INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA AND PACIFIC OFFICE

REPORT OF THE

SEVENTH MEETING OF AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) TRANSITION TASK FORCE (ATNTTF/7) OF APANPIRG

Shanghai, China 18-22 April 2005

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1. Opening of the Meeting

1.1 The Seventh Meeting of the ATN Transition Task Force of the ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG) was held in Shanghai, China from 18 to 22 April 2005. The meeting was hosted by the Air traffic Management Bureau (ATMB) of the Civil Aviation Administration of China (CAAC).

1.2 The meeting was opened by Ms. Lu Xiaoping, Deputy Director General of ATMB. Ms. Lu Xiaoping extended welcome to all the participants to Shanghai to exchange views on technical development for systematic implementation of ATN in the Asia and Pacific Region. She stated that CAAC actively responded to the initiative of ICAO, conducted considerable technical researches, equipment development, etc. for ATN implementation. She expressed that hope that through this meeting, it is expected to strengthen the coordination and cooperation among the Civil Aviation Authorities in the region to facilitate the ATN implementation. She also expressed her pleasure in hosting the meeting. She thanked ICAO for organizing the meeting in Shanghai.

1.3 On behalf of Mr. L.B. Shah, Regional Director, ICAO Asia and Pacific Office, Mr. K.P. Rimal, Regional Officer, CNS of the ICAO Regional Office expressed gratitude and appreciation to the ATMB for hosting the meeting in Shanghai and for the excellent arrangement made for the meeting. He highlighted the tasks completed by the Task Force and outlined the objective of the Seventh Meeting.

1.4 Mr. Craig Head, Chairman of the Task Force, welcomed the participants and stated that six years have now passed since the ATN Transition Task Force first began. In that time, the Task Force had developed many plans and technical documents to assist the region in the implementation of the ATN SARPs. The time has now come to put these plans and documents into practice. According to the ATN Transition Task Force calendar, 2005 should be a year of progress in implementing the AMHS and ATN in the Asia and Pacific Regions. He stated that it is important for the region to move quickly in the implementation phase of the AMHS to assist in reducing technical complexities such as routing and disruption to service if there are too many isolated areas of AFTN and AMHS systems scattered throughout the region.

1.5 Mr. Wang Lan Zhi, Director General, Eastern Region of ATMB extended warm welcome to the participants to Shanghai and also provided an overview of history of Shanghai and highlighted the fast growing economic developments. He assured his assistance for the success of the meeting.

1.6 Mr. Yu Bo, Deputy Director General of the Eastern Region of ATMB thanked ICAO, speakers and the participants.

2. Attendance

2.1 The meeting was attended by 52 participants from twenty States: Australia, Bangladesh, Brunei Darussalam, Cambodia, China, Hong Kong China, DPR Korea, Fiji, India, Indonesia, Japan, Malaysia, Mongolia, New Zealand, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, United States and Vietnam. A list of participants is at Attachment 1.

3. Officers and Secretariat

3.1 Mr. Craig Head, Chairman of the Task Force, presided over the meeting.

3.2 Mr. K.P. Rimal, Regional Officer, CNS was the Secretary of the meeting who was assisted by Mr. Li Peng, Regional Officer, CNS of the ICAO Asia and Pacific Office.

4. Agenda

4.1 The Agenda adopted by the meeting was as follows

Agenda Item 1: Review latest developments in the Aeronautical Communication Panel (ACP)

Agenda Item 2: Review ATN Technical Documentation on:
- System Integrity
- Performance
- System Management
- Documentation Tree

Agenda Item 3: Review Changes to ATN Router Documentation:
- Reference Document for the ATN Router Description
- ATN Router ICDs

Agenda Item 4: Review Changes to AMHS Documentation:
- Reference Document for the AMHS Description
- Development Work on AFTN/AMHS Operating Procedures
- Directory Services
- MTA Routing Policy
- AMHS Naming Plan
- AMHS Naming Registration Form
- AMHS ICD

Agenda Item 5: Review Status on AIDC Documentation

Agenda Item 6: Update Tables and Charts for the ground-to-ground part of the CNS FASID
- AIDC
- AMHS
- ATN Routers

Agenda Item 7: Review State's ATN Implementation/Operational activities and issues

Agenda Item 8: Review status of implementation of AFTN circuits

Agenda Item 9: Review the Subject/Task List of the ATN Transition Task Force, identify future work and develop ground-to-ground ATN implementation strategy

Agenda Item 10: Any Other Business

5. Organization, Working Arrangements and Language

The Task Force met as a single body except that on 18, 19 and 20 April 2005 the Working Group of the Task Force met separately to deal with the tasks assigned to it. The working language was English inclusive of all documentation and this Report. Lists of Working Papers and Information Papers presented at the meeting are at Attachment 2.

6. Title and Terms of Reference

Title: ATN Transition Task Force

Terms of Reference (TOR)

Plan for implementation of the Aeronautical Telecommunication Network (ATN) in the ASIA/PAC region to meet performance and capacity requirements of CNS/ATM Systems. The planning also addresses the ongoing development of the AFS including digital speech communication.

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Agenda Item 1: Review latest developments in the Aeronautical Communication Panel (ACP)

Ground-ground communications

TCP/IP

1.1 The meeting noted developments in the ACP on matters of interest to the Task Force. The meeting was informed by the United States that the ATN protocol suite 8208 and TCP/IP dual stack protocols will be implemented, where required in the United States. It was also noted that dual stack protocol will be implemented at the entry/exit points between EUR region and other regions where ATN in full compliant with the SARPs is being or has been implemented to ensure interoperability between Regions.

1.2 The ASIA/PAC ATN Transition Task Force had clarified that TCP/IP may only be used as an encapsulation sub-network of the ATN under bilateral agreement between States. Administrations in the ASIA/PAC region are expected to provide AMHS over ATN infrastructure that complies with provisions of Doc. 9705.

Air-ground communications

1.3 It was noted that in the EUR region full SARPs compliant air/ground data over VDL Mode 2 is being implemented for CPDLC. Current planning is to require mandatory carriage of VDL Mode 2 for new aircraft as well as for ACCs by 2009 and for all aircraft by 2014. Introduction of air/ground data transmissions for CPDLC in the U.S is foreseen by 2010.

1.4 It was also noted that introduction of materials on the use of TCP/IP in the air-ground data links require significant technical work that may only be completed in a three to five years time frame. Initial operational deployment of an air/ground TCP/IP internet can only takes place when this work is completed.

Voice-over-Internet Protocol (VoIP)

1.5 It was noted that ACP is also considering possible usage of VoIP. If feasible, the introduction of VoIP could reduce the need for communication links with adjacent centres. Currently, at least two dedicated links are required, one for voice and another one for data. VoIP, together with TCP/IP data, could reduce these links to one. Similarly, use of VoIP over air/ground links may, if feasible, allow for more parties to use the same frequency, including data communications. So far, the studies are based on what is happening in EUROCAE in this regard.

1.6 In the ASIA/PAC region VoIP option is not considered to support ATS direct speech communications however the developments in this field are being monitored. The United States informed the meeting that VoIP is provided for operational use between some centres in the United States and the service is meeting operational and performance requirements.

Migration to BUFR coded OPMET messages

1.7 The meeting noted that through the European Air Navigation Planning Group, ICAO has been requested to provide guidance to achieve a uniform global approach to the implementation of Binary Universal Form for the Representation of meteorological data (BUFR) coded OPMET messages, including early advice on the likely time-frame for ATSMHS extended services to accommodate BUFR coded messages. The time frame for this transition is from 2007 to 2015.

1.8 The ACP will be invited by the AMOSSG to develop a global plan for the introduction of BUFR coded OPMET messages.

Use of Lower Cases characters in the NOTAM messages

1.9 The meeting noted that at the request from the user community, the Air Navigation Commission (ANC) is considering to allow for the inclusion of lower case letters, in addition to upper case letters, in the NOTAM message text.

1.10 The meeting was not able to ascertain the extent of changes and the approximate cost that would be required to make modifications to permit the use of both lower and upper cases characters in the AFTN messages. Most centers would require extensive software changes. Some centres have the capability to handle lower cases.

1.11 It was also noted that the AFTN/AMHS gateway service fully complies with the provisions of Annex 10 and will not have the capability to handle both upper and lower case characters.

1.12 In view of the foregoing the participants and members of the Task Force were requested to examine the possibility to allow both upper and lower cases characters to be handled by AFTN including the extent of changes that would be required and inform the Secretariat before 15 June 2005.

Agenda Item 2: Review ATN Technical Documentation

2. Under this agenda item, the meeting reviewed several technical documents including integrity policy, system management policy, and communication performance and updated the documentation tree.

System Integrity Policy and System Management Policy

2.1 The meeting reviewed the draft of ASIA/PAC Aeronautical Telecommunication Network System Integrity Policy presented by USA. It was noted that the paper was also presented at the ACP Working Group N meetings in Bangkok November 2003. The System Integrity Policy defines the rules governing the protection of ATN data, services, and resources associated with ATN applications and processes from both unintentional defect and deliberate attack. The document contains high-level system integrity requirements, defines system integrity services and associated policy statements, and requires that ATN systems undergo a verification and authorization process whereby systems are formally approved for operation by a Designated Approving Authority.

2.2 The meeting also reviewed the draft of ASIA/PAC Aeronautical Telecommunication Network System Management Policy, which had been prepared in accordance with tasks identified. The paper was reviewed and discussed at the ATNTTF WG/11 meeting in Bangkok September 2004. It was also presented to SGN4 of WGN of ACP. The System Management Policy defines the rules governing management of ATN data, services, and resources associated with ATN applications and processes. The document defines system management services and associated policy statements, and requires that all ATN systems have a responsible system manager.

2.3 The meeting endorsed the draft of ASIA/PAC Aeronautical Telecommunication network System Integrity Policy and the draft of ASIA/PAC Aeronautical Telecommunication Network System Management Policy and formulated the following draft Conclusion.

Draft Conclusion 7/1 - ATN System Integrity Policy and System Management Policy

That, ASIA/PA**C** Aeronautical Telecommunication Network System Integrity Policy at Appendix A to this report and ASIA/PAC Aeronautical Telecommunication Network System Management Policy at Appendix B be adopted and published.

Communication Performance Document

2.4 The meeting reviewed the comments resulted from a review by OPLINK Panel on draft Asia/Pacific Region ATN Performance Document (herein after refers to as RP).

2.4.1 At the OPLINKP Working Group meeting held in France in September 2004, the RP document was presented. It was noted that there was a need to develop a guidance document for the regional planning group to develop Required Communication Performance based on the ICAO RCP concept. The RP document had been developed in that context. The OPLINKP has also been tasked to develop the RCP Manual, which is currently at final stage of development and will be ready for final review at OPLINKP/1 scheduled to be held in September 2005. It was found that the scope of the OPLINKP RCP Manual has a substantial overlap with the RP document.

2.4.2 It was informed that RCP considered by OPLINK Panel covers the operational aspect of performance. It includes requirements for both the voice communication and data communication, where the data communication may be implemented in ATN or other communication system such FANS 1/A. It was recommended to modify the RP document to accommodate other elements without restricting to the ATN and technical aspect.

2.4.3 It was noted that OPLINKP is currently working on the RCP manual as guidance materials which was enhanced substantially at the OPLINKP WG Toulouse meeting in September 2004.

2.4.4 It was concluded that RP document was considered useful, as Asia/Pacific region would be able to prepare future activities for performance. The RP has to be aligned to the finalized OPLINKP RCP Manual. It was noted that duplications detected in the Regional Performance Document should be deleted, while the emphases are to be placed on those areas where the regional group is responsible.

2.4.5 Based on the above comments made by the OPLINK Panel, the meeting reviewed the revised fourth draft of Communication Performance Document, which has been aligned to the latest draft of the RCP Manual developed by OPLINKP. The meeting endorsed the proposed changes to the document and the executive summary was added with necessary editorial changes. The meeting thanked the Task Force member from Japan for his continuous effort to have the document complemented and formulated the following draft Conclusion.

Draft Conclusion 7/2 - Communication Performance Document

That, the Communication Performance Document provided in the Appendix C be adopted.

ATN Documentation Tree

2.5 The meeting reviewed and adopted the third edition of ATN Documentation Tree presented by the Secretariat. There is a need to further update the Documentation Tree based on the result of this meeting.

2.5.1 The ASIA/PAC ATN Documentation Tree provides an index and hierarchy of relevant ATN documents. The first Edition of this document was adopted by APANPIRG/13 under Conclusion 13/14 in 2002. The second Edition of the document was reviewed by the ATNTTF WG/6 meeting in Canberra and finalized at its seventh meeting in Fiji with appropriate recommendations. The proposed changes were endorsed by ATNTTF/5 held in Phuket and its updated version was adopted by APANPIRG/14 under Conclusion 14/13 in 2003. It was reissued as part of ATN Planning Documents in March 2004.

2.5.2 The 3rd Edition of the ATN Document Tree was prepared in accordance with the task assigned to the Secretariat by the ATNTF WG/11. In the draft 3rd Edition of the Documentation Tree, the proposed matrix structure was integrated with additional category of ATN reference documents. The new edition of the document includes Basic/ANP, the checklist for initial activities for implementation of ATN, Regional Communication Performance. The documentation profile has been updated. The documentation profile has been arrangement in the order of a) planning policy; b) router infrastructure; c) ATN application; technical support document; and d) reference document.

2.5.3 In order for readers to trace the history of these regional ATN related documents, additional information was provided in the Remark part of the documentation profile to indicate dates of adoption and the date of updating of the tree.

2.5.4 The meeting agreed that the AMHS Description document and the ATN Router Description document are to be used for information purposes only and are to be read in conjunction with all other plans and technical documents listed in the ATN Documentation Tree. Any inconsistency in the information contained within these documents shall be considered the lowest ranked in order of precedence to all other documents within the ATN Documentation Tree. That is all other documents within the ATN Documentation Tree will take precedence over the contents in the AMHS Description and ATN Router Description documents.

2.5.5 The third edition of ATN Documentation Tree provided at Appendix D was adopted and the following decision was reached.

Decision 7/3 - ATN Documentation Tree

That, the Third Edition of ATN Documentation Tree provided in the Appendix D be adopted together with its profile description as a reference document for States to use.

Agenda Item 3: Review Changes to ATN Router Documentation

Reference Document for the ATN Router Description

3.1 The meeting had not received any proposal to amend the reference document for the ATN Router Description.

ICD for G/G Router ISO/IEC 8208 Sub-network

3.2 The meeting recalled that at the Eleventh Meeting of the ATNTTF Working Group held in September 2004, USA was tasked to update an ATN Ground to Ground Router ICD to include information of ISO/IEC 8208 Sub-Network.

3.2.1 The meeting reviewed the draft ICD prepared by USA. It was however recognized that the sub network Router ICD for ISO/IEC8208 should be separately published as the First Edition. This ICD provides guidelines mainly for ISO/IEC 8208 sub-network connections used to communicate between the boundaries intermediate systems that form nodes of the Asia/Pacific regional network to assure interoperability. It addresses the physical, data link and sub-network layers of the ATN G/G router ISO/IEC 8208 sub-network using the International Organization for Standardization (ISO), Information Processing Systems Open Systems Interconnection (OSI) Basic Reference Model.

3.2.2 The meeting therefore reviewed the ICD in light of the above and endorsed the First Edition of the Asia/Pacific ICD for ATN Ground-Ground Router for the ISO/IEC8208 Sub-Network provided in Appendix E for use in the Asia/Pacific Region.

Interface Control Document for ATN G/G ROUTER

3.3 The meeting also updated the ICD for ATN G/G Router and publish it as the Second Edition. This ICD specifies the interface requirements for the ATN Internet Communication Service (ICS) routing and routing protocols of the ATN G/G Boundary Intermediate Systems that form nodes of the Asia/Pacific ATN regional backbone network and/or have inter-State connectivity, to ensure interoperability between States.

3.3.1 It also addresses the upper sub-layer of the network layer of the ATN G/G router using the ISO/ OSI Basic Reference Model. These ICD guideline provisions comprise G/G router functional requirements associated with ATN Protocol Requirements Lists (APRLs) relevant to the ATN Internet Communication Service (ICS) routing protocol (ISO/IEC 8473-1 CLNP) and routing protocol (ISO/IEC 10747 IDRP).

3.4 In light of the foregoing, the meeting formulated the following draft Conclusion.

Draft Conclusion 7/4 - ATN Router ICDs

That, the First Edition of the ASIA/PAC Router ICD for ISO/IEC8208 Sub-Network provided in Appendix E and the Second Edition of the ASIA/PAC ICD for ATN Ground-Ground Router Internet Communication Service provided in Appendix F be adopted.

3.4.1 The meeting agreed to update the ATN Documentation Tree to indicate scope of these ICDs and their relationship.

Agenda Item 4: Review Changes to AMHS Documentation

Reference Document for the AMHS Description

4.1 The meeting reviewed and adopted the Reference Document for the AMHS Description. The document provides description of AMHS functionality, system performance, information security requirements and system management requirements.

4.1.1 It was noted that the AMHS transition descriptions currently contained in the AMHS ICD had been extracted and integrated into the AMHS Description Document. Additional information on the transitional guidance material has also been included in the document. The meeting reached the following decision to adopt the reference document.

Decision 7/5 - Reference Document for AMHS Description

That, the Reference Document for AMHS Description provided in Appendix G be included in the Documentation Tree and published for use by States to assist implementation of AMHS.

ACP WGN4 on ATN Directory

4.2 It was noted that ACP WGN envisages that Directory functions will be included as part of some standardized AMHS Implementation Profiles. However, since not all the Directory functions that could be implemented based on sub-volume VII are required to support AMHS, it has started working on identifying those elements related to the ATN DIR schema (object classes and attribute types) that could contribute to AMHS implementation profiles.

4.2.1 While considering this issue the meeting agreed that the object classes and attributes proposed in ACP WGN4 should be reviewed and compared against those in the Technical Document, and further action should be taken as appropriate. The meeting therefore assigned this task to the Working Group of the Task Force and reached the following decision.

Decision 7/6 - Study of the object classes and Attributes proposed in ACP WGN-4

That, the Working Group continue to monitor the activities carried out by ACP WGN-4 and report results to the Task Force at its next meeting.

Results of an ATN Directory Survey by Eurocontrol

4.2.2 The EUR region is currently starting deployment of an AMHS service, and Eurocontrol is currently studying issues related to a Directory service to support the regional AMHS. Eurocontrol is examining various non-X.500 protocols to enable AMHS users to access Directory, including LDAP (Lightweight Directory Access Protocol) and WEB (HTTP-based protocols). These protocols are based on the IP protocol suite instead of ISO and ITU-T protocols, since the EUR region is implementing AMHS based on an IP network instead of ATN/OSI. (The EUR region is considering “dual stack” directory servers to provide inter-regional X.500 DAP access to ATN/OSI users as well as to intra-regional IP users.) However, the selection of the Directory access protocol in the EUR region is not yet established.

4.2.3 The Eurocontrol survey also reported that the ATN Directory specifies non-standard schema elements that are not directly supported by standard X.500 DAP, LDAP or WEB. Use of these schema elements therefore carries cost implications since supporting them would require modification of commercial off-the-shelf (COTS) products.

4.2.4 The WGN meeting agreed that these ATN-specific directory definitions should be reviewed with a goal of simplification.

4.2.5 Taking note of the foregoing the meeting agreed to assign this task to the Working Group and formulated the following decision

Decision 7/7 - Review impact on the implementation of Directory Service in the region

That, the Working Group to review the impact on the implementation of Directory in the Region, and study the impact of delaying implementation until the review of ATN-specific schema elements has been carried out by WGN.

ASIA/PAC Technical Document on the use of Directory Services

4.3 The meeting reviewed the technical Document on the use of Directory Services presented by the Rapporteur of the ATNTTF Working Group. The document gives a comprehensive introduction to the ATN Directory Service and establishes which of the object classes (database record types) and attributes (contents of each record type) will be supported in the Region. It was recognized that as future work, profiles for the directory access and exchange protocols need to be generated.

4.3.1 In light of foregoing, the meeting formulated the following draft conclusion and Decision:

Draft Conclusion 7/8 - ATN Directory Service

That, ASIA/PAC Technical Document on the use of ATN Directory Services provided in Appendix H be adopted.

Decision 7/9 - Development of profiles for the directory access and exchange protocols

That, the Task Force Working Group further develops the profiles for the directory access and exchange protocols

Interim Regional AMHS Address Database

4.4 The meeting discussed a proposal for establishment of a centrally administered AMHS database that can be used during the initial phase of AMHS implementation until a regional Director Service is established.

4.4.1 States in the Asia/Pacific region are currently in the process of implementing AMHS services to replace AFTN services in accordance with the ATN transition plan of APANPIRG. As the number of AMHS User Agents (UA) and Message Transfer Agents (MTA) in the region grows, there is an urgent requirement for a regional database of AMHS addresses. AMHS address lookup is envisaged as one of the first applications for the ATN Directory Services and there is an urgent need to establish a regional AMHS address database as a stopgap measure that States will be able to access to obtain information on MTA and UA addresses, points of contact, etc.

4.4.2 A directory service will become essential when the number of User Agents and Message Transfer Agents in the Region becomes large enough to render a manually administered table-based database impractical. Eventually, it is envisaged that a worldwide Directory Service will be implemented when regional Directory servers are linked.

4.4.3 The meeting further discussed how to manage such a database. It was proposed that the ICAO Asia and Pacific Regional Office administer such a database. It was also recognized the need for new information to be distributed to States as soon as it becomes valid in order to make most efficient use of the AMHS system. The database administered by ICAO Regional Office could be made available via a web portal, possibly in formats such as XML or even simple CSV as well as human-readable HTML to enable a degree of automated processing. However, it was informed that the ICAO Asia and Pacific Regional Office might not have the required resource to support and maintain such a database.

4.4.4 The meeting, therefore, requested Thailand, where the ICAO Regional Office is located, to provide necessary support to the Regional Office to carry out this task. Thailand indicated that it would support if details of the requirements were identified. Accordingly, the meeting requested Japan to study the detailed requirements for the resource needed and inform ICAO Regional Office to take further action in coordination with AEROTHAI, Thailand.

The AFTN/AMHS operational procedure

4.5 The meeting reviewed a draft of the AFTN/AMHS operational procedure presented by USA. The meeting considered it might be premature to complete such kind of operational manual as not much experience had been gained through the trial operations. The meeting decided to postpone the development of the AFTN/AMHS operational procedure until sufficient experience is gained.

AMHS/MTA Routing Policy

4.6 The meeting reviewed the draft AMHS/MTA Routing policy to be used within the Asia/Pacific Region for implementation of AMHS presented by Thailand. The development of AMHS message routing policies was based on the need for States and AMHS administrators to be able to control the flow of messages into individual AMHS systems.

4.6.1 The AMHS/MTA Routing Policy document covers policy for AMHS systems to route AMHS messages between MTAs within the Region both in the transitional phase and final phase of AMHS implementation. It also outlines the policy for inter-region AMHS connections between the regions. The document does not, however, specify the characteristics for MTAs or how the connections between MTAs are established.

4.6.2 As result of review, the meeting formulated the following draft conclusion:

Draft Conclusion 7/10 - AMHS/MTA Routing Policy

That, AMHS/MTA Routing Policy as provided in the Appendix I to this report be adopted.

AMHS Addressing Scheme and Private Management Domain Name Value

4.7 The meeting reviewed a working paper presented by Hong Kong China, which outlines the Translated Form (XF) and Common AMHS Addressing Scheme (CAAS) Addressing Scheme. A draft of the AMHS Addressing Scheme and Private Management Domain (PRMD) value for each State/Air Traffic Service Organization (ATSO) in the ASIA/PAC Region was recommended for endorsement by the ATN Transition Task Force.

4.7.1 To facilitate the orderly, systematic and global implementation of the AMHS to replace the aging AFTN and CIDIN, the ICAO Secretary General issued in May 2003 a State Letter referenced SP 54/1-03/39 concerning the development of AMHS Addressing Scheme and Private

Management Domain (PRMD) Name Value. So far Hong Kong, China and Maldives are the only two Management Domains (MDs), which have declared the use of CAAS scheme in the ASIA/PAC Region. Apparently, the unenthusiastic responses from other states/authorities may be due to the lack of clear understanding of the concept. As it was considered important to have the proper address developed well before AMHS implementation in the Region, the APANPIRG/15 Meeting requested Hong Kong, China to develop a comprehensive draft of AMHS Addressing Scheme and PRMD value for each State/ATSO in the ASIA/PAC Region with options of both XF and CAAS addresses.

4.7.2 The paper analyzed the merits of using Common AMHS Addressing Scheme (CAAS) was analyzed and the meeting identified the need to transfer from Translated Form (XF) Addressing Scheme to CAAS. States were encouraged to adopt CAAS based on recommendations contained in the Edition 3 of Doc. 9705 that "an AMHS MD should implement the CAAS at the earliest opportunity" and encourage States/ATSOs to use CAAS directly in their AMHS transition/implementations. It was noted that this recommendation is also provided in the ICAO State letter and in the ASIA/PAC AMHS Naming Plan. The suggested values for the CAAS for all States/ATSOs in the ASIA/PAC Region was provided in the paper assuming each State deploys one MTA. Some examples of CAAS for some States/ATSOs in the ASIA/PAC Region were also provided assuming multiple MTAs are deployed. States/ATSOs shall refer to the examples given to develop their own CAAS address schemes for single or multiple MTAs option.

4.7.3 The meeting endorsed the description of the two addressing scheme. The meeting agreed that the proposed sample values of CAAS Addressing Scheme for States/ATSOs in ASIA/PAC Region should be circulated to States for consideration. The meeting also agreed that the information provided in the presentation be included in the 3rd Edition of the AMHS Naming Plan. Accordingly the meeting formulated the following draft Conclusion:

Draft Conclusion 7/11 - AMHS Addressing Scheme and AMHS Naming Plan

That,

a) the updated ASIA/PAC AMHS Naming Plan as provided in the Appendix J be adopted; and

b) ICAO issue a State letter requesting States to reconsider and adopt the proposed AMHS Address System and PRMD value.

ASIA/PAC AMHS MTA/UA Naming Registration Table & Contact List

4.8 The meeting reviewed a draft of table for registering AMHS MTA/UA and a contact list for use in the Asia/Pacific Region.

4.8.1 At the Eleventh Meeting of the ATNTTF Working Group held in September 2004, Hong Kong, China was tasked to prepare a draft table for registration of AMHS MTA/UA and a contact list for use in the Asia/Pacific Region. The registration table and sample contact list had been prepared based on comments received from all the Working Group members.

4.8.2 The Meeting endorsed the final draft of table for registering AMHS MTA/UA and a contact list for use in the Asia/Pacific Region with slight amendment made during the meeting to reflect the information for MTA/UA. Accordingly the meeting formulated the following draft Conclusion:

Draft Conclusion 7/12 - ASIA/PAC AMHS MTA/UA Naming Registration Table and Contact List

That,

a) the Table for registering AMHS MTA/UA and a Contact List for use in the Asia/Pacific Region as provided in Appendix K be adopted; and

b) the registration Table be circulated to States by ICAO with a request to commence the registration process.

Agenda Item 5: Review Status on AIDC Documentation

ICD for ATN AIDC

5.1 The meeting noted that the Task Force was expected to complete development of an Interface Control Document (ICD) for the ATN ATS inter-facility ground/ground data communications (AIDC) application and present the document for consideration by this meeting. The meeting was advised that due to various factors it was not possible to complete the document.

5.2 It was noted that ICAO Doc 9705 Edition 3 defines Version 1 of the AIDC application. The Working Group N of the Aeronautical Communications Panel (ACP WGN) is currently awaiting a revised set of AIDC operational requirements from the OPLINK Panel before proceeding with the development of specifications for a Version 2 AIDC. These operational requirements must be approved by a meeting of the OPLINK Panel before they become available to ACP WGN for work.

5.3 The OPLINKP/1 meeting is anticipated in October 2005. However, the summary of meeting discussions of the recent OPLINKP Joint WGA/WGB meeting in Toulouse (13–24 September 2004) expressed "a concern that AIDC may not be ready for OPLINKP/1". This was noted by the ACP WGN/4 meeting (New Orleans, November 2004), and it was subsequently noted in the ACP WGN/4 meeting report that "there would be no AIDC Version 2 delivery to the ACP/1 meeting". OPLINKP WGB (21–25 February 2005) has since discussed AIDC and PANSATM Doc. 4444 for amendment, but the status of these discussions, and whether material will be available for OPLINKP/1, is not known. The timing when ACP WGN might be able to start development of Version 2 AIDC is therefore uncertain.

ATN Security and AIDC

5.4 It was noted at the ACP WGN/2 meeting (Bangkok, 2003) that the ATN security solution couldn't be applied to Version 1 AIDC owing to the fact that it does not use the Dialogue Service. Possible solutions have been mooted to address this deficiency, including re-specifying AIDC over the GACS application, and enabling applications to invoke the Security Service Object (SSO) directly rather than through the UCLS SASO. However, such developments will probably wait work starting on AIDC Version 2.

Development of the ATN AIDC ICD

5.5 Under the current circumstances, it was recognized that it would be premature to proceed with the development of the Interface Control Document for ATN AIDC Version 1.Delaying work on the ICD is not expected to have an adverse impact on the deployment of AIDC in the region as existing operational requirements are currently being met by APANPIRG AIDC based on AFTN procedure. In view of the above the meeting reached the following decision.

Decision 7/13 - Development of the ICD for AIDC

That, the work on the Interface Control Document for the ATN AIDC be delayed until performance criteria have been properly addressed by the appropriate bodies within ICAO.

AIDC Performance Requirements

Performance requirements

5.6 The Regional Airspace Safety Monitoring Advisory Group (RASMAG) of APANPIRG has drafted guidance material on the methodologies for monitoring the performance of ATS data link applications, including AIDC (*Draft Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Datalink Systems in the Asia/Pacific Region*). This is expected to be reviewed at the RASMAG/3 meeting (6-7 June 2005) with the aim of seeking endorsement by APANPIRG/16 as standard guidance material for end-to-end safety and performance monitoring of ATS data link systems in the Asia/Pacific region.

5.6.1 The guidance material currently being drafted by RASMAG establishes guidelines for safety and performance monitoring of ATS data links, including AIDC. However, there are questions over the benefits of performance monitoring without first determining the performance requirement.

APANPIRG AIDC and ATN AIDC

5.7 During the discussion, it was recalled that the Sixth meeting of the Task Force had identified three options for implementation of AIDC as follows:

1) Existing AIDC over AFTN;

2) Existing AIDC over AFTN/AMHS; and

3) Fully ATN compliant AIDC

5.8 The meeting also identified for future considerations the need for eventual transition from AFTN based AIDC to ATN AIDC. The timescale of such a transition will have to be identified, and a transition plan formulated upon completion of the ICD to allow States that are considering implementing AIDC to plan accordingly.

Agenda Item 6: Update Tables and Charts for the ground-to-ground part of the CNS FASID

Table CNS 1D- ATS Inter-facility Data communications (AIDC)

6.1 The meeting noted that the format of Table CNS-1D to reflect requirement for ATS Inter-facility Data Communication (AIDC) developed by APANPIRG and contained in Part IV of the ASIA/PAC Facilities and Services Implementation Document (FASID) was slightly modified to improve presentation of requirements. The entries in the Table were required to complete reflecting existing and /or planned operational requirements for AIDC, where this function was required.

6.2 The meeting further noted that in its Conclusion 15/16, APANPIRG/15 had requested ICAO to circulate Table CNS-1D to ASIA/PAC States to specify operational requirement for AIDC where such requirements are mature or are foreseen in light of emerging operational requirements. In accordance with Conclusion 15/16 the Table was circulated and the responses from States were reflected in the Table. The meeting reviewed the Table and updated the requirements. It was agreed that the existing Table CNS-1D, which was included in the FASID Table as a sample, should be replaced with the new table CNS-1D.

6.3 In view of the foregoing the meeting formulated the following draft Conclusion.

Draft Conclusion 7/14 - Amendment to the ASIA/ PAC CNS FASID Table CNS-1D - AIDC

That, the Table CNS-1D-ATS Inter-facility Data Communication (AIDC) Plan reflected in Part IV CNS of the ASIA/PAC FASID be amended by replacing the existing Table CNS-1D with an updated Table provided in Appendix L in accordance with established procedure

Table CNS-1B - ATN Router Plan and Table CNS-1C - AMHS Plan

6.4 The meeting noted that in accordance with Conclusion 15/17 and 15/18 of APANPIRG/15, amendment proposals APAC 05/14 –Table CNS-1B and APAC 05/15- Table CNS 1C were circulated to States on 16 March 2005 for comments. States were expected to provide comments by 12 May 2005. The existing Tables CNS-1B and CNS-1C contained in Part IV of the ASIA/PAC FASID will be replaced with an updated Tables upon completion of approval process of the amendment proposals.

6.5 The meeting reviewed the Tables circulated to States and provided some updated information. Participants were however requested to arrange dispatch of formal comments to the ICAO Regional Office by the deadline of 12 May 2005 so that actions on these items would be completed and the APANPIRG/16 meeting to be held in August 2005 could be notified for action accordingly.

Agenda Item 7: Review State's ATN Implementation/Operational activities and issues

7 Under this agenda item, the meeting reviewed several information papers and one working paper on States ATN implementation activities.

Use of TCP/IP Protocols in ASIA/PAC Region

7.1 The meeting reviewed an information paper presented by member of USA tasked by the ATNTTF Working Group. The paper described the Asia/Pacific ATN Internet consisting of ATN Ground-Ground Routers and its initial use by AFTN/AMHS Gateways. It further described the default interconnection of these routers by 8208 point-to-point circuits. It was noted that TCP/IP may be used to interconnect ATN Ground-Ground Routers by bilateral agreement between states/administrations; however the ATN Internet using CLNP and IDRP is still required in order to ensure regional interoperability. This paper described two known common methods to use an IP sub-network: XOT and the IP SNDCF. It was noted that AFTN terminals may be connected to AFTN switches via TCP/IP.

7.1.1 Hong Kong, China commented that, due to the wide availability of low-cost equipment, use of TCP/IP is inevitable. However, there is a security concern needs to be addressed by the ICAO for such use. So far, related working papers of ACP WG-N have focused on the data-link security protection provided via data encryption and authentication of VPN tunnels. However, security protection at the ATN end systems is not much addressed. With the scope of ATN that will cover a wide aviation community including airlines and service agents, connection of the TCP/IP-based ATN to the public Internet through some user systems/workstations will be an unavoidable situation. This will open up a path for the external hackers as well as ingression of virus, spyware and the like that cannot be protected by the firewall (which also requires very frequent software upgrades in an operational environment). It was suggested that the ACP WG-N should look into this area for using TCP/IP in the ATN in a safe and secure manner, and in line with the ATN System Integrity Management policies.

Japan and the United States - AMHS Operational Service

7.2 Japan informed the meeting that on 15 March 2005, Japan and the United States commissioned the AMHS operational service using AMHS/AFTN gateways through the 64 Kbps ATN circuit, which installed between Salt Lake City and Tokyo in 2003. The AMHS service was first initiated between Japan and the United States in August 2004 but it was temporarily suspended due to some technical reasons. The AMHS operational service has been used to carry all the AFTN messages between the US and Japan and it forms part of the Aeronautical Fixed Service infrastructure. The current AFTN service between Salt Lake City and Tokyo will be retained as backup temporarily and it is planned to be decommissioned within six months.

Dual Stack ATN Router developed by China

7.3 China informed the meeting that under an ATN Research project of CAAC, a type of dual stack ATN router had been developed by Aero-Info Technologies Co., Ltd. China. The router does not only comply with the ISO/OSI protocol stacks but also support IP protocol stacks that are extensively used by more and more civil aviation systems. Therefore, the ATN routers developed can be connected to those TCP/IP systems thus there will be broader application area.

7.3.1 The ATN router supports ISO/OSI protocol stacks and complies with ICAO SARPs and technical provisions for data-link layer, network layer and transport layer. However, the most of application systems currently used by CAAC are based on TCP/IP protocol stacks and the platforms supporting these applications also have to support TCP/IP protocol stacks. In order to continue providing connectivity to these platforms and supporting the TCP/IP based applications it is necessary to develop ATN router with dual-stacks capability. This task was given by ATMB/CAAC for the

development of the extended function over the standard ATN router. It was informed that the conversion job between different protocol stacks is realized through a gateway server. It was also informed that the function of dual stack router has been successfully tested.

7.3.2 The operation of the dual Stack ATN router developed by CAAC was demonstrated during the meeting.

AMHS Testing in Hong Kong, China

7.3.3 Hong Kong, China shared its experience in AMHS trials and testing with the meeting members. The AMHS was extensively tested using an emulated tripartite configuration with a routing MTA between a source MTA and a destination MTA. Both recorded and simulated AFTN/X.400 messages were used. Recorded AFTN messages were used to verify whether the system is able to operate with real live AFTN traffic. Simulated AFTN messages, each containing a continuous sequence number in the content and generated by an external PC at one message per second, were used for continuous AMHS loading tests for a number of hours to verify the system's message handling capacity and to ascertain whether there is any message loss/duplication. After-test checking of missing and duplicated messages was automated by a specially developed program and input/output message logs of each MTA. The results revealed that there were duplicated messages as well as missing messages that would not be detected by the operations staff or the system in a real operational environment.

7.3.4 Hong Kong, China advised members that extensive loading tests should be conducted during system acceptance. Though data communication protocols will ensure message integrity in data links, messages can be lost within the end systems under various situations such as internal software interface and server/ LAN changeovers, depending on the specific designs. In AFTN operations, missing messages in a message switching system is protected by the CSN, but there is no similar protection in AMHS operations. To resolve the problem and reducing the testing effort, missing-message protection should be provided by refining the AMHS SARPs or the AMHS Routing Policy (to a certain extent), to be explored by the Task Force and/or the ACP WG-N.

ATN Development Plan and Preparation in Indonesia

7.4 Indonesia informed the meeting of the progress of the preparation for ATN implementation in Indonesia.

7.4.1 It was noted that Indonesia was drawing up a transition plan of migration from AFTN to ATN in four phases. The ATN Routers will be installed in Jakarta and Ujung Pandang. More routers will be deployed as the next step in Denpasar, DGAC Head Quarter and NASC respectively. The ATN implementation plan would commence in September 2006.

ATN Implementation Plan in the Republic of Korea

7.5 Republic of Korea informed the meeting of their current operational status of AFTN and the future transition plan to ATN.

7.5.1 The ROK installed AMHS in 2001 as the first step to accept the ATN standard of ICAO and to smoothly cope with requirements of increasing air traffic volume. The AMSH is in operation in a form of AFTN/AMHS for the domestic service. The AFTN communication networks of Republic of Korea and AIS automation systems were separately installed and they are integrated by Frame Relay for the Wide Area Network (WAN) and/or Local Area Network (LAN) or the Asymmetric Digital Subscriber Line (ADSL) within each airport terminal. A 9600bps X.25 satellite circuits (SAT/d) for AFTN communications between Seoul and Beijing was installed and the 9600bps X.25 circuit (LDD/d) for AFTN communication between Seoul and Tokyo was implemented. Republic of Korea is considering a variety of ways to provide the application of ATN. Furthermore,

the ROK is planning to supplement the existing system in cooperation with China and Japan for the establishment of ATN without delays.

Network Configurations to be used during AFTN/AMHS Transition in Sri Lanka

7.6 Sri Lanka informed the meeting that according to the 1st Edition of Asia Pacific Regional Interface Control Document (ICD) for ATS Message Handling System, transition plan based on a set of network configurations was considered for implementation during the transition from AFTN to AMHS.

7.6.1 From the point of view of an individual State participating in the regional transition, Sri Lanka suggests four generalized phases that could be adopted in all transition approaches and makes a review on these approaches and their network configurations. It was highlighted that the noteworthy features of one of the transition approaches which is expected to provide the States concerned with the opportunity to commence the transition at the earliest possible instance and also to bring about tangible benefits to the users of message handling system from the very beginning of the transition

Regional planning for the transition to BUFR-coded OPMET information

7.7 The meeting recalled APANPIRG Decision 15/40, *Planning for migration to BUFR-coded aeronautical meteorological messages*, that tasked the ATN transition Task Force and the OPMET Management Task Force (OPMET/M TF) to address the issues related to the transition to BUFR-coded aeronautical meteorological information. It was also recalled in this regard, that the transition should be held in a coordinated manner by all ICAO regions within a timeframe of eight years between 2007 and 2015.

7.7.1 The meeting was informed that the 3rd meeting of OPMET/M TF reviewed in detail the current situation with the transition to BUFR code and concluded that, due to the complexity of the issue, the development of the regional transition plan would require more time than initially envisaged by APANPIRG. In order to address the transition issues from both COM and MET perspective, OPMET/M TF/3 meeting proposed that a joint meeting of the OPMET/M TF and ATN Transition Task Force should be held in March 2006.

7.7.2 Japan clarified that the current operational AMHS service is a basic AMHS, which processes AFTN messages. It may not be able to support those extended service. To support BUFR code, necessary study is required. The USA confirmed that the AMHS commissioned may be able to support the emerging requirement if necessary changes are made to the software. In order to provide a better understanding on the requirement for transition to BUFR code, the meeting formulated the following Decision:

Decision 7/15 - Study for transition to BUFR Code

That, the ATNTTF Working Group study the capability of AMHS being introduced in the region and detailed requirement for the BUFR code. The result of study to be presented to the next OPMET/M Task Force meeting to be held early 2006.

7.7.3 The meeting noted the need to migrate to BUFR code. The suggested time frame of 2010 for the use of BUFR code between five OPMET data banks in the ASIA/ PAC region namely Bangkok, Brisbane, Nadi, Singapore and Tokyo was also noted.

7.7.4 The Chairman of the Task Force would coordinate and discuss with the Chairman of OPMET/M for the next step to be taken and the result of discussion by ATNTTF.

Agenda Item 8: Review status of implementation of AFTN circuits

Table CNS-1A - AFTN Plan

8.1 Under this agenda item the meeting noted that the Table CNS-1A-AFTN Pan was reviewed and updated regularly by the ATN Transition Task Force Meetings and the CNS/MET Sub-Group meetings to reflect the changes in status of AFTN circuits implemented based on changes in operational requirements and circuit performance.

8.2 In accordance with Conclusion 15/19 of APANPIRG/15, an amendment proposal APAC 05/11-CNS had been circulated to States on 11 March 2005 for comments. States were expected to provide comments by 9 May 2005. The existing Table CNS-1A contained in Part IV of the ASIA/PAC FASID will be replaced with the updated Table upon completion of approval process of the Amendment Proposal APAC 05/11-CNS. The meeting provided some updated information on the AFTN plan. The participants were requested to arrange forwarding of formal comments by the target date of 9 May 2005 to finalize approval process of amendment of the Plan and to arrange timely notification to APANPIRG at its 16th meeting to be held in August 2005.

AFTN Performance

8.3 The meeting recalled that the ASIA/PAC/3 RAN Meeting formulated three Conclusions relating to AFTN performance and established reliability requirements of 97% or higher for the AFTN circuits. Regarding the need to exchange data on AFTN circuit performance and transit time statistics, it was recognized that as stated in Conclusion 10/2 and 10/3 of the ASIA/PAC/3RAN meeting it is not required to exchange performance reports, if the established requirements were met consistently.

8.4 New Zealand proposed that in view of the modern communication links that exceeds the actual data traffic level to the extent that circuit loading statistics are effectively insignificant and the bi-annual collection of loading statistics would not be required.

8.5 The meeting also noted that amendment proposal APAC05/12-CNS was processed to include a methodology for calculation of AFTN circuit loading for circuits operating at 9600 bps and 64Kbps as such methodologies were not included in the FASID. The Task Force had recognized the need to provide such information to assist States where circuit loading statistics were required to be taken to maintain and achieve permissible loading.

8.6 The meeting agreed that it will not be necessary to compile and review the statistics on a routine manner for all AFTN circuits in view of the high quality, capacity and reliability of leased circuits available in the region. However, it was recognized that where circuit occupancy exceed the permissible levels specified in the Manual of Planning and Engineering of AFTN, Doc. 8259, circuit loading statistics should be compiled and exchanged to initiate remedial action before the overloading situation approaches.

8.7 In view of the foregoing the meeting formulated the following draft conclusion:

Draft Conclusion 7/16 - AFTN performance reports

That States operating AFTN circuits;

a) may discontinue the practice of exchanging AFTN circuit performance charts, transit time statistics and circuit loading statistics where performance requirements are satisfied consistently; and

b) exchange circuit loading statistics only for those circuits where occupancy level exceed permissible levels specified in the Manual on Planning and Engineering of AFTN, Doc. 8259.

Upgrading of the Tokyo/Moscow AFTN circuit

8.8 Japan informed the meeting that a proposal received from the Russian Federation to make a routing change to use the Tokyo/Moscow circuit, as a back up to the Tokyo/Khabarovosk circuit was not acceptable. Japan had proposed to the Russian Federation to upgrade the Tokyo/Moscow circuit from 200 baud to 2400 bps as had been previously agreed by both States at the CNS/MET SG6 meeting.

8.9 In mid-March 2005, Japan received another proposal from the Russian Federation to close down the Tokyo/Moscow circuit and exchange all "U" AFSRA traffic through the Tokyo/Khabarovsk circuit. Japan responded to the Russian proposal in April 2005, first proposing to upgrade the Tokyo/Moscow inter-regional trunk circuit as agreed, and alternatively, if the Russian Federation could not afford the cost of both the Tokyo/Moscow and Tokyo/Khabarovsk circuits, to upgrade the Tokyo/Moscow inter-regional trunk circuit and to withdraw the Tokyo/Khabarovsk circuit, as study has indicated that it would be more cost-effective to upgrade the Tokyo/Moscow circuit than to retain the Tokyo/Khabarovsk circuit. However, Japan identified that this alternative would require changes to the ICAO Asia/Pacific Basic ANP and the ICAO AFTN Routing Directory. The Secretariat informed the meeting that subject to mutual agreement between Japan and the Russian Federation to maintain only the Tokyo/Moscow circuit, a provision for alternate routing could be explored in coordination with States concerned.

Agenda Item 9: Review the Subject/Task List of the ATN Transition Task Force, identify future work and develop Ground-to-ground ATN implementation strategy

Strategy for Implementation of ATN in the ASIA/PAC Region

9.1 The Eleventh meeting of the ATN Transition Task Force Working Group held in Bangkok from 13 to 17 September 2004 had recognized a need to develop a strategy for implementation of the ground-to-ground ATN in the ASIA/PAC region in order to provide guidance to States to proceed with implementation activities as per the agreed strategy.

9.2 The draft strategy was reviewed by the meeting and modified as required. The meeting agreed that the initial first draft strategy provided in Appendix M to the report should be presented to APANPRG for review and adoption. It was also recognized that the strategy needs to be reviewed from time to time in light of developments and as required.

9.3 In view of the foregoing the meeting formulated the following draft conclusion.

Draft Conclusion 7/17 - Strategy for Implementation of ATN in the ASIA/PAC Region

That, the Strategy for Implementation of ATN in the ASIA/PAC Region provided in Appendix M of this report be adopted and States be notified.

Terms of Reference and Subject/ Tasks List of the ATN Transition Task Force

9.4 The meeting reviewed the Terms of Reference and Subject/Tasks List of the Task Force, taking note of the relevant items of the key priority for the CNS/ATM Implementation approved by APANPIRG/15. The meeting also reviewed the two additional tasks referred in Decision15/22 of APANPIRG/15 meeting regarding the need for the development of AMHS performance characteristics and the determination of a sunset date for AFTN.

9.5 While reviewing the Tasks List, it was noted that of the 10 Tasks 5 Tasks were fully completed, one items each of the 5 Tasks were on hold awaiting result of the global activities undertaken by the ACP. The Task Force was monitoring developments in the OPLINKP and ACP to seek guidance to carry out the tasks. The guidance from the OPLINK and ACP on the remaining Tasks is uncertain at this stage. However, if the desired result becomes available it could easily addressed and the work could progress. The updated Tasks List is provided in Appendix N.

9.6 With regard to the two Tasks assigned to the Task Force referred to in Decision 15/22 of APANPIRG the meeting noted the deliberations at the Working Group meeting held in Bangkok in September 2004. Regarding the AMHS performance it was considered that AMHS Description Document would provide adequate guidance on performance. The Working Group was tasked to review AMHS performance related information already contained in the documents adopted by APANPIRG and ascertain the need to consolidate information in one single document or to develop a completely new document on performance. In view of the above the meeting reached the following decision:

Decision 7/18 - Development of AMHS performance document

That, the Working Group review AMHS performance related information already contained in the documents adopted by APANPIRG, data collected by States who have implemented AMHS and ascertain the need to consolidate information in one single document or to develop a completely new document

9.7 The meeting was informed that the Working Group/11 meeting held in Bangkok had clarified that it would be logical to establish a sunset date for the AFTN when AMHS implementation has progressed satisfactorily in the region. The meeting recognized that it would be premature at this stage to establish a sunset date for international AFTN connections given the current lack of maturity and operational experience of AMHS.

9.8 The meeting did not feel the need to continue to wait the outcome of the Panels to complete the remaining work. Since all the major tasks had already been completed including the ATN ground-to-ground transition plan and associated FASID Tables it was proposed to dissolve the ATN Transition Task Force and assign the residual tasks to the proposed Group. In light of the above the meeting formulated the following draft decision.

Draft Decision 7/19 – Dissolution of the ATN Transition Task Force

That, the ATN Transition Task Force be dissolved as it has completed major tasks and the residual work would be absorbed by the proposed ATN Implementation Co-ordination Group.

9.9 The meeting recognized a need to carry out coordination to ensure satisfactory transition from AFTN to ATN without causing any disruption to services and proposed to establish an ATN Implementation Co-ordination Group of APANPIRG. In addition to the new tasks the Group should also absorb the residual tasks of the ATN Transition Task Force. In view of the above the meeting proposed a new Terms of Reference of the Group and developed the Tasks List provided in Appendix N and formulated a Draft Decision as follows:

Draft Decision 7/20 – Establishment of an ATN Implementation Co-ordination Group

That, an ATN Implementation Co-ordination Group be established composed of membership of the ATN Transition Task Force and any other State or organization willing to contribute to the activities of the Group with the Terms of Reference and Tasks List provided in Appendix O.

Working Group of the ATN Transition Task Force

9.10 The meeting agreed that the Working Group of ATN Transition Task Force would continue to deal with the tasks assigned to it by this meeting until the first meeting of the ATN Implementation Coordination Group meeting. The meeting reached the following decision.

Decision 7/21 – Continuation of the ATN Transition Task Force Working Group

That, the ATN Transition Task Force Working Group continue to deal with the assigned tasks until the first meeting of the proposed Group.

Agenda Item 10: Any Other Business

Next meeting of the Group

10.1 The next meeting of the Group will be held in Bangkok during the second week of March 2006. Exact date of the meeting will be notified to the members immediately after the APANPIRG/16 meeting to be held in August 2005.

Note of appreciation

10.2 The meeting expressed its appreciation and gratitude to the Air Traffic Management Bureau (ATMB) CAAC and the Eastern Region of ATMB for the excellent arrangement made for the meeting and for the warm hospitality extended to all the participants and the opportunity provided to visit the advanced Area Control Centre in Shanghai.

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Appendix A to the Report

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PAC
AERONAUTICAL TELECOMMUNICATIONS NETWORK
SYSTEM INTEGRITY POLICY

First Edition – April 2005

ASIA/PAC AERONAUTICAL TELECOMMUNICATIONS NETWORK SYSTEM INTEGRITY POLICY

1. Purpose. This document prescribes the system integrity policy and associated requirements applicable to the Aeronautical Telecommunications Network (ATN). It applies to ATN implementations and defines the rules governing the protection of ATN data, services and resources associated with ATN applications and processes from both unintentional defects and deliberate attack. The design, implementation and operation of the ATN must support the complete and consistent enforcement of this system integrity policy.

2. Applicability. For the purpose of this policy, the ATN encompasses hardware, software, procedures, standards, facilities, and personnel. System Integrity services provided in support of the ATN protect all data transmitted, stored, or processed by the system, for various levels of sensitivity.

3. Authority. This document is published in accordance with the authority of the International Civil Aviation Organization (ICAO).

4. Implementation and Enforcement. This system integrity policy defines a minimum set of rules to be enforced for the protection of data, services, and resources under ATN cognizance. Regional and local authorities may apply more stringent rules or constraints, while not degrading the ATN system integrity posture and maintaining consistency with the minimum essential required system integrity rules identified in this ATN System Integrity Policy.

5. System Integrity Requirements. System integrity requirements apply to the protection of the physical information technology, the communications equipment, and the data and information systems. Protection also applies to the facilities, environment, hardware, software, and people associated with the ATN. The fundamental ATN system integrity requirements are:

(1) Protect all ATN data directly associated with ATN applications and processes including ATN messages and stored information from unauthorized disclosure, modification, or deletion.

(2) Protect ATN services and resources from unauthorized use and denial of service.

6. System Integrity Services. Safe and secure operation of the ATN depends upon the accurate and consistent enforcement of six high level services: confidentiality, data integrity, authenticity, availability, accountability, and interoperability.

(1) Confidentiality: Ensures data is not disclosed to unauthorized entities. For the ATN, confidentiality, when appropriate, extends to data associated with ATN support applications and processes including system management and security applications.

(2) Data Integrity: Ensures data has not been altered or destroyed in an unauthorized manner.

(3) Authenticity: Ensures that the source of data or the identity of an entity is as claimed.

(4) Availability: Ensures resources, services, and data are accessible and usable on demand or in a timely, reliable manner by an authorized entity.

(5) Accountability. Enables activities to be traced to users and processes that may then be held responsible for those actions. For ATN, accountability includes the authenticity security service, which provides for identification and authentication users associated with ATN operational and support applications and processes.

(6) Interoperability. Ensures that ATN systems and procedures are compatible and that they operate in a consistent and cohesive fashion,

7. System Integrity Policy Statements. The ATN system integrity policy is intended to result in management, operational, and technical controls implemented on a regional or local level to provide system integrity services meeting the fundamental system integrity requirements. Accordingly, the following functional policy statements are identified in terms of the defined services:

(1) Functional Policy Statements

a. Confidentiality

(a) ATN data shall be protected from unauthorized disclosure during processing, transmission, and storage commensurate with the designated sensitivity of the data.

b. Data Integrity

(a) ATN data shall be protected from unauthorized or undetected modification during transmission, storage, and processing.

c. Authenticity

(a) ATN users and processes shall be uniquely identified.

(b) ATN users and processes shall be authenticated before being granted access to ATN data, services, and resources.

d. Availability

(a) ATN data, services, and resources shall be available for use by authorized users and processes.

e. Accountability

(a) ATN data, services, and resources shall be protected from unauthorized use or tampering.

(b) ATN users and processes shall have access only to those ATN data, services, and resources for which they have authorization.

(c) An audit trail of use of ATN data, services, and resources by ATN users and processes shall be maintained.

f. Interoperability

(a) ATN systems shall be interoperable across domains through conformance to Document 9705.

8. Verification and Authorization. The process used by an independent agent to confirm or establish that the management, operational, and technical controls effectively meet the system integrity requirements is termed *verification*. Verification includes establishing that the system integrity functional policy is adequately provided. The *authorization* by responsible entities to place a system into operation is based on the verified effectiveness of management, operational, and technical controls.

(1) Verification

a. ATN systems shall be verified to have system integrity commensurate with the risk and magnitude of harm resulting from unauthorized disclosure, modification, or deletion of ATN data, or unauthorized use and denial of service of ATN services and resources.

(2) Authorization

a. ATN systems shall be formally approved for operation by the cognizant Designated Approving Authority (DAA).

b. Significant changes to ATN systems shall require another formal approval (or re-authorization).

Seventh Meeting of Aeronautical Telecommunication Network (ATN)
Transition Task Force of APANPIRG (ATNTTF/7)

Appendix B to the Report

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PAC
AERONAUTICAL TELECOMMUNICATIONS NETWORK
SYSTEM MANAGEMENT POLICY

First Edition – April 2005

AERONAUTICAL TELECOMMUNICATIONS NETWORK
SYSTEM MANAGEMENT POLICY

1. Purpose: This document prescribes the system management policy and associated requirements applicable to the Aeronautical Telecommunications Network (ATN). It applies to ATN implementations and defines the rules governing the management of ATN data, services and resources associated with ATN applications and processes. The design, implementation and operation of the ATN must support the complete and consistent enforcement of this system management policy.

2. Applicability: For the purpose of this policy, the ATN encompasses hardware, software, procedures, standards, facilities, and personnel.

3. Authority: This document is published in accordance with the authority of the International Civil Aviation Organization (ICAO).

4. Implementation and Enforcement: This system management policy defines a minimum set of operational procedures to be followed and technical data, i.e., management information, to be collected and monitored to support the management of ATN data, services, and resources. Local authorities may apply additional procedures and collect/monitor additional technical data to suit local needs, while not degrading the ATN system management posture and maintaining consistency with the minimum essential required system management requirements identified in this ATN System management Policy.

5. System management Services: A comprehensive approach to management of the ATN depends upon the accurate and consistent enforcement of six high level services: fault management, configuration management, accounting management, performance management, and security management.

a. Fault Management - Fault management facilities allow system managers to detect problems in the network and include mechanisms for the detection of and isolation and recovery from abnormal system operation.

b. Accounting Management - Accounting management facilities allow a system manager to determine the usage of system resources and to allocate costs and charges on resources utilization.

c. Configuration and Name Management - Configuration management facilities allow system managers to exercise control over the configuration of the system. Network and system configurations may be changed to alleviate congestion, isolate faults, or otherwise meet changing user needs.

d. Performance Management - Performance management facilities provide the system manager with the ability to monitor and evaluate the performance of the system.

e. Security Management - Security management facilities allow a system manager to manage those services that provide access protection of system resources.

6. System management Policy Statements: The ATN system management policy is intended to result in operational procedures and the collection and monitoring of technical parameters to react to system faults and security events and to adequately provision ATN services and resources. Accordingly, the following functional policy statements are identified in terms of the defined services:

(1) Functional Policy Statements

a. Fault Management

(a) Abnormal system operation impacting ATN services and resources shall be detected, isolated, and recovery measures shall be taken.

b. Accounting Management

(a) The usage of ATN system resources for cost purposes is a local matter.

c. Configuration and Name Management

(a) A record of the changes to the logical and physical configuration of ATN resources shall be maintained.

(b) A record of the assignment and change of AMHS names, NSAP Addresses, subnetwork addresses, and technical parameters affecting interoperability shall be maintained.

d. Performance Management

(a) The usage of ATN resources shall be monitored and analysis performed to determine future resource allocation.

e. Security Management

(a) Security events impacting ATN services and resources shall be monitored and handled through a security incident response capability and contingency planning.

7. Responsible System Manager: Each organization shall designate a System Manager responsible for the system management of their organizational services and resources and responsible for system management coordination with the responsible system managers of other organizations.



INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PAC

Communication Performance for ATN

First Edition - April 2005

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Related References
[1] ICAO Manual on Required Communication Performance (to be presented at OPLINKP/1 meeting, Sept. 2005)
[2] Document 9694 ICAO Manual of ATS Data Link Applications
[3] Document 9739 ICAO (CAMAL) Edition 2 Part V — Enhanced ATN Services
Chapter 2 — ATN Systems Management, 2.2.2 Performance Management Requirements

Appendix
ICAO Document 9739 (CAMAL) Edition 2
Part V Enhanced ATN Services
Chapter 2 ATN Systems Management,
2.2.2 Performance Management Requirements

EXECUTIVE SUMMARY

This document provides guidance on the aeronautical communication performance to be established. Before describing communication performance, the characteristics of aeronautical communication and performance are described.

There are many elements in the CNS/ATM system. In order to provide aeronautical communication services, both functional capability and its performance need to be identified. There are operational and technical levels, both having functional capability and its performance and the required performance. The performance requirement specifies how well the planned system should be implemented. While the required system is implemented, performance is monitored and evaluated against the required performance. The required and implemented performance cannot be justified at technical or element level without aligning them to the required performance at the operational or system level where the elements are part of the operational services or the system.

The document provides the information on the model of (operational) aeronautical communication process and communication transaction developed by OPLINK Panel and contained in the ICAO RCP Manual. Based on the performance characteristics, the RCP types are introduced in the ICAO RCP Manual. Three specific RCP types; RCP 240, RCP 120 and RCP 15 are also provided in the RCP Manual.

While determining RCP type for a planned ATM function in airspace, the communication transactions are identified and the most stringent communication performance requirement is selected as the RCP type for the required ATM function.

Most stringent communication performance requirement is selected as the RCP type for the airspace while prescribing RCP type for ATM functions in a planned airspace.

While complying with RCP type, the elements of operational communication performance requirements including technical and human factor will have to be derived. Where the prescribed RCP type is identified as the compliance target, the actual performance monitoring of each element will provide the compliance evidences of the prescribed RCP type. How and who are responsible to derive technical performance requirements are not identified in the ICAO RCP Manual. The regional planning group is expected to address this issue.

A brief description of ATN applications and ATN communication services is also provided. The performance characteristics and network topology of each ATN application and the components of ATN communication services for air-ground as well as ground-ground communication are shown in diagrams.

Relevant information regarding the ATN performance monitoring is extracted from the ICAO Document 9739 and provided in the Appendix to the document for easy reference.

1. Introduction

1.1 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 Performance. This document was developed in response to that action.

1.2 Scope

The document provides guidance on the aeronautical communication performance to be planned, implemented and also for operation. The ultimate goal of the document is to provide a set of performance requirements for planning, technical candidates for implementing the required performance, and performance management consideration during the operational phase of the Aeronautical Telecommunication system in the Asia/Pac Region.

Before providing such a detailed, concrete guidance, it has to be clearly understood what is meant by the performance we are discussing, and how the performance requirements is planned and implemented in the aeronautical communication systems (including hardware, software and human machine interface), and also how the planned performance is monitored and improved. Without such understandings, the performance measurements and evaluation will be wasted without any useful results.

In order the document to be useful in the Asia/Pacific region where the operational environments are considerably different within the Region in terms of the air space complexities and traffic (air traffic as well as data traffic), the guidance in the document has to be adaptable to the environment of the interest.

Performance is related to all phases of the activities in the Aeronautical Telecommunication System Life Cycle; the planning and implementation phases as well as operational phase. This implies there are various types of personnel involved as the readers of the document. It is important to identify the readers of the document, and the organization of the document for the focused readers. Since the APANPIRG is a planning group, and the planning phase has the greatest influences on the performance, the document is focused to the planning phase. Essentially the implementation and operational aspects of performance are embedded within the planning aspect. Without any planning, the monitoring and evaluating performance are not useful, since it would not be clear what is to be measured and what is the reference to be compared with and evaluated to.

2. Preliminary Considerations on Performance

2.1 Functional Capabilities and its Performance

For any systems to be implemented and operated, there are two categories of requirements; functional capability and its performance. Functional capability requirements specify the functions to be implemented together with benefits of the planned system. Performance requirements specify how well the implemented system has to be operated in terms of speed, reliability, and so forth.

In order to effectively and efficiently provide the benefits of the planned system specified in the functional capability requirements, the performance requirements have to be established and implemented.

The functional capability requirements of the planned system like Global Air Traffic Services can be found in SARPs and Regional ICDs (Interface Control Documents), but the performance requirements cannot be documented as a single body of requirements.

Even if the functional capability requirements, like the Global Air traffic Services, are the same, the required implementation details can be fairly different, since each system implementation consists of the products or services available in the planned airspace.

In airspaces, it may be planned to provide different mix of ATM functions from others, and the most stringent performance requirement will be dominant in the performance considerations.

There would be structural complexity of airspace different from other airspaces, so that it may be required to reflect such complexity to the performance considerations.

There could be the case that any implemented system satisfying the functional capability requirements do not mean that it always satisfies the needed performance.

The performance requirements have to be developed based on the ATM function type and the airspace environment where the CNS/ATM System is planned to be used. Based on such performance requirements, the implementation, monitoring, evaluation and improvement of the CNS/ATM system will follow, satisfying the required performance.

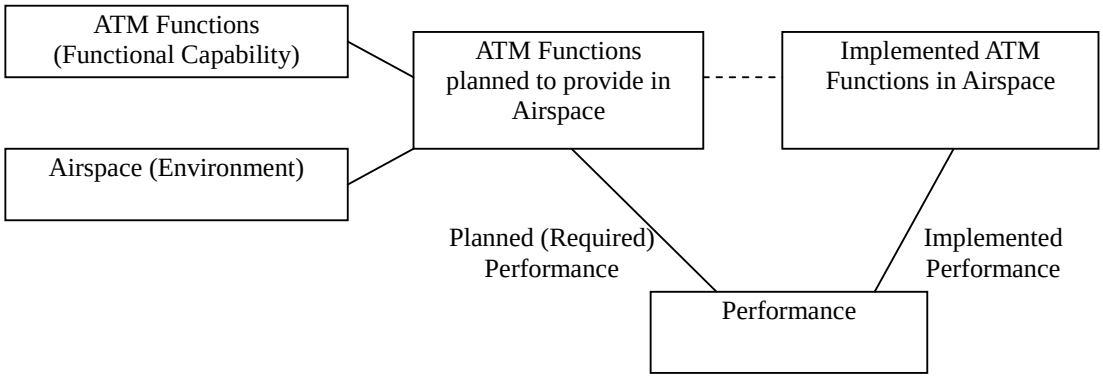


Figure 2.1 Functional Capability and its Performance

2.2 Required Performance and Implemented Performance

Performance is determined in the planning phase, and the performance is monitored and evaluated after implementation. It should be noted that in the activity for determining performance, the *required* performance is determined, while in the activity for monitoring and evaluating performance, the *implemented* performance is monitored and evaluated against the required performance to be complied with.

Obviously the monitoring and evaluating implemented performance are meaningful only if the required performance is appropriately determined.

If the required performance is determined unnecessarily high, then the cost of implementation will be unnecessarily high. If the required performance is determined too low than necessary, the operation based on the system is deteriorated or the system is useless.

The determination of required performance is not simply to give a number but it has to give rationale for determining the required performance.

2.3 Activities related to Performance

Although the planning activity for any system implementation can be taken place within a State or an organization without any coordination with other activities, it is desirable for the planning activity to

be coordinated with subsequent activities, such as implementation, monitoring, evaluation and improvement, since the planned performance requirements are referred by the subsequent activities and there are many different personnel involved in these activities. Moreover, in a planned system like Global Air Traffic Services, where many States and Organizations are involved, it is imperative to coordinate among the States and Organizations.

In order to make such coordination for planning possible, it has to be agreed and shared the understanding of what is meant by 'performance', how it can be analyzed and stated. This can be called the 'understanding performance' prior to determining required performance.

a) Understanding (Required) Performance

Before engaging in the performance related activities where the coordination is needed, the meaning of the performance has to be shared among the concerned parties. This includes the definition of the performance as well as the procedures to derive and document the required performance.

b) Determining Required Performance

Applying the shared understanding of performance, a specific performance requirement has to be developed for the Air Traffic Services in the airspace where the CNS/ATM system is planned.
The performance requirements have to be developed based on the analyses of the services provided and the environment of the services provided.

c) Prescribing Required Performance

The determined required performance has to be documented in a formal way.

d) Complying Implemented Performance with Required Performance

Based on the stated performance requirements, the system has to be developed. The system has to be deployed based on the satisfied implementation of the requirements.

e) Monitoring and Evaluating Implemented Performance
The performance of implementation has to be monitored and evaluated regularly. The monitoring parameters have to be planned before the implementation.

e) Improving Performance
If there are any anomalies in the monitored performance, the actions have to be taken to improve the performance. There should be the performance reference established during the planning phase to judge the performance anomaly.

2.4 System and System Elements
Any system consists of system objectives and system elements.

For instance, the Air Traffic Management system has ATM system objectives and ATM system elements; namely Communication, Navigation and Surveillance.

The Communication sub-system in turn has the sub-system objectives and sub-system elements, namely ground sub-system elements, airborne sub-system elements and air-ground communication sub-system elements.

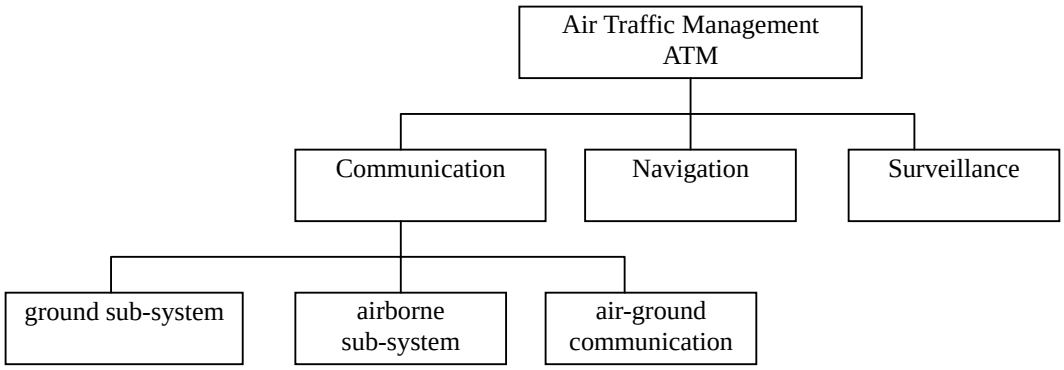


Figure 2.2 System and System Elements in CNS/ATM

Each system, sub-system and element has its own functional capability as well as its own performance characteristics. Even if one element of sub-system is implemented with potentially high performance but other elements are at lower levels of performance, the potential performance of the element is under-used, i.e. its performance is excessive and cannot contribute to the performance of the sub-system as a whole. Conversely, if one element of sub-system is at lower level of performance than other elements, then the performance of sub-system is bound by the lower level of performance of that element.

What is important here is that performance of each element is at same level and it is also at same level as the required performance of the sub-system.

In the CNS/ATM context, the Required Navigation Performance (RNP) and the required

Communication Performance (RCP) is defined, and the Required Surveillance Performance (RSP) may also be defined. Even defining the Required Total System Performance (RTSP) is suggested.

The navigation system is considered as an autonomous, while the communication system is considered as an end-to-end system of response oriented. The surveillance system may be considered as a throughput oriented as well as a response oriented system.

These three elements of the ATM have different performance characteristics and their performance parameters are currently incompatible to the others.

2.5 Operational Performance Requirement and Technical Performance Requirement

Usually systems provide some services while the systems consist of some elements. With respect to performance, there are two levels of performance requirements, one at the operational service level and the other mainly at the technical and element level. For instance, the ICAO RCP is at the operational performance level, while there are many elements in communication system with their own technical performance. As noted before, these two levels have to be aligned to each other.

One of the issues to be dealt with is how to map the operational performance requirements to the technical performance requirements of consisting elements.

Technical performance, whether it is required or implemented, cannot be justified without the matching operational performance requirements, since the ultimate goal of system is to provide services not technology.

Another issue is whether the performance requirements are regulatory or guides for implementations and operations.

3. Operational Communication and its Performance in CNS/ATM

Before discussing communication performance, it is necessary to agree with the model of communication in the CNS/ATM, especially operational communication process model. OPLINKP adopted the following model for the operational communication process.

3.1 Operational Communication Transaction
The Figure 3.1 shows the operational communication transaction as a communication process model.

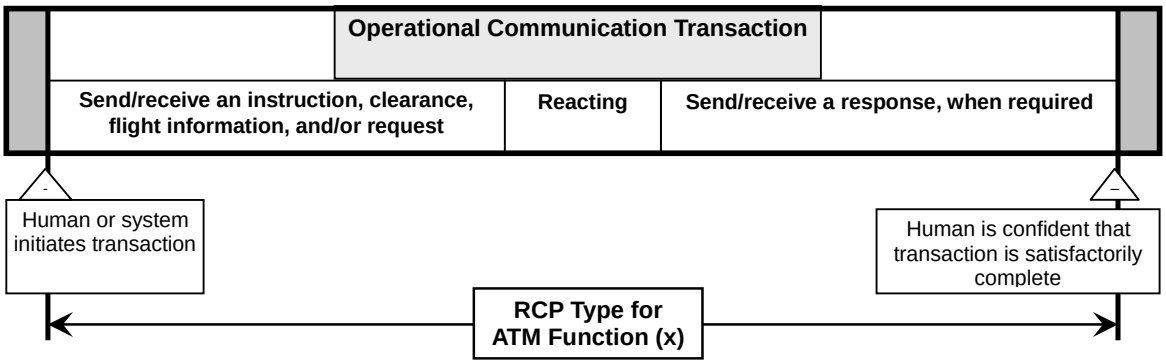


Figure 3.1 Model of Operational Communication Transaction

It should be noted that the RCP type is defined for each ATM Function.

An operational communication transaction starts when human or system initiated the transaction. It should be noted that the transaction could be initiated by a human or automatically by the system.

There are three parts in the transaction;
1) Send/receive an instruction, clearance, flight information, and/or request,
2) Reacting
3) Send/receive a response, when required.

The first part of transaction (send/receive an instruction, clearance, flight information, and/ request) includes the human machine interface (HMI) of initiator, the technical communication from initiator to responder, and the HMI of responder.

The second part of transaction is the reaction by responder. The third part of transaction is similar to the first part except that the direction of communication is from the responder to the initiator of the transaction.

The transaction includes human factors as well as technical factors. The transaction ends when human is confident of completion. It should be noted that there is always human involved, even if the transaction is initiated by system.

It should also be noted that the transaction is two-way communication when required.

In order to communicate, communication transaction has to be initiated. There is a possibility that the communication transaction may fail to be initiated. The communication transaction is either initiated or not initiated.

After a communication transaction has successfully been initiated, the communication transaction may be completed within a given time duration. There is a possibility that the communication transaction will not be completed within the given time duration, taking longer or even never terminating. The communication transaction is either completed within the given time duration or not completed within the given time duration.

If the communication transaction is not completed within the given time duration, the initiator of the communication transaction should revert to an alternative procedure.

If the communication transaction is completed within certain time duration, there may be communication transaction errors. These errors, if any, are either detected or undetected.

3.2 Performance Characterization of Operational Communication Transaction

In this section, the operational communication transaction is characterized for performance description.

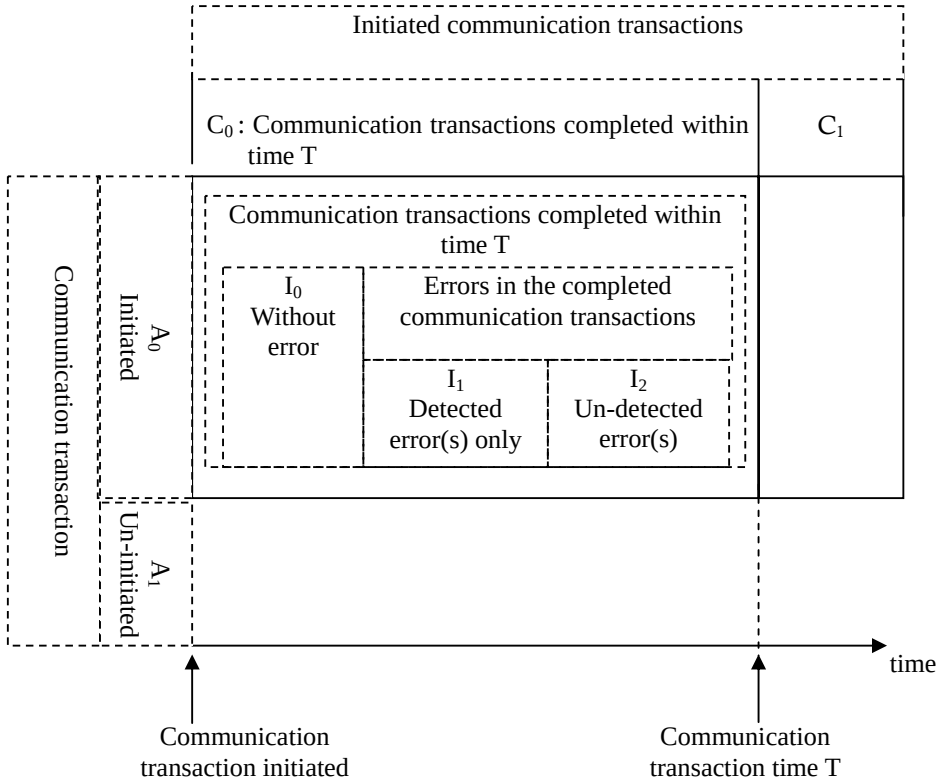


Figure 3.2 Performance Characterization of Operational Communication Transaction

The symbols in the Figure 3.2 are defined as follows.

- T: The maximum time for the completion of the operational communication transaction after which the initiator should revert to an alternative procedure.
- A_0: probability of communication transactions initiated
- A_1: probability of communication transactions not initiated
- C_0: probability of initiated communication transactions completed within T
- C_1: probability of initiated communication transactions not completed within T
- I_0: probability of completed communication transactions within T without error
- I_1: probability of completed communication transactions within T with detected error(s) only
- I_2: probability of completed communication transactions within T with undetected error(s)

where

$A_0 + A_1 = 1$

$C_0 + C_1 = 1$

$I_0 + I_1 + I_2 = 1$

The probability of completed communication transactions within T with undetected error(s): I_2 can only be provided by manual analyses.

3.3 Required Operational Communication Performance

3.3.1 Parameters of RCP

OPLINKP has developed the Required Communication Performance: RCP. It should be noted that the RCP developed by the OPLINKP is operational communication performance.

The performance characteristics of the communication transaction are described using the following four parameters. The set of parameters are a subset of the parameters described in Figure 3.2.

The RCP parameters are as follows.

1) Communication transaction time (T): The maximum time for the completion of the operational communication transaction after which the initiator should revert to an alternative procedure.
2) Availability (A_0): The probability that an operational communication transaction can be initiated.
3) Continuity (C_0): The probability that an initiated operational communication transaction can be completed within the communication transaction time (T).
4) Integrity (I_2): The probability of completed communication transactions within the communication transaction time (T) with undetected error(s)

3.3.2 RCP Types and Specific RCP Types

a) RCP type naming convention

In order to simplify RCP type naming convention and to make the required communication transaction time readily apparent to airspace planners, aircraft manufacturers and operators, the RCP type is specified by the value for the communication transaction time associated with the ATM function.

The values of four parameters are associated with each RCP type.

b) Specific RCP type

ICAO RCP manual specifies three RCP types;

- RCP 240,
- RCP 120 and
- RCP 15,

where the numbers; 240, 120 and 15; are the communication transaction time T in seconds.

RCP 240 is selected based on the ICAO document; PANS ATM 4444,

5.4.2.6.4 Longitudinal distance-based separation minima in an RNP RNAV environment using ADS

5.4.2.6.4.3 For aircraft cruising, climbing or descending on the same track, the following separation minima may be used:

Separation minima	*RNP type*	*Maximum ADS periodic reporting interval*
93 km (50 NM)	*10*	*27 minutes*
	4	*32 minutes*
55.5 km (30 NM)	*4*	*14 minutes*

5.4.2.6.4.3.2 The communication system provided to enable the application of the separation minima in 5.4.2.6.4.3 shall allow a controller, within 4 minutes, to intervene and resolve a potential conflict by contacting an aircraft using the normal means of communication. An alternative means shall be available to allow the controller to intervene and resolve the conflict within a total time of 10½ minutes, should the normal means of communication fail.

where '4 minutes' equates to 240 seconds.

RCP 120 is selected based on another ICAO document on 'to expedite and maintain an orderly flow of air traffic'.

RCP 15 is selected for 'separation assurance in continental en-route airspace'.

The integrity parameter value of each RCP type is selected as 10^{-3} since the communication transaction includes human.

3.4 Activities deriving RCP type

The ICAO RCP manual describes three steps of activities to determine, prescribe and comply with the RCP type. These three steps are briefly described below.

3.4.1 Determining RCP type

For a particular ATM function to be provided, the communication transactions for the ATM function are assessed, and the RCP type for each communication transaction is derived. The most stringent RCP type among the RCP types is selected for the ATM function. The assessment includes environmental factors.

3.4.2 Prescribing RCP type

An RCP type should be selected in order to meet requirements for the intended ATM function to be provided in a given airspace.

For a particular flight phase or airspace, where a mixture of ATM functions are provided, the most stringent RCP type among the RCP types of ATM functions is selected.

3.4.3 Complying with RCP type

At the complying stage, the following sub-steps are proposed,

1) establish compliance target,
2) validate assumptions, and
3) analyze actual performance.

It should be noted that the compliance activity starts to establish the target and after analyzing actual performance, evidence of compliance is documented. The actual performance is analyzed against to the compliance targets.

The following is a part of discussions at the OPLINKP with respect to compliance and approval.

There is an obligation on the part of the State and the aircraft operator to show that the procedures, aircraft equipage and airspace infrastructure comply with the RCP type. This compliance is performed as part of different approval types. The different approval types are the ATS provider approval, aircraft operator approval, and aircraft type design approval. These separate and distinct types of approvals collectively define the conceptual "ATM system approval." In cases for which there is no regulatory basis for approval of a part of the ATM system, "approval" denotes the activities that take place to show compliance with the requirements allocated to that part of the ATM system.

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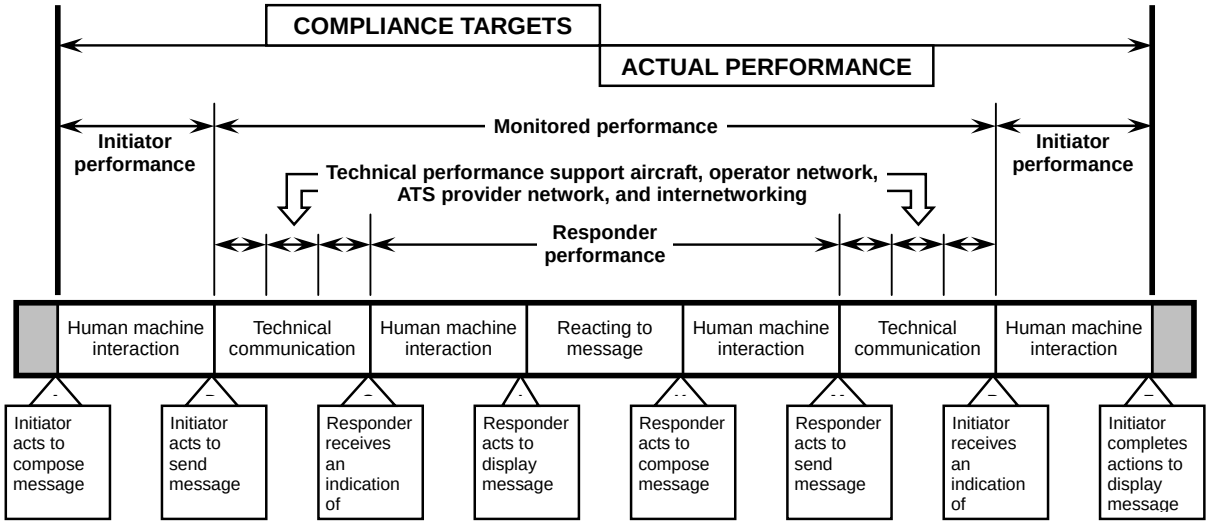


Figure 3.3 Complying with RCP type for Data Communication

a) Mapping from Operational Performance Requirements to Performance Requirements of Elements

In this stage, the compliance targets are mapped to the technical elements that comprise the communication system. Such mapping could be decided by regional group or some other organization

It should be emphasized that the sound engineering decisions have to be made in determining the RCP type and the performance requirements of consisting elements.

b) Human Factor Performance

The communication transaction includes human factors. Without monitoring human factor directly, the performance including human factors can be monitored in such a way that by monitoring the performance from point D to point P in Figure 3.3, the technical performance from point D to point G, and from point M to P, the responder's performance from point G to point M will be provided.

3.5 Role and Responsibility of Regional Planning Group

There remain some unfinished tasks with respect to performance. Regional Planning groups may play the role of determining, prescribing, and complying with the RCP types in airspaces in the region.

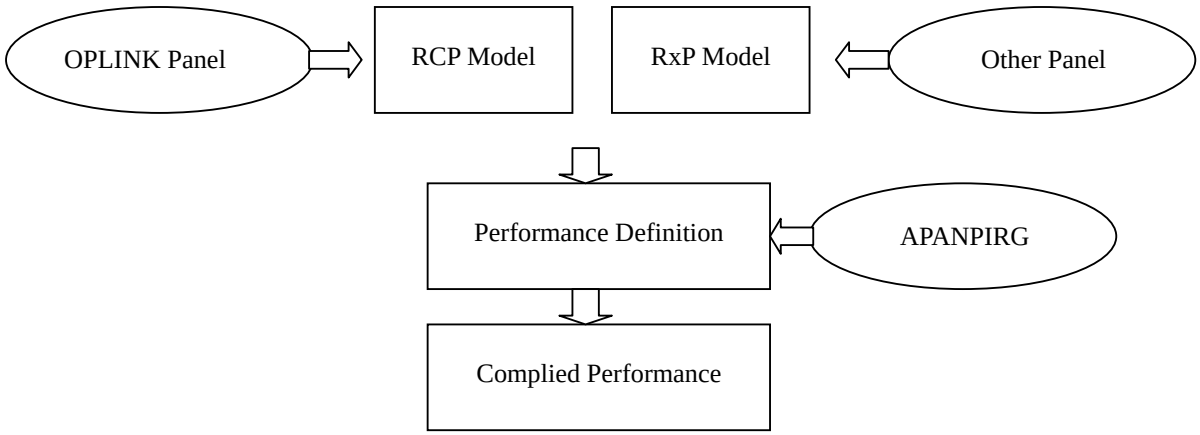


Figure 3.5 Role and Responsibility of Regional Planning Group

4. Aeronautical Telecommunication Network and its Performance

4.1 Aeronautical Telecommunication Network (ATN) in the CNS/ATM context

4.1.1 ATN Applications

The Aeronautical Telecommunication Network (ATN) is a portion of the CNS/ATM. The operational requirements (functional) for the ATS Data Link Applications are documented in the ICAO manual (DOC 9694). The Figure 4.1 depicts the position of the ATN within the CNS/ATM.

The ATS Data Link Applications documented in DOC 9694 include CPDLC, ADS (ADS-C; C for Communication), FIS, AIDC, and DLIC. They are also implemented in other communication systems as well as in the ATN as ATN Data Link Applications.

There are compatibility issues between implementations of same ATS Data Link Application in the ATN and the other communication systems.

One of the ATS Data Link Applications documented in DOC 9694 is ADS-B; B for broadcast, considered as a Surveillance capability, and is not included in the ATN Applications.

There is another ATN Application; AMHS not included in the ATS Data Link Applications. The AMHS has a corresponding legacy system; AFTN and the two communication systems co-exist via gateway functionality.

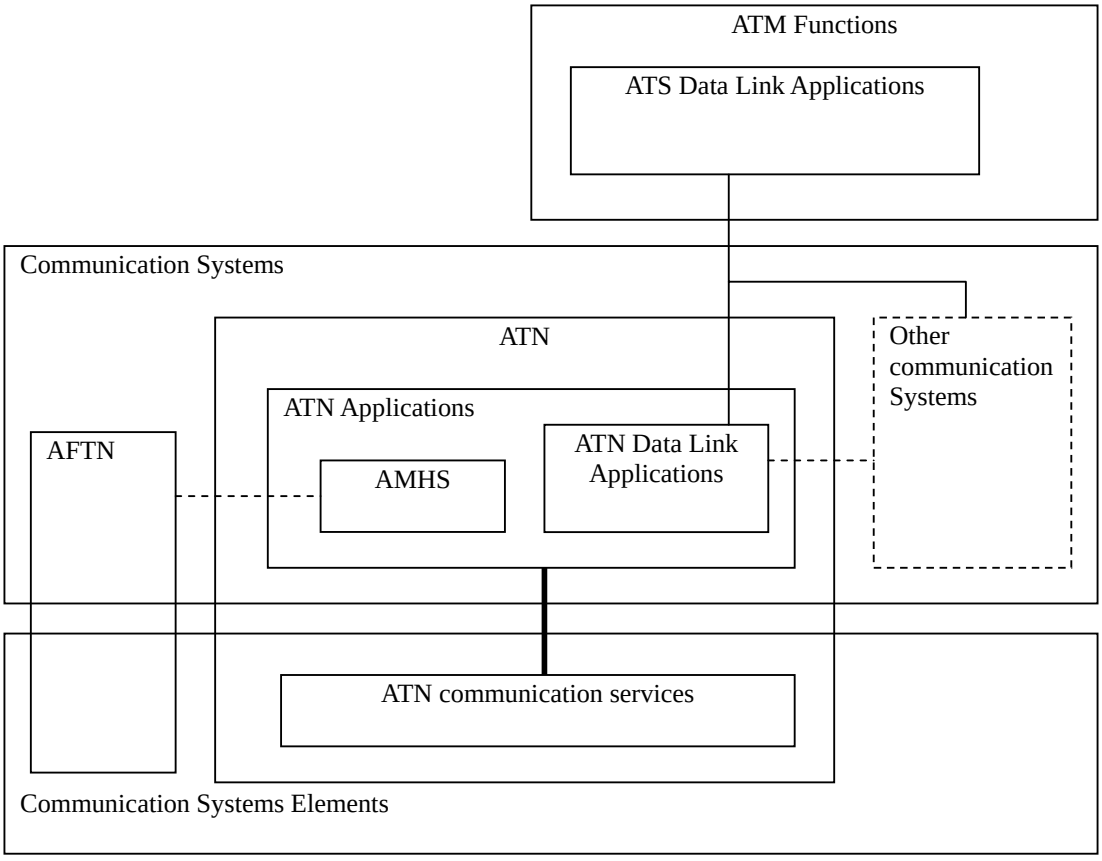


Fig. 4.1 ATN in the CNS/ATM

The ATN applications may also classified as Air-to-Ground and Ground-to-Ground. Table 4.1 depicts the classification of the ATN Applications.

Table 4.1 Classification of ATN Applications

Name of ATN Application	ATS Data Link application	Air-Ground (A-G) or Ground-Ground (G-G)
CPDLC	Yes	A-G
ADS (ADS-C)	Yes	A-G
FIS (ATIS, METAR)	Yes	A-G
DLIC (CM)	Yes	A-G
AIDC	Yes	G-G
AMHS	No	G-G

4.1.2 Characteristics of ATN Applications

There are three ATN Air-to-Ground applications; CPDLC, ADS and FIS defined as the ATN applications. Besides these three, CM (Context Management) or DLIC (Data Link Initiation Capability) is defined. In the Ground-to-Ground communication, two applications; AMHS and AIDC are defined. Each application has its own specific features and the performance requirements.

a) CPDLC

The CPDLC is the typical Air-to-Ground application that the model described in the previous sections reflects the features of CPDLC, two-way communication with human factors. The CPDLC is a type of 'Connection-Oriented-like' communication, where a 'CPDLC-Start' has to be invoked for the establishment of a CPDLC connection before any CPDLC messaging. One of CPDLC specific requirements may be the number of CPDLC connections supported at any one time, since the CPDLC will be kept connected during the flight.

b) ADS

The invocation of ADS starts at on the ground to initiate the Airborne System to generate and report the ADS messages. The ADS has less human factors where the messages are generated by the Airborne System. The ADS is a type of Connectionless-like communication, that is, the message can be sent without any 'Connection Establishment Message'. The ADS is a part of the Surveillance function, but it has a different feature from the Radar Surveillance, since the ADS transfer delay is not constant, and the ADS periodic reports from each aircraft are asynchronous. One of ADS specific requirements may be the number of ADS connections supported at any one time, since the ADS will be kept connected during the flight.

c) FIS

Currently there are two functions provided in the FIS; ATIS and METAR. The invocation of the FIS starts at the Airborne System/Pilot requesting the FIS information. The corresponding Ground System sends back the requested information, or sends back 'processing' if the requested information is not ready. Similar to the ADS, The FIS is a type of Connectionless-like communication, that is, the message can be sent without any 'Connection Establishment Message'. Currently the FIS is not a performance sensitive application, since the FIS is the planning-oriented application, but in future there may be some added functions of performance sensitive.

d) CM

The CM is not really an application in a sense of other Air-to-Ground applications. It provides the address services for the other Air-to-Ground applications. The CM is not a performance sensitive application, since it can be used only once within a specific airspace.

e) AIDC

The AIDC is a Ground-to-Ground application between two neighboring FIRs. Besides the physical connection established between two neighboring FIRs, one logical connection (i.e. association) per flight transferred between two neighboring FIRs, has to be maintained in the AIDC. One of AIDC specific requirements may be the number of the AIDC (logical) connections supported at any one time.

f) AMHS

The AMHS is a Ground-to-Ground application of the 'Store-and-Forward' mode. The AMHS is not a performance sensitive application, in fact there is no time related performance requirements for the AMHS.

4.1.3 Topological Characteristics of ATN Applications

There are three different topologies of the ATN Applications.

1) Air-to-Ground Applications Type(e.g. CPDLC, ADS, FIS, CM)

The topological scheme of End System:ES in the Air-to-Ground ATN applications is as follows.

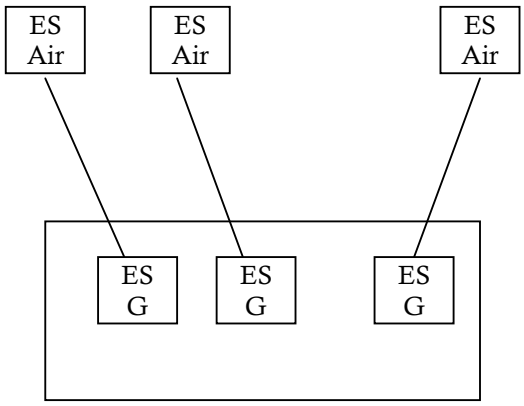


Figure 4.2 Air-to-Ground Applications Network Topology

- Two End Systems (one Airborne ES and one Ground ES) are connected by a separate connection path which includes one Air-to-Ground data link and possibly multiple Ground-to-Ground sub-networks.
- How to accommodate multiple Ground ESs of same type (e.g. CPDLC-Ground-ESs, ADS-Ground-ESs) depends on the implementation.
- Actual performance of each Air-to-Ground application, especially for Ground ES, depends on how many active connections are allowed at one time.
- It is meaningful to address the End-to-End performance, especially the response time performance of the Air-to-Ground applications for both Airborne ES and Ground ES, but it is less meaningful to address the throughput for Airborne ES.

2) Ground-to-Ground Interactive Applications Type (e.g. AIDC)

One of the topological schemes of Ground-to-Ground applications is a simple connection between two ESs (two Ground ESs) as shown below.

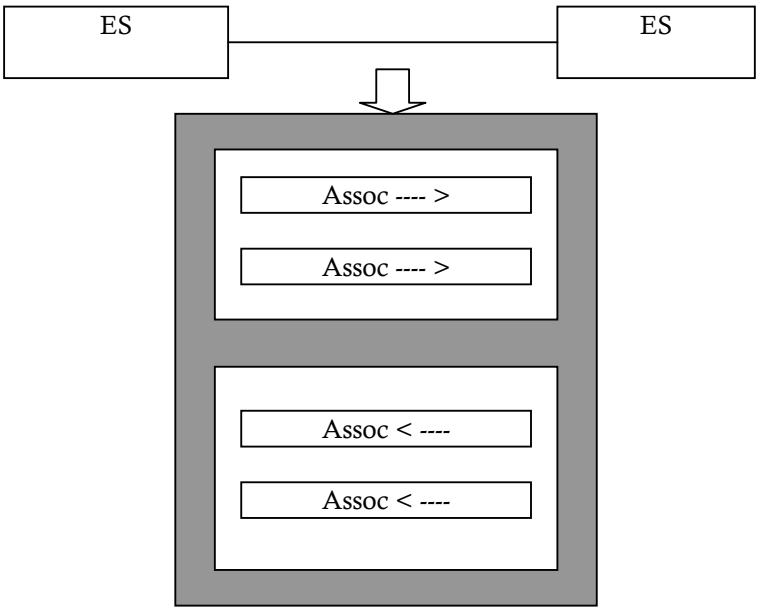


Figure 4.3 Ground-to-Ground Interactive Applications Network Topology

The connection of this type is physically simple, but logically is not simple, for instance, AIDC has a complex structure of connection.

Multiple logical connections (also called ‘associations’) are active at one time where one association between two ESs represents the AIDC communication with respect to each flight.

Since there exist two directions of flights between two FIRs using AIDC, there are two different classes of associations representing the flights of each direction between FIRs.

3) Ground-to-Ground Store-and-Forward Applications Type (e.g. AMHS)

Another type of topological scheme of Ground-to-Ground ATN applications is a network of servers as shown below.

Within a network of servers, where the mode of communication is ‘store-and-forward’, the End-to-End response time is less meaningful, although it is not useless.
Here the ‘End-to-End’ envisages the originator-to-destination, but the server-to-server in between can be viewed as the ‘end-to-end’ or ‘End System to End System’.

Within a network of the store-and-forward servers, it is more meaningful to address the capability of each server, e.g. throughput, rather than the origin-to-destination aspect.

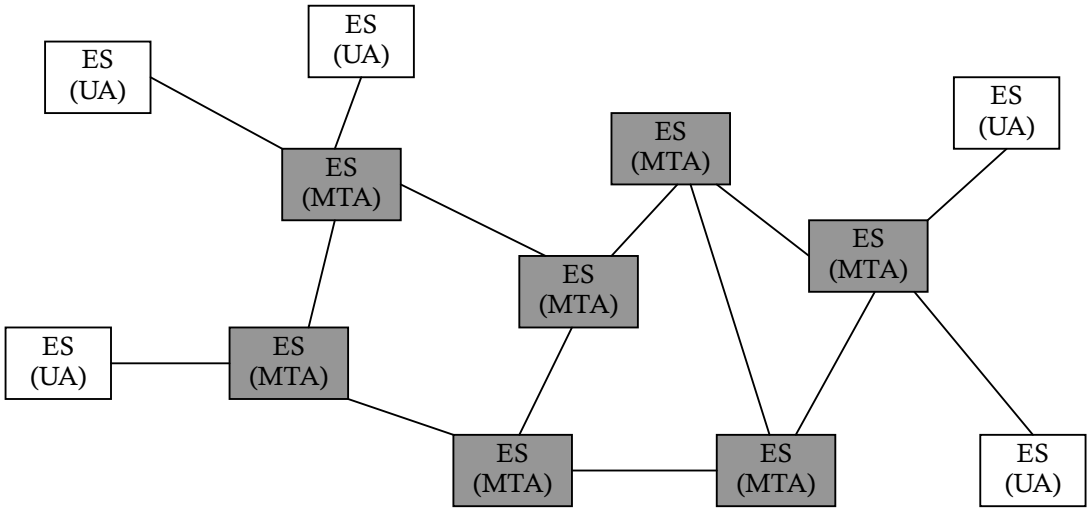


Figure 4.4 Ground-to-Ground Store-and-Forward Applications Network Topology

4.2 ATN Communication Services

4.2.1 Air-Ground ATN Application and ATN Communication Services
ATN Communication Services' elements in the Air Ground ATN Applications are depicted in the Figure 4.5.

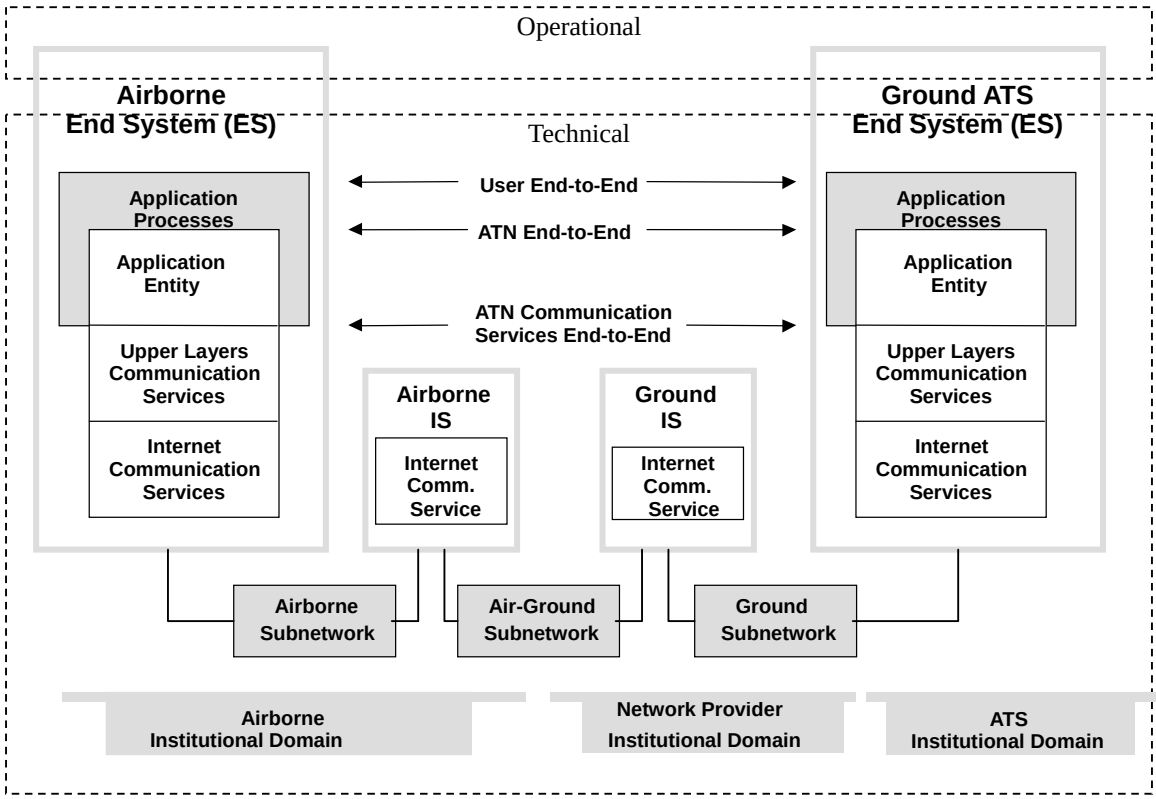


Figure 4.5 Technical Elements of Air-Ground Communication

4.2.2 Ground-Ground ATN Application and ATN Communication Services
ATN Communication Services' elements in the Ground-Ground ATN Applications are depicted in the Figure 4.6.

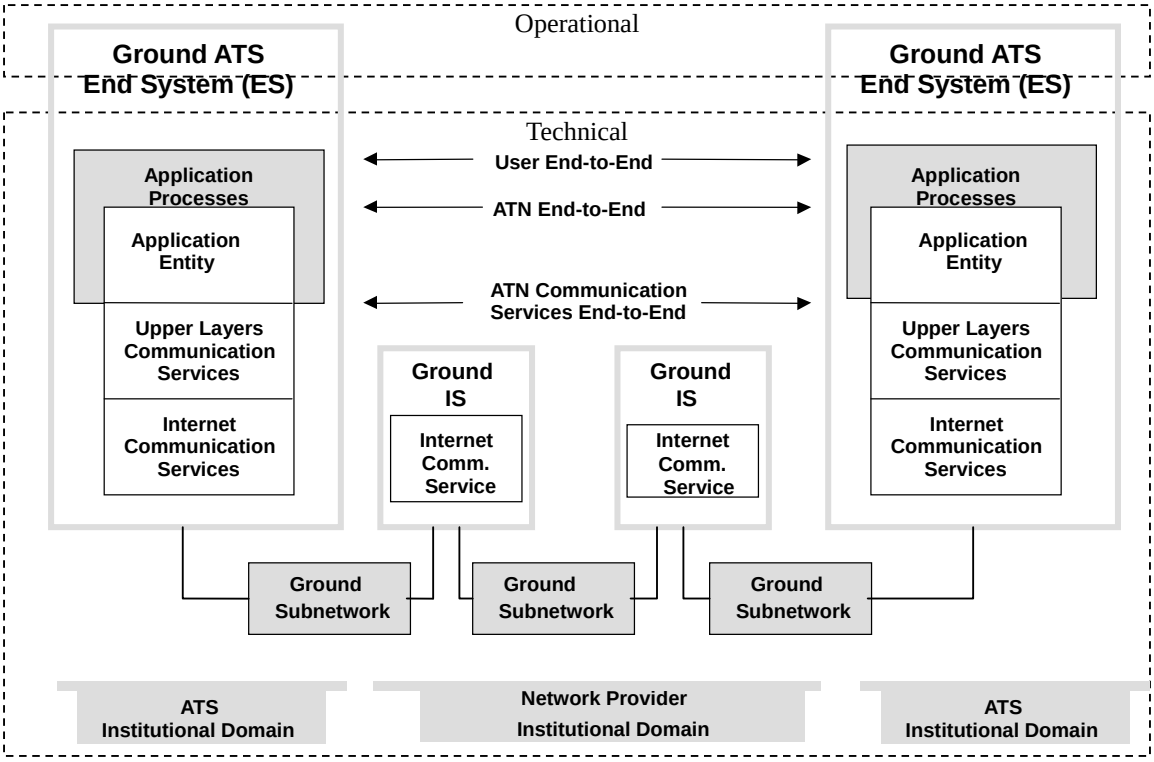


Figure 4.6 Technical Elemetnts of Ground-Ground Communication

4.3 Planning for Monitoring, Evaluating and Improving Performance

Once the Required Communication Performance is planned (i.e. derived and stated) and installed, the performance is monitored, evaluated and improved as necessary.

At the planning stage, the monitoring points, the measurement metrics and parameters are necessary to be identified.

4.3.1 Operational Performance Monitoring

As described above, there are two major components of operational performance, namely human factor performance and technical communication performance.

a) Monitoring Human Factor Performance

By monitoring operational performance and the technical performance, human factor performance is possibly being estimated.

b) Monitoring Technical Communication Performance
In the following, the Monitoring Technical Performance is discussed further.

4.3.2 Monitoring Technical Communication Performance

4.3.2.1 Performance Monitoring Points

Following the Guidance Materials of ATN System Management Services, the monitoring points, measurement metrics and parameters are listed below.

The following figure shows the possible monitoring points (a through e) in ATN Communication Services.

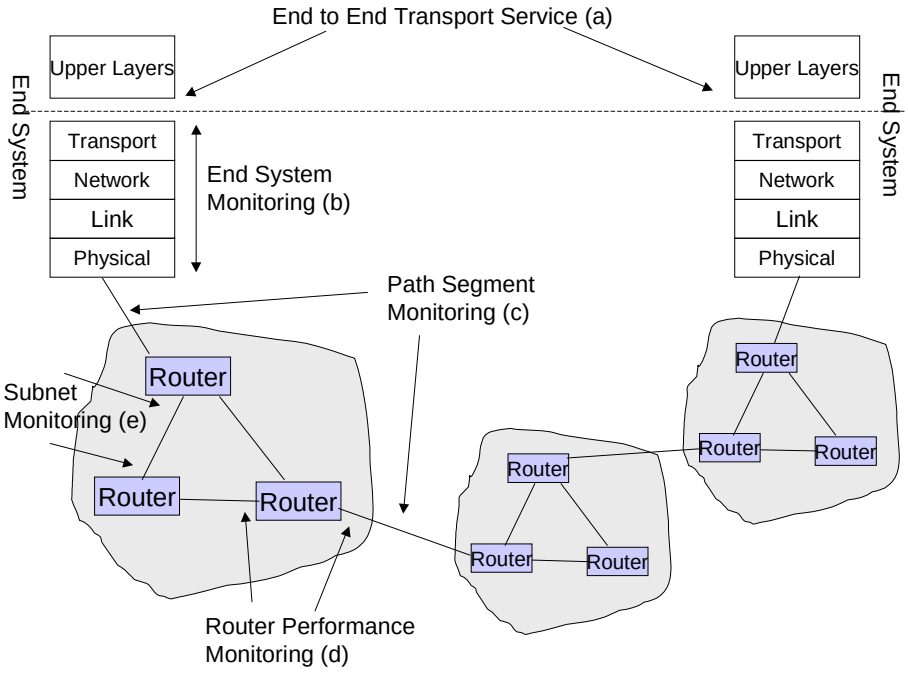


Figure 4.7 Performance Monitoring Points

Note 1; Two Performance metrics; Elapsed Time and Throughput:
There are two metrics of time related performance measurements; elapsed time and throughput.
The elapsed time is the time difference between the service requested and the service completed for a service requested. The throughput is the number of services processed during a certain time interval. The utilization of system providing services is closely related to the throughput.

The elapsed time is the metric related to the individual service request, while the throughput is the server wide metric of performance, counting the number of the completed services in a sampling duration, and the utilization is the rate of system busy during a sampling duration.

There is a close relationship between the elapsed time and the utilization of the server. If there is no other service request, i.e. zero utilization at the time, the service requested can be served immediately without any extra delay. The more services are requested, the more chances for waiting in the server queue, and the queue will be built up proportional to the rate of service requests. The higher utilization means the larger elapsed time, hence the larger delay on the average.
If D_0 denotes the delay when the network is idle, and U is a value between 0 and 1 that denotes the current utilization, the effective delay D is given by a simple formula;

$D = D_0 / (1-U)$

See, for instance D.E. Comer, 'Computer Networks and Internets', Third Edition, Prentice Hall, 2001
It implies that, if the system is experiencing the 50% utilization currently, the delay will be doubled on the average. If preoccupied with the utilization, the elapsed time will be sacrificed.

The things will be complicated further in a network with the multiple paths of services and the multiple stages of servers.

If the throughput or utilization is adopted as a performance metric, it is important to select an appropriate sampling duration of monitoring, for instance, the peak throughput or utilization is significantly different from the daily average throughput or utilization.

Note 2; Link Level Performance
The Data Link Level performance is the basic element of the network performance, but in a network like the ATN, the Data Link Level performance is less visible and possibly less relevant. The ultimate services are the End User Services, or the application level services. Also from the communication service provision viewpoint, it is important to manage the network and inter-network level performance. But the data link level within a sub-network is less visible, since the communication within a sub-network is dynamic and correlating the individual data link performance to the network level performance is a hard task, and some links of a communication path may be managed by different organizations, and it is again hard to collect the detailed performance information.

Another reason of the invisible link level performance is that the whole sub-network or communication path may be supported by some independent service providers, and the detailed data link level is again invisible from the outside.

The IDRP (Inter-Domain Routing Protocol) adopted by the ATN is based on the principle that each domain does not need to expose the routing details within a Domain to the outside. It is only necessary to show the Quality of Service Parameter values at the entry/exit points of the domain. Such a scheme makes the detailed Data Link Level Performance information invisible to the outside of the sub-network.

The monitoring points given in the Figure 4.7 can be re-organized to the following Figure 4.8 in terms of a hierarchy of services and communication elements.

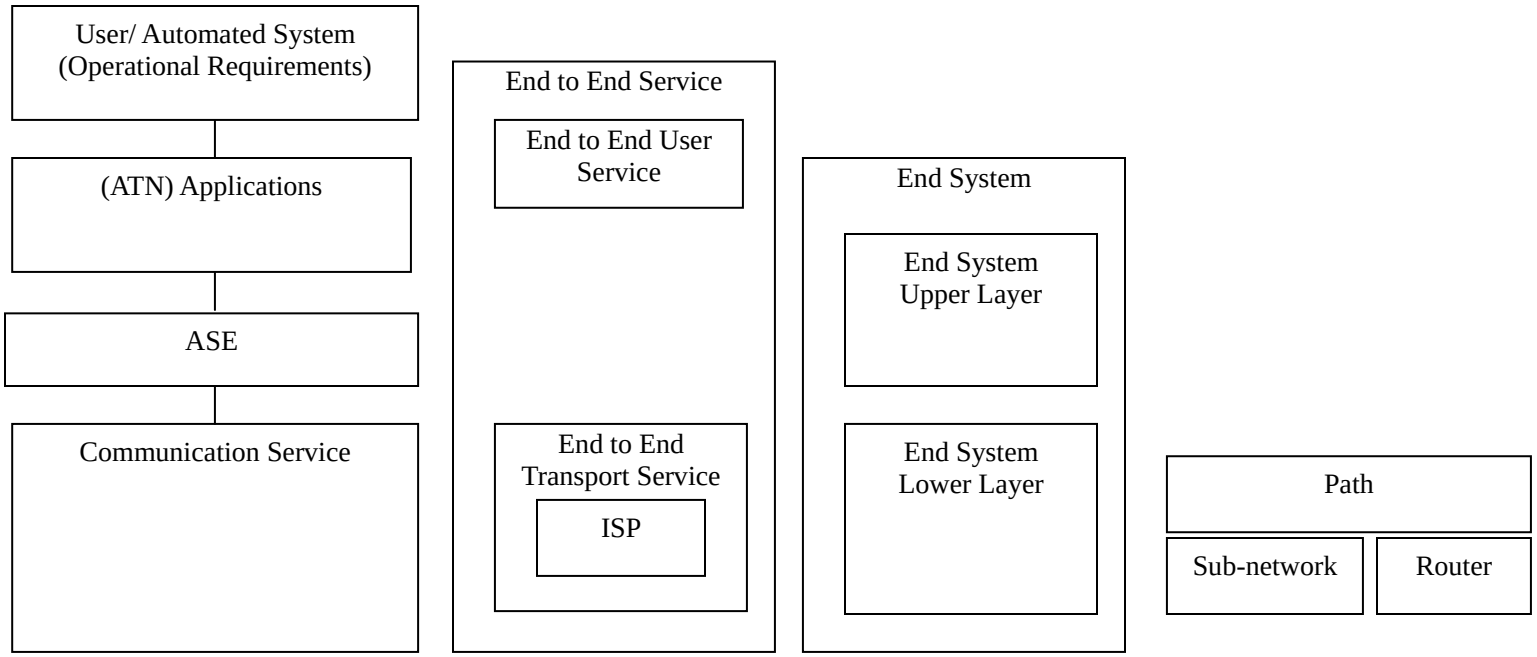


Figure 4.8 Performance Monitoring Points Diagram

The monitoring points then are listed as in the Table 4.2 below.

Table 4.2 Performance Monitoring Points

<table>
<tr><td></td><td>End to End Service</td><td>End System</td><td rowspan="3"></td></tr>
<tr><td>User/Automated System</td><td>End to End User Service (Operational Requirements)</td><td></td></tr>
<tr><td>(ATN)Application
ASE</td><td rowspan="2"></td><td rowspan="2">End System Upper Layers</td></tr>
<tr><td>Communication Service</td><td>End to End Transport Service (Service Level Agreement with ISP)</td><td>End System Lower Layers</td><td>Path Segment
Sub-network, Router</td></tr>
</table>

4.3.2.2 Performance Monitoring Parameters

Based on the Performance Monitoring Points listed above, the Performance Metrics for each Monitoring Points are listed as follows;

Table 4.3 Performance Metrics for each Monitoring Point Type

Monitoring Points		Performance Metrics
End to End Service		● Availability ● Reliability ● Continuity ● End-to-End Transfer Delay ● Integrity ● Throughput ● Connection Establishment Delay
Operational Requirements	General Requirements	(Air-Ground) ● Probability of non-receipt of a message ● Probability that non-receipt of a message will fail to be notified ● Probability that a message will be misdirected
	Application Specific Requirements	See the following Table 4.4 as an example
	Transfer Delay	See the following Table 4.5 as an example.
End System(Lower and Upper Level)		● Internal Performance of Systems ● Availability ● Reliability ● Continuity ● Transfer Delay ● Integrity ● Throughput ● Connection Establishment Delay
Path Segment		● Reliability ● Transit Delay ● Integrity ● Throughput
Sub-network		● Availability ● Reliability ● Transit Delay ● Continuity ● Integrity ● Throughput ● Connection Establishment delay ● Data loss rate
Router	Packet Forwarding	● Packets successfully forwarded ● Percentage of packet discarded

	Routing Updates	• Availability • Reliability • Continuity • Time elapsed from a change in the network topology to this change being reflected in all affected routing tables
	Air-Ground Routers	• Number of Air-Ground virtual circuits supported at any time • Number of IDRP adjacencies
Service Level Agreement with ISP		• Reliability • Transit Delay • Throughput

Table 4.4 Application-specific Performance Requirements [ICAO DOC 9694]

Application	Availability	Integrity	Reliability	Continuity
CM / DLIC	99.9%	10^{-6}	99.9%	99.9%
ADS	99.996%	10^{-7}	99.996%	99.996%
CPDLC	99.99%	10^{-7}	99.99%	99.99%
D-FIS	99.9%	10^{-6}	99.9%	99.9%
AIDC	99.996%	10^{-7}	99.9%	99.9%

Table 4.5 Transfer Delay Performance Requirements [ICAO DOC 9739]

Performance Levels (ATSC Class)	Mean End-To-End Transfer Delay (sec)	95% End-To-End Transfer Delay (sec)	99.996% End-To-End Transfer Delay (sec)
A	0.5	0.7	1
B	1	1.5	2.5
C	2	2.5	3.5
D	3	5	8
E	5	8	12.5
F	10	15	22
G	12	20	31.5
H	15	30	51
I	30	55	90
J	60	110	180

It should be noted that the parameters in the Table 4.5 are not compatible to the RCP type parameters described above.

The following Table 4.6 shows the detailed parameters for the Performance Management Objectives identified.

Table 4.6 Metrics/Parameters for ATN Performance based on the ATN Performance Management Requirements

No	A/G G/G	Objectives	Metrics (Metrics in the previous table to be applied)	Detailed Measurement Parameters
1	A/G & G/G*	End User QoS Measurement Note: G/G* mainly interactive G/G applications	Availability	● Successful attempt to use the service ● Failed attempt to use the service ● Connection re-tried
			Reliability	● Number of messages sent to a given destination ● Number of those received without errors by that destination ● Residual error not detected by the destination(by manual analysis)
			Continuity	● Service interrupted ● Corresponding resumption of service
			End to End Transfer Delay	● Transmission time and reception time of each message ● Transport round trip delay
			Integrity	● Message delivered successfully ● Message delivered with errors not detected ● Message with errors in fact message is correct ● Probability of errors being mis-detected ● Message rejected
			Throughput	● Number of messages sent(size and time)
			Connection Establishment Delay	● Time to establish a transport connection ● Time to establish a connection using Dialogue Service ● Time to establish an application specific relationship

2	A/G & G/G	End System(Upper & Lower Layer) Monitoring Note: There are four types of ES 1) A/G(Air)ES 2) A/G(Ground)ES 3) G/G(Interactive) ES 4) G/G(S&F)ES	Internal Performance of System	● Number and size distribution (mean and max) of packets sent and received at the internet level, for each priority and ATSC class, and possibly ISP(Internet Service Provider). ● Transit delay of a packet through the End System
			Availability	● Successful attempt to use the service ● Failed attempt to use the service ● Connection re-tried
			Reliability	● Number of messages sent to a given destination ● Number of those received without errors by that destination ● Residual error not detected by the destination(by manual analysis)
			Continuity	● Service interrupted ● Corresponding resumption of service
			Transfer Delay	● Relay time of each message(G/G-S&F-ES)
			Integrity	● Message delivered successfully ● Message delivered with errors not detected ● Message with errors in fact message is correct ● Probability of errors being mis-detected ● Message rejected
			Throughput	● Number of messages received/sent(size and time)
			Number of Active Connections	● Number of Active Logical / Physical Connections (A/G-Ground-ES and G/G-Interactive-ES)
			Storage Capacity(G/G-S&F-ES)	● Number of messages stored

3	A/G & G/G	Sub-network Service Monitoring	Availability	● Successful attempt to use the service ● Failed attempt to use the service
			Reliability	● Number of messages sent ● Number of messages received
			Transit Delay	● (Connection Oriented mode) Can use acknowledgement mechanism; it is not suitable for end-to-end sub-network and real time. ● (Connectionless mode)Using special link level test packet with time-stamp or using CLNP echo for the round trip delay; it needs a special care to segregate the sub-network from multiple hops and to segregate the internal processing time in the system(Router/ End System);
			Continuity (depends on sub-network type)	● Service Interruption ■ (Connection oriented mode) un-commanded loss of a sub-network connection or ■ inability of the sub-network to accept data for sending on the established connection ■ (Connectionless mode) transmission failure ● Resumption of Service ■ (Connection Oriented mode) Successful re-establishment of connection ■ (Connectionless mode) The time of the next successful transmission attempt

			Integrity	• (Connectionless mode) CLNP header checksum; it is not mandatory in the ATN SARPs for End System to generate. • Deflate checksum (whole packet checksum); it is optional. • Number of packets sent over the sub-network • Number of packets received over the sub-network • Number of packets rejected by the sub-network • Number of packets received with a failed CLNP header checksum or Deflate checksum failure
			Throughput	• Number of messages sent (size and time) over each communication path; offline analyses required.
			Connection Establishment Delay	(Connection Oriented mode only) • The time of each sub-network connection initiated • The time of successful connection establishment
4	A/G & G/G	Measurement of Path Segment performance	Reliability	• Number of packets on entry and exit
			Throughput	• Number of packets on entry and exit
			Transit delay	• Each individual packet on entry and exit, or • Sample packet on the link or • Periodic echo packet on the data flow
5	A/G & G/G	Monitoring for Excess Capacity	Throughput	• Peak throughput
6	A/G & G/G	Planning Future Capacity		• Network Design Models • Data volumes for each sub-network on a point to point basis and during each sample period • Data volumes(both bytes and packets) handled by each Router during each sample period
7	A/G & G/G	Dynamic (Sub-network) Capacity Management	Indicating the need for Additional Capacity	• Queuing delay for packet transmission; average queue length during a sample period(or absolute queue delay per packet)
			Indicating When Additional Capacity is no longer Needed	• Queuing delay for packet transmission; average queue length during a sample period(or absolute queue delay per packet)

			Adding and Removing Additional Sub-network Capacity	● It needs System Management Action
8	A/G & G/G	Router Forwarding Measurement	Integrity	● Packets successfully forwarded ● Percentage of packet discarded ● Reasons packets discarded
9	A/G & G/G	Router Key Parameters measurement	Internal Performance of System	● System parameters(e.g. memory utilization) ● The number of entries in the Forwarding Information Base(FIB)
10	A/G & G/G	Measurement Route Convergence Times	Internal Performance of System	● Routing events ● Clock synchronization accuracy
11	A/G	Air-Ground Router Overhead Measurement		● Establishment and termination of adjacencies with Airborne Router ● Establishment and termination of sub-network connection with Airborne Router ● Maximum number of adjacencies and sub-network connections
12	A/G & G/G	Analysis of Data Stream Performance (depends on the Service Level Agreements with ISP(Internet Service Providers)	Reliability	● Number of packets on entry and exit
			Throughput	● Number of packets on entry and exit
			Transit delay	● Each individual packet on entry and exit, or ● Sample packet on the link or ● Periodic echo packet on the data flow
13	A/G & G/G	Monitoring of Service Provider Compliance by Aggregate Data Flow (depends on the Service Level Agreements with ISP(Internet Service Providers)	Reliability	● Same as others but the aggregated values
			Throughput	● Same as others but the aggregated values
			Transit delay	● Same as others but the aggregated values
14	A/G & G/G	Monitoring of User Message Delivery	Integrity	● Mis-delivered user message ● Not delivered to the intended recipient(lost or mis-delivered) with notification to the originator ● Not delivered to the intended recipient(lost or mis-delivered) with no notification to the originator

15	A/G & G/G	Monitoring of User Message transfer Times (depends on the types of applications)	Transfer Delay	(Conformed Service, e.g. LACK in CPDLC) ● Round trip time based on the acknowledge procedure of applications; it needs to factor out the processing time in the system. (Unconfirmed Services) ● Measurement based on timestamp, clock synchronization, or system management echo function. (For both cases) ● Factor out human response time, system processing time.

Note; It should be noted that the monitoring points/parameters listed above are not guaranteed to be technically or practically feasible. For the details, consult to the original document; ICAO Doc 9739, Part V, section 2.2.2

5. Summary

The current document provides the guidelines for the performance related considerations. In the document, preliminary considerations on the performance, the RCP developed by the OPLINKP, the ATN performance and monitoring its performance are described.

Regarding the definition of communication performance, the OPLINK Panel is finishing to develop the ICAO Manual on the RCP. The ICAO RCP manual will provide the detailed descriptions and explanations related to the Operational Communication Performance Requirements: RCP.

In future, the specific RCP parameter values (or the ranges of values) for a specified ATS functions and the airspaces may be given, which currently are partially determined.

Appendix

ICAO DOC 9739 (CAMAL) Edition 2 Part V Chapter 2 ATN System management Services 2.2.2 Performance Management Requirements, p.p. V-2-35-67

Performance Management Requirements

Note 1. This chapter is concerned with the derivation of Performance Management requirements for the ATN Internet and Upper Layers, including applications. A top down analysis is presented, first identifying the objectives for Performance Management and then going on to look at how these objectives are met, from which system and tool requirements can be derived.

Note 2. It should be noted that this analysis does not attempt to determine how difficult or costly each identified requirement is to implement.

Derivation of Performance Management Objectives

1.1 ISO/ITU-T standards define performance management as follows:
Performance management enables the behavior of resources in the OSI Environment and the effectiveness of communication activities to be evaluated. Performance management includes functions to:

1. gather statistical information;
2. maintain and examine logs of system state histories
3. determine system performance under natural and artificial conditions; and
4. alter system modes of operation for the purpose of conducting performance management activities.

1.2 In an ATN context, there are three basic purposes for which the above procedures will be conducted:

a)The end-to-end performance will need to be measured in order to ensure that the operational requirements are being met.

b)Users will wish to monitor the performance of ATN Internet Service Providers (ISPs) and subnetwork providers, and, in particular, to assess their compliance with service level agreements (this could be for both Operational and Financial reasons).

c)ISPs will wish to monitor the performance of the network, to ensure that they are maintaining service level agreements, to ensure that the network capacity will match future requirements (Capacity Planning), and to ensure that the service that their users require is being delivered, and in the most cost effective manner.

1.3 It should be noted that the end-to-end service may be provided by multiple ISPs operating in serial.

1.4 In order to determine the Performance Management objectives, it is thus necessary to look at each of the above purposes, to identify the performance monitoring points, and to consider the different relationships between ISPs. In particular, service agreements will relate to path segments though the ATN Internet and a given path segment may be maintained by more than one ISP in series. The performance management models that result from this scenario need also to be considered.

1.5 Performance Monitoring Points

1.5.1 Figure 2.2-1 illustrates the various performance monitoring points (PMPs) that are required in the ATN Internet Communication Service (ICS). These are:

a)**The End to End Transport Service** measures the end-to-end service provided to a TS-User. Performance monitoring is required here in order to measure the overall performance characteristics of the ATN ICS.

b)**End System Monitoring (Lower Layers)** is required to determine the part of the end to end ICS overhead attributable to the End System itself. This should be a small component of the overall end-to-end figure, but this still needs to be demonstrated.

c)**Path Segment Monitoring** is required to monitor the performance of ISPs and to measure the contribution to the end-to-end overhead of the routers and subnetworks operated by an End User.

d)**Router Performance Monitoring** is required to measure the performance of individual routers and to determine their contribution to the end-to-end overhead.

e)**Subnetwork Performance Monitoring** is required to monitor the compliance of subnetwork providers with performance level agreements and to measure the contribution of each subnetwork to the end-to-end overhead.

1.5.2 In addition, PMPs are required in the upper layers of the ATN, which includes the application ASEs and ASE-Users:

a) End System Monitoring (Upper Layers) is required to determine the part of the end to end overhead attributable to that part of the system which uses the ICS. Note that some aspects of upper-layer performance characteristics may vary dynamically depending upon the particular implementation architecture. For example, a distributed architecture may at times be subject to LAN congestion delays in the local application system.

b)The End to End ASE Service measures the end-to-end service provided to application software which uses the communication services of the complete ATN stack. Performance monitoring is required here in order to measure the technical performance of the standardised application protocols.

c)**The End to End User Service** measures the end-to-end service as perceived by the human user, or in the case of automated functions, at the highest level of the automated processing thread. Performance monitoring is required here in order to verify that the end to end service meets the operational requirements.

1.6 End to End Service Monitoring

1.6.2 An end user of the ATN (typically a CAA or Airline) is interested in ensuring that the required end-to-end Quality of Service is being maintained. At the same time, they will also have an Accounting Management objective to monitor the cost of using the ATN, and, whilst this is a different subject, the data capture requirements will be similar.

1.6.3 The end-to-end quality of service (QoS) can be broken down into the following parameters:

a)**Availability**: "The ability of a system to perform its required function at the initiation of the intended operation. It is quantified as the proportion of the time the system is available to the time the system is planned to be available".

b)**Reliability**: "The probability that the system will deliver a particular message without errors."

c)**Continuity**: "The probability of a system to perform its required function without unscheduled interruptions during the intended period of operations."

d)**End-to-End Transfer Delay**: "The period elapsed from the time at which the originating user initiates the triggering event until the time the transmitted information has been received by the intended recipient."

e)**Integrity**: "The probability that errors will be mis-detected. This may be when a correct message is indicated as containing one or more errors, or when a message containing one or more errors is indicated as being correct."

f)**Throughput**: "The quantity of data (e.g. measured in characters) that can be sent during a given period."

g)**Connection Establishment Delay**: "The time from initiating an end-to-end connection to its successful establishment (i.e. when messages can be sent).

Note. The definitions of Availability, Reliability, Continuity, Transit Delay and Integrity are taken from the ADSP Manual [8].

1.6.3 The operational requirements for performance management require the ability to measure each of the above Quality of Service metrics on an end-to-end basis i.e. between an application user and each other end user of the ATN with which it communicates. [Objective 1]

1.7 End System Monitoring

1.7.3 End Users typically own and operate the End Systems that form the first part of the chain of end to end communications. They will need to monitor the internal performance of these systems. [Objective 2]

1.7.4 This is so that the actual performance provided by the ISP(s) used for end-to-end communications can be calculated, and to enable performance trends in the local system to be monitored for capacity planning purposes.

1.8 Subnetwork Service Monitoring

Note. An ATN ISP or end user may also operate subnetworks and hence wish to monitor their internal operation. However, the internal monitoring of subnetworks is outside of the scope of this analysis.

1.8.3 An ISP or End User will need to monitor the operation of each subnetwork they use in order to ensure that the expected/required Quality of Service is being maintained. [Objective 3]

1.8.4 The Quality of Service metrics to be measured are very similar to those for the end-to-end service and will always include: Availability, Reliability, Continuity, Transit Delay, Integrity and Throughput. In addition, there will be subnetwork specific metrics. For example. a connection mode subnetwork (e.g. X.25) will have a connection set-up delay metric, while a Frame Relay circuit has only a maximum guaranteed throughput, with the possibility of data loss, and hence the data loss rate will need to be monitored and compared with offered traffic load.

1.9 Path Segment Monitoring

1.9.3 An ISP or End User will need to monitor the overall performance of each path through their segment of the ATN Internet [Objective 4]. The metrics measured will be those specific to a connectionless service i.e. Throughput, Reliability, Integrity and Transit Delay.

1.9.2 Performance achievement will also need to be measured against the theoretical maximum so that excess capacity can be removed [Objective 5]. Trend analysis will also need to be performed so that future growth can be predicted and hence future capacity growth planned and installed when needed [Objective 6].

1.9.3 ISPs and End Users may also wish to manage their capacity dynamically. This make take the form of bringing on additional capacity to meet busy hour requirements, according to a defined schedule, or simply be reacting to reports of congestion by opening up new circuits. [Objective 7].

1.10 TN Router Performance Monitoring

1.10.3 General ATN Router performance may be considered in two separate parts: forwarding and route updates. There are also special considerations for Air/Ground Router performance.

1.11 Packet Forwarding

1.11.1 An ISP or End User will need to monitor the following packet forwarding metrics [Objective 8]:

a) Packets successfully forwarded during a given measuring period (e.g. per second)

b) Percentage of packets discarded.

1.11.2 As the service level requirements can vary by both ATSC Class and priority, these metrics will need to be broken down by both of these parameters.

1.11.3 Key parameters of the router that affect forwarding need also to be measured. These include the size of the Forwarding Information Base (FIB). [Objective 9].

1.12 Routing Updates

1.12.1 An ISP or End User will need to monitor the route convergence rate. That is the time elapsed from a change in the network topology to this change being reflected in all affected routing tables. [Objective 10].

1.11.2 This metric is important in the maintenance of Availability, Reliability and Continuity targets as packet loss can occur during this period. The target convergence rate may be derived empirically or from simulation models.

1.13 Air/Ground Routers

1.13.1 Ground/Ground Routers typically support a limited number of fixed adjacencies. However, Air/Ground Routers will support a large and variable number of adjacencies with aircraft, with each adjacency supported by one or more virtual circuits. The performance of the router may be affected by the number of such adjacencies maintained, and performance will thus need to be measured against the adjacencies and virtual circuits supported. It will thus be necessary to monitor the number of air/ground virtual circuits supported at any one time, and the number of IDRP adjacencies. [Objective 11].

114. Service Level Management

1.14.1 Service guarantees will need to be put in place to ensure that the end-to-end Quality of Service required to meet the operational requirements is achieved. When this service is provided via multiple ISPs in serial, there are two possible models for maintenance of the end-to-end Quality of Service:

a) The end user(s) have separate service level agreements with each ISP that supports (in serial) the end-to-end path.

b) The end user(s) have a single service agreement with one ISP who is also responsible for the service provided by any other ISP en route.

1.15 Separate Service Level Agreements

1.15.1 Whilst this model is, on first appearances, easier for the ISPs to operate, it pushes the complexity onto the end users, who have to be aware of the paths that their data takes, and who are required to negotiate with each ISP en route. This potentially makes for many small contracts between users and ISPs. It may thus be more costly to implement because of this contractual overhead.

1.15.2 In this model, each ISP will need to be able to demonstrate to an End User that they are meeting the service requirement for the path segment under their control. It will thus be necessary to monitor incoming packets from either users or other ISPs and analyse them by sending end user. Similarly, the ISP will need to analyse traffic at each exit point. [Objective 12].

1.15.3 Analysis of traffic by source is potentially a very costly exercise as each packet has to be metered.

1.16 Single User Service Agreements

1.16.1 This model can be operated in two different ways, which can be labeled as "microscopic" or "macroscopic". In the microscopic view, one ISP simply becomes the "agent" of an end user, and organizes the separate contracts with each other ISP en route. In order to monitor compliance, each data flow will still need to be identified as above, and the end user's agent will collate the information together and monitor the overall performance, as above.

1.16.2 In the macroscopic view, an ISP will aggregate together the traffic from all of its users and thence identify the traffic volumes it will exchange with each other ISP. On the basis of agreed traffic volumes, the ISPs may then guarantee minimum service levels to each other. A given ISP may then offer a service guarantee to its end user, and base this guarantee on the knowledge of which ISPs lie on the route and by summing the guaranteed minimum service levels.

1.16.3 The macroscopic view is simpler to achieve because it requires only that each ISP monitors its own part of the ATN Internet (as in 2.2.2.1.9, Path Segment Monitoring above). However, it will probably need to be coordinated through an industry forum that will also receive, collate and monitor the overall service provided to end users. [Objective 13].

1.17 Operational Requirements

1.17.1 Monitoring the end-to-end performance of the ATN service provided to application users is a stated requirement. The objective is to enable evaluation of the operational effectiveness of the communication resources by means of statistical information and logs of system state histories.

1.17.2 The workload of the applications can be measured, globally or on a connection basis, by the accounting management parameters.

1.17.3 The ADSP Manual defines in Part I, Chapter 3 Appendix A three types of communication systems performance requirements related to the ATS data link applications:

a)General Performance Requirements

b)Application Specific Performance Requirements

c)Transfer Delay Requirements

1.18 General Performance Requirements

1.18.1 The general performance requirements on the air-ground applications are:

a) the probability of non-receipt of a message will be equal to or less than 10^{-6},

b) the probability that non-receipt of a message will fail to be notified to the originator will be equal to or less than 10^{-9}, and

c) the probability that a message will be misdirected will be equal to or less than 10^{-7}.

1.18.2 These performance requirements can be designed into a system, and bench-tested before operational use. However, there is still a need to monitor whether the requirements are being met during operational use. [Objective 14].

1.19 Application Specific Performance Requirements

1.19.1 The performance requirements specific to each air-ground application are also defined in the ADSP Manual [8], as shown in Table 2.2-3.

Table 2.5-3. Application-specific Performance Requirements

Application	Availability	Integrity	Reliability	Continuity
CM / DLIC	99.9%	10^{-6}	99.9%	99.9%
ADS	99.996%	10^{-7}	99.996%	99.996%
CPDLC	99.99%	10^{-7}	99.99%	99.99%
D-FIS	99.9%	10^{-6}	99.9%	99.9%
AIDC	99.996%	10^{-7}	99.9%	99.9%
ADS-B	99.996%	10^{-7}	99.996%	99.996%

1.19.2 It is necessary to make assumptions as to what period of time these statistical figures are to be measured over. For example, if averaged over a week then the achieved performance in one particular minute could have been well outside of these requirements.

1.19.3 Again, there is a need to monitor whether these requirements are being met during operational use of the ATN by applications. This objective is covered by 2.2.2.1.6, End to End Service Monitoring above.

1.20 Transfer Delay Requirements

1.20.1 The performance available to each air-ground application is also defined in the ADSP Manual, as shown in Table 2.2-4.

Table 2.5-4. Transfer Delay Performance Requirements

Performance Levels (ATSC Class)	Mean End-To-End Transfer Delay (sec)	95% End-To-End Transfer Delay (sec)	99.996% End-To-End Transfer Delay (sec)
A	0.5	0.7	1
B	1	1.5	2.5
C	2	2.5	3.5
D	3	5	8
E	5	8	12.5
F	10	15	22
G	12	20	31.5
H	15	30	51
I	30	55	90
J	60	110	180

1.20.2 The requested ATSC class (A through H) can be selected by the application user on dialogue initiation, and is not known in advance.

1.20.3These transfer delay figures are intended to represent the total transfer time from human user input at one side to human user perception at the other end. As the actual transit delay is indirectly dependant on the requested class of communication service, this parameter should be made available with the transit delay measurements. [Objective 15].

1.21 Derivation of QoS Characteristics

1.21.1 It is not a straightforward matter to translate from the operational performance requirements described above into the QoS characteristics of a communications subnetwork. In fact it would be misleading to attempt to do so. The reason is that the end-to-end delay has to be distributed between all the elements (human, automation and communications) involved in the information exchange. There are several discrete entities which require a performance "budget" to be allocated to them, within the overall performance constraints. The following illustration relates to an air-to-ground message:

a) Human User (Air) - thinking time and data input budget
b) Avionics automation (processing) and local data transfer (between equipment) budget
c) Airborne communications processing budget (end system)
d) Air/ground subnetwork budget
e) Ground/ground subnetwork budget
f) Ground communications processing budget (end system)
g) Ground Automation (Data Processing) budget (e.g. FDPS)
h) Local distribution (communications) budget (FDPS to controller positions)
i) Local display automation (processing) budget
j) Human User (Controller) budget

1.21.2 The budget allocation for ground to air messages can be similarly expressed.

1.21.3 When it comes to matching responsibilities for achieving the required performance to the decomposition, the full complexity becomes apparent:

a)Human factors influence the rate at which the users can input or access messages at the HMIs

b)The aircraft manufacturer, airline and avionics industry all play a part in constraining the performance capabilities of the avionics sub-systems and also the on-board communications processors and sub-network interfaces (radios)

c)Theoretical air-ground sub-network performance is governed by the technical solutions (standards) that are invoked, but practical performance is also influenced by congestion and interference levels in a particular environment

d)Theoretical ground sub-network performance is influenced by technical solutions and network design (topology and sizing), but practical performance is also influenced by congestion and network component availability

e)Service providers may be involved in the ground communications processing

f)ATSOs own the FDPS and will therefore influence the effectiveness with which the automation processes data messages to the correct local destination

g)ATSOs also own the internal centre architecture, and specify local communications bandwidths to controller positions

h)Control position design influences the time taken for a message to be presented, and human factors influence the time taken for the recipient to recognise, understand and action the message

1.21.4 As the overall communications characteristics are the result of the aggregation of (possibly several) subnetwork performance and processing performance, it may be useful to develop the concept of "Achievable Communications Performance" (ACP), based on these parameters and calculated at the sub-network level for different traffic and environmental scenarios. The ACP for any given component (e.g. the air-ground subnetwork) can then be compared with the "budget" for that component, to determine whether overall performance target is likely to be met.

1.21.5 During such an analysis, it would also be possible to "trade" budgets between components (use a higher performance but higher cost ground sub-network, in order to accommodate a lower performance, but cheaper, air-ground sub-network.) This kind of analysis constitutes "End to End systems engineering".

2. Fulfillment of Objectives

2.1 As presented below, there is a general requirement to log events locally for later, offline, analysis [Req 1]. Unless stated otherwise, all requirements to log or record events given below imply a local log, rather than a standard SM log that is visible to an SM Agent.

2.2 *Objective 1: End User QoS Measurement*

2.2.1 The end user will need to be able to monitor each of the QoS metrics identified in 2.2.2.1.6, End to End Service Monitoring above.

2.2.2Availability

2.2.3In order to determine the percentage availability according to the above definition, the end user will need to record each successful attempt to use the service [Req 2] and each failed attempt [Req 3]. Analysis of such a record can then determine the percentage availability achieved over a given time period. [Req 4]

2.2.4It is not always straightforward to identify a failure of a connection oriented service, as there may be instances where the connection responder deliberately rejects the connection attempt as part of the normal user protocol operation. Also, the connection may be re-tried by intermediate protocol layers that are not visible to the end-user.

2.2.5Reliability

2.2.6 In order to determine the probability that a message is delivered without errors it will be necessary to record both the number of messages sent to a given destination [Req 5] and those received without errors by that destination, analyzed by sender [Req 6]. Comparison of these two records may then determine the percentage reliability. [Req 7]

2.2.7 There may still be residual errors which are not detected by the destination system. The only way to detect such errors would be an offline comparison of the actual messages logged by the sending system and by the receiving system. This could be undertaken on a statistical sampling basis, to avoid the otherwise prohibitive overhead of having to replay every single application message.

2.2.8 Continuity

2.2.9 In order to determine the continuity, it will be necessary to record each service interruption and each corresponding resumption of service [Req 8]. For the connection-oriented end-to-end service, a service interruption event can be equated to the uncommanded loss of a transport connection, and service resumption to the successful re-establishment of such a transport connection. Analysis of this log can determine the continuity level achieved. [Req 9]

2.2.10 End-to-end Transit Delay

2.2.11 Note that this can vary according to message priority, and ATSC Class.

2.2.12 End-to-end transit delay could be measured by recording the transmission time of each message, and the reception time of each message, at each end of the connection. Comparison of these two records can then determine the actual transit delay provided that both end users have synchronized clocks.

2.2.13 Synchronised clocks can be an impractical requirement, although time synchronization to some degree of accuracy for ATN Routers seems an inevitable requirement (see Objective 10: Measurement of Route Convergence Times). Logging the transmission of each message is expensive and will result in large log files. Some applications have timestamps built-in to certain protocol elements. However, the semantics of the timestamp information are ill-defined and application-specific. Fortunately, there is a more readily available metric from which end-to-end ICS transit delay can be estimated; this is the transport round trip delay.

2.2.14 The connection mode transport protocol (TP4) can readily measure the round trip delay from transmission of a data TPDU to reception of the corresponding AK TPDU. Simply dividing this figure in two gives an estimate for the transit delay, assuming that the transit delay is the same on average in both directions.

2.2.15 In practice, a TS user message (TSDU) may be split into several TPDUs, and transmitted with overlapping acknowledgements. However, the transit delay for the total message can still be estimated by measuring the delay from the transmission of the first TPDU of the TSDU to the reception of the AK TPDU for the last TPDU making up the TSDU, and then subtracting from this the estimated transit delay for a single TPDU. The result is the estimated transit delay for the whole message.

2.2.16 This is an estimate, and each estimation is subject to an error. However, the errors should balance out over several messages, although the potential for systematic errors due to asymmetrical paths in each direction does exist. The transport protocol should record the estimated transit delay for each message, transmission time and the size of each message [Req 10]. Later analysis of the record can then provide an accurate estimate of the achieved end-to-end transit delay, analyzed by message size, and transmission time [Req 11].

2.2.17 Integrity

2.2.18 A high degree of message integrity is built-in to the ATN by design, e.g. by employing the error detection capabilities of the TP4 protocol. However, it is necessary to monitor the probability of errors being mis-detected in order to verify that the theoretical integrity performance targets are in fact being maintained.

2.2.19 By definition, the integrity of the ATN ICS cannot be measured by the ATN Internet because to measure it implies that the Internet can detect its own mistakes - in which case it could then correct them. Integrity has to be measured by the end user either by comparing messages sent and received at each end of the communications path, or by adding an additional message integrity check on transmission, and recording, on reception, the number of messages received correctly and the number received with errors. In the former case, analysis requires access to logs at both end of the communications path while, in the latter case, access is required to only one log. Routine offline comparison of sent and received message logs can thus be used to provide the integrity metric. [Req 12]

2.2.20 Note that the integrity measurement includes not only messages delivered with errors which are not detected at the time of processing, but also error indications which are given when the message was in fact correct (e.g. failure of the checksum algorithm). Thus it is necessary to log not only the content of successful messages, but also (a statistical sample of) rejected messages.

2.2.21 In addition, security provisions are expected to require the use of digital signatures for authentication purposes. A digital signature provides a high quality integrity check. In practice, a likely reason for authentication failure is an undetected network error. When such security mechanisms are implemented, authentication failures should be logged as well as numbers of messages successfully received [Req 13]. The integrity achieved can then be computed from such a record - assuming that real security violations can be filtered out [Req 14].

2.2.22 Throughput

2.2.23 Throughput achieved can be simply measured provided that a log of each message sent (size and time of transmission) over each communications path is maintained [Req 15]. Throughput achieved can then be determined by analysis of the log [Req 16].

2.2.24 Connection Establishment Delay

2.2.25 In the ATN, there are at least three possible measures of connection establishment delay. One is the time taken to establish a transport connection, another is the time taken to establish a connection using the Dialogue Service, and a third is the time taken to establish an application-specific relationship (e.g. to complete the CPDLC-Start service). The latter may be significantly longer than the former, as it usually requires an exchange of messages after the transport connection has been established - although this can be avoided in some cases.

2.2.26 The time taken to establish a transport connection is the proper measure for the performance of the ATN Internet. However, the end user only sees dialogue service connection establishment time. On the other hand, the problem of using this as a metric is that it includes the response time of the remote application. It therefore is not a correct estimate of the performance of the ATN Internet.

2.2.27 Arguably, both metrics need to be recorded and analyzed. Therefore, an ATN End System will need to log both dialogue service D-STARTs [Req 17] and transport connection connect requests [Req 18], and the time at which the request was made. Similarly, an ATN End System needs to log the time at which the connection was successfully established [Req 19]. Later analysis can then determine the mean for both logs [Req 20].

2.2.28 Note that some application services will establish a transport connection, but not a Dialogue, by sending an application response via a negative D-START response primitive. Thus, apparently unsuccessful Dialogue establishments must also be logged.

2.3 *Objective 2: End System (Lower Layers) Monitoring*

2.3.1 In order to monitor End System performance and to quantify the performance of ISPs, the operator of an End System will need to know:

a)At the Internet level, the number and size distribution (mean and max) of packets sent and received, analysed by priority and ATSC Class [Req 21]. When the End System is connected to multiple ISPs, the above will need to be broken down by ISP as well.

b)The transit delay of a packet through the End System (incoming and outgoing) [Req 22]. Note that this need not be measured all the time, but could be measured during system testing and then taken as a system characteristic.

2.3.2 This information will enable the computation of the traffic load on the End System and the load applied to each ISP [Req 23]. The per packet transit delay needs to be subtracted from the end-to-end transit delay in order to compute the ISP transit delay.

2.4 *Objective 3: Subnetwork Service Monitoring*

2.4.1 It is not possible to deal with all aspects of subnetwork monitoring without considering each type of subnetwork. This analysis seeks only to establish the generic requirements. Specific subnetwork monitoring requirements will need to be determined on a case by case basis.
2.4.2 Availability

2.4.3 In order to determine the percentage availability of a subnetwork, the subnetwork user will need to record each successful attempt to use the service and each failed attempt [Req 24]. Analysis of such a record can then determine the percentage availability [Req 25].

2.4.4 It is not always straightforward to identify a failure of a connection oriented subnetwork, as there may be instances where the connection responder deliberately rejects the connection attempt as part of the normal user protocol operation.

2.4.5 Reliability

2.4.6 In order to determine the probability that a packet is delivered without errors it will be necessary to record both the number of packets sent and received at both ends of a subnetwork [Req 26]. Comparison of these two records may then determine the percentage reliability [Req 27].

2.4.7 Continuity

2.4.8 In order to determine the continuity, it will be necessary to record each service interruption and each corresponding resumption of service [Req 28]. For connection mode subnetworks, a service interruption event can be equated to the uncommanded loss of a subnetwork connection, or the inability of the subnetwork to accept data for sending on an established connection. Service resumption is then the successful re-establishment of the connection and the resumption of data transfer. For connectionless subnetworks a service interruption can be equated to a transmission failure, with service resumption being the time of the next successful transmission attempt. (Note that on some connectionless subnetworks, it may not be possible to detect transmission failure).

2.4.9 Analysis of the logs can then determine the number of interrupted and uninterrupted service invocations and hence the continuity of service provided by the subnetwork [Req 29].

2.4.10 End-to-end Transit Delay

2.4.11 There is no general purpose mechanism to measure transit delay over subnetworks. A connectionless network, such as an Ethernet, has no acknowledgement mechanism that would allow round-trip times to be measured. In such cases, transit delay can only be measured by using special link level test packets to convey a time-stamp (assuming clock synchronization) or to "echo back" a response and thereby derive the transit delay from the round trip time.
2.4.12 On the other hand, a connection mode subnetwork, such as X.25, does provide an acknowledgement mechanism, but this is not necessarily end-to-end across the subnetwork and has no real-time constraints. It is thus unsuitable for measurement of transit delay.

2.4.13 The CLNP Echo is potentially available to provide an estimate of round trip delay between a pair of Routers or a Router and an End System attached to the same subnetwork. However, the processing delay within the target system is potentially significant and will need to be independently measured and factored out. Furthermore, CLNP echo is of limited value when more than one subnetwork joins the same pair of systems, as it is not possible to guarantee which subnetwork is used to transfer the Echo packet.

2.4.14 A strategy for measurement of transit delay will need to be developed for each type of subnetwork. For connectionless subnetworks, or wide area networks involving multiple hops, this will need to be based on some kind of subnetwork specific echo packet. For single hop connection mode networks this may use the subnetwork's own acknowledgement procedures.

2.4.15 For example, in VDL Mode 2, the air/ground data link uses a connection mode variant of HDLC (the AVLC) which could be used to measure round trip time and hence to estimate transit delay.

2.4.16 Integrity

2.4.17 Data integrity problems can be measured by two ATN Internet mechanisms:

a)The CLNP Header Checksum. This only covers the CLNP header, and its generation by a sending End System is not mandatory in the ATN SARPs. It is therefore of limited value.

b)The Deflate checksum. This provides an integrity check over the entire packet and is therefore a very good check on integrity. However it is only available when the optional Deflate-based compression is used.

2.4.18 A log should be kept of the number of packets sent and received over a subnetwork, those rejected by the subnetwork, and those received with a failed CLNP Header checksum, or a Deflate checksum failure [Req 30]. Later analysis of the log, compared with errors detected by the subnetwork user, can then provide an estimate of the subnetwork undetected error rate [Req 31].

2.4.19 Throughput

2.4.20 Throughput achieved can be simply measured provided that a record of each packet sent (size and time of transmission) over each communications path is maintained [Req 32]. Offline analysis of this record may then be used to determine throughput. [Req 33]

2.4.21 Connection Establishment Delay

2.4.22 For connection mode subnetworks, the time at which each subnetwork connection is initiated and the time of successful establishment should be recorded [Req 34]. Later analysis of the record can then be used to determine the subnetwork connection establishment delay [Req 35].

2.5 *Objective 4: Measurement of Path Segment Performance*

2.5.1 The requirements for measuring path segment performance are related to the performance management model adopted. They are hence discussed in Objective 12: Analysis of Data Stream Performance below.

2.6 *Objective 5: Monitoring for Excess Capacity*

2.6.1 Excess capacity occurs when there exist underused data links. These could potentially be removed or replaced by less performant and lower cost data links.

2.6.2 Two metrics are required to determine excess capacity: the actual throughput over each subnetwork (peak) and the available throughput. When the peak throughput is significantly lower than the available throughput then the data link may be eliminated if a suitable (and also underused) alternative exists. Alternatively, it could be replaced by a lower cost/capacity subnetwork. The throughput threshold when a lower cost/capacity subnetwork is realistic needs also to be known.

2.6.3 Subnetwork throughput is determined from subnetwork monitoring (see Throughput 2.2.2.2.4.19). The available throughput and the threshold for downgrading to a lower cost/capacity subnetwork are required to be known a priori. A monitoring tool should be available to monitor subnetwork utilisation and report on candidates for downgrading [Req 36].

2.7 *Objective 6: Planning Future Capacity*

2.7.1 Capacity planning requires the development of a network design model [Req 37]. This will comprise the Routers, subnetwork interconnections and predictions of data flows through the internetwork, with both normal and busy hour profiles required. From this model, the capacity requirements of subnetwork connections and Routers can be predicted.

2.7.2 In the ATN, the Network Design Model is complicated by the existence of ATSC Class which restricts the options for data flow, as well as other types of traffic such as AOC. It will also be necessary to use the model to predict behaviour during outages. For this reason, more than a simple static model may be required, in order to simulate the impact of subnetwork connection and Router loss, and to demonstrate that there is sufficient capacity to maintain the required Quality of Service to high priority applications during such failures.

2.7.3 The model will require good quality information on the expected traffic flows if it is to be useful. Furthermore, accurate predictions of future traffic levels will be necessary if it is to be used to plan the growth of the network. This requires capture of information on current network loading and analysis of historical network performance information in order to perform trend analysis and hence to predict future growth.

2.7.4 The following data is thus required to be recorded during daily operations and kept for historical analysis:

a)Data volumes for each subnetwork on a point to point basis and during each sample period [Req 38].

b)Data volumes (both bytes and packets) handled by each Router during each sample period [Req 39].

2.7.5 The above needs to be analyzed by priority and ATSC Class.

2.8 *Objective 7: Dynamic Capacity Management*

2.8.1 There are three requirements that flow from this. The first is a need for an indication that the packet flow rate over a given subnetwork has increased beyond some threshold that implies a need for additional capacity. The second is a corresponding indication that the additional capacity is no longer required, and the third is the means to bring on new capacity.

2.8.2 *Indicating the need for Additional Capacity*

2.8.3 The first indication that the applied load is reaching the limits of the subnetwork will be an increase in the queuing delay for packet transmission over that subnetwork. This could be measured as either the absolute queuing delay per packet, or, perhaps more easily, as the average queue length during a sample period. As queue length is proportional to queuing delay, this should be sufficient.

2.8.4 An alternative mechanism might be to measure the actual throughput over some period and compare it against the maximum achievable. However, this requires knowledge of the maximum achievable throughput and, as this is not necessarily a constant (if the subnetwork includes an element of statistical multiplexing), this can be difficult to predict accurately. This can be further complicated if more than one subnetwork is already used to support a router to router adjacency.

2.8.5 Average queue length is thus the preferred mechanism for determining when an event should be generated requesting additional capacity. As the quality of service requirements can differ by priority, there may need to be different reporting thresholds for different priority bands [Req 40].

2.8.6 *Indicating When Additional Capacity is no longer Needed*

2.8.7 The inverse of the above may be readily adopted as the signal that indicates when capacity may be reduced i.e. when the average queue length drops below some threshold, However, the normal queue length (i.e. when load and capacity are in balance) will be between zero and one. Therefore, the measure of average queue length will have to be a real number if it is to be useful [Req 41].

2.8.8 Alternatively, if throughput levels are used to determine when the additional capacity is to be provided, then throughput monitoring (as in Objective 5: Monitoring for Excess Capacity) should also be used to determine when the additional capacity is to be withdrawn.

2.8.9 *Adding and Removing Additional Subnetwork Capacity*

2.8.10 There is a need for Systems Management Actions to be provided to bring up new subnetwork connections or to remove existing subnetwork connections in response to the above events. While these actions could be invoked by a remote manager, the simplest implementation is probably to have a local response (i.e. within the Systems Management Agent) [Req 42].

2.9 *Objective 8: Router Forwarding Measurement*

2.9.1 In addition to the data forwarded by a Router, as required above, a complete assessment of the Router's performance will also require that packet discards are recorded and analyzed by discard reason [Req 43].

2.9.2 If the reason for packet discard is "congestion", then this may be indicative of a lack of network capacity. There is thus a need to report, to a Network Manager, when the number of such discards exceeds a given threshold during a reporting period [Req 44].

2.10 *Objective 9: Router Key Parameters Measurement*

2.10.1 The key parameters of the Router that affect forwarding must also be measured. This may include system specific parameters [Req 45] (e.g. memory utilization) and the number of entries in the Forwarding Information Base (FIB) [Req 46].

2.11 *Objective 10: Measurement of Route Convergence Times*

2.11.1 The measurement of Route Convergence Time requires that each Router records each routing event for collection and later analysis [Req 47]. Furthermore, so that routing events in different routers can be correlated, each must have a synchronised clock [Req 48]. The accuracy of the synchronization is for further study.

2.11.2 An offline tool will be required to perform the analysis. This will analyse the logs provided by each Router and correlate routing events between routers. This tool will be required to determine the time taken from each change in the network topology to a stable routing set being reached in every router, including the elimination of any false routes that may have been introduced as a consequence of the change.

2.11.3 Trend analysis of route convergence rates will also be necessary against historical data in order to predict the need for higher performance routers. This is so that the convergence time does not increase to the point at which the end-to-end Quality of Service falls below acceptable levels [Req 49].

2.12 *Objective 11: Air/Ground Router Overhead Measurement*

2.12.1 An Air/Ground Router will need to log:
a)Establishment and termination of adjacencies with Airborne Routers [Req 50].

b)Establishment and termination of subnetwork connections with Airborne Routers [Req 51].

2.12.2 A tool will be required to analyze such logs and thus to determine the numbers of such adjacencies and subnetwork connections at any one time and to compare this against the monitored performance of the router. The maximum number of adjacencies and subnetwork connections that can be maintained without significantly impacting performance can then be determined, and hence the need for future capacity planned [Req 52].

2.13 *Objective 12: Analysis of Data Stream Performance*

Note. The need for this objective depends upon the model for service level agreements developed by the industry.

2.13.1 If the performance assessment mechanism adopted by the ISP requires that data flows are individually monitored, then the ISP will need to demonstrate compliance with Quality of Service metrics for a given user's data flows. In turn, this requires identification and metering of data flows on both entry to and exit from the ISP.

2.13.2 The metrics to be monitored are those appropriate to a connectionless internet i.e. Transit Delay, Integrity, Throughput and Reliability [Req 53].

2.13.3 The metering of packets (both by number and size) on entry and exit can be used to assess both throughput and reliability. Note that as different service levels may apply to different priorities and ATSC class, data flows may require separate meters by priority and ATSC Class, as well as other traffic types such as AOC.

2.13.4 Throughput can then be measured by direct computation of the metered values. An assessment of reliability can be gained by comparing counts of packets that entered the ISP's network with those on exit [Req 54].

2.13.5 Measurement of transit delay is not quite so straightforward. The "brute force" approach would be to log each individual packet on entry and exit and to record the time of entry and exit. Offline analysis could then compute the transit delay for each packet and hence the average transit delay, etc. Alternatively, time-stamped user messages could be sent. Both of these would require synchronized clocks at each end.

2.13.6 However, this approach would be computationally expensive and is not readily justifiable. Instead two approaches are possible:

a)A sample of such packets is logged. The sampling procedure could use some algorithm based on the packet identifier in order to select packets for logging and this would guarantee the same packets were selected at each end of the link. The approach is basically the same as the brute force approach, but it does reduce the amount of data to be logged and processed.

b)Periodic echo packets are sent on the data flow. These can be used to directly compute the round trip delay and hence derive the transit delay.

2.13.7 As the computational effort is much lower, the use of periodic echo packets for transit delay monitoring is to be preferred. The echo packets will need to be sent at various ATSC classes and priorities in order to determine the service levels for each ATSC class and priority [Req 55].

2.14 *Objective 13: Monitoring of Service Provider Compliance by Aggregate Data Flows*

> *Note. The need for this objective depends upon the model for service level agreements developed by the industry.*

2.14.1 In the macroscopic view, the ISP is interested only in the total data flow at each entry and exit point. There is no analysis to the level of individual data flows. In general, this objective requires less computational effort than Objective 12 and hence it may be preferred.

2.14.2 The metrics are still the same i.e. Throughput, Transit delay and Reliability. Again, they may need to be metered by ATSC Class and priority. However, the meters are on aggregate values and not on individual data flows [Req 56].

2.14.3 Total throughput can be calculated from this information as can an overall assessment of reliability. Transit delay will have to be determined by use of periodic echo packets between all entry points and all exit points. The echo packets will need to be sent at various ATSC classes and priorities in order to determine the service levels for each ATSC class and priority [Req 57].

2.15 *Objective 14: Monitoring of User Message Delivery*

2.15.1 In monitoring the general performance objectives for user message delivery, it is necessary to define, for every application, at what point a "message" is considered to be submitted to the communication subsystem, and at what point it is considered to be received. There is a finite possibility of user messages being lost or corrupted in the local end-systems, or of failure to resolve a recipient address correctly after the message is deemed to have been submitted. There is also the possibility of message submission being refused at source (e.g. due to lack of local resources), but such messages would not be included in the non-receipt statistics.

2.15.2 For ATN applications, a "User" message can be considered as submitted or received when it crosses the ASE service boundary. Although there is no requirement for the abstract ASE service to be physically realized, there would seem to be a requirement, from a performance management standpoint, that an event is logged whenever a user message crosses the notional ASE service boundary. [Req 58].

2.15.3 The requirement is to detect user messages which were submitted and then either:
a)mis-delivered (i.e. delivered, but to a peer user other than the intended recipient),

b)not delivered to the intended recipient (lost or mis-delivered), with notification to the originator,

c)not delivered to the intended recipient, with no notification to the originator.

2.15.4 Two approaches are possible:

a)In the direct end to end approach, user messages submitted and received are logged at each peer user system and the logs are later compared in order to detect mis-matches.

b)Alternatively, the probability of message loss occurring within the peer end systems could be computed by analysis of local traces, and the probability of message loss or mis-direction by the ICS computed separately, and then the figures combined.

2.15.5 In any case, it is not possible to monitor the non-receipt statistics in real-time. The analysis must be performed off-line, probably by statistical sampling rather than analysis of every user message. The non-receipt statistics must then be aggregated over an agreed period of time. [Req 59].

2.16 *Objective 15: Monitoring of User Message Transfer Times*

2.16 1 There is no general purpose mechanism to measure transit delay between application users. An unconfirmed application message such as an ADS Report, has no acknowledgement, and in such cases the transit delay can only be definitively measured by use of time-stamps.

2.16.2 On the other hand, a confirmed application service, such as CM-Logon, does provide an acknowledgement, but this has no real-time constraints and is thus unsuitable for measurement of transit delay. Other application services have optional responses, such as CPDLC LACK messages, and these could potentially be utilized to measure round-trip times when present. However, the processing delay within the target system is potentially significant and will need to be independently measured and factored out.

2.16.3 A strategy for measurement of transit delay will need to be developed for each type of application. For unconfirmed application messages, this will need to be based on timestamps and synchronized clocks, or else some kind of systems management echo function will have to be defined. For confirmed application services this may use the application's own acknowledgement procedures.

2.16.4 To measure transfer times directly would require time-stamping of all application data at the moment it is submitted to the communications subsystem for sending. Then, assuming synchronized clocks across the ATN, the receiving system can directly compare the times of sending and receiving. If clocks are not synchronized, it would be possible to estimate the time differential between pairs of systems by the exchange of calibration messages.

2.16.5 However, there is no systematic time-stamping of application APDUs in the currently-defined ATN applications. Time stamps are available in:
a) All CPDLC uplink and downlink messages, where the date/time can be set, with 1 sec resolution, by the CPDLC-User.
b) All ADS reports sent air-ground, with 1 sec resolution.

2.16.6 Use should be made of application time-stamps, where available, to estimate the end to end transfer delays of user messages. [Req 60].

2.16.7 Where application messages are not time-stamped and/or there is no time synchronization, the "typical" transit delay can be estimated via a round trip exchange. The measure then includes "budgets" for human response times, system processing times and communication transit delays. If no dialogue was in place, the delay includes the connection establishment delay and the transfer delay for the two messages. Otherwise, the delay includes the data transfer delay for the two messages only.

2.16.8 For each confirmed application service, the mean and maximum round trip delay values can be measured directly. [Req 61].

2.16.9 For all applications, including unconfirmed services, the transfer delay can be estimated by factoring out the delay imposed by the ATN internet and upper layers from the delay imposed by the human response time and system processing time. The latter will be fairly static, while the ATN internet transit delays can be determined as described in 2.2.2.2.2.10: End to End Transit Delay.

2.16.10 The objective is to maintain a log of user message transfer times vs. requested ATSC class for offline statistical analysis. Over a given period, the mean, 95% and 99.996% end to end transfer delays can then be computed for received user messages for each ATSC class. [Req 62].

2.16.11 Note that it is not necessarily an error when an individual message exceeds one of the transfer time thresholds, since a finite percentage of messages are allowed to exceed the delay thresholds. The question remains whether or not to:

a)signal to the peer users when an individual message exceeds one of the transit time thresholds, or

b)notify the SM manager when an individual message exceeds one of the transit time thresholds.

2.3 Summary of Performance Management Requirements

The following requirements have been derived from the preceding analysis. There is also an implicit requirement [Req 63] to be able to selectively enable and disable event logging where a requirement to log an event is identified.

General

All ATN systems are required to keep local event logs for the recording of designated systems management events. Some mechanism must also be provided to transfer these logs to an offline processor. [REQ 1].

All ATN Systems are required to log each successful and each unsuccessful attempt to establish a connection over a connection mode subnetwork. [REQ 24].

All ATN Systems are required to log the number of successful and unsuccessful attempts to send a packet over a connectionless subnetwork. [REQ 24].

All ATN Systems are required to log the number of packets sent and received over each subnetwork or subnetwork connection, and to count the volume of data sent and received, analyzed by priority and ATSC Class. [REQ 26, REQ 32, REQ 38].

All ATN Systems are required to log the time of uncommanded loss of a subnetwork connection. [REQ 28].

When possible, ATN systems are required to log the time of each failure to transmit a packet over a connectionless subnetwork, and time of the next successful transmission attempt. [REQ 28].

All ATN Systems are required to keep a count of the number of packets received with a CLNP header checksum failure. [REQ 30].

When Deflate is implemented, ATN Systems are required to keep a count of the number of packets received with a Deflate checksum failure. [REQ 30].

On each connection mode subnetwork, an ATN system is required to log the time at which each connect request is sent and the time at which the connection is successfully established. [REQ 34].

All ATN Systems are required to monitor average queue length analyzed by priority during each sampling period, and to generate a notification when the average queue length exceeds a set threshold (high watermark) or drops below another set threshold (low watermark). [REQ 40, REQ 41].

When subnetworks or subnetwork connections can be dynamically managed, Systems Management actions are required to be available to activate and deactivate them. [REQ 42].It should be possible to selectively enable and disable event logging where a requirement to log an event is identified. [REQ 63].

End System

The user application is required to record, in a local log, each successful attempt to establish an end-to-end connection [REQ 2].

The user application is required to record, in a local log, each unsuccessful attempt to establish an end-to-end connection [REQ 3].

The transport layer is required to record, in a local log, the number and total size of user messages sent on each transport connection, in a measurable time period. [REQ 5, REQ 15].

The transport layer is required to record, in a local log, the number and total size of user messages received, with and without errors, on each transport connection, in a measurable time period. [REQ 6, REQ 15].

The transport layer is required to record, in a local log, each connect request, and the time at which the connect request was issued. [REQ 18].

The transport layer is required to record, in a local log, the time of each successful connection establishment. [REQ 19].

The transport layer is required to record, in a local log, each uncommanded transport connection loss. [REQ 8].

The transport layer is required to record the measured round trip delay between transmission of a TPDU and its acknowledgement together with an indication of whether the TPDU marks the end of a TSDU. [REQ 10].

When authentication is implemented, authentication failures are to be logged. [REQ 13].

The Dialogue Service is required to record, in a local log, each connect request, and the time at which the connect request was issued. [REQ 17].

The Dialogue Service is required to record, in a local log, the time of each successful connection establishment. [REQ 19].

The number, average and maximum size of CLNP packets sent and received during a reporting period are required to be logged. These are to be analyzed by ATSC Class and priority, and by each data link. [REQ 21].

The mean transit delay of packets through an End System is required to be measured under various loading conditions. [REQ 22].

An event is required to be logged whenever a user message crosses the notional ASE service boundary. [REQ 58].

Use should be made of application time-stamps, where available, to log the end to end transfer delays of user messages. [REQ 60].

For each confirmed application service, the round trip delay between request and confirmation messages should be logged. [REQ 61].

Router

ATN Routers are required to keep counts of packets forwarded and data volumes, analyzed by priority and ATSC Class. [REQ 39].

ATN Routers are required to log packet discards by discard reason. [REQ 43].

When the rate of packet discards due to congestion in a given period exceeds a defined threshold, then a notification should be sent to a network manager. [REQ 44].

System specific parameters that affect forwarding performance should be logged [REQ 45].

Changes to the number of entries in a Router's FIB should be logged. [REQ 46].

ATN Routers are required to log each route received and each route advertised to another router, recording the time received/advertised. [REQ 47].

ATN Routers are required to maintain synchronized clocks, to a specified accuracy, for event logging purposes. [REQ 48].

An Air/Ground Router should log the establishment and termination of adjacencies with Airborne Routers [REQ 50].

An Air/Ground Router should log the establishment and termination of subnetwork connections with Airborne Routers [REQ 51].

Depending on the performance assessment model adopted, ATN Routers may be required to meter each data flow, counting number of packets and data volumes for each identified data stream, where a data stream is identified by a unique combination of source, destination, priority and ATSC Class. [REQ 53].

Depending on the performance assessment model adopted, ATN Routers may be required to meter the number of packets and data volumes received from each identified source and sent to each identified destination. Separate meters are required for each ATSC Class and priority. [REQ 56].

Offline Analysis Tools

A tool is required to process logs of connection establishment successes and failures in order to determine the service availability. [REQ 4].

A tool is required to process logs of messages sent and received on individual transport connections and to correlate the logs at both ends of the same transport connection, in order to determine reliability. [REQ 7].

A tool is required to analyze transport layer logs for uncommanded transport connection disconnects and the later successful re-establishment to the transport connection to the same destination, if any. This is to measure service continuity. [REQ 9].

A tool is required to analyse TPDU round trip delay logs in order to estimate the average transit delay per user message. [REQ 11].

A tool is required to analyse the user messages recorded (both airborne and ground). The tool would correlate individual messages and compare them for any loss of data integrity.
[REQ 12].

A tool is required to analyze logs of security authentication failures, in order to assess the data integrity achieved. [REQ 14].

A tool is required to analyze logs of messages sent and received per transport connection, correlated with application type, in order to determine the achieved throughput for each application. [REQ 16].

A tool is required to analyze End System logs to determine the load placed on the network by the End System. [REQ 23].

A tool is required to analyze subnetwork access logs in order to derive the percentage availability of each subnetwork. [REQ 25].

A tool is required to analyze subnetwork usage logs, to correlate the logs of all users of a given subnetwork, and hence to determine subnetwork reliability. [REQ 27].

A tool is required to analyze subnetwork logs in order to determine the continuity of service. [REQ 29].

A tool is required to analyze packet received counts, and CLNP Header and Deflate checksum failures in order to assess subnetwork integrity. [REQ 31].

A tool is required to analyze logs of data volumes sent over each subnetwork in order to determine the achieved throughput. [REQ 33].

A tool is required to analyze logs to determine the connection establishment delay for subnetworks, transport and dialogue services. [REQ 35, REQ 20].

A tool is required to analyze logs of subnetwork usage in order to compare achieved utilisation against available capacity and hence to identify where excess capacity may exist. [REQ 36].

A Network Design Model is required for capacity planning purposes. [REQ 37].

A tool is required to analyze router logs of packets forwarded and discarded and hence to assess router throughput. [REQ 43].

A tool is required to measure route convergence rates and to predict future trends in route convergence rates. [REQ 49].

A tool is required to analyze the impact on an Air/Ground Router of the number of Airborne Router adjacencies and subnetwork connections that it supports. [REQ 52].

Depending on the performance assessment model adopted, a tool may be required to analyze data stream meters in order to determine throughput and reliability as provided to each service user. [REQ 54].

A tool is required to generate echo packets in order to measure roundtrip delay and hence transit delay for each identified data stream. [REQ 55, REQ 57].

Depending on the performance assessment model adopted, a tool may be required to analyze meters at entry and exit points in order to determine throughput and reliability as provided by the Service Provider. [REQ 56].

A tool is required to compare end system logs of user messages sent versus those delivered, non-delivered and mis-delivered. The non-receipt statistics must then be aggregated over an agreed period of time. [REQ 59].

A tool is required to analyze logs of user message transfer times vs. requested ATSC class. Over a given period, the mean, 95% and 99.996% end to end transfer delays should be computed for received user messages for each ATSC class. [REQ 62].

Open Issues

A strategy is required on a per subnetwork basis to measure transit delay over that subnetwork.

Subnetwork specific monitoring criteria need to be developed.

There is the potential need for an industry group to collate together ISP performance statistics and to plan development of future capacity.

The question remains whether or not to signal to the peer users and/or notify the SM manager when an individual user message exceeds one of the transit time thresholds.

A strategy for measurement of transit delay will need to be developed for each type of application.

"User" Communications Performance Over ATN

Communications performance (per Doc. 9705, Table 1-1, ATSC class specifying 95% one-way transit delay) is specified by "user" systems in the initial connection request for e.g. CPDLC, ADS, or CM.

The sender of a user message thus requests that a particular ATSC class be assigned to that message. The ATN Internet will use best endeavors to honor that request. If the requested ATSC class is unavailable, the first known ATSC class higher than that requested or, if there is no such route, the first known route of lower ATSC class than that requested is provided.

The recipient of a user message knows the ATSC class requested for the current dialogue, but has no knowledge of the ATSC class(es) of the route actually used. (For example, for CM, the ground "user" system has no means of knowing the ATSC class available or used for the CM Logon request, i.e. the ground "user" system is unaware of the sub-network used, or the communication performance available, at time of log-on).

For example, when a "user" system requests a connection, it specifies an ATSC communication class C or D, e.g. within a CPDLC_connect_request issued by a ground system. If the requested 'C' is not available, and there is no better class available, the next best would be offered until 'no preference' is reached. Neither the requesting nor confirming "user" is notified of the class eventually used.

If communication via any path, at any class, is or becomes completely unavailable, the "user" is notified by a provider abort (i.e. in the example case, TP4 notifies the Dialogue Service, which notifies the CPDLC ASE, which notifies both the air and ground "user" systems via the CPDLC-provider-abort service).

The ATSC class established and made available for a connection is dependent upon sub-network availability (e.g. VHF, Mode-S, Satellite), and performance subsequently provided to the "users" can therefore change after connection is established if, for example, a sub-network becomes available or is temporarily lost. This can happen between "user" messages, or within the same "user" message, and will result in a performance increase or degradation over that previously observed for these "users". The requesting "user" is not notified of any such changes, but must infer it from observed performance.

Systems Management (SM) functions could report e.g. excessive delays, based on monitoring done by protocol layer (e.g. transport, CPDLC ASE). The output of such SM functions could for example be communicated to technical watch facilities, or the "user" systems, if desired. This has not yet been specified. Such notifications could then be used for example to terminate communications if the offered performance went too low, though this would ignore the fact that any degradation could be only temporary. SM functions are designed for communications system monitoring, and not for "user" service observation. Therefore, use of SM functions may provide information to the "users", but should not be viewed as a replacement for operational datalink Service level monitoring.

Recommendations for initial ATN datalink operations have been made in other fora as follows:

a)End Users should identify requirements for the SM Manager specifications to enhance, but not replace, Service level monitoring. This could include e.g. aborting the link based on performance observed for other "users" and this aircraft (e.g. AOC exchanges), or aborting the link if the available sub-networks are reduced to only those known to be incapable of meeting the originally specified class of service based on static definitions.

b)ATN "user" systems should consider implementing timer monitoring functions for CPDLC connection requests, and connection triggering messages for ADS, to establish the current performance being offered.

c)ATN "user" systems should consider implementing timer monitoring functions for other regular exchanges, at the Service Level, to identify changes in performance levels. The aim would be to terminate the connection if performance drops below that operationally required for datalink in the area concerned.

For those End User systems which use Logical Acknowledgements, CPDLC round-trip monitoring could be based on LACK message

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INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA AND PACIFIC OFFICE

ASIA/PAC REGIONAL AERONAUTICAL TELECOMMUNICATION NETWORK (ATN)

DOCUMENTATION TREE

Third Edition – April 2005

Issued by the ICAO Asia/Pacific Regional Office, Bangkok

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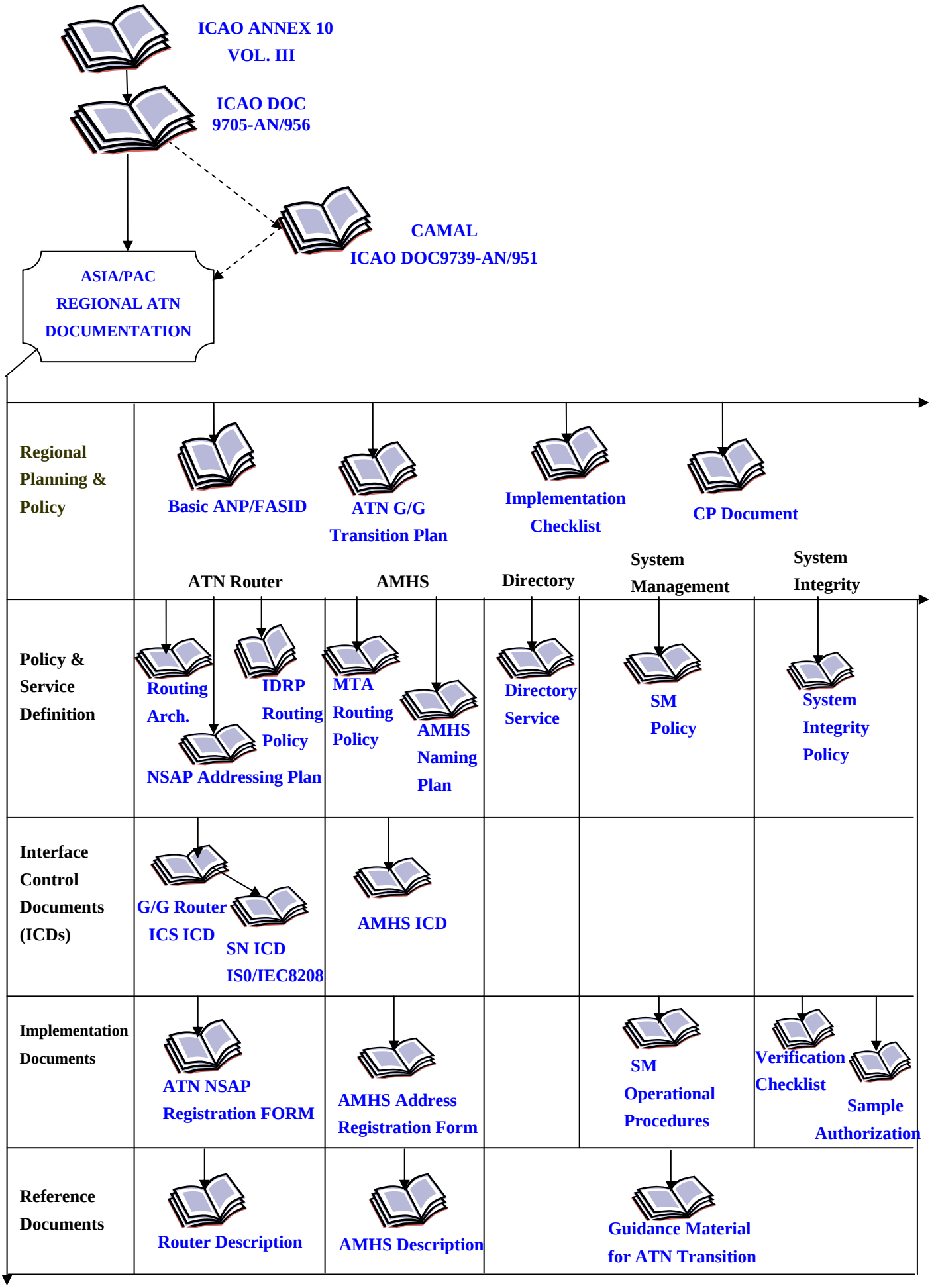
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ATN DOCUMENTATION TREE

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DOCUMENTATION TREE - APRIL 2005



3. DOCUMENTATION PROFILES

3.0 ATN Documentation Tree

Title: ATN Documentation Tree

Latest Version: 3rd Edition - 2005

Purpose: This document provides index hierarchy on relevant ATN documents that are available to assist States in their ATN planning and implementation programmers.

Contents: Names of the relevant documents; Brief introduction to the purpose and contents of each document. It also provides last edition and history of the documents.

Remark: The 1st Edition of this document was developed by ATNTTF/4 in 2002 and adopted by APANPIRG/13 under Conclusion 13/14. It was further updated in 2003, 2004 and 2005 respectively to reflect those latest ATN planning and implementation related documents developed by ATN Transition Task Force.

STANDARDS AND TECHNICAL PROVISIONS

3.1 ICAO Annex10 Vol. III

Title: International Standards and Recommended Practices, Aeronautical Telecommunications, Annex 10 Volume III.

Latest Version: First Edition - 1995 and its last update in January 2004 including Amendment 79

Purpose: This ICAO document defines the Standards and Recommended Practices (SARPs) for the Aeronautical Telecommunication Network (ATN) in its Part I.

Contents: Subjects covered by the document:

- Part I – Digital Data communication Systems;
  - Chapter 1 – Definitions;
  - Chapter 3 – **Aeronautical Telecommunication Network;**
  - Chapter 4 – Aeronautical Mobile-Satellite Service;
  - Chapter 6 – VHF Air-Ground Digital Link (VDL);
  - Chapter 8 – AFTN.

- Part II – Voice Communication Systems;
  - Chapter 2 – Aeronautical Mobile Service;
  - Chapter 4 – Aeronautical Speech Circuits;
  - Chapter 5 – Emergency Locator Transmitter (ELT) for search and rescue.

3.2 Manual of Technical Provisions for the Aeronautical Telecommunication Network - ICAO DOC 9705 – AN/956

Title: Manual of Technical Provisions for the Aeronautical Telecommunication Network (ATN)

Latest Version: 3rd Edition - 2002

Purpose: This ICAO manual contains detailed technical information and serves to further elaborate on the ATN standards as defined in Chapter 3 of Annex 10, Volume III, Part I.

Contents: Subjects covered by the document:

- Sub-Volume I – Introduction and System Level Requirements;
- Sub-Volume II – Air-Ground Applications;
- Sub-Volume III – Ground-Ground Applications;
- Sub-Volume IV – Upper Layer Communications Services (ULCS);
- Sub-Volume V – Internet Communications Services (ICS);
- Sub-Volume VI – ATN Systems Management Provisions;
- Sub-Volume VII – ATN Directory Service;
- Sub-Volume VIII – ATN Security Service;
- Sub-Volume IX – ATN Identifier Registration.

3.3 Comprehensive Aeronautical Telecommunication Network Manual (CAMAL) – ICAO DOC 9739 – AN/961

Title: Comprehensive Aeronautical Telecommunication Network (ATN) Manual.

Latest Version: 2nd Edition - 2002

Purpose: This document provides guidance material in support of the ATN SARPS as defined in Annex10, Vol. III and Doc9705.

Contents: Subjects covered by the document:

- Components, functionality and concepts of the ATN;
- ATN Internet lower layer routing protocols;
- ATN Upper layer application protocols;
- ATN sub networks and corresponding SNDCF's layers;
- Air-ground applications, ADS, CPDLC, CM, FIS;
- Ground-Ground applications ATSMHS, AIDC.

PLANNING AND POLICIES

3.4 Basic Air Navigation Plan (BANP) and Facilities and Services Implementation Document (FASID) ICAO Doc9673

Title: ASIA/PAC Basic Air Navigation Plan/Facilities and Services Implementation Document.

Latest Version: 1st Edition – August 2001

Purpose: This document contains operational requirements for facilities and services as specified in Part IV, CNS of both the ASIA/PAC BANP and FASID. The regional policy and procedures regarding implementation of ATN adopted by APANPIRG is provided in

the BANP. The detailed planning and implementation information is provided in the relevant CNS tables of FASID.

Contents: Subjects covered by the document:

- Table 1A, AFTN/Circuit Plan;
- Table 1B, ATN Router Plan;
- Table 1C, ATSMHS Routing Plan;
- Table 1D, AIDC Circuit Plan.

Remark: This planning and implementation document has been amended from time to time in accordance with the established procedure. The ATN related tables were gradually introduced into this planning document and/or updated later through such amendment process. The CNS Tables 1A, 1B, 1C and 1D were updated in 2004 and adopted by APANPIRG/15. The operational requirements for using AIDC between States to be included in the Table 1D were required to be identified by States. Therefore the Table 1D was circulated to States in early 2005 for comments.

3.5 ATN Ground-Ground Transition Plan

Title: ASIA/PAC ATN Transition Plan.

Latest Version: 2nd Edition - March 2004

Purpose: This document describes the transition activities that are to be performed by States in the region for a coordinated migration from AFTN to the new ATN environment.

Contents: Subjects covered by the document:

- Existing ground infrastructure;
- ATN End system applications;
- ATN Traffic, both ground-ground and air-ground communication paths;
- ATN routing architecture;
- ATN backbone trunks;
- Interconnection of ATN routers;
- Transition activities.

Remark: This document was adopted by APANPIRG/12 with its Conclusion 12/14. Subsequent to discussions stemming from the CNS/MET SG/5 meeting in 2003, much of the document's contents has been transferred into the CNS FASID. As it is part of ASIA/PAC Regional ATN Planning Document, it was reissued as Second Edition in March 2004.

3.6 Checklist for Implementation of Ground/Ground ATN Infrastructure

Title: Checklist for Implementation of Ground/Ground ATN Network Infrastructure

Latest Version: 2nd Edition - March 2004

Purpose: The checklist indicates those **initial activities** that are to be performed by States for a coordinated migration from AFTN to the new ATN environment.

Contents: This document describes the steps of implementation which should be considered by the States.

Remark: It was adopted by ANPANPIRG/13 in 2002

3.7 Communication Performance for ATN

Title: ASIA/PAC Regional Communication Performance Document for ATN

Latest Version: Revision 4.0 - April 2005 was endorsed as first Edition by the ATNTTF/7.

Purpose: This document provides guidance on the ATN performance. Information on the definition of Required Communication Performance (RCP) defined by OPLINKP and the monitoring of ATN performance are provided. A set of performance parameters is described for planning phase. The operational environments are considerably different within the ASIA/PAC Region because of the air space complexities and traffic volume (air traffic as well as data traffic). Therefore, guidance provided in the document has to be adaptable to the environment of interest.

Contents: Subjects covered by the document:

- Background;
- Basics of Performance;
- Definition of Operational Aeronautical Telecommunication Process;
- Characterization of Aeronautical Telecommunication Performance;
- Required Operational Communication Performance: RCP;
- RCP Types;
- Understanding, Determining , Prescribing and Complying with RCP Types Performance;
- ATN; ATN Applications and ATN Communication Services
- Monitoring, ATN Performance.

Remark: The first draft of this document was reviewed in April 2002 by ATNTTF/4 and was updated in 2003 and 2004. The document was further revised in early 2005 to align with the RCP Manual being developed by OPLINKP. It was endorsed as 1st Edition by ATNTTF/7.

ATN GROUND INFRASTRUCTURE (Router and Routing)

3.8 ATN Routing Architecture

Title: ASIA/PAC ATN Routing Architecture

Latest Version: 2nd Edition - March 2004

Purpose: This document provides technical guidance on the transition to the Aeronautical Telecommunication network (ATN) for the ground-ground communication in the ASIA/PAC Region. The routing architecture is designed primarily for the ground-ground infrastructure to eventually replace the existing AFTN. It is intended that this architecture will also be suitable for the accommodation of the air-ground communications traffic in the future.

Contents: Subjects covered by the document:

- Routing Domain Fundamentals;
- Router Fundamentals;
- ASIA/PAC Regional Routing Architecture;
- Routing domains;
- ATN Transition.

Remark: This document was adopted APANPIRG/12 in 2001 for distribution to States in the ASIA/PAC and adjacent regions. This document as part of ATN Planning document was included in its 2nd Edition which was issued in March 2004.

3.9 ATN IDRP Routing Policy

Title: ASIA/PAC ATN Inter Domain Routing Policy (IDRP)

Latest Version: 2nd Edition - May 2004

Purpose: This document provides policy for ATN routers operating in the ASIA and Pacific Region in support of ATSMHS and other ATN applications. The ASIA/PAC ATN IDRP document would allow States/Organizations to have additional local routing policies. Such policies may include various local preferences or Quality of Service based routing, for example: routing based on line error rates, delay, capacity and priority.

Contents: Subjects covered by the document:

- Routing policy goals
- Policy requirements for ATN routers

Remark: This document was adopted by APANPIRG/14 in 2003 under Conclusion 14/14. It was further updated in May 2004.

3.10 ATN NSAP Addressing Plan

Title: ASIA/PAC ATN Network Service Access point (NSAP) Addressing Plan.

Latest Version: 2nd Edition - March 2004

Purpose: This document provides technical guidance and recommendations for the assignment of ATN NSAP addresses within the region. It also defines the methods by which values are assigned to each field of the NSAP Address and specifies the assumptions upon which the addressing format has been defined.

Contents: Subjects covered by the document:

- NSAP Address structure to be adopted by states of the ASIA/PAC Region;
- Recommendations for the values of each field of the NSAP address;
- Authority responsible for NSAP field assignments.

Remark: The 1st Edition of this document was adopted by APANPIRG/12 in 2001 for distribution to States in the ASIA/PAC and adjacent regions. It was reissued as part of the 2nd Edition of the Regional ATN Planning Document in March 2004.

3.11 ASIA/PAC Interface Control Document (ICD) for ATN Ground-Ground Router

Title: ASIA/PAC Interface Control Document (ICD) for Aeronautical Telecommunication Network (ATN) Ground-Ground Router.

Latest Version: 2nd Edition - April 2005

Purpose: This Interface Control Document (ICD) specifies the interface requirements for the ATN Internet Communication Service (ICS) routed and routeing protocols of the ATN G/G Boundary Intermediate Systems that form nodes of the Asia/Pacific ATN regional backbone network and/or have inter-State connectivity, to ensure interoperability between States. This ICD addresses the upper sub-layer of the network layer of the ATN G/G router using the ISO/OSI Basic Reference Model. These ICD guideline provisions comprise G/G router functional requirements associated with ATN Protocol Requirements Lists (APRLs) relevant to the ATN Internet Communication Service (ICS) routed protocol (ISO/IEC 8473-1 CLNP) and routing protocol (ISO/IEC 10747 IDRP).

Contents: Subjects covered by the document:

- ATN G/G Router Overview;
- Network Layer 3 – Connectionless Network Protocol (CLNP)
- Network Layer 3 – Inter-Domain Routing Protocol (IDRP)
- CLNP and IDRP ATN Protocol Requirements Lists (APRLs) relevant to support layer 3 interface requirements.

Remark: The First Edition of this document was adopted by APANPIRG/14 in 2003. It was further updated and endorsed by ATNTTF in April 2005 as the Second Edition.

3.11.1 G/G Router ICD for ISO/IEC 8208 Sub-Network

Title: ASIA/PAC Ground-Ground Router Interface Control Document (ICD) for ISO/IEC 8208 Sub-Network.

Latest Version: 1ST Edition - April 2005

Purpose: This Interface Control Document (ICD) provides guidelines for interconnecting ATN G/G routers between States/organizations based on ISO/IEC 8208 sub network. The guidelines are mainly for ISO/IEC 8208 sub-network connections used to communicate between the boundaries intermediate systems that form nodes of the Asia/Pacific regional network to assure interoperability. It addresses the physical, data

link and sub-network layers of the ATN G/G router ISO/IEC 8208 sub-network using the International Organization for Standardization (ISO) Information Processing Systems Open Systems Interconnection (OSI) Basic Reference Model.

Contents: Subjects covered by the document:

- ISO Layer 1 - Physical layer;
- ISO layer 2 - Data Link Layer
- ISO layer 3 - Network Layer interface requirements between G/G routers;
- Recommended interface parameters; and
- SNDCF (ISO/IEC 8473-3) ATN Protocol Requirements Lists (APRLs) relevant to support layer 1 to layer 3 interface requirements.

Remark: This ICD applies to the ISO/IEC 8208 connections over point-to-point circuit The 1st Edition of this document was endorsed by ATNTTF in April 2005.

3.12 ATN NSAP Registration Form

Title: ASIA/PAC ATN Network Service Access Point (NSAP) Address Registration Form.

Latest Version: 2nd Edition - March 2004

Purpose: This document provides the provisions and information required for registration of devices that are to connect to the ATN environment within the Region.

Contents: Subjects covered by the document:

- Registration of NSAP Addresses for ATN Routers and ATN End-System;
- Registration of Communication Circuits for ATN Routers and ATN End-Systems.

Remark: 1st Edition of this document was adopted by APANPIRG/12 in 2001. It was included in the 2nd Edition of the Regional ATN Planning Document issued in March 2004. The form when completed should be sent to ICAO Asia and Pacific Regional Office for registration.

ATN APPLICATIONS – AMHS

3.13 AMHS MTA Routing Policy

Title: ASIA/PAC Regional AMHS MTA Routing Policy.

Latest Version: 1st Edition - April 2005

Purpose: To refine the implementation planning for AMHS, this document is required for determination of the routing of AMHS messages between systems within the Region and to systems outside the Region. This document presents AMHS routing policies to be used within the ASIA/PAC Region. The development of this AMHS routing policies is based on the need of States and AMHS administrators to be able to control the flow of messages into individual AMHS systems.

Contents: Subjects covered by the document:

This document covers policy for AMHS systems to route AMHS messages between MTAs within ASIA/PAC Region both in the transitional phase and final phase of AMHS implementation. It also outlines the policy for inter-region AMHS connections between the Region and other regions. It also describes the MTA backbone sites in the Asia and Pacific Region.

Remark: It does not, however, specify the characteristics for MTAs or how the connections between MTAs are established. This document was reviewed by ATNTTF WG in 2004 and subject to be endorsed by the ATNTTF/7 and adopted by APANPIRG/16 in 2005.

3.14 AMHS Naming Plan

Title: ASIA/PAC ATS Message Handling System (AMHS) Naming Plan.

Latest Version: 3rd Edition – April 2005

Purpose: This document provides technical guidance and recommendations for the AMHS naming conventions to be adopted by AMHS users within the Region. It also provides guidance to States in the assignment and registration of the addresses and names to be used for ATS Message Handling Service (ATSMHS).

Contents: Subjects covered by the document:

- CAAS-Addressing scheme;
- XF-Addressing scheme;
- Conventions for use of CAAS-Addressing Format;
- Conventions for use of XF-Addressing Format;
- General use of X.400 O/R Addresses.

Remark: The 1st Edition of this document was adopted by APANPIRG/12 in 2001. It was updated and included as part of the 2nd Edition of the Regional Planning Document issued in March 2004. It was further amended to provide guidance to States for the management of AMHS addresses and registration with ICAO headquarters for their selection of AMHS addressing scheme.

3.15 AMHS Interface Control Document (ICD)

Title: ASIA/PAC Interface Control Document (ICD) for ATS Message Handling System (AMHS)

Latest Version: 1ST Edition – September 2002

Purpose: This document has been developed in order to facilitate interoperability between States in the deployment of AMHS within the ASIA/PAC Region.

Contents: Subjects covered by the document:

- AMHS functions;
- Network configuration;
- Protocol specification overview;
- AMHS specifications;

- Upper layer specifications;
- Lower layer specifications;
- AHMS PICS.

Remark: The 1st Edition of this document was endorsed by CNS/MET/SG/6 provided as an Appendix to its report. It was adopted and published as 1st Edition by ANPANPIRG/13 in 2002 under Conclusion 13/15**.**

3.16 AMHS Naming Registration Form

Title: AMHS Naming Registration Form

Latest Version: 2nd Edition – April 2005

Purpose: This document specifies the provisions and information that are required for registration of MTAs and UAs devices. It also lists the required information of a focal contact point responsible for ATSMHS administration for use in the ASIA/PAC Region.

Contents: Subjects covered by this registration Form:

- Table 1a - AMHS MTA and UA Register;
- Table 1b - AMHS MTA Administrator Contact List.

Remark: 1st Edition of this document was developed by the ATNTTF in 2004. The 2nd Edition was endorsed by ATNTTF in April 2005. Additional information of a contact point is required to be included in a separate table when the registration is made. The form when completed should be sent to ICAO Asia and Pacific Regional Office for registration.

ATN TECHNICAL DOUCMENTATION

3.17 Directory Services

Title: ASIA/PAC Technical Document on Use of Directory Services.

Latest Version: 1st Edition – April 2005

Purpose: This document gives a comprehensive introduction to the ATN Directory Services and specifies lists of object classes (database record types) and attributes (contents of each record type) to be supported in the Region.

Contents: Subjects covered by the document:

- Over of ATN Directory Services;
- Rationale for ATN-DS;
- X.500 Data Model, X.500 Directory Protocol and detailed X.500 data concepts;
- Usage of ATN Directory Services;
- Use of ATN-Directory Service by AMHS and by Context Management;
- Application of ATN-DS to the Asia and Pacific Regions;
- ASIA/PAC regional ATN-DS Profile and deployment schedule.

Remark: The 7th meeting of ATN Transition Task Force while endorsed the 1st Edition of this document discussed the cost implications at the initial stage of ATN/AMHS implementation. It was proposed to set up an interim regional AMHS address database.

3.18 System Management Policy

Title: ASIA/PAC ATN System Management Policy

Latest Version: 1st Edition - April 2005

Purpose: The System Management Policy defines the rules governing management of ATN data, services, and resources associated with ATN applications and processes. The document defines system management services and associated policy statements, and requires that all ATN systems have a responsible system manager.

Contents: Subjects covered by the document:

- Purpose;
- Applicability;
- Authority;
- Implementation and Enforcement;
- System Management Services;
- System Management Policy Statements;
- Responsible System Manager.

Remark: Work on this item is still pending (ATNTTF WG/12)

3.19 ASIA/PAC Regional ATN Implementation System Management Operational Procedures

Title: ASIA/PAC Regional ATN Implementation System Management Operational Procedures.

Latest Version: 1st Edition - August 2004

Purpose: This document provides initial directions and guidance in the identification, development, and selection of ATN administrative management tools, agreements and materials necessary to facilitate and continue operations required for transition from current systems to the ATN.

Contents: Subjects covered by the document:

- Introduction of Applicable Management Concepts
- Establishment of Documents Governing ATN Service Management
- Activities Performed
- Definition of Management Information
- Sample Agreements
- Recommendation
- Regional System Management Coordination

Remark: The 1st Edition of this document developed by the ATNTTF/6 was adopted by APANPIRG/15 in 2004.

3.20 System Integrity Policy

Title: ASIA/PAC ATN System Integrity Policy

Latest Version: 1st Edition – April 2005

Purpose: The System Integrity Policy defines the rules governing the protection of ATN data, services, and resources associated with ATN applications and processes from both unintentional defect and deliberate attack. The document contains high-level system integrity requirements, defines system integrity services and associated policy statements, and requires that ATN systems undergo a verification and authorization process whereby systems are formally approved for operation by a Designated Approving Authority.

Contents: Subjects covered by the document:

- Purpose
- Applicability
- Authority
- Implementation and Enforcement
- System Integrity Requirements
- System Integrity Services
- System Integrity Policy Statements
- Verification and Authorization

Remark: The 1st Edition of ASIA/PAC ATN System Integrity Policy was endorsed by ATNTTF/7 in April 2005.

3.21 System Integrity Verification Checklist

Title: ASIA/PAC System Integrity Verification Checklist.

Latest Version: Draft - April 2005 (to be developed)

Purpose: The System Integrity Verification Checklist contains a sample list of management, operational and technical controls which are examined during the verification process.

Contents: Subjects covered by the document:

- Sample Management Controls;
- Sample Operational Controls;
- Sample Technical Controls.

3.22 System Integrity Authorization Sample

Title: ASIA/PAC System Integrity Sample Authorization

Latest Version: Draft - April 2005 (to be developed)

Purpose: The sample System Integrity authorization provides a signature template for the formal approval for operation by the Designated Approving Authority.

Contents: Subjects covered by the document:

- Statement/Signature for Verification;
- Statement/Signature for Authorization.

REGIONAL REFERENCE DOCUMENTS

3.23 Guidance Material for Ground Elements in ATN Transition

Title: Guidance Material for Ground Elements in ATN Transition.

Latest Version: 2nd Edition - 2000

Purpose: This document contains guidance material for ATN transition planning within the ASIA/PAC Region. The material is technical in nature, and the description is brief so that the intention of the document is to provide the whole picture of the subject. The material is intended for the Regional Planning. Although the plan itself is mainly left to States for planning and implementation, it is hard to differentiate the regional planning from State planning.

Contents: Subjects covered by the document:

- ATN overview
- Ground-ground service components;
- Air-ground service components;
- ATN security service;
- ATN system management;
- ATN directory;
-
- Planning Issues to be considered
  - ATM operational concept;
  - Transition planning;
  - Implementation planning.
  - Proposed regional planning activities for transition;

- Proposed State planning activities for transition;
- Guidance material for ground based elements;
- Integration of new and existing infrastructure;
- Message service definition, benefit and procedure in inter-domain operation;
- Guidance for administrative domain definition;
- Guidance for architectural design of ATN ground elements;
- Connection for inter-domain operation and guidance material;
- Identification of traffic type, quality of service with respect to inter-domain operation;
- Performance issues of reliability, maintainability, and reliability with respect to inter-domain operation;
- Transition paths and transitional procedure in inter-domain operation;
- Cost analysis of ATN ground elements in transitional development for inter-domain operation;
- ATN security solution.

Remark: The 1st Edition of this document was developed at first meeting of ATNTTF in 1999 and it was further updated before its adoption by APANPIRG/10 under Conclusion 10/11. It is considered as a reference document.

3.24 Reference Document for the ATN Router Description

Title: **ASIA/PAC ATN Router Description Document**

Latest Version: Edition 1.2 - May 2004

Purpose: This document describes the protocol, performance, and management requirements for the G/G BIS (Class 4) routers that form nodes of the ASIA/PAC regional network Backbone and/or have inter-State/inter-region connectivity within the ASIA/PAC Region. It provides essential procurement guidance for G/G routers to ensure the interoperability of the ATN network within in the ASIA/PAC Region. This document should be used in conjunction with ICAO Doc 9705 “Manual of Technical Provisions for the Aeronautical Telecommunication Network”, the ASIA/PAC Regional Router Interface Control Document (ICD) for ATN G/G Router, and other applicable documents as highlighted in this document.

Contents: Subjects covered by the document:

- ATN G/G Router Protocol Characteristics introduction ;
- Network Layer Requirements;
- Routing and Routed Protocols;
- Subnetwork Dependent Convergence function (SNDCF);
- Link Layer Requirements - X.25 and LAN;
- Physical Layer Requirements - X.25 and LAN;
- Performance Requirements;
- Network Management Requirements.

Remark: This reference document was developed by ATNTTF/6 in 2004 for use as advisory purposes only and is to be read in conjunction with all other plans and technical documents listed in the ATN Documentation Tree. Any inconsistency in the information contained within these documents shall be considered the lowest ranked in order of

precedence to all other documents within the ATN Documentation Tree. That is all other documents within the ATN Documentation Tree will take precedence over the contents in the ATN Router Description Document

3.25 Reference Document for the AMHS Description

Title: ASIA/PAC Regional Aeronautical Telecommunication Network (ATN) Air Traffic Service (ATS) Message Handling System (AMHS) Description

Latest Version: Edition 1 - April 2005

Purpose: This document describes the functionality, system, performance, information security, and system management requirements of the AMHS system implemented in the ASIA/PAC Region. The AMHS system includes ATS Message Server, ATS Message User Agent, and AFTN/AMHS Gateway. The AFTN/AMHS Gateway is only needed during the early stage of ATN/AMHS implementation to operate AMHS and AFTN concurrently.

Contents: Subjects covered by the document:

- Introduction on AMHS functionality including basic ATSMHS and extended ATSMHS;
- AMHS requirements including message server, user agent, AFTN/AMHS gateway;
- Upper layer requirements;
- Performance and network management;
- Information Security.

Remark: This reference document was developed by ATNTTF/6 in 2004 and further updated in October 2004. It was finalized by ATNTTF/7 in April 2005. This document is for use as advisory purposes only and is to be read in conjunction with all other plans and technical documents listed in the ATN Documentation Tree. Any inconsistency in the information contained within these documents shall be considered the lowest ranked in order of precedence to all other documents within the ATN Documentation Tree. That is all other documents within the ATN Documentation Tree will take precedence over the contents in the AMHS Description Document.

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Seventh Meeting of Aeronautical Telecommunication Network (ATN)
Transition Task Force of APANPIRG (ATNTTF/7)

Appendix E to the Report



INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC
INTERFACE CONTROL DOCUMENT
FOR AERONAUTICAL TELECOMMUNICATION NETWORK
GROUND-GROUND ROUTER
ISO/IEC 8208 SUB-NETWORK

First Edition - 2005

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EXECUTIVE SUMMARY

The Aeronautical Telecommunication Network (ATN) is a global inter-network that provides digital communications to satisfy the increasing telecommunication demands of air traffic service communication, aeronautical operational control, aeronautical administrative communication, and aeronautical passenger communication.

The ATN is composed of a network infrastructure and applications that provide the global communication for ground-ground (G/G) and air-ground services. The ATN network infrastructure includes ATN backbone communication links, ATN routers, and end systems. The ATN applications include among others context management (CM), controller-pilot data link communication (CPDLC) and air traffic service message handling service (ATSMHS).

The Asia/Pacific region is implementing an ATN network to support regional and global ATN services. This Interface Control Document (ICD) specifies the ISO/IEC 8208 sub-network interface requirements for of ATN G/G Boundary Intermediate Systems that form nodes of the Asia/Pacific ATN regional backbone network and/or have inter-State connectivity, to ensure interoperability between States. This ICD applies to point-to-point ISO/IEC 8208 connections between Boundary Intermediate Systems.

1.0 Introduction

1.1 Purpose and Scope

This document provides Interface Control Document guidelines for ISO/IEC 8208 sub-network connections used to communicate between the boundary intermediate systems that form nodes of the Asia/Pacific regional network Backbone and/or have inter-State/organization connectivity within the Asia/Pacific region, to assure interoperability.

The scope of this ICD and its relationship to the ATN router ICD is shown in Figure 1-1. This ICD addresses the physical, data link and sub-network layers of the ATN G/G router ISO/IEC 8208 sub-network using the International Organization for Standardization (ISO) Information Processing Systems Open Systems Interconnection (OSI) Basic Reference Model. These ICD guideline provisions include:

1. ISO layer 1 to layer 3 interface requirements between G/G routers;

2. G/G router functional requirements associated with ATN Protocol Requirements Lists (APRLs) relevant to support layer 1 to layer 3 interface requirements.

This ICD applies to the ISO/IEC 8208 connections over point-to-point circuits.

This document is based on ICAO Doc. 9705 Edition 2. The paragraph numbers in the APRLs are referred to ICAO Doc. 9705 Edition 3.

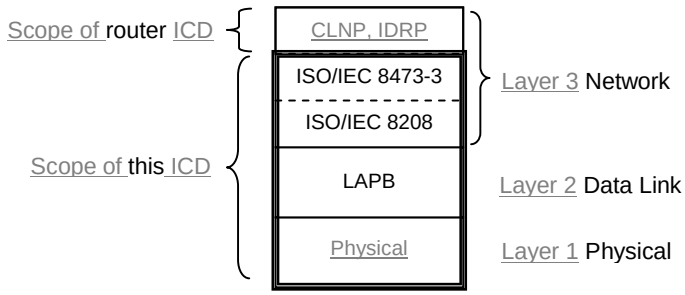


Figure 1-1: BIS Protocol Stack and Scope of this Document

1.2 Organization

This document is organised as follows:

- **Section 1, INTRODUCTION,** summarises the contents of this document and reference documents.

- **Section 2, PHYSICAL LAYER,** provides the physical interface requirements for a point-to-point circuit.

- **Section 3, DATA LINK LAYER,** provides the data link layer interface requirements using link access procedure balanced (LAPB) to support the interface between G/G routers.

- **Section 4, NETWORK LAYER,** provides the interface requirements to support the sub-network and sub-network dependent convergence function (SNDCF) for ISO/IEC 8208 sub-networks.

1.3 ATN Documentation Tree and Reference Documents

1.3.1 ATN Documentation Tree

Figure 1-2 shows the ATN documentation tree for the Asia/Pacific ATN documents. This figure provides a hierarchical representation of the relationship between the various ICAO ATN documents and Asia/Pacific regional ATN router ICD and router sub-network ICDs. From this documentation tree, the relationship between this ICD and other documents is clearly defined.

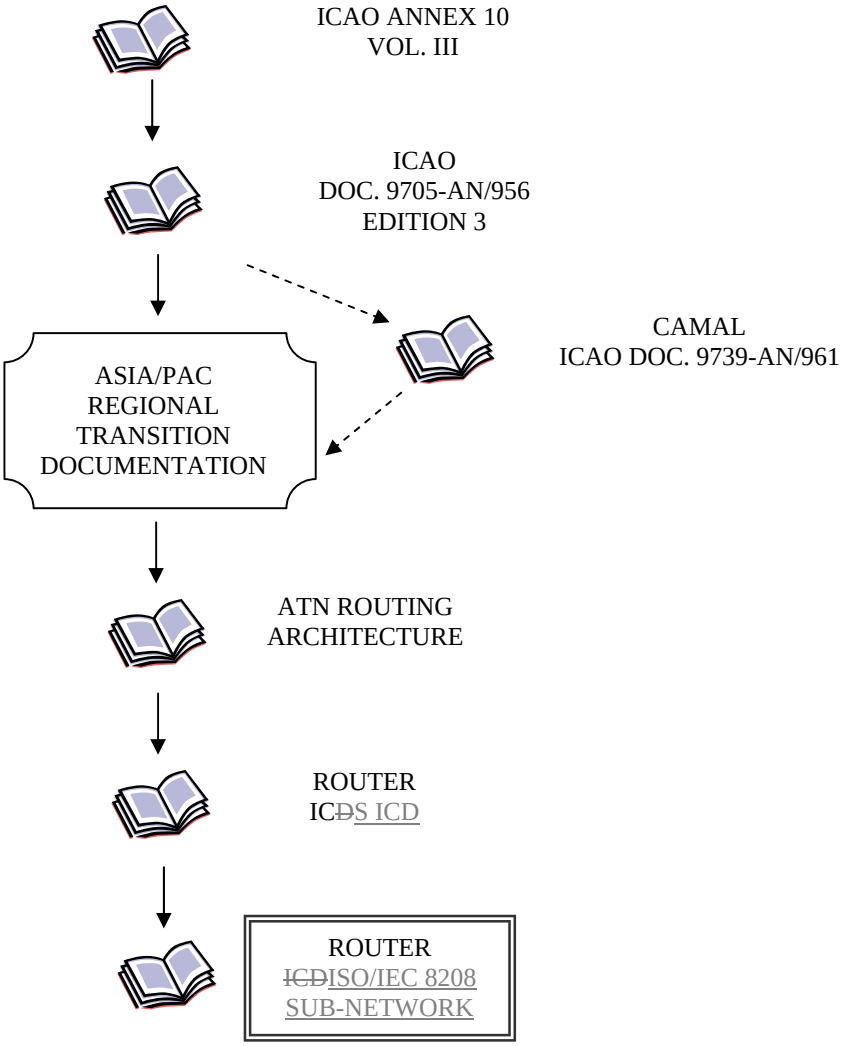


Figure 1-2: ATN Documentation Tree

1.3.2 Documents

1.3.2.1 Applicable Documents

The following documents, with specific editions and/or versions, contain requirements which, through reference in this text, constitute requirements of this document. The requirements for the Asia/Pacific Regional Router ICD for ATN G/G Router are found in the following documents:

1. ITU-T Rec. X.25, (1984), Interface Between Data Terminal Equipment (DTE) and Data Circuit-terminating equipment (DCE) for Terminals Operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit, Section 2, 3 and 4.
2. ISO/IEC 8208: 1995, Information Technology – Data Communications – X.25 Packet Level Protocol for Data Terminal Equipment (Revision of ISO/IEC 8208:1990).
3. ICAO Doc. 9705-AN/956. Manual of Technical Provisions for the Aeronautical Telecommunication Network, Edition 3 – 2001, sub-volume V.
4. ISO/IEC 8473-3: 1995 Information Technology – Protocol for providing the connectionless-mode network service Part 3 – Provision of the underlying service by an X.25 sub-network.
5. Asia/Pacific Interface Control Document for Aeronautical Telecommunication Network Ground-Ground Router
6. Asia/Pacific ATN Addressing Plan.
7. Table CNS-1B of the Asia/Pacific FASID.

1.3.2.2 Supporting Documents

The following documents are supporting documents applicable to the Asia/Pacific Regional Router ICD for ATN G/G Router. These documents do not form a part of this ICD and are not referenced within the document, however, these documents provide supporting background information for better understanding of this ICD.

1. ICAO Annex 10 - Volumes I and II, Fifth Edition, Incorporating Amendment 70.
2. ISO/IEC TR 9575:1995 Information Technology – Telecommunications and Information Exchange between Systems — OSI Routing Framework.
3. Asia/Pacific ATN Routing Architecture.

1.4 APRL Nomenclature

The APRLs in this document use the following conventions and symbols:

M	[M]andatory - the capability must be supported
MO	Mandatory to implement but optional for use
O	[O]ptional - The capability may optionally be supported
O.<n>	[O]ptional, but support of at least one of the group of options labelled by the numeral <n> is required
X or P	prohibited/precluded - i.e. the capability must not be supported.
OX or OP	Optional to implement but precluded for use
<pred>:	Condition item symbol, including predicate identification
^	Logical negation, applied to a condition item's predicate
<r>	Receive aspects of an item
<s>	Send aspects of an item
Y	[Y]es, indicates that an implementation must support the item
N	[N]o, indicates that there is no requirement for the an implementation

2.0 Physical Layer (Layer 1)

The physical layer of the G/G router in this document supports the connection of a point-to-point circuit. The physical layer characteristics are based on mutual agreement between States and service providers.

3.0 Data Link Layer (Layer 2)

The data link layer of ATN G/G router defined in this document uses Link Access Procedure Balanced (LAPB). The following sections provide the requirements for LAPB. LAPB shall comply with ITU X.25, 1984.

3.1 Procedures

3.1.1 Link-level control procedures between the routers shall comply with LAPB procedure.

3.1.2 Link-level control procedures between the routers shall be configured in an Asynchronous Balanced Mode (ABM) defined in ITU X.25, section 2.3 and 2.4.

3.1.3 The router shall be as a logical Data Terminal Equipment (DTE) or Data Communication Equipment (DCE), as specified in ITU X.25 for a point-to-point circuit or under mutual agreements between States/organisations.

3.2 Frame Structure

The unit of transmission is the frame that shall comply with the LAPB frame structure as defined in ITU X.25, section 2.2.

3.3 Link Control Parameter Setup

Table A-1 in Appendix A defines the recommended X.25 data link layer level parameter values, which are highlighted in the following paragraphs.

3.3.1 Time-out functions are necessary to ensure recovery action is taken by a combined station to respond to I-frames, S-frames, and U-frames that require acknowledgment. Timers shall be adjustable in one-second increments within a range of 2 to 120 seconds.

3.3.2 The retransmission attempts parameter shall indicate the maximum number of unsuccessful transmission attempts to complete successful transmission. A value in the range 3 to 7 is recommended for private interfaces for low to medium circuit speeds.

3.3.3 The maximum number of sequentially numbered outstanding I frames shall be seven for private terrestrial interfaces.

3.3.4 The DTE and DCE shall use the same value for maximum number of sequentially numbered outstanding I frames in all cases.

3.3.5 Interfaces operating over satellite circuits shall use modulo 128 numbering for the maximum number of sequentially numbered outstanding I frames, and select a value appropriate for the frame size and signalling speed.

4.0 Network Layer (Layer 3)

The first sub-layer is the sub-network, which is X.25 PLP layer complying with ISO/IEC 8208. The second sub-layer is SNDCF complying with ISO/IEC 8473-3.

The third sub-layer includes CLNP and IDRP, which respectively comply with ISO/IEC 8473-1 and 10747 with specific requirements defined by ICAO Doc. 9705. The third sub-layer is beyond the scope of this document, but is addressed by the Asia/Pacific Interface Control Document for Aeronautical Telecommunication Network Ground-Ground Router.

4.1 ISO/IEC 8208 Sub-Network

The router is capable of establishing one or more connections to other ATN routers via an ISO/IEC 8208 point-to-point circuit. For such circuits, the sub-network layer shall use ISO/IEC 8208 to access the services of the data link layer.

4.1.1 Procedures

Packet level procedures between the sub-networks are described herein and in accordance with ISO/IEC 8208, section 4 through section 11.

4.1.2 Packet Structure

The packet structure shall comply with the packet structure described in ISO/IEC 8208 section 12.

4.1.3 Functionality and Specific Setup

The sub-network layer shall support the functions defined in ISO/IEC 8208. The functions and specific setup are highlighted as follows.

4.1.3.1 Each router shall be capable of initiating an ISO/IEC 8208 sub-network connection.

4.1.3.2 The usage of diagnostic codes shall be established by mutual agreement between States/organisations.

4.1.3.3 Tables in Appendix A provide ISO/IEC 8208 recommended interface parameters for a point-to-point circuit.

The values of parameters in Appendix A are recommended values only for guidance. However, the actual values used for the circuit shall be defined by mutual agreement between States/organisations.

4.1.3.4 When connectivity is provided by a point-to-point circuit, the DTE addresses shall be 10 decimal digits and be agreed between States/organizations during the implementation planning.

4.1.3.5 Each router shall be capable of terminating a sub-network connection.

4.1.3.6 The M-bit shall be supported to indicate a message transfer that consists of more than one packet.

4.1.3.7 Q-bit and D-bit shall be both set to 0.

4.1.4 Use of Switched Virtual Circuits

The use of Switched Virtual Circuits (SVCs) is preferred. The use of Permanent Virtual Circuits (PVCs) shall be taken into the consideration of the service availability.

4.1.4.1 CR Packet Transmission at Call

1. In the case that two-way virtual circuit is an SVC, although not essential it is desirable to tune the transmission of CR packets when call are made between two peers for the following reasons:
   - To avoid collisions between transmitted and received calls, avoiding excessive protocol exchanges;
   - To make for more easily comprehensible communications logs.
2. In the case of PVCs, calls are made directly without the transmission of CRV packets.

4.2 Sub-Network Dependent Convergence Functions (SNDCF)

Sub-Network Dependent Convergence Functions (SNDCF) must be implemented in the router for each type of underlying sub-network. The purpose of a SNDCF is to provide the connectionless sub-network service assumed by the ATN Internet Protocol over real sub-network.

When a G/G router interfaces with another G/G router via a point-to-point circuit, the SNDCF shall comply with the following requirements:

1. The SNDCF shall provide byte- and code-independent service to the CLNP as specified in ICAO Doc. 9705, section 5.7.2;

2. The SNDCF that is used with the ISO 8208 sub-network for the G/G router shall comply with the APRLs given in Appendix B.

APPENDIX A - X.25 RECOMMENDED INTERFACE PARAMETERS FOR POINT-TO-POINT CIRCUIT

A.0 X.25 Minimum Recommended Interface Parameters for a Point-to-Point Circuit

This appendix provides the X.25 minimum recommended interface parameters for point-to-point circuit. Other values may be established by mutual agreement

A.1 Data Link Layer Interface Parameters

Table A-1 provides the data link layer (LAPB) interface parameters.

A.2 Packet Layer Interface Parameters

Tables A-2.1 through A-2.21 provide the packet layer protocol (PLP) interface parameters.

Table A-1: Data link Layer (LAPB) Interface Parameters

Parameter	Range of Values	G/G Router Recommended Value	Comments
Max Outstanding Frames (k)	Normal Mode: 1-7 Extended Mode: 1-127	7	
ACK Receipt Timer (T1)	Packet Size T1 0-896 3 897-1536 6 1537-2048 9 above 2048 14	1 second	Based on 9.6Kbps
ACK Send Timer (T2)	1 – 3000 milliseconds	700 milliseconds	T2 < T1
ACK Delay	Disable or 1– 300 milliseconds	400 milliseconds	Delay before transmitting a delayed RR. ACK Delay << T1
REJ Timer	.1 – 100 seconds	2.5 seconds	Time LABP expects to receive reply to sent REJ TPDU
Idle Channel State Timer (T3)	.1 – 320 seconds	25 seconds	T3 > T4
Idle Probe Timer (T4)	Disable or .1 – 300 seconds	10 seconds	
Maximum Number Bits in I-Frame (N1)	261–263 517–519 1029–1031 2053–2055 4101–4103	2053	N1 = X.25 data size+ X.25 protocol length + LAPB protocol length
Frame Retry Counter (N2)	1–255	10	
Frame Sequence	Modulo 8 or Modulo 128	Modulo 8	Modulo 128 should be used for Satellite

A.2 Packet Layer Interface Parameters

Table A-2.1 General DTE Characteristics

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
Vs	Virtual Call	3.4, 3.7	Y
Vp	Permanent Virtual Circuit	3.4, 3.7	N
Ec/8	DTE/DCE (1988) environment	3.1.1	N
Ec/4	DTE/DCE (1984) environment	3.1.2	Y
Ec/0	DTE/DCE (1980) environment	3.1.3	N
Et/t	DTE/DTE in fixed role as DTE	3.3	Y
Et/d	DTE/DTE with dynamic role selection	4.5	N
M8	Packet sequence numbering modulo 8	13.2, 12.1.1	Y
M128	Packet sequence numbering modulo 128 (extended)	13.2, 12.1.1	N, O (Note 1)
Rna	Is the Reference Number optional user facility supported (DTE/DTE only)?	13.29	N

Note 1: To be used if Satellite links are being used within the network path.

Table A-2.2 Link Layer Interactions

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
L1a	Restarting of the packet layer initiated (in the DTE) on completion of link layer initialization	3.10	Y
L1b	Restarting of the packet layer initiated (in the DTE) on recovery from failure of the link layer	10	Y
L2	Can packets consisting of a non-integral number of octets be received from the link layer	12	N

Table A-2.3 General Packet Formatting

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
P2	Do all (DTE) transmitted packets consist of an integral number of octets?	12.1	Y
P3a	Do all (DTE) transmitted packets contain General Format Identifier?	12.1.1	Y
P3b	Do all (DTE) transmitted packets contain Logical Channel Identifier	12.1.2	Y
P3c	Do all (DTE) transmitted packets contain Packet Type Identifier?	12.1.3	Y
P4	Are all (DTE) received packets that do not contain valid GFI, LCI and PTI fields treated as erroneous?	12.1.1 table 3, 12.1.3, 12.1.2, table 6, tables 31–36	Y

Table A-2.4 Packet Layer Functions Independent of Logical Channels

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
Z1i	DTE restarts the packet layer as initiator	12.6.1	Y
Z1r	DTE restarts the packet layer as responder	12.6.1	Y
Z2r	DTE receives DIAGNOSTIC packet	11.1, 12.7	Y
Z2s	DTE sends DIAGNOSTIC packet	12.7, table 24	Y
Z3	DISCARD, or ERROR restart, on erroneous received packets not assignable to a logical channel and not covered by item Z2s	11.1, tables 31-32	Y
Z4i	DTE initiating On-line Facility Registration	13.1, 12.9.1	N

Table A-2.5 Call Setup

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
S1a	Outgoing Virtual Calls support Fast Select, no restriction on response	5.2.4, 13.16	N
S1b	Outgoing Virtual Calls support Fast Select with restricted response	13.16	N
S1c	Outgoing Virtual Calls support non-Fast-Select	5.2.4	Y
SP1b	DTE sends CALL REQUEST, basic format	12.2.3.1	Y
SP1e	DTE sends CALL REQUEST, extended format	12.2.3.1, 12.2.3.2	N
SP2b	DTE receives CALL CONNECTED, basic format	12.2.4.1	Y
SP2e	DTE receives CALL CONNECTED, extended format	12.2.4.1, 12.2.4.2	N
S2a	Incoming Virtual Calls support Fast Select with acceptance possible	5.2.3, 13.17	N
S2b	Incoming Virtual Calls support Fast Select, always cleared	13.17	Y
S2c	Incoming Virtual Calls support non-Fast-Select with acceptance possible	5.2.3	N
S2d	Incoming Virtual Calls support non-Fast-Select, always cleared	5.2.3	N
SP3b	DTE receives INCOMING CALL, basic format	12.2.3.1	Y
SP3e	DTE receives INCOMING CALL, extended format	12.2.3.1, 12.2.3.2	N
SP4b	DTE sends CALL ACCEPTED, basic format	12.2.4.1	Y
SP4e	DTE sends CALL ACCEPTED, extended format	12.2.4.1, 12.2.4.2	N
DN1	D-bit negotiation is supported for outgoing Virtual Calls	6.3	N
DN2	D-bit negotiation is supported for incoming Virtual Calls	6.3	N

Table A-2.6 Call Clearing

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
C1	Call clearing is supported to respond to an indication of Clearing	5.5.2	Y
C2a	Call clearing is supported to abort an outgoing Virtual Call attempt	5.4, 5.5.1, 5.5.3	Y
C2b	Call clearing is supported to reject an incoming Virtual Call	5.3, 5.5.1, 5.5.3	Y
C2c	Call clearing is supported to clear an established Virtual Call	5.5.1, 5.5.3	Y
CP1b	DTE receives CLEAR INDICATION, basic format	12.2.5.1	Y
CP1e	DTE receives CLEAR INDICATION, extended format	12.2.5.1, 12.2.5.2	N
CP2b	DTE sends CLEAR CONFIRMATION, basic format	12.2.6.1	Y
CP2e	DTE sends CLEAR CONFIRMATION, extended format	12.2.6.1, 12.2.6.2	N
CP3b	DTE sends CLEAR REQUEST, basic format	12.2.5.1	Y
CP3e	DTE sends CLEAR REQUEST, extended format	12.2.5.1, 12.2.5.2	N
CP4b	DTE receives CLEAR CONFIRMATION, basic format	12.2.6.1	Y
CP4e	DTE receives CLEAR CONFIRMATION, extended format	12.2.6.1, 12.2.6.2	N

Table A-2.7 Resetting of Logical Channels

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
Rsi	Resetting is supported when DTE is an initiator	12.5.1, 12.5.2	Y
RSr	Resetting is supported when DTE is a responder	12.5.1, 12.5.2	Y

Table A-2.8 Interrupt Transfer

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
Ls	Sending Interrupts	6.8, 12.3	Y
Lr	Receiving Interrupts	6.8, 12.3	Y

Table A-2.9 Sending Data

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
DS1	Sending of DATA packets is supported	6, 6.1, 6.2, 7.1, 12.3	Y
DS2	Send-window rotation on receiving updated P(R) values	7.1, 7.1.2, 7.1.3	Y
DS3	Response to flow control by received RNR and RR packets	7.1.5, 7.1.6, 12.4.1, 12.4.2	Y
DS4a	Sending M=0 in DATA packets	6.4, 6.5, 6.7	Y
DS4b	Sending M=1 in DATA packets	6.4, 6.5, 6.7	Y
DS5a	Sending Q=0 in DATA packets	6.6	Y
DS5b	Sending Q=1 in DATA packets	6.6	N

Table A-2.10 Receiving Data

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
DR1	Receiving DATA packets	6, 6.1, 6.2, 7.1.1, 7.1.2, 7.1.3, 12.3.1	Y
DR2	Receive-window rotation by sending updated P(R) Values	7.1.2, 7.1.3	Y
DR3	Flow control by sending RNR and RR packets	7.1.5, 7.1.6, 12.4.1, 12.4.2	Y
DR4a	Receiving M=0 in DATA packets	6.4, 6.5, 6.7	Y
DR4b	Receiving M=1 in DATA packets	6.4, 6.5, 6.7	Y
DR5a	Receiving Q=0 in DATA packets	6.6	Y
DR5b	Receiving Q=1 in DATA packets	6.6	N
DR6	Requesting packet retransmission by sending REJECT packets	13.4.1, 12.8	N
DR7a	Recovery from receipt of DATA packets containing invalid P(S), by ERROR-R Action.	11.3(a)	Y (Note 1)
DR7b	Recovery from receipt of DATA packets containing invalid P(S), by: requesting packet retransmission	11.3(b)	Y (Note 1)
DR7c	Recovery from receipt of DATA packets containing invalid P(S), by: ignoring the packet and waiting for a correct retransmitted packet.	11.3(c)	N
DR8a	Recovery from receipt of DATA packets with invalid User Data field, by: ERROR-R Action	11.3(a)	Y (Note 2)
DR8b	Recovery from receipt of DATA packets with invalid User Data field, by: requesting packet retransmission	11.3(b)	Y (Note 2)
DR8c	Recovery from receipt of DATA packets with invalid User Data field, by: ignoring the packet and waiting for a correct retransmitted packet.	11.3(c)	N
DR9	Window Status Transmission Timer Procedure	11.2.2	Y

Note 1: Since DR7a and DR7b are mutually exclusive in a DTE receiving DATA packets, DTEs will be provisioned to support one or the other depending on their location in the network.

Note 2: Since DR8a and DR8b are mutually exclusive in a DTE receiving DATA packets, DTEs will be provisioned to support one or the other depending on their location in the network.

Table A-2.11 Delivery Confirmation

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
DC	Support of Delivery Confirmation	6.3, 6.5, 6.7, 7.1.4	N

Table A-2.12 Values of Cause Codes and Diagnostic Fields

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
Y1a	In RESTART REQUEST packets sent (by DTE), when Cause equals 0, Diagnostic Codes equal specific codes	12.6.1.1, 12.6.1.2, tables 24 -25	Y
Y1b	In RESTART REQUEST packets sent (by DTE), when Cause equals 0, Diagnostic Codes equal generic codes (including 0)	12.6.1.1, 12.6.1.2, tables 24 -25	Y
Y1c	In RESTART REQUEST packets sent (by DTE), when Cause equals 0, Diagnostic Codes equal 0, always	12.6.1.1, 12.6.1.2, tables 24 -25	N
Y1d	In RESTART REQUEST packets sent (by DTE), when Cause equals 128, private Diagnostic Codes are specified	12.6.1.1, 12.6.1.2, tables 24 -25	N
Y1e	In RESTART REQUEST packets sent (by DTE) Causes and Diagnostic Codes other than in items Y1a and Y1b	12.6.1.1, 12.6.1.2, tables 24 -25	N
Y2a	In RESTART INDICATION packets received (by DTE), Cause = 0 or 128, any diagnostic code value	12.6.1.1, table 9, 12.6.1.2	Y
Y2b	In RESTART INDICATION packets received (by DTE), Cause is not equal to 0 or 128, any diagnostic code value	12.6.1.1, table 9, 12.6.1.2	Y
Y3a	In CLEAR REQUEST packets sent (by DTE), when Cause equals 0, Diagnostic Codes equal specific codes	12.2.3.1.1, 1.2.2.3.2 tables 24 –25	Y
Y3b	In CLEAR REQUEST packets sent (by DTE), when Cause equals 0, Diagnostic Codes equal generic codes (including 0)	12.2.3.1.1, 12.2.3.1.2, tables 24 -25	Y
Y3c	In CLEAR REQUEST packets sent (by DTE), when Cause equals 0, Diagnostic Codes equal 0, always	12.2.3.1.1, 12.2.3.1.2, tables 24 –25	N
Y3d	In CLEAR REQUEST packets sent (by DTE), when Cause equals 128, Diagnostic Codes equal private diagnostic codes	12.2.3.1.1, 12.2.3.1.2, tables 24 –25	Y
Y3e	In CLEAR REQUEST packets sent (by DTE) Causes and Diagnostic Codes other than in items Y3a and Y3b	12.2.3.1.1, 12.2.3.1.2, tables 24 –25	N
Y4a	In CLEAR INDICATION packets received (by DTE), Cause equals 0 or 128, any diagnostic code values	12.2.3.1.1, table 7, 12.2.3.1.2	Y
Y4b	In CLEAR INDICATION packets received (by DTE), Cause is not equal to 0 or 128, any diagnostic code value	12.2.3.1.1, table 7, 12.2.3.1.2	Y
Y5a	In RESET REQUEST packets sent (by DTE), when Cause equals 0, Diagnostic Codes equal specific Diagnostic codes	12.5.1.1, 12.5.1.2, tables 24 –25	Y
Y5b	In RESET REQUEST packets sent (by DTE), when Cause equals 0, Diagnostic Codes equal generic diagnostic codes (including 0)	12.5.1.1, 12.5.1.2, tables 24 –25	Y
Y5c	In RESET REQUEST packets sent (by DTE), when Cause equals 0, Diagnostic Codes equal 0, always	12.5.1.1, 12.5.1.2, tables 24 –25	N
Y5d	In RESET REQUEST packets sent (by DTE), when Cause equals 128, Diagnostic Codes equal private Diagnostic codes	12.5.1.1, 12.5.1.2, tables 24 –25	N
Y5e	In RESET REQUEST packets sent (by DTE) Causes and Diagnostic Codes other than in items Y5a and Y5b	12.5.1.1, 12.5.1.2, tables 24 –25	N
Y6a	In RESET INDICATION packets received (by DTE), Cause equals 0 or 128, any diagnostic code value	12.5.1.1, table 8, 12.5.1.2	Y
Y6b	In RESET INDICATION packets received (by DTE), Cause is not equal to 0 or 128, any diagnostic code value	12.5.1.1, table 8, 12.5.1.2	Y

Table A-2.13 Facilities Sent in Outgoing Call Request Packets

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
FS1pi	Flow Control Parameter Negotiation, packet size	13.12, 15.2.2.1.1	N
FS1wi	Flow Control Parameter Negotiation, window size	13.12, 15.2.2.1.2	N
FS2ib	Throughput Class Negotiation (basic)	13.13, 15.2.2.2.1	N
FS2ie	Throughput Class Negotiation (extended)	13.13, 15.2.2.2.2	N
FS3b	Closed User Group Selection, basic format	13.14.6, 15.2.2.3.1	N
FS3e	Closed User Group Selection, extended format	13.14.6, 15.2.2.3.2	N
FS4b	Closed User Group With Outgoing Access Selection, basic format	13.4.7, 15.2.2.4.1	N
FS4e	Closed User Group With Outgoing Access Selection, extended format	13.4.7, 15.2.2.4.2	N
FS5	Bilateral Closed User Group Selection	13.15, 15.2.2.5	N
FS6a	Fast Select	13.16, 15.2.2.6	N
FS6b	Reverse Charging	13.18, 15.2.2.6	N
FS7i	Network User Identification	13.21, 13.21.3, 15.2.2.	N
FS8i	Charging Information, requesting service	13.22, 15.2.2.8.1	N
FS9b	ROA Selection, basic format	13.23, 13.23.2, 15.2.2.9.1	N
FS9e	ROA Selection, extended format	13.23, 13.23.2, 15.2.2.9.2	N
FS12	Transit Delay Selection and Indication	13.27, 15.2.2.13	N
FS99i	Local non-X.25 facilities, following Facility Marker	15.1, table 18	N
FS98i	Remote non-X.25 facilities, following Facility Marker	15.1, table 18	N
FS20i	Facility Marker, ITU-T-specified DTE facilities	15.1	N
FS21i	Calling Address Extension	14.1, 15.3.2.1	N
FS22i	Called Address Extension	14.2, 15.3.2.2	N
FS23i	Minimum Throughput Class Negotiation (basic)	14.3, 15.3.2.3.1, table 20a	N
FS23i	Minimum Throughput Class Negotiation (extended)	14.3, 15.3.2.2, Table 20b	N
FS24i	End-to-End Transit Delay Negotiation	14.4, 15.3.2.4	N
FS25i	Expedited Data Negotiation	14.7, 15.3.2.7	N
FS26i	Priority	14.5, 15.3.2.5	N
FS27i	Protection	14.6, 15.3.2.6	N

Table A-2.14 Facilities Sent in Outgoing Call Accept Packets

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
FS1pr	Flow Control Parameter Negotiation, packet size	13.12, 15.2.2.1.1, table 13	N
FS1wr	Flow Control Parameter Negotiation, window size	13.12, 15.2.2.1.2, table 13	N
FS2rb	Throughput Class Negotiation (basic)	13.13, 15.2.2.2.1, table 20a	N
FS2re	Throughput Class Negotiation (extended)	13.13, 15.2.2.2.2, table 20b	N
FS7r	Network User Identification	13.21, 13.21.3, 15.2.2.7	N
FS8r	Charging Information, requesting service	13.22, 15.2.2.8.1	N
FS10r	Called Line Address Modified Notification	13.26, 15.2.2.12	N
FS20r	Facility Marker, ITU-T-specified DTE facilities	15.1	N
FS22r	Called Address Extension	14.2, 15.3.2.2	N
FS24r	End-to-End Transit Delay Negotiation	14.4, 15.3.2.4	N
FS25r	Expedited Data Negotiation	14.7, 15.3.2.7	N
FS26r	Priority	14.5, 15.3.2.5	N
FS27r	Protection	14.6, 15.3.2.6	N
FS98r	Remote non-X.25 facilities, following Facility Marker	15.1, table 18	N
FS99r	Local non-X.25 facilities, following Facility Marker	15.1, table 18	N

Table A-2.15 Facilities Sent in Clear Request Packets

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
FS10d	Called Line Address Modified Notification	13.26, 15.2.2.12	N
FS13	Call Deflection Selection	13.25.2.2, 15.2.2.10	N
FS20d	Facility Marker, ITU-T-specified DTE facilities	15.1	N
FS22d	Called Address Extension	14.2, 15.3.2.2	N
FS98d	Remote non-X.25 facilities, following Facility Marker	15.1, table 18	N
FS99d	Local non-X.25 facilities, following Facility Marker	15.1, table 18	N

Table A-2.16 Facilities received in Incoming call Packets

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
FR1pi	Flow Control Parameter Negotiation, packet size (Note 1)	13.12, 15.2.2.1.1	N
FR1wi	Flow Control Parameter Negotiation, window size (Note 1)	13.12, 15.2.2.1.2	N
FR2ib	Throughput Class Negotiation (basic)	13.13, 15.2.2.2.1, table 20a	N
FR2ie	Throughput Class Negotiation (extended)	13.13, 15.2.2.2.2, table 20b	N
FR3b	Closed User Group Selection, basic format	13.14.6, 15.2.2.3.1	N
FR3e	Closed User Group Selection, extended format	13.14.6, 15.2.2.3.2	N
FR4b	Closed User Group With Outgoing Access Selection, basic format	13.4.7, 15.2.2.4.1	N
FR4e	Closed User Group With Outgoing Access Selection, extended format	13.4.7, 15.2.2.4.2	N
FR5	Bilateral Closed User Group Selection	13.15, 15.2.2.5	N
FR6a	Fast Select (Note 1)	13.16, 13.17, 15.2.2.	N
FR6b	Reverse Charging (Note 1)	13.18, 13.19, 15.2.2.	N
FR11	Call Redirection or Call Deflection Notification	13.25.3, 15.2.2.11	N
FR12i	Transit Delay Selection and Indication	13.27, 15.2.2.13	N
FR20i	Facility Marker, ITU-T-specified DTE facilities	15.1	N
FR21	Calling Address Extension	14.1, 15.3.2.1	N
FR22i	Called Address Extension	14.2, 15.3.2.2	N
FR23b	Minimum Throughput Class Negotiation (basic)	14.3, 5.3.2.3.1, table 20a	N
FR23e	Minimum Throughput Class Negotiation (extended)	14.3, 15.3.2.3.1, table 20b	N
FR24i	End-to-End Transit Delay Negotiation	14.4, 15.3.2.4	N
FR25i	Expedited Data Negotiation	14.7, 15.3.2.7	N
FR26i	Priority	14.5, 15.3.2.5	N
FR27i	Protection	14.6, 15.3.2.6	N
FR99i	Local non-X.25 facilities, following Facility Marker	15.1, table 18	N

Table A-2.17 Facilities Received in Incoming call Connect Packets

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
FR1pr	Flow Control Parameter Negotiation, packet size (Note 1)	13.12, 15.2.2.1.1, table 14	N
FR1wr	Flow Control Parameter Negotiation, window size (Note 1)	13.12, 15.2.2.1.2, table 14	N
FR2rb	Throughput Class Negotiation (basic)	13.13, 15.2.2.2.1, table 20a	N
FR2re	Throughput Class Negotiation (extended)	13.13, 15.2.2.2.2, table 20b	N
FR10r	Called Line Address Modified Notification	13.26, 15.2.2.12	N
FR12r	Transit Delay Selection And Indication	13.27, 15.2.2.13	N
FR20r	Facility Marker, ITU-T-specified DTE facilities	15.1	N
FR22r	Called Address Extension	14.2, 15.3.2.2	N
FR24r	End-to-End Transit Delay Negotiation	14.4, 15.3.2.4	N
FR25r	Expedited Data Negotiation	14.7, 15.3.2.7	N
FR26r	Priority	14.5, 15.3.2.5	N
FR27r	Protection	14.6, 15.3.2.6	N
FR99r	Local non-X.25 facilities, following Facility Marker	15.1, table 18	N

Table A-2.18 Facilities Received in Clear Indication Packets

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
FR8ad	Charging Information, monetary unit	13.22, 15.2.2.8.2	N
FR8bd	Charging Information, segment count	13.22, 15.2.2.8.3	N
FR8cd	Charging Information, call duration	13.22, 15.2.2.8.4	N
FR10d	Called Line Address Modified Notification	13.26, 15.2.2.12	N
FR99d	Local non-X.25 facilities, following Facility Marker	15.1, table 18	N
FR20d	Facility Marker, ITUT-specified DTE facilities	15.	N
FS22d	Called Address Extension	14.2, 15.3.2.2	N

Table A-2.19 Facilities Received in Clear Confirmation Packets

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
FR8af	Charging Information, monetary unit	13.22, 15.2.2.8.2	N
FR8bf	Charging Information, segment count	13.22, 15.2.2.8.3	N
FR8cf	Charging Information, call duration	13.22, 15.2.2.8.4	N

Table A-2.20 Values for Flow Control Parameters and Throughput Class, Virtual Call Service

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
V1s	What values are supported for default packet sizes, sending (octets)? (Notes 1 and 5)	16.2.2.5	Shall support a default of one or more of these values: 16, 32, 64, 128, 256, 512, 1024, 2048, 4096
V1r	What values are supported for default packet sizes, receiving (octets)? (Notes 1 and 5)	16.2.2.5	Shall support a default of one or more of these values: 16, 32, 64, 128, 256, 512, 1024, 2048, 4096
V2s	What values are supported for default window sizes, sending? (Note 6)	16.2.2.6	1 -127
V2r	What values are supported for default window sizes, receiving? (Note 6)	16.2.2.6	1 -127
V3s	What values are supported for default throughput classes, sending (bps)? (Note 7)	16.2.2.7, tables 20a and 20b	Shall support a default of one or more of these values: 75, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 48000, 64000
V3r	What values are supported for default throughput classes, receiving (bps)? (Note 7)	16.2.2.7, tables 20a and 20b	Shall support a default of one or more of these values: 75, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 48000, 64000
V5	Can different default packet sizes be set for sending and receiving? (Notes 1 and 5)	13.9	N
V7	Can different window sizes be set for sending and receiving? (Note 6)	13.10	N
V8	Can different default throughput classes be set for sending and receiving?	13.11	N
V9s	What values are supported in flow control parameter negotiation for packet sizes, sending (octets)? (Note 1)	15.2.2.1.1	16, 32, 64, 128, 256, 512, 1024, 2048, 4096
V9r	What values are supported in flow control parameter negotiation for packet sizes, receiving (octets) (Note 1)	15.2.2.1.1	16, 32, 64, 128, 256, 512, 1024, 2048, 4096
V10s	What values are supported in flow control parameter negotiation for window sizes, sending (octets)?	15.2.2.1.2	1-127
V10r	What values are supported in flow control parameter Negotiation for window sizes, receiving (octets)?	15.2.2.1.2	1-127
V11s	What values are supported in flow control parameter negotiation for throughput class, sending (bps)?	15.2.2.2, tables 20a and 20b	N
V11r	What values are supported in flow control parameter negotiation for throughput class, receiving (bps)?	15.2.2.2, tables 20a and 20b	N

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
V12	Is the packet size of 128 octets supported for sending and receiving?	15.2.2.1.1	Y
V13	Is the window size of 2 supported for sending and receiving?	15.2.2.1.2	Y

Note 1: V1s, V1r, V9s, V9r. The term "packet size" refers to the maximum length of the User Data Field in a DATA packet.

Note 5: The Non-standard Default Packet Size will be manually provisionable. A value of 128 is the standard default per ISO/IEC 8208. Support for the Online Facility Registration is not required.

Note 6: The Non-standard Default Window Size will be manually provisionable. A value of 2 is the standard default per ISO/IEC 8208. Support for the Online Facility Registration is not required.

Note 7: the non-standard default throughput will be manually provisionable. The non-support for the Online Registration Facility is not required.

Table A-2.21 Timers, Retransmission Counts and Logical Channel Ranges

Item	Function	ISO/IEC 8208 Reference	G-G Router Support
	(Note 1)		
T20	Restart Request Response Timer Y Y	18, table 26	Y
T21	Call Request Response Timer Y Y	18, table 26	Y
T22	Reset Request Response Timer	18, table 26	Y
T23	Clear Request Response Timer	18, table 26	Y
T24	Window Status Transmission Timer	18, table 26	Y
T25	Window Rotation Timer	18, table 26	Y
T26	Interrupt Response Timer	18, table 26	Y
T27	Reject Response Timer	18, table 26	N
T28	Registration Request Response Timer	18, table 26	N
LC8	Maximum number of active SVCs (Switched Virtual Circuits)	3.7	Local choice for DTE/DCE

Note 1: All timers use ISO/IEC 8208 default values.

APPENDIX B- SNDCF (ISO/IEC 8473-3) APRLS

B.0 SNDCF (ISO/IEC 8473-3) APRLs

An implementation of the SNDCF for ISO/IEC 8208 sub-networks shall be used in ATN G/G router and the SNDCF implementation shall be in compliance with the ATN Protocol Requirements Lists (APRLs) given in this appendix.

B.1 SNDCF for use with ISO 8208 Sub-networks - Function

Table B-1 provides the functions of SNDCF for use with ISO 8208 sub-network.

Table B-1: SNDCF for use with ISO 8208 Sub-networks - Function

Item	Function	ISO/IEC 8473-3 Reference	Status	ATN Support	G/G Router Support
XSNUD	Is Sub-network User Data of at least 512 octets transferred transparently by the SNDCF ?	5.2	M	M	Y
XSNTD	Is Transit Delay determined by the SNDCF prior to the processing of user data ?	5.2	M	M	Y
	Call Setup Considerations Is a new call setup:	5.3.1			
XCalla	a. when no suitable call exists ?	5.3.1 a.	O.3	O.3	Y
XCallb	b. when queue threshold reached ?	5.3.1 b.	O.3	O.3	N
XCallc	c. by systems management ?	5.3.1 c.	O.3	O.3	Y
XCalld	d. when queue threshold reached and timer expires ?	5.3.4	O.3	O.3	N
XCalle	e. by other local means?	5.3.1	O.3	O.3	N
	Call clearing considerations Are calls cleared:	5.3.2			
XClra	a. when idle timer expires	5.3.2 a., 5.3.4	O	O	Y
XClrb	b. when need to re-use circuit	5.3.2 b.	O	O	N
XClrc	c. by systems management	5.3.2 c.	O	O	Y
XClrd	d. by provider ?	5.3.2 d.	M	M	Y
XClrer	e. by other local means?	5.3.2	O	O	N
XPD	X.25 Protocol Discrimination	5.3.3	M	M	Y
XVCC	Resolution of VC collisions	5.3.5	M	M	Y
XMCR	Multiple VCs responding	5.3.6	M	M	Y
XMCI	Multiple VCs initiating	5.3.6	O	O	N
Xpri	X.25 Priority procedure	5.3.7	O	M	N

B.2 SNDCF for use with ISO 8208 Sub-networks - X.25 Call User Data

Table B-2 provides the X.25 call user data requirements of SNDCF for use with ISO 8208 sub-network.

Table B-2: SNDCF for use with ISO 8208 Sub-networks - X.25 call user data

Item	Parameter	ISO/IEC 8473-3 Reference	Status	ATN Support	G/G Router Support
PD-s	<s> Protocol Discriminator	5.3.3	M	M	Y
PD-r	<r> Protocol Discriminator	5.3.3	M	M	Y
LI-s	<s> Length Indication	5.3.6	XMCI:M	XMCI:M	N
LI-r	<r> Length Indication	5.3.6	M	M	Y
Ver-s	<s> SNCR Version	5.3.6	XMCI:M	XMCI:M	N
Ver-r	<r> SNCR Version	5.3.6	M	M	Y
SNCR-s	<s> SNCR Value	5.3.6	XMCI:M	XMCI:M	N
SNCR-r	<r> SNCR Value	5.3.6	M	M	Y

B.3 SNDCF for use with ISO 8208 Sub-networks - ISO 8208 SNDCF Timers

Table B-3 provides the timers of SNDCF for use with ISO 8208 sub-network.

Table B-3: SNDCF for use with ISO 8208 Sub-networks - ISO 8208 SNDCF Timers

Item	Timer	ISO/IEC 8473-3 Reference	Status	Values	ATN Support	G/G Router Support
XIDL	X25 VC Idle	5.3.4	XClra:O	Any	XClra:O	Y, 0 to 72000 sec.
XNVC	additional VC	5.3.4	O	Any	M	Y, 0 to 72000 sec.

B.4 SNDCF for use with ISO 8208 Sub-networks - Multi Layer Dependencies

Table B-4 provides multi layer dependency requirements of SNDCF for use with ISO 8208 sub-network.

Table B-4: SNDCF for use with ISO 8208 Sub-networks - Multi layer dependencies

Item	Dependency	ISO/IEC 8473-3 Reference	Status	ATN Support	G/G Router Support
XSSg-r	<r> Maximum SN data unit size (Rx)	5.2	>=512	>=512	>=512
XSSg-s	<s> Maximum SN data unit size (Tx)	5.2	>=512	>=512	>=512
Xvc	X.25 Virtual call service	5.3.8	M	M	Y
Xdt	X.25 Data transfer	5.3.8	M	M	Y
Xfc	X.25 flow control procedures	5.3.8	M	M	Y
Xfrp	X.25 flow control + reset packets	5.3.8	M	M	Y
Xccp	X.25 call setup and clear packets	5.3.8	M	M	Y
Xdp	X.25 DTE and DCE data packets	5.3.8	M	M	Y
Xrs	X.25 restart procedures	5.3.8	M	M	Y
XDct	X.25 DCE timeouts	5.3.8	M	M	Y
XDtT	X.25 time limits	5.3.8	M	M	Y
Xpco	X.25 network packet coding	5.3.8	M	M	Y
Xfcn	X.25 flow control parameter negotiation	5.3.8	O	O	Y
Xtd	X.25 transit delay selection and negotiation	5.3.8	O	O	Y
Xtc	X.25 throughput class negotiation	5.3.8	O	O	Y
Xoth	Other X.25 elements	5.3.8	O	O	N

APPENDIX C - ACRONYMS

C.0 Acronyms

This appendix defines the acronyms used in this document.

ABM	Asynchronous Balanced Mode
ATSMHS	ATS Message Handling System
APRLs	ATN Protocol Requirement Lists
ATN	Aeronautical Telecommunications Network
CLNP	Connectionless Network Protocol
CPDLC	Controller Pilot Data Link Communications
DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
G-G(G/G)	Ground-Ground
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
IDRP	Inter Domain Routing Protocol
IEC	International Electrotechnical Commission
ISO	International Standardization Organization
ITU	International Telecommunications Union
ITU-T	ITU Telecommunications Sector
LAPB	Link Access Procedure Balanced
OSI	Open Systems Interconnection
PICS	Protocol Implementation Compliance Statement
PVC	Permanent Virtual Circuit
QOS	Quality of Service
SNDCF	Sub Network Dependent Convergence Functions
SVC	Switched Virtual Circuit
TPDU	Transport Protocol Data Unit

Seventh Meeting of Aeronautical Telecommunication Network (ATN)
Transition Task Force of APANPIRG (ATNTTF/7)

Appendix F to the Report



INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC INTERFACE CONTROL DOCUMENT FOR AERONAUTICAL TELECOMMUNICATION NETWORK GROUND-GROUND ROUTER

SECOND EDITION - 2005

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EXECUTIVE SUMMARY

The Aeronautical Telecommunication Network (ATN) is a global inter-network that provides digital communications to satisfy the increasing telecommunication demands of air traffic service communication, aeronautical operational control, aeronautical administrative communication, and aeronautical passenger communication.

The ATN is composed of a network infrastructure and applications that provide the global communication for ground-ground (G/G) and air-ground services. The ATN network infrastructure includes ATN backbone communication links, ATN routers, and end systems. The ATN applications include among others context management (CM), controller-pilot data link communication (CPDLC) and air traffic service message handling service (ATSMHS).

The Asia/Pacific region is implementing an ATN network to support regional and global ATN services. This Interface Control Document (ICD) specifies the interface requirements for the ATN Internet Communication Service (ICS) routed and routeing protocols of the ATN G/G Boundary Intermediate Systems that form nodes of the Asia/Pacific ATN regional backbone network and/or have inter-State connectivity, to ensure interoperability between States.

Interface Control Documents (ICDs) for sub-networks are provided in separate documents.

1. Introduction

1.1. Purpose and Scope

This document provides Interface Control Document guidelines for the boundary intermediate systems that form nodes of the Asia/Pacific regional network Backbone and/or have inter-State/organization connectivity within the Asia/Pacific region, to assure interoperability.

The scope of this ICD and its relationship to sub-network ICDs is shown in Figure 1-1. This ICD addresses the upper sub-layer of the network layer of the ATN G/G router using the International Organization for Standardization (ISO) Information Processing Systems Open Systems Interconnection (OSI) Basic Reference Model. These ICD guideline provisions comprise G/G router functional requirements associated with ATN Protocol Requirements Lists (APRLs) relevant to the ATN Internet Communication Service (ICS) routed protocol (ISO/IEC 8473-1 CLNP) and routeing protocol (ISO/IEC 10747 IDRP). This document is based on ICAO Doc. 9705 Edition 2. The paragraph numbers in the APRLs are referred to ICAO Doc. 9705 Edition 3.

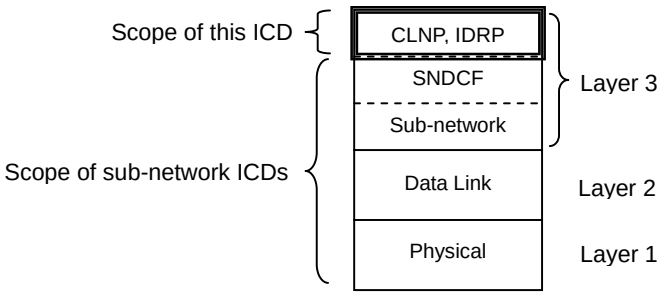


Figure 1-1: BIS Protocol Stack and Scope of this Document

1.2. ATN Documentation Tree and Reference Documents

1.2.1 ATN Documentation Tree

Figure 1-2 shows the ATN documentation tree for the Asia/Pacific ATN documents. This figure provides a hierarchical representation of the relationship between the various ICAO ATN documents and Asia/Pacific regional ATN router ICD. From this documentation tree, the relationship between this ICD and other documents is clearly defined.

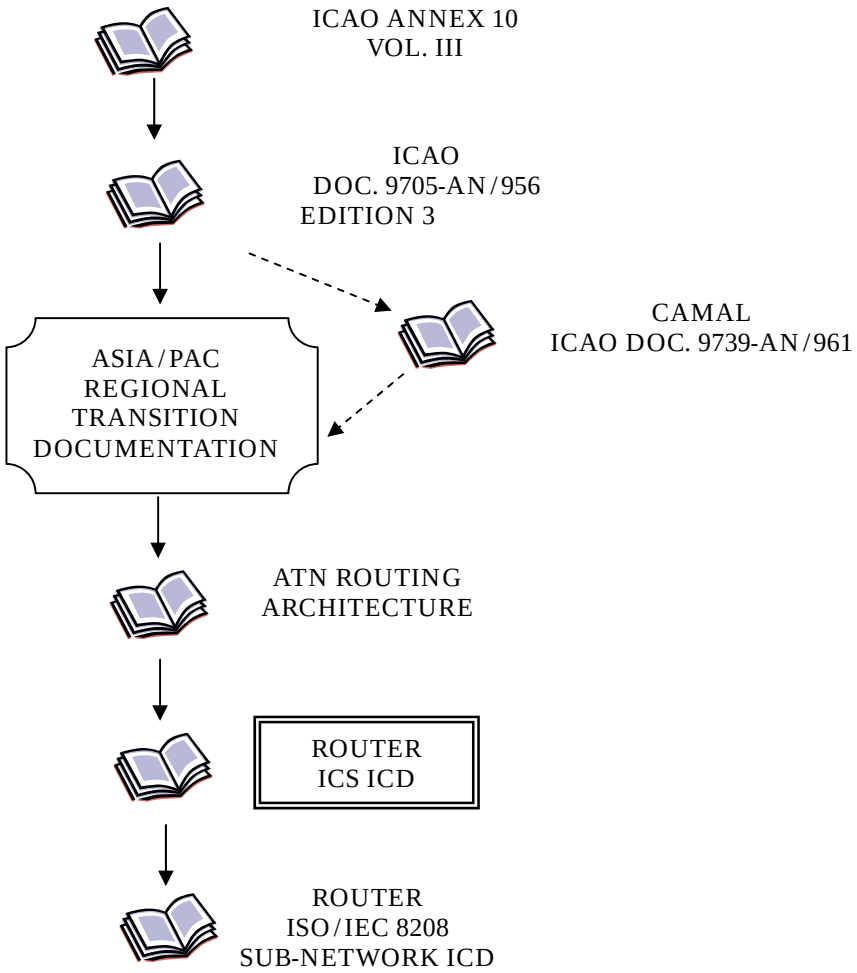


Figure 1-2: ATN Documentation Tree

1.2.2 Documents

1.2.2.1. Applicable Documents

The following documents, with specific editions and/or versions, contain requirements which, through reference in this text, constitute requirements of this document. The requirements for the Asia/Pacific Regional Router ICD for ATN G/G Router are found in the following documents:

1. ICAO Doc. 9705-AN/956 Manual of Technical Provisions for the Aeronautical Telecommunication Network, Edition 3 – 2001, sub-volume V.
2. ISO/IEC 10747: 1994 Information Technology – Telecommunications and Information Exchange between Systems – Protocol for exchange of inter-domain routing information among intermediate systems to support forwarding of ISO 8473 PDUs.
3. ISO/IEC 8473-1: 1994 Information Technology – Protocol for providing the connectionless-mode network service Part 1 – Protocol Specification.
4. Asia/Pacific ATN Addressing Plan.
5. Asia/Pacific ATN IDRP Routing Policy.
6. Table CNS-1B of the Asia/Pacific FASID.

1.2.2.2. Supporting Documents

The following documents are supporting documents applicable to the Asia/Pacific Regional Router ICD for ATN G/G Router. These documents do not form a part of this ICD and are not referenced within the document, however, these documents provide supporting background information for better understanding of this ICD.

1. ICAO Annex 10 – Volumes I and II, Fifth Edition, Incorporating Amendment 70.
2. ISO/IEC TR 9575:1995 Information Technology – Telecommunications and Information Exchange between Systems – OSI Routing Framework.
3. Asia/Pacific ATN Routing Architecture.

1.3. APRL Nomenclature

The APRLs in this document use the following conventions and symbols:

M	[M]andatory - the capability must be supported
MO	Mandatory to implement but optional for use
O	[O]ptional - The capability may optionally be supported
O.<n>	[O]ptional, but support of at least one of the group of options labelled by the numeral <n> is required
X or P	prohibited/precluded - i.e. the capability must not be supported.
OX or OP	Optional to implement but precluded for use
<pred>:	Condition item symbol, including predicate identification
^	Logical negation, applied to a condition item's predicate
<r>	Receive aspects of an item
<s>	Send aspects of an item
Y	[Y]es, indicates that an implementation must support the item
N	[N]o, indicates that there is no requirement for the an implementation

2. Network Layer (Layer 3)

1. The third sub-layer of the Network Layer includes the connectionless network protocol (CLNP) and inter-domain routeing protocol (IDRP), which respectively comply with ISO/IEC 8473-1 and ISO/IEC 10747, with specific requirements defined by ICAO Doc. 9705.

2.1. Connectionless Network Protocol (CLNP)

The G/G router interprets the CLNP protocol data unit (PDU) header and forwards the PDU to another G/G router without flow control or connection setup. The CLNP protocol functions shall be as specified in ISO/IEC 8473-1 and sections 5.6.2 and 5.6.3 of ICAO Doc. 9705 in accordance with the APRLs in Appendix A.

2.2. Inter-Domain Routing Protocol (IDRP)

The IDRP protocol function shall be specified as in ISO/IEC 10747 in accordance with APRLs in Appendix B.

APPENDIX A - CLNP APRLs

A.0 CLNP APRLs

This appendix provides CLNP APRLs for ATN G/G router. The APRLs define the capabilities and options of the protocol that, at minimum, are required to be implemented for the ATN G/G router for ICAO Asia/Pacific regional ATN.

A.1 Support of ATN-Specific Network Layer Features

Table A-1 provides the requirements for CLNP network layer features.

Table A-1: Support of ATN-specific network layer features

Index	Item	Doc 9705 Ref.	ATN Support	G/G Router Support
ATN CLNP1	Encoding and use of the Security Parameter	5.6.2.2	M	Y
ATN CLNP2	Management of Network Priority	5.6.2.3, 5.2.8.4	M	Y
ATN CLNP4	Echo Request Function	5.6.3.3	O	Y
ATN CLNP5	Congestion Management	5.6.2.4	M	N, O
ATN CLNP6	Echo Response Function	5.6.3.4.1	M	Y
ATN CLNP7	Echo Response parameter setting	5.6.3.4.2, 5.6.3.4.3, 5.6.3.4.4	M	Y

A.2 Major Capabilities

Table C-2 provides the CLNP major capabilities.

Table A-2: Major Capabilities

Item	Capability	ISO/IEC 8473 Reference	Status	ATN Support	G/G Router Support
ES	End System		O.1	O.1	N
IS	Intermediate System		O.1	O.1	Y
FL-r	<r> Full protocol	8473-1: 6	M	M	Y
FL-s	<s> Full protocol	8473-1: 6	M	M	Y
NSS-r	<r> Non-segmenting subset	8473-1: 5.2	M	M	Y
NSS-s	<s> Non segmenting subset	8473-1: 5.2	IS:M ^IS:O	IS:M ^IS:O	Y
IAS-r	<r> Inactive subset	8473-1: 5.2	ES:O	ES:O	N
IAS-s	<s> Inactive subset	8473-1: 5.2	IAS-r:M ^IAS-r:X	IAS-r:M ^IAS-r:X	N
S802	SNDCF for ISO 8802	8473-2: 5.4	O.2	O	Y
SCLL	SNDCF for CL Link Service	8473-4: 5.3.1	O.2	O	N
SCOL	SNDCF for CO Link Service	8473-4: 5.3.2	O.2	O	N
SX25	SNDCF for ISO 8208	8473-3: 5.4	O.2	O	Y
ATN SNDCF	SNDCF for Mobile Sub-networks	Doc. 9705 Ref: Chapter 5.7	N/A	ISMOB:M ISGRD:O ^IS:O	N/A

ISMOB: If ISO/IEC 8473 is used over Mobile Sub-networks, then ISMOB is true, else ISMOB is false.

ISGRD: If ISO/IEC 8473 is used over Ground Sub-networks, then ISGRD is true, else ISGRD is false.

O.1: The supported functions, NPDUs, associated parameters and timers required for Intermediate Systems are provided in the APRLs. C.3 through C.10.

O.2: APRLs for the SNDCF for use with ISO/IEC 8208 sub-networks are provided in B.1 through B.4.

A.3 Ground-Ground Router - Supported Functions

Table A-3 specifies the ATN G/G router supported functions.

Table A-3: G/G Router - Supported Functions

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	G/G Router Support
iPDUC	PDU Composition	6.1	M	M	Y
iPDUD	PDU Decomposition	6.2	M	M	Y
iHFA	Header Format Analysis	6.3	M	M	Y
iPDUL	<s> PDU Lifetime Control	6.4	M	M	Y
iRout	Route PDU	6.5	M	M	Y
iForw	Forward PDU	6.6	M	M	Y
iSegm	Segment PDU	6.7	iDSNS:M	iDSNS:M	N
iReas	Reassemble PDU	6.8	O	O	N
iDisc	Discard PDU	6.9	M	M	Y
iErep	Error Reporting	6.10	M	M	Y
iEdec	<s> Header Error Detection	6.11	M	M	Y
iSecu	<s>Security	6.13 Doc 9705 Ref: 5.6.2.2	O	M	Y
iCRR	<s> Complete Route Recording	6.15	O	OX	N
iPRR	<s> Partial Route Recording	6.15	O	M	Y
iCSR	Complete Source Routing	6.14	O	OX	N
iPSR	Partial Source Routing	6.14	O	OX	N
iPri	<s> Priority	6.17, Doc 9705 Ref: 5.6.3.5	O	M	Y
iQOSM	<s> QOS Maintenance	6.16	O	M	Y
iCong	<s> Congestion Notification	6.18, Doc. 9705 Ref: 5.6.2.4	O	M	Y
iPadd	<s> Padding	6.12	M	M	N, O
iEreq	Echo request	6.19, Doc. 9705 Ref: 5.6.3.3	O	O	Y
iErsp	Echo response	6.20	O	M	Y
iSegS	Create segments smaller than necessary	6.8	O	O	N
iDSNS	Simultaneous support of sub-networks with different SN-User data sizes	6.7	O	O	N

A.4 Supported Security Parameters

Table A-4 specifies the ATN G/G router supported security parameters.

Table A-4: G/G Router Supported Security Parameters

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	G/G Router Support
iSADSSEC	Source Address Specific Security	7.5.3.1	iSecu:O.5	iSecu:O	N
iDADSSEC	Destination Address Specific Security	7.5.3.2	iSecu:O.5	iSecu:O	N
iGUNSEC	Globally Unique Security	Doc. 9705 Ref. 5.6.2.2	iSecu:O.5	iSecu:M	Y

O.5: The Security parameter within a single NPDU specifies a security format code indicating Source Address Specific, Destination Address Specific or Globally Unique Security.

A.5 Quality of Service Maintenance Function

Table A-5 specifies the ATN G/G router quality of service maintenance function.

Table A-5: Quality of Service Maintenance Function

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	G/G Router Support
IQOSNAVAIL	If requested QOS not available, deliver at different QOS	6.16	iQOSM:M	iQOSM:M	Y
IQOSNOT	Notification of failure to meet requested QOS	6.16	iQOSM:O	iQOSM:O	N
	Which of the following formats of QOS are implemented ?				
ISADDQoS	Source Address Specific QoS	7.5.6.1	iQoSM:O.3	iQOSM:O	N
IDADDQoS	Destination Address Specific QoS	7.5.6.2	iQoSM:O.3	iQOSM:O	N
IGUNQoS	Globally Unique QoS	7.5.6.3	iQoSM:O.3	iQOSM:M	Y
iSvTD	Sequencing versus Transit Delay	7.5.6.3	iGUNQoS:O.4	iGUNQoS:O.4	N
iCongE	Congestion Experienced	7.5.6.3	iGUNQoS:O.4	iGUNQoS:M	N, O
iTDvCst	Transit Delay versus Cost	7.5.6.3	iGUNQoS:O.4	iGUNQoS:O.4	N
iREPvTD	Residual Error Probability versus Transit Delay	7.5.6.3	iGUNQoS:O.4	iGUNQoS:O.4	N
iREPvCst	Residual Error Probality versus Cost	7.5.6.3	iGUNQoS:O.4	iGUNQoS:O.4	N

O.3: The Quality of Service Maintenance parameter within a single NPDU specifies a QoS format code indicating Source Address Specific, Destination Address Specific or Globally Unique QoS.

O.4: If the QoS format code indicates that the Globally Unique QoS maintenance function is employed, then each bit in the associated parameter value may be set to indicate the order of intra and inter domain routing decisions based on QoS. The parameter values which apply to inter-domain routing are provided in Table 4 of ISO/IEC 10747.

A.6 Boundary Intermediate Systems - Supported NPDUs

Table A-6 specifies the ATN G/G router supported NPDUs.

Table A-6: G/G Router - Supported NPDUs

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	G/G Router Support
iDT-t	DT (full protocol) transmit	7.7	M	M	Y
iDT-r	DT (full protocol) receive	7.7	M	M	Y
iDTNS-t	DT (non-segment) transmit	7.7	M	M	Y
iDTNS-r	DT (non-segment) receive	7.7	M	M	Y
IER-t	ER transmit	7.9	M	M	Y
IER-r	ER receive	7.9	M	M	Y
iERQ-t	ERQ transmit	7.10	iEreq:M	iEreq:M	Y
iERQ-r	ERQ receive	7.10	M	M	Y
iERP-t	ERP transmit	7.11	iErsp:M	iErsp:M	Y
iERP-r	ERP receive	7.11	M	M	Y

A.7 Ground-Ground Router - Supported Data PDU (DT PDU) Parameters

Table A-7 describes the ATN G/G router supported DT PDU parameters.

Table A-7: G/G Router - Supported DT PDU Parameters

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	G/G Router Support
idFxPt-s	<s> Fixed Part	7.2	M	M	Y
idFxPt-r	<r> Fixed Part	7.2	M	M	Y
idAddr-s	<s> Addresses	7.3	M	M	Y
idAddr-r	<r> Addresses	7.3	M	M	Y
idSeg-s	<s> Segmentation Part	7.4	M	M	Y
idSeg-r	<r> Segmentation Part	7.4	M	M	Y
idPadd-s	<s> Padding	7.5.2	M	M	Y
idPadd-r	<r> Padding	7.5.2	M	M	Y
idSecu-s	<s> Security	7.5.3	iSecu:M	iSecu:M	Y
idSecu-r	<r> Security	7.5.3	iSecu:M	iSecu:M	Y
idCRR-s	<s> Complete Route Recording	7.5.5	iCRR:M	-	N
idCRR-r	<r> Complete Route Recording	7.5.5	iCRR:M	-	N
idPRR-s	<s> Partial Route Recording	7.5.5	M	M	Y
idPRR-r	<r> Partial Route Recording	7.5.5	iPRR:M	iPRR:M	Y
idCSR-s	<s> Complete Source Routing	7.5.4	iCSR:M	-	N
idCSR-r	<r> Complete Source Routing	7.5.4	iCSR:M	-	N
idPSR-s	<s> Partial Source Routing	7.5.4	M	M	Y
idPSR-r	<r> Partial Source Routing	7.5.4	iPSR:M	-	N
idQOSM-s	<s> QOS Maintenance	7.5.6	M	M	Y
idQOSM-r	<r> QOS Maintenance	7.5.6	iQOSM or iCong:M	iQOSM or iCong:M	Y
idPri-s	<s> Priority	7.5.7	M	M	Y
idPri-r	<r> Priority	7.5.7	iPRi:M	iPri:M	Y
idData-s	<s> Data	7.6	M	M	Y
idData-r	<r> Data	7.6	M	M	Y
idUnSup2	Are received PDUs containing parameters selecting unsupported type 2 functions discarded and where appropriate an Error Report PDU generated ?	6.19	M	M	Y
idUnSup3	Are parameters selecting unsupported Type 3 functions ignored ?	6.19	M	M	Y

A.8 Ground-Ground Router - Supported Error Report PDU (ER PDU) Parameters

Table A-8 specifies the ATN G/G router supported ER PDU parameters.

Table A-8: G/G Router - Supported ER PDU Parameters

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	G/G Router Support
ieFxPt-s	<s> Fixed Part	7.2	M	M	Y
ieFxPt-r	<r> Fixed Part	7.2	M	M	Y
ieAddr-s	<s> Address	7.3	M	M	Y
ieAddr-r	<r> Address	7.3	M	M	Y
iePadd-s	<s> Padding	7.5.2	M	M	Y
iePadd-r	<r> Padding	7.5.2	M	M	Y
ieSecu-s	<s> Security	7.5.3	iSecu:M	iSecu:M	Y
ieSecu-r	<r> Security	7.5.3	iSecu:M	iSecu:M	Y
ieCRR-s	<s> Complete Route Recording	7.5.5	iCRR:M	iCRR:M	N
ieCRR-r	<r> Complete Route Recording	7.5.5	iCRR:M	-	N
iePRR-s	<s> Partial Route Recording	7.5.5	M	M	Y
iePRR-r	<r> Partial Route Recording	7.5.5	iPRR:M	iPRR:M	Y
ieCSR-s	<s> Complete Source Routing	7.5.4	iCSR:M	-	N
ieCSR-r	<r> Complete Source Routing	7.5.4	iCSR:M	-	N
iePSR-s	<s> Partial Source Routing	7.5.4	M	M	Y
iePSR-r	<r> Partial Source Routing	7.5.4	iPSR:M	-	N
ieQOSM-s	<s> QOS Maintenance	7.5.6	M	M	Y
ieQOSM-r	<r> QOS Maintenance	7.5.6	iQOSM or iCong:M	iQOSM or iCong:M	Y
iePri-s	<s> Priority	7.5.7	M	M	Y
iePri-r	<r> Priority	7.5.7	iPri:M	iPri:M	Y
ieDisc-s	<s> Reason for Discard	7.9.5	M	M	Y
ieDisc-r	<r> Reason for Discard	7.9.5	M	M	Y
ieData-s	<s> Data	7.6	M	M	Y
ieData-r	<r> Data	7.6	M	M	Y
ieUnsup2	Are received PDUs containing parameters selecting unsupported type 2 functions discarded ?	6.21	M	M	Y
ieUnsup3	Are parameters selecting unsupported Type 3 functions ignored ?	6.21	M	M	Y

A.9 Ground-Ground Router - Supported Echo Request PDU (ERQ PDU) Parameters

Table A-9 specifies the ATN G/G router supported ERQ PDU parameters.

Table A-9: G/G Router - Supported ERQ PDU Parameters

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	G/G Router Support
iqFxPt-s	<s> Fixed Part	7.2	M	M	Y
iqFxPt-r	<r> Fixed Part	7.2	M	M	Y
iqAddr-s	<s> Addresses	7.3	M	M	Y
iqAddr-r	<r> Addresses	7.3	M	M	Y
iqSeg-s	<s> Segmentation Part	7.4	M	M	Y
iqSeg-r	<r> Segmentation Part	7.4	M	M	Y
iqPadd-s	<s> Padding	7.5.2	M	M	Y
iqPadd-r	<r> Padding	7.5.2	M	M	N, O
iqSecu-s	<s> Security	7.5.3	iSecu:M	iSecu:M	N, O
iqSecu-r	<r> Security	7.5.3	iSecu:M	iSecu:M	Y
iqCRR-s	<s> Complete Route Recording	7.5.5	iCRR:M	M	N
iqCRR-r	<r> Complete Route Recording	7.5.5	iCRR:M	-	N
iqPRR-s	<s> Partial Route Recording	7.5.5	M	M	Y
iqPRR-r	<r> Partial Route Recording	7.5.5	iPRR:M	iPRR:M	Y
iqCSR-s	<s> Complete Source Routing	7.5.4	iCSR:M	-	N
iqCSR-r	<r> Complete Source Routing	7.5.4	iCSR:M	-	N
iqPSR-s	<s> Partial Source Routing	7.5.4	M	M	Y
iqPSR-r	<r> Partial Source Routing	7.5.4	iPSR:M	-	N
iqQOSM-s	<s> QOS Maintenance	7.5.6	M	M	Y
iqQOSM-r	<r> QOS Maintenance	7.5.6	iQOSM or iCong:M	iQOSM or ICong:M	Y
iqPri-s	<s> Priority	7.5.7	M	M	Y
iqPri-r	<r> Priority	7.5.7	iPRi:M	iPri:M	Y
iqData-s	<s> Data	7.6	M	M	Y
iqData-r	<r> Data	7.6	M	M	Y
iqUnSup2	Are received PDUs containing parameters selecting unsupported type 2 functions discarded and where appropriate an Error Report PDU generated ?	6.19	M	M	Y
iqUnSup3	Are parameters selecting unsupported Type 3 functions ignored ?	6.19	M	M	Y

A.10 Ground-Ground Router - Supported Echo Reply PDU (ERP PDU) Parameters

Table A-10 specifies the ATN G/G router supported ERP PDU parameters.

Table A-10: G/G Router - Supported ERP PDU Parameters

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	G/G Router Support
ipFxPt-s	<s> Fixed Part	7.2	M	M	Y
ipFxPt-r	<r> Fixed Part	7.2	M	M	Y
ipAddr-s	<s> Addresses	7.3	M	M	Y
ipAddr-r	<r> Addresses	7.3	M	M	Y
ipSeg-s	<s> Segmentation Part	7.4	M	M	Y
ipSeg-r	<r> Segmentation Part	7.4	M	M	Y
ipPadd-s	<s> Padding	7.5.2	M	M	N,O
ipPadd-r	<r> Padding	7.5.2	M	M	N,O
ipSecu-s	<s> Security	7.5.3	iSecu:M	iSecu:M	Y
ipSecu-r	<r> Security	7.5.3	iSecu:M	iSecu:M	Y
ipCRR-s	<s> Complete Route Recording	7.5.5	iCRR:M	M	N
ipCRR-r	<r> Complete Route Recording	7.5.5	iCRR:M	-	N
ipPRR-s	<s> Partial Route Recording	7.5.5	M	M	Y
ipPRR-r	<r> Partial Route Recording	7.5.5	iPRR:M	iPRR:M	Y
ipCSR-s	<s> Complete Source Routing	7.5.4	iCSR:M	-	N
ipCSR-r	<r> Complete Source Routing	7.5.4	iCSR:M	-	N
ipPSR-s	<s> Partial Source Routing	7.5.4	M	M	Y
ipPSR-r	<r> Partial Source Routing	7.5.4	iPSR:M	-	N
ipQOSM-s	<s> QOS Maintenance	7.5.6	M	M	Y
ipQOSM-r	<r> QOS Maintenance	7.5.6	iQOSM or iCong:M	iQOSM or ICong:M	Y
ipPri-s	<s> Priority	7.5.7	M	M	Y
ipPri-r	<r> Priority	7.5.7	iPRi:M	iPri:M	Y
ipData-s	<s> Data	7.6	M	M	Y
ipData-r	<r> Data	7.6	M	M	Y
ipUnsup2	Are received PDUs containing parameters selecting unsupported type 2 functions discarded and where appropriate an Error Report PDU generated ?	6.19	M	M	Y
ipUnsup3	Are parameters selecting unsupported Type 3 functions ignored ?	6.19	M	M	Y

A.11 Ground-Ground Router - Timer and Parameter Values

Table A-11 specifies the ATN G/G router Timer and parameter values.

Table A-11: G/G Router - Timer and Parameter Values

Item	Timer	ISO/IEC 8473-1 Reference	Status	ATN Support	G/G Router Support
iReasTim	Reassembly Timer	6.8	iReas:M	M	Y

APPENDIX B - IDRP APRLS

B.0 IDRP APRLs

This appendix provides IDRP APRLs for ATN G/G routers. The APRLs define the capabilities and options that, at a minimum, are required to be implemented for the ATN G/G router under an Asia/Pacific ATN environment.

B.1 ATN Specific Protocol Requirements

Table B-1 describes the ATN specific protocol requirements.

Table B-1: ATN specific protocol requirements

Index	Item	Doc. 9705 Ref	ATN Support	G/G Router Support
ATNIDRP1	Encoding and use of the Security Path Attribute	5.8.3.2.2, 5.8.3.2.3	M	Y
ATNIDRP2	Does this G/G ROUTER immediately re-advertise routes if the security information contained in the routes's path attribute change?	5.8.3.2.7	M	Y
ATNIDRP3	Support of 'policy based route aggregation'	5.8.3.2.6.2	O	N
ATNIDRP4	Support of 'policy based route information reduction'	5.8.3.2.6.5	O	N
ATNIDRP5	Support of aggregation of routes with identical NLRI using 'true route aggregation'	5.8.3.2.6.3	O.1	N
ATNIDRP6	Support of aggregation of routes with identical NLRI using 'route merging'	5.8.3.2.6.3	O.1	N
ATNIDRP7	Support of aggregation of security path attribute information field	5.8.3.2.6.4	M	N

B.2 IDRP General

Table B-2 describes the IDRP general requirements.

Table B-2: IDRP General Requirements

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
BASIC	Are all basic G/G ROUTER functions implemented?	12.1	M	M	Y
MGT	Is this system capable of being managed by the specified management information?	11	M	O	N
VER	Does this G/G ROUTER support Version Negotiation?	7.8	M	M	Y
RTSEP	Does this G/G ROUTER support the ROUTE_SEPARATOR attribute?	7.12.1	M	M	Y
HOPS	Does this G/G ROUTER support the RD_HOP_COUNT attribute?	7.12.13	M	M	Y
PATH	Does this G/G ROUTER support the RD_PATH attribute?	7.12.3	M	M	Y
CAPY	Does this G/G ROUTER support the Capacity Attribute?	7.12.15	M	M	Y
FSM	Does this G/G ROUTER manage ROUTER-ROUTER connections according to the G/G ROUTER FSM description?	7.6.1	M	M	Y
FCTL	Does this G/G ROUTER provide flow control?	7.7.5	M	M	Y
SEQNO	Does this G/G ROUTER provide sequence number support?	7.7.4	M	M	Y
INTG1	Does this G/G ROUTER provide Data Integrity using authentication type 1?	7.7.1	O.1	M	Y
INTG2	Does this G/G ROUTER provide Data Integrity using authentication type 2?	7.7.2	O.1	O	N
INTG3	Does this G/G ROUTER provide Data Integrity using authentication type 3?	7.7.3	O.1	O	N
ERROR	Does this G/G ROUTER handle error handling for IDRP?	7.20	M	M	Y
RIBCHK	Does this G/G ROUTER operate in a "fail-stop" manner with respect to corrupted routing information?	7.10.2	M	M	Y

B.3 IDRP Update Send Process

Table B-3 describes the IDRP update send process requirements.

Table B-3: IDRP Update Send Process Requirements

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
INT	Does the G/G ROUTER provide the internal update procedures?	7.17.1	M	M	Y
RTSEL	Does this G/G ROUTER support the MinRouteAdvertisementInterval Timer?	7.17.3.1	M	M	Y
RTORG	Does this G/G ROUTER support the MinRDOriginationInterval Timer?	7.17.3.2	M	M	Y
JITTER	Does this G/G ROUTER provide jitter on its timers?	7.17.3.3	M	M	Y

B.4 IDRP Update Receive Process

Table B-4 describes the IDRP update receive process requirements.

Table B-4: IDRP Update Receive Process Requirements

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
INPDU	Does the G/G ROUTER handle inbound PDUs correctly?	7.14	M	M	Y
INCONS	Does this G/G ROUTER detect inconsistent routing information?	7.15.1	M	M	Y

B.5 IDRP Decision Process

Table B-5 describes the IDRP decision process requirements.

Table B-5: IDRP Decision Process Requirements

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
TIES	Does this G/G ROUTER break ties between candidate routes correctly?	7.16.2.1	M	M	Y
RIBUPD	Does this G/G ROUTER update the Loc-RIBs correctly?	7.16.2	M	M	Y
AGGRT	Does this G/G ROUTER support route aggregations?	7.18.2.1, 7.18.2.2, 7.18.2.3	O	ATNIDRP3^ATNIDRP5:M	N
LOCK	Does this G/G ROUTER provide interlocks between its Decision Process and the updating of the information in its Adj-RIBs-In?	7.16.4	M	M	Y

B.6 IDRP Receive

Table B-6 describes the IDRP receive requirements.

Table B-6: IDRP Receive Requirements

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
RCV	Does the G/G ROUTER process incoming PDUs and respond correctly to error conditions?	7.14, 7.20	M	M	Y
OSIZE	Does this G/G ROUTER accept incoming OPEN PDUs whose size in octets is between MinPDULength and 3000?	6.2, 7.20	M	M	Y
MXPDU	Does the G/G ROUTER accept incoming UPDATE, IDRP ERROR and RIB REFRESH PDUs whose size in octets is between minPDULength and maxPDULength?	6.2, 7.20	M	M	Y

B.7 IDRP CLNS Forwarding

Table B-7 describes the IDRP connectionless network service (CLNS) forwarding requirements.

Table B-7: IDRP CLNS Forwarding

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
PSRCRT	Does the G/G ROUTER correctly handle ISO/IEC 8473 NPDUs that contain a partial source route?	8	M	O	N
DATTS	Does the G/G ROUTER correctly extract the NPDU-derived Distinguishing Attributes from an ISO/IEC 8473 NPDU?	8.2	M	M	Y
MATCH	Does the G/G ROUTER correctly match the NPDU-derived Distinguishing Attributes with the corresponding FIB-Atts?	8.3	M	M	Y
EXTF	Does the G/G ROUTER correctly forward NPDUs with destinations outside its own routing domain?	8.4	M	M	Y
INTF	Does the G/G ROUTER correctly forward NPDUs with destinations inside its own routing domain?	8.1	M	M	Y

B.8 IDRP Optional Transitive Attributes

Table B-8 describes the requirements for IDRP optional transitive attributes.

Table B-8: IDRP Optional Transitive Attributes Requirements

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
MEXIT	Does this G/G ROUTER support use of the MULTI-EXIT DISC attribute?	7.12.7	O	O	N, O

B.9 Generating Well-Known Discretionary Attributes

Table B-9 describes the G/G router requirements for generating well-known discretionary attributes.

Table B-9: Generating Well-Known Discretionary Attributes Requirements

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
EXTG	Does the G/G ROUTER support generation of the EXT_INFO attribute?	7.12.2	O	O	N
NHRS	Does the G/G ROUTER support generation of the NEXT_HOP attribute in support of route servers?	7.12.4	O	O	N
NHSN	Does the G/G ROUTER support generation of the NEXT_HOP attribute to advertise SNPAs?	7.12.4	O	O	N
DLI	Does the G/G ROUTER support generation of the DIST_LIST_INCL attribute?	7.12.5	O	O	N
DLE	Does the G/G ROUTER support generation of the DIST_LIST_EXCL attribute?	7.12.6	O	O	N
TDLY	Does the G/G ROUTER support generation of the TRANSIT DELAY attribute?	7.12.8	O	O	N
RERR	Does the G/G ROUTER support generation of the RESIDUAL ERROR attribute?	7.12.9	O	O	N
EXP	Does the G/G ROUTER support generation of the EXPENSE attribute?	7.12.10	O	O	N
LQOSG	Does the G/G ROUTER support generation of the LOCALLY DEFINED QOS attribute?	7.12.11	O	OX	N
HREC	Does the G/G ROUTER support generation of the HIERARCHICAL RECORDING attribute?	7.12.12	O	OX	N
SECG	Does the G/G ROUTER support generation of the SECURITY attribute?	7.12.14	O	M	Y
PRTY	Does the G/G ROUTER support generation of the PRIORITY attribute?	7.12.16	O	O	N

B.10 Peer Entity Authentication

Table B-10 describes peer entity authentication requirements.

Table B-10: Peer Entity Authentication Requirements

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
AUTH	Does this G/G ROUTER correctly authenticate the source of a PDU?	7.7.2	O	M	Y

Note. Only support for an Authentication Code 1 is required

B.11 Propagating Well-Known Discretionary Attributes

Table B-11 describes requirements for propagating well-known discretionary attributes.

Table B-11: Propagating Well-Known Discretionary Attributes

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
EXTGP	Does the G/G ROUTER support propagation of the EXT_INFO attribute?	7.12.2	M	M	Y
NHRSP	Does the G/G ROUTER support propagation of the NEXT_HOP attribute in support of route servers?	7.12.4	O	O	N
NHSNP	Does the G/G ROUTER support propagation of the NEXT_HOP attribute to advertise SNPAs?	7.12.4	O	O	N
DLIP	Does the G/G ROUTER support propagation of the DIST_LIST_INCL attribute?	7.12.5	O	M	Y
DLEP	Does the G/G ROUTER support propagation of the DIST_LIST_EXCL attribute?	7.12.6	O	M	Y
TDLYP	Does the G/G ROUTER support propagation of the TRANSIT DELAY attribute?	7.12.8	O	O	N
RERRP	Does the G/G ROUTER support propagation of the RESIDUAL ERROR attribute?	7.12.9	O	O	N
EXPP	Does the G/G ROUTER support propagation of the EXPENSE attribute?	7.12.10	O	O	N
LQOSP	Does the G/G ROUTER support propagation of the LOCALLY DEFINED QOS attribute?	7.12.11	O	OX	N
HRECP	Does the G/G ROUTER support propagation of the HIERARCHICAL RECORDING attribute?	7.12.12	O	OX	N
SECP	Does the G/G ROUTER support propagation of the SECURITY attribute?	7.12.14	O	M	Y
PRTYP	Does the G/G ROUTER support propagation of the PRIORITY attribute?	7.12.16	O	O	N

B.12 Receiving Well-Known Discretionary Attributes

Table B-12 describes the requirements for receiving well-known discretionary attributes.

Table B-12: Receiving Well-Known Discretionary Attributes

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
EXTR	Does the G/G ROUTER recognise upon receipt the EXT_INFO attribute?	7.12.2	M	M	Y
NHRSR	Does the G/G ROUTER recognise upon receipt the NEXT_HOP attribute?	7.12.4	M	M	Y
DLIR	Does the G/G ROUTER recognise upon receipt the DIST_LIST_INCL attribute?	7.12.5	M	M	N
DLER	Does the G/G ROUTER recognise upon receipt the DIST_LIST_EXCL attribute?	7.12.6	M	M	N
TDLYR	Does the G/G ROUTER recognise upon receipt the TRANSIT DELAY attribute?	7.12.8	M	M	Y
RERRR	Does the G/G ROUTER recognise upon receipt the RESIDUAL ERROR attribute?	7.12.9	M	M	Y
EXPR	Does the G/G ROUTER recognise upon receipt the EXPENSE attribute?	7.12.10	M	M	Y
LQOSR	Does the G/G ROUTER recognise upon receipt the LOCALLY DEFINED QOS attribute?	7.12.11	M	O	N
HRECR	Does the G/G ROUTER recognise upon receipt the HIERARCHICAL RECORDING attribute?	7.12.12	M	M	Y
SECR	Does the G/G ROUTER recognise upon receipt the SECURITY attribute?	7.12.14	M	M	Y
PRTYR	Does the G/G ROUTER recognise upon receipt the PRIORITY attribute?	7.12.16	M	M	Y

B.13 IDRP Timers

Table B-13 describes the IDRP timer requirements.

Table B-13: IDRP Timers Requirements

Item	Description	ISO/IEC 10747 Ref.	ISO Status	ATN Support	G/G Router Support
Ta	KeepAlive time	7.6.5	M	M	Y
Tr	Retransmission (tr) timer	7.6.5	M	M	Y
Tmr	maxRIBIntegrityCheck timer	7.10.2	M	M	Y
Tma	MinRouteAdvertisement timer	7.17.3.1	M	M	Y
Trd	MinRDOriginationInterval timer	7.17.3.2	M	M	Y
Tcw	closeWaitDelay timer	7.6.4	M	M	Y

APPENDIX C - ACRONYMS

C.0 Acronyms

This appendix defines the acronyms used in this document.

APRLs	ATN Protocol Requirement Lists
ATN	Aeronautical Telecommunications Network
ATSMHS	Air Traffic Service Message Handling Service
CLNP	Connectionless Network Protocol
CM	Context Management
CPDLC	Controller-Pilot Data Link Communication
ES	End System
FIB	Forwarding Information Base
G-G (G/G)	Ground-Ground
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
ICS	Internet Communication Service
IDRP	Inter Domain Routing Protocol
IEC	International Electrotechnical Commission
ISO	International Standardization Organization
ITU	International Telecommunications Union
ITU-T	ITU Telecommunications Sector
NPDU	Network Protocol Data Unit
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PICS	Protocol Implementation Compliance Statement
QOS	Quality of Service
RIB	Routing Information Base
SNDCF	Sub Network Dependent Convergence Functions

Seventh Meeting of Aeronautical Telecommunication Network (ATN)
Transition Task Force of APANPIRG (ATNTTF/7)

Appendix G to the Report

INTERNATIONAL CIVIL AVIATION ORGANIZATIONA
ASIA AND PACIFIC OFFICE

Asia/Pacific Regional Aeronautical Telecommunication Network (ATN) Air Traffic Service (ATS) Message Handling System (AMHS) Description

FIRST EDITION – APRIL 2005

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1.0 Introduction

The Aeronautical Telecommunication Network (ATN) is a global inter-network that provides digital communications necessary to the automated systems that include; air traffic service communication (ATSC), aeronautical operational control (AOC), aeronautical administrative communication (AAC), and aeronautical passenger communication (APC).

The ATN is composed of a network infrastructure and applications, and provides the global communication for ground-ground (G/G) and air-ground (A/G) services. The major components of ATN network are routers (Intermediate Systems: IS) including G/G routers and A/G routers, and communication sub-networks including air-ground and ground-ground sub-networks. The ATN applications include, among others, context management (CM), controller-pilot data link communication (CPDLC), air traffic service message handling services (AMHS). The applications are hosted by the End Systems (ES).

The Aeronautical Fixed Telecommunication Network (AFTN) and the Message Switching System are being incrementally replaced by a regional ATN ground network and AMHS. This document describes AMHS system in the Asia/Pacific region.

1.1 Scope

This document describes the functionality, system, performance, information security, and system management requirements of the AMHS system in the Asia/Pacific region. The AMHS system includes ATS Message Server, ATS Message User Agent, and AFTN/AMHS Gateway. The AFTN/AMHS Gateway is only needed during the early stage of ATN/AMHS implementation to operate AMHS and AFTN concurrently. This document provides essential procurement guidance for the AMHS system to assure the interoperability of the AMHS within the Asia/Pacific Region. This document includes:

1. AMHS functionalities including basic and extended AMHS service;
2. AMHS system requirements;
3. AMHS performance requirements to ensure the performance of Asia/Pacific AMHS;
4. Information security requirements; and
5. System management requirements.

This document should be used in conjunction with ICAO Doc. 9705 “Manual of Technical Provisions for the Aeronautical Telecommunication Network”[1,2], the Interface Control Document (ICD) for Asia/Pacific Regional AMHS, and other applicable documents as highlighted in this document.

1.2 Standard Compliance

1.2.1 ICAO Doc 9705 Edition 2 and Edition 3

This document is applicable to ATN AMHS that is defined in sub-volume III of the ICAO Doc 9705.

While the current version of ICAO Doc 9705 is Edition 3, there are two major differences between the AMHS requirements specified in Edition 2 and Edition 3:

1) ICAO Doc 9705 Edition 3 includes extended service; and
2) ICAO Doc 9705 Edition 3 does not include pass-through service.

It is further noted that the technical provisions are generally backwards compatible between successive editions. While Doc 9705 Edition 3 incorporates technical provisions for AMHS enhancements such as extended service, these enhancements are not mandatory for AMHS, and the use of these enhancements for AMHS is not currently planned in the Asia/Pacific region on a regional basis. Both ICAO Doc 9705 Editions 2 and 3 satisfy the system level requirements specified in this document.

The AMHS specified in ICAO Doc 9705 is implemented over the ATN protocol stack, which is based on the ISO Open Systems Interconnect (OSI) protocols. This uses the Connectionless Network Protocol (CLNP) as the network protocol and the Connection Oriented Transport Class 4 Protocol (COTP4) as the transport protocol.

1.3 Introduction to the ATS Message Handling System (AMHS)

1.3.1 Aeronautical Fixed Telecommunications Network (AFTN)

The *ATS Message Handling System (AMHS),* which has been defined in the ICAO Aeronautical Telecommunication Network (ATN) standards, is intended to be a replacement for the current *Aeronautical Fixed Telecommunications Network (AFTN*). AFTN is a store-and-forward messaging service for conveyance of text messages using character-oriented procedures. AFTN messages are forwarded on a hop-by-hop basis using pre-configured routes that are the most expeditious to affect delivery to the addressee. AFTN has diversion routing lists agreed to by the Administrations operating the communication centres where the AFTN switches reside. These lists are statically configured and used to immediately reroute traffic in the event of a circuit outage in a fully automatic communication centre and to manually reroute traffic within 10 minutes in a non-fully automatic communication centre. Under AFTN procedures the sending station will hold messages transmitted, and in the event that continuity of message traffic is not maintained, they are re-transmitted. Continuity of message traffic is supervised using sequence numbers applied to all traffic over a particular channel. The AFTN system is depicted in Figure 1.

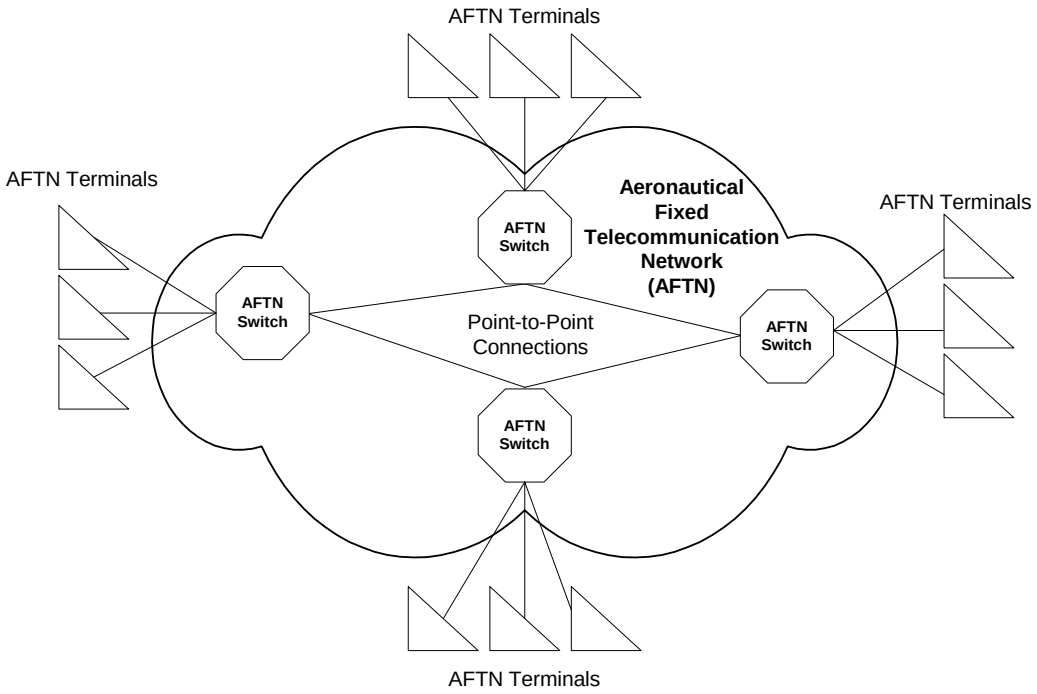


Figure 1 – AFTN System

1.3.2 OSI X.400 Message Handling System

The ATS Message Handling System is based on the OSI X.400 Message Handling System. It is important to note that the X.400 Message Handling System is not a physical system with actual physical entities but rather is an architectural model for specifying functions or services provided by logical entities and the protocols between these logical entities. Figure 2 depicts the OSI X.400 architecture in the overall *Message Handling Environment (MHE).* As is depicted there is an outer infrastructure and inner infrastructure. The outer infrastructure is the *Message Handling System (MHS),* which is a generic messaging system from the perspective of MHS Users.

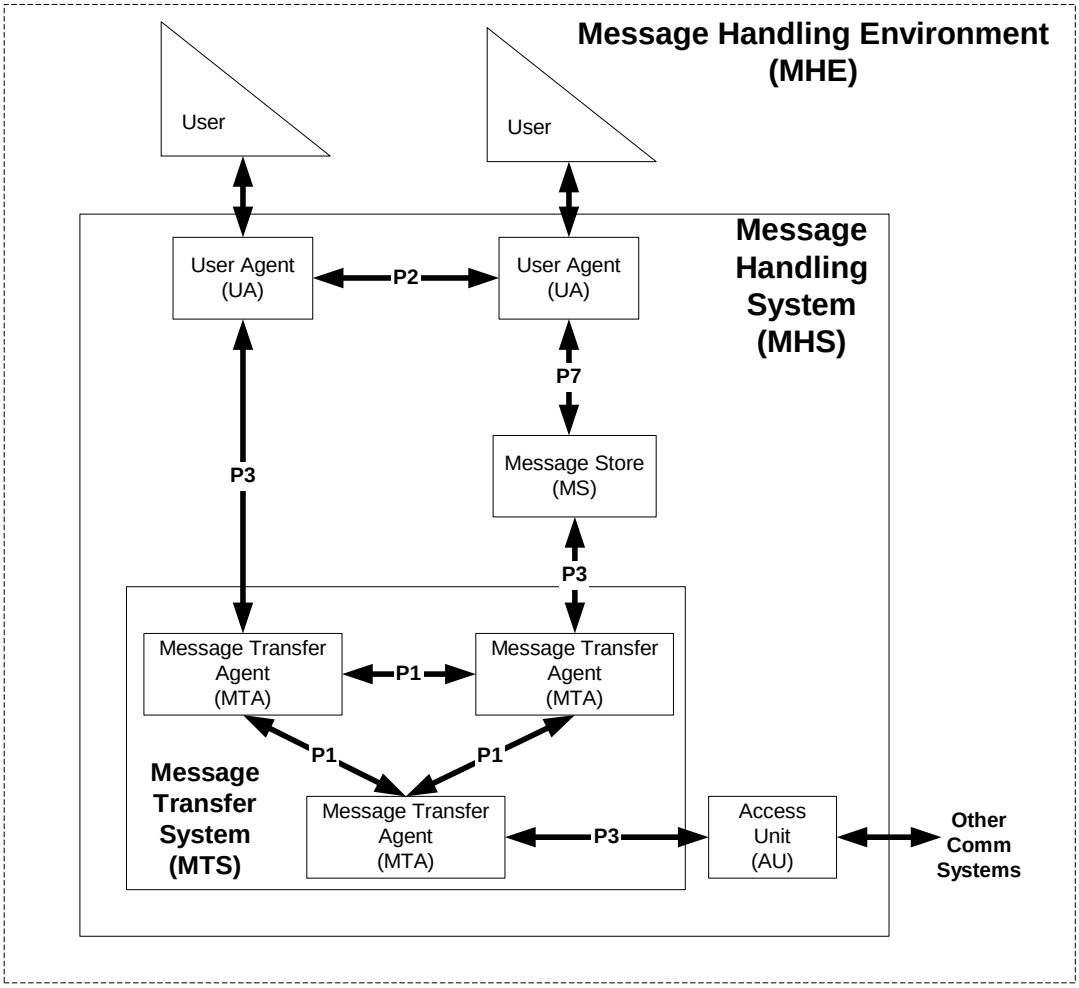


Figure 2 – X.400 Architecture and Protocols

The inner infrastructure is the *Message Transfer System (MTS)*, which provides the store and forward capability of the MHS. The MTS consists of a network of *Message Transfer Agents (MTA)*. Informally, MTAs are "message routers", that is, they function as routers at the message level to forward messages across the MHS. MTAs forward messages using the Recipient Address in the message (as opposed to the network address of a network level packet which a "network router" uses). MTAS MTAs communicate with one another using the P1 protocol. The P1 protocol defines a message envelope (which would be called a header at the network level). The P1 envelopes contain routing and control information and thus determine how message exchange occurs among MTAs.

MTS users within the MHS are either *User Agents (UA)* or *Message Stores (MS).* A UA is essentially a unit (of software) that interacts with the MTS on behalf of a user. A UA functions to permit the user to send and receive mail, for example, like the Microsoft Outlook Express software that may be resident on a PC. UAs communicate with one another using the P2 protocol. The P2 protocol defines the content and format of an interpersonal message. The P2 protocol defines a P2 heading, which is equivalent to the address on a personal letter and a P2 body which is made up of one or more P2 body parts, each containing information in different formats. As described above the P1 protocol between MTAs will encapsulate a P2 interpersonal message with control information during MTA to MTA communication

A MS is, as the name suggests, a unit that stores messages on behalf of a UA. When a MTA has a message to deliver to a UA it delivers it to the MS instead of the UA. The UA can then retrieve the message from the MS at its convenience. Access to a MS by a UA in the X.400 MHS is similar to Outlook Express accessing a mail server using the Internet's POP3 protocol. A UA communicates with a MS using the P7 protocol. The P7 protocol defines procedures for message submittal, message retrieval, and message administration.

MTS users communicate with MTAs using the P3 protocol. The P3 protocol defines procedures for message message delivery and as in the case for the P7 protocol defines procedures for message submittal and message administration.

The final entity in the diagram is an *Access Unit (AU).* The AU is simply a gateway to another communications system. In the original X.400 specifications, AUs were expected to provide an interface to pre-X.400 technologies such as telex, and teletex. As will be described below, ICAO defines two AUs. One is the AFTN/AMHS Gateway and the other is the CDIN/AMHS Gateway. Note that many X.400 vendors offer AUs that provide gateway service to TCP/IP mail service in the form of an X.400 to SMTP gateway.

1.3.3 ATS Message Handling Service (ATSMHS)

The message handling service provided in the ATN is called the *ATS Message Handling Service (ATSMHS).* This service is specified using X.400 standards following the X.400 architecture described above. There are two levels of ATSMHS service: Basic ATS Message Service and Extended ATS Message Service.

- **Basic ATS Message Service** provides a nominal capability equivalent from a user perspective to those provided by AFTN.

- **Extended ATS Message Service** provides enhanced features such as supporting transfer of more complex message structures (body parts), use of the directory service, and support for security.

1.3.4 ATS Message Handling System (AMHS)

ICAO Doc 9705 distinguishes the service from the set of computing and communication resources implemented by ATS organizations to provide the ATS message handling service. The set of computing and communication resources is called the *ATS Message Handling System (AMHS).* For Basic ATS Message Service, the following AMHS entities are defined:

- **ATS Message Server** - An X.400 MTA and optionally one or more MSs

- **ATS Message User Agent** – An X.400 UA

- **AFTN/AMHS Gateway** – An MTA and an AFTN specific AU, called a Message Transfer and Control Unit (MTCU) and a Control Position.

- **CDIN/AMHS Gateway** – An MTA and a CDIN specific AU, called a Message Transfer and Control Unit (MTCU) and a Control Position.

1.4 Initial AMHS Configuration

Figure 3 depicts the initial AMHS configuration. In this configuration the AFTN system is still in place, a supporting network of ATN Ground-Ground Routers is introduced, and AFTN/AMHS Gateways are introduced to begin the transition to ATN-based ATSMHS. In this configuration, basic ATS message service is provided. From a users perspective at an AFTN terminal there should be no difference from the AFTN only environment. The advantage of the ATN is that the Ground-Ground routers of the ATN perform re-routing automatically without the need for pre-configured diversion routing list and they permit direct MTA-to-MTA routing rather than having messages relayed through intervening MTA.

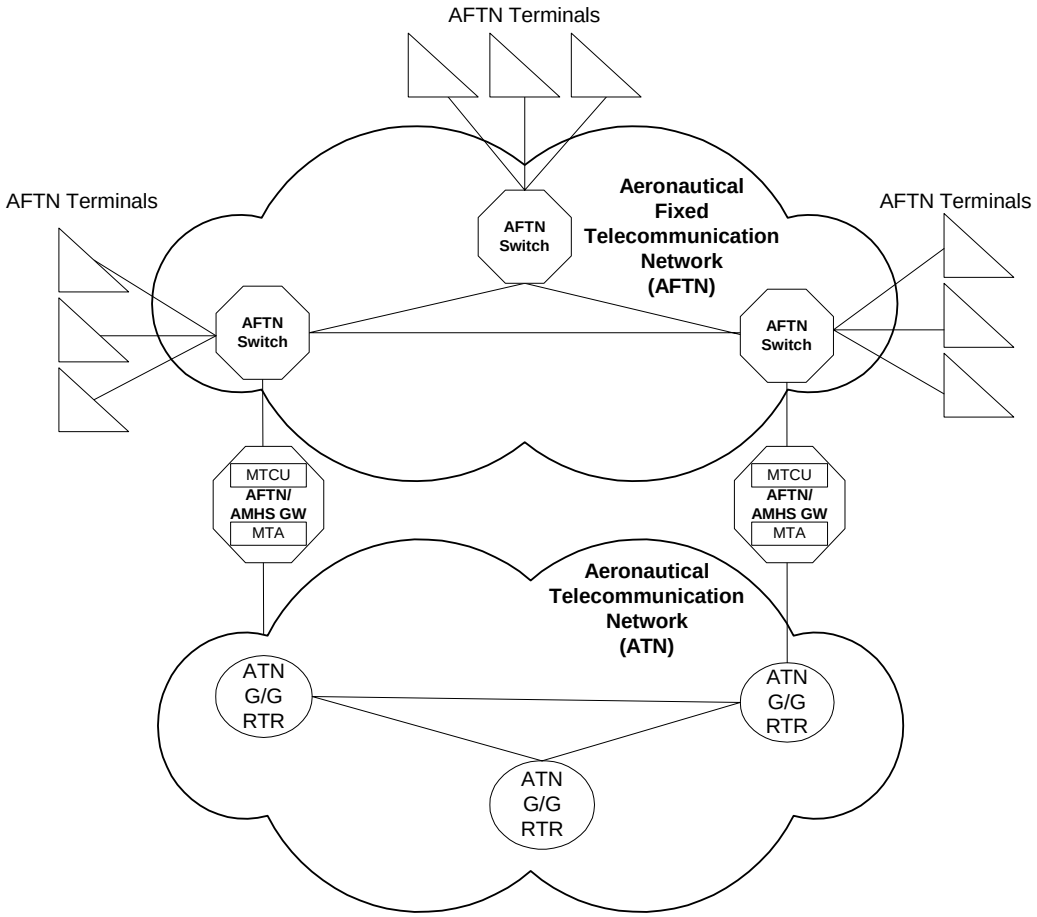


Figure 3 – Initial AFTN – AMHS Gateway System

1.5 Evolving AMHS Configuration

Figure 4 depicts the evolving AMHS configuration. In this configuration AFTN terminals and associated AFTN switches are still in place to accommodate administrations that have not yet switched to AMHS. The evolving system now has AMHS terminals. These terminals have ATS message user agents embedded in them. The AMHS user terminals interface to ATS Message Servers, which as described above, will have an MTA to interface the ATN MTS and most likely an embedded MS capability to permit storage of messages which terminals are not in-use. Administrations may introduce AMHS terminals while at the same time maintaining AFTN terminals. In this case, it is likely that a combination AFTN/AMHS Gateway and ATS Message Server will be employed. It is anticipated that gateway vendors will provide this upgrade path.

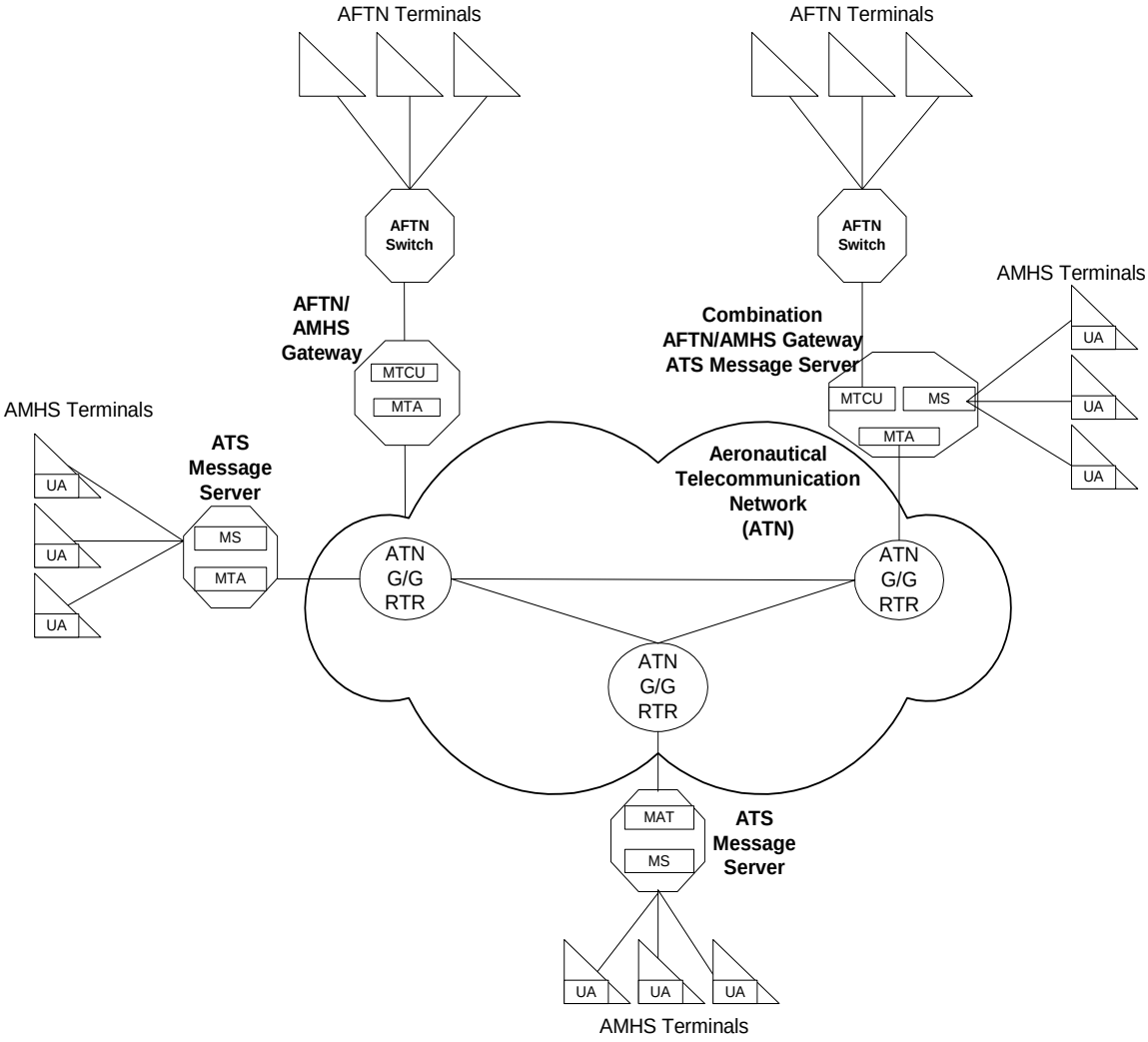


Figure 4 – Evolving AMHS System

1.6 AMHS with Extended Services

Figure 5 depicts an AMHS configuration with extended services. Extended services will generally involve support from an X.500 directory service. The directory may be used to enhance the AMHS system. For example, the directory may be accessed by UA to obtain the O/R address and capabilities of potential message recipients. The directory may be accessed by MTAs to look up the MTA serving a recipient and to look up the NSAP address of the serving MTA. Access is via a Directory User Agents (DUA) in the UA or MTA.

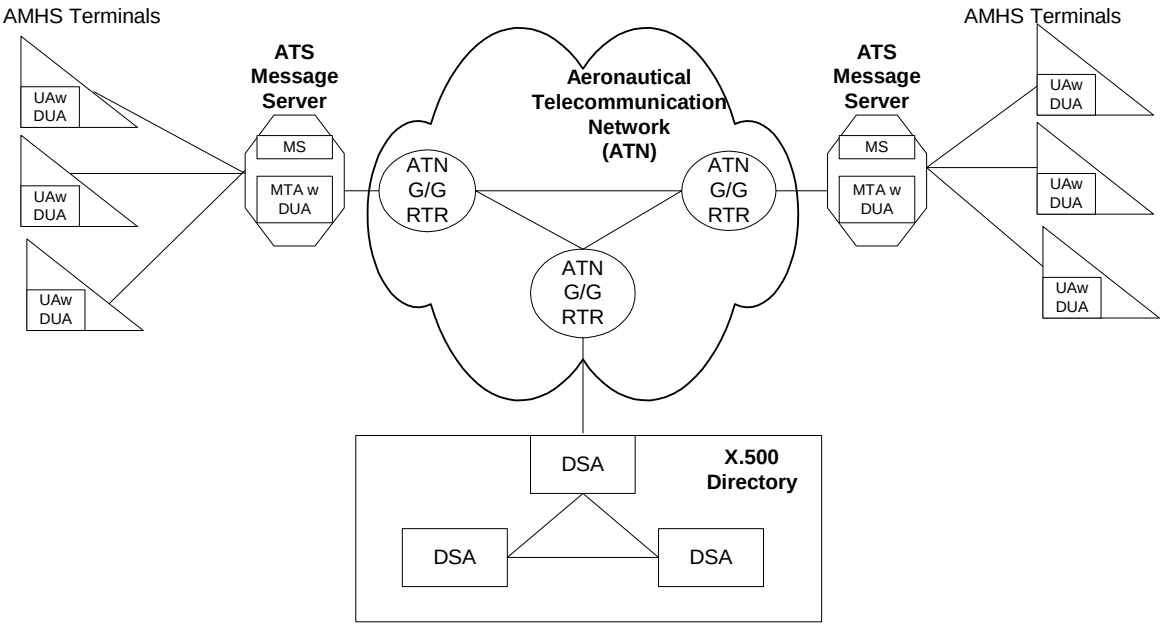


Figure 5 – AMHS with Extended Services

The directory will also enable enhanced security services. In this case a UA may access the directory to obtain X.509 public key certificates. X.509 certificates enable messages to be transmitted with the authentication security service. Authentication ensures that the identity of a peer is a claimed and that a particular message came from an authentic peer.

Other extended services include support for body parts in other than text format. For example, AMHS will be able to transmit meteorological data in Binary Universal Form Representation (BUFR) defined by the World Meteorological Organization (WMO).

2.0 Documents

2.1 Applicable Documents

The following documents, with specific editions and/or versions, contain requirements which, through reference in this text, constitute requirements of this document. The requirements for the AMHS system descriptions are specified in the following documents:

1) *ICAO Doc. 9705-AN/956*. Manual of Technical Provisions for the Aeronautical Telecommunication Network, Second Edition– 1999.

2) *ICAO Doc. 9705-AN/956*. Manual of Technical Provisions for the Aeronautical Telecommunication Network, Third Edition– 2002.

3) *ISO/IEC 10021_1:1990.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 1: System and Service Overview.

4) *ISO/IEC 10021_1/Amd.2:1994.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 1: System and Service Overview.

5) ISO/IEC 10021_1:1999. Information Technology — Message Handling Systems (MHS) — Part 1: System and Service Overview.

6) *ISO/IEC 10021_2:1990.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 2: Overall Architecture.

7) *ISO/IEC 10021_2/Amd.1:1993.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 2: Overall Architecture.

8) *ISO/IEC 10021_2/Amd.2:1994.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 2: Overall Architecture.

9) *ISO/IEC 10021_2:1999.* Information Technology — Message Handling Systems (MHS) — Part 2: Overall Architecture.

10) *ISO/IEC 10021_3:1990.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 3: Abstract Service Definition Conventions.

11) *ISO/IEC 10021_4:1990.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 4: Message Transfer System: Abstract Service Definition and Procedures.

12) *ISO/IEC 10021_4/Amd. 1:1994.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 4: Message Transfer System: Abstract Service Definition and Procedures.

13) *ISO/IEC 10021_4:1999.* Information Technology — Message Handling Systems (MHS) — Part 4: Message Transfer System: Abstract Service Definition and Procedures.

14) *ISO/IEC 10021_5:1990.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 5: Message Store: Abstract Service Definition.
15) *ISO/IEC 10021_5/Amd. 1:Date.* Message Store Extensions and Message Store Logs.

16) *ISO/IEC 10021_5:1999.* Information Technology — Message Handling Systems (MHS) — Part 5: Message Store: Abstract Service Definition.

17) *ISO/IEC 10021_6:1990.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 6: Protocol Specifications.

18) *ISO/IEC 10021_6:1999.* Information Technology — Message Handling Systems (MHS) — Part 6: Protocol Specifications.

19) *ISO/IEC 10021_7:1990.* Information Technology — Text Communication — Message_Oriented Text Interchange System (MOTIS) — Part 7: Interpersonal Messaging System.

20) *ISO/IEC 10021_7:1999.* Information Technology — Message Handling Systems (MHS) — Part 7: Interpersonal Messaging System.

21) *ISO/IEC ISP 12062_1:1995.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 1: IPM MHS Service Support.

22) *ISO/IEC ISP 12062_1:1999.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 1: IPM MHS Service Support. (Edition 3)

23) *ISO/IEC ISP 12062_2:1995.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 2: AMH21 — IPM Content.

24) *ISO/IEC ISP 12062_2:1999.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 2: AMH21 — IPM Content. (Edition 3)

25) *ISO/IEC ISP 12062_3:1995.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 3: AMH22 — IPM Requirements for Message Transfer (P1).

26) *ISO/IEC ISP 12062_3:1999.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 3: AMH22 — IPM Requirements for Message Transfer (P1). (Edition 3)

27) *ISO/IEC ISP 12062_4:1995.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 4: AMH23 — IPM Requirements for MTS Access (P3).

28) *ISO/IEC ISP 12062_4:1999.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 4: AMH23 and AMH25 — IPM Requirements for MTS Access (P3) and MTS 94 Access (P3). (Edition 3)

29) *ISO/IEC ISP 12062_5:1995.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 5: AMH24 — IPM Requirements for Enhanced MS Access (P7).

30) *ISO/IEC ISP 12062_5:1999.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 5: AMH24 — IPM Requirements for Enhanced MS Access (P7). (Edition 3)

31) *ISO/IEC ISP 12062_6:1999.* Information technology — International Standardized Profiles AMH2n — Message Handling Systems — Interpersonal Messaging — Part 6: AMH26 — IPM Requirements for Enhanced MS 94 Access (P7). (Edition 2)

32) Asia/Pacific Region Interface Control Document (ICD) for ATS Message Handling System (AMHS), Version 1.0, September 2002.

2.2 Reference Documents

The following documents are reference documents applicable to the AMHS descriptions. These documents do not form a part of this document and are not referenced within the document.

1) *ICAO Doc. 9739-AN/961*. The Comprehensive Aeronautical Telecommunication Network (ATN) Manual (CAMAL) First Edition, January 1999.

2) *ISO/IEC 8348:1993.* Information technology - Open Systems Interconnection - Network Service Definition.

3.0 AMHS Functionality

The AMHS provides the ATS message exchange between service users. Implemented over ATN network, the ATS message service is an implementation of message handling system based on ISO/IEC 10021 or ITU-T X.400.

The ATS message service may have two levels of services: the Basic ATS Message Service and the Extended ATS Message Service.

3.1 Basic ATS Message Service

The Basic Service is based on the first version of the ISO/IEC International Standardized Profiles (ISP), published in 1994 and based on the ISO/IEC 10021:1990 set of standards.

3.2 Extended ATS Message Service

The Extended Service is based on the third version of the ISO/IEC ISP, published in 1999 and based on the ISO/IEC 10021:1999 set of standards. The Extended Service is a superset of Basic Service, and is backward compatible with the Basic Service.

3.3 Asia/Pacific ATS Message Handling Service (ATSMHS)

In the initial stage, the Asia/Pacific ATSMHS will only provide the Basic Service. Eventually, the Extended Service will be supported by all AMHS.

4.0 AMHS System Requirements

The Asia/Pacific AMHS includes three types of end systems:

1) ATS message server;

2) ATS Message User Agent; and

3) AFTN/AMHS gateway.

The AMHS end systems should comply with the requirements in accordance with the Protocol Implementation Conformance Statement (PICS) specified in Asia/Pacific Regional AMHS ICD [32].

4.1 ATS Message Server

An ATS message server includes a Message Transfer Agent (MTA) and optionally one or several Message Stores (MSs). The MTA transfers messages and delivers them to the intended recipients. The MS is a functional entity whose primary purpose is to store and permit retrieval of delivered messages.

The Asia/Pacific ATS message server should comply with the following requirements in accordance with the Asia/Pacific AMHS ICD[32].

1. the profile specification expressed in ICAO Doc 9705 section 3.1.2.2.2.1; and

2. the provisions related to traffic logging as specified in ICAO Doc 9705 section 3.1.2.2.2.2.

The Extended ATS Message Service is out of the scope in this document.

4.2 ATS Message User Agent

An ATS Message User Agent includes a User Agent (UA) functional object as defined in ISO/IEC 10021-2. UA is an application process that interacts with the Message Transfer Agent (MTA) or a Message Store (MS), to submit messages on behalf of a single user. Both MTA and MS functional object are defined in ISO/IEC 10021-2.

For the support of the Basic ATS Message Service, an ATS message user agent should comply with the following requirements in accordance with Asia/Pacific AMHS ICD.

1. the UA profile specified in ICAO Doc 9705 section 3.1.2.2.1.1, based on AMH21 as specified in ISO/IEC ISP 12062-2:1995 (1st or later Edition) and for messages including a body part whose type is an Extended Body Part Type of general-text-body-part type; and

2. the provisions related to traffic logging as specified in ICAO Doc 9705 section 3.1.2.2.1.2.

The Extended ATS Message User Agent is out of the scope in this document.

4.3 AFTN to AMHS Gateway

An AFTN /AMHS gateway provides an inter-connection between the AFTN and the ATN AMHS. The AFTN/AMHS gateway consists of the following four logical components:

1. AFTN component;
2. ATN component;
3. Message transfer and control unit; and
4. Control position.

The ATN component includes a MTA and an Access Unit (AU) defined in ISO/IEC10021-2. The AU delivers the indirect users' messages, such as AFTN messages, to AMHS.

The AFTN/AMHS gateway requirements are defined in ICAO Doc 9705 section 3.1.2.3 and Asia/Pacific AMHS ICD.

4.4 AMHS Addressing Scheme

The AMHS address includes Common AMHS Addressing Scheme (CAAS) Address and translated-form (XF) Address.

Both CAAS and XF address are used in Asia/Pacific Region. The AMHS addressing in Asia/Pacific region should comply with the requirements provided in ICAO Doc 9705 section 3.1.2.1.5.

5.0 Upper Layer Requirements

5.1 ATN AMHS

According to ICAO Doc 9705, ATN AMHS is over a Connectionless Network Protocol (CLNP) based ATN network. In order to implement ATN AMHS in Asia/Pacific Region, upper layers including presentation and session layer should comply with the upper layer requirements defined in Asia/Pacific AMHS ICD.

6.0 Performance Recommendations

The ATN AMHS performance requirements depend on the ATN network, AMHS service requirements, and bilateral agreements.

The follows are the baseline AMHS performance requirements.

6.1 Communications Performance and Capacity

The required communication performance of the AMHS (circuit speeds, number of circuits, message conveyance capability, maximum message transit time etc.) should be first determined. This may be achieved by analysis of existing communications traffic levels and the bandwidth and latency requirements of current and future applications. The following are general minimum guidelines for AMHS.

1. The minimum WAN speed should be 64 Kbps.

2. The minimum LAN speed should be 10 Mbps.

3. The AMHS message conveyance capability should be calculated based on existing and projected traffic.

4. The ATN AMHS maximum message transit time should be determined bilaterally to meet the end-to-end performance requirement.

6.2 Availability and Reliability

The availability of message service is determined based on Mean Time Between Failures (MTBF) of the AMHS and downtime, which are in turn determined bilaterally to meet the end-to-end performance requirements. In the network design, availability requirements should first be determined and the network should then be designed to achieve this with given equipment reliability. Availability requirements are normally higher for ATS Message server and AMHS/AFTN gateway than ATS Message User Agent.

1. For ATS Message server and AMHS/AFTN gateway, a high level of availability of the message service is required. This may be achieved either by using ATS Message Server and AMHS/AFTN gateway that have internal redundancy (e.g. dual-redundant systems) or by the use of multiple non-redundant AMHS, with automatic switchover capability in the event of failure.

Where such high levels of availability are not required, use of multiple AMHS with manual switchover in the event of failure within a certain time period, or identification of faults and replacement of malfunctioning units within a certain time period, may be acceptable methods of meeting availability

requirements.

2. The maximum allowed message service downtime is determined based on maintenance contract. Use of multiple or redundant AMHS may help to maintain message service availability during scheduled maintenance downtime.

7.0 Information Security

7.1 Message Exchange Security

According to ICAO Doc 9705 section 3.1.2.1.2.3, in the Basic Service, security should be obtained by procedural means rather than by technical features inherent to the AMHS.

Security of Extended Service is out the scope in this document.

7.2 AMHS Security

The security of each AMHS is considered a local issue.

8.0 AMHS with Extended Services

Network Management Recommendations

The AMHS should provide a network management agent capable of supporting local management provisions.

The Common Management Information Protocol (CMIP) is the network management protocol specified for ATN according to ICAO Doc 9705. ATN network management sees the use of CMIP to allow direct access to network management information across domains in real-time. However, there are currently no requirements for such real-time inter-domain management information sharing within the Asia/Pacific region. Further, there are very few commercially available CMIP products at present. Implementation of ATN SARPs compliant CMIP agent is therefore optional for Asia/Pacific region AMHS at present.

For local management of AMHS within a domain, use of the Simple Network Management Protocol (SNMP) is recommended, given the widespread availability of commercial-off-the-shelf (COTS) SNMP server (network management) products.

APPENDIX A ACRONYMS

AAC	Aeronautical administrative communication
A/G	Air-Ground
AMH2n	Application Message Handling profile #2n, n=1,2,3…
AMHS	ATS Message Handling System
AOC	Aeronautical Operational Control
APC	Aeronautical Passenger Communication
ATC	Air Traffic Control
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Service
ATSC	ATS Communication
ATSMHS	ATS Message Handling Service
AU	Access Unit
CLNP	Connectionless Network Protocol
CAAS	Common AMHS Addressing Scheme
DUA	Directory User Agent
ES	End system
G/G	Ground-Ground
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IPM	Interpersonal Messaging
IS	Intermediate System
ISO	International Standardization Organization
ISP	International Standardized Profiles
MS	Message Store
MTA	Message Transfer Agent
MTS	Message Transfer System
MTBF	Mean Time Between Failures
P1	MTS Transfer Protocol
P3	MTS Access Protocol
P7	MS Access Protocol
PICS	Protocol Implementation Conformance Statement
SARPs	ICAO Standard and Recommended Practices
UA	User Agent
XF	Translated-form

Seventh Meeting of Aeronautical Telecommunication Network (ATN)
Transition Task Force of APANPIRG (ATNTTF/7)

Appendix H to the Report



INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC TECHNICAL DOCUMENT ON USE OF DIRECTORY SERVICES

FIRST EDITION -APRIL 2005

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1 Introduction

The introduction of the ATN applications, especially AMHS, changes the way that information is exchanged within Administrations as well as between States. The ATN Panel recognized that the need for the exchange of information could best be provided for through the definition of a directory service. The definition of the directory services was completed and published as Sub-Volume VII of ICAO Doc. 9705 Edition 3.

This document presents information on the planning of implementation of the ATN Directory Services (ATN-DS) within the Asia/Pacific Region.

1.1 Definitions and Acronyms

AMHS	ATS Message Handling System
ATN	Aeronautical Telecommunication Network
ATN-DS	ATN Directory Service
BIS	Boundary Intermediate System
DIT	Directory Information Tree
DMD	Directory Management Domain
DSA	Directory Service Agent
DUA	Directory User Agent
ICAO	International Civil Aviation Organization

2 Asia-Pacific Background

The Asia/Pacific Region is moving rapidly towards the deployment of both an ATN infrastructure (backbone routers) and the ATN AMHS. In conjunction with these implementations, it would be advantageous to begin implementing the ATN-DS to ease the transition to the use of AMHS and for the future use of both air-ground applications and the implementation of ATN security.

3 Overview of Plan for ATN Use

3.1 Description of AMHS Plans

The Asia/Pacific Region has published plans for the implementation of the ATN AMHS within the region. Most States within the Region have announced plans to implement AMHS-capable systems in the 2005 timeframe. These implementation plans are the first step in the migration from the AFTN to the AMHS. The Region has further published the specification of the minimum AMHS planned for the Region. This document specifies that the initial implementation will be based on Edition 2 of ICAO Doc. 9705, with further planning required to migrate to the Edition 3 specification.

3.2 Description of Air-Ground Application Plans

The Asia/Pacific plans for the introduction and use of ATN Air-Ground applications are under development. This Section will be updated to summarize those plans as they are completed.

4 Overview of ATN Directory Services

The ATN-DS is defined in Sub-Volume VII of Edition 3 of ICAO Doc. 9705. It defines the ATN-specific directory schema and the protocol subsets needed to store, retrieve, and use the associated entries. The following sections present an overview of the current ATN-DS definition.

4.1 Rationale for ATN-DS

The ATN employs increasingly sophisticated applications that must work on and across computer networks and systems from multiple States and vendors. An ITU-T X.500-based Directory Service constitutes one of these distributed applications that at the same time can provide significant support to the realization of other distributed applications. X.500 Directory Information Concepts X.500 Data Model

The information repository of the ATN Directory is a distributed database capable of storing information about people and objects in various nodes or servers distributed across a network. It is these servers, acting in concert, which provide the potentially global access to information made possible by X.500 technology.

Distributing information in this manner has various advantages over the conventional method of centralizing information storage, for example:

- The information is kept “close” to those people or processes which are most likely to make heaviest use of it or to be responsible for keeping it up to date. This is likely to reduce access time and network costs, and increase the likelihood that the stored information will be accurate;

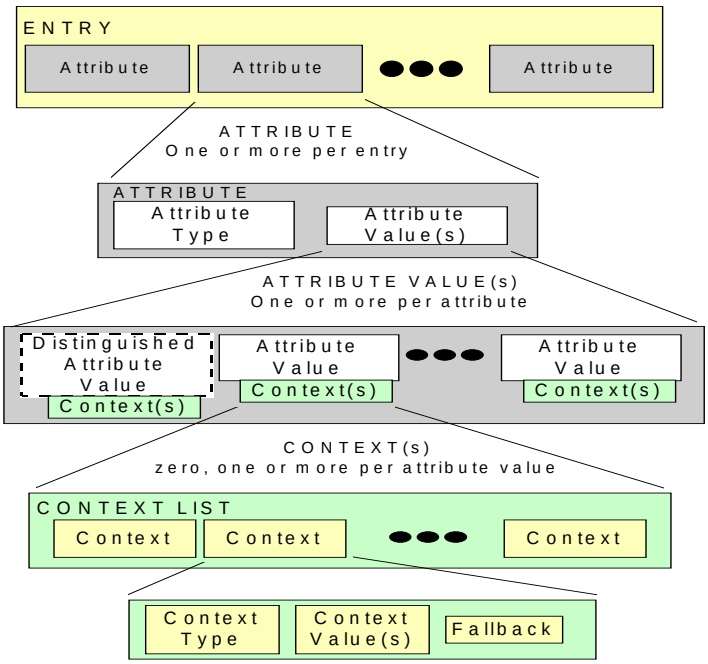
- Since the information is distributed across several servers, the impact of a given server becoming inactive, for whatever reason, is only to make unavailable the information for which that server is responsible, rather than bringing down the entire database, as would be the case if a centralized server were to go down;

- The ATN Directory has the capability to grow indefinitely in size and storage capacity through the simple addition of new nodes. Such growth might be achievable with a centralized system, but would be less practical.

The ATN-DS database is distributed across directory servers called Directory Service Agents or DSAs. The ATN-DS data maintained by the DSAs are defined using a structure known as the Directory Schema. The information held by the ATN-DS is collectively termed the Directory Information Base (DIB), and the organization of the data within the DIB is defined by the Directory Information Tree or DIT.

The DIB is made up of entries, each one of which describes a single object in the real world (for example, “person”). Objects are defined by an ***object class*** definition. The contents of an entry (object class) is a group of features called ***attributes*** that are used to describe that object. Each attribute in turn has a type and one or more values (for example, the entry for the object “person” may have a “telephone-number” attribute with one or more telephone number values). In addition, there may be one or more context values per attribute value. These context values are used to specify information that determines the applicability of that attribute (for example, a context would be used to tell how a time or date value should be interpreted). Figure 4.2-1 depicts these relationships.

Figure 4.2-1 Directory Entry Structure



The DIT defines the organization of the information of the DIB by defining logical hierarchies of objects classes.

The structure defined by the DIT provides the mechanism for the naming of objects in the DIB. Each entry in the ATN-DS has a Relative Distinguished Name (RDN) that identifies an entry. Figure 4.2-2 shows an example directory schema in which {country = “US”}, {organization = “XYZ, Inc.”} and {locality = “Boston”} are all examples of RDNs. The sequence of RDNs all the way to a leaf, or end, node forms a distinguished name (DN). The DN is a globally unique identifier for a directory object. In Figure 4.2-2, the DN for the research department of XYZ, Inc. is {country = “US”, locality = “Boston”, organization = “XYZ, Inc”, organizational unit = “Research”}. Note that the alias entry for {organizational unit = “Production”} is under the Canadian company, so there are two valid, but unique, DNs.

The Directory specifies a set of rules called the Directory schema that dictates the types and attributes valid for DIB entries. In addition, a Directory system schema dictates how

operational information (e.g. create/modify time stamps, administrative roles, etc) is stored in the Directory.

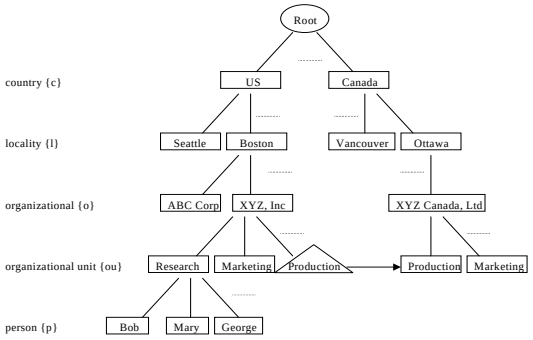


Figure 4.2-2 Directory Schema

Note: The directory schema in Figure 4.2-2 only shows a partial schema based upon the country-based schema. An additional branch of the schema (not shown) is organization-based and has the organization attached directly to the root node.

4.1.1 X.500 Directory Protocol Concepts

The ATN-DS user (person or process) accesses the ATN-DS via a client process known as a Directory User Agent (DUA). The DUA interfaces with the ATN-DS using a protocol between itself and one of the ATN-DS servers, which are termed Directory System Agents (DSA). Usually the DSA contacted would be the one “closest” to the DUA in terms of connection cost or organizational affiliation.

The DSAs and the information that they store in their respective DIBs comprise the ATN-DS. The DSAs also communicate between themselves via a set of protocols which embody a set of operations that may be performed on the ATN-DS information. Each DSA knows how to contact a number of other DSAs (at least one). This is the mechanism through which a request for information can be propagated throughout the distributed directory: if a particular DSA is unable to satisfy a request, the request is forwarded to another DSA which is more likely to have the necessary information, and so on.

There are four kinds of protocols associated with the ATN-DS: the Directory Access Protocol (DAP), the Directory Systems Protocol (DSP), the Directory Information Shadowing Protocol (DISP) and the Directory Operational Binding Protocol (DOP). These protocols provide the means for the various ATN-DS agents—the Directory User Agent (DUA) and Directory Service Agent (DSA)—to perform operations on the DIB. Figures 4.2-3 and 4.2-4 show two different views of the ATN-DS model, and are further explained below.

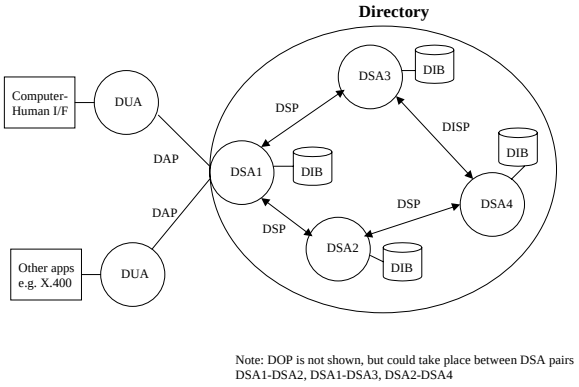


Figure 4.2-3 Directory Model

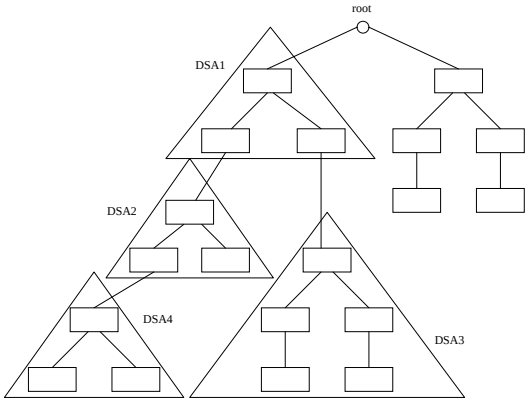


Figure 4.2-4 Directory Model Showing DSAs

Users access the ATN-DS via the DUA. Note that the "user" can be either a human or an application. The DAP provides the means for the DUA to communication with the DSA. The DSA manages the information in the ATN-DS. DSAs communicate with each other via the DSP (for distributed directory operations, e.g. search and read as directed by a DUA command) and the DISP (for DIB replication transfers). The DOP defines the operational relationship (i.e. administrative agreements) between pairs of cooperating DSAs. Note that the DAP and DSP also make use of the Remote Operations Service Element (ROSE) and Association Control Service Element (ACSE) ASEs. Note that some actions, like the DSA interface to the local DIB, are beyond the scope of the ATN-DS.

The DUA can perform a number of operations with the DSA. These include read (read, compare, abandon), search (list, search) and modify (add entry, remove entry, modify entry, modify RDN) operations. The DSA, upon receipt of a query from the DUA, can perform basically the same operations but these are predicated with "chain", which implies that the DSA will pass on the request to as many DSAs as necessary in order to complete the request. There is also a "referral" response, which a DSA can return to either the requesting DSA or DUA. The referral response is used when the DSA has

knowledge of the proper DSA to contact (i.e. name and address). The DSA or DUA that receives the referral response can then contact that DSA directly in order to carry out the operation.

The DOP has two types of binding that can be established: the Hierarchical Operational Binding (HOB) and Shadow Operational Binding (SOB). The HOB governs the relationship between a pair of DSAs, such as DSA1 and DSA2 in Figure 4.2-4. Some properties of the DIT governed by DSA1 will apply to the DIT governed by DSA2. The HOB provides a mechanism for the subordinate DSA (e.g. DSA2) to receive any administrative information from its superior DSA (e.g. DSA1). The SOB is responsible for setting up the binding necessary between two DSAs so that replication can take place. This typically involves determining the portion of the DIT to be copied as well as the supplier and consumer DSAs. Once this binding is known, the DISP can be used. The DISP consists of three operations which involve the replication of DIT information: Coordinate Shadow Update, Request Shadow Update, and Update Shadow.

4.1.2 Detailed X.500 Data Concepts

4.1.2.1 Directory Schema

The ATN Directory Schema constitutes the framework within which ATN-DS information is stored. It consists of a set of rules and definitions which define the naming of entries, the content of attributes and entries, the structure of the ATN-DS as a whole and hierarchical relationships between entries.

The Schema comprises the following components:

- **Name Form** definitions, which describe how ATN-DS entries should be named;
- **DIT Structure Rules**, which define hierarchical relationships between entries of different object classes;
- **DIT Content Rules**, which allow the inclusion in entries of attributes not indicated in the entries' structural object classes;
- **Object Class** definitions, which are used principally to distinguish between entries representing different types of object.
- **Attribute Type** definitions, which hold information regarding a particular quality or characteristic of an object represented by a Directory entry.
- **Matching Rule** definitions. Each attribute has associated with it a set of matching rules which determine how values of the attribute may be matched against other values.

4.1.2.2 Name Form

Each entry in the ATN-DS is identified by at least one unique name, called the entry's Distinguished Name (DN). The DN is formed in the following fashion:

- The DIB is organized into a tree-shaped hierarchy, the Directory Information Tree (DIT), in which each entry has exactly one superior entry but may have many subordinate entries. This organization is illustrated in Figure 4.2-5.

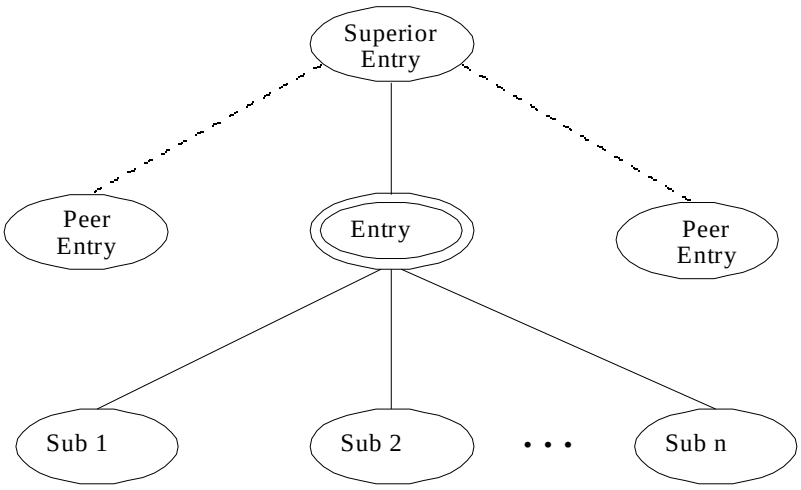


Figure 4.2-5: The basic structure of the Directory Information Tree.

Clearly, each superior entry may have many subordinates, so the entry may be one of many siblings at the same level in the tree:

- Each entry contains at least one attribute value which is designated as the entry's name at that level, i.e. relative to all its siblings. This name, known as the entry's Relative Distinguished Name or RDN, must be unique among all the entry's siblings.

- The unique name of the entry, it's Distinguished Name or DN, is formed by concatenating the RDN of the entry with those of each of its superiors, from the top of the DIT down to the entry.

4.1.2.3 DIT Structure Rules

The placement of entries within a portion of the DIT is governed by rules set out by the responsible authority, known as *DIT Structure Rules*. Each entry in the Directory contains an attribute of the type **governingStructureRule** which holds the structure rule that governs the possible placement of the entry. The entry may only be placed in a portion of the DIT if the Directory schema holds a DIT structure rule that matches that held in the entry.

The DIT structure rule consists of three parts:

1. A unique identifier;

2. A name form identifier which specifies the name form that entries governed by this structure rule will take;

3. A list of superior structure rule identifiers which denote where in the DIT the entry may be placed, i.e. which classes of entry it may be placed subordinate to.

4.1.2.4 DIT Content Rules

The content of an entry, in terms of the attributes it contains, is regulated primarily by the entry's structural and auxiliary object classes. However, additional contents may be specified by the definition of a *DIT Content Rule* associated with the entry's structural object class.

A DIT content rule specifies the following:

- The identifier of the structural object class to which it applies;

- The identifiers of the auxiliary object classes permitted in entries governed by the rule (optional);

- The identifiers of the mandatory attributes required for entries governed by the content rule, in addition to those mandated in the structural and auxiliary object classes (optional);

- The identifiers of the optional attributes required for entries governed by the content rule, in addition to those named in the structural and auxiliary object classes (optional);

- A list of identifiers of optional attributes from the entry's structural and auxiliary object classes that the content rule precludes from appearing in entries governed by the rule (optional).

Note that, unlike the characteristics of an object class, those of a DIT content rule are *not* inherited by any subclasses of the object class to which it applies.

DIT content rules are thus useful in the following ways:

- They permit the modification of an object class at a particular level in the object class hierarchy, while avoiding the inclusion of the modifications into the object class chain;

- They permit the exclusion of certain optional attributes from entries of a given object class without modifying the object class itself;

- They allow the inclusion of individual attributes into entries, without reference to other object classes.

4.1.2.5 Object Classes

ATN-DS object classes are used principally to distinguish between entries representing different types of object. Each ATN-DS entry must belong to at least one object class, and contains an attribute, the value(s) of which indicate(s) the object class(es) to which the entry belongs. Following from this descriptive function, the entry's object class serves several specific functions within the Directory:

- It governs the attributes the entry contains;

- It governs the *position* the entry may take in the Directory structure;

- It governs the *administrative policy* associated with the entry.

Object classes may be defined in international standards, by other standards or implementer bodies, by vendors, or by users (private object classes). The mechanism for object class definition is described in Section 12.3.3 of [ISO 9594/2]. The ATN-DS contains a set of ATN-specific object classes for use within the context of the ATN.

5 Overview of ATN Directory Services Concept Of Operations

To support the addition of directory services to the ATN, it was necessary to develop a directory services concept of operations. The concept of operations was published in the second edition of ICAO Doc. 9739 (the ATN guidance material). Much of the following description is based upon that text.

5.1 Architecture Model

5.1.1 Domains

The ATN-DS is based on the ITU-T X.500 directory model. That model includes the concept of Directory Management Domains (DMDs). A DMD consists of the DSAs and DUAs managed by one organization, plus the DIT entries that are mastered on those DSAs. A Directory Service constitutes the directory information and operations (services) provided by one or more DMDs to a community of users. The ATN Directory Service, which serves the entire set of CAAs and Organizations, includes or involves several DMDs as depicted in the following figure.

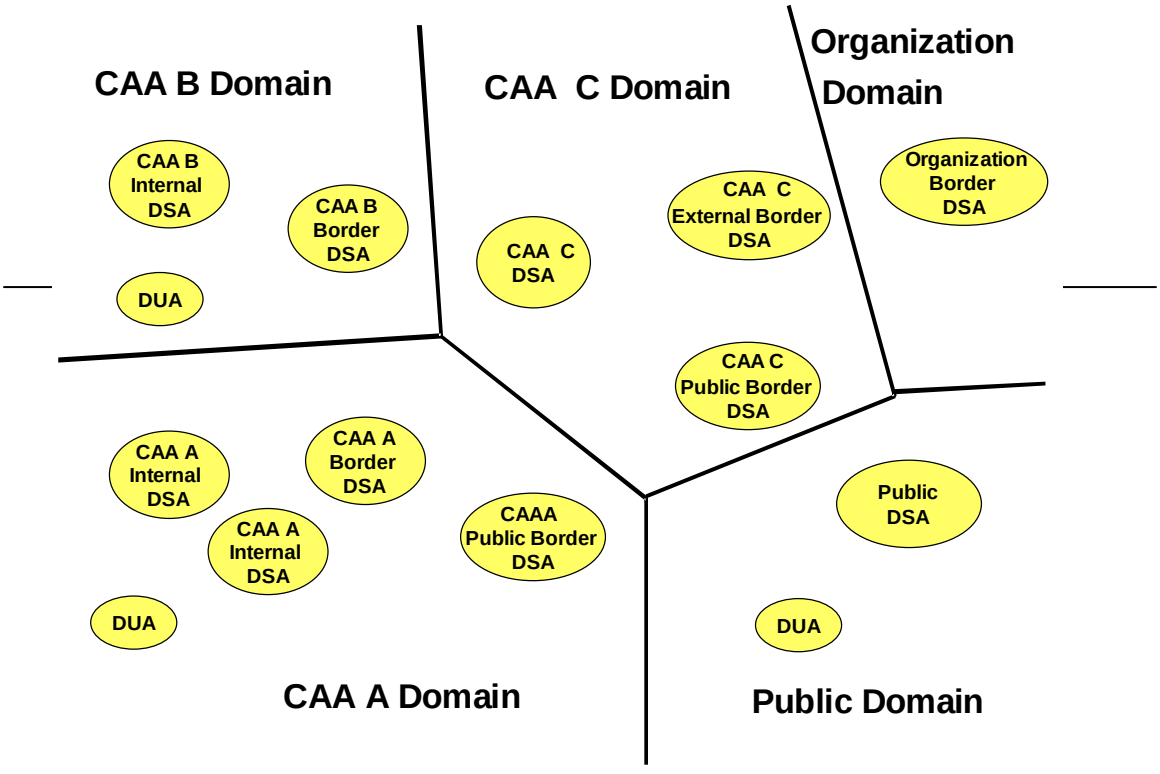


Figure 5.1-1: DMDs in the ATN Directory Service Architectural Model

Each CAA or Organization constitutes its own DMD. The ATN-DS consists of those DMDs that are the top nodes in the ATN DIT (either c=<country, o=<caa> or o=<organization>). Each DMD is managed by the owner of the DMD; there is no central agency managing the ATN Directory Services. The public domain constitutes general Directory Services provided to the public outside of CAAs and Organizations ascribing to the procedures of ICAO and the ATN, and is actually a conglomeration of public Directory services and cooperating DMDs.

Directory domains are linked to provide an integrated Directory Service. Of interest are the following Directory Services:

a. CAA and Organization Directory Services provided to staff (e.g. over intranets);

b. the overall ATN Directory Service provided across the ATN;

c. specific external Directory Services in which CAAs and Organizations may participate for a community of users not necessarily open to the public; and

d. the Public Directory Service provided to the public at large.

DMDs are linked to provide these services through the use of Border DSAs. Border DSAs are those owned by or operated on behalf of one domain, but which participate in the Directory Service of a broader domain and are accessible from users and/or DSAs in that broader domain. Border DSAs act as the interface and interconnection points (inwards to internal information, outwards to external information). The terms “Public Border DSA” and “External Border DSA” are used to distinguish such DSAs that are participating in a Public Directory Service or Extranet-based Directory Service respectively.

Figure 5.1-2 illustrates how the Directory Services map to the physical components and DMDs.

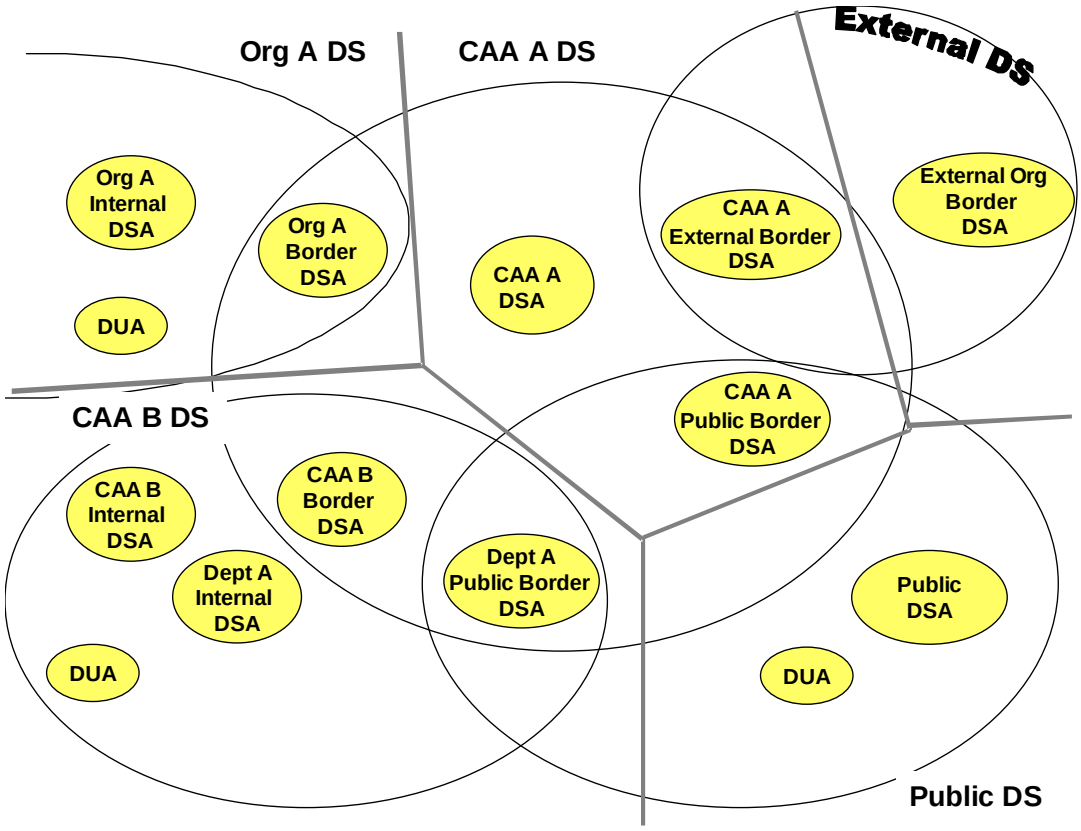


Figure 5.1-2: Directory Services

Through the public domain, the ATN Directory Services may be connected into the global Directory Service.

The Border DSAs, owned and operated by CAAs and Organizations, are participating in the ATN-DS and are in a different integrity sub-domain/network than the internal DSAs. Similarly, Public Border DSAs are participating in the Public Directory Service and are thus in a low integrity sub-domain.

The Border DSAs provide the logical linkages between domains and allow a larger Directory Service to be built from what would otherwise be islands of directories. Two types of linkage are possible: chaining, in which requests are passed along from one domain to another, and shadowing, in which information is copied between domains so that requests can be answered within a domain other than that which owns the master entry. The ATN Directory Architecture may use both kinds of linkage. Chaining is predominantly carried out using the DSP protocol and shadowing is predominantly carries out with the DISP protocol; this is how the different linkages are shown in the diagrams in this specification.

Note: There is a third way of retrieving information from remote DSAs, known as referral. This method does not require the linkage between DSAs but requires that a DSA have knowledge about what information is contained in other DSAs.

Figure 5.2-3 illustrates the minimum connections Border DSAs provide.

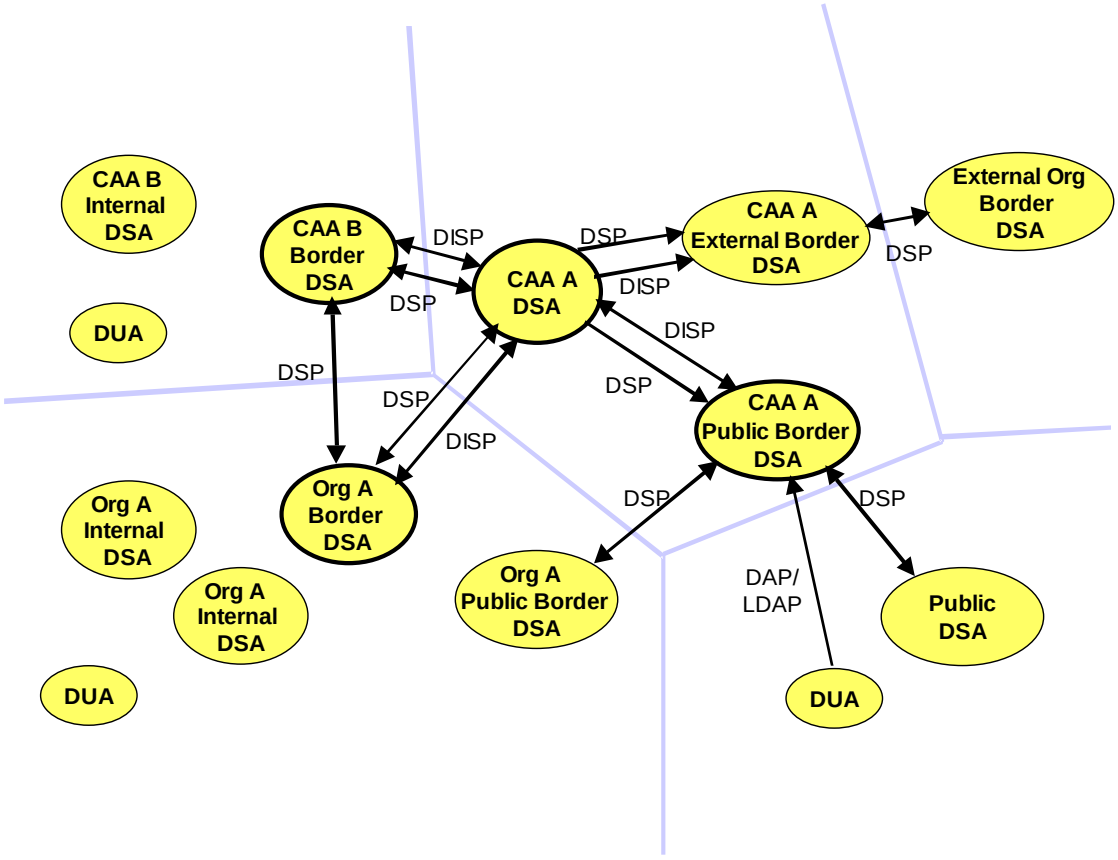


Figure 5.2-3: Minimum Connections

The following sections examine the CAA domains in detail, describing the mandatory and recommended connections and the information that flows across them.

5.1.2 CAA and Organization Domains

Each CAA or Organization is responsible for its own DMD. The management of the DSAs and DUAs within a DMD's domain is the responsibility of the owner of the DMD, but the management may be delegated to another organization or State. The owner of a DMD is responsible for the definition and management of its own DIT subtree, which is mastered on its own DSAs.

Each CAA may field a Border DSA, which is the DSA designated as the interface point to the CAA's Directory Service for the ATN-DS. A CAA may also have one or more

Internal DSAs, but the Border DSA is the CAA's connection into the ATN-DS. A CAA will typically choose to have a distinct DSA for this purpose, separated from its internal network with appropriate security/access controls. The internal network of DSAs can be considered a high integrity domain since it is under the control of one DMD, services a small community of users and can be protected on an intranet. The Border DSA and ATN domain are considered a medium integrity domain since they require cooperation between several DMDs, service a large community of users and are protected on the ATN.

If a CAA chooses not to implement X.500 protocols internally, it will still need to field an X.500-compliant Border DSA in order to participate in the ATN-DS. The CAA must ensure that any internal Directory Service is capable of making requests (for external information) to the Border DSA. The CAA must also ensure that the Border DSA is capable of presenting the appropriate information to the ATN-DS.

Figure 5.2-4 shows an example of the minimum information a department in a CAA masters and shadows at the domain boundary.

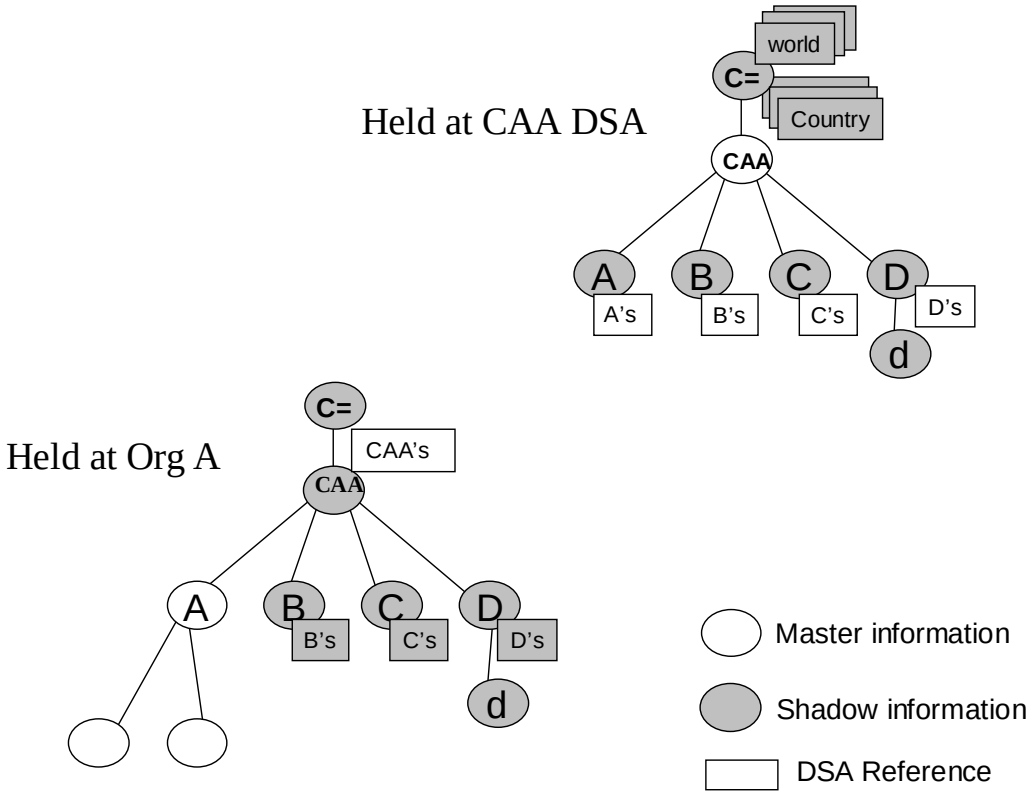


Figure 5.2-4: Minimum Information Mastered and Shadowed

A CAA may hold shadows (copies) of the c=<country> and o=<caa> entries and may maintain a superior reference (pointer) to that CAA's DSA. It may hold shadows of other organizational (ou) entries (e.g., B, C, D) in its domain and may maintain references to the Border DSAs of other CAAs, all of which it will obtain through shadowing between its Border DSA and other ATN DSAs. It may also hold information from other departments (e.g. d) which are considered to have a high availability requirement. This will also be shadowed across other ATN DSAs.

The connectivity requirements are shown in the following figure. Minimal requirements are shown with bold/thick lines. Recommended or optional connectivity is shown with normal lines.

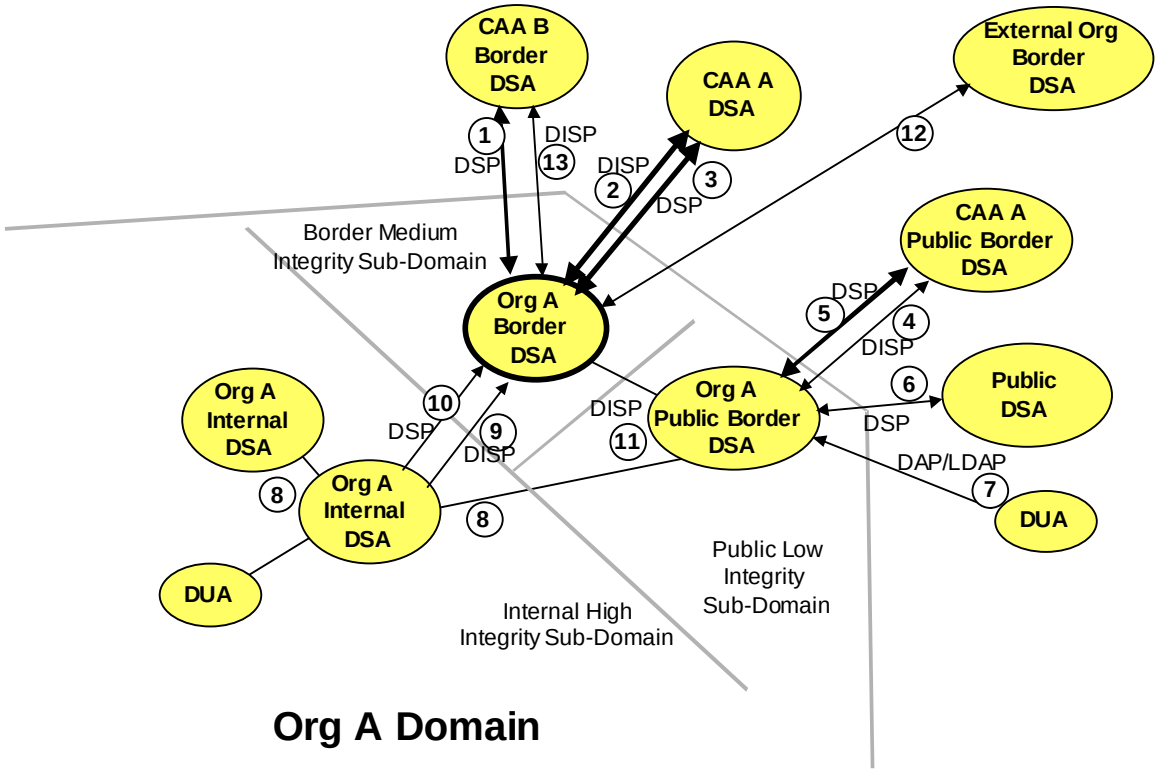


Figure 5.2-5: Connectivity Requirements

The Border DSA may support DISP shadowing with the other CAA DSA (2) in order to supply its own o = <caa> entry plus high availability information from its own subtree, and to obtain the shadowed external information and knowledge references described above. CAA policy may determine if external directory information will be further copied from the Border DSA to the Internal DSAs in the CAA.

The Border DSA may accept DSP chaining of requests from other Border DSAs (1) (3). A CAA may decide whether such requests are ever chained into internal DSAs or

whether they are always answered from information it holds itself. It is recommended that a Border DSA always answer external requests instead of chaining inwards. This requires it to hold all information a department wishes to make available to an external domain. This information is mastered on the internal DSAs and periodically shadowed (9) to the Border DSA using DISP or other means (such as bulk file transfer).

The Border DSA chains outwards (1,3) any internal requests (10) for external information it does not have. The Border DSA is able to chain requests directly to another CAA's Border DSA (1) for information that is located in another CAA's DIT subtree.

Information which a CAA wishes to make available in the public domain may be shadowed to other DSAs for further distribution (2). Alternatively, a CAA may choose to field its own Public Border DSA and to shadow the information to it using DISP or other means (11). The Public Border DSA may accept chaining (6) from DSAs in the public domain in general, and even direct DAP/LDAP requests (7) over the Internet. It may accept chaining from other government Public Border DSAs (5) and maintain, through shadowing (4) of entries and knowledge references.

The inner structure and behavior of CAA Directory domains are up to the CAAs (8–11). CAAs may also have communication links to external organizations (12) and direct shadowing with other CAAs (13) beyond that described here.

The Border DSA function needs to be highly available and reliable. Each State and Organization needs to design its Border DSA(s) to achieve the required availability (e.g. 99.5%) to provide the Directory Service (information access) 24 hours a day, 7 days a week. Reliability of the service may be achieved by several means at the CAA’s discretion.

There needs to be a high level of assurance that only the allowed components interact for the purposes for which the architecture model indicates. Ideally, the DSAs in a CAA Domain may be capable of strong authentication between themselves and with other DSAs. However, the assurance may be achieved through network level security features.

6 Usage of ATN Directory Services

6.1 Use of ATN-DS by AMHS

The ATN AMHS is defined in a way that the use of directory is not mandatory until edition 3. Even at that point, use of the ATN-DS is optional. The ATN-DS is particularly suited to the AMHS application since significant information about users and other AMHS systems may be obtained directly from the ATN-DS.

6.1.1 Retrieval of Addressing Data

The ATN AMHS requires the mapping of user names (email addresses) to a series of specific AMHS attributes that include the MTA name of the next system and the NSAP of the next hop routing.

If an implementation does not support the ATN-DS, this information must be maintained locally in tables. As with any table-driven approach, the administration of the tables may require significant resources.

The use of the ATN-DS greatly simplifies the retrieval of addressing information. The MTA can map to the complete set of addresses for MTA routing based on a query to the DSA. The query response will return the information that will be used within the lower layer protocol connection establishment.

The ATN-DS will also be useful in the conversion between AFTN and AMHS addresses since the information will be in the appropriate user records. This will make transition seamless since the presence or absence of certain address types will indicate the type of user.

6.1.2 Retrieval of MTA Capabilities

As AMHS is deployed, MTAs with different capabilities will be implemented. Unless all MTAs are constrained to use only the minimum mandatory features, the selection of which options to use and the capabilities of a remote MTA will become a problem. This is where the ATN-DS can provide significant assistance. Within the DIB, descriptions of MTA capabilities will be available through standard directory queries.

6.2 Use of Directory Services by Context Management

As the concept for the ATN evolved, modifications in order to support security measures and directory interaction became necessary. Some of the issues that the ICAO ATN Panel had to keep in mind when planning to meet the security requirements were:

- Impact on performance (including message sizes, numbers of transactions, impact on transaction times, etc.) should be minimized
- Interoperability considerations of the new features with previous versions of applications
- Operational concept impacts, e.g. an application should not have to behave significantly different with the new enhancements, nor should new features preclude a previously defined operational need
- Impact on the existing standards and changes required to SARPs

After careful consideration and much debate, it was decided that security could be best implemented through changes presented in Edition 3 of ICAO Doc. 9705. The security enhancements make use of the Context Management (CM) application for key information and key usage exchange for air-ground applications. Additionally, all of the air-ground applications were modified slightly in order to provide the Dialogue Service (DS) with new security parameters.

Security introduced new functionality to the air-ground applications. The main impacts of security as far as applications were concerned are exchanging keys, giving an indication of the domain those keys are valid for, indicating to the DS the level of security required, and ensuring that received primitives are consistent with the local security policy. Since all applications must be able to pass the new DS parameters and check to make sure they are consistent with local security policy (in itself not too big a change), the remaining decision was how to pass the key and key usage information—whether it should be done on a per application basis or by CM on behalf of the other applications.

6.2.1 The CM Security Concept

CM was chosen as the means to exchange key and key usage information between aircraft and ground systems. The modifications to the CM application itself consisted of additional D-START parameters for air- and ground-initiated services and user data on ground-initiated services. These modifications also retained backwards compatibility with Version 1 CM applications. As previously mentioned, if each air-ground application had to perform its own key exchanges, there would have to be new services to negotiate this, along with corresponding new user data to support the key exchange. There might also be more duplication of key negotiations, as there may be no indication of domain usage per application (i.e. a CPDLC application in one facility might not know if a CPDLC application in another can use the same key, so there could be multiple key negotiations which are in fact unnecessary). The CM security and directory modifications

alleviate these problems, and in fact provide solutions to others (e.g. how to get downstream facility application information, including security information).

The way CM operates with security is very much the same as how it operates without security. A CM-air-user indicates whether or not a secure logon is required (based on local requirements; however the ground has the ultimate decision on whether or not security is required for its airspace). If security is required by the ground system and correctly requested by the aircraft, then the ground will return application information, including security information, for each application the aircraft supports. Note that the ground should not send key information for an application that was not indicated in the CM-logon request by the aircraft. This is easily controlled by local policy. The security information provided for each application includes the public key and a domain usage indicator. The domain usage indicator is a Boolean value; if set to true then the key that is provided for that application will work for all other applications within that CM domain (signified by the ADM field of the NSAP). If not provided, new key information must be obtained for another facility within that CM domain. This determination will be based upon the local security architecture.

Additionally, secure versions of the CM-forward and CM-update were added which allow the use of the CM-forward/CM-update combination for secured services. For the secure CM-update, not was key information added to the user data (as for a secure CM-logon response), but a facility designation field was added as well. This allows, for example, a CM facility which has just completed a secure CM-logon service with an aircraft to send to that aircraft a secure CM-update identifying the facility designation, CPDLC application information, and key information of the facility with which the aircraft needs to perform an NDA connection. This can be done during a non-time critical period (such as before pushback). The ground system can then perform a CM-forward (or some other local ground-ground forwarding service) to give the aircraft information to that NDA facility. Now both the NDA ground system and the aircraft will have all of the necessary information for secure services with each other, which saves time when the actual connection needs to be made. If need be, more secure CM-updates may be invoked in order to give the aircraft additional information such as en route FIS facilities' addresses and security information.

6.2.2 CM Directory Concept

The last section described at a high level how security works between peer applications (air-ground and ground-ground). However, an important step was not described: how is the key information for the applications retrieved by the ground CM application? The answer is via a directory service. The CM technical provisions recommend that the ATN Directory service as specified in Sub-volume VII be used. The ATN Directory service is an X.500-based directory that contains all of the information and basic protocols necessary for ATN operation. It can also function in a secure mode which allows cross-domain key information requests. It should be noted that there still need to be additional requirements developed in order to perform Directory services, and that implementing states will need to perform more in-depth operational analysis and develop operational concepts for the implementation of Sub-volume VII services. However, the tools necessary are already in Sub-volume VII, and the user requirements are in the CM

technical provisions. Additionally, AOC applications can make use of the same directory in order to obtain application and security information.

While one of the main functions of the directory concept is to enable secure ATN services, additional capability afforded by a directory becomes evident. This is the ability of a CM application to obtain, in a standardized way, information for other facilities as well as provide to the directory information about itself and aircraft it has performed services with.

7 Application of ATN Directory Services to the Asia-Pacific Region

7.1 Use in support of General ATN Operation

The Asia/Pacific Region is moving towards the implementation of a complete ATN infrastructure. Within this environment, the infrastructure (set of BIS routers) will initially be based upon Edition 2 of ICAO Doc. 9705. After initial implementation, it is expected that States within the Region will begin to migrate towards Edition 3. The major change in the infrastructure is the addition of ATN security. The specification of security is based upon the use of a certificate-based authentication system. Although this system, specified in ICAO Doc. 9705 Sub-Volume VIII and Sub-Volume V, can be implemented without the Directory Services, implementation will be considerably easier using it. Therefore, as States move to the use of ATN security in their BIS routers, it is expected that Directory Services will also be implemented to support this.

7.2 Use in support of AMHS

The States within the Asia/Pacific Region are expected to begin to deploy the ATN-DS as soon as significant experience is gained in the deployment of the AMHS. The ATN-DS provides considerable support for the AMHS. In particular, it allows for easier look-up of users' AMHS addresses as well as information about NSAP addresses and MTA capabilities.

7.3 Use in support of Air-Ground Applications

The use of the ATN-DS in support of air-ground applications is expected. The main purpose of using the ATN-DS is to provide an infrastructure for implementing security services.

8 Asia-Pacific Regional ATN Directory Services Profile

The details of the Asia-Pacific ATN-DS Profile are still under development as the deployment schedule remains undetermined. It is planned to finalize the contents of the Regional profile based on the availability of products and implementations and the requirements of States at the time of deployment approaches.

9 Asia-Pacific Regional ATN Directory Services Deployment Schedule

Plans by the Asia-Pacific States have not been provided at this time. This Section will be updated as States within the Region develop their plans for the deployment of this service.

Appendix A: Directory Services Data Definitions

Table 8-1 ISO/IEC 9594-7:1995 Object Classes as Specified in ISO/IEC ISP 15126-1

Ref. No.	Object Class	ATN DSA	Use in Asia/Pacific
1	top	m	Y
2	alias	m	Y
3	country	m	Y
4	locality	m	Y
5	organization	m	Y
6	organizationalUnit	m	Y
7	person	m	Y
8	organizationalPerson	m	Y
9	organizationalRole	m	Y
10	groupOfNames	o	N
11	groupOfUniqueNames	o	N
12	residentialPerson	o	N
13	applicationProcess	m	Y
14	applicationEntity	m	Y
15	dSa	m	Y
16	device	m	Y
17	strongAuthenticationUser	m	Y
18	certificationAuthority	m	Y

Table 8-2 DSA Object Classes Defined in ISP 15126-1

Ref. No.	Object Class	ATN DSA	Use in Asia/Pacific
1	ispApplicationEntity	o	N

Table 8-3 DSA Object Classes Defined in ISO/IEC ISP 11189

Ref. No.	Object Class	ATN DSA	Use in Asia/Pacific
1	mhs-distributionList	m	Y
2	mhs-message-store	m	Y
3	mhs-message-transfer-agent	m	Y[1]
4	mhs-user	m	Y[1]
5	mhs-user-agent	m	Y[1]

1. Required by AMHS.

Table 8-4 DSA Object Classes Defined by the ATN

Ref. No.	Object Class	ATN DSA	Use in Asia/Pacific
1	Atn-AmhsUser	m	Y
2	Atn-OrganizationalUnit	m	Y[1]
3	Atn-OrganizationalPerson	m	Y
4	Atn-OrganizationalRole	m	Y
5	Atn-ApplicationEntity	m	Y
6	Atn-CertificationAuthority	m	Y
7	Atn-AmhsDistributionList	m	Y
8	Atn-AmhsUserAgent	m	Y
9	Atn-Gateway	m	Y
10	Atn-Aircraft	m	N
11	Atn-Facility	m	Y
12	Atn-AmhsMD	m	Y
13	Atn-IdrpRouter	m	Y
14	Atn-DirectorySystemAgent	m	Y
15	Atn-Organization	m	Y

1. Required by AMHS.

Table 8-5 ATN Object Class and Attribute Contents in the ATN Directory

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
alias	Y	x			
aliasedEntryName	Y	x		x	
applicationEntity	Y	x			
commonName	Y	x		x	
description	Y	x			x
localityName	Y		x		x
organizationName	Y	x			x
organizationalUnitName	Y	x			x
presentationAddress	Y	x		x	
seeAlso	Y		x		x
supportedApplicationContext	Y		x		x
applicationProcess	O	x			
commonName	Y	x		x	
description	Y	x			x
localityName	Y		x		x
organizationalUnitName	Y	x			x
seeAlso	O, N		x		x
atn-AmhsUser (subclass of mhsUser)	Y	x			x
mhs-deliverable-content-length	Y		x		x
mhs-deliverable-content-types	Y		x		x
mhs-deliverable-eits	Y		x		x
mhs-message-store-dn	Y		x		x
mhs-or-addresses	Y	x		x	

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
mhsPreferredDeliveryMethods	Y		x		x
atn-PerCertificate	Y	x			x
atn-DerCertificate	Y	x			x
atn-extended-service-support	Y	x		x	
atn-amhs-direct-access	Y	x		x	
atn-AF-address	Y	x			x
atn-Cidin-mcf	N	x			x
atn-Ax-or-primary-Ax-address	Y	x			x
atn-secondary-Ax-address	Y	x			x
atn-ApplicationEntity (subclass of X.521 applicationEntity)	O	x			
commonName	Y	x		x	
description	Y	x			x
localityName	Y		x		x
organizationName	Y	x			x
organizationalUnitName	Y	x			x8
presentationAddress	Y	x		x	
seeAlso	O, N		x		x
supportedApplicationContext	Y		x		x
atn-facilityName	Y	x			x
atn-aircraftIDName	N	x			x
atn-PerCertificate	O, N	x			x
atn-DerCertificate	O, N	x			x
atn-version	Y	x			x
atn-CertificationAuthority	O, N	x			
authorityRevocationList	Y	x		x	

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
cACertificate	Y	x		x	
certificateRevocationList	Y	x		x	
commonName	Y	x		x	
crossCertificatePair	Y	x			
description	Y	x			x
destinationIndicator	Y	x			x
facsimilieTelephoneNumber	Y	x			x
localityName	Y	x			x
organizationalUnitName	Y	x			x
physicalDeliveryOfficeName	Y	x			x
postOfficeBox	Y	x			x
postalAddress	Y	x			x
preferredDeliveryMethod	Y	x			x
registeredAddress	Y	x			x
roleOccupant	Y	x			x
seeAlso	O, N	x			x
stateOrProvinceName	Y	x			x
streetAddress	Y	x			x
telexTerminalIdentifier	N	x			x
telexNumber	N	x			x
x121Address	Y	x			x
mhs-deliverable-content-length	Y		x		x
mhs-deliverable-eits	Y		x		x
mhs-message-store-dn	Y		x		x
mhs-or-addresses	Y		x		x

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
mhsPreferredDeliveryMethods	Y		x		x
mhs-deliverable-content-types	Y		x		x
atn-DirectorySystemAgent	Y	x			
commonName	Y	x		x	
description	Y	x			x
knowledgeInformation	Y	x			x
localityName	Y	x			x
organizationName	Y	x			x
organizationalUnitName	Y	x			x
presentationAddress	Y	x		x	
seeAlso	Y	x			x
supportedApplicationContext	Y	x			x
atn-PerCertificate	Y	x		x	
atn-DerCertificate	Y	x		x	
atn-Facility	Y	x			
locality	Y		x		x
country	Y		x		x
atn-FacilityName	Y	x		x	
atn-PerCertificate	Y	x			x
atn-DerCertificate	Y	x			x
atn-ApplicationEntityName	Y	x			x
atn-Aircraft	N	x			
country			x		x
atn-AircraftIDName		x		x	
atn-PerCertificate		x			x

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
atn-DerCertificate		x			x
atn-ApplicationEntityName		x			x
atn-OrganizationalUnit (subclss of organizationalUnit)	Y	x			
businessCategory	Y	x			x
description	Y	x		x	
destinationIndicator	Y		x		x
facsimileTelephoneNumber	Y	x			x
internationalISDNNumber	Y		x		x
localityName	Y	x		x	
organizationalUnitName	Y	x		x	
physicalDeliveryOfficeName	N	x			
postalAddress	N	x			
postalCode	N	x			x
postOfficeBox	N	x			x
preferredDelivery	Y		x		x
registeredAddress	N		x		x
searchGuide	N		x		x
seeAlso	N	x			x
stateOrProvinceName	N	x			x
streetAddress	N	x			x
telephoneNumber	N	x			x
teletexTerminalIdentifier	N		x		x
telexNumber	N		x		x
userPasssword	O		x		x
x121Address	Y		x		x

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
atn-facilityName	Y	x		x	
atn-version	Y	x			x
atnPerCertificate	N	x			x
atnDerCertificate	N	x			x
atn-Organization (subclass of organization)	Y	x			
businessCategory	Y	x			x
description	Y	x		x	
destinationIndicator	Y		x		x
facsimileTelephoneNumber	Y	x			x
internationalISDNNumber	N		x		x
localityName	N	x		x	
organizationalName	Y	x		x	
physicalDeliveryOfficeName	O	x			
postalAddress	O	x			
postalCode	O	x			x
postOfficeBox	O	x			x
preferredDelivery	O		x		x
registeredAddress	O		x		x
searchGuide	O		x		x
seeAlso	O	x			x
stateOrProvinceName	O	x			x
streetAddress	O	x			x
telephoneNumber	Y	x			x
teletexTerminalIdentifier	N		x		x
telexNumber	N		x		x

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
userPasssword	O		x		x
x121Address	Y		x		x
atn-facilityName	Y	x		x	
atn-version	Y	x			x
atnPerCertificate	N	x			x
atnDerCertificate	N	x			x
atn-AmhsDistributionList (subclass of distributionList)	O	x			
commonName	O	x			x
description	O	x			x
mhs-deliverable-content-types	O	x			x
mhs-deliverable-eits	O	x			x
mhs-dl-submit-permissions	O	x			x
mhs-or-addresses	O	x			x
mhs-PreferredDeliveryMethods	O	x			x
Organization	O	x			x
organizationalUnitName	O	x			x
owner	O	x			x
seeAlso	O	x			x
atn-amhs-extended-service-support	O	x		x	
atn-PerCertificate	N	x			x
atn-DerCertificate	N	x			x
atn-Cidin-mcf	N	x			x
atn-AF-address	Y	x			x
atn-Ax-or-primary-Ax-address	Y	x			x
atn-AmhsUserAgent (subclass of MHS User Agent)	Y	x			

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
commonName	Y	x		x	
presentationAddress	Y	x		x	
description	Y	x			x
localityName	Y	x			x
organizationName	Y	x			x
organizationalUnitName	Y	x			x
seeAlso	O	x			x
supportedApplicationContext	Y	x			x
owner	Y	x			x
mhs-deliverable-content-length	Y	x			x
mhs-deliverable-content-types	Y	x			x
mhs-deliverable-eits	Y	x			x
mhs-or-addresses	Y	x			x
mhsUndeliverableEITS	Y	x			x
atn-amhs-extended-service-support	Y	x		x	
atn-AmhsGateway (subclass of atn-applicationEntity)	Y	x			
commonName	Y	x		x	
description	O	x			x
localityName	O		x		x
organizationName	Y	x			x
organizationalUnitName	Y	x			x
presentationAddress	O	x		x	
seeAlso	O		x		x
supportedApplicationContext	Y		x		x
atn-facilityName	O	x			x

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
atn-aircraftIDName	N	x			x
atn-PerCertificate	N	x			x
atn-DerCertificate	N	x			x
atn-version	O				
owner	Y	x		x	
mhs-deliverable-content-types	Y	x		x	
protocolInformation	O	x		x	
mhs-deliverable-classes	Y	x		x	
atn-mtcu-characteristics	O	x		x	
atn-Ax-or-primary-Ax-address	Y	x			x
atn-AF-address	Y	x			x
atn-OrganizationalPerson (subclass of X.521 organizationalPerson)	Y	x			
businessCategory	Y	x			x
commonName	Y	x			x
description	Y	x			x
destinationIndicator	Y		x		x
facsimileTelephoneNumber	Y	x			x
internationalISDNNumber	N	x			x
locatlityName	Y	x		x	
organizationalUnitName	Y	x		x	
physicalDeliveryOfficeName	Y	x		x	
postalAddress	Y	x		x	
postalCode	Y	x		x	
postOfficeBox	Y	x		x	
preferredDeliveryMethod	Y	x		x	

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
registeredAddress	O, N		x		x
seeAlso	O, N	x			x
stateOrProvinceName	Y	x		x	
streetAddress	Y	x		x	
surname	Y	x		x	
telephoneNumber	Y	x		x	
teletexTerminalIdentifier	N		x		x
telexNumber	N	x			x
atn-facilityName	Y	x		x	
title	Y	x		x	
uniqueIdentifier	Y		x		x
userPassword	Y	x			x
x121Address	Y		x		x
mhsORAddressWithCapabilities	Y	x			
mhs-deliverable-content-length	Y		x		x
mhs-deliverable-content-types	Y		x		x
mhs-deliverable-eits	Y		x		x
mhs-message-store-dn	Y		x		x
mhs-or-addresses	Y	x			x
mhsPreferredDeliveryMethods	Y		x		x
mhsUndeliverableEITS	Y		x		x
atnPerCertificate	Y	x			x
atnDerCertificate	Y	x			x
generationQualifier	Y		x		x
givenName	Y		x		x

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
initials	Y		x		x
atn-OrganizationalRole (subclass of X.521 organizationalRole)	Y	x			
commonName	Y	x		x	
description	Y	x			x
destinationIndicator	Y		x		x
facsimilieTelephoneNumber	Y	x			x
localityName	Y		x		x
internationalISDNNumber	N		x		x
stateOrProvinceName	N		x		x
streetAddress	Y		x		x
organizationalUnitName	Y	x			x
physicalDeliveryOfficeName	Y		x		x
postOfficeBox	Y		x		x
postalAddress	Y		x		x
postalCode	Y		x		x
preferredDeliveryMethod	O, N		x		x
registeredAddres	Y		x		x
roleOccupant	Y	x			x
seeAlso	O, N	x			x
telephoneNumber	Y	x		x	
teletexTerminalIdentifier	N		x		x
telexNumber	N		x		x
x121Address	Y		x		x
atn-facilityName	Y	x		x	
atn-PerCertificate	Y	x			x

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
atn-DerCertificate	Y	x			x
mhs-deliverable-content-length	Y		x		x
mhs-deliverable-content-types	Y		x		x
mhs-deliverable-eits	Y		x		x
mhs-message-store-dn	Y		x		x
mhs-or-address	Y	x			x
mhsPreferredDeliveryMethods	Y		x		x
mhsUndeliverableEITS	Y		x		x
atn-AmhsMD	Y	x			
atn-global-domain-identifier	Y	x		x	
atn-icao-country-code	Y	x		x	
atn-IdrpRouter (subclass of device)	Y	x		x	
commonName	Y	x		x	
description	Y	x			x
localityName	Y		x		x
organizationName	Y	x			x
organizationalUnitName	Y	x			x
owner	Y	x			x
seeAlso	O, N		x		x
serialNumber	Y		x		x
atn-Net	Y	x		x	
atnPerCertificate	N	x			x
atnDerCertificate	N	x			x
atn-Version	Y	x			x
country	Y	x			

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
countryName	Y	x		x	
description	Y		x		x
searchGuide	O, N		x		x
device	O	x			
commonName	Y	x		x	
description	Y	x			x
localityName	Y		x		x
organizationName	Y	x			x
organizationalUnitName	Y	x			x
owner	Y	x			x
seeAlso	O, N	x			x
serialNumber	Y	x			x
dsa	Y	x			
commonName	Y	x		x	
description	Y	x			x
knowledgeInformation	O, N		x		x
localityName	Y		x		x
organizationName	Y		x		x
organizationalUnitName	Y		x		x
presentationAddress	Y		x		x
seeAlso	O, N		x		x
supportedApplicationContext	Y	x			x
group Of Names	N	x			
businessCategory	Y	x			x
commonName	Y	x		x	

Object Class	Used in Asia/Pacific	Implementation Specified in 7.4		Data Population Specified by ASN.1	
Attribute		**Mand.**	**Opt.**	**Mand.**	**Opt.**
member	Y	x		x	
description	Y	x			x
organizationName	Y	x			x
organizationalUnitName	Y	x			x
owner	Y	x			x
seeAlso	O		x		x
locality	Y	x			
description	Y		x		x
localityName	Y	x			x
searchGuide	O		x		x
seeAlso	O		x		x
stateOrProvinceName	Y	x			x
streetAddress	Y	x			x

Seventh Meeting of Aeronautical Telecommunication Network (ATN)
Transition Task Force of APANPIRG (ATNTTF/7)

Appendix I to the Report

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC REGIONAL AMHS MTA ROUTING POLICY

First Edition- APRIL 2005

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1.0 Introduction

Within the Asia/Pacific Region, work is underway to implement the ATN AMHS as a replacement and complement to the AFTN. The Region has already prepared planning documents on AMHS naming standards as well as draft guidelines on the implementation of AMHS within the Region. To progress implementation, planning documents for the routing of AMHS message between systems within the Region and to systems outside the Region are needed to serve as guidance.

1.1 Objective

This document presents AMHS routing policies to be used within the Asia/Pacific Region for implementation of AMHS. The development of AMHS message routing policies is based on the need for States and AMHS administrators to be able to control the flow of messages into individual AMHS systems.

1.2 Scope

The MTA routing policy document covers policy for AMHS systems to route AMHS messages between MTAs within Asia/Pacific Region both in the transitional phase and final phase of AMHS implementation. It also outlines the policy for inter-region AMHS connections between the regions. It does not, however, specify the characteristics for MTAs or how the connections between MTAs are established.

1.3 Reference

1) ICAO Doc. 9705-AN/956 *Manual of Technical Provisions for the Aeronautical Telecommunication Network (ATN).* Third Edition 2002.

2) ICAO Doc. 9739-AN/961 *Comprehensive Aeronautical Telecommunication Network (ATN) Manual.* First Edition 2000.

3) ICAO AFSG Operations Group *Routing Directory for AFTN and CIDIN Centres in the EUR/NAT Region.* Part IV COM Charts per ICAO Region, Version 1.2 – March 2004.

4) ATNTTF/6 – *Report of the Sixth Meeting of Aeronautical Telecommunication Network (ATN) Transition Task Force of APANPIRG (ATNTTF/6).* Table CNS-1A AFTN-PLAN, Appendix A – April 2004

5) ATNTTF/6 – *Report of the Sixth Meeting of Aeronautical Telecommunication Network (ATN) Transition Task Force of APANPIRG (ATNTTF/6).* Table CNS-1B ATN Router Plan, Appendix A – April 2004

6) ATNTTF/6 – *Report of the Sixth Meeting of Aeronautical Telecommunication Network (ATN) Transition Task Force of APANPIRG (ATNTTF/6).* Table CNS-1C ATSMHS Implementation Plan, Appendix A – April 2004

7) ATNTTF/6 – WP10. *MTA Transitional Routing Policy*. Presented by Japan.

8) ATNTTF/6 – WP15. *AMHS Routing Impact*. Presented by Hong Kong, China.

2.0 Background

The ATN AMHS is designed according to the X.400 email standards. It is further complemented by the history that ICAO has with the AFTN. As an X.400-based system, the ATN AMHS is specified in such a way that messages can be transferred from the sender to the recipient by passing reliably through intermediate ATN AMHS systems.

The ATN AMHS system at originating station, when it first receives a newly submitted message, must determine the ATN AMHS system that will receive the AMHS message. This may be:

- the destination ATN AMHS,
- a relay ATN AMHS, or
- the AFTN.

If one looks at the Internet and its SMTP-based email system as an example, it becomes clear that routing policies need to be developed for the successful exchange of messages between senders and recipients. First, it is possible for any AMHS system to send a message directly to the destination AMHS system if it has the appropriate NSAP and TSEL of the destination system. This is due to the fact that ATN routing should provide a path between any two ATN end systems. Second, it is logical that some, if not most, ATN operators will choose to manage their systems in a way that limits its use of bandwidth and the amount of information it must maintain. Third, systems will most likely be configured to take advantage of logical cooperation between States and Organizations to minimize costs and complexity.

Of particular concern is the need for ATN system operators to be able to control what systems are able to get connected to its system and to protect the integrity of its systems through access control.

3.0 Routing Overview

The ATN AMHS is not defined with routing protocols that dynamically pass routing information amongst the cooperating ATN AMHS systems. Rather, the “routing tables” maintained by the ATN AMHS are static and are typically established through manual configuration by system operators.

The ability of ATN AMHS systems to dynamically route AMHS messages is based on the implementation and sophistication of the algorithms and is not based on provisions in the SARPs or X.400 standards.

AMHS MTAs perform routing by matching the X.400 O/R address with the routing information maintained by the MTA. The destination MTA affects whether direct delivery or relaying messages is required. The complexity of routing decisions that a particular MTA makes is entirely a local implementation issue.

3.1 Routing Fundamentals

An MTA becomes responsible for the routing and delivery of a message when it is successfully submitted to the MTA either from a UA (or MS), another MTA or directly connected AMHS gateway. The MTA routing process is entirely based upon the destination addresses and the internal routing tables. An MTA compares the destination addresses against its criteria for forwarding to another MTA. If the results of the MTA lookup are not in the current traceable information, the message is forwarded. If it is in the current traceable information, an NDR is generated and the message is discarded.

The central issue in establishing a local MTA routing table is the trade-offs between: routing table size, performance, and security. Routing decisions and security are considered in the next section.

The trade-off between routing table size and performance is due to the nature of routing. For optimal performance – which means a single hop between source MTA and destination MTA – each MTA would potentially need routing information about every other MTA in the ATN. While in early stages of AMHS implementation, the number of MTAs may be small. In later stages the number of MTAs maybe too large for simple routing table to process. As the number of entries rise in the routing table, the costs of searching the table and the complexity of maintaining the table will increase. On the other side, as the number of routing entries is reduced the potential for longer message propagation delays increase as messages are routed and relayed through other MTAs.

The development of routing policies attempts to optimize the performance while maintaining a reasonable sized routing table.

3.2 Routing and Security

Routing can be performed by providing each MTA with sufficient information so that the MTA can send every AMHS message directly to its destination. In other words, AMHS messages would always go directly from the sender to the recipient MTA and leave the routing process for the network infrastructure.

Routing can also be performed by providing each MTA with the addresses of only a limited number of other MTAs, which is called "Access Control List." In this case, an AMHS message addressed to one of the limited MTAs would be routed just like the first case; but a message addresses to any other MTA would need to be relayed.

The choices of which method of routing is to be used, is a decision by the operators of the MTAs. In the first case, MTAs must be configured to accept Bind Requests from any MTA (as indicated by the MTA-name parameter). This implies that all incoming Bind Requests will be accepted and traffic will be accepted. In the second case, an MTA may compare the MTA-name against a list of MTAs from which it will accept connections, and forward messages.

However, considering security for the first case, an MTA configured to accept all incoming Bind Requests, regardless of the source system, is open to both malicious attacks and traffic. A malicious attacker may launch a Denial of Service (DoS) by sending many Bind Requests (and associated large amounts of data) to a MTA in order to overwhelm it. Similarly, if traffic is being accepted from all MTAs, a system must be engineered to provide for larger number of incoming connections, potentially larger traffic loads are generated and consequently increasing the system complexity. Therefore, both security and network management technique should be implemented together with this policy to prevent the problems, such as authentication using IDRP version 2 or router authentication on network sub-layer.

For the second case, security aspect is already considered when the MTA operator generates the "Access Control List." The MTA system only accepts Bind Request and messages from MTAs within the list and denies Bind Requests from the rest. This policy is similar with the current AFTN routing table and therefore shares the same deficiencies, such as inflexibility, but it offers greater control for the operator.

It is desirable for MTA operators to be able to provide sufficient security with delivering and receiving messages with minimum resource utilization. However, the policy and implementation of any supporting mechanism are considered a local or bilateral matter for operators.

4.0 AMHS MTA routing policy

4.1 Backbone MTAs

Backbone MTAs are the currently assigned inter-regional MTAs, which are entry/exit points of AMHS connection between Asia/Pacific region and other regions. Each backbone MTA should independently send/receive messages with other (backbone) MTAs of other regions and between each other within the region. Because the networking capability of the ATN, the operation of backbone MTA is more flexible and can handle more capacity than the current AFTN operation. Therefore, unlike the AFTN, the designation of backbone MTAs can be independent of the main inter-region communication links at the respective COMM Centers. The table of proposed location of backbone MTAs within Asia/Pacific region is provided in Appendix B.

4.2 AMHS System Interconnection

Within the Asia/Pacific Region, routing of AMHS messages will be as follows:

- **Messages exchanged within the region:** All MTA within the region should be able to send/receive AMHS message directly with each other or have direct MTA-to-MTA routing. Consequently, the number of hop for sending a message within the region will be one, and the MTA routing table will contain entries of all other MTAs within the region.

- **Messages exchanged between States within the Region and other regions:** All AMHS messages exchanged between States within Asia/Pacific region and others should pass through backbone MTAs. To send AMHS messages to other MTAs outside the region, the source MTA will first send those messages to backbone MTA responsible for sending messages to the destination MTAs. In reverse direction, the backbone MTAs act as a gateway for incoming messages from corresponding MTAs outside of the region and relays the messages to the destination MTA within the region.

However, the aforementioned routing policy will not be fully implemented immediately due to the different AMHS transition timeframes of each State. Instead, there will be a transitional period during which the Aeronautical Fixed Service (AFS) in the region will be provided by a mixture of interoperating AMHS and AFTN sites, with “islands” of directly connected AMHS sites gradually expanding and merging, and AFTN links progressively being eliminated. The transitional routing policy and example figures are presented in Appendix A.

APPENDIX A Transitional Routing Policy

During the transition period, it is proposed that the following transitional policy be adopted to ensure smooth transition from AFTN to AMHS.

- **Message exchanged between states that have implemented AMHS:** States that have implemented AMHS shall use direct MTA-to-MTA routing among themselves, forming an "island" of AMHS sites. Whenever a new AMHS system is implemented, it is necessary to carry out coordination with all States in the island, and connection tests between the new system and all other AMHS systems to which it will connect should be performed prior to commissioning. This method gives efficient message routing, but is subject to coordination efforts. However, as more States join in the "AMHS Island", more tests and coordination are required, and the implementation process of the new MTA may be delayed. To ease the transition process for some States, the following steps are recommended:
  - If the new MTA is classified as non-backbone MTA, it is recommended that during the initial phase of implementation, the new MTA only exchange AMHS messages with the backbone MTA within its geographic region. This step will provide "default path" for non-backbone MTA during the initial transition period. As the new non-backbone MTA gain more experience from the operation of AMHS, it may enter bi-lateral agreement with other MTAs to establish direct message exchange at a later stage.
  - If the new MTA is classified as backbone MTA, it is recommended that the new MTA carry out coordination and connection tests with all other backbone MTAs in the island prior to commissioning.

- **Message exchanged between States using AFTN and States using AMHS:** The AMHS/AFTN gateway function should be implemented alongside with the AMHS systems to provide message exchange service with states using AFTN. However, in order to avoid changes in the AFTN routing directory, the AMHS should also route messages to adjacent states, which are using AFTN, based on the current AFTN Routing Directory. It should be noted that even if a state connects to other states using only AMHS, an AMHS/AFTN gateway function would still be necessary to support domestic legacy AFTN networks.

The following figures illustrate the AMHS routing mechanism and transitional routing policy:

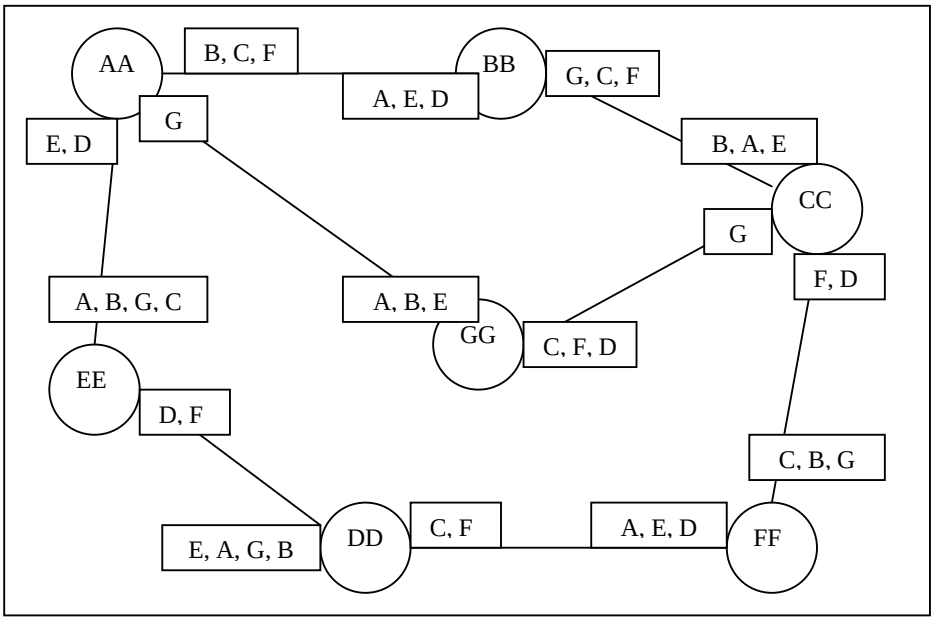


Figure 1 Example of configuration with all organization using AFTN

Figure 1 displays the configuration where all organizations have implemented AFTN and already configured the routing paths among themselves. The circle illustrates an organization with its name inside. The lines between circles illustrate the physical connections between organizations. The box above the line adjacent to the circle shows the routing configuration on that connection. The box with letters 'C, F' signifies that all messages with destination addresses starting with C or F will be routed though this connection.

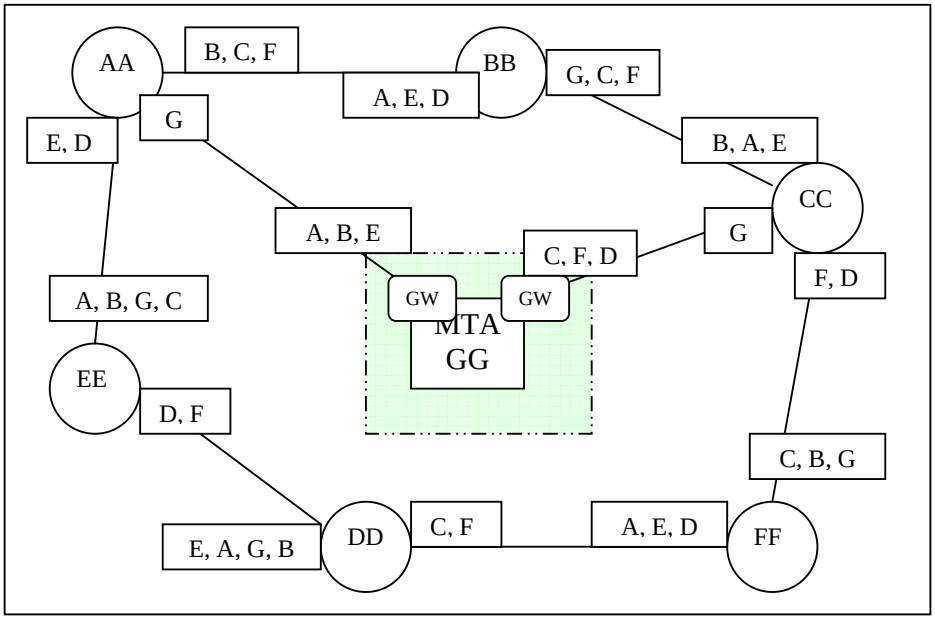


Figure 2 Example of configuration with only one MTA presented among AFTN nodes

Figure 2 displays the configuration when one organization has started implementing AMHS and setting up MTA. In this example, the organization GG is the first to implement MTA. However both organization AA and CC, to whom GG is connected, have not implemented AMHS. Furthermore, the MTA of GG will require function of AFTN/AMHS gateway to be able to seamlessly transmit messages with AFTN sites. Therefore, following the transitional policy, the messages from GG to AA and CC will follow the same AFTN configuration as in figure 1. For GG, messages with destination addresses starting with C, F and D will be routed through AFTN/AMHS gateway and to organization CC, and messages with destination addresses starting with A, B, and E will be routed through gateway to organization AA.

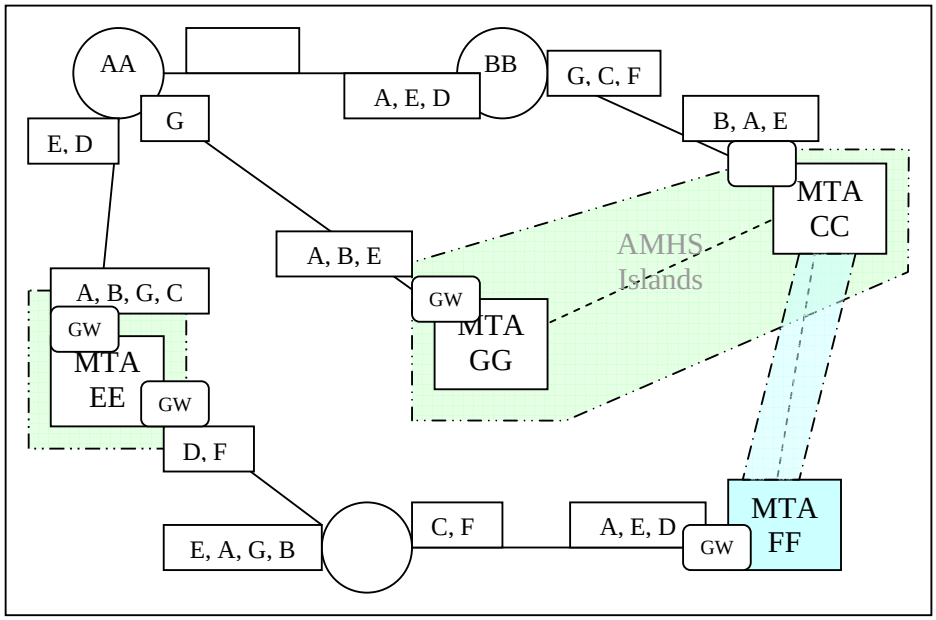


Figure 3 Example configuration with more than one MTAs and non-backbone MTA

Figure 3 displays the situation when more than one organizations have implemented AMHS in the region. In this example, organization GG, CC, FF, and EE have implemented MTA systems. Organization GG, CC, and EE are the proposed location of backbone MTA and GG establishes AMHS connection with CC, therefore forming 'AMHS Island' among them. Because the MTA of EE does not have direct connections to other MTAs, it will connect with neighbor AFTN using gateway functions as described in figure 2. As previously stated in the policy, the gateways should be configured to be compatible with the routing table configuration as defined in figure 1. Organization FF, however, is classified as non-backbone MTA location and does not join the 'AMHS Island' initially. FF first establishes AMHS connection and exchanges all AMHS messages with CC only. As FF becomes confident in AMHS operation, it may enter bi-lateral agreement with GG to test and later establish AMHS connection.

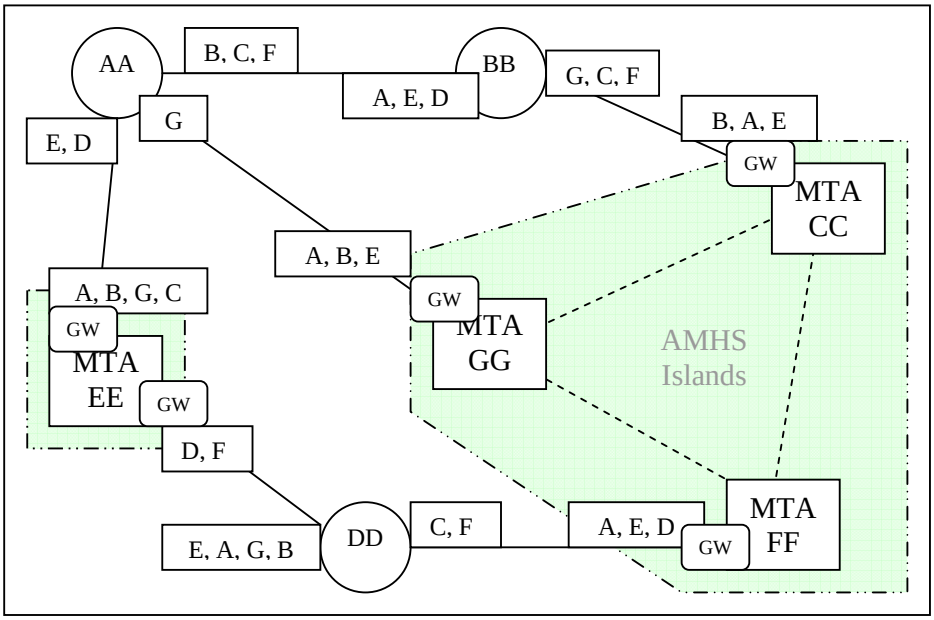
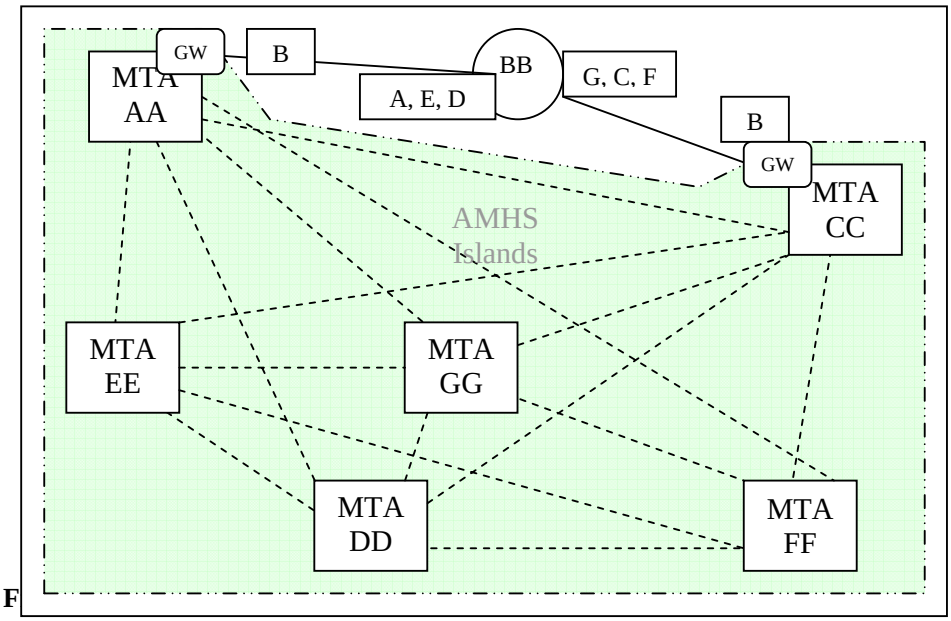


Figure 4 Example configuration with more than one MTAs presented

Figure 4 displays the situation when more than one organizations have implemented AMHS in the region. Following figure 3, after organization FF becomes confident with the AMHS operation and request bi-lateral agreement with organization GG, it establishes 'logical AMHS connection' with GG. Consequently, all MTAs within the island establish logical 'direct MTA-to-MTA[1]' connections, which are illustrated as dotted lines, for transmitting AMHS messages between themselves. The AFTN/AMHS gateway functions are still required at the edge of the island where messages are transmitted from AMHS MTAs to AFTN.

[1] The above "direct MTA-to-MTA" connection shows a logical connection and it may not be necessarily the same as a physical connection using ATN Routers. At least two physical connections are necessary between the organization GG, CC and FF in the above case.



F

Figure 5 displays the situation when more organizations have implemented AMHS than AFTN. All MTAs will from AMHS islands and have logical 'direct MTA-to-MTA[2]' connection between them. At the edge of the island, MTAs will connect with AFTN using AFTN/AMHS gateway functions. From the figure, however, only organization BB has not implemented AMHS MTA, thus the gateways are configured to send messages with destination addresses starting with B only.

[2] The above "direct MTA-to-MTA" connection shows a logical connection and it may not be necessarily the same as a physical connection using ATN Routers. At least one physical path must exist between the MTAs.

APPENDIX B Table of Proposed Backbone MTAs Site in Asia/Pacific Region

The following table contains the proposed location of Backbone MTAs within the Asia/Pacific region:

Name and location of Proposed Backbone MTA
NFFN – Nadi International Airport, Fiji
NZCH – Christchurch International Airport, New Zealand[3]
RJAA – New Tokyo International Airport, Japan
VABB – Mumbai/Jawaharlal Nehru International Airport, India
VHHH – China (Hong Kong) COMM Center
VTBB – Bangkok ACC/FIC/COM, Thailand
WSSS – Singapore Changi Airport, Singapore
YBBB – Brisbane (FIS/FIC/ACC/COM/MET/NOF), Australia
ZBBB – Beijing City, China

Table 1 Proposed Backbone MTA in Asia/Pacific Region[4]

[3] The connection between New Zealand and the US will be considered as a restricted link for AMHS use only.
[4] KSLC [Salt Lake City, US] is considered to be in the North America region and thus is outside the scope of this table. However, there are many pacific islands with connections with KSLC. They will be considered exceptions because they will become UAs to the KSLC AMHS as stated in the table CNS-1C [5].

APPENDIX C ACRONYMS

AFS	(Aeronautical Fixed Service)
AFTN	(Aeronautical Fixed Telecommunication Network)
AMHS	(ATS message handling system)
ATN	(Aeronautical Telecommunication Network)
ATS	(Air Traffic Service)
ATSMHS	(ATS Message Handling Service)
DoS	(Denial of Service)
IDRP	(Inter-domain Routing Protocol)
MS	(Message Storage)
MTA	(Message Transfer Agent)
NDR	(Non-Delivery Report)
NSAP	(Network Service Access Point)
O/R Address	(Originator/Recipients Address)
SARPs	(Standards and Recommended Practices)
SMTP	(Simple Mail Transfer Protocol)
TBD	(To Be Determined)
TBP	(To Be Proposed)
TSEL	(Transport Selector)
UA	(User Agent)

Seventh Meeting of Aeronautical Telecommunication Network (ATN)
Transition Task Force of APANPIRG (ATNTTF/7)

Appendix J to the Report

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC
ATS Message Handling System (AMHS) Naming Plan

THIRD EDITION - APRIL 2005

EXECUTIVE SUMMARY

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

Based upon the ATN SARPs as published in ICAO Annex 10 and ICAO Doc. 9705, naming and addressing plans are required to be developed by ICAO regions concerned. These Regional Plans will provide guidance to States in the assignment and registration of addresses and names to be used for the Aeronautical Telecommunication Network (ATN).

The ASIA/PAC ATN AMHS Naming Plan aligns itself with the global AMHS naming scheme.

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

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

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

1. INTRODUCTION

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

The information contained in this document is drawn from a number of developments from the third meeting of the ATN Panel and planning activities in Europe.

1.1 Objectives

The objective of the document is to provide guidance in the naming convention to be used for the AMHS in the ASIA/PAC Region.

1.2 Scope

The scope of the document includes:

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

The ASIA/PAC Regional ATN AMHS naming convention presented here will comply with the relevant formats as specified in ICAO Doc. 9705.

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

1.3 References

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

Reference 2 ICAO Location Indicators – Document 7910

1.4 Definitions

MF-Address (MHS-form address) is the Originator/Recipient name of an AMHS user.

CAAS-Address (Common AMHS Address Scheme) is a MF-Address of which the organization-name attribute identifying the user within an AMHS Management Domain is selected by the Management Domain itself and shall be supplied to ICAO for publication.

XF-Address (Translated-form address) is a particular MF-Address of which all attributes identifying the user within an AMHS Management Domain may be converted by an algorithmic method to and from an AFTN form address.

1.5 Abbreviations

The following abbreviations are used in this document:

ADMD Administration Management Domain

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

2. AMHS NAMING CONVENTION

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

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

2.1 MHS Addressing Scheme

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

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

Table 2-1 Mnemonic form address attributes of MHS

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

2.2 MF-Addressing Scheme in AMHS

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

Two types of MF-address in AMHS are defined in Doc9705 (reference 1), namely Common AMHS Addressing Scheme (CAAS) and XF (Translated-form) Addressing Scheme. They differ in the number of attributes being selected from mnemonic form of MHS addressing scheme,

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

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

2.3 Naming Convention For CAAS Format

It is recommended that ICAO register with the ITU-T the ADMD name “ICAO” as an international ADMD under the “XX” country code. It was also recommended that ICAO establishes and maintains a register of PRMDs allocated by air traffic service providers according to the “XX” + “ICAO” address structure. The management of this register would be established and maintained in the same way as the Location Indicators (Doc 7910) and Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services (Doc 8585).

The Air Navigation Commission on the 1st of June 2000 approved these recommendations. On the basis of these recommendations, the ASIA/PAC Region accepted the format for the allocation of the first two attributes used in the O/R name. It was proposed that a common naming convention be used worldwide to help stream line the addressing scheme and to ensure compatibility and consistency with other neighboring

regions. This scheme would be based on the work that has been ongoing in Europe. It was also stressed that if States have not already started their implementation programmes for AMHS that when planning to do so they should adopt the CAAS-Address format and not the XF-Address format.

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

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

2.3.1 Country Name

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

2.3.2 ADMD

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

2.3.3 PRMD

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

The contents of this field can include the ICAO Location Indicator specified in ICAO Document 7910 or the name of the Air Traffic Service Organization (ATSO) that has been registered with ICAO. Where an ATSO has not yet assigned their PRMD then a default value will be allocated, which will use either one or two letters of the ICAO Country Indicator specified in ICAO Document 7910. This has been chosen for its simplistic and non-ambiguous format, which is already managed by ICAO. Hence providing an easier management role for ICAO who will be responsible for maintaining the register of all PRMDs allocated under the ADMD of "ICAO".

2.3.4 Organization Name

The organization name is used to define the local or national geographical routing information. This information is to be assigned by the ATSO (for example can be based on the ICAO location indicator as specified in ICAO Document 7910 or some other value determined by an ATSO and published by ICAO). Figure 2 - 1 provides a pictorial view of how the organization name can be used in relation with the lower attribute structure.

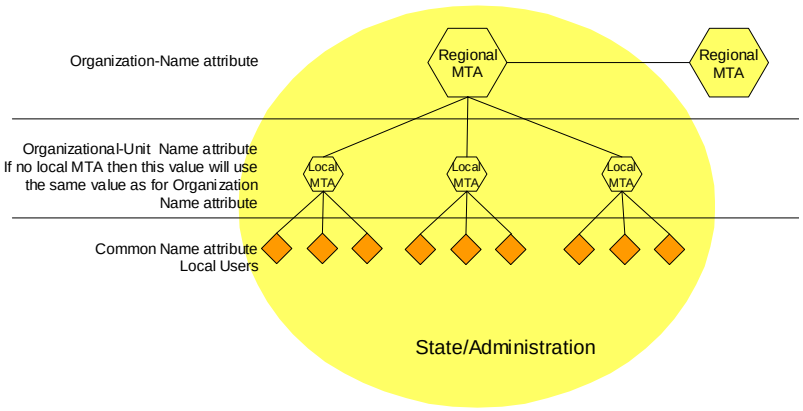


Figure 2 -1 Lower Attribute Structure

2.3.5 Organizational Unit Name OU1

Each State or organization is allocated a unique ATS message organizational name. As all States are familiar with the ICAO four character location indicator defined in ICAO document 7910. It is proposed that the organization unit name 1 use the location indicator to identify the Message Transfer Agent (MTA) site, encoded as a Printable String.

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

2.3.6 Common Name

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

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

Attribute	Assigned By	Value	Comment
Country-name (C)	ITU-T	XX	International Organization
ADMD (A)	ICAO	ICAO	ICAO Responsibility to register
PRMD (P)	ATSO	e.g. THAILAND	ATSO registered private domain with ICAO.
Organization name (O)	ATSO	e.g. VTBB	Local/national geographical information, which can be based on ICAO Location Indictors (Doc 7910)
Organizational-Unit name (OU1)	ATSO	e.g. VTBB	ICAO Location Indicator (Doc 7910)
Common Name (CN)	ATSO	e.g. VTBBYFYX	AFTN address

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

2.4 Naming Convention For XF-Address Format

The attributes to be used for the XF-Address format are as described in ICAO Document 9705 and presented below as follows:

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

2.4.1 Country Name

As proposed in Section 2.3.1

2.4.2 ADMD

As proposed in Section 2.3.2

2.4.3 PRMD

As proposed in Section 2.3.3

2.4.4 Organization Name

This field has already been defined by ICAO Document 9705. The value of this field contains the encoded printable string “AFTN”.

2.4.5 Organizational Unit Name OU1

The organizational unit name 1 attribute is used to contain the 8-character alphabetical value of the AFTN address indicator of the user, encoded as a Printable String.

Possible example of an O/R address is shown in Table 2-3

Table 2-3 Example of XF-Address AMHS Naming Convention

Attribute	Assigned By	Value	Comment
Country-name (C)	ITU-T	XX	International Organization
ADMD (A)	ICAO	ICAO	ICAO Responsibility to register
PRMD (P)	ATSO	e.g. Y	ICAO Country Indicator or ATSO registered private domain with ICAO
Organization-name (O)	ATSO	AFTN	AFTN name
Organizational-Unit name (OU1)	ATSO	e.g. YBBBYFYX	AFTN address indicator

2.5 General Use of X.400 O/R Addresses

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

3. PRMD-name values and Address Scheme Registration

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

3.1 XF Addressing Scheme

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

The XF Addressing Scheme is simple to implement because the *organization-name* always takes the fixed value "AFTN" and the *organization-unit-name-1* is used to store the AFTN address. Hence, only the *PRMD-name* is required for AFTN to XF address translation and there are no more than 200 of such entries. The ATN SARPs Edition 2 provided the XF addressing requirements. However, the XF scheme does not support the addressing of multiple MTAs within a MD for more operational choice by States/ATSO. For example, having two MTAs as entry/exit points of a MD can serve the purpose of load balancing as well as providing a hot-backup site to enhance the performance and availability of the AMHS service. The drawback on the use of XF is that, unlike the CAAS that allows multiple *organization-name* values, XF supports only one value. Hence an AMHS initially using XF addressing will need to be changed back to CAAS addressing at a later time (when the system will be in operation delivering live traffic). With this in conjunction with the limited value (i.e. for simplicity) of XF addressing, the ATN SARPs Edition 3 encourages the direct use of CAAS addressing right in the beginning of AMHS implementation.

3.2 Common AMHS Addressing Scheme

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

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

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

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

4. PRMD-name value

PRMD-name takes either ICAO Nationality Letters as specified in Doc7910 or values declared by respective AMHS MD. The Nationality Letters will be taken as the default values if States/ATSOs do not respond to ICAO's State Letter. Hence, values of the *PRMD-name* may take any one of the following three forms: -

(a) Value declared by AMHS MD which is different from Nationality Letter, e.g. Hong Kong, China declared

the value "HongKong" as *PRMD-name.*

(b) Value declared by AMHS MD but follows the Nationality Letter, e.g. New Zealand declared the value "NZ" as *PRMD-name.*

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

4.1 PRMD-name value for XF

In the XF Addressing Scheme, the *organization-name* value is fixed as "AFTN" and there is no *common-name* attribute. Therefore, only the *PRMD-name* is required by AMHS MD for AFTN/XF address translation. To streamline the choice of *PRMD-name* value and to simplify the conversion, it would be more convenient and logical to make use of the Nationality Letters in AFTN location indicator as the *PRMD-name* value. Table 1a gives the suggested values if States/ATSOs in ASIA/PAC choose to use XF for the time being.

4.2 PRMD-name value for CAAS

In CAAS, the *organization-name* value is not fixed. To minimize the influence of the legacy AFTN address structure on CAAS and to present explicitly the name of the States/ATSOs administering the AMHS MD, it would be advisable to use full name of the States/ATSOs as the *PRMD-name* value. This is given in Table 1b.

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

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

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

State/ATSO: A

PRMD-name	B
Organization-name	*x*
Organization-unit-name-1	[XXXX]

B= name of State/ATSO in alphanumeric characters

x = name of the organization in alphanumeric characters. The syntax and value are to be defined by the considered State/ATSO.

[XXXX] = 4-letter AFTN location indicator(s) that is associated with the organization

e.g. COUNTRYABCD

PRMD-name	COUNTRYABCD
Organization-name	CAANAME
Organization-unit-name-1	VKKK VKKA VKSA VKSP

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

State/ATSO: A

PRMD-name	B
Organization-name	[PPPP]
Organization-unit-name-1	n[XXXX]

[PPPP] = 4-letter AFTN location indicator representing a geographical unit

n[XXXX] = n number of 4-letter AFTN location indicator(s) that is associated with the unit

e.g. COUNTRYMNPQ

PRMD-name	COUNTRYMNPQ
Organization-name	VZSS
Organization-unit-name-1	VZAC VZAG VZAH VZAP VZAR VZAT VZJC VZSL VZSS

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

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

State/ATSO: A

PRMD-name	B
Organization-name	m[PPPP]
Organization-unit-name-1	n[XXXX] per [PPPP]

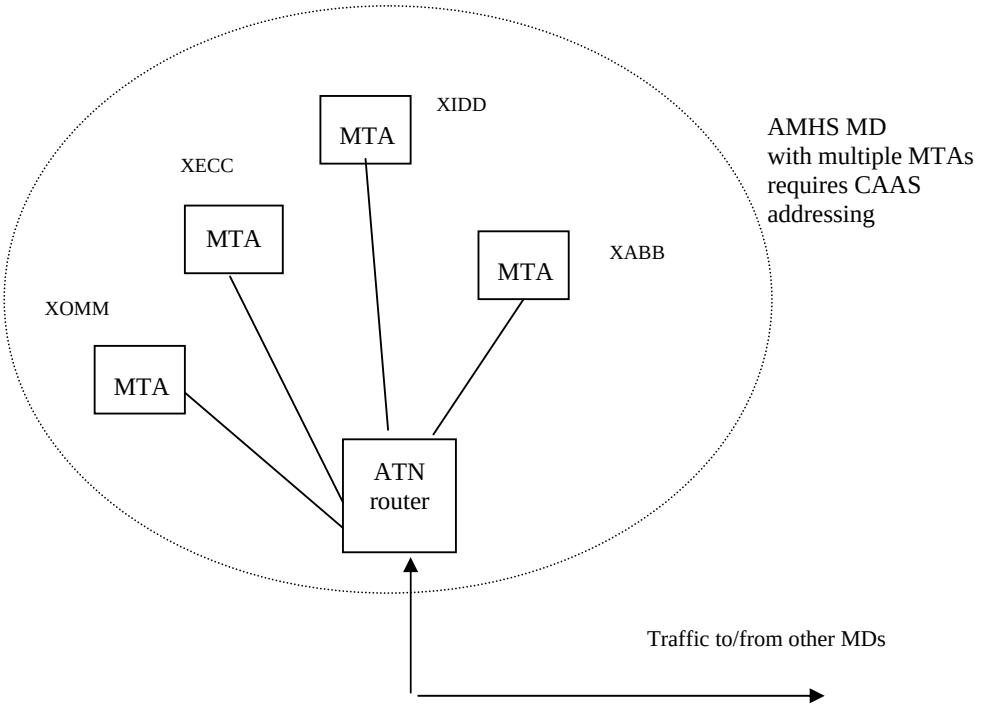
m[PPPP] = m number of 4-letter location indicator each representing different geographical unit

n[XXXX] = n number of 4-letter location indicator(s) that are associated with a particular geographical unit

e.g. COUNTRYXYZ

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

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



Note: 1. Each MTA, as an end system, should have its own NSAP address.

2. Traffic between MTAs within the domain is a local matter.

Table 2a provides suggested values for the CAAS for all States/ATSOs in the ASIA/PAC region assuming each State deploys one MTA. Table 2b provides examples of CAAS for some States/ATSOs in ASIA/PAC region assuming multiple MTAs are deployed. States/ATSOs shall refer to the examples given to develop their own CAAS address scheme for single or multiple MTAs option.

Table 1a

Suggested *PRMD-name* values of the AMHS MD in ASIA/PAC region assuming all States/ATSOs using XF

States	AMHS Address Specification			
	Nationality Letters or Designator	**Country-name attribute**	**ADMD-name attribute**	**PRMD-name attribute**
American Samoa	NST*	XX	ICAO	NST
Australia	Y*	XX	ICAO	Y
Bangladesh	VG	XX	ICAO	VG
Bhutan	VQ	XX	ICAO	VQ
Brunei Darussalam	WBSB, WBAK	XX	ICAO	WB
Cambodia	VD	XX	ICAO	VD
China	ZP, ZS, ZU, ZW, ZG,ZH,ZL, ZY, ZB	XX	ICAO	ZB
Cook Islands	NC	XX	ICAO	NC
Dem. People's Rep. Of Korea	ZK	XX	ICAO	ZK
Democratic Republic of Timor-Leste	WP	XX	ICAO	WP
Fiji	NF	XX	ICAO	NF
French Polynesia	NT	XX	ICAO	NT
Hong Kong (China)	VH	XX	ICAO	VH
Wallis and Futuna Island (France)	NL	XX	ICAO	NL
India	VA, VI, VO, VE	XX	ICAO	VA
Indonesia	WA,WI,WR	XX	ICAO	WA
Japan	RJ,RO	XX	ICAO	RJ
Kiribati	NG	XX	ICAO	NG
Lao People's Dem. Rep.	VL	XX	ICAO	VL
Macau (China)	VM	XX	ICAO	VM
Malaysia	WB	XX	ICAO	WB
Malaysia (Peninsular)	WM	XX	ICAO	WM
Maldives	VR	XX	ICAO	VR
Marshall Islands (U.S.)	PK	XX	ICAO	PK

Micronesia (Federated States of)	PT	XX	ICAO	PT
Mongolia	ZM	XX	ICAO	ZM
Myanmar	VY	XX	ICAO	VY
Nauru	AN	XX	ICAO	AN
Nepal	*VN*	XX	ICAO	VN
New Caledonia (France)	NW	XX	ICAO	NW
New Zealand	NZ	XX	ICAO	NZ
Niue Island (New Zealand)	NI	XX	ICAO	NI
Pakistan	OP	XX	ICAO	OP
Palau Islands (U.S.)	PTR*	XX	ICAO	PTR
Papua New Guinea	AY	XX	ICAO	AY
Philippines	RP	XX	ICAO	RP
Rep. Of Korea	RK	XX	ICAO	RK
Samoa	NS	XX	ICAO	NS
Singapore	WS	XX	ICAO	WS
Solomon Islands	AG	XX	ICAO	AG
Sri Lanka	VC	XX	ICAO	VC
Tai Wan (China)	RC	XX	ICAO	RC
Thailand	VT	XX	ICAO	VT
Tonga	NFT*	XX	ICAO	NFT
Tuvalu	NGF*	XX	ICAO	NGF
Vanuatu	NV	XX	ICAO	NV
Viet Nam	VV	XX	ICAO	VV

Table 1b

Suggested *PRMD-name* values of the AMHS MD in ASIA/PAC region assuming all States/ATSOs using CAAS

States	AMHS Address Specification			
	Nationality Letters or Designator	**Country-name attribute**	**ADMD-name attribute**	**PRMD-name attribute**
American Samoa	NST*	XX	ICAO	SAMOA-US
Australia	Y*	XX	ICAO	AUSTRALIA
Bangladesh	VG	XX	ICAO	BANGLADESH
Bhutan	VQ	XX	ICAO	BHUTAN
Brunei Darussalam	WBSB, WBAK	XX	ICAO	BRUNEI
Cambodia	VD	XX	ICAO	CAMBODIA
China	ZP, ZS, ZU, ZW, ZG,ZH,ZL, ZY, ZB	XX	ICAO	CHINA
Cook Islands	NC	XX	ICAO	COOK-IS
Dem. People's Rep. Of Korea	ZK	XX	ICAO	DP-REP-KOREA
Democratic Republic of Timor-Leste	WP	XX	ICAO	EAST-TIMOR
Fiji	NF	XX	ICAO	FIJI
French Polynesia	NT	XX	ICAO	POLYNESIA
Hong Kong (China)	VH	XX	ICAO	HONGKONG
Wallis and Futuna Island (France)	NL	XX	ICAO	WALLIS-IS
India	VI, VA, VO, VE	XX	ICAO	INDIA
Indonesia	WA,WI,WR	XX	ICAO	INDONESIA
Japan	RJ,RO	XX	ICAO	JAPAN
Kiribati	NG	XX	ICAO	KIRIBATI
Lao People's Dem. Rep.	VL	XX	ICAO	LAO
Macau (China)	VM	XX	ICAO	MACAU
Malaysia	WB	XX	ICAO	MALAYSIA
Malaysia (Peninsular)	WM	XX	ICAO	MALAYSIA-PENIN
Maldives	VR	XX	ICAO	MALDIVES
Marshall Islands (U.S.)	PK	XX	ICAO	MARSHALL

Micronesia (Federated States of)	PT	XX	ICAO	MICRONESIA
Mongolia	ZM	XX	ICAO	MONGOLIA
Myanmar	VY	XX	ICAO	MYANMAR
Nauru	AN	XX	ICAO	NAURU
Nepal	VN	XX	ICAO	NEPAL
New Caledonia (France)	NW	XX	ICAO	NEW-CALEDONIA
New Zealand	NZ	XX	ICAO	NEW-ZEALAND
Niue Island (New Zealand)	NI	XX	ICAO	NIUE-IS
Pakistan	OP	XX	ICAO	PAKISTAN
Palau Islands (U.S.)	PTR*	XX	ICAO	PALAU-IS
Papua New Guinea	AY	XX	ICAO	PAPUA-NG
Philippines	RP	XX	ICAO	PHILIPPINES
Rep. Of Korea	RK	XX	ICAO	REP-KOREA
Samoa	NS	XX	ICAO	SAMOA
Singapore	WS	XX	ICAO	SINGAPORE
Solomon Islands	AG	XX	ICAO	SOLOMON-IS
Sri Lanka	VC	XX	ICAO	SRI-LANKA
Tai Wan (China)	RC	XX	ICAO	TAIBEI
Thailand	VT	XX	ICAO	THAILAND
Tonga	NFT*	XX	ICAO	TONGA
Tuvalu	NGF*	XX	ICAO	TUVALU
Vanuatu	NV	XX	ICAO	VANUATU
Viet Nam	VV	XX	ICAO	VIETNAM

Table 2a

Suggested CAAS Addressing Scheme

assuming all States/ATSOs in ASIA/PAC deploy one MTA

States	AMHS Address Specification				
	Country-name attribute	**ADMD-name attribute**	**PRMD-Name attribute**	**Organization-name**	Organisation-unit-name-1
American Samoa	XX	ICAO	SAMOA-US	NSTU	All 4-letter location indicators of the State contained in Doc7910
Australia	XX	ICAO	AUSTRALIA	YSSY	Ditto
Bangladesh	XX	ICAO	BANGLADESH	VGZR	Ditto
Bhutan	XX	ICAO	BHUTAN	VQPR	Ditto
Brunei Darussalam	XX	ICAO	BRUNEI	WBSB	Ditto
Cambodia	XX	ICAO	CAMBODIA	VDPP	Ditto
China	XX	ICAO	CHINA	ZBBB	Ditto
Cook Islands	XX	ICAO	COOK-IS	NCRG	Ditto
Dem. People's Rep. Of Korea	XX	ICAO	DP-REP-KOREA	ZKKK	Ditto
Democratic Republic of Timor-Leste	XX	ICAO	EAST-TIMOR	WPAT	Ditto
Fiji	XX	ICAO	FIJI	NFFN	Ditto
French Polynesia	XX	ICAO	POLYNESIA	NTAA	Ditto
Hong Kong (China)	XX	ICAO	HONGKONG	HKGCAD	Ditto
Wallis and Futuna Island (France)	XX	ICAO	WALLIS-IS	NLWW	Ditto
India	XX	ICAO	INDIA	VABB	Ditto
Indonesia	XX	ICAO	INDONESIA	WAAA	Ditto
Japan	XX	ICAO	JAPAN	RJAA	Ditto
Kiribati	XX	ICAO	KIRIBATI	NGTA	Ditto
Lao People's Dem. Rep.	XX	ICAO	LAO	VLVT	Ditto
Macau (China)	XX	ICAO	MACAU	VMMC	Ditto
Malaysia	XX	ICAO	MALAYSIA	WBFC	Ditto
Malaysia (Peninsular)	XX	ICAO	MALAYSIA-PENIN	WMKK	Ditto
Maldives	XX	ICAO	MALDIVES	VRMM	Ditto

Marshall Islands (U.S.)	XX	ICAO	MARSHALL	PKMJ	Ditto
Micronesia (Federated States of)	XX	ICAO	MICRONESIA	PTKK	Ditto
Mongolia	XX	ICAO	MONGOLIA	ZMUB	Ditto
Myanmar	XX	ICAO	MYANMAR	VYYY	Ditto
Nauru	XX	ICAO	NAURU	ANAU	Ditto
Nepal	XX	ICAO	NEPAL	VNKT	Ditto
New Caledonia (France)	XX	ICAO	NEW-CALEDONIA	NWWW	Ditto
New Zealand	XX	ICAO	NEW-ZEALAND	NZAA	Ditto
Niue Island (New Zealand)	XX	ICAO	NIUE-IS	NIUE	Ditto
Pakistan	XX	ICAO	PAKISTAN	OPKC	Ditto
Palau Islands (U.S.)	XX	ICAO	PALAU-IS	PTRO	Ditto
Papua New Guinea	XX	ICAO	PAPUA-NG	AYPY	Ditto
Philippines	XX	ICAO	PHILIPPINES	RPLL	Ditto
Rep. Of Korea	XX	ICAO	REP-KOREA	RKSI	Ditto
Samoa	XX	ICAO	SAMOA	NSFA	Ditto
Singapore	XX	ICAO	SINGAPORE	WSSS	Ditto
Solomon Islands	XX	ICAO	SOLOMON-IS	AGGH	Ditto
Sri Lanka	XX	ICAO	SRI-LANKA	VCCC	Ditto
Tai Wan (China)	XX	ICAO	TAIBEI	RCTP	Ditto
Thailand	XX	ICAO	THAILAND	VTBB	Ditto
Tonga	XX	ICAO	TONGA	NFTF	Ditto
Tuvalu	XX	ICAO	TUVALU	NFGU	Ditto
Vanuatu	XX	ICAO	VANUATU	NVVV	Ditto
Viet Nam	XX	ICAO	VIETNAM	VVVV	Ditto

Table 2b

Suggested sample CAAS Addressing Scheme for some States/ATSOs in ASIA/PAC deploying multiple MTAs

States	AMHS Address Specification				
	Country-name attribute	**ADMD-name attribute**	**PRMD-name attribute**	**Organization-name**	Organisation-unit-name-1
Australia	XX	ICAO	AUSTRALIA	YBBN	YA*, YB*, YC*, YD*,YE*,YF*, YH*, YI*, YJ*, YK*
				YSSY	YL*, YM*, YN*, YO*, YP*, YQ*, YR*, YS*, YT*, YU*, YV*,YW*, YY*
China	XX	ICAO	CHINA	ZBBB	ZB*, ZS*, ZW*, ZY*, ZU*
				ZGGG	ZG*, ZJ*, ZH*, ZL*, ZP*
Japan	XX	ICAO	JAPAN	RJAA	RJ*
				ROAH	RO*
Thailand	XX	ICAO	THAILAND	VTBB	VTB*, VTC*
				VTSS	VTP*, VTS*, VTU*

* * * * *

AMHS NAMING REGISTRATION FORM
Table 1a - AMHS MTA and User Agent Register

Explanation of the Table 1a

Legend:	
Contracting State :	Authority administering the MTA.
MTA ID :	Numbering scheme where each MTA is assigned with an ordinal number.
User Agent ID :	Sub-ordinate number assigned to the User Agent Name registered under a MTA.
Addressing scheme :	Addressing scheme recommended by ATN SARPS. Values are limited to XF or CAAS.
Country-name :	The “C” value of AMHS MD identifier.
Administration-domain-name :	The “A” value of AMHS MD identifier.
Private-domain-name :	The “P” value of AMHS MD identifier.
Organization name :	The “O” value of attributes identifying an geographical unit or an organization within MD. The value is fixed for XF addressing scheme. (O=AFTN)
Organization-unit-name-1 :	The “OU1” value of attributes identifies 4-letter location indicator within the organization “O”. Depending upon the prevailing condition, some letters can be represented by wildcard (*).
User Agent (Direct User only) :	The “CN” value (Common Name) of attributes identifies a User Agent (UA) i.e. direct user within MD. It is presented in 8-character AFTN address format to enable the UA to receive message from AFTN indirect user. This field will be blanked when the OU1 is not equipped with UA.
Description of user :	Brief description of the UA, the direct user. NOC = network operating centre

Legend:	
MTA Name :	The name of the MTA hosting the AMHS user. (Used in AMHS binds.)
NSAP address :	NSAP address of the MTA. The NSAP address assignments should follow the ICAO recommendation in ASIA/PAC ATN Network Service Access Point (NSAP) Addressing Plan
TSEL value :	TSEL value of the MTA.
Capability :	The type of services supported by the MTA and the edition of relevant document (the number in parenthesis). Basic Service =A, File Transfer Body Part =B, Directory Service =C, Security = D; System Management = F, AMHS/AFTN Gateway=H

Table 1a – AMHS MTA and User Agent Register

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
Contracting State	**MTA ID**	**User Agent ID**	**Addressing scheme**	**Country-name**	**Administration - domain-name**	**Private-domain -name**	**Organization-name**	**Organization-unit-name-1**	**User Agent (Direct User only)**	**Description of user**	**MTA Name**	**NSAP address**	**TSEL value**	**Capability**
			CAAS/XF	**(C)**	**(A)**	**(P)**	**(O)**	**(OU1)**	**(CN)**					
China	**1**		**CAAS**	**XX**	**ICAO**	**China**	ZBBB	ZB*			**zbmta**	**47002781815A4200010101020202028002010001**	**MHS**	**A(2) C(2)**
CAAS with multiple MTA								ZS*						
								ZW*						
								ZY*						
								ZU*						
		1.1						ZBBB	ZBBBYFUA	NOC operator				
		1-2						ZBAA	ZBAAYMUA	MET UA				
		1.3						ZSSS	ZSSSYFUA	NOC operator				
	2		**CAAS**	**XX**	**ICAO**	**China**	ZGGG	ZG*			**zgmta**	**47002781815A4200010102020202028002010001**	**MHS**	**A(2), C(2)**
								ZH*						
								ZL*						
\								ZP*						
								ZJ*						
		2.1						ZGGG	ZGGGYFUA	NOC Operator				
		2.2						ZJHK	ZJHKYFUA	NOC Operator				
Hong Kong, China	**3**		**CAAS**	**XX**	**ICAO**	**Hong Kong**	HKGCAD	VH*			**hkgmta**	**47002781815648000101010202020280020100 01**	**MHS**	**A(2), B(1), C(2)**
(CAAS with single MTA)		3.1						VHHH	VHHHYFUA	NOC operator				

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
Contracting State	**MTA ID**	**User Agent ID**	**Addressing scheme**	**Country-name**	**Administration - domain-name**	**Private-domain -name**	**Organization-name**	**Organization-unit-name-1**	**User Agent (Direct User only)**	**Description of user**	**MTA Name**	**NSAP address**	**TSEL value**	**Capability**
			CAAS/XF	**(C)**	**(A)**	**(P)**	**(O)**	**(OU1)**	**(CN)**					
		3.2						VHHH	VHHHYFUB	NOC operator				
		3.3						VHHH	VHHHCPAU	UA at CPA				
Macau China	**4**		**XF**	**XX**	**ICAO**	**VM**	AFTN				**mcumta**	**47002781815648000101010202020028002010001**	**MHS**	**A(2)**
Thailand	**5**		**XF**	**XX**	**ICAO**	**VT**	AFTN				**thmta**	**47002781815654000101010202020028002010001**	**MHS**	**A(2)**
Philippines	**6**		**XF**	**XX**	**ICAO**	**RP**	AFTN				**phmta**	**47002781815651000101010202020028002010001**	**MHS**	**A(2)**

Important Note: All data shown in the forms are for illustration only, not the actual data for operational use.

TABLE CNS 1D - ATS INTERFACILITY DATA COMMUNICATION (AIDC) PLAN

Explanation of the Table

Column

1. Administration - the name of the Administration, State or Organization responsible for management of the AIDC

2. Location of AIDC and system

3. AIDC Pair - the name of the city or location of the end of the AIDC service and correspondent Administration.

4. AIDC Standard used

5. Target Date of Implementation – date of implementation of the AMHS services

6. Remarks

* TBD - to be determined

TABLE CNS-1D
ATS INTERFACILITY DATA COMMUNICATION (AIDC) ROUTING PLAN

Administration	Location of AIDC end system	AIDC Pair		AIDC standard used	Target date of Implementation	Remarks
		Correspondent location	Correspondent Administration			
1	2	3		4	5	6
Australia	Brisbane	Chistchuch				Implemented
		Jarkata				2007
		Nadi				2005 TB confirmed
Bangladesh	Dhaka	Kalkota				tbd
Bhutan						
Brunei Darussalam	brunei	Singapore,				2007
Cambodia		bangkok				tbd
China	Haikou Guangzhou	HongKong	Hong Kong CAA	AFTN	2007	Ungergoing operational trial with SANYA ACC
Hong Kong, China		HongKong				
		Guangzhou	CAAC	AFTN	2008	Undergoing technical trial with Guangzhou Control
		Taibei Manila	Taibei CAA Manila CAA	TBA TBA	2007/2008 TBA	
Macao, China						
Cook Islands						
Democratic People's Republic of Korea	Pyongyang	Shenyang				2008
Fiji		New Zealand				2007
India	Mumbai	Muscat				2007

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ATS INTERFACILITY DATA COMMUNICATION (AIDC) ROUTING PLAN

Administration	Location of AIDC end system	AIDC Pair		AIDC standard used	Target date of Implementation	Remarks
		Correspondent location	Correspondent Administration			
1	2	3		4	5	6
Indonesia	Jakarta		Australia			2007
			Singapore			2006
	Makassar		Australia			
Japan	Tokyo	Oakland				Implemented AFTN
	Tokyo	Anchorage				Implemented AFTN
	Tokyo		Republic of Korea			TBD
Kiribati						
Lao People's Democratic Republic						
Malaysia	Kuala Lumpur	Singapore,Bangkok				2007
Maldives						
Marshall Islands						
Micronesia (Federated States of)						
Mongolia	Ulaanbaatar	Beijing	CAAC			2008 AFTN
Myanmar						
Nauru						
Nepal						
New Zealand	Auckland	Brisbane	Australia	AFTN	Implemented	ATN AIDC 2008/09
		Nadi	Fiji	AFTN	2005	"
		Oakland	USA	AFTN	Implemented	"
		Tahiti	France	AFTN	2005	"
Palau						
Papua New Guinea						
Philippines	Manila	Singapore, HongKong				TBD
Republic of Korea	Seoul					TBD with Japan

TABLE CNS-1D
ATS INTERFACILITY DATA COMMUNICATION (AIDC) ROUTING PLAN

Administration	Location of AIDC end system	AIDC Pair		AIDC standard used	Target date of Implementation	Remarks
		Correspondent location	Correspondent Administration			
1	2	3		4	5	6
Samoa						
Singapore	Singapore	Kuala Lumpur				correspondent change
		Jarkata				orrespondent change
Solomon Islands						
Sri Lanka						
Thailand	Bangkok	Phnom Penh	Cambodia	ATN	2007	
		Vientiane	Laos	ATN	2007	
		Kuala Lumpur	Malaysia	ATN	2007	
		Yangon	Myanmar	ATN	2007	
		Hochiminh	Viet Nam	ATN	2007	
Tonga						
Vanuatu						
Viet Nam	HCM	Bangkok			2007	

STRATEGY FOR IMPLEMENTATION OF THE AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) IN THE ASIA/PAC REGION

Considering that:

a) the requirement for a robust ground-to-ground Aeronautical Telecommunication Network (ATN) to meet growing need for a digital data communications to support the Air Traffic Management Operational Concept;

b) the availability of ICAO SARPs and Technical Manuals for implementation of ATN;

c) the awareness generated in States for replacement of the present AFTN with digital data network by conducting various seminars and meetings;

d) the availability of several guidance materials, interface control documents (ICDs) required to assist States to ensure harmonization of procedures and protocol to assure inter-operability within the region;

e) the agreement in EUR region to provide gateways to support ATN protocol suites implemented in adjacent region;

f) the feasibility of introducing SARPs compliment air-ground application in a secured network without prolonged delay;

g) the lack of SARPs for an alternative TCP/IP protocol for immediate use and introduction of material on the use of TCP/IP for air-ground application, require significant technical work, which is not likely to be completed in the near future for amendment to Annex 10 SARPs and associated technical provisions in ATN documentations;

h) the need to migrate to Binary Universal form of representation of meteorological data (BUFR) coded OPMET messages; the emerging need to use lower case letters in NOTAM messages; and

i) the trial and demonstrations conducted by several States in the ASIA/PAC region for implementation of ATN/AMHS and actions taken by States for introduction of ATN/AMHS;

THE GENERAL STRATEGY FOR THE IMPLEMENTATION OF THE ATN INFRASTRUCTURE AND ASSOCIATED GROUND TO GROUND APPLICATIONS IN THE ASIA/PAC REGION SHOULD BE AS FOLLOWS:

a) Implementation be in full compliance with Annex 10 SARPs, PANS, ICDs and guidance materials adopted by APANPIRG;

b) in the ASIA/PAC region ground-to-ground ATN will initially support the implementation of ATS Message Handling System (AMHS) to replace AFTN;

c) Strategically deploy the ATN infrastructure with a limited number of ATN Backbone routers to support other ground-to-ground and air-ground applications;

d) during the transition phase, some AFTN system may remain in operation. A reasonable time frame should be established for their replacement with AMHS;

e) MTA sites should provide AFTN/AMHS gateways during the transition phase;

f) States should work co-operatively to assist each other on a multinational basis to implement the ATN expeditiously and to ensure system inter-operability;

g) States should organize training of personnel to provide necessary capability to maintain and operate the ground-to-ground ATN infrastructure and applications;

h) upon successful deployment of ground-to-ground ATN infrastructures and applications within the region, States gradually introduce ATN air-ground infrastructures and applications.

TITLE AND TERMS OF REFERENCE

TITLE: ATN Transition Task Force

TERMS OF REFERENCE:

Plan for implementation of the Aeronautical Telecommunication Network (ATN) in the ASIA/PAC region to meet performance and capacity requirements of CNS/ATM Systems. The planning also addresses the ongoing development of the AFS including digital speech communication.

SUBJECT/TASKS LIST OF THE ATN TRANSITION TASK FORCE

No.	Ref.	Task	Priority	Action Proposed/In Progress	Target
1	RAN/3 C 10/12 C 10/11d	Subject: ATN Transition Guidance Material. Task: Develop Regional ATN Transition Guidance Material.		1) Development of detailed guidance material.	Completed
2	RAN/3 C 10/11d	Subject: ATN Transition Plan Task: Develop an ATN Transition Plan to provide seamless transition to ATN.		1) Develop Ground Transition Plan taking into account Air-to-Ground aspects. 2) Develop a set of planning documents covering: i) ATN Regional Routing Architecture ii) ATN Naming and Addressing Conventions, and iii) Documentation of the Assigned ATN Names and Addresses.	Completed
3		Subject: ATN major elements. Task: Provide performance and functional requirements of ATN.	A	1) Develop ATN Technical Documents. System integrity - Performance - System Management	~~2004~~ (2006 Monitor development in ACP) ~~2004~~ Completed ~~2004~~ Completed
4	RAN/3 C 10/11b	Subject: AFTN related issues Task: Review operation of AFTN.	B	1) Evaluate and review the effect of increases or decreases in capacity and network changes, on circuit loading. 2) Plan network changes for support of OPMET and AIS databases, automated VOLMET broadcast.	Completed Completed

No.	Ref.	Task	Priority	Action Proposed/In Progress	Target
5		Subject: Planning and implementation information in ANP. Task: Develop G/G part of the CNS FASID.	A	Development of detail description for the existing tables and Charts for the G/G part of the CNS FASID. 1) Table CNS 1B – ATN Router Plan 2) Table CNS 1C – ATS MHS 3) Table CNS 1D – AIDC Routing Plan	Completed
6		Subject: ATN Documentation Task: Development of ATN Routing Documentations and ICDs.	A	Development of ATN Documents: 1) A Router ICD 2) A Routing policy for IDRP 3) A Routing policy for MTA 4) Directory of Service 5) An AMHS ICD 6) An AIDC ICD	Completed Completed ~~2004~~ Completed ~~2004~~ Completed Completed ~~2004~~ 2006 Monitor development in ACP
7		Subject: Use of the public Internet Task: Develop guidance material for the use of the public internet technology to support AFTN, where required.	A	Study the possibility of using the public Internet and develop guidance material for its use to support low speed AFTN stations, as an interim measure, with particular emphasis on security and reliability.	Completed

No.	Ref.	Task	Priority	Action Proposed/In Progress	Target
8		Subject: Use of IP Task: Develop guidance material for the use of IP as a Sub-Network for ATN	B	In accordance with the work being performed by ACP, develop guidance material for the support of IP as a Sub-Network of the ATN, with particular emphasis on system compatibility between adjacent centers and security.	(2006 Monitor development in ACP)
9		Subject: AMHS Naming Registration Task: Develop registration forms for assigning AMHS address for the region	A	To develop an AMHS Naming Registration Form List of contact point To develop procedures for completing the Form. Establishment of an interim database for directory service	~~2004~~ Completed 2006 2006 (Monitor development in ACP for change in procedure at the Global Level)
10		Subject: AFTN/AMHS Transitional/Operational Procedures Tasks: Revise and develop transitional/operational procedures applicable to the use of the AMHS.	A	To review existing AFTN transitional/operational procedures and develop a new transitional and operational procedures applicable to the operation and use of the AMHS. Awaiting few more sites to be on line to proceed with development of operational procedures.	~~2004~~ 2006 (Monitor development in ACP)

TITLE AND TERMS OF REFERENCE

TITLE: ATN IMPLEMENTATION COORDIANTION GROUP

TERMS OF REFERENCE:

Coordinate ATN implementation and transitional issues in the Asia and Pacific region and address relevant system management, operational procedures and emerging issues that may arise.

SUBJECT/TASKS LIST OF ATN IMPLEMENTATION COORDIANTION GROUP

No.	Ref.	Task	Priority	Action Proposed/In Progress	Target
1		Subject: ATN Implementation coordination Task: Review of implementation problems and develop coordinated solutions	A	-States to report and share implementation and operational experience gained; -Analyze problems and develop coordinated solutions.	Continiues/2008
2		Subject: ATN Operational procedures Task: Develop appropriate ATN operational procedures.	A	To review existing AFTN transitional/operational procedures and develop a new transitional and operational procedures applicable to the operation and use of the AMHS. - To developed coordinated AFTN routing change with AMHS routing change procedures; - To coordinate AMHS MTA routing tables	2007
3		Subject: ATN Certification and validation process. Task: Development of ATN validation and certification procedure.	A	Develop ATN System integrity	Monitor development in ACP
4		Subject: ATN Documentation Task: Development of ATN ICDs.	A	Development of ATN Documents: - AIDC ICD	2007 Monitor development in ACP

No.	Ref.	Task	Priority	Action Proposed/In Progress	Target
5		Subject: Use of IP Task: Develop guidance material for the use of IP as a Sub-Network for ATN	B	In accordance with the work being performed by ACP, develop guidance material for the support of IP as a Sub-Network of the ATN, with particular emphasis on system compatibility between adjacent centers and security.	2007 Monitor development in ACP
6		Subject: AMHS operational management system Task: Development of interim database for directory services		To develop procedures for completing the Form	2007 Monitor development in ACP
7		AMHS performance			

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The Seventh Meeting of Aeronautical Telecommuniation Network (ATN)
Transition Task Force of APANPIRG
Shanghai, China, 18-22 April 2005

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Attachment 2

International Civil Aviation Organization

THE SEVENTH MEETING OF AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) TRANSITION TASK FORCE OF APANPIRG

中国民用航空总局
空中交通管理局

LIST OF WORKING AND INFORMATIKON PAPERS

WP No.	Agenda Item	Subject	Presented by
1	-	Provisional Agenda	Secretariat
2	8	AFTN Performance Report	Secretariat
3	7	Regional Planning for the Transition to BUFR-Coded OPMET Information	Secretariat
4	2	ATN Documentation Tree	Secretariat
5	9	Terms of reference (TOR) and Subject/Tasks List of the ATN Transition Task Force	Secretariat
6	5	Current status of the ATN AIDC Application	Rapporteur of WG
7	4	ASIA/PAC Technical Document on Use of Directory Services	Rapporteur of WG
8	1	ACP WGN/04 Discussions on Directory Services	Japan
9	4	A Proposal for an Interim Regional AMHS Address Database	Japan
10	2	Report on OPLINKP WG Review of ASIA/PAC Regional ATN Performance Document	Japan
11	2	Draft Communication Performance for ATN	Japan
12	4	AMHS Addressing Scheme and Private Management Domain Name Value for Each State in the Asia and Pacific Region	Hong Kong, China
13	4	Final Draft of ASIA/PAC Regional AMHS MTA/UA Naming Registration Table & Contact List	Hong Kong, China
14	4	Draft ASIA/PAC Aeronautical Telecommunication Network (ATN) Air Traffic Service (ATS) Message Handling System Description	Secretariat

WP No.	Agenda Item	Subject	Presented by
15	8	Review the ASIA/PAC AFTN Plan - Table CNS-1A	Secretariat
16	6	Table CNS-1D - ATS Inter-Facility Data Communication (AIDC)	Secretariat
17	1	Progress Of Activities In ACP On The Aeronautical Telecommunications Network	Secretariat
18	4	AMHS/MTA Routing Policy	Thailand
19	6	Review the ASIA/PAC AMHS Plan - Table CNS-1C	Secretariat
20	6	Review the ASIA/PAC ATN Router Plan - Table CNS-1B	Secretariat
21	5	Status on the Production of ASIA/PAC Regional ICD for AIDC	Thailand
22	3	ASIA/PAC ICD for ATN Ground-Ground Router for the ISO/IEC 8208 Sub-Network	USA
23	8	AFTN Circuit Loading Statistics	New Zealand
24	7	Draft Strategy for Implementation of Ground-to-ground ATN in the ASIA/PAC region	Chairman and Secretariat
25	2	ASIA/PAC ATN System Management Policy	USA
26	2	ASIA/PAC ATN System Integrity Policy	USA
27	4	Report on ATNTTF WG Transitional Documentation ATN Operational Procedure	Rapporteur of WG
28	4	ASIA/PAC Technical Documentation on the use of Directory Service	Rapporteur of WG
29	7	ATN Router ICD and ISO/IEC 8208 Sub-net	Rapporteur of WG

Attachment 3

IP No.	Agenda Item	Subject	Presented by
1	-	Meeting bulletin	Secretariat
2	7	Use of TCP/IP Protocols in ASIA/PAC Region Aeronautical Telecommunication Network	USA
3	7	Japan-US AMHS Operational Service	Japan
4	7	Dual Protocol Stack ATN Router	China
5	7	Network Configurations to be used during the phased AFTN/AMHS transition	Sri Lanka
6	7	ATN deployment plan in Indonesia	Indonesia
7	7	ATN implementation plan in the Republic of Korea	Republic of Korea
8	8	AFTN Coordination between Japan and the Russian Federation	Japan