AFI AMHS Manual

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Appendix F

AMHS Pre-operational Tests	
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References

[1]   ICAO Annex 10 – Aeronautical Telecommunications, Volume II: Communication Procedures

[2]   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 Service (ATSMHS), First Edition – 2010

[3]   AFI Doc 020 – AFI AMHS Manual, Main Part

[4]   AFI Doc 020 – AFI AMHS Manual, Appendix B, AFI ATS Messaging Service Profile

[5]   AFI Doc 020 – AFI AMHS Manual, Appendix C, AMHS Testing Requirements

[6]   AFI Doc 020 – AFI AMHS Manual, Appendix D, AMHS Conformance Tests [7]

        AFI Doc 020 – AFI AMHS Manual, Appendix E, AMHS Interoperability Tests

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1. <u>Introduction</u>

1.1 Purpose of the Document

The purpose of the document is to define AMHS Pre-operational Tests in order to ensure the interoperability between AMHS systems prepared for going into operation. The document defines the objectives and prerequisites as well as the tests themselves.

The AMHS Pre-operational Tests are interoperability type tests. They are the last tests between Operational Systems and should be performed within the operational network environment before the "AMHS cut-over".

After "AMHS cut-over" the AMHS relation between the two systems is operational. That means: the exchange of the complete operational traffic (or a part of that) is performed by means of AMHS only. For this traffic no other means (AFTN or CIDIN) are used.

1.2 Objectives of the Pre-operational Tests

The objectives of the AMHS Pre-operational Tests are:

1. To test the interoperability between the AMHS systems in an operational environment.

2. To test the integrity of the messages exchanged.

3. To test the message exchange after a disturbance (e.g. queued messages).

The prerequisites of the AMHS Pre-operational Tests are:

Successful performance of AMHS Conformance Tests as specified in [6], through which the compliance of all systems under test to the [2] has been demonstrated, and

Successful performance of AMHS Interoperability Tests as specified in [7], through which the interoperability of these AMHS systems in a test (bed) environment has been demonstrated, and

Successful performance of Underlying Network Tests, through which is demonstrated that the underlying (IP) network is available and stable, and
System configuration on both systems (The agreed set is loaded and established.)

The messages used in the AMHS Pre-operational Tests are generated either:

Manually; or

using parallel duplicated traffic;

1.3   Test Overview

The following tests have to be performed:

1. Go-No-go Test:
    A simple test which checks that the configuration and underlying network functions are operating correctly. It is a prerequisite for the subsequent tests.

2. Traffic duplication and verification:
    For selected AFTN addressee indicators all traffic[1] will be duplicated to corresponding AMHS recipient addresses on the remote system. On the remote system the AFTN message received will be compared with the copy received by the AMHS user.

3. Stress test:
    The outgoing AMHS traffic recorded in one day within the previous test is repeated from one to the other system and vice versa. To simulate an outage between the involved systems the LAN connection can be disabled; in consequence the messages are queued. If enough messages are queued the LAN connection will be enabled.

4. (Optional) Selected test cases from the AMHS Interoperability Tests:
    Due to the fact that in the pre-operational test phase the operational system with the complete operational setup is used, a selection of interoperability tests may be repeated.

The estimated duration of the AMHS Pre-operational Tests is 4 days and calculated as follows:

Test ID	Duration	Remark
PRE001 and PRE002	1 hour	inclusive set-up / co-ordination
PRE003	3 days	
PRE004	0,5 day	
optional (selected Interoperability Tests)	1 hour	

Table 1: Estimated duration of the AMHS Pre-operational Tests

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[1] Traffic consisting of the locally originated AFTN flow and the incoming AFTN flow;

Locally originated AFTN flow: national AFTN traffic received by the COM Centre addressed to international (or national) communication partners;
Incoming AFTN flow: international AFTN traffic received by the COM Centre addressed to international (or national) communication partners.

1.4 Document Structure

Chapter 1 presents the purpose, objectives and test overview.

Chapter 2 presents the test environment used for AMHS Pre-operational Testing.

Chapter 3 defines the set-up and configuration of the AMHS systems.

Chapter 4 defines the addressing plan for AMHS Pre-operational Testing.

Chapter 5 contains the description of the Pre-operational Tests.

2. AMHS Pre-operational Test Environment

2.1 Application infrastructure

The AMHS systems prepared for going into operation are interconnected by means of the operational infrastructure (cf. Figure 1).
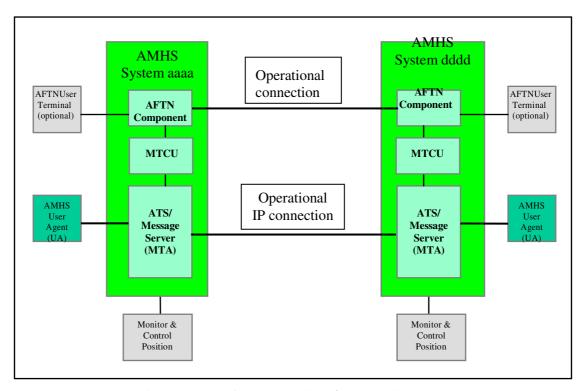

Figure 1: AMHS Pre-operational Test Environment

2.2 Transport infrastructure

In the AFI Region, the infrastructure to be used is based on the TCP/IP protocol (IPv4/IPv6). In line with existing recommendations[2], the operational IP connection should utilise IPv6 at the international level and should provide a redundant connectivity. The redundancy concept of the network ensures the reach ability in any case between the MTAs, while the MTA uses single IP addresses only.

Figure 2 shows a generic example how a redundant IP connectivity can be designed. The real configuration and details shall be agreed between the test partners.

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[2] The AFICONTROL Task Force for Aeronautical data exchange over IP (iPAX-TF) had recommended to use IPv6 on international level (between the member States) and had proposed an IPv6 addressing plan. In this context AFICONTROL acts on behalf of the ANSPs as a "IPv6 provider" towards RIPE Network Coordination Centre (NCC) and is responsible for the registration and maintenance of the IPv6 addresses for the AFI (AFICONTROL member) States. (The RIPE NCC is one of five Regional Internet Registries (RIRs) providing Internet resource allocations, registration services and co-ordination activities that support the operation of the Internet globally.)
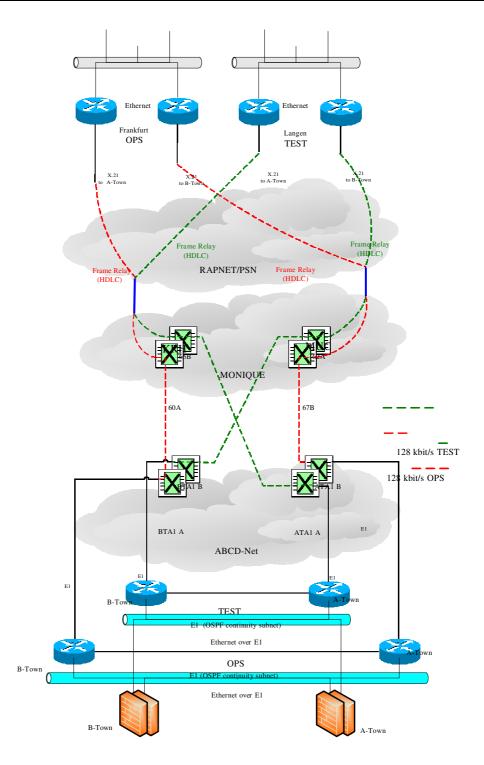
Figure 2: Example for a redundant international IP connection (Operational and Test)

Note. – This figure has to be replaced by the real configured and used infrastructure.

The RAPNET/MONIQUE/ABCD-Net infrastructure in this case should be replaced by PENS partly or completely later on if available.

3.   <u>Operational system setup - Configuration</u>

The AMHS Systems involved in the pre-operational tests are expected to be configured "as close" to the Operational Systems as possible (with respect to routing tables and look-up tables).

Special addresses needed for testing are listed in this document.

MTA names etc. shall follow the recommendations laid down in [3]. For completeness they are listed hereafter.

3.1   Configuration Lower Layers

Item	Test partner 1	Test partner 2	recommended values
TSAP	TBD	TBD	e.g. '544350' ("TCP") or '4D4853' ("MHS")
IPv6 Address	TBD	TBD	in line with the AFICONTROL addressing plan
IP Port	TBD	TBD	102

Table 2: Configuration Lower Layers

3.2   Configuration Upper Layers

Item	Test partner 1	Test partner 2	recommended values
MTA Name	MTA-aaaa[3]-1	MTA-dddd[4]-1	cf. [3] section 8.2
Password	ICAO-aaaa-1	ICAO-dddd-1	cf. [3] section 8.2
PSAP	not used	not used	not used
SSAP	not used	not used	not used
Number of incoming associations	TBD	TBD	5, should be equal to the outgoing number

[3] Where aaaa = the location indicator of the MTA location of the Test partner 1.

[4] Where dddd = the location indicator of the MTA location of the Test partner 2.

Item	Test partner 1	Test partner 2	recommended values
Number of outgoing associations	TBD	TBD	5, should be equal to the incoming number
Protocol type	X.400/1988	X.400/1988	cf. PDR M6080001 Phasing out of IPM 1984
Dialogue mode	Monologue	Monologue	see [4]

Table 3: Configuration Upper Layers

4. Addressing Plan for AMHS Pre-operational Testing

4.1 User addresses

To meet the scope of testing, the test-address space used by AMHS Pre-operational Testing should include for each test partner as minimum one AMHS user.

4.1.1 AMHS Users for Test partner 1

User Name	MF-address	Remarks
aaaaAMHA	/C=XX/A=ICAO/P=bbbb/O=cccc/OU1=aaaa /CN=aaaaAMHA	or other than AMHA
		or more

Table 4: Registered AMHS Users (Test partner 1)

Example:

User Name	MF-address	Remarks
*FVHA*AMHA	/C=XX/A=ICAO/P=AENA/O=*FVHA*/OU1=*FVHA* /CN=*FVHA*AMHA	

4.1.2 AMHS Users for Test partner 2

User Name	MF-address	Remarks
ddddAMHA	/C=XX/A=ICAO/P=eeee/O=ffff/OU1=dddd /CN=ddddAMHA	or other than AMHA
		or more

Table 5: Registered AMHS Users (Test partner 2)

Example:

User Name	MF-address	Remarks
*HKNA*YFYA	/C=XX/A=ICAO/P=*NAIROBI*/O=*HKNA*/OU1=*HKNA* /CN=*HKNA*YFYA	

4.2 Addresses for Traffic Duplication

Due to the fact that the Pre-operational tests will be performed in an operational environment the addresses selected for duplication cannot be pre-determined in this document. The following tables show two different possibilities how to define these addresses. The test partners have all freedom in definition and selection.

It is recommended to select those addresses for duplication to which a moderate number of messages are usually transmitted.

4.2.1 AFTN Addresses selected for Traffic Duplication -Test partner 1 to Test partner 2

AF Address	O/R address	Remarks
ddaaCOPY	/C=XX/A=ICAO/P=eeee/O=ffff/OU1=ddaa /CN=ddaaCOPY	Copy of a real ddaa address
ddbbCOPY	/C=XX/A=ICAO/P=eeee/O=ffff /OU1=ddbb /CN=ddbbCOPY	Copy of a real ddbb address
ddccCOPY	/C=XX/A=ICAO/P=eeee/O=ffff /OU1=ddcc /CN=ddccCOPY	Copy of a real ddcc address
		or more

Table 6: AFTN addresses -Test partner 1 to Test partner 2

Example:

AF Address	O/R address	Remarks
*HKNA*COPY	/C=XX/A=ICAO/P=AENA/O=*HKNC*/OU1=*HKNA* /CN=*HKNA*COPY	real address: *HKNA*YNYX
*HKNB*COPY	/C=XX/A=ICAO/P=AENA/O=*HKNC*/OU1=*HKNB* /CN=*HKNB*COPY	real address: *HKNB*YMYX
*HKNC*COPY	/C=XX/A=ICAO/P=AENA/O=*HKNC*/OU1=*HKNC* /CN=*HKNC*COPY	real address: *HKNC*ZAZX

4.2.2 AFTN Addresses selected for Traffic Duplication -Test partner 2 to Test partner 1

AF Address	O/R address	Remarks
aaaaAMHA	/C=XX/A=ICAO/P=bbbb/O=cccc/OU1=aaaa /CN=aaaaAMHA	Copy of a real aaaa address
aaaaAMHB	/C=XX/A=ICAO/P=bbbb/O=cccc/OU1=aaaa /CN=aaaaAMHB	Copy of another real aaaa address
aaccAMHC	/C=XX/A=ICAO/P=bbbb/O=cccc/OU1=aacc /CN=aaccAMHC	Copy of a real aacc address
		or more

Table 7: AFTN addresses -Test partner 2 to Test partner 1

Example:

AF Address	O/R address	Remarks
*FVHA*AMHA	/C=XX/A=ICAO/P=*ZIMBABWE*/O=*FVHA*/OU1=*FVHA* /CN=*FVHA*AMHA	real address: *FVHA*YNYX
*FVHA*AMHB	/C=XX/A=ICAO/P=*ZIMBABWE*/O=*FVHA*/OU1=*FVHA* /CN=*FVHA*AMHB	real address: *FVHA*YMYX
*FVHA*AMHC	/C=XX/A=ICAO/P=*ZIMBABWE*/O=*FVHA*/OU1=*FVHA* /CN=*FVHA*AMHC	real address: *FVHA*NAXX

4.3 DL addresses

It is recommended to use for DLs specific Common Names (CN) to make it transparent for the users that this special O/R address is related to a Distribution list. The CN of a DL O/R address should in line with the definition for PDAI in [1].

4.4 AFTN and X.400 Routing Tables

It is recommended that the systems involved in the Pre-operational Tests are configured with the latest valid **AFTN Routing Table** available in the AMC system including the minor changes needed for the Pre-operational Tests themselves.

Only for the selected traffic (bilaterally agreed addresses) shall AFTN routing paths through the MTCU be set up.

Furthermore it is recommended that the systems are configured with the **complete X.400 Routing Table** covering all existing PRMD names. For all PRMD names which are not involved in the Pre-operational Tests, a default routing to a "Dummy MTA direction" shall be
defined in order to handle exceptional situations within the Pre-operational Tests as well as for
future
operations.

Only for the selected traffic (bilaterally agreed addresses) shall respective X.400 routing paths through the MTCU or to the adjacent MTA be set up.

The recommended complete setup of the X.400 Routing table allows the responsible international COM Centre to ensure that each message entered into an international Network (AFTN, CIDIN as well as AMHS) is correct in format and addressing. When using a reduced X.400 routing table, (use of general default routing entries), such checking of addressing cannot be performed, especially if domestic UAs are connected. Only with the full set of PRMD routing entries, is a minimum checking of address validity possible.

4.5 Look-up Tables

4.5.1 Generic look-up Tables

It is recommended that the systems are configured with the complete set of information required for the address translation.

The tables needed are reflected in the Intra MD Addressing function of the ATS Messaging Management Centre (AMC). From the AMC the complete **MD Look-up Table** (AMHSMDRegisterExport.csv) and the complete **CAAS Look-up Tables** (CaasTable.csv) can be downloaded.

Loading of the complete tables is recommended to ensure that the AMHS application is able to handle the extensive content of the tables covering the address translation of all existing AFTN addresses into AMHS O/R addresses (XF as well as CAAS) and vice versa.

4.5.2 User address look-up Table

It is recommended to start Pre-operational tests and operations with empty **User address look-up tables**.

This kind of functionality should be foreseen for exceptional users and situations. Each entry in this table shall be coordinated with the AMC for the Regional and world-wide use.

5. Test Description

5.1 Test Scenarios

The tests are described in the following test scenarios:

PRExxx   where xxx is the scenario number.

The following table contains an overview of the test scenarios:

Test-case id	Test function
PRE001	Go-NoGo test Test partner 1 to Test partner 2
PRE002	Go-NoGo test Test partner 2 to Test partner 1
PRE003	Exchange of duplicated Operational messages, check of integrity.
PRE004	Stress / Load Test (queued data)

Table 8: Test Scenario overview

5.2 Pre-operational AMHS Tests

This section contains the test-cases. Each test-case is written on a test sheet, which should be completed during testing.

The top of test-sheet contains the **test-case id** and a description of the **tested functionality**.

The **Test description** contains the instructions for the tester, the addresses used and the test message used.

The **Test control** contains the expected reaction/observation of the Systems under Test (SUTs).

The section **Test result** is used to log the test results.

5.2.1 <u>Go-NoGo test</u>

Test reference :	Tested functionality :
PRE001	This is a simple test with the purpose to check that the configuration and underlying network work correctly. It is a prerequisite for subsequent tests. An FF priority message is sent from Test partner 1 to Test partner2.

Test description:

From aaaaAMHA send the following FF priority message to ddddAMHA:

```
PRE001
12345678901234567890123456789012345678901234567890123456789
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAA
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
BBBBBBB
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCC
```

(and   so   on   till)

ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ

ZZ

Check the correct reception at ddddAMHA and send the following acknowledgement if the message is received correctly.

ACK001 PLS CONTINUE WITH PRE002

Test control:

Check the correct reception of the message at ddddAMHA. No difference must exist between the message as defined above and the received message.

Test result:

PASS	**FAILED**	**INCONCLUSIVE**

Test reference :	Tested functionality :
PRE002	This is a simple test with the purpose to check that the configuration and underlying network work correctly. It is a prerequisite for subsequent tests. An FF priority message is sent from Test partner 2 to Test partner1.

Test description:

From ddddAMHA send the following message to aaaaAMHA:

PRE002
```
123456789012345678901234567890123456789012345678901234567890123456789
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAA
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
BBBBBBB
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCC

(and so on till)
```

ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ

ZZ

Check the correct reception at aaaaAMHA and send the following acknowledgement if the message is received correctly.

From aaaaAMHA send the following message to ddddAMHA:

ACK002 PLS CONTINUE WITH PRE003

Test control:

Check the correct reception of the message at aaaaAMHA. No difference must exist between the message as defined above and the received message.

Test result:

PASS	FAILED	INCONCLUSIVE

5.2.2 **Duplicated message exchange**

Test reference: PRE003	Tested functionality:
	For selected AFTN destination addresses all traffic will be duplicated to corresponding AMHS recipient addresses at the remote system. At the remote system the AFTN messages received will be compared with the copies transmitted via AMHS.

The following table can be used to make notes of the Test Control result.

Test Control	Result
1. Compare the number of messages received as AFTN copy with the number of messages received as AMHS copy	
2. Compare the contents of the messages.	
3. The messages can be displayed on two screens and compared one by one.	
4. The traffic log can be exported and compared (partly) electronically/in an automated way.	
5. Check the event logging of the system for abnormalities in the area of AMHS / X.400 / AFTN/AMHS Gateway.	
6. Check whether NDRs have been received or transmitted.	
7. Check for events at the Control Position.	
8. X.400 / AMHS diagnostics, check the number of associations used (in particular possible hanging/unused associations).	
9. Monitor the underlying network infrastructure (network specialist).	

The test is failed if messages are lost, duplicated or corrupted. The other observations have to be forwarded to each other in the form of a test log and discussed in a test review.

Test result:

PASS	FAILED	INCONCLUSIVE

5.2.3 <u>Stress / Load Test</u>

Test reference :	Tested functionality :
PRE004	This test is performed to observe the behaviour of both systems during a load/stress situation. The traffic exchanged in test PRE003 is repeated in a burst fashion.

<u>**Test description:**</u>

1. Disable the duplication of traffic on both sides.

2. Three tests should be run. The amount of messages shall be:

   100 for the first test

   200 for the second test

   400 for the third test.

3. Both sides shall retrieve the outgoing AMHS traffic exchanged in PRE003 for an agreed day.

4. Both sides shall inform each other about the amount of messages to be expected.

5. At **Test partner 2** (or 1) interrupt the LAN connection to **Test partner 1** (or 2) by an adequate command (should be agreed between the Test partners).

6. At **Test partner 1** and **Test partner 2** "repeat" the messages retrieved in step 2 and observe a queue with a length as communicated in step 3.

7. The moment to re-connect the LAN is co-ordinated by telephone. Note down the time it takes from re-connecting the LAN till the moment the queues are empty.

8. At **Test partner 2** (or 1) re-establish the LAN connection by adequate means (commands).

9. Observe and notice the incoming and outgoing message flow.

<u>**Test control:**</u>

1. The number of messages received shall be equal to the number of messages expected.

2. Check the event logging of the system for abnormalities in the area of AMHS / X.400 / AFTN/AMHS Gateway.

3. Check the event logging / traffic traces for NDRs.

4. Check for Control Position events.

5. Check the X.400 / AMHS diagnostics, check the number of associations used (in particular possible hanging/unused associations).

6. Monitor the underlying network infrastructure (network specialist).

7. At both sides note the amount of time needed to flush the queues.

The following table can be used to make notes of the Test Control result.

Test Control	Result		
	100	**200**	**400**
1. The number of messages received shall be equal to the number of messages expected.			
2. Check the event logging of the system for abnormalities in the area of AMHS / X.400 / AFTN/AMHS Gateway.			
3. Check the event logging / traffic traces for NDRs.			
4. Check for events at the Control Position.			
5. Check the X.400 / AMHS diagnostics, check the number of associations used (in particular possible hanging/unused associations).			
6. Monitor the underlying network infrastructure (network specialist).			
7. At both sides note the amount of time needed to flush the queues.			

The test is failed if messages are lost, duplicated or corrupted. The other observations have to be forwarded to each other in the form of a test log and discussed in a test review.

Test result:

PASS	**FAILED**	**INCONCLUSIVE**

5.2.4 Additional selected and agreed Interoperability Tests

Here the selected and bilaterally agreed Test cases should be listed.

END of Appendix F