International Civil Aviation Organization

MIDANPIRG Communication Navigation and Surveillance Sub-Group (CNS SG)

Sixth Meeting
(Tehran, Iran, 9 – 11 September 2014)

Agenda Item 3: Global and Regional Developments related to CNS

EUR Doc 020 and 021

(Presented by the Secretariat)

SUMMARY

This paper presents the ICAO EUR AMHS Manual (EUR Doc 020), Edition 9.0 and ICAO EUR ATS Messaging Management Manual (EUR Doc 021), Edition 10.0.

Action by the meeting is at paragraph 3.

REFERENCES

- COG/59 Report
- EUR AFSG/18 Report

1. INTRODUCTION

1.1 The Eighteenth Meeting of the EANPG Aeronautical Fixed Service Group (AFSG) held from 7 to 11 April 2014 in the ICAO EUR/NAT Office in Paris.

2. DISCUSSION

2.1 The meeting may wish to note that the AFSG/18 meeting was presented with the following updated EUR documents :

- ICAO EUR AMHS Manual (EUR Doc 020), Edition 9.0 (**Appendix A**); and
- ICAO EUR ATS Messaging Management Manual (EUR Doc 021), Edition 10.0 (**Appendix B**).

2.2 These documents have been approved at the EANPG Programme Coordination Group (COG/59) meeting which was held from 1 to 4 July 2014 in Rome, Italy and are available under the following link on the ICAO EUR/NAT website:
http://www.paris.icao.int/documents_open/subcategory.php?id=48.

2.3 The COG/59 meeting requested comments to these updated documents.

3. ACTION BY THE MEETING

3.1 The meeting is invited to note and comment if any to the documents in **Appendices A** and **B.**

EUR Doc 020

EUR AMHS Manual

EUR AMHS Manual	
Document Reference:	EUR AMHS Manual, Main Part
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Document Control Log

Edition	Date	Comments	section/pages affected
0.1	29/11/2001	Creation of the document.	all
0.2	13/03/2002	Incorporation of comments of FPG Meetings in Geneva and Berlin	all
0.3	19/03/2002	Incorporation of comments from Switzerland	Annex D
0.4	28/03/2002	Incorporation of comments to paragraph 1.1.4; presentation to AFSG/5 (April 2002)	1.1.4
0.5	28/02/2003	Incorporation of comments of AFSG/5; updates and new sections and new chapter, presentation to AFSG/6 (April 2003)	3.1, 3.2, 4.3, 5., 9.1
0.6	09/08/2005	Revision of the document structure, updates of chapters, new sections	all
0.7	03/02/2006	Inclusion of new and updates of sections and chapters, update of statistic paragraphs, deletion of CIDIN/AMHS Gateway requirements	1, 2.2.3.2, 7, 8.1, 5.9, 6.4.5.2, early 9.1.2.6
0.8	09/03/2006	Editorials, reformatting of the notes, updates of chapters, new sections	all 3.5, 6.1.5, 6.5, 8.5.1
0.9	19/03/2006	Editorial refinements of chapters and sections	1, 2.2.1, 3.5, 6.4.1, 6.5
1.0	27/04/2006	Adopted version (AFSG/9)	
1.1	13/03/2007	Editorial updates, incorporation of CP06-002, CP06-003 and CP06-004, Update of Appendices A - F (CP06-001, CP07-001)	all 7.3.2.2, 7.3.2.3, 8.2
2.0	26/04/2007	Adopted version (AFSG/10)	
2.1	19/03/2008	Incorporation of CP-AMHSM-08-004	5.9
3.0	24/04/2008	Adopted version (AFSG/11)	
3.1	17/11/2008	Change of references from ICAO Doc 9705 to ICAO Doc 9880 (CP-AMHSM-08-006), editorial improvements	all

3.2	12/12/2008	Incorporation of comments of PG M34 meeting, inclusion of ACP WG M Amendment Procedure	Attachment B
3.3	08/02/2009	Incorporation of CP-AMHSM-08-005, CP-AMHSM-08-007, CP-AMHSM-08-008,	3.5, 3.6 and 5.2, 2.2, 3.2, 4.3, 9.1
3.4	11/02/2009	Incorporation of CP-AMHSM-09-002	3.3 and 3.4
3.5	11/03/2009	Update of the referenced documents	References
4.0	02/04/2009	Adopted version (AFSG/12)	
4.1	12/03/2010	Incorporation of CP-AMHSM-09-004 and CP-AMHSM-09-005	References, 2.1.3.3, 2.2.3.1, 3.6.1
5.0	17/06/2010	Adopted version (AFSG/14)	
5.1	24/09/2010	Incorporation of CP-AMHSM-10-001, minor editorial updates	References
5.2	30/11/2010	Removal of CAMAL from the reference list	References
6.0	14/04/2011	Adopted version (AFSG/15)	
6.1	19/03/2012	Incorporation of CP-AMHSM-11-001 and CP-AMHSM-12-001, CP-AMHS-12-002	3.2.5.4, 9.1.3, 9.2, 3.7, 4.4
7.0	26/04/2012	Adopted version (AFSG/16)	
7.1	25/03/2013	Incorporation of CP-AMHSM-12-003, CP-AMHSM-12-005 CP-AMHSM-12-007, CP-AMHSM-12-010	6.5.3, 1.5, 3.7.1, 8.3, 8.4,
8.0	25/04/2013	Adopted version (AFSG/17)	
8.1	12/03/2014	Incorporation of CP-AMHSM-12-014, CP-AMHSM-13-007, CP-AMHSM-14-002 CP-AMHSM-13-005	3.1.3.2, 3.5.4, 5.2.2, 8.4, 3.2.4.2.1.2, 3.2.7.2.4, 5.2.6, 5.2.10, 5.6.3, 5.7.1, 5.8.1, 5.9.6, 6.4.1.3
9.0	10/04/2014	Adopted version (AFSG/18)	

Scope of the Document

This document has been developed by the ICAO EUR Aeronautical Fixed Service Group (AFSG) in order to present a comprehensive collection of information pertaining to the implementation of ATSMHS in the ICAO EUR Region.

It is intended that the document will evolve into an EUR ICAO Document containing guidance material on EUR AMHS implementation.

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LIST OF APPENDIXES OF THE EUR AMHS MANUAL

References

ICAO Documentation

[1] ICAO Annex 10 – Aeronautical Telecommunications, Volume II and Volume III

[2] ICAO Annex 11 – Air Traffic Services

[3] ICAO Doc 9880-AN/466: Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols, Part II – Ground-Ground Applications - Air Traffic Services Message Handling Services (ATSMHS), First Edition – 2010

[4] ICAO Doc 9880-AN/466: Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols, Part III – Upper Layer Communications Service (ULCS) and Internet Communications Service (ICS), , First Edition – 2010

[5] ICAO Doc 9880-AN/466: Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols, Part IV – Directory Services, Security and Systems Management, First Edition – 2010

[6] ICAO Doc 9896-AN/469: Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocols, First Edition – 2010

[7] ICAO Doc 7910, Location Indicators,

[8] ICAO Doc 8585, Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services

[9] ICAO Doc 8259-AN/936: Manual on the Planning and Engineering of the Aeronautical Fixed Telecommunication Network, Fifth Edition – 1991

[10] ICAO Doc 7754, Vol. I, EUR BASIC ANP Basic Air Navigation Plan – European Region –

[11] ICAO Doc 7754, Vol. II, EUR ANP (FASID) Facilities and Services Implementation Document (FASID) – European Region –

[12] EUR Doc 021, ATS Messaging Management Manual

SPACE Documentation

[13] WP201 – Location of AMHS message servers and AFTN/AMHS gateways, SPACE/NATS/201/WPR/034, Version 2.0, 30/06/2002

[14] WP202 – Specification of European AMHS performance objectives, SPACE/EURO/202/WPR/045, Version 2.0, 30/06/2002

[15] WP211 – Topology between servers and gateways, SPACE/DFS/211/WPR/059, 2.0, 08/11/2002

[16] WP223 – Study of routing strategy in SPSOs, SPACE/STNA/223/WPR/120, Version 2.0, 11/11/2002

[17] WP232 – AMHS security issues in SPACE participating States/ Organisations, SPACE/Eurocontrol/232/WPR/047, Version 1.0, 13/09/2001

[18] WP233 – AMHS institutional and financial issues in SPACE participating States/ Organisations, SPACE/STNA/233/WPR/192, Version 1.0, 11/09/2002

[19] WP234 – Analyse requirements for System Management at AMHS level, SPACE/NATS/234/WPR/051, Version 2.0, 30/06/2002

[20] WP411 – SPACE Final Report, SPACE/STNA/411/WPR/224, Version 1.0, 02/12/2002

General technical literature

[21] ISO/IEC 10021-2: Information Technology – Message Handling Systems (MHS): Overall architecture

[22] ISO/IEC 10021-10 International Standard, Information technology – Message Handling Systems (MHS): MHS routing (1998)

Table of Figures

Index of Tables

1 Structure of the EUR AMHS Manual

1.1 The EUR AMHS Manual consists of the "Main Part" and the Appendices.

1.2 In the main part, the following Chapters have been introduced, with the view to provide general guidance and detailed information on requirements concerning AMHS implementation in the EUR Region.

1. Introduction
2. EUR AMHS Requirements
3. European ATS Messaging Service Profile
4. System implementation - Guidelines for system requirements
5. AMHS management
6. Tests and validation of systems
7. Operational procedures and Recommendations
8. Miscellaneous

1.3 Then, for easy reference, the Change Control Mechanism of the EUR AMHS Manual has been included as Attachment A.

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

1.5 The following Appendices to the EUR AMHS Manual have been produced:

- Appendix A: Abbreviations, Glossary and Definitions
- Appendix B: European ATS Messaging Service Profile
- Appendix C: AMHS Testing Requirements
- Appendix D: AMHS Conformance Tests
- Appendix E: AMHS Interoperability Tests
- Appendix F: AMHS Pre-operational Tests
- Appendix G: European Directory Service (EDS)

1.6 *Note.– The EUR AMHS Manual is a "living" document. The AFSG Planning Group, as the editor, has collected necessary and relevant information to be used for the Regional deployment of AMHS. All interested partners are invited to contribute. Do not hesitate to contact the Planning Group; each comment, remark or correction is welcome.*

2 Introduction

2.1 Background Information

2.1.1 AFS

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

2.1.1.2 The following categories of message are handled by the AFS:

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

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

2.1.2 AFTN/CIDIN

2.1.2.1 Initially, the operational requirements for such an information exchange were met by the development of the Aeronautical Fixed Telecommunications Network.
The AFTN provides a store-and-forward messaging service for the conveyance of text messages in ITA-2 or IA-5 format, using character-oriented procedures.
Although AFTN served its purpose well for many years, AFTN technology has become outdated due to the fact that is remains bound to its telex/telegraphic origins.

2.1.2.2 One major step towards overcoming the limitations of the AFTN was taken with the introduction of the Common ICAO Data Interchange Network, which is based on packet switching techniques.
The CIDIN provides a common transport service for the conveyance of binary or text application messages in an expeditious and reliable manner.
In the EUR Region, the CIDIN provides the enhanced backbone data communications infrastructure for the AFTN and a general data communications service to non-AFTN applications such as OPMET.

2.1.3 AMHS

2.1.3.1 The most recent development with regard to messaging in the ATS environment is the AMHS. The AMHS is a natural evolution from AFTN/CIDIN, replacing the telegraphic style of working with a modern Message Handling System based on international Standards.

2.1.3.2 It is presumed that the ATSMHS, being an ATN application, utilises the infrastructure of the ATN internetwork. However this is not a prerequisite for the initial deployment of the ATSMHS.

2.1.3.3 There are several advantages of AMHS over AFTN/CIDIN including:

- increased speed, capacity and throughput
- enhanced reliability
- extended functionality
- interoperability with other global messaging services
- security capabilities
- use of COTS equipment and services

Furthermore, AMHS offers services meeting non-AFTN communication requirements.

2.1.3.4 The provisions pertaining to ATSMHS, such as SARPs, technical specifications and general guidance material, are contained in the following ICAO documents, which constitute the main references for this Manual.

- Annex 10, Volume II, Chapter 4 [1]
- Annex 10, Volume III, Part I, Chapter 3 [1]
- Doc 9880 Part II [3]
- ICAO EUR BASIC ANP[10]
- ICAO EUR ANP (FASID) [11]

2.1.4 ACCESS and SPACE

2.1.4.1 ACCESS Project

2.1.4.1.1 The “ATN Compliant Communications - European Strategy Study” (ACCESS) project was undertaken between January 1997 and March 1999 by National Air Traffic Services Ltd (NATS), the Service Technique de la Navigation Aérienne (STNA) and the Deutsche Flugsicherung (DFS) and part-funded from the European Commission’s programme for financial aid in the field of Trans-European Networks - Transport (TEN-T).

2.1.4.1.2 As TEN-T ATM Project 1996-GB-94-S, “Aeronautical Telecommunications Network -Implementation Feasibility Studies”, the main objectives of the study were:

a) Development of an ATN Architecture;

b) Development of an Implementation Plan in the European core area in conjunction with EUROCONTROL;

c) Interoperability and validation trials between States using ATN-compliant ATS Message Handling Services.

2.1.4.1.3 The geographical area considered in the ACCESS study comprised the following countries: Belgium, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and the United Kingdom. These States were chosen for the following reasons:

a) They had a direct connection to the European Central Flow Management Unit and/or were involved in the control of North Atlantic traffic;

b) The study was representative of both Oceanic and Continental ATC.

However, the architectural principles proposed in this Study are also applicable to the whole European area.

2.1.4.1.4 Similarly, whilst the ATN is designed to accommodate all aeronautical communications, the ACCESS Study concentrated on those directly related to the provision of Air Traffic Services (ATS). The other users of the ATN were not ignored, but the resulting network architecture does not consider those user requirements. However, this does not invalidate the design of the ATN in this study.

2.1.4.2 SPACE Project

2.1.4.2.1 The SPACE (Study and Planning of AMHS Communications in Europe) Project is a European Commission Project co-funded by the Commission of the European Union in the framework of the TEN-T ATM Programme. This project is run by a consortium of the following European States and Organisations: France (DGAC/STNA), Germany (DFS GmbH), Spain (Aena), United Kingdom (NATS Ltd) and the EUROCONTROL Agency.

2.1.4.2.2 The overall objective of SPACE is to develop plans to upgrade the current European-wide AFTN messaging system and to replace it using X.400 compliant systems based on the AMHS technical specifications developed by the ICAO ATN Panel and contained in Doc 9880, Part II (old Sub-Volume 3 of ICAO Doc 9705).

2.1.4.2.3 The SPACE Project comprises the following main phases:

- Phase 1: Definition of a European AMHS addressing plan;
- Phase 2: Technical design for the European AMHS; and
- Phase 3: Overall implementation plan.

2.1.4.2.4 The deliverables of the project complement the SARPs and technical specifications by addressing technical issues that are generally of an implementation nature such as:

- the location of servers and gateways;
- the definition of performance objectives;
- the definition of address conversion and routing strategy;
- etc.

2.1.4.2.5 One of the major deliverables of the SPACE Project is the definition of a common unique world-wide addressing scheme. This scheme - the Common AMHS Addressing Scheme (CAAS) - has subsequently been endorsed by the AFSG and the ATN Panel working groups and included in old Edition 3 of ICAO Doc 9705 which was replaced by Doc 9880, Part II.

2.1.4.2.6 The overall implementation plan is developed primarily for the benefit of the partners of the SPACE Consortium but is complemented by a set of extensibility principles in order to help other States and Organisations in planning the deployment of their own AMHS system.

2.2 ATSMHS Overview

2.2.1 General

2.2.1.1 The ATN technical specifications for the Air Traffic Services Message-Handling Service (ATSMHS) define the ICAO store and forward messaging service used to exchange ATS messages between users over the ATN internet.

2.2.1.2 The set of computing and communication resources implemented by Air Navigation Service Providers (ANSP) to provide the ATS Message Handling Service is commonly referred to as AMHS (ATS Message Handling System).
The ATS Message Handling System technical specifications are compliant with mature message handling systems standards such as ISO/IEC 10021 [22] and ITU-T X.400.

2.2.2 Functional Components

In terms of functionality, the ATSMHS comprises the following components:

(a) the Message Transfer Agent (MTA) which performs the function of the message switch,
(b) the User Agent (UA) which performs the user access to the MTA and provides an appropriate user interface,
(c) the Message Store (MS) which provides the intermediary storage between MTA and UA and is usually co-located with the MTA, and
(d) the Access Unit (AU) which provides for intercommunication with other Messaging Systems.

2.2.3 End systems

2.2.3.1 Three categories of ATN end systems are defined for the support of the ATS Message Handling Service:

- the ATS message server
- the ATS message user agent
- the AFTN/AMHS gateway

2.2.3.2 Together, these systems provide connectivity between users at ATN end systems and users at AFTN Stations in three different end-to-end configurations:

a) from an AFTN/CIDIN Station to another AFTN Station over the ATN;
b) from an AFTN/CIDIN Station to an ATN End System, and vice versa;
c) from an ATN End System to another ATN End System.

2.2.4 Levels of service

2.2.4.1 Two levels of service are defined within the ATS Message Handling Service:

1. The Basic ATS Message Handling Service;
2. The Extended ATS Message Handling Service.

2.2.4.2 The Basic ATS Message Handling Service meets the basic requirements of the MHS Profiles published by ISO as International Standardized Profiles (ISPs), and it incorporates additional features to support the service offered by the AFTN.

2.2.4.3 Compared to the service of the AFTN, the Basic ATS Message Handling Service offers some significant improvements such as:

- practically unlimited message length;
- virtually no limit on the number of addressees of a message;
- provision of non-delivery reports;
- indication of the subject of a message.

2.2.4.4 The Extended ATS Message Handling Service provides functionality in addition to those of the Basic ATS Message Handling Service such as the introduction of directory services and security mechanisms. Furthermore, in addition to IA-5 text, the extended service allows for the transfer of binary coded data, files etc.

2.2.4.5 The Extended ATS Message Handling Service is backwards compatible with the Basic ATS Message Handling Service.

2.2.5 Inter-operability

2.2.5.1 During the transition phase from the AFTN or the CIDIN to the AMHS the interoperability between systems is achieved by the use of the AFTN/AMHS gateway.

2.2.5.2 The technical specifications for the AFTN/AMHS gateway have been defined by ICAO.

3 EUR AMHS Requirements

3.1 Quality of Service Requirements

3.1.1 Scope

3.1.1.1 The purpose of this section is to define quality of service (QoS) requirements and set target performance objectives for the European AMHS. To this end, the properties of the AMHS are considered from the outside of the network, i.e. at its boundary, without taking into account the way in which the service, as defined on its boundary, is provided from within the network.

3.1.1.2 The performance requirements dealt with in this section are the common understanding on what the applications will get in terms of performance and what level of performance the network has to provide. The performance parameters are therefore necessary for designing applications as well as the network itself.

3.1.1.3 This section is organised as follows:

3.1.1.3.1 First, a collection of terms and concepts is set up for discussing quantitative properties of the service delivered by the AMHS.

3.1.1.3.2 Second, numerical values for performance parameters are defined using the following input:

- anticipated location of message servers and gateways;
- analysis of existing and projected message flows in the EUR area based on presently available information;
- general design principles;
- user expertise.

3.1.1.4 As in most cases, in order to arrive at concrete values for the performance parameters, a number of assumptions and restrictions are made:

- QoS is not dependent on traffic volumes;
- QoS is measured between originator-recipient pairs;
- QoS is not geographically dependent;
- QoS is not dependent on time;
- QoS represents worst case performance;
- the underlying network should be sized to accommodate QoS;
- degree of corruption is not relevant to the Corruption QoS parameter;
- corruption is not dependent on message size;
- non reachability due to network causes is typically of the order of a few minutes (60 per year);
- the bit error rate of an HDLC link is of the order 10^{-11}.

3.1.2 Quantitative approach

3.1.2.1 The formal analysis and formulation of network performance requirements is a difficult task and the pragmatic solution often adopted is to over-dimension the network, resulting in sufficient capacity and service assurance but also significantly higher costs. At a time when ANSPs are becoming increasingly cost conscious, this solution is not acceptable.

This sub-section gives an overview of the problems of quantitative analysis of message handling with special reference to the AMHS.

Existing networks are studied and existing literature and study results (EATCHIP, ACCESS, SPACE) are used.

3.1.2.1.1 Comparison with the development of CIDIN

The introduction of CIDIN in Europe was done with new technology over a period of 15 years, with no overall CIDIN capacity planning. The CIDIN development is characterised by continual upgrading.

In the case of the AMHS, the technology is not new, but is well tried. For this reason it makes sense to establish quantitative performance requirements for it from the beginning. Unfortunately, there is very little experience available and techniques for the specification of performance requirements for message handling systems do not exist.

3.1.2.1.2 The process of continual upgrading

Since the task of specifying numerical requirements is so difficult, most networks experience a process of continual upgrading in order to correct errors in the initial numerical requirements estimates but also to cope with increasing demands on performance. A typical approach of network operators is to keep utilisation of individual network components below a certain level, e.g. 50%. As soon as this level is reached in a component, it is upgraded. This is based on the experience that when components reach high utilisation levels, highly non-linear effects occur and the performance of the network as a whole is no longer predictable.

3.1.2.1.3 EATCHIP – Application requirements for data communications services

In the framework of EATCHIP[1] a study of requirements which ATC applications place on data communications services was conducted. The results of this study, collated in a report titled “Application Requirements for Data Communication Services” have been used as an initial source of information. It must be pointed out that this study was performed with little regard to the actual networks which provide or should provide data communications services.

3.1.2.1.4 ACCESS - ATN Compliant Communications European Strategy Study[2]

This study investigated the ways in which user requirements placed on data transmission through the ATN Internet could be modelled. Although there are significant differences between the behaviour of packets in a connectionless network infrastructure and the behaviour of messages, the modelling approach defined in this study provides valuable insight into the problem of determining QoS parameters.

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[1] EATCHIP : European ATC Harmonisation and Implementation Programme

[2] Project run under the Trans-European Networks for Transport (TEN-T), ATM Task 1996-GB-94-S

3.1.2.1.5 SPACE – Study and Planning of AMHS Communications in Europe[3]

As part of the SPACE project, a specific work package defined performance parameters and set corresponding numerical values in order to capture all performance aspects that are relevant to the European AMHS. Results of this work package are extensively used in this section.

3.1.2.2 Quantitative aspects of the AMHS

3.1.2.2.1 Messages as the basis of the analysis

In dimensioning the AMHS only complete messages should be considered for the following reasons:

- the message is the basic unit of data at the user interface;
- whole messages are stored and forwarded by MTAs in the network;
- in formulating performance requirements, transport or sub-network performance is not taken into account.

Of course, in dimensioning the network, it will be necessary to consider performance aspects of lower level infrastructure as well, but as a result of the user requirements formulated in this document and their impact on MTA performance.

Further, it is important to note that the specification of performance requirements is based on individual messages, independently of all other messages.

When considering message size, only the volume of user information is relevant since the user has no control (or only very limited control) over the data overhead involved in message handling.

Formulating performance requirements of a given user, taking into account the simultaneous use of the network by other users, does not appear to be feasible. However, it has to be recognised that, in a real world situation, the performance of the network for a given message certainly does depend on the presence of other messages currently being processed. The performance requirements specified here represent minimum or worst-case performance under the load conditions (Traffic Volume Requirements) identified in the framework of the SPACE project.

3.1.2.2.2 Types of performance parameters

There are two distinct groups of performance parameters to be considered in connection with the AMHS.

Parameters not dependent on message volumes: These parameters describe the quality of service (QoS), which is available to each individual message considered by itself, e.g. transit time. They can be measured, i.e. they are the quantitative results of the way in which messages are handled by the network.

Message volumes: These parameters describe the volumes of messages, message sizes and their distribution geographically, as they could be generated by users of the network. The parameters could be measured in the user end systems but it is not realistic to measure them in the network.

[3] Project run under the Trans-European Networks for Transport (TEN-T), ATM Task FR/98/228

3.1.2.2.3 QoS per individual message

QoS requirements have to be satisfied under worst possible/allowable traffic volumes and most unfavourable originator/recipient pairs within a specific network configuration. Consequently, QoS is formulated for each individual message, independently of other messages being handled by the network.

This choice has been made for the following reasons:

- it is difficult to imagine that users would accept a QoS which is dependent on the demands which other users place on the network at the same time;
- the network has to be dimensioned to handle the maximum message volumes, while performing sufficiently well;
- the QoS requirements represent "worst case" performance when maximum degradation through interaction with other traffic occurs.

It must be pointed out, that AMHS provides the facilities to send messages many orders of magnitude greater than AFTN, with attachments measured in Mb. Clearly transfer times for such messages will be considerably longer than for the short text messages exchanged in AFTN. It is, thus, necessary to qualify the statement that QoS is independent of message size by adding ‘for messages containing similar information to that carried over the AFTN’. If a quantitative limit is required, this will be between 4Kb and 6Kb, being the equivalent size of an AFTN message including the AMHS header.

3.1.2.2.4 Independence of QoS on location and time

QoS for an originator/recipient pair is most likely dependent on the relative locations of the two end systems, i.e. whether messages are transmitted with more or less hops through MHS systems (MTAs etc.). However, for simplicity reasons and since QoS requirements are “worst case” requirements, they are stated independently of the location of a message server.

Furthermore, QoS requirements remain constant at all times and are not dependent on date and time of day.

The AMHS performance requirements for the AFTN/AMHS Gateways, could, by agreement, be deemed to apply to interfaces between AMHS functions and AFTN functions in Gateways, e.g. a boundary point consisting of an interface between an internal Message Store and an AFTN handler within a Gateway.

3.1.2.2.5 Dependence of QoS on the AMHS service used

It may be necessary to specify different QoS levels for the AMHS corresponding to different sets of services used, i.e. there may be different classes of messages with respect to QoS. The number of QoS levels should be kept small for simplicity and the way in which service parameters map a message to a QoS level must be simple.

The values of QoS provided by the AMHS are useful to the application designer in deciding which services to use and how they are used. For example, the degree of certainty that a message will reach its destination will determine whether AMHS acknowledgement services are used and in what way. Furthermore, the values of QoS are useful in designing higher-level protocols.

3.1.3 Specification of performance requirements

3.1.3.1 The specification and meaningful application of performance requirements is not a simple task. This sub-section outlines some of the difficulties involved and principles to be adopted.

3.1.3.1.1 Statistical significance

The way in which performance parameters are formulated is necessarily statistical in nature. This is due to the large number of factors, which affect the performance of the network, such as:

- the current network configuration;
- the current overall load of the network, i.e. the behaviour of all users considered as a whole; and
- the dynamic properties of network nodes and transmission systems.

3.1.3.1.2 The need for measurement

For the specification and application of performance requirements to be meaningful, there has to be a framework for measuring performance with respect to the performance parameters. Aspects of a measurement framework which have to be considered are:

- because of the non-deterministic nature of network performance, measurements need to involve large samples of messages, as described in the previous section;
- measurements must be made at different locations simultaneously;
- consistent decisions have to be made as to where measurements are performed, e.g. at service interfaces in MTAs, UAs etc.

3.1.3.1.3 Network aspects relevant to performance

The following list contains factors which can affect message handling performance:

- processing speed, limits the capacity due to the store and forward nature of message handling;
- the finite transmission capacity (line speed) of links between nodes, limits the network throughput;
- the transmission times across links, affects the message transit time since complete messages are stored and forwarded a number of times between originator and recipient;
- the efficiency of message queues;
- transmission line failures and errors are obvious sources of degraded performance;
- table configuration errors can have major negative effects on network performance;
- software failures, which are difficult to treat quantitatively.

In designing the network, the performance requirements (amongst other things) have to be translated into properties of individual network components such that overall requirements are satisfied. Of course other considerations such as policy, expandability, ease of maintenance etc. enter into the network design as well.

3.1.3.2 AMHS Quality of Service Requirements

3.1.3.2.1 For reasons of completeness, simplicity and relevance, a minimal set of parameters was selected out of the large range of possibilities for expressing performance properties, to form a suitable "frame of reference" for discussing the dynamic properties of the European AMHS:

These parameters defined and described in the following sub-sections in more detail, are:

- **Destination Non-Reachability;**
- **Maximum Transit Time;**
- **Message Corruption.**

The selection of these three parameters has been made for the sake of:

- Completeness: all relevant performance aspects of AMHS are covered;
- Simplicity: the formulation of requirements is intentionally kept simple; and
- Relevance: no aspects are included which are not considered to be relevant.

If the performance of the AMHS is such that these parameters are exceeded, then the service is deemed to be of poor quality.

3.1.3.2.2 Destination Non-Reachability

Destination Non-Reachability is expressed with respect to pairs of addresses (originator / recipient). It is the probability that a message sent by the originator will not reach the recipient within the Maximum Transit Delay (as defined below).

The above definition shows that the parameters Destination Non-Reachability and Maximum Transit Time (see below) are not independent of each other: their definitions are coupled. This is intentional. The philosophy behind this definition is that the value of a message to a person or an application receiving it is dependent on its timely receipt. It is assumed, for a given flow type, that all messages belonging to it have the same value of this parameter.

The definition of Destination Non-Reachability is independent of whether the long (or infinite) transit time for a message is reported to its originator or not. It is also independent of whether acknowledgement procedures within the AMHS or on an application level detect the long (or infinite) transit time or not.

Destination Non-Reachability includes the cases in which messages are “lost”, i.e. do not reach their destination in finite time. The probability of message loss must be negligible and this probability is included in the total probability of Destination Non-Reachability. However, there remains a need (for procurement purposes) to place a separate figure on this probability. In keeping with the above rationale, it is required that the probability of message loss is, at most, one tenth of the probability of Destination Non-Reachability.

3.1.3.2.3 Maximum Transit Delay

The Maximum Transit Delay is the time within which a single message has to be transmitted through the network end-to-end so that its transmission is of value to the applications (users). Time critical services, such as CCAMS, impose very stringent requirements for the timely delivery of messages to end users.

If this time is exceeded, the receipt of the message is, in principle, of no value to the application. If the non-receipt within this time is known to the application, then, presumably, error procedures, such as message retransmission, will be initiated.

The transit delay is the time taken by the network to make the message available to the Message Store associated with the message recipient (UA). Therefore the boundary points of the network may, in this context, be considered to be the MTAs connected to the UAs serving the originators/recipients. The boundary points can also be the MTA functionality within AFTN/AMHS Gateways.

It must be borne in mind, that the parameters Maximum Transit Delay and Destination Non-Reachability only have significance when they are taken together.

3.1.3.2.4 Message Corruption

The third Quality of Service Parameter concerns message integrity and is called "Message Corruption". It is the probability that each 1,000 octet content block of a message which arrives at its destination, has been corrupted in any way. The definition of Message Corruption applies only to messages which reach their recipients within the Maximum Transit Delay.

"Corruption" means a deviation, end-to-end, of the content of the received message from the content of the original message. The "content" is also deemed to include parameters, such as originator address, which are delivered together with the message. Corruption can also result from unauthorised changes to a message.

Since the volume unit for defining Message Corruption is large (1,000 octets), the requirement is almost independent of the size of (current) messages. This simplification is based on the assumption that corruption is due to unforeseen system malfunctioning, e.g. faulty software. The corruption of messages due to such causes is not likely to be dependent on the size of messages. (This may need to be reconsidered with the potential forthcoming applications that interchange messages with binary body parts).

The probability of corruption due to other parameters such as system load, queue sizes, transmission errors etc. is almost negligible.

It is estimated, that the volume dependent non-detected bit error probability for a 1000 octet message traversing the AMHS and involving 5 links and 5 different systems (MTAs, UAs, MSs) is of the order of one bit in 10^5 or less. This justifies the (almost) volume-independent character of the Message Corruption parameter.

3.1.3.3 QoS Flow Type Classes

3.1.3.3.1 Different types of information exchange, called Flow Types here, place different QoS requirements on the AMHS.

In principle, each Flow Type might need to be associated with its own specific values of the three QoS parameters. However, taking into account the large number of possible Flow Types, this would result in a very complex analysis. A suitable approach to reducing this complexity is the introduction of “QoS Flow Type Classes” as follows:

Define a number of "QoS Flow Type Classes" and associate a set of fixed values of the three QoS parameters with each class. Depending on the properties and needs of applications using specific Flow Types, assign these to the QoS Flow Type Classes.

When engineering the network, message traffic volumes of each class need to be taken into account rather than individual Message Flow Types.

3.1.3.3.2 Three QoS Flow Type Classes

The approach outlined above is simple and practical provided the number of classes is small. In addition, there is a requirement that the QoS Flow Type Class, to which a message belongs, can be coded in some way in the message itself. This requirement comes from the fact that all AMHS components, e.g. MTAs, must be able, at least in principle, to adapt their processing to the QoS Flow Type Class. The means for this coding must come from standard MHS protocol elements, since development specific to AMHS has to be avoided and the possibility of using third-party-service must be kept open. This rules out, for example, the representation of QoS Flow Type Classes by specific User Parts.

The use of the MHS message priority parameter with three values, "urgent", "normal" and "non urgent", belonging to the P1 protocol handled by MTAs, is currently also not suitable for this purpose. The association of values to messages originating from and destined for the AFTN is fixed by technical specifications, since such messages traverse an AFTN/AMHS Gateway. This means that values of the MHS priority parameter cannot be freely assigned to message types which are currently handled by the AFTN.

There is no short-term solution to this problem. However, in the long-term, when the majority of messages handled by the AMHS are originated by and destined for native users, the priority parameter may become available for this purpose, keeping in mind, nevertheless, that various practical issues may need to be resolved.

3.1.3.3.3 In keeping with the three possible values of the MHS message priority parameter, three corresponding QoS Flow Type Classes are defined:

a) The "High QoS" Flow Type Class

Properties of this QoS Flow Type Class are:

- message transmissions are part of procedures, i.e. the sending and receipt of messages necessarily lead to actions or processing. Without receipt of the message, these actions or processing would not take place, or
- any corrupt information in messages could have serious consequences. This possibility has to be negligible.

b) The "Medium QoS" Flow Type Class

This class has similar properties to the High QoS Flow Type Class; however the Maximum Transit Time requirement can be somewhat less stringent. This distinction is important, because it can be expected that the Maximum Transit Time requirement will have a sensitive effect on network dimensioning.

Properties of this QoS Flow Type Class are:

- message transmissions tend to be of the nature of "information distribution" or "broadcast", possibly based on distribution lists rather than being parts of operational procedures. They are normally not acknowledged. Transit time and reachability constraints are not critical. In the case of non-delivery of messages, this may be noticed by users, in which case backup activities could be initiated, or
- message corruption could have serious consequences and needs to be as low as for the previous class.

c) The "Low QoS" Flow Type Class

This class has similar properties to the Medium QoS Flow Type Class; however the Destination Non-Reachability and Message Corruption requirements can be somewhat less

stringent. This is due to a certain amount of redundancy in the message contents and/or the regular updating and transmission of messages with similar content.

3.1.4 Numerical requirements

3.1.4.1 QoS values

3.1.4.1.1 Resulting from the SPACE project, numerical values are assigned to the Performance Parameters defined for the European AMHS. These values, contained in Table 1, are based on the quantitative analysis of the Communications Service Attributes defined in the framework of EATCHIP as well as performance parameters of typical message switching equipment (see - Guidelines for system requirements).

	High QoS Flow Type Class	Medium QoS Flow Type Class	Low QoS Flow Type Class
Destination Non-Reachability (probability)	$< 10^{-4}$	$< 10^{-4}$	$< 10^{-3}$
Maximum Transit Delay	< 10 seconds	< 5 minutes	< 5 minutes
Message Corruption (probability)	$< 10^{-6}$	$< 10^{-6}$	$< 10^{-5}$

Table 1: Numerical values of SPACE QoS performance requirements

3.1.4.2 It must be noted that the above numerical values:

- have been defined as initial requirements for the AMHS network of the States having participated in the SPACE project;
- could be adopted as possible quantitative and qualitative characteristics for setting up the EUR AMHS network;
- will be reviewed on the basis of compiled AMHS operational experience.

3.1.5 Application of performance requirements

3.1.5.1 The QoS parameters are obviously of importance to the network operators, users and application designers.

3.1.5.2 The QoS requirements along with the volume requirements for each of the Flow Type Classes at the boundary of the network (servers and gateways) are used, in conjunction with a set of well defined design principles (see 3.3 AMHS topology), in order to:

- determine the local performance of servers and gateways, thus dimensioning their configuration,
- determine the throughput of MTAs and capacity of links,
- draft possible network configurations and select the “optimum” network design, and measure actual network performance.

3.1.6 Measurement

3.1.6.1 The specification of numerical values for Performance Requirements is meaningless unless provision is foreseen for measurement of network performance. Such measurement is needed:

- when implementing and enforcing Service Level Agreements between AMHS service providers and users;
- for acceptance testing of network components;
- to determine network capacity;
- to gain experience in network operation (e.g. testing of various routing strategies, etc.).
- to manage the network efficiently.

3.1.6.2 Technically, network performance measurement involves, among other things:

- generation of large message/data volumes;
- automation of measurement;
- time-stamping of messages;
- use of statistical analysis.

Note.– The content of this section is basing on material developed in the framework of the SPACE project. Input reference: [14] WP202 – Specification of European AMHS performance objectives, SPACE/EURO/202/WPR/045, Version 2.0, 30/06/2002

3.2 AMHS Addressing

3.2.1 Introduction

3.2.1.1 This section aims at the production of the AMHS Addressing Plan for all the potential AMHS users in the EUR Region. This Plan should define the AMHS users addressing in an intuitive way and it should be comprehensible and meaningful to the human user and independent of the use (or not) of any type of Directory service such as X.500.

3.2.1.2 The Addressing Plan should also provide the rules to extend the addressing defined to other ANSPs (or not yet identified users).

3.2.2 Requirements

3.2.2.1 The AMHS addressing scheme should meet all of the following requirements:

- The addressing scheme should be as uniform as possible across all AMHS implementations in different Regions (as it is currently the case for AFTN addresses);
- The same addressing scheme should be maintained when indirect AMHS users (i.e. AFTN users or CIDIN users) migrate to AMHS. This implies that the AMHS addressing scheme is pre-defined and published before actual operation of the newly implemented AMHS;
- The addressing scheme should be independent of any constraints that may be imposed by Management Domains (MDs) in the Global MHS (i.e. the non-AMHS services

operating globally as commercial services) or by national regulations that may vary from Region to Region; and

- The addressing scheme should allow for the interchange messages with MDs in the Global MHS.

3.2.3 MHS Addressing structure

Each MHS address consists of a set of MHS standard components referred to as address attributes.

3.2.3.1 High level MHS address attributes

3.2.3.1.1 The high level MHS attributes identify an MHS Management Domain as specified in ISO/IEC 10021-2, Section 18.3 [21]. They are determined by the structuring of Management Domains of the MHS Region/organisation to which the address belongs. Each attribute must be registered with an appropriate registration authority to ensure that all addresses remain unambiguous. They are as follows:

- **Country (C) Name:** this is mandatory, and the possible range of values of the attribute is drawn from the ISO 3166 register of country names. The register contains a special value 'XX', allocated for the purposes of international organisations (i.e. those that are established by international treaty) which do not ‘reside’ within any particular country;

- **Administrative Management Domain (ADMD) Name:** this is mandatory, and its value is the name of an MHS Service provider in the context of a particular country. ADMD Names must be registered by a national registration authority. ADMDs registered under the 'XX' country must obtain that registration from the Telecommunication Standardisation Sector of the International Telecommunication Union (ITU-T);

- **Private Management Domain (PRMD) Name:** this is optional, and its value is the name of an MHS service usually operated by a private organisation. PRMD names must be registered either with their respective ADMDs, or with a national register of PRMDs.

3.2.3.1.2 For example, the high level address of a PRMD in the United Kingdom might be:

C = GB; ADMD = BT; PRMD = British Gas;

3.2.3.2 Low level MHS address attributes

3.2.3.2.1 They are as follows:

- **Organisation name:** the organisation name is the most significant naming attribute of the O/R address. Many organisations will operate as sub-naming authorities, allocating name space below their organisation name attribute. The function of the domain names, both Administrative and Private, is to provide a relaying mechanism for delivery of the message to the intended destination. Relaying to the intended destination is made easier by the combination of a unique Organisation Name within a unique PRMD name, thus ensuring that all MHS organisations are uniquely identified.

- **Organisational unit name:** the organisational unit (OU) names are used within the context of a hierarchical addressing structure as identified by the organisation name attribute, and should be used to identify meaningful subdivisions of that namespace. The X.400 O/R address allows for up to 4 occurrences of the OU name attribute to be

specified, each up to 32 characters in length, in descending order of significance within the organisational hierarchy.

The other *OU name* (*OU2-4*) attributes can be used to further subdivide the namespace represented by the *OU1* attribute if necessary. Subordinate OU names should only be used if all superior OU names are in use.

- **Common Name:** The common name attribute is the preferred way of identifying distribution lists and computer applications, avoiding the (mis)use of the personal name attribute. The common name attribute can be up to 64 characters in length.

3.2.3.2.2 A complete list of attributes with different information concerning on the maximum length and type of allowed characters for each attribute type is provided in the following Table:

MNEMONIC FORM ADDRESS ATTRIBUTE	CHARACTERISTICS
Country name	2 alpha or 3 numeric
ADMD name	16 PrintableString
PRMD name	16 PrintableString
Organisation name	64 PrintableString
Organisational unit name	32 PrintableString
Common name	64 PrintableString

Table 2: Mnemonic O/R address attributes maximum length and types

3.2.4 AMHS Addressing Schemes

3.2.4.1 XF-Addressing Scheme

3.2.4.1.1 The AMHS technical specifications describe a potential AMHS addressing scheme, the XF-Address (translated), composed of the following:

a) an AMHS Management Domain identifier;

b) an organisation-name attribute:

1) as specified in ISO/IEC 10021-2, Section 18.3,

2) taking the 4-character value “AFTN”, and

3) encoded as a Printable String; and

c) an organisational-unit-names attribute:

1) as specified in ISO/IEC 10021-2, Section 18.3,

2) comprising a sequence of one single element, which takes the 8-character alphabetical value of the AF-Address (AFTN-form address) of the user, and

3) encoded as a Printable String.

Note 1.– An XF-Address is a particular MF-Address whose attributes identifying the user within an AMHS Management Domain (i.e. those attributes other than country-name, administration-domain-name and private-domain-name) may be converted by an algorithmic method to and from an AF-Address. The algorithmic method requires the additional use of look-up tables which are limited, i.e. which include only a list of AMHS Management Domains rather than a list of individual users, to determine the full MF-Address of the user.

Note 2.– An MF-Address (MHS-form address) is the address of an AMHS user.

3.2.4.1.2 A summary of XF-Addressing Scheme can be found in the following table:

Attribute	Attribute value	Remark
Country-name (C)	C = "XX", as already obtained by ICAO from ITU-T	
ADMD-name (A)	A = "ICAO", as already registered by ICAO at ITU-T	
PRMD-name (P)	P = private-domain-name, taking the value of the one or two-letter ICAO Nationality Letters as specified in Document 7910.	Default value will be used to ensure that the attribute value is always defined.
Organisation-name (O)	O = "AFTN", taking the 4-character value "AFTN" encoded as a Printable String.	
Organisational-unit-name (OU1)	OU1 = the 8-letter AF-address (or AFTN indicator) of the considered user.	

Table 3: XF-Addressing Scheme

Example: XF AMHS Address for the Southampton Tower
/C=XX/A=ICAO/P=EG/O=AFTN/OU1=EGHIZTZX

3.2.4.2 CAAS Addressing Scheme

The Common AMHS Addressing Scheme (CAAS) adopted by ATNP and collected in old Doc 9705 (3rd Edition) (replaced by Doc 9880, Part II) is aligned with the addressing scheme developed in Europe by the SPACE Project Team and endorsed by the third meeting of the Aeronautical Fixed Services Group (AFSG) of the European Air Navigation Planning group (EANPG).

3.2.4.2.1 High-level attributes

3.2.4.2.1.1 The following preferred high-level MD and address structure that meets all of the requirements outlined in paragraph 3.2.1 above:

- Country Name = 'XX';
- ADMD Name = 'ICAO';

- PRMD Name = preferred operating name assigned by each ANSP or group of ANSPs.

In this way, ICAO creates an international ADMD without addressing constraints imposed from outside ICAO and its members.

3.2.4.2.1.2 This scheme has placed two requirements on ICAO:

- To obtain from the ITU-T the registration of the name 'ICAO' (or some other suitable acronym agreed between ICAO/ANC and ITU-T); and
- To establish and maintain a register of PRMDs established by ANSPs that operate using the 'XX' + 'ICAO' address structure, in a way similar to Doc 7910 [7]and Doc 8585 [8].

*Note.– This scheme does **not** require ICAO itself to operate the ADMD systems since this is normally delegated to the participating ANSPs.*

3.2.4.2.1.3 This registration will enable the establishment of regional AMHS services and their later interconnection, and it will provide ANSPs with a good deal of stability within which they can develop their AMHS plans.

3.2.4.2.2 Low level attributes

3.2.4.2.2.1 The CAAS addressing scheme includes the following attributes:

- Organisation name (O) = Region,
- Organisational unit 1 (OU1) = Location,
- Common name (CN) = User

3.2.4.2.2.2 Consequences:

- Each ANSP will define the values for the Organization-Name attribute (O) in its Management Domain. The character set to be used for this attribute will be the set of characters allowed by the ASN.1 type "PrintableString".
- Organisational Unit 1 (OU1) will be the 4-character ICAO Location Indicator (as specified in ICAO Doc 7910 [7]) of the user.
- Common Name (CN) will include the 8-character AFTN address for AFTN users.

3.2.5 EUR AMHS Addressing Plan

3.2.5.1 EUR AMHS Addressing Scheme

3.2.5.1.1 EUR AMHS Addressing Scheme was endorsed by the third meeting of the Aeronautical Fixed Services Group (AFSG) of the European Air Navigation Planning group (EANPG) and is fully compliant with the CAAS Addressing Scheme described above.

3.2.5.1.2 This scheme has been adopted for potential EUR AMHS users, both already identified and users not currently defined.

3.2.5.1.3 This section consists of the Addressing Plan to be used by EUR Organisations implementing AMHS and a database in which addresses of potential users are collected.

3.2.5.1.4 Major concepts of this EUR AMHS Addressing Plan are shown as follows:

Attribute	Attribute value	Remark
Country-name (C)	C = "XX", as already obtained by ICAO from ITU-T	
ADMD-name (A)	A = "ICAO", as already registered by ICAO at ITU-T	
PRMD-name (P)	P = a name to be defined by each ANSP and registered by ICAO. Such a name will identify a State, an Organisation, or an organisation within a State.	In the absence of such a name being registered by the ANSP at ICAO, a default value will be used to ensure that the attribute value is always defined. This default value is the ICAO two letter State/territory identifier, as may be found in Doc 7910.
Organisation-name (O)	O = a value corresponding to local/national geographical information, e.g. a region or a geographical area within a State where the user is located.	The syntax and value are to be defined by the considered ANSP. The table associating such an organisation-name to each ICAO Location Indicator (4 characters) needs to be registered and published by ICAO.
Organisational-unit-name (OU1)	OU1 = the ICAO Location Indicator (4 characters) of the considered user;	
Common-name (CN)	CN = the 8-letter AF-address (or AFTN indicator) of the considered user, irrespective of whether it is a direct or indirect user.	

Table 4: EUR AMHS Addressing Plan

Example: MF AMHS Address of Malaga's ARO (belongs to Seville region):
/C=XX/A=ICAO/P=Aena/O=LECS/OU=LEMG/CN=LEMGZPZX

3.2.5.2 Distribution lists.

3.2.5.2.1 The scheme to be used for the identification of AMHS Distribution Lists is the same as for potential AMHS users.

3.2.5.2.2 The O and OU attributes would then represent the expansion point of the distribution list.

3.2.5.3 Indirect AMHS users

3.2.5.3.1 EUR AMHS Addressing Scheme shall be applicable to both direct and indirect users in the EUR Region as soon as the scheme is published. This scheme should be published through ICAO and other appropriate bodies (e.g. the ECAC community or EUROCONTROL Member States). EUR users should use the XF-address of users outside the EUR Region until another addressing scheme (CAAS) is published by the organisations responsible for those users.

3.2.5.3.2 As soon as all ANSPs have published their addressing scheme (CAAS), there would be no more need for EUR ANSPs to support XF-addresses for users within the EUR Region.

3.2.5.4 European Services and Applications

3.2.5.4.1 A special case of the EUR AMHS Addressing Plan is the allocation of a discrete PRMD-name (P=EUROPE) dedicated for use by European Services and Applications for which Location Indicators have been allocated in ICAO Doc 7910, Section: EU – Europe (ICAORD).

3.2.5.4.2 The respective Organisation-name (O) consists of a value corresponding to the specific European Service or Application.

3.2.5.4.3 When assigning a new value to the Organisation-name attribute, the following rules should be considered:

1. It should be as short as possible;

2. It should only comprise standard characters, i.e. no accented letters or letters only used in specific geographical areas;

3. The use of figures is not advisable.

3.2.5.4.4 The assignment of the value to the Organisation-name attribute should be coordinated with the ATS Messaging Management Centre (AMC) Operator to ensure unique naming under the PRMD-name P=EUROPE (detailed information on the AMC is provided in section 6.5).

3.2.5.4.5 With the assignment and publication of the Organisation-name attribute the ATS Messaging Management Centre (AMC) Operator ensures convertibility (update of the respective CAAS Table) and routing of the complete address of the new European Service or Application via the AFTN/CIDIN/AMHS within EUR, by following the defined procedure.

3.2.5.4.6 This particular PRMD is a virtual PRMD, defined for ICAO Europe in a way similar to the “ICAO” ADMD at a global level. It is formed by the organisations in charge of the centralised European Services and Applications. Two cases may occur for such organisations being part of PRMD “EUROPE”:

1. Organisations hosting European Services and Applications, which have already implemented AMHS, and which manage their respective MTAs. Some specific requirements apply to them. They are listed in sections 9.1.3 and 9.2;

2. Organisations hosting European Services and Applications, which are still using AFTN to connect their applications, by means of connections to AFTN/AMHS gateways of other PRMDs. The present section 3.2.5.4 is defined to also cover this special case for addressing, without any additional requirements.

3.2.5.4.7 Within this PRMD, clauses of ICAO Doc 9880 which refer to a “matter local to an AMHS Management Domain” or to a “matter of policy local to an AMHS Management Domain” therefore may be interpreted as referring to a “matter local to each organisation managing a European Service or Application part of the “EUROPE” AMHS Management Domain”.

3.2.6 Guidelines on PRMD Name assignment

3.2.6.1 Purpose

3.2.6.1.1 A PRMD-name attribute shall be formulated and assigned by each ANSP in order to uniquely identify the AMHS Management Domain of which the considered ANSP is in charge. Practically, the PRMD-name attribute identifies that part of the AMHS for which an ANSP is responsible.

3.2.6.2 Assignment rules

3.2.6.2.1 When assigning a value to the PRMD-name attribute the following rules should be considered:

1. It should be representative of the whole AMHS Management Domain for which the ANSP is responsible;

2. It should be as short as possible, an acronym would be sufficient;

Note.– The use of the two-letter ISO 3166 country codes (e.g. FR for France, AU for Australia, US for the United States, etc.) is not advisable, as these codes are used as values of the Country-name attribute and not the PRMD-name attribute. This may confuse the operators.

3. It should be stable and not subject to changes unless there are duly justified technical and/or operational reasons;

4. It should be unique and unambiguous;

Note.– Care should be taken not to use a name or an acronym such as "civil aviation", "ANSP", "DGAC".

5. A default value has been reserved in order to ensure that this attribute value is always defined. This default value is the ICAO two letter State/territory identifier, as may be found in Doc 7910 [7].

6. It should only comprise standard characters, e.g. no accented letters or letters only used in specific geographical areas;

7. The use of figures is not advisable.

3.2.6.3 Registration

3.2.6.3.1 Once assigned by the concerned ANSP, the PRMD-name value(s) shall be registered and published by ICAO after checking its uniqueness, as described in paragraph 3.2.6.2.

Note.– ICAO being the naming authority for AMHS addresses, there is no requirement to register the PRMD-name value(s) with a national authority.

3.2.7 Guidelines on Organisation Name assignment

3.2.7.1 Purpose

3.2.7.1.1 The purpose of the Organisation-name attribute is to allow each ANSP to split, if needed, the AMHS Management Domain (MD) for which it is responsible in distinct geographical areas.

3.2.7.1.2 Within a given AMHS Management Domain (identified by the "C", "A" and "P" attributes) two potential AMHS network architectures are possible:

1. centralised architecture, with one single ATS message server; and

2. geographically distributed architecture, with several regional ATS message servers.

3.2.7.1.3 It is to be noted that architectural aspects and addressing aspects are not completely linked together, in effect the agreed addressing scheme does not place any constraints on the AMHS network deployment plan.

Both types of architecture have advantages and drawbacks, as summarised in the following Table 5.

	Centralised architecture	**Distributed architecture**
Applicability	Relatively small MD; Relatively small number of users.	Large MD; Large number of users.
Advantages	Easy management (one server).	A high quality of service can be offered to the users; Each server is dimensioned to match the requirements of the users attached to it; Allows a better load sharing on the network.
Drawbacks	Require a high grade of service from the network (e.g. in terms of availability, end-to-end throughput, etc.)	A highly distributed architecture may increase the complexity of the management of addresses by operational staff.

Table 5: Centralised AMHS architecture versus distributed AMHS architecture

3.2.7.2 Assignment rules

3.2.7.2.1 Before assigning a value to the Organisation-name attribute, each ANSP should follow the following 3-step process:

1. Develop the general architecture of the AMHS to be implemented;

2. Define the location and the number of sites at which ATS Message Server could be installed within a foreseeable time frame (e.g. 5, 10 or 15 years); and

3. Chose and assign a name to each one of these sites.

3.2.7.2.2 A specific case is the situation where a single ATS Message Server is implemented in an AMHS MD, providing services to AMHS users that are all directly attached to this server (centralised architecture). For simplification, it is suggested that a single organisation-name (O) value be allocated to all Location Indicators in the AMHS MD.

3.2.7.2.3 Potential criteria for the selection of sites include:

- Geographic divisions, such as: North, South, East, West, etc.;
- Administrative divisions of the concerned ANSP, such as ATS, Meteorological, etc.;
- Operational divisions centred around the ACCs (if more than one ACCs exist);
- Operational divisions centred around the main airports;
- Mapping of the AMHS architecture on the existing AFTN/CIDIN architecture;
- A mixture of the above criteria; and
- Other.

Note.– Care should be taken not to define too many geographical areas within a given AMHS MD as this may lead to less efficient message routing.

3.2.7.2.4 When assigning a value to the Organisation-name attribute, the following rules should be considered:

1. It should be as short as possible;

2. It should only comprise standard characters, i.e. no accented letters or letters only used in specific geographical areas;

3. The use of figures is not advisable.

Note.– Typically, an ANSP defines different values for the Organisation-name attribute only if it plans to implement a distributed AMHS architecture in the short, medium or long term future. ANSPs not planning to implement a distributed AMHS architecture allocate a single value for this attribute.

3.2.7.3 Registration

3.2.7.3.1 Once assigned by the concerned ANSP, the Organisation-name values shall be registered and published by ICAO, as described in paragraph 3.2.8.3.

Note.– ICAO being the registration authority for AMHS addresses, there is no requirement to register the Organisation-name value(s) with a national authority.

3.2.8 Address conversion

3.2.8.1 Addressing Plans requirements

3.2.8.1.1 The selected address conversion strategy must take into account the following principles:

- The selected address conversion solution shall be able to support any X.400 addressing plan making use of any address form.
- The AFTN address of an AFTN or AMHS user is unambiguous, internationally recognised and shall not be replaced by another value.

3.2.8.1.2 The addresses to be considered are: AFTN, XF-form, CAAS and MF (non-CAAS). It can be concluded that:

- All EUR AFTN/AMHS gateways shall implement the conversions AFTN<=>XF;
- All EUR AFTN/AMHS gateways shall implement the conversions AFTN<=>ANSPs;
- All EUR ANSPs gateways should implement the conversions AFTN<=>ANSPs, together with an ANSPs address space within their remit (technical specifications recommendation);
- To deal with the arrival of spurious XF addresses at EUR ANSPs MDs from the global AMHS, the redirection XF=> ANSPs could be supported by all ANSPs;
- If an ANSP defined an MF (non-ANSP) address space, then all gateways would have to support the conversion AFTN<=> MF (non-ANSP). This is an undesirable alternative since a global and common CAAS has been recommended by ICAO.

3.2.8.2 Address Conversion Scenarios and Criteria

3.2.8.2.1 The identified scenarios are the following: single conversion, AMHS transit conversion, AFTN transit conversion and multiple transit conversion.

3.2.8.2.2 Once the scenarios have been established, the following considerations for the address conversion have to be performed:

- The result of the address conversion performed in an AFTN/AMHS gateway shall depend only on the pre-defined pair of unambiguously associated AFTN and AMHS addresses, and not on the gateway itself, according to the form published by ICAO and defined by the delivering MD.
- It is recommended that each gateway performing address conversion should have access to the minimal necessary information to perform mappings between AFTN addresses and AMHS addresses and vice-versa. The complete mappings between AFTN addresses and their AMHS equivalents should be published (in electronic form) and made available to all gateways that support address translations.
- The conversion process shall be easy to use and manage, and efficient.

3.2.8.2.3 As a conclusion, a compromise solution combining the use of algorithmic tables and X.500 directory is preferred for the address conversion.

3.2.8.3 General model for address distribution and gateway address conversion

3.2.8.3.1 A model of address distribution and gateway address conversion is depicted in Figure 1 below. The figure represents information exchanges between ICAO and three ANSPs implementing AMHS Gateways, concerning address conversion. ANSP1 and ANSP2 implement a distributed address publishing service (APS), e.g. by means of ATN X.500 Directory Services. This allows electronic distribution. ANSP3 provides this information to ICAO for manual collation and distribution (e.g. on paper, electronic database), and does not support a directory.

The dotted arrows represent exchanges that are performed in a non-electronic way, e.g. through "paper" procedural exchanges. The full arrows represent exchanges that are performed electronically using appropriate communication protocols.

3.2.8.3.2 The model identifies a number of components that are necessary for address conversion:

1) Collection and distribution of the basic addressing information that establishes equivalence between the different addresses identifying each AMHS and AFTN/CIDIN user; the content of this information **must** be standardised and made available to all AFTN/AMHS Gateways;

2) Access to, and/or import of the basic addressing information into AFTN/AMHS gateways. This depends on the particular gateway implementation;

3) Re-structuring the basic addressing information into a format suitable for use by each gateway's internal address conversion procedures (AMI). This is again gateway implementation specific;

4) The internal procedures and data structures of the gateway (AMP and AMT) that make use of the re-structured addressing information. This is gateway implementation specific.

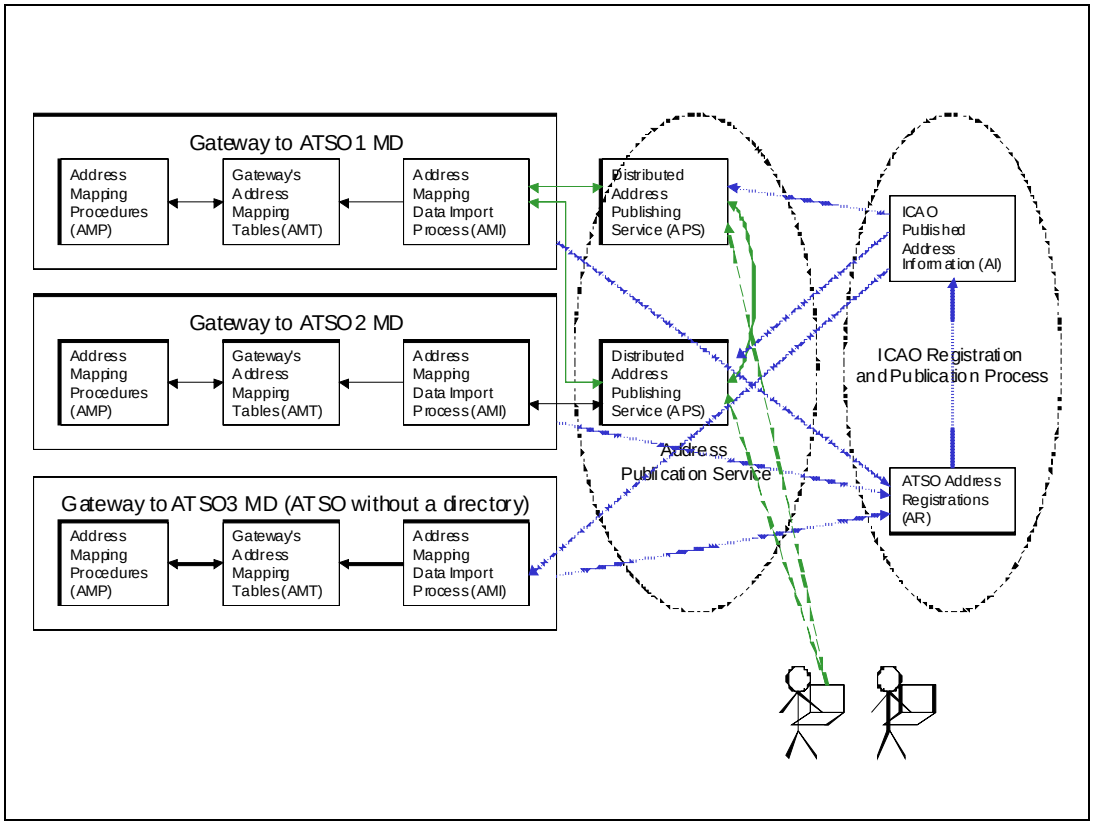

Figure 1: General model for gateway address conversion

3.2.8.3.3 The address mapping information content held in AMT and distributed through APS is identical in nature.

3.2.8.3.4 The structure of APS must be compatible with many different systems (e.g. different ANSP's Gateways), and must therefore be standardised. There are a number of possibilities for structuring APS:

- As an X.500 Directory Information Tree, thereby enabling implementation of a Distributed APS;
- By some other electronic means (e.g. CSV files);
- On paper.

3.2.8.4 The impact of different paths through the AFTN and AMHS

3.2.8.4.1 There is also a potential need for messages to undergo multiple address conversions. In order to minimise message rejection and to regulate the responsibilities for conversions, the following rules should apply:

- Originating MDs (for originator's addresses) shall generate addresses according to the form published by ICAO and defined by the delivering MD (for recipient addresses);
- Delivering MDs shall be authorised to reject messages received with recipient addresses which do not comply with the address form published by ICAO and defined by the delivering MD;
- Delivering MDs should have the capability of redirecting potential internal XF addresses to the corresponding MF(S) form addresses for use within their delivering MD, for a transition period of at least 6 months after publication of the appropriate ICAO documentation;
- Transit domains should not attempt to perform any AMHS <-> AMHS mapping unless a specific bilateral agreement has been established with the delivering MD (for recipient's addresses) or the originating MD (for originator addresses). Transit MD should only use the attributes C, A, P (which are invariant and predetermined for all AMHS address forms in the ATS) in selecting a message route.

3.2.8.5 Recommended AMHS Address Conversion Strategy

3.2.8.5.1 The recommended AMHS address conversion strategy is the means by which the general model represented in Figure 2 should be realised by States in the EUR Region. It is also applicable on a worldwide basis and has been presented and adopted by the ICAO ATNP as the general AMHS address conversion strategy. This strategy is made of the following elements:

1) the establishment, by an appropriate ICAO body or entity, of an ICAO Registration and Publication process as a set of procedures for collecting and publishing AMHS address conversion information on a periodic basis (e.g. twice yearly). This will include:

   a) the MD information included in the ICAO Registry of AMHS Management Domains, i.e. the MD identifier and the corresponding ICAO State/territory two letter identifier, together with the specification of the type of implemented addressing scheme (XF or CAAS);

   b) for those MDs having implemented the CAAS, the mapping information providing the organisation-name address attribute for each ICAO Location Indicator;

2) a Distributed Address Publishing Service (APS), based on ATN Directory Services, that allows publication of real-time AMHS address conversion information. This is to

be implemented at the earliest opportunity upon ANSPs initiative, with the following principles:

a) use of the directory scheme;

b) initial population of the Directory Information Base with the information distributed through the ICAO Registration and Publication process;

c) implementation of a single Directory System Agent (DSA) per ANSP to hold the MD Registry sub-tree, the world-wide ANSP information distributed through the ICAO Registration and Publication process, and the local AMHS MD address conversion information sub-tree; and

3) in co-existence with the use of Address Mapping Tables (AMT) directly derived from the information published through the ICAO Registration and Publication process, for ANSPs that choose to defer the implementation of ATN Directory Services.

3.2.8.5.2 As a local implementation matter, ANSPs that envisage implementation of Directory Services for the purpose of the Distributed address publication service (APS) at the same time as they implement AMHS, should also consider the use of directory solutions as a technical option for the gateway's address mapping tables (AMT).

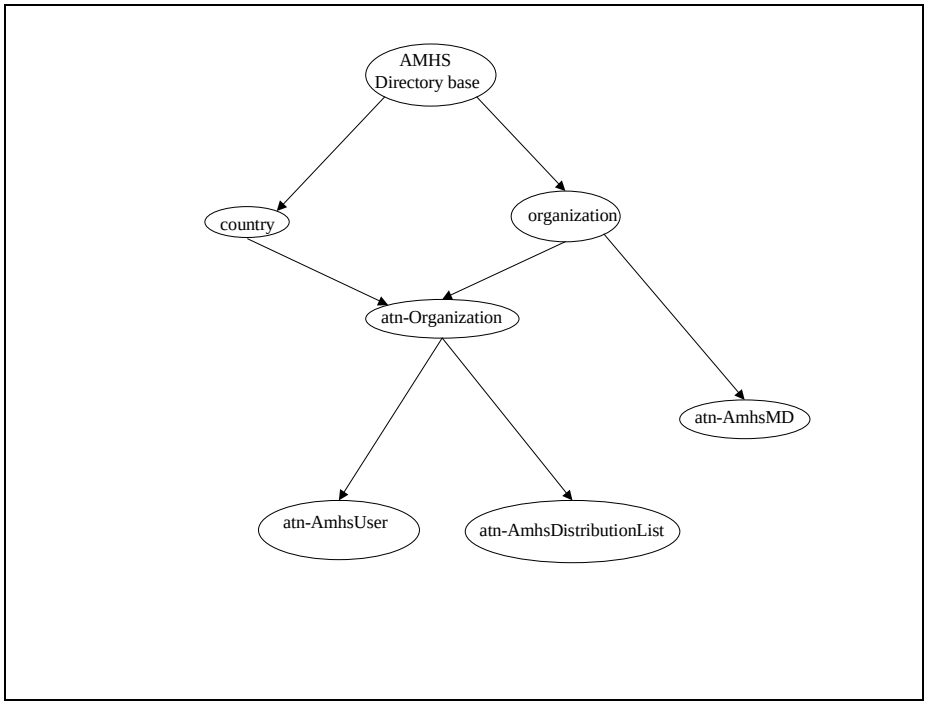

Figure 2: DIT structure for AMHS address conversion

3.2.8.6 Regional provisions

3.2.8.6.1 The strategy above is complemented by the following transitional provisions which may apply regionally.

3.2.8.6.2 In case the first element in the above strategy is not implemented by ICAO in a timeframe compatible with early AMHS implementations, an equivalent process may be set up on an ad-hoc basis among ANSPs forming an AMHS island. This is particularly applicable to any European ANSPs being early AMHS implementers.

3.2.8.6.3 In case of ANSPs implementing the second element in the above strategy that initially prefer to group together for the implementation of a single ICAO Regional DSA, the following should apply:

- the MD Registry sub-tree;
- a local AMHS MD ANSPs information sub-tree for each of the ANSPs in the group;
- and the world-wide ANSPs information distributed through the ICAO Registration and Publication process.

3.2.8.6.4 The Regional DSA thereby becomes an aggregation of the local DSAs envisaged in the principle strategy.

3.2.8.6.5 In the EUR Region, the creation of an Offline Management Centre is recommended to consolidate, co-ordinate and distribute AMHS user address changes across the Region. This Offline Management Centre should implement such a Regional DSA in support of its address management activities.

3.3 AMHS topology

3.3.1 General potential AMHS topologies

3.3.1.1 As for any other network topology, an AMHS topology describes the connectivity among the nodes - which are in this case AMHS COM Centres – and links – which are AMHS logical connections at the ISO/OSI application layer.

3.3.1.2 From a theoretical viewpoint, there are many possible solutions for a network topology. Each of the chosen designs has distinct properties in terms of cost, transit time (number of hops to be passed), routing complexity, reliability (survivability). Furthermore, from a more practical perspective, a network topology is also often related to the organisation and relationships between its users, and possibly network managers. In a situation where traffic flows are not equally distributed between nodes (from a statistical perspective), the traffic patterns have also a great influence on designed topologies.

3.3.1.3 General network topologies include:

- Tree-shaped topologies, including
  - Star,
  - String,
- Partially meshed topologies, including
  - Double star (two interconnected stars centred on two distinct “hubs”),
  - Ring,
  - Hyper-ring (two rings with several links interconnecting them),
- Hybrid topologies, e.g. using a partial mesh backbone between some nodes and star from the backbone nodes to other nodes,
- Full meshed topology.

3.3.1.4 A general analysis of such topologies, based on the properties listed above, is provided in the following.

3.3.1.5 Reliability, transit time, cost and operational complexity are all factors affected by the topology of a network. Table 6 summarises the characteristics of the topological structures addressed above in order to indicate the advantages of certain topologies over others.

3.3.1.6 In Table 6 measures are used to evaluate the technical merit of a topological structure: Number of links, maximum number of hops, complexity and reliability. Each of these measures is described below.

3.3.1.7 A low *number of links* per node for a design will often be associated with low cost. Vice versa, a higher link-per-node ratio indicates a more expensive network topology. The tree shaped topologies (star, string) have the lowest number of links per node. Ring and hyper-ring architectures have a small number of links per node. At the opposite end from the tree structures, the full mesh network marks the upper limit of the link-per-node ratio.

3.3.1.8 Clearly, a smaller number of *hops* from a source node to a destination node will result in shorter transit times. Here, a full meshed topology is the most desirable. The star topologies, with their very small number of hops, are also very desirable. On the other hand, string and simple ring architectures can have a significantly greater numbers of hops. – A large number of hops is associated with a large number of intermediate nodes and links which have to be dimensioned for conveyance of transit traffic. The related capacity enhancements also constitute a cost factor.

3.3.1.9 *Complexity* provides here a measure for the effort to be spent on network design, establishment of appropriate (re-)routing mechanisms and network operations. The number of potential paths between nodes, as well as the need to sum up multi-hop traffic (in order to get capacity figures for nodes and links), increase the complexity of the network design task. The complexity for re-routing of traffic increases also with the number of candidate links providing alternative paths between each pair of nodes. Finally, the effort for network management and maintenance grows with the number of links providing connectivity between a given set of nodes. Centralised (star) topologies are easier to maintain than those that are highly distributed (as meshed structures).

3.3.1.10 The *reliability* of a network increases with the number of established links allowing alternative paths in case of link failures (provision of adaptive routing assumed). More precisely, if *n* represents the minimum number of nodes to which any node is connected (*n*-connectivity) then we can expect that the probability that a given node has access to at least one of its neighbours increases with the quantity of *n*. A partial mesh topology has 2-connectivity or greater, a full mesh offers as upper limit a (N-1) connectivity (where N represents the number of nodes).

Topology	Number of Links	Relative Number of Links	Max Hop Count	Complexity	Reliability
Star (tree)	N-1	Lowest	2	Lowest	Lowest
Double Star	2 (N-2)+1	Low	2	Low	High at core, low at remote locations
String (tree)	N-1	Lowest	N-2		
Ring	N	Low	(N-1)/2	Low	Moderate

Topology	Number of Links	Relative Number of Links	Max Hop Count	Complexity	Reliability
Hyper-Ring	2 N	Low	2	Low	Moderate
Partial mesh	Moderate	Moderate		High	Good
Full mesh	[N*(N-1)]/2	Highest	1	High	Highest

Table 6: Comparison of alternative network topologies

3.3.2 Design elements for the European AMHS

3.3.2.1 In application of the principles above, the following elements have been taken into account for the definition of the European AMHS topology:

1. Quality of service (Transit delays),
2. Quality of service (Availability / Reliability),
3. Cost effectiveness,
4. Complexity of operation,
5. Responsibility for transit traffic.

3.3.2.2 Most of these criteria were already defined as the main considerations for AFTN topology design (ref. ICAO Doc 8259-AN/936/1991 [9]).

3.3.3 Possible approaches for the European AMHS topology

3.3.3.1 SPACE recommendation for a fully-meshed topology

3.3.3.1.1 The objective of ensuring transit delays compatible with the QoS performance requirements specified in section 3.1.4 led to the SPACE recommendation of a **fully-meshed topology for the AMHS network deployed in the EUR Region**, thereby minimising the number of hops between any pair of International MTAs / ATS Message Servers in this area (ref. [15] and SPACE WP321 Report “AMHS Extensibility Principles”).

3.3.3.1.2 The end-to-end transit delay in networks is mainly caused by the processing time in the nodes passed by a message and the transmission times on the links between these nodes. With given processing times, link speed, average message length and protocol overhead a first estimation of the number of allowable hops for a given maximum end-to-end transit delay is possible. – For a link speed of 256 kbps five hops are allowed in the international network to meet the maximum end-to-end transit delay for the high QoS class. With 64 kbps only two hops are allowed (ref. [15] and [20]).

3.3.3.1.3 To be realistic, such a recommendation implies that an underlying network forming a common lower layer infrastructure would be available across the considered geographical area. The requirements placed upon such an underlying network are described in section 3.5.

3.3.3.1.4 This approach favours criteria 1 (QoS – transit delays) and 2 (QoS – availability) among those listed in section 3.3.2. No other topology could rate better than a fully-meshed network regarding these objectives.

3.3.3.1.5 As far as criteria 3 (cost effectiveness) and 4 (complexity of operation), it may be considered that the need to establish and maintain AMHS connections with any other International ATS Message Server in the EUR network represents a non-optimised cost (in network capacity and required staff). However, although parallel operations have to be performed with all communication partners in such a network topology, the similarity between these operations reduces complexity and increases efficiency, thereby reducing the negative impact on costs.

3.3.3.1.6 Complexity of operation, although obviously higher that in a tree-shaped network, is probably lower than in some partially-meshed topologies where network behaviour, required tasks and diagnostics vary depending on the existence or not of a direct link between both MTAs.

3.3.3.1.7 The factor of responsibility of transit traffic (criterion 5) should also be considered. In the fully meshed topology each MTA is managing its own traffic with no transit traffic coming from other international MTAs (except re-routing), representing a clear advantage in comparison with other topologies.

3.3.3.1.8 It must be noted that an AMHS fully-meshed topology could lead to approximately 50 AMHS connections to/from each COM centre, when AMHS is fully deployed in the EUR Region, based on the current number of international COM Centres. This is significantly different from the current AFTN/CIDIN topology in Europe, which is a partially-meshed network with a maximum of 12 connections (AFTN and/or CIDIN) from a COM Centre to its adjacent Centres. Appendix A to the ATS Messaging Management Manual [12] specifies how transition may take place from the current CIDIN connectivity and topology to a fully meshed AMHS network.

3.3.3.2 CFMU approach for a hybrid topology

3.3.3.2.1 The CFMU is in a specific situation as a European Facility, which is an end-user of communication flows, rather than a COM Centre like other parties in the international AFTN/ CIDIN/ AMHS network. The organisation of the CFMU in two Centres also creates specific requirements.

3.3.3.2.2 Because of the significant change between the current CIDIN topology and a fully-meshed network, and due to specific operational requirements related to CFMU contingency (see AFSG/PG31 WP08, “Considerations in the integration of CFMU in the AMHS network”, Roma, March 2008), CFMU favours for AMHS a hybrid topology similar to the current CIDIN connectivity:

- A double-star to six adjacent COM Centres, through which CFMU traffic is relayed to other communication partners;
- The existing AFTN/CIDIN topology between these six COM Centres and other COM Centres in Europe when the traffic flow is originated/directed to a State “beyond” those of the six COM Centres.

3.3.3.2.3 Such a topology could be revisited when more experience is gained in AMHS operation, and depending upon the availability of some automatic re-routing capabilities. Based on such conditions a more complete level of meshing could be envisaged. Such an approach clearly favours criteria 2 (availability) and 4, in order to reduce complexity of operation.

3.3.3.3 Approach favouring cost effectiveness

3.3.3.3.1 Based on the estimation that cost reductions could be obtained if only a partially-meshed topology is implemented, some States have expressed their intention to limit the establishment of direct links from their international MTA to the international MTAs in other States with which they have a given volume of traffic, or specific connectivity requirements.

3.3.3.3.2 In this approach favouring criterion 3 (cost effectiveness), the goal is to reduce the workload and cost of operation, including configuration, testing and in service support.

- Initial system configuration,
- Interoperability testing,
- Transition activity,
- In service support, including fault management,
- Re-testing when MTAs are changed and/or upgraded.

3.3.3.3.3 Whilst the intent to minimise operation costs is obviously a valid objective, this should not be detrimental to the overall quality of service and to the (partly contradictory) objective to minimise the number of hops in the network. Furthermore it may also be considered that when a certain number of AMHS connections is established from a COM Centre, and a high AMHS operational experience is available in that COM Centre, then the establishment of an additional connection to another COM Centre increases only marginally the cost of operation.

3.3.3.4 Influence of the current AFTN/CIDIN topology

3.3.3.4.1 This subject has been partly and/or indirectly addressed in the sections above.

3.3.3.4.2 With the assumption that approximately 50 States are part of the EUR Region, a fully-meshed AMHS network when AMHS is available is all of these States will also represent approximately 50 direct AMHS connections (international MTA to MTA associations) to/from each COM Centre. This number is to be compared to the current number of (intra-Europe) international connections to/from an international COM centre, which is between three and twelve links before migration to AMHS.

3.3.3.4.3 If transition was to take place quickly (e.g. between a few months and one or two years) from the pre-AMHS situation to such a fully-meshed topology, the effort would indeed be considerable and the target would be difficult to achieve. However, it is recognised that the transition to AMHS at the European scale will be progressive and may take a number of years.

3.3.4 Recommended European AMHS topology

3.3.4.1 The objective of this section is to specify a European AMHS topology which meets the various objectives expressed in section 3.3.3, taking into account the fact that they are sometimes contradictory.

3.3.4.2 The general principle adopted is that the expected quality of service, in terms of transit times and availability (criteria 1 and 2) should be maintained to define the target topology.

3.3.4.3 This leads to confirm that **the AMHS topology in Europe should be fully-meshed, as a long-term objective**. However, it should also be recognised that:

- there is a pre-requisite to the implementation of such a topology, which is the availability of a seamless underlying network across the considered geographical area;
- during the transition to this target topology, a partially-meshed network following the constraints of the various ANSPs and participants to the EUR AMHS network.

3.3.4.4 Principles need to be established for the transition phase, so that a clear direction is provided to ANSPs implementing AMHS in their COM Centres.

3.3.4.5 These principles are the following:

1. until a common underlying network at a European scale is available, the implemented AMHS topology should:
    a. **at least replicate the former AFTN/CIDIN topology**;
    b. in areas where a common underlying network is already available but for a smaller area than Europe (e.g. multi-States, or "sub-Regional"), **implement a fully-meshed AMHS island, with at least two entry points** into the island;
2. when a common underlying network at a European scale is available, and while transition to the fully-meshed target is in progress, the topology should be such that:
    a. **no more than two hops are needed for communication between any two International MTAs** in the considered area;
    b. **Two distinct paths are available at AMHS level** for communication between any two International MTAs.

3.3.4.6 The transitional partially-meshed topology specified in item 2 above can be achieved, for example, by the establishment of several partly overlapping fully-meshed AMHS islands:

- each pair of AMHS islands must have a non-empty intersection, with at least two "multi-island" AMHS COM Centres;
- the central facilities (e.g. CFMU, EAD, etc.) must form a fully meshed island with the "multi-island" AMHS COM Centres.

3.3.4.7 This example is depicted in Figure 3.

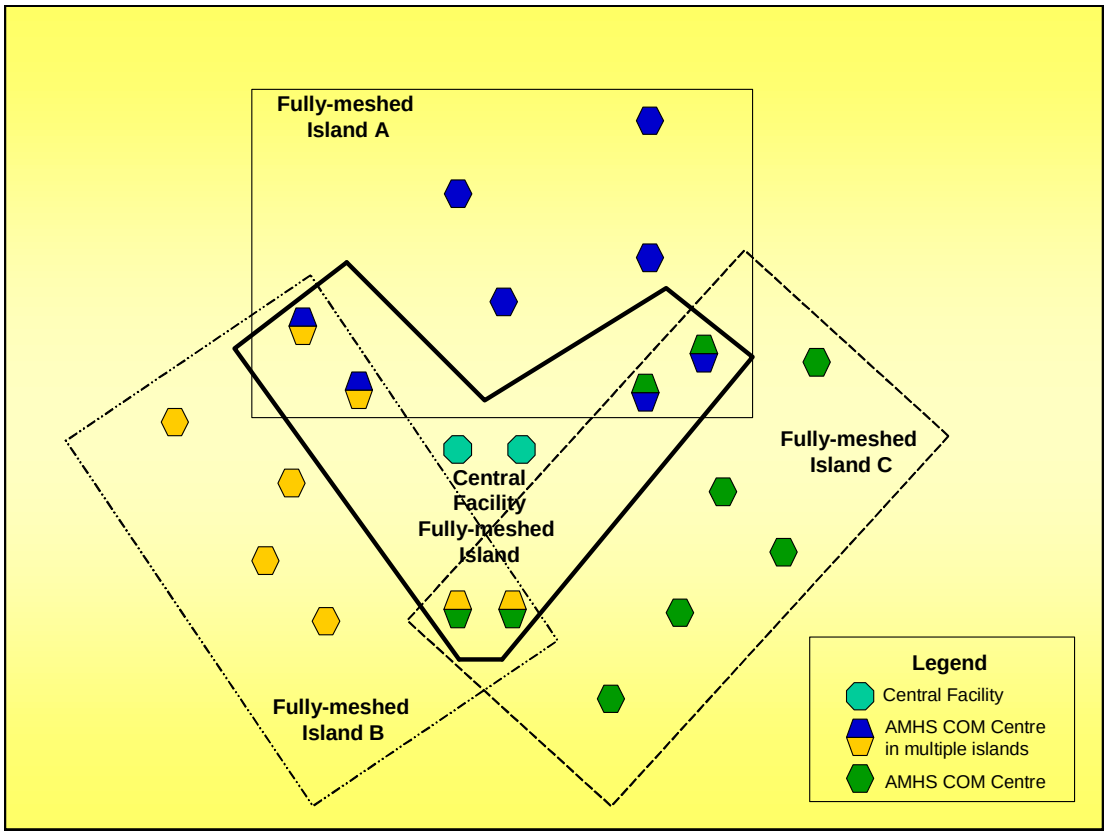

Figure 3: Example of partially-meshed AMHS topology before transition to fully-meshed

3.3.4.8 In line with the numerical requirements for QoS adopted in section 3.1.4, the strategy for AMHS topology may be reviewed on the basis of compiled AMHS operational experience, when a common underlying network at a European scale is available and a significant number of AMHS COM Centres are in operation.

3.4 Routing mechanisms

3.4.1 Available routing mechanisms

3.4.1.1 AMHS uses the routing mechanisms of its X.400 base standards. X.400 routing is static by nature, it uses the address attributes forming O/R addresses to determine the next hop towards which the message must be routed:

- local delivery,
- AFTN/AMHS gateway (MTCU), or
- adjacent MTA inside the AMHS Management Domain of the current MTA,
- adjacent MTA in a different AMHS Management Domain.

3.4.1.2 Conceptually, X.400 routing tables are made of records associating a potential combination of address attribute values to a next hop. For each message, the route record with the best match for each AMHS recipient's address attributes is looked for in the routing table, to determine where the message is to be routed. In case of a message with multiple recipients and different routes, the message is "expanded" or "split" into several messages, according to the various destinations.

3.4.1.3 This section focuses on international AMHS routing, i.e. inter-domain routing.

3.4.1.4 Unlike in AFTN, where any substring from 1 to 7 characters may be used to determine a route, X.400 address attribute values are generally considered "as a whole" when looking for a best match. Some X.400 implementations may implement substring matching but this is not a standard feature.

3.4.1.5 Inter-domain routing, from an international MTA in an AMHS MD to an international MTA in another AMHS MD, should therefore use only entire address attribute values. The attributes Country-name, ADMD-name, PRMD-name and potentially Organization-name, usually represented by their initials C, A, P and O are sufficient for Inter-domain routing. Organization-name must be used only in specific cases, when destinations are located in AMHS MDs with multiple International MTAs, and having implemented the CAAS Addressing Scheme.

3.4.1.6 It may be noted that ISO/IEC 10021-10 (2003) [22], which is aligned on ITU-T Recommendation X.412 (1999), "INFORMATION TECHNOLOGY – MESSAGE HANDLING SYSTEMS (MHS) – MHS ROUTING" describes an X.400/MHS Routing functionality based on Directory Services. There is no requirement to implement this feature in AMHS, including when the Extended ATS Message Handling Service is deployed.

3.4.2 X.400 re-routing mechanisms

3.4.2.1 Based on the general routing principles described above, re-routing consists in the definition of an alternative route to the intended destination, if for any reason there is a transfer-failure or delivery-failure to the initially determined next hop.

3.4.2.2 Re-routing may be either manual or automatic. In the first case, the MTA operator, in view of the transfer-failures, modifies temporarily (or definitively) the routing tables to specify an alternative next hop. The main requirements placed on the software by manual re-routing are related to:

- the ease of reconfiguration;
- the immediate applicability of the modification: it is preferable that the routing be modifiable on line, or require only a fast restart or parameter load.

3.4.2.3 Regarding automatic re-routing, although not prevented by the X.400 base standards, nor by the way they are designed, this feature was initially not a standard practice in X.400 products. The main reasons were the following:

1. MHS/X.400 was initially designed for messaging traffic with relatively low transfer time requirements, clearly non-real time, where it was possible to "wait" for the availability of a connection to the intended MTA, in case such a connection was not immediately available;

2. In this context, the usual practice in the store-and-forward MHS/X.400 is to store a message, and, in case of transfer failure to the next MTA, to perform a pre-defined number of "retry" towards this same MTA (based on timers), before a non-delivery-report is sent back to the message-originator (or to the originating-MTA).

3.4.2.4 However, due to the adoption of X.400 by communities with more stringent transfer time and availability requirements (Defence, Air Traffic Services), it should be possible to obtain from X.400 software manufacturers automatic re-routing mechanisms.

3.4.2.5 The principle of such re-routing would be that, after the number of retries to the main route to the next MTA, an alternative route already specified in the routing table would be used. It is important that those responsible for system operation be aware that this re-routing facility is activated.

3.4.2.6 Care should be taken about a possible interaction with X.400 timers when such a mechanism is used. For example, if no alternative route is specified, a MTA will retry to transfer until the expiry the MTA and MTS timers, before a NDR is generated. If an alternative route is defined, then a time allocation should be kept to use the alternative route before the timers expire. This should be considered in conjunction with the re-routing mechanisms at the underlying network level: timers and re-routing mechanisms at the underlying network level have to be shorter than timers and re-routing mechanisms at the AMHS level. The reason for this is that most of the time the unavailability of a P1 association is going to be caused by a transitional problem in the underlying network.

3.4.3 Routing in the recommended EUR AMHS topology

3.4.3.1 In the fully-meshed target topology, routing is trivial as there is a direct route from any International MTA to any other International MTA in the EUR AMHS network.

3.4.3.2 Transfer failures could be caused by unavailability of underlying network (that have their own resources to recover the failure, out of AMHS procedures) or by the failure of the destination MTA itself. In such a situation re-routing does not improve quality of service, but simply overloads the AMHS network by moving the problem from place to place. Depending on the underlying network and on the operator capability (e.g. depending upon the management tools and information available to him/her) to determine the reason of a failure, manual re-routing may however have benefit in some cases.

3.4.3.3 Automatic or manual re-routing is required, however, for efficient handling of AMHS traffic to other ICAO Regions (see next section).

3.4.3.4 In the temporary partially-meshed topology, the next hop for each destination MTA is either of the following:

1. the destination MTA itself, if a direct connection/route exists, or

2. an intermediate MTA which has a direct connection to the destination MTA.

3.4.3.5 The first case is identical to the situation of a fully-meshed AMHS network, where automatic re-routing is not really useful but manual re-routing may have some value, if an accurate fault diagnosis can be established.

3.4.3.6 In the second case, the availability of two distinct paths established as a design principle enables to use manual or automatic re-routing at AMHS level. Use of re-routing is essential in this situation, and automatic re-routing should be preferred whenever as it is available. This allows to make sure that the failure of an international MTA (e.g. in one of the multi-island AMHS COM Centres, in the depicted example) does not cause loss of communication between two islands.

3.4.3.7 Therefore, in the partially meshed network, it is recommended that:

1. one single route be specified in the AMHS routing tables if a direct connection exists,

2. a main route and an alternate route be specified in the AMHS routing tables if no direct connection exists and a two hops path is required between the considered MTA and the destination MTA.

3.4.4 Routing to/from other ICAO Regions

3.4.4.1 For message flows incoming to or outgoing from the EUR Region, the routing strategy is to route messages from/to one of the Regional boundary ATS Message Servers to/from the international MTA of the destination/source EUR AMHS MD, using either a single direct route if existing, or one of the main/alternate routes in case a two hops path is available between these MTAs.

3.4.4.2 The assumption is that, in the target environment, these Regional boundary ATS Message Servers would be implemented by States or ANSPs that already provide Regional boundary AFTN/CIDIN COM centres towards other ICAO Regions.

3.4.4.3 For resilience purposes, a minimal number of two inter-Regional boundary MTAs needs to be implemented to connect to each other ICAO Region. To gain full benefit of this duplication, automatic or manual re-routing is required, so that alternate routing via the “alternative” MTA can be activated in case of loss of connectivity with the “main” boundary MTA to be used.

3.4.4.4 The “alternative” MTA can be connected with the same MTA in the other ICAO Region, as the “main” MTA, or preferably it can also be connected with an alternative MTA in the other ICAO Region.

3.5 Underlying network

3.5.1 Background

3.5.1.1 In terms of the ISO/OSI seven layer model, AMHS resides in the application layer. The design of such an application is dictated by both the end users, who best know their particular needs, and by the state of the art technological environment, which determines the way in which these needs are transformed to concrete technical specifications. The current situation, the way of migrating from this situation to the targeted future, the process flow, the safety requirements, the security requirements, the quality of service requirements and the expected results are all translated into the application specification. These requirements not only affect the design of the application but their influence permeates to the lower layers.

3.5.1.2 Therefore, the creation of an appropriate underlying network is seen as essential for the smooth deployment of AMHS.

3.5.2 General principles

3.5.2.1 In current communications practices, the independency between application and network levels is highly desirable.

3.5.2.2 The separation of application and network brings several benefits:

- the provision, development and management of the network and AMHS can proceed largely independently (provided sufficient capacity is available within the network), leaving each discipline free to concentrate on its particular sphere of competence,
- there are economies of scale to be gained by the sharing of the network between multiple applications, resulting in better utilisation of resources,
- the increased size of the network (over a purely AMHS network) should deliver a better quality of service and in particular a more robust infrastructure,
- routing, at the AMHS level, is independent of the lower level network and in particular any European International ATS Message Server is directly accessible by any other.

3.5.2.3 The logical connection (links) of the AMHS topology implemented by means of a transport service could make use of the physical connectivity provided by a layer-3 network infrastructure.

3.5.2.4 The following Figure 4 illustrates the relationship between logical and physical connectivity for the international AMHS. Each international COM centre will accesses the underlying network over the local network node through a network access line.

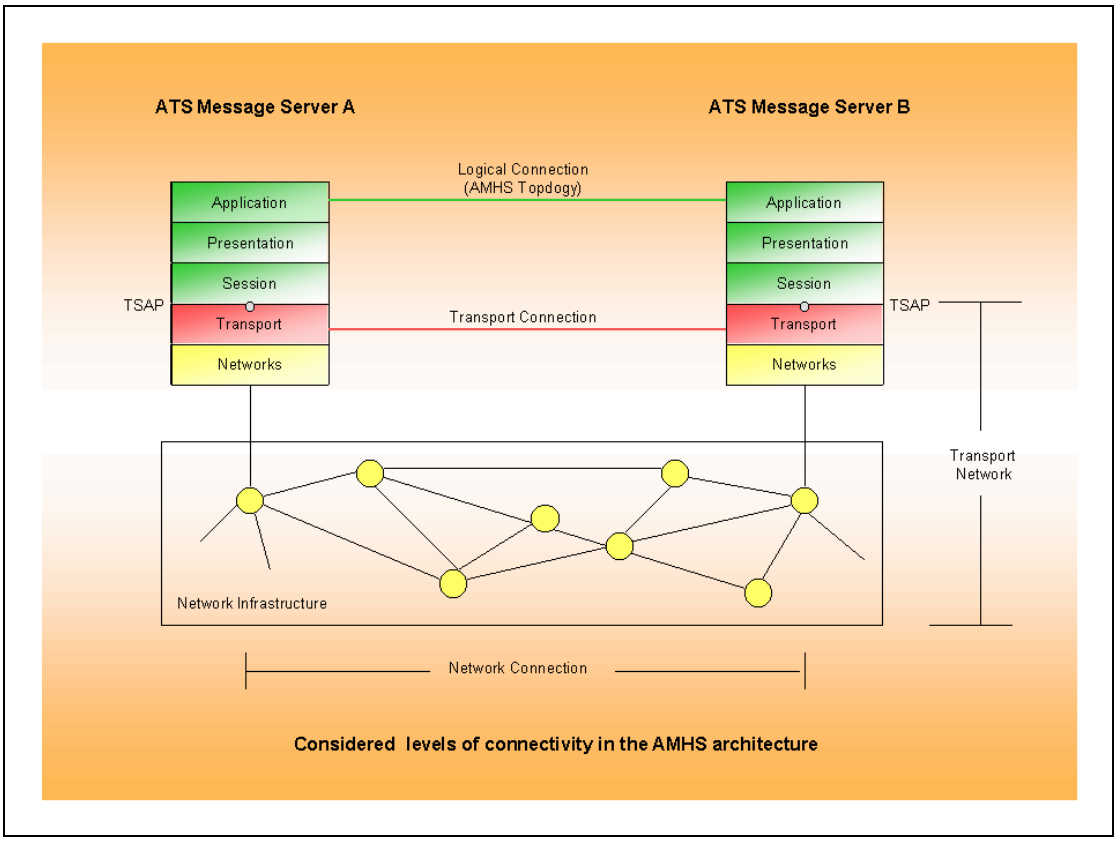

Figure 4: Logical and physical AMHS connectivity

3.5.3 Considerations

3.5.3.1 In the European area, a European wide TCP/IP based communications service dedicated to Air Traffic Management Communications is envisaged for supporting current and forthcoming applications.

3.5.3.2 This approach is supported by ANSPs' large experience in defining general principles (addressing, routing, …) and providing TCP/IP services for supporting ATC operational applications.

3.5.3.3 Furthermore, concerning international communications, ANSPs are acquiring expert knowledge about underlying network interoperability.

3.5.3.4 The European AMHS will be implemented on top of a TCP/IP stack, as stipulated by EANPG Conclusion 44/45:

> "That, States in the EUR Region use the TCP/IP communication protocol for the initial implementation of ATS Message Handling Systems, as a transition mechanism to enable AMHS operations to commence ahead of eventual full SARPs compliant data transmission systems."

3.5.3.5 At the time of the EANPG conclusion, the reasons for using TCP/IP communication in support of AMHS operation were:

1. There was no European ATN/OSI internet communication service available, nor were there any real plans for implementation of such a service for other ATN applications in a timeframe compatible with the short-term implementation planned for AMHS. In the longer term, i.e. for the target profile, there was no sufficient reason identified that could justify the substitution of the initial TCP/IP underlying network with a fully ATN-compliant infrastructure.

2. Following successful testing results, there was a straightforward activity supported by EUROCONTROL and Member States, aiming at the establishment of an international TCP/IP infrastructure for aeronautical purposes in the ECAC area.

3. There were already national AMHS implementations in place based on the TCP/IP protocol suite. In addition, ANSPs have the necessary TCP/IP expertise on hand from various national applications.

4. The broad market of TCP/IP products would facilitate rapid implementation with reasonable costs.

3.5.3.6 Through Amendment 83 to ICAO Annex 10 (November 2008), the possibility to implement ATN/IPS was introduced into the SARPs, thus rendering the deployment of AMHS over TCP/IP fully SARPs compliant.

3.5.3.7 The de-coupling that exists in an AMHS system between upper layers and lower layers (transport and network services) allows implementing AMHS systems with multiple lower layer protocol stacks (ATN/OSI, TCP/IP, TP0/X.25).

3.5.3.8 The ability to implement AMHS over multiple lower layer stacks may be used to ensure global AMHS interoperability. In particular, as other Regions may deploy AMHS based on ATN/OSI, there could be a need for a limited number of Regional boundary ATS Message Servers (inter-Regional entry-exit points) to implement dual stacks. However, as most AMHS products support TCP/IP, the relevance of such a requirement can only be

determined when inter-Regional communication discussions are initiated between peer inter-Regional entry-exit points.

3.5.4 Conclusion

3.5.4.1 An underlying network infrastructure that can provide physical connectivity between AMHS systems needs to be implemented as a Common Facility, in a timeframe compatible with the short-term AMHS deployment plan. It is foreseen that the Pan-European IP network resulting from the ongoing PENS programme, launched under the aegis of EUROCONTROL, will form an appropriate basis for this network infrastructure.

3.5.4.2 Bilateral or multilateral connectivity arrangements should be made to accommodate initial AMHS operations, until such a common facility becomes available.

3.5.4.3 In any case, the AMHS Quality of Service requirements, as they are prescribed for the various flow class types, should be supported by any type of underlying network infrastructure used. In this direction, the recommended availability is in the order of 99.99% with a mean time to restore outages in the order of 5 minutes.

3.6 Interregional communication aspects

3.6.1 Guidance provided by ATNP on "AMHS over TCP/IP"

3.6.1.1 As a consequence of EANPG Conclusion 44/45, the ATNP provided guidance for implementation of “AMHS over TCP/IP” in 2002. Following the introduction of ATN/IPS SARPs through Amendment 83 to Annex 10 in 2008, these guidelines have been superseded by events, but they are **presented** hereunder **for historical purposes**.

”1. It has been observed that some States or even Regions are implementing or planning to implement AMHS systems making use of lower communication layers that are not conformant to the ATN Internet Communication Services (ICS). Such AMHS systems conform to Doc 9705, Sub-Volume III, Chapter 1 (replaced with Amendment 83 by Doc 9880, Part II), with the exception of the clauses related to interfacing with ATN ICS. The most frequent occurrence of such non-compliant systems is related to AMHS systems making use of TCP/IP lower layers through a RFC1006 interface ("AMHS over TCP/IP").

2. Due to the store-and-forward nature of the AMHS, this can be done without compromising the end-to-end interoperability at the AMHS application layer with SARPs-compliant AMHS implementations, but at the cost of some dual-stack systems[4] for lower layers. Strict conformance to Doc 9705, Sub-Volume III, Chapter 1 is required, with the only exception of clause 3.1.2.2.2.1.2 ("Use of Transport Service"), to ensure such end-to-end interoperability.

3. The reasons invoked by States adopting such local policies include the following:

- The need for an immediate or short-term transition from existing ground networks, and in particular from X.25 networks that are reaching obsolescence;

- The use of a common ground network infrastructure shared with other ground applications, such as radar data distribution or inter-centre communications (such as OLDI in Europe), such infrastructure being sometimes already in operation.

[4] Such dual-stack systems are beyond the baseline ATN architecture which is specified by ICAO.

4. It should be noted that in all known cases, the IP network used or planned to be used is a network infrastructure in which switching equipment and links are dedicated to ATS communications, building a so-called "private" IP network.

5. It is recognized that other transition strategies can also be developed, that make use of the proposed IP SNDCF to enable IP sub-networks to be used as ATN sub-networks, in a fully SARPs-compliant ATN ICS architecture. However such an architecture is not discussed in the present document.

6. Despite the fact that the implementation of "AMHS over TCP/IP" can meet, as described above, the specific objectives of a State on a local or regional basis, the attention of implementers should be drawn to the fact that the implementation of two different architectures has the following drawbacks:

- It limits "any-to-any" communication between AMHS systems on a global basis that could be needed in specific cases, e.g. for performance requirements;

- it requires the implementation by some States of "dual-stack" AMHS systems, to gateway between AMHS systems using the ATN ICS and AMHS systems using TCP/IP. This may reduce performance and availability;

- The cost of such gateway facilities is expected to be borne by States implementing non SARPs-compliant AMHS systems.

7. In view of the elements above, the following guidance is offered by the ATN Panel on the use of "AMHS over TCP/IP":

a) "AMHS over TCP/IP" implementations should not be presented as fully SARPs-compliant ATN implementations.

b) Non-SARPs-compliant "AMHS over TCP/IP" implementations are seen as a “local solution” within a State or Region. Inter-State or inter-Regional connections between such systems using TCP/IP should be subject to bilateral/regional agreements.

c) States or Regions that implement "AMHS over TCP/IP" systems within their domains are responsible for taking those necessary measures to ensure interoperability with SARPs-compliant implementations in other States or Regions.

d) Appropriate security measures should be taken when using an IP network, irrespective of whether AMHS uses TCP/IP directly or via the IP SNDCF.

8. The ATNP will continue to monitor related developments and will provide further guidance as appropriate.”

3.6.1.2 With introduction of the Internet Communications Service (see Doc 9880 – Part III [4]) the “European” solution “AMHS over TCP/IP” is now fully SARPs compliant.

3.7 European Directory Service

3.7.1 This section provides general information on the European Directory Service (EDS) Operational Concept. Appendix G of the EUR AMHS Manual provides the details of the concept.

3.7.2 Directory services are seen as a global function. However they are expected to be implemented at a regional and international level rather than on a global basis. The EDS is specified as a common European facility but is also open to support, to coordinate with and to integrate with States and Organisations outside Europe. The EDS Operational Concept considers distribution and use of information at the national level a local implementation matter.

3.7.3 The EDS Operational Concept adopted and refined the approach of the ATN Directory as specified by ICAO Doc 9880 Part IV. The EDS is specified in support of ATN applications such as the AFTN/AMHS Gateway. In addition the EDS supports human users interfacing the EDS through their Directory User Agent (DUA).

3.7.4 The architecture of the EDS allows for centralised management of information, versioning of information as well as periodic and automated distribution of information using X.500 Directory protocols. In parallel the EDS Operational Concept reduces the individual effort of States and Organisations for management and coordination.

3.7.5 The EDS Operational Concept takes into account the existing infrastructure for management and distribution of AMHS address information by the ATS Messaging Management Centre (AMC) and deploys the EDS in three steps. In the first, initial step, the information is maintained and managed by AMC and distributed by AMC and EDS. In the second, intermediate step, the information is maintained by EDS and managed and distributed by AMC and EDS. In the third, final step, the information is maintained, managed and distributed by EDS. The stepwise introduction of EDS for AMHS address information ensures a smooth introduction of European directory services and seamless operation of the AMHS.

3.7.6 In support of the AMHS, the EDS provides and distributes in the initial step information to support the messaging functions name resolution, user capabilities and AFTN/AMHS address conversion. The EDS is prepared to support further ATN applications and functions such as AMHS security.

4 European ATS Messaging Service Profile

4.1 Introduction

4.1.1 The detailed specifications for ATSMHS are currently spread over a number of different documents such as the ISO/IEC ISPs, ICAO SARPs and technical specifications (Annex 10 and Doc 9880) and the SPACE Final Report.

4.1.2 The EUR-ATSMHS Profile is intended to provide one single document that brings together these specifications by referencing the basic documents and by providing any additional specifications necessary for ATSMHS implementation in the EUR Region.

4.1.3 The scope of the Profile is limited to the specification of those aspects of systems that are involved in exchange ATS messages between international COM Centres. Other aspects, that involve gateways e.g. to the AFTN and CIDIN or communications that remain entirely within a State, are not dealt with in this Profile.

4.1.4 The first version of the EUR-ATSMHS profile was developed by EUROCONTROL. Following a thorough review procedure which was supported by various stakeholders (suppliers, SPACE, COMT, AFSG), the Profile has been approved for use in the specification and procurement of AMHS systems in the EUR Region and it has been included as Appendix B to the EUR AMHS Manual.

4.2 EUR ATSMHS Profile Objectives

4.2.1 The purpose of the Profile is to provide a single, relatively short specification containing interoperability requirements between international Message Transfer Agents (MTA).

4.2.2 Furthermore, the Profile contains the following requirements applicable within the EUR Region:

- Use of TCP/IP for the underlying Data Communications Service;
- Message Legal Recording;
- Distribution Lists;
- Use of IPM File Transfer Body Parts for the transfer of binary data (e.g. to support WMO BUFR coded messages);
- Specifications of message maximum and minimum lengths (e.g. to support ADEXP messages).

4.3 Scope of Profile

4.3.1 The EUR-ATSMHS Profile specifies a number of AMHS protocols and systems capabilities for the exchange of ATS messages between direct and indirect AMHS users through international MTAs. In other words, the Profile is intended to ensure end-to-end message transfer between International COM Centres over AMHS.

4.3.2 The Profile is applicable to the following aspects of message interchange:

- Transfer of messages between the AMHS systems at International COM Centres operated by different ANSPs;
- Submission, Delivery and Retrieval of messages that are to be transferred between AMHS systems operated by different ANSPs;
- The content of Message Envelopes, IPM Headings, Body Part Types and AMHS Addressing used for the protocols identified above.

4.3.3 The Profile does not specify any of the purely local requirements within an ANSPs individual systems – e.g. MTS Access, MS Access, and interconnections between MTAs within an ANSP's Private Management Domain, other than to ensure adequate interchange of ATS messages internationally. Nor does it specify aspects of interconnections between Regional AMHS/AFTN gateways where additional requirements may apply, such as support of an ATN lower layer protocol stack as specified in ICAO Document 9880, Part III [4].

4.3.4 Access to the Directory Information used to support Directory Name Resolution and address mapping between AFTN and AMHS address forms is indicated for information only.

4.3.5 The following diagram illustrates the scope of the protocols and system types specified in the EUR-ATSMHS Profile:

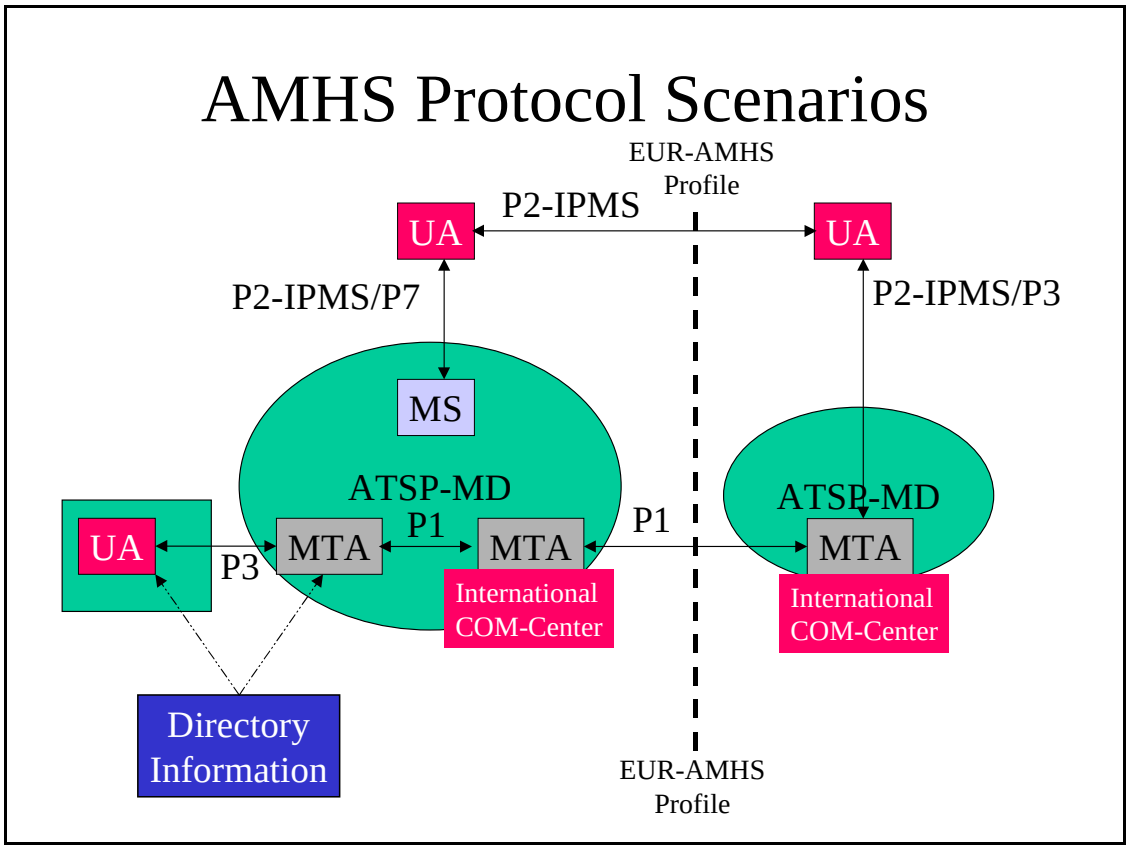

Figure 5: AMHS Systems and interconnecting Protocols

4.3.6 The Profile applies to the following AMHS system components:

- User Agents UA
- Message Transfer Agents MTA
- Message Stores MS

4.3.7 The Profile applies to the following AMHS protocols:

- IPM Content P2
- Message Transfer P1
- Message Submission/Delivery P3
- Message Retrieval P7

4.3.8 The Profile specifies a Profile of ATS Message Handling Service conformance called the EUR-AMHS Profile. It is based on the requirements of following:

- The Basic ATS Message Handling Service (Bas), introduced in the Doc 9880, Part II, para. 1.1.3-1.1.8;
- A number of further Functional Groups and options selected from the Extended ATS Message Handling Service (Ext), introduced in the Doc 9880, Part II, para. 1.1.3-1.1.8;
- Further requirements specified by the SPACE Final Report for use in Europe.

4.3.9 The resulting scope is sufficient to ensure inter-State message interchange using AMHS according to the Basic AMHS requirements stated in Doc 9880, which covers Basic Message Transfer Capabilities, Distribution Lists, appropriate message size capability and Legal Recording.

4.3.10 In addition, the following requirements are included:

- Use of TCP/IP as the underlying Data Communications Service;

It must be pointed out that specification of an AMHS based on TCP/IP necessarily references a wide range of standards from different sources. This is complicated by the fact that procurement of a complete AMHS/TCP solution involves the specification of three different system component types (Message Transfer Agents, Message Stores and User Agents), each of which has a number of implementation options. The Profile therefore also provides guidance on the correct use of the referenced ISO/IEC ISPs, ICAO Documents and Internet RFCs for each type of system.

- Provision for the transfer of binary data using the File Transfer Body Part

It must be pointed out that the originally planned mechanism for this requirement was to use the Bilaterally Defined Body Part. However, this was found to be deficient in two ways:

a) its use is now discouraged by the base standards;

b) it provides no way for recipients to determine the nature of the binary encoding actually contained in a received Bilaterally Defined Body Part.

For these reasons, the use of the Bilaterally Defined Body Part was removed from old Doc 9705 during 2003 now Doc 9880, Part II, and was replaced by the File Transfer Body Part, which is known to overcome the previously mentioned drawbacks.

4.3.11 Security requirements are not a mandatory part of the EUR-ATSMHS Profile. However, the Profile mandates IP address validation and the protocol includes system identification following transport connection establishment. It must be pointed out that certain Messaging Application Security functions are also mandated in the MHS S0 optional Functional Group for the Extended ATS Message Handling Service but these are not mandated by this Profile.

4.4 Use of the Directory

Under development

5 System implementation - Guidelines for system requirements

5.1 Introduction

5.1.1 This section is intended to deal with technical and operational requirements for a COM system replacing the AFTN/CIDIN system by an AMHS or adding the ATSMHS capability. As indicated by its title, this section covers guidelines for requirements not specified in the AMHS technical specifications, but considered by the Group important enough for being included in a Call for Tender for the procurement of an AMHS system.

5.1.2 The main input of this section was a subset of the specifications of an actual Call For Tender issued by one of the Group members, adapted and modified in order to have a 'template' able to be used by any ANSP who intends to procure an AMHS system.

5.1.3 The section covers technical and operational requirements like:

- General facilities
- Addressing - mapping table facilities
- Queue management facilities
- Message repetition facilities
- Tracing facilities
- Sizing
- Availability and reliability

5.1.4 For such a COM system in the following paragraphs the term "**AMHS System**" will be used.

5.1.5 Due to the character of this section (as guidelines for system requirements) the term "**should**" is used. In a specific Call for Tender this term can be replaced by shall.

5.2 General requirements

5.2.1 The AMHS System should implement the ATSMHS and AFTN/AMHS Gateway facilities in accordance to the specifications defined in the latest approved ATN technical specifications for Basic Services, but supporting AFTN messages with a message length up to 64 Kbytes.

Note.– This requirement is not covered by the technical specifications, which mandate support of standard AFTN message length only.

5.2.2 The AMHS System should support the monologue dialogue-mode and one or several incoming and outgoing P1 associations with an MTA partner simultaneously .

Note.– An MTA may establish permanent or dynamic (i.e. on-demand) P1 associations. The type and specific number of associations to be set up for operations depends on different factors and has to be agreed between the MTA partners, after consideration of their traffic exchange requirements.

5.2.3 The AMHS System should support simultaneous associations with several MTA partners (one or several associations with each MTA partner) with the same or different "transport" protocols (e.g. TCP/IP to be used within EUR, ATN/OSI).

5.2.4 The AMHS System should support the total number of simultaneous associations (sum of all associations) without any restrictions caused by inherent limitations of the system (memory, interfaces, etc).

5.2.5 The AMHS System should allow control of establishment of associations with MTA partners via on-line operator commands; i.e., it should be able to:

- Prevent/allow the establishment of associations with a given MTA partner by AMHS System (local MTA), by MTA partner only or by both partners.
- Prevent/allow the establishment of associations with all configured MTA partners by AMHS System (local MTA), by all MTA partners only or by all partners.
- Force the termination of associations already established with a given MTA partner.
- Force the termination of associations already established with all configured MTA partners.

Note.– The number of actual simultaneous associations to be supported will depend on:

- *the target 'logical' AMHS network topology: for example each centre establishes direct associations with all the other centres or each centre establishes associations with adjacent centres only (as in AFTN);*
- *whether permanent or dynamic connections will be established. Such distinction is only applicable in case there is no requirement for continuous traffic exchange.*

5.2.6 The AMHS System should implement MTA queues. These queues will keep the AMHS messages that:

a) either are pending to be sent;

b) or have been transmitted but for which a delivery report is expected.

Note 1.– The queue referred to in a) is typically implemented in the MTA.

Note 2.– The queue of messages for which a DR is expected is normally implemented in the User Agents and MTCUs of the AFTN/AMHS gateways.
The reaction of an AMHS System in case of loss of a DR is fixed (implementation matter): E.g., would it have to resend the message after timeout? How many attempts to resend the message should be made? A DR or NDR is addressed to the originator of the message; therefore it should be left to the originator to react upon non-arrival of a DR as it is his task to react upon reception of a NDR. If the originator is an indirect (AFTN) user, the AFTN/AMHS gateway has to perform this task on his behalf. Furthermore, a report may take another route than the message it refers to, that means it does not necessarily pass through the same MTAs as the original message.

5.2.7 There should be a logical MTA queue per configured MTA partner. Management of these queues is specified in section 5.4).

5.2.8 The configuration of an MTA partner (via on-line commands) should provide flexibility for each of its parameters. For example:

a) It should be possible to configure the "transport" protocol (e.g. ATN, TCP/IP, TP0/X.25) to be used per each MTA partner.

b) In case of selection of TP0/X.25, it should be allowed to configure at least two local X.25 attachments to be used for the connections, several calling – called addresses to be used for initiating a call or acceptance of an incoming call, etc.

c) It should be possible to configure the maximum number of simultaneous associations with each MTA partner.

d) It should be possible to configure whether the associations have to be left permanently established or whether they have to be established and closed depending on traffic.

5.2.9 The AMHS System should allow configuration of all profile items if possible.

5.2.10 The AMHS System should allow configuration of the following profile items, at least:

a) Mapping between AFTN priorities and AMHS Message Transfer Envelope priorities.

b) Values of "rn" and "rnr" in the notification-requests element in the recipient fields in the IPM heading. These values should depend on the value of the AFTN priority.

Note 1.– Both functions are implemented in the UAs and MTCUs of the AFTN/AMHS gateway as the MTA does not deal with the ATS Message Priority (or AFTN priority) which is contained in the ATS Message Header as part of the IPM body.

Note 2.– The technical specifications specify the values of these profile items. It is good practice that the implementation allows the possibility to change them just by configuration in case operational experience recommended other settings. The processing is an implementation matter.

5.3 Addressing – mapping tables requirements

5.3.1 The AMHS System should support the CAAS (see section 3.2).

5.3.2 The AMHS System should process and manage AMHS messages received with the O/R name in the XF Addressing Scheme also, even if the ANSP has chosen the CAAS for its internal users.

5.3.3 The AMHS System should provide mechanisms to import mapping tables needed in the AFTN/AMHS Gateway. The tables to be imported will be downloadable from the AMC system.

5.3.4 The implemented facilities in the AFTN/AMHS Gateway which map an AFTN address to an O/R name should be flexible enough to accommodate different O/R structures (Addressing Schemes) and use the minimum number of configuration / lookup tables with the minimum number of entries. As an example for the implementation of the mapping of an AFTN address to an O/R name, the following information should be entered in configuration tables:

a) Attributes and associated values that are fixed for each State. E.g. in the case of States using the address scheme described in section 3.2 the attributes and associated values to be entered should be Country, ADMD and PRMD. Each entry will be indexed by the ICAO routing area or State/territory identifying letters (1 or 2 first characters of the AFTN address).

b) Attributes whose values can be determined directly from the AFTN address. E.g., in the case of States using the CAAS described in section 3.2, the Organisation Unit 1

attribute (first to fourth characters in the AFTN address) and the Common Name (all characters in the AFTN address) should be declared here for them.

c) Attributes whose values depend on a mapping table. For each such attribute for each State, the following should be specified: the name of the mapping table and the subset of the AFTN address (e.g. one to four first characters, the complete AFTN address, wild characters could be used to define the subset ...) that gives the index to the mapping table. The mapping table itself should also be provided. E.g., in the case of countries using the CAAS address scheme described in section 3.2, the value for the Organisation attribute should be defined this way.

5.3.5 The possibility to use a directory should also be contemplated, even if this is not part of the Basic Services.

5.4 Queue management requirements

5.4.1 The AMHS System should provide, in addition to a pure diversion facility of outgoing queues, a reprocessing of messages in X.400 (outgoing) queues in case of longer outages of adjacent MTAs (non-reachability).

Note.– Such reprocessing facilities will be very important during the time period when both AMHS and AFTN/CIDIN centres coexist in the EUR Region.

5.4.2 Two types of reprocessing should be envisaged:

- at the pure X.400 level;
- at the AFTN level (in the case of AFTN/AMHS Gateways).

Reprocessing at the pure X.400 level

5.4.3 The reprocessing at pure X.400 level should allow:

- to extract messages waiting in an X.400 queue from this queue;
- to process these messages again by the X.400 routing software; and
- to route according to possible new or temporarily modified X.400 routing tables.

Such a mechanism would allow to extract the messages from the queue associated to a non-reachable MTA. The messages could be routed through another centre (MTA) and forwarded through the alternate route only for those recipient addresses for which alternate routes have been activated. For all other recipients addresses the messages remain in the queue. This kind of reprocessing prevents a general forwarding of messages to other centres (MTAs) containing recipient addresses for which rerouting is not intended.

5.4.4 The reprocessing at the pure X.400 level should be present in the ATS Message Servers, in AFTN/AMHS Gateways.

Reprocessing at the AFTN level

5.4.5 The reprocessing at AFTN level should allow:

- to extract messages waiting in an X.400 queue;
- to re-process them by the AFTN layer; and

- to route them according to the current AFTN, CIDIN and X.400 routing tables respecting the updated route availability information (predefined alternate routing).

This reprocessing would solve the problem of non-reachability due to outages, in a heterogeneous AFTN/CIDIN/AMHS environment.

5.4.6 An X.400 queue can contain messages, reports and probes. The AFTN reprocessing function should only concern the messages.
These messages can be of different 'types': messages from AFTN/AMHS gateways, 'pure' UA to UA exchanges, etc. All these messages will be IPM messages, so there is no way to distinguish them at the X.400 (envelope) protocol level.

5.4.7 The reprocessing should be restricted to messages generated by an AFTN/AMHS gateway.

5.5 Message repetition requirements

5.5.1 The AMHS System should provide powerful message repetition facilities in the AFTN, CIDIN and AMHS subsystems implementation.

5.5.2 The repetition facilities should be able to repeat messages as they were originally transmitted i.e. sent to all recipients following the same transmission paths.

5.5.3 Additionally, the repetition facilities should be able to specify (with the use of wildcards) 'detailed' or 'generic' destinations. Such destinations can be an AFTN address, an O/R name, all AFTN addresses mapped to a given Ax, all O/R names of a given PRMD, etc.

5.5.4 The AMHS System should find all the messages that were transmitted to such specified 'generic' destinations within a specified time interval and retransmit them only to pending destinations and following the current routing. To avoid a transmission to other destinations originally contained in the message the addresses not matched by the 'generic' destination should be suppressed (address stripping).

5.6 Tracing facilities requirements

5.6.1 The AMHS System should provide a facility to allow generation of X.400 probes.

5.6.2 The user interface of the facility should allow entering of the priority, the O/R name of the originator / destinations and the message length.

5.6.3 The AMHS System should send the reports regarding the probes (delivery, non-delivery) to a configurable instance (e.g. the rejection queue).

Note.– This requirement relates to a user interface requirement. The user needs some notification when the delivery report related to the probe has been received. It is an implementation matter to decide whether this is performed just by allocating a fixed originator O/R name to one of the queues of the system or by another way.

The contents of such reports should be decoded and presented in a 'human' readable and understandable format.

5.6.4 The AMHS System should provide association-tracing facilities to monitor in real time the establishment, interruption and finalisation of associations related to adjacent MTAs.

5.7 Sizing requirements

5.7.1 The sizing of the AMHS System operational platform should support the traffic in peak hour situations with:

a) Average peak hour total CPU usage at 30% maximum.

b) Communication adapters loaded at a maximum 30% of their real bandwidth capacity (not the theoretical one) and excluding the redundancy needs.

Note.– The previous values have to be reconsidered by each ANSP depending on the expected lifetime of the AMHS System. As e.g., if the lifetime is expected to be 10 years and the traffic estimates for the peak hour relate to the end of the lifetime, the usage requirements for the CPU and the communication adapters are typically greater than 30% (if not, the purchased system will be oversized during quite a number of years).

c) Processing time of a message (High QoS flow type class, see section 3.1) at least less than 1.5 seconds. The processing time is defined as the difference between the moment the latest character of the message enters into the AMHS System and the moment the first character of the message is sent out. This applies for all implemented in / out protocol combinations. For messages of other flow types, the processing time should be less than 3 seconds.

Note.– This value, especially for AMHS, has significant implications in the platform sizing and total network transit time (this also depends on the network topology, see section 3.3 AMHS topology). If the value is too low, a very powerful platform is required; If the value is too high, it could introduce a significant delay in the overall message transmission (especially if the other centres also have high values).

d) Response time to configuration / management on-line commands less than 3 seconds. This response time is related to requests from a management position for actions which do not require a query / browsing of a log (e.g. close a PVC, create an Ax, etc).

e) At least 50% of the disk space remaining available after:

i) all the standard and specific developed software versions (including the possibility of more than one software versions and two configurations per version) are present on disk,

ii) all logs and archive folders corresponding to the number of days to be kept on-line in the system are present on disk.

Note.– The precise number of days depend on the particular policy of each ANSP to comply with the ICAO Legal Requirements (see section 9.1 Legal Recording in AMHS).
If its policy indicates that all the data has to be kept on the AMHS System, the system is dimensioned to support at least 30 days. If the policy indicates that the data are saved for such purpose somewhere else (e.g. in another system, in an external media like CD-ROM, DAT, cartridge, etc.), data concerning fewer days need to be kept on-line (e.g. three days, one week...).

Note.– As for the CPU and communication adapter usage, the value for disk space is reconsidered by each ANSP depending on the expected lifetime of the AMHS System and the traffic estimates related to this lifetime.

5.8 Availability and reliability requirements

5.8.1 The AMHS System should operate 24 hours per day and 365 days per year.

Note.– The values provided below represent 'minimum' requirements. Each ANSP may reconsider them according to its own policy and internal SLAs with its internal users.

5.8.2 Interruptions for system maintenance and installation should be limited to the strict minimum and should be less than 60 minutes.

5.8.3 After power is switched on, the AMHS System should be fully operational after a maximum of 15 minutes.

5.8.4 The AMHS System should auto monitor:

- the state of its application processes;
- the state of its system processes;
- the state of its system components (hardware).

5.8.5 The AMHS System should generate an SNMP MIB of the states monitored (see above).

5.8.6 The AMHS System should automatically try to recover from failure conditions in its application processes. If it is not possible to recover without impacting the service, the AMHS System should terminate all its application processes in an orderly manner and restart them afterwards automatically.

5.8.7 The AMHS System should allow an operator to:

a) Stop the AMHS application gracefully (with automatic restart).
b) Stop the AMHS application gracefully (with no automatic restart).
c) Force the AMHS application to stop (with no automatic restart).
d) Start the AMHS application with message recovery (messages that were in queue when the system was stopped are processed and forwarded).
e) Start the AMHS application without message recovery (messages that were in queue when the system was stopped are discarded).

5.8.8 The AMHS System should lose no message that has been acknowledged by it (according to the respective messaging protocol), unless an operator explicitly requests to drop the messages.

5.8.9 The AMHS System should lose no message because of its load.

5.8.10 In case of a switchover (cluster, master/standby) configuration the following requirements apply:

a) After detection of failure of the primary system unit or after an operator command, the switchover process should last less than five minutes. The duration of the switchover is counted as the time from the failure detection (or operator command) until the time the AMHS restarts forwarding messages again (assuming there are messages in queue or there are new incoming messages).
b) The time needed for the standby unit to detect failure of the primary one should be less than three minutes.
c) The switchover process should be completely automatically without requiring any plugging/unplugging of any type of cables (communications, disks ...). A matrix

switch action (if a matrix switch is proposed) is not considered as a cable plug / unplug.

5.8.11 Any period of time longer than one minute, during which the AMHS System does not perform message switching (in a total or partial manner) due to software or hardware problems, should be considered as an interruption of service.

5.8.12 An interruption of service of an AMHS System should be less than 10 minutes when the recovery is automatic. The duration of an interruption is calculated as the time from the moment the last received message was forwarded until the moment the AMHS System starts forwarding messages again (assuming there are messages in queue or there are new incoming messages).

5.8.13 There should be no more than one interruption of service without automatic recovery in a sliding window of six months.

5.8.14 There should be no more than one interruption of service with automatic recovery per day.

5.8.15 There should be no more than two interruptions of service with automatic recovery per month.

5.8.16 There should be no more than three interruptions of service with automatic recovery in a sliding window of three months.

5.8.17 The MTBF of the AMHS System hardware should be higher than 52 weeks.

5.9 Requirements for statistics

5.9.1 The AMHS System should monitor and produce statistics per direct MTA partner as follows, where the term “data message” includes all X.400 P1 information objects, i.e. messages, probes and reports:

a) Number of data messages transmitted
b) Average size of the data messages transmitted
c) Maximum size of the data messages transmitted
d) Average number of destination addresses per message transmitted
e) Number of data messages received
f) Average size of the data messages received
g) Maximum size of the data messages received
h) Average transfer time
i) Number of delivery reports transmitted (a subset of item a)
j) Number of non-delivery reports transmitted (a subset of item a)
k) Number of delivery reports received (a subset of item e)
l) Number of non-delivery reports received (a subset of item e)
m) Minimum size of data messages received
n) Minimum size of data messages transmitted
o) Maximum, mean and minimum response time
p) Number of recipients processed
q) Number of messages deferred (the criterion for a deferred message should be specified by a configurable system parameter)
r) Number of messages redirected
s) Number of messages rejected
t) Number of loops detected

5.9.2 The AMHS System and its management tools should enable to monitor and produce statistics per direct MTA partner, related to traffic volume and quality of service at an overall system level, as follows:

a) Overall traffic volume at the level of IP packets;

b) Maximum outage duration of association between MTAs (if any);

c) Cumulated outage duration of association between MTAs (if any).

Note.– The use of IP network measurement tools distinct from the message switch, and/or manual intervention may be required to produce these elements.

5.9.3 Additionally the AMHS System should produce the information specified in 5.9.1 and 5.9.2 for all partner MTAs as a total.

5.9.4 The AMHS System should be able to generate the above statistics in at least the following intervals: 1 day interval, 1 hour interval, 30 minutes interval or better.

5.9.5 The AMHS System should be flexible in configuring other intervals for application statistics generation.

5.9.6 The AMHS System should be flexible in generating statistics at a more detailed level, as e.g., MTA route entries, particular O/R attributes, individual O/R names (to be discussed).

Note.– Each ANSP may consider what requirements on statistics are put on the AMHS System in accordance with its requirements (national and international) and its policy for statistics production. E.g., there can be ANSPs which transfer the traffic logs to another system which will produce all required statistics; in such a case, the AMHS System may be relieved of too many statistics requirements. If an ANSP does not have such other system, it is the responsibility of the AMHS System itself to produce all statistics needed.

5.9.7 The AMHS System should be able to export specific statistic files on a monthly basis. Such a statistic file should contain daily as well as peak hour statistical data in a standard format, covering certain items in 5.9.1 and all items in 5.9.2, because of their specific international relevance. Detailed specifications of the file formats and statistical indicators are provided in the ATS Messaging Management Manual.

6 AMHS management

6.1 Introduction

6.1.1 In general, network management is essential for reliable and efficient operation of a network like the EUR AMHS Network.

6.1.2 This chapter contains a general introduction on the management aspects for an EUR AMHS network. It contains a list of required functions that are to be fulfilled by a management system.

6.1.3 The breakdown of the management areas is according to the ISO FCAPS scheme.

6.1.4 At the end in section 6.5 the European approach of AMHS Network management by implementing the ATS Messaging Management Centre is described.

6.2 Requirements for AMHS Management

6.2.1 The following AMHS Management activities can be distinguished:

Timeframe **Activity**	**Online 24 hr*7 day**	**Off line - short term**	**Offline – long term**
Fault Management	Helpdesk, fault reporting. 1st line support. Service availability monitoring	Fault resolution, fault management	High level changes to increase reliability, reduce user queries
Configuration Management	These are not a regular feature of online systems management. System and user changes recorded online but usually applied to offline system.	Activation/turn-up of changes. Regular published changes	High level planning, for international connectivity and national service upgrades
Accounting management	N/A	Production of regular statistics	Policy and planning activities relating to budgeting, charging, capacity planning
Performance management	Monitoring utilisation, processors, queues, connections, discs etc.	Performance tuning activities	Long term and international planning for capacity management

Timeframe Activity	Online 24 hr*7 day	Off line - short term	Offline – long term
Security	Monitoring for attacks, taking countermeasures	Regular health checks, reviewing warnings from industry and other ANSPs, security training	Security policy, significant architecture/topology changes to increase security

Table 7: Breakdown of activities by timeframe

6.3 System Management data flows

6.3.1 How system management will be implemented and operated at local level can be freely chosen by a State. The ATN technical specifications define requirements to make information available to other States through XMIBs, with as a primary goal the support of boundary management.

6.3.2 The ATN technical specifications define the XMIB sets, and the information is used to serve the following purposes:

- Enable other participating organisations to query the current operational status of the ATN system (ES or IS);
- The cross domain MIB should support the capability to allow a SM Manager to be warned by notification as soon as an error occurs in an adjacent domain.

6.3.3 This “public” management information is to be made freely available by the State to the international community.

6.3.4 Alarms raised in one management domain that affect the provision of AMHS service shall be made available to other management domains.

Note.– The exact standard distribution of reports and alarms is for further study.

6.4 Realisation options

6.4.1 Information database

6.4.1.1 For the exchange of information with the management database the ISO XMIB solution is foreseen in the technical specifications. In this context, States have been requested to implement XMIBs from the onset of AMHS for international co-ordination. Eventually a conversion mechanism should be implemented.

6.4.1.2 Such an implementation should cover both the AMHS application (entry and exit MTAs, Gateways, MTCUs and routes through a State carrying traffic) and the underlying ATN network XMIBs.

6.4.1.3 A capability to broadcast alarms to other States should be foreseen.

Note.– The use of XMIB is under discussion. Especially in the light of TCP/IP in the EUR Region other options (MIB) may be studied.

6.4.2 Fault management

6.4.2.1 Fault management can be subdivided in 3 distinct areas:

- Fault rectification – the process of providing a long term solution to a fault. This is highly implementation dependent and thus very much a national issue.
- Fault management – the process of ensuring that faults are correctly recorded, assigned for rectification and the entire process managed Also this is a national function.
- Fault reporting – covers the area of helpdesks and first line support and spans both local and international systems.

6.4.2.2 Helpdesks can be organised either nationally or internationally. In the international model a centralised regional or global helpdesk operates on behalf of member States which maintain the operational responsibility for their own domains.

6.4.2.3 The international approach has a better overview of the network as a whole, offers economies of scale and relieves national operations centres. The national approach deals more efficiently with local users in the local situation.

6.4.2.4 Weighing advantages and disadvantages a regional helpdesk has been chosen for the EUR AMHS.

Note.– The Terms of Reference of the Helpdesk are to be defined. For the time being the helpdesk is of passive nature and is intended to operate off-line.

6.4.3 Configuration Management

6.4.3.1 Although Configuration Management is a local responsibility there is a significant requirement for co-ordination of addressing and routing information.

6.4.3.2 An AMHS Offline Management Centre is created to consolidate, co-ordinate and distribute AMHS address and routing information across the EUR Region. The configuration changes follow the 4-week AIRAC cycle.

6.4.3.3 The following information will be co-ordinated and maintained:

- Declaration and changes to PRMD;
- Declaration and changes to mapping of “4 character Location Indicator” to “Geographical Unit”, i.e. relationship between OU1 and O attributes;
- Declaration and changes to mappings of “8 character AFTN address” and Geographical unit i.e. Common Name to OU1;
- Declaration and changes of network addresses for primary and backup boundary MTAs and AFTN/AMHS gateways;
- General awareness of deployment and transition activities;
- Routing and alternate routing.

6.4.3.4 ICAO will hold a registry of PRMDs.

6.4.4 Accounting management

6.4.4.1 In the initial phase of AMHS operation accounting will not be performed.

6.4.4.2 Cost assignment will eventually be locally introduced.

Note.– The requirements for eventual later implementation of the facility are under study.

6.4.5 Performance management

6.4.5.1 Performance

6.4.5.1.1 Online performance monitoring includes monitoring of metrics like queue size, transit times utilisation factors and status, where manual and/or automatic procedures are being invoked when thresholds are passed.

6.4.5.1.2 Offline performance management is aimed at the ability of the service to meet future needs. This requires accurate statistics on traffic patterns and system performance.

6.4.5.1.3 Both management aspects are local to an ANSP and no matter for international harmonisation.

6.4.5.2 Statistics

6.4.5.2.1 It is recommended that statistics should be collected using the internationally agreed objects (MTA). (For detailed requirements for statistics see 5.9)

6.4.5.2.2 Implementers should use a flexible design and should be able to obtain the information down to the level of individual operators or recipients with a granularity of 30 minutes or better.

6.4.5.2.3 A minimum set of monthly statistic should be exportable. Such a file should contain daily as well as peak hour statistical data in a standard format. Detailed specifications are provided in the ATS Messaging Management Manual.

6.4.5.3 Reporting of statistics

6.4.5.3.1 The statistic file containing daily as well as peak hour statistical data should be provided to the ATS Messaging Management Centre monthly.

6.4.5.3.2 There are no specific recommendations for statistics that are to be reported for national use.

6.4.6 Security Management

6.4.6.1 The management of security within a State is considered to be a local issue. However, when a breach of security or a threat is detected, it is recommended that the helpdesk is informed, and that the helpdesk subsequently passes on security warnings to other States and Regions and co-ordinates exchanges.

6.5 Implementation of AMHS Management in the EUR Region

6.5.1 Introduction

6.5.1.1 This section is intended to give the reader information necessary for an understanding of AMHS Management as currently planned, and has been written for those implementing, operating, using and planning the procurement of management systems.

6.5.1.2 Section 6.5.3 defines a group of functions known as "off-line" management functions. To a certain extent, these functions represent updated CIDIN Management Functions already being carried out. They are not highly demanding in an implementation and operational sense and shall be introduced first.

6.5.1.3 The other functions in the context of AMHS Management are termed "on-line" functions. They are defined in section 6.5.4.

6.5.2 On-line and off-line management

6.5.2.1 The Terms “Off-line” and “On-line”

6.5.2.1.1 A basic principle underlying the structure of AMHS management is the distinction between the two groups of functions designated as "off-line" and "on-line" management functions.

6.5.2.1.2 **Off-line** functions do not need to be executed in a short time period. These relate to medium and long-term requirements and include, e.g., collection and processing of information from COM Centres (inventory, planning, addressing, statistics, etc.) and preparation of configuration proposals (routing, addressing). Provision of technical support (help desk, consultancy, etc.) is also included in off-line management, even though these functions do not belong to one of the OSI Functional Areas.

6.5.2.1.3 **On-line** management refers to functions that shall be executed in a short time period in order to maintain the level of service required from AMHS. This necessitates the rapid exchange of management information between the COM centres and possibly between the COM centres and AMHS Management Unit (on-line Regional Help Desk).

6.5.2.2 The Distinction

6.5.2.2.1 The terms “off-line” and “on-line” are used to classify two separate groups of functions. The following table summarises the distinction with respect to a number of characteristics.

Characteristic	off-line	on-line
on-line connections between the systems?	not essential	essential
human intervention in the “management loop”	yes	in transition phase and in exceptional circumstances

Characteristic	off-line	on-line
new application software to be implemented in AMHS centres?	not essential	essential
operational time constraint	a few time-critical functions	more time-critical functions
degree of technical sophistication	relatively simple	more complex
period of operation	office hours	7 days / 24 hours
order of implementation	it is being implemented	to be studied

Table 8: Characteristics of "off-line" and "on-line" functions

6.5.2.3 Implementation Aspects

6.5.2.3.1 The off-line group of functions is less demanding than the on-line functions to implement. They can be introduced within a relatively short timescale.

6.5.2.3.2 The on-line functions are more ambitious and not yet defined as the off-line functions. The timescale for their implementation is longer and network management experience in the AMHS context needs to be built up before they can be introduced. The introduction of an on-line mode of operation supplementing the off-line mode is expected to be a major design issue.

6.5.3 AMHS off-line Management

6.5.3.1 AMHS off-line Management is described in the ATS Messaging Management Manual. ATS Messaging refers to the integrated, heterogeneous messaging environment comprising AFTN, CIDIN and AMHS.

6.5.3.2 The ATS Messaging Management Manual provides the information necessary for understanding and operating within the environment of the integrated AFTN/CIDIN/AMHS off-line Management.

6.5.3.3 The ATS Messaging Management Manual describes the framework in which the services of the ATS Messaging Management Centre (AMC) are provided to States/ANSPs in the EUR/NAT Regions, and, in a more limited manner, to States/ANSPs in other Regions.

6.5.3.4 Two categories of AMHS off-line Management Functions are defined, i.e.: Implementation Support Functions primarily for States in the process of implementing AMHS, and Operational Functions in support of States with AMHS in operational service:

6.5.3.5 Implementation Support Functions:

- Download support information
- AMHS PDR monitoring
- Inter-working test support
- View operational data
- Implementation planning

- Helpdesk function

6.5.3.6 Operational Functions:

- Network inventory
- Network planning
- Routing management
- Address management
- AMHS user capabilities management
- Security management (for future development)
- Statistics
- Support

6.5.3.7 The AMC procedures associated with the performance of the AMHS off-line management functions by Co-operating COM Centres (CCCs) are described in detail in the ATS Messaging Management Manual.

6.5.3.8 The goal of the AMC is twofold:

- the AMC facilitates the transition from CIDIN/AFTN to AMHS, particularly with routing management and address management functions;
- the AMC provides new tools in support of AMHS operations.

6.5.3.9 When States in the EUR/NAT Regions implement AMHS, the transition is complex to manage. Considering that ill-coordinated actions may create risks for the overall ATS Messaging quality of service, it is therefore recommended that every State implementing AMHS in the EUR/NAT Regions participates in AMC activities.

6.5.3.10 Detailed information on the AMC organisation, features, functions, procedures and implementation issues can be obtained from the AMC.
(https://www.eurocontrol.int/amc/).

6.5.4 AMHS on-line Management

- to be studied if needed -

7 Tests and validation of AMHS systems

7.1 Objective

7.1.1 Experience has shown that, although it is claimed that systems have been implemented according to the one set of protocol specifications, they are often not capable of inter-working. This is due to errors in implementation or to different interpretations of the specifications (SARPs and Doc 9880). Testing and validation of systems according to the same set of principles aims at the detection of such errors and the prevention of incompatibility instances.

7.1.2 The primary objective of this chapter is to formulate recommendations for testing the ability of a given AMHS implementation to function as required at the level of an International Communication Centre within the AFTN/CIDIN/AMHS network environment.

7.1.3 This chapter provides general information on the AMHS testing concept. The actual testing methodologies, configurations and procedures are defined in Appendix C, Appendix D, Appendix E and Appendix F. In these Appendices, tests are described in sufficient detail to give an appreciation of the variety of functions that are covered, the facilities required and the expected results.

7.2 General Principles

7.2.1 The creation of standards for testing is subject to consideration by a number of standardization bodies concerned with open systems (e.g. ISO, ITU-T).

7.2.2 In these standards, *conformance testing* is prescribed for testing a protocol implementation (IUT) with respect to its specification.

7.2.3 If conformance testing could be done in a complete and correct manner then two different implementations that passed the conformance test would be interoperable. In practice, conformance testing does not necessarily reach the intended point of completeness and correctness. Consequently, conformance testing may be followed by *interoperability testing* to determine whether two or more implementations will produce the expected behaviour under actual operating conditions.

7.2.4 In a more detailed analysis of the objectives of conformance and interoperability testing the following distinctions can be made:

- The primary objective of interoperability testing is to confirm the end-to-end interoperability of two systems, which have both been developed to a common specification. Performance and load testing are possible, at least in principle.

- Conformance testing can be defined as the exhaustive testing of an IUT against the functions and procedures defined in an agreed standard. Performance and load testing are not usually part of conformance testing which is restricted to the “logic” of the protocol implementation.

7.2.5 Furthermore, two essential practical differences between conformance and interoperability testing should be pointed out:

- Incorrect protocol behaviour. – Conformance testing allows "provoking" of the IUT, through incorrect protocol behaviour, in order to study its stability. Interoperability testing provides only limited possibilities due to (normally) correct protocol implementations in real systems.

- Distribution of test locations. – Conformance testing can be performed locally between IUT and a conformance testing equipment. Interoperability testing is normally distributed over at least two remote locations, therefore requiring more co-ordination effort.

7.2.6 Figure 6 depicts the principal differences in test arrangements for interoperability and conformance testing.

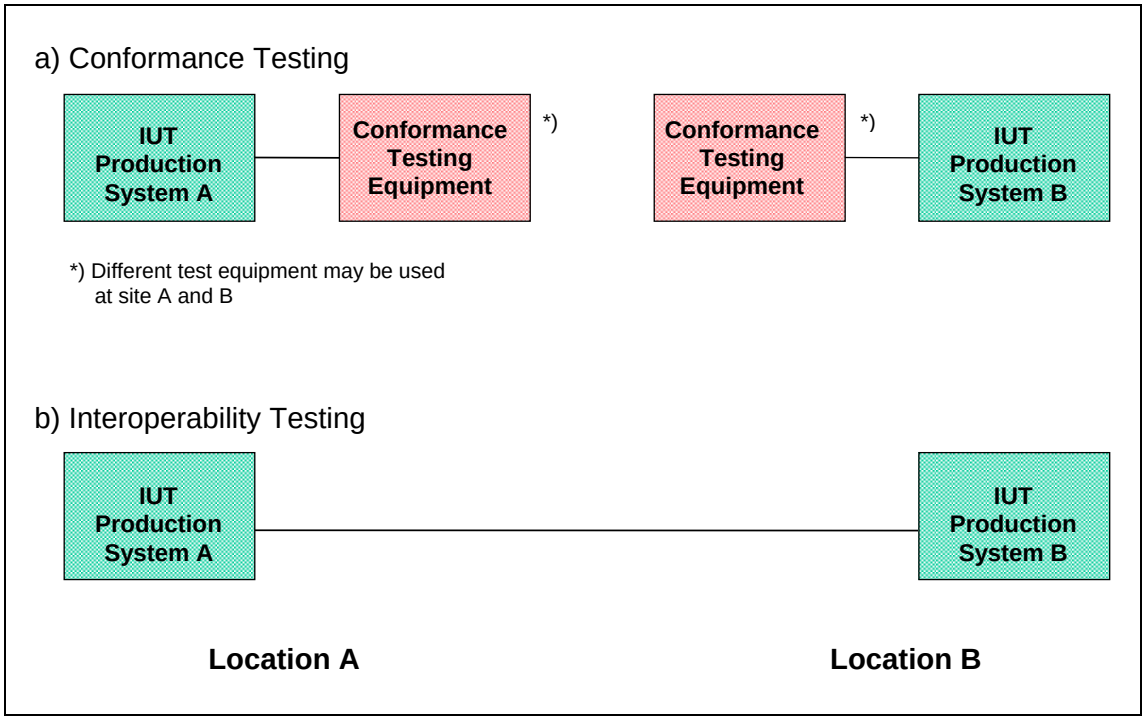

Figure 6: Principal test arrangements for conformance and interoperability testing

7.3 AMHS testing concept

7.3.1 Testing strategy

7.3.1.1 AMHS system implementations consist of protocol layers according to the principles of the Reference Model for Open Systems Interconnection. The AMHS functions to be tested reside in the application layer of the ISO/OSI reference model. The underlying layers provide supporting communication services, however they are not primarily subject to testing.

7.3.1.2 Figure 7 provides a generic functional presentation of an AMHS implementation under test.

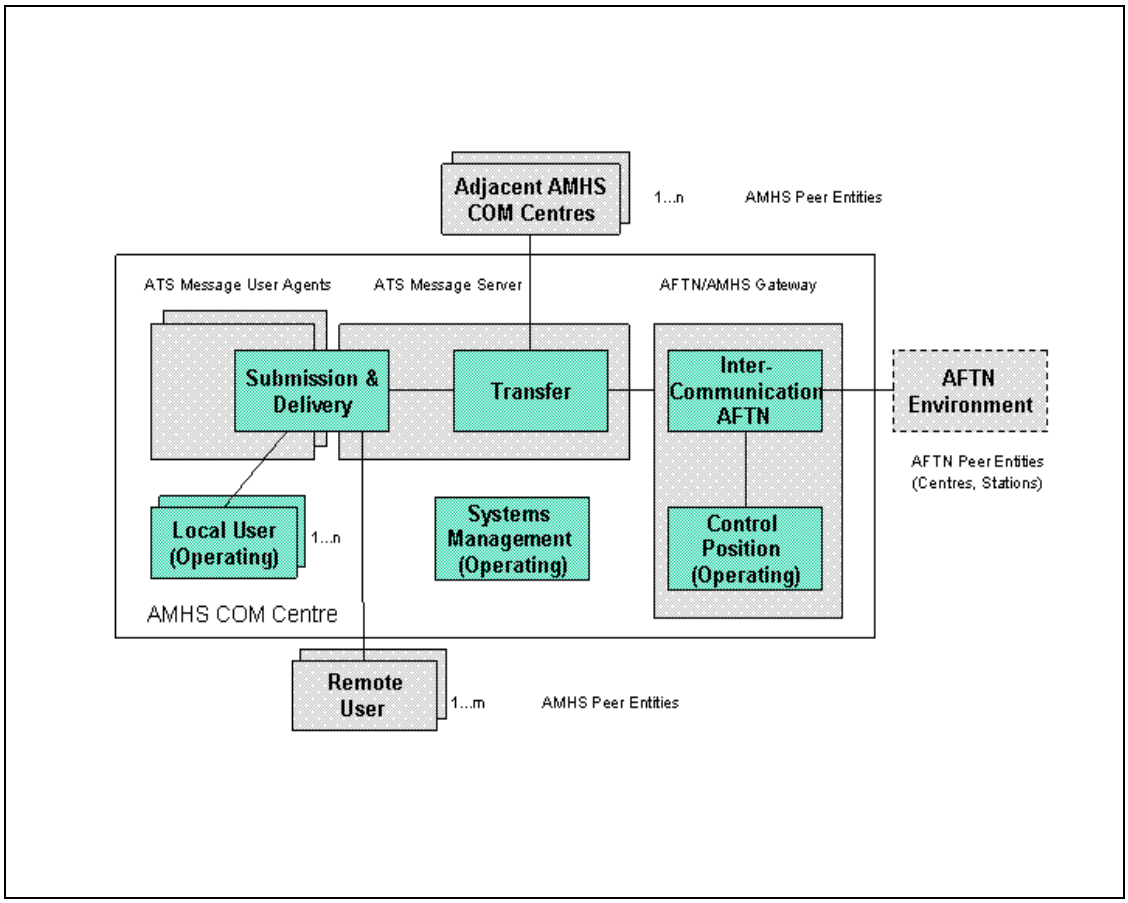

Figure 7: Functional view of an AMHS IUT

7.3.2 AMHS testing phases

7.3.2.1 AMHS Conformance testing

7.3.2.1.1 For the purposes of AMHS, *conformance testing* is considered mandatory and shall be performed in parallel with or after the acceptance testing of a new system.

7.3.2.1.2 The new system is tested as a *black box,* meaning that that required features are verified by observation of the external *behaviour* of the IUT upon stimulation with well-defined input events.

7.3.2.1.3 A *conformance testing equipment,* called the *AMHS test tool,* is used typically for the production of such input events and the monitoring of the resulting outputs from the IUT. In case such an AMHS test tool or reference implementation is *not* available, a test environment could be configured by using functional components of the IUT itself. Testing in such an environment may be seen as consistency testing rather than conformance testing.

7.3.2.1.4 The main AMHS functional areas covered by conformance testing are:

- Transfer of messages probes and reports;
- Submission of messages and probes / delivery of messages and reports;
- Intercommunication with AFTN;
- Naming and addressing;

- Parameters;
- System management functions.

7.3.2.2 AMHS Interoperability testing

7.3.2.2.1 After successful completion of conformance testing, *interoperability testing* is recommended, particularly between AMHS implementations of different manufacturers.

7.3.2.2.2 As a first step to interoperability testing the interconnection between pairs of systems should be established and checked.

7.3.2.2.3 Then, at the bilateral level, the following functional areas should be covered:

- Submission, Transfer and Delivery operations (AMHS to AMHS)
- Gateway operations (AFTN to AMHS)
- Gateway operations (AMHS to AFTN)
- Gateway operations (AFTN to AMHS to AFTN)
- Gateway operations– special case scenarios
- Stress traffic situations
- Submission/Transfer/Delivery and Relay operations
- Test of special situations

7.3.2.2.4 At the multilateral level, interoperability testing involves more than two organizations, interchanging normal messages and generating specific reactions of their systems.

7.3.2.3 AMHS Pre-operational testing

7.3.2.3.1 Before going into operation, *pre-operational testing* should be carried out between the AMHS systems concerned, within the operational network environment and using duplicated operational traffic.

7.3.2.3.2 The configuration details and the actual sub-sets of traffic to be used, have to be co-ordinated between the test partners. In any case, the operational traffic selected for this purpose should be traffic under the responsibility of the Communication Centres under test.

7.3.2.3.3 The AMHS relation between the two systems is considered operational, if the exchange of the total of operational traffic between them (or a subset of that), is performed by means of AMHS only. For this operational traffic no other transmission means (AFTN or CIDIN) is used.

7.4 Integration to the operational network

7.4.1 A common stepwise transition plan for migrating a successfully tested system into the operational AFTN/CIDIN/AMHS network should be applied.

8 Operational procedures and Recommendations

8.1 Introduction of a new AMHS COM Centre in the AMHS network

8.1.1 Scope of the procedure

8.1.1.1 This procedure specifies the actions necessary to perform the introduction of a new AMHS COM Centre in the International AMHS network. The term "new AMHS COM Centre" may refer to three distinct cases:

- the COM Centre already exists. It provides CIDIN and possibly conventional AFTN connectivity, and it supports the AFTN application of the CIDIN for national users. AMHS is introduced as an additional functionality and service in the existing COM Centre. This case corresponds to the majority of COM Centres in the EUR/NAT Regions;

- the COM Centre already exists. It provides conventional AFTN connectivity. AMHS is introduced as an additional functionality and service in the existing COM Centre. This case corresponds to a smaller number of COM Centres in the EUR/NAT Regions;

- the COM Centre does not exist yet and it will start operational service directly with AMHS. Although theoretically possible, there is no such case foreseen in practice in the EUR/NAT Regions. This case will consequently not be further discussed in the present version of the procedure[5].

8.1.1.2 From the above, it results that, strictly speaking, the procedure is related to the introduction of the AMHS operational service in a COM Centre of the international AFTN/CIDIN/AMHS network.

8.1.2 Target AMHS network

8.1.2.1 The target AMHS network which this procedure aims at reaching, when applied to all COM Centres in the EUR/NAT Region, has the following characteristics:

- it is an integrated AMHS network, composed of one single AMHS island in which all COM Centres are interconnected;

- it is a fully-meshed network, which means that there is an any-to-any connectivity at the level of AMHS connections (associations between MTAs) between COM Centres.

8.1.3 Assumptions

8.1.3.1 The principles of [1] are used for the definition of procedure.

8.1.3.2 The procedure relies heavily upon the use of the ATS Messaging Management Centre, implementing off-line management of AFTN, CIDIN and AMHS.

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[5] It might be subject for further study if a future major reorganisation of European COM Centres were envisaged in the future.

8.1.4 Qualitative objectives

8.1.4.1 The proposed approach aims at three main goals:

1. to migrate all the flows conveyed over the CIDIN link to the AMHS connection. CIDIN connectivity is not maintained at the end of the transition;

2. to migrate operational flows progressively to the AMHS connection, so as to:

   - facilitate operational validation (reduce the number/extent of changes at each step, to facilitate the analysis of behaviour/results),

   - enable easy rollback, in case it would be absolutely needed;

3. to limit impact on COM Centres other than those to which the procedure is applied, to reduce as much as possible inter-Regional co-ordination tasks during transition. Co-ordination will still be needed anyway, making use of the AMC.

8.1.5 General procedure

8.1.5.1 The introduction of a new AMHS COM Centre to the operational AFTN/CIDIN/AMHS network shall be performed in a stepwise manner. Initially, the activation of an operational AMHS connection takes place, after appropriate lower layer connectivity has been implemented and bilateral interoperability testing has been successfully completed. Then progressive migration of AMHS, AFTN and CIDIN traffic to the new connection is performed.

8.1.5.2 The detailed description of this procedure is provided in the ATS Messaging Management Manual (see [12]).

8.2 Recommended default values for international MTA names and passwords

8.2.1 Introduction

8.2.1.1 AMHS implementation requires the setting of the MTA names and passwords for each communication partner (MTA) connected. In a future fully meshed AMHS Network, unique identification of the MTAs would be required. Additionally, the naming should respect the knowledge and experiences of the operator staff, in order to avoid any unnecessary complications in the transition to AMHS.

8.2.1.2 One way to achieve this is to use a scheme, in which MTA names and passwords contain keywords which uniquely identify the MTA and facilitate recognition.

8.2.2 Default values for international MTA names

8.2.2.1 The recommended scheme of MTA names consists of:

- the term “MTA”;
- the Location Indicator of the MTA location; and
- a number (for future extensions if required).

8.2.2.2 All items are separated by a hyphen (hexadecimal 2D). The result is a printable string which can be exchanged in a message without difficulties.

Example: In accordance with this scheme the name of the MTA in Frankfurt, Germany should be: MTA-EDDD-1.

8.2.2.3 This scheme could be used for the national MTA naming as well.

8.2.3 Default values for international MTA passwords

8.2.3.1 Password complications arise because manufacturers deviate in the interpretation of an "empty" password. Some implementations await "nothing", some hexadecimal 00, others a single "space" character. To avoid misinterpretations during establishment of association(s) all tests could be performed with a common (known) password. Individual secure passwords could be established later, in order to ensure the necessary security of operational AMHS facilities.

8.2.3.2 The recommended scheme of the default password consists of:

- the term "ICAO";
- the Location Indicator of the MTA location; and
- the specific number of the MTA.

8.2.3.3 All items are separated by a hyphen (hexadecimal 2D). The result is a printable string which can be exchanged in a message without difficulties.

Example: In accordance with this scheme the default password of the MTA in Frankfurt, Germany should be: ICAO-EDDD-1.

8.2.3.4 By following this scheme, the default passwords of future MTAs can be determined at any time. If there are no other security requirements such a scheme can simplify the integration of new MTAs in a fully meshed AMHS Network topology.

8.3 Recommended setting of timers

8.3.1 Message related timers

8.3.1.1 MTS Timer related to Message lifetime

8.3.1.1.1 If the MTS (Message Transfer System) cannot deliver a message within a determined period of time, a NDR will be returned to the originator.

8.3.1.1.2 If this MTS timer is different per message priority and potentially different at each MTA, an AMHS user will receive NDRs depending on the different settings, which could create confusion and result in inaccurate NDR handling.

8.3.1.1.3 In order to ensure that the behaviour of the MTS is predictable it is recommended that every MTA in the AMHS network should use the same timer values related to message lifetime and that these values should be the same for messages of any priority.

8.3.1.1.4 Furthermore, the recommended value for the MTS timer related to message lifetime should ensure that:

- temporary communication failure / maintenance actions do not cause timer expiry;
- Direct Users do not receive unnecessary NDRs (if values are too low);
- message lifetime does not conflict with 'latest delivery' (optional Element of Service);

8.3.1.1.5 Based on the above analysis, the following values of the message lifetime MTS timer are recommended:

Message priority	Message lifetime
Urgent	168 hours (7 days)
Normal	168 hours (7 days)
Non-urgent	168 hours (7 days)
Report	168 hours (7 days)

Table 9: Recommended Message Lifetime per priority

8.3.1.1.6 This recommended timer setting ensures that in normal situations no NDR is generated with diagnostic code 'maximum-time-expired'. AMHS COM Centre operators can act in accordance with established procedures, when a message queue is detected.

8.3.1.2 Usage of the Latest Delivery Time

8.3.1.2.1 As outlined in Doc 9880 the Element of Service "latest delivery time" should never be set in an MTCU.

8.3.1.2.2 Furthermore, it is recommended not to set this parameter in an UA by default.

8.3.2 Network related timers

Tbd.

8.4 Recommended SVC processing in MTCU

8.4.1 Introduction

8.4.1.1 In a specific operational scenario in a mixed AFTN/AMHS environment it was observed that the original originator information of SVC messages ADS UNKNOWN was lost due to double conversion from AFTN (SVC message) to AMHS (NDR) and back to AFTN (SVC message).

8.4.1.2 Such a scenario is relevant during the migration to AMHS when traffic is relayed by AMHS "bridging" two AFTN areas by an AMHS connection as shown in Figure 8.

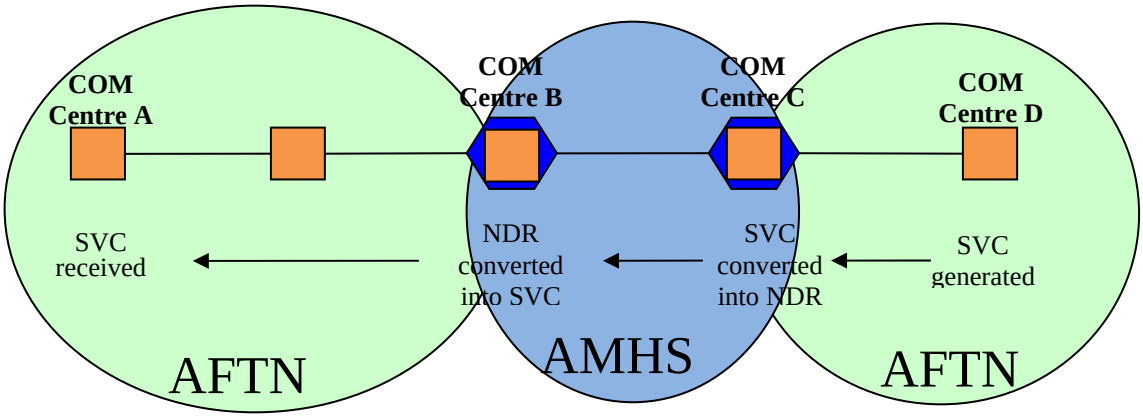

Figure 8: Mixed AFTN/AMHS environment

8.4.1.3 If COM Centre A sends an AFTN message to COM Centre D containing an unknown address, then COM Centre D generates an AFTN SVC message (ADS UNKNOWN).

8.4.1.4 Due to the fact that between A and D an AMHS network exists, the SVC message originated from COM Centre D will be converted into an NDR in COM Centre C, assuming the subject AMHS message has passed through COM Centre C.

8.4.1.5 The NDR generated in COM Centre C will be converted back to an AFTN SVC message (ADS UNKNOWN) in COM Centre B, but with the originator of COM Centre B.

8.4.1.6 Consequently, COM Centre A receives an AFTN SVC message (ADS UNKNOWN) with the originator of COM Centre B. The originator of the original AFTN SVC message (ADS UNKNOWN – COM Centre D) is lost.

8.4.2 Recommended processing related to AFTN SVC message (ADS UNKNOWN)

8.4.2.1 In order to avoid the loss of the original originator information as described in 8.4.1 above, it is recommended for the MTCU to handle all AFTN SVC messages (ADS UNKNOWN) as if the subject AMHS message has not passed through it; in this case it is foreseen that the AFTN SVC message (ADS UNKNOWN) is forwarded as an Interpersonal Message, as configured for all other types of SVC messages.

8.4.2.2 To implement handling as above, the conversion of an AFTN SVC message (ADS UNKNOWN) into an NDR as specified in ICAO Doc 9880, Part II, 4.4.4.1.1 a) shall be deactivated, allowing for the alternative MTCU reaction (ICAO Doc 9880, Part II, 4.4.4.1.1 b)), which is to convey any AFTN SVC message as an IPM.

8.4.2.3 A side effect of such processing for Direct Users is that a User Agent receiving an IPM instead of an NDR is aware that the intended recipient was an Indirect User (e.g. an AFTN station).

8.4.3 Recommended processing related to AFTN SVC message other than ADS UNKNOWN

8.4.3.1 Due to the strict implementation of the SVC processing according to ICAO Doc 9880, Part II, paragraph 4.2.1.4, it may not be possible in some cases to convert and/or forward

AFTN SVC messages through the AFTN/AMHS Gateway. In particular, an AFTN SVC message can be prevented from passing through an AMHS link interconnecting two AFTN islands. Such behaviour does not meet the operational expectations. In order to avoid the potential loss of any AFTN SVC message it is recommended for the AFTN/AMHS Gateway to process AFTN SVC messages as follows:

8.4.3.2 Any AFTN service message SVC QTA RPT requesting from an originator repetition of an incorrectly received message should be processed according to Annex 10 Vol. II, 4.4.11.1 and 4.4.16.2.2. If the message(s) requested for repetition cannot be repeated for any reason, the AFTN component should forward the service message to the MTCU for further processing, i.e. conversion into an IPM conveying the SVC towards its destination.

8.4.3.3 The AFTN component should forward any other AFTN SVC message which is not addressed to the AFTN/AMHS Gateway to the MTCU for further processing in the same manner.

8.4.3.4 Any SVC message addressed to the AFTN/AMHS Gateway should be processed as specified in Annex 10, Vol. II. Depending on the position where the AFTN SVC message is to be displayed (control position, local AFTN terminal or local AMHS User Agent) the AFTN SVC message may or may not pass through the MTCU; this is considered a local implementation matter.

9 Miscellaneous

9.1 Legal Recording in AMHS

9.1.1 Annexes to the Convention on Civil Aviation

9.1.1.1 In an AMHS environment the rules for recording of communication are valid as expressed in Annexes 10 [1] and 11 [2] to the Convention on Civil Aviation, in sections 3.5 and 6 respectively. For easy reference, the pertinent paragraphs are quoted below.

9.1.1.2. A telecommunication log, written or automatic, shall be maintained in each station of the Aeronautical telecommunication service except that in an aircraft station, when using radiotelephony in direct communication with an aeronautical station, need not maintain a telecommunication log. [Annex 10, 3.5.1.1]

9.1.1.3 Telecommunication log, written or automatic, shall be retained for a period of at least thirty days. When logs are pertinent to inquiries or investigations they shall be retained for longer periods until it is evident that they will be no longer required. [Annex 10, 3.5.1.5]

9.1.1.4 Recommendation.— In all cases where automatic transfer of data to and/or from air traffic services computers is required, suitable facilities for automatic recording should be provided. [Annex 11, 6.2.2.3.3]

9.1.1.5 All facilities for direct-speech or data link communications between air traffic services units and between air traffic services units and appropriate military units shall be provided with automatic recording. [Annex 11, 6.2.2.3.7]

9.1.1.6 Recommendation.— All facilities for direct speech or data link communications required under 6.2.2.2.1 [Annex 11] and 6.2.2.2.2 [Annex 11] and not otherwise covered by 6.2.2.3.7 [Annex 11] should be provided with automatic recording. [Annex 11, 6.2.2.3.8]

9.1.1.7 Recommendation.— In all cases where automatic exchange of data between air traffic services computers is required, suitable facilities for automatic recording should be provided. [Annex 11, 6.2.3.5]

9.1.2 Manual on detailed technical specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI standards and protocols

9.1.2.1 In the Manual on detailed technical specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI standards and protocols [Doc 9880] the logging provisions for the Basic and Extended ATS Message Handling Service are defined. The AMHS management shall include logging provisions which are defined for the ATS Message User Agent, for the ATS Message Server and for the AFTN/AMHS Gateway. Pertinent extracts from this Manual are presented below for easier reference.

9.1.2.2 AMHS Traffic logging upon origination [Doc 9880 , Part II, 2.7]

9.1.2.2.1 An AMHS Management Domain shall be responsible for long-term logging of all messages in their entirety, which are originated by its direct AMHS users, for a period of at least thirty days.

9.1.2.3 Traffic logging requirements at an ATS Message User Agent [Doc 9880, Part II, 3.1.3]

9.1.2.3.1 *Note.– The requirement expressed in 9.1.2.2.1 may be implemented in the ATS Message User Agent.*

9.1.2.4 Traffic logging requirements at an ATS Message Server [Doc 9880, Part II, 3.2.3]

9.1.2.4.1 The ATS Message Server shall perform a long-term logging, for a period of at least thirty days, of the actions taken with respect to every message received at the ATS Message Server, whether from an ATS Message User Agent or from another ATS Message Server, and to every report received or generated at the ATS Message Server.

9.1.2.4.2 For the long-term logging of information related to a message submitted to or received by an ATS Message Server, the following parameters related to the message shall be logged:

a) *message-identifier*;
b) *priority*;
c) *content-type*;
d) *originator-name*;
e) *recipient-name* elements on responsibility list;
f) message-content-size;
g) last element of the *trace-information* (if any);
h) arrival-time or submission-time;
i) transfer destination (if any);
j) transfer time (if any);
k) *this-recipient-name* (if message delivery is performed by the ATS Message Server);
l) *delivery-time* (if any);
m) delivery and/or non-delivery reports generated (if any); and
n) event date/time.

Note.– The responsibility list identifies recipients whose perRecipientIndicator responsibility bit has the abstract-value "responsible".

9.1.2.4.3 For the long-term logging of information related to a report generated or received by an ATS Message Server, the following parameters related to the report shall be logged:

a) *report-identifier*;
b) *subject-identifier*;
c) *actual-recipient-name* elements;
d) *report-type* elements;
e) *report-destination-name*;
f) last element of the *trace-information* (if any);
g) *arrival-time* in the ATS Message Server or generation time;
h) transfer destination (if any);
i) transfer time (if any);
j) *OR-name* of the report recipient (if report delivery is performed by the ATS Message Server);
k) *delivery-time* (if any); and
l) event date/time.

9.1.2.5 Traffic logging requirements at an AFTN/AMHS Gateway [Doc 9880, Part II, 4.3.1]

9.1.2.5.1 The Message Transfer and Control Unit shall perform long-term logging, as specified in 9.1.2.5.2 to 9.1.2.5.5, for a period of at least thirty days, of information related to the following exchanges of information objects with the ATN Component and with the AFTN Component:

a) AMHS message transfer out (to the ATN Component);
b) AMHS report transfer out (to the ATN Component);
c) AMHS message transfer in (from the ATN Component);
d) AMHS report transfer in (from the ATN Component);
e) AFTN message conveyance out (to the AFTN Component);
f) AFTN message conveyance in (from the AFTN Component);
g) AFTN service message indicating an unknown addressee indicator conveyance in (from the AFTN Component); and
h) AFTN service message indicating an unknown addressee indicator conveyance out (to the AFTN Component).

9.1.2.5.2 For the long-term logging of information related to an AMHS Message Transfer In and AFTN message conveyance out, the following parameters, relating to the messages, shall be logged by the Message Transfer and Control Unit:

a) input *message-identifier*;
b) *IPM-identifier*, if any;
c) *common-fields* and either *receipt-fields* or *non-receipt-fields* of IPN (Inter-Personal Notification), if any;
d) action taken thereon (reject with *non-delivery-reason-code* and *non-delivery-diagnostic-code*, convert as AFTN message, convert as AFTN acknowledgement message, splitting due to number of recipients or message length, delivery report generation);
e) event date/time;
f) Origin line of converted AFTN message or service message, if any; and
g) transmission identification of AFTN message(s) or service message(s), if returned by the AFTN Component.

9.1.2.5.3 For the long-term logging of information related to AFTN message conveyance in and AMHS Message Transfer Out, the following parameters, relating to the messages, shall be logged by the Message Transfer and Control Unit:

a) Origin line of AFTN message (or AFTN acknowledgement message);
b) transmission identification of AFTN message or service message, if any;
c) action taken thereon (reject with rejection cause, convert as IPM, convert as RN, AFTN service message indicating an unknown addressee indicator generation);
d) event date/time;
e) *MTS-identifier*, if any; and
f) *IPM-identifier*, if any.

9.1.2.5.4 For the long-term logging of information related to an AMHS Message Report In and/or AFTN Service Message indicating an unknown addressee indicator conveyance out, the following parameters, relating to the report and/or service message, shall be logged by the Message Transfer and Control Unit:

a) *report-identifier* (if report in);
b) *subject-identifier* (if report in);
c) action taken thereon if report in (discard, convert into AFTN service message);
d) event date/time;
e) Origin line of converted AFTN service message (if service message out);

f) Origin line of subject AFTN message (if service message out and no report in); and
g) transmission identification of AFTN message or service message, if any.

9.1.2.5.5 For the long-term logging of information related to an AFTN Service Message indicating an unknown addressee indicator conveyance in and/or to an AMHS Message Report Out, the following parameters, relating to the service message and/or report, shall be logged by the Message Transfer and Control Unit:

a) Origin line of converted AFTN service message (if service message in);
b) Origin line of subject AFTN message (if service message in);
c) transmission identification of AFTN message or service message, if any;
d) action taken thereon if AFTN service message in (discard, convert into AMHS report);
e) *report-identifier* (if report out);
f) *subject-identifier* (if report out); and
g) event date/time

9.1.2.5.6 If, for any reason, the processing of the AMHS component cannot be properly achieved, the procedure shall unsuccessfully terminate and:

1) logging of the error situation and reporting to a control position, and

2) storage of the concerned message for appropriate action at the control position,

shall be performed.

Note.– ICAO Doc 9880, Part II [3] specifies all cases for the AFTN/AMHS Gateway in more detail.

9.1.3 Additional logging requirements for PRMD "EUROPE" and AMHS MDs adjacent to this MD

9.1.3.1 AMHS Traffic logging upon origination

9.1.3.1.1 In addition to 9.1.2.2.1 above, in the specific case of PRMD "EUROPE", the referred Doc 9880 requirement applies to each European Service or Application part of the "EUROPE" AMHS Management Domain.

9.1.3.2 Traffic logging requirements at an ATS Message Server

9.1.3.2.1 In addition to 9.1.2.4.2 above, in the specific case of PRMD "EUROPE" and of PRMDs adjacent to PRMD "EUROPE", for the long-term logging of information related to a message submitted to or received by an ATS Message Server, the following parameters related to the message shall also be logged:

a) the last element of the *internal-trace-information* (if any).

9.1.3.2.2 In addition to 9.1.2.4.3 above, in the specific case of PRMD "EUROPE" and of PRMDs adjacent to PRMD "EUROPE", for the long-term logging of information related to a report generated or received by an ATS Message Server, the following parameters related to the report shall also be logged:

a) the last element of the *internal-trace-information* (if any).

9.2 Specific requirements applying to PRMD "EUROPE"

9.2.1 Local identifier values in MTS-Identifiers

9.2.1.1 There is no base standard requirement ensuring that MTS-Identifiers generated by different MTAs managed by different organisations within PRMD "EUROPE" would be different. From a theoretical viewpoint, there is a possible risk of duplicate use of MTS-Id. An additional requirement applying only to MTAs belonging to PRMD "EUROPE" is therefore needed to remove this risk. The requirement is specified in the clause which follows.

9.2.1.2 Organisations coordinating under the aegis of ICAO-Europe to form PRMD "EUROPE" shall agree upon, and implement a technical means ensuring uniqueness of the *local-identifier* sub-part values of the *MTS-identifier* and *report-identifier* elements generated by MTAs belonging to PRMD "EUROPE".

9.2.1.3 It may be noted that one such technical means could be the insertion of the *MTA-name* as a prefix to *the local-identifier* element.

9.2.2 Trace-information and internal-trace-information

9.2.2.1 *Trace-information* is used in MHS/X.400 systems to provide information about the path followed by a message, probe or report. However, *trace-information* includes only MD-related records. In the context of PRMD "EUROPE" where MTAs are managed by independent organisations, *trace-information* is more difficult to use and may be seen as ambiguous. Additional requirements applying only to MTAs belonging to PRMD "EUROPE" are therefore needed to enable accurate identification of the source MTA and related organisation. These requirements are specified in the clause which follows. They are based on the use of *internal-trace-information* which, conversely to *trace-information*, includes the *MTA-name* and thus provides an accurate reference. The base X.400 standards allow a MTA to remove internal-trace-information before sending a message, probe or report to an adjacent MD. This has to be avoided for MTAs belonging to PRMD "EUROPE", to make sure that:

a) the accurate tracing information is maintained when exiting PRMD "EUROPE", and

b) loop detection algorithms counting the number of trace-information-elements and internal-trace-information-elements will be effective for messages exchanged within PRMD "EUROPE".

9.2.2.2 MTAs belonging to PRMD "EUROPE" shall insert *internal-trace-information*, if not yet present, in the messages, probes and reports which they transfer. If internal trace is present, these MTAs shall append an *InternalTraceInformationElement to internal-trace-information*. MTAs belonging to PRMD "EUROPE" shall be prevented from removing *internal-trace-information* from messages, probes and reports transferred to MTAs outside PRMD "EUROPE".

9.2.2.3 Due to the use of *internal-trace-information* for tracing purposes when exiting PRMD "EUROPE", it becomes necessary that this information become subject to long-term logging for all MTAs adjacent to PRMD "EUROPE", and by extension, for all ATS Message Servers.

9.2.3 Use of PerDomainBilateralInformation

9.2.3.1 *PerDomainBilateralInformation* is an optional element which may be used in MHS/X.400 systems to exchange (at P1 level) information related to a message, probe or report and intended for a given MD. There is no known example of ANSPs using this

information element in the European AMHS, however, this is not precluded by any of the applicable standards and documents. A *PerDomainBilateralInformation* information element includes the Global Domain Identifier (GDI) of the MD for which the information is intended. In the context of PRMD "EUROPE" where MTAs are managed by independent organisations, bilateral information, if used, would be between a PRMD other than "EUROPE" and an organisation part of PRMD "EUROPE". In such a case, the GDI for PRMD "EUROPE" may be seen as ambiguous to specify the intended recipient of bilateral information. Additional requirements applying to MTAs belonging to PRMD "EUROPE", and to their partners for this type of exchanges, are therefore needed to enable accurate identification of the destination MTA and related organisation. These requirements are specified in the clause which follows.

9.2.3.2 If *PerDomainBilateralInformation* is used in reception by one of the organisations coordinating under the aegis of ICAO-Europe to form PRMD "EUROPE", the sub-element *bilateral-information* shall be structured in a way such that the relevant organisation and/or its MTA can be identified unambiguously among the organisations forming PRMD "EUROPE" and/or their MTAs.

9.3 Institutional / financial issues

- to be developed -

Attachment A: Change Control Mechanism of the EUR AMHS Manual and its Appendices .

Note.– Changes, problems or defects detected concerning the Standards and Recommended Practices (SAPS) summarised in the ICAO Documentation (Doc 9880 as well as Doc 9537) are not affected by this mechanism. For these documents the change control process set up by ACP and its Working groups, by using PDR (Preliminary Defect Reports) applies.

Proposals to introduce changes to the EUR AMHS Manual and its Appendices may arise from users, implementers or manufacturers. The procedure for submission and processing of a Defect Report (DR) or a Change Proposal (CP) involves the following steps:

A.1 Procedure for DR

a) A problem is detected concerning the operation of the AMHS network, which is reflected in the EUR AMHS Manual and may be attributed to implemented AMHS procedures and/or inconsistencies in the documentation.

b) The problem is reported to the Rapporteur of the AFSG Planning Group (PG), by submission a defect report (DR). A standard reporting format is used (see attached template).

c) The Rapporteur assigns a number and priority to the defect report and introduces it to the agenda of an upcoming meeting of the PG.

d) The PG evaluates the report and either adopts it as a working item or rejects it. The party, which submitted the defect report, is notified accordingly.

e) Experts of the PG are assigned to the problem and milestone dates are set.
Outside expertise may be invited to participate, as appropriate.

f) The PG develops proposals for resolving the problem and submits them to the AFSG for approval.

g) The AFSG approves or rejects the presented proposals. In case of the latter, the subject is referred back to the PG (step e) or discarded.

h) The PG drafts appropriate text for amendment of the EUR AMHS Manual and submits it to the AFSG for approval.

i) The AFSG approves or rejects the proposed material. In case of the latter, the subject is referred back to the PG (step h).

j) The proposed amendments to the EUR AMHS Manual are presented to the EANPG for approval.

k) Solutions are implemented.

Steps (f) and (h) may run in parallel.

A.2 Procedure for CP

The same structured procedure, with the exception of steps (f) and (g) applies in case of proposed enhancements to the EUR AMHS Manual or inconsistencies in existing EUR AMHS documentation.

In this case, a change proposal (CP) should be submitted to the PG. The format of the CP is similar to that of the DR.

(If Doc 9880 documentation is concerned the change control process set up by ACP and its Working groups has to be followed (see Attachment B).)

A.3 Template for Defect Reports / Change Proposals

TEMPLATE FOR DEFECT REPORTS / CHANGE PROPOSALS

DR_____ **CP_____**

Title:	Short, indicative textual name
Reference:	Number assigned by the PG Rapporteur
Originator reference:	Provided by the originator
Submission date:	
Submitting State/Organization:	
Author:	
Contact Information:	e-mail, fax, telephone and postal address
Experts involved:	
Status:	Assigned by the PG Rapporteur
Priority:	Assigned by the PG Rapporteur
Document reference:	Affected section(s) of the EUR AMHS Manual or its Appendices
Description of defect:	Nature of the problem in detail Reason(s) for requesting changes
Assigned expert(s):	
Task history:	Working Papers and Information Papers Produced on the subject
Proposed solution:	Including amendments to the text, if feasible

DR/CP STATUS control sheet				
Event	**Date**	**Status**		**Remark**
DR or CP received submission date		Set to submitted		
discussion at PG/ ...		Set to accepted	Set to rejected	
Date for development of proposals/ solutions				Responsible:
discussion at PG/ ...		Set to resolved		
presentation to AFSG/ ...		Set to adopted	Set to rejected	
Date for development of amendment to the Manual				Responsible:
discussion at PG/		Set to approved		
presentation to AFSG/ ...		Set to approved for application		
Additional DATES and comments				

Attachment B: Amendment Procedure for the detailed Technical Specifications for Air/Ground and Ground/Ground Data Links

(updated 2008-06-12)

Published in the Report of the twelfth meeting of the Aeronautical Communications Panel (ACP), Working Group M (WG M) -(Reconstituted), Montreal, 16-19 June 2008

B.1 Introduction

B.1.1 Detailed technical specifications for air/ground and ground/ground data link systems are contained in the following ICAO documents:

ATN/OSI	Doc 9880, Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols
ATN/OSI	Doc 9705, Manual on technical provisions of the aeronautical telecommunication network (to be withdrawn)
ATN/OSI	Doc 9739, Comprehensive Aeronautical Telecommunication Network (ATN) Manual (to be withdrawn)
AMS(R)S	Doc AMSRS, Manual for Aeronautical Mobile Satellite (Route)_Service
VDL Mode 2	Doc 9776, Manual on VHF Digital Link (VDL) Mode 2
VDL Mode 3	Doc 9805, Manual on VHF Digital Link (VDL) Mode 3 (currently not being maintained)
VDL Mode 4	Doc 9816, Manual on VHF Digital Link (VDL) Mode 4
HF data link	Doc 9741, Manual on HF Data Link

B.2 Amendment Procedure

B.2.1 ACP Working Group M (WG M) will continue to maintain the material identified in section B.1.1 as indicated in the terms of reference agreed in ACP. In this task, the working group will consider proposals for amending this material as a result of ongoing validation of the detailed technical specifications and experience gained during the implementation of these systems. Amendments are necessary when a statement of information in the manuals or their supporting material, if not corrected, will prevent the system from meeting its stated operational requirements.

B.2.2 Amendment Proposals will be submitted to ACP Working Group M, preferably in the format of Table B-2. ACP Working Group M will review each amendment proposal and agree on the changes, to be made to the relevant detailed technical specifications. The amendment proposals will be distributed to the members of WG M by the secretariat through placing the information on the ACP website. This would also enable all panel members to also consider the proposals.

B.2.3 Amendment Proposals may be required when:

i. implementation hardships occur, resulting from schedule and/or costs;

ii the detailed technical specifications over-specify the actual requirements for achieving interoperability or may unnecessarily constrain implementation or further development;

iii the detailed technical specifications inadequately specify the actual requirements for achieving the intended operational capabilities;

iv ambiguities in the detailed technical specifications result in different implementations that are not interoperable;

v interoperability discrepancies are discovered.

Note.– Should a State [or a relevant international organization] identify a safety critical problem, which might e.g. necessitate grounding of aircraft, an ICAO fast track procedure should be established. Such a procedure would enable an amendment of the SARPs at very short notice (e.g. 1 - 2 months). A fast track procedure is not expected to be required for detailed technical specifications.

B.3 Maintenance procedures

B.3.1 The following maintenance procedures apply:

i interested parties submit an amendment proposal, preferably using the form in Table B-2. The proposal will address aspects relating to the backwards compatibility of the amendment proposal. The proposal will also indicate a category from Table B-1 and identify a coordinator.

ii the amendment proposals will be placed on the ACP website as soon as practicable;

iii WG M will consider amendment proposals will be submitted not later than four weeks prior to a WG M meeting;

iv the amendment proposal will be reviewed during meetings of WG M. If necessary, a special group will be formed to study detailed aspects of the proposal. If the working group cannot complete its re view, the amendment proposal will be added to the list of action items.

v the Working Group M will recommend to ICAO on the amendments necessary;

vi ICAO will publish regularly the necessary amendments to the manuals on detailed technical specifications and implementation aspects.

Table B-1 Category of an Amendment Proposal (AP)

Category	Description
Critical	The AP addresses a serious flaw in the manuals text which either: a) if implemented in an operational system could jeopardize safety in the air, and/or b) would result in non-interoperability between operational systems which have implemented the amendment proposal and those which have not.
Bug	The AP addresses bugs in the manuals, which affect SARPs, and/or operational implementations to be fully compliant with the technical provisions in the manuals.
Clarification	The AP clarifies an ambiguity or omission in the manuals. APs in this category are useful but not essential to ensure interoperability and proper functioning of the system.
Minor	The AP clarifies or improves the internal consistency of the manuals, but has no effect on implementations.
Editorial	The AP corrects one or more editorial or typographical errors in the manuals, or adds detail, which has no effect on implementations.
Registration	The AP proposes placeholders for activities other than those identified in the manuals.

Table B-2 Format of an Amendment Proposal (AP)

Title:	
AP working paper number and date:	
Document(s) affected:	Doc 9880, Manual on detailed technical specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI standards and protocols Doc AMSRS, Manual for Aeronautical Mobile Satellite (Route) Service Doc 9776, Manual on VHF Digital Link (VDL) Mode 2, Doc 9816, Manual on VHF Digital Link (VDL) Mode 4 Doc 9741, Manual on HF Data Link
Sections of Documents affected:	
Coordinator:	
Coordinators address:	
Coordinators Phone:	
Coordinators Fax:	
Coordinators e-mail address:	
Category:	CRITICAL | BUG | CLARIFICATION | MINOR | EDITORIAL | REGISTRATION
Problem description:	
Background:	
Backwards compatibility:	
Amendment Proposal:	
WG-M status:	PROPOSED | APPROVED | PENDING | REJECTED

-END-

EUR Doc 021

ATS Messaging Management Manual

ATS Messaging Management Manual	
Document Reference:	ATS Messaging Management Manual
Author:	EUROCONTROL, AFSG Operations Group
Revision Number:	Version 10.0
Date:	10/04/14
Filename:	ATS Messaging_Management_Manual_v10_0.doc

Document Control Log

Edition	Date	Comments	section/pages affected
0.1	Feb 22nd, 2005	Integration of document from DEL1 and DEL2	all
0.2	March, 21st, 2005	Inclusion of comments by AFSG OG-07-03 and AFSG PG-19 meetings Proposed issue for submission to AFSG/8	all chapters
0.3	March, 24th, 2005	Minor editorial enhancements of Executive Summary and of section 2.2.7.8 (para 2) Reformatting of figures 2 and 3 Update of table of abbreviations (AMC, SADIS) Proposed issue for submission to AFSG/8	1, 2 26, 26, 48, 117, 91
1.0	May, 2nd, 2005	Approval of edition 0.3 in the absence of comments at AFSG/8	
1.1	Feb 17th, 2006	Refinement of user categories and integration of access rights (Appendix B), Re-ordering of the AMF-I function list, Alignment of the AMF-O function specification on the final AMC implementation specification, Minor modification of Statistics Update procedure, insertion of the detailed specification of statistics (Appendix C), Add procedure for the introduction of a COM Centre in the AMHS network, General editorial update to remove the notion that the AMC is a system to be implemented in the future	15-22, 114-121 26, 29-39 47, 62, 63, 65, 67, 68 92-93, 119-130 95-113 all chapters
1.2	March, 31st, 2006	Integration of editorial comments by AFSG OG-08-03 and AFSG PG-23 meetings	
2.0	May, 4th, 2006	Approval of edition 1.2 (in the absence of comments) at AFSG/9 for publication as edition 2.0.	
2.1	March, 8th, 2007	Major editorial update consisting in the merging of material from CIDIN Management Manual to form a stand-alone manual and remove the notion of "companion documents". The main impacts are on: • Introduction, • Overall framework, • AMHS Operational functions where the description of AFTN/CIDIN functions is	 3-4 6-28 47-71

Edition	Date	Comments	section/pages affected
		integrated within the description of AMF-O functions. Minor update of Appendix A to re-align on recent testing philosophy as reflected in EUR AMHS Manual. Editorial and limited technical update of Appendix C to reflect AFSG PG findings about statistical indicators.	105 125-131
2.2	April, 10th, 2007	Editorial: in section 4.2.4, insertion of the missing word "identifying", section A.3.2.5: Deletion of the word "parallel" from the traffic description, to read "duplicated operational traffic", as a follow-up to the discussion in PG-27	65 116
3.0	May, 10th, 2007	Approval of changes shown in edition 2.2 (in the absence of comments) at AFSG/10 for publication as edition 3.0. Addition of COM Centre Operators as Read-only users as per AFSG10/WP13 Formatting as ICAO Manual Integration of Attachment A regarding document change management procedure	All 20, 23 All
3.1	16/07/2007	Reformatting and structuring in line with the EUR AMHS Manual (ICAO EUR Doc 020) e.g. placing of sections and attachments, paragraph numbering (CP-AMMM-07-001)	All
3.2	19/03/2008	Incorporation of CP-AMMM-07-002 and CP-AMMM-08-001	B.2.1, B.2.2, 4.2.7
4.0	24/04/2008	Adopted version (AFSG/11)	
4.1	09/02/2009	Inclusion of sections regarding the specification of COM Charts, Path Function, Regions and Transfer Data between areas. Alignment on status of AMC application including Phase 2 functions and enhancements. Taking into account modified procedures with ICAO for address management. Alignment of AMF-I functions with terminology. Inclusion of modified “COM Charts publication” procedure, transferred from ENRD Part I Editorial improvements	4.3.11 to 4.3.14, 4.4.1.9, B2.2 5.1.8

Edition	Date	Comments	section/pages affected
4.2	16/03/2009	Inclusion of comments subsequent to the OG-11-03 meeting: Alignment of groups of functions on the way they are implemented in AMC application, including merging of network planning with network inventory; expanded description of miscellaneous functions.	Appendix D Chapter 4
4.3	20/03/2009	Incorporation of editorial comments for presentation at AFSG/12.	all
5.0	22/05/2009	Adopted version (AFSG/12)	
5.1	22/03/2010	Incorporation of CP-AMMM-09-002 and CP-AMMM-09-003	5.1.4.1., Appendices D, E and F
6.0	17/06/2010	Adopted version (AFSG/14)	
6.1_1	21/10/2010	Incorporation of DR-AMMM-10-001, CP-AMMM-10-001	5.1.1.5, 5.1.3, 5.1.4.2, 5.1.5
6.2	26/11/2010	Removal of ICAO Doc 9739 (CAMAL) from Reference list due to lack of maintenance by ICAO	References
6.3	24/03/2011	Incorporation of DR-AMMM-10-002, CP-AMMM-10-002	D.1.1.2, 4.3.5.2, 5.1.5, D.3.1, D.3.2
7.0	14/04/2011	Adopted version (AFSG/15)	
7.1	19/03/2012	Incorporation of CP-AMMM-11-001	2.4.3, 5.1.5
8.0	26/04/2012	Adopted version (AFSG/16)	
8.1	28/03/2013	Incorporation of CP-AMMM-12-001	5.1.1.5, 1. Data Entry Phase
9.0	25/04/2013	Adopted version (AFSG/17)	
9.1	13/03/2014	Incorporation of CP-AMMM-13-001 Incorporation of CP-AMMM-13-002 Incorporation of CP-AMMM-14-001	4.3.6, 4.2.4.4 ff. D.5 A.3.3.1, A.3.3.4
10.0	10/04/2014	Adopted version (AFSG/18)	

EXECUTIVE SUMMARY

This document is the ATS Messaging Management Manual. In this document, ATS Messaging refers to the integrated, heterogeneous messaging environment made of AFTN, CIDIN and AMHS.

This document is an outcome of the task resulting from the EANPG conclusion 45/10, which stated the following:

> *"CONCLUSION 45/10 – ATSMHS NETWORK MANAGEMENT*
>
> *That EUROCONTROL be invited to consider extending the Common ICAO Data Interchange Network (CIDIN) Management Service (CMC) to provide ATS Message Handling Service (ATSMHS) off-line network management."*

It describes the framework in which the services of the ATS Messaging Management Centre (AMC) are provided to States/ANSPs in the EUR/NAT Regions, and, in a more limited manner, to States/ANSPs in other Regions, under control by the AFSG. This framework is largely based on the earlier CIDIN Management framework and organisation.

Two categories of Off-Line Management Functions are defined, Implementation Support Functions primarily for States in the process of implementing AMHS, and Operational Functions in support of States with AFTN, CIDIN and/or AMHS in operational service, as follows:

Implementation Support Functions:

- AMHS MD contacts
- Implementation planning
- Inter-working test support
- Monitoring of AMHS documentation maintenance
- Helpdesk functions
- View operational data

Operational Functions:

- Network inventory
- Routing management
- Address management
- AMHS User Capabilities management
- Statistics

- Support functions
- Miscellaneous functions
- Security management (for future development)

The AMC procedures associated with the performance of the functions by Co-operating COM Centres (CCCs) are described in the document.

The goal of the AMC in which the described functions are implemented is twofold:

1. the AMC facilitates the transition from CIDIN/AFTN to AMHS, particularly with its routing management function;
2. the AMC provides new tools in support of AMHS operation, address management and AMHS User Capabilities management, that will serve during transition and in the target AMHS network.

When States in the EUR/NAT Regions implement AMHS, transition is complex to manage and ill-coordinated actions create a risk for the overall ATS Messaging quality of service. It is therefore recommended that every State implementing AMHS in the EUR/NAT Regions should participate in AMC activities.

Furthermore, as address management is critical to the successful operation of ATS Messaging, every State implementing AMHS in the EUR Region must participate in the address management function of the AMC.

Table of contents

References

[1] CIDIN Management Manual, 5th Edition, September 2006

[2] SPACE Final Report, Version 1.0, dated December 2002, referenced SPACE/STNA/411/WPR/224

[3] CIDIN CMC User Manual, Version 2.4, dated March 2004

[4] CIDIN CCC User Manual, Version 2.4, dated March 2004

[5] ICAO Document 9880, AN/466 – Manual on Detailed Technical Specifications for the Aeronautical Telecommunications Network (ATN) using ISO/OSI Standards and Protocols, Part II – Ground-Ground Applications – Air Traffic Services Message Handling Services (ATSMHS), First Edition – 2010

[6] ICAO EUR Doc 020, EUR AMHS Manual, latest Version

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1 Introduction

1.1 Scope of the document

1.1.1 This document is the ATS Messaging (AFTN/CIDIN/AMHS) Management Manual. It is intended to give the reader all additional information necessary for an understanding of the integrated AFTN/CIDIN/AMHS Off-line Management as currently implemented including some information on future planning. It has been written for those performing management operations as well as those implementing and planning the procurement of ATS Messaging systems, including management platforms for such systems.

1.1.2 In the context of this Manual, ATS Messaging Management refers to the "ATS Messaging part" of the AFS[1], i.e. the integrated messaging environment made of AFTN, CIDIN and AMHS interconnected between themselves. Other AFS components, e.g. ATS speech communications or inter-centre communications (ICC), are considered out of the current scope of ATS Messaging Management.

1.1.3 This integrated management is a combination of the CIDIN and AFTN Off-line Management previously implemented in the CIDIN Management Centre (CMC), and of AMHS Off-line Management Functions which justified the extension to the AMC concept.

1.1.4 It is assumed that the reader is familiar with the AFTN, CIDIN and AMHS concepts as described in the relevant ICAO Manuals. A list of these is provided in the "References" section. Familiarity with AFTN/CIDIN and AMHS operational requirements, as well as with CIDIN network operation would also be useful.

1.2 Goal of the document

1.2.1 The goal of this document is to be a self-contained description of ATS Messaging Management, describing and specifying:

- AMHS Off-line Management Functions - Implementation support (AMF-I), and
- AMHS/ CIDIN/ AFTN Off-line Management Functions - Operations (AMF-O),

that are implemented in the ATS Messaging Management Centre (AMC).

1.2.2 The main purpose of AMF-I functions is to provide support to States that are in the process of implementing AMHS, and do not yet have AMHS in operational use. However, they may also be used by States that have already started operational use of AMHS, e.g. to plan future evolution of their AMHS systems.

1.2.3 On the other hand, AMF-O functions provide an essential tool to States that have AFTN and/or CIDIN and/or AMHS in operational use, in order to help managing the Regional ATS Messaging network, particularly during its transition from AFTN/CIDIN to AMHS.

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[1] SADIS (Satellite Distribution System for Information relating to Air Navigation), On-Line Data Interchange (OLDI) and ICC (Inter-Centre Communications) / AIDC (ATS Inter-Facility Data Communication), although sometimes considered as "message-oriented", are not transferred using the AFTN / CIDIN / AMHS messaging networks. They are not in the scope of ATS Messaging Management as defined in this document.

1.2.4 These functions will be operated by the AMC Operator and they will be used by various categories of users in ANSPs co-operating in ATS Messaging Management (both inside the EUR/NAT Regions and outside this area).

1.2.5 Prior to the specification of the functions, the overall framework for ATS Messaging Management is defined. This framework is largely based on the CIDIN Management framework and organisation as described in Chapter 3 of the CIDIN Management Manual. The reason is twofold:

- from an institutional and administrative viewpoint, the provision of AMHS Off-line Management is performed as an expansion to the CMC functions, as decided by the EANPG/45 meeting. After agreeing that "...EUROCONTROL be invited to consider expanding the CMC functions to provide an ATSMHS centralised off-line management service. This service should be available from the start of the deployment of ATSMHS in Europe and should function in the same administrative framework as the CIDIN management service.", this meeting made the following formal conclusion:

  "CONCLUSION 45/10 – ATSMHS NETWORK MANAGEMENT

  That EUROCONTROL be invited to consider extending the Common ICAO Data Interchange Network (CIDIN) Management Service (CMC) to provide ATS Message Handling Service (ATSMHS) off-line network management."

- from a technical and operational perspective, the AMHS implementation is defined as the way to replace the CIDIN and AFTN, which are now hit by obsolescence, with more modern technology. One of the main initial goals of AMHS Management is to facilitate transition from CIDIN/AFTN to AMHS. It is therefore logical that the concepts developed for CIDIN Management be adapted to also encompass AMHS and provide an integrated management service.

1.3 Structure of the document

1.3.1 Apart from the present introduction, this document comprises the following Chapters:

- Overall framework for ATS Messaging Management, which defines the concepts, terms and organisation that are used for the definition of ATS Messaging Off-Line Management Functions;

- AMHS Implementation Support Functions, which provides the identification of requirements, and a specification of AMF-I functions and associated procedures;

- AFTN / CIDIN / AMHS Operational Functions, which provides the identification of requirements, and a specification of AMF-O functions and associated procedures.

2 Overall framework for ATS Messaging Management

2.1 Why ATS Messaging Management has been developed

2.1.1 History

2.1.1.1 ATS Messaging Management was developed in two main phases:

- The CIDIN Management Centre (CMC) was first implemented to manage CIDIN and, to a lower extent, AFTN. Its operational service started at the end of 2001.

- When the AMHS implementation started in Europe, the need to expand the CMC functions to also cover AMHS was recognised and endorsed by the EANPG. Therefore from 2004 to 2006, the integrated ATS Messaging Management concept and the associated Management Centre were designed, encompassing AMHS, CIDIN and AFTN management. The ATS Messaging Management Centre (AMC) started its operational service at the beginning of 2007.

2.1.1.2 The framework for ATS Messaging Management reflects this phased implementation, which took place in parallel with the evolution of networking technologies in the ATS Messaging network in Europe.

2.1.2 The Co-operation base

2.1.2.1 The need for the initial introduction of network management into CIDIN arises, at least partly, from the way CIDIN is traditionally operated. Following ICAO principles (derived from the operation of the AFTN), each State is responsible for the operation of its own COM Centre as dictated by ICAO SARPs and Technical Provisions, and in accordance with all resolutions for the Region. Any addressable unit (CIDIN exit centre) within the State must also comply with the SARPs and be reachable via the COM Centre. The same principles apply with the AMHS.

2.1.2.2 This operational philosophy is based on a high level of co-operation among States: this is one of the important characteristics of the AFTN/CIDIN/AMHS and an aspect which probably makes it unique in data networks.

2.1.2.3 However this arrangement is not without its difficulties: any one State has a number of immediate neighbours with which it needs to co-ordinate intensively, but, in principle, it may need to co-ordinate also with any other State in the Region. This means that in a Region made up of n States, there will be a maximum of n(n-1)/2 possible co-ordination relationships. The situation becomes even more complicated when relationships with neighbouring Centres in other Regions are considered.

2.1.3 The former management situation

2.1.3.1 Considering the origins of CIDIN in the AFTN, long before the AMHS was developed, it is not surprising that techniques used for managing CIDIN have been adopted from the AFTN. Some features of these are:

- each Centre is operated independently with its own operations staff; there were formerly no formal network management procedures in operation except for the automatic procedures (such as selection of outgoing PVCs) contained in the CIDIN protocols;

- day-to-day operations were based solely on bilateral co-ordination between pairs of neighbouring States;

- network planning was performed by pairs or groups of the States concerned and subject to approval by ICAO Meetings (see next point);

- official network planning was performed in ICAO Regions, with a cycle time of the order of several months or one year;

- matters affecting more than one ICAO Region were co-ordinated between pairs or groups of States concerned; occasionally supra-regional planning meetings were held.

2.1.3.2 These points emphasise the co-operative nature of all planning and operational aspects of CIDIN: except for various administrative activities performed by ICAO, there was formerly no centralised co-ordinating, operating or management body for the network working on a daily basis.

2.1.4 The Need

2.1.4.1 The need for increased operational effectiveness in CIDIN was demonstrated by the following trends:

- increasing number of Centres co-operating in the EUR Region,

- increasing volumes of traffic and new applications,

- increasing cost-consciousness in the administrations operating COM Centres.

2.1.4.2 These trends indicated that the network management techniques taken over from the conventional AFTN were no longer sufficient for CIDIN.

2.1.4.3 When compared with the conventional AFTN, CIDIN has a higher inherent network resilience due, amongst other things, to the following features:

- a procedure which allows any entry centre to ascertain whether a given exit centre is operational (exit address reachable) or not;

- the possibility of access to the AFTN from CIDIN via an alternate exit address in case the primary exit address is not reachable;

- the use of alternate outgoing PVCs in relay centres for relaying CIDIN packets on alternate routes if primary outgoing PVCs are not operational.

2.1.4.4 Considering the network trends described above, a need was apparent for network management functions to be implemented which operated in a time period longer than those listed above, but more frequently than the existing manual procedures.

2.1.4.5 This operational philosophy is based on a high-level of co-operation among States, which are each responsible for the operation of their own COM Centres as dictated by ICAO SARPs and Technical Specifications and in accordance with Regional resolutions. The basic principle of equal status among all States operating COM Centres is also recalled.

2.1.4.6 Overall, this co-operation principle is not be altered by the introduction of AMHS in conjunction with AFTN and CIDIN, and as a progressive replacement for these technologies. Various options for the institutional framework of AMHS implementation and operation in

Europe were examined by the SPACE project. The outcome of this study was SPACE Recommendation 1, which states that *"There is a consensus to recommend the rapid implementation of the AMHS in a co-operative framework, with each ATSO operating as a national AMHS Management Domain, to ease the transition from the existing and obsoleting AFTN/CIDIN to the new AMHS technology". (ref. [2])*

2.1.4.7 The introduction of CIDIN in Europe provided a higher resilient network than AFTN, but also introduced the need for new network management techniques, combining the centralisation of certain management functions with the traditional distributed day-to-day operation of the ATS Messaging network.

2.1.4.8 The reasons for introducing centralised off-line CIDIN management are in general applicable to AMHS, apart from those directly related to CIDIN-protocol specifics. The latter are also required in a combined AFTN/CIDIN and AMHS environment to smoothen transition.

2.1.4.9 Furthermore, whilst CIDIN was principally aimed at providing messaging network robustness and some increase in capacity, the introduction of AMHS brings both a solution to the AFTN/CIDIN obsolescence issue and a major expansion capability. This AMHS expansion capability encompasses several aspects such as a major potential capacity increase, as well as flexibility and openness for new types of traffic flows and of users.

2.1.4.10 This increased capacity, flexibility and functionality of AMHS is not without consequences on management, in the sense that it also introduces new requirements in terms of network management. A simple example is address management: the ability to introduce more flexibility in the user addressing scheme, that is made possible by the AMHS CAAS Addressing Scheme is balanced by the need to publish such flexible user addresses, by means of a more dynamic and frequent mechanism than the currently used ICAO documents (e.g. Doc 7910).

2.1.4.11 In summary, the rationale for introducing centralised AMHS Off-Line Management as an AMHS Common Facility for European States is very similar the reasons that led to the definition of CIDIN Management.

2.1.5 The Centralisation of ATS Messaging Management

2.1.5.1 The Status of COM Centres

2.1.5.1.1 Because of the basic principle of equal status among all States operating COM Centres, no provision had previously been made for unique or special functions, including network management, to be performed at a specific place in the network: any function which is performed at one Centre could or should be performed at all Centres. This means that the former situation did not contain or even allow the presence of a non-distributed, i.e. centralised network management functions.

2.1.5.1.2 It must, however, be recognised that one of the reasons for the stability and robustness of the AFTN/CIDIN/AMHS is the very distribution of operational responsibility. Any introduction of non-distributed functions had to consider carefully the possibility of keeping distributed operational functions for stability reasons.

2.1.5.2 Arguments for Introducing Centralised Functions

2.1.5.2.1 Some of the arguments which supported this approach are the following:

- Network management operations use a database describing the current configuration, alarms etc. Different management functions need to share this one common database which must be accurate for the whole network at all times. It need not be implemented centrally and at one location but it must be seen, at least logically, as one "central", monolithic set of data.

- Network management operations can only give network-wide, optimal results when it is in a position to "view" and "have control" of the whole network. This means that the data available to it must relate to the whole network and any other controlling instance must be tightly coupled with it.

- The communication paths between elements in the network and a Management Centre (star configuration) are far simpler to operate than a situation in which there is a set of many-to-many relationships. This is also true for communication relationships with other management domains (e.g. Regions).

- Specialised network management experience and equipment resources can be better utilised if they are located at one or at a few central sites. Also the growth of knowledge and experience is better because one central team remains aware of all network problems and their solutions.

- Management responsibility and the associated tasks are easier to define and monitor if they are centralised. The procedures involving operations personnel at different sites are easier to implement and are more robust if there is a management component in the network responsible for overall co-ordination.

2.1.5.2.2 The CIDIN management concept was therefore based, at least partly, on a centralised approach. This was a departure from the former situation in which each Centre in principle carried out the same functions.

2.1.5.2.3 Similar arguments also favour the centralisation of support functions. Because of

- the increasing numbers of CIDIN Centres becoming part of the network,

- the wealth of experience in implementing the network which is continually being built up and

- the need for new network participants to be able to take advantage of this experience,

a centralisation of support functions also appeared desirable.

2.1.5.3 The impact of AMHS introduction

2.1.5.3.1 The basic principle of equal status among all States operating COM Centres is obviously maintained in an integrated AFTN/CIDIN/AMHS environment. However, a certain degree of centralisation is also introduced in AMHS through the concept of "Common Facility" defined by the SPACE project.

2.1.5.3.2 SPACE considered that in addition to the individual State's task to implement and operate a national AMHS system, the overall AMHS transition plan in Europe also includes "*implementation tasks for Common Facilities, that are explicitly dependent on collective efforts of States, and which benefit the overall community of co-ordinating States or ATSOs in the considered [geographical] area"*. (ref. [2], Executive Summary section 6).

2.1.5.3.3 Although an AMHS Common Facility is not necessarily centralised, among the nine Common Facilities defined by SPACE (ref. [2], Executive Summary section 6), many of them should be by nature centralised. The AMHS Off-line Management Centre is one of these, and several other facilities might be included or are, as a minimum, related to AMHS Management:

1. the afore-mentioned AMHS Off-line Management Centre,
2. Directory Services,
3. Regional Helpdesk,
4. Regional XMIB (Cross-Domain Management Information Base) Service,
5. Testing and Training Facility.

2.1.5.3.4 Items 1 and 3 above are considered as directly in the scope of AMHS Off-Line Management Functions, and consequently in the scope of the ATS Messaging Management as currently defined. Items 2 and 4 are definitely in the scope of AMHS Management, but more “on-line” related. The Testing and Training Facility, although related to AMHS Management, is not in the scope of the present activity.

2.1.5.3.5 In summary, the centralisation of management functions which was introduced by CIDIN Management is reinforced with the introduction of AMHS Management.

2.2 The ATS Messaging Management Centre

2.2.1 In the situation described in section 2.1.3, Management operations have been organised by the AFSG Operations Group, OG, mainly using manual techniques. The centralised point of co-ordination was the “focal point”. With the introduction of more automatism and system support, the need for centralising has increased.

2.2.2 The entity where unique management functions are carried out is called the "ATS Messaging Management Centre", AMC. It is made up of two components:

- the ATS Messaging Management operating position, manned by the “AMC Operator” and
- systems for maintaining the central repository of network information, for performing automatic functions and for communication. They are called "AMC Systems" and they are under the responsibility of EUROCONTROL.

2.2.3 When implementing certain management functions at a single site (or a small number of sites), the risk associated with centralisation (value of the data stored, importance of system availability, high reachability by users) had to be addressed.

2.3 Methodology for the definition of requirements

2.3.1 Off-line and On-line Management

2.3.1.1 A basic principle underlying the structure of ATS Messaging management is the distinction between the two groups of functions designated as "off-line" and "on-line" management functions. On-line management refers to functions that shall be executed in a

short time period in order to maintain the level of service required from AMHS/CIDIN/AFTN. This necessitates the rapid exchange of management information between COM Centres and the ATS Messaging Management Centre.

2.3.1.2 Off-line functions do not need to be executed in a short time period. These relate to medium and long-term requirements and include, e.g., collection and processing of information from COM Centres (statistics, inventory, etc.) and preparation of configuration proposals (capacity and routing). Provision of technical support (certification, consultancy, etc.) is also included in off-line management.

2.3.1.3 The terms “off-line” and “on-line” are used to classify two separate groups of functions The following table summarises the distinction with respect to a number of characteristics.

characteristic	**off-line**	**on-line**
computer-to-computer connections between ATS Messaging Management Centre and COM Centres?	not applicable	essential
human intervention in the “management loop” between management centre and COM Centres?	yes	in transition phase and in exceptional circumstances
new application software to be implemented in COM Centres?	not essential	essential
operational time constraint	no time-critical functions	some time-critical functions
degree of technical sophistication	relatively simple	more complex
period of operation	office hours	7 days / 24 hours
order of implementation	to be implemented first	implementation only after off-line functions have been in operation

Table 1: Characteristics “off-line” and “on-line”

2.3.1.4 The current implementation of ATS Messaging Management includes only off-line management functions. On-line functions may be designed and implemented in the future.

2.3.2 Requirements Definition

2.3.2.1 The design and implementation of CIDIN Management, in the first instance, and then of the integrated ATS Messaging Management has been and will continue to be "driven" by an analysis of network management requirements. The requirements definition contained in this document has been derived from:

- Version 1.0 of the CIDIN Management Manual, for which information had been collected via a questionnaire,

- investigations of further developments in CIDIN Management after that initial document was published, which were documented in subsequent versions of the CIDIN Management Manual,

- investigation of how Management requirements evolve when AMHS is introduced in the network,

- considerations made during the CMC operation, and

- considerations made during AMC implementation.

2.3.2.2 The method for defining requirements has consisted of the following steps:

- creation of an initial set of five functional groups which should cover all activities in the context of CIDIN Off-line Management, addressing operational support. This was expanded upon introduction of AMHS Management,

- as part of this expansion process, creation of an additional set of functions dedicated to AMHS implementation support,

- at each of these stages, survey of all network management activities and their assignment to the functional groups based on their commonality and use of the same data and

- high-level description of the functions within each group.

2.3.3 Relation to OSI Systems Management

2.3.3.1 OSI Systems Management classifies network management and administration functions in the following functional areas:

- configuration management

- fault management

- performance management

- security management

- accounting management

2.3.3.2 Currently only the first four of these are considered relevant to ATS Messaging. In ATS Messaging management as defined in this document, the emphasis is placed on configuration management, other areas being addressed to a lesser extent only.

2.3.4 Functional groups

2.3.4.1 Five functional groups gathering off-line management operational functions were initially defined as part of CIDIN Management:

- network inventory,

- network planning,

- routing management,

- statistics,
- support functions.

2.3.4.2 With the advent of AMHS Management, network planning was merged with network inventory, and the functional groups were complemented with:

- address management,
- AMHS User Capabilities management,
- miscellaneous functions
- security management (not implemented yet).

2.3.4.3 Another high level group of functions was introduced as part of AMHS Management, to serve the specific purpose of providing support to AMHS implementation support activities. This set of functions was not structured using functional groups, and as a whole it is named "AMHS Management Functions - Implementation Support" (AMF-I).

2.3.5 AMC Operator functions

2.3.5.1 The functional groups listed above are those needed and accessible by the majority of users of the AMC. In addition to these functions, a set of restricted functions has also been defined to manage the overall operation of the AMC. These functions are named “AMC Operator functions”, in general they are not described in this document.

2.4 Structure of the ATS Messaging network in the AMC

2.4.1 The Management Area

2.4.1.1 The geographical area within which the ATS Messaging Management Centre services are offered is primarily focused on the ICAO EUR/NAT Regions. Additionally, the use of some functions is possible by States / COM Centres in other ICAO Regions.

2.4.1.2 Other ICAO Regions should consider providing a similar AMC function to support AMHS deployment within their Region.

2.4.1.3 In the AMC, the ATS Messaging network is represented as a set of Management Domains, each of them comprising one or several COM Centres. The notion of Management Domain is identical to the notion of AMHS Management Domain defined in the ICAO Manual on Detailed Technical Specifications for the ATN (ref. [5]). This representation is used for the high-level structure of management information in the AMC.

2.4.1.4 The global ATS Messaging network is represented in the AMC, with a different level of details depending on whether or not the COM Centre / AMHS MD belongs to the Management Area.

2.4.2 COM Centres

2.4.2.1 The COM Centres in the EUR/NAT Regions which participate in ATS Messaging management activities are called "Co-operating COM Centres", CCC. The descriptor "Co-operating" is a necessary part of this term because some Centres within the geographical area may choose not to participate in the management procedures defined here. The Management

Area is defined to be the complete set of CCCs (and the links between them). Within the management area, it is essential that all Centres “co-operate” for the purposes of ATS Messaging Management, i.e. adhere to the specifications contained in this document.

2.4.2.2 The COM Centres out of the EUR/NAT Regions which participate in ATS Messaging management activities by using the functions allowed to them are called "External COM Centres".

2.4.2.3 From a technical viewpoint, three categories of COM Centres are considered in ATS Messaging Management:

1. a CIDIN (and AFTN) COM Centre, is a well-known notion which will not be further detailed. The only point worth being emphasized here is that all CIDIN and AFTN-addressable units within the State must be reachable via the COM Centre;

2. an AFTN (only) COM Centre is a conventional AFTN Centre without CIDIN capability. The number of such Centres is already low and further decreasing within the considered geographical area. However, outside the geographical area and at its boundary, many COM Centres are within this category. Again, all AFTN-addressable units within the State must be reachable via the COM Centre;

3. an AMHS COM Centre is a COM Centre in which AMHS is in operational use. The ATS Message Server included in the COM Centre is the "International ATS Message Server", which forms the boundary between national and international AMHS communications, as defined in SPACE (ref. [2] section 1.6). During the first stages of transition from CIDIN/AFTN to AMHS, AMHS COM Centres will in most cases maintain CIDIN and AFTN functionality, until all adjacent States have migrated to AMHS. For this reason, as far as ATS Messaging Management is concerned, an AMHS COM Centre will generally designate a COM Centre that simultaneously supports AMHS, CIDIN and AFTN, but not necessarily with the same communication partners.

2.4.2.4 It may be recalled at this stage that two sets of functions have been defined as part of AMHS Management, corresponding to two slightly distinct targets in terms of users:

- COM Centres in categories 1 and 2 above, starting or having started the implementation of AMHS, without being yet in an operational phase, are provided with "AMHS Off-line management implementation support functions". The main goal of these functions is to provide information regarding common implementation issues;

- COM Centres in category 3 above having started the operation of AMHS are provided with "AMHS Off-line management operational functions". The goal of these functions is to provide off-line support to the operation of AMHS COM Centres.

2.4.2.5 For easier referencing, these two sets of functions are abbreviated with the terms "AMF-I" (AMHS Off-line Management Functions - Implementation Support) and "AMF-O" (AMHS Off-line Management Functions - Operational). AMF-O functions also address CIDIN and AFTN Management.

2.4.3 AMHS Management Domains

2.4.3.1 In the AMHS environment, an AMHS Management Domain represents the whole set of AMHS systems and resources operated by a single organisation. Typically, an AMHS Management Domain corresponds to an ATS Message Server (“AMHS switch”), an

AFTN/AMHS Gateway (generally co-located with the CIDIN COM Centre), and the ATS Message User Agents that are implemented as interfaces to AMHS direct users.

2.4.3.2 SPACE recommended *"the rapid implementation of the AMHS in a co-operative framework, with each ATSO operating as a national AMHS Management Domain"* (ref. [2], Executive Summary, section 5).

2.4.3.3 The general model for ATS Messaging Management is that of one Management Domain for each State in the Management area, in which the COM Centre includes an ATS Message Server. There can be one or several COM Centres in each AMHS Management Domain, and in the vast majority of cases there is one single COM Centre.

2.4.3.4 However SPACE did also foresee that in some cases, a small number of States might group together, based on bilateral or multilateral discussions, to form a single Management Domain.

2.4.3.5 At present, all identified AMHS Management Domains are Private Management Domains (PRMDs) operating under the ICAO Administrative Management Domain (ADMD). The ATS Messaging Management framework could also be applicable in an ATS Messaging environment made of a combination of ADMDs and PRMDs, as long as no hierarchical difference is made between these domains, but this does not appear to be a likely scenario for future AMHS deployment.

2.4.3.6 An exception is the Private Management Domain 'Europe' (PRMD=EUROPE) which has been assigned to unify the AMHS addressing for European Services and Applications. The respective EU Location Indicators are published in ICAO Doc 7910, Section: EU – Europe (ICAORD). The AMC Operator is responsible for the maintenance of the tables related to the assigned and published EU Location Indicators (AFTN/CIDIN/AMHS Routing and Address Management).

2.5 AMC Participants

Two major groups of AMC participants are defined in ATS Messaging Management:

- the AMC Operator is a logical view of a group of individuals manning the AMC operating position. More generally, the term "AMC Operator" may be used for the organisation to which these individuals belong. Such an organisation may be a COM Centre, but this is not a mandatory requirement. The AMC Operator is responsible for overall operation of the AMC and of associated procedures;

- AMC users, which gather all the other groups of people accessing the AMC. The term "user" is general in nature and it is adopted to identify a person accessing the AMC without being necessarily bound by strict procedures. Conversely, the term Operators, as in "CCC Operators" defined in the section below, is used for people who deal with day-to-day operation and follow strictly the AMC procedures. The term "Operators" is reserved for such users in the documentation regarding the AMC. In general these users belong to a population composed of:

    - personnel from COM Centres in the considered geographical area, i.e. either CCCs or External COM Centres;

    - ANSP personnel implementing AMHS. They generally have a close relationship with COM Centre staff.

2.5.1 Participants

2.5.1.1 AMF-I Users

2.5.1.1.1 The term "AMF-I User" is reserved for AMC users specifically involved in AMHS Off-Line Management – Implementation Support functions, on behalf of the AMHS Management Domain and/or COM Centre implemented by their State/Organisation.

2.5.1.1.2 In a given State/Organisation within the Management Area, the access to the AMC is not limited to CCC Operators, in particular for AMF-I functions. Users of AMF-I could be for example AMHS project managers and/or implementation engineers, with no direct role in systems operation. However, it is assumed that only personnel from States/ANSPs, EUROCONTROL and ICAO Officers are allowed to use the services of the ATS Messaging Management Centre[2].

2.5.1.1.3 For the sake of AMHS Management functions, it is necessary to "associate" AMF-I Users with AMHS Management Domains. The associated Management Domain is the AMHS MD implemented (or going to be implemented) by the State/ANSP or Organisation to which the AMF-I User belongs. In a parallel way to the operation of the AMC (where two CCC Operators (one + back-up) are defined for each COM Centre, see section below), it is proposed that two AMF-I Users be associated with each COM Centre and/or with each AMHS Management Domain.

2.5.1.2 CCC Operators

2.5.1.2.1 The person representing a Cooperating COM Centre (a CCC) for purposes of ATS Messaging Management is the CCC Operator. From an administrative viewpoint the notion of CCC Operator is identical to the CCC to which this person belongs.

2.5.1.2.2 Since AMHS is going to be implemented in connection with existing CIDIN/AFTN Centres, a small number of assumptions/principles is proposed to classify the different categories of ATS Messaging Management users/participants:

- CCC Operators have their primary interest in AMF-O functions, even if AMHS is not yet in operation in their COM Centre;
- CCC Operators always have access to AMF-I functions;
- an AFTN (only) COM Centre being entitled to be a CCC, it can also participate in AMHS Management provided that it obtains or has already obtained the status of CCC. It is not distinguished from a (CIDIN and/or AMHS) CCC for the analysis of ATS Messaging Management user categories.

2.5.1.2.3 **CCC Operators are the main AMC user category for Operational functions.**

2.5.1.2.4 The term CCC Operator equally applies to CCCs which have or have not yet implemented AMHS. It is also independent of the implementation of CIDIN or only of AFTN, combined or not with AMHS.

2.5.1.2.5 When States in the EUR/NAT Regions implement AMHS, transition is complex to manage and ill-coordinated actions create the risk of numerous message non-deliveries. The

[2] This precludes, for example, staff from industrial companies from being AMC users.

following recommendation is therefore made: **Every State implementing AMHS in the EUR/NAT Regions should participate in AMC activities.**

2.5.1.2.6 **Furthermore, as address management is critical to the successful operation of ATS Messaging, every State implementing AMHS in the EUR Region must participate in the address management function of the AMC.**

2.5.1.2.7 There should consequently be one CCC Operator + his/her backup for each ANSP (or State) in the EUR/NAT Regions operating AMHS.

2.5.1.3 External COM Centres

2.5.1.3.1 In the context of the integrated ATS Messaging Management Centre, External COM Centres are COM Centres external to the EUR/NAT Regions. They are expected to be generally adjacent (from a telecommunications viewpoint) to at least one CCC, but this is not a mandatory criterion. External COM Centres that are "several hops away", in terms of AMHS connections, are entitled to be External COM Centres as far as the AMC is concerned.

2.5.1.3.2 The following criteria qualify a COM Centre outside the EUR/NAT Regions to become an External COM Centre:

- the COM Centre is adjacent to the EUR/NAT Regions in the AFTN; or
- the COM Centre supports (or actively plans to support) CIDIN operationally[3]; or
- the COM Centre supports (or actively plans to support) AMHS operationally.

2.5.1.3.3 Operators of External COM Centres are designated as “External COM Operators”.

2.5.1.3.4 External COM Operators are associated to an External COM Centre, and thus to an AMHS Management Domain. They are expected to participate to some AMF-O functions (e.g. network inventory, address management), but not to all of them (e.g. no routing management). It is useful that they have access to AMF-I functions in the same way as a user in the EUR/NAT Regions.

2.5.1.4 Participating COM Centres

2.5.1.4.1 Some COM Centres, or AMHS Management Domains may wish to participate informally in AMC activities. Informally means that they would not directly input information into the AMC, neither as CCCs nor as External COM Centres, but they would rather submit information by ad-hoc means (fax, phone, e-mail, etc.) to the AMC Operator, who would enter this information in the AMC database. They are also expected to receive information they request from the AMC Operator, provided that such requests are limited in number and volume of data. They may be located either inside or outside the EUR/NAT Regions. They are represented in the AMC database in the same way as External COM Centres.

2.5.1.5 Read-Only Users

2.5.1.5.1 It is also possible that other users distinct from AMF-I Users, CCC Operators, and External COM Operators may wish to have a limited access to some AMF-I and AMF-O functions. Such users would be personnel from ANSPs and ICAO CNS Officers. They cannot

[3] In such a case it is often adjacent to, or a few CIDIN hops away, from the EUR/NAT Region.

be formally involved in AMC procedures, so they would have only a viewing access to some of the AMC functions. They are denominated “Read/Only Users”.

2.5.1.5.2 Only people belonging to the following personnel categories shall be entitled to become Read-Only Users, subject to the accreditation procedures defined in section 2.5.2:

- ANSP personnel involved in ATS Messaging activities;
- EUR COM Centre Operators;
- EUROCONTROL personnel involved in ATS Messaging or AMC systems activities;
- CNS Officers in ICAO Headquarter or Regional Offices.

2.5.1.6 Non-Participating COM Centres

2.5.1.6.1 For completeness of the terminology, the term "Non-Participating COM Centre" is also defined. It identifies a State or COM Centre which is not involved in any way in AMC activities.

2.5.1.7 Access to AMC functions by each user category

2.5.1.7.1 The following table depicts the access to AMC functions which is available to each user category.

AMC functions / user categories	AMF-I functions	AMF-O functions	AMC Operator functions
AMC Operator	yes	yes	yes
CCC Operators	yes	yes	no
External COM Operators	yes	access to some functions	no
AMF-I Users	yes	read-only access to some functions	no
Read/Only Users	read-only access to some functions	read-only access to some functions	no
Participating COM Centres	indirect access to some functions through AMC Operator	indirect access to some functions through AMC Operator	no

Table 2: Status of participants in ATS Messaging Management

2.5.1.7.2 It should be noted that a distinct functional subset (and associated AMC user menu) is defined for each user category accessing some functions, as described in the above table. For example, External COM Operators do not have access to all AMC functions.

2.5.1.7.3 The accurate list of functions that can be accessed by each user category is provided as Appendix B, together with the description of the access rights model used for their specification. Any modification to this list shall be approved by AFSG or an AFSG subgroup prior to the opening of AMC services to its users.

2.5.2 Administrative procedures and responsibilities

2.5.2.1 General

2.5.2.1.1 The responsibilities of a CCC Operator and of the AMC Operator are defined for each functional group in Chapters 3 and 4 of this Manual. In essence, these responsibilities consist in complying with the requirements expressed in the ATS Messaging Management Manual and in performing the tasks defined in the document.

2.5.2.1.2 To guarantee the confidentiality and integrity of data contained in the AMC database, it is necessary to grant access rights of a given user category only to people who are duly identified and have the right to view and/or modify such data. This process is called accreditation of users.

2.5.2.1.3 A procedure is defined hereafter for the accreditation of a user in each category.

2.5.2.2 Accreditation of CCC Operators

2.5.2.2.1 The accreditation procedure which exists for CCC Operators is based on the State/ANSP sending a letter to EUROCONTROL, to designate the CCC Operator(s), and providing the details which will enable the Operator to be entered as a user in the EUROCONTROL portal.

2.5.2.3 Selection of AMC Operator

2.5.2.3.1 A procedure also exists for the selection of the AMC Operator. It is based on a call for tender by EUROCONTROL to select the body (generally an ANSP) and persons who will be the AMC Operator (and his/her back-up). This selection process replaces the accreditation procedure.

2.5.2.4 Accreditation of AMF-I Users

2.5.2.4.1 Each State or COM Centre shall be allowed to designate one + backup AMF-I User associated to its COM Centre. The request to register the selected person as the AMF-I User associated with the COM Centre shall be submitted to EUROCONTROL according to one of the following methods:

- by the CCC Operator of the corresponding COM Centre, at any time of the year,
- by the representative of the State to the AFSG, taking the opportunity of the yearly AFSG meeting,
- by the Secretary of the AFSG, at any time in the year, as far as ICAO Officers are concerned.

2.5.2.5 Accreditation of External COM Operators

2.5.2.5.1 Each External COM Centre shall be allowed to designate one External COM Operator + backup associated to its COM Centre.

2.5.2.5.2 For the case of such States, with whom there is not necessarily a direct contact yet established, the goal of the procedure is to make sure that only well-identified people with an appropriate level of responsibility are authorised to access the AMC. Support of the ICAO Regional Offices is needed in this regard as they maintain permanent contacts with the considered ANSPs.

2.5.2.5.3 The request to register the selected person as an External COM Operator shall be submitted to EUROCONTROL according to one of the following methods:

- by the ANSP of the COM Centre, at any time of the year. Such a request need to be validated as follows:
    - in a first stage the request is sent to the CNS Officer of the corresponding ICAO Regional Office, who ensures that the request is submitted by a due representative of the ANSP before endorsing the request;
    - the request is endorsed by the CNS Officer of the ICAO Regional Office, and then relayed to EUROCONTROL who accepts the request;
- by the representative of the State to the AFSG, taking the opportunity of the yearly AFSG meeting, for States outside the EUR/NAT Regions who participate in the meeting.

2.5.2.6 Accreditation of Participating COM Operators

2.5.2.6.1 Each Participating COM Centre shall be allowed to designate one Participating COM Operator + backup associated to its COM Centre.

2.5.2.6.2 For the case of such States, with whom there is generally not a direct contact yet established, the goal of the procedure is to make sure that the information received by ad-hoc means from the Participating COM Operator can be looked at with confidence that it reflects the decisions of the COM Centre.

2.5.2.6.3 Only well-identified people with an appropriate level of responsibility must be authorised to send information to the AMC Operator, as this information will be entered in the AMC database. Support of the ICAO Regional Offices is needed in this regard as they maintain permanent contacts with the considered ANSPs.

2.5.2.6.4 The request to register the selected person as a Participating COM Operator shall be submitted to EUROCONTROL according to the same methods as for External COM Centres and External COM Operators (see section 2.5.2.5 above).

2.5.2.7 Accreditation of Read-Only Users

2.5.2.7.1 Concerning Read-Only users, the requirement for accreditation is related to the confidentiality of information in the AMC database.

2.5.2.7.2 The request to register the selected person as a Read-Only User shall be submitted to EUROCONTROL according to one of the following methods, at any time of the year, depending on the personnel category to which the person belongs:

- for personnel of ANSPs and COM Centre Operators in the EUR/NAT Regions:
    - by the CCC Operator of the COM Centre in the ANSP;

- by the AMF-I User (if any) associated with the same COM Centre;

- for personnel of ANSPs in other Regions: by the ANSP, at any time of the year, subject to endorsement by the ICAO CNS Officer of the considered Region;

  - by the Secretary of the AFSG for ICAO CNS Officers.

2.5.3 Organisation and relationships

The general AMC organisation is based on a co-operation between ICAO and EUROCONTROL, in which:

- ICAO, through its groups and bodies, makes decisions and monitors the work and activities performed;

- EUROCONTROL is responsible for system development and implementation, and for the funding and management of the AMC operator contract.

2.5.3.1 Bodies involved in ATS Messaging Management

EANPG European Air Navigation Planning Group

The EANPG is the Planning and Implementation Regional Group of the ICAO EUR Region.

AFSG Aeronautical Fixed Service Group

The AFSG is an EANPG contributory body established to pursue the tasks and issues related to the Aeronautical Fixed Service in support of the relevant ICAO Strategic Objectives.
One of the main tasks of the AFSG is the implementation planning and the operational oversight and management of the EUR/NAT AFTN/CIDIN/AMHS network (Aeronautical Fixed Telecommunication Network / Common ICAO Data Interchange Network / ATS Message Handling System). The AFSG co-ordinates the inter-Regional aspects of the task with corresponding bodies of adjacent Regions.

OG Operations Group

The OG is a working group of the AFSG.
The OG is responsible for the AFTN/CIDIN/AMHS operation in the EUR/NAT Region. It co-ordinates the operational activities between the COM Centres to ensure the continuous service of the network and it is responsible for ATS Messaging Management as well.

EUROCONTROL

In the context of ATS Messaging Management, EUROCONTROL is responsible for development and implementation of the AMC systems and funding the AMC Service. In this context, it also provides the technical support (AMC Systems) for the AMC and contracts the AMC Operator.

2.5.3.1.1 The relationships between these bodies are as shown in Figure 1 below.

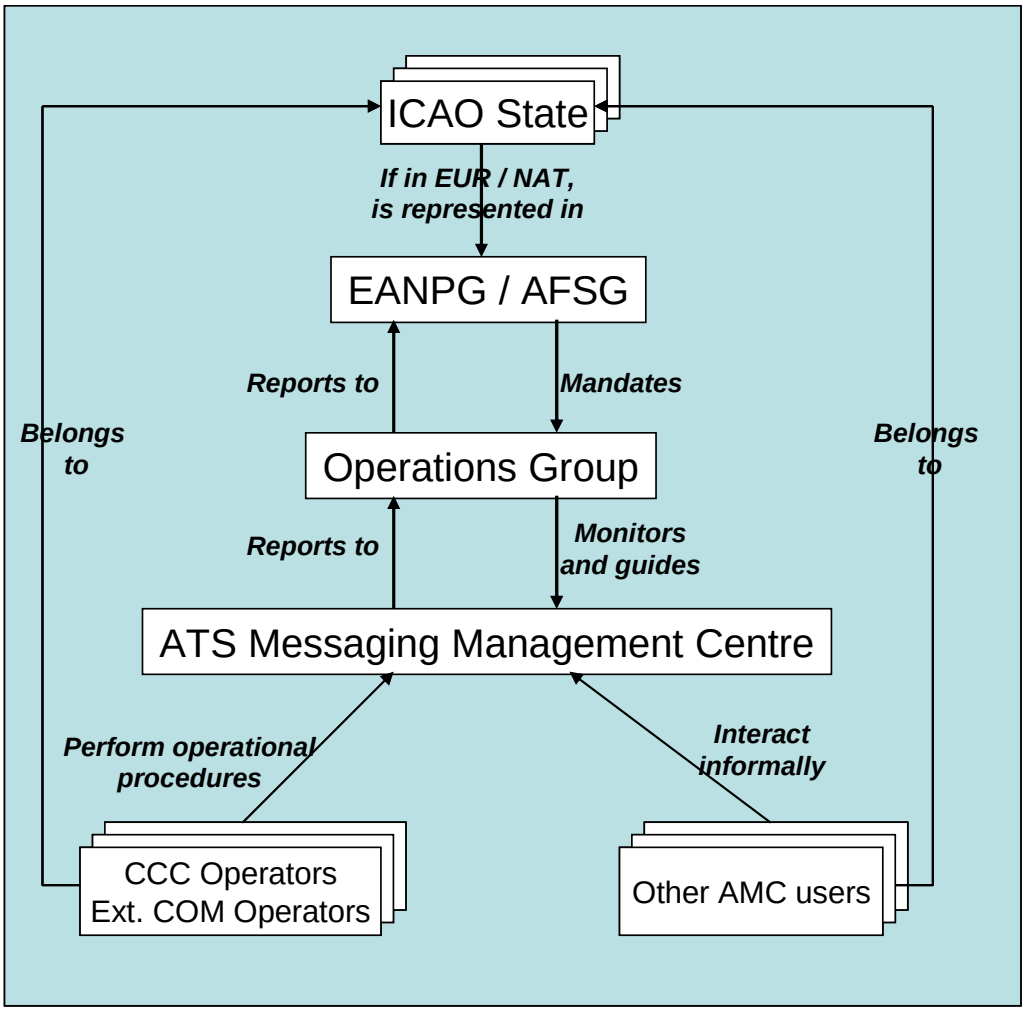

Figure 1: Relationships among organisations

2.6 ATS Messaging Management framework

2.6.1 The concepts defined above form the framework in which the ATS Messaging Management is implemented, for the management of the integrated AFTN/CIDIN/AMHS network.

3 AMHS Implementation Support Functions

3.1 Identification of AMF-I functions

3.1.1 List of functions

3.1.1.1 The following general list of functions is defined as part of AMF-I:

- **AMHS MD contacts:** this enables AMF-I Users to enter contact information for their AMHS MD, and to identify persons and contacts involved in AMF-I activities within each Management Domain;

- **Implementation planning:** this enables to exchange information about implementation plans of ANSPs in the EUR/NAT Regions. This is a reply to a general reciprocal requirement for ANSPs, to provide and obtain such a view about what potential communication partners in the Region are intending in terms of AMHS implementation;

- **Inter-working test support:** this includes the provision of test specifications, for potential download by AMF-I Users, the access to a database describing the testing environment implemented by other ANSPs (as opposed to operational equipment that is described in the AMF-O database), as well as test planning tools. Because of the fully-meshed AMHS topology which is being aimed at in the Region, AMHS test activities should be very intensive during the whole transition period;

- **Monitoring of AMHS documentation maintenance**: this consists in the provision of information about the status and progress of AMHS-related potential defect reports (PDRs) and amendments proposals (APs) handled by the "AMHS documentation maintenance body", i.e. the ICAO Aeronautical Communications Panel (ACP);

- **Helpdesk functions**, where informal support can be obtained about implementation matters, including FAQs, AMHS implementers' forum, etc. They also include the provision of support information, which is uploaded by AMC Operators, based on a number of criteria, for downloading by the AMF-I Users. It is foreseen that such information will include technical documentation (EUR AMHS Manual, public ICAO documents), study work documentation (e.g. SPACE), EUR-AMHS Profile, guidance material and tutorial information, etc.;

- **View operational data:** this consists in the provision of a "view-only" access to operational functions and information concerning in particular network inventory, network planning, routing management, address management and statistics where provided. This information may all be needed for detailed implementation plans, regarding system configuration.

3.1.1.2 It should be noted that the functions above have been organised according to functional areas: for example the technical "download" action is common to several functions.

3.1.2 Procedures associated with AMF-I functions

3.1.2.1 As may be seen above, the AMF-I functions generally aim at making information available to AMHS implementers, providing a focal point:

- from where AMF-I Users can retrieve information useful to develop their implementation plans,

- where they can publish information related to their implementation plans which could be valuable to other States in the process of studying and/or implementing AMHS.

3.1.2.2 In these functions, there is no direct relation to the AIRAC cycle, nor to a given operational cycle.

3.1.2.3 Another aspect is that for information published by States, such information is generally under control of the publishing State only, and does not require formal co-ordination procedure.

3.1.2.4 Therefore, AMF-I procedures are kept as simple as possible, as in general they do not require to be co-ordinated by the AMC Operator.

3.1.2.5 Whilst the AMC implementation defines the concept of "data areas": background area, pre-operational area and operational area (which is extremely useful where co-ordination is required), AMF-I functions do not make use of this concept:

3.1.2.6 **In AMF-I functions, information is considered valid as soon as it is posted, either by the AMC Operator or by an AMF-I User.**

3.1.2.7 Examples of posting are:

- by the AMC Operator is for the "download support information" function,

- by an AMF-I User is for the "implementation planning" function.

3.1.2.8 Validity of the posted information is therefore assumed to be checked upstream of the publication process, internally to the considered State/AMHS MD for AMF-I Users, or in accordance with the defined procedures for the AMC Operator.

3.1.2.9 Information posted by AMF-I Users is however limited to closed lists, except "comments" type fields which give some more flexibility. Information concerning several AMHS MDs (e.g. description of a test activity) can be posted only by the AMC Operator. For the sake of security, files can also only be uploaded by the AMC Operator. The sending of a file to the AMC Operator for posting is assumed to be performed by e-mail outside the AMC functions.

3.1.2.10 Additionally, as a "website good practice", the AMC Operator shall be allocated the formal role of moderator where required (e.g. forums, FAQs, etc.). However, it is expected that in a professional environment such as the ATS Messaging Management context, this task allocation will remain formal and should not be frequently invoked.

3.1.3 Participation of States/AMHS MDs to AMF-O functions

3.1.3.1 AMF-I functions are in principle oriented for use by States in the EUR/NAT Regions in which AMHS is not yet in operational use.

3.1.3.2 However, at some point in time and as the result of the procedure above, AMHS is going to become operational in States that are using AMF-I functions.

3.1.3.3 It is recommended that the CCC Operators of such States start using AMF-O functions related to AMHS approximately three months before starting operational service. It

should be mandatory that they do so at least one month before, so as to enter the formal and detailed network planning cycle at least one AIRAC cycle ahead of roll over.

3.1.3.4 Meanwhile, AMF-I Users in these States will still have a view-only access to Operational data.

3.2 Description of functions

This section provides an informal description of functions implemented in the AMHS Implementation Support Functions of the ATS Messaging Management Centre. It also includes indications about the way they are expected to work, and some reasons and background information for implementing these functions are also given.

3.2.1 AMHS MD contacts

3.2.1.1 This function provides information about persons and contact points involved in AMHS implementation and testing.

3.2.1.2 It enables AMF-I Users:

- to provide information to other States by entering data related to a person or contact associated to the considered AMHS MD for AMHS implementation matters,
- to view equivalent data for persons and contacts in other States.

3.2.1.3 The provided information includes:

- name and contact information,
- AMHS personal role and local title.

3.2.2 Implementation planning

3.2.2.1 This function provides information about implementation plans by States in the geographical area.

3.2.2.2 It enables AMF-I Users:

- to provide information to other States with regard to their plans for AMHS deployment,
- to know when other States are planning to deploy AMHS.

3.2.2.3 The provided information includes:

- planned dates for major steps in AMHS deployment (for each system category),
- intentions for inter-Regional gateway capability,
- national messaging plans.

3.2.3 Inter-working test support

3.2.3.1 During the implementation phase of AMHS in the EUR/NAT Regions, inter-working test activities will be very important and should represent a significant workload percentage in the overall implementation activities.

3.2.3.2 Such test activities can be efficiently supported by AMF-I functions, by the provision of information related to the testing environment, the provision of test specification, and a support for the co-ordination and planning of test campaigns.

3.2.3.3 This function provides:

- the capability to download test documentation, including for example:
  - recommendations for the testing strategy,
  - test scenarios,
  - test specifications,
  - traffic description in support of tests,
  - blank test reports;
- a test environment database containing information about the test environment of each AMHS MD. The contents of this database should be similar to the contents of the operational database, as far as network inventory is concerned, but with a lesser degree of detail:
  - AMHS system information (ATS Message Server or MTA, AFTN/AMHS gateway, ATS Message User Agent),
  - Network layer information;
- a test activities database containing information about test activities that have been already achieved, or are in progress or planned, showing involved AMHS MDs, test dates, additional information such as test sets performed, specific results to be noted, etc.;
- a test planning table showing availabilities for test activities by each AMHS MD interested in testing.

3.2.4 Monitoring of AMHS documentation maintenance

3.2.4.1 When a potential defect in ICAO Document 9880 is identified, the person who detected it generally submits a “Potential Defect Report” (PDR) or an Amendment Proposal (AP) to the body in charge of maintenance of these documents.

3.2.4.2 This body is the ICAO Aeronautical Communications Panel (ACP), at the moment of writing the present document.

3.2.4.3 PDRs and/or APs should be processed in accordance with well-established procedures, which allow the PDR to progress until a final status which can be either REJECTED, if the potential defect was not a defect of the Document, but e.g. a

misinterpretation, or RESOLVED, in which case the PDR then includes amended clauses for the considered Document, to correct the defect.

3.2.4.4 When the PDR and/or the AP reaches the RESOLVED status, the associated change becomes immediately applicable to all existing implementations, not waiting for the publication of an Amendment to or new Edition of the considered Document. This procedure was put in place because in a technically complex environment such as ATN or AMHS, technical defects need to be corrected generally faster than what a formal publication process enables.

3.2.4.5 For AMHS implementers in the EUR/NAT Regions, it is therefore useful to monitor the submission of PDRs/APs and their progress through ACP activities, as well as those already RESOLVED, so as to be aware of already identified defects and of forthcoming modifications to technical implementations.

3.2.4.6 This function provides:

- a summary and detailed view of all AMHS and Directory PDRs and APs, and more if appropriate,
- a link to the web site hosting Maintenance mailing lists and procedures,
- tools to submit a PDR/AP (blank template).

3.2.5 Helpdesk functions

3.2.5.1 The Helpdesk functions are a set of functions from where support information can be downloaded, and in which informal questions can be asked, and non-formal support obtained. They include:

- a Download Support Information function;
- an AMHS Implementers' Forum, where questions and support may be dynamically asked;
- a Frequent Asked Questions (FAQs) area, where AMHS implementation guidance information may be found.

3.2.5.2 Because of the global scope of AMHS for the exchange of ATS messages, AMHS technology and AMHS implementation are the subject of a number of documents produced by numerous organizations and/or bodies. This documentation is generally available but spread over various web sites worldwide. It is useful for States that are in the process of implementing AMHS to have a focal point where relevant information can be found, either directly or by means of hyperlinks to the source of information.

3.2.5.3 The Download Support Information function aims at meeting this requirement. It also offers a placeholder in which further documents, not yet in existence or not identified at present, could be posted to be made available to AMF-I Users. This function includes:

- the provision of a summary view of all documents stored as support information,
- the capability to view and download the support documents.

3.2.5.4 The envisaged support information encompasses:

- ICAO Document 9880, AN/466 – Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols, Part II, Ground-Ground Applications – Air Traffic Services Message Handling Service (ATSMHS), subject to authorization from the ICAO publication department (copyright issue),

- EUR AMHS Manual, developed by the AFSG,

- EUR-AMHS Profile, developed by EUROCONTROL,

- SPACE final report, phase reports and work package reports, developed by the SPACE Consortium (Aena, DFS, EUROCONTROL, NATS and STNA under management by STNA),

- guidance material and tutorial information (to be developed).

3.2.5.5 Any document made available should comply with some basic principles:

- it should be produced by (or on behalf of) either an ICAO body, or a State/ANSP or Organization recognised by ICAO;

- it should be a final document (i.e. not “work in progress” or “working draft”);

- it should not include any reference to an industrial company or implementation;

- it should not conflict with already published documents, to avoid causing confusion to readers;

- it should not be subject to copyright;

- its publication in AMF-I functions should be approved by an AFSG subgroup.

3.2.5.6 The FAQs area is similar to the “download support information” as far as guidance material and tutorial information is concerned. The choice of publishing a piece of information in one area or the other should be considered depending on the size and level of formalism of the considered material. Posting information under the FAQs section is under the responsibility of the AMC Operator.

3.2.6 View operational data

3.2.6.1 When implementing AMHS in their Management Domain, it is useful that AMF-I Users have access to information about AMHS systems already in operation, and about potential changes in the operational environment. Such information is essentially provided by AMHS Off-Line Management Operational Functions (AMF-O) and existing CMC functions.

3.2.6.2 Based on the requirement to integrate AMHS Management with CIDIN Management, AMF-I Users have access to the “view operational data” group of AMF-O functions. This group of functions gives access to operational data related to functional areas that are:

a) common to CIDIN and AMHS Management (Network Inventory, Routing Directory, etc.),

b) specifically related to AMHS: Address Management, AMHS User Capabilities Management.

3.3 Management of AMF-I Users

3.3.1 AMF-I Users are associated to the AMHS MD which they are in the process of implementing. Each such AMHS MD is assumed to "include" one international COM Centre, and a test environment for the purpose of the inter-working test support function.

3.3.2 The functions related to the creation, modification or deletion of an AMF-I User are out of the scope of the AMHS Off-line Management Functions. They are performed directly by the database manager (EUROCONTROL) and not under control of the AMC Operator.

3.3.3 In general, there is a one to one relationship between an international COM Centre and an AMHS MD, the latter having either the characteristics declared to ICAO, or the default characteristics planned for in Document 9880, which are PRMD-name = Nationality Letters, Addressing Scheme = XF.

3.3.4 In this way there is always one AMHS MD to which each COM Centre can be associated, this is done as part of the "AMHS MD Register" function. When the messaging network evolves, it is possible that States group together to implement AMHS by means of a single AMHS MD spanning over their areas of responsibility. In this case there would be a several to one relationship between COM Centres and AMHS MD. The same situation also occurs for States with multiple COM Centres, they are expected to implement one single AMHS MD.

3.3.5 There is a several to one relationship between AMF-I User and AMHS MD. Like CCC Operators, there may be occasionally a reason for an AMF-I User to be associated with more than one AMHS MD at the moment of implementation and for the sake of AMF-I functions.

3.4 Functional specifications

This section provides a high level functional specification of requirements implemented in the AMHS Implementation Support Functions of the ATS Messaging Management Centre.

The view of functional requirements which is given below reflects primarily the view that is given to AMF-I Users. Furthermore, functional requirements needed for management of these functions by AMC Operators are also described.

3.4.1 Conventions

3.4.1.1 In this chapter, titles of level 3 sections (e.g. 3.3.2, 3.3.3 etc.) identify functions or group of functions (e.g. "Download Support Information"), which are visible at the first level in the function menu. Names between quotes (e.g. "Test Activities Database") identify functions visible at a lower level in the function menu.

3.4.1.2 Words in bold identify the name of **sub-functions**.

3.4.1.3 Actions are identified by one or two words in capital letters, e.g. MODIFY or UPLOAD TEMPLATE. Other actions, such as standard Microsoft Windows buttons, click-able words, etc. are identified by their name starting with a capital letter, e.g. Open. Actions may be implemented e.g. by buttons to be clicked.

3.4.1.4 Formal procedures are also identified by their name in capital letters, but which can span over several words, e.g. PDR TABLE UPDATE.

3.4.1.5 Formally defined information elements are identified in italics, such as (PDR) *Title*. The name of the element can be local to the function.

3.4.1.6 The use of a "shall" statement denotes a formal requirement that must be implemented in the AMC as part of AMF-I.

3.4.2 AMHS MD Contacts

3.4.2.1 This function shall provide:

- the capability for an AMF-I User to provide and modify information about persons and contacts related to the implementation of their AMHS Management Domain,
- the capability to view similar information from other AMHS Management Domains.

3.4.2.2 This function shall include:

- full name, personal role and local title of the person,
- contact information (e-mail, phone, fax, etc.)

3.4.2.3 Actions associated with this function for AMF-I Users shall be View, CREATE, MODIFY, DELETE and REPORT, with access rights restricted to the associated AMHS MD.

3.4.2.4 Actions associated with this function for AMC Operators shall be identical to actions for AMF-I Users, without restrictions concerning access rights, i.e. AMC Operators shall be allowed to modify any AMHS MD's information, after discussion with the considered MD.

3.4.3 AMHS Implementation planning

3.4.3.1 This function shall provide access to an implementation planning table providing planning information for each AMHS MD in the database, comprising:

- Server Location,
- major Implementation Planning milestone dates,
- Inter-Regional Gateway Capability intentions,
- Comments.

3.4.3.2 Actions associated with this function for AMF-I Users shall be MODIFY (to enter, modify or delete data), with access rights restricted to the associated AMHS MD, and considering that a blank entry is present initially for each AMHS MD.

3.4.3.3 Actions associated with this function for AMC Operators shall be identical to actions for AMF-I Users, without restrictions concerning access rights, i.e. AMC Operators shall be allowed to modify any AMHS MD's information, after discussion with the considered MD.

3.4.4 Inter-working test support

3.4.4.1 This group of functions shall include:

- the capability to "Download Test Documentation";

- access to a test environment database, through a function named "Test Environment Data". This database shall contain information about the test environment of each AMHS MD including:

    - AMHS Test Systems information (ATS Message Server or MTA, AFTN/AMHS gateway, ATS Message User Agent),

    - Network layer information;

- access to a "Test Activities Database" containing information about tests planned, in progress or already achieved, taking the form of a table showing *involved AMHS MDs*, *test dates* and *comments*, e.g. for results;

- access to a "Test Planning" function (at a weekly level), taking the form of a shared diary table showing availabilities for test activities by each AMHS MD interested in testing.

3.4.4.2 For AMF-I Users, actions associated with the "Download Test Documentation" and "Test Activities Database" shall be Open and Save. For AMC Operators, additional actions associated with these functions shall be CREATE, MODIFY, DELETE and UPLOAD.

3.4.4.3 Actions associated with the "Test Environment Data" and "Test Planning" functions for AMF-I Users shall be CREATE, MODIFY, DELETE, with access rights restricted to the associated AMHS MD. Actions for AMC Operators shall be identical to actions for AMF-I Users but without restriction of access rights.

3.4.5 Monitoring of AMHS documentation maintenance

3.4.5.1 This group shall be composed of two functions as follows:

- the "PDRs and APs" function shall provide:

    1. a summary tabular view of all AMHS and Directory PDRs/APs, including reference, title, status, last modification date,

    2. the capability to view the PDR/AP details when selecting one PDR/AP in the table,

    3. the capability to download the PDR/AP details when selecting one PDR/AP in the table,

- the "AMHS Documentation Maintenance Procedures" function shall provide:

    1. an indication of the body in charge of the maintenance of SARPs and Detailed Technical Specifications,

    2. a list of Contact Points,

    3. a link to the web site hosting Maintenance mailing lists and procedures,

    4. the capability to download the Maintenance procedure description,

    5. the capability to download a blank PDR/AP template.

3.4.5.2 Actions associated with the "PDRs and APs" function for AMF-I Users shall be VIEW and DOWNLOAD. No specific action shall be defined for AMF-I Users in relation with the "AMHS Documentation Maintenance Procedures" function.

3.4.5.3 Additional actions associated with the "PDRs and APs" function for AMC Operators shall be CREATE, MODIFY, DELETE and UPLOAD. The actions for the "AMHS Documentation Maintenance Procedures" function shall be MODIFY INFO, CREATE, MODIFY, DELETE (for *Contact Points*), UPLOAD PROC[edure], UPLOAD TEMPLATE.

3.4.5.4 Procedures associated with this function are PDR TABLE UPDATE.

3.4.6 Helpdesk functions

3.4.6.1 The Helpdesk functions shall include three functions:

- a "Download Support Information" function;
- an "AMHS implementers' forum", where questions and support may be dynamically asked;
- a Frequent Asked Questions ("FAQs") area, where AMHS implementation guidance information may be found.

3.4.6.2 The "Download Support Information" function shall provide:

- a summary tabular list of all documents stored as support information,
- the capability to view the documents,
- the capability to download the documents.

3.4.6.3 Actions associated with the "Download Support Information" function for AMF-I Users shall be Open (for viewing) and Save (for download).

3.4.6.4 Additional actions associated with this function for AMC Operators shall be CREATE, MODIFY, DELETE and UPLOAD.

3.4.6.5 Procedures associated with this function are DOCUMENT PUBLICATION.

3.4.6.6 The DOCUMENT PUBLICATION procedure defines the procedure by which documents can be submitted and approved for posting on the AMC as part of the download support information function.

3.4.6.7 Actions associated with the "AMHS Implementers' forum" for AMF-I Users shall be usual functions for web forums NEWTHREAD and REPLY. Additional actions for AMC Operators shall be EDIT, DELETE and DELETE THREAD.

3.4.6.8 Only AMC Operators shall be entitled to post under the "FAQs" section. Actions associated with this function for AMF-I Users shall be Open (for viewing) and Save (for download).

3.4.6.9 Additional actions associated with the "FAQs" function for AMC Operators shall be CREATE, MODIFY, DELETE and UPLOAD.

3.4.7 View operational data

3.4.7.1 This function shall provide AMF-I Users with access to the high level group of AMF-O functions called “View Operational Data”, and including the “Network Inventory”, “Routing Directory” and “Statistics” functions.

3.4.7.2 Access shall be given to the AFTN, CIDIN and AMHS sub-functions of these functions. Actions shall be as specified in these AMF-O functions.

3.4.7.3 This function shall also provide AMF-I Users with view-only access to operational data managed by the AMF-O functions called “Address Management”, which includes “AMHS MD Register” and “Intra-MD Addressing”, and “AMHS User Capabilities Management”.

3.4.8 AMC Operator functions for AMF-I Administration

3.4.8.1 There shall be two functions in this group, respectively named:

- “Associate AMC Users to AMHS MDs”, and
- “Notify Database Changes to AMF-I Users”.

3.4.8.2 These functions shall be reserved for AMC Operators.

3.4.8.3 Actions related to the “Associate AMC Users to AMHS MDs” function shall be ASSOCIATE.

3.4.8.4 It shall be possible to associate several persons (AMF-I Users) to one AMHS MD. It shall be possible to associate one person (AMF-I User) to several AMHS MDs. It shall be possible that no AMF-I User be associated to an AMHS MD.

3.4.8.5 Actions associated with the “Notify Database Changes to AMF-I Users” function shall be REPORT and SEND NOTIFICATION.

3.4.8.6 From an implementation viewpoint, these functions are grouped with other functions dedicated to the AMC Operator, under the menu chapter named "AMC Miscellaneous ", as all these functions are of the same administrative nature.

3.4.9 Common Actions

3.4.9.1 Data input or modification shall always be performed in two stages:

- preparation of the input or modification,
- validation or cancellation of the prepared input or modification.

3.4.9.2 Two common SUBMIT and CANCEL actions shall be offered in conjunction with CREATE and MODIFY actions, when used in a function or sub-function.

3.5 Procedures

3.5.1 Document Publication

Actors

- the AMF-I User, or group of users, willing to publish a document
- the AMC Operator

Purpose

Several AMF-I functions include the publication of one or several documents by means of files uploaded in the ATS Messaging Management Centre. A set of rules need to be observed to make a document able to be published. This procedure is the means to check that conformance with these rules is ensured before posting the document for download or viewing by all AMF-I Users.

Description

The publisher (in general the author) of the document shall prepare its submission by checking that it complies with the publication rules (see section 3.2.5.5), and submit it to an AFSG subgroup which is the body responsible for approval of publication. The AFSG subgroup shall verify that rules are being complied with and transfer the document to the AMC Operator for publication. In case of non-compliance, the subgroup shall inform the document publisher of the detected non-compliance and ask for an iteration of the procedure.

triggers

decision to publish a document	Any AMF-I User or group of users is free to propose a document for publication in AMF-I function when he believes that the information contained in the document is of value to States implementing AMHS.

actions

prepare document for publication	The publisher checks that the document complies with the rules, and he updates it as appropriate.
submission for approval to the appropriate AFSG subgroup	The publisher sends the document as a working paper to the next meeting of the appropriate AFSG subgroup, either PG or OG, with the recommendation that the document be approved for AMF-I publication. This submission is done in accordance with the subgroup's current working practices.
send approved document to AMC Operator	After approval by the subgroup, the AFSG subgroup chairman, or a person to whom he delegated the task (can be the document publisher) sends the document by e-mail or any appropriate means to the AMC Operator.

upload of document by AMC Operator	Upon receipt of the document with the status “approved” from the AFSG subgroup, the AMC Operator uses the UPLOAD action of the appropriate AMF-I function to publish the document and to make it available to all AMF-I Users. If the status is “approved subject to agreed amendments”, the AMC Operator checks that these have been duly performed before uploading the document.

decisions

doc complies with publication rules ?	The decision is based on the publication rules listed in section 3.2.5.5 and on any additional criteria that the subgroup may deem appropriate. In case of minor non-compliance, the decision can be “approved subject to agreed amendments” so as to avoid a full cycle of iteration.

3.5.2 PDR Table Update

Actors

- the ICAO body in charge of documentation (SARPs/technical specifications) maintenance (currently the ICAO Aeronautical Communications Panel, Working Group M - Maintenance)
- the AMC Operator

Purpose

The AMC Operator needs to store PDR/AP information in the “Monitoring of AMHS Documentation Maintenance” function of the AMC, whenever a change occurs in the status of existing PDRs/APs, or when a new PDR/AP is published. The goal is not to replace the SARPs/technical specifications maintenance procedures, but to offer a focal point for up-to-date information about active and already closed PDRs/APs.

Description

The AMC Operator is registered as a member of the appropriate mailing lists for AMHS and Directory documentation (SARPs/technical specifications) maintenance. As such, he receives by e-mail information about the status of PDRs/APs, and about discussion of PDRs/APs between list members. The AMC Operator analyses the received information and he publishes in the AMC, using the appropriate AMF-I function and actions, only the changes that have been approved by the ICAO body in charge of documentation maintenance for the considered PDRs/APs[4].

triggers

[4] AMF-I Users interested in the full thread of discussions about a PDR/AP, not only in formal status changes, should register as members of the mailing lists for the maintenance body. Only this registration will allow them to participate in PDR/AP discussions, since it is not the goal of the AMC to offer a place for PDR/AP discussion.

new PDR/AP information	When a new PDR/AP is sent by a contributor to the mailing list, the person in charge within the maintenance body distributes the PDR/AP with a unique number and the indication that it is a new PDR/AP with status SUBMITTED, via the mailing lists. The person in charge also sends a formal message when the status of a PDR changes, in accordance with the maintenance procedures (see section 3.2.4 for more details).

actions

receive information via PDR/AP mailing lists	the AMC Operator receives all e-mails related to PDR/AP information and discussion, as a member of the documentation maintenance mailing lists.
analyse PDR/AP information	the AMC Operator analyses whether the e-mail reflects a change in status or is just a contribution to the discussion.
update table and upload PDR/AP file and attachments (if any)	the AMC Operator updates the fields of the PDR/AP table in the "PDRs and APs" function, and upload accordingly the PDR/AP file received via the mailing list. If the PDR/AP is embedded in the e-mail and not attached as a separate file, the AMC Operator stores it as a local file complying with the file naming and syntax characteristics, before uploading it. Any file or document (if new or modified) supportive of the PDR/AP is also uploaded as an attachment in the "References" section of the function.

decisions

new PDR/AP or new status for existing PDR/AP ?	The determination of the nature of the received e-mail is easy, either in the e-mail subject, or in the body in the PDR/AP (based on the "Status" and "PDR Revision Date" fields). New "official" PDR/AP and notification of status change can also be originated by the maintenance body chairman. This provides an additional decision criterion.

4 AFTN / CIDIN / AMHS Operational functions

4.1 Identification of AMF-O functions

4.1.1 The following functions are defined as part of AMF-O:

- **Network inventory:** the purpose of this function is to maintain in a central database information on the configuration of the ATS Messaging network including all of its relevant components. It provides information about each COM Centre in the Management Area. The provided information includes non-technical information, e.g. location, contacts for the COM Centre, system configuration data (functionality, connections, etc.) as well as planned changes in the connections and VCGs;

- **Routing management:** this function deals with the creation and distribution of AMHS, CIDIN and AFTN routing tables for all COM Centres in the Management Area. This function benefits greatly from the centralisation in AMC systems because routing has to be considered in the context of the whole network, and not just for individual COM Centres and their neighbouring Centres. The three routing tables are closely inter-related to each other, because changes in the AMHS routing impact AFTN and CIDIN routing during the transition from AFTN/CIDIN to AMHS, particularly at the boundary between the AMHS island and its adjacent CIDIN COM Centres;

- **Address management:** this function allows to manage and distribute two or three sets of information:

  - the ICAO Register of AMHS Management Domains, which is made of a table contained the list of agreed MD names and addressing schemes (CAAS or XF) for every State worldwide,

  - a set of CAAS tables (or O/OU1 correspondence information), containing detailed addressing information for each State having selected the CAAS,

  - potentially a user address look-up table (or individual user address information), for the support of addresses of AMHS Management Domains having selected neither CAAS nor XF, if any;

- **AMHS User Capabilities management:** this function allows to manage and distribute information about the functional capabilities of an AMHS user. This function will be particularly useful when the AMHS expands to new functions and/or new message types (e.g. BUFR, security, extended service, etc.), to determine the capabilities of a message recipient before sending the message;

- **Statistics:** this function consists in the collecting, processing and publishing of statistical data which can serve (among others) the following purposes:

  - allow for more efficient network planning, e.g. identify bottlenecks and under-utilised resources, and by deriving trends in traffic patterns,

  - lead to better routing management by identifying major flows, and

  - provide information for cost/benefit analyses.

It is important in the context of AMHS deployment, because there is no practical knowledge base yet for dimensioning the AMHS network. It is thus essential that accurate statistics be gathered on both the traffic patterns (at the level of MHS and of lower layers to properly take into account protocol overhead effects), and how the systems perform, so as to predict future needs and ensure the ability of the service to meet these needs;

- **Support functions**: this function is used to enable operational, engineering, administrative staff at CCCs and their administrations to be assisted by AMC staff. It is also a repository of information where the experience gained by CCC Operators collectively, as reported to the AFSG OG, can be shared for mutual benefit. It provides a means by which informal questions can be asked, and non-formal support obtained;

- **Miscellaneous functions**: a number of functions are useful for efficient AFTN/CIDIN/ AMHS operational management without being exclusively related to one of the main functions above. They can provide reference information entered by the AMC Operator for use by CCC Operators (Regions, ANP locations, Bulletin board, AMC Operator details). This group also includes functions dedicated to data presentation using specific formats (Com Charts, Path Function, AIRAC Cycle) or common report formats (Static Report);

- **Security management:** this function may include the implementation of a Public Key Infrastructure (PKI), allowing to manage and distribute keys and certificate information for AMHS users, certificate revocation lists (CRLs), etc. This is a pre-requisite to the introduction of secure AMHS, thereby enabling originating users to include message origin authentication and content integrity elements in their messages (by means of digital signatures) and recipient users to verify the corresponding signatures. Additional functions may also be included under the general function “security management”, such as publication of security alerts, etc.

  Note.– This function will not be deployed at this stage of the AMC project. It requires further study, and any requirements will be agreed by the AFSG before future implementation.

4.2 Description of functions

4.2.1 Network inventory

4.2.1.1 This function provides inventory information about interconnected COM Centres. It is composed of six sub-functions:

- "Persons and Contacts", providing contact details for persons involved, at various levels, in the operation and management of the COM Centre;

- "COM Centres", providing general information such as:

  - location, administrative status (Internal, External, etc.),

  - Region in which the COM Centre is located, COM Charts in which it is displayed,

  - general system functionality (Conventional AFTN, CIDIN/AFTN, ATS Message Server, AFTN/AMHS Gateway, etc.);

- "AFTN/CIDIN Capabilities", providing detailed configuration elements regarding CIDIN in the COM Centre, and addresses for the supported CIDIN applications;

- "AMHS Capabilities", providing the AMHS system description, including:

  - AMHS functional characteristics (profile), and/or gateway characteristics,

  - upper layer configuration details, including mta-name, P-, S- and T- selectors, session mode, etc.,

  - lower layer capability (RFC1006 over TCP/IP, ATN, TP0 over X.25);

- "VCGs", providing an inventory of the Virtual Circuit Groups:

  - which are existing and established with Remote COM Centres with which CIDIN PVCs or SVCs exist;

  - for which updates are planned in relation with planned updates of CIDIN PVCs or SVCs, including details of the planned event (date, type of change, etc.);

- "Connections" with remote ATS Messaging systems, including details and bandwidth characteristics for implemented connections and planned updates of connections:

  - Supported ATS messaging protocol, AFTN, CIDIN or AMHS, including the various possible configurations for each of these (e.g. AFTN over X.25, CIDIN PVC or SVC, AMHS in various stacks – ATN or TCP/IP),

  - ATN/CLNP, IP or X.25 network access, including address details, when applicable,

  - link type, capacity and supplier,

  - additionally, for planned updates, details of the planned event (date, type of change, etc.).

4.2.1.2 Because of the principle of the data areas and of the ATS Messaging Management procedures, this function is part of the existing menu titles: “View Operational Data”, “Enter Background Data”, etc.

4.2.2 Routing management

4.2.2.1 This function provides routing information for the configuration of interconnected COM Centres including AMHS systems (ATS Message Servers and AFTN/AMHS Gateways), CIDIN and AFTN switches.

4.2.2.2 The Routing management function is one of the most important functions of the AMC, because it benefits greatly from the centralised nature.

4.2.2.3 Routing is complex in CIDIN/AFTN/AMHS because it has to be considered in the context of the whole network, not just for individual Centres and their adjacent Centres. In particular, the complexity comes from AFTN address mapping within the CIDIN (Destination Address – Ad – to Exit Address – Ax – relationship). Because of all of these reasons, changes in CIDIN/AFTN/AMHS routing tables have to be closely coordinated between CCCs, with the support of the AMC.

4.2.2.4 AMHS routing, in the target architecture and topology defined by SPACE (see ref. [2], section 6.2.2 and SPACE Recommendation 5), is intended to be much simpler. In the "fully-meshed" topology that is intended between AMHS COM Centres in Europe, every Centre is adjacent to every Centre by means of a direct network connection and AMHS association. Direct routing can be achieved from any MTA to any MTA, although MHS/X.400 operates natively in "store-and-forward" mode.

4.2.2.5 However this target architecture is an ideal view which will not be reached for a number of years. There are several key conditions that must be met before this can be achieved:

- availability of a pan-European seamless IP inter-network infrastructure,
- AMHS in operation in every European State,
- CIDIN/AFTN connections maintained only in Inter-Regional Boundary COM Centres.

4.2.2.6 In practice, transition to this target architecture is likely to be quite complex from a routing perspective, because of:

- restrictions in the physical connectivity (not fully meshed) that may enforce a store-and-forward usage of AMHS,
- inter-relation between AMHS routing and CIDIN/AFTN routing, at the boundary of the "AMHS Island",
- phased implementation of AMHS by States in Europe.

4.2.2.7 Thus, it can be foreseen that each transition from CIDIN/AFTN to AMHS in a given State will require significant amendments in AMHS, CIDIN and AFTN routing tables not only in adjacent States but also in a number of other COM Centres. The Routing Management function of the AMC and the associated co-ordination procedures are particularly beneficial to the management of the amendments mentioned above.

4.2.2.8 The AMC Routing Management function is composed of three sub-functions, "AFTN Routing Table", "CIDIN Routing Table" and "AMHS Routing Table".

4.2.2.9 This sub-function provides for each technology implemented in each COM Centre, the adjacent COM Centre to which messages must be directed for each destination.

4.2.2.10 The possibility of alternate routing is included in the three "Routing Tables" sub-function.

4.2.2.11 Additional functions dedicated to the AMC Operator and related to Routing can be defined in the integrated ATS Messaging Management environment, taking into account the interconnected AMHS/CIDIN/AFTN network. These AMC Operator functions include:

- support to the update of AFTN and CIDIN routing tables when introducing a new AMHS COM Centre in the network,
- a potential support to the creation of AMHS routing tables.

4.2.2.12 The AMC Operator will also have the possibility to use the outcome of the Statistics function (see section 4.2.5), when generating new routing tables.

4.2.3 Address management

4.2.3.1 This function is a key function among AMF-O. It is used in support of address conversion, which is itself critical to AMHS operation during transition from CIDIN/AFTN to AMHS.

4.2.3.2 It handles only AMHS management information, because CIDIN-specific addresses, and particularly Ae/Ax addresses are limited to a small number of addresses built upon the basis of well-known ICAO Location Indicators complemented with pre-defined suffixes. Thus, CIDIN address information is manipulated in Network Inventory but it does not require a specific function to be handled.

4.2.3.3 The following provides a little background information about AMHS addresses, to illustrate where the address management requirement exactly comes from, and what its implications are.

4.2.3.4 To send a message to an AMHS user, it is necessary to know either:

- its AMHS address, also known as OR-address in the X.400 terminology; or
- a directory name, that can be converted into its O/R address at some point in the transmission path, this operation being called address resolution. In AMHS, address resolution must be performed by the originating MTA or at least in the originating AMHS Management Domain, in compliance with the X.400 base standards (see X.400 clause 13.2).

4.2.3.5 In both cases, the accurate AMHS address and/or directory name of the recipient needs to be available to either the originating user, or to an AMHS system in the originating AMHS MD.

4.2.3.6 Such an AMHS address is composed of two parts:

- a global domain identifier, which is globally unique within ICAO and AMHS, and
- a set of “low level” address attributes, which uniquely identify the user within the considered MD.

4.2.3.7 The set of OR-addresses adopted for AMHS (direct and indirect) users within a given AMHS MD is called the *addressing plan* of the AMHS MD. Such an addressing plan should comply with one of the *addressing schemes* defined in Doc 9880, the *XF-addressing scheme* or the *CAAS addressing scheme* (see ref. [5], section 2.5.1.4).

4.2.3.8 The global domain identifier is under control by ICAO at a worldwide level, so as to ensure global uniqueness. The “low level” address attributes are under the full control of the AMHS MD to which the considered user belongs: if the MD decides to change the addresses of users within its MD, all users in other MDs sending messages to the considered MD must be informed of this situation (by means of Address Management) and, at the moment when the change is made, must start using the new user addresses when communicating with users in the considered MD.

4.2.3.9 The important point here is therefore that an address modification in one AMHS MD creates a requirement for originators (or gateways) and/or systems performing name resolution in all other AMHS MDs to use the modified address[5].

4.2.3.10 Three sets of information, corresponding to three distinct levels of detail need therefore to be managed:

- the AMHS MD Register, which contains the list of agreed MD names and addressing schemes (CAAS or XF) for every State worldwide. In this table, there is one or several (at most around 10) entries or rows for each AMHS Management Domain. This is more or less equivalent to the level of detail provided in CIDIN: an AMHS MD may be seen as the granularity as a CIDIN COM Centre., i.e. one MD or COM Centre nationally;

- a set of CAAS tables, containing detailed addressing information for each State having selected the CAAS. This table, which is required for every State/AMHS MD having selected CAAS, contains potentially one entry (or row) for each ICAO Location Indicator[6] in the State;

- potentially, addressing information about AMHS users belonging to AMHS Management Domains having selected neither CAAS nor XF. In such a case, the stored data must allow the mapping between the AF-Address of the user and its full set of OR-address attributes. However it is uncertain, at this stage, whether this level of detail would be required: if all States choose either CAAS or XF, then there is no need for such this information.

4.2.3.11 Each entry in the AMHS MD Register consists of the following:

- the *name* of the State or Organization identified by the entry;

- the *Nationality Letters* (two letters) or a *designator* made of 2, 4, 5 or 7 characters found in AFTN addresses of users in the considered State/Organization, and enabling to unambiguously derive the AMHS MD to which such user addresses belong. This Nationality Letters/Designator element must be used as the index key to the Register as it uniquely identifies the entry in the Table;

- the global domain identifier of the Management Domain, made of three elements/columns, the *country-name attribute* (which normally always takes the value "XX"), *ADMD-name attribute* (which normally always takes the value "ICAO"), and the *PRMD-name attribute*, which takes the ICAO globally-unique value adopted by the considered MD;

- the *addressing scheme*, which identifies the scheme adopted by the considered AMHS MD. This element normally always takes either of the following values: "CAAS" or "XF";

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[5] Redirection mechanisms may be used in the recipient MD, where the address modification has occurred, to help managing the transition period and correctly deliver messages still using the previous address. However this cannot be considered as a stable solution, it impacts performance and use of system resources. Ultimately message originators have to use the new (modified) address.

[6] As defined in ICAO Document 7910.

- the *ATN directory naming-context*, which is a placeholder for the element unambiguously identifying the ATN Directory sub-tree in which information regarding the considered MD will be found when AMHS Directory is implemented;

- a *comment*, which for CAAS MDs may include the cross-reference to the name of the detailed CAAS table.

4.2.3.12 This table provides a several-to-one relationship between Nationality Letters/designator and PRMD-name: several entries may correspond to the same AMHS MD (PRMD), depending upon the range of nationality letters, Location Indicators and segments of AFTN addresses that are needed to unambiguously associate an AFTN address to the corresponding AMHS MD.

4.2.3.13 A detailed CAAS table includes, for each AMHS MD, potentially:

- one entry for each Location Indicator belonging to the AMHS MD, which in a CAAS address is borne by the *organisational-unit-names* attribute (OU1),

- each entry also includes the associated geographical unit identification, grouping several Location Indicators, which in a CAAS address is borne by the *organisation-name* attribute (O).

4.2.3.14 The address management function is tightly related to the Nationality Letters and Location Indicators defined in ICAO Document 7910. Location Indicators can be viewed by all AMC users, using the "View ANP Locations" function under "Miscellaneous Functions". These data are taken from an external ANP database periodically updated with the electronic contents of each new Doc 7910 Edition. Furthermore a local replication of this external database is maintained in the AMC, to ensure that a potential mistake in the Doc 7910 publication has no impact on operational data.

4.2.3.15 The address management function must enable:

- the gathering of information to be entered in the AMHS MD Register and CAAS addressing information held in the AMC:

    - from States/AMHS MDs for information about States in the EUR/NAT Regions and in other ICAO Regions;

    - from ICAO Headquarters (or other ICAO Regional Offices) for information about States in the EUR/NAT Regions and in other Regions, including validation of changes when required;

    - a reverse information flow from the AMC to ICAO Headquarters for synchronisation;

- the publication of this information, for retrieval by CCC Operators as an input to the configuration of the AMHS systems in their respective AMHS MDs.

4.2.3.16 In addition to the above requirement, depending on how it is implemented, the address management function might enable the publication of this information for retrieval by AMHS message originators with addresses of message recipients, potentially at each ATS Message User Agent. However, this aspect of the function is more related to directory functionality, and the provision of this service is not a priority of the ATS Messaging Management. It may rather be part of a true directory service, which may be provided by ATS Messaging Management at a later stage, when services are provided also to AMHS users themselves and not only to the

currently defined AMC users (mostly COM Centre Operators). Such a potential extension in the scope of AMC users will be a major evolution subject to prior approval by AFSG.

4.2.3.17 A model for gateway address conversion had been established by SPACE (see ref. [2], section 6.5.4). It made the assumption that the central repository of information, the ICAO Published Address Information (AI) would be managed directly by ICAO Headquarters and that information is exchanged directly between ICAO HQ and States/ANSPs.

4.2.3.18 Although technically valid, this model is not likely to be implemented by the ICAO HQ in a timeframe compatible with forthcoming AMHS implementations in the EUR/NAT Regions.

4.2.3.19 This situation had been anticipated by SPACE, (see ref. [2], section 7.2.1), which concluded that:

> "In the EUR Region, [SPACE] recommended the creation of an Offline Management Centre to consolidate co-ordinate and distribute AMHS user address changes across the Region."

4.2.3.20 This leads to a refined model for the global management of AMHS addressing information, which is represented in Figure 2.

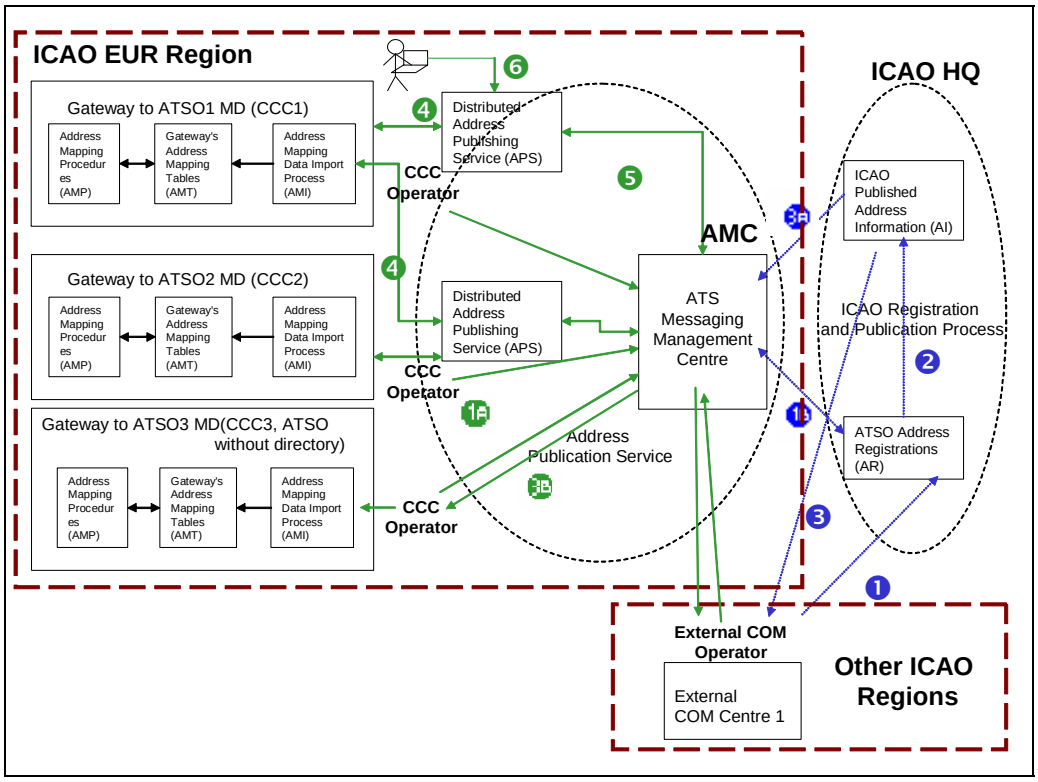


Figure 2: AMHS address management model

4.2.3.21 The procedures associated with this function include:

- the procedures needed to update, validate and manage the address information between the AMC Operator and the CCC Operators (i.e. a formal specification of arrows 1A, 3B, 5);

- the procedures needed to co-ordinate between the EUR AMC Operator and the ICAO HQ (i.e. a formal specification of arrows 1B and 3A in the model of Figure 2).

4.2.3.22 It may also be noted that SPACE recommended that *"the Distributed Address Publishing Service (APS) be based on ATN Directory Services, […] to be implemented at the earliest opportunity upon ANSPs' initiative, with the following principles:*

- *use of the directory scheme;*
- *initial population of the Directory Information Base with the information distributed through the ICAO Registration and Publication process."*

4.2.3.23 This aspect is more relevant to technical implementation strategies. This approach is nevertheless significantly different from the AMC technical implementation. It is not intended to implement address management using Directory Services as part of the present project, because it would offer a lesser degree of integration with existing functions such as other AMF-O functions described in earlier sections of the present document.

4.2.4 AMHS User Capabilities management

4.2.4.1 This function is exclusively related to AMHS, because individual CIDIN and/or AFTN users do not need to be handled by ATS Messaging Management.

4.2.4.2 The AMHS User Capabilities management function allows to manage and distribute information about the functional capabilities of an AMHS user. It will be particularly useful when the AMHS expands to new functions and/or new message types (e.g. BUFR, security, extended service, etc.), to determine the capabilities of a message recipient before sending the message.

4.2.4.3 The AMHS User Capabilities management function must enable:

- the gathering of information descriptive of AMHS User Capabilities, including:
  - from States/AMHS MDs for information about States in the EUR/NAT Regions and in other ICAO Regions;
  - from ICAO Headquarters (or other ICAO Regional Offices) for information about States in the EUR/NAT Regions and in other Regions;
  - a reverse information flow from the AMC to ICAO Headquarters for information about States in the EUR/NAT Regions;
- the publication of this information, for retrieval by CCC Operators as an input to the configuration of the AMHS systems in their respective AMHS MDs.

4.2.4.4 In addition to the above requirement, depending on how it is implemented, the AMHS User Capabilities management function, like the address management function, enables the publication of this information for direct retrieval by AMHS message originators when generating a message to its possible recipients, potentially at each ATS Message User Agent. However, this aspect of the function is more related to directory functionality, and the provision of this service is not a priority of the ATS Messaging Management.

4.2.4.5 With the adoption of the Operational Concept of the European Directory Service (EDS) and its introduction as Appendix G of the EUR AMHS Manual, the relevant co-operation between the EDS and the AMC was foreseen and an initial connection between the two was established.

4.2.4.6 It should be noted that the AMHS user capability function defined in ICAO Document 9880 based on ATN Directory Services and in line with ITU-T Recommendation X.400, was expanded to adapt the proven operational AMC procedures. A flexible assignment of the AMHS User Capabilities was introduced by usage of profile names.

4.2.4.7 The considered AMHS User Capabilities information comprises the direct as well as the indirect AMHS users and includes:

- the AMHS user OR-address and AF-address, as a reference and
- the following Capability Classes:
  - Body-parts (which includes the former capability elements as defined in ICAO Document 9880 like 'maximum deliverable content length' and 'encoded information types – EITS'),
  - Address type,
  - IPM heading extensions,
  - Directory,
  - AMHS Security.

4.2.4.8 The composition of the resulting profile name is detailed in Appendix D, Section D.5.

4.2.5 Statistics

4.2.5.1 This function, although identified for a long time as being in the scope of CIDIN and ATS Messaging Management, was not implemented for CIDIN. It is useful to implement this function as part of AMHS Management, in order to build a knowledge base for current and future dimensioning of the underlying network.

4.2.5.2 It is also easier to implement with AMHS systems than with CIDIN systems. The reason is that the desired statistics have been identified before procurement by most States of AMHS systems, thereby enabling States to include in their AMHS systems call for tenders the requirement to gather at least raw data for this purpose.

4.2.5.3 The requirement to monitor and produce statistics for the communication between a given MTA and its adjacent MTAs has been developed by SPACE and integrated into the EUR AMHS Manual (see ref. [6], section 5.9), which recommends that an AMHS System and its management tools monitor and produce, or enable to do so, a number of statistical indicators related to:

- Number and size of data messages transmitted and received,
- Transfer and response times,
- MTA behaviour regarding specific functions,
- IP traffic volume,
- Quality of service information.

4.2.5.4 The statistics function of AMF-O must therefore enable:

- the provision by CCC Operators to the AMC Operator, of statistics produced by their AMHS COM Centres and concerning each adjacent MTA in other COM Centres;

- the aggregation by the AMC Operator of these individual statistics into a consolidated database;

- the publication by the AMC Operator of the aggregated/processed data for retrieval by CCC Operators.

4.2.5.5 At a later stage, the statistics function of AMF-O could enable:

- the production and publication by the AMC Operator of a high-level statistical report providing summary information about AMHS operation in the EUR/NAT Regions;

- the production and publication by the AMC Operator of a traffic matrix providing AMHS traffic volume information in the EUR/NAT Regions.

4.2.5.6 Statistical data needs to be produced by COM Centres on a monthly basis. To preserve consistency with other AMC procedures, collection and publication of data remains in accordance with the AIRAC cycle. The collected statistical data should include:

- data corresponding to the peak hour traffic over the past month,

- total data corresponding to the daily traffic over the past month.

4.2.5.7 Not all elements listed in the EUR AMHS Manual are strictly needed to give a reasonably useful view of AMHS operational behaviour in the EUR/NAT Regions. To avoid manipulating excessive volumes of data, the collected information is limited to the following elements among those listed in that document:

- Number of data messages transmitted

- Average size of the data messages transmitted (without header size figures if possible)

- Maximum size of the data messages transmitted

- Average number of destination addresses per message transmitted

- Number of data messages received

- Average size of the data messages received

- Maximum size of the data messages received

- Average transfer time

- Number of messages rejected (if any)

- Overall traffic volume at the level of IP packets (peak hour and total cycle time period)

- Maximum outage duration of association between MTAs (if any)

- Cumulated outage duration of association between MTAs (if any)

4.2.6 Miscellaneous functions

4.2.6.1 This section provides a description of a set of miscellaneous functions related to support, reference information and data presentation under specific or transverse formats.

4.2.6.2 The Support (helpdesk) functions are a set of functions in which informal questions can be asked, and non-formal support obtained. It includes two sub-functions:

- a Frequent Asked Questions (**FAQs**) area;
- an **Inter-working problems** area.

4.2.6.3 The objective of the "Support" functions is to receive and process questions / problems from CCC Operators and to record them along with their answers / solutions in the database for future usage.

4.2.6.4 The goal of the "View Bulletin Board" function is to facilitate communication between the AMC Operator and other AMC users. It enables users to see the bulletin board posted by the AMC Operator, to retrieve the e-mail address of the AMC Operator and to automatically create a blank e-mail to that address.

4.2.6.5 The "View AIRAC Cycle" function includes two sub-functions:

- a **View AIRAC Cycle** sub-function, showing the details of the current AIRAC cycle, and its splitting into five phases as described in Section 5.1 related to AMC procedures;
- a **View AIRAC Dates** sub-function, showing in calendar format AIRAC dates between any two dates specified by the user.

4.2.6.6 The goal of the "AMC Operator Details" function is to provide fully detailed contact information for the members of the AMC Operator Team, using the same format as for the COM Centre Persons and Contacts.

4.2.6.7 The function named "Documentation Part of ENRD" enables AMC users to download this document which includes, in particular, a description and explanation of the routing table format, as well as Operational procedures.

4.2.6.8 The "Path Function" calculates end-to-end paths in the integrated network, taking into account the routing in each network technology and the specified routes via gateways (AFTN to AMHS and vice-versa). It is closely related to the Routing management function, as it directly exploits the contents of a given set of routing tables.

4.2.6.9 The goal of the "View ANP Locations" function is to serve as a reference for Locations used in the AMC. It provides a view of all locations known to the AMC, primarily coming from the current Edition of ICAO Document 7910, and imported into the AMC from an external EUROCONTROL reference database named "ANP database". When needed for operational purposes, the AMC Operator also has the ability to create additional or modified ANP locations and territories. Such locations and territories are then qualified as "unofficial", conversely to imported records which are considered as "official". An unofficial territory can also be used as an alternative to a country, if required.

4.2.6.10 The goal of the "Regions" function is to provide general information about each ICAO Region, including postal address of the Regional Office, ICAO persons and contacts and COM Centres associated with each Region.

4.2.6.11 The "Send E-mail to User Groups" function enables an AMC user to retrieve other AMC user details, including e-mail address, based on a filter including the COM Centre and user category. Filtered users can then be selected individually or as a whole, and a draft e-mail to the selected users can be created in a new local email agent window, subject to a number of conditions being fulfilled on the workstations (availability of MS-Outlook, etc.).

4.2.6.12 The goal of the "COM Charts" function is to provide a graphical view of the topology data included in the network inventory, i.e. the COM Centres and the connections between them. Several COM Charts are available, following the structure of ICAO Regions, but with the ability to also include more COM Centres, e.g. inter-Regional Boundary Gateway COM Centres for communication with the considered Region, and located in other Regions. At any time, the COM Chart which is visible to AMC users represents the status of the current operational configuration of the network.

4.2.6.13 The Static Report function provides the capability to download a set of PDF and/or Excel files containing, in a format suitable for printing (.pdf) or computer usage (.xls), the AMC data corresponding to the current operational configuration of the network. Due to the huge volume of data included in the AMC, the PDF Static Report is made of four different files corresponding to the main functions of the AMC (AMF-O functions):

- network inventory,
- routing directory,
- address management,
- AMHS User Capabilities.

4.2.6.14 The Static Report (updated data) function provides the capability to download a PDF and/or Excel file containing, in a format suitable for printing (.pdf) or computer usage (.xls), the description of the COM Centres where changes will occur at the next AIRAC date, in the data related to the four functions in section 4.2.6.13 above. The intended modifications are shown in red to enable a quick identification of the foreseen changes.

4.2.7 Security management

4.2.7.1 At present ATS Messaging security is mostly subject to procedural guidelines defined at the AFSG level, and no provisions have been included yet for the management of security functions and/or procedures in the ATS Messaging Management Centre.

4.2.7.2 The main goal of implementing security management in Off-Line management should be the provision of a Public Key Infrastructure (PKI) and high-level Certification Authority (CA) for ANSPs in the EUR/NAT Regions. SPACE identified that this is a pre-requisite to the introduction of AMHS security (see ref. [2], section 7.3.5) which is specified in ICAO Document 9880 as being based on digital signature mechanisms.

4.2.7.3 Not taking the opportunity of the existence of the AMC is likely to delay significantly the implementation of AMHS Security. It should be noted, however, that SPACE considered that the decision to implement AMHS Security would be a major decision from an institutional perspective (see ref. [2], section 7.3.5). At present, this decision has not been made yet at a European ICAO level. The AMHS Security Forum aimed at coordinating the implementation of AMHS Security in the European AMHS has not been formed either.

4.2.7.4 **In this context, the present section describes the foreseen goal and scope of Security management function, when implemented in the ATS Messaging Management Centre. Such an implementation is not expected, however, to take place at the same time as other functions described in this document, but only at a later stage and after specific approval by AFSG. The development of detailed functional and implementation specifications are left for future study.**

4.2.7.5 In parallel with the address management model depicted in Figure 2, a similar model could be established for security management, enabling security to be implemented both with States/ANSPs having implemented their own Certificate Authority (CA), and with States/ANSPs having not yet their own CA but relying upon the services of the Regional CA implemented in the ATS Messaging Management Centre. In doing so, the AMC would act as the root CA for the ICAO EUR/NAT Regions.

4.2.7.6 The security management function should enable:

- the allocation of CA certificates and associated key pairs to Certification Authorities established by national ANSPs in the EUR/NAT Regions,
- if required, the allocation of user certificates and associated key pairs to individual users in national ANSPs in the EUR/NAT Regions,
- the creation and distribution of certificate revocation lists (CRLs).

4.2.7.7 From a technical perspective, allocating certificates as part of this function requires that owners of certificates are also managed, i.e. CAs and more important, AMHS users if certificates are specifically granted to individual users.

4.2.7.8 This function may be further complemented with other sub-functions related to security management. Security management encompasses many fields, which are not currently envisaged as being dealt with by the ATS Messaging Management Centre. As an example, such other functions could be:

- the management of security aspects over the underlying IP infrastructure,
- the establishment and operation of security provisions at a procedural level,
- the provision of AMHS-related (or non-specific) computer emergency alerts and advisory services,
- etc.

4.2.7.9 Procedures associated with security and CA management are critical, from a technical and legal perspective, to ensure that the security policy is met by the implemented solutions.

4.2.7.10 The access rights to this function may need to be managed separately, due to its specific nature. This will need to be determined at an early stage of the specification and development of security management, for appropriate structuring of the application.

4.3 Functional specifications

4.3.1 Conventions

4.3.1.1 In this chapter, titles of level 3 sections (e.g. 4.3.2, 4.3.3 etc.) identify functions (e.g. “Network inventory”), which are at the lowest level in the menu.

4.3.1.2 Words in bold identify the name of **sub-functions.**

4.3.1.3 Actions corresponding to buttons to be clicked are identified by a word in capital letters, e.g. CREATE.

4.3.1.4 Formal procedures are also identified by their name in capital letters, but which can span over several words, e.g. INVENTORY UPDATE.

4.3.1.5 Formally defined information elements are identified in italics, such as (PDR) *title*. The name of the element can be local to the function.

4.3.1.6 The use of a "shall" statement denotes a formal requirement implemented in the AMC as part of AMF-O, when the AMC application is developed.

4.3.2 Use of Data Areas

4.3.2.1 In the AMC implementation the concept of “data areas” is defined, as a means of helping to specify the services provided by the system and the procedures to be used with it:

- the Operational Area contains the "published" data. Everything in it can be read by all users and modified by none;

- the Pre-operational Area is a set of data being prepared by the AMC Operator which can then be transferred by him as one consistent set to the Operational Data Area. This is the only way in which the operational data area gets changed. The data in the Pre-operational Area is accessible by CCC Operators as data in preparation for becoming operational. It is managed by the AMC Operator but is not manipulated by him there. Instead, he will copy validated data from the Background Data Area (see below) to the Pre-operational Data Area;

- Data gets manipulated in the Background Area. The AMC Operator can manipulate it all; each CCC Operator / Ext. COM Operator can read and manipulate only his "own" data. The database system prevents records from being updated simultaneously by more than one user.

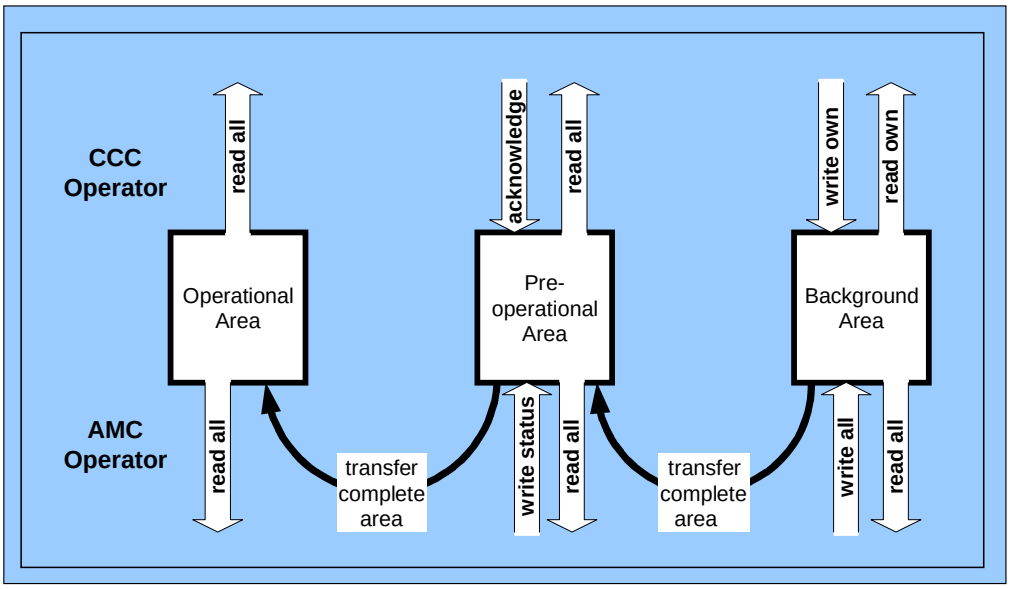


Figure 3: Schematic representation of the three Data Areas

4.3.3 Network Inventory

4.3.3.1 This function shall provide:

- the capability for a CCC Operator / Ext. COM Operator to declare modify network inventory information related to his COM Centre,
- the capability to view network inventory information from other COM Centres.

4.3.3.2 This function shall include:

- a **Persons and Contacts** sub-function to provide details about the persons in charge of the COM Centre operation and management,
- a **COM Centres** sub-function to provide general information about the COM Centre,
- an **AFTN/CIDIN capabilities** sub-function to provide AFTN/CIDIN system description,
- an **AMHS capabilities** sub-function to provide AMHS system description,
- a **VCGs** sub-function to describe details of CIDIN Virtual Circuit Groups including details of planned VCGs (for COM Centres with CIDIN capability only),
- a **connections** sub-function to describe AFTN, CIDIN and AMHS connections details as well as details about planned connections.

4.3.3.3 Actions associated with this function for CCC Operators / Ext. COM Operators, depending on the considered sub-function and data area, shall be View, CREATE, MODIFY, DELETE and REPORT.

4.3.3.4 The AMC Operator actions shall be identical to CCC Operators' or Ext. COM Operators' actions. Additionally the AMC Operator shall have the right to MODIFY data submitted by CCC Operators and Ext. COM Operators, before using the Transfer Data between Areas group of functions.

4.3.3.5 The INVENTORY UPDATE procedure defined in section 5.1.2 shall be used.

4.3.4 Routing Management

4.3.4.1 This function shall provide:

- the capability for the AMC Operator to prepare and propose recommended routing tables for all COM Centres in the Management Area,
- the capability for CCC Operators to inspect and acknowledge routing tables for their COM Centres, and to view and download proposed or released routing information for all COM Centres.

4.3.4.2 This function shall include:

- an **AFTN Routing Table** sub-function, which contains all AFTN routes from each COM Centre, including internal routes to an AFTN/AMHS Gateway,

- a **CIDIN Routing Table** sub-function, which contains all CIDIN routes from each COM Centre supporting CIDIN operationally,

- an **AMHS Routing Table** sub-function, which contains all AMHS routes from each COM Centre supporting AMHS operationally, including internal routes to an AFTN/AMHS Gateway,

- an **Acknowledgement** sub-function present only in the Pre-Operational area.

4.3.4.3 This function does not exist in the Background Area for CCC Operators. In the Pre-Operational and in the Operational areas, actions associated with this function for CCC Operators shall be View, REPORT and EXPORT.

4.3.4.4 In the Pre-Operational Area, the Acknowledgement sub-function shall include the actions MODIFY, SUBMIT and CANCEL for CCC Operators.

4.3.4.5 The AMC Operator, depending on the considered data area, shall have:

- the right to View, CREATE, MODIFY, DELETE, REPORT, EXPORT, IMPORT, SUBMIT and CANCEL data belonging to each of the **routing tables**,

- the possibility to ”Manage Background Data” and in particular the usage of the **Routing Matrices** function,

- the usage of the **Transfer Data between Areas** group of functions.

4.3.4.6 The ROUTING UPDATE defined in section 5.1.3 shall be used.

4.3.5 Address management

4.3.5.1 This function shall provide:

- the capability for a CCC Operator / Ext. COM Operator to declare modification of address information related to its AMHS Management Domain,

- the capability to view and download address information from other AMHS Management Domains.

4.3.5.2 This function shall include:

- an **AMHS MD Register** sub-function, which contains all MD information registered by ICAO Headquarters,

- an **intra-MD addressing** sub-function, which contains:.

    - the CAAS addressing information: For each MD selected CAAS, the CAAS table shall contain at minimum the “Default Entry” (Organisation-name attribute associated to one ICAO Location Indicator which consists of the Nationality Letters plus the wild card character(s) ‘*’, see also Appendix D, Section D.3.). For MDs selected XF addressing scheme the table shall be empty,

    - all user addresses (if any individually defined). Entries to this table should be done in exceptional cases only, when operationally required.

4.3.5.3 Procedures associated with these sub-functions shall be:

- The AMHS MD REGISTER UPDATE procedure which allows the AMHS MD parameters (PRMD-name, etc…) stored in the database to be modified,

- The INTRA-MD ADDRESSING UPDATE procedure, which allows the declaration to the AMC and to ICAO Headquarters of intended creation and/or modification of CAAS elements and of user addresses, and the modification within one AIRAC cycle of such information within the EUR/NAT Regions. This procedure is based on the INVENTORY UPDATE and on ROUTING UPDATE procedures.

4.3.5.4 The **intra-MD addressing** sub-function and the associated procedure shorten to a single AIRAC cycle the overall declaration, registration and publication cycle of address modifications depicted in Figure 2, which without the AMC would last several AIRAC cycles.

4.3.5.5 Actions associated with the **AMHS MD Register** sub-function for CCC Operators / Ext. COM Operators shall be limited to View, REPORT and EXPORT, because this information can only be modified after coordination with ICAO Headquarters. Data modification shall therefore be allowed only to the AMC Operator. This sub-function does not exist in the Background Area for CCC Operators and Ext. COM Operators.

4.3.5.6 Actions associated with the **intra-MD addressing** sub-function for CCC Operators / Ext. COM Operators, depending on the considered data area, shall be View, CREATE (CREATE CAAS ENTRY, CREATE USER ADDRESS), MODIFY, DELETE, REPORT, IMPORT (IMPORT CAAS TABLE, IMPORT USER ADDRESSES), and EXPORT (EXPORT CAAS TABLES and EXPORT USER ADDRESSES).

4.3.5.7 Additional actions associated with the **AMHS MD Register** sub-function for the AMC Operator, depending on the considered data area, shall be CREATE, MODIFY, DELETE, ADD STATE/ORG, ADD COM CENTRE, REPORT, IMPORT, EXPORT and CHECK CONSISTENCY.

4.3.5.8 The IMPORT (single or multiple) action shall allow to insert data from files in standard format (CSV) in the AMHS MD Register and CAAS table(s).

4.3.5.9 The EXPORT actions shall allow to gather data from the AMHS MD table, CAAS table and user table to files in standard format (CSV). It must be noted that files exported from the Background Area are not for operational use. Files exported from the Operational Area must be used during the current cycle, and files exported from the Pre-Operational Area (with status “Released”) can be used to prepare the next cycle (see procedures in sections 5.1.4 and 5.1.5).

4.3.5.10 The AMC Operator actions associated with the **intra-MD addressing** sub-function shall be identical to CCC Operators’ / Ext. COM Operators’ actions, depending on the considered data area. Additionally the AMC Operator shall have the right to MODIFY data submitted by all CCC Operators / Ext. COM Operators (after dialogue with the relevant Operator) in the Background Area.

Note 1.– In the initial case of a closed European AMHS Island (not connected to any other Region in AMHS but only in CIDIN/AFTN), the formal ICAO publication is not required for address management within the Region. The remaining CIDIN/AFTN forms an “isolation layer” in which all AMHS addresses are converted back to AF-Addresses. Address updates between two AMHS islands not connected in AMHS, neither directly or indirectly, is not strictly required.

Note 2.– Any ICAO Region implementing AMHS is likely to face the same requirement for (at least) intra-island address update publication mechanisms. For interconnected AMHS Islands, inter-Regional use of AMC by External COM Centres, or direct co-ordination between Regional "AMHS Address Publication Centres" (such as the AMC in Europe) implementing the Address Publishing Service shown in Figure 2, will be required to enable shortening of the modification cycle inter-Regionally in the same way as within a Region.

4.3.6 AMHS User Capabilities management

4.3.6.1 The **AMHS User Capabilities** function shall provide a user description (addresses and capabilities).

4.3.6.2 The user addresses shall be displayed for reference only. The user address modification itself shall be performed using the address management function (see 4.3.5).

4.3.6.3 Actions associated with this function for CCC Operators shall be CREATE, MODIFY, DELETE, REPORT, IMPORT and EXPORT in the Background Data Areas, and limited to REPORT and EXPORT actions in the Pre-operational and Operational Data Areas.

4.3.6.4 The IMPORT (single or multiple) action shall allow to insert data from files in one or several standard formats (CSV, LDIF, text, etc.) into the **AMHS User Capabilities**.

4.3.6.5 The EXPORT action allows to gather data from the **AMHS User Capabilities** into files in on one or several standard formats (CSV, LDIF, text, etc.).

4.3.6.6 The AMC Operator actions, depending on the considered data area, shall be identical to CCC Operators' actions. Additionally the AMC Operator shall have the right to MODIFY data submitted by CCC Operators (after dialogue with the relevant CCC Operator), before using the **Transfer Data between Areas** group of functions.

4.3.6.7 The Transfer Data between Areas group of functions shall be updated to take into account the newly created sub-function.

4.3.6.8 The procedure associated with this function shall be the USER UPDATE procedure, which allows the creation and modification of user information. This procedure is based on INVENTORY UPDATE defined in the CIDIN Management Manual.

4.3.7 Statistics

4.3.7.1 This function shall provide:

- the capability to gather statistics data in a predefined database,
- the capability for the AMC Operator to process these data,
- the capability to view and download relevant information.

4.3.7.2 This function shall include:

- a **monthly statistics** sub-function, showing daily data for the considered month, on a COM Centre to COM Centre basis;
- a **peak hour statistics** sub-function, showing the peak hour determined over the considered month and the associated traffic data, on a COM Centre to COM Centre basis.

4.3.7.3 Actions associated with this function for CCC Operators, depending on the considered data area, shall be View, EXPORT DEMO FILE, IMPORT STATISTICS and CREATE.

4.3.7.4 Depending on the data area, the CCC Operator shall view either his own statistics (background area) or the consolidated statistic tables generated by the AMC Operator (pre-operational and operational areas).

4.3.7.5 Additional actions associated with this function for AMC Operator, in the background data area, shall be through the Process Statistics function of the Manage Background Data group of functions. This function shall include three sub-functions:

- **table generation,**
- **monthly statistics,**
- **peak hour statistics.**

4.3.7.6 The IMPORT STATISTICS action shall allow CCC Operators to introduce statistics from their Com Centres into the AMC (with the pre-defined format specified in Appendix C).

4.3.7.7 The GENERATE TABLES actions in the Process Statistics function shall enable to AMC Operator to create consolidated tables and publish them as part of AMF-O functions.

4.3.7.8 The procedure associated with this function shall be the STATISTICS UPDATE procedure, by which statistics are provided by CCC Operators and published by the AMC Operator, for use by CCC Operators.

4.3.8 Miscellaneous functions

4.3.8.1 Support Functions

4.3.8.1.1 These functions shall provide:

- the capability for the AMC Operator to enter support information and upload related reference documents,
- the capability for all users to view and retrieve this information and references.

4.3.8.1.2 These functions shall include:

- a **FAQs** sub-function,
- an **Interworking problems** sub-function.

4.3.8.1.3 Actions associated with these functions for CCC Operators shall be View and Download reference.

4.3.8.1.4 Additional actions associated with these functions for the AMC Operator shall be CREATE, MODIFY, DELETE, UPLOAD REFERENCE, SUBMIT and CANCEL.

4.3.8.2 View Bulletin Board

4.3.8.2.1 This function shall provide:

- the capability for all users to view the bulletin board and the AMC Operator e-mail address, and to create a draft e-mail to that address using the local e-mail agent;

- the capability for the AMC Operator, using the associated function "Edit Bulletin Board" (reserved for AMC Operators), to edit the text and look of the Bulletin Board, using RTF (Rich Text File) format.

4.3.8.2.2 The actions associated with this function for AMC users shall be SEND MAIL and REPORT.

4.3.8.2.3 Additional actions associated with the Edit Bulletin Board function for the AMC Operator shall be RESET, PREVIEW and SUBMIT.

4.3.8.3 View AIRAC Cycle

4.3.8.3.1 This function shall provide:

- the capability to view the current AIRAC cycle,

- the capability to view all AIRAC dates between two dates specified by the user.

4.3.8.3.2 This function shall include:

- a **view AIRAC cycle** sub-function, in which the only action shall be REPORT;

- a **view AIRAC dates** sub-function, in which the only actions are SEARCH and REPORT.

4.3.8.4 AMC Operator details

4.3.8.4.1 This function shall provide:

- the capability for the AMC Operator to enter contact details regarding each member of the AMC Operator Team,

- the capability for all other AMC users to view this contact information.

4.3.8.4.2 The only action associated with this function for AMC Users shall be REPORT.

4.3.8.4.3 Additional actions associated with this function for the AMC Operator shall be CREATE, MODIFY and DELETE.

4.3.8.5 Documentation Part of ENRD

4.3.8.5.1 This function shall provide:

- a summary tabular list of all versions of the Documentation Part of ENRD stored in the AMC,

- the capability to view the documents,

- the capability to download the documents.

4.3.8.5.2 Actions associated with this function for AMC Users shall be Open (for viewing) and Save (for download).

4.3.8.6 Path Function

4.3.8.6.1 This function shall provide the capability for users to calculate and view end-to-end paths, from a Source COM Centre to a Destination COM Centre, in the integrated network, taking into account the routing in each network protocol and the specified routes via gateways (AFTN to AMHS and vice-versa).

4.3.8.6.2 This function shall be capable of using data from any area and from any routing matrix available in the considered area, in the Routing Directory function.

4.3.8.6.3 This function shall be capable of calculating routes in normal conditions (no failure) and in link failure or COM Centre failure conditions, using alternate routings entered in the Routing Directory (if any).

4.3.8.6.4 This function shall be capable of displaying the calculated path on the respective COM Chart.

4.3.8.6.5 The only action associated with this function shall be SEARCH, once the basic or extended search criteria are entered, and VIEW PATH ON CHART.

4.3.8.7 View ANP Locations

4.3.8.7.1 This function shall provide the capability for all users to view ANP Territories and Locations used in the AMC, including those which are coming from ICAO Document 7910 and those specifically created by the AMC Operator as unofficial.

4.3.8.7.2 This function shall include a SEARCH area based on the country-name.

4.3.8.7.3 This function shall display the following data in tabular format:

- the country name;
- the territory code, which in general corresponds to the pair of ICAO nationality letters for the considered country, but which may be different where more than two letters are needed to identify the country or territory;
- the territory name, which is generally left blank, but which may include a name in the following cases:
    - when nationality letters are specifically defined for a given territory within a country, or
    - when the territory is an unofficial territory created by the AMC Operator as an alternative to a country;
- the Location Indicator and location name, as defined in ICAO Document 7910 or entered by the AMC Operator if unofficial;
- the official or unofficial status of the location record.

4.3.8.7.4 The “View ANP Locations” function shall be for display only and shall not include any associated action.

4.3.8.7.5 The associated “Manage ANP Locations” function (reserved for AMC Operators) shall enable the AMC Operator:

- to manage the update of AMC when a new Edition of ICAO Documents 7910 is published and incorporated in the external ANP database; and
- to create unofficial locations and territories when required.

4.3.8.8 Regions

4.3.8.8.1 This function shall provide:

- the capability for all users to view general information related to all ICAO Regions;
- the capability for the AMC Operator to enter and modify general data related to all ICAO Regions.

4.3.8.8.2 This function shall display the following data:

- Postal address of the ICAO Regional office and remarks;
- Regional persons and contacts;
- The list of associated COM Centres.

4.3.8.8.3 The only action associated with this function for AMC Users shall be REPORT.

4.3.8.8.4 Additional actions associated with this function for the AMC Operator shall be CREATE PERSON, MODIFY, SUBMIT and CANCEL.

4.3.8.9 Send E-Mail to user groups

4.3.8.9.1 This function shall provide:

- the capability for all users to display a set of AMC users, based on a filter by COM Centre and user group;
- the capability to select all or part of the displayed users, and to create an e-mail to the addresses of these people using MS-Outlook, if installed on the user’s workstation.

4.3.8.9.2 This function shall display for the filtered persons the name, associated COM Centre, User Group and e-mail address and a check box to select or unselect the person as an e-mail recipient.

4.3.8.9.3 The actions associated with this function for AMC Users shall be SELECT ALL, UNSELECT ALL and SEND WITH LOCAL MAIL AGENT.

4.3.8.10 COM Charts

4.3.8.10.1 This function shall provide:

- the capability for all users to view and retrieve COM Charts for all ICAO Regions;

- the capability for the AMC Operator, using the associated function “Edit COM Charts” (reserved for AMC Operators), to edit the COM Charts graphically.

4.3.8.10.2 This function shall display data found in the Network Inventory.

4.3.8.10.3 The main actions associated with this function for AMC Users shall be SHOW COM CHART and Save as PDF.

4.3.8.10.4 This function shall be part of the “View Operational Data” group of functions, because it displays data present in the operational data area.

4.3.8.10.5 Additional actions associated with the related Edit COM Charts function (restricted for use by the AMC Operator only) shall be EDIT POSITIONS, EDIT LABELS, CREATE FULLY MESHED ISLAND, EDIT FULLY MESHED ISLAND, EDIT BOUNDARY, SUBMIT and CANCEL.

4.3.8.11 Static Report

4.3.8.11.1 This function shall provide the capability for all users to download the static report in four PDF files and one single Excel file, or in a zipped format.

4.3.8.11.2 This function shall be part of the “View Operational Data” group of functions, because data contained in the Static Report reflect the content of the operational data area.

4.3.8.12 Static Report (updated data)

4.3.8.12.1 This function shall provide the capability for all users to download the static report (updated data) in single PDF or Excel file, or in a zipped format.

4.3.8.12.2 This function shall be part of the “View Pre-Operational Data” group of functions, because data contained in the Static Report reflect the content of the pre-operational data area regarding COM Centres for which pre-operational data differs from operational data.

4.3.9 Security management

4.3.9.1 The complete functional specification of this function is for further study.

4.3.9.2 Subject to the conclusions of the study mentioned above, this function should provide:

- the capability to import certification authority (CA)-related information,
- the capability to store and export CA-related information,
- the capability to import user certificate information,
- the capability to store and export user certificates.

4.3.9.3 The establishment of a Certification Authority (CA) for each ANSP is out of the scope of the AMC.

4.3.9.4 The definition of the relationship between the AMC and each CA is out of the scope of the present project, and should be part of the study mentioned above (there may be e.g. legal and institutional issues).

5 AMC Procedures

The procedures described in this document are operational procedures of two kinds:

- AMC Operational Procedures, i.e. sequence of operations which specify how AMC Systems must be used by CCC Operators and the AMC Operator. The description of such procedures is intended to be exhaustive in this document;

- some AMHS Operational Procedures that are of special importance to AMHS operation during the transition to AMHS, and which make an intensive use of AMC Operational Procedures. The description of such procedures is NOT intended to be exhaustive in this document. These procedures will be developed in AFSG Subgroups and included in Appendix A to this document when appropriate.

5.1 AMC Operational Procedures

5.1.1 General view

5.1.1.1 This document adopts a simplified representation of procedures, compared to the representation used earlier.

5.1.1.2 In particular, the relationship to time is described in a general manner, using a splitting of the AIRAC cycle into five phases. The interactions between AMC Operator tasks and CCC Operator tasks are not detailed here. Such interactions are expected to be based on the use of triggers and messages in the Bulletin Board.

5.1.1.3 A general view of the different phases composing the procedures is provided in the Figure 4 below, in relation with the AIRAC cycle. The milestones are common to all procedures.

General View

Day in Cycle	Calendar date	Data Entry by CCC / Ext COM / AMC	Data Validation and Processing by AMC	ACK Phase by CCC	ACK Processing by AMC	Data Retrieval and Implementation (by CCC) Data Publication (by AMC)
1	13/02					
2	14/02					
3	15/02					
4	16/02					
5	17/02					
6	18/02					
7	19/02					
8	20/02					
9	21/02					
10	22/02					
11	23/02					
12	24/02					
13	25/02					
14	26/02					
15	27/02					
16	28/02					
17	01/03					
18	02/03					
19	03/03					
20	04/03					
21	05/03					
22	06/03					
23	07/03					
24	08/03					
25	09/03					
26	10/03					
27	11/03					
28	12/03					

LEGEND

- AMC Operator locks COM Centres
- AMC Operator releases the routing matrix
- AMC Operator transfers to pre-operational area
- AMC Operator moves data to operational area, unlocks COM Centres and makes official publications; CCC Operators use new data for operational service; AMC Operator sends export files to ICAO HQ
- Weekends

Figure 4: The AMC phases

5.1.1.4 In general, CCC Operators and External COM Operators have a similar role. There are however two significant differences as far as procedures are concerned:

- External COM Operators have an active access to a more limited set of functions. Typically, in the beginning they should mainly participate in network inventory, address management and AMHS User Capabilities management. However, this may evolve in the future using the AMC "Assign Functions to User Types" function. In the general description which follows the distinction in available functions to each "user category" applies but is not recalled, unless specifically required;

- as a consequence of the above, External COM Operators are not involved in ACK/NACK phases.

5.1.1.5 There are 5 AMC phases in an AIRAC cycle as follows:

1. Data Entry Phase

Starts day 1, suspended day 7, resumes day 15, ends day 28

CCC/External COM Operator tasks: Data entry in the background area for network inventory, network planning, intra-MD address, AMHS User Capabilities, statistics.

AMC Operator tasks: Data entry in the background area for MD Register and on behalf of Participating COM centres, data entry for network inventory, network planning, intra-MD address, AMHS User Capabilities, statistics.

Note.– Any data entered between day 15 and day 28 will not be included into the pre-operational or operational areas until the following cycle.

2. Data Validation and Processing Phase

Starts day 8, ends day 14

CCC/External COM Operator tasks: Coordination with AMC Operator

AMC Operator tasks: Lock COM centres, create/modify routing tables, process statistic data, propose new data to the CCC/External COM Operators by moving background data into the pre-operational area.

3. Acknowledgement Phase

Starts day 15, ends day 20

CCC Operator tasks: Check new data in the pre-operational area and acknowledge it.

AMC Operator tasks: None

4. Acknowledgement Processing Phase

Starts day 21, ends day 24

CCC Operator tasks: Coordination with AMC Operator

AMC Operator tasks: Check all ACKs, if there are NACKs coordinate with those COM Centres, release the routing matrix.

5. Data Retrieval and Implementation Phase

Starts day 25, ends day 28

CCC/External COM Operator tasks: Retrieve new data in the preoperational area, implement address and routing data in the systems at 1100h UTC of Day 28.

AMC Operator tasks: Inform the Participating COM Centres about the acknowledged data, move pre-operational data to operational area on day 28 at 11

UTC, unlock the COM centres, inform the ICAO about address modifications.

5.1.2 Network Inventory Update

Actors

- the CCC Operators,
- the External COM Operators,
- the AMC Operator (also co-ordinates with the Participating COM Centres)

Purpose

New or modified data has to be entered into the database in a co-operative effort by CCC Operators, External COM Operators and the AMC Operator.

Description

New or modified data on the configuration of their own Centre(s) as well as planning information is entered by CCC Operators and External COM Operators into the Background Area. It is validated against known data by the AMC Operator before being moved into the Pre-operational Area.

Actions

enter data in Background Area	The new or modified information of the COM Centre is entered by the CCC Operator/External COM Operator into the Background Area. CCC Function: Enter Background Data / Network Inventory
enter / validate data in Background Area	The AMC Operator checks the input data of a COM Centre in its Background Area and modifies it as he sees fit (validation). For example, the AMC Operator is responsible for the overall correctness of the data and its consistency. He can also work on behalf of any COM Centre. AMC Function: Enter Background Area / Network Inventory
Lock COM Centre	Locking and unlocking is a means of ensuring the consistency of data in the Pre-operational Area.
Transfer to Pre-operational Area	All data relating to one COM Centre or all the COM centres are transferred to the Pre-operational Area in one batch. AMC Function: Transfer Data between Areas / To Pre-operational Area
Unlock COM Centre	Locking and unlocking is a means of ensuring the consistency of data in the Pre-operational Area.

co-ordinate	In case of inconsistencies or problems the AMC Operator and the CCC Operator/ External COM Operator concerned communicate directly by telephone, email or fax. As a result of this co-ordination, the AMC Operator may need to modify data in the Background Area and the CCC Operator/ External COM Operator may need to re-inspect data in the Pre-operational Area. CCC / AMC Functions: None

5.1.3 Routing Update

Actors

- the CCC Operators
- the AMC Operator

Purpose

This is one of the major procedures in ATS Messaging Management Centre. Its purpose is to derive optimal routing tables from the configuration description in the database, publish the routing tables, agree them with CCC Operators and to implement them in COM Centres.

Description

The AMC Operator decides, possibly in co-operation with CCC Operators, whether new routing tables should be generated and published in this cycle (for example when a new AMHS link is available). He can make the early stages of his preparation available as Routing Matrices ("in preparation" status) in the Pre-operational Area. If before the end of the Data Validation Phase he creates new tables which he wants to be implemented, he sets a trigger in the Bulletin Board.

CCC Operators monitor the Bulletin Board for triggers to start the Routing Update Procedure. If such a trigger is found, CCC Operators react to the proposed Routing Matrix by acknowledging with an ACK or NACK before the End of the ACK Phase. They may need to co-ordinate with the AMC Operator for this.

The AMC Operator looks at the acknowledgements in the ACK Processing Phase and decides whether to cause the Routing Matrix to be implemented. He may need to co-ordinate with CCC Operators for this. If a new Routing Matrix is to be implemented, the proposed versions is modified to have "released" status", indicating that this version is to be implemented in this cycle.

If a new Routing Matrix is to be implemented, CCC Operators can prepare for entering the necessary tables into their systems. The actual implementation takes place on Day 28, the AIRAC Date.

On Day 28 the AMC Operator transfers the contents of the Pre-operational Area to the Operational Area. If a new Routing Matrix is to be implemented, this is transferred, otherwise the old Routing Matrix is restored.

Actions

Lock all COM Centres	First it is necessary to lock all COM Centres to maintain data consistency. AMC Functions: Manage Background Data / Lock/Unlock COM Centre
Create RM in Background Area	These Routing Matrices are due to changes in the network configuration, new AMHS link, traffic patterns, etc. AMC Functions: Manage Background Data / Routing Matrices / Routing Matrix, AFTN Matrix, CIDIN Matrix, AMHS Matrix AMC Functions: Manage Background Data / Routing Directory / AFTN, CIDIN, AMHS AMC Functions : Manage Background Data / Routing Update for transition to AMHS
Transfer RM (“in preparation”) to Pre-Operational	The Routing Matrix which is being proposed is transferred to Pre-operational Area with status “in preparation”. AMC Functions: Transfer Data between Areas / To Pre-operational Area
Co-ordinate	Informal co-ordination between AMC Operator and CCC Operators may be necessary. CCC/AMC Functions: None
Set RM to status “proposed”	Modify Routing Matrix status from “in preparation” to "proposed” AMC Functions: Manage Pre-Operational Data / Modify Routing Matrix Status
Enter ACK NACK	The CCC Operators investigate the proposed Routing Matrix and agree (ACK) or disagree (NACK) with it. In the latter case, reasons should be given. There may be a need to co-ordinate with the AMC Operator on this. CCC Functions: View Pre-Operational Data / Routing Directory
Co-ordinate (AMC)	If one or more NACKs have been given as acknowledgements, the AMC Operator may need to co-ordinate with those CCC Operators. He has the possibility of overriding the poll on the proposed Routing Matrix. He decides accordingly on whether to release the proposed Routing Matrix. CCC Functions extended: View Pre-operational data / Routing Directory

Set RM to status “released” (implementation date = Day 28)	Modify Routing Matrix status from “proposed” to “released”. AMC Functions: Manage Pre-operational Data / Modify Routing Matrix Status
Restore old Routing Matrix in Pre-operational Area (if needed)	If no new Routing Matrix is to be implemented, the old Routing Matrix has to be restored in Pre-operational Area before the Pre-operational Area is transferred to the Operational Area. This is because the whole content of the Pre-Operational Area with its new Network Inventory data has to be transferred to the Operational Area. However the proposed Routing Matrix has not been accepted and should not be transferred to the Operational Area. AMC Functions: Transfer Data between Areas / To Pre-operational Area
Prepare Routing Matrix implementation	Preparation on the part of CCC Operators could be downloading of their own Routing Tables and preparing to enter them into the systems. CCC Functions: View Pre-operational Data / Routing Directory
Implement Routing Matrix	The CCC Operators set the Routing Tables to become live at 1100h UTC on Day 28. CCC/AMC Functions: None
Transfer Pre-operational to Operational	At 1100h UTC on Day 28 the current contents of the Pre-operational Area will become the data of the Operational Area. AMC Functions: Transfer Data between Areas / To Operational Area
Unlock all COM Centres	In preparation for the next cycle, all COM Centres are unlocked. AMC Functions: Manage Background Data / Lock/Unlock COM Centre

Decisions

Need for Routing Matrix update?	A decision is made by the AMC Operator, based on his network management experience, whether a new Routing Matrix needs to be generated in this management procedure cycle. He needs to reach this decision before the end of the Data Validation Phase.

Any NACKs or need to co-ordinate?	If there are no NACKs, the way forward is clear. If there are NACKs, the AMC Operator may need to co-ordinate with those CCC Operators who did not accept the proposed Routing Matrix in order to clarify their reasons. It could be that there are misunderstandings or that the CCC Operators would be prepared to accept the proposed Routing Matrix after talking with the AMC Operator. *Note that, in any case, no changes are made to the proposed Routing Matrix.*
Decision to release?	The final decision as to whether the Routing Matrix is to be released, and thus become operational on Day 28, lies with the AMC Operator. He needs to take this decision before the end of the ACK Processing Phase.

5.1.4 AMHS MD Register Update

5.1.4.1 Context

At a global level, ICAO Headquarters will manage the official AMHS MD Register, thereby ensuring uniqueness of domain names for AMHS MDs.

The Register is being created upon the basis of a State Letter process, and the content of the Register is of high institutional value, although it also has important technical/operational effects. Modifications need to be officially requested by States and accepted by ICAO Headquarters. ICAO Regional Offices are expected to have a co-ordination role in this process, whenever required.

This institutional process is out of the scope of the AMC. The outcome of this process is the publication by ICAO Headquarters of an update of the AMHS MD Register. The publication mode and frequency are not determined at present, but a possible option is publication on the ICAOnet website.

In the short- to medium-term, ICAO HQ will utilize the European ATS Messaging Management Centre (AMC) and has urged the States to follow the procedures for AMHS address coordination through the AMC given in Appendix E (see ICAO State Letter - Ref.: AN 7/49.1-09/34 from 14 April 2009).

The modifications considered in this section are those relevant to a Management Domain as a whole[7], as seen internationally from other Management Domains. This includes exclusively:

1. the creation of a new (real or foreseen) AMHS MD, corresponding to new ICAO Nationality Letters or to a new Designator composed of 4, 5 or 7 letters. The word “new” in this context means “not yet included in the Register”;

[7] Modifications regarding addressing within an AMHS MD are out of the scope of the present procedure, they are discussed in section 5.1.5 (Intra-MD addressing update). Although intra-MD addressing modifications (e.g. modifying the CAAS table) are also subject to ICAO Publication, they do not have the same effect on global AMHS operation.

2. the deletion of a registered (real or foreseen) AMHS MD, corresponding to existing ICAO Nationality Letters or Designator;

3. the modification of the Global Domain Identifier – abbreviated as GDI, and made of Country-name, ADMD-name and PRMD-name – of a registered (real or foreseen) AMHS MD, for a value of ICAO Nationality Letters or Designator that is already present in the Register. Two sub-cases of this may occur:

    a) the new value of the GDI does not exist yet in the Register;

    b) the new value of the GDI already exists for another value of ICAO Nationality Letters or Designator. This case means in practice that the State or Organization identified by the ICAO Nationality Letters or Designator whose GDI value is modified joins an existing AMHS MD with the already existing GDI.

4. the addition of new ICAO Nationality Letters or of a new Designator composed of 4, 5 or 7 letters, that will map to an already registered (real or foreseen) AMHS MD.

The use of this procedure should be very infrequent, due to the following facts:

- ICAO Nationality Letters and Designators, which are derived from ICAO Documents 7910 (and possibly 8585) are very stable;

- GDIs for AMHS MDs should be very stable. Ideally they should be unchanged until AMHS is eventually withdrawn from aeronautical communications, maybe 20+ years from now;

- AMHS MDs have been registered, with a reserved default GDI value, for each ICAO Member State and registered Nationality Letters.

In practice the most likely change should be from the default reserved GDI (C=XX/A=ICAO/default PRMD-name) to a GDI with a State-selected PRMD-name, when AMHS maturity progressively grows among ICAO Member States. This corresponds to case 3a) above.

The AMHS MD Register update procedure could be complex because the envisaged changes have significant implications on AMHS operation, including:

- AFTN/AMHS address conversion, because the modifications impact the mapping;

- AMHS routing, because the GDI modification impacts AMHS routing tables.

A consequence is also that the AMHS MD Register update procedure is likely to create interactions with other procedures[8], which may themselves be triggered separately for other reasons, such as a planned configuration change.

To minimize such interactions, the two following recommendations are therefore made:

[8] In particular, a change in the Global Domain Identifier of an AMHS MD generates an editorial update of the AMHS Routing Matrices, which may therefore interact with the Routing Directory function. A change in the selected Addressing Scheme for a given MD generates the need for an Intra-MD Addressing Update.

Recommendation 1

When the Global Domain Identifier (GDI) of an AMHS MD needs to be modified (case 3a above), this has an editorial impact on AMHS Routing Tables. To avoid conflicts of such routing edits with simultaneous routing updates, and because routing tables are managed as a whole, it is recommended to refrain from planning Regional routing updates at the same cycle as a GDI change.

Recommendation 2

All other changes above (cases 1, 2, 3b and 4) affect AMHS Routing Tables **both** operationally and editorially. Hence, it is recommended that such changes be carefully planned by an appropriate body (an AFSG subgroup) ahead of their applicability dates, before being introduced in the AMC. The conjunction of such changes with other routing updates in the same cycle should be avoided whenever possible.

5.1.4.2 Procedure specification

Actors

- CCC Operators
- External COM Operators,
- AMC Operator,
- ICAO Headquarters and Regional Offices (for validation and publication of official AMHS MD Register).

Purpose

New or modified data has to be entered into the AMHS MD table.

Description

Modification requests submitted by States regarding major changes (change of PRMD-name, change of addressing scheme) are received from ICAO, after validation for official purposes, by the AMC Operator. The AMHS MD Register Update is executed for all changes applicable at the end of the current AIRAC cycle.

The AMC Operator updates the AMHS MD Register during the Data Entry Phase, taking a special care of any interaction with other functions. Actions described in this section are strictly relevant to the AMHS MD Register Update procedure, but a collateral effect of these can be to trigger the execution of another procedure. Coordination may take place at this stage, in particular to tackle such potential interactions, based on the information provided by the Operator in the Pre-Operational Area (status “in preparation”), to make sure that the foreseen changes are agreeable.

He transfers the updated tables to Pre-operational Area with status “released” before the end of the Data Validation Phase, and sets a trigger in the Bulletin Board to inform CCC Operators/External COM Operators of the change.

CCC Operators/External COM Operators monitor the Bulletin Board for triggers to start the AMHS MD Register Update Procedure. If such a trigger is found, CCC Operators/External COM Operators react and prepare the implementation of the new tables.

On Day 28 the AMC Operator transfers the contents of the Pre-operational Area to the Operational Area. An AMC export file is created and sent to ICAO for synchronisation of the official Register of AMHS MDs.

Actions

Enter or modify data on background Area	The new or modified information related with the AMHS MD Register is entered by the AMC Operator into the Background Area. He needs to perform this action before the end of the Data Entry Phase. AMC Functions: Manage Background Data / AMHS MD Register
Lock all COM Centres	Locking is a means of ensuring the consistency of data. AMC Functions: Manage Background Data / Lock/Unlock COM Centre
Transfer data to Pre-Operational Area	The modified tables are transferred to the Pre-operational Area, with the status “in preparation” so as to enable co-ordination to take place. AMC Functions: Transfer Data between Areas / To Pre-operational Area
Co-ordinate	It is important that CCC Operators/External COM Operators can co-ordinate with the AMC Operator to ensure that all changes are agreeable. In principle, if recommendations not to combine Regional routing updates with Register updates have been followed, this should be easy to achieve. CCC / AMC Functions: None
Prepare implementation of AMHS MD table	Preparation on the part of a CCC Operator/External COM Operator could be the exportation of the AMHS MD table to prepare to enter these into his system. CCC Functions: View Pre-operational Data / Address Management / AMHS MD Register
Transfer data to Operational Area	At 1100h UTC on Day 28 the current contents of the Pre-operational Area will become the data of the Operational Area. AMC Functions: Transfer Data between Area / To Operational Area
Unlock all COM Centres	In preparation for the next cycle, all COM Centres are unlocked. AMC functions: Manage Background Data / Lock/Unlock COM Centre
Implement AMHS MD table	The CCC Operators/External COM Operators set the AMHS MD tables and to become live at 1100h UTC on Day 28 CCC / AMC Functions: None

Provision of AMHS MD Register update to ICAO HQ	The AMC Operator sends an address management Export file (AMHS MD Register) from the AMC to the ICAO HQ so that it can be officially published in the next release of the ICAO Register of AMHS MDs. CCC / AMC Functions: None

5.1.5 Intra-MD addressing Update

Actors

- CCC Operators,
- External COM Operators,
- AMC Operator (also coordinating with Participating COM Centres),
- ICAO Headquarters and Regional Offices (as a source of information and for official publication)

Purpose

New or modified data concerning intra-MD addressing, has to be entered into the CAAS table and/or user table (depending on the elements to be modified) in a co-operative effort by CCC Operators, External COM Operators and the AMC Operator.

Description

The beginning of this procedure is similar to the Inventory Update procedure, as CCC Operators/External COM Operators enter their intended changes in the AMC database. The end of this procedure is similar to the Routing Update procedure, as CCC Operators have to implement the Operational intra-MD addressing information gathered and validated by the AMC Operator.

External COM Operators also have to implement the same information.

During the Data Entry Phase, new or modified data for intra-MD addressing of their own Centre(s) is entered by CCC Operators/External COM Operators into the Background Area. It is validated against known data by the AMC Operator before being moved into the Pre-operational Area.

In parallel with this activity, the AMC Operator performs the same type of data entry as described above for the European PRMD (CAAS Table of PRMD=EUROPE), the Participating COM Centres and for other areas of the world, based on the inputs he received from ICAO Regional Offices and/or from ICAO Headquarters. If necessary, he coordinates with appropriate bodies to sort out any identified inconsistency.

Note.– In the context of the modification of the CAAS Table of PRMD=EUROPE, the AMC Operator has to ensure the respective update of the AFTN/CIDIN/AMHS Routing Tables.

When the AMC Operator considers that the data is of good quality he moves data to the Pre-Operational Area.

When this is completed, the AMC Operator sets a trigger in the Bulletin Board informing CCC Operators/ Ext. COM Operators that an intra-MD address update is needed.

The CCC Operators/External COM Operators monitor the Bulletin Board for triggers on intra-MD addressing. If such a trigger is found, CCC Operators/External COM Operators can prepare for entering the necessary tables into their systems. The AMC Operator informally also advises Participating COM Centres about the agreed modifications. The actual implementation takes place on Day 28, the AIRAC Date.

On Day 28 the AMC Operator transfers the contents of the Pre-operational Area to the Operational Area. The new intra-MD addressing (AMHS MD table, CAAS table and/or User table) is transferred.

At that date, the AMC Operator provides the ICAO HQ with an AMC export file including the address modifications performed, so that they can be officially published by ICAO.

Actions

Enter data in Background Area	The new or modified information of the COM Centre is entered by the CCC Operator/External COM Operator into the Background Area. The AMC Operator may need to perform the same action for the Participating COM Centres. For Non-Participating COM Centres, AMC Operator action is based upon official documents received from the ICAO HQ or Regional Offices. CCC/AMC Functions: Enter Background Data / Address management / Intra-MD Addressing
Co-ordinate with ICAO	In case the AMC Operator identifies inconsistencies between the ICAO published data and the AMC data, he coordinates directly with appropriate bodies (ICAO HQ and/or other ICAO Regions) by telephone, email or fax. As a result of this co-ordination, the AMC Operator may need to modify data in the Background Area. CCC / AMC Functions: Enter Background Data / Address Management / Intra-MD addressing
Validate modified data against known data in Background Area	The AMC Operator checks the input data of CCC Operator/External COM Operator in the Background Area and modifies it as he sees fit (validation). For example, the AMC Operator is responsible for the overall correctness of the data and its consistency. He can also work on behalf of any COM Centre. AMC Functions: Enter Background Data / Address Management / Intra-MD addressing

Co-ordinate with CCCs	In case of inconsistencies or problems the AMC Operator and the CCC Operator/External COM Operator concerned communicate directly by telephone, email or fax. As a result of this co-ordination, the AMC Operator or the CCC Operator may need to modify data in the Background Area and the CCC Operator/External COM Operator may need to re-inspect data in the Pre-Operational Area. CCC / AMC Functions: None
Lock COM Centres	Locking is a means of ensuring the consistency of data in the Pre-Operational Area. AMC Functions: Manage Background Data / Lock/Unlock COM Centre
Transfer to Pre-Operational Area	All data relating to all COM centres are transferred to Pre-Operational Area in one batch. AMC Functions: Transfer Data between Areas / To Pre-Operational Area
Unlock all COM Centres	In preparation for the next cycle, all COM Centres are unlocked. AMC Functions: Manage Background Data / Lock/Unlock COM Centre
Advise Participating COM Centres as appropriate	In the Data Retrieval Phase, the AMC Operator informally advises about changes that are being performed in the address management function. AMC Functions: None
Prepare intra-MD addressing implementation	Preparation on the part of CCC Operator/External COM Operator could be the exportation of CAAS table to enter it into their systems. CCC Functions: View Pre-operational Data / Address Management / Intra-MD addressing / Export
Implement intra-MD addressing	The CCC Operators/External COM Operators set the Intra-MD Addressing tables to become live at 1100h UTC on Day 28. CCC / AMC Functions: None
Transfer pre-operational to operational	At 1100h UTC on Day 28 the current contents of the Pre-operational Area will become the data of the Operational Area. AMC Functions: Transfer Data between Areas / To Operational Area

Provision of intra-MD addressing update to ICAO HQ	The AMC Operator sends an address management Export file (CAAS tables) from the AMC to the ICAO HQ so that it can be officially published in the next release of the ICAO Register of AMHS MDs. CCC / AMC Functions: None

Decisions

Data of good quality?	The AMC Operator has overall responsibility for the quality of data in the database. He must ensure that he is satisfied with the quality of data entered by CCC Operators/External COM Operators before the data is transferred to the Pre-Operational Area.
Data consistent ?	The AMC Operator checks that the data published by ICAO HQ is consistent with the AMC data. When doing this, he takes care of potential mis-synchronisation between the ICAO publication and the AMC. AMC Functions: Enter Background Data / Address Management / Intra-MD Addressing / Import
Agree with new / modified data in Pre-Operational Area ?	The data entered by a CCC Operator/External COM Operator may have been modified by the AMC Operator before the data was transferred to the Pre-Operational Area. The CCC Operator/External COM Operators may not necessarily agree with modifications made by the AMC Operator. If not, they need to co-ordinate with the AMC Operator and (perhaps) re-enter the data.

5.1.6 AMHS User Capabilities Update

Actors

- CCC Operators,
- External COM Operators,
- AMC Operator (also coordinating with Participating COM Centres)

Purpose

New or modified data has to be entered into the User table in co-operative effort by CCC Operators/External COM Operators and the AMC Operator.

Description

During the Data Entry Phase, new or modified data on the configuration of their own Centre(s) is entered by CCC Operators/External COM Operators, or by the AMC Operator on behalf of Participating COM Centres, into the Background Area. It is validated against known data by the AMC Operator before being moved into the Pre-operational Area. The AMC Operator performs this activity alone for External COM Centres.

At the beginning of the Data Validation Phase the AMC Operator sets a trigger in the Bulletin Board.

CCC Operators/External COM Operators monitor the Bulletin Board for triggers to start the User table Update. If such a trigger is found, CCC Operators/External COM Operators can prepare for entering the User table into their systems. The actual implementation takes place on Day 28, the AIRAC Date.

On Day 28 the AMC Operator transfers the contents of the Pre-operational Area to the Operational Area. He informally advises Participating COM Centres about the performed changes. The new User table is transferred.

Actions

Enter data in Background Area	The new or modified information of the COM Centre is entered by the CCC Operator/External COM Operator into the Background Area. This is possible only for their own centres. CCC Functions: Enter Background Area / AMHS User Capabilities
Validate data modified in against known data Background Area	The AMC Operator checks the input data in the Background Area and modifies it as he sees fit (validation). For example, the AMC Operator is responsible for the overall correctness of the data and its consistency. He can also work on behalf of any COM Centre. AMC Functions: Manage Background Data / AMHS User Capabilities
Co-ordinate	In case of inconsistencies or problems the AMC Operator and the CCC Operator/External COM Operator concerned communicate directly by telephone, email or fax. As a result of this co-ordination, the AMC Operator may need to modify data in the Background Area and the CCC Operator/External COM Operator may need to re-inspect data in the Pre-operational Area. CCC / AMC Functions: None
Lock COM Centres	Locking is a means of ensuring the consistency of data in the Pre-operational Area. AMC Functions: Manage Background Data / Lock/Unlock COM Centre
Transfer to Pre-operational Area	All data relating to all COM Centres are transferred to the Pre-operational Area in one batch. AMC Functions: Transfer Data between Areas / To Pre-operational Area

Prepare User table implementation	Preparation on the part of CCC Operator/External COM Operator could be, for example, the exportation of the User table to enter it into his system. CCC Functions: View Pre-operational Data / AMHS User Capabilities / Export
Implement User table	The CCC Operators/External COM Operators set the User table to become live at midnight on Day 28. CCC / AMC Functions: None
Transfer pre-operational to operational	At 1100h UTC on Day 28 the current contents of the Pre-operational Area will become the data of the Operational Area. AMC Functions: Transfer Data between Areas / To Operational Area
Unlock all COM Centres	In preparation for the next cycle, all COM Centres are unlocked. AMC Functions: Manage background Data / Lock/Unlock COM Centre

Decisions

Data of good quality?	The AMC Operator has overall responsibility for the quality of data in the database. He must ensure that he is satisfied with the quality of data entered by CCC Operators/External COM Operators before the data is transferred to the Pre-operational Area.

5.1.7 Statistics Update

Actors

- CCC Operators,
- AMC Operator

Purpose

This procedure gathers, compiles and publishes statistics.

Description

The CCC Operators import in the Background Area statistics from their systems for the previous month during the Data Entry Phase. The AMC Operator validates these imports.

In the Data Validation Phase, the AMC Operator processes statistics to obtain consolidated tables and reports on statistics. He checks the quality of result produced by automated functions.

When satisfied with the result, he transfers the statistics to the Pre-Operational Area and sets a trigger in the Bulletin Board to inform CCC Operators. CCC Operators can then start to inspect statistics and investigate problems shown by these, if any.

On Day 28, the AMC Operator transfers the statistics to the Operational Area.

When two AIRAC dates occur during the same month, the procedure is executed only once for the past month. At the latest during the cycle preceding this event, the AMC Operator coordinates with CCC Operators to decide which AIRAC date will be skipped.

Actions

Enter statistics from the previous month in Background Area	CCC Operators import statistics from his system. These statistics concern the previous month. The importation format is predefined. CCC Functions: Enter Background Data / Statistics / Import
Validate data import by CCC Operators	The AMC Operator validates the quality of statistics import by CCC Operators (format, pertinence, etc…) AMC Functions: Manage Background Data / Process Statistics / Monthly Statistics and Peak Hour Statistics
Co-ordinate	In case of problems the AMC Operator and the CCC Operators concerned communicate directly by telephone, email or fax. As a result of this co-ordination, the AMC Operator or the CCC Operator may need to modify data in the Background Area. CCC / AMC Functions: None
Process statistics	The AMC Operator gathers imported statistics and creates new consolidated tables with the help of the function “generate tables”. AMC Functions: Manage Background Data / Process Statistics / Table Generation
Transfer result to Pre-operational Area	All consolidated tables are transferred to the Pre-operational Area. AMC Functions: Transfer Data between Areas / To Pre-operational Area
Transfer to Operational Area	All consolidated tables are transferred to the Operational Area. AMC Functions: Transfer Data between Areas / To Operational Area
Retrieve and inspect statistics	The CCC Operators retrieve and inspect the result of processed statistics and identify potential problems (network dimensioning, recurrent unavailability, etc….) CCC Functions: View Operational Area / Statistics / Monthly Statistics and Peak Hour Statistics

CCC investigate solution	The CCC Operators investigate the identified issue and determine an appropriate solution, which they may take into account by an action in the next cycle – or later (Example: modify link dimensioning) CCC / AMC Functions: None

Decisions

Data of good quality?	The AMC Operator has overall responsibility for the quality of data in the database. He must ensure that he is satisfied with the quality of data imported by CCC Operators before use function to generate statistics tables and statistics reports.

5.1.8 COM Charts update and publication procedure

5.1.8.1 Description

Actors

Users for View:

- AMC Operator,
- CCC Operators,
- External COM Operators,
- AMF-I Users,
- Read/Only Users.

Note.– The users receiving the COM Charts by e-mail need to be defined.

Users for Update:

- AMC Operator,
- CCC Operators,
- External COM Centre Operators,
- CNS Officers (if not registered via AMC Operator, for other ICAO Regions (e-mail)).

Purpose

The aim of the procedure is to ensure that the COM Charts are produced and published regularly, in a common form and constant quality independent on the actors involved.

Additionally the procedure shall ensure that users which are not able to access the AMC are provided with these COM Charts.

Description

The procedure consists of the main following subtasks:

- Data entry in background area (common task with Inventory Update)

- Designing/Editing of the COM Chart
- Validation of the COM Chart by transfer into Pre-Op and then Operational area
- Distribution of the COM Chart(s) (by ENRD, Part IV)

Actions

Enter data in Background Area	The new or modified information of the COM Centre is entered by the CCC Operator/External COM Operator into the Background Area. The AMC operator may receive additional inventory data about other regions from other sources (CNS officers via e-mail, publications, meeting reports, etc.) and enter these data in the AMC. CCC Function: Enter Background Data / Network Inventory
Designing/editing of the COM Charts in the Background Area	The resulting modifications caused by the update or input of new data have to be checked in the background area. Necessary corrections have to be performed to ensure the readability of the COM Charts e.g. move of the placements of a COM Centre symbol or other measures. AMC Function: AMC Miscellaneous / Edit Com Charts
Lock COM Centre	Locking and unlocking is a means of ensuring the consistency of data in the Pre-operational Area.
Transfer to Pre-operational Area	The finalised COM Chart data are transferred into the pre-operational area together with all data from network inventory, routing directory etc. COM Charts are not visible in that area, this task is however necessary to prepare the transfer to operational area at the end of the cycle. AMC Function: Transfer Data between Areas / To Pre-operational Area
Transfer pre-operational to operational	At 1100h UTC on Day 28 the current contents of the Pre-operational Area will become the data of the Operational Area. AMC Functions: Transfer Data between Areas / To Operational Area
Unlock COM Centre	Locking and unlocking is a means of ensuring the consistency of data in the Pre-operational Area.

Preparation of ENRD, Part IV –"Booklet" (once a year)	Update of the Tables of the COM Centres and Location Indicators in accordance with the inventory or DOC 7910, if any. Summarise and/or marking of the changes in the COM Charts and in the Tables of the COM Centres and Location Indicators. Update of the addresses in the distribution list in accordance with the inventory updates. CCC / AMC Functions: indirect use of Network Inventory, View ANP Locations, Manage ANP Locations
Distribution of the COM Charts (by ENRD, Part IV) (once a year)	Composition of the material to be published, including: • Build / making of a PDF file of the COM Charts • Prepare the file including all details as described in 5.1.8.2 Publication via e-mail, once a year in coordination with Operations Group CCC / AMC Functions: None

5.1.8.2 Structure of the COM Charts Booklet

5.1.8.2.1 The COM Charts Booklet consists of:

1. Overview of the Routing Directory Documentation (ENRD)
2 Introduction
2.1 Use of the Part IV
2.2 Guidance to the link capacity
2.3 Changes in the Part IV
3 COM Charts
3.1 COM Chart of AFI Region
3.2 COM Chart of ASIA/PAC Region
3.3 COM Chart of EUR/NAT Region
3.4 COM Chart of MID Region
3.5 COM Chart of NAM/CAR Region
3.6 COM Chart of SAM Region
3.7 COM Chart of connections between Regions (Interregional COM Chart)
4 Tables of the COM Centres and Location Indicators
4.1 Table of the COM Centres in the AFI Region
4.2 Table of the COM Centres in the ASIA/PAC Region
4.3 Table of the COM Centres in the EUR/NAT Region
4.4 Table of the COM Centres in the MID Region

4.5 Table of the COM Centres in the NAM/CAR Region

4.6 Table of the COM Centres in the SAM Region

4.7 Table of the COM Centres in the Interregional COM Chart

5.1.8.3 Additional remarks

5.1.8.3.1 It is recommended to limit the distribution list to those recipients only which do not have the possibility to access the COM Charts via the AMC.

5.2 AMHS Operational Procedures

The migration from AFTN/CIDIN to AMHS requires the development of AMHS Operational Procedures, to ensure that transition steps are performed smoothly and without service disruption.

AMC functions, and specifically the routing management function, are of utmost importance to the performance of these AMHS Operational Procedures. It is one of the main goals of ATS Messaging Management to provide support to the transition to AMHS.

Therefore, the AMHS Operational Procedures that are most needed to this are included as Appendices to this document. They include:

- Appendix A: the procedure for the introduction of a new COM Centre in the EUR/NAT AMHS network,

- [to be expanded as deemed necessary by AFSG].

Attachment A: Change Control Mechanism of the ATS Messaging Management Manual

Note.– Changes, problems or defects detected concerning the Standards and Recommended Practices (SARPs) or Technical Provisions summarised in the ICAO Documentation (Annex 10, Document 9880) are not affected by this mechanism. For these documents the change control process set up by ACP and its Working groups is applicable.

Proposals to introduce changes to the ATS Messaging Management Manual may arise from users, implementers or manufacturers. The procedure for submission and processing of a Defect Report (DR) or a Change Proposal (CP) involves the following steps:

A.1 Procedure for DR

a) A problem is detected concerning the operation of the AMHS network, which is reflected in the ATS Messaging Management Manual and may be attributed to implemented AMHS procedures and/or inconsistencies in the documentation.

b) The problem is reported to the Rapporteur of the AFSG Operations Group (OG), by submission a defect report (DR). A standard reporting format is used (see attached template).

c) The Rapporteur assigns a number and priority to the defect report and introduces it to the agenda of an upcoming meeting of the OG. If necessary, he refers to the Planning Group (PG) Rapporteur.

d) The OG evaluates the report and either adopts it as a working item or rejects it. The party, which submitted the defect report, is notified accordingly.

e) Experts of the OG are assigned to the problem and milestone dates are set.
Outside expertise may be invited to participate, as appropriate.

f) The OG develops proposals for resolving the problem and submits them to the AFSG for approval.

g) The AFSG approves or rejects the presented proposals. In case of the latter, the subject is referred back to the OG (step e) or discarded.

h) The OG drafts appropriate text for amendment of the ATS Messaging Management Manual and submits it to the AFSG for approval.

i) The AFSG approves or rejects the proposed material. In case of the latter, the subject is referred back to the OG (step h).

j) The proposed amendments to the ATS Messaging Management Manual are presented to the EANPG for approval.

k) Solutions are implemented.

Steps (f) and (h) may run in parallel.

A.2 Procedure for CP

The same structured procedure, with the exception of steps (f) and (g) applies in case of proposed enhancements to the ATS Messaging Management Manual or inconsistencies in existing EUR AMHS documentation.

In this case, a change proposal (CP) should be submitted to the OG. The format of the CP is similar to that of the DR.

(If ICAO SARPs and/or Technical Specifications are concerned the change control process, set up by ACP and its Working groups, has to be followed by using appropriate procedures.)

A.3 Template for Defect Reports / Change Proposals

TEMPLATE FOR DEFECT REPORTS / CHANGE PROPOSALS

DR_____ **CP_____**

Title:	Short, indicative textual name
Reference:	Number assigned by the OG Rapporteur
Originator reference:	Provided by the originator
Submission date:	
Submitting State/Organization:	
Author:	
Contact Information:	e-mail, fax, telephone and postal address
Experts involved:	
Status:	Assigned by the OG Rapporteur
Priority:	Assigned by the OG Rapporteur
Document reference:	Affected section(s) of the ATS Messaging Management Manual
Description of defect:	Nature of the problem in detail Reason(s) for requesting changes
Assigned expert(s):	
Task history:	Working Papers and Information Papers Produced on the subject
Proposed solution:	Including amendments to the text, if feasible

DR/CP STATUS control sheet				
Event	**Date**	**Status**		**Remark**
DR or CP received submission date		Set to submitted		
discussion at OG/ ...		Set to accepted	Set to rejected	
Date for development of proposals/ solutions				Responsible:
discussion at OG/ ...		Set to resolved		
presentation to AFSG/ ...		Set to adopted	Set to rejected	
Date for development of amendment to the Manual				Responsible:
discussion at OG/		Set to approved		
presentation to AFSG/ ...		Set to approved for application		
Additional DATES and comments				

Attachment B: List of Abbreviations

ACK	Acknowledgement
ACP	Aeronautical Communications Panel
Ad	(CIDIN) destination address
ADMD	Administrative Management Domain
Ae	(CIDIN) entry address
Aena	Aeropuertos Españoles y Navegación Aérea
AF-Address	AFTN-Form Address
AFS	Aeronautical Fixed Service
AFSG	Aeronautical Fixed Service Group
AFSG OG	AFSG Operations Group
AFSG PG	AFSG Planning Group
AFTN	Aeronautical Fixed Telecommunications Network
AI	Address Information
AIDC	ATS Inter-facility Data Communications
AMC	ATS Messaging Management Centre
AMF-I	AMHS Off-line Management Functions – Implementation Support
AMF-O	AMHS Off-line Management Functions – Operational
AMHS	ATS Message Handling System
AMI	Address Mapping data Import
AMP	Address Mapping Procedure
AMSG	ATN Maintenance Subgroup
AMT	Address Mapping Table
ANC	(ICAO) Air Navigation Commission
ANSP	Air Navigation Services Provider
AP	Amendment Proposal
APS	Address Publishing Service

AR	Address Registration
ATN	Aeronautical Telecommunication Network
ATNP	Aeronautical Telecommunication Network Panel
ATS	Air Traffic Services
ATSMHS	ATS Message Handling Services
ATSO	Air Traffic Services Organisation
Ax	(CIDIN) exit address
BUFR	Binary Universal Form for the Representation of meteorological data
CA	Certificate Authority
CAAS	Common AMHS Addressing Scheme
CCC	Cooperating COM Centre
CIDIN	Common ICAO Data Interchange Network
CMC	CIDIN Management Centre
COM	Communication Centre
CRL	Certificate Revocation List
DFS	DFS Deutsche Flugsicherung GmbH
EANPG	European Air Navigation Planning Group
EATMP	European Air Traffic Management Plan
EIT	Encoded Information Type
ENRD	EUR/NAT Routing Directory
EUR	European (ICAO Region)
FAQ	Frequently Asked Questions
FTBP	File Transfer Body Part
GDI	Global Domain Identifier
HQ	Headquarters
ICAO	International Civil Aviation Organisation
ICAORD	ICAO Regional Director
ICC	Inter-Centre Communications

IP	Internet Protocol
MD	Management Domain
MF	MHS-form (address)
MHS	Message Handling System
MTA	Message Transfer Agent
NACK	Negative Acknowledgement
NAT	North Atlantic (ICAO Region)
NATS	National Air Traffic Services Ltd
NSAP	Network Service Access Point
O	Organisation-name (address attribute)
OG	Operations Group (see AFSG OG)
O/R	Originator/Recipient
OLDI	Online Date interchange
OSI	Open Systems Interconnection
OU	Organisation-Unit-names (address attribute)
PDR	Potential Defect Report
PG	Planning Group (see AFSG PG)
PKI	Public Key Infrastructure
PRMD	Private Management Domain
SADIS	Satellite Distribution System for Information Relating to Air Navigation
SARPs	Standards and Recommended Practices
SPACE	Study and Planning of AMHS Communications in Europe
SPSO	SPACE participating States/Organisations
STNA	Service Technique de la Navigation Aérienne
TCP/IP	Transmission Control Protocol/Internet Protocol
TEN-T	Trans-European Networks-Transport
TPn	Transport Protocol Class n (n=0 or n=4)
UA	User Agent

WP	Work Package
XF	Translated-form (address)
XMIB	Cross-Domain Management Information Base

END of document

A. Appendix A – Procedure for the introduction of a new COM Centre in the EUR/NAT AMHS network

A.1 Scope and goals of the procedure

A.1.1 Scope of the procedure

A.1.1.1 This procedure specifies the actions necessary to perform the introduction of a new COM Centre in the International EUR/NAT AMHS network. The term "new COM Centre" may refer to three distinct cases:

1. the COM Centre already exists. It provides CIDIN and possibly conventional AFTN connectivity, and it supports the AFTN application of the CIDIN for national users. AMHS is introduced as an additional functionality and service in the existing COM Centre. This case corresponds to the majority of COM Centres in the EUR/NAT Regions;

2. the COM Centre already exists. It provides conventional AFTN connectivity. AMHS is introduced as an additional functionality and service in the existing COM Centre. This case corresponds to a smaller number of COM Centres in the EUR/NAT Regions;

3. the COM Centre does not exist yet and it will start operational service directly with AMHS. Although theoretically possible, there is no such case foreseen in practice in the EUR/NAT Regions. This case will consequently not be further discussed in the present version of the procedure[9].

A.1.1.2 From the above, it results that, strictly speaking, the procedure is related to the introduction of the AMHS operational service in a COM Centre of the international AFTN/CIDIN/AMHS network.

A.1.2 Target AMHS network

The target AMHS network which this procedure aims at reaching, when applied to all COM Centres in the EUR/NAT Regions, has the following characteristics:

- it is an integrated AMHS network, composed of one single AMHS island in which all COM Centres are interconnected;

- it is a fully-meshed network, which means that there is an any-to-any connectivity at the level of AMHS connections (associations between MTAs) between COM Centres.

A.1.3 Qualitative objectives

The proposed approach aims at three main goals:

[9] It might be subject for further study if a future major reorganisation of European COM Centres were envisaged in the future.

1. migrate all the flows conveyed over the AFTN or CIDIN link to the AMHS connection. CIDIN connectivity is not maintained at the end of the transition;

2. migrate operational flows progressively to the AMHS connection, so as to:

   - facilitate operational validation (reduce the number/extent of changes at each step, to facilitate the analysis of behaviour/results),

   - enable easy rollback, in case it would be absolutely needed;

3. limit impact on COM Centres other than those to which the procedure is applied, to reduce as much as possible inter-Regional co-ordination tasks during transition. Co-ordination will still be needed anyway, making use of the AMC.

A.2 General procedure description

A.2.1 Terminology

In the context of this procedure, the following terms are used:

- the "considered COM Centre" refers to the COM Centre which is being introduced in the AMHS network. For convenience in the procedure description, this COM Centre is also named "COM Centre B", and "COMB" represents the 4-letter Location Indicator of COM Centre B;

- an "adjacent Centre" designates a COM Centre which is adjacent to the considered COM Centre in the AFTN or CIDIN topology before introduction of AMHS in the latter;

- a "non-adjacent Centre" designates a COM Centre which is not adjacent to the considered COM Centre in the AFTN or CIDIN topology;

- the "remote COM Centre" refers to the AMHS COM Centre with which the considered COM Centre B implements an operational AMHS connection, as part of the present procedure. The remote COM Centre can be adjacent or non-adjacent as defined above. It is also named "COM Centre C", and "COMC" represents the 4-letter Location Indicator of COM Centre C.

A.2.2 Structure of the procedure

A.2.2.1 For each considered COM Centre, the procedure is composed of:

- a set of pre-requisite tasks to be performed once;

- a set of tasks T1, T2, Ti to be performed iteratively with every other AMHS COM Centre C1, C2, Cn in the network. The overall goal of this set of tasks is to implement an AMHS connection between the considered COM Centre and C1, C2, Cn, and to migrate operational traffic to this connection.

A.2.2.2 The order of tasks to be performed with a given COM Centre (adjacent or not) is fixed, but the performance of the tasks for a set of COM Centres can take place either sequentially or in parallel, or using any combination of both approaches, provided that the order of tasks is not altered for each COM Centre. This is depicted in Figure 5 below.

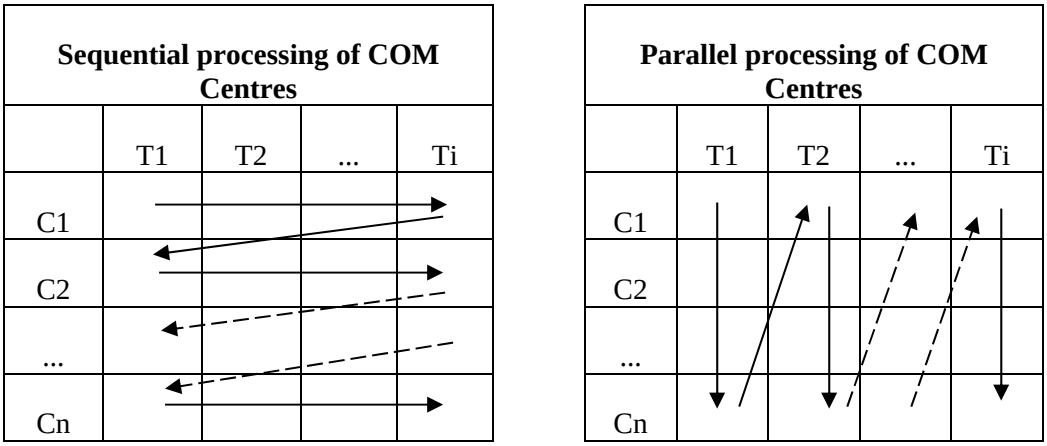


Figure 5: Task sequencing in the procedure

A.2.2.3 It is recognised that the actual sequencing of tasks may depend on a number of factors, which include (but are not limited to):

- the availability of lower layer communication systems,
- the number of AMHS Centres already involved in the AMHS network,
- the topology of the AMHS network before the considered COM Centre is introduced,
- the time at which the considered COM Centre is introduced in the network (more parallelism is likely to be adopted when more confidence is gained in the AMHS technology, i.e. at the later stages of the Regional transition to AMHS).

A.2.2.4 For the sake of simplicity, and also because it is most likely to happen in this way in the beginning of transition to AMHS, the procedure is described in accordance with the sequential processing of COM Centres illustrated in Figure 5.

A.2.3 Pre-requisite tasks

Before a COM Centre starts supporting the AMHS operational service operationally, a set of pre-defined tasks shall be completed in accordance with the applicable ICAO standards, principles and procedures, including:

1. procurement of an AMHS system comprising at least an ATS Message Server and an AFTN/AMHS Gateway conformant at least to the following documentation:
    a. Profile for ATS Messaging using AMHS and TCP/IP (also known as "EUR-AMHS Profile"), MTA requirements (section 6.5),
    b. EUR AMHS Manual,
    c. ATS Messaging Management Manual,

d. by virtue of the documents above, selected requirements of ICAO Document 9880 [5];

2. appropriate training for AFTN/CIDIN/AMHS COM Centre operators, so that they become aware of X.400 concepts and operation;

3. availability of an "AMHS expertise unit" in the COM Centre, familiar with AMHS specifications and operational implications;

4. participation in AMC activities by accreditation of CCC Operators and AMF-I Users associated with the considered COM Centre and corresponding AMHS Management Domain (MD);

5. successful installation, technical and operational acceptance of the AMHS system;

6. conformance testing of the AMHS system (this task may be part of the acceptance procedures included in item 5 above);

7. inter-operability testing of the AMHS system with peer test systems in States or COM Centres with which the system will be operationally interconnected;

8. declaration and update as appropriate of the COM Centre implementation plans in the AMC "Implementation Planning" function.

A.2.4 Iterative tasks to be performed with every other AMHS COM Centre

A.2.4.1 This section lists the tasks that have to be performed between the considered COM Centre (COM Centre B) and every other AMHS COM Centre already integrated in the European AMHS network, the latter being called "the remote COM Centre", as defined in section A.2.1.

A.2.4.2 The following tasks shall be performed:

Task T1: implementation of lower layer IP connectivity, with a level/quality of service adequate for operational communications;

Task T2: bilateral testing;

Task T3: activation of an operational AMHS connection (an association or a set of associations between peer MTAs) between the considered COM Centre B and the remote COM Centre C;

Task T4: gradual integration of the considered COM Centre B in the network by progressive migration of traffic flows from the existing CIDIN/AFTN connectivity (CIDIN VCs or AFTN circuits), if any, to the AMHS connection between both COM Centres. Each step of this migration may be seen as a sub-task of the introduction procedure and it may be subject to the same sequencing rules as described for tasks in section A.2.2 above;

Task T5: deactivation and deletion of the existing CIDIN/AFTN connectivity (CIDIN VCs or AFTN circuits) between both COM Centres, if any.

A.2.4.3 The order in which every other COM Centre C is processed in accordance with the task list above depends on a number of factors, among which the most important is the availability of lower layer communications between both COM Centres. As a guideline, the general sequence for the implementation of such AMHS connections should be as follows:

1. adjacent COM Centres;
2. non-adjacent COM Centres between which no indirect AMHS connectivity is available;
3. non-adjacent COM Centres between which indirect AMHS connectivity is already available (in AMHS, using store-and-forward through other AMHS COM Centres).

A.2.4.4 If for the considered COM Centre B, none of the adjacent CIDIN/AFTN COM Centres supports AMHS yet, when COM Centre B introduces AMHS operational service, stage 1 of the sequence above cannot be performed and shall be skipped.

A.2.4.5 The decision to implement an AMHS connection at a given date between the considered COM Centre B and each remote COM Centre C is a matter of mutual agreement between both Centres, after preliminary co-ordination and planning. The following AMC functions should be used in support of such co-ordination:

- AMHS implementation planning,
- interworking test support,
- network inventory and network planning.

A.2.4.6 This procedure assumes that it is the responsibility of the considered COM Centre B, which is not yet (or not fully) integrated in the network to initiate the co-ordination described above.

A.3 Detailed description of the iterative tasks

A.3.1 Task T1: Implementation of lower layer connectivity

A.3.1.1 Prior to pre-operational testing and to the establishment of the operational AMHS connection, lower layer IP connectivity shall be implemented between the two COM Centres, either on a point-to-point basis or, preferably, by access to a common IP inter-network. The connectivity solution shall offer a level or quality of service adequate for operational communications.

A.3.1.2 This shall be achieved by bilateral co-ordination between the two COM Centres, and with any other party as appropriate, depending on the retained technical solution.

A.3.1.3 The actual technical means and procedures to be used for this purpose are out of the scope of the present procedure.

A.3.2 Task T2: Bilateral testing

A.3.2.1 Bilateral testing shall be performed with the remote COM Centre. Bilateral testing shall include inter-operability testing and pre-operational testing.

A.3.2.2 Inter-operability testing shall be performed using AMHS test platforms for each COM Centre. The test platform may be located in the Centre itself or elsewhere in the considered State.

Note.– Inter-operability testing may have been performed between the two considered COM Centres as part of the pre-requisite tasks described in section A.2.3. In such a case there is no need to repeat such tests as part of the procedure.

A.3.2.3 In the case where there is no test system available in one of the COM Centres, more limited inter-operability testing may be performed with the operational AMHS system, using exclusively test addresses reserved for this purpose. Special care should be taken that such tests do not impact the operational service delivered by the system. This should be envisaged only where a high level of confidence exists that the tests will be successful (e.g. if successful inter-operability testing with another AMHS system of the same type/manufacturer has already been performed in the past).

A.3.2.4 The inter-operability tests should conform with the recommendations of the EUR AMHS Manual. They shall include at least the validation of the following functions:

- AMHS message/report transfer between both Centres,
- AMHS routing in each Centre,
- AMHS message submission/delivery in each Centre,
- AFTN/AMHS conversion in each Centre,
- management of integrated AFTN/CIDIN/AMHS routing in each Centre.

A.3.2.5 Bilateral pre-operational testing shall be performed with the remote COM Centre. These tests should be performed using duplicated operational traffic and within the operational network environment before the "AMHS cut-over". If possible, the IP connectivity intended for operational service should be used for this purpose, in order for the queue behaviour and transit time to be representative of the operational environment. The pre-operational tests should conform with the recommendations of the EUR AMHS Manual.

A.3.3 Task T3: activation of an operational AMHS connection

A.3.3.1 At the latest 28 days (one AIRAC cycle) before the planned activation date, the CCC Operator of the considered COM Centre shall enter detailed planning information in the AMHS connection in the AMC database, using the "network inventory" and "network planning" functions. The "COM Centres", "AMHS capabilities" and "connections" sub-functions should be used for this purpose. The planned AMHS connection shall be created with the indication "no operational traffic" in the "remark" field.

Note.– It is preferred that any activation of an operational AMHS connection takes place on an AIRAC date. It is appreciated that due to technical/staffing or other local issues that activation may not be possible between the connecting States. If the latter is the case, the connecting COM Centres must ensure that bi-lateral agreement is achieved with all affected

States and in all cases the AMC Operator is kept informed of the connecting States intentions and arrangements.

A.3.3.2 In the data entry phase of the AIRAC cycle preceding the planned activation date, the CCC Operator shall indicate the activation of the connection (and of the AMHS system if it is the first connection), using the same AMC functions as above.

A.3.3.3 If not existing yet (i.e. if the AMHS connection is the first one for the considered COM Centre), the AMHS routing table for Centre COMB shall be created in the AMC routing directory function by the AMC Operator. All entries in the AMHS routing table (for all destination AMHS MDs) are configured with only a "existing main" and set to "MTCU". This action is in fact performed automatically by the AMC application and confirmed by the AMC Operator.

A.3.3.4 The parameters of the AMHS association shall be entered by both COM Centres in their respective systems, using the information provided by the AMC "network inventory" function (AMHS capabilities). On the bilaterally agreed date the association shall be activated by each COM Centre.

A.3.4 Task T4: Progressive migration of traffic flows

A.3.4.1 Task structure

A.3.4.1.1 This task is composed of a maximum of four steps, noted from T4 Step1 to T4 Step4, with Step4 possibly further subdivided in sub-steps Step4a, Step4b etc.

A.3.4.1.2 For convenience in the description of this task, "COM Centre A" identifies a COM Centre which is before Com Centre B in the flow direction from A to B to C. "COM Centre D" identifies a COM Centre which is after Com Centre C in the flow direction from A to B to C to D. "COMA" and "COMD" represent the 4-letter Location Indicators of COM Centre A and COM Centre D, respectively. The same terminology is used in the reverse flow direction, i.e. from COM Centre D to C to B to A.

A.3.4.1.3 Note.– some steps or actions within a step may be not required, depending on the connectivity available between COM Centre B and COM Centre C (whether they are AFTN or CIDIN/AFTN COM Centres, and according to the categories identified in section A.2.4.3) prior to performing T4.

A.3.4.2 T4 Step1: migration of AMHS traffic for reception by the COM Centres

A.3.4.2.1 Description

Step1 consists in the integration in the AMHS network of the local and incoming AMHS traffic in the considered COM Centre B, which is directed to the remote COM Centre C (and vice-versa). This integration is performed by routing of such traffic over the newly implemented AMHS connection.

A.3.4.2.2 The remote COM Centre C shall be contacted by the considered COM Centre B and an AIRAC date for migration to Step1 shall be agreed.

A.3.4.2.3 During the data entry phase of the AIRAC cycle before the agreed date, the CCC Operator of the considered COM Centre shall inform the AMC Operator by means of a change request message. The CCC Operator shall also update the AMC "Network

Inventory/Connections" function, by modification of the "Remark" field in the AMHS connection entry. This field shall be set to "Step1: restricted to incoming AMHS traffic between COMB and COMC" (COMB and COMC being the locations indicators of the COM Centres).

A.3.4.2.4 During the data validation and processing phase of the AIRAC cycle, the AMC Operator shall modify the AMHS routing table of the considered COM Centre B: in the entry with destination to the AMHS MD of the remote COM Centre C, the "existing main" columns shall be set to specify COM Centre C itself. Reciprocally, the AMHS routing table of the remote COM Centre C shall also be modified: the "existing main" columns of the entry with destination to the AMHS MD of the considered COM Centre B shall be modified to specify COM Centre B itself. There shall be no other modification of the AMC routing tables in relation with this Step1 of the migration.

A.3.4.2.5 At the end of the cycle and upon successful completion of the "Routing Update" procedure, both COM Centres shall implement the modified routing tables and activate them on the agreed AIRAC date.

A.3.4.2.6 The CCC Operator of the considered COM Centre B shall inform the AMC Operator of the successful performance of the step (or sub-step), or, conversely, about any issue having occurred.

A.3.4.2.7 Note.– Tasks T3 and T4 Step1 may be performed together during the same AIRAC cycle. In such a case the description of the AMHS connection in the network inventory function shall be as specified for T4 Step1.

A.3.4.3 T4 Step2: additional migration of AFTN traffic for reception by the COM Centres

A.3.4.3.1 Description

Step2 consists in the further integration in the AMHS network of the local and incoming AFTN traffic in the considered COM Centre, which is directed to the remote COM Centre (and vice-versa). This integration is performed by routing of such traffic over the newly implemented AMHS connection.

A.3.4.3.2 The remote COM Centre shall be contacted by the considered COM Centre and an AIRAC date for migration to Step2 shall be agreed.

A.3.4.3.3 **Recommendation**: a minimum duration of one AIRAC cycle should be observed between the agreed dates for Step1 and Step2.

A.3.4.3.4 During the data entry phase of the AIRAC cycle before the agreed date, the CCC Operator of the considered COM Centre shall inform the AMC Operator, by means of a change request message. The CCC Operator shall also update the AMC "Network Inventory/Connections" function, by modification of the "Remark" field in the AMHS connection entry. This field shall be set to "Step2: restricted to incoming AFTN and AMHS traffic between COMB and COMC".

A.3.4.3.5 During the data validation and processing phase of the AIRAC cycle, the AMC Operator shall modify the AFTN routing table of the considered COM Centre B: in the entry with destination to the remote COM Centre C, the "existing main" columns shall be set to specify "MTCU". Reciprocally, the AFTN routing table of the remote COM Centre C shall also be modified, if needed: the "existing main" columns of the entry with destination to the

considered COM Centre B shall be set to "MTCU". There shall be no other modification of the AMC routing tables in relation with this Step2 of the migration.

A.3.4.3.6 At the end of the cycle and upon successful completion of the "Routing Update" procedure, both COM Centres shall implement the modified routing tables and activate them on the agreed AIRAC date.

A.3.4.3.7 The CCC Operator of the considered COM Centre B shall inform the AMC Operator of the successful performance of the step (or sub-step), or, conversely, about any issue having occurred.

A.3.4.4 T4 Step3: additional migration of CIDIN traffic for reception by the COM Centres

A.3.4.4.1 Description

Step3 consists in the further integration in the AMHS network of the incoming CIDIN traffic in the considered COM Centre B, which is directed to the remote COM Centre (and vice-versa). This integration is performed by routing of such traffic over the newly implemented AMHS connection. This incoming CIDIN traffic enters COM Centre B coming from one or several COM Centres A.

A.3.4.4.2 The remote COM Centre C shall be contacted by the considered COM Centre and an AIRAC date for migration to Step3 shall be agreed.

A.3.4.4.3 **Recommendation**: a minimum duration of one AIRAC cycle should be observed between the agreed dates for Step2 and Step3.

A.3.4.4.4 During the data entry phase of the AIRAC cycle before the agreed date, the CCC Operator of the considered COM Centre B shall inform the AMC Operator by means of a change request message. The CCC Operator shall also update the AMC "Network Inventory/Connections" function, by modification of the "Remark" field in the AMHS connection entry. This field shall be set to "Step3: restricted to incoming AFTN, CIDIN and AMHS traffic between COMB and COMC".

A.3.4.4.5 During the data validation and processing phase of the AIRAC cycle, the AMC Operator shall modify the AFTN routing tables of a number of COM Centres A, changing the contents of the route columns for the destination corresponding to the Remote COM Centre C destination, as follows:

A.3.4.4.6 From each CIDIN COM Centre A in the network,

a) the current "Existing Main" value for destination COM Centre C shall be determined looking at the AFTN Routing Table of COM Centre A;

b) the routing path from COM Centre A to COM Centre C shall be determined using the AMC Path Function;

c) if the considered COM Centre B is included in the path, and located in this path before the current indication of the "Existing Main" route (as found in item a. above), then the value of "Existing Main" for the destination corresponding to COM Centre C in the AFTN Routing Table of this COM Centre A shall be modified and set to the CIDIN Ax of COM Centre B.

d) the process above shall repeated for the other route values for destination COM Centre C in the routing table of COM Centre A, i.e. the values of "Existing Alternate", "Planned Main" and "Planned Alternate", if they are present[10].

A.3.4.4.7 The reciprocal operation shall be performed in the reverse flow direction, i.e. from each CIDIN COM Centre D in the network towards COM Centre B. For each COM Centre D as appropriate (based on the same process as above), the value of "Existing Main" (and/or of "Existing Alternate", "Planned Main" and "Planned Alternate", if present) for the destination corresponding to COM Centre B in the AFTN Routing Table of COM Centre D shall be modified and set to the CIDIN Ax of COM Centre C. There shall be no other modification of the AMC routing tables in relation with this Step3 of the migration.

A.3.4.4.8 To perform the tasks described in A.3.4.4.5 and A.3.4.4.7 above, the AMC Operator shall use the "Routing Update for transition to AMHS" function of the AMC, which automatically determines the modifications to be performed in the various AFTN Routing Tables for all source COM Centres A and D. The AMC Operator then accepts (or rejects) the proposed changes to AFTN Routing Tables.

A.3.4.4.9 Considering the number of COM Centres impacted during this step or each of its sub-steps, it is important that as many ACKs as possible be obtained from CCC Operators during the ACK phase of the cycle.

A.3.4.4.10 At the end of the cycle and upon successful completion of the "Routing Update" procedure, all COM Centres in the network shall implement the modified routing tables and activate them on the agreed AIRAC date.

A.3.4.4.11 The CCC Operator of the considered COM Centre B shall inform the AMC Operator of the successful performance of the step (or sub-step), or, conversely, about any issue having occurred.

A.3.4.5 T4 Step4: completion of transition by migration of CIDIN relay traffic

A.3.4.5.1 Description

Step4 consists in the final integration in the AMHS network of the remaining CIDIN traffic between COM Centre B and COM Centre C, i.e. CIDIN traffic coming from (one or several) COM Centre(s) A and directed to (one or several) CIDIN COM Centre(s) D located after COM Centre C. This traffic is relayed in the considered COM Centre B towards CIDIN COM Centre C, where it is relayed again towards COM Centre D (and vice-versa from D to A). This integration is performed by routing of such traffic over the newly implemented AMHS connection.

A.3.4.5.2 The remote COM Centre C shall be contacted by the considered COM Centre B and an AIRAC date for migration to Step4 shall be agreed.

A.3.4.5.3 **Recommendation**: a minimum duration of one AIRAC cycle should be observed between the agreed dates for Step3 and the beginning of Step4.

[10] In general, as COM Centre C is a CIDIN Centre, only the "Existing Main" value is specified and it has the value of the CIDIN Ae/Ax address of COM Centre C. However other situations might be found in specific cases and it is necessary to cover all possible cases.

A.3.4.5.4 Note.– Depending on the number of considered COM Centres D (and reciprocally COM Centres A in the other direction), this step may be split in several sub-steps, each of them enabling to handle a limited number of COM Centres D (in the direction from A to D) and of COM Centres A (in the direction from D to A). This detailed phasing shall be agreed between COM Centre B and COM Centre C.

A.3.4.5.5 During the data entry phase of the AIRAC cycle before the agreed date, the CCC Operator of the considered COM Centre B shall inform the AMC Operator, by means of a change request message, specifying the sub-step (if any) and the destination COM Centres taken into account in each direction during the sub-step. The CCC Operator shall also update the AMC "Network Inventory/Connections" function, by modification of the "Remark" field in the AMHS connection entry. This field shall be set to "Step4i: CIDIN relay traffic from COMB to COMD1, COMD2, etc. and from COMC to COMA1, COMA2, etc.".

A.3.4.5.6 During the data validation and processing phase of the AIRAC cycle, the AMC Operator shall modify the AFTN routing tables of a number of COM Centres A, changing the contents of the route columns for each of the destinations corresponding to a COM Centre D (i.e. a COM Centre which is reached from Com Centre A via CIDIN relay in COM Centres B and C, successively). This action shall take place once for the whole step, during the first sub-step if such a splitting in sub-steps is adopted, as follows:

A.3.4.5.7 From each CIDIN COM Centre A in the network, and for each destination in its AFTN routing table, corresponding to a potential COM Centre D:

a) the current "Existing Main" value for the considered destination shall be determined looking at the AFTN Routing Table of COM Centre A;

b) the routing path from COM Centre A to the COM Centre corresponding to the current "Existing Main" shall be determined using the AMC Path Function;

c) if COM Centre B and COM Centre C are included in the path in the order "A – B – C – Existing Main" (C and EXIST_MAIN being potentially equal), then the value of "Existing Main" for the considered destination in the AFTN Routing Table of this COM Centre A shall be modified and set to the CIDIN Ax of COM Centre B;

d) the process above shall be repeated for the other route values for the considered destination in the routing table of COM Centre A, i.e. the values of "Existing Alternate", "Planned Main" and "Planned Alternate", if they are present.

A.3.4.5.8 Furthermore, during the same data validation and processing phase, the AMC Operator shall modify the AFTN and AMHS Routing Tables of the considered COM Centre B:

- in the AFTN routing table of COM Centre B, in the entry for each destination corresponding to a COM Centre D handled during the sub-step and for which a route has been modified for one COM Centre A, the "existing main" columns shall be set to specify "MTCU"; and

- in the AMHS routing table of COM Centre B, in the entry with destination to each AMHS MD corresponding to a COM Centre D handled during the sub-step, the "existing main" columns shall be set to specify "COM Centre C".

A.3.4.5.9 The reciprocal operation shall be performed in the reverse flow direction, i.e. from each CIDIN COM Centre D in the network, towards each of the COM Centres A. For each

COM Centre D as appropriate (based on a process reciprocal to the description in A.3.4.5.6), the value of "Existing Main" for the considered destination in the AFTN Routing Table of COM Centre D shall be modified and set to the CIDIN Ax of COM Centre C (once for the whole step). The AFTN and AMHS Routing Tables of COM Centre C shall also be modified accordingly for each destination corresponding to a COM Centre A handled during the sub-step, to specify "MTCU" and "COM Centre B", respectively.

A.3.4.5.10 To perform the tasks described in A.3.4.5.6 and A.3.4.5.9 above, concerning the modification of AFTN Routing Tables of COM Centres A and D, the AMC Operator shall use the "Routing Update for transition to AMHS" function of the AMC, which automatically determines the modifications to be performed in the various AFTN Routing Tables for all source COM Centres (A and D). The AMC Operator then accepts (or rejects) the proposed changes to AFTN Routing Tables.

A.3.4.5.11 Considering the magnitude of changes performed during this step or its first sub-step, when the exit addresses in Centres A and D are changed, it is important that as many ACKs as possible be obtained from CCC Operators during the ACK phase of the cycle.

A.3.4.5.12 At the end of the cycle and upon successful completion of the "Routing Update" procedure, all COM Centres in the network shall implement the modified routing tables and activate them on the agreed AIRAC date.

A.3.4.5.13 The CCC Operator of the considered COM Centre B shall inform the AMC Operator of the successful performance of the step (or sub-step), or, conversely, about any issue having occurred.

A.3.5 Task T5: deactivation and deletion of the former CIDIN/AFTN connectivity

A.3.5.1 After successful completion of Task T4, and when full confidence has been gained that the former AFTN Circuit or CIDIN VCs is/are no more needed (including for back-up purposes) between COM Centre B and COM Centre C if they are adjacent, this connectivity shall be successively deactivated and deleted.

A.3.5.2 In the data entry phase of the AIRAC cycle preceding the planned deactivation date, the CCC Operator of the considered COM Centre B shall indicate the deactivation of the connection, using the network inventory "connections" sub-function. The connection shall temporarily remain in the database with the indication "pending deletion" in the "remark" field.

A.3.5.3 On the following AIRAC date, the connection shall be deactivated by both COM Centres.

A.3.5.4 In the data entry phase of the AIRAC cycle preceding the planned deletion date, the CCC Operator shall delete the connection from the AMC database.

A.3.5.5 On the following AIRAC date, the connection shall be deleted by both COM Centres.

A.4 Illustration of task 4 steps

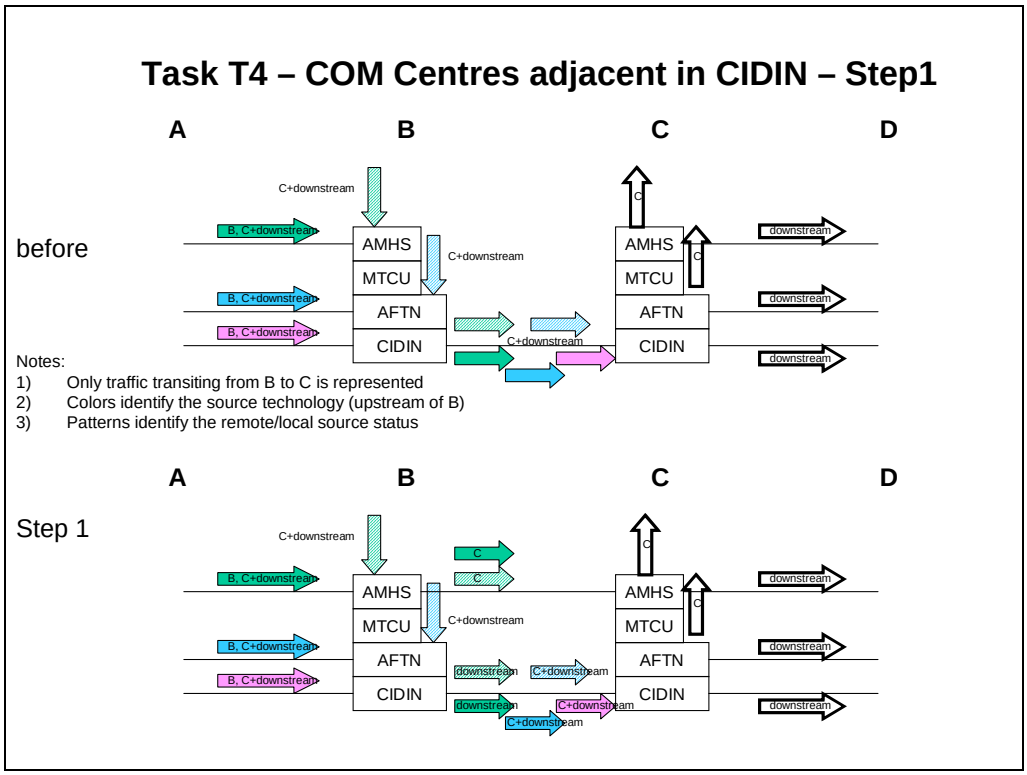


Figure 6: Task T4 - COM Centres adjacent in CIDIN - Step1

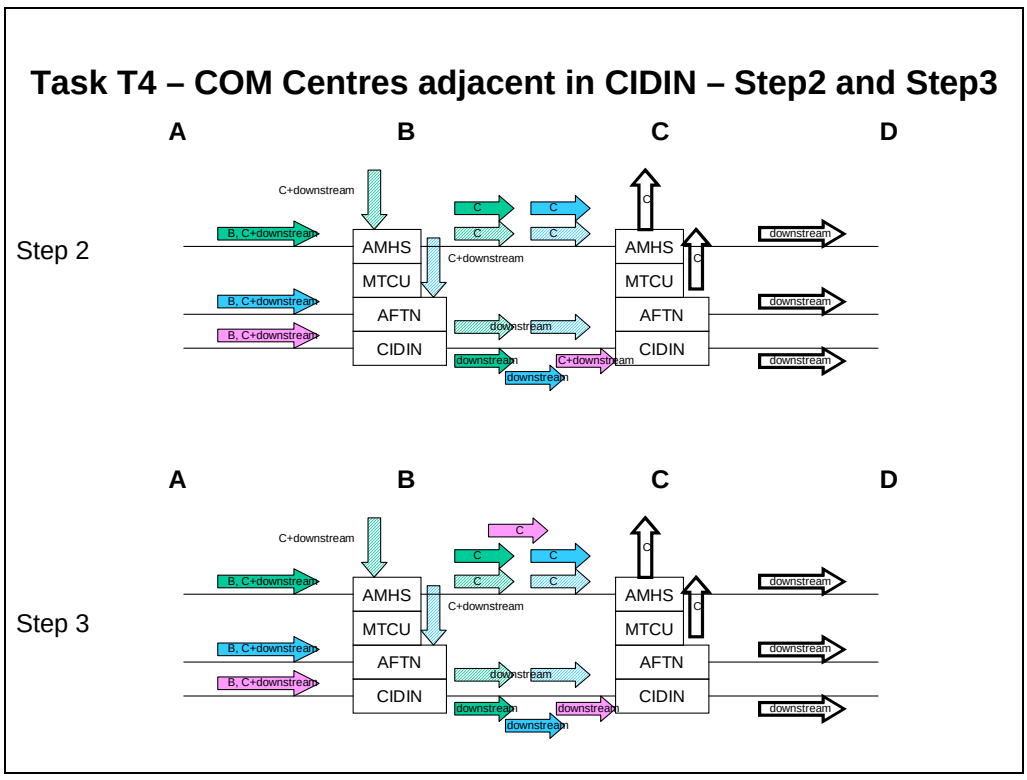


Figure 7: Task T4 - COM Centres adjacent in CIDIN - Step2 and Step3

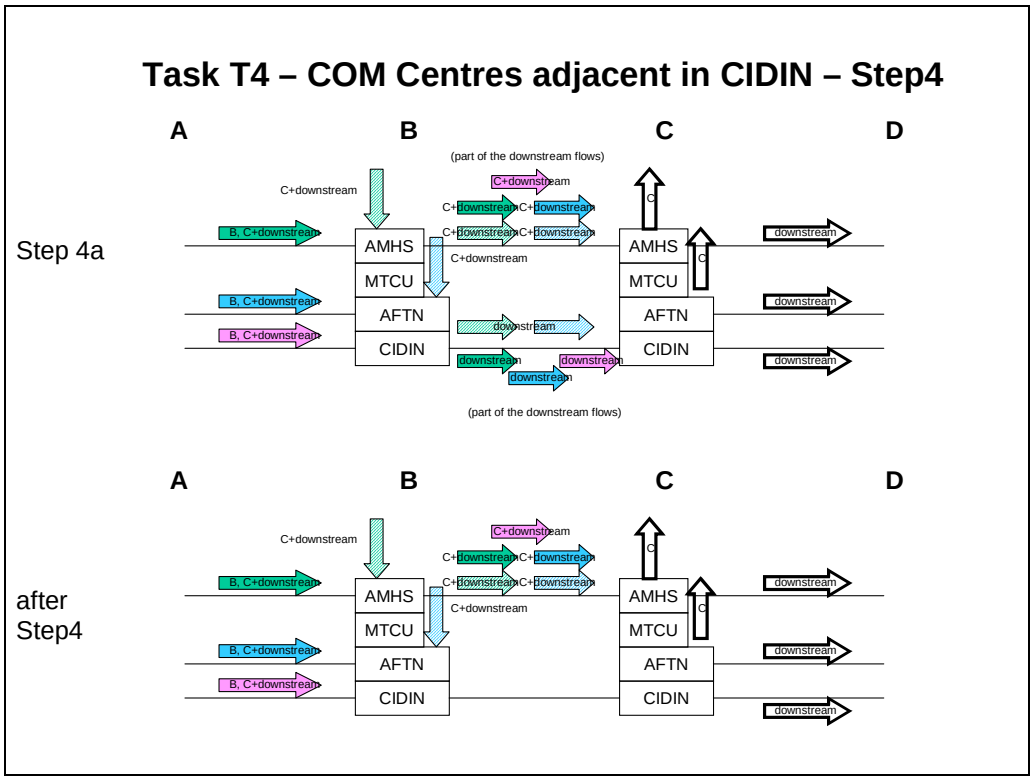


Figure 8: Task T4 - COM Centres adjacent in CIDIN - Step4

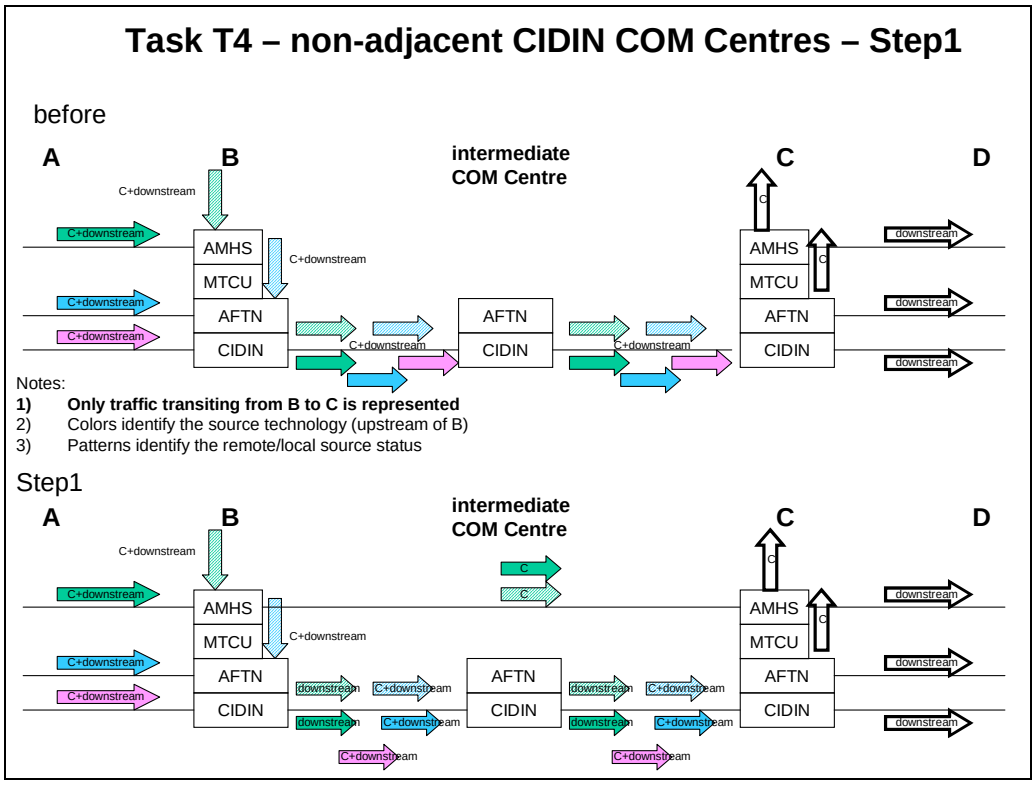


Figure 9: Task T4 - non-adjacent CIDIN COM Centres - Step1

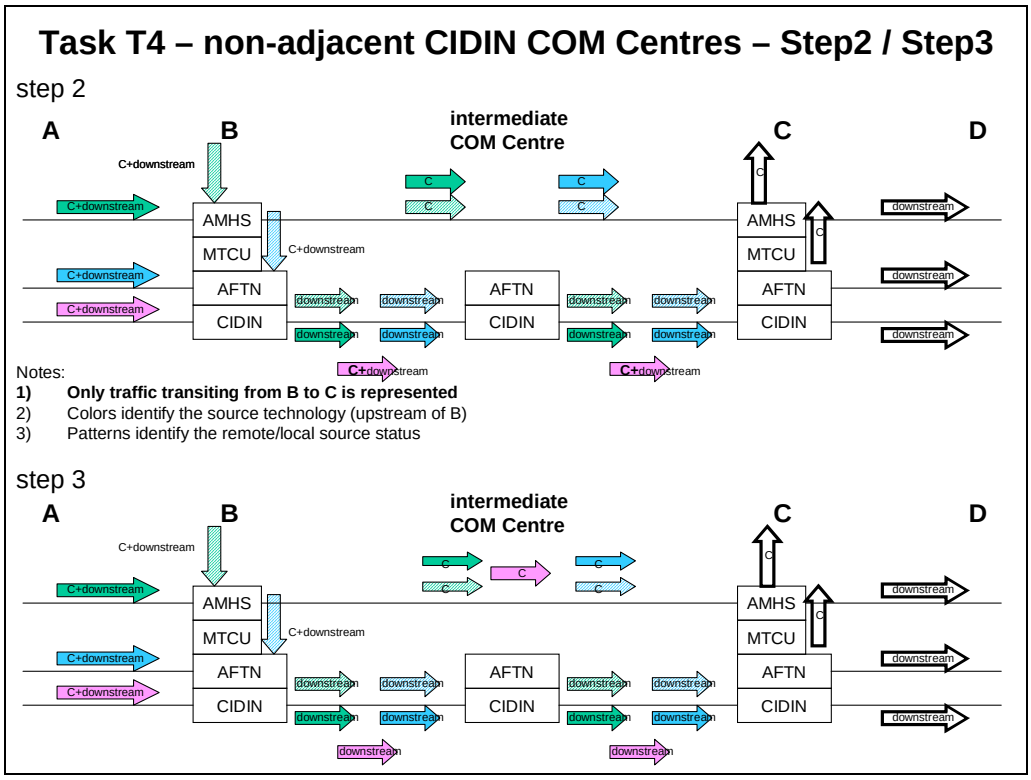


Figure 10: Task T4 - non-adjacent CIDIN COM Centres - Step2 and Step3

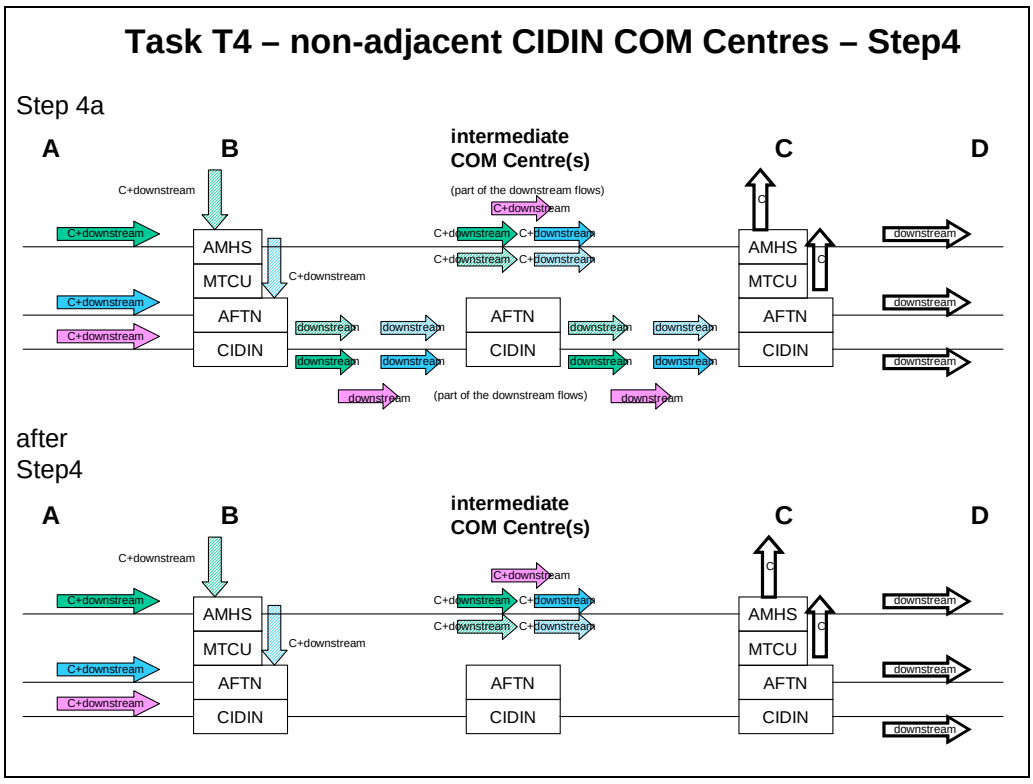


Figure 11: Task T4 - non-adjacent CIDIN COM Centres - Step4

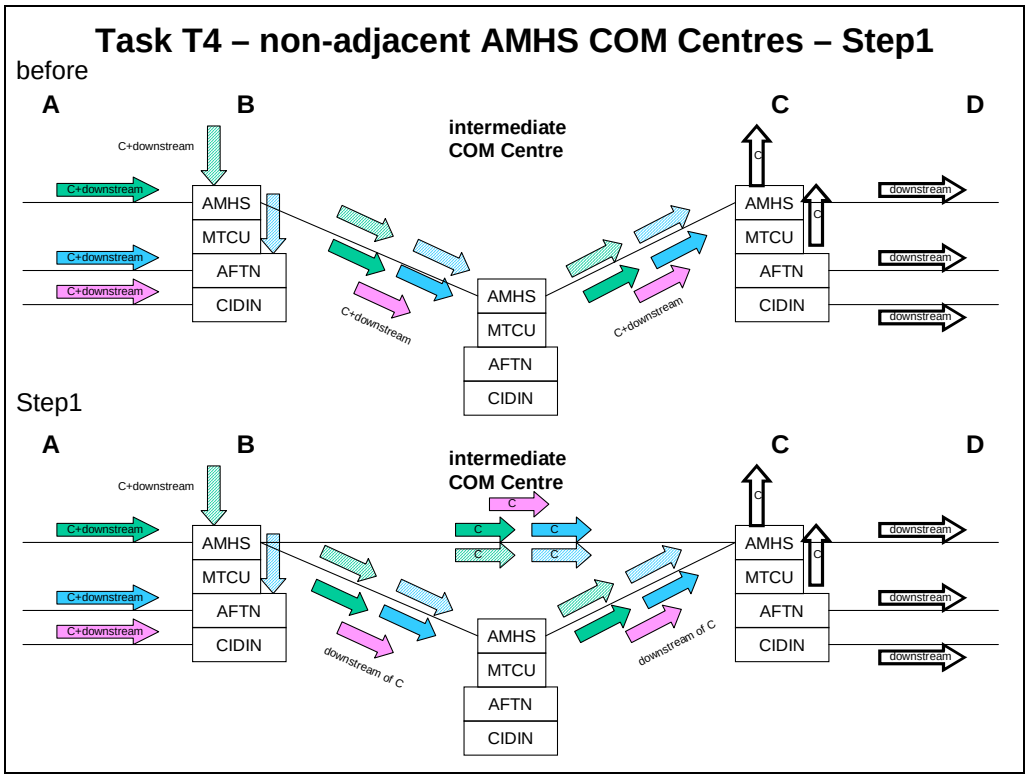


Figure 12: Task T4 - non-adjacent AMHS COM Centres - Step1

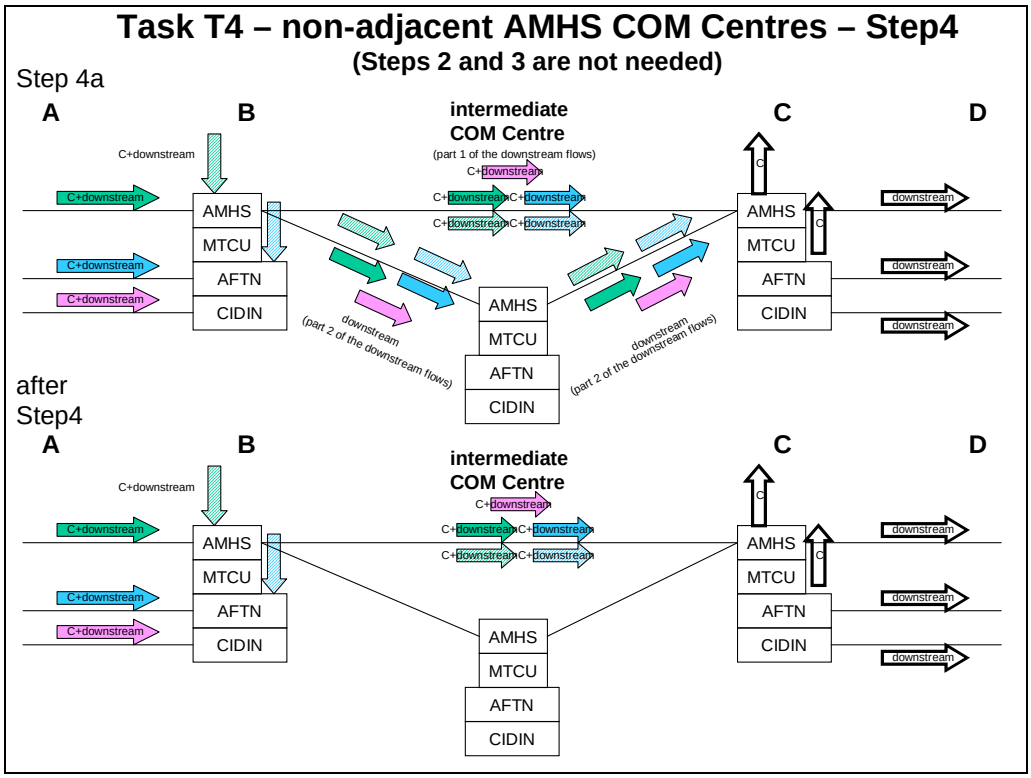


Figure 13: Task T4 - non-adjacent AMHS COM Centres - Step4

END of Appendix A

B. Appendix B – detailed access rights for each user category

B.1 Model for access rights specification

B.1.1 Groups of AMC functions

Access rights are defined for each user category in accordance with principles that are described in section 6.2.

AMC functions include approximately 100 functions and sub-functions. To limit the number of cases, functions are aggregated in groups upon which a common logic can be applied in terms of access rights.

These groups of functions are as follows:

- "operational functions" (former CCC functions complemented with AMF-O functions);
- "view operational data" (a subset of the above, operational functions in the operational area);
- "view pre-operational data" (same principle, in the pre-operational area);
- "enter background data" (same principle, in the background area);
- "general COM Centre functions" is a transverse group of operational functions in all three areas, which includes functions related to "high level" COM Centre information, encompassing:
    - Persons & Contacts,
    - COM Centres,
    - AFTN/AMHS Capabilities,
    - AMHS Capabilities,;
    - and the equivalent planning functions;
- "topology and routing-related functions" is a transverse group of operational functions in all three areas, which includes functions related to detailed topology and routing information, encompassing:
    - (CIDIN) VCGs,
    - Circuits,
    - AMHS Connections,
    - Routing Directory and its sub-functions,
    - the equivalent planning functions and sub-functions,

- the "Path" function in the Miscellaneous Group of functions;

- "Miscellaneous functions" is a subset of operational functions, as defined in the CMC;
- Among "Miscellaneous functions", the "support functions", "view bulletin board" and "view AIRAC cycle" are considered as related to the execution of procedures along the AIRAC cycle;
- "Privileged functions" is as defined in the CMC for the CMC Operator, expanded with AMF-O functions specific to the AMC Operator;
- "Implementation Support Functions" are AMF-I functions as defined in chapter 3 of the Manual;
- "download-type AMF-I functions" are a transverse subset of the above consisting of:
  - download support information,
  - AMHS PDR monitoring,
  - download test documentation,
  - test activities database;
- "coordination AMF-I functions" are a transverse subset of the AMF-I functions which allow AMHS MDs to plan and coordinate their implementation activities, consisting of:
  - test environment data,
  - test planning,
  - implementation planning;
- "help functions" are as defined in the CMC, complemented with additional AMC information.

B.1.2 Definition of access right categories

The following access rights are defined, they can apply individually to a given function or sub-function for a given user category:

- R/W ("Read/Write"): gives the rights to read, create, modify and delete data relevant to any COM Centre, or to data not associated with a given COM Centre (e.g. Helpdesk);
- R/W (own only): gives the rights to read, create, modify and delete data relevant to the COM Centre to which the considered user is associated;
- R(all) / W(own): this right is specific to implementation support functions where viewing and modifying data can be performed in the same function. It gives the rights to read data relevant to all COM Centres and to create, modify and delete data relevant to the COM Centre to which the considered user is associated;
- R/W (own via AMC): this right is specific to Participating COM Operators, it gives the rights to request the AMC Operator:

- to retrieve and provide information contained in the database (equivalent to "Read") regarding any COM Centre;

- to create, modify and delete data relevant to the Participating COM Centre to which the considered user is associated (equivalent to "Write");

- R ("Read "): gives the rights to read data relevant to any COM Centre;

- R (via AMC Op): this right is specific to Participating COM Operators, it gives the rights to request the AMC Operator to retrieve and provide information contained in the database regarding any COM Centre.

B.2 Access rights to each function/sub-function by user category

B.2.1 Principles for user access

The adopted principles enabling to determine detailed access rights for each user category are described below. They are based on Figure and they refine the classification provided by the figure. These principles are as follows:

1. the AMC Operator has a R/W access to all functions where data input is possible (e.g. Enter Background Data, Manage Background Data, Implementation Support Functions);

2. the AMC Operator has a R access to all functions where viewing only is possible (e.g. View Operational Data);

3. only the AMC Operator has access to privileged and administrative functions;

4. the CCC Operator has a R/W (own only) access to all operational functions where data input is possible (e.g. Enter Background Data);

5. the CCC Operator has a R(all) / W(own) access to all operational functions where simultaneous data viewing and input for a given Centre is possible (e.g. Acknowledgement);

6. the CCC Operator has a R access to all functions where viewing only is possible (e.g. View Operational Data, View Pre-Operational Data, Miscellaneous);

7. the Ext COM Operator has the same rights as the CCC Operator for all general COM Centre functions (including network inventory) and for miscellaneous functions (except "Path function");

8. the Ext COM Operator has the same rights as the CCC Operator for address management and AMHS User Capabilities management functions;

9. the Ext COM Operator has no access to any routing-related function, nor to any statistics function;

10. the AMF-I User has a R access to the "view operational data" operational functions and sub-functions;

11. the AMF-I User and the Read-Only User have no access to any of the "view pre-operational data" or "enter background data" operational functions and sub-functions;

12. the AMF-I User has a R access to all miscellaneous functions;

13. the AMF-I User has a R access to all download-type AMF-I functions;

14. the AMF-I User has a R(all) / W(own) access to all coordination AMF-I functions;

15. the AMF-I User has a R/W access to the helpdesk functions;

16. the CCC Operator has the same access rights as the AMF-I User as far as AMF-I functions are concerned;

17. the Ext COM Operator has the same access rights as the AMF-I User as far as AMF-I functions are concerned;

18. the Read-Only User has a R access to the general COM Centre functions, including "AFTN/CIDIN Capabilities" and "AMHS Capabilities", and to the Address Management functions in the "View Operational Data" group of functions;

19. the Read-Only User has a R access to topology and routing-related functions, including COM Charts, and to statistics function;

20. the Read-Only User has a R access to the miscellaneous functions except to “Send E-Mail to User Groups”;

21. the Read-Only User has a R access to all AMF-I functions;

22. the Participating COM Operator has a R (via AMC Op) access to the Network Inventory functions, and to the Address Management functions in the "View Operational Data" group of functions;

23. the Participating COM Operator has a R/W (own via AMC) access to the Network Inventory functions, and to the Address Management functions in the "Enter Background Data" group of functions;

24. the Participating COM Operator has no access to the AMHS User Capabilities management function to avoid massive informal data exchanges;

25. the Participating COM Operator has no access to any routing-related function, nor to any statistics function;

26. the Participating COM Operator has a R (via AMC Op) access to only some AMF-I functions to avoid massive informal data exchanges;

27. all users (except Participating COM Operators) have a R access to the Help functions, except for the "AMC User Manual" function which is for the AMC Operator only;

28. the Participating COM Operator has no access to any "View Pre-Operational Data" function, nor to any "Miscellaneous" function.

Note.– The principles expressed above are listed as guidelines for the specification of detailed access rights for each user category. They are only an intermediate tool, and only the detailed specification of access rights in the next section should be seen as binding.

B.2.2 Detailed specification of access rights

See next pages

AMC FUNCTIONS AND SUB-FUNCTIONS			USER CATEGORIES											
Group	Function	Sub-Function	AMC Operator		CCC Operator		Ext. COM Operator		AMF-I User		Read-Only User		Particip COM	
OPERATIONAL_FUNCTIONS														
View Operational Data														
	Network Inventory													
		Persons & Contacts	R	2	R	6	R	7	R	10	R	18	R (via AMC Op)	22
		COM Centres	R	2	R	6	R	7	R	10	R	18	R (via AMC Op)	22
		AFTN/CIDIN Capabilities	R	2	R	6	R	7	R	10	R	18	R (via AMC Op)	22
		AMHS Capabilities	R	2	R	6	R	7	R	10	R	18	R (via AMC Op)	22
		VCGs	R	2	R	6	R	7	R	10	R	19	R (via AMC Op)	22
		Connections	R	2	R	6	R	7	R	10	R	19	R (via AMC Op)	22
	Routing Directory													
		AFTN Routing Table	R	2	R	6		9	R	10	R	19		25
		CIDIN Routing Table	R	2	R	6		9	R	10	R	19		25
		AMHS Routing Table	R	2	R	6		9	R	10	R	19		25
	Address Management													
		AMHD MD Register	R	2	R	6	R	8	R	10	R	18	R (via AMC Op)	22
		Intra-MD Addressing	R	2	R	6	R	8	R	10	R	18	R (via AMC Op)	22
	User Capabilities Management		R	2	R	6	R	8	R	10	R	19		24
	Statistics													
		Monthly Statistics	R	2	R	6		9	R	10	R	19		24
		Peak Hour Statistics	R	2	R	6		9	R	10	R	19		24
	Static Report		R	2	R	6	R	7	R	10	R	19	R (via AMC Op)	22
	COM Charts		R	2	R	6	R	7	R	10	R	19	R (via AMC Op)	22
OPERATIONAL_FUNCTIONS														
View Pre-Operational Data														
	Network Inventory													
		Persons & Contacts	R	2	R	6	R	7		11		11		28
		COM Centres	R	2	R	6	R	7		11		11		28
		AFTN/CIDIN Capabilities	R	2	R	6	R	7		11		11		28
		AMHS Capabilities	R	2	R	6	R	7		11		11		28
		VCGs	R	2	R	6	R	7		11		11		28
		Connections	R	2	R	6	R	7		11		11		28
	Routing Directory and ACK													
		AFTN Routing Table	R	2	R	6		9		11		11		28
		CIDIN Routing Table	R	2	R	6		9		11		11		28
		AMHS Routing Table	R	2	R	6		9		11		11		28
		Acknowledgement	R/W	1	R(all)/W(own)	5		9		11		11		28

AMC FUNCTIONS AND SUB-FUNCTIONS			USER CATEGORIES											
Group	Function	Sub-Function	AMC Operator		CCC Operator		Ext. COM Operator		AMF-I User		Read-Only User		Particip COM	
	Address Management													
		AMHD MD Register	R	2	R	6	R	8		11		11		28
		Intra-MD Addressing	R	2	R	6	R	8		11		11		28
	User Capabilities Management		R	2	R	6	R	8		11		11		28
	Statistics													
		Monthly Statistics	R	2	R	6		9		11		11		28
		Peak Hour Statistics	R	2	R	6		9		11		11		28
	Static Report (Updated Data)		R	2	R	6	R	8		11		11		28
Enter Background Data														
	Network Inventory													
		Persons & Contacts	R/W	1	R/W (own only)	4	R/W(own only)	7		11		11	R/W(own via AMC)	23
		COM Centres	R/W	1	R/W (own only)	4	R/W(own only)	7		11		11	R/W(own via AMC)	23
		AFTN/CIDIN Capabilities	R/W	1	R/W (own only)	4	R/W(own only)	7		11		11	R/W(own via AMC)	23
		AMHS Capabilities	R/W	1	R/W (own only)	4	R/W(own only)	7		11		11	R/W(own via AMC)	23
		VCGs	R/W	1	R/W (own only)	4	R/W(own only)	7		11		11	R/W(own via AMC)	23
		Connections	R/W	1	R/W (own only)	4	R/W(own only)	7		11		11	R/W(own via AMC)	23
	Address Management													
		Intra-MD Addressing	R/W	1	R/W (own only)	4	R/W(own only)	8		11		11	R/W(own via AMC)	23
	User Capabilities Management		R/W	1	R/W (own only)	4	R/W(own only)	8		11		11		24
	Statistics													
		Monthly Statistics	R/W	1	R/W (own only)	4		9		11		11		25
		Peak Hour Statistics	R/W	1	R/W (own only)	4		9		11		11		25
OPERATIONAL_FUNCTIONS														
Miscellaneous Functions														
	Support Functions													
		FAQs	R/W	1	R	6	R	7	R	12	R	20		28
		Interworking Problems	R/W	1	R	6	R	7	R	12	R	20		28
	View Bulletin Board		R	2	R	6	R	7	R	12	R	20		28
	View AIRAC Cycle													
		View AIRAC Cycle	R	2	R	6	R	7	R	12	R	20		28
		View AIRAC Dates	R	2	R	6	R	7	R	12	R	20		28
	AMC Operator Details		R/W	1	R	6	R	7	R	12	R	20		28
	Documentation Part of ENRD		R/W	1	R	6	R	7	R	12	R	20		28
	Path Function		R	2	R	6		9	R	12	R	19		28
	View ANP Locations		R	2	R	6	R	7	R	12	R	20		28
	Regions		R/W	1	R	6	R	7	R	12	R	20		28
	Send E-Mail to User Groups		R/W	1	R	6		9	R	12		20		28

AMC FUNCTIONS AND SUB-FUNCTIONS			USER CATEGORIES											
Group	Function	Sub-Function	AMC Operator		CCC Operator		Ext. COM Operator		AMF-I User		Read-Only User		Particip COM	
Privileged Functions (sub-functions are not detailed in this group)														
Manage Background Data														
	AMHS MD Register		R/W	1		3		3		3		3		3
	Lock/Unlock COM Centre		R/W	1		3		3		3		3		3
	Routing Directory		R/W	1		3		3		3		3		3
	Routing Matrices		R/W	1		3		3		3		3		3
	Edit Bulletin Board		R/W	1		3		3		3		3		3
	Process Statistics		R/W	1		3		3		3		3		3
	Show Modified Information		R/W	1		3		3		3		3		3
	Routing Update for Transition to AMHS		R/W	1		3		3		3		3		3
Transfer Data between Areas														
	To Pre-Operational Area		R/W	1		3		3		3		3		3
	To Operational Area		R/W	1		3		3		3		3		3
	Modify Routing Matrix Status		R/W	1		3		3		3		3		3
	Generate Static Report		R/W	1		3		3		3		3		3
	Generate Static Report (updated data)		R/W	1		3		3		3		3		3
AMC Miscellaneous														
	Manage ANP Locations		R/W	1		3		3		3		3		3
	Show Inconsistencies		R/W	1		3		3		3		3		3
	Reference Tables		R/W	1		3		3		3		3		3
	Edit Com Charts		R/W	1		3		3		3		3		3
	ANP FASID Report		R	2		3		3		3		3		3
	Assign Functions to User Groups		R/W	1		3		3		3		3		3
	Associate AMC Users to COM Centres		R/W	1		3		3		3		3		3
	Show Users		R/W	1		3		3		3		3		3
	Notify Database Changes to AMF-I Users		R/W	1		3		3		3		3		3
IMPLEMENTATION_SUPPORT FUNCTIONS														
AMHS MD Contacts														
	Persons and Contacts		R/W	1	R(all)/W(own)	16	R(all)/W(own)	17	R(all)/W(own)	14	R	21	R (via AMC Op)	26
AMHS Implementation Planning														
	Implementation Planning		R/W	1	R(all)/W(own)	16	R(all)/W(own)	17	R(all)/W(own)	14	R	21	R (via AMC Op)	26
Interworking Test Support														
	Download Test Documentation		R/W	1	R	16	R	17	R	13	R	21		
	Test Activities Database		R/W	1	R	16	R	17	R	13	R	21		
	Test Environment Data		R/W	1	R(all)/W(own)	16	R(all)/W(own)	17	R(all)/W(own)	14	R	21	R (via AMC Op)	26
	Test Planning		R/W	1	R(all)/W(own)	16	R(all)/W(own)	17	R(all)/W(own)	14	R	21		

AMC FUNCTIONS AND SUB-FUNCTIONS			USER CATEGORIES											
Group	Function	Sub-Function	AMC Operator		CCC Operator		Ext. COM Operator		AMF-I User		Read-Only User		Particip COM	
AMHS PDR Monitoring														
	PDRs and APs		R/W	1	R	16	R	17	R	13	R	21		
	AMHS Documentation Maintenance Procedures		R/W	1	R	16	R	17	R	13	R	21	R (via AMC Op)	26
Helpdesk Functions														
	Download Support Information		R/W	1	R	16	R	17	R	13	R	21	R (via AMC Op)	26
	Implementers' Forum		R/W	1	R/W	16	R/W	17	R/W	15	R	21		
	FAQs		R/W	1	R/W	16	R/W	17	R/W	15	R	21		
Help														
	About ATS Messaging Management Application		R	27	R	27	R	27	R	27	R	27		
Logout														

END of Appendix B

C. Appendix C – Definition of collected statistics

C.1 Statistical data sets

The AMC statistics function shall manage statistics indicators as defined below. Two sets of statistical data shall be compiled for each international MTA by CCC Operators:

- Monthly Statistics: one set of data regarding one month, with one record for each day of the considered month and each adjacent international MTA. Total numbers are cumulated over one day, averages and maxima are determined over one day;

- Monthly Peak Hour Statistics: one set of data regarding the peak hour during the considered month. The peak hour is defined as the hour in which the sum of the number of transmitted information objects data messages and of the number of received data messages to/from an adjacent MTA is a maximum. To determine the values of the corresponding statistical indicators, measures are made for every hour (from 00:00 to 00:59, 01:00 to 01:59, and so on). All statistical indicators related to the determined peak hour of the considered month as well as the date and start time of the peak hour are stored.

Most of the indicators are on a MTA-to-MTA direct relation basis. Only international AMHS connections are considered in the AMC statistics.

Note.– The term "data message" or "message" used below includes all X.400 P1 information objects, i.e. messages, probes and reports.

C.2 Monthly statistical indicators

The statistics indicators shall be as defined below. They are components of each record corresponding to one international MTA adjacent to the managed MTA and the measurement interval of one day within the considered month:

Ind1- Number of data messages transmitted daily: This element is defined as the number of information objects which the managed MTA has transmitted to the adjacent MTA, during the measurement interval (each day of the considered month).
name = TOT_NBR_MSG_TX
integer (unit=messages)
range = 0..33554431 (32M)

Ind2- Average size of the data messages transmitted daily: This element is defined as the average size of information objects which the managed MTA has transmitted to the adjacent MTA, during the measurement interval (each day of the considered month). The value is the size of the encoded ASN.1 information object.
name = TOT_AVSI_MSG_TX
integer (unit=bytes)
range = 0..33554431 (32 Megabytes)
the null value is reserved for "no data available"

Ind3- Maximum size of the data messages transmitted daily: This element is defined as the size of the largest information object which the managed MTA has transmitted to the adjacent MTA, during the measurement interval (each day of the considered month). The value is the

size of the encoded ASN.1 information object.
name = TOT_MXSI_MSG_TX
integer (unit=bytes)
range = 0..33554431 (32Megabytes)
the null value is reserved for "no data available"

Ind4- Number of data messages received daily: This element is defined as the number of information objects which the managed MTA has received from the adjacent MTA, during the measurement interval (each day of the considered month).
name = TOT_NBR_MSG_RX
integer (unit=messages)
range = 0..33554431 (32M)

Ind5- Average size of the data messages received daily: This element is defined as the average size of information objects which the managed MTA has received from the adjacent MTA, during the measurement interval (each day of the considered month).
name = TOT_AVSI_MSG_RX
integer (unit=bytes)
range = 0..33554431 (32Megabytes)
the null value is reserved for "no data available"

Ind6- Maximum size of the data messages received daily: This element is defined as the size of the largest information object which the managed MTA has received from the adjacent MTA, during the measurement interval (each day of the considered month). The value is the size of the encoded ASN.1 message.
name = TOT_MXSI_MSG_RX
integer (unit=bytes)
range = 0..33554431 (32Megabytes)
the null value is reserved for "no data available"

Ind7- Average number of destination addresses per message transmitted daily: This element is defined as the average number (rounded up or down to the nearest integer value) of recipient addresses included per information object which the managed MTA has sent to the adjacent MTA, during the measurement interval (each day of the considered month).
name = TOT_AVDE_MSG_TX
integer (unit=recipients)
range = 0..32767
the null value is reserved for "no data available"

Ind8- Average transfer time (AIRAC cycle basis): This element is defined as the average transfer time, over one day, of a sample message from the managed MTA to the adjacent MTA.
name = TOT_MSG_AVTT
integer (unit = milliseconds)
range = 0..4194303 (4M)
the null value is reserved for "no data available"

Note.– The detailed definition of this element and procedure for its measurement are for further study by AFSG subgroups.

Ind9- Number of messages rejected daily: This element is defined as the number of information objects received from the adjacent international MTA and rejected by the managed MTA, during the measurement interval (each day of the considered month). An information object is considered to be rejected when the managed MTA discards the object for at least one recipient or in its entirety, independent if a report is generated or not and

independent from the reason.
name = TOT_MSG_REJ
integer (unit=messages)
range = 0..1048575 (1M)

Note.– Information objects which passed a DL expansion may be counted if they are rejected.

Ind10- Overall traffic volume at the level of IP packets (daily total): This element is defined as the amount of bytes of the IP packets which the managed MTA has transmitted towards the adjacent MTA, during the measurement interval (each day of the considered month).
name = TOT_VOL_IPP_TX
integer (unit=bytes)
range = 0.. 2147483647 (2Gigabytes)

Note.– It may be necessary to use IP network measurement tools distinct from the message switch statistics to produce this element. In case no distinction can be made between the traffic generated by X.400 message transfer and other types of traffic (e.g. directory) the total traffic will be provided.

Ind11- Maximum outage duration of association between MTAs (if any): This element is defined as the duration of the largest outage period calculated as the time when it becomes impossible to establish any association to an adjacent MTA to the time a message is transferred successfully to that adjacent MTA, each day of the considered month.
name = TOT_MAX_OUTT
integer (unit = minutes) or "no data available"
range = 0..4095 (4k)

Note 1.– In addition to failure situations, outage period can be influenced by three factors:

- *system implementation and timers,*
- *operator interventions,*
- *traffic volume.*

Note 2.– Only outage durations which last one minute or longer are relevant.

Note 3.– Manual intervention may be required, at least partly, to produce this element, e.g. by storage of information about outages.

Ind12- Cumulated outage duration of association between MTAs (if any): This element is defined as the cumulated duration of the outage periods (using the same definition of outage period as in Ind11 above), each day of the considered month.
name = TOT_CML_OUTT
integer (unit = minutes) or "no data available"
range = 0..4095 (4k)

Note 1.– Only outage durations which last one minute or longer are relevant and are cumulated with a granulation of seconds.

Note 2.– Manual intervention may be required, at least partly, to produce this element, e.g. by storage of information about outages.

C.3 Monthly Peak Hour Statistics

The peak hour shall be determined for each MTA-to-MTA relation. It should be noted that the peak hour is likely to vary depending on which MTA-to-MTA relation is considered.

The statistic indicators shall be as defined below. They are components of each record corresponding to one international MTA adjacent to the managed MTA and to the peak hour within the considered month:

Ind13- Number of data messages transmitted during the peak hour: This element is defined as the number of information objects which the managed MTA has transmitted to the adjacent MTA, during the peak interval of the considered month.
name = PK_NBR_MSG_TX
integer (unit=information objects)
range = 0.. 1048575 (1M)

Ind14- Average size of the data messages transmitted during the peak hour: This element is defined as the average size of information objects which the managed MTA has transmitted to the adjacent MTA, during the peak interval of the considered month. The value is the size of the encoded ASN.1 message.
name = PK_AVSI_MSG_TX
integer (unit=bytes)
range = 0..33554431 (32Megabytes)
the null value is reserved for "no data available"

Ind15- Maximum size of the data messages transmitted during the peak hour: This element is defined as the size of the largest information object which the managed MTA has sent to the adjacent MTA, during the peak interval of the considered month. The value is the size of the encoded ASN.1 message.
name = PK_MXSI_MSG_TX
integer (unit=bytes)
range = 0..33554431 (32Megabytes)
the null value is reserved for "no data available"

Ind16- Number of data messages received during the peak hour: This element is defined as the number of information objects which the managed MTA has received from the adjacent (adjacent international) MTA, during the peak interval of the considered month.
name = PK_NBR_MSG_RX
integer (unit=information objects)
range = 0.. 1048575 (1M)

Ind17- Average size of the data messages received during the peak hour: This element is defined as the average size of information objects which the managed MTA has received from the adjacent MTA, during the peak interval of the considered month.
name = PK_AVSI_MSG_RX
integer (unit=bytes)
range = 0..33554431 (32Megabytes)
the null value is reserved for "no data available"

Ind18- Maximum size of the data messages received during the peak hour: This element is defined as the size of the largest information object which the managed MTA has received from the adjacent MTA, during the peak interval of the considered month. The value is the size of the encoded ASN.1 message.
name = PK_MXSI_MSG_RX
integer (unit=bytes)

range = 0..33554431 (32Megabytes)
the null value is reserved for "no data available"

Ind19- Average number of destination addresses per message transmitted during the peak hour: This element is defined as the average number (rounded up or down to the nearest integer value) of recipient addresses included per information object which the managed MTA transmitted to the adjacent MTA, during the peak interval of the considered month.
name = PK_AVDE_MSG_TX
integer (unit=recipients)
range = 0..32767
the null value is reserved for "no data available"

Ind20. Average transfer time (peak hour basis): This element is defined as the average transfer time, over the peak interval of the considered month, of a sample message from the managed MTA to the adjacent MTA.
name = PK_MSG_AVTT
integer (unit = milliseconds)
range = 0.. 4194303 (4M)
the null value is reserved for "no data available"

Note.– The detailed definition of this element and procedure for its measurement are for further study by AFSG subgroups.

Ind21- Number of messages rejected during the peak hour: This element is defined as the number of information objects received from the adjacent international MTA and rejected by the managed MTA, during the peak interval of the considered month. A message is considered to be rejected when the managed MTA discards the object for at least one recipient or in its entirety, independent if a report is generated or not and independent from the reason.
name = PK_MSG_REJ
integer (unit=messages)
range = 0..1048575 (1M)

Note.– Information objects which passed a DL expansion may be counted if they are rejected.

Ind22- Overall peak hour traffic volume at the level of IP packets: This element is defined as the amount of bytes of IP packets which the managed MTA has transmitted towards the adjacent MTA, during the peak interval of the considered month.
name = PK_VOL_IPP_TX
integer (unit=bytes)
range = 0.. 2147483647 (2Gigabytes)

Note.– It may be necessary to use IP network measurement tools distinct from the message switch statistics to produce this element. In case no distinction can be made between the traffic generated by X.400 message transfer and other types of traffic (e.g. directory) the total traffic will be provided.

C.4 Indicators and flow directions

Among the statistics indicators listed in sections C.2 and C.3 above, three categories can be found with regard to flow directions (identified in bold in the text below):

1. Indicators which are related to the flow direction (**from** the considered COM Centre **to** the adjacent COM Centre, or vice-versa), and which are available for both directions in the considered COM Centre. By nature, they are coupled:

   - indicators Ind1 and Ind4, number of messages **transmitted**/ **received** daily,
   - indicators Ind2 and Ind5, average message size **transmitted**/ **received** daily,
   - indicators Ind3 and Ind6, maximum message size **transmitted**/ **received** daily,
   - and their equivalents during the peak hour (Ind13 and Ind16, Ind14 and Ind17, Ind15 and Ind18, respectively);

2. Indicators which are related to the flow direction (from the considered COM Centre to the adjacent COM Centre, or reverse), and which are available for one direction only in the considered COM Centre. They are the following:

   - indicator Ind7, average number of destination addresses per message **transmitted** daily,
   - indicator Ind8, average transfer time daily (**from** the managed MTA **to** each other MTA),
   - indicator Ind9, number of messages rejected daily (number of messages **received from** the adjacent MTA and then rejected),
   - indicator Ind10, overall traffic volume at the level of IP packets (daily total), **from** the managed MTA **to** the adjacent MTA);
   - and their equivalents during the peak hour (Ind19, Ind20, Ind21 and Ind22, respectively);

3. Indicators which are not related to the flow direction:

   - indicator Ind11: maximum outage duration of the association **between** MTAs,
   - indicator Ind12: cumulated outage duration of the association **between** MTAs.

It should be noted that for indicators in category 1 (indicators Ind1 to Ind6, Ind13 to Ind18), the same information is theoretically available from the two COM Centres at each extremity of an AMHS Connection. This characteristic should be used for consolidation of statistical data.

C.5 Structure of the Statistic data sets

During each month, a CCC Operator will build two statistical data sets in table format.

These data sets are based on the AMC model of one MTA per COM Centre.

The monthly statistics table shall include 16 columns as follows:

- STAT_ID, which is a unique numerical index for each record (a row in the table);
- SOURCE_COM, which identifies the COM Centre (his COM Centre Location Indicator) of the considered MTA. Each row in the table shall contain the same value;

- DESTIN_COM, which identifies the destination COM Centre, i.e. the COM Centre Location Indicator of the considered adjacent MTA. There shall be one row in the table for each destination COM Centre with which there is an AMHS connection from the source COM Centre;

- DATE, which identifies the date represented by the record. The format shall be dd/mm/yyyy;

- one column for each of the indicators from Ind1 to Ind12 above.

Each row of the table contains the values of the statistical data for the AMHS connection between SOURCE_COM and DESTIN_COM, during one day of the considered month, as seen from SOURCE_COM. There should consequently be n multiplied by d rows (or records) in the table, where n is the number of AMHS COM Centres adjacent to SOURCE_COM and d is the number of days in the month.

The peak hour statistics table shall include 14 columns as follows:

- STAT_ID, which is a unique numerical index for each record (a row in the table);

- SOURCE_COM, which identifies the source COM Centre (his COM Centre). Each row in the table shall contain the same value;

- DESTIN_COM, which identifies the destination COM Centre (his COM Centre). There shall be one row in the table for each destination COM Centre with which there is an AMHS connection from his COM Centre;

- PEAK_HOUR, which identifies the peak hour for communications between the source COM Centre and the destination COM Centre. The format shall be dd/mm/yyyy hh:mm, where hh:mm identifies the UTC time at which the peak hour began (e.g. 23/10/2005 11:00, if the peak hour in the considered month was on 23rd October 2005, from 11:00 UTC to 11:59);

- one column for each of the indicators from Ind13 to Ind22 above.

Each row of the table contains the values of the statistical data for the AMHS connection between SOURCE_COM and DESTIN_COM, during the peak hour over the considered month. There should consequently be n rows (or records) in the table, where n is the number of AMHS COM Centres adjacent to SOURCE_COM.

Each of these tables shall be stored either as an Excel file or as a CSV file (comma-separated value) by the CCC Operator, for IMPORT into the AMC. The first row (or first record of the file) shall include the column heads using the indicator names defined above.

CSV files shall conform to the following rules:

- separator combinations: either of the following:

    - field separator = semicolon (ASCII hexa 3B), decimal separator = comma (ASCII hexa 2C), or

    - field separator = comma (ASCII hexa 2C), decimal separator = dot (ASCII hexa 2E);

- in practice no decimal separator should in fact be used, as all indicators are defined as integer. The above is just for consistency with CSV files produced by Excel;

- record separator: CR (ASCII hexa 0D) or LF (ASCII hexa 0A), or CR/LF (ASCII hexa 0D/0A);

- use of thousand separator (as in 300,000 / 300.000 / 300 000) shall be prevented;

- use of quotes of any kind shall be prevented.

There shall consequently be two statistics files produced by each CCC Operator each month, either manually or automatically by the COM Centre system.

C.6 Examples of statistics in tabular format

Example of monthly statistic table for COM Centre LFLF with 15 adjacent AMHS COM Centres (to be provided in CSV format), for February 2006 (indicator values should all be different)

STAT_ID	SOURCE_COM	DESTIN_COM	DATE	TOT_NBR_MSG_T	TOT_AVSI_MSG_	TOT_MXSI_MSG_	TOT_NBR_MSG_R	TOT_AVSI_MSG_	TOT_MXSI_MSG_I	TOT_AVDE_MSG_	TOT_MSG_AVTT	TOT_MSG_REJ	TOT_VOL_IPP_TX	TOT_MAX_OUTT	TOT_CML_OUTT
1	LFLF	EBBB	01/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
2	LFLF	EBBD	01/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
3	LFLF	EDDD	01/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
4	LFLF	EGGG	01/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
5	LFLF	EHAM	01/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
6	LFLF	EKCH	01/02/2006	100	350	13000	160	325	8600	4		3	420000	10	26
7	LFLF	LEEE	01/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
8	LFLF	LFPY	01/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
9	LFLF	LGGG	01/02/2006	100	350	13000	160	325	8600	5		3	420000	10	26
10	LFLF	LHBP	01/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
11	LFLF	LIII	01/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
12	LFLF	LOWW	01/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
13	LFLF	LPPT	01/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
14	LFLF	LSSS	01/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
15	LFLF	UUUU	01/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
16	LFLF	EBBB	02/02/2006	100	350	13000	160	325	8600	4		3	420000	10	26
17	LFLF	EBBD	02/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
18	LFLF	EDDD	02/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
19	LFLF	EGGG	02/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
20	LFLF	EHAM	02/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
21	LFLF	EKCH	02/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
22	LFLF	LEEE	02/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
23	LFLF	LFPY	02/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
24	LFLF	LGGG	02/02/2006	100	350	13000	160	325	8600	4		3	420000	10	26
25	LFLF	LHBP	02/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
26	LFLF	LIII	02/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
27	LFLF	LOWW	02/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
28	LFLF	LPPT	02/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
29	LFLF	LSSS	02/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
30	LFLF	UUUU	02/02/2006	100	350	13000	160	325	8600	4		3	420000	10	26
31	LFLF	EBBB	03/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
32	LFLF	EBBD	03/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
33	LFLF	EDDD	03/02/2006	100	350	13000	160	325	8600	5		3	420000	10	26
34	LFLF	EGGG	03/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
35	LFLF	EHAM	03/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
36	LFLF	EKCH	03/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
37	LFLF	LEEE	03/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
38	LFLF	LFPY	03/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
39	LFLF	LGGG	03/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
40	LFLF	LHBP	03/02/2006	100	350	13000	160	325	8600	4		3	420000	10	26
41	LFLF	LIII	03/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
42	LFLF	LOWW	03/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
43	LFLF	LPPT	03/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
44	LFLF	LSSS	03/02/2006	100	350	13000	160	325	8600	2		3	420000	10	26
45	LFLF	UUUU	03/02/2006	100	350	13000	160	325	8600	3		3	420000	10	26
[to be continued for each day of the month]															

Example of peak hour statistic table for COM Centre LFLF with 15 adjacent AMHS COM Centres (to be provided in CSV format), for February 2006

STAT_ID	SOURCE_COM	DESTIN_COM	DATE	PK_NBR_MSG_TX	PK_AVSI_MSG_T	PK_MXSI_MSG_T	PK_NBR_MSG_RX	PK_AVSI_MSG_R	PK_MXSI_MSG_R	PK_AVDE_MSG_T	PK_MSG_AVTT	PK_MSG_REJ	PK_VOL_IPP_TX
1	LFLF	EBBB	14/02/2006 06:00	66	390	4800	65	420	4900	2		1	42100
2	LFLF	EBBD	15/02/2006 11:00	72	360	4600	59	390	4700	4			43000
3	LFLF	EDDD	21/02/2006 08:00	70	380	4600	59	420	4800	3		1	42500
4	LFLF	EGGG	21/02/2006 10:00	68	370	4700	62	410	4900	3			42400
5	LFLF	EHAM	21/02/2006 11:00	66	360	4800	65	400	4500	5		1	42300
6	LFLF	EKCH	16/02/2006 09:00	76	410	4800	65	370	4500	2		1	42800
7	LFLF	LEEE	13/02/2006 07:00	62	410	4600	59	370	4700	2			41500
8	LFLF	LFPY	15/02/2006 19:00	74	420	4700	62	380	4800	3		1	42900
9	LFLF	LGGG	16/02/2006 12:00	74	400	4900	68	360	4600	3		1	42700
10	LFLF	LHBP	13/02/2006 09:00	64	400	4700	62	360	4800	2		1	41800
11	LFLF	LIII	14/02/2006 10:00	68	380	4900	68	410	4500	3		1	42400
12	LFLF	LOWW	16/02/2006 11:00	72	390	4500	56	420	4700	4		1	42600
13	LFLF	LPPT	14/02/2006 07:00	70	370	4500	56	400	4600	3		1	42700
14	LFLF	LSSS	27/02/2006 17:00	64	420	4900	68	390	4750	2		1	42200
15	LFLF	UUUU	06/02/2006 10:00	60	420	4500	56	380	4600	2		1	42000

C.7 Examples of statistics in CSV format

Example of monthly statistic table for COM Centre LFLF with 15 adjacent AMHS COM Centres (to be provided in CSV format), for February 2006 (indicator values should all be different)

STAT_ID;SOURCE_COM;DESTIN_COM;DATE;TOT_NBR_MSG_TX;TOT_AVSI_MSG_TX;TOT_MXSI_MSG_TX;TOT_NBR_MSG_RX;TOT_AVSI_MSG_RX;TOT_MXSI_MSG_RX;TOT_AVDE_MSG_TX;TOT_MSG_AVTT;TOT_MSG_REJ;TOT_VOL_IPP_TX;TOT_MAX_OUTT;TOT_CML_OUTT
1;LFLF;EBBB;01/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
2;LFLF;EBBD;01/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
3;LFLF;EDDD;01/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
4;LFLF;EGGG;01/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
5;LFLF;EHAM;01/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
6;LFLF;EKCH;01/02/2006;100;350;13000;160;325;8600;4;;3;420000;10;26
7;LFLF;LEEE;01/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
8;LFLF;LFPY;01/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
9;LFLF;LGGG;01/02/2006;100;350;13000;160;325;8600;5;;3;420000;10;26
10;LFLF;LHBP;01/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
11;LFLF;LIII;01/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
12;LFLF;LOWW;01/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
13;LFLF;LPPT;01/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
14;LFLF;LSSS;01/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
15;LFLF;UUUU;01/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
16;LFLF;EBBB;02/02/2006;100;350;13000;160;325;8600;4;;3;420000;10;26
17;LFLF;EBBD;02/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
18;LFLF;EDDD;02/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
19;LFLF;EGGG;02/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
20;LFLF;EHAM;02/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
21;LFLF;EKCH;02/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
22;LFLF;LEEE;02/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
23;LFLF;LFPY;02/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
24;LFLF;LGGG;02/02/2006;100;350;13000;160;325;8600;4;;3;420000;10;26
25;LFLF;LHBP;02/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
26;LFLF;LIII;02/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
27;LFLF;LOWW;02/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
28;LFLF;LPPT;02/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
29;LFLF;LSSS;02/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
30;LFLF;UUUU;02/02/2006;100;350;13000;160;325;8600;4;;3;420000;10;26
31;LFLF;EBBB;03/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
32;LFLF;EBBD;03/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
33;LFLF;EDDD;03/02/2006;100;350;13000;160;325;8600;5;;3;420000;10;26
34;LFLF;EGGG;03/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
35;LFLF;EHAM;03/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
36;LFLF;EKCH;03/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
37;LFLF;LEEE;03/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
38;LFLF;LFPY;03/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
39;LFLF;LGGG;03/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
40;LFLF;LHBP;03/02/2006;100;350;13000;160;325;8600;4;;3;420000;10;26
41;LFLF;LIII;03/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
42;LFLF;LOWW;03/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
43;LFLF;LPPT;03/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
44;LFLF;LSSS;03/02/2006;100;350;13000;160;325;8600;2;;3;420000;10;26
45;LFLF;UUUU;03/02/2006;100;350;13000;160;325;8600;3;;3;420000;10;26
[to be continued for each day of the month]

Example of peak hour statistic table for COM Centre LFLF with 15 adjacent AMHS COM Centres (to be provided in CSV format), for February 2006

STAT_ID;SOURCE_COM;DESTIN_COM;DATE;PK_NBR_MSG_TX;PK_AVSI_MSG_TX;PK_MXSI_MSG_TX;PK_NBR_MSG_RX;PK_AVSI_MSG_RX;PK_MXSI_MSG_RX;PK_AVDE_MSG_TX;PK_MSG_AVTT;PK_MSG_REJ;PK_VOL_IPP_TX
1;LFLF;EBBB;14/02/2006 06:00;66;390;4800;65;420;4900;2;;1;42100
2;LFLF;EBBD;15/02/2006 11:00;72;360;4600;59;390;4700;4;;;43000
3;LFLF;EDDD;21/02/2006 08:00;70;380;4600;59;420;4800;3;;1;42500
4;LFLF;EGGG;21/02/2006 10:00;68;370;4700;62;410;4900;3;;;42400
5;LFLF;EHAM;21/02/2006 11:00;66;360;4800;65;400;4500;5;;1;42300
6;LFLF;EKCH;16/02/2006 09:00;76;410;4800;65;370;4500;2;;1;42800
7;LFLF;LEEE;13/02/2006 07:00;62;410;4600;59;370;4700;2;;;41500
8;LFLF;LFPY;15/02/2006 19:00;74;420;4700;62;380;4800;3;;1;42900
9;LFLF;LGGG;16/02/2006 12:00;74;400;4900;68;360;4600;3;;1;42700
10;LFLF;LHBP;13/02/2006 09:00;64;400;4700;62;360;4800;2;;1;41800
11;LFLF;LIII;14/02/2006 10:00;68;380;4900;68;410;4500;3;;1;42400
12;LFLF;LOWW;16/02/2006 11:00;72;390;4500;56;420;4700;4;;1;42600
13;LFLF;LPPT;14/02/2006 07:00;70;370;4500;56;400;4600;3;;1;42700
14;LFLF;LSSS;27/02/2006 17:00;64;420;4900;68;390;4750;2;;1;42200
15;LFLF;UUUU;06/02/2006 10:00;60;420;4500;56;380;4600;2;;1;42000

END of Appendix C

D. Appendix D – Description of AMC CSV files

D.1 CSV Format

D.1.1 General

D.1.1.1 Comma Separated Values (CSV) files are commonly used to exchange data structured in table form. Even though widely used there is no universally valid specification. Reference to RFC 4180[11] could be made, but would require to identify deviations and exceptions.

D.1.1.2 AMC CSV files contain usually[12] ASCII for character encoding and consist of two or more lines separated by a line break. Either LF (0x0A) only, or the sequence CR (0x0D) followed by LF (0x0A), shall be used as line break. The last line must not be terminated by a line break.

D.1.1.3 Example:
<first line><line break>
<second line><line break>
...
<last line>

D.1.1.4 Each line of an AMC CSV file consists of delimited values (fields) terminated by a line break. The semicolon (0x3B) is used as a delimiter. The last field must not be followed by a delimiter. Spaces are considered part of a field and should not be ignored.

D.1.1.5 Example:
<field1>;<field2>;<field3>;<field4><line break>

D.1.1.6 The AMC CSV file composes of the following lines:

- Identification line, followed by
- Header line, followed by
- Zero or more data line

D.1.2 Identification Line

D.1.2.1 The identification line consists of the following fields:

- Version (mandatory)
- Title (mandatory)
- Cycle (conditional)

[11] [1] Y. Shafranovich: "Common Format and MIME Type for Comma-Separated Values (CSV) Files", October 2005, RFC 4180, http://tools.ietf.org/html/rfc4180

[12] exceptions are allowed in State names (e.g. Côte d'Ivoire, Réunion) according ISO/IEC 8859-1.

- AIRAC date corresponding to the cycle (conditional)
- Area (mandatory)
- Status (conditional)
- Time stamp (mandatory)

D.1.2.2 The version depicts the used structure and format of the csv file. The above structure is valid for the Version '1.1'.

D.1.2.3 The title uniquely identifies the kind of information (table) contained in the file e.g. AmhsMdRegister. The title consists of upper and lower case letters; white spaces are excluded.

D.1.2.4 The cycle identifies the operational cycle and is given by freetext e.g. OPER69. The cycle is present when the file is exported from the Pre-operational or from the Operational area. Otherwise the field is left empty.

D.1.2.5 The AIRAC date is present when the cycle is present, otherwise it is left empty. This date uses the following format: DD.MM.YYYY 11:00:00. The time zone is excluded as the time stamp refers to UTC, and the time is fixed as it is imposed by the procedure. The value of the date depends from which area the file is exported:

- when the file is exported from the Pre-operational area, the AIRAC date value is the "Implementation Date" entered by the AMC Operator in "Modify Routing Matrix Status", and displayed in "View Pre-Operational Data" / "Routing Directory" / "Acknowledgement";
- when the file is exported from the Operational area, the AIRAC date value is the date of the last "Transfer to Operational Area", which is displayed in the COM Charts.

D.1.2.6 The area indicates the AMC area from which the information originates from. It may take one of the following values: Background, Pre-operational, or Operational.

D.1.2.7 The status identifies the state of the table, it is present only when the file is exported from the Pre-operational area, otherwise it is empty. When present, it may take one of the following values, entered by the AMC Operator in "Modify Routing Matrix Status", and displayed in "View Pre-Operational Data" / "Routing Directory" / "Acknowledgement":

- In preparation,
- Proposed, or
- Released.

D.1.2.8 The time stamp indicates the time of generation of the file and uses the following format: DD.MM.YYYY HH:MM:SS. The time zone is excluded as the time stamp refers to UTC.

D.1.3 Header Line

D.1.3.1 The header line contains a description for each field in the data line(s).

D.1.4 Data Lines

D.1.4.1 Each data line consists of the same number of fields as indicated in the header line.

D.1.4.2 Optional fields may be omitted and indicated by empty strings.

D.1.5 Naming of AMC CSV files

D.1.5.1 The name of an AMC CSV file shall follow the structure of the identification line of the corresponding file, including all fields present in that line except the version field.

D.1.5.2 Fields shall be separated by an underscore (0x5F). Spaces (0x20) shall be replaced by underscores (0x5F). Dots (0x2E) and colons (0x3A) shall be replaced by dashes (0x2D).

D.1.5.3 Examples:

AmhsMdRegister_OPER70_18-12-2008_11-00-00_Pre-operational_Released_15-12-2008_12-37-45.csv

AmhsCaasTables_Background_01-12-2008_12-37-45.csv

D.2 AMHS MD related file (MD look-up table)

D.2.1 Relation to Doc 9880– Part II

D.2.1.1 Doc 9880– Part II, paragraph 4.3.2.2.1 specifies the different **types of entries** in a **MD look-up table**. These are:

1. a country (two-letter designator as specified in ICAO Document 7910);
2. a country or location (four-letter designator as specified in ICAO Document 7910);
3. an organization within a country (combination of an element as in items 1) or 2) above with a three-letter designator as specified in ICAO Document 8585);
4. an organization at a location (combination of a four-letter designator as specified in ICAO Document 7910 with a three-letter designator as specified in ICAO Document 8585);

D.2.1.2 Paragraph 4.4.2.1.4.1 b) 1) states how to use these types of entries to determine "the country-name, administration-domain-name and private-domain-name address attributes belonging to the single AMHS Management Domain":

"… among the entries of the MD look-up table matching exactly the following character substrings of the AF-Address and selected, if several matches are found, on the basis of a decreasing order of precedence from i) to iv):

i) characters 1 to 7,

ii) characters 1, 2, 5, 6 and 7,

iii) characters 1, 2, 3 and 4,

iv) characters 1 and 2; …"

D.2.1.3 The last match of Character 1 and 2 is related to in a MD look-up table entry type 1.

D.2.1.4 The following table gives an overview about the "matches" and the related MD look-up table entry types:

Match type	MD look-up table entry type	Examples
i) characters 1 to 7	MD entry type 4 MD entry type 3(2)	EUECX** WBSBAFR,
ii) characters 1, 2, 5, 6 and 7	MD entry type 3(1)	LF and AFR, ED and DLH
iii) characters 1, 2, 3 and 4	MD entry type 2	BKPR, FME*
iv) characters 1 and 2; and	MD entry type 1	LF, ED, EG, K*

Note.– The "wildcard" (*) is used to represent all characters from A till Z.

Table 3: "Match types" in a MD look-up table

D.2.1.5 The examples show that there is no difference between MD entry type 4 and 3 (2) while MD entry type 3 (1) represent a special case.

D.2.2 Representation of the MD look-up table entry types in the AMC

D.2.2.1 In the AMC the different **MD look-up table entry types** are represented as follows:

MD look-up table entry type	Description	Examples
MD entry type 1	Two letters, where the last could be a wildcard character	LF, K*[13]
MD entry type 2	Four letters, where the last could be a wildcard character	BKPR, FME*[14]
MD entry type 3(1)	Seven letters, where the third and fourth or the second to fourth are represented by wildcard characters	LF**AFR,[15] Y***DLH[16]
MD entry type 3(2) case 1 identical to MD entry type 4 MD entry type 3(2) case 2	Case 1 Case 2: Seven letters, where the fourth is represented by a wildcard character	WBSBAFR FME*AFR[17]

[13] *Note 1.– This wildcard is used for States for which one letter is assigned to fulfil the two-letter designator requirement.*
[14] *Note 2.– This wildcard is used for States for which three letters are assigned to fulfil the four-letter designator requirement.*
[15] *Note 3.– The two wildcards are used to identify an Organisation within a State/country.*
[16] Combination of wildcards – see Note 1 and Note 3 above
[17] see Note 2 above

MD look-up table entry type	Description	Examples
MD entry type 4	Seven letters, where the last or the two last could be wildcard characters	EDDFDLH, EGGYYM*,[18] EUECX**[19]

Note.– The "wildcard" character used in the AMC is an asterisk (*) which represents one of the characters from A till Z. (cf. Doc 9880 – Part II, 4.3.2.2.2)

Table 4: MD look-up table entry type description

D.2.2.2 The conversion algorithm has to ensure the correct differentiation between the **MD look-up table entry types**.

D.2.3 Structure of the related AMC CSV file (Version 1.1)

D.2.3.1 The title in the identification line is *AmhsMdRegister*.

D.2.3.2 The header line contains the description of the record elements following in the Data line(s). Following elements are provided:

- Name (mandatory element)
- Nationality Letters (mandatory element, upper case)
- country-name (mandatory element, upper case)
- ADMD-name (mandatory element, upper case)
- PRMD-name (mandatory element, upper case)
- Addressing scheme (mandatory element, upper case)
- ATNDir (optional element)
- Comments (optional element)

D.2.3.3 Example:

1.1;AmhsMdRegister;OPER70;18.12.2008 11:00:00;Pre-operational;Released; 15.12.2008 12:37:45
Name;Nationality Letters;country-name;ADMD-name;PRMD-name;Addressing scheme;ATNDir;Comments
Canary Islands;GC;XX;ICAO;AENA;CAAS;;
Spain;GE;XX;ICAO;AENA;CAAS;;
Spain;LE;XX;ICAO;AENA;CAAS;;
Solomon Islands;AG;XX;ICAO;AG;XF;;
Argentina;SA;XX;ICAO;SA;CAAS;;

D.3 AMHS CAAS related file (CAAS look-up table)

D.3.1 Relation to Doc 9880– Part II

D.3.1.1 Doc 9880– Part II, paragraph 4.3.2.3.1 specifies the entries in a **CAAS look-up table** which shall include a list of entries providing the correspondence between the *organization-*

[18] The wildcard(s) is (are) used to identify a group of Organisations.
[19] see [7] above

name and *organizational-unit-names* address attributes in each AMHS Management Domain having selected the CAAS addressing scheme. These are:

- an ICAO Location Indicator as specified in ICAO Document 7910, identifying a location within the AMHS Management Domain, which contains the first four characters of the AF-Address and is identical to the *organizational-unit-names* attribute value for all AMHS direct and indirect users with CAAS addresses in this location; and
- the *country-name*, *administration-domain-name*, *private-domain-name* and *organization-name* attribute values for all AMHS direct and indirect users with CAAS addresses in the location identified by the previous item.

D.3.1.2 The CAAS look-up table maintained in the Message Transfer and Control Unit shall include for each MD selected CAAS with a single organization-name attribute at least the default entry (see D.3.1.4 ff.). In case of multiple organization-name attributes default entries are required as well but complemented with entries for specific Location Indicators listed in ICAO Document 7910.

D.3.1.3 As an implementation matter, "wild cards" may be used to optimise the amount of information stored. A "wild card" character is a character that can be replaced by any alphabetical character (cf. Doc 9880 – Part II, 4.3.2.3.3). The use of wild card characters in the CAAS look-up table is limited to the *organizational-unit-names* attribute OU1 (see D.3.2).

D.3.1.4 The Default Entry consists of an organization-name attribute O and one organizational-unit-name attribute OU1 (cf. D.3.2) covering all Location Indicators assigned to this organization-name attribute.

D.3.1.5 Management Domains with multiple organization-name attributes shall provide the respective default entries also.

D.3.1.6 Examples for default entries with a single organization-name attribute:

Management Domain / State	***organization-name O***	***organizational-unit-name OU1***
Australia	YBBN	Y***
Hong Kong, China	HKGCAD	VH**
Switzerland	LS	LS**

Table 5: Examples for default entries (single organization-name attribute)

D.3.1.7 Examples for default entries with multiple organization-name attributes:

Portugal	***organization-name O***	***organizational-unit-name OU1***
	LPAZ	LPAZ
	LPAZ	LPCR
	…	…
	LPAZ	LPSJ
default entry:	LPPT	LP**

Table 6: Example Portugal (multiple organization-name attributes)

China	***organization-name O***	***organizational-unit-name OU1***
default entry:	ZBBB	ZB**
default entry:	ZBBB	ZS**
default entry:	ZBBB	ZT**
default entry:	ZBBB	ZU**
default entry:	ZBBB	ZW**
default entry:	ZBBB	ZY**
default entry:	ZGGG	ZG**
default entry:	ZGGG	ZH**
default entry:	ZGGG	ZJ**
default entry:	ZGGG	ZL**
default entry:	ZGGG	ZP**

Table 7: Example China (multiple organization-name attributes)

D.3.2 Representation of the CAAS look-up table entry types in the AMC

D.3.2.1 In the CAAS look-up table only in *organizational-unit-name* entries wildcards are allowed and are used as trailing characters only, i.e. an alphabetic character will never follow a wildcard character:

***organizational-unit-name* type**	**Description**	**Examples**
type 1	One letter and three wildcard characters, if all Location Indicators of this State are allocated to one *organization-name*	Y***
type 2	Two letters and two wildcard characters, if all Location Indicators of this State are allocated to one *organization-name*	LS**
type 3	Three letters and one wildcard character, if all Location Indicators of this State or “area” are allocated to one	FME* EDA*

	organization-name	
type 4	Four letters, Location Indicator as listed in Doc 7910 allocated to a specific *organization-name*	LFLF, KATL

Note.– The "wildcard" character used in the AMC is an asterisk (*) which represents one of the characters from A till Z. (cf. Doc 9880 – Part II, 4.3.2.3.3)

Table 8: organizational-unit-name type description

D.3.3 Structure of the related AMC CSV file (Version 1.1)

D.3.3.1 The title in the identification line is *AmhsCaasTables*.

D.3.3.2 The Header line contains the description of the record elements following in the Data line(s). Following elements are provided:

- country-name (mandatory element, upper case)
- ADMD-name (mandatory element, upper case)
- PRMD-name (mandatory element, upper case)
- organization-name (mandatory element, upper case)
- organizational-unit-name (mandatory element, upper case)

D.3.3.3 Example:

```
1.1;AmhsCaasTables;OPER70;18.12.2008 11:00:00;Pre-operational;Released; 15.12.2008 12:37:45
country-name;ADMD-name;PRMD-name;organization-name;organizational-unit-name
XX;ICAO;AENA;GCCC;GCCC
XX;ICAO;AENA;GCCC;GCFV
.
:
XX;ICAO;GERMANY;EDWW;EDW*
XX;ICAO;GERMANY;ETCC;ET**
.
:
XX;ICAO;HONGKONG;HKGCAD;VH**
XX;ICAO;LD;LDZA;LD**
.
:
XX;ICAO;AUSTRALIA;YBBN;Y***
```

D.4 AMHS User Address look-up table of individual users

D.4.1 Relation to Doc 9880– Part II

D.4.1.1 Doc 9880– Part II, paragraph 4.3.2.4.1 specifies the entries in a **user address look-up table** which includes a list of entries, each of them comprising:

- the AF-Address of either an indirect AMHS user who also has a MF-Address, or of a direct AMHS user who has an AF-Address for communication with indirect AMHS users; and
- the MF-Address of that AMHS user, either direct or indirect, including all its address attributes.

D.4.1.2 The table must allow to derive unambiguously item b) from item a), and vice-versa, by a searching operation in the user address look-up table.

D.4.1.3 In order not to restrict the potential form of an MF-Address, a user address look-up table supports in the attributes included under item b) all the general attribute types authorized in ISO/IEC 10021-2, section 18.5, Table 10.

D.4.2 Representation of the User Address look-up table entry types in the AMC

D.4.2.1 The AMC representation of user addresses is limited to the general attribute types authorized in ISO/IEC 10021-2, section 18.5, Table 10, for mnemonic-form addresses, and it also includes domain-defined attributes which are authorised by Doc 9880.

D.4.3 Structure of the related AMC CSV file (Version 1.1)

D.4.3.1 The title in the identification line is *UserAddresses.*

D.4.3.2 The header line contains the description of the record elements following in the Data line(s). Following elements are provided:

- MD-common-name (mandatory element)
- user-short-name (mandatory element)
- AFTN-addr-ind (mandatory element, upper case)
- country-name (mandatory element, upper case)
- ADMD-name (mandatory element, upper case)
- PRMD-name (mandatory element, upper case)
- organization-name (optional element)
- organizational-unit-name1 (optional element)
- organizational-unit-name2 (optional element)
- organizational-unit-name3 (optional element)
- organizational-unit-name4 (optional element)
- common-name (optional element)
- surname (optional element)
- given-name (optional element)
- initials (optional element)
- generation-qualifier (optional element)
- dda1-type (optional element)
- dda1-val (optional element)
- dda2-type (optional element)
- dda2-val (optional element)
- dda3-type (optional element)
- dda3-val (optional element)
- dda4-type (optional element)

- dda4-val (optional element)

D.4.3.3 Example:

1.1;UserAddresses;OPER70; 18.12.2008 11:00:00;Pre-operational;Released; 15.12.2008 12:37:45
MD-common-name;user-short-name;AFTN-addr-ind;country-name;ADMD-name;PRMD-name;organization-name;organizational-unit-name1;organizational-unit-name2;organizational-unit-name3;organizational-unit-name4;common-name;surname;given-name;initials;generation-qualifier;dda1-type;dda1-val;dda2-type;dda2-val;dda3-type;dda3-val;dda4-type;dda4-val
LU;BAI;LUBLYDYX;XX;ICAO;LU;Balts, AIRPORT INT.;LUKK;LUBL;;;LUBLYDYX;;;;;;;;;;;

D.5 AMHS User Capabilities related file (AMHS User Capabilities Management)

D.5.1 Relation to Doc 9880– Part II

D.5.1.1 Doc 9880– Part II, does not specify explicitly the entries to describe the capabilities of a Direct AMHS user represented by a user address (O/R address).

D.5.1.2 The AMHS User Capabilities published in the AMC should give an overview of all AMHS direct and indirect users and their capabilities in order to determine which kind of messages could be exchanged between the communication partners.

D.5.2 Representation of the User Address related capabilities

D.5.2.1 The AMHS User Capabilities are represented by pre-defined capabilities and values. Additional capabilities and values may be defined in the future. The following Capability Classes and values could be selected at present:

Capability class	Capabilities	Value	Remark
Body-parts	IA5 BP and GT BP (Repertoire A), up to 1800 characters	A2	(IA5 BP - ia5-text body part, GT BP - general-text-body-part, FTBP - file-transfer-body-part) Only one of the entries is selectable
	IA5 BP and GT BP (Repertoire A), up to 16k characters	A16	
	IA5 BP and GT BP (Repertoire A), up to 64k characters	A64[20]	
	IA5 BP and GT BP (Repertoire A and B), up to 1800 characters	B2	
	IA5 BP and GT BP (Repertoire A and B), up to 16k characters	B16	

[20] If higher values are required the use of file-transfer-body-part is recommended.

Capability class	Capabilities	Value	Remark
	IA5 BP and GT BP (Repertoire A and B), up to 64k characters	B64[21]	
	Text-body-part type A and FTBP	A64+F2048[22]	
	Text-body-part type B and FTBP	B64+F2048	
	FTBP, up to 1M bytes	F1024[23]	Only selectable if A64+F2048 or B64+F2048 is not selected
	FTBP, up to 2M bytes	F2048	
	FTBP, up to 4M bytes	F4096	For later use
	FTBP, up to 8M bytes	F8192	For later use
Address type	Distribution List	DL	Exactly one of the three is selectable
	Elementary Address	EA	
	Group of Addresses	GA	
IPM heading extensions	Support of IPM heading extension information	IHE	
Directory	Use of Directory Services	DIR	
AMHS Security	Use of AMHS Security features	SEC	

Table 9: Capability classes and capability values

D.5.2.2 The values of the selected Capability Class items are compiled in the order of Table 9 to a text string representing a profile name.

D.5.2.3 The Capability Class items within the profile name are separated by a hyphen ('-'). Within a Capability Class item the plus sign ('+') is used as separator.

D.5.2.4 The Capability Class items have different rules for occurrence.

a) **Body-parts**: occurrence always, one of the following combinations only:

- An, Support of this body-part type only
- Bn, Support of this body-part type only
- Fm Support of this body-part type only
- An-Fm, Support of a single body-part of either type
- Bn-Fm, Support of a single body-part of either type

[21] same note as above

[22] Other values not recommended.

[23] Lower values not recommended

- An+Fm, Support of a single body part of either type or two body-parts of different types
- Bn+Fm, Support of a single body part of either type or two body-parts of different types

	Capability Class	**Contents**	**Maximum body-part size**
An	text-body-part type A	Support of the basic ia5-text body part, the extended ia5-text-body-part and the extended general-text-body-part with repertoire group A (ISO 646)	n= 2, 16 or 64
Bn	text-body-part type B	Support of the basic ia5-text body part, the extended ia5-text-body-part and the extended general-text-body-part with repertoire group A (ISO 646), and the extended general-text-body-part with repertoire group B (Basic-1/ISO 8859-1)	n= 2, 16 or 64
Fm	file-transfer-body-part	Support of the file-transfer-body-part (the content of an FTBP is not restricted to binary data only)	m=1024 and 2048

Table 10: Abbreviations used for Body-parts classes

Note.– The "Maximum body-part size" is interpreted typically as the size of the payload; i.e. the number of characters in a textual body part resp. size of the conveyed file in bytes in case of the FTBP.

b) **Address type**: occurrence always, one of DL | EA | GA only

c) **IPM heading extensions**: occurrence IHE optional (if present, no ATS message header is used in text-body-part type A or text-body-part type B; otherwise, ATS message header is used; ATS message header in FTBP is excluded.)

d) **Directory**: occurrence DIR optional

e) **AMHS Security**: occurrence SEC optional

D.5.2.5 The AMC representation of user addresses is limited to the general attribute types authorized in ISO/IEC 10021-2, section 18.5, Table 10, for mnemonic-form addresses, and it also includes domain-defined attributes which are authorised by Doc 9880.

D.5.2.6 One data line is created for each AMHS User (direct/indirect).

D.5.3 Structure of the related AMC CSV file (Version 1.2)

D.5.3.1 The title in the identification line is *UserCapabilitiesManagement*.

D.5.3.2 The header line contains the description of the record elements following in the Data line(s). The following elements are provided:

MD-common-name	(mandatory element)
user-common-name	(mandatory element)

AFTN-addr-ind	(mandatory element, upper case)
country-name	(mandatory element, upper case)
ADMD-name	(mandatory element, upper case)
PRMD-name	(mandatory element, upper case)
organization-name	(optional element)
organizational-unit-name1	(optional element)
organizational-unit-name2	(optional element)
organizational-unit-name3	(optional element)
organizational-unit-name4	(optional element)
common-name	(optional element)
surname	(optional element)
given-name	(optional element)
initials	(optional element)
generation-qualifier	(optional element)
dda1-type	(optional element)
dda1-val	(optional element)
dda2-type	(optional element)
dda2-val	(optional element)
dda3-type	(optional element)
dda3-val	(optional element)
dda4-type	(optional element)
dda4-val	(optional element)
profile-name	(mandatory element)

D.5.3.3 Example:

1.2;UserCapabilitiesManagement;OPER.130;17.10.2013 11:00:00;Operational;;18.10.2013 14:28:11
MD-common-name;user-short-name;AFTN-addr-ind;country-name;ADMD-name;PRMD-name;organization-name;organizational-unit-name1;organizational-unit-name2;organizational-unit-name3;organizational-unit-name4;common-name;surname;given-name;initials;generation-qualifier;dda1-type;dda1-val;dda2-type;dda2-val;dda3-type;dda3-val;dda4-type;dda4-val;profile-name
GERMANY;EDDDYFYA;EDDDYFYA;XX;ICAO;GERMANY;EDDD;EDDD;;;;EDDDYFYA;;;;;;;;;;;;;A64-EA
AUSTRIA;LOOOYFYA;LOOOYFYA;XX;ICAO;AUSTRIA;LOVV;LOOO;;;;LOOOYFYA;;;;;;;;;;;;;;A64-F2048-EA-DIR

D.6 Routing Table related CSV files (AFTN, CIDIN and AMHS)

D.6.1 Relation to ENRD Part 1 – Documentation

D.6.1.1 The EUR/NAT Routing Directory (ENRD) Part I – Documentation contains the explanation of the tables used within the EUR AFTN/CIDIN/AMHS Routing Directory which are provided by the AMC. In Chapter 2 the detailed description of the elements is provided.

D.6.1.2 For those elements which are used in the CSV files only the description is provided as footnote(s).

D.6.2 Structure of the AFTN Routing Table related AMC CSV file (Version 1.1)

D.6.2.1 The title in the identification line is *AFTNRoutingTable.*

D.6.2.2 The header line contains the description of the record elements following in the Data line(s). Following elements are provided:

COM Centre[24]	(mandatory element)
Matrix Version[25]	(optional element)
Destination	(mandatory element)
Current Or Planned	(mandatory element – either 'C' for current in service or 'P' for planned)
Main	(mandatory element – if 'Main MTCU' is 'N': 4 letters upper case, if 'Main MTCU' is 'Y': empty)
Main Protocol	(mandatory element – if 'Main MTCU' is 'N': AFTN or CIDIN, if 'Main MTCU' is 'Y': empty)
Main MTCU	(mandatory element – either 'N' for no routing or 'Y' for routing via the MTCU)
Alternate	(optional element)
Alternate Protocol	(optional element)
Alternate MTCU	(optional element – default entry 'N')
Coordination For Alternate	(optional element – default entry 'N')
Event Type	(optional element – entries only in case of Planned)
Planned Date	(optional element – entries only in case of Planned)
Description	(optional element – entries only in case of Planned)

D.6.2.3 Example:

```
1.1;AFTNRoutingTable;OPER.78;22.10.2009 11:00:00;Operational;;11.11.2009 14:25:15
COM Centre;Matrix Version;Destination;Current Or Planned;Main;Main Protocol;Main
MTCU;Alternate;Alternate Protocol;Alternate MTCU;Coordination For Alternate;Event Type;Planned
Date;Description
EDDD;OPER.78;A;C;EGGG;CIDIN;N;LIII;CIDIN;N;N
EDDD;OPER.78;BG;C;BICC;CIDIN;N;EGGG;CIDIN;N;Y
EDDD;OPER.78;BI;C;BICC;CIDIN;N;EGGG;CIDIN;N;Y
EDDD;OPER.78;BKPR;C;BICC;CIDIN;N;EGGG;CIDIN;N;Y
:
EDDD;OPER.78;EUCB;C;LFPY;CIDIN;N;;;N;N
EDDD;OPER.78;EUCH;C;EBBD;CIDIN;N;;;N;N
EDDD;OPER.78;EUECY;C;;;Y;LEEE;;N;N
EDDD;OPER.78;EV;C;UUUU;CIDIN;N;EPWW;CIDIN;N;N
EDDD;OPER.78;EY;C;EPWW;CIDIN;N;UUUU;CIDIN;N;N
```

[24] represents the COM Centre concerned

[25] represents the Matrix version from which the table is derived

EDDD;OPER.78;F*;C;;;Y;LEEE;CIDIN;N;N
EDDD;OPER.78;FH;C;EGGG;CIDIN;N;BICC;CIDIN;N;N
EDDD;OPER.78;FJ;C;EGGG;CIDIN;N;;;N;N
:
EDDD;OPER.78;G*;C;;;Y;LEEE;CIDIN;N;N
EDDD;OPER.78;GV;C;LPPT;CIDIN;N;LEEE;CIDIN;N;N
:
EDDD;OPER.78;U*;C;UUUU;CIDIN;N;;;N;N
EDDD;OPER.78;UK;C;LKPR;CIDIN;N;UUUU;CIDIN;N;N
EDDD;OPER.78;UL;C;ULLL;CIDIN;N;;;N;N
EDDD;OPER.78;UM;C;UUUU;CIDIN;N;LKPR;CIDIN;N;N
EDDD;OPER.78;UMK;C;ULLL;CIDIN;N;UUUU;CIDIN;N;N
EDDD;OPER.78;V;C;EGGG;CIDIN;N;LIII;CIDIN;N;N
EDDD;OPER.78;W;C;EGGG;CIDIN;N;LIII;CIDIN;N;N
EDDD;OPER.78;Y;C;EGGG;CIDIN;N;LIII;CIDIN;N;N
EDDD;OPER.78;Z;C;EGGG;CIDIN;N;LIII;CIDIN;N;N

D.6.3 Structure of the CIDIN Routing Table related AMC CSV file (Version 1.1)

D.6.3.1 The title in the identification line is *CIDINRoutingTable.*

D.6.3.2 The header line contains the description of the record elements following in the Data line(s). Following elements are provided:

COM Centre[26]	(mandatory element)
Matrix Version[27]	(optional element)
Destination	(mandatory element)
Current Or Planned	(mandatory element – either ‘C’ for current in service or ‘P’ for planned)
Main	(mandatory element)
Routing Cost	(mandatory element)
Alternate	(optional element)
Coordination For Alternate	(optional element – default entry ‘N’)
Event Type	(optional element – entries only in case of Planned)
Planned Date	(optional element – entries only in case of Planned)
Description	(optional element – entries only in case of Planned)

D.6.3.3 Example:

1.1;CIDINRoutingTable;OPER.78;22.10.2009 11:00:00;Operational;;11.11.2009 14:26:33
COM Centre;Matrix Version;Destination;Current Or Planned;Main;Routing Cost;Alternate;Coordination For Alternate;Event Type;Planned Date;Description
EDDD;OPER.78;BICC;C;EKCH;10;EBBB;N
EDDD;OPER.78;EBBB;C;EBBB;10;EHAM;N
EDDD;OPER.78;EBBD;C;EBBD;10;LFPY;N
EDDD;OPER.78;EFHK;C;EKCH;10;EHAM;N
EDDD;OPER.78;EGGG;C;EHAM;10;EBBB;N

[26] represents the COM Centre concerned

[27] represents the Matrix version from which the table is derived

EDDD;OPER.78;EHAM;C;EHAM;10;EKCH;N
EDDD;OPER.78;EKCH;C;EKCH;10;EHAM;N
EDDD;OPER.78;ENHB;C;EKCH;10;EHAM;N
EDDD;OPER.78;EPWW;C;EKCH;10;LKPR;N
EDDD;OPER.78;ESSS;C;EKCH;10;EHAM;N
EDDD;OPER.78;LBSF;C;LKPR;10;LOOO;N
EDDD;OPER.78;LCNC;C;LOOO;10;LSSS;N
EDDD;OPER.78;LDDD;C;LOOO;10;LSSS;N
EDDD;OPER.78;LEEE;C;LEEE;10;LFLF;N
EDDD;OPER.78;LFLF;C;LFLF;10;LSSS;N
EDDD;OPER.78;LFPY;C;LFPY;10;EBBD;N
EDDD;OPER.78;LGGG;C;LOOO;10;LSSS;N
EDDD;OPER.78;LIII;C;LSSS;10;LOOO;N
EDDD;OPER.78;LKPR;C;LKPR;10;LOOO;N
EDDD;OPER.78;LLBG;C;LOOO;10;LSSS;N
EDDD;OPER.78;LOOO;C;LOOO;10;LSSS;N
EDDD;OPER.78;LPPT;C;LEEE;10;LFLF;N
EDDD;OPER.78;LRBB;C;LOOO;10;LKPR;N
EDDD;OPER.78;LSSS;C;LSSS;10;LFLF;N
EDDD;OPER.78;LTAC;C;LOOO;10;LKPR;N
EDDD;OPER.78;LZIB;C;LOOO;10;LKPR;N
EDDD;OPER.78;ULLL;C;UUUU;10;EKCH;N
EDDD;OPER.78;UUUU;C;UUUU;10;LOOO;N

D.6.4 Structure of the AMHS Routing Table related AMC CSV file (Version 1.1)

D.6.4.1 The title in the identification line is *AMHSRoutingTable.*

D.6.4.2 The header line contains the description of the record elements following in the Data line(s). Following elements[28] are provided:

COM Centre[29]	(mandatory element)
Matrix Version[30]	(optional element)
Destination C	(mandatory element)
Destination ADMD	(mandatory element)
Destination PRMD	(mandatory element)
Destination O	(optional element)
Current Or Planned	(mandatory element – either ‘C’ for current in service or ‘P’ for planned)
Main	(mandatory element – if ‘Main MTCU’ is ‘N’: 4 letters upper case, if ‘Main MTCU’ is ‘Y’: empty)
Main MTCU	(mandatory element – either ‘N’ for no routing or ‘Y’ for routing via MTCU)
Alternate	(optional element)

[28] A more detailed description of the elements is provided in the ENRD Part1 – Documentation, Chapter 2.

[29] represents the COM Centre concerned

[30] represents the Matrix version from which the table is derived

Alternate MTCU	(mandatory element – either 'N' for no routing or 'Y' for routing via MTCU)
Coordination For Alternate	(optional element – default entry 'N')
Comments	(optional element)
Event Type	(optional element – entries only in case of Planned)
Planned Date	(optional element – entries only in case of Planned)
Description	(optional element – entries only in case of Planned)

D.6.4.3 Example:

```
1.1;AMHSRoutingTable;OPER.78;22.10.2009 11:00:00;Operational;;11.11.2009 14:26:49
COM Centre;Matrix Version;Destination C;Destination ADMD;Destination PRMD;Destination
O;Current Or Planned;Main;Main MTCU;Alternate;Alternate MTCU;Coordination For
Alternate;Comments;Event Type;Planned Date;Description
EDDD;AMHS78.27;XX;ICAO;AENA;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;BOLIVIA;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;CHILE;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;COLOMBIA;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;ECUADOR;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FA;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FB;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FC;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FD;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FE;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FG;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FI;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FK;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FL;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FM;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FME;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FO;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FRENCH GUIANA;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FS;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FT;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FV;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FX;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FY;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;FZ;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GA;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GB;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GF;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GG;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GL;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GM;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GO;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GQ;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GS;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GU;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;GUYANA;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;PERU;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;SA;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;SB;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;SG;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;SURINAME;;C;LEEE;N;;Y;N;
EDDD;AMHS78.27;XX;ICAO;URUGUAY;;C;LEEE;N;;Y;N;
```

EDDD;AMHS78.27;XX;ICAO;VENEZUELA;;C;LEEE;N;;Y;N;

END of Appendix D

E. Appendix E – Short term Procedures for Global AMHS Address Coordination

E.1 Introduction

E.1.1 The short-term procedures for global AMHS address coordination were developed by the air traffic services (ATS) message handling system (AMHS) Inter-Regional Coordination Team (in short, the IRC Team) formed to address inter-regional air traffic services (ATS) message handling system (AMHS) issues under coordination by the ICAO European and North Atlantic Office (Paris) (EUR/NAT) Office, with the endorsement of the European Air Navigation Planning Group (EANPG).

E.1.2 These procedures were adopted by ICAO and included in the State letter (AN 7/49.1-09/34 from 14th of April 2009).

E.1.3 The overall goal of these procedures is to ensure for the short-term that the global AMHS address management is performed in a consistent manner, both from an operational viewpoint and from an official (institutional) viewpoint.

E.1.4 For the medium and long-term a task force will be set up by the Air Navigation Bureau to develop appropriate recommendations regarding the future evolution of AMHS address management, including the potential establishment of management centres in ICAO Regions, if needed. This task force should be composed of representatives of ICAO Contracting States in various regions.

E.2 Background on Global AMHS Address Management in the short-term using AMC

E.2.1 The approach for global AMHS address management in the short-term is the following:

a) for operational purposes, there is an agreement to use the AMC in the short-term by the European (EUR) and the Asia/Pacific (ASIA/PAC) Regions, as well as by the United States Federal Aviation Administration (FAA). Other regions which have not discussed AMHS management so far should be encouraged to use the AMC as soon as they start studying AMHS implementation; and

b) for institutional aspects, ICAO intends to publish, on its web site, an official version of the register.

E.2.2 Furthermore, the official ICAO Register and the operational AMC contain the same data and must be periodically aligned.

E.2.3 The working arrangements proposed in this paper are designed for a global AMHS address management using AMC. This implies that **the use of AMC should be strongly recommended to every ICAO Contracting State worldwide, as soon as there is an AMHS project or implementation in that State.** The procedures rely upon the fact that all States be involved in AMHS, i.e. all States which may declare changes in AMHS addressing are AMC users.

E.2.4 The basis for these procedures should be that AMC is used operationally and that ICAO Headquarters publishes the AMHS MD Register officially on its website using AMC data.

E.3 Scope of envisaged AMHS Address Changes

E.3.1 The possible changes in AMHS addresses which need to be managed as part of the AMHS address management are classified in two categories and include the following modifications:

a) Major changes (should not be frequent):

1) Modification[31] of PRMD-name,

2) Change of addressing scheme, among those defined in ICAO Doc 9880, from "XF" to "CAAS" or vice-versa (less likely to happen);

b) Minor changes (expected to be more frequent):

1) Modifications in CAAS table (associations between Location Indicator – "OU" address attribute value and "O" address attribute value).

E.3.2 Major changes have either an institutional impact or a major operational impact.

E.3.3 Minor changes have only an operational impact, which may be much more limited, depending on the magnitude of changes which may be roughly assessed on the basis of:

a) the number of Location Indicators impacted by the change; and/or

b) the frequency of messages to/from users in the locations of which the Location Indicators are impacted.

E.3.4 Exceptionally, a minor change may have an institutional impact. However this should be very rare and as no specific procedure is defined for this such situations will be handled case by case on an ad hoc basis.

E.4 Assumptions related to the procedures

E.4.1 Official interactions

E.4.1.1 Major changes, due to their institutional impact or major operational impact, must be subject to official interactions between the States and ICAO. These interactions are assumed to be based on the exchange of written documents by fax or letter. Pro formas for such documents are provided in Appendix F.

E.4.2 Systems

E.4.2.1 In the short-term, only two systems are available to contribute to AMHS address management, as mentioned above:

[31] The term "modification" should be understood here in a general way, meaning addition, modification or deletion.

a) the AMC implemented by EUROCONTROL under the aegis of the ICAO EUR Office (Paris), for all operational purposes, following an EANPG/45 conclusion; and

b) the ICAO AMHS MD Register, for official purposes. This system is loaded with AMC data to ensure consistency with the operational status of the AMHS network.

E.4.3 Participants

E.4.3.1 The procedures rely upon the fact that all States/ANSPs involved in AMHS participate in AMC activity. Participants to the procedures are expected to be:

a) States, both as the potential initiators of changes in AMHS addressing and as implementers of AMHS systems. The notion of "State" therefore includes:

   1) the people in charge of official declarations, for major changes;

   2) Cooperating COM Centre (CCC) Operators[32] in charge of operational management of AMHS. They use AMC data to configure their message switches and AFTN/AMHS gateways;

   3) Other AMC users, such as AMHS project managers, engineers involved in AMHS projects, COM Centre personnel, etc. (several AMC user categories are defined for them, including "AMF-I User[33]" and "Read-only user");

b) ICAO Regional Offices as a possible interface for the States in each ICAO Region. The regional office is represented by the CNS Officer;

c) ICAO Headquarters, represented by the Air Navigation Bureau and more specifically (if needed) by its Communications, Navigation and Surveillance/Aeronautical Information Resource Services Section (CNS/AIRS) Section;

d) AMC Operators, responsible for overall operation of the AMC and of associated procedures.

[32] In the current AMC terminology, the term CCC is limited to Europe, and External COM Centre is used for States outside Europe. This distinction should disappear, and the terminology/documentation should be updated, when global use of AMC is started based on these procedures.

[33] The term "AMF-I User" denotes an AMC user specifically involved in AMHS Off-Line Management – Implementation Support functions, on behalf of his/her State or ANSP, e.g. the project leader for AMHS implementation.

E.5 Procedure for major changes

E.5.1 A simplified diagram of the proposed procedure for major changes is provided in Figure 14. The main stages are as follows:

1. an accredited person in the considered State declares the change to ICAO, using a standard written pro forma – "ICAO" in this case means the regional office for the ICAO Region where the State is located. The pro forma includes the applicability date of the change (an AIRAC date);

2. the CNS Officer in the regional office, in coordination with ICAO Headquarters as appropriate[34], validates the acceptability of the declared change from an official and institutional viewpoint;

3. after validation, the CNS Officer forwards the declaration of change to the AMC operator, using appropriate means such as fax, e-mail, etc. (different from data entry in AMC);

4. the AMC operator enters data in the AMC based on the input received from the regional office, at the appropriate time considering the applicability date of the change and using the AMC operational procedures;

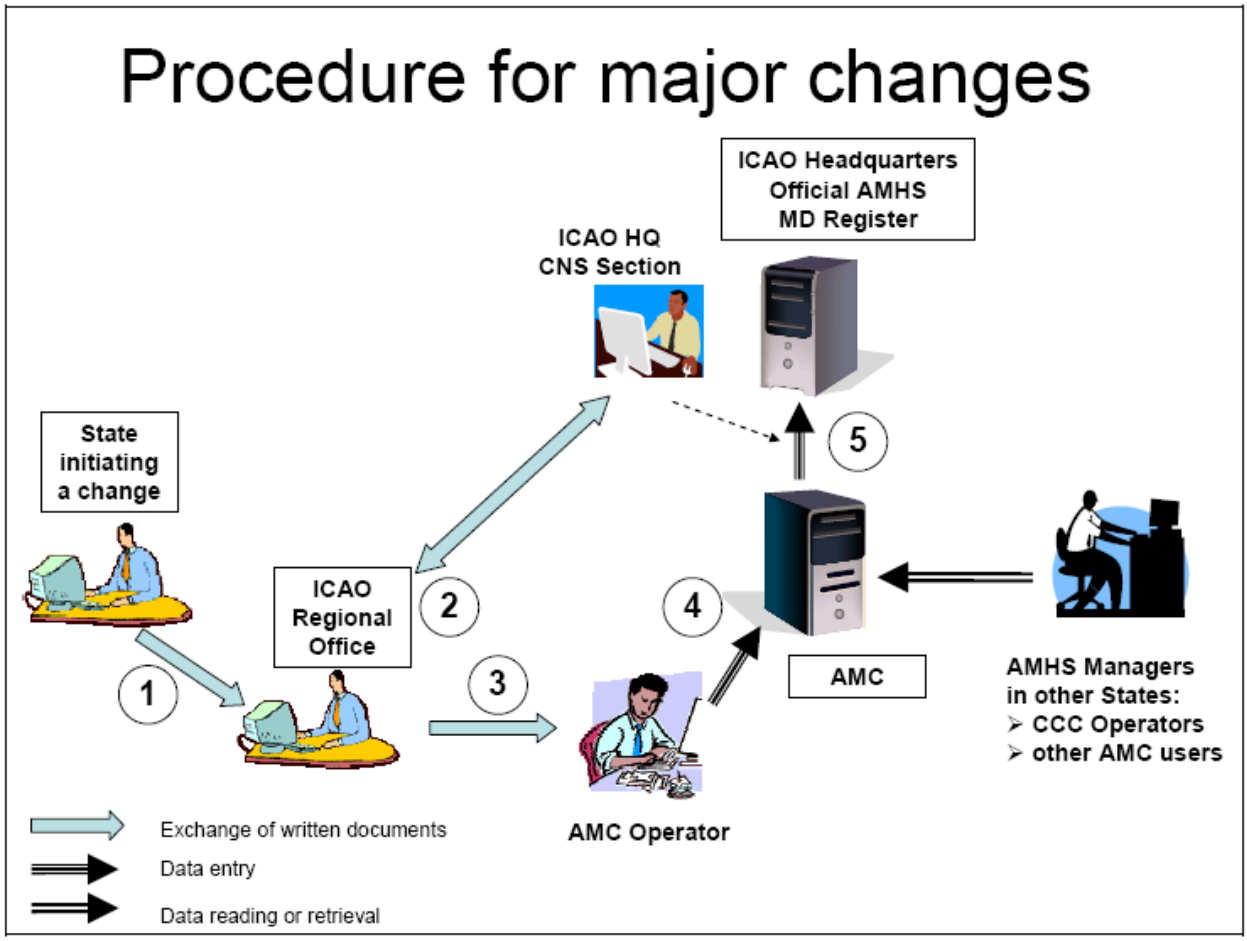
5. at the date of applicability, i.e. at each AIRAC cycle date, the ICAO Headquarters CNS/AIRS Section retrieves an AMHS address management export file from the AMC and uploads it to the ICAO Official AMHS MD Register.

E.5.2 Steps 3 to 5 are performed as part of the normal AMC operation. This means that, in parallel with this process, standard AMC procedures are followed by the AMC operator and by AMHS managers in other States. The CCC operators exploit the AMC data reflecting the change, together with other AMHS management data, to update their systems.

E.5.3 At each stage, coordination may take place, if needed, between the different parties involved to ensure the correctness of the proposed change.

[34] e.g. to ensure global uniqueness of a requested PRMD-name with respect to other requests under consideration in other regions.

Figure 14: Procedure to handle major AMHS address changes



E.6 Procedure for minor changes

E.6.1 A simplified diagram of the proposed procedure for minor changes is provided in Figure 15. The main stages are as follows:

1. the CCC operator in the considered State enters data corresponding to the intended change in the AMC, using the standard AMC operational procedures, taking into account the applicability date of the change (an AIRAC date);

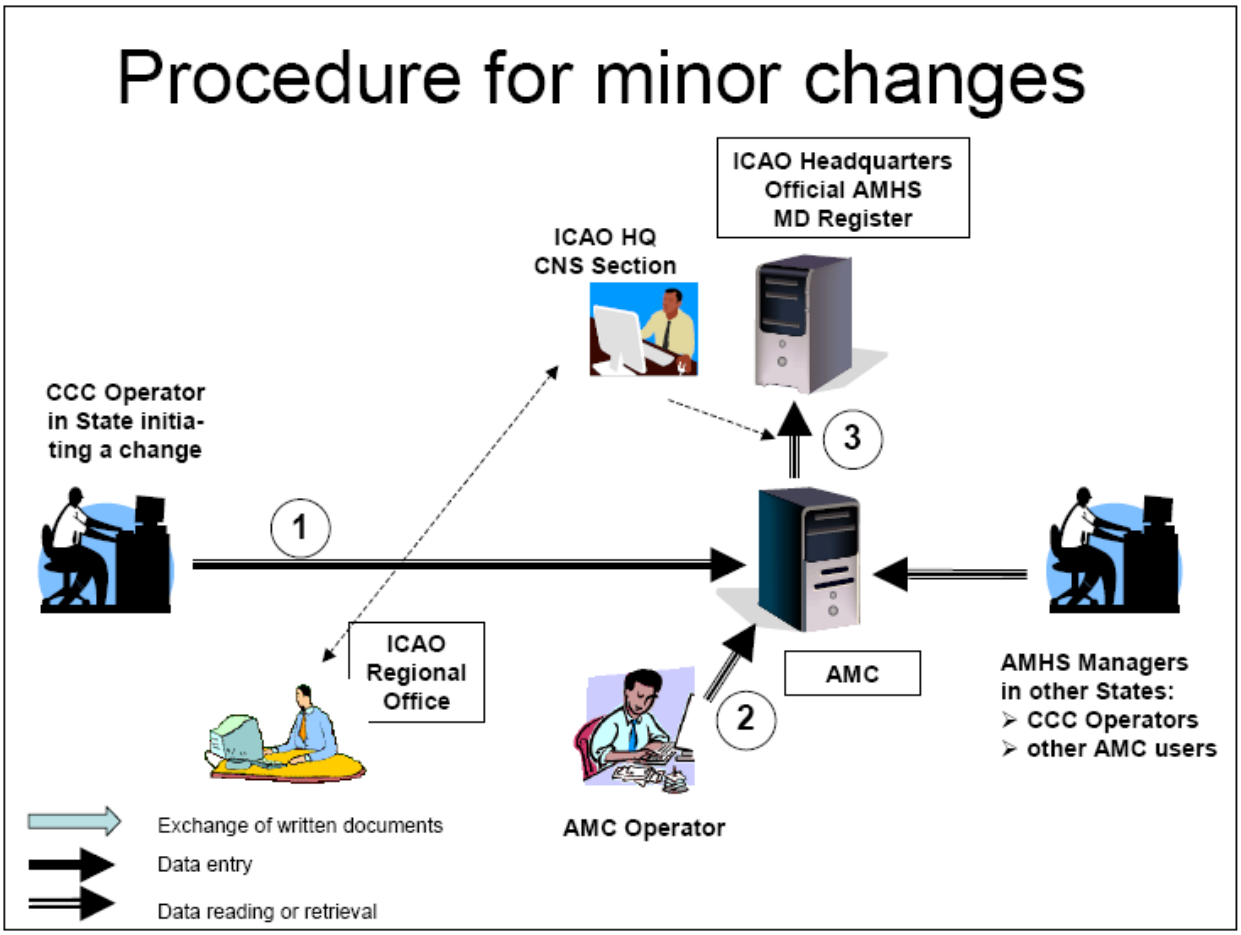
2. the AMC operator performs the standard AMC operational procedures, such that the status of changed data is passed to “operational” at the applicability date;

3. at the date of applicability, i.e. at each AIRAC cycle date, the ICAO HQ CNS/AIRS Section retrieves an AMHS address management export file from the AMC and uploads it to the ICAO Official AMHS MD Register (this is identical to stage 5 in the procedure for major changes).

E.6.2 This is performed as part of normal AMC operation. This means that in parallel with this process, standard AMC procedures are followed by the CCC operators and other AMC users to exploit the AMC data reflecting the change, together with other AMHS management data, to update their systems.

E.6.3 At each stage, coordination may take place if needed between the different parties involved, and with the CNS Officer in the regional office if needed[35], to ensure the correctness of the proposed change.

Figure 15: Procedure to handle minor AMHS address changes



END of Appendix E

[35]The regional office needs to be involved only in exceptional cases, such as institutional impact of a minor change.

F. Appendix F – Pro forma for modification of AMHS MD Identifier and/or Addressing Scheme (major change)

Part 1: Modification of PRMD-name Registration

State: ……..

Nationality letters: …….……

PRMD-name registered before modification: .....

Please consider the following options in case of modification:

Option A: the PRMD-name to be the following reserved identifier.

Option B: the PRMD-name to be modified as proposed below, after validation by the Secretariat.

Option C: the PRMD-name to remain unchanged (only the addressing scheme is modified, see Part 2).

Please specify your choice (A, B or C): ☐

If choice is B, please specify the proposed PRMD-name identifier:

P =

Proposed applicability date for the modification (an AIRAC date): ……...……..

Name of organization managing the AMHS MD (if applicable): ……...……..

The contact point: ……...……...

Postal/electronic mail address and telephone/fax number: ……

Additional comments:

Pro forma for modification of AMHS MD Identifier and/or Addressing Scheme (major change) page - 2 -

Part 2: Modification of declaration of addressing scheme

State: ……..……

Nationality letters: …….……

PRMD-name registered before modification: .....

Addressing scheme declared before modification: .....

Please select one of the following options in case of modification:

Choice A: AMHS user addresses to be allocated by application of the (recommended) CAAS addressing scheme in the AMHS MD operated in the above State.

Choice B: AMHS user addresses to be allocated by application of the (default) XF addressing scheme in the AMHS MD operated in the above State.

Choice C: the addressing scheme to remain unchanged (only the PRMD-name is modified, see Part 1).

Please specify your choice (A, B or C): ☐

If choice is A (CAAS), please fill in the following table for all Location Indicators found in Doc 7910 under the above nationality letters.

Organization-name for the group of locations	**Location Indicators**

(table to be expanded as appropriate)

Pro forma for modification of AMHS MD Identifier and/or Addressing Scheme (major change) page - 3 -

Proposed applicability date for the modification (an AIRAC date): …….

Name of organization managing the AMHS MD (if applicable): …….

The contact point: ……..

Postal/electronic mail address and telephone/fax number: ……

END of Appendix F