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Agenda Item 3CNS Developments3.3Follow-up Activities for the Implementation of Ground-Ground
Communications

AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) INTERNET PROTOCOL SUITE - FAA PLAN TO COMPLY WITH ICAO DOCUMENTS

(Presented by the United States of America)

SUMMARY

The objective of this paper is to summarize the options available to assist in the transition to replace an aging Aeronautical Fixed Telecommunication Network (AFTN) infrastructure. International Civil Aviation Organization (ICAO) Documents specify the process needed to support the exchange of flight plans, meteorological data, flight tracking and flight transfer information between ICAO Contracting States which utilize the Transport Control Protocol/Internet Protocol (TCP/IP) network. This paper addresses each option and the associated implementation and operational activities related to Open System Interconnection (OSI) and Simple Mail Transfer Protocol (SMTP) based Air Traffic Service Message Handling System (AMHS) service.

1. Introduction

1. Background

1.1 The OSI based AMHS, as specified in ICAO Document 9705 Edition 3, was adopted for implementation in the Asia/Pacific region in 1998 which was further confirmed in 2005. The AMHS network in the Asia/Pacific Region is based on an Aeronautical Telecommunication Network (ATN) Router with X.25 subnet. However, a plan is underway to utilize the TCP/IP network to take advantage of the recent publication of the ICAO Document 9880 Part IIB.

1.1.2 The European Region implemented AMHS service between Germany and Spain in 2007. Service between Argentina and Paraguay was implemented in late 2007. Both the European and South America Regional AMHS networks are based on OSI based AMHS using Industry Standard RFC1006.

1.1.3 The ICAO Aeronautical Communication Panel (ACP) also plans to publish ICAO Document 9896 Internet Protocol Suite (IPS) Technical Manual which recommends the use OSI based AMHS over TCP/IP network in addition to IP based application such as SMTP as the application for transporting flight plans and other associated ground-to-ground data.

1.1.4 There are two parts in the Aeronautical Telecommunication Network (ATN) service: applications and its controlling network. In supporting TCP/IP network, there are 5 options that can be identified under current ICAO Documents:

- 1. AMHS using RFC1006 over TCP/IP Router (IPv4)
- 2. AMHS using RFC2126 over TCP/IP Router (IPv6)
- 3. AMHS using RFC1006 then tunnelling over TCP/IP Router (IPv6)
- 4. AMHS using CLNP over ATN IP SNDCF Router (IPv4)
- 5. SMTP over TCP/IP Router (IPv6)

Note: These options have been suggested by the Aeronautical Communication Panel Working Group I but have not yet been finalized.

2. Applications

2.1 The applications include AMHS, AMHS/AFTN Gateway, and SMTP. AMHS is only compatible with AFTN through an AFTN/AMHS Gateway. An SMTP message is not compatible with either AMHS or AFTN without a gateway.

2.1.2 Figure 1 depicts the message conversion between AFTN, AMHS and SMTP. A direct gateway between SMTP and AFTN is not knowingly commercially available as of yet.



Figure 1- Message Flow

2.1.3 IP Sub Network Dependent Convergence Function (SNDCF) as specified in ICAO Document 9705: This approach recommends the OSI X.400 based AMHS with Inter-Domain Routing Protocol (IDRP) using an ATN router with IP Subnet interface. This application can interface directly with the TCP/IP network through the ATN router. This option will not be further addressed since no region has adopted this approach for Aeronautical Fixed Services (AFS).

2.1.4 OSI X.400 based AMHS with RFC1006/2126 as specified in ICAO Document 9880 Part II B: This approach allows the OSI based AMHS to interface directly with the TCP/IP network without the need of an ATN Router.

2.1.5 SMTP as an IPS Based application for AMHS as specified in ICAO Document 9896 (project publication in late 2008): This approach recommends the use of the commercially available free text email system. It is the standard e-mail protocol on the Internet and part of the TCP/IP protocol suite, as defined in IETF RFC 2821.

2.1.6 SMTP defines the message format and the message transfer agent (MTA) as the process which stores and forwards the mail. SMTP was originally designed for only plain text (ASCII text), but other encoding methods enable executable programs and multimedia files to be attached to and transported with the e-mail message. This approach allows direct connection to the TCP/IP network.

2.2 TCP/IP Network

2.2.1 All applications have the capability to transport messages across networks just as SMTP is able to do. This is usually referred to as "SMTP mail relaying". A network consists of the mutually-TCP-accessible hosts on the public internet, the mutually-TCP-accessible hosts on a firewall-isolated TCP/IP Intranet, or hosts in some other Local Area Network (LAN) or Wide Area Network (WAN) environment utilizing a non-TCP transport-level protocol.

2.2.2 Using SMTP or AMHS, the process can transfer messages to another recipient within the same network or to another network via a relay or gateway process which is accessible and compatible to both networks. In this way, a message may pass through a number of intermediate relay or gateway hosts on its path from sender to its ultimate recipient. However, that recipient is required to have an identical application to decode the message (e.g. AMHS-AMHS, SMTP-SMTP) or the use of an applicable gateway such as AMHS/AFTN gateway or AMHS/SMTP gateway to decode the message.



2.2.3.1 Figure 2 depicts a common TCP/IP network with different applications.

Figure 2- TCP/IP Network with different and compatible applications

3. Discussion

3.1 OSI AMHS with RFC1006/2126 Development

3.1.1 OSI based AMHS with RFC1006 has been implemented in the Asia/Pacific, United States, Europe, Caribbean, and South America Regions in the last few years. Therefore, there are minimal technical and operational risks involved in implementing AMHS service.

3.1.2 The RFC2126 which supports IPv6 protocol with greater security and message format should be commercially available in 2008. However, additional time will be needed to perform and evaluate conformance tests with AMHS and AFTN.

3.2 SMTP Development

3.2.1 There are two approaches to convert between SMTP and X.400, encapsulation or address mapping. SMTP will require a gateway to X.400 to gain access to AMHS and AFTN. This gateway is commercially available but will need some custom modifications to meet compatibility requirements for AFTN and AMHS environments. The extent of the modifications is unknown at this time. Additionally, conformance and validation tests of the SMTP gateway in the AMHS environment will be necessary.

3.2.2 A SMTP/AMHS gateway is needed for the SMTP message to be converted to the AMHS X.400 and then to AFTN since a direct SMTP/AFTN gateway is not known to be available at this time.

4. Conclusion

4.1 The implementation of SMTP based AMHS can be achieved with the implementation of SMTP/AMHS Gateway or SMTP/AFTN Gateway. This will require funding for development, operational and conformance testing, procurement and implementation.

4.1.2 The security mandates and additional operational requirements to support SMTP in addition to AFTN and AMHS in States with major hubs will result in additional operating costs.

4.1.3 The conversion to AFTN message format from other message formats such as AMHS or SMTP is required due to the existing ATC infrastructure applications throughout all Civil Aeronautics Authorities (CAAs) which includes the FAA National Airspace System (NAS). In other words, the AFTN format header is required to be compatible with flight data filing, display, and processing systems such as a HOST computer, Flight Data Input/Output, etc. until these systems are replaced with an IP based application. Other equipments such as Flight plan consistency tool will need to be considered.

4.1.4 States which have invested in the OSI based AMHS, with RFC1006, should continue to implement the system. However when RFC2126 become commercially available, States with OSI based AMHS would be encouraged to follow the ICAO guidance and implement this protocol within their regions.

4.1.5 States that decide to implement SMTP based AMHS would provide a SMTP/AMHS/AFTN Gateway to ensure compatibility with both AMHS and AFTN environments. Figure 3 depicts the messages being distributed by a TCP/IP network consisting of AFTN, AMHS, and SMTP applications.



Figure 3 – TCP/IP Network consisting of AFTN, AMHS, and SMTP applications

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