Jacksons airport	Jacksons APP Moresby ACC	I	60	I(A/C)	200						
PHILIPPINES											
Manila	Manila APP	I F<2012	60	I(A/C) M(A/C/S) F<2012	90						
Tagaytay	Manila ACC	~~X~~	~~250~~	MI(A/C/S)	250						
Clark	Clark APP	I	70	MI(A/C)	70						
Mactan	Mactan APP	I F<2012	70	I(A/C)	70						
Kalibo	Kalibo/Caticlan APP	F<2012		M(A/C/S) F<2012							
Bacolod	Bacolod APP	F<2012		M(A/C/S) F<2012							
Davao	Davao APP	F<2012		M(A/C/S) F<2012							
Subic ~~Bay~~	Subic APP	I	70	I(A/C)	70						
Laoag	Manila ACC Manila ATM Center			MI(A/C) M(A/C/S) F<2012	250 250						
Aparri	Manila ATM Center			M(A/C/S) F<2012							

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Mount Majic	Manila ACC			MI(A/C)	250						
	Manila ATM Center			M(A/C/S) F<2012							
Palawan RCAG	Manila ATM Center			M(A/C/S) F<2012							
Zamboanga	Manila ATM Center			M(A/C/S) F<2012							
Manila ATM Center	Manila ATM Center					F<2012					
Puerto Princesa	Manila ATM Center					F<2012					
REPUBLIC OF KOREA											
Jeju	Jeju TWR							I			
	Jeju APP	I	60	I(A/C)	200						
Cheongju	CheongjuTWR										
Incheon-1	Incheon TWR					F<2008		I	I		
	Seoul APP, ACC	I	60	MI(A/C)	200						
Incheon-2	Incheon TWR										
	Seoul APP, ACC	I	60	MI(A/C)	200						
Yangyang	Yangyang TWR										
Gimhae	Gimhae TWR							I			
	Gimhae APP	I	60	I(A/C)	200						
Daegu	Daegu APP	I	60	MI(A/C)	200						
Cheongju	Jungwon APP	I	60	MI(A/C)	200						
Gimpo	Gimpo TWR							I	F<2006		
	Gimpo APP, ACC	I	60	MI(A/C)	200			I			
SINGAPORE											
Singapore	Singapore ACC	I	220	MI(A/C)	250	F<2010	I				
	Singapore APP	I	70	MI(A/C)	200						
	Singapore TWR							I	I		
	Singapore APP	I	70	MI(A/C)	200						
SOLOMON ISLANDS											

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
SRI LANKA											
Bandaranaike Airport	Colombo APP	I	90								
Mount Piduruthalagala	Colombo ACC			MI(A/C)	200	F<2010	I				ADS-C trial
THAILAND											
Bangkok	Bangkok APP Bangkok ACC Bangkok TWR	I	80	~~I(A/C)~~ MI(A/C)	~~250~~ 250	F<2010					
Bangkok/ Suvarnabhumi AP	Bangkok APP Bangkok ACC Bangkok/SVB TWR	I	80	MI(A/C/S)	250			I	I		A-SMGCSLevel2
Chiang Mai	Chiang Mai APP Bangkok ACC	I>2010	60	MI(A/C)>2010 F(A/C/S)<2010	250 250						
Ubon Rachathani	Bangkok ACC			MI(A/C)>2009 F(A/C/S)<2009	250 250						
Surat Thani	Bangkok ACC Hat Yai APP Phuket APP			MI(A/C)>2009 F(A/C/S)<2009	250 250						
Hat Yai	Hat Yai APP Bangkok ACC	I>2010	60	F(A/C/S)<2010	250						
Phuket	Phuket APP	I>2009	60	F(A/C/S)<2009	250						
~~Bangkok~~	~~Bangkok TWR~~										
Phitsanulok	Phitsanulok APP	I	60								
Hua Hin	Hua Hin APP	I	60								
U Taphao (Military Installation)	U Taphao			I(A/C)	200						
TONGA						F<2010					
UNITED STATES											
Alaska	ACC					2003	I<2006				

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Hilo, Hawaii	ACC APP TWR	I	60	I(A/C)	200						
Honolulu, Hawaii	ACC APP TWR	I	60	I(S)							
Kahului, Hawaii	APP TWR	I	60	I(A/C)							
Kokee, Hawaii	ACC	I	200								
Lihue, Hawaii	APP TWR	I	60	I(A/C)							
Mount Kaala, Hawaii	ACC	I	200	I(A/C)							
Pahoa, Hawaii	ACC			I(A/C)							
Kunianiau, Hawaii	ACC			I(A/C)							
Guam	ACC	I	200	I(A/C)							
Mount Santa Rosa, Guam	APP TWR	I	60	I(A/C)							
Mount Santa Rosa, Guam	ACC	I									
Kona, Hawaii	ACC			F(A/C)	200						
Mount Kaala, Hawaii	ACC	F	250								
Mount Santa Rosa, Guam	ACC	F<2000	250	F(S)<2000	250						
VANUATU											
VIET NAM											
Hanoi/Noibai	Hanoi ACC ~~Hanoi ACC~~ Noibai APP Noibai TWR	I	80	MI(A/C) MI (A/C)	200 250	F<2013		 F<2011	 F<2011		
Danang/Sontra	Ho Chi Minh ACC Danang APP ~~Ho Chi Minh~~ Honoi ACC	I I	80 80	MI (A/C)	250		 ~~F<2006~~				

TABLE CNS 4A - SURVEILLANCE SYSTEMS

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	A-SMGCS	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Qui Nhon	Ho Chi Minh ACC Danang APP Hanoi ACC			MI (A/C)	250						
Ca Mau	Ho Chi Minh ACC			MI (A/C)	250						
Nghe An/Vinh	Hanoi ACC			MI (A/C)	250						
Tansan Nhat	Tansan Nhat APP Ho Chi Minh ACC Tansan Nhat TWR	I F	80	MI (A/C)	250	F<2011	I (2006)	F<2012	F<2012		F<2010

Table CNS 4B

ATS AUTOMATION SYSTEMS

EXPLANATION OF THE TABLE

Column

1 Name of State/Territory and location of ATS automation systems within the State

2 Air traffic services unit served by the ATS automation systems

AACC — Area approach control centre
ACC — Area control
APP — Approach control
EC — En-route centre
FIS — Flight information service
SMC — Surface movement control
TCU — Terminal control unit
TMA — Terminal control area
TWR — Tower control

3 Surveillance sensor linked to the ATS automation systems. Four-letter FIR identifier, enclosed in parenthesis, shown for surveillance sensors outside the FIR.

4 Radar data processing system

5 Flight data processing system

6 Minimum safe altitude warning system

7 Automatic dependent surveillance

ADS B — Automatic dependent surveillance broadcast
ADS C — Automatic dependent surveillance contract

8 Controller-pilot data link communications

9 ATS interfacility data link communications

10 Processing area of the radar data processing system in nautical miles

11 Number of ATS positions

12 Remarks

Note.— The following codes are used in columns 4 to 11:

I —Required and implemented

X — Required but implementation status not determined

N — Required but not implemented

A — Existing facility provided to supplement or substitute the requirement

F — Future plan
< Year — Planned commissioning year, to be used as appropriate in conjunction with “F” and “N”
> Year — Planned decommissioning year, to be used as appropriate in conjunction with “A” and “I

State/Territory Location	ATS unit served	Data source	RDP	FDP	MSAW	ADS	CPDLC	AIDC	Processing area (NM)	Operator positions	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
AUSTRALIA											
~~Adelaide~~	~~AACCTCU TWR~~	~~Adelaide PSR/SSR Summertown SSR~~	~~2>1998~~						~~Maximum~~	~~12 5~~	
Adelaide	TCU TWR	Adelaide PSR/SSR Summertown SSR	~~2<1998~~ I	~~<1998~~ I	I	**	**	F<2011	Maximum 2600x3000	5	** Available – not used
~~Brisbane~~	~~AACC TWR~~	~~Brisbane PSR/SSR Darwin SSR Tindal SSR Mt. Alma SSR Mt Boyce SSR Mt. Hardgrave SSR Mt. Somerville SSR Oakey SSR Sydney PSR/SSR Tabletop Mt. SSR The Round Mountain SSR~~	~~2>1998~~						~~4x512x512~~	~~22~~	
Brisbane	~~ACC~~ EC	Brisbane PSR/SSR Darwin SSR Tindal SSR Mt. Alma SSR Mt. Boyce SSR Mt. Hardgrave SSR Mt. Somerville SSR Oakey SSR Sydney PSR/SSR Tabletop Mt. SSR The Round Mountain SSR	I	I	I	~~2<1998~~	~~2<1998~~	~~2<1998~~	Maximum 2600x3000 2600x3000	47	
Brisbane	Brisbane and Coolangatta TMAs TWR	Brisbane PSR/SSR Mt. Boyce SSR Mt. Hardgrave SSR Mt. Somerville SSR Oakey SSR	~~2<1998~~ I	~~I~~ I	I	**	**	F<2011	Maximum 2600x3000	8	

State/Territory Location	ATS unit served	Data source	RDP	FDP	MSAW	ADS	CPDLC	AIDC	Processing area (NM)	Operator positions	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
~~Cairns~~	~~AACC TWR~~	~~Hanns Tableland SSR Redden Creek PSR/SSR~~	~~2>1998~~						~~1024x1024~~		
Cairns	TCU TWR	Hanns Tableland SSR Redden Creek PSR/SSR	~~2<1998~~ I	~~<1998~~ I	I	**	**	F<2011	Maximum 2600x3000	~~4~~ 5	
~~Coolangatta~~	~~AACC TWR~~	~~Redden Creek PSR/SSR~~	~~2>1998~~						~~1024x1024~~	6	
~~Melbourne~~	~~Melbourne and Canberra AACC TWRs~~	~~Brisbane PSR/SSR Darwin SSR Tindal SSR Mt. Alma SSR Mt Boyce SSR Mt. Hardgrave SSR Mt. Somerville SSR Oakey SSR Sydney PSR/SSR Tabletop Mt. SSR The Round Mountain SSR~~	~~2>1998~~						~~1024x1024~~	24	
Melbourne	~~ACC~~ EC	Brisbane PSR/SSR Darwin SSR Tindal SSR Mt. Alma SSR Mt Boyce SSR Mt. Hardgrave SSR Mt. Somerville SSR Oakey SSR Sydney PSR/SSR Tabletop Mt. SSR The Round Mountain SSR	I	I	I	~~2<1998~~	~~2<1998~~	~~2<1998~~	Maximum 2600x3000	45	
Melbourne	Melbourne and Canberra TMAs TWRs	Gellibrand Hill PSR/SSR Adelaide SSR East Sale SSR Mt. Bobbara SSR	~~2<1998~~ I	I	I	**	**	F<2011	Maximum 2600x3000	10	

State/Territory Location	ATS unit served	Data source	RDP	FDP	MSAW	ADS	CPDLC	AIDC	Processing area (NM)	Operator positions	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
		Mt. Boyce SSR Mt. Macedon SSR Mt Majura SSR Sydney SSR Summer town SSR									
~~Perth~~	~~AACC TWR~~	~~Perth PSR/SSR Kalmunda SSR~~	~~2>1999~~						~~1024x1024~~	~~13~~	
Perth	TCU TWR	Perth PSR/SSR Kalmunda SSR	~~2<1999~~ I	I	I	**	**	F<2011	Maximum 2600x3000	~~6~~ I	
~~Sydney~~	~~AACC TWR~~	~~Sydney PSR/SSR Mt. Boyce SSR Mt. Bobbara~~	~~2>1999~~						~~512x512~~	~~13~~	
Sydney	TCU TWR	Sydney PSR/SSR Mt. Boyce SSR Mt. Bobbara	~~2<1999~~ I	~~<1999~~ I	I	**	**	F<2011	Maximum 2600x3000	6	
Sydney	TWR	Sydney surface movement radar	~~2~~ I						Aerodrome precincts	5	
Sydney	TCU	Parallel approach runway monitor	I						Sydney 34L & R and 16L & R approaches	2	
BANGLADESH											
BHUTAN											
BRUNEI DARUSSALAM											
Berakas			<1997	<1997					512x512		
Brunei	APP		2						150x150		
CAMBODIA											
CHINA											
Beijing	APP ACC		2						~~Radius 200~~ 1024x1024		
Changchun	APP		2						1024x1024		
Changsha	APP		2						1024x1024		
Chengdu	APP ACC		2						~~Radius 200~~ 1024x1024		
Chongqing	APP		2						1024x1024		
	ACC										

State/Territory Location	ATS unit served	Data source	RDP	FDP	MSAW	ADS	CPDLC	AIDC	Processing area (NM)	Operator positions	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Dalian	APP ACC		2						~~Radius 200~~ 1024x1024		
Fuzhou	APP		2						1024x1024		
	ACC										
Guangzhou	APP ACC		2						~~Radius 200~~ 1024x1024		
Guilin	APP		2						1024x1024		
	ACC										
Guiyang	APP ACC		2						~~Radius 200~~ 1024x1024		
Haikou	APP		2						1024x1024		
Hangzhou	APP		2						1024x1024		
	ACC										
Harbin	APP		2						512x512		
	ACC										
Hefei	APP		2						1024x1024		
	ACC										
Hohhot	APP		2						1024x1024		
	ACC										
Jinan	APP		2						1024x1024		
	ACC										
Kunming	APP ACC		2						~~Radius 200~~ 1024x1024		
Lanzhou	APP		2						1024x1024		
	ACC										
Lianyungang	APP		2						512x512		
Nanchang	APP ACC		2						~~Radius 200~~ 1024x1024		
Nanjing	APP		2						512x512		
	ACC										
Qingdao	APP		2						1024x1024		
	ACC										
Sanya	APP		2						512x512		
	ACC										
Shanghai	APP ACC		2						~~Radius 200~~ 1024x1024		
Shantou	APP		2						1024x1024		
	ACC										
Shenzhen	Shenzen APP ACC		2						~~Radius 200~~ 1024x1024		

State/Territory Location	ATS unit served	Data source	RDP	FDP	MSAW	ADS	CPDLC	AIDC	Processing area (NM)	Operator positions	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
	Guangzhou APP ACC										
Shenyang	APP		2						1024x1024		
	ACC										
Shijiazhuang	APP		2						1024x1024		
Tianjin	APP		2						1024x1024		
Taiyuan	APP		2						1024x1024		
	ACC										
Urumqi	APP		2						1024x1024		
	ACC										
Wenzhou	APP		2						512x512		
	ACC										
Wuhan	APP ACC		2						~~Radius 200~~ 1024x1024		
Xi'an	APP ACC		2						~~Radius 200~~ 1024x1024		
Xiamen	APP		2						1024x1024		
	ACC										
Zhanjiang	APP		2						1024x1024		
Zhengzhou	APP ACC		2						~~Radius 200~~ 1024x1024		
Zhuhai	APP		2						1024x1024		
COOK IS.											
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA											
	APP ACC		1						Radius 200	6	
FIJI											
Nadi	ACC			I		ADSC-I ADSB-F<2010	I	I	250		
FRENCH POLYNESIA (France)											
Tahiti	TWR APP ACC			2							
Tahiti	ACC					ADS-C <1998					

State/Territory Location	ATS unit served	Data source	RDP	FDP	MSAW	ADS	CPDLC	AIDC	Processing area (NM)	Operator positions	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
GUAM (United States)											
Anderson	ACC		2						200x200		
HONG KONG, China											
Hong Kong	APP ACC TWR		2	2	2000				250x250		
Hong Kong	ACC					ADS-C <TBA					
INDIA											
Chennai				2		I	I				
Delhi					I						
Kolkata						I	I				
Mumbai					I						
INDONESIA											
Bali	Bali ACC APP	N<2003	2						1024x1024	4	
Jakarta	Jakarta ACC APP Soekamo-Hatta TWR Jakarta FIC	1	2	2	I	I	I	N<2002	2048x2048	40	SSR (Banda Aceh/ Medan/Pekanbaru/ Tanjung Pinang/ Benjarmasin/ Yogyakarta/ Surabaya) Cengkareng MSSR will be connected to RDP F<2000
Medan	Medan ACC	F<2003	2								
Ujung Pandang	Ujung Pandang ACC APP	N<2003	2					N<2003	4036x4036	20	SSR(Balikpupen, Banjanhasin, Maiden, Surabaya, Bali, Waingapu, Kendar, Biak)
JAPAN											
Chubu	APP		2	2					70x70		
Fukuoka	APP		2	2					70x70		
Fukuoka	ACC		2	2					500x800		
Haneda	Tokyo APP		2	2					70x70		
Narita	APP		2	2					70x70		
Okinawa	Naha APP		2	2					360x700		
Osaka	APP		2	2					80x80		

State/Territory Location	ATS unit served	Data source	RDP	FDP	MSAW	ADS	CPDLC	AIDC	Processing area (NM)	Operator positions	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
Sapporo	ACC		2	2					500x700		
Tokyo	ACC		2	2					500x875		
KIRIBATI											
LAO PEOPLE'S DEMOCRATIC REPUBLIC											
MACAO, China											
Colanne	Macao TWR		2	~~2<1997~~ 2<2010					500x500	3	
MALAYSIA											
Kinabalu	ACC APP TWR		I	I	I				20 000x20 000	3	
Kuching	APP ACC TWR		I	I	I				20 000x20 000	3	
Langkawi	APP		I	I	I				20 000x20 000	1	
Subang	Kuala Lumpur ACC APP TWR		I	I	I	F<2002	F<2002		20 000x20 000	11	
MALDIVES											
MARSHALL IS.											
MICRONESIA (FEDERATED STATES OF)											
MONGOLIA											
MYANMAR											
Yangon	APP ACC		2<1997						440x440		
NAURU											

State/Territory Location	ATS unit served	Data source	RDP	FDP	MSAW	ADS	CPDLC	AIDC	Processing area (NM)	Operator positions	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
NEPAL											
Kathmandu	APP		2<1997			ADS-C <2000					
NEW ZEALAND											
Auckland	Auckland ACC TWR		I	I	<2003	ADS-C I	I	I	5500x2500		
Christchurch	Christchurch ACC TWR Wellington TWR		I	I	<2003				1024x1024		
PAPUA NEW GUINEA											
Port Moresby	ACC		2	2<1999		ADS-C <2000			200 Radius		
PHILIPPINES											
Laoag	Manila ACC		2	2		ADS-C <TBA			1024x1024		
Mactan	APP		2			ADS-C <TBA			200x200		
Manila	APP		2			ADS-C <TBA			200x200		
Mt. Majic	Manila ACC		2			ADS-C <TBA			1024x1024		
Subic	APP		2			ADS-C <TBA			200x200		
Tagaytay	Manila APP		2			ADS-C <TBA			1024x1024		
REPUBLIC OF KOREA											
Daegu or Incheon	ACC	8 PSRs/SSRs	3 <2001	3 <2001					Radius 200	6	
Gimhae	APP		2	2	1 (low altitude alert)				60x60	3	
Incheon	APP	2 PSRs/SSRs in Incheon 1 PSR/SSR in Gimpo	2	2	1				60x60	8	
Jeju	APP	PSR/SSR	2	2	1 (low altitude alert)				60x60	3	
SINGAPORE											
Singapore	ACC		I	I	I	ADS-C _I	I		1024x1024		

State/Territory Location	ATS unit served	Data source	RDP	FDP	MSAW	ADS	CPDLC	AIDC	Processing area (NM)	Operator positions	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
	APP TWR										
SOLOMON IS.											
SRI LANKA											
Colombo	ACC		2	2<TBA		ADS-C & B TBA			200 Radius		
THAILAND											
Bangkok	APP ACC		2	2		ADS-B <1996			1024x1024		
Chiang Mai	Chang Mai APP Bangkok ACC		2						1024x1024		
Phuket	APP		2						1024x1024		
Hatyai	APP		2						1024x1024		
TONGA											
UNITED STATES											
Hilo	APP TWR		2						60x60		
Honolulu	ACC		2	2					500x500		
Honolulu	APP TWR		2						60x60		
VANUATU											
VIET NAM											
Ho Chi Minh	ACC		2	2	I	ADS-C I	I		1024x1024	16	
Hanoi	ACC		2	2	I				1024x1024	8	

PROPOSED MODIFICATION TO GUIDELINES FOR THE DEVELOPMENT OF ADS-B IMPLEMENTATION PLAN

That, States be advised to use the following guidelines for the development of ADS-B implementation plan.

a) minimize capital and operating costs of ADS-B data facilities;

b) give priority to provide ADS-B coverage over major traffic flows and *those airspaces currently not covered by radar. ADS-B should have overlapping area with existing radar coverage.*

c) provide ADS-B coverage in areas within 150 NM from FIR boundaries;

d) suitable sites with power, shelter, access routes and data communication links shall be preferred; and

e) overlapping of ADS-B coverage is preferred.

f) Integrate ADS-B data with the ATM automation system wherever possible taking advantage of synergies with other means of surveillance (such as radar, ADS-C, flight plan tracks) ;

g) Mandate ADS-B OUT equipage on the aircraft operating in the airspaces, at the flight levels or area where currently no radar surveillance is available and where ADS-B based services are offered (served with ADS-B ground stations).

h) Expand the "mandate" to aircraft operating in other airspace when the ANSP is able to provide ADS-B based services in the airspace.

i) ADS-B Implementation is more effective when it is implemented regionally both on the ground and on the aircraft.

j) When considering the benefits of ADS-B Implementation, it is necessary to consider the total benefits to all stakeholders (airline operators, passengers, efficiency of the ATM network, and society etc) and not only the benefit derived for airlines operators and air navigation services providers.

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TABLE FOR SSR MODE S II CODE COORDINATION

Explanation of the Table

Column

1 Name of country/Territory and Location of the facility

2 Coordinates Latitude and Longitude

3 AMSL – Elevation of Radar head above the Means Sea Level in meters

4 Air Traffic Services Unit served by the facility

5 Coverage of SSR Mode S Radar in nautical miles/flight level

6 SIC - System Identifier Code in decimal

7 II Code- Interrogator Identifier in decimal

8 Remarks

Note:

SAMPLE TABLE

State/Territory Location	Coordinates		AMSL	ATS UNIT	Coverage	SIC	II Code	Remarks
			Meter	served	NM/Flt	Decimal	Decimal	
1	2		3	4	5	6	7	8
Thailand								
Donmuang				Bangkok APP Bangkok ACC Bangkok TWR	250	18	2	
Suvarnabhumit				Bangkok APP Bangkok ACC Bangkok TWR	250	34	3	
Chiang Mai				Chiang Mai APP Bangkok ACC	250	98	4	
Ubonratchathani				Bangkok ACC	250	162	5	
Surathani				Bangkok ACC Hat Yai APP Phuket APP	250	82	7	
Phuket				Phuket APP	250	66	8	
Hayai				Hat Yai APP	250	50	9	

Planning criteria for SSR Mode S Interrogator Identifier codes

1. Introduction

1.1 In order to selectively interrogate a Mode S equipped aircraft, the ground station needs to know the aircraft's Mode S address and its approximate position. To acquire the address of a Mode S equipped aircraft, the ground station transmits all-call interrogations. A Mode-S equipped aircraft will respond to such interrogations with its unique address. Once the response is received by the ground station, the aircraft will be added to the ground station's file of acquired aircraft – the aircraft is in an "acquired" state.

1.2 Once the aircraft is in the acquired state (i.e. in the list of aircraft of which the Mode S address has been acquired) the aircraft should be instructed to not longer respond to (or "locked out from" Mode S all calls from that particular ground station, in order to minimize all-call synchronous garbling. This is achieved when the aircraft receives Mode S selectively addressed interrogations that contain an instruction to the on-board transponder to not respond to Mode S all call interrogations.

1.3 When an aircraft is within the range of 2 (or more) Mode S ground stations, it must acquire the "lock out" status from each ground station. This is known as multi site acquisition and lock out.

1.4 In order to allow the aircraft to identify the ground station, each Mode S station has been assigned a Interrogator Identifier (II). 15 II codes have been identified. (For aircraft complying with the provisions of Annex 10, Volume IV, Amendment 73 or later an additional 63 codes known as Surveillance Identifier (SI) can be used. This technique is not addressed here). The purpose of the II (or SI) is to prevent aircraft that have been acquired by the SSR interrogator to respond to Mode-S all-call requests from that particular interrogator. These aircraft are "locked out" by the transponder to respond to further Mode-S all-call interrogations.

1.5 Measures must be taken to avoid that aircraft within the coverage of more than one SSR Mode S ground station will receive interrogations with the same Interrogator Identifier. This will be achieved by securing that Mode S ground stations with overlapping coverage have been assigned different Interrogator Identifiers. The assignment of Interrogator Identifier codes should be subject to Regional coordination.
Note: Detailed information is available in Annex 10, Volume IV and the ICAO Manual on the Secondary Surveillance Radar (SSR) Systems (Doc 9684) which has been the main source for the information provided in this material. These ICAO publications are recommended for further consultation and details on the use of SSR Mode S

2 Interrogator Identifier

2.1 The Interrogator Identifier (II) is a four digit code (0 – 15) which is transmitted by the SSR-S interrogator when transmitting a Mode S only all-call (or a Mode S selective) interrogation. It serves the purpose to identify (by the SSR transponder in the aircraft) the SSR-S ground station. The purpose of the II is to prevent aircraft that have been acquired by the SSR interrogator to respond to Mode S all-call requests from that particular interrogator (ground station). These aircraft are "locked out" by the transponder to respond to further Mode-S all-call interrogations.

2.2 A Mode-S only all-call interrogation elicits replies only from Mode S transponders and is used in conjunction with the Mode A/C only all-call interrogation. The (uplink) format for the Mode S only all-call is as follows:

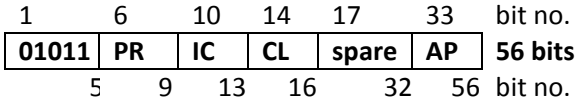


Figure 1

This message contains the following information:
Bit 1-5 01011 (decimal value 11); defines the uplink format and the content of bits 6 – 56
Bit 6-9 PR (probability of reply) (this information is not further addressed here)
Bit10-13 IC (Interrogator Code). These four bit contain the Interrogator Identifier (0-15) or the last four bits of the Surveillance Identifier (SI) (See paragraph 1.4)
Bit 14-16 CL (Code Label). If CL=000, the information in the IC field is the Interrogator Identifier. If CL is 001 to 100 (1 to 4), the information int the ICA field is the Surveillance Identifier (See paragraph 1.4).
Bit 33-56 AP (Address/Parity) For a Mode S only all-call, the address consist of 24 one's, on which the parity is overlaid.

2.3 A Mode S only all-call reply, in which the II (or SI) is encoded in the PI field, has the following format:

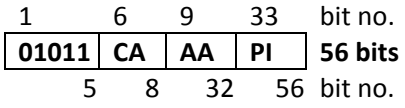


Figure 2

This message contains the following information:
Bit 1-5 01011 (decimal value 11); defines the downlink format and the contents of bits 6 – 56
Bit 6-8 CA (Capability) An encoded definition of the communications capability of the transponder
Bit 9-32 AA (Address Announced) 24 bit aircraft address
Bit 33-56 PI (Parity / Interrogator Identifier) Interrogator identity code, on which the parity is overlaid

2.4 Following the Mode S only all-call reply, the ground station will send a selective interrogation, which has the following format:

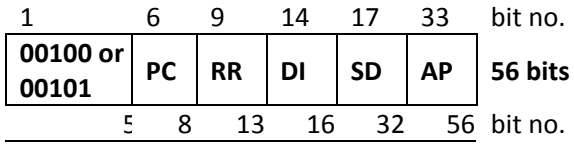


Figure 3

This message contains the following information:
Bit 1-5 00100 0r 00101 (decimal value 4 or 5); defines the uplink format and the contents of bits 6-56;
4 = altitude request; 5 =identity request
Bit 6-8 PC (Protocol); if PC=1, the transponder shall commence to lock out
Bit 9-13 RR (Reply Request); command the length and content of a requested reply
Bit 14-16 DI (Designator Identification); identifies the structure of the SD field
Bit 17-32 SD (Special Designator); contains a number of control codes, specific to SSR
Bit 33-56 AP (Address/Parity); aircraft address on which the parity is overlaid

2.5. The aircraft responds as requested by the selective interrogation.

3. Coordination and operation of adjacent Mode S ground stations

3.1 Coordination is required when adjacent Mode S ground stations have overlapping coverage. This coordination is particularly important where radar coverage crosses national boundaries. The following example illustrates difficulties that may arise if two Mode S stations, with overlapping coverage, use the same Interrogator Identifier.

3.1.1 In Figure 4, an aircraft travelling from A to B will, when entering the coverage area of SSR Mode-S ground station P, in response to regular all-call interrogations, be acquired by ground station P. From there-on, it will only respond to selective interrogations from ground station P. When the aircraft enters into the (overlapping) coverage of SSR Mode-S ground station R (at point F), it will continue to respond to selective interrogations from ground station P and not respond to any interrogation from ground station R. Only after the aircraft has left the coverage of ground station P (point G in Figure 4), and it has not received any selective interrogation for about 18 seconds, the aircraft returns to the “non-acquired” status and responds to Mode-S all-call requests from ground station R and subsequent selective calls from ground station R. This situation is undesirable.

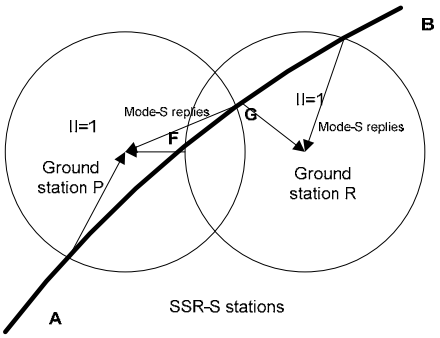


Figure 4

3.1.2 In figure 5, ground station P and ground station R have a different Interrogator Identifier. In this case, an aircraft travelling from A to B will, when entering the coverage area of SSR Mode-S ground station P, in response to regular all-call interrogation, be acquired by ground station P. When entering the coverage of SSR Mode-S ground station R the aircraft will, in response to all-call interrogations from SSR Mode-S ground station R, be acquired by ground station R as well and also respond to selective interrogations from ground station R. on the track between F and G, the aircraft will respond to selective interrogations from ground station P AND ground station R. After leaving the coverage area of ground station P (point G in figure 5) the acquired status of the aircraft with ground station P will be lost.

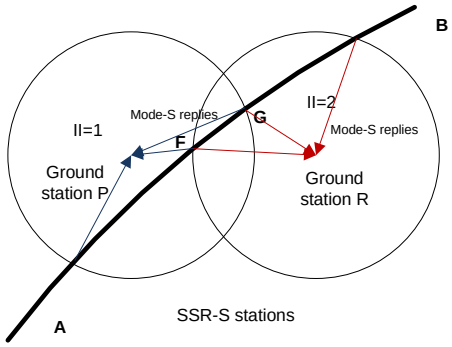


Figure 5

3.1.3 Ground station linking

3.1.3.1 The situation as described in paragraph 3.1.1 above, where the aircraft is not detected by SSR Mode S ground station R on the path between point F and G can be avoided if the two SSR S ground stations share their table of acquired aircraft (in particular the 24 bit aircraft address and the approximate location of the aircraft). In that case, ground station R can send selective interrogations to the aircraft and obtain valid responses. This process, known as ground station linking, will allow for the use of the same Interrogator Identifier by the two ground stations with overlapping coverage areas.

3.1.4 Using multiple Interrogator Identifier codes by a single Mode S ground station.

3.1.4.1 Another method avoiding the aircraft in the example in paragraph 3.1.1 above not being surveyed by ground station R is the use of two interrogator codes by ground station R. In this case, in the sector of one Mode S ground station that is overlapping with another ground station using the same Interrogator Identifier, a different Interrogator Identifier should be used. However, it is not recommended to use more than one Interrogation Identifier by one single Mode S ground station. When multiple Interrogator Identifier codes are used by one single Mode S ground stations, the total number of interrogator codes used by the ground station shall not be more than 2. Also, the different interrogator codes shall not be interleaved (i.e. in different sectors only different Interrogator Identifier codes shall be used.

3.1.5 The above examples illustrates the need for SSR Mode-S ground stations having overlapping coverage, to be assigned a unique II in the area of overlap, except in the case as described in paragraph 3.1.3. The coverage area is assumed to be the maximum distance/height combination within which the aircraft can receive interrogation requests from the Mode-S ground station. This area may be smaller (or bigger) than the actual operational coverage area of the [ACC/FIR] sector in which ATC provides radar services. As a general rule the coverage area of the SSR Mode S ground station coincides with the radio horizon from the aircraft and is actually depending on the aircraft's operating altitude.

4. Interrogator Identifier codes.

4.1 Four bits are available for 16 different Interrogator Identifier codes (see paragraph 2.2 above).

4.1.1 Interrogator Identifier code 0 (zero)

4.1.1.1 Interrogator Identifier code 0 (zero) shall only be used for supplementary acquisition based on lockout override. This code is not available for [regular] Mode S acquisition and lockout purposes

4.1.1.2 This leaves Interrogator Identifier codes 1-15 for assignment to Mode S ground stations with overlapping coverage

.

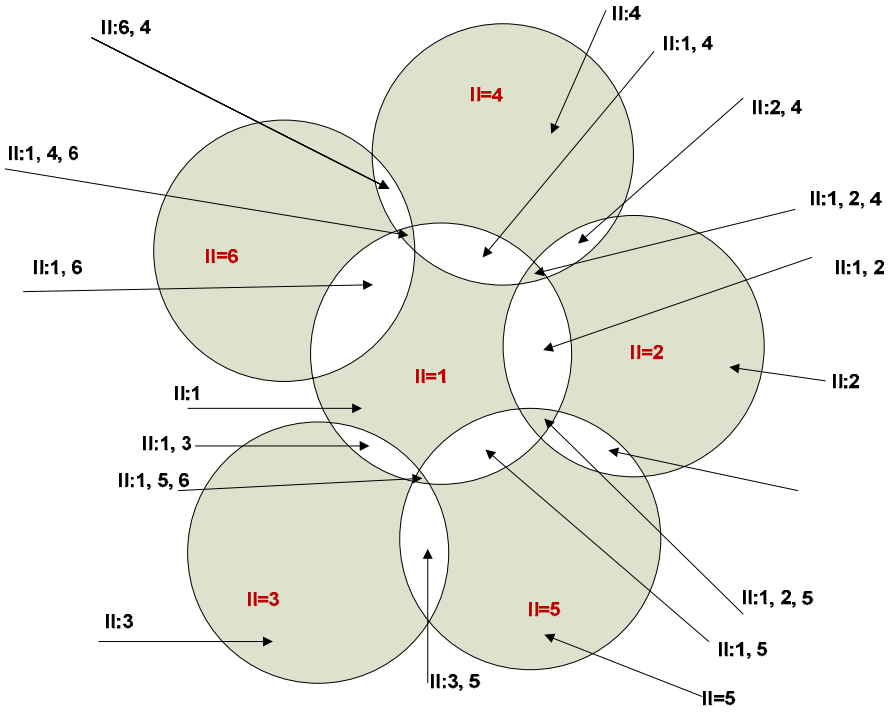
Note: additional 63 codes are available as Surveillance Indicator in particular for use in areas where the avai1able 15Interrogator Identifier codes are not sufficient. The use of the Surveillance Indicator is not addressed here as it requires aircraft to comply with specific provisions; see paragraph 1.4 above.

Note: This would allow aircraft operating at higher altitudes to remain undetected by one ground station in case they are already locked out by another ground station with overlapping areas at higher altitudes. In case where operational circumstances require, alternative maximum flight levels and coverage areas can be applied.

5. Practical examples of Interrogator Identifier code assignments

(See also the Manual on Secondary Surveillance Radar (SSR) Systems (ICAO Doc 9684)

5.1 Figure 6 provides an example of assigned Interrogator Identifier code for Mode S stations with overlapping areas. In the areas of overlap, the aircraft responds to all-call interrogations and selective interrogations from more than one ground station, as indicated.



II=Interrogator Identifier

II=1; Interrogator Indentifier code assigned to MODE S ground station

II:1, 2, 5: Interrogator Identifier codes used in coverage area, including overlapping areas

Figure 6

5.2 A more complex example for SSR Mode S Interrogator Identifier code assignments is in Figure 7. It shows that in many cases the Interrogator Identifier codes can be assigned very efficiently. It also shows cases whereby Mode S ground stations are linked, so they can use the same Interrogator Identifier code and a case where one Mode S ground station is assigned two Interrogation Identifier codes

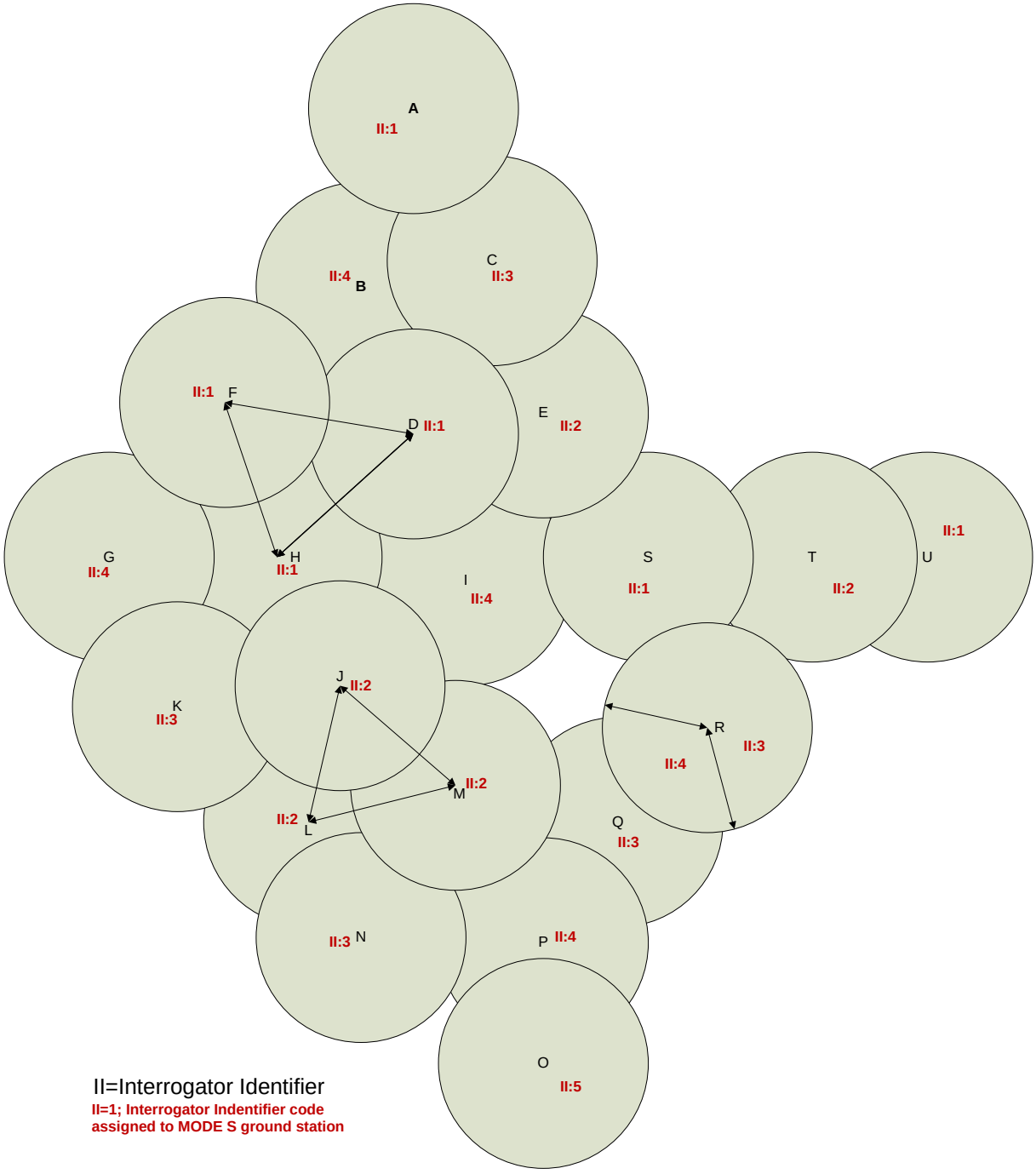


Figure 7

6. Proposed planning parameters for SSR Mode S ground stations.

6.1 DOC of two SSR Mode S ground stations has the same maximum flight level

6.1.1 In Figure 8, SSR Mode S stations P and Q have the same II code assigned. An aircraft travelling from **A** to **B**, will be within the DOC of the SSR Mode S station P and locked out for Mode S All-Calls (it will only respond to selective calls from ground station P). After the aircraft leaves the DOC of ground station P (at **B)**, it will continue to be locked out from All-Calls by Mode S ground station P as well as from All-Calls from ground station Q, although it is now within the coverage of ground station Q as well. (The coverage for ground station P is to point C, but the DOC is only to point B). When the aircraft is beyond point C, it will no longer receive signals from SSR Mode S station P (ground station P is beyond the radio horizon of the aircraft) and after 18 seconds, the aircraft SSR Mode S transponder will be unlocked. It will then start responding to All-Calls from SSR Mode S station Q. In this situation, the DOC of station Q can be close to point C (as shown in the drawing).

In this case, the minimum separation of the two SSR Mode S ground stations in equal to the sum of the distance to the radio horizon of the aircraft to ground station P plus the range (as per DOC) of SSR Mode S ground station Q plus a small buffer (10 NM is proposed).

Note: Once the aircraft is not longer receiving selective interrogations from one ground station, it will, after a period of about 18 seconds start, responding to all calls from any Mode S ground station. Assuming the aircraft travels at a speed of about 1000 km/hr., this would result in an aircraft displacement of 2.6 NM (over the period of 18 seconds).

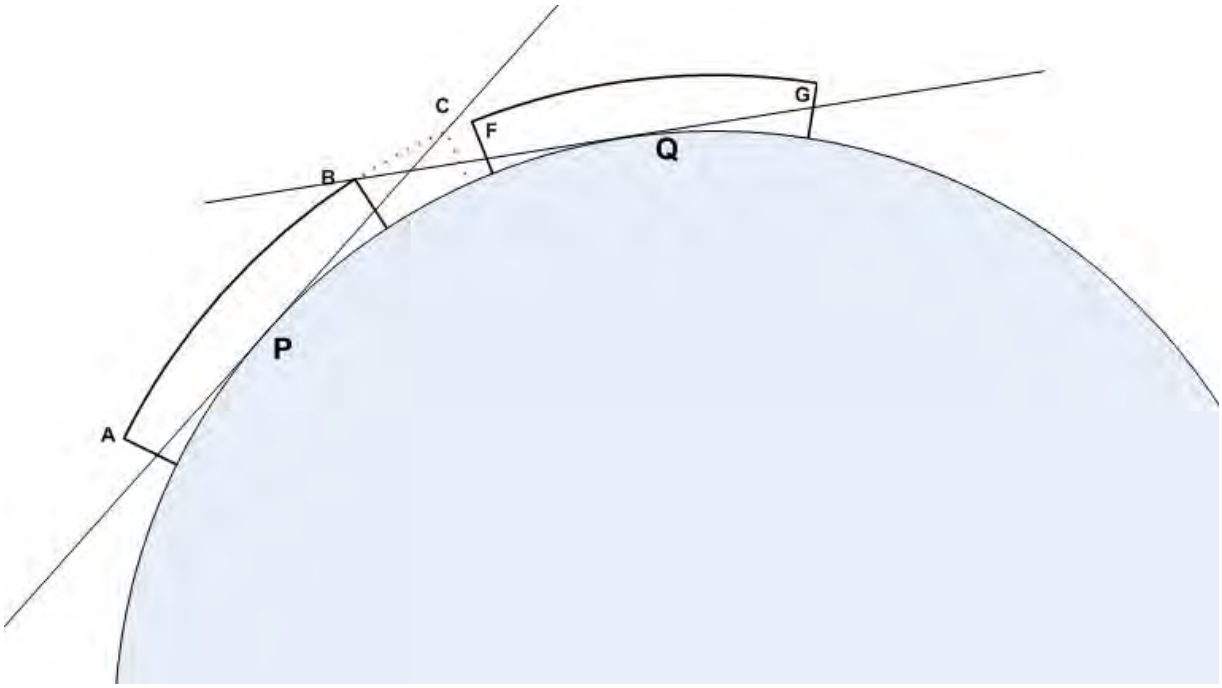


Figure 8

6.1.2 Similarly, for an aircraft travelling from G to F (see Figure 8) and further into the DOC of ground station P, the minimum separation distance needs to be equal to the sum of the distance to the radio horizon of the aircraft to ground station Q plus the distance of the DOC-range from point B to

ground station P plus a small buffer (buffer not shown in Figure 8). Note that in this case the aircraft may still be locked out by ground station Q when inside the coverage of ground station P but, when it reaches point B where the aircraft enters to DOC of ground station P (and where ground station Q is below the radio horizon), it will no longer receive signals from ground station Q, become unlocked and can respond to All-Calls from ground station P.

6.1.3 In summary, the separation distance between two SSR Mode S ground stations, with the same maximum DOC flight level, is the sum of the DOC-range and the distance to the radio horizon at maximum range/altitude. In case range of the DOC-range of the two ground stations is different, the largest of the two values "DOC-range + radio horizon" needs to be selected.

6.1.4 When plotting this information on a map, the DOC of one station and the radio horizon contour of other (nearby) station may not overlap.

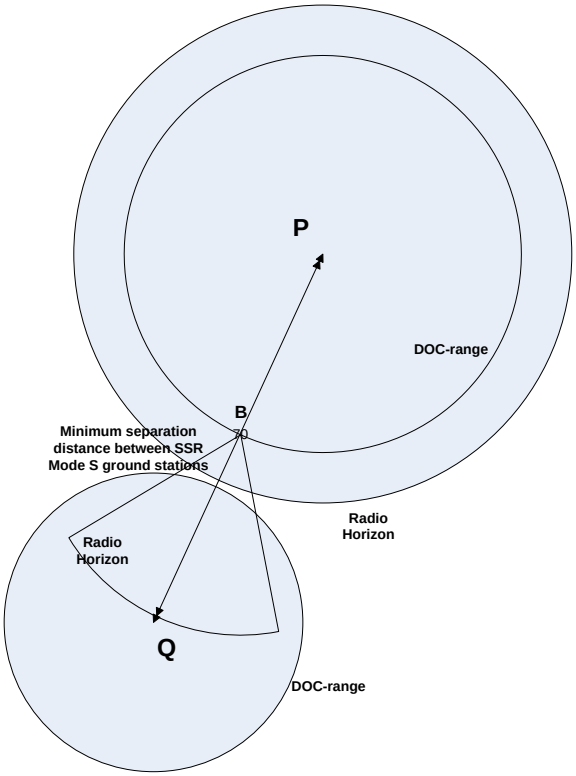


Figure 9

An aircraft entering the DOC of ground station Q needs to be beyond the radio horizon of ground station P; an aircraft entering the DOC of ground station P needs to be beyond the radio horizon of ground station Q.

Note: see paragraph 7.1 for calculation examples

6.1.5 In case the DOC for SSR Mode S ground stations P and Q have a different maximum flight level as in figure 9, the minimum required separation distance between the ground stations can be calculated as follows:

6.2 DOC of two SSR Mode S ground stations has the different maximum flight levels

a. Aircraft travelling from A to B and further, at maximum altitude for ground station P: No constraints with regard to the location of ground station Q, as the aircraft is operating outside the promulgated maximum flight level of ground station Q.

b. Aircraft traveling from G' to F' (at the same flight level as the maximum of the DOC for ground station P) and further to B. Aircraft entering at point B the DOC of ground station P are required to not longer receiving signals from ground station Q. This would require ground station Q to be below the radio horizon, seen from point B. The separation distance in this case needs to be the range of DOC of ground station P plus the distance to the radio horizon of point B plus a small buffer (10 NM is proposed)

c. Aircraft travelling from A' to B' at the same (reduced) flight level as the maximum flight level (DOC) for station Q: Aircraft entering the DOC for ground station F are required to no longer receiving signals from ground station P. The minimum separation distance is the sum of the distance to the radio horizon at point F to ground station P (at the (reduced) flight level for ground station Q) plus the DOC-range for ground station Q plus a small buffer

d. Aircraft travelling from G to F at the maximum flight level (DOC) for station Q: Minimum separation distance is the sum of the distance to the radio horizon at point B' to ground station Q at the reduced flight level plus the DOC-range for ground station P plus a small buffer.

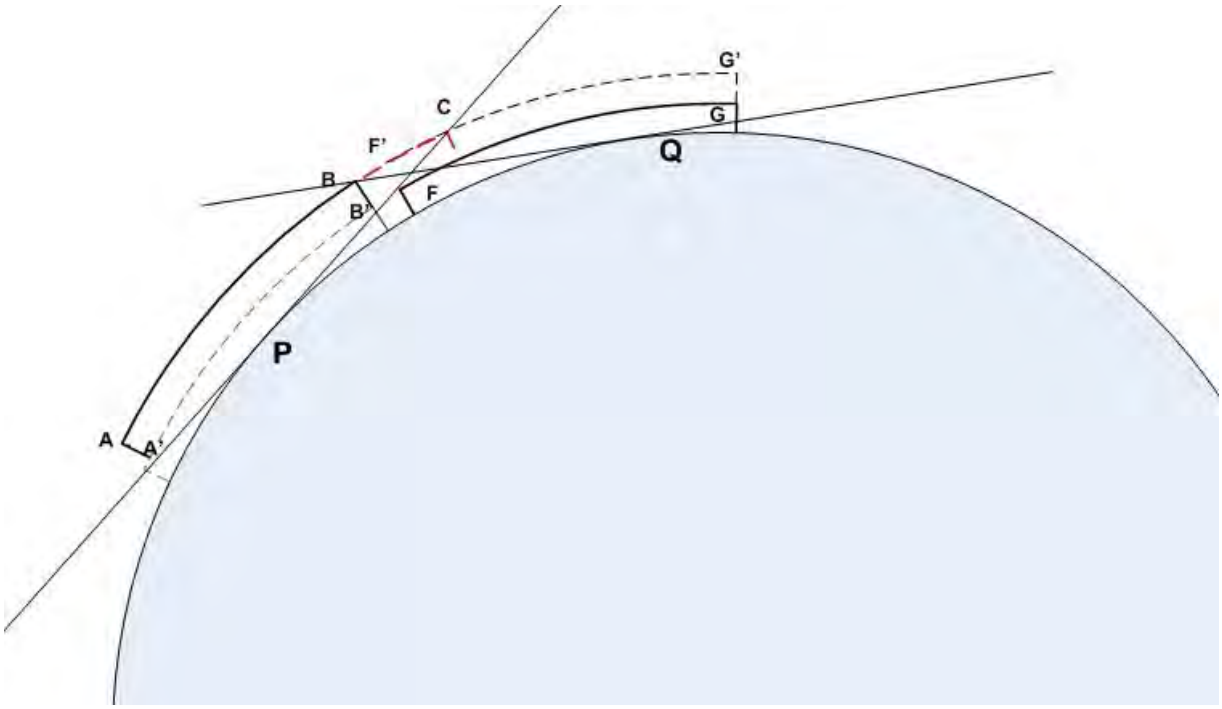


Figure 10

Note: see paragraph 7.2 for calculation examples

6.3 No DOC provided

6.3.1 In case no DOC is provided, maximum coverage is assumed to be protected. In this case, the DOC and the distance to the radio horizon are the same. Coverage areas are compatible if they do not overlap (and maintain a small buffer). In this case it is proposed that SSR Mode S II codes need to be protected up to flight level 450 (45000ft).
Note: The same protection is offered to ACC-upper and FIS upper communication frequencies'

6.4 Mode S ground stations have different II codes.

6.4.1 When SSR Mode S ground stations have different II codes, no separation criteria between the Mode S ground stations need to be applied.

7. Calculation examples.

7.1 DOC same maximum flight level (see also Figure 8)

SSR Mode S station P: DOC 200NM/45000ft
SSR Mode S station Q: DOC 100NM/45000ft

(i) Separation distance between SSR Mode S stations for aircraft travelling from P to Q at FL 450:

Radio horizon [P] +DOC-range [Q] + buffer = 261 +200 + 10 NM = 471 NM (Re. Paragraph 6.1.1)
(Radio horizon [P] is the radio horizon at the maximum DOC-altitude) of ground station P)

(ii) Separation distance for SSR Mode S stations for aircraft travelling from Q to P at FL 450

Radio horizon [Q] + DOC-range [P] + buffer = 261 +100 + 10 NM = 371 NM (Re. Paragraph 6.1.2)
(Radio horizon [Q] is the radio horizon at the maximum DOC-altitude of ground station Q)

Note: Radio horizon [P] is equal to radio horizon [Q]

Minimum separation required: 471 NM

7.2 DOC different maximum flight level (see also Figure 10):

SSR Mode S station P 200 NM/45000 ft
SSR Mode S station Q 60 NM/10000 ft

(i) Separation distance between SSR Mode S stations for aircraft travelling from P to Q at FL 450:

No restrictions (Re. Paragraph 6.2.a)

(ii) Separation distance between SSR Mode S stations for aircraft travelling from Q to P at FL 450:

Radio horizon [Q'] + DOC-range [P] + buffer = 261 + 200 + 10 = 471 NM (Re Paragraph 6.2.b)
(Radio horizon [Q'] is the radio horizon at the maximum DOC-altitude of ground station P)

Note: Radio horizon Q' is equal to radio horizon P

(iii) Separation distance between SSR Mode S stations for aircraft travelling from P to Q at FL 100

Radio horizon [P'] + DOC-range [Q] + buffer = 123 + 60 + 10 NM = 193 NM (Re. Paragraph 6.2.c)
(Radio horizon [P'] is the radio horizon at the maximum DOC-altitude of ground station Q)

Note: Radio horizon P' is equal to radio horizon Q

(iv) Separation distance between SSR Mode S stations for aircraft travelling from Q to P at FL 100:

Radio horizon [Q] + DOC-range [P] = 200 + 123 + 10 NM = 333 NM (Re. Paragraph 6.2.d)
(Radio horizon [Q] is the radio horizon at the maximum DOC-altitude of ground station Q)

The largest of the three separation distances needs to be maintained.

(v) Following the same methodology as in paragraph 6.1, for two SSR Mode S stations with a DOC of 60 NM/10000ft a separation distance of 193 NM is required.

8. The separation distance considerations above do not include for compensation in case the SSR Mode S station is located well above MSL. In case the actual height of the SSR Mode S station is know, the distance to the radio horizon, as shown above, needs to be increased with the distance to the radio horizon, seen from the location of the SSR Mode S ground station.

As an example, a radar station at a height of about 3000 ft (1000 m) would require an additional separation of 67 NM, to be included in the calculation of the separation distances identified in paragraph 7.

It would therefore be necessary to introduce, both in the data relevant to the radar location, to introduce the actual height of the radar station (re. MSL).

9. Effectively, the separation distance required between two SSR Mode S ground stations with the same II code can be summarized as the sum of the range of the ground station plus the distance to the radio horizon at maximum altitude of the designated operational coverage. In case no DOC is specified, a DOC of 260nm/45000ft is assumed.

International Civil Aviation Organization | Organisation de l'aviation civile internationale | Organización de Aviación Civil Internacional | Международная организация гражданской авиации | منظمة الطيران المدني الدولي | 国际民用航空组织

Tel.: +1 (514) 954-8219 ext. 6712

Ref.: E 3/5-09/61 30 June 2009

Subject: ICAO Position on issues of critical concern to international civil aviation to be discussed at the International Telecommunication Union (ITU) World Radiocommunication Conference (2011) (WRC-11)

Action required: To consider the ICAO Position when developing your State's position for WRC-11 and to support the ICAO Position during WRC-11

Sir/Madam,

1. I have the honour to inform you that the Council, at the ninth meeting of its 187th Session, held on 22 June 2009, reviewed the ICAO Position on issues of critical concern to aviation which are on the agenda of the International Telecommunication Union (ITU) World Radiocommunication Conference (2011) (WRC-11), now scheduled for 23 January to 17 February 2012. The proposed ICAO Position was developed by the Air Navigation Commission and sent to you for comments in State letter E 3/5-08/69 dated 28 November 2008. At the above-referenced meeting, the Council approved the ICAO Position as contained in the attachment to this letter.

2. The main principles which governed the development of the attached ICAO Position can be summarized as follows:

a) the ITU Radio Regulations need to ensure that the safety of civil aviation is not compromised;

b) the ITU Radio Regulations shall not be in conflict with ICAO Standards and Recommended Practices; and

c) the frequency allocations to aeronautical safety services shall be protected in conformity with internationally agreed requirements. Changes to frequency allocations need to be supported by adequate studies in the ITU-R Sector or in ICAO, as appropriate.

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3. The ICAO Position addresses all regulatory aspects on aeronautical matters on the agenda for the WRC-11. Items of main concern to aviation, include spectrum requirements for unmanned aircraft systems, regulatory measures to facilitate introduction of new aeronautical mobile (R) services in a number of frequency bands, long-term spectrum availability and access to spectrum to meet the requirements of the aeronautical mobile satellite (R) service, and review of footnotes to the table of frequency allocations. Two items address possible allocations for radiolocation and oceanographic radar in the high frequency (HF) and very high frequency (VHF) spectrum which includes a number of frequency bands for aeronautical safety communications. Early proposals for an agenda item addressing possible new allocations to the mobile satellite service (MSS) have identified aeronautical mobile and aeronautical radionavigation spectrum as being potential candidates for sharing with the MSS, which would ultimately reduce aviations access to this frequency band.

4. Other issues of interest to aviation include the following: A review of the international regulatory framework; a revision of the maritime HF channelling arrangements; continued access for aviation to the 37 - 38 GHz band; software defined radios and cognitive radios; a primary allocation to the radiolocation service in the band 15.4 - 15.7 GHz band which is used by the aeronautical radionavigation service; potential interference from short-range devices and; a potential allocation to the amateur service in the non-directional radio beacon (NDB) band.

5. In accordance with the action taken by the Council, the approved ICAO Position will be submitted by ICAO to the ITU WRC-11 in the form of an information paper. The ICAO Position takes into consideration, to the maximum extent possible, the currently available results of studies on allocation matters which are taking place in the ITU, regional telecommunication organizations and ICAO. Therefore, prior to WRC-11, new developments on spectrum issues, resulting from studies indicated above, may require that additional material, complementing the ICAO Position, be submitted to the conference. Where necessary, such material will be submitted to Council for approval.

6. Assembly Resolution A36-25 instructs the Council and the Secretary General, as a matter of high priority, to ensure that the resources necessary to support increased participation by ICAO to international and regional spectrum management activities are made available. With a view to increasing the awareness of and support for the aviation requirements of ITU WRC-11, ICAO will undertake, within the budget limits of the Organization and wherever possible, to present the ICAO Position to regional telecommunication organizations, such as the Asia/Pacific Telecommunity (APT), African Telecommunications Union (ATU), Conférence Européenne des Administrations des Postes et des Télécommunications (CEPT), Inter-American Telecommunication Commission (CITEL), League of Arab States (LAS) and the Regional Commonwealth in the Field of Communications (RCC).

7. Active support to the ICAO Position by States at the WRC, and in regional and other international activities conducted in preparation for the WRC, is deemed the only means to ensure that the results of the WRC-11 reflect civil aviation’s need for spectrum (Assembly Resolution A36-25 refers). You are therefore requested to undertake to provide civil aviation experts to fully participate in the development of your State’s and regional positions, and to ensure, to the maximum extent possible, that representatives from your civil aviation administration are included in the national and international preparations, and in your national delegation to the conference.

8. At WRC-11, a delegation from ICAO will participate in the work of the conference and will assist States by presenting the agreed aviation position and coordinating with aviation delegates as required in the course of the conference.

9. May I request that the information contained herewith, as approved by the Council, be considered for incorporation into your State's position for the WRC-11 and that your delegation to the conference be prepared to support the ICAO Position on issues of concern to international civil aviation.

Accept, Sir/Madam, the assurances of my highest consideration.

Taïeb Chérif
Secretary General

Enclosure:
ICAO Position for the ITU WRC-11

ATTACHMENT to State letter E 3/5-09/61

ICAO POSITION FOR THE INTERNATIONAL TELECOMMUNICATION UNION (ITU) WORLD RADIOCOMMUNICATION CONFERENCE 2011 (WRC-11)

SUMMARY

This paper reviews the agenda for the ITU WRC-11, discusses points of aeronautical interest and provides the ICAO Position for these agenda items.

The ICAO Position aims at protecting aeronautical spectrum for radio-communication and radionavigation systems required for current and future safety-of-flight applications. In particular, it stresses that safety considerations dictate that exclusive frequency bands must be allocated to safety critical aeronautical systems and that adequate protection against harmful interference must be ensured. It also includes proposals for new aeronautical allocations to support new aeronautical applications.

Support of the ICAO Position by Contracting States is required to ensure that the position is supported at the WRC-11 and that aviation requirements are met.

CONTENTS

1. Introduction

2. Spectrum requirements for international civil aviation

3. Aeronautical aspects on the agenda for WRC-11

Attachment

Agenda for ITU WRC-11

1. INTRODUCTION

1.1 This paper contains the ICAO Position on issues of interest to international civil aviation to be decided at the 2011 ITU World Radiocommunication Conference (WRC-11). The agenda of the conference is contained in the attachment. The ICAO Position should be considered in conjunction with section 7-II of the *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including Statement of Approved ICAO Policies* (Doc 9718) (Civil aviation frequency allocations – ICAO policies and related information). An updated version of this section is available on website http://www.icao.int/anb/panels/acp (see webpage: Repository) which includes the amendments to the Radio Regulations as agreed at WRC-07. Also available at the above-mentioned website are the ITU WRC Resolutions referenced in the ICAO Position.

1.2 ICAO supports the working principle as utilized in studies for WRC-07 and reflected in the WRC-07 Conference Preparatory Meeting report material on Agenda Item 1.6. In particular that compatibility of ICAO standard systems with "existing or planned aeronautical systems operating in accordance with international aeronautical standards will be ensured by ICAO". Compatibility of ICAO standard systems with non-ICAO standard systems will be addressed in ITU.

2. SPECTRUM REQUIREMENTS FOR INTERNATIONAL CIVIL AVIATION

2.1 The safety of air operation is dependent on the availability of reliable communication and navigation services. The Eleventh Air Navigation Conference (AN-Conf/11), which was held in Montreal, Canada from 22 September to 3 October 2003, noted that States, international organizations and ICAO had embarked on communication, navigation and surveillance/air traffic management (CNS/ATM) systems planning, intended to improve aircraft operations by making use of modern CNS/ATM technologies. The AN-Conf/11 endorsed the global air traffic management operational concept, to be used as guidance for the development of ICAO CNS/ATM related provisions. The planning horizon used for the concept was up to and beyond the year 2025.

2.2 The development of new CNS/ATM provisions is highly dependent upon the availability of radio frequency spectrum that can support the high integrity and availability requirements associated with aeronautical safety systems, and demands special conditions to avoid harmful interference to these systems. It was recognized by AN-Conf/11 that currently available spectrum for CNS/ATM systems may need to be supplemented with new allocations to enable the introduction of new systems in aviation while the requirements for spectrum for current systems are to be maintained until a future undetermined period. **Article 4.10** of the Radio Regulations states that ITU Member States recognize that the safety aspects of radionavigation and other safety services requires special measures to ensure their freedom from harmful interference. These factors need to be taken into consideration in the allocation, assignment and use of frequencies for aeronautical systems. In particular, the sharing of aeronautical safety services with other aeronautical services or non-aeronautical services must be considered with extreme care. Where sharing conditions cannot meet the above requirements, exclusive aeronautical allocations need to be secured to preserve the integrity of aeronautical services.

2.3 The demand for access to airspace is continuously increasing. Whilst recognizing the current global economic climate, total world airline scheduled passenger traffic in terms of passenger-kilometres has been predicted to grow at an average annual rate of 4.6 per cent up to the year 2025 [Ref: "*Outlook for Air Transport to the Year 2025* (Circular 313)"]. The continuous increase in air traffic

movements as well as the additional requirement for new and emerging applications such as unmanned aircraft systems are placing increased demands on both the aviation regulatory and air traffic management mechanisms. As a result the airspace is becoming more complex and the demand for frequency assignments and hence spectrum allocations is increasing. Whilst some of this demand can be met through the improved spectral efficiency of new radio systems it is inevitable that existing allocations may need to be broadened or additional aviation spectrum allocations sought to meet this demand. While it is expected that WRC-11 will be able to address a majority of these requirements, consideration by future conferences (WRC-15 and beyond) will be necessary to fully meet the future aviation requirements.

2.4 The draft ICAO Position was developed in 2008 with the assistance of the Aeronautical Communications Panel (ACP) Working Group F (frequency) and was reviewed by the Air Navigation Commission (ANC) at the tenth meeting of its 179th Session on 18 November 2008. Following the review by the ANC, it was submitted to ICAO Contracting States and international organizations for comment. After final review of the ICAO Position and the comments by the ANC on 5 May 2009, it was approved by Council on 22 June 2009. It is expected that, during the course of the preparatory activities for the WRC-11 further updates to the ICAO Position may become necessary. States and international organizations are requested to make use of the ICAO Position, to the maximum extent possible, in their preparatory activities for the WRC-11 at the national level, in the activities of the regional telecommunication organizations[1] and in the relevant meetings of the ITU.

3. AERONAUTICAL ASPECTS ON THE AGENDA FOR WRC-11

Note 1.— The statement of the ICAO Position on an agenda item is given in a text box at the end of the section addressing the agenda item, after the introductory background material.

*Note 2.— No impact on aeronautical services has been identified from WRC-11, Agenda Items **1.6**, **1.8**, **1.10**, **1.11**, **1.13**, **1.16, 1.17**, **1.18, 1.20, 1.24**, **2, 3**, **5**, **6**, **7,** and **8.1** which are therefore not addressed in the position.*

[1] African Telecommunication Union (ATU), Asia-Pacific Telecommunity (APT), European Conference of Postal and Telecommunications Administrations (CEPT), Inter-American Telecommunication Commission (CITEL), League of Arab States (LAS) and the Regional Commonwealth in the Field of Communications (RCC).

WRC-11 Agenda Item 1.1

Agenda Item Title:

To consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution 26 (Rev. WRC-07).

Discussion:

Allocations to the aeronautical services are generally made for all ITU Regions and normally on an exclusive basis. These principles reflect the global process of standardization within ICAO for the promotion of safety and to support the global interoperability of radiocommunication and radionavigation equipment used in civil aircraft. In some instances, however, footnotes to the ITU Table of Frequency Allocations allocate spectrum in one or more countries to other radio services in addition or alternatively to the aeronautical service to which the same spectrum is allocated in the body of the table.

The use of country footnote allocations to non-aeronautical services in aeronautical bands is generally not recommended by ICAO, on safety grounds, as such use may result in harmful interference to safety services. Furthermore, this practice generally leads to an inefficient use of available spectrum to aeronautical services, particularly when the radio systems sharing the band have differing technical characteristics. It also may result in undesirable (sub)-regional variations with respect to the technical conditions under which the aeronautical allocations can be used. This can have a serious impact on the safety of aviation.

A number of footnotes in aeronautical bands that should be deleted for safety and efficiency reasons are discussed below:

a) In the bands used for the ICAO standardized non-directional beacons (NDB), (255 - 526.5 kHz), Footnote No **5.72** allows for the use of the bands 283.5 - 490 and 510 - 526.5 kHz by Norwegian fixed stations located north of 60°. The use of NDBs in these bands is expected to continue for the foreseeable future. Whilst operation of these fixed links has not caused a problem in the past, it would be preferable if the footnote allocation could be removed.

b) In the bands used for the ICAO instrument landing system (ILS), (marker beacons 74.8 - 75.2 MHz; localizer 108 - 112 MHz and glide path 328.6 - 335.4 MHz) and the VHF omnidirectional radio range system (VOR); 108 - 117.975 MHz, Nos. **5.181**, **5.197** and **5.259** allow for the introduction of the mobile service on a secondary basis and subject to agreement obtained under No. **9.21** of the Radio Regulations when these bands are no longer required for the aeronautical radionavigation service. The use of both ILS and VOR is expected to continue. In addition, WRC-03, as amended by WRC-07, has introduced No. **5.197A** stipulating that the band 108 - 117.975 MHz is also allocated on a primary basis to the aeronautical mobile (R) service, limited to systems operating in accordance with recognized international aeronautical standards. Such use shall be in accordance with Resolution **413 (Rev. WRC-07)**. The use of the band 108 - 112 MHz by the aeronautical mobile (R) service shall be limited to systems composed of ground-based transmitters and associated receivers that provide navigational information in support of air navigation

functions in accordance with recognized international aeronautical standards. As a result, access to these bands by the mobile service is not feasible, in particular since no acceptable sharing criteria that secure the protection of aeronautical systems have been established to date. Nos. **5.181**, **5.197** and **5.259** should now be deleted since they do not represent a realistic expectation for an introduction of the mobile service in these bands.

c) In the band 1 215 - 1 300 MHz, which is used by civil aviation for the provision of radionavigation services through No. **5.331.** Footnote No. **5.330** allocates the band in a number of countries to the fixed and mobile service. Given the receiver sensitivity of aeronautical uses of the band, ICAO does not support the continued inclusion of an additional service through country footnotes. ICAO would therefore urge administrations to remove their name from the No. **5.330**.

d) In the band 1 559 - 1 610 MHz, which is used for elements of the ICAO global navigation satellite system (GNSS), Nos. **5.362B** and **5.362C** allow the operation of the fixed service in some countries on a primary basis until 1 January 2010 and on a secondary basis until 1 January 2015. This band is allocated, on a worldwide, primary basis, to the aeronautical radionavigation service (ARNS) and to the radionavigation-satellite service (RNSS). The band already supports operation of two prime elements of the global navigation satellite system (GNSS), i.e. GLObal NAvigation Satellite System (GLONASS) and global positioning system (GPS), the standards for which have been adopted into ICAO SARPs. SARPs for other RNSS systems, such as the European Galileo system, are under development. Studies undertaken in preparation for WRC-2000 indicate that a geographical separation distance exceeding line-of-sight (in the order of 400 km) between aircraft using GNSS and stations of the fixed service is required to ensure safe operation of GNSS. This is a very severe restriction, which can prohibit the safe use of GNSS over wide areas around any fixed service installation. Were a fixed service to be introduced into this band then harmful interference situations could arise leading to disruption to GNSS, affecting the safety of aircraft in flight. Thus, the WRC-2000 agreement to terminate all use by the fixed service in this band in 2015 still constitutes a severe and unacceptable constraint on the safe and effective use of GNSS in some areas of the world. It is, therefore, recommended that deletion of these allocations be effective from 2011.

e) In the band 4 200 - 4 400 MHz, which is reserved for use by airborne radio altimeters, No. **5.439** allows the operation of the fixed service on a secondary basis in some countries. Radio altimeters are a critical element in aircraft automatic landing systems and serve as a sensor in ground proximity warning systems. Interference from the fixed service has the potential to affect the safety of all weather operations. Deletion of this footnote is recommended.

ICAO Position:

To support the deletion of No **5.72** as access to these bands by the fixed service could create the potential for harmful interference to important radionavigation systems used by aircraft to navigate especially in the North Sea.

To support deletion of Nos. **5.181, 5.197** and **5.259**, as access to these bands by the mobile service is not feasible and could create the potential for harmful interference to important radionavigation systems used by aircraft at final approach and landing as well as the aeronautical mobile service introduced as a result of WRC-03 and 07.

To support deletion of No. **5.330** .as access to the band by the fixed and mobile services could potentially cause harmful interference to services used to support aircraft operations.

To support the deletion of Nos. **5.362B** and **5.362C** as of 2011 in order to remove harmful interference that can be caused by the fixed service to essential aeronautical radionavigation satellite functions in the band 1 559 - 1 610 MHz and to permit the full utilization of GNSS services to aircraft on a global basis.

To support deletion of No. **5.439** as a measure to protect safety critical operation of radio altimeters in the band 4 200 - 4 400 MHz.

Note 1.— Administrations indicated in the footnotes mentioned in the ICAO Position above which are urged to remove their country names from these footnotes are as follows:

No. ***5.72***	*Norway*
No. ***5.181***	*Egypt, Israel and Syrian Arab Republic*
No. ***5.197***	*Pakistan and Syrian Arab Republic*
No. ***5.259***	*Egypt, Israel and Syrian Arab Republic*
No. ***5.330***	*Angola, Bahrain, Bangladesh, Cameroon, Chad, China, Eritrea, Ethiopia, Guyana, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Mozambique, Nepal, Pakistan, the Philippines, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Togo, United Arab Emirates, and Yemen*
No. ***5.362B***	*Algeria, Armenia, Azerbaijan, Belarus, Benin, Bulgaria, Democratic People's Republic of Korea, France, Gabon, Georgia, Germany, Guinea, Guinea-Bissau, Kazakhstan, Kyrgyzstan, Lithuania, Moldova, Nigeria, Pakistan, Poland, Romania, Russian Federation, Senegal, Spain, Swaziland, Tajikistan, Tanzania, Turkmenistan, Uganda, Ukraine, and Uzbekistan*
No. ***5.362C***	*Chad, Congo, Egypt, Eritrea, Iraq, Israel, Jordan, Malta, Qatar, Somalia, Sudan, Syrian Arab Republic, Togo, and Yemen*
No. ***5.439***	*Libyan Arab Jamahiriya and Iran (Islamic Republic of)*

WRC-11 Agenda Item 1.2

Agenda Item Title:

Taking into account the ITU-R studies carried out in accordance with Resolution 951 (Rev. WRC-07), to take appropriate action with a view to enhancing the international regulatory framework.

Discussion:

The growing use of radiocommunications in modern society for applications from mobile communications, through item tracking to surveillance has led to an increase in demand for spectrum. Whilst new and innovate technologies are increasing the efficiency with which these services are provided, demand has still outpaced the efficiencies made.

There is a view within a number of administrations that the current ITU processes for addressing additional spectrum needs are not flexible enough to meet the timescales demanded by industry. Resolution **951** seeks to review the way in which spectrum at the global level is managed with a view to adopting best practices which it is hoped will enable even greater efficiencies to be achieved in the way spectrum is assigned and used.

Aviation is reliant on spectrum being available for the provision of communications, navigation and surveillance functionality. Given the safety criticality of the systems supporting this functionality they are designed to be robust and require an environment that is free from interference.

Resolution **951** potentially offers aviation an opportunity to improve the flexibility with which spectrum allocated to aeronautical services can be used as well as potentially tighten the regulatory provisions that ensure the protection of aviation systems. Conversely it also has the potential to reduce the protection afforded to aviation systems if the appropriate action is not taken to ensure that greater flexibility does not lead to greater risk of interference.

ICAO Position:

Support new provisions or modifications to existing provisions that improve the flexibility with which spectrum allocated to aeronautical safety services can be used by aviation and/or tighten regulatory provisions that enhance the protection of aviation systems.

Ensure that any other measures taken at WRC-11 under Agenda Item 1.2 do not have an adverse impact on the use or protection of aeronautical systems.

WRC-11 Agenda Item 1.3

Agenda Item Title:

To consider spectrum requirements and possible regulatory actions, including allocations, in order to support the safe operation of unmanned aircraft systems (UAS), based on the results of ITU-R studies, in accordance with Resolution 421 (WRC-07).

Discussion:

Unmanned aircraft systems (UASs) have proven the ability for an aircraft to be piloted remotely over significant distances, as well as work at shorter ranges either within or out-of-sight of the remote pilot. However, such flights have taken place in segregated airspace, ensuring the safety of both the air vehicle itself as well as other airspace users.

Based on the potential for UASs to operate reliably, a number of commercial applications have been identified from emergency services to high altitude communications platforms. Additionally, applications have been identified where UAS technology could provide a commercial and/or safety benefit by replacing either the pilot or co-pilot onboard a manned aircraft.

As a result, the deployment of UASs is expected to be significant, with a requirement for operation throughout the airspace structure. The current provisions of providing segregated airspace will therefore become impractical and hence a way must be found to allow these aircraft to integrate with the current airspace users in a safe and seamless manner.

This agenda item therefore seeks to identify the spectrum requirements necessary to support the safe operation of UASs in current and future airspace structures. UASs will require high integrity communications link(s) between the unmanned aircraft (UA) and remote control centres capable of relaying the necessary air traffic control messages as well as flight critical aircraft information. In addition, sense and avoid functions may require new sensors on the UA to provide situational awareness.

Command and Control

For UASs to safely integrate with existing airspace users the remote pilot must be able to reliably monitor the status of the UA, pass control instructions to that UA, and also interact with the relevant air traffic controller appropriate to the airspace within which the UA is flying. For UA flying/manoeuvring in a localized area this might be provided by a line-of-sight link. However, for UA flying trans-horizon this may require the use of a combination of a terrestrial radio network or a satellite network.

Relay of Air Traffic Control (ATC) Communications

Safe operation of aircraft manned or unmanned depends on the communication with ATC. The rules of air traffic rely on the fact that the pilot acts according to instructions received from ATC. If the pilot does not sit in the aircraft, this means for the ATC system operated today, that a voice channel has to be maintained to relay information from radio in the aircraft to the pilot on ground

and back. Early concepts assume that this function could be part of the command and control links if the voice is digitized.

Sense and Avoid

The safe flight operation of UA necessitates advanced techniques to detect and track nearby aircraft, terrain and obstacles in order to ensure they avoid these objects in a manner equivalent to that achieved by manned aircraft. These advance techniques may require the use of additional radio systems and hence spectrum. The remote pilot will need to be aware of the environment within which the aircraft is operating and be able to identify the potential threats to the continued safe operation of the aircraft and take the relevant action. Given the scarcity of spectrum, care must be taken to ensure that the spectrum requirements identified to meet such applications are kept to a minimum.

It should be noted that the aeronautical future communications system may be able to prove some capacity to meet the requirements for both command and control (including the relaying of ATC communications) as well as sense and avoid applications but care must be taken when dimensioning both systems to avoid double accounting. A number of existing allocations to the aeronautical mobile satellite (route) service such as the allocation in the frequency range 5 000 - 5 150 MHz might provide some of the capacity required although issues with existing and planned systems will need to be resolved.

Payload

The spectrum requirements to support the functionality of a payload are not critical to the safe operation of that aircraft. Therefore this agenda item whilst recognizing the need for spectrum to support the payload, specifically excludes the allocation of spectrum at WRC-11 under this agenda item for payload applications. However it does call for the development of an ITU-R Report or Recommendation on how to accommodate UAS payload requirements. Therefore ICAO would oppose the use of this agenda item to seek new spectrum allocations to meet payload requirements.

Spectrum for UAS for safety and regularity of flight, and in particular when the UAS operates in civil airspace, needs to be accommodated under an allocation to the aeronautical mobile (R) service, aeronautical mobile satellite (R) service, or the aeronautical radionavigation service, in order to receive the sufficient status and protection from harmful interference.

In addition to the safety communications detailed above, most UAS also need spectrum for the operation of a payload. Agenda Item 1.3 requires no action by WRC-11 on this subject. Therefore ICAO would not support the use of this agenda item to seek new spectrum allocations to meet payload requirements.

Existing AM(R)S, AMS(R)S and ARNS allocations should be examined to check whether they can provide suitable bandwidth before new allocations to these services are considered.

ICAO Position:

To support, based on the results of studies identified in Resolution **421**, any modification to existing allocations, or new allocations required to accommodate UAS operations in non-segregated airspace while maintaining the safety and regularity of flight of all types of aircraft.

Accordingly, to ensure that allocations used, in particular, for UAS command and control, ATC relay and sense and avoid in non-segregated airspace are in the AM(R)S, AMS(R)S and/or ARNS and do not adversely affect existing aeronautical systems

To oppose the use of this agenda item to seek new spectrum allocations to meet payload requirements.

WRC-11 Agenda Item 1.4

Agenda Item Title:

To consider, based on the results of ITU-R studies, any further regulatory measures to facilitate introduction of new aeronautical mobile (R) service (AM(R)S) systems in the bands 112 - 117.975 MHz, 960 - 1 164 MHz and 5 000 - 5 030 MHz in accordance with Resolutions 413 (Rev. WRC-07), 417 (WRC-07) and 420 (WRC-07).

Discussion:

As a result of WRC-07 allocations for the aeronautical mobile (route) service (AM(R)S) were either made or modified to support the aeronautical future communications infrastructure (FCI). In particular, an AM(R)S allocation in the bands 112 - 117.975 MHz was modified, and another was added to the band 960 - 1 164 MHz, in accordance with Resolutions **413** and **417** respectively. The resolutions in part specify regulatory restrictions on the operation of AM(R)S in those bands, including that systems are limited to those meeting ICAO standards. (i.e. "systems operating in accordance with international aeronautical standards"). Compatibility of the AM(R)S with ICAO standardized systems will be addressed in ICAO. Compatibility with in-band and adjacent band non-ICAO systems identified in the resolutions will be addressed in the ITU.

WRC-11, Agenda Item 1.4 allows aviation the opportunity to complete the studies necessary to answer questions raised in Resolutions **413** and **417** and propose to WRC-11 any additional regulatory measures that might be required to facilitate the introduction of new AM(R)S systems in the bands 112 - 117.975 and 960 - 1 164 MHz. Additionally it allows, under Resolution **420**, aviation to seek a new allocation to AM(R)S in the frequency band 5 000 - 5 030 MHz for surface applications at airports provided that requirements for that system cannot be satisfied in the 5 091 - 5 150 MHz band, and that it is compatible with RNSS in the 5 000 - 5 030 MHz band and the radio astronomy service (RAS) in the adjacent 4 990 - 5 000 MHz band.

ICAO will work with the ITU to provide the relevant data and technical expertise to allow the required compatibility studies between the FCI and non-ICAO standardized systems identified in the resolutions to be undertaken in a timely manner. As agreed, any compatibility issues between ICAO standardized systems will be undertaken within ICAO.

It should be noted that the existing aeronautical mobile satellite (R) service allocation in the 5 000 - 5 030 MHz band may be considered for unmanned aircraft systems as part of WRC-11, Agenda Item 1.3 studies.

ICAO Position:

To support as required, based on the results of studies identified in Resolution **413**, the inclusion in the Radio Regulations of further regulatory measures that will facilitate the introduction of future AM(R)S systems in the band 112 - 117.975 MHz.

To support as required, based on the results of studies identified in Resolution **417**, the inclusion in the Radio Regulations of further regulatory measures that will facilitate the introduction of future AM(R)S systems in the band 960 - 1 164 MHz.

If the spectrum requirements for surface applications at airports cannot be fully accommodated within the 5 091 - 5 150 MHz band, and based on the results of successful compatibility studies identified in Resolution **420**, support a new allocation to the AM(R)S in the band 5 000 - 5 030 MHz.

WRC-11 Agenda Item 1.5

Agenda Item Title:

To consider worldwide/regional harmonization of spectrum for electronic news gathering (ENG), taking into account the results of ITU-R studies, in accordance with Resolution 954 (WRC-07).

Discussion:

The use of terrestrial portable radio equipment by services ancillary to broadcasting is an essential element to the way global news coverage meets the public expectation for instant images of internationally news worthy events such as natural disasters. This agenda item seeks to address the spectrum needs associated with such equipment. As the scope of this agenda item is not limited in terms of frequency bands within which studies can take place, except by the practicality of the ENG equipment, aeronautical bands could be targeted.

ICAO Position:

To oppose any allocation that would adversely affect the interests of aviation.

WRC-11 Agenda Item 1.7

Agenda Item Title:

To consider the results of ITU-R studies in accordance with Resolution 222 (Rev. WRC-07) in order to ensure long-term spectrum availability and access to spectrum necessary to meet requirements for the aeronautical mobile-satellite (R) service, and to take appropriate action on this subject, while retaining unchanged the generic allocation to the mobile-satellite service in the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz.

Discussion:

WRC-07 agreed on Agenda Item 1.7 for WRC-11 to consider the results of ITU-R studies to ensure long-term spectrum availability and access to spectrum necessary to meet the requirements for aeronautical mobile-satellite (R) service (AMS(R)S) in accordance with Resolution **222 (Rev. WRC-07)**.

In 1995, ICAO standardized the use of the satellite frequencies in the bands 1 525 - 1 559 MHz (space-to-Earth) and 1 626.5 - 1 660.5 MHz (Earth-to-space) as an essential element for the aeronautical safety communication service via satellite communication systems.

Up until 1997 the MSS sub-bands 1 545 - 1 555 MHz (space-to-Earth) and 1 646.5 - 1 656.5 MHz (Earth-to-space) were allocated exclusively to the AMS(R)S for communications relating to safety and regularity of flights.

WRC-97 adopted new generic MSS allocations in the 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz bands. In replacement of the exclusive AMS(R)S allocation it adopted No **5.357A** giving priority and protection to AMS(R)S in the MSS sub-bands 1 545 - 1 555 MHz and 1 646.5 - 1 656.5 MHz.

WRC-2000 reviewed the studies called for by WRC-97 and Resolution **222** (WRC-2000) was adopted, indicating (under its resolves) that:

- administrations shall ensure that the spectrum needed for AMS(R)S communications within priority categories 1 to 6 of **Article 44** in the bands where No. **5.357A** applies is accommodated; and,

- administrations shall ensure that MSS operators carrying non-safety-related traffic yield capacity to accommodate the spectrum requirements for AMS(R)S communications.

Also, in response to Resolution **222** "invites ITU-R", the ITU-R developed Report **M.2073** "Feasibility and practicality of prioritization and real-time pre emptive access between different networks of mobile-satellite service in the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz". This report identified a number of significant technical, operational and economic issues that would have to be overcome to make prioritization and intersystem real-time *pre-emptive access between different networks* a reality.

Accordingly the report concluded, *inter alia*, that "prioritization and intersystem real-time *pre-emptive access between different networks* " is not practical and, without significant advance in technology, it is unlikely to be feasible for technical, operational and economical reasons. As a consequence such an

approach cannot be used as an effective method to ensure long-term spectrum availability and protection for the AMS(R)S communications in these bands.

Although No. **5.357A** gives priority status for AMS(R)S versus other MSS, in practice the current application of the regulatory conditions governing such priority status does not satisfy spectrum requirements for AMS(R)S. This situation has raised some strong concerns for the civil aviation community.

In addition, since 1997, the allotment of spectrum to mobile-satellite service providers has been organized under the provisions of various regional Memoranda of Understanding (MoU). The allotments agreed under the provisions of these MoUs are not available in the public domain and are not known to ICAO. This makes it virtually impossible for aviation to develop long-term planning for using this spectrum. ICAO has also been informed that the current provisions and procedures for AMS(R)S under these MoUs (which effectively bypass the open coordination process as is normal under the provisions of the ITU) are insufficient to satisfy future demand for AMS(R)S spectrum.

Accordingly, based on all the above, WRC-07 adopted Agenda Item 1.7 for WRC-11 and modified Resolution **222** calling for, in summary:

(a) studies on existing and future spectrum requirements of AMS(R)S;

(b) the assessment of whether the long-term requirements of the AMS(R)S can be met within the existing allocations with respect to No. **5.357A**, while retaining unchanged the generic allocation for the mobile-satellite service in the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz;

(c) completion of studies to determine the feasibility and practicality of technical or regulatory means in order to ensure adequate access to AMS(R)S spectrum, other than the coordination process (see Resolves 1 of **Resolution 222 (Rev. WRC-2007)**) or the means considered in Report ITU-R **M.2073**;

(d) the studies of existing MSS allocations, or identification of new allocations, “only for satisfying” the requirements of the AMS(R)S if these requirements (referred to above in (a) and (b)) cannot be met.

Resolution **222** also invites ICAO to participate in the above studies within the ITU-R.

In this connection, it should be noted that it is extremely important to ensure that allocations under No. **5.357A** should incorporate the strengthened regulatory provisions and technical means resulting from the studies called for in (c).

Furthermore, the studies under Agenda Item 1.7 should take into account the number of aircraft already equipped with standardized AMS(R)S technology, the life cycle of the AMS(R)S systems spread over several decades and the technical and operational advantages of using the bands identified in No. **5.357A**. Every effort should be made to ensure the long term spectrum availability and access for AMS(R)S in these bands.

Hence, in the first instance the AMS(R)S spectrum needs under WRC-11, Agenda Item 1.7 should be accommodated in the bands under No. **5.357A** and if the long-term needs cannot be satisfied in those bands, then additional spectrum should be made available in other frequency bands.

Resolution **222** contains a number of provisions that clarify the protection of AMS(R)S in the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz. Depending on decisions taken by WRC-11 consequential action may be required to preserve these provisions in the Radio Regulations.

Information note: There are other WRC-11 agenda items, which look at requirements for mobile satellite spectrum, such as Agenda Item 1.3 and Agenda Item 1.25.

ICAO Position:

Taking into account the results of ITU-R studies, support further regulatory provisions to strengthen AMS(R)S access to the bands 1 545 - 1 555 MHz and 1 646.5 -1 656.5 MHz including, if required, changes to No. **5.357A**, No. **5.362A** and Resolution **222**.

If the studies identified by Res. **222** (**Rev. WRC-07**) indicate that the long term needs of AMS(R)S cannot be satisfied in the bands 1 545 - 1 555 MHz and 1 646.5 - 1 656.5 MHz, then support AMS(R)S in other frequency bands through appropriate regulatory provisions.

WRC-11 Agenda Item 1.9

Agenda Item Title:

To revise frequencies and channelling arrangements of Appendix 17 to the Radio Regulations, in accordance with Resolution 351 (Rev. WRC-07), in order to implement new digital technologies for the maritime mobile service.

Discussion:

Within the frequency range 4 - 10 MHz, various frequency bands are allocated to the aeronautical mobile (R) service and the allotment plan for these frequency bands is in **Appendix 27** to the Radio Regulations. Aviation must be satisfied that the introduction by the maritime mobile service of any new modulation techniques, and or changes to the table contained in **Appendix 17**, must not cause harmful interference to the aeronautical mobile (R) service.

ICAO Position:

Ensure that the introduction by the maritime mobile service of any new modulation techniques, and or changes to the table contained in **Appendix 17**, does not cause harmful interference to the aeronautical mobile (R) service.

WRC-11 Agenda Item 1.12

Agenda Item Title:

To protect the primary services in the band 37 - 38 GHz from interference resulting from aeronautical mobile service operations, taking into account the results of ITU-R studies, in accordance with Resolution 754 (WRC-07).

Discussion:

The frequency band 37 - 38 GHz is currently allocated on a primary basis to the fixed, mobile, space research (space-to-Earth) and the fixed-satellite (space-to-Earth) services. Aeronautical mobile services which are not excluded from the mobile service allocation have the potential to cause interference to other systems operating in this band. This agenda item, noting that there are currently no aeronautical systems deployed or planned to be deployed in the band seeks to ensure that the existing systems operating in the band continue to be able to operate without fear of interference from aeronautical mobile systems.

Currently there are studies underway in the ITU-R to identify frequency bands to support a wireless network for use within aircraft. As planned such a system could be implemented in a manner that will be fully compatible with other co-primary users of the band 37 - 38 GHz. Therefore until those studies have shown that the band is not suitable for such a use ICAO opposes excluding the aeronautical mobile service from the existing mobile service allocation in this band. Alternatively technical protection limits for existing co-primary systems should be introduced such that AMS can be developed in a manner that ensures compatibility with those existing systems.

ICAO Position:

To oppose excluding aeronautical use of the existing mobile service allocation in the band 37 - 38 GHz.

To support the use of technical protection limits to ensure that any future AMS system in the band 37 - 38 GHz will be compatible with other co-primary services.

WRC-11 Agenda Item 1.14

Agenda Item Title:

To consider requirements for new applications in the radiolocation service and review allocations or regulatory provisions for implementation of the radiolocation service in the range 30 - 300 MHz, in accordance with Resolution 611 (WRC-07).

Discussion:

The radiolocation service operating in the VHF frequency range is coming under increased pressure from co-frequency fixed and mobile services. There is therefore a need to allocate spectrum within the frequency range 30 - 300 MHz that can accommodate radars displaced by the fixed and mobile service and also meet emerging requirements for greater resolution and range for various space object detection applications. This agenda item seeks to identify a suitable spectrum allocation in the frequency range 30 - 300 MHz that can support the needs of the radiolocation service.

Aviation operates a number of services in various bands within the frequency range 30 - 300 MHz including the instrument landing system (ILS), VHF omni-directional ranging (VOR) and air-ground communications. It is essential that these systems continue to be afforded the protection that they require to meet the demanding requirements of a safety of life service. In general, ICAO does not support the shared use of spectrum between aeronautical safety services like ARNS, AM(R)S and AMS(R)S and other (non-aeronautical) services. The frequency bands listed below are already heavily used and will continue to be heavily used with the implementation of new aeronautical systems:

74.8 - 75.2 MHz	Marker beacons
108 - 112 MHz	ILS localizers, GBAS, VOR
112 - 117.975	VOR, GBAS, GRAS, air-ground communications
117.975 - 137 MHz	Air-ground communications

In addition, due to the potential for high powered transmitters in the radiolocation service, compatibility studies should consider adjacent aeronautical bands, as well as those that could be impacted by spurious and harmonic emissions.

ICAO Position:

Oppose, under this agenda item, any change to the allocations in the 74.8 - 75.2 MHz, and/or 108 - 137 MHz bands.

Ensure that any allocation made as a result of this agenda item does not adversely affect the operation of existing and planned aeronautical systems.

WRC-11 Agenda Item 1.15

Agenda Item Title:

To consider possible allocations in the range 3 - 50 MHz to the radiolocation service for oceanographic radar applications, taking into account the results of ITU-R studies, in accordance with Resolution 612 (WRC-07).

Discussion:

There is an increasing interest, on a global basis, in the operation of high-frequency oceanographic radars for the measurement of coastal sea surface conditions to support environmental, oceanographic, meteorological, climatologically, maritime and disaster mitigation operations. Currently there are no HF radiolocation allocations in which to operate such radars. This agenda seeks to address this shortfall by making a suitable allocation in the frequency band 3 - 50 MHz that can operate in harmony with current services within the stated frequency range.

Within the frequency range 3 - 50 MHz there are a number of allocations to the aeronautical mobile (R) service. These allocations are used to provide long range, over the horizon air traffic control, flight information and operational control services over the oceans and remote areas of the world. Any new allocation must ensure that the protection currently afforded to the aeronautical mobile (R) service is not compromised.

ICAO Position:

Ensure that any allocation made as a result of this agenda item shall not cause harmful interference to the operation of existing and planned aeronautical systems that operate in or adjacent to the frequency band 3 - 50 MHz.

WRC-11 Agenda Item 1.19

Agenda Item Title:

To consider regulatory measures and their relevance, in order to enable the introduction of software-defined radio and cognitive radio systems, based on the results of ITU-R studies, in accordance with Resolution 956 (WRC-07).

Discussion:

The advantages and disadvantages of software-defined and cognitive radio systems for aviation are discussed below:

Software-Defined Radios

Although aviation has a long history with multi-mode radios where several functions (e.g. ILS, DME, MLS, VOR) are combined in a single unit, a software-defined radio system is a radiocommunications system where components that have typically been implemented in hardware (i.e. mixers, filters, amplifiers, modulators/demodulators, detectors. etc.) are instead implemented using software on a computer or other embedded computing devices. This gives the capability for the radio to tune over a large frequency range and use any modulation scheme that can be implemented via software. Once produced a change of frequency or modulation scheme can be achieved through a simple software upload.

The flexibility these radios have means that they offer significant benefits to radio users as changes to the radio system can be achieved in a short space of time without having to purchase new hardware and is being studied as part of the flexible airborne architecture concept. However as a change in radio parameters can be achieved through a software upload, if the regulation of the use of these radios is not sufficiently robust they could be prone to misuse or computer viruses causing them to operate on frequencies that they were not originally intended to. It is therefore essential that the relevant measures are put in place to ensure that a software defined radio cannot operate in an aeronautical band unless certified and installed by a qualified manufacturer and similarly that aeronautical software defined radios cannot unintentionally change characteristics from those for which they have been certified.

Cognitive Radio Systems

Cognitive radio systems are software defined radios that operate by automatically changing their transmission or reception parameters to communicate efficiently avoiding interference with licensed or unlicensed users. This alteration of parameters is based on the active monitoring of several factors in the external and internal radio environment, such as radio frequency spectrum, user behaviour and network state. These systems rely on being able detect all transmitters. Many aeronautical systems however are based on a ground-based transmitter providing a service to airborne receivers. In that case it is very possible for a cognitive radio to be beyond the line-of-sight of the transmitter but still within line-of-sight of the airborne receiver. This can result in interference to that receiver. It is therefore essential to ensure that the correct regulatory provisions are put in place to protect aeronautical services.

ICAO Position:

To support the inclusion of regulatory measures in the Radio Regulations that preclude the operation of software defined radios in the bands allocated to aeronautical services unless they are intended and have been properly certified for use in an aeronautical application.

To support the inclusion of regulatory measures in the Radio Regulations that preclude the operation of cognitive radio systems in bands allocated to aeronautical services.

WRC-11 Agenda Item 1.21

Agenda Item Title:

To consider a primary allocation to the radiolocation service in the band 15.4 - 15.7 GHz, taking into account the results of ITU-R studies, in accordance with Resolution 614 (WRC-07).

Discussion:

Radars in the radiolocation service operate on a primary basis worldwide in the band 15.7 - 17.3 GHz. Emerging requirements for increased resolution and range accuracy necessitate wider emission bandwidths. This agenda item seeks to provide adequate spectrum for new radar systems by considering that the band 15.4 - 15.7 GHz be additionally allocated on a primary basis worldwide for the radiolocation service.

This band is used by aeronautical radar systems (ground and airborne) operating under the ARNS allocation. They cater for short-range surveillance and precision functions. In aviation, they find considerable application in precision monitoring, approach and surface detection functions as well as for airborne weather radar (AWR) systems where their shorter wavelength is suitable for the detection of storm clouds. One of the vital safety functions of AWR is to give warning of hazardous weather and ensure safe separation of aircraft from hazardous weather conditions. In most countries the carriage of AWR by aircraft is a mandatory requirement.

These aeronautical radars are to remain in service for many years into the future. The allocation of the radiolocation service in these bands needs to be based upon the results of studies in ITU-R, demonstrating that sharing with the radionavigation service on a primary basis is feasible. These studies should also result in ITU-R regulatory provisions and recommendations where necessary stipulating the conditions of the use of these bands by the radiolocation service. Any allocation to the radiolocation service on a primary basis should be considered with a condition indicating that the radiolocation service shall not cause harmful interference to nor claim protection from the (aeronautical) radionavigation service.

ICAO Position:

Accept the primary allocation of the radiolocation service in the band 15.4 - 15.7 GHz, on the basis of agreed studies showing compatibility which take into account the protection of the use of this band by aviation.

Any allocation to the radiolocation service in this band shall be made with the condition that no harmful interference is caused to the aeronautical radionavigation service and that no protection is required to the radiolocation service from the aeronautical radionavigation service.

WRC-11 Agenda Item 1.22

Agenda Item Title:

To examine the effect of emissions from short-range devices on radiocommunication services, in accordance with Resolution 953 (WRC-07).

Discussion:

This agenda item seeks to study emissions from short-range devices (SRD)s, in particular radio frequency identification (RFID), inside and outside the frequency bands designated in the radio regulations for industrial, scientific and medical (ISM) applications to ensure adequate protection of radiocommunication services. The scope of Agenda Item 1.22 appears to be very broad which is therefore of concern to aviation as it is not clear whether aeronautical bands will be affected. From the wording of the resolution it is uncertain whether it seeks to find new non-ISM bands for SRDs or to make regulatory provisions to protect other services including aeronautical services from SRDs. Furthermore, in ITU-R the term SRD is largely undefined. For example, Recommendation **SM.1538.2**, "for the purpose of the Recommendation" defines SRDs as "intended to cover radio transmitters which provide either unidirectional or bidirectional communication and which have low capability of causing interference to other radio equipment". In Resolution **953** (WRC-07) they are defined as "radio transmitters or receivers, or both, and hence are not considered as ISM applications under No. **1.15".** Neither definition, nor the wording of the agenda item or the resolution, sufficiently constrain the actions that could occur.

The effect of some short range devices on existing radiocommunication systems has been studied by the ITU and various regional radio regulatory bodies. For example, ITU within TG 1/8 has extensively studied the effect of a specific short range device technology, ultra wideband, on existing radiocommunication systems. The conclusion of that study is that without constraints, those short-range devices have the potential to cause harmful interference to certain aviation systems.

SRDs normally operate on a licence exempt basis. Considering the mobility of aircraft and the large "viewing" area to which aircraft are exposed, together with the variability and uncertainty of a significant number of factors (such as SRD emitter density, signal characteristics, activity factors) necessary for the interference analysis of such devices with systems operating within aeronautical safety services, SRD devices should in general not be operated in frequency bands allocated to safety services. In those cases where such use cannot be avoided, administrations should take all steps necessary to ensure that SRD devices do not cause harmful interference to the reception by stations operating under a safety service allocation. The level of harmful interference into safety systems needs to be determined on a case-by-case basis in form of a safety analysis. This analysis would assess the use being made of the safety system and demonstrate that the required levels of integrity, reliability, and availability are still maintained under all operational conditions. Factors such as the impact on link budget margins for safety services, and measures to preclude interference from SRD devices that malfunction need to be considered.

Given the safety nature of the services provided by aeronautical systems, the broad scope of the agenda item, and based on studies currently conducted, it is essential that relevant regulatory provisions are included in the Radio Regulations to ensure that short-range devices cannot cause harmful interference to aeronautical systems.

ICAO Position:

Oppose operation of short-range devices in any bands allocated to aeronautical services.

Support the inclusion in the Radio Regulations of appropriate regulatory provisions (see Resolution **953**) to ensure that short-range devices, operating outside of aeronautical bands, do not cause harmful interference to aeronautical systems operating in allocated aeronautical bands.

WRC-11 Agenda Item 1.23

Agenda Item Title:

To consider an allocation of about 15 kHz in parts of the band 415 - 526.5 kHz to the amateur service on a secondary basis, taking into account the need to protect existing services.

Discussion:

Aeronautical non-directional beacons (NDB) operate in parts of the band prescribed for study under this agenda item. Whilst the long-term goal may be to remove NDBs from use, this is unlikely to be achieved in the near future. It is therefore essential to ensure that whatever action is taken under this agenda item does not adversely affect NDB operations.

ICAO Position:

To ensure that any allocation made to the amateur service shall not cause harmful interference to the operation of aeronautical systems operating under allocations to the aeronautical radionavigation service.

WRC-11 Agenda Item 1.25

Agenda Item Title:

To consider possible additional allocations to the mobile-satellite service, in accordance with Resolution 231 (WRC-07).

Discussion:

This agenda item seeks to identify new allocations that can be made to the mobile satellite service in both the Earth-to-space and space-to-Earth directions with particular focus on the frequency range 4 - 16 GHz.

Report **M.2077** already indicates a shortfall of spectrum available for the satellite component of IMT, however studies need to be done to identify additional spectrum for MSS systems which are not part of the satellite component of IMT.

It should be noted that WRC-11, Agenda Item 1.7 will include studies for AMS(R)S spectrum requirements, including those which may be required as a result of Agenda Item 1.3. If those requirements for AMS(R)S cannot be satisfied with the existing 1 545 - 1 555 MHz and 1 646.5 - 1 656.5 MHz bands, then it authorizes the study of existing MSS allocations, or identification of new allocations, limited to satisfying those AMS(R)S requirements. As a result, it is not expected that AMS(R)S allocations will be addressed under this agenda item.

Care must be taken however to ensure any regulatory action taken as a part of this agenda item does not impact existing AMS(R)S allocations, or any new allocations that may come as a result of studies under Agenda Item 1.3 or 1.7.

Additionally, work within the ITU-R to address this agenda item has identified a number of frequency bands currently used by the radionavigation service for such systems as radio altimeters, MLS and radars. It is essential that these systems remain fully protected and that no allocations are made that adversely affect their operation.

ICAO Position:

To oppose any allocation that would adversely affect the interests of aviation.

WRC-11 Agenda Item 4

Agenda Item Title:

In accordance with Resolution 95 (Rev. WRC-03), to review the resolutions and recommendations of previous conferences with a view of possible revision, replacement or abrogation.

ICAO Position:

Resolutions:

Resolution No.	***Title***	***Action recommended***
18 *(Rev WRC-07)*	Relating to the procedure for identifying and announcing the position of ships and aircraft of States not parties to an armed conflict	No change
20 *(Rev. WRC-03)*	Technical cooperation with developing countries in the field of aeronautical telecommunications	No change
26 *(Rev. WRC-07)*	Footnotes to the Table of Frequency Allocations in Article 5 of the Radio Regulations	No change
27 *(Rev. WRC-07)*	Use of incorporation by reference in the Radio Regulations	No change
28 *(Rev. WRC-03)*	Revision of references to the text of ITU-R recommendations incorporated by reference in the Radio Regulations	No change
63 *(Rev. WRC-07)*	Protection of radiocommunication services against interference caused by radiation from industrial, scientific and medical (ISM) equipment	No change
95 *(Rev. WRC-07)*	General review of the resolutions and recommendations of world administrative radio conferences and world radiocommunication conferences	No change
114 *(Rev. WRC-03)*	Studies on compatibility between new systems of the aeronautical radionavigation service and the fixed-satellite service (Earth-to-space) (limited to feeder links of the non-geostationary mobile-satellite systems in the mobile-satellite service) in the frequency band 5 091 - 5 150 MHz	No change
205 *(Rev. MOB-87)*	Protection of the band 406 - 406.1 MHz allocated to the mobile-satellite service	No change

Resolution No.	***Title***	***Action recommended***
207 *(Rev. WRC-03)*	Measures to address unauthorized use of and interference to frequencies in the bands allocated to the maritime mobile service and to the aeronautical mobile (R) service	No change
217 *(WRC-97)*	Implementation of wind profiler radars	No change
222 *(Rev. WRC-07)*	Use of the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz by the mobile-satellite service	Modify as necessary based on studies carried out under WRC-11, Agenda Item 1.7
225 *(Rev .WRC-07)*	Use of additional frequency bands for the satellite component of IMT-2000	No change
339 *(Rev. WRC-07)*	Coordination of NAVTEX services	No change
354 (WRC-07)	Distress and safety radiotelephony procedures for 2 182 kHz	No change
356 (WRC-07)	ITU maritime service information registration	No change
405	Relating to the use of frequencies of the aeronautical mobile (R) service	No change
413 *(WRC-07)*	Use of the band 108 - 117.975 MHz by aeronautical services	Modify as necessary based on studies carried out under WRC-11, Agenda Item 1.4 and other studies
417 (WRC-07)	Use of the band 960 - 1 164 MHz by the aeronautical mobile (R) service	Modify as necessary based on studies carried out under WRC-11, Agenda Item 1.4
418 (WRC-07)	Use of the band 5 091 - 5 250 MHz by the aeronautical mobile service for telemetry applications	No change
419 (WRC-07)	Considerations for use of the band 5 091 - 5 150 MHz by the aeronautical mobile service for certain aeronautical applications	No change
420 (WRC-07)	Consideration of the frequency bands between 5 000 and 5 030 MHz for aeronautical mobile (R) service surface applications at airports	Delete after WRC-11 (WRC-11, Agenda Item 1.4)

Resolution No.	***Title***	***Action recommended***
421 (WRC-07)	Consideration of appropriate regulatory provisions of the operation of unmanned aircraft systems	Delete after WRC-11 (WRC-11, Agenda Item 1.3)
608 *(WRC-03)*	Use of the frequency band 1 215 - 1 300 MHz by systems of the radionavigation satellite service	Delete after studies completed
609 *(WRC-07)*	Protection of aeronautical radionavigation systems from the equivalent power flux-density produced by radionavigation satellite service networks and systems in the 1 164 - 1 215 MHz band	No change
610 *(WRC-03)*	Coordination and bilateral resolution of technical compatibility issues for radionavigation satellite networks and systems in the band 1 164 - 1 300 MHz, 1 559 - 1 610 MHz and 5 010 - 5 030 MHz	No change
611 (WRC-07)	Use of portion of the VHF band by the radiolocation service	Delete after WRC-11 (WRC-11, Agenda Item 1.14)
612 (WRC-07)	Use of the radiolocation service between 3 and 50 MHz to support high-frequency oceanographic radar operations	Delete after WRC-11 (WRC-11, Agenda Item 1.15)
614 (WRC-07)	Use of the band 15.4 - 15.7 GHz by the radiolocation service	Delete after WRC-11 (WRC-11, Agenda Item 1.21)
644 *(Rev. WRC-07)*	Telecommunication resources for disaster mitigation and relief operations	No change
705 *(MOB-87)*	Mutual protection of radio services operating in the band 70 - 130 kHz	No change
729 *(WRC-07)*	Use of frequency adaptive systems in the MF and HF bands	Delete after WRC-11
748 (WRC-07)	Compatibility between the aeronautical mobile (R) Service and the fixed satellite service (Earth-to-space) in the band 5 091 - 5 150 MHz	No change
754 (WRC-07)	Consideration of modification of the aeronautical component of the mobile service allocation in the 37 - 38 GHz band for protection of other primary service in the band	Delete after WRC-11 (WRC-11, Agenda Item 1.12)
805 (WRC-07)	Agenda for the 2011 World Radiocommunication Conference	Delete after WRC-11

Resolution No.	*Title*	*Action recommended*
951 *(Rev. WRC-07)*	Options to improve the international spectrum regulatory framework	Delete after WRC-11
953 (WRC-07)	Protection of radiocommunication services from emissions by short range devices	No change
956 (WRC-07)	Regulatory measures and their relevance to enable the introduction of software-defined radio and cognitive radio systems	No change

Recommendations:

Recommendation No.		*Action recommended*
7 *(Rev. WRC-97)*	Adoption of standard forms for ship station and ship earth station licences and aircraft station and aircraft earth station licences	No change
9	Relating to the measures to be taken to prevent the operation of broadcasting stations on board ships or aircraft outside national territories	No change
71	Relating to the standardization of the technical and operational characteristics of radio equipment	No change
75 *(WRC-03)*	Study on the boundary between the out-of-band and spurious domains of primary radars using magnetrons	No change
401	Relating to the efficient use of aeronautical mobile (R) worldwide frequencies	No change
608 *(Rev. WRC-07)*	Guidelines for consultation meetings established in Resolution **609 (WRC-03)**	No change

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Attachment

ITU-R RESOLUTION 805 (WRC-07)

Agenda for the 2011 World Radiocommunication Conference

The World Radiocommunication Conference (Geneva, 2007),

considering

a) that, in accordance with No. **118** of the ITU Convention, the general scope of the agenda for a world radiocommunication conference should be established four to six years in advance and a final agenda shall be established by the Council two years before the conference;

b) Article **13** of the ITU Constitution relating to the competence and scheduling of world radiocommunication conferences and Article **7** of the Convention relating to their agendas;

c) the relevant resolutions and recommendations of previous world administrative radio conferences (WARCs) and world radiocommunication conferences (WRCs),

recognizing

a) that this conference has identified a number of urgent issues requiring further examination by **WRC-11**;

b) that, in preparing this agenda, many items proposed by administrations could not be included and have had to be deferred to future conference agendas,

resolves

to recommend to the Council that a world radiocommunication conference be held in 2011 for a period of four weeks, with the following agenda:

1. on the basis of proposals from administrations, taking account of the results of **WRC-07** and the Report of the Conference Preparatory Meeting, and with due regard to the requirements of existing and future services in the bands under consideration, to consider and take appropriate action with respect to the following items:

1.1 to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution **26 (Rev. WRC-07)**;

1.2 taking into account the ITU-R studies carried out in accordance with Resolution **951 (Rev. WRC-07)**, to take appropriate action with a view to enhancing the international regulatory framework;

1.3 to consider spectrum requirements and possible regulatory actions, including allocations, in order to support the safe operation of unmanned aircraft systems (UAS), based on the results of ITU-R studies, in accordance with Resolution **421 (WRC-07)**;

1.4 to consider, based on the results of ITU-R studies, any further regulatory measures to facilitate introduction of new aeronautical mobile (R) service (AM(R)S) systems in the bands 112 - 117.975 MHz, 960 - 1 164 MHz and 5 000 - 5 030 MHz in accordance with Resolutions **413 (Rev. WRC-07)**, **417 (WRC-07)** and **420 (WRC-07)**;

1.5 to consider worldwide/regional harmonization of spectrum for electronic news gathering (ENG), taking into account the results of ITU-R studies, in accordance with Resolution **954 (WRC-07)**;

1.6 to review No. **5.565** of the Radio Regulations in order to update the spectrum use by the passive services between 275 GHz and 3 000 GHz, in accordance with Resolution **950 (Rev. WRC-07)**, and to consider possible procedures for free-space optical-links, taking into account the results of ITU-R studies, in accordance with Resolution **955 (WRC-07)**;

1.7 to consider the results of ITU-R studies in accordance with Resolution **222 (Rev. WRC-07)** in order to ensure long-term spectrum availability and access to spectrum necessary to meet requirements for the aeronautical mobile-satellite (R) service, and to take appropriate action on this subject, while retaining unchanged the generic allocation to the mobile-satellite service in the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz;

1.8 to consider the progress of ITU-R studies concerning the technical and regulatory issues relative to the fixed service in the bands between 71 GHz and 238 GHz, taking into account Resolutions **731 (WRC-2000)** and **732 (WRC-2000)**;

1.9 to revise frequencies and channelling arrangements of Appendix 17 to the Radio Regulations, in accordance with Resolution **351 (Rev. WRC-07)**, in order to implement new digital technologies for the maritime mobile service;

1.10 to examine the frequency allocation requirements with regard to operation of safety systems for ships and ports and associated regulatory provisions, in accordance with Resolution **357 (WRC-07)**;

1.11 to consider a primary allocation to the space research service (Earth-to-space) within the band 22.55-23.15 GHz, taking into account the results of ITU-R studies, in accordance with Resolution **753 (WRC-07)**;

1.12 to protect the primary services in the band 37-38 GHz from interference resulting from aeronautical mobile service operations, taking into account the results of ITU-R studies, in accordance with Resolution **754 (WRC-07)**;

1.13 to consider the results of ITU-R studies in accordance with Resolution **551 (WRC-07)** and decide on the spectrum usage of the 21.4-22 GHz band for the broadcasting-satellite service and the associated feeder-link bands in Regions 1 and 3;

1.14 to consider requirements for new applications in the radiolocation service and review allocations or regulatory provisions for implementation of the radiolocation service in the range 30-300 MHz, in accordance with Resolution **611 (WRC-07)**;

1.15 to consider possible allocations in the range 3-50 MHz to the radiolocation service for oceanographic radar applications, taking into account the results of ITU-R studies, in accordance with Resolution **612 (WRC-07)**;

1.16 to consider the needs of passive systems for lightning detection in the meteorological aids service, including the possibility of an allocation in the frequency range below 20 kHz, and to take appropriate action, in accordance with Resolution **671 (WRC-07)**;

1.17 to consider results of sharing studies between the mobile service and other services in the band 790-862 MHz in Regions 1 and 3, in accordance with Resolution **749 (WRC-07)**, to ensure the adequate protection of services to which this frequency band is allocated, and take appropriate action;

1.18 to consider extending the existing primary and secondary radiodetermination-satellite service (space-to-Earth) allocations in the band 2 483.5-2 500 MHz in order to make a global primary allocation, and to determine the necessary regulatory provisions based upon the results of ITU-R studies, in accordance with Resolution **613 (WRC-07)**;

1.19 to consider regulatory measures and their relevance, in order to enable the introduction of software-defined radio and cognitive radio systems, based on the results of ITU-R studies, in accordance with Resolution **956 (WRC-07)**;

1.20 to consider the results of ITU-R studies and spectrum identification for gateway links for high altitude platform stations (HAPS) in the range 5 850-7 075 MHz in order to support operations in the fixed and mobile services, in accordance with Resolution **734 (Rev. WRC-07)**;

1.21 to consider a primary allocation to the radiolocation service in the band 15.4-15.7 GHz, taking into account the results of ITU-R studies, in accordance with Resolution **614 (WRC-07)**;

1.22 to examine the effect of emissions from short-range devices on radiocommunication services, in accordance with Resolution **953 (WRC-07)**;

1.23 to consider an allocation of about 15 kHz in parts of the band 415-526.5 kHz to the amateur service on a secondary basis, taking into account the need to protect existing services;

1.24 to consider the existing allocation to the meteorological-satellite service in the band 7 750-7 850 MHz with a view to extending this allocation to the band 7 850-7 900 MHz, limited to non-geostationary meteorological satellites in the space-to-Earth direction, in accordance with Resolution **672 (WRC-07)**;

1.25 to consider possible additional allocations to the mobile-satellite service, in accordance with Resolution **231 (WRC-07)**;

2. to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with Resolution **28 (Rev. WRC-03)**, and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with principles contained in the Annex 1 to Resolution **27 (Rev. WRC-07)**;

3. to consider such consequential changes and amendments to the Radio Regulations as may be necessitated by the decisions of the conference;

4. in accordance with Resolution **95 (Rev. WRC-07)**, to review the resolutions and recommendations of previous conferences with a view to their possible revision, replacement or abrogation;

5. to review, and take appropriate action on, the Report from the Radiocommunication Assembly submitted in accordance with Nos. **135** and **136** of the Convention;

6. to identify those items requiring urgent action by the Radiocommunication Study Groups in preparation for the next world radiocommunication conference;

7. to consider possible changes in response to Resolution **86** (Rev. Marrakesh, 2002) of the Plenipotentiary Conference: "Advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks", in accordance with Resolution **86 (Rev. WRC-07)**;

8. in accordance with Article 7 of the Convention:

a) to consider and approve the Report of the Director of the Radiocommunication Bureau:

b) on the activities of the Radiocommunication Sector since **WRC-07**;

c) on any difficulties or inconsistencies encountered in the application of the Radio Regulations; and

d) on action in response to Resolution **80 (Rev. WRC-07).**

8.1 to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, taking into account Resolution **806 (WRC-07)**,

resolves further

to activate the Conference Preparatory Meeting and the Special Committee on Regulatory/Procedural Matters,

invites the Council

to finalize the agenda and arrange for the convening of **WRC-11**, and to initiate as soon as possible the necessary consultations with Member States,

instructs the Director of the Radiocommunication Bureau

to make the necessary arrangements to convene meetings of the Conference Preparatory Meeting and to prepare a report to **WRC-11**,

instructs the Secretary-General

to communicate this resolution to international and regional organizations concerned.

— END —

WAFS developments presented at the CNS/MET SG/13 Meeting

WAFS developments presented to the meeting include:

- WAFC backup tests for SIGWX forecasts in BUFR-code and PNG-chart form, which are performed quarterly (the next test will be performed the last week of July 2009 as WAFC London serves as a backup to WAFC Washington). The tests during the past year have been successful and for the most part, transparent to the WAFS users. Administrative messages via SADIS are sent in advance of the backup tests.

- Wind and temperature performance indicators for Australia and New Zealand were added to the WAFCs websites in 2008. The WAFCs have studied the cost and feasibility of providing global performance indicators in digital and chart format which will be presented to the WAFSOPSG/5 to determine if the task should be conducted. (WAFSOPSG C 4/11 refers)

- Administrative messages identifying errors to the SIGWX forecasts (in BUFR code and/or PNG chart form) was deferred in view of APANPIRG/19 C19/44 which calls for guidance on the use of administrative messages. The draft guidance on the use of administrative messages is subject to WAFSOPSG/5 approval, which would lead to corrections to the WAFS SIGWX before the end of 2009. WMO bulletin headers FXUK65 EGRR and FXUS65 KKCI will be used for corrections to the SIGWX generated by WAFC London and Washington. Implementation of the new administrative messages will be communicated via the WAFS Change Implementation Notice Board (http://www.icao.int/anb/wafsopsg/WAFS%20change%20notice%20board.pdf).

- In accordance with the PIRGs, a training proposal in the form of web-based interactive tutorials will be presented by the WAFCs to the WAFSOPSG/5 meeting and may be available in 2010 or 2011 with endorsement of the WAFSOPSG/5 meeting.

- Coordination with Tropical Cyclone Advisory Centres (TCAC) in harmonizing SIGWX of TC with advisories successful and if endorsed by the WAFSOPSG/5 meeting will be a regular practice.

- Workshop on GRIB 2 forecasts of turbulence, icing and cumulonimbus to address visual issues to be held in Paris, France from 14-15 September 2009. Agenda available on the WAFSOPSG website listed below.

- Web-based tutorials on GRIB 2 forecasts of turbulence, icing and cumulonimbus subject to WAFSOPSG/5 approval and expected to be available mid-late 2010.

- Suggested actions by the WAFS Provider State include:

  -Review discussion of WAFSOPSG/5 meeting and associated guidance material
  -further details of WAFS developments
  -WAFC backup tests and procedures
  -implementation of new administrative messages on corrected SIGWX
  -monitor the development of web-based distribution of WAFS forecasts in chart form
  -progress of developing concatenated WAFS forecasts
  -WAFCs performance indicators for wind and temperature and developments at www.icao.int/anb/wafsopsg/

SADIS specific developments include:

- cessation of the SADIS 1G satellite broadcast on 05 January 2009

- update to the SADIS Users Guide (SUG) – fourth edition that conforms to Amendment 74 to Annex 3 and the cessation of the SADIS 1G and the use of PNG chart for volcanic ash advisories in graphical form

- development of alternative SADIS 2G hardware that includes
  -NetSys SADIS Transcoder (NST) as a partial to the whole system and presents data in UDP-multicast output (http://www.netsys.co/za or email info@netsys.co.za)
  -VADOS VadEDGE 4100-series router for SADIS 2G in TCP/IP or UDP multicast (http://www.vados.com/new/index.php or email sadis2g@vados.com)

- initial phase of enhancements to the SADIS FTP service

- second phase of enhancements to the SADIS FTP service for increased security in 2010 with parallel operations of existing FTP service for 12 months

- procurement of SADIS 2G data backup arrangement with the US NWS Telecommunications Gateway (NWSTG) and the SADIS OPMET Gateway (NATS) utilizing ISDN to the uplink facility at Whitehill bypassing Exeter

- SADIS workstation software evaluations (7 of 8 software evaluations meet the software requirements of the SADISOPSG/13 meeting) (http://www.metoffice.gov/uk/sadis/software/index.html)

- GRIB 2 WAFS data trial on SADIS 2G where compressed transmission times are expected to be at least twice that of existing GRIB 1, but half that of uncompressed GRIB 2

- distribution of GRIB 2 WAFS data on SADIS via SADIS FTP and possible infrastructure upgrade needed to accommodate satellite distribution

- visit the SADIS website (www.icao.int/anb/sadisopsg) to obtain the following information:

  -procurement guidelines for the SADIS second-generation (SADIS 2G) VSAT reception system
  -latest (4th edition) SADIS Users Guide
  -alternate SADIS 2G hardware
  -development SADIS FTP Secure service
  -updates on satellite distribution of GRIB 2 WAFS via SADIS 2G

**SUMMARY OF THE STRATEGIC ASSESSMENT TABLES:
CURRENT AND PROJECTED DATA VOLUMES 2010-2013**

Table 1. OPMET data volumes per day (in K bytes)

Region	***Current 2009***	*Projected 2010*	*Projected 2011*	*Projected 2012*	*Projected 2013*
ASIA	**973**	991	1015	1038	1061

Table 2. PNG data volumes per day (in K bytes)

Region	***Current 2009***	*Projected 2010*	*Projected 2011*	*Projected 2012*	*Projected 2013*
ASIA	**0**	200	200	200	200

Table 3. AIS data volumes per day (in K bytes)

Region	***Current 2009***	*Projected 2010*	*Projected 2011*	*Projected 2012*	*Projected 2013*
ASIA	**0**	2	2	2	2

SADIS STRATEGIC ASSESSMENT TABLES CURRENT AND PROJECTED DATA VOLUMES 2010-2013

Note.— 1 octet = 1 byte = 1 character.

Table 1. ASIA— OPMET data volumes

OPMET data	***Current 2009***	*Projected 2010*	*Projected 2011*	*Projected 2012*	*Projected 2013*
ALPHANUMERIC DATA					
Number of **FC bulletins** issued per day	**145**	150	155	160	165
Number of **FT bulletins** issued per day	**366**	375	385	395	405
Number of **SA bulletins** issued per day	**2319**	2350	2400	2450	2500
Number of **SP bulletins** issued per day	**35**	40	45	50	55
Number of **SIGMET** bulletins issued per day	**84**	90	95	100	105
BINARY DATA					
Number of other bulletins issued per day	**0**	0	0	0	0
TOTALS					
Total number of OPMET bulletins per day	**2949**	3005	3075	3145	3215
Average size of OPMET bulletin (bytes)	**330**	330	330	330	330
Total estimated OPMET data volume per day (in K bytes)	**973**	**991**	**1015**	**1038**	**1061**

Note. – No provision is being made for the distribution of BUFR-coded OPMET data. Capacity for this data may need to be included in future depending on the issuance of this data in the region.

Table 2. ASIA — PNG data volumes

Graphical information in the PNG chart form	***Current 2009***	*Projected 2010*	*Projected 2011*	*Projected 2012*	*Projected 2013*
TOTALS					
Total number of PNG charts per day	**0**	2	2	2	2
Average size of charts (bytes)	**100000**	100000	100000	100000	100000
Total estimated volume of PNG charts per day (in K bytes)	**0**	**200**	**200**	**200**	**200**

Note. – Provision is made for the distribution of PNG-encoded VAG.

Table 3. ASIA — AIS data volumes

AIS data	***Current 2009***	*Projected 2010*	*Projected 2011*	*Projected 2012*	*Projected 2013*
ALPHANUMERIC AIS DATA (NOTAM related to volcanic ash, ASHTAM)					
Number of ASHTAM bulletins issued per day	**0**	2	2	2	2
Number of NOTAM bulletins issued per day	**0**	2	2	2	2
TOTALS					
Total number of AIS bulletins per day	**0**	4	4	4	4
Average size of AIS bulletin (byte)	**600**	600	600	600	600
Total estimated volume of AIS data per day (in K bytes)	**0**	**2**	**2**	**2**	**2**

Note. – Provision is made for the distribution of ASHTAMs and NOTAMs related to volcanic ash.

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LIST OF AERODROMES FOR NEW OPMET EXCHANGE SCHEME IN US

These stations are taken from the Annex 1 **(FASID TABLE MET 2A)** and are grouped by region.

This list of about 450 OPMET locations is the same for the three different types of OPMET collectives listed above.

East FTUS71 SAUS71 SPUS71	East FTUS71 SAUS71 SPUS71	East FTUS71 SAUS71 SPUS71	Southern FTUS72 SAUS72 SPUS72	Southern FTUS72 SAUS72 SPUS72	Southern FTUS72 SAUS72 SPUS72	Central FTUS73 SAUS73 SPUS73	Central FTUS73 SAUS73 SPUS73	Central FTUS73 SAUS73 SPUS73	West FTUS74 SAUS74 SPUS74	West FTUS74 SAUS74 SPUS74	Alaska/Pacific FTUS75 SAUS75 SPUS75
KABE	KEWR	KPQI	KABI	KHOT	KSJT	KABR	KHON	KRST	KACV	KPAE	PABR
KACK	KFAY	KPSM	KABQ	KHOU	KSPG	KALO	KHUF	KSAW	KALW	KPDX	PABI
KACY	KFLO	KPVD	KABY	KHRL	KSSI	KAPN	KHUT	KSBN	KBFI	KPHX	PACV
KAGC	KGFL	KPWM	KACT	KHRO	KTCC	KASE	KICT	KSDF	KBFL	KPIH	PADL
KAGS	KGON	KRDG	KAEX	KHSV	KTCL	KATY	KIND	KSGF	KBIL	KPMD	PADU
KALB	KGSO	KRDU	KAFW	KIAH	KTCS	KAXN	KINL	KSLN	KBKE	KPRB	PAEN
KAND	KGSP	KRIC	KAHN	KINK	KTLH	KAZO	KJAC	KSPI	KBLI	KPRC	PAGA
KAOO	KHKY	KROA	KALI	KJAN	KTPA	KBFF	KJLN	KSTC	KBOI	KPSP	PAGK
KART	KHPN	KROC	KAMA	KJAX	KTRI	KBIS	KJMS	KSTJ	KBTM	KREL	PAGV
KAVL	KHTS	KRWI	KANB	KJBR	KTUL	KBJC	KJXN	KSTL	KBUR	KRDD	PAIL
KAVP	KHYA	KSAV	KAPF	KLBB	KTUP	KBRL	KLAN	KSUS	KBYI	KRDM	PAKN
KBAF	KIAD	KSBY	KATL	KLCH	KTXK	KBTL	KLAR	KSUX	KBZN	KRNO	PAKT
KBDL	KIAG	KSLK	KAUS	KLFT	KTYR	KCGI	KLBF	KTYC	KCDC	KSAC	PASC
KBDR	KILG	KSWF	KBFM	KLIT	KTYS	KCID	KLEX	KUIN	KCEC	KSAN	PASI
KBFD	KILM	KSYR	KBHM	KLRD	KVCT	KCMI	KLNK	KWRL	KCLM	KSBA	PATA
KBGM	KINT	KTEB	KBNA	KLRU	KVLD	KCNU	KLOZ	KALN	KCTB	KSBP	PAUN
KBGR	KIPT	KTOL	KBPT	KMAF	KVRB	KCOS	KLSE	KBDE	KEKO	KSCK	PAVD
KBKW	KISP	KTTN	KBRO	KMCN	TIST	KCOU	KMBS	KBKF	KEUG	KSEA	PHJH
KBOS	KJFK	KUNG	KBTR	KMCO	TISX	KCPR	KMCI	KCIU	KFAT	KSFF	PHMK
KBTV	KJST	KUIV	KCHA	KMEI	TJBQ	KCYS	KMDW	KELO	KFLG	KSFO	PMDY
KBUF	KLBE	KAKR	KCLL	KMEM	TJMZ	KDDC	KMHK	KIRK	KGCN	KSHR	
KBWI	KLCK	KAPG	KCNM	KMFE	TJPS	KDEC	KMKC	KIRK	KGEG	KSJC	
KCAE	KLEB	KBED	KCRP	KMGM	TJSJ	KDEN	KMKE	KLBL	KGGW	KSLC	
KCAK	KLGA	KBKL	KCSG	KMIA	TKPK	KDET	KMKG	KLCU	KGTF	KSMF	
KCAR	KLUK	KBVY	KCSV	KMKL	TNCM	KDLH	KMLI	KOFK	KHLN	KSMX	
KCHO	KLYH	KCEF	KDAB	KMLB	KBQK	KDSM	KMOT	KSDM	KHQM	KSNA	
KCHS	KMDT	KEWB	KDAL	KMLC	KCEW	KDTW	KMSN	KSTP	KIDA	KSNS	
KCKB	KMFD	KFRG	KDFW	KMLD	KDLF	KEAU	KMSP	KYIP	KIWA	KTUS	
KCLE	KMGW	KFVE	KDHN	KMOB	KBSF	KEGE	KOMA		KLAS	KTVL	
KCLT	KMHT	KHFD	KDMN	KMSL	KNEW	KEVV	KORD		KLAX	KIWF	
KCMH	KMIV	KHVN	KELP	KMSY	KMGP	KFAR	KOSH		KLGB	KUKI	
KCRW	KMRB	KLWM	KEYW	KORC		KFNT	KOTM		KLMT	KYKM	
KCVG	KMSS	KMMU	KFLL	KPBI		KFSD	KOWB		KLVM	KYUM	
KDAN	KMTN	KNKT	KFSM	KPDK		KFWA	KPAH		KMFR	KCXL	
KDAY	KMYR	KOQU	KFTW	KPFN		KGCK	KPIA		KMLS	KMYV	
KDCA	KORF	KPLB	KFTY	KPIE		KGFK	KPIR		KMRY	KNID	
KDUJ	KORH	KSCH	KGGG	KPNS		KGJT	KPLN		KMSO	KRNT	
KECG	KPHF	KUCA	KGLS	KROW		KGRB	KPTK		KOAK	KSBD	
KEKN	KPHL	KWRI	KGNV	KRSW		KGRI	KPUB		KOGD	KTIW	
KELM	KPIT		KGPT	KSAT		KGRR	KRAP		KOLM		
KERI	KPKB		KGUP	KSFB		KGYY	KRFD		KONT		
KEWN	KPOU		KGWO	KSHV		KHIB	KRKS		KOTH		

CNS/MET SG/13-IP/7
Agenda Item 8 (3)

International Civil Aviation Organization
THIRTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND METEOROLOGY SUB-GROUP OF APANPIRG (CNS/MET SG/13)

Bangkok, Thailand, 20 – 24 July 2009

Agenda Item 8: Implementation of the World Area Forecast Systems (WAFS)

3) Review the status of implementation and utilization of the WAFS products

FURTHER OBSERVATIONS ON WAFS TRIAL GRIDDED FORECASTS

(Presented by Hong Kong, China)

SUMMARY

This paper presents further observations on the WAFS trial gridded forecasts of icing, turbulence and cumulonimbus clouds.

This paper relates to

Strategic Objectives:
A: Safety – Enhance global civil aviation safety
D: Efficiency – Enhance the efficiency of aviation operations

Global Plan Initiatives:
GPI-18 Aeronautical information
GPI-19 Meteorological Systems

1. INTRODUCTION

1.1 The WAFS trial gridded forecasts of icing, turbulence and cumulonimbus clouds (CB) have become available for some time for evaluation by users. The gridded forecasts of WAFC London are based on the Unified Model (UM) of the UK Met Office while those of WAFC Washington are based on the Global Forecast System (GFS) of NOAA/NCEP. The WAFS trial gridded forecasts consist of 37 parameters for icing, turbulence and CB for each valid time at T+6 h, T+12 h, … up to T+36 h. Before their operational use, the following issues need to be addressed:

(a) develop a practicable visualization scheme to present the complete suite of forecast information, including high at-a-glance products, to the end users; and
(b) ensure the quality of the forecasts, requiring systematic verification and harmonization of the forecasts from the two WAFCs.

1.2 For the first issue, a separate IP will be presented by Hong Kong, China at this meeting. For the second issue, the WAFSOPG/4 meeting formulated Conclusion 4/17 that the WAFCs Provider States, in coordination with WAFSOPG Members from IATA, IFALPA and WMO, to undertake systematic comparisons of trial gridded forecasts of icing, turbulence and cumulonimbus

clouds of the two WAFC models, highlighting characteristics of areas with different values. The results of these systematic comparisons should lead to the alignment of algorithms used by the two WAFCs.

1.3 In view of the importance of evaluation of new products prior to their provision to the users for operational use, the Hong Kong Observatory (HKO) has made available selected gridded forecasts from the two WAFCs, together with the corresponding SIGWX charts and satellite pictures, on HKO's dedicated aviation weather website (http://wafs-grid-fc.weather.gov.hk/) for evaluation by aviation users. A number of observations had previously been presented in the CNS/MET SG/12 meeting last year. This paper reviews the previous observations and presents additional observations on some other aspects of the gridded forecasts generated by WAFC London (hereafter denoted as UK) and WAFC Washington (hereafter denoted as US). To facilitate comparison of the trial gridded forecasts, they are visualized using the same plotting scheme as presented in IP/18 for CNS/MET SG/12, viz. only the gridded values for each grid box are plotted, according to the defined colour scale, without smoothing nor interpolation of the data.

2. OBSERVATIONS ON GRIDDED FORECASTS

2.1 The following differences between the trial gridded forecasts of the two WAFCs were reported in CNS/MET SG/12 last year:

(a) "CB horizontal extent": CB coverage is more extensive with generally larger forecast values in the UK forecast compared with that of US. Furthermore, small values of CB horizontal extent are given almost everywhere in the UK forecast;

(b) "ICAO height at CB top": the UK forecast generally gives more extensive but lower heights of CB top (generally below 37kft) compared with that of US (above 43 kft);

(c) "Mean in-cloud turbulence potential" at FL180: the UK forecast generally gives wider range and higher turbulence potential values compared with that of US. On the other hand, small values of mean in-cloud turbulence potential are given almost everywhere in the US forecast;

(d) "Maximum icing potential" at FL180: significant differences are observed in the spatial coverage over the tropical and higher latitude regions with the US forecast giving generally higher icing potential over the tropical region and the UK forecast giving generally higher icing potential over the higher latitude regions;

(e) "Maximum CAT potential" at FL340: the UK forecast generally gives much less extensive CAT areas compared with that of US.

2.2 Figure 1 shows the above-mentioned T+24 h trial gridded forecasts of the two WAFCs based on 12 UTC on 2 July 2009, together with the absolute differences between the forecasts of the two centres. The following is observed:

(a) "CB horizontal extent" (Figure 1(a)-(c)): similar to the observation in last year, CB coverage in the UK forecast is still more extensive compared with that of US and small values of CB horizontal extent are still given almost everywhere in the UK forecast. However, the forecast values in the US forecast, reaching 50-75% (which means OCNL following the Annex 3 specification) over many areas in the tropics, now appear larger than those given in the UK forecast for the same areas, which are mostly below 3%. Due to this discrepancy in the range of values, the difference map (Figure 1(c)) appears to be the union of the forecasts of the two centres;

(b) "ICAO height at CB top" (Figures 1(d)-(f) and 1(p)-(q)): the UK forecast still generally gives more extensive CB areas compared with that of US, but the UK forecast heights now reach 37 kft and 43 kft or above. However, the difference map (Figure 1(f)) appears to be the union of the forecasts of the two centres, except over some small areas near the tropics where the two forecasts agree. Comparing Figures 1(p)-(q) with the MTSAT-1R IR satellite imagery in Figure 1(r), it is obvious that the UK significantly over-forecast CB for vast areas in the Pacific Ocean, which should be under the influence of the subtropical ridge. The US forecast appears more realistic;

(c) "Mean in-cloud turbulence potential" at FL180 (Figure 1(g)-(i)): the UK and US forecasts now give values with similar range, but the UK forecast shows small values almost everywhere. The difference map (Figure 1(i)) also appears to be the union of the forecasts of the two centres, indicating little agreement between them;

(d) "Maximum icing potential" at FL180 (Figure 1(j)-(l)): significant differences are still observed in the spatial coverage over the tropical and higher latitude regions, with the US forecast giving larger areas of high icing potential over the tropical region and the UK forecast giving larger areas of high icing potential over the higher latitude regions. The difference map (Figure 1(l)) clearly shows large discrepancies over the higher latitude regions, with smaller discrepancies over the tropical region;

(e) "Maximum CAT potential" at FL340 (Figure 1(m)-(o)): the UK forecast generally gives much less extensive CAT areas compared with that of US, except for a few areas over the Southern Hemisphere. The difference map (Figure 1(o)) also appears to be the union of the forecasts of the two centres, indicating little agreement between them.

2.3 Summarizing the above observations, it is apparent that the trial gridded forecasts of the two WAFCs have yet to be harmonized, as evidenced by the difference maps which, in most cases, appear to be the union of the forecasts of the two centres, indicating little agreement between them. The following paragraphs provide additional observations on some other aspects of the gridded forecasts.

Seasonal changes

2.4 As the observations presented in CNS/MET SG/12 and in Figure 1 of this paper pertain to the summertime in the Northern Hemisphere, it is interesting to also consider the situation for the wintertime in the Northern Hemisphere. Figure 2 shows the T+24 h gridded forecasts of the two WAFCs based on 00 UTC 6 Jan 2009.

2.5 Comparing Figure 2 with Figure 1, the observations in para. 2.2 above (which pertain to the summertime in the Northern Hemisphere) also appear applicable for this different season (wintertime in the Northern Hemisphere). The following additional observations are noted:

(a) "Mean in-cloud turbulence potential" (Figure 2(e)-(f)): large values are forecast by UK for high latitudes in both hemispheres, which are not given in the US forecast. With benefit of hindsight, Figures 1(g)-(h) also show this pattern in the UK forecast;

(b) ""Maximum icing potential" at FL180 (Figure 2(g)-(h)): at the high latitudes (up to about 55°N), large values (> 85%) are forecast by UK, but much smaller values (mostly < 30%) are forecast by US. From a recent scientific paper on icing

climatology[1], it is rather doubtful to expect such high values of the icing potential at this height in the wintertime (see Figure 3 for variation of icing frequencies at different heights with the months, indicating non-occurrence of icing at FL180 in the wintertime north of 25°N);

(c) "Maximum CAT potential" at FL340 (Figure 2(i)-(j)): large values are forecast by UK for a number of isolated locations which are not evident in the US forecast. By examining consecutive forecasts, these isolated locations appear to be stationary and associated with mountainous regions such as western coast of North America, Greenland, Iceland, Scandinavia, Antarctica, southern tip of South America, New Zealand, etc.

Diurnal changes

2.6 Apart from the seasonal aspect, it is also interesting to look at diurnal changes. Figure 4 shows the T+24 h gridded forecasts of "ICAO height at CB top" issued by the two WAFCs valid at 00 UTC and 06 UTC (i.e. 08 H and 14 H local time in Hong Kong) on 18 August 2008. Figure 5 shows the MTSAT-IR infrared satellite imageries, with deep convection indicated in red (see separate information paper for CNS/MET SG/13 on the method for identifying deep convection on satellite imageries), which correspond to these times for comparison. The UK forecasts are obviously giving much more extensive CB areas compared to the US forecasts, corroborating with the observations in para. 2.2(b) above. The satellite imageries show much smaller CB areas which correspond better with the US forecasts. Furthermore, while the weather was generally fine over southern China throughout the period (Figures 5(a)-(b)), both UK and US forecasts appear to over-forecast CB occurrence over this region at 06 UTC (14 H local time), probably due to difficulties of the models in handling the CB development induced by daytime solar heating.

CB associated with tropical cyclones

2.7 The satellite imageries in Figure 5 clearly show the deep convection associated with a tropical cyclone (TC Nuri) east of the Philippines. However, the UK forecasts of "ICAO height at CB top" (Figures 4(a) and 4(c)), covering extensive areas of the Pacific Ocean and South China Sea, cannot distinguish the CB associated with the TC. On the other hand, the US forecasts indicate an area of CB in good agreement with the TC location, even though it is very difficult, if at all possible, to identify this area to be associated with a TC without referring to the satellite imageries. Figures 6 and 7 show a recent case for TC Linfa and the above observations are still valid. As pointed out in the other information paper on visualization of the gridded forecasts, there is indeed a need to consider including safety-related SIGWX features such as TC in the high "at-a-glance" products for the users.

3. ACTION BY THE MEETING

3.1 The meeting is invited to note and exchange views on the information provided in this paper.

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[1] Bernstein, B.C. and Christine LeBot, 2009: An Inferred Climatology of Icing Conditions Aloft, Including Supercooled Large Drops Part II: Europe, Asia and the Globe, *Journal of Applied Meteorology and Climatology*, American Meteorological Society.

WAFC London T+24 h Gridded Forecasts (based on 12 UTC 2 July 2009)	WAFC Washington T+24 h Gridded Forecasts (based on 12 UTC 2 July 2009)	Absolute Difference in the T+24 h Gridded Forecasts of the two WAFCs (based on 12 UTC 2 July 2009)

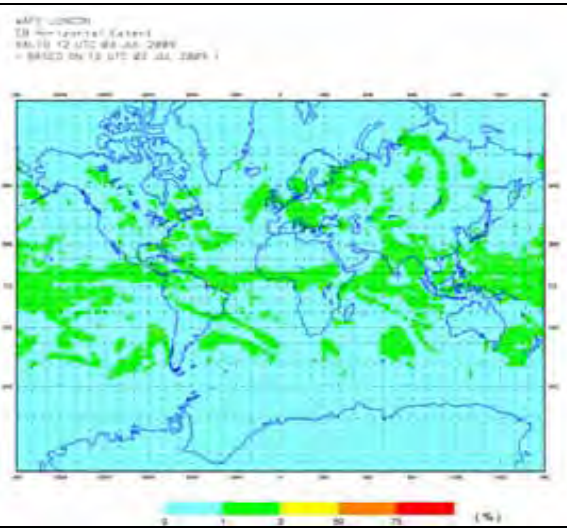
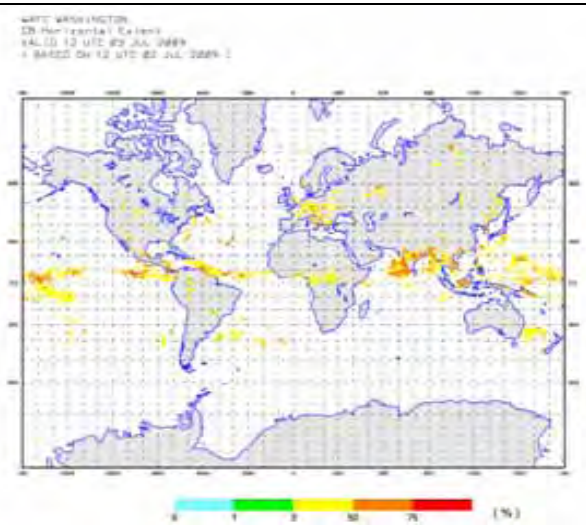
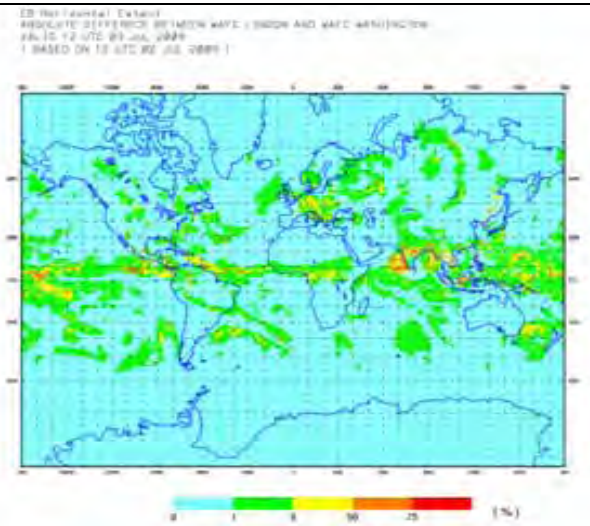

		

Fig. 1(a) “CB horizontal extent” [UK]	Fig. 1(b) “CB horizontal extent” [US]	Fig. 1(c) “CB horizontal extent” [UK-US]

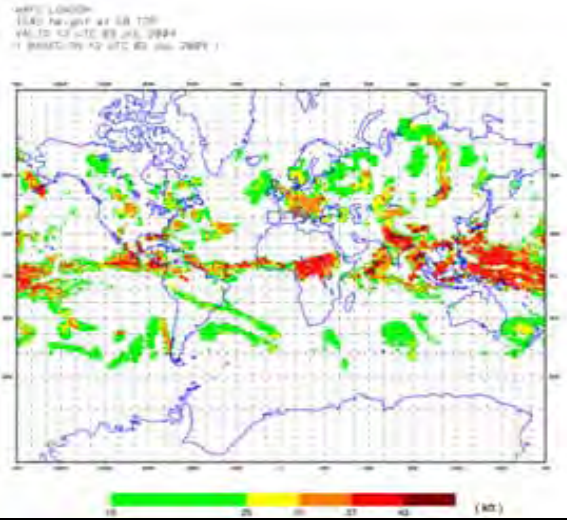
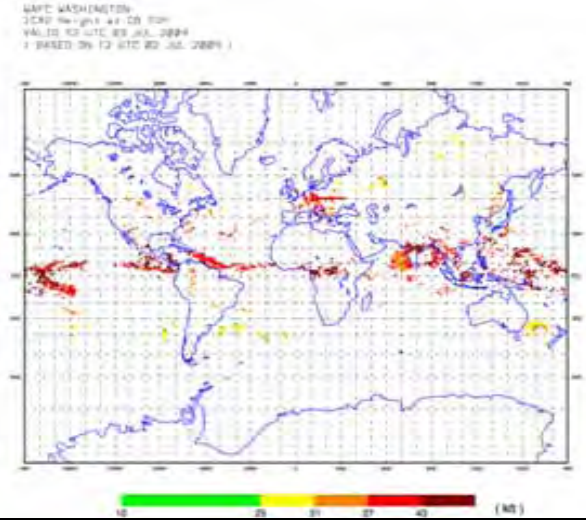
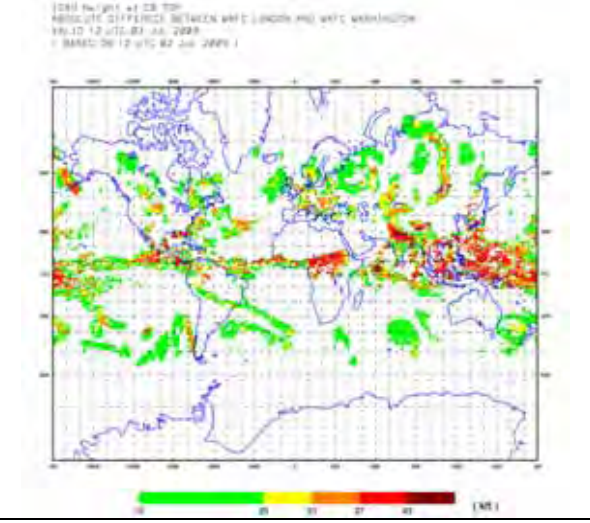

		

Fig. 1(d) “ICAO height at CB top (kft)” [UK]	Fig. 1(e) “ICAO height at CB top (kft)” [US]	Fig. 1(f) “ICAO height at CB top (kft)” [UK-US]

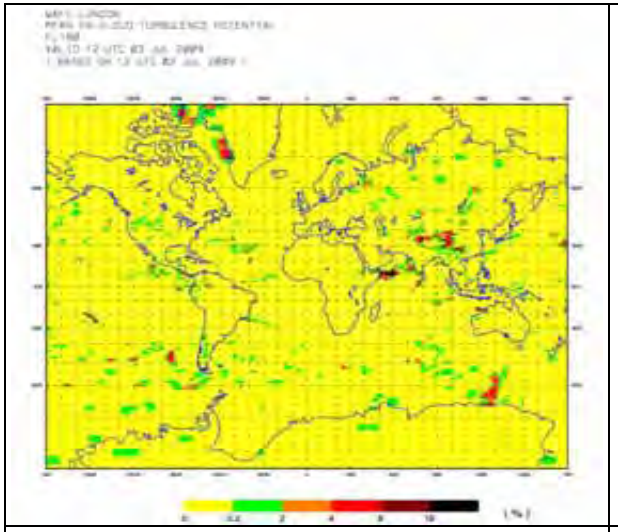


Fig. 1(g) “Mean in-cloud turbulence potential at FL 300” [UK]

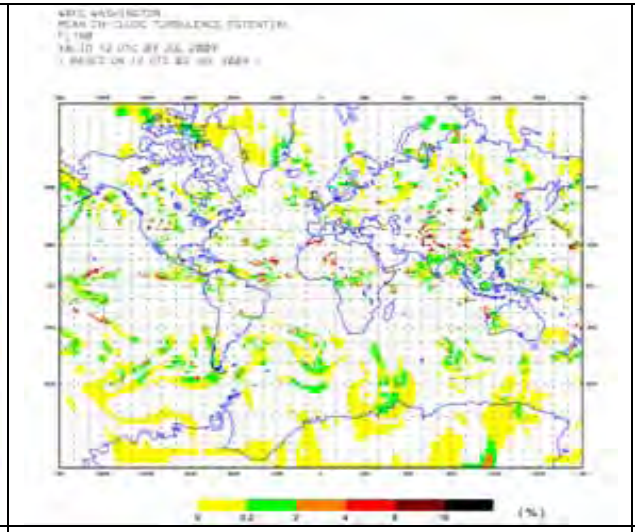


Fig. 1(h) “Mean in-cloud turbulence potential at FL 300” [US]

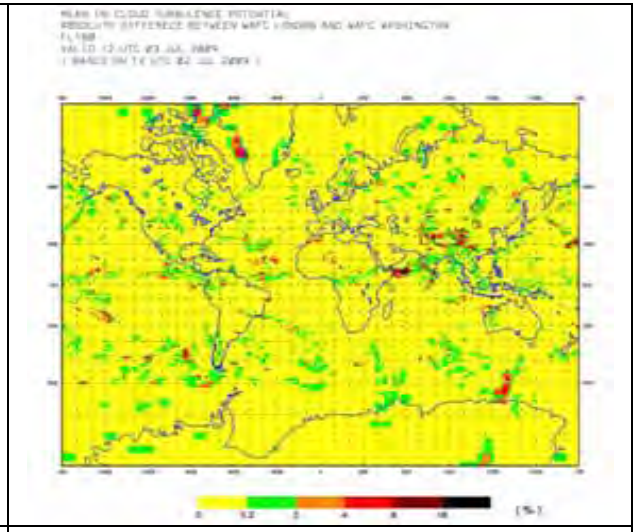


Fig. 1(i) “Mean in-cloud turbulence potential at FL 300” [UK-US]

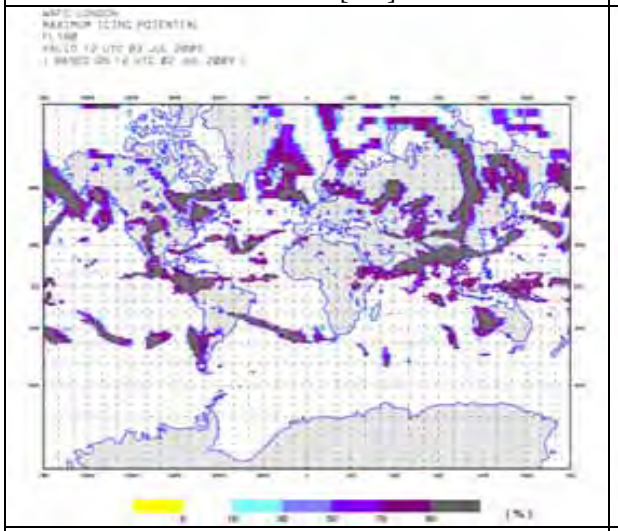


Fig. 1(j) “Maximum icing potential at FL180” [UK]

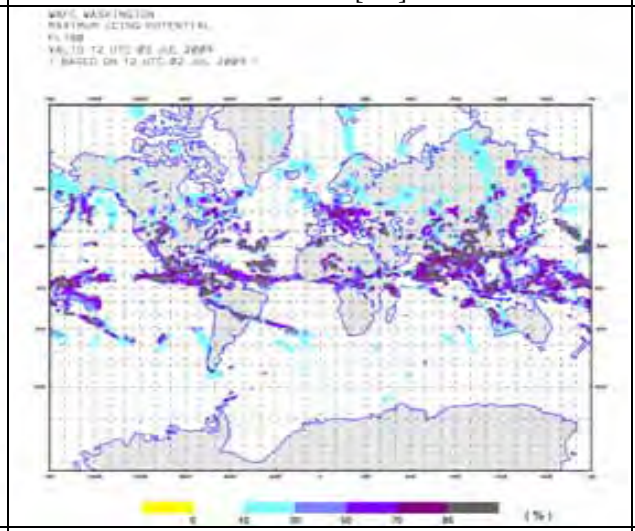


Fig. 1(k) “Maximum icing potential at FL180” [US]

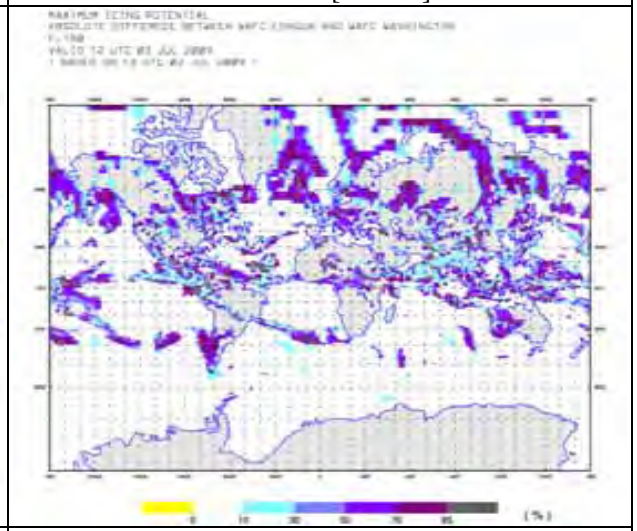


Fig. 1(l) “Maximum icing potential at FL180” [UK-US]

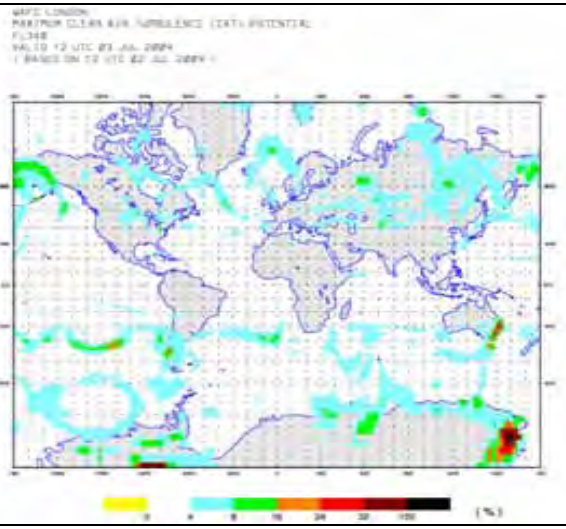


Fig. 1(m) “Maximum CAT potential at FL340” [UK]

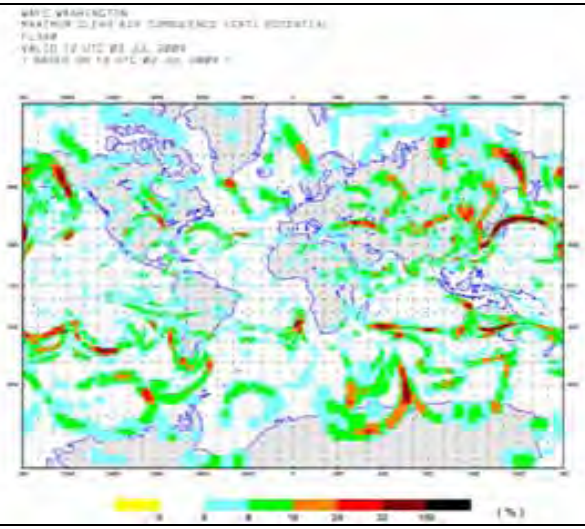


Fig. 1(n) “Maximum CAT potential at FL340” [US]

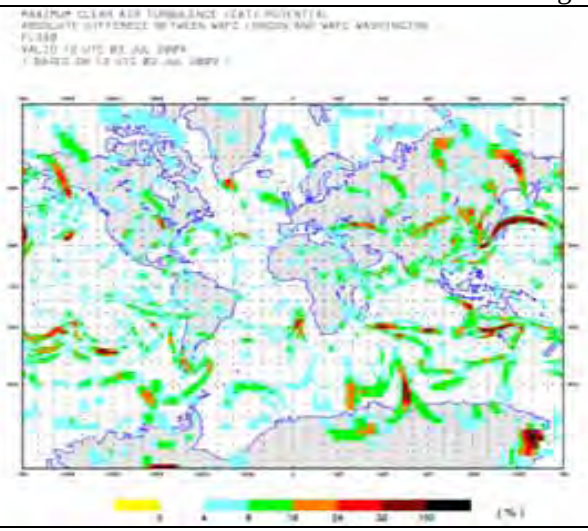
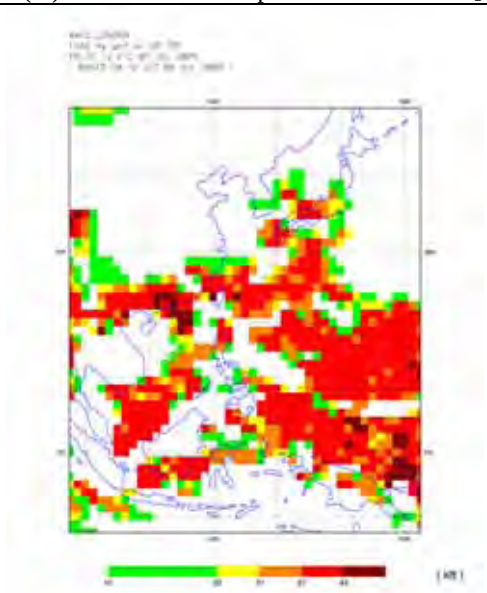
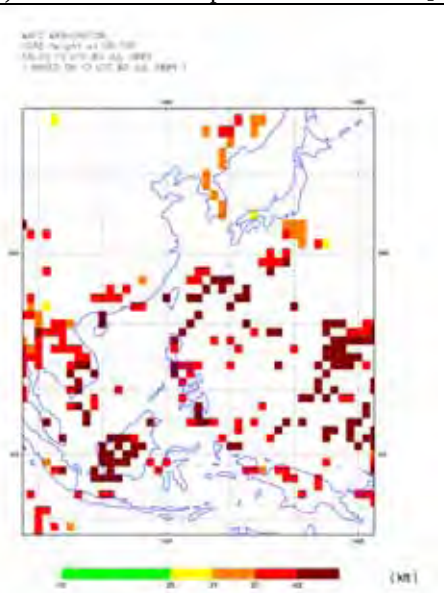
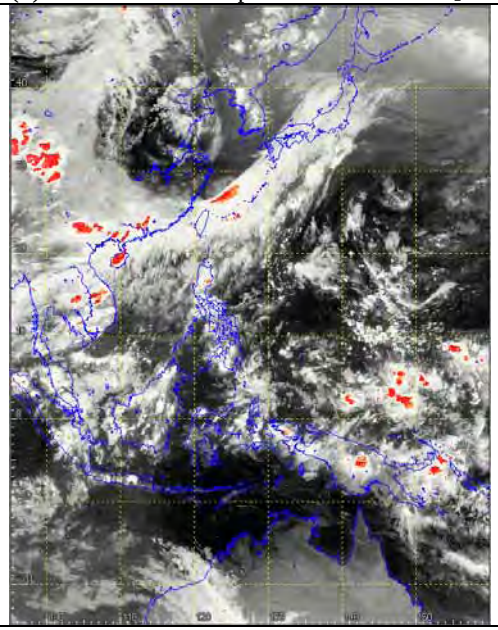


Fig. 1(o) “Maximum CAT potential at FL340” [UK-US]







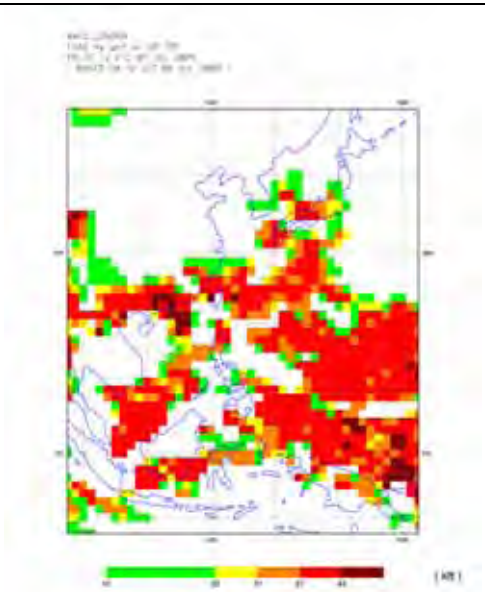
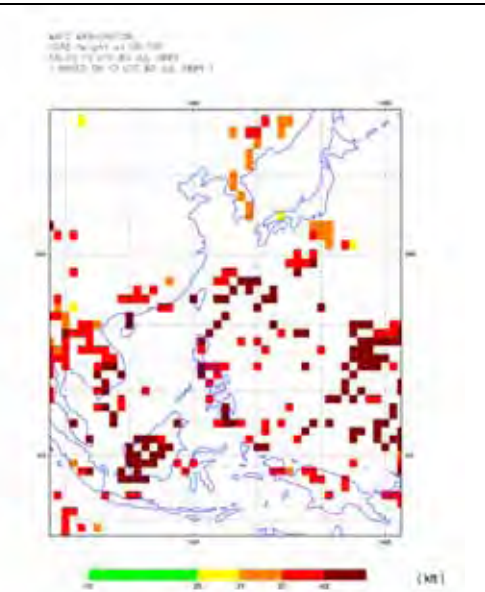
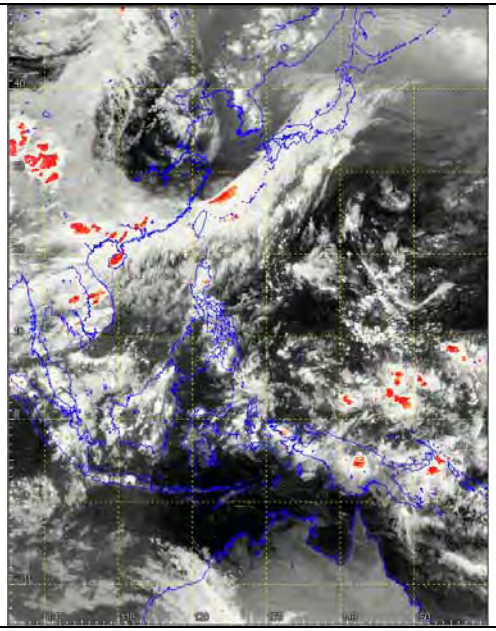
		

Fig. 1(p) “ICAO height at CB top (kft)” [UK]	Fig. 1(q) “ICAO height at CB top (kft)” [US]	Fig. 1(r) MTSAT-1R IR satellite picture, with deep convection indicated in red, at 11:30 UTC 3 July 2009

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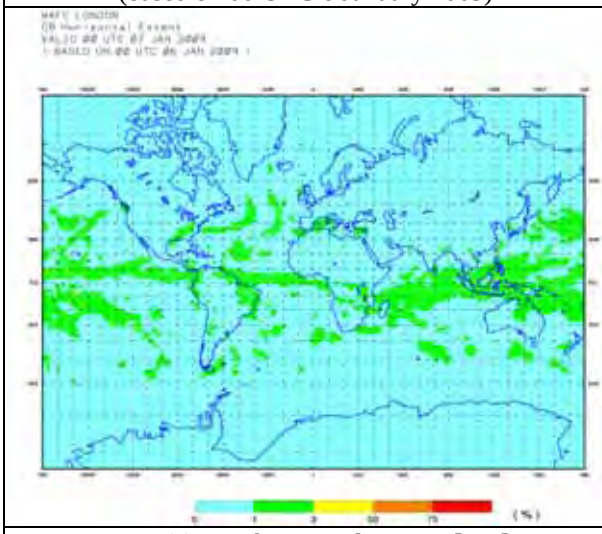
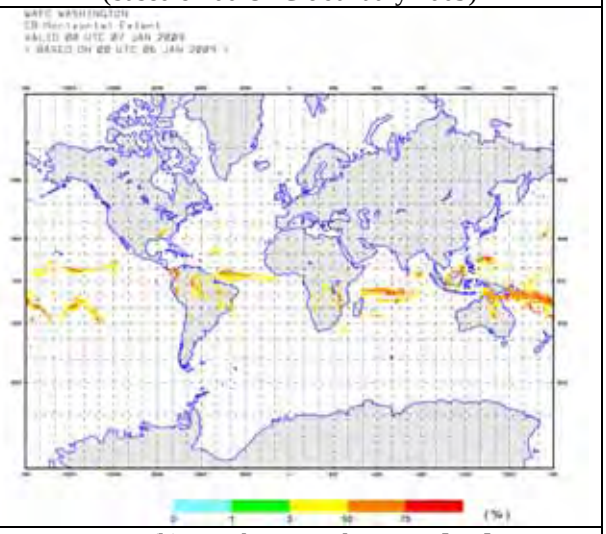
	

Fig. 2(a) "CB horizontal extent" [UK]	Fig. 2(b) "CB horizontal extent" [US]

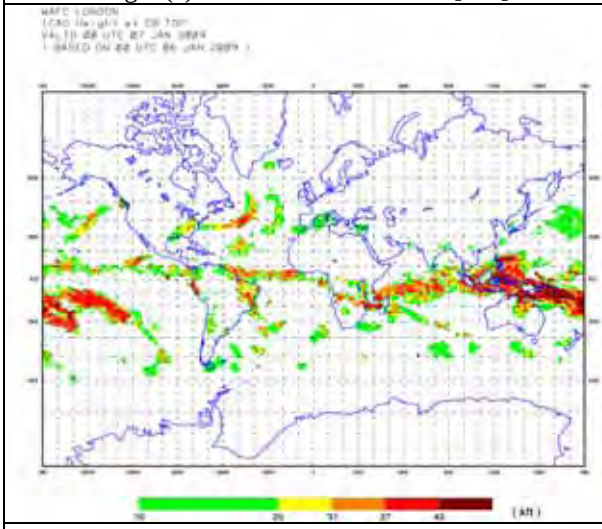
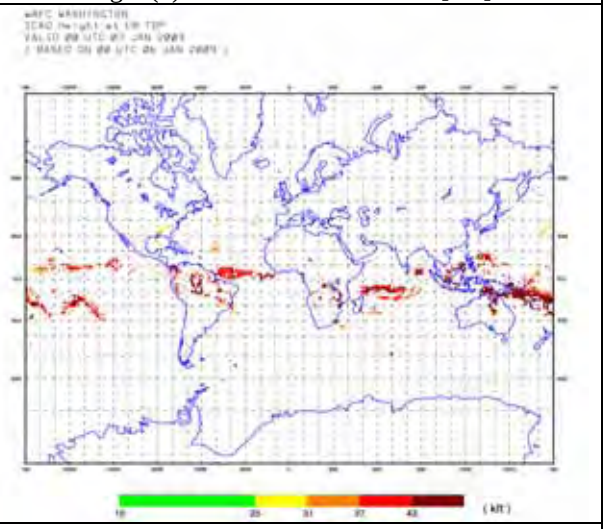

	

Fig. 2(c) "ICAO height at CB top (kft)" [UK]	Fig. 2(d) "ICAO height at CB top (kft)" [US]

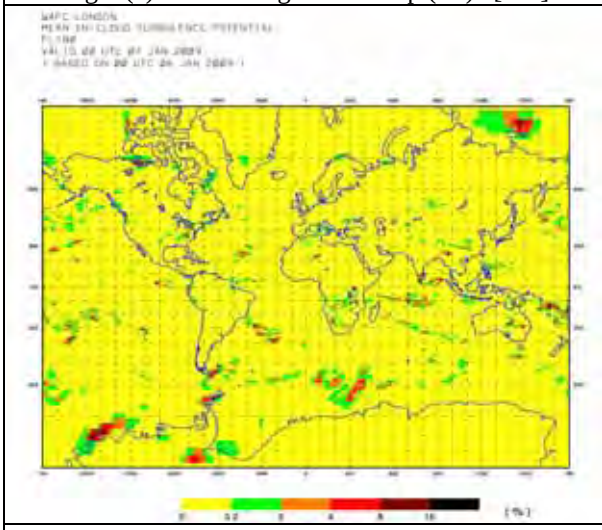
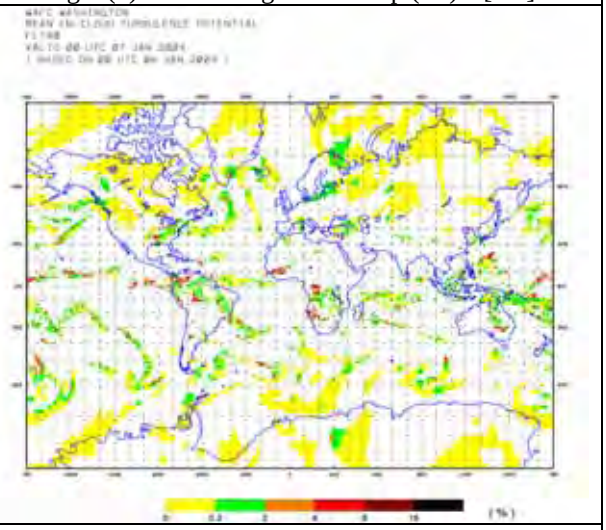

	

Fig. 2(e) "Mean in-cloud turbulence potential at FL 300" [UK]	Fig. 2(f) "Mean in-cloud turbulence potential at FL 300" [US]

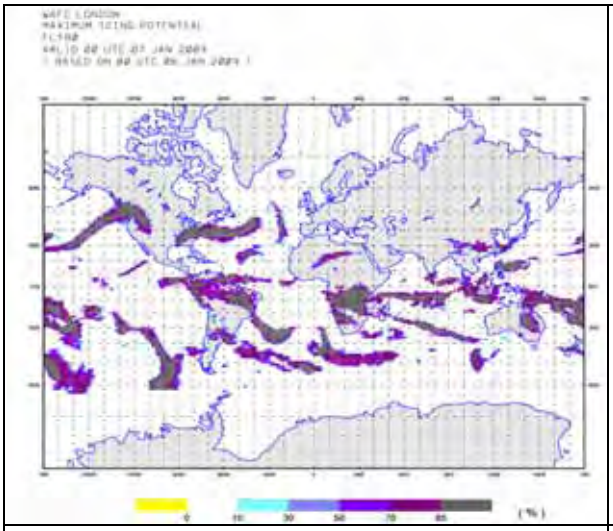


Fig. 2(g) “Maximum icing potential at FL180” [UK]

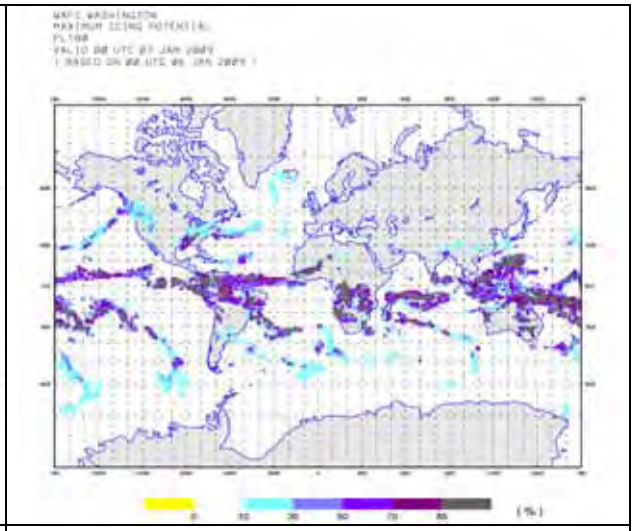


Fig. 2(h) “Maximum icing potential at FL180” [US]

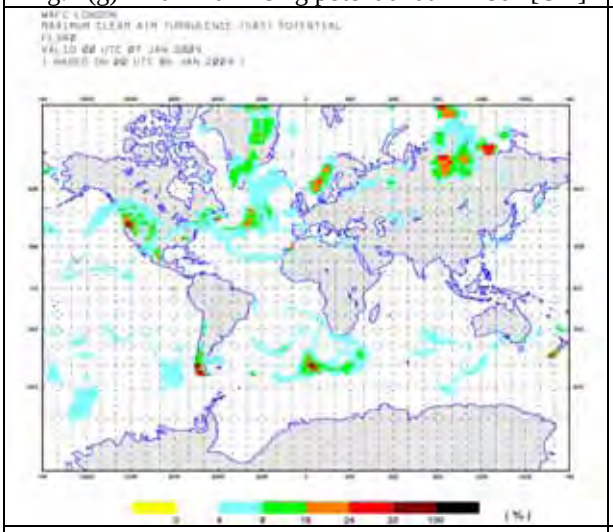


Fig. 2(i) “Maximum CAT potential at FL340” [UK]

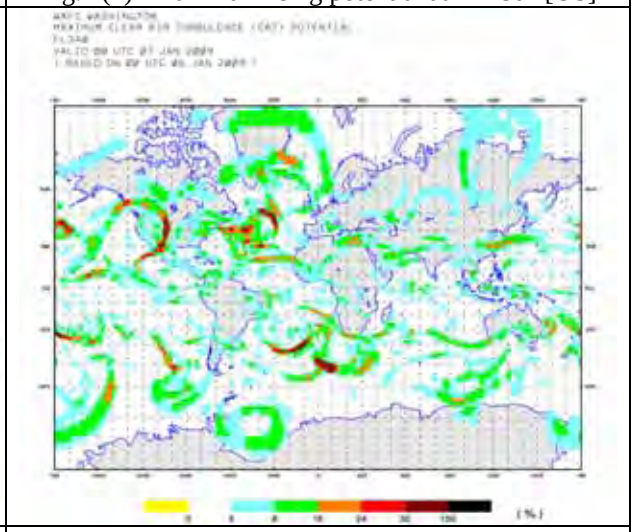


Fig. 2(j) “Maximum CAT potential at FL340” [US]

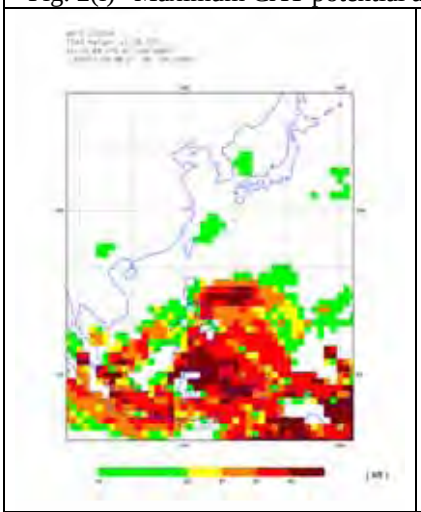


Fig. 2(k) “ICAO height at CB top (kft)” [UK]

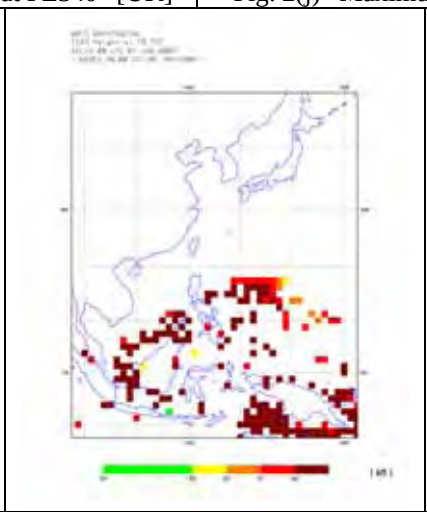


Fig. 2(l) “ICAO height at CB top (kft)” [US]

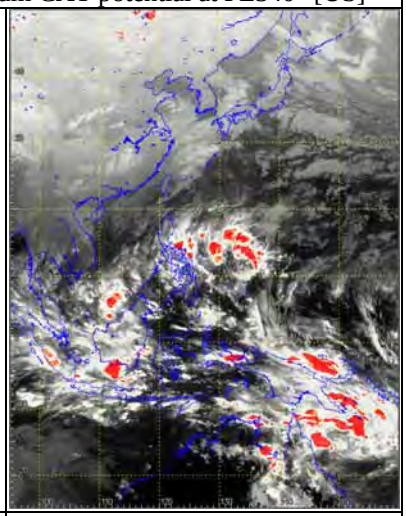


Fig. 2(m) MTSAT-1R IR satellite picture, with deep convection indicated in red, at 23:30 UTC 6 January 2009

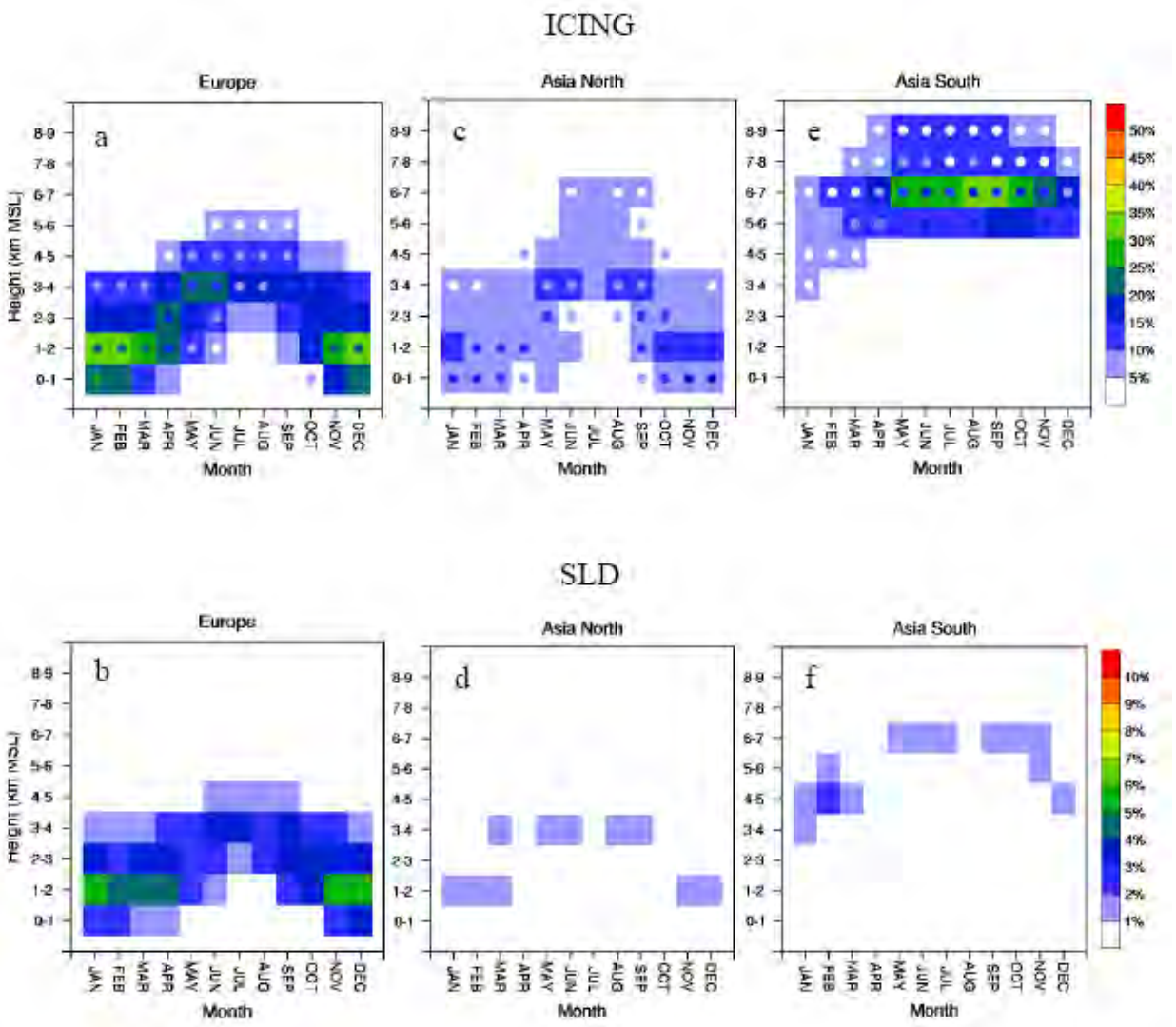


Fig. 5. Time-height plots of icing frequencies for all European stations (a, b) and Asian stations to the north (c, d) and south (e, f) of 25°N latitude. CIP-sonde values are shown as filled boxes, while SIGMA-index values are shown as embedded dots (icing only). Note that when icing frequencies from the two techniques fall into the same range, that the SIGMA-index dot will not be visible (e.g. at 2-3km over Europe during January).

Figure 3 Time-height plots of icing/supercooled large drop (SLD) frequencies for Europe, Asia North and Asia South (Ref.: Bernstein, B.C. and Christine LeBot, 2009: An Inferred Climatology of Icing Conditions Aloft, Including Supercooled Large Drops Part II: Europe, Asia and the Globe, *Journal of Applied Meteorology and Climatology*, American Meteorological Society.)

WAFC London T+24 h “ICAO height at CB top (kft)” Forecasts	WAFC Washington T+24 h “ICAO height at CB top (kft)” Forecasts

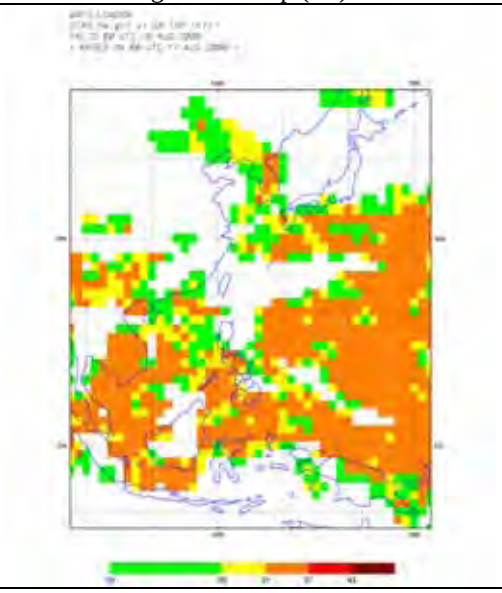
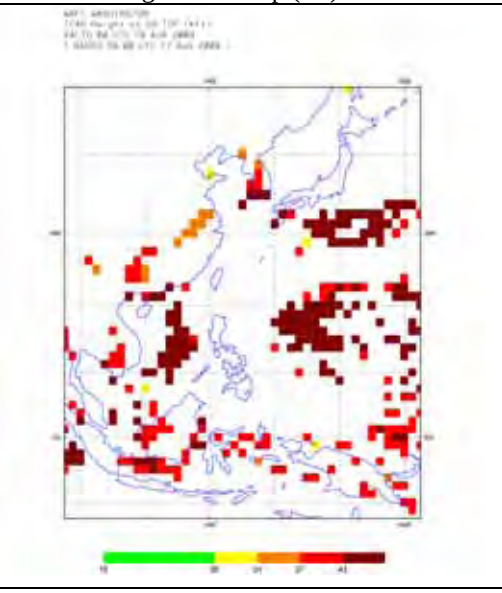

	

Fig. 4(a) Based on 00 UTC 17 August 2008 [UK]	Fig. 4(b) Based on 00 UTC 17 August 2008 [US]

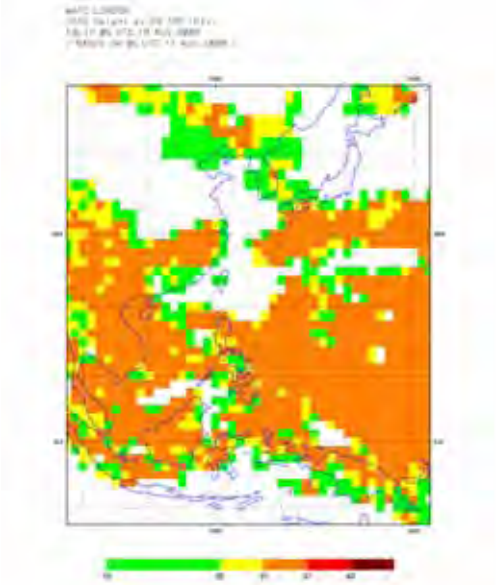
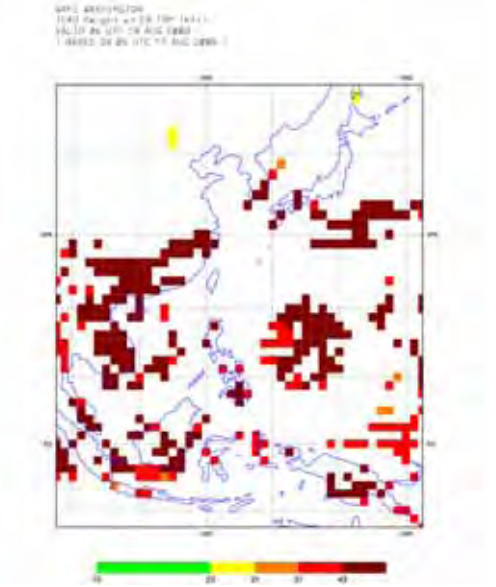

	

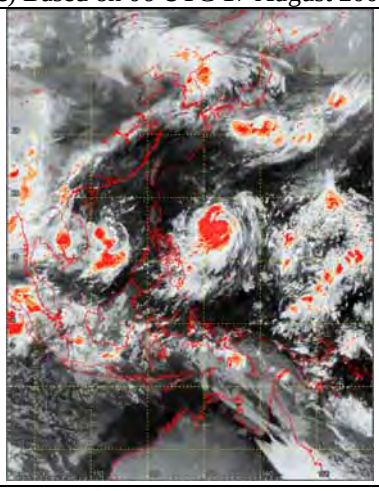
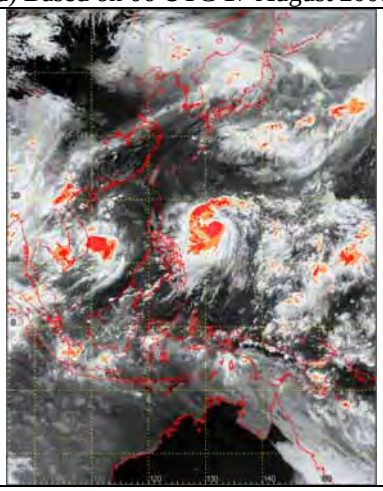
Fig. 4(c) Based on 06 UTC 17 August 2008 [UK]	Fig. 4(d) Based on 06 UTC 17 August 2008 [US]
	

Fig. 5(a) MTSAT-1R infrared satellite imagery, with deep convection indicated in red, at 23:30 UTC on 17 August 2008	Fig. 5(b) MTSAT-1R infrared satellite imagery, with deep convection indicated in red, at 05:30 UTC on 18 August 2008

WAFC London T+24 h "ICAO height at CB top (kft)" Forecasts	WAFC Washington T+24 h "ICAO height at CB top (kft)" Forecasts

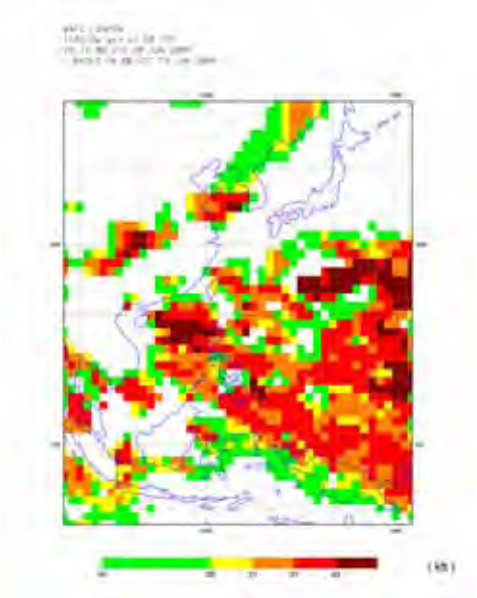
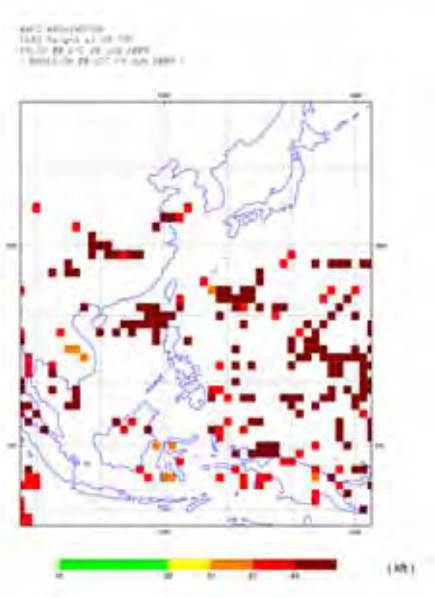

	

Fig. 6(a) Based on 00 UTC 19 June 2009 [UK]	Fig. 6(b) Based on 00 UTC 19 June 2009 [US]

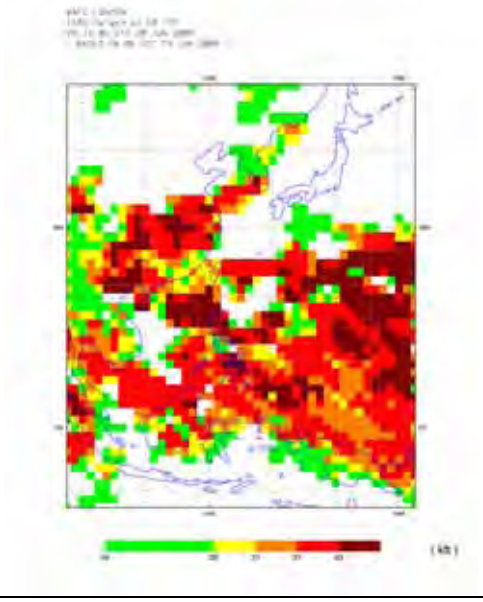
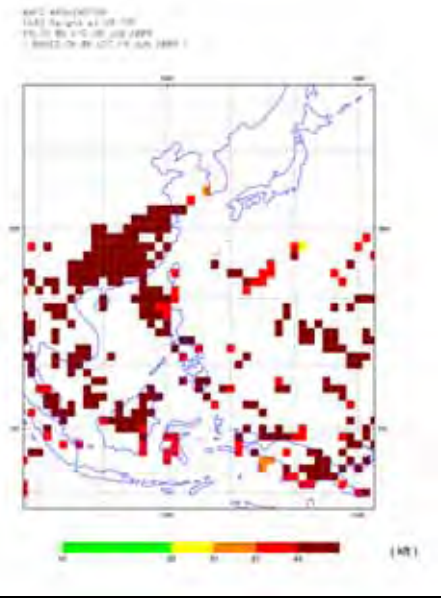

	

Fig. 6(c) Based on 06 UTC 19 June 2009 [UK]	Fig. 6(d) Based on 06 UTC 19 June 2009 [US]

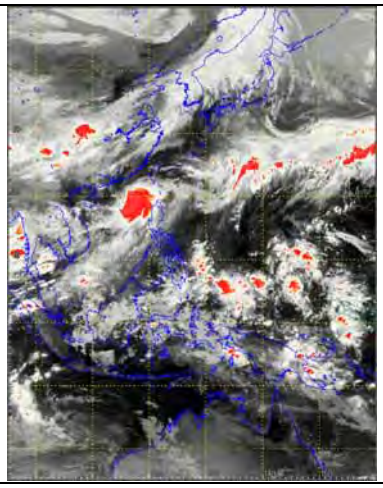


Fig. 7(a) MTSAT-1R infrared satellite imagery, with deep convection indicated in red, at 23:30 UTC on 19 June 2009

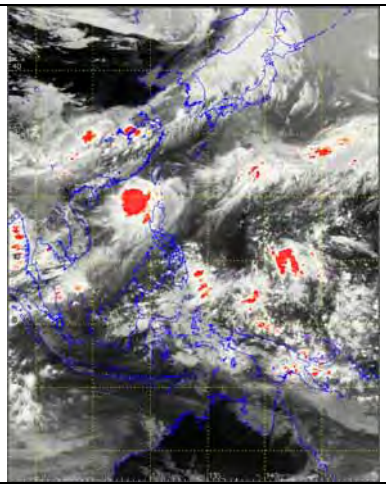


Fig. 7(b) MTSAT-1R infrared satellite imagery, with deep convection indicated in red, at 05:30 UTC on 20 June 2009

ASIA/PAC WAFS IMPLEMENTATION TASK FORCE

1. Terms of Reference

Expedite the implementation of the World Area Forecast System (WAFS) in the Asia and Pacific Regions.

2. Work Programme

The work to be addressed by the ASIA/PAC WAFS Implementation Task Force (WAFS/I TF) includes:

(a) Coordinating the outstanding implementation of SADIS 2G service in the Asia and Pacific Regions.

(b) Coordinating the migration of ISCS G2 service to ISCS G3 service in the Asia and Pacific Regions.

(c) Coordinating the arrangement of training and providing user's feedback on the utilization of gridded forecasts of icing, turbulence and cumulonimbus clouds.

(d) Coordinating the migration of GRIB1 to GRIB2 WAFS data.

(e) Coordinating the provision of assistance to States to ensure that WAFS can be effectively implemented in the Asia and Pacific Regions.

(f) Providing inputs (via the CNS/MET SG) to APANPIRG on the regional planning and development of WAFS for coordination with the WAFSOPSG.

(g) Keeping the ASIA/PAC WAFS Implementation Plan and Procedures up to date.

The work is expected to be carried out primarily by correspondence.

3. Composition

The Task Force is composed by experts from:

Australia; Hong Kong, China (Chairman); India; Japan; New Zealand; Singapore; Thailand; United Kingdom; United States and IATA.

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ASIA/PAC WAFS Implementation Plan and Procedures

12th Edition - July 2009

ASIA/PAC WAFS Implementation Plan and Procedures

12th Edition - July 2009

Introduction

1. The Asia/Pacific WAFS Implementation Plan and Procedures has been revised to take account of progress made in the region.

The Implementation of WAFS

2. This plan is based on the understanding that the implementation of WAFS in the Asia/Pacific Region involves:

a. Production and dissemination by the WAFCs of global forecast winds, temperatures, tropopause height, tropopause temperature and humidity in GRIB format.

b. The implementation of a communication system/s for the distribution of WAFS products in the Asia/Pacific Region, to all the States that require the products in support of international air navigation. This will be achieved via satellite broadcast (SADIS and ISCS/2). States may need to use an alternative distribution system.

c. The production and distribution (via satellite broadcast) by the WAFCs, of Global, quality controlled SWH (FL 250 - 630) in BUFR format and in PNG format for the ICAO standard areas.

d. The production and distribution (via satellite broadcast) by the WAFCs of quality controlled SWM (FL 100 - 250) in BUFR format and in PNG format over limited geographical areas where required by PIRGs.

e. The capability of States to convert current BUFR and GRIB messages to graphical products on an operational basis.

f. Transition from SADIS 1G to SADIS 2G service.

g. Transition from ISCS G2 to ISCS G3 service.

h. Implementation of WAFS Internet File Server (WIFS).

i. Development and utilization of gridded forecasts of icing, turbulence and convective clouds.

j. Transition from GRIB1 to GRIB2 WAFS data.

SIGWX Forecasts

3. There will be an ongoing requirement for NMSs to monitor the quality of WAFC products.

4. Action required to be taken by States to adhere to the provision of Annex 3 to ensure the relevant advisories for tropical cyclones, volcanic ash, the accidental release of radioactive material and SIGMETs are made available to the WAFCs in a timely manner. The WAFS Implementation Task Force will coordinate with the ICAO Secretariat and the VAACs in the Region to also make available ASHTAMs and NOTAMs for VA to the WAFCs in a timely manner.

5. The SIGWX forecasts produced by WAFC Washington are also available on the US NWS Aviation Weather Center Internet site at: http://www.nws.noaa.gov/iscs. All WAFC London and WAFC Washington products are available on the internet-based SADIS FTP server, together with appropriate GRIB and BUFR decoding facilities (Note: not including the visualization software).

6. States are encouraged to provide inputs to the surveys on the operational efficacy of SADIS and ISCS/2 for the purpose of improving the quality of service and to send comments to the WAFCs about the quality and accuracy of SIGWX on a frequent and regular basis. Contact details for comments are:

WAFC Washington

i. NWS/Aviation Weather Center
Attention: Mr Michael Pat Murphy
Science Officer
7220 NW 101st Terrace
Kansas City, Missouri
USA 64153-2371
ii. E-mail addressed to: Michael.Pat.Murphy@noaa.gov
iii. Fax number: 1 816 880 0650

WAFC London

i. The Met. Office
Attention: Mr. Nigel Gait
International Aviation Manager
Fitzroy Road
Exeter
Devon EX1 3PB
United Kingdom
ii. E-mail addressed to: nigel.gait@metoffice.com
iii. Fax number: +44 (1392) 885 681

Gridded Forecasts of Icing, Turbulence and Convective Clouds

7. Gridded forecasts of icing, turbulence and convective clouds are made available on a trial basis by the two WAFCs via the Internet for evaluation by NMSs. Visualization of the gridded forecasts to provide “at a glance” products for flight planning purposes is being developed by the WAFCs. Regional training will be provided to WAFS users on the utilization of the gridded forecasts.

Distribution of WAFS Products

8. The two WAFCs distribute by satellite broadcast global forecast winds, temperatures, tropopause height, tropopause temperature and humidity in GRIB format, global quality controlled SWH and quality controlled SWM for limited geographical areas in PNG and BUFR formats. Suitable decoding and visualization software is required by States in the Asia/Pacific Region to operationally construct graphical SIGWX from the BUFR messages. The provision of PNG formatted SIGWX charts is expected to continue at least until 2010.

Transition from SADIS 1G to SADIS 2G service

9. On 12 November 2004, WAFC London launched the SADIS 2G service that was required as a result of SADISOPSG Conclusion 9/15. This new service is available to new and current SADIS users. The SADIS 1G service has ceased operation on 5 January 2009. States should arrange for the procurement of the necessary hardware, and as necessary, compliant visualization software for transition to the SADIS 2G service in time. Guidance material for users accessing the SADIS 2G broadcast is available at the SADIS web site – http://www.metoffice.gov.uk/sadis/index.html.

Transition from ISCS G2 to ISCS G3 service

10. WAFC Washington plans to implement the ISCS G3 service and to terminate the existing ISCS G2 service by 30 June 2012. The WAFS Internet File Server (WIFS) will also be implemented by March 2010. Upon advice of the implementation plan from WAFC Washington, States should make the arrangements for the installation of the necessary hardware for transition to the ISCS G3 in time.

Indicative Timetable for Implementation of WAFS

11. The table given in Attachment 1 provides an indicative timetable for the implementation of WAFS within the Asia/Pacific Region.

Volcanic Ash Advisory Centres (VAACs)

12. The VAACs are encouraged to monitor WAFS SIGWX forecasts that cover their areas of responsibility, and to advise the appropriate WAFC to ensure the accurate inclusion of the volcanic ash symbol.

Tropical Cyclone Advisory Centres (TCAC)

13. The TCACs are encouraged to monitor WAFS SIGWX forecasts that cover their areas of responsibility, and to advise the appropriate WAFC to ensure the accurate inclusion of the tropical cyclone symbol.

14. The operational contact points in the WAFCs for coordination with the VAACs and TCACs are:

WAFC Washington

i. NWS/Aviation Weather Center

7220 NW 101st Terrace
Kansas City, Missouri
USA 64153-2371

ii. Tel: 1 816 584 7269

WAFC London

i. The Met. Office
Attention: WAFC London Forecaster
Fitzroy Road
Exeter
Devon EX1 3PB
United Kingdom

ii. Tel: 00-44-1392-884926 or 00-44-1392-884908

ASIA/PAC WAFS Implementation Plan and Procedures **Attachment 1**

Indicative Timetable for Implementation of WAFS

Item	Task/Stage of Implementation of WAFS	Anticipated Date
1	WAFC London products on access controlled internet site	Completed
2	The establishment of back-up distribution arrangements for WAFS products	Completed
3	Training in the operational conversion of GRIB forecasts to Wind / Temp charts	Completed
4	All states that receive GRIB products capable of converting GRIB forecasts to Wind / Temp charts	Completed
5	Removal of T4 Facsimile Wind / Temp charts from the satellite broadcast	Completed
6	Training in the operational conversion of BUFR to SIGWX charts	Completed
7	States having the ability to operate the decoding software to convert BUFR SIGWX messages into graphical format	Completed
8	The satellite distribution by the two WAFCs of global SWH and of SWM for limited geographical areas in BUFR format	Completed
9	Launch of SADIS 2G service	Completed
10	SADIS 2G seminar for ASIA/PAC States	Completed
11	Removal of T4 Facsimile SIGWX products from the satellite broadcast	Completed
12	Procurement of SADIS 2G hardware by SADIS user States	Completed
13	Termination of the SADIS 1G service	Completed

Item	Task/Stage of Implementation of WAFS	Anticipated Date
14	Launch of trial gridded forecasts of icing, turbulence and convective clouds	Completed
15	Implementation of ISCS G3 service	TBD
16	Implementation of WAFS Internet File Server (WIFS)	March 2010
17	Workshop on gridded forecasts of icing, turbulence and convective clouds	September 2009
18	WAFCs begin parallel broadcast of WAFS forecasts in the GRIB2 code form	mid-late 2009
19	WAFCs provide web-based gridded forecasts of icing, turbulence and convective clouds	2010/2011
20	Regional training on the use of the gridded forecasts	2010-11
21	WAFS end-user workstations upgraded to accept the GRIB2 code form	November 2011 – November 2013
22	Termination of the ISCS G2 service	30 June 2012
23	Broadcast of WAFS forecasts in the GRIB 1 and WAFS SIGWX forecasts in the BUFR code form and PNG chart form ceases	November 2013

TERMS OF REFERENCE OF ASIA/PAC OPMETMANAGEMENT TASK FORCE (OPMET/M TF)

1. Terms of Reference

-Review the OPMET exchange schemes in the ASIA/PAC and MID Regions and develop proposals for their optimization taking into account the requirements by the aviation users and the current trends for global OPMET exchange;

-Develop standardized quality control, monitoring and management procedures related to ROBEX exchange and other exchanges of OPMET information;

- Regularly update the regional guidance material related to OPMET exchange;

-Liaise with other groups dealing with communication and/or management aspects of the OPMET exchange in ASIA/PAC and other ICAO Regions (ASIA/PAC ATN Implementation Coordination Group, BMG EUR Region, CNS/MET SG MID Region, SADISOPSG).

2. Work Programme

The work to be addressed by the ASIA/PAC OPMET Management Task Force includes:

(a) to examine the existing and any new requirements for OPMET exchange in ASIA/PAC and MID regions and assess the feasibility of satisfying these requirements, taking into account the availability of the data;

(b) to keep under review the ROBEX scheme and other OPMET exchange schemes and prepare proposal for updating and optimizing of the schemes;

(c) to review and update the procedures for interregional OPMET exchange and ensure the availability of the required ASIA/PAC and MID OPMET data for the AFS satellite broadcasts (ISCS and SADIS);

(d) to keep under review and provide timely amendments to the regional guidance material on OPMET exchange; to ensure that guidance material contains procedures for the exchange of all required OPMET data types: SA, SP, FT, WS, WC, WV, FK, FV, UA;

(e) to conduct trials and develop procedures for quality control, monitoring and management of the OPMET exchange; to foster implementation of quality management of OPMET data by the ROBEX centres and the RODBs;

(f) to monitor in coordination with the ATN 1C Group, the transition to an alternative code (i.e. XML) for OPMET exchange;

(g) to participate in the regular regional SIGMET tests;

(h) to further develop quality control guidance material and to promote implementation of quality control for OPMET management.

3. Composition

(a) The Task Force is composed by experts from:
Australia; China; Fiji; Japan; Hong Kong, China; India; Indonesia;
Malaysia, Singapore; Thailand; United Kingdom; United States; and Viet Nam;

(b) Representatives of IATA, EUR BMG and MID OPMET Bulletin Board are invited to participate in the work of the Task Force

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High lights of OPMET/M TF/7 Meeting relevant to Agenda 9 (1)

- 91% of total bulletins were transmitted by the Bangkok RODB to the London IROG within 3 minutes during the backup test for the Singapore RODB for 6 hours on 16 March 2009

- Bangkok RODB will modify software to handle non-transmitted messages (3/4 of total) to correct WMO Abbreviated Header Line (ABL) date time group

- Singapore performance indices (compliance, regularity, and availability) well exceeded .9 except for METAR and/or TAF from the Middle East, Iran, Pakistan, India, Thailand, Indonesia and the South Pacific where it was determined that the low values in Thailand were due to partial availability of METAR data not documented in the ROBEX Handbook Table A, which has since been corrected

- First comparison of performance indices between RODBs (Singapore, Brisbane and Bangkok) revealed higher indices for Singapore and contributed to the different validation reference in that Singapore uses real time monitoring and the other RODBs reference the ROBEX Handbook Tables. Future comparison will reference the ROBEX Handbook Tables that are updated using mean real time monitoring.

- Incorrectly formatted multi-part bulletins (second part of multi-part bulletin without header information) was identified by Brisbane RODB and requested further investigation by AFTN communications centres (Mumbai, Bangkok, Singapore)

- Asia/Pacific Region issues incorrect optional group (PZB) in the second part of the multi-bulletin data as identified by Hong Kong, China when investigating the incorrect documentation in the ROBEX Handbook in that it referenced PAB for the optional group (findings after the meeting). The RODBs and ROBEX Bulletin Communications Centres agreed to implement RRx as the optional code in multi-part bulletins on 1 February 2010 to comply to the WMO Manual on the Global Telecommunications System (WMO No. 386).

- Investigation in the unnecessary bulletin truncation for messages whose length is less than 1800 characters at an AFTN Centre will be conducted

- SIGMET timing and format compliance monitoring by the Singapore RODB revealed compliance of 83, 95, and 89% for WS, WC and WV SIGMET types. Errors identified include incorrect header time, multiple FIR listings, NIL for weather phenomenon, no space in the SIGMET sequence number, and incorrect validity times (> 4 hours) or the incorrect date associated with the validity time.

- Status of OPMET exchange in XML in that enabling clauses to use XML in Annex is planned for 2013 and contingent of steps of development such as the pilot project in 2009 and endorsement by the ICAO ANC in 2010 (The CNS/MET SG/13 meeting noted that XML is not expected to be implemented until 2016 or 2019 and made aware that an implementation plan will be necessary in due time)

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IATA LIST OF AERDROMES NOT ISSUING METAR/TAF AND SUMMARY BY STATE

Summary: Missing OPMET on SADIS

State	METAR	TAF
China	No METAR on SADIS for ZKPY, ZUXC	No METAR on SADIS for ZKPY, ZUXC
Cook Islands	NO METAR on SADIS	TAF randomly on SADIS
Fiji	METAR for NFFN on SADIS only	TAF randomly on SADIS No TAF for NFNA
French Polynesia (France)	METAR on SADIS for NTAA only	No TAF on SADIS for NTGG
India	No METAR on SADIS for VOCL, VEBS, VIPK, VOBG	No TAF on SADIS for VEBS, VIPK, VOBG
Indonesia	METAR received randomly for WABB, WADA, WALL, WAMM, WAPP, WIHH	TAF randomly on SADIS for WABB
Kiribati	No METAR on SADIS	TAF randomly on SADIS
Maldives	No METAR for VRMG	
Marshall Islands	No METAR on SADIS METAR for PKMJ randomly	
Myanmar	No METAR on SADIS for VYSW	No TAF on SADIS for VYMD, VYSW
Nauru	NO METAR on SADIS	No TAF on SADIS
Nepal	METAR not available for 24 hours on SADIS	Only two TAF for VNKT? There are more TAF available, because NEPAL is sending other TAF to some private addresses
New Caledonia (France)	No METAR on SADIS	
Niue	No METAR on SADIS	No TAF on SADIS
Northern Mariana Islands (United States)		Only two TAF per day for PGRO? Only three TAF per day for PGUA?
Pakistan	No METAR on SADIS for OPGD, OPFA, OPMT, OPPI, OPQT	No TAF on SADIS for OPMT, OPPI, OPQT
Papua New Guinea	No METAR on SADIS for AYDU, AYGA, AYMD, AYMH	No TAF on SADIS
Philippines	NO METAR on SADIS for RPMB, RPVP	No TAF on SADIS forRPMB
Republic of Korea	No METAR on SADIS for RKJJ, RKJK, RKSO	No TAF on SADIS for RKJJ, RKJK, RKSO
Samoa	No METAR on SADIS	No TAF on SADIS
Solomon Island		TAF randomly on SADIS
Sri Lanka	No METAR on SADIS for VCCH, VCCC, VCCJ	No TAF on SADIS for VCCH, VCCC, VCCJ
Thailand	No METAR on SADIS for VTPB, VTSE, VTSK, VTUL, VTUQ	No TAF on SADIS for VTPH
Tonga	No METAR on SADIS	TAF randomly on SADIS No TAF for NFTV
Tuvalu	No METAR on SADIS	TAF randomly on SADIS
United States	No METAR on SADIS for PABE, PAHO, PAMC, PANT, PASN, PATK, PAUN, PAYA	Only two TAF per dayfor PHJH? No TAF on SADIS for PABA, PACZ, PADK, PAEH, PAFB, PALU, PANT, PATC, PAED,

State	METAR	TAF
		PAEI
Vanuatu	No METAR on SADIS	No TAF on SADIS for NVSS
Viet Nam	No METAR on SADIS for VVPB, VVDB, VVDL, VVNT	No TAF on SADIS for VVPB, VVDB, VVDL, VVNT
Wallis and Futuna Islands	No METAR on SADIS	No TAF on SADIS
Wake Island (United States)		NO TAF on SADIS for PWAK

Missing METAR from AOP Aerodromes

Bhutan	VQPR
	ZKPY
China	ZUXC
Cook Islands	NCRG
Fiji	NFNA
French Polynesia (France)	NTGG
India	VOCL
	WABB
	WABP
	WAJJ
	WAKK
	WALR
	WAMM
	WAOO
	WIDN
Indonesia	WIMG
Kiribati	NGTA
Maldives	VRMG
Nauru	ANYN
New Caledonia (France)	NWWW
Niue	NIUE
Pakistan	OPGD
	NSAP
Samoa	NSFA
Sri Lanka	VCCH
	NFTF
Tonga	NFTV
Tuvalu	NGFU
	NVSS
Vanuatu	NVVV
Viet Nam	VVPB
Wallis and Futuna Is. (France)	NLWW

Missing TAF from AOP Aerodromes

Bhutan	VQPR
	ZKPY
China	ZUXC
Fiji	NFNA
French Polynesia (France)	NTGG
	WABB
	WABP
	WAJJ
	WAKK
	WALL
	WALR
	WAMM
	WAOO
	WAPP
	WATT
	WIBB
	WIDN
	WIMG
	WIOO
Indonesia	WIPP
Niue	NIUE
Papua New Guinea	AYVN
Samoa	NSAP
Sri Lanka	VCCH
Tonga	NFTV
	PAED
United States	PAEI
Vanuatu	NVSS
Viet Nam	VVPB
Wallis and Futuna Is. (France)	NLWW

Missing METAR from Non-AOP Aerodromes

	VEBS
	VIPK
India	VOBG
	WADA
	WARJ
	WARQ
	WASS
Indonesia	WBKT
Myanmar	VYSW
	OPFA
	OPMT
	OPPI
Pakistan	OPQT
	AYDU
	AYGA
Papua New	AYMD
Guinea	AYMH
	RPMB
Philippines	RPVP
	RKJJ
	RKJK
Republic of Korea	RKSO
	VCCC
Sri Lanka	VCCJ
	VTPB
	VTSE
	VTSK
	VTUL
Thailand	VTUQ
	PABE
	PABT
	PACV
	PAHO
	PAMC
	PANT
	PASN
	PATK
	PAUN
	PAYA
United States	PHNY
	VVDB
	VVDL
Viet Nam	VVNT

Missing TAF from Non-AOP Aerodromes

	VEBS
	VIPK
India	VOBG
	WADA
	WARJ
	WARQ
	WASS
Indonesia	WBKT
	WMAU
Malaysia	WMBA
	VYMD
Myanmar	VYSW
	OPMT
	OPPI
Pakistan	OPQT
	AYDU
	AYGA
	AYMD
	AYMH
	AYMO
Papua New	AYNZ
Guinea	AYWK
Philippines	RPMB
	RKJJ
	RKJK
Republic of Korea	RKSO
	VCCC
Sri Lanka	VCCJ
Thailand	VTPH
	PABA
	PACZ
	PADK
	PAEH
	PAFB
	PALU
	PANT
United States	PATC
	VVDB
	VVDL
Viet Nam	VVNT
Wake Island (United States)	PWAK

IATA LIST OF AERODROMES ISSUING 2 TAF

NTTB	BORA BORA MOTU MUTE	French Polynesia (France)
OPKC	KARACHI INTL	Pakistan
OPLA	LAHORE INTL	
OPNH	NAWABSHAH	
VAAH	AHMEDABAD	India
VAAU	AURANGABAD	
VABB	MUMBAI/CHHATRAPATI SHIVAJI INT	
VABM	BELGAUM	
VABO	VADODARA	
VABP	BHOPAL	
VABV	BHAVNAGAR	
VAGO	GOA	
VAID	DEVI AHILYABAI HOLKAR	
VAJB	JABALPUR	
VAJM	JAMNAGAR	
VAKJ	KHAJURAHO	
VANP	NAGPUR	
VAPO	PUNE	
VARK	RAJKOT	
VARP	RAIPUR	
VCBI	COLOMBO	SriLanka
VECC	KOLKATA	India
VEPT	PATNA	
VEVZ	VISHAKHAPATNAM	
VGEG	CHITTAGONG/SHAH AMANAT(RM)INTL	Bangladesh
VIAR	AMRITSAR	India
VIBN	VARANASI	
VIDP	DELHI/INDIRA GANDHI	
VOBG	BANGALORE	
VOBZ	VIJAYWADA	
VOCB	COIMBATORE	
VOCI	COCHIN INTL	
VOCL	CALICUT/KARIPUR	
VOHS	HYDERABAD/RAJIV GANDHI	
VOHY	HYDERABAD	
VOMD	MADURAI	
VOML	MANGALORE	
VOMM	CHENNAI	
VORY	RAJAMUNDRY	
VOTP	TIRUPATI	
VOTR	TIRUCHIRAPPALLI	
VOTV	THIRUVANANTHAPURAM	
ZMUB	ULAANBAATAR	Mongolia

ROBEX HB - list of updates – June 2009

Text

-Removal of FASID Tables MET 4A, 4B and 4C as reference

Table A (METAR)

-added VTSH (Songkhla) with bulletin time HH+00 to SATH32 Bulletin for Bangkok ROBEX Centre

-added YPWR (Woomera) to SAAU32 bulletin for Brisbane ROBEX Centre

-updated foot note 2, HH+30, by adding "RCKH and RCSS not available 1600-2200" in the SAHK31 bulletin for Hong Kong ROBEX Centre

-received updates from India; however, none were made based on the following: Mumbai CCCC is VABB not VECC and aerodrome names reference Doc 7910 and dissemination addresses for Kolkata are suspect (VTBBYZYX, YBZZSPWX, WSSSYZYX, RJAAYPYX and RJTDYZYX) as they are not duplicated anywhere else in the table. Need to also address the bulletin spread of 20 minutes for Delhi.

-received requested change for Malaysia, but only noticed a change for WBKL, Labuan (RMAF), and WMKD, Kuantan (RMAF) in that the location name omitted (RMAF), which was not performed because Doc 7910 shows (RMAF) in the location name. Malaysia will make request to Secretary General to remove to remove (RMAF) and inform the ICAO RO in order to update the appropriate documents (ROBEX HB, FASID Tables).

-Received request from CAEMSA-SP Technical Expert to remove the foot note *** from AGGH (Honiara (Henderson)) in SANG31 bulletin because METAR is issued and disseminated 24 hours a day.

-Add RODB Tokyo and RODB Brisbane to the distribution of SATH31, SATH32 and SATH33 bulletins

-Add ZSFZ (FUZHOU/Changle) to SACI32 ZBBB bulletin

-Added footnotes: *Available 0000-1100 and **Available 2300-1400 for SATH31 bulletin with qualifier * applying to VTCH, VTCL, VTCN, VTCP, VTPB, VTPH and VTPM and qualifier ** applying to VTCT, VTPO and VTPP

-Added footnotes: *Available 0000-1100 and **Available 2300-1400 and ***on request and applied * to VTSC, VTSF, VTSH, VTSK, VTSR, and VTST and ** to VTSB, VTSG and VTSM and *** to VTSE

-Added footnotes: *Available 0000-1100 and **Available 2300-1400 and ***on request and applied * to VTBO, VTUI, VTUL, VTUO, VTUV and VTUW and ** to VTUD, VTUK and VTUQ and *** to VTUJ.

-Inquire at OPMET/M TF/7 meeting status of Muan (should they be in the ROBEX scheme in the exchange of METAR)

Table B (FT TAF)

-Italicized the non-AOP aerodromes (reflected in note 4 of explanation)

-Added TAF validity requirements in column 2 in parenthesis if different from operational practice (reflected in note 3 of explanation)

-Move VTCT (Chiang Rai Intl Airport), VTSG (Krabi) and VTUU (Ubon Ratchathani) from FTTH31, FTTH32 and FTTH33 bulletins and put in new FTAE33 VTBB bulletin (effective 1 August 2009)

-Add RODB Tokyo and RODB Brisbane to the distribution of FTTH31, FTTH32 and FTTH33 bulletins

-Add ZSFZ (FUZHOU/Changle) to FTCI32 ZBBB bulletin

-Changed footnote of issuance times to 0500/1100 for FTAE32 and placed this footnote on VYMD while removing the footnote from VDPP and VDSR

-Changed filing time to 0500 and 1100 with associated start of validity to 0600 and 1200 for FTTH31, 32 and 33. Also, added Bangkok (VTBBYPYX) in bold font in the RODB/ROBEX Centre column.

Table C (ROBEX exchange of METAR and TAF compared with ASIA/PAC FASID Table MET 1A)

-For VTCT (Chiang Rai Intl Airport), VTSG (Krabi) and VTUU (Ubon Ratchathani) entries, the new FTAE33 VTBB bulletin (effective 1 August 2009) was added in addition to the current bulletins

-Add SACI32 ZBBB and FTCI32 ZBBB bulletins for ZSFZ (Fuzhou/Changle)

-Add FTCI41 ZBBB bulletin for ZJSY (Sanya/Phoenix)

Appendix D – ROBEX Collection and Dissemination of AIREP Bulletins

-Added HAIKOU/Meilan (ZJHK) MWO to the UACI31 AIREP bulletin for the Beijing (ZBBB) ROBEX Centre

-Removed SANYA/Fenghuang (ZJSY) MWO to the UACI31 AIREP bulletin for the Beijing (ZBBB) ROBEX Centre

Appendix E - Focal Points

-Changed PAB to PZB for the optional group in the WMO Header for the second part of a multi bulletin (will be used until the new RRA optional group is effective in the Asia/Pacific Region).

-Added a note about the elimination of the Pxx group for multi bulletins in the WMO Manual on Global Telecommunication System (WMO No. 386) and that RRA will take its place in the Asia/Pacific Region on 1 February 2010 (implementation date decided by the RODBs and ROBEX Bulletin Collection Centres).

Appendix I - Focal Points

-Updated New Zealand focal point

-Updated Australia focal point

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Asia/Pacific OPMET data banks ICD - list of updates - June 2009

Text
Reflects non issuance of FC TAF in the Asia/Pacific Region
Changed the definition of FT TAF to be with a period of validity of at least 12 hours

RODB updates from

Bangkok	Appendix A
Brisbane	Appendix B
Singapore	Appendix D
Tokyo	Appendix E

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Asia/Pacific Regional SIGMET Guide – list of updates - June 2009

Appendices A-C

-Updated FASID Tables MET 1B, 3A, 3B (Appendices A-C) in accordance with the approval of amendment proposal APAC 09/1

Appendix H

-Updated Appendix H

Australia
Added Melbourne (World MET Centre, Bureau of Meteorology) - YMMC, WSAU21 with YBBB and YMMM FIR/ACC served
Changed all other WS WMO SIGMET Headings for Australia from WSAU31 to WSAU21
Cambodia
Updated MWO location for provision of SIGMET for Phnom Penh FIR:
KUNMING/Wujiaba on behalf of Phnom Penh with corresponding location indicator ZPPP with WMO SIGMET Headings WSKP31, WCKP31 and WVKP31
China
Added WC SIGMET Headings WCCI33 and WCCI35 for Beijing/Capital MWO (ZBAA) and Haikou/Meilan MWO (WCCI35)
Added ZJSA as FIR/ACC Served for Haikou/Meilan (ZJHK) MWO
Changed FIR/ACC Served from RCTP to RCAA for Taibei/Taibei Intl MWO
DPR Korea
Removed No SIGMET issued in remarks for Sunan MWO for DPR Korea
India
Added WV WMO SIGMET Heading WVIN31 to Chennai (VOMM) MWO
Malaysia
Added WS WMO SIGMET Headings WSMS31, WCMS31 and WVMS31 to Kota Kinabalu/Kota Kinabalu Intl (WBKK) MWO
Northern Mariana Islands (United States)
Removed SAPAN I. (OBYAN) Intl MWO from Appendix as it is not listed in MET Table 3B
Papua New Guinea
Removed WMO SIGMET Heading WVNG01 from Papua New Guinea
Thailand
Updated MWO location and location indicator for the Thailand MWO to Bangkok/Suvarnabhumi Intl Airport (VTBS)

Appendix J

-Clarification in procedures for WS SIGMET (not initiated by advisory) – section 3.2.1
-Clarification in that FK and FV messages are only counted if received by AFTN (not GTS and WAFS) to avoid duplicate advisory counts – section 3.3.2.1 (and in general text 3.5.4)
-Updated WS test collection and analysis point of contact – section 3.4.3, as well as associated references from rapporteur of the OPMET/M TF to WS SIGMET test contact – section 3.4.2 and section 2.3
-Add TC/VA in front of advisories in 3.3.2.1 for clarity

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EXCHANGE OF OPERATIONAL METEOROLOGICAL (OPMET) INFORMATION

(FASID Tables MET 2A, ROBEX Handbook and Asia/Pacific OPMET data banks interface control document ~~MET 2B, MET 4A, MET 4B and MET 4C~~)

Exchange of METAR, SPECI and TAF

24. The ROBEX Handbook ~~FASID Tables MET 4A and MET 4B~~ sets out the Regional OPMET Bulletin Exchange (ROBEX) Scheme for the collection and dissemination of METAR, SPECI, air-reports (AIREP) and TAF. These tables contain information regarding the designated ROBEX centres and their respective areas of responsibility.
~~[ASIA/PAC/3, Recs. 9/6 and 9/8]~~
~~[APANPIRG/7, Conc. 7/20]~~
[APANPIRG/20, Conc. 20/xx]

~~*Note.— Details of the ROBEX procedures regarding the exchange of OPMET information required under the scheme are given in the ROBEX Handbook prepared by the ICAO Asia and Pacific Regional Office (Bangkok) in coordination with the ICAO Middle East Regional Office (Cairo).*~~

25. The ROBEX Handbook ~~FASID Tables MET 4A and MET 4B~~ should be updated, as necessary, by the ICAO Asia and Pacific Regional Office (Bangkok) in coordination with the ICAO Middle East Regional Office (Cairo) on the basis of changes in the pattern of aircraft operations, the Statement of Basic Operational Requirements and Planning Criteria and in consultation with those States and international organizations directly concerned.
~~[ASIA/PAC/3, Rec. 9/8]~~
[APANPIRG/20, Conc. 20/xx]

26. Requirements for METAR, SPECI and TAF not carried on the ROBEX Scheme which should be available at meteorological offices are contained in FASID Table MET 2A. This table should be updated, as necessary, by the ICAO Regional Office on the basis of changes in the pattern of aircraft operations, the Statement of Basic Operational Requirements and Planning Criteria, and in consultation with those States and international organizations directly concerned.
[ASIA/PAC/3, Recs. 9/1 and 9/8]

27. The exchanges indicated in FASID Table MET 2A should be implemented as soon as possible, but only for those related to current aircraft operations. New exchanges should be started coincidently with the introduction of new aircraft operations. Any changes in this respect (i.e. additional OPMET information needed or OPMET information no longer required) should be notified to the corresponding meteorological authority which, in turn, should inform the ICAO Regional Offices concerned.
[ASIA/PAC/3, Rec. 9/8]

OPMET data banks to support the ROBEX Scheme

28. The OPMET data banks in Bangkok, Brisbane, Nadi, Singapore and Tokyo have been designated to support the ROBEX scheme and serve States in the ASIA/PAC regions to access OPMET information which is required but not received. The Asia/Pacific OPMET data banks interface control document ~~FASID Table MET 4C~~ sets out the responsibilities of the ASIA/PAC OPMET data banks for collection and dissemination of OPMET bulletins together with procedures to be used in communicating with the data banks to support the ROBEX Scheme. The Asia/Pacific OPMET data banks interface control document is maintained by the ICAO Asia and Pacific Regional Office (Bangkok) in coordination with the regional OPMET data banks.
~~[APANPIRG/7, Rec. 7/20]~~
[APANPRG/20, Conc. 20/xx]

~~*Note.— A list of the OPMET information available at the OPMET data banks to serve the ASIA/PAC regions, together with the procedures to be used in communicating with the data banks, is contained in the Asia/Pacific OPMET data banks interface control document prepared by the ICAO Regional Office, Bangkok.*~~

3. EXCHANGE OF OPERATIONAL METEOROLOGICAL INFORMATION (FASID Tables MET 2A, ROBEX Handbook and Asia/Pacific OPMET data banks interface control document ~~MET 2B, MET 4A, and MET 4B~~)

3.1 The requirements for the exchange of METAR, SPECI and TAF, not catered for by the ROBEX Scheme, to meet the requirement of international flight operations in the ASIA/PAC Region are shown in FASID Table MET 2A.

~~3.2 FASID Table MET 2B contains the exchange requirements in the ASIA/PAC Region for SIGMET messages including those for volcanic ash and/or tropical cyclones.~~

3.~~3~~2 The ROBEX Handbook ~~FASID Table MET 4A~~ sets out the Regional OPMET Bulletin Exchange (ROBEX) Scheme for the exchange of METAR, SPECI, air-reports (AIREP) and TAF. The ROBEX Handbook should be updated, as necessary, by the ICAO Asia and Pacific Office (Bangkok) in coordination with the ICAO Middle East Office (Cairo).

~~*Note. Details of the ROBEX procedures including the exchange of OPMET information required under the Scheme are given in the* ROBEX Handbook *published by the ICAO Asia and Pacific Office, Bangkok in co-ordination with the ICAO MID Office, Cairo.*~~

3.~~4~~3 The Asia/Pacific OPMET data banks interface control document ~~FASID Table MET 4B~~ reflects the requirements for the operation of the ASIA/PAC OPMET data banks to support the ROBEX Scheme. The Asia/Pacific OPMET data banks interface control document is maintained by the ICAO Asia and Pacific Office (Bangkok) in coordination with the regional OPMET data banks. The responsibilities of the ROBEX OPMET data banks are as follows:

a) support the ROBEX Scheme to facilitate a regular exchange of OPMET information within the ASIA/PAC Regions;

b) operate as Inter-regional OPMET Gateways (IROG) with responsibility of exchanging the OPMET information between ASIA/PAC Regions and other Regions; and

c) provide request/response facilities for users to obtain non regular or occasional information.

~~*Note. The interrogation procedures applicable to the OPMET data banks and data banks catalogues are provided in the* ASIA/PAC Regional Interface Control Document (ICD) OPMET Data Bank Access Procedures*, published by the ICAO Asia and Pacific Office, Bangkok*~~

AOP aerodormes 30H TAF SADIS

(Note these are not necessarily compliant to the aerodrome names in the ICAO Location Indicators (Doc 7910))

ICAO Indicator	Aerodrome name	Country	Implementation of 30 H TAF
			(red – not implemented Green – implemented)
OPKC	KARACHI INTL	Pakistan	
OPLA	LAHORE INTL	Pakistan	
OPPS	PESHAWAR	Pakistan	
PAFA	FAIRBANKS	USA	Not in Region
PANC	ANCHORAGE	USA	Not in Region
PACD	COLD BAY	USA	Not in Region
PAKN	KING SALMON	USA	Not in Region
PGUM	GUAM	USA	(not in ROBEX)
PHNL	HONOLULU	USA	(not in ROBEX)
RCKH	KAOHSIUNG INTERNATIONAL	China	
RCTP	TAIPEI/CHIANG KAI SHEK	China	
RJAA	NARITA	Japan	
RJBB	OSAKA	Japan	
RJCC	SAPPORO	Japan	
RJCH	HAKODATE	Japan	
RJGG	NAGOYA	Japan	
RJSS	SENDAI	Japan	
RKPC	JEJU	Republic of Korea	
RKSI	SEOUL INCHEON INTL	Republic of Korea	
RKSS	SEOUL GIMPO	Republic of Korea	
ROAH	NAHA	Japan	
VAAH	AHMEDABAD	India	

RPLL	MANILA	Philippines	
RPVM	CEBU	Philippines	
UEEE	YAKUTSK	Russia	Not in Region
UHHH	KHABAROVSK	Russia	Not in Region
UHMM	MAGADAN	Russia	Not in Region
UHPP	PETROPAVLOVSK-KAMCHATSKY	Russia	Not in Region
UHSS	YUZHNO	Russia	Not in Region
VABB	MUMBAI/CHHATRAPATI SHIVAJI INT	India	
VHHH	HONG KONG	Hong Kong (China)	
VIAR	AMRITSAR	India	
VIDP	DELHI/INDIRA GANDHI	India	
VMMC	MACAU	Macao (China)	
VTBD	BANGKOK	Thailand	
VTBS	BANGKOK/SUVARNABHUMI INTL	Thailand	
VTCC	CHIANG MAI	Thailand	
VTSP	PHUKET	Thailand	
VVTS	HOCHIMINH/TANSONNHAT	Viet Nam	
WAAA	UJUNG PANDANG	Indonesia	
WABB	BIAK	Indonesia	
WALL	BALIKPAPAN	Indonesia	Not in ROBEX
WAMM	MANADO	Indonesia	Not in ROBEX
WIII	JAKARTA/SOEKARNO HATTA	Indonesia	
WMKK	KUALA LUMPUR SEPANG	Malaysia	
WMSA	KUALA LUMPUR/SUBANG	Malaysia	
WSSS	SINGAPORE/CHANGI	Singapore	
YBBN	BRISBANE	Australia	
YMML	MELBOURNE	Australia	

YPAD	ADELAIDE	Australia	
YPDN	DARWIN	Australia	
YPPH	PERTH INTL	Australia	
YSSY	SYDNEY / KINGSFORD SMITH	Australia	
ZBAA	BEIJING/CAPITAL	China	
ZBTJ	TIANJIN/BINHAI	China	
ZGGG	GUANGZHOU/BAIYUN	China	
ZGSZ	SHENZHEN BAOAN	China	
ZMUB	ULAAN BAATAR	Mongolia	
ZPPP	KUNMING WUJIABA	China	
ZSPD	SHANGHAI PUDONG	China	
ZWSH	KASHI	China	
ZWWW	URUMQI	China	

Non-AOP aerodromes 30H TAF SADIS

ZJHK	HAIKOU/MEILAN	China	
PADK	ADAK	USA	Not in Region
PASY	SHEMYA	USA	Not in Region
PMDY	MIDWAY	USA	
PWAK	WAKE IS	USA	
VOHS	HYDERABAD	India	Not in ROBEX

AOP aerodromes 24H TAF SADIS

RJTT	HANEDA	Japan	27 hour TAF issued
YPPD	PORT HEADLAND	Australia	

6 July 2009: 17/53 = 32%

ASIA/PAC TASK FORCE ON THE IMPLEMENTATION OF VOLCANIC ASH AND TROPICAL CYCLONE ADVISORIES AND SIGMET (VA/TC IMPLEMENTTAION TF)

1. Terms of Reference

(a) Monitor the implementation of the tropical cyclone (TC) and volcanic ash (VA) advisories and SIGMETs within the ASIA/PAC Region and identify any deficiencies.

(b) Coordinate operational issues related to the issuance of the VA and TC advisories and SIGMETs.

c) Continually seek ways to improve the operational effectiveness of the IAVW and the TC advisory and warning system;

d) Provide advice to the CNS/MET Sub-group on the above issues.

2. Work Programme

The work to be addressed by the ASIA/PAC VA/TC Implementation Task Force includes:

(a) review procedures for the issuance of VA and TC advisories and SIGMETs in the region and propose actions for their improvement;

(b) investigate the deficiencies in the format and dissemination of the VA and TC advisories and SIGMETs and propose actions for their elimination;

(c) investigate the need of the States for guidance and/or training related to the implementation of IAVW and tropical cyclone warning system;

(d) follow the developments in the States related to the improvement of the VA and TC advisories and warnings and provide regional input on these matters to the IAVW Operations Group (through APANPIRG);

(e) coordinate regular regional SIGMET tests;

(f) assist in development and implementation of regional project on related performance objective;

(e) report on its work to the CNS/MET Sub-group of APANPIRG.

The work is expected to be carried out primarily by correspondence.

3. Composition

(a) The Task Force is composed by experts from:

Australia, Japan (Rapporteur), New Zealand, United Kingdom, United States, China, Tonga and Maldives.

(b) IATA is invited to participate in the work of the Task Force.

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Expanded WV SIGMET test procedure

Time(UTC)	Event/Action
01:00	Start of exercise (issuing NOTAM)
02:00	**VAAC Tokyo :** Senario : Volcanic ash is detected on satellite imagery ● Issue a test VAA for eruption of Canlaon ● Issue VAGs to the Website
	VAAC Darwin : ● Transmit the test VAA for eruption of Canlaon
Between 02:00 and 02:10	**MWOs :** ● Issue a test VA SIGMET during 10 minute period
03:00	**VAAC Tokyo :** Senario: Volcanic ash dissipated on satellite imagery ● Issue a test VAA for VA dissipation (Cancellation of the test SIGMET is omitted)
	VAAC Darwin : ● Transmit the test VAA for VA dissipation (Cancellation of the test SIGMET is omitted)
04:00	End of exercise (issuing NOTAM)

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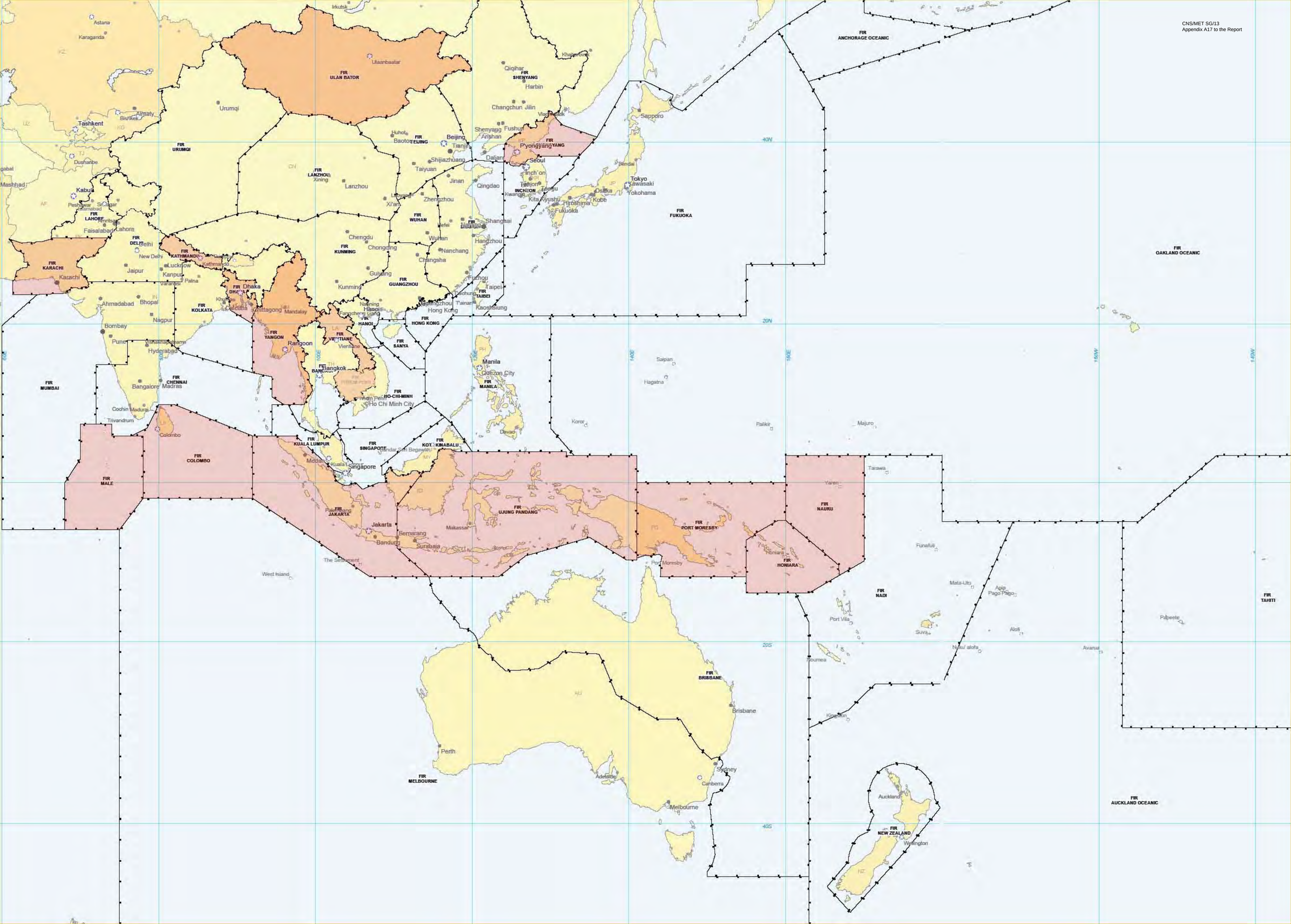
FIR ANCHORAGE OCEANIC
FIR ULAN BATOR
FIR SHENYANG
FIR URUMQI
FIR BEIJING
FIR PYONGYANG
FIR LANZHOU
FIR FUKUOKA
FIR LAHORE
FIR WUHAN
FIR DELHI
FIR KATHMANDU
FIR KUNMING
FIR OAKLAND OCEANIC
FIR KARACHI
FIR GUANGZHOU
FIR TAIBEI
FIR KOLKATA
FIR HONG KONG
FIR HANOI
FIR YANGON
FIR VIENTIANE
FIR SANYA
FIR MUMBAI
FIR CHENNAI
FIR BANGKOK
FIR HO CHI MINH
FIR MANILA
FIR KUALA LUMPUR
FIR SINGAPORE
FIR KOTA KINABALU
FIR COLOMBO
FIR MALE
FIR JAKARTA
FIR UJUNG PANDANG
FIR PORT MORESBY
FIR HONIARA
FIR NAURU
FIR NADI
FIR TAHITI
FIR BRISBANE
FIR MELBOURNE
FIR AUCKLAND OCEANIC
FIR NEW ZEALAND
Astana
Karaganda
Irkutsk
Ulaanbaatar
Khabarovsk
Qiqihar
Harbin
Changchun
Jilin
Vladivostok
Sapporo
Urumqi
Almaty
Bishkek
Tashkent
Huhot
Baotou
Beijing
Tianjin
Shenyang
Anshan
Fushun
Pyongyang
Seoul
Dushanbe
Shijiazhuang
Daljan
Sendai
Taiyuan
Jinan
Inch'on
Tokyo
Kawasaki
Yokohama
Mashhad
Kabul
Lanzhou
Qingdao
Daejon
Taegu
Osaka
Kobe
Peshawar
Islamabad
Srinagar
Xi'an
Zhengzhou
Kita Kyushu
Hiroshima
Fukuoka
Amritsar
Faisalabad
Lahore
Hefei
Shanghai
Chengdu
Wuhan
Delhi
New Delhi
Chongqing
Hangzhou
Nanchang
Changsha
Kathmandu
Lucknow
Jaipur
Kanpur
Guiyang
Karachi
Varanasi
Patna
Kunming
Fuzhou
Taipei
Dhaka
Ahmadabad
Bhopal
Calcutta
Chittagong
Mandalay
Taichung
Nanning
Guangzhou
T'ainan
Kaohsiung
Hong Kong
Nagpur
Haiqou
Bombay
Pune
Rangoon
Vientiane
Manila
Hyderabad
Bangkok
Quezon City
Saipan
Hagatna
Bangalore
Madras
Cochin
Madurai
Ho Chi Minh City
Trivandrum
Davao
Koror
Palikir
Majuro
Colombo
Medan
Singapore
Tarawa
Yaren
Jakarta
Semarang
Bandung
Surabaja
Makassar
Port Moresby
Honiara
Funafuti
West Island
The Settlement
Mata-Utu
Apia
Pago Pago
Port Vila
Suva
Alofi
Nuku'alofa
Avarua
Noumea
Papeete
Kingston
Perth
Brisbane
Sydney
Adelaide
Canberra
Melbourne
Auckland
Wellington
40N
20N
20S
40S
140E
160E
160W
140W

Terms of Reference of the MET/ATM Task Force

Terms of Reference

a) Evaluate the current and future requirements for MET in support of ATM in the ASIA/PAC Region and provide guidance material to assist States to develop MET services to meet these requirements.

b) Monitor the emerging capabilities and developments of MET and as necessary update regional plans for the implementation of MET services and facilities.

c) Promote communication between MET and ATM communities in the ASIA/PAC Region to enhance the level of understanding of MET requirements and capabilities in support of ATM.

d) Report to the CNS/MET Sub-group of APANPIRG for further co-ordination through the ICAO Secretariat with other relevant bodies.

Membership

Australia, China, Hong Kong, China, Japan, New Zealand, United States, IATA

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ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM (REGIONAL)

REGIONAL PERFORMANCE OBJECTIVE: APAC-CNS 1 **IMPROVED COMMUNICATIONS INTEROPERABILITY-** **IMPLEMENTATION OF AERONUTICAL TELECOMMUNICATION NETWORK (ATN) FOR GROUND – GROUND COMMUNICATION NETWORK**	
Benefits	
Safety	• Will provide reliable means of communication for Air Navigation Services, with the provision of automatic switching capability, in the event of failure of current media
Efficiency	• Routers will have the capability of choosing between different media based on defined criteria. • Multiplicity of protocols used for different communication requirements will be avoided; • Provision for low case characters and graphic message included;

Strategy
Short term (2009-2012)

ATM OC COMPONENTS	TASKS	TIME FRAME	RESPONSIBILITY	STATUS
AOM *(Airspace Organisation and Management)*	Facilitate implementation of Ground to Ground Aeronautical Telecommunication Network (ATN) in the Asia and Pacific Regions			
	• Review the ATN Implementation Strategy, , revise it when necessary taking into account the current developments.	2009	ATNICG.	The strategy to be reviewed and updated by ATNICG/4 Meeting was held from 4 to 8 May 2009
	o Review the Status of implementation of ATN at the Backbone Boundary Intermediate System hubs	2009	ATNICG	ATNICG to review the progress of ATN Implementation in its Fourth Meeting
	• States hosting Backbone Boundary Intermediate Stations to organize Testing of their system on bilateral basis	2010	States hosting Backbone Boundary Intermediate Systems	Letter dated 2 February 2009 sent to the States hosting BBIS hubs urging them to organize testing of their systems on bilateral basis and report the outcomes to ATNICG

	• Implementation of AMHS Directory Service. Availability of AMC Software considered essential for the efficient management of AMHS Addresses. ICAO HQ requested to facilitate transfer of AMC Software from Eurocontrol to meet the requirements of Asia and Pacific Region.	2010	ICAO Asia/Pacific Office, ICAO HQ and Aerothai.	Being coordinated between ICAO Asia/Pacific Office, ICAO HQ and Aerothai
	• States hosting Backbone Boundary Intermediate System hubs to implement dual stack ATN (ATN over OSI and ATN over IPS). APANPIRG, through Conclusion 19/20 urges States to complete the implementation of dual stack ATN by 2011	2011	Asia and Pacific Region States hosting Backbone Boundary Intermediate Systems	States hosting BBIS hubs have been reminded of APANPIRG Conclusion 19/20 and urged to complete the installation by 2011
	• Completion of Networking with the BIS States	2012	Asia and Pacific Regions States	Some States started implementation and conducted operational trials
	• Review if implementation objectives have been met.	2009 - 2012	ATNICG	ATNICG to periodically review the status and dreiction in which the implementation is progressing and to ensure that the implementation efforts are leading towards the defined objectives
GPIs	GPI/17: Data link applications; GPI/22: Communication infrastructure			
References	• *Annex 10, Aeronautical Telecommunications, Volume III (Part I – Digital Data Communication Systems)* • *Manual on Detailed Technical Specifications for the Aeronautical Telecommunications Network (ATN) using ISO/OSI (Doc 9880)* • *ICAO Aeronautical Telecommunication Network (ATN) Manual for ATN using IPS Standards and Protocols (Doc 9896)* • *Manual on Required Communication Performance (Doc 9869)* • *Comprehensive Aeronautical Telecommunication Network (ATN) Manual (Doc 9739)* • *Manual of Technical Provisions for the Aeronautical Telecommunication Network (Doc 9705)* • *Regional Implementation guidance materials adopted by APANPIRG*			

(Amendmed 31 March 2009)

ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM (REGIONAL)

REGIONAL PERFORMANCE OBJECTIVE: APAC-CNS 2 **ENHANCED COMMUNICATIONS AND SURVEILLANCE CAPABILITY IN OCEANIC AREAS**	
Benefits	
Environment	• reductions in fuel consumption and gaseous emissions as a result of efficiency gains;
Safety	• improved monitoring of airspace will result in safety enhancement
Efficiency	• facilitate utilization of advanced technologies (e.g, area navigation, UPRs, DARPs) and ATC decision support tools (e.g., vertical and lateral adherence monitors, short and medium term conflict detection), thereby enhancing safety and increasing efficiency. • enable aircraft to conduct flight more closely to preferred trajectories; • increase airspace capacity by enabling implementation of RHSM using data link;

Strategy
Short term (2009-2010)

ATM OC COMPONENTS	**TASKS**	**TIME FRAME**	**RESPONSIBILITY**	**STATUS**
AOM *(Airspace Organisation and Management)* **CM** *(Conflict Management)* **AUO** *(Airspace Users Operations)*	Improve provision of satellite based communications and surveillance capabilities to enable FANS 1/A data link (ADS-C, CPDLC) to RNP 4 and RCP 240 specifications.			
	• codify/quantify existing anecdotal information and combine with available end-to-end system performance data. to summarise current satellite data link performance;	2009	Regional ANSPS, operators, FITS, CRAs. Communications Service providers (CSP)	Report to Satellite Operational Continuity Meeting (SOCM), Bangkok, Thailand, August 2009
	• identify non conformities in current satellite data link performance against; o specifications in FANS 1/A Operations Manual (FOM); o specifications in Global Operations Data Link Document (GOLD); o specifications in RCP Manual (Doc 9869); and o specifications in Oceanic SPR)	2009	Regional ANSPS, operators, FITS, CRAs.	review status and identify issues at Satellite Operational Continuity Meeting (SOCM), August 2009

	• provide summary information on non conformities in current satellite data link performance to all affected parties in the end-to-end communications chain.	2009	Satellite Operational Continuity Meeting (SOCM) April 2009 to summarise and circulate information to affected parties, including CSP, Ground Earth Station (GES) providers, equipment suppliers and satellite service providers.	
	• develop a regional strategy and work programme to identify/design suitable long term mitigations and solutions to non conformities that will enable continuous operational compliance with specifications for RNP4 and RCP 240.	2010	Regional ANSPs, operators, FITS, CRAs, CSP, Ground Earth Station (GES) providers, equipment suppliers and satellite service providers.	Consider convening SOCM/2 to progress this work
	• Develop a sample service level agreement for possible use by ANSPs	2010	Regional ANSPs, operators, FITS, CRAs, CSP	
	• Implement mitigations and solutions in accordance with timelines in regional strategy	2010	Regional ANSPS, operators, FITS, CRAs, CSP, Ground Earth Station (GES) providers, equipment suppliers and satellite service providers.	
	• monitor implementation progress	2010	Regional FITS, CRAs provide feedback to all affected parties	Consider convening SOCM/3 to finalise this work
GPIs	GPI/5: RNAV and RNP, GPI/7: dynamic and flexible ATS route management, GPI/17: data link applications and GPI/22: Communication Infrastructure;			
References	• *Manual on Required Communication Performance (Doc 9869)* • *RTCA DO-306/EUROCAE ED-122, Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace (the "Oceanic SPR')* • *FANS-1/A Operations Manual (FOM)* • *Global Operational Data Link Document (GOLD)* • *Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data Link Systems in the Asia/Pacific Region* • *CEANS Report(2008) on ANS Infrastructure* • *APANPIRG Conclusion 19/24*			

(Amended 31 March 2009)

ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM (REGIONAL)

REGIONAL PERFORMANCE OBJECTIVE: APAC-CNS 3 **IMPROVED SITUATIONAL AWARENESS AND SURFACE SURVEILLANCE-IMPLEMENTATION OF THE ADS-B TO GROUND SURVEILLANCE**					
Benefits					
Environment	• Reductions in fuel consumption and subsequent lower gas emissions				
Efficiency	• Increased flexibility and flow of traffic operations • Ultimately, when performing *radar-like* control, potential redesign of airspace taking into account the application of reduced separation minima, integrate use of aircraft navigation and surveillance capability				
Safety	• Introduction of surveillance in a non-radar environment • Support to search and rescue operations				
Strategy *Medium Term (2011-2015)* ***Short term (2010)***					
ATM OC COMPONENTS	***TASKS***	***TIME FRAME STARTED***	***RESPONSIBILITY***	***STATUS***	***REMARKS***
AOM *(Airspace Organisation and Management)* **AUO** *(Airspace Users Operations)*	Implementation of ADS-B based surveillance service in the sub-regions.				
ATMSDM (**ATM** *Service Delivery Management)*	• Compare currently available technologies with respect to concept of operations, relative costing, technical and operational performance and maturity of alternative technology/solutions (primary, secondary radar including Mode-S, ADS-B, multilateration, ADS-C)	2009	ADS-B Study and Implementation Task Force (ADS-B SITF)	In progress	Regional Guidance material on comparison of technologies issued

	• Develop an implementation plan for near term ADS-B applications in the Asia Pacific Region including implementation target dates taking into account: o available equipment standards; readiness of airspace users and ATS providers; o identifying sub-regional areas (FIRs) where there is a positive cost/benefit outcome expected for near-term implementation of ADS-B OUT; o developing a standardised and systematic task-list approach to ADS-B OUT implementation; and o holding educational seminars and provide guidance material to educate States and airspace users on what is required to implement ADS-B OUT	2009-10	ADS-B Study and Implementation Task Force	In progress	The FASID Table CNS 4A and 4B – surveillance and ATM automation being updated; ADS-B Seminar conducted annually; potential sub- regions for using ADS-B identified; Requirement for avionics specification for the near term application are being developed based on AMC2024 and Australian CASA document.
	• Develop Guidance Material to support harmonized regulation of ADS-B systems required on board the aircraft.	2010	ADS-B Study and Implementation Task Force	To be started	Forty Fifth DGCA Conference, through its Action Item 45/3 invited ICAO APANPIRG ADS-B Study and Implementation Task Force (ADS-B SITF) to develop the guidance material.

	• Study and identify applicable multilateration applications in the Asia and Pacific Region considering: - Concept of use/operations; - Required site and network architecture; - Expected surveillance coverage; Cost of system; Recommended separation minimas; and - If multilateration can be successfully integrated into an ADS-B OUT system for air traffic control	2011	ADS-B Study and Implementation Task Force	In progress	Concept of using multlateration has been developed; Some states have plan in place to introduce multilateration in particular & integrate it with A-SMGCS and Terminal area and Enroute surveillance application
	• Coordinate ADS-B implementation plan and concept of operations with other ICAO regions where ADS-B implementation is going on and with relevant external bodies such as EUROCONTROL, EUROCARE, RTCA and Industry.	2013	ADS-B Study and Implementation Task Force	In progress	Updated information on ADS-B in Europe and North American Regions is provided to Task Force Meeting annually; Some Industry representatives provide input at ADS-B Seminar and meetings

	• Develop **Terms of Co-operation** for SEA which will include: • Establishing model documents for possible use by States when - Agreeing to share ADS-B data and DCPC (such as VHF radio voice communication) capability between adjoining States for various ADS-B applications (including a sample letter of agreement); or - Establishing ADS-B avionics fitment mandates • Identifying optimum coverage for ADS-B ground stations and associated VHF radio voice communication in the sub-regional FIR boundary areas.	2011	South East Asia (SEA) Sub-Regional ADS-B Implementación Working Group	In progress	Terms of co-operation developed; sample agreement of data sharing developed; Some location for ADS-B ground stations identified. CBA for SEA project being progressed; Implementation plan being developed.

	Develop an **implementation plan** for near term ADS-B application in SEA which will deliver efficient airspace and increased safety on a regional basis that includes: • Schedule and priority dates to bring into effect ADS-B based services taking into account: - Timing of any equipage mandates; - Timing of any ATC automation upgrades to support ADS-B; - Timing of commissioning of any ADS-B data sharing and associated VHF radio voice communication facilities • Consideration of major traffic flows:				Major traffic flow from Australia to Singapore through Indonesia and L642 and M771 in SEA being considered
linkage to GPIs	GSI-12 Use of Technology to Enhance Safety; GPI/9 Situational Awareness; GPI/5: RNAV and RNP, GPI/7: dynamic and flexible ATS route management, GPI/17: data link applications and GPI/22: Communication Infrastructure;				
References	Report of AN CONF/11; Global ATM Operational Concept (Doc9854); Global Air Navigation Plan (Doc9750); Technical Provisions for Mode S Services and Extended Squitter (Deco9871) APANPIRG/16/17/19 report on ADS-B ADS-B related regional guidance materials adopted by APANPIRG				

(Amended 24 July 2009)

ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM
(REGIONAL)

REGIONAL PERFORMANCE OBJECTIVE: APAC-4 **IMPROVED COORDINATION BETWEEN ACCs IN ADJACENT FIRS ALONG MAJOR TRAFFIC FLOW - IMPLEMENTATION OF ATS INTER-FACILITY DATA COMMUNICATION (AIDC) IN ASIA/PACIFIC REGION**	
Benefits	
Safety	• Will provide efficient and more reliable means of communication between ACCs in adjacent FIRs for the exchange of traffic coordination related operational messages. • Significantly reduce the coordination errors observed in controller to controller verbal communication across FIR boundaries thus enhance flight safety
Efficiency	• Increased efficiency for air traffic handover between ATS units • Will improve ATS direct communication between ATS units along the major traffic • Will improve the speed and capacity ; • Will facilitate inter-automation systems communication.

Strategy
Short term (2009-2015)

ATM OC COMPONENTS	**TASKS**	**TIME FRAME**	**RESPONSIBILITY**	**STATUS**
AOM *(Airspace Organisation and Management)* **CM** (Conflict management) **SDM** (ATM service delivery management)	Facilitate implementation of ATS Inter-facility Data Communication in the Asia and Pacific Regions			
	• Review the Status of Implementation	2009	ATNICG. ADS-B SITF	The status was reviewed and updated by ATNICG/4 and ADS-B SITF Meetings scheduled in May 2009
	o Review the Options available for the implementation of AIDC in the region. Discuss options adopted by different states.	2009	ATNICG AEROTHAI	ATNICG has reviewed the options available for implementing in its Fourth Meeting
	• Review implementation issues related to ATS automation systems and recommend methods of mitigating those issues	2009	ADS-B SITF CNS/MET SG/13	The automation issues was discussed in the ADS-B SIFT/8. Table CNS 4B was updated and endorsed by CNS/MET SG/13

	• AIDC Seminar: A Seminar to be conducted to discuss various implementation issues and promote implementation	2009	ICAO Asia/Pacific Office	Seminar to be conducted
	• Develop implementation strategy to decide whether to continue pursuing AFTN AIDC or to choose ATN AIDC over OSI or IPS	2010	APANPIRG	ATN AIDC is currently not in use.
	• State to be informed about the strategy adopted by APANPIRG and urged to implement AIDC	2011	ICAO Asia/Pacific Office	A State Letter to be issued urging the States to implement AIDC
	• Trials to be conducted. Monitoring mechanism to be developed	2011-2014	APANPIRG	State Letter to be issued urging the States to expedite implementation and status to be monitored.
	• Review if implementation objectives be met.	2009 - 2015	APANPIRG	APANPIRG to periodically review the status and direction in which the implementation is progressing and to ensure that the implementation efforts are leading towards the defined objectives
GPIs	GPI/17: Data link applications, GPI/22: Communication infrastructure			
References	• *Air Traffic Management* (Doc 4444) • *Manual of Air Traffic Services Data Link Applications* (Doc 9694) • *Manual of Technical Provisions for the Aeronautical Telecommunication Network (Doc 9705)* • *Asia/Pacific Regional Interface Control Document (ICD) for ATS Interfacility Data Communication (AIDC)*			

(Amended 24 July 2009)

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REGIONAL PERFORMANCE OBJECTIVE: APAC – MET 1 **Implement International Airways Volcano Watch (IAVW), International Tropical Cyclone Watch (ITCW) and SIGMETs**				
Benefits				
Safety **Efficiency**	• Improve in-flight safety by providing information on volcanic ash, tropical cyclone or other hazardous weather • Improve pre-flight planning by optimizing flight routes with respect to volcanic ash and hazardous weather phenomena			
Strategy **Short term/*Medium term (2011 - 2015)***				
ATM OC COMPONENTS	**TASKS**	**TIME FRAME**	**RESPONSIBILITY**	**STATUS**
MET	• Monitor and provide assistance in the regional implementation of volcanic ash and tropical cyclone advisories and SIGMET	2009 - 2015	VA/TC/I TF	In progress
	• Conduct periodic tests for SIGMET on volcanic ash and tropical cyclones in view of assessing improvements in their implementation	2009 - 2015	VA/TC/I TF & OPMET/M TF	In progress
	• Conduct periodic tests for SIGMET for hazardous weather phenomena other than volcanic ash and tropical cyclone in view of assessing improvements in their implementation	2009 - 2015	RODB & OPMET/M TF	In progress
	• Update the Regional SIGMET Guide to keep it consistent with Annex 3	2010, 2013	VA/TC/I TF & OPMET/M TF & RO	In progress
Linkage to GPIs	GPI/19 – Meteorological Systems			
References	• *Annex 3* • *Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds (Doc 9691)* • *Handbook on the International Airways Volcano Watch (IAVW) Operational Procedures and Contact List (Doc 9766)* • *Asia/Pacific Regional SIGMET Guide*			

REGIONAL PERFORMANCE OBJECTIVE: APAC – MET 2 **Implement WAFS and associated developments**				
Benefits				
Safety **Efficiency**	• Improve the regional implementation of weather forecasts (upper-level winds, turbulence, icing, cumulonimbus) used by airlines and ATM needed to optimize flight routes which will provide an increase in efficiency and reduced carbon emissions			
Strategy **Short term/*Medium term (2011 - 2015)***				
ATM OC COMPONENTS	**TASKS**	**TIME FRAME**	**RESPONSIBILITY**	**STATUS**
MET	• Assist the regional implementation of new gridded products for turbulence, icing and cumulonimbus forecasts	2009-2011	WAFS/I TF	In progress
	• Facilitate in organizing regional training of new gridded products for turbulence, icing and cumulonimbus forecasts	2010-2011	WMO & ICAO	In progress
	• Monitor the migration to ISCS G3	2012	WAFS/I TF	In progress
Linkage to GPIs	GPI/19 – Meteorological Systems			
References	• *Annex 3* • http://www.icao.int/anb/wafsopsg/ • http://www.icao.int/anb/sadisopsg/ • Asia/Pac WAFS Implementation Plan and Procedures			

REGIONAL PERFORMANCE OBJECTIVE: APAC – MET 3 **Develop regional MET requirements to support ATM**				
Benefits				
Safety **Efficiency**	• Improve efficiency of ATM and airlines by providing tailored regional MET products needed to optimize flight routes in all weather conditions			
Strategy **Short term/*Medium term (2011 - 2015)***				
ATM OC COMPONENTS	**TASKS**	**TIME FRAME**	**RESPONSIBILITY**	**STATUS**
MET	• Conduct MET ATM meeting in 2009 to determine actions needed to obtain regional MET requirements to support ATM	2009	MET ATM	In progress
	• Conduct survey on regional ATM requirements for MET information	2009 - 2011	MET ATM	To commence after MET ATM meeting
	• Conduct MET seminar in 2010 to further develop list of possible regional MET requirements to support ATM	2010	MET ATM	future
	• Facilitate implementation of new terminal forecast (under development by WMO)	2010-2016	MET ATM	future
Linkage to GPIs	GPI/19 – Meteorological Systems			
References	• *Manual on co-ordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services (Doc 9377)*			

REGIONAL PERFORMANCE OBJECTIVE: APAC – MET 4 **Improve OPMET exchange efficiency**				
Benefits				
Safety **Efficiency**	• Increase OPMET availability and reliability needed for flight planning (efficiency) and in-flight re-planning (safety)			
Strategy **Short term/*Medium term (2011 - 2015)***				
ATM OC COMPONENTS	**TASKS**	**TIME FRAME**	**RESPONSIBILITY**	**STATUS**
MET	• Improve the availability of OPMET data at the Regional OPMET Data Banks (RODB)	2009 - 2015	OPMET/M TF	In progress
	• Improve the inter-regional OPMET exchange	2009 - 2015	OPMET/M TF	In progress
	• Improve the availability of OPMET data in the Pacific	2009 - 2015	OPMET/M TF &TCB & PASO & States	In progress
	• Review and update regional ROBEX tables and guidance material	2009 - 2015	OPMET/M TF & RO	In progress
	• *Facilitate and monitor the migration to AIM and new MET codes (e.g. XML) for METAR/SPECI, TAF and SIGMET*	*TBD*	*OPMET/M TF & RO*	*TBD*
Linkage to GPIs	GPI/19 – Meteorological Systems (Note: if sufficient assessment information is available at the OPMET/M TF/7 meeting, use as baseline and provide a target level of improvement in the first 3 bullets)			
References	• *SADIS User Guide* • *ROBEX Handbook* • *Asia/Pacific OPMET Data Banks Interface Control Document*			

CNS/ATM Implementation Planning Matrix

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
AUSTRALIA	ATN tests were conducted. BIS Router and Backbone BIS Router and AMHS implemented.	AFTN based AIDC Implemented between Brisbane and Melbourne, Auckland, Nadi and Auckland. AIDC is also in use between Melbourne and Mauritius.	Implemented and integrated with ATM systems to support FANS1/A equipped aircraft.	Implemented	Implemented		16 ADS-B sites are operational. A total of 28 UAP ground stations are expected to become operational throughout 2007. Additional 20 stations have been delivered in 2007 for installation at en-route radar site and other sites. 5NM Separation service has been introduced. NFRM on the carriage and use of ADS-B avionics has been issued. WAM installed in Tasmania. Commissioning expected 2009. Provides radar like WAM data and ADS-B data.	FANS 1/A ADS-C implemented.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
AUSTRALIA (Cont'd)							ASMGCS with multilateration being installed at Melbourne, Sydney, Brisbane and Perth. Operational between 2009 -2010 Multilateration based precision runway monitor to be commissioned in 2010.		
BANGLADESH	BIS Router and AMHS planned for 2011.	AIDC between Dhaka and CTG, Dhaka and Sylhet planned for 2011.		Not yet planned	Not yet planned		Not yet planned	Not yet planned	
BHUTAN	ATN BIS Router and UA service 2011.					Procedures developed for NPA.			
BRUNEI DARUSSALAM	ATN BIS Router planned for 2009 and AMHS planned for 2009-2011.								

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
CAMBODIA	BIS Router and AMHS planned for 2011.	Planned 2009	Planned 2009			Procedure developed for NPA.			
CHINA	ATN Router and AMHS deployed in 2008. Tripartite BBIS trial completed with Bangkok and Hong Kong, China in Jan. 2003. ATN trial with Hong Kong using XOT over internet conducted in 2006, Further trials planned in 2009. AMHS/ATN tests with Macau is on going.	AIDC between some of ACCs within China has been implemented. AIDC between several other ACCs are being implemented. AIDC between Sanya and Hong Kong put in to operational use in Feb 2007. AIDC between Qingdao and Incheon planned for 2013.	Implemented to ATS Rout. L888 route, Trial on HF data link conducted for use in western China.	Implemented in certain airspace. L888, Y1 and Y2 routes.	RNAV (GNSS) implemented in certain airports. Beijing, Guangzhou, Tianjin.	Ali, Linzhi and Lhasa airports	ADS-B trial has been conducted in 2006. 5 UAT ADS-B sites are operational and used for flight training of CAFUC. Another ADS-B project for ATS route between Chengdu and Jiuzhai using 1090ES conducted since 2008. Will be followed by Chengdu – Lhasa and B215 route.	FANS 1/A based ADS-C implemented. L888 route.	
HONG KONG, CHINA	ATN and AMHS technical trial with Japan conducted in 2003.	AFTN-based AIDC with Sanya put into operational use in February 2007.	FANS 1/A based CPDLC trials completed in 2002.	Implemented in certain airspace	Implemented in certain airspace.	RNAV (GNSS) departure procedures implemented in July 2005.	A-SMGCS trial using ADS-B/ Multilateration technology on the prime airport surveillance area completed in 2006.	FANS 1/A trials for ADS-C completed in 2002.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
HONG KONG, CHINA (Cont'd)	64 Kbps ATN Link with Bangkok put into operational use in June 2004. Preliminary ATN/AMHS technical trials with China (Beijing) using VPN over Internet connection conducted in September 2006. Operational AMHS commissioned in June 2009. ATN/AMHS interoperability test with Macao commenced in July 2009. ATN/AMHS interoperability tests with other adjacent communications centres will commence in late 2009. ATN/AMHS operations planned for 2010.	AIDC trial with other adjacent ATS authorities planned for end 2009/2010.	VDL Mode-2 technical trial conducted in 2002. D-ATIS, D-VOLMET and 1-way PDC implemented in 2001. PDC service upgraded to 2-way data link in June 2008.			Flight check for RNAV Procedures conducted in April 2008. 6- months operational trial commenced in February 2009.	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 was conducted in April 2007. Further ADS-B trial planned for 2010.		

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
MACAO, CHINA	ATN AMHS interoperability with China started 25 March with planned duration of 2 months. ATN & AMHS tests with Hong Kong commenced on July 2009.								ATZ within Hong Kong and Guangzhou FIRs. In ATZ full VHF coverage exist. Radar coverage for monitoring purposes.
COOK ISLANDS									
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	The ATN BIS Router and AMHS to be implemented in 2011.	With neighboring ACCs to be implemented TBD		Implemented in certain ATS routes G711, B467		RNAV(GNSS) Non-precision approach to be implemented in 2011.	ADS-B has been used as back-up surveillance of SSR since 2008.		
FIJI	ATN BIS Router and AMHS implementation by 4th quarter 2010.	AFTN based AIDC implemented between Nadi, Brisbane, Auckland and Oakland.	Implemented and integrated with ATM systems to support FANS1/A equipped aircraft.	Implemented		Implemented	ADS-B implementation in 2009/2010.	FANS 1/A ADS-C implemented.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
FRANCE ***(French Polynesia Tahiti)***		Implementation of limited message sets with adjacent centres under discussion.	FANS-1. Implemented since 1996.					FANS 1/A ADS-C implemented since March 1999.	
INDIA	ATN BBIS router and AMHS Physical installation over. SAT in May 2008, coordinating with China, Thailand and Singapore for conduct of test.	AFTN Based AIDC Coordinating with Bangladesh and Pakistan and, we are ready.	FANS-1 implemented at Kolkata, Chennai, Mumbai and Delhi.	SBAS Technical development in 2007. Implementation planned for 2009.			Trial planned for 2006. ASMGCS Implemented at IGI Airport New Delhi.	FANS 1/A ADS-C implemented at Kolkata, Chennai, Delhi and Mumbai.	
INDONESIA	ATN BIS Router and AMHS planned for trial in 2009. Trial with Singapore planned.	Brisbane and Makassar in planned in June 2009.	FANS-1/A. CPDLC in Ujung Pandang FIRs already trial start from 2008 and will be implemented in 2009.			Procedure to be completed in 2006 for NPA.	22 ADS-B ground stations have been installed in 2009. Upgrading ATC automation at Makasar for ADS-B application capabilities in 2009.	FANS 1/A ADS-C trial planned at Jakarta and Ujung Pandang ACC in 2007.	MATSC new version with capability for ADS-B and Mode-S will be operated in 2009.

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
JAPAN	ATN BBIS already implemented. AMHS implemented between Japan and USA in 2005 and between Japan and Hong Kong, China, ROK, Singapore, Australia planned for 2009-2011. Connection test between Taibei 2008 – ongoing.	AIDC based. AFTN procedure implemented with Oakland and Anchorage. Planned between Incheon ACC and Fukuoka ATMC 2009. Between Fukoka, ATMC and Taibei ACC 2012.	FANS1/A system Implemented in Fukuoka FIR.	SBAS implemented RNAV5 implemented.	RNAV1 implemented	RNP Approach implemented	Two (2) Multilateration will be implemented in January 2010.	FANS 1/A. ADS-C implemented in Fukuoka FIR.	
KIRIBATI									
LAO PDR	ATN BIS Router and AMHS completed planned for implementation with Bangkok in 2010.	AIDC with Bangkok planned for 2010.		Implemented. Planned for 2011.					
MALAYSIA	ATN BIS Router completed 2007. AMHS planned in 2011	AFTN AIDC planned with Bangkok ACC in 2011.	Implemented for Bay of Bengal in July 2008.	Implemented for Oceanic Routes.	Basic RNAV implemented	NPA at KLIA implemented	Implementation of ADS-B proposed in 2010 - 2015.	FANS 1/A ADS-C implemented for Bay of Bengal on July 2008	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
MALDIVES	ATN BIS Router/AMHS planned for implementation in the 2011.	Planned for 2011.	FANS1/A installed Trials planned in last quarter of 2007.	Trials planed for 2005-2008. Implementation in later 2008.			Trials planned for 2007-2008. Implementation in late 2008.		
MARSHALL ISLANDS						NPA implemented at Majuro Atoll.			
MICRONESIA (EDERATED STATES OF)									
Chuuk				Implemented					
Kosrae				Implemented					
Pohnpei				Implemented					
Yap				Implemented					
MONGOLIA	ATN BIS Router and AMHS planned for 2005 and 2006. Trial with Bangkok conducted.		Function available. Regular trials are conducted.		GPS procedures are being developed and implemented at 10 airports.		ADS-B trial in progress implementation planned for 2006.	FANS 1/A ADS-C implemented since August 1998.	
MYANMAR	Trial for ATN BIS Router with Thailand planned for 2006. Test with China planned for 2006.		Implemented since August 1998.					Implemented since August 1998.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
NAURU									
NEPAL	BIS Router and AMHS planned for 2010.	AFTN/AMHS based AIDC between KTM-CAL, KTM-BAN, KTM-LHASA planned for 2010.			GPS departure and approach has been developed for 8 airports and planned for implementation in 2008.		ADS-B feasibility study planned for 2007.		
NEW CALEDONIA							Tontouta ACC 2009 Tontouta APP 2009.		
NEW ZEALAND	BIS Router and AMHS implementation planned for 2010.	AFTN based AIDC implemented between New Zealand, Australia, Fiji, Tahiti, Chile and USA.	FANS-1/A. Implemented	Will be implemented as required.	RNAV procedures being implemented as developed.	RNP AR APCH implemented at Queenstown (ZQN).	Domestic trial was conducted in 2005. Use will be re-evaluated in 2008. Trial of Area MLAT conducted in 2006. ADS-B planned as an element of MLAT at specific sites for domestic use.*	FANS 1/A Implemented	*MLAT being implemented in Auckland (Surface Movement) and Queenstown.

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
PAKISTAN	Implementation of ATN considered for Phase II (2005-2010).	Implemented between Karachi and Lahore ACCs	Implementation planned from 2005-2010.	Planned for 2005-2010.	RNAV arrival and departure procedure being developed.	NPA procedure are being developed.	Feasibility study for using ADS-B is in hand. One station was installed at ACC Karachi and evaluation is in progress.	Planned for 2005-2010.	Existing Radar system being upgraded.
PAPUA NEW GUINEA				Implemented		Implemented at certain aerodromes.			
PHILIPPINES	ATN G/G BIS Router/AMHS implemented in 2006. AMHS trials with Singapore by end 2008 and Hong Kong planned in 2009.	Planned for 2011.	CPDLC Planned for 2011.				Included in CNS/ATM Project and scheduled for implementation in 2011.	FANS 1/A ADS-C planned for 2011.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
REPUBLIC OF KOREA	ATN BIS Router/AMHS planned for 2011.	AFTN based AIDC planned for 2009 between Incheon ACC and Fukuoka ATMC. AIDC between Incheon and Qingdao planned for 2013.	PDC & D-ATIS implemented 2003.			NPA procedure developed at Incheon International Airport in 2008.	ADS-B trials planned for 2008-2009 at Incheon International Airport.	FANS 1/A based ADS-C implemented since 2003 for contingency purpose.	
SINGAPORE	AMHS implemented. ATN BIS Router trial with Malaysia commenced in 2007 and with Indonesia in 2009. ATN/AMHS trial planned with Australia, India, Thailand, UK and Philippines.	ATN based AIDC to be implemented	Implemented since 1997. Integrated in the ATC system in 1999.		RNAV SIDS and STARS implemented in 2006.	NPA Procedure implemented in 2005.		FANS 1/A ADS-C implemented since 1997. Integrated with ATC system in 1999.	
SRI LANKA	ATN BIS Router Planned for 2009. AMHS planned along with BIS in 2009.		PDLC in trial operation since November 2000.				ADS-B Trials planned for 2010 and implementation in 2011.	FANS 1 /A ADS-C trial since November 2000.	GPS based domestic route structure being developed.

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
THAILAND	BBIS/BIS Routers already implemented. Target date for AMHS in 2008.	AFTN based AIDC planned for 2010.	FANS-1/A Implemented.	Under implementation	Implemented at Phuket Airport	Implemented at Phuket	Multilateration implemented in 2006 at Suvarnbhumi Int'l. Airport. 22 ADS-B ground stations will be implemented in 2008.	FANS 1/A ADS-C Implemented.	
TONGA	AMHS planned for 2008.					NPA planned for 2007.	Trial planned for 2010		CPDLC and ADS-C is not considered for lower airspace
UNITED STATES	AMHS implemented. AMHS Atlanta Sept 2009 to serve CAR/SAM,/ North Atlantic/Europe	AFTN based AIDC implemented.	FANS-1/A based CPDLC implemented.	Implemented	Implemented		Implemented	Implemented	
VANUATU									

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
VIET NAM	BIS Routers planned for 2009. ATN/AMHS trial in 2010 and operation in 2012.	AFTN based AIDC implemented in 2009. Trial for ATN based AIDC planned in 2010.	CPDLC operational trial conducted in early 2007.	For en-route TBD.	RNAV		TBD.	FANS 1/A ADS-C operational trial conducted for oceanic area of Ho Chi Minh FIR since March 2002.	

* Navigation – Navigation including Performance Based Navigation (PBN), APV and precision approach

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**
Provision of ATIS as specified in FASID Table CNS 2 (Doc 9673)	Bangladesh	To broadcast current, routine terminal information to arriving and departing aircraft to ease congestion on the Tower and Approach channels affecting safety of aircraft operation.	May 2007	Provide aerodrome Terminal Information broadcast system to ease congestion on VHF and to reduce controllers work load	The ATIS equipment installed has been out of service due to maintenance problem and is beyond repair. It is required to provide a new equipment. New ATIS equipment had already been installed and put into trial operation on 14 May 2008. Effort is required to resolve the technical problem and provide ATIS for operational use within shortest possible time. Further updates on the Status are required.	Civil Aviation Authority of Bangladesh	September 2009	A
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.	1998 Early 2008 Feb. 2009	Improvements in the quality of link to RCAG stations and power supply system are required.	Action should be taken to provide reliable links between the RCAG stations and Yangon ACC. ICAO missions were conducted. An action plan was developed to upgrade equipment at RCAG stations, provide VSAT link at all RCAG stations, to improve power supply system. 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. New HF transmitters were used to provide service to aircraft flying beyond VHF coverage in a small portion of Yangon FIR	DCA Myanmar	Revised target date is end of 2009 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.	A

Identification		Deficiencies			Corrective Action			
Requirement	**States/facilities**	**Description**	**Date first reported**	**Remarks**	**Description**	**Executing body**	**Target date for completion**	**Priority for action**
~~Requirement for provision of ATIS as specified in FASID Table CNS2 (Doc. 9673 Vol.II)~~	~~Nepal~~	~~To broadcast current, routine terminal information to arriving and departing aircraft to ease congestion on the Tower and Approach channels affecting safety of aircraft operation.~~	~~April 2005~~	~~Provide aerodrome Terminal Information broadcast system to ease congestion on VHF and to reduce controllers work load~~	~~ATIS equipment provided in 2001 remained unusable due to technical problem which is still under investigation and rectification.~~ ~~On 14 March 2008, Nepal informed that ATIS TIA revived since 5 November 2007 on reduced range condition. It was under maintenance for normal operation. Nepal advised on 21 August 2008 that ATIS is functioning normal.~~	~~Civil Aviation Authority of Nepal~~	~~September 2008~~ ~~Official notification of the normal operation of the ATIS and request for removal this deficiency from the deficiency list was received from Nepal on 29 August 2008.~~	~~A~~
Requirements for provision of AFS circuits between Hong Kong and Manila is specified in FASID Table CNS 1A and 1D (Doc.9673 Vol.II)	Philippines	Total disruption of the AFTN circuit between Manila and Hong Kong after Philippines Long Distance Telephone Company (PLDT) failed to provide communication link between Manila and Hong Kong. The AFTN circuit performance had experienced 339 minutes circuit outage in June 09 due to equipment failure. The ATS direct speech circuit between Manila and Hong Kong had 3617 minutes outage in June 2009.	February 2007 June 2009	It is urgently required to improve the performance of the AFTN circuit to meet the requirement for the exchange of safety messages between Manila and Hong Kong within the established transit time of 5 minutes. It is also required to restore normal operation of the ATS direct speech circuit as soon as possible.	Prolonged delay in rectification of problem experienced at Manila has resulted in diversion of message traffic for a long time via Taibei with alternate routing via Hong Kong/Fukuoka/Singapore/Manila causing traffic congestion as well as higher transit time of AFTN message. Remedial actions for improvement of the circuit performance was discussed among ICAO Secretariat, Hong Kong CAD and the CAAP Philippines. ICAO mission was carried out and action plan was developed.	Civil Aviation Authority of the Philippines (CAAP)	By the end of September 2009 The circuit was resumed operational on 4 May 2008. However, the unstable and unreliable performance of the circuits is not acceptable. The Philippines is urged to rectify the deficiencies of the AFTN and ATS direct speech circuits without further delay.	U

Summary of MET Gaps in South Pacific
(Source: TCB - CAEMSA-SP draft reports)

State	Gap	State action proposed	Target date
Cook Islands	MET Obs. Instr. – NCRG (night)	Install AWOS – supply tower	2010
	no LOA - MET & CAA	Negotiate agreement	2009
	no MOU -TAF – Fiji & Cook Is.	Formulate agreement	2009
	no MET authority assigned	Request government designation	2009
	Unreliable MET data outer Is.	Improve comms, maint, monitor	2010
	Unawareness of Ann 3 changes	Improve info w/ ICAO	2009
	no QMS	Utilize knowledge in Fiji	2009
	Lack of wind shear warnings	Improve forecasts through study	2010
	Lack of QMS auditor	CIMS to train auditor	2009
	Transmission of MET inconsist.	Team w/ NZ CAA to use VSAT	2009
Fiji	Cost recovery out of date	Develop accurate cost model	2009
	no LOA – MET & CAA	Develop LOA after cost model	2009
	QMS not complete	Continue QMS development/ISO	2010/2012
	no bilat agr for TAF service	Develop MOUs after regional cost model	2010
	no delegation of MET oversight	Continue to develop	2011
	Add wind sensors TDZ NFNS	Continue current efforts	2009
	Auto AIREP data – needs dissem	Improve dissem of auto AIREP	2009
	Segments of MET service disaster plan lacking	Develop Suva and/or develop MOU with other State(s)	2010
	Lack of NCRG TAF monitoring	Coord w/ CI in montrg (night – cloud and wind shear)	2010
	Ann 3 / WMO changes insufficiently disseminated	Improve procedure to diss. MET standard changes	2009
Kiribati	***MET Obs. Instr. NGTA*, PLCH *(deficiency AP-MET-02)***	**Purchase/install AWOS**	**2009/2010**
	no MET authority assigned	Continue declaration process	2010
	no MOU – MET support Fiji	Negotiate agreement	2009
	no QMS	Execute KMS strategic plan/ISO	2011/2013
	Need for trained staff for TAF	Develop trng sched and needs to provide to WMO for funds/trng	2009/2013
	no LOA – MET & CAA	Develop LOA	2009
	Tx of MET inconsistent	Explore NZ CAA for VSAT	2010
	Collection/tx of MET info insuf.	Train flight service staff in obs. & monitor procedures	2009
	Current ICAO/WMO docs not avail	Ensure procedures provide info of changes to necessary parties	2009
	Tsunami not in disaster plan	Develop procedures for Tsunami warnings to aviation users	2009
	WAFS forecasts not avail		
Nauru	no MET authority assigned	Rewrite Nauru Civil Aviation Act	2009

State	Gap	State action proposed	Target date
	no MOU – TAF/SIGMET PNG	Negotiate agreement	2009
	no MET authority assigned	Develop designation	2009
	Current ICAO/WMO docs not avail	Ensure current docs are obtained	2009
	Lack of temperature/dewpoint at aerodrome	NOTAM no temp or dewpnt or NOTAM temp/dewpnt measured 2 km away	Immediate
	no MET observations (short term)	Repair equipment via tech support by Airways NZ	2009
	no MET observations (long term)	**Install automated weather observing system at AUUU**	**2011-2012**
	Staff not to WMO standards	**Train FIC staff to WMO stds via trainers in Solomon Islands**	**2009**
	METAR not provided	Re-establish METAR prgm	2009/10
	Comms unreliable	Implement VSAT via Airways NZ	2009/10
	no QMS for METAR	Establish QMS for METAR	2009/10
	no QMS for CAA	Establish QMS/ISO for CAA	2011/13
	WAFS forecasts not avail		
Samoa	no QMS implementation	Develop QMS/ISO	Dec 2010
	No oversight of SMD	Liaise with PASO for oversight Certify SMD	2010 2011
	No anemometer output and limited communications avail for MET data access by users	NZ Airways Corporation install displays for wind info Upgrade MET facilities at Faleolo Intl	2009 2010
	No cloud base or visibility sensors at Faleolo	Installation of AWS with cloud ceiling and visibility sensors	2010
	Forecasters (NSMA) not compliant with WMO qualifications	Investigate options with WMO	2009
	No formal agreement for the provision of TAF from Fiji	Develop bi-lateral agreement on the provision of TAF	2010
	No agreement of MET services for CAA	Develop LOA between MET and CAA	2009
Solomon Is.	AGGH METAR does not comply to ROBEX	Update ROBEX HB (RO)	2009
	TAF not accurate and timely	Establish aviation frcstng unit at AGGH	2009
	no calibrated MET obs (wind, vis, cloud) AGGH (deficiency AP-MET-01)	**Replace and/or calibrate MET obs. equipment AGGH**	**2008/2009**
	MET enclosure poor at AGGH	Develop MET enclosure at AGGH	2008
	METAR avail inconsist	Improve avail of METAR and monitoring	2008
	no QMS for METAR	Develop QMS for METAR	2009
	Tx of METAR not in accord to ROBEX HB	**Tx METAR w/i 5 min of report time to Brisbane**	**Immediate**

State	Gap	State action proposed	Target date
	ICAO/WMO docs not current	Obtain updated ICAO/WMO docs	2009
	no formal oversight	Confirm oversight	2009
	no LOA between MET & CAA	Develop LOA MET & CAA	2009
	Need planning for METAR/TAF avail at altern AGGM	Include AGGM in SANG31 and FTNG31 bulletins	As required
	no QMS implementation	Develop QMS/ISO	2010/2013
	WAFS forecasts not avail	**Procure ISCS**	**2010**
	Comms unreliable	Implement VSAT via Airways NZ	2009
	Gaps in disaster plan for provision of MET service	Improve disaster plan via MOU w/ other MET service	2009
	Changes to Annex 3 not communicated	Disseminate Annex 3 changes to appropriate parties	2009
Tonga	no MET auth and oversight designation	TCA define MET auth and oversight	2009
	AIP needs to reflect MET auth	Include MET auth in AIP	2009
	no cost recovery model	Develop cost recovery model	2010
	no LOA between MET & CAA	Develop LOA MET & CAA	2010
	no QMS established	Develop QMS	2011
	no bilat for TAF w/ Fiji	Develop bilat for TAF from Fiji	2009
	no post disaster recovery for provision of MET in disast plan	Include post disaster recovery for MET in disast plan	2009
	Pilot briefings sometimes outdated	Links to NWS should be deleted if not information not timely	2009
	Met obs not optimal (vis, cloud especially at night)	**Upgrade obs equipment and optimize locations**	**2009-10**
	Action items from APAC MET SIP not current	Revise action items from SIP	2009
	Lack of monitoring of active volcanoes		
Vanuatu	Draft report not submitted yet		

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Proposed list of APANPIRG Air Navigation Deficiencies as a result of the ICAO TCB CAEMSA-SP

COOK ISLANDS:

- NIL

FIJI:

- NIL

KINGDOM OF TONGA

- Lack of monitoring of active volcanoes – non-compliance with IAVW provisions. Reference Annex 3, 3.6 and 4.8 *(Note that Annex 3, 3.6 does not say that it needs to establish a state volcanic observatory – only that the information be provided to ATS, etc..)*

KIRIBATI

- Lack of WAFS products needed for pre-flight briefing. Annex 3, Chapter 9 and Appendix 2, 2.1 and Appendix 8.

NAURU:

- MET Observations at Nauru International – AUUU: No METAR/SPECI observing program is in place. TAF issuance monitoring and amending not supported by an observing program. Reference Annex 3, 4.3.1 and no calibrated and maintained equipment available for measuring wind speed and direction: no calibrated and maintained equipment available for the measurement of temperature and dew point; lack of automatic instruments to support accurate visibility and cloud base observations. Reference Annex 3, 4.5, 4.6 and Appendix 3 Section 4

- Lack of WAFS products needed for pre-flight planning. Reference Annex 3, Chapter 9 and Appendix 2, 2.1 and Appendix 8.

SOLOMON ISLANDS:

- Lack of WAFS products needed for pre-flight briefing. Annex 3, Chapter 9 and Appendix 2, 2.1 and Appendix 8.

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TERMS OF REFERENCE OF CNS/MET SUB-GROUPS

1) Ensure the continuing and coherent development of the ASIA/PAC Reginal Air Navigation Plan in the CNS/MET fields in accordance with the Global Air Navigation Plan.

2) Review and identify deficiencies that impede the implementation or provision of efficient CNS/MET services in the ASIA/PAC Region.

3) Monitor CNS/MET systems research and development, trial and demonstrations in the fields of CNS/MET and facilitate the transfer of this information and expertise between States.

4) Make specific recommendations and guidance materials aimed at improving CNS/MET services by the use of existing procedures and facilities and/or through the evolutionary implementation of CNS/ATM systems.

5) Review and Identify Inter-regional and intra-regional co-ordination issues in the fields of CNS/MET and recommend actions to address those issues.

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SUBJECT/TASKS LIST IN THE CNS/MET FIELDS

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

TASKS NO. 1 TO 31 HAVE BEEN COMPLETED AND REMOVED FROM THE LIST

No.	Ref.	Associated Strategic Objective & GPIs	Task	Priority	Action Proposed/In Progress	Action by	Target Date
1 (32)	RAN/3 C.8/14 APANPIRG/14 (TOR 3)	A-Safety E-Continuity GPI-19	Subject: Inadequate implementation of procedures for advising aircraft on volcanic ash and tropical cyclones Task: Monitoring of the implementation of international airways volcano watch (IAVW) and tropical cyclone advisories and SIGMETs	A	Monitor and provide assistance in the implementation of volcanic ash and tropical cyclone advisories and SIGMETs procedures to ensure provision of timely information on volcanic ash and tropical cyclones to aircraft.	CNS/MET SG Task Force on the implementation of Volcanic Ash and Tropical Cyclone advisories and SIGMETs (VA/TC/I TF)	On going
2 (35)	(TOR 3)	D – Efficiency All GPIs	Subject: To facilitate regional implementation of CNS/ATM Tasks: a) coordinate training/workshops to allow States to develop and implement new CNS/ATM procedures; b) encourage States to participate in the evaluation and training of new CNS/ATM systems;	A	1) Identify topics for training, develop syllabi and plan training programme; 2) Encourage States in the evaluation and training of new CNS/ATM systems; 3) Co-ordinate with States and monitor progress;	CNS/MET SG	On-going On-going On-going

No.	Ref.	Associated Strategic Objective & GPIs	Task	Priority	Action Proposed/In Progress	Action by	Target Date
			c) progress the adoption of WGS-84 co-ordinate system and introduction of high integrity systems for the management of the co-ordinate data.		4) Collect information and suggest methods of resolving problems commonly faced by the States.	ATM/AIS/SAR CNS/MET SG	On-going
3 (36)	APANPIRG D. 4/46 RAN/3 C.12/3 APANPIRG 5/3 (TOR 3)	D – Efficiency All GPIs	Subject: Provision of adequate CNS/MET services Task: Monitor CNS/ATM systems research and development, trials and demonstrations in the fields of CNS/MET and facilitate the transfer of this information and expertise between States.	A	1) Encourage States to conduct R&D, trials & demonstrations of new CNS/MET services; 2) Monitor global developments that may have beneficial consequences on regional planning activities; 3) Consolidate information on new capabilities in the CNS/ATM system, for the Sub-Groups review and action; 4) Serve as a focal point for review of ongoing work of Regional formal and informal working groups that is relevant to CNS/MET; 5) Provide for coordinated training/seminars to keep all States informed on developments of trials and demonstrations.	CNS-MET	On-going
4 (37)	C 12/24	D – Efficiency GPI-19	Subject : Transition to the GRIB and BUFR coded WAFS products	A	1) Monitoring of implementation of BUFR coded SIGWX forecasts	CNS/MET SG	Completed

No.	Ref.	Associated Strategic Objective & GPIs	Task	Priority	Action Proposed/In Progress	Action by	Target Date
			Task : Implementation of the transition to the GRIB and BUFR coded WAFS products		2) Monitoring of the migration to SADIS 2G 3) Assist in preparation for the new gridded products for turbulence, icing and cumulonimbus 4) Monitoring of the migration to ISCS G3	WAFS Implementation Task Force WAFS/I TF WAFS/I TF	Completed 2013 2009-2012
5 (38)	C12/36 APANPIRG C14/45	D – Efficiency GPI-19	Subject: Developing the new requirements for MET products and services in support of ATM.	A	1) Development of the initial draft of the MET Chapter; 2) Development of the MET components of the CNS/ATM concept/ strategy; 3) Inclusion of ATM requirements for MET information in the CNS/ ATM Plan; 4) MET/ATM Coordination Seminar – February 2006. 5) Conduct survey on ATM requirements for MET information 6) MET/ATM meeting in 2009 7) MET/ATM seminar in 2010	CNS/MET SG with assistance of MET WG on CNS/ATM Plan CNS/MET SG METATM TF METATM TF MET ATM TF MET ATM TF	Completed Completed Completed Completed Reconvene 2009 2010

No.	Ref.	Associated Strategic Objective & GPIs	Task	Priority	Action Proposed/In Progress	Action by	Target Date
6 (39)	APANPIRG/13 D 13/28	A - Safety D – Efficiency GPI-19	Subject: To improve the efficiency of the regional and inter-regional OPMET exchange and the availability of OPMET information from the ASIA/PAC Region Task: Review and optimize the ROBEX scheme and other OPMET exchanges; introduce monitoring and management procedures for the ROBEX centres and Regional OPMET data banks	A	1) Review and update regional ROBEX tables and relevant documents; 2) Propose optimization changes to the ROBEX scheme; 3) Improve the availability of OPMET data at the Regional OPMET Data Banks (RODB); 4) Improve the availability of OPMET information from the Pacific States; 5) Introduce monitoring and management Procedures.	CNS/MET SG OPMET Management Task Force (OPMET/M TF)	~~Completed~~ Recurrent task Completed On-going On-going Completed
7 (43)		D- Efficiency GPI17,18,19,22	Subject: Implementation of data link Task: Encourage implementation	A	Encourage States to implement CPDLC, D-ATIS, D-VOLMET, PDC and DPC	CNS/MET SG	Continuous SIP Seminar on DFIS was conducted. in 2008 -
8 (45)	APANPIRG List of deficiencies	A – Safety GPI - 19	Subject: Implementation of SIGMET Task: Improve regional procedures and availability of SIGMET from ASIA/PAC States	A	1) Assist States in implementing SIGMET requirements; 2) Conduct regular SIGMET tests; 3) Review and update training and guidance material; 4) Regular monitoring on the availability and quality of	CNS/MET SG VA/TC/I TF	Recurrent task Recurrent task ~~Completed~~ Recurrent task Recurrent

No.	Ref.	Associated Strategic Objective & GPIs	Task	Priority	Action Proposed/In Progress	Action by	Target Date
					SIGMET and advisories.		task
9 (46)	APANPIRG/17 C 17/23	D-Efficiency GPI-5 GPI-11	Subject: To implement Performance Based Navigation Concept in Asia/Pacific Region Task: Implement Performance Based Navigation in the Region.	A	1) To conduct Workshops/Seminars in the Region to familiarize the States about PBN Concept 2) To develop roadmap for implementation of RNP and RNAV procedures	CNS/MET SG ATM/AIS/SAR SG CNS/MET SG	Seminar and Workshop on PBN were Conducted in 07/08 and in 03/2009 Regional PBN plan to be adopted in 2009.
10 (48)		D-Efficiency GPI22 GPI9	Subject: FASID Task: Updating of FASID Table CNS-1B, CNS-1C, CNS-1E, CNS-4A and CNS 4B.	A	Seek State revision of Tables prior to March 2010. Review and update FASID Tables with the assistance of the Secretariat	CNS/MET SG	The plan need to be further updated. Amendment proposal process by Mar.2010
11 (49)		A-Safety D-Efficiency E-Continuity GPI23	Subject: WRC-2011 (2012) Task: Supporting ICAO position for ITU WRC-2011 on agenda items related to civil aviation	A	Seek States to support ICAO position at regional telecommunity – APT APG and at WRC.	CNS/MET SG	2012 RPG to be held in December 09
12 (50)	TBD by APANPIRG/20	D-Efficiency E-Continuity GPI21 GPI11	Subject: SBAS capability study Task: conduct study on the need for and feasibility of establishing a regional SBAS capability	B	To conduct study by members of the CNS/MET Sub-group	CNS/MET SG	2011

No.	Ref.	Associated Strategic Objective & GPIs	Task	Priority	Action Proposed/In Progress	Action by	Target Date
13 (51)	TBD by APANPIRG/20	A-Safety D-Efficiency GPI9	Subject: Study of using SSR Mode S SI code Task: , Study on the need for introduction of SSR Mode S SI code for future use in the Asia and Pacific region	B	To conduct study by members by the CNS/MET Sub-group	CNS/MET SG	2012

*** Number in bracket indicates sequential number since establishment of the Sub-group.**

Thirteenth Meeting of the Communications/Navigation/Surveillance and Meteorology Sub-group (CNS/MET SG/13) of APANPIRG

Bangkok, Thailand
20-24 July 2009

ATTACHMENT 1

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ATTACHMENT 2

International Civil Aviation Organization

THIRTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND METEOROLOGY SUB-GROUP OF APANPIRG (CNS/MET SG/13)

Bangkok, Thailand, 20 – 24 July 2009

LIST OF INFORMATION AND WORKING PAPERS

WP/IP No.	Agenda Item	Subject	Presented by	Remarks
WP/1	-	Provisional Agenda	Secretariat	A
WP/2	3 (1)	Review the Report of the Fourth Aeronautical Telecommunication Network Implementation Coordination Group Meeting (ATNICG/4)	Secretariat	C
WP/3	3 (3)	CNS/ATM Implementation and Planning Matrix	Secretariat	C
WP/4	13	Key Priorities and Performance Objective	Secretariat	A
WP/5	2 (1)	Review the APANPIRG/19 Report and Subsequent ANC/ Council Actions with respect to CNS/MET issues	Secretariat	A
WP/6	2 (1)	Review of Actions on the Report of the Twelfth CNS/MET Sub-group and APANPIRT/19 Meetings	Secretariat	A
WP/7	2 (2)	Action Items of the 45th DGCA Conference	Secretariat	A
WP/8	6 (1)	Review Report of the Eighth Meeting of Automatic Dependent Surveillance-Broadcast (ADS-B) Study and Implementation Task Force	Secretariat	C
WP/9	15	Terms of Reference and Tasks List of the CNS/MET Sub-group	Secretariat	A
WP/10	5 (2)	Navigation Strategy for the Asia/Pacific Region	Secretariat	C
WP/11	10 (3)	Proposed regional issue of warnings to international aviation	New Zealand	M

WP/IP No.	Agenda Item	Subject	Presented by	Remarks
WP/12	4 (2)	Use of Satellite Voice Communications for ATC purposes	Australia	C
WP/13	5 (3)	Proposal for Regional Cooperation on Ionosphere Characterization	Australia	C
WP/14	8 (1)	Summary of recent and forthcoming developments to the SADIS	SADIS Provider State	M
WP/15	8 (1)	Summary of recent and forthcoming developments to the WAFS	WAFC Provider State	M
WP/16	8 (2)	SADIS Strategic Assessment Tables 2009-2013	SADIS Provider State	M
WP/17	6 (2)	Review Surveillance Strategy for Asia/Pacific Region	Secretariat	C
WP/18	2 (3)	Outcomes from the ATM/AIS/SAR/SG/20 Meeting	Secretariat	A
WP/19	2 (3)	Report on activities of the RASMAG	Secretariat	C
WP/20	9 (1, 2)	Seventh Meeting of the OPMET Management Task Force	Secretariat of OPMET/ M TF	M
WP/21	9 (3)	Review the Implementation of 30-H TAF in the ASIA/PAC Region	Secretariat	M
WP/22	14 (2)	Status of MET Deficiencies	Secretariat	M
WP/23	13	Identification of Regional Performance Objectives	Secretariat	C
WP/24	13 (2)	Introduction to Performance Framework Forms (MET Related)	Secretariat	M
WP/25	8 (3)	Regional Progress in WAFS Implementation	Chairman WAFS Task Force	M
WP/26	9	Use of Degrees Magnetic for Measuring and Reporting the Surface Wind Direction	China	M
WP/27	9 (3)	Temperature Group in TAF	Hong Kong, China	M
WP/28	14 (1)	Status of CNS Deficiencies	Secretariat	C

WP/IP No.	Agenda Item	Subject	Presented by	Remarks
WP/29	8 (2)	Use of the Public Internet to Access Aeronautical Meteorological Data	USA	M
WP/30	8 (2)	Changes to Users Methods of Accessing WAFS Products via the Washington World Area Forecast Center (WAFC)	USA	M
WP/31	8 (2)	Current Work to Further Harmonize ISCS and SADIS OPMET Data	USA	M
WP/32	10 (3)	Implementation of SIGMET for Accidental Release of Radioactive Material into the Atmosphere	USA	M
WP/33	9 (2)	OPMET Data Deficiencies	IATA	M
WP/34	7 (1)	ICAO Position for the International Telecommmunication Union (ITU) World Radiocommunication Conference (2011) (WRC-11) Agenda Items	Secretariat	C
WP/35	9 (1)	Provision of OPMET Bulletin (Compilation and Transmission)	IATA	M
WP/36	9 (1)	IATA OPMET Data Monitoring for SADIS Broadcast	IATA	M
WP/37	9 (2)	The Re-planning of TAF Valid 24 and 30-Hour Implementation in Viet Nam	Viet Nam	M
WP/38	4 (3)	Development of VHF COM Frequency Management	Secretariat	C
WP/39	6 (3)	Coordination and Management of SSR Mode S Interrogator Identifier Codes	Secretariat	C
WP/40	10 (2)	Cost Recovery by Volcano Observatories for Providing Volcanological Information to Aviation	Australia	M
WP/41	10 (3)	Progress with SIGMET Tests – WC and WV	Japan	M
WP/42	6 (1)	Regional ADS-B Equipage Requirement	IATA	C
WP/43	13 (1)	Performance-Based Approach Measurement	Secretariat	A

WP/IP No.	Agenda Item	Subject	Presented by	Remarks
WP/44	5 (1)	Outcomes from the PBN Task Force/5 Meeting	Secretariat	C
		INFORMATION PAPERS		
IP/1	-	Meeting Bulletin	Secretariat	A
IP/2	10 (1)	Follow-up of METWSG/2 Action Items Agreed	Secretariat	M
IP/3	9 (1)	Action Agreed of AMOFSG/7	Secretariat	M
IP/4	8 (1)	Follow-up of Conclusions of WAFSOPSG/4 Meeting	Secretariat	M
IP/5	14 (2)	Review of the Co-operative Agreement for the Enhancement of Meteorological Services for Aviation in the South Pacific (CAEMSA-SP)	Secretariat	M
IP/6	8 (3)	Visualization of WAFS Trial Gridded Forecasts	Hong Kong, China	M
IP/7	8 (3)	Further Observations on WAFS Trial Gridded Forecasts	Hong Kong, China	M
IP/8	10 (2)	Darwin VAAC Report July 2008 – June 2009	Australia	M
IP/9	10 (3)	SIGMET for the Phnom Penh FIR by Kunming MWO on behalf of Phnom Penh MWO	China	M
IP/10	10 (3)	Development of Deep Convection Satellite Products	Hong Kong, China	M
IP/11	10 (3)	New Zealand SIGMET	New Zealand	M
IP/12	6	ADS-B decisions by Australia	Australia	C
IP/13	6	Australian ADS-B aircraft equipage mandate for flight in the upper space	Australia	C
IP/14	11	National Operations Centre Meteorological Support Unit	Australia	M
IP/15	11 (2)	Computation of Windshear and Turbulence Parameters from Aircraft Data	Hong Kong, China	M

WP/IP No.	Agenda Item	Subject	Presented by	Remarks
IP/16	12	Aerodrome Climatological Summaries	Australia	M
IP/17	8 (2)	Development of File Server in Support of International Satellite Communication System	USA	M
IP/18	8 (3)	Report of the ISCS Operational Efficacy	USA	M
IP/19	9 (2)	Climatology to Build a Better TAF	USA	M
IP/20	9 (2)	United States Naming Convention for the FASID Table MET 1A	USA	M
IP/21	9 (2)	TAF Verification in the United States	USA	M
IP/22	10 (2)	Update on Warning Systems for Aviation Related to Volcanic Eruptions in the Russian Far East	USA	M
IP/23	10 (2)	Effects on Aviation Operations of Recent Volcanic Eruptions in the North Pacific	USA	M
IP/24	11 (2)	Development of Thunderstorm Nowcasting Products in Support of ATM	Hong Kong, China	M
IP/25	10 (3)	Indices of Significant Weather for Issuance of SIGMET	Japan	M
IP/26	12 (2)	ASEAN-ROK Training Workshop on Aviation Meteorology	Republic of Korea	M
IP/27	12 (2)	The USOAP Audit in Korea for Aviation MET Service	Republic of Korea	M
IP/28	3 (2)	COM Co-ordination Meeting	Secretariat	C
IP/29	4 (3)	Seminar on DFIS in the Asia and Pacific Region	Secretariat	C
IP/30	5 (3)	Seminar on Testing of Navigation and Surveillance Facilities and Validation of Flight Procedures	Secretariat	C
IP/31	11	Current Situation of the Air Traffic Meteorology Center	Japan	M
IP/32	10 (3)	Review of the Expanded WV SIGMET Test	Japan	M

WP/IP No.	Agenda Item	Subject	Presented by	Remarks
IP/33	4 (2)	APANPIRG Discussion on AMSS Voice Communication	Secretariat	C
IP/34	15	U.S. Next Generation Air Transportation System (NextGen)	USA	C
IP/35	5 (3)	FAA GBAS Update	USA	C
IP/36	3 (2)	Telecommunications Evolution	USA	C
IP/37	4 (2)	Proposal for Amendment to Doc 7030 on the Use of SATCOM Voice for Routine ATS Communications in NAT Region	Secretariat	C
IP/38	6 (3)	Progress Report on Bilateral Coordination activities related with SSR Mode S II Code	Japan	C
IP/39	7 (2)	Outcome of the Second Meeting of the APT Conference Preparatory Group for WRC-2011 (APG2011-2)	Secretariat	C
IP/40	13	ICAO Special Implementation Project (SIP) Workshop on the Development of National Performance Framework to Achieve a Global ATM System	Secretariat	A
IP/41	2 (1)	Action Consequent to Discontinuation of Asia/Pacific Regional Plan for new CNS/ATM Systems	Secretariat	A
IP/42	5 (3)	US GPS Performance Commitment	USA	C
IP/43	8 (1)	Executive Summary of SADISOPSG/14 Meeting	Secretariat	M
IP/44	4 (1)	Evolving Satellite Communication Service Provision and Performance	Secretariat	C
IP/45	4	Use of SATCOM Voice Systems in lieu of a Second HG Communications System	New Zealand	C

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