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Agenda Item 3: Discussions and Review AMHS Activities

**ASIA/PACIFIC REGIONAL AERONAUTICAL
TELECOMMUNICATION NETWORK (ATN) AIR TRAFFIC SERVICE (ATS) MESSAGE
HANDLING SERVICE (AMHS) DESCRIPTION**

(Presented by U.S.A.)

SUMMARY

This paper provides the description for the Asia/Pacific regional ATN AMHS. This paper discusses the AMHS related protocols, performance, network management, and security requirements.



**INTERNATIONAL CIVIL AVIATION
ORGANIZATION
ASIA AND PACIFIC OFFICE**

DRAFT

**Asia/Pacific Regional Aeronautical
Telecommunication Network (ATN) Air Traffic
Service (ATS) Message Handling Service (AMHS)
Description**

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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) include 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 service (ATSMHS, AMHS). Applications are hosted by End Systems (ES).

Aeronautical Fixed Service (AFS) communications in the Asia/Pacific region are currently provided by the Aeronautical Fixed Telecommunication Network (AFTN). This is being incrementally replaced by a region-wide network of AMHS systems along with the introduction of a regional ATN ground network. This document describes AMHS systems 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 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. AMSH 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”, which specifies the ATN Standards and Recommended Practices (SARPs), 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. ATN AMHS must conform to the mandatory ATN SARPs requirements of AMHS.

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 SARPs are generally backwards compatible between successive editions. While Doc 9705 Edition 3 incorporates SARPs 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. Neither is the pass-through service currently planned in the Asia/Pacific region. Therefore, both SARPs Edition 2 compliant AMHS and SARPs Edition 3 compliant AMHS may satisfy the requirements of this document.

1.2.2 ATN AMHS and IP-based AMHS

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 Protocol (COTP4) as the transport protocol.

Although the ATN is the SARPs designated network for supporting ATN applications, the EUR region has proposed the implementation of AMHS over the Internet Protocol (IP) protocol stack using TCP (Transport Control Protocol) as the transport protocol and IPv4 as the network protocol. This will allow AMHS to leverage readily available commercial off-the-shelf (COTS) IP network technology. However, such IP-based ATN applications are not compliant with ICAO Doc. 9705, and cannot be connected directly to ATN AMHS systems as the network and transport protocols differ — a gateway system is required to interface the two.

According to “Guidance provided by ATNP on “AMHS over TCP/IP”” at the ATNP Joint meeting of Working Group A/Working Group B in Toulouse in October 2002[1], use of non-SARPs compliant IP-based AMHS systems within a state or among a group of states is a local issue, but in order to ensure global interoperability with ATN compliant AMHS systems, states adopting IP-based AMHS must be responsible for providing gateway facilities to handle any necessary conversion to and from ATN-based AMHS, and must bear the associated costs.

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 ATN G/G router 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 5: AMH26 — IPM Requirements for Enhanced MS 94 Access (P7). (Edition 2)
- 32) *Interface Control Document (ICD) for ATS Message Handling System (AMHS) in Asia/Pacific Region*, Issue 1.2, November 2001.
- 33) *AMHS Naming*, ATN Seminar, Chiang Mai, Thailand, 11 to 14 December 2001.
- 34) *AMHS Connection Test via ATN Router between the United States and Japan*, Version 1.0, June 2003.

2.2 Reference Documents

The following documents are reference documents applicable to the ATN G/G router descriptions. These documents do not form a part of this document and are not referenced within the document.

- 1) Flimsy 2 Rev. B, Guidance provided by ATNP on “AMHS over TCP/IP”, Agenda item 8: TCP/IP Issue, ATNP Joint meeting of Working Group A/Working group B, Toulouse,

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- 2) ICAO Doc. 9739-AN/961. The Comprehensive Aeronautical Telecommunication Network (ATN) Manual (CAMAL) First Edition, January 1999.
- 3) 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 ATS Basic Service

The Basic Message 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 ATS Extended Service

The Extended Message 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 ATS Extended Service is a superset of ATS Basic Service, and is backward compatible with the Basic ATS Service.

3.3 Asia/Pacific AMHS Service

In the near future, the Asia/Pacific AMHS will only provide the Basic ATS service. Eventually, the Extended Service will be supported by all AMHS users.

4.0 AMHS System Requirements

The Asia/Pacific AMHS includes three types of end systems:

- 1) ATS message server;
- 2) ATS message agent; and
- 3) AFTN/AMHS gateway.

The AMHS end systems **shall** comply with the following requirements in accordance with the Protocol Implementation Conformance Statement (PICS) specified in Asia/Pacific Regional AMHS ICD [32].

4.1 User Agent

An ATS 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.

4.1.1 User Agent for Basic Service

For the support of the Basic ATS Message Service, an ATS message user agent **shall** 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 supporting the requirements of Repertoire Group A, 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.

4.1.2 User Agent for Extended Service

For the support of the Extended ATS Message Service, an ATS message user agent **shall** comply with the following requirements.

1. the specification of ICAO Doc 9705 section 3.1.2.2.1.3.1, which mandates the support of the IPM Business Class (BC) Functional Group (FG) as specified in ISO/IEC ISP 12062-2:1999 (3rd Edition), and the support of bilaterally defined body parts, in addition to the Message Content profile specification defined for the Basic ATS Message Service;

2. the UA profile specified in ICAO Doc 9705 section 3.1.2.2.1.3.2, based on either of the following profiles, and depending on the inclusion of a MS in the attachment ATS Message Server, and on the application-contexts supported by the attachment ATS Message Server:
 - a) AMH23 (MTS Access - P3) as specified in ISO/IEC ISP 12062-4:1999;
 - b) AMH25 (MTS 94 Access - P3) as specified in ISO/IEC ISP 12062-4:1999;
 - c) AMH24 (Enhanced MS Access - P7) as specified in ISO/IEC ISP 12062-5:1999;
or
 - d) AMH26 (Enhanced MS 94 Access - P7) as specified in ISO/IEC ISP 12062-6:1999.
3. the Directory User Agent (DUA) profile specified in ICAO Doc 9705 section 3.1.2.2.1.4 and referring to Sub-Volume 7.

4.2 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 ATS message server **shall** comply with the following requirements in accordance with Asia/Pacific AMHS ICD.

4.2.1 Message Server for Basic Service

To support the Basic ATS Message Service, the message server **shall** comply with the following requirements in accordance with Asia/Pacific AMHS ICD.

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.

4.2.2 Message Server for Extended Service

To support the Extended ATS Message Service, the message server **shall** comply with the following requirements.

1. one or several of the MTS-access and/or MS-access profiles specified in ICAO Doc 9705 section 3.1.2.2.2.3, based on the following profiles, depending on the inclusion of a MS in the ATS Message Server, and on the application-contexts supported by the ATS Message Server:

- a) AMH12 (MTS Access - P3) as specified in ISO/IEC ISP 10611-4:1999;
 - b) AMH14 (MTS 94 Access - P3) as specified in ISO/IEC ISP *10611-4:1999*;
 - c) AMH13 (Enhanced MS Access - P7) as specified in ISO/IEC ISP 10611-5:1999; and
 - d) AMH15 (Enhanced MS 94 Access - P7) as specified in ISO/IEC ISP 10611-6:1999.
2. the DUA profile specified in ICAO Doc 9705 section 3.1.2.2.2.4 and referring to Sub-Volume 7.

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 **shall** comply with the requirements defined in ICAO Doc 9705 section 3.1.2.3 in accordance with Asia/Pacific AMHS ICD.

4.4 AMHS Address 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 **shall** comply with the requirements provided in ICAO Doc 9705 section 3.1.2.1.5, and the specifications defined in AMHS Naming document [33].

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 **shall** comply with the upper layer requirements defined in Asia/Pacific AMHS ICD.

5.2 IP-based AMHS

As mentioned in section 1.2.2, the implementation of IP-based AMHS is not SARPs-compliant and is a local issue. The IP-based AMHS should be converted into CLNP-based when it enters the global ATN network. Since IP protocol stack does not have presentation and sessions layer, the Regions/States deploying IP-based network for ATN should develop functions/approaches to enable the AMHS over IP network. This solely is a local issue.

6.0 Performance Recommendations

The ATN AMHS system performance requirements depend on the ATN network, AMHS service requirements, and bilateral agreements.

The follows are the baseline AMHS system performance requirements.

6.1 Communications Performance and Capacity

The required communication performance of the AMHS (circuit speeds, number of circuits, throughput 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 **shall** be 64 Kbps.
2. The minimum LAN speed **shall** be 10 Mbps.
3. The AMHS **shall** have a throughput no less than 3600 messages/hour based on estimated traffic in 2005 [34].
4. The ATN AMHS processing delay **shall** not exceed TBD* milliseconds.
5. The availability of AMHS system **shall** be no lower than TBD*%.
6. The maximum message service downtime **shall** be TBD*.
7. The ATN AMHS **shall** have a MTBF (Mean Time Between Failures) of service no less than TBD* hours.

* note: to 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. 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 higher for AMHS server and AMHS/AFTN gateway than AMHS agent.

1. For AMHS server and AMHS/AFTN gateway, a high level of availability of the message service is required. This may be achieved either by using AMHS 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.

The maximum allowed message service downtime is determined based on maintenance contract. Use of multiple or redundant routers may help to maintain message service availability during scheduled maintenance downtime.

7.0 Information Security

7.1 Message Exchange Security

7.1.1 Basic Service

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.

7.1.2 Extended Service

In the Extended ATS Message Service, Asia/Pacific AMHS **shall** comply with the security requirements defined in ICAO Doc 9705 section 3.1.2.1.2.3.2~3.1.2.1.2.3.4.

7.2 AMHS System Security

The security of each AMHS system is deemed a local issue.

8.0 Network Management Recommendations

The AMHS **shall** 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)
AMHS	(ATS message handling system)
AOC	(Aeronautical operational control)
APRL	(ATN profile requirement list)
ATC	(Air Traffic Control)
ATN	(Aeronautical Telecommunication Network)
ATS	(Air Traffic Service)
ATSC	(ATS Communication)
ATSMHS	(ATS Message Handling System)
AU	(Access Unit)
BIS	(Boundary Intermediate System)
CLNP	(Connectionless Network Protocol)
CLNS	(Connectionless Network Service)
CSMA/CD	(Carrier Sense Multiple Access with Collision Detection)
DUA	(Directory User Agent)
ES	(End system)
ESs	(End Systems)
G/G	(Ground-Ground)
ICAO	(International Civil Aviation Organization)
ICD	(International Code Designator)
IDRP	(Inter-Domain Routing Protocol)
IEC	(International Electrotechnical Commission)
IEEE	(International Electrical and Electronics Engineering)
IS	(Intermediate system)
ISO	(International Standardization Organization)
ISs	(Intermediate Systems)
LLC	(Logical Link Control)
MAC	(Multiple Access Control)
MS	(Message Store)
MDI	(Medium Independent Interface)
MTA	(Message Transfer Agent)
MTBF	(Mean Time Between Failure)
NPDUs	(Network Protocol Data Units)
NSAP	(Network Service Access Point)
PDU	(Protocol Data Unit)
PICS	(Protocol Implementation Conformance Statement)
PLP	(Packet Layer Protocol)
QOS	(Quality of Service)
RD	(Routing domain)
RIB	(Routing Information Base)
SARPs	(Standard and Recommendation Practices)

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RDs	(Routing Domains)
SNDCF	(Subnetwork Dependent Convergence Function)
SNICF	(Subnetwork Independent Convergence Function)
TBD	(To Be Determined)
TBP	(To Be Proposed)
UA	(User Agent)