



*International Civil Aviation Organization*

**SIXTEENTH MEETING OF THE  
COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND  
METEOROLOGY SUB-GROUP OF APANPIRG (CNS/MET SG/16)**

Bangkok, Thailand, 25 – 29 July 2012

**Agenda Item 3: Aeronautical Fixed Service (AFS)**

3) discuss AIDC ICD issue and other AFS related issues

**INFORMATION MANAGEMENT BASED NETWORK PLANNING**

(Presented by the United States of America)

**SUMMARY**

This paper conveys the implementation issues in supporting International Civil Aviation Organization (ICAO) Roadmap 2: Communication, Appendix 1: Technology Roadmaps, to be presented at the upcoming Air Navigation Conference. Roadmap 2 indicates the merger of Air Traffic Service Inter-Facility Data Communication (AIDC) and Air Traffic Service Message Handling System (AMHS) into Information Management beginning at approximately 2020. Roadmap 2 further shows the phasing out of Internet Protocol version 4 (IPv4) by 2020. This paper is a preliminary analysis of the planned Information Management Service (IMS) environment using IPv6 network. A thorough analysis should be considered at the ICAO Regional level and Panel level to ensure a smooth transition. An IMS Operational Concept should be developed as a guideline for States to plan accordingly.

*This paper relates to –*

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

**C: Environmental Protection and Sustainable Development of Air Transport -**

*Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment*

**Global Plan Initiatives:**

GPI-22 Communication infrastructure

**1. Introduction**

1.1. At the Twelfth Air Navigation Conference to be held in Montreal from 19-30 November 2012, a Working Paper AN-WP/8643 will be presented by the Director of the Air Navigation Bureau introducing the Fourth Edition of the Global Air Navigation Plan (GANP). This Plan includes “Roadmap 2: Communication” which highlights the evolution of core components of the Air Traffic Service Ground-Ground Communication.

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1.2. Roadmap 2 specifies the implementation of an Information Management Service beginning at approximately 2020. This approach requires an underlying common network to support the dynamic distribution of data seamlessly based on demand. Under Roadmap 2, Information Management is being considered to begin the replacement of the AMHS, starting from 2020.

1.3. Asia/Pacific and other ICAO regions are in the process of completing their AMHS implementations. The Asia/Pacific region is expected to complete implementation within its major hubs in the region by the end of 2013 and complete all connections by 2015.

1.4. The ICAO Aeronautical Communication Panel (ACP) has specified the use of Internet Protocol version 6 (IPv6) addressing, with ATS global address assignment. However, no progress has been reported.

1.5. Internet Protocol version 4 (IPv4) has been used for AMHS and other ATS data between States. Voice over Internet Protocol (VoIP) will be implemented in the near future, also using IPv4.

**2. Discussion**

2.1 Transition to an Information Management Service, such as System Wide Information Management (SWIM), requires an underlying network with robustness to ensure that data distribution complies with time-sensitivity requirements. It is critical that an Operational Concept be developed which clearly defines the function of the network and its SWIM component. Industry currently defines “the network” as a cloud with no required functions, such as legal recording, tracking of unknown addresses, delivery assurance, and sender/receiver information. The underlying ATS network also needs to include the responsibility for IP address management, Domain Name Service (DNS), network security, and administrative domain(s). The Aeronautical Fixed Telecommunication Network (AFTN) and AMHS currently provide these functions based on point-to-point circuits. If AMHS is to be phased out in favor of IMS, these functions need to be clearly assigned. Future planning for IMS environment should be considered now, since it will take considerable funding and time to plan for this service. The IMS approach is a solution for future ATC related data distribution but it should be noted that it has taken significant time to implement AMHS by allowing the dual operation of AFTN and AMHS and the fact that implementation schedules of States have not been synchronized.

2.2 The Aeronautical Telecommunication Network Internet Protocol Suite (ATN IPS) Doc. 9896 specifies the use of IPv6 as an underlying network for time sensitive ATS data. However, it does not detail clearly the formation of an IPv6 network. This leads to a number of interpretations and solutions: Private IPv6 ATS networks, IPv6 tunneling over public internet, and Private IPv6 networks between domains. Furthermore, there are many options to support IPv6, but a unified approach has not been selected whether IPv6 native, IPv4/6 conversion, or dual stack IPv4/6 (See Table 1 for a high-level comparison). A unified approach is critical as these options are not necessary compatible to one another.

**Table 1 IPv6 Implementation Options**

	<b>Private IPv6 ATS Network</b>	<b>IPv6 tunneling over public internet</b>	<b>Private IPv6 Network through Inter-Domains</b>
Definition	A closed private network with a single domain administrator	States contract individual Internet Service providers for an IPv6 service	Existing networks interfaces to one another using IPv6 with a common interface and management policy
Advantages	Provides a common network for all members  Supports Quality of Service  Supports Time sensitive delivery	Provide a common network for all members  Requires the least time to establish a network  Cheapest solution to implement.	Uses existing networks  Supports Quality of Service  Supports Time sensitive delivery
Disadvantages	Most expensive solution  Requires establishment of network domain administrators  Required State Members to enter into contract agreements	Quality of Service is not guaranteed  Time sensitive data cannot be supported  Cannot support global IPv6 assigned addresses  Might not comply with information security regulation required by State Members  Bandwidth might not be available due to “peak time” consumption	Requires State Members to implement the upgrade  Development of interface and network management policy is time consuming

2.3 IMS is designed to distribute data more efficiently thus reducing the redundancy of network inter-connections. However, the concept of IMS is not yet well defined and understood by the user community. Currently, all messages distributed through the AFTN/AMHS are being recorded and tracked with all coordination based on direct point-to-point connections. The AFTN/AMHS provides a common addressing scheme to ensure global message distribution and global compatibility.

2.3.1 In order to manage IMS, and for IMS to perform effectively and efficiently, both the network and the IMS functions should be in the same administrative domain in order to perform message tracking, recording, authentication, Domain Name Service (DNS) provision, address management, etc.

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2.3.2 There are many types of messages being distributed through the AFTN/AMHS: Flight Plan/clearance, Air Traffic Service Inter-Facility Data Communication (AIDC), Aeronautical Information Management (AIM) NOTAM messages, OPMET data, International Search and Rescue, etc. These messages are generated by their respective systems which might not have capability to perform recording, tracking, distributing and format conversion provided by AFTN/AMHS. An Operational Concept that specifies message communication between these systems, without AFTN/AMHS, is critical for IMS to be successful.

2.3.3 Under the IMS environment, there are two options to support tracking, legal recording, and message management:

2.3.3.1 Allocate the function to message generating system: this approach will require extensive coordination within ICAO member States but also with other users (airlines, service providers, government agencies). In addition, this approach will require each message generating system to establish bi-lateral message coordination between widely distributed systems instead of adjacent the State to State coordination used for AFTN/AMHS. Gateways will also be required during the period of transition.

2.3.3.2 Implement the functions in the IMS messaging system: this approach will allow the coordination to remain between adjacent States. The IMS/SWIM system will be required to perform message format conversion during the transition period.

2.4 Moving to IMS environment is a major change in operational concept for the network operation and distribution of the messages. Therefore, an Operational Concept and related system functional specification must be developed in order to successfully comply with the ICAO Roadmap 2 timeframe.

2.5 AMHS implementation experience should be considered in developing a IMS environment Operational Concept such as :

- a) AFTN message formats that are not always compliant with ICAO Annex II and other provisions in the PANS;
- b) Many facilities no longer exist but their AFTN addresses were never removed;
- c) Today's AMHS underlying network protocols are not compatible;
- d) Online Centralized Directory Service implementation was postponed because of security concerns and network incompatibilities. Directory Service is partially supported by an offline Address Management Center with public internet access;
- e) Requiring each AMHS implementation to provide an AFTN/AMHS gateway is a time consuming process that caused overall delay of AMHS implementation; and
- f) Dual AFTN/AMHS operation required significant training and revision of operational procedures.

2.6 Furthermore, a clear implementation interpretation for the IPv6 underlying network is required to ensure compatibility and effectively support an IMS environment.

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**3. Need for a Clear IMS/SWIM Operational Concept**

3.1 It is strongly recommended that the meeting adopt a recommendation to APANPIRG to request ICAO headquarters to develop a clear IMS/SWIM Operational Concept at global level that identifies the impact to message generating systems before 2015 for States to begin IMS/SWIM environment implementation in 2020. An IPv6 network architecture to support IMS/SWIM must be finalized by 2015. Furthermore, a cost and benefit analysis is a critical document for States to plan and justify their budget allocation accordingly since this approach will impact many systems and telecommunication network planning and operation.

**4. Action by the Meeting**

4.1 The meeting is invited to:

- a) note the proposed Information Management Service and associated IPv6 network under consideration by the ICAO Air Navigation Conference;
- b) recommend that ATNICG should develop a plan to support IPv6 network implementation;
- c) request that the ICAO Headquarters consider the development of a IMS Operational Concept and finalizing IPv6 network configuration;
- d) request that cost-benefit analyses be a consideration for the implementation of an IPv6 network and IMS/SWIM.

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