Air Navigation Services
of the Czech Republic

AFTN/AMHS system
Technical Requirements Specification

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Document Title:

AFTN/AMHS system
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1 INTRODUCTION

ANS of the CR (hereinafter referred to as the Purchaser) is the Czech Air Navigation Service Provider. One of the communication services provided by the Purchaser is the aeronautical fixed service nowadays represented by AFTN and CIDIN. Current system providing AFTN/CIDIN must stay as separate system but lately will be exchanged by newly supplied AFTN/AMHS system.

This specification describes in detail requirements for phased implementation of AFTN/AMHS system solution composing of one fully redundant platform for operational use and one additional platform for test and backup purposes.

1.1 General definitions

AFTN

Whenever the term AFTN is used in this tender specification it means Aeronautical Fixed Telecommunication Network that is a worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics. Detailed specification is defined by ICAO Annex 10 [1] and [2].

AMHS

Whenever the term AMHS is used in this tender specification it means ATS Message Handling System as defined by [3] and [10] .

IP

Whenever the term IP is used in this tender specification it means Internet Protocol according to RFCs (Internet source, http://rfc.net).

1.2 Terminology

1.2.1 Definitions

In this document the following standard terminology is used to indicate the status of technical requirements:

- **shall** denote a requirement that is mandatory and must be addressed in the offer presented by the Tenderer
- **should** denote a requirement that is highly desirable. Such requirements must be addressed in the offer but can be listed separately in the cost quotation
- **may** denote an optional requirement.
- **will** denote a statement of intent.

To avoid confusion with their natural meanings in the English language, the words shall, should, may and will take on the meaning stated above only where printed in boldface. When printed in normal (Times New Roman) typeface, the natural English meaning is meant. For example, this sentence will not denote any intention.

Purchaser - ŘLP ČR, s.p. (ANS of The CR)
Contractor - A company, which contractually provides services and/or supplies
Tenderer - A company, which offers to deliver services and/or supplies for a price (potential Contractor)

1.2.2 Structure and Contents of Requirement Number

The requirements in these specifications have unique identification. The identification tag has the following syntax "[AMHS-TYPE-REQUIREMENT_ATTRIBUTE- NUMBER].).

The TYPE can be:
"**CMR**" for a requirement specified in the Commercial specification document.
"**TEC**" for a requirement specified in this technical document;

The REQUIREMENT_ATTRIBUTE can be:
"**M**" for mandatory requirement (**"shall"**);
"**D**" for Desirable requirements (**"should"**);
"I" for Intents (**"will"**)

The NUMBER is constituted of the document paragraph number followed by an internal numbering value within the paragraph. For clear understanding, the following paragraph represents a requirement, namely ***AMHS***, ***TEC***hnical, ***M***andatory within the subsection ***1.4*** paragraph number ***1***, and therefore it can be identified by ***[AMHS-TEC-M-1.4-(1)]***.

(1) ***[AMHS-TEC-M-1.2.2-(1)]***

The Tenderer's reply to the tender **shall**, inter alia, contain a part that will clearly state whether and how is the requirement fulfilled (compliance matrix part).

(2) ***[AMHS-TEC-M-1.2.2-(2)]***

The Tenderer **shall** in his offer deliver all relevant documentation in original documentation (Users guide, system description, administration guide, etc.) written in English.

(3) ***[AMHS-TEC-M-1.2.2-(3)]***

Those original documents **shall** be used as referenced sources for compliance matrix part.

(4) ***[AMHS-TEC-M-1.2.2-(4)]***

The compliance matrix part **shall** have the following structure for each requirement stated in this document:

Requirement identification
[AMHS-TEC-M-NUMBER-(REQUEST_NUM)]

Compliance status
Fully compliant, partially compliant, Non ;

Description
The required functionality is implemented by using…

References to the original documentation
For details refer to XY1 part of the delivered document XYZ1, and part XY5 in the document XYZ2.

1.3 Acronyms and abbreviations

ACK	Acknowledgment (message)
ADEXP	ATS Data Exchange Presentation (format)
Ae	Entry address (CIDIN)
AFSG	Aeronautical Fixed Services Group
AFTN	Aeronautical Fixed Telecommunication Network
AMHS	ATS Message Handling System; sometimes referred to as Aeronautical Message Handling System
ANSP	Air Navigation Service Provider
Async	Asynchronous
ATIS	Automatic Terminal Information Service
ATS	Air Traffic Services
Ax	Exit address (CIDIN)
bash	Bourne-Again-Shell
CAAS	Common AMHS Addressing Scheme
CD	Compact Disc
CID	Channel Identification
CIDIN	Common ICAO Data Interchange Network
CL	Current Loop
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CMOS	Central monitoring system
COM	Communications
COTS	Commercial off-the-shelf
CPSN	CIDIN packet sequence number
CST	Central Server Technology room
dBA	Decibel on the A-weighted scale according to US Environmental Protection Agency
DIR	Directory
DPN	Data Packet Node (Nortel's equipment DPN-100/xx)
DVD	Digital Versatile Disc
EMC	Electromagnetic Compatibility
ENQ	Enquiry (message)
ETX	End of text
EU	European Union
EUR	European (region according ICAO)
FAT	Factory Acceptance Testing
FCP	Final CIDIN packet indicator
FDP	Flight data processing (system)
FPA	Final Pre-operational Acceptance
FPL	Flight Plan Message
FTBP	File Transfer Body Part
FW	Firewall
Gcc	C-language compiler (GNU Compiler Collection)
GUI	Graphical User Interface
H24	Means working 24 hours a day
H8	Means working 8 hours a day, practically from 08.00 to 16.00
HDLC	High-level Data Link Control (protocol)
HMI	Human-Machine Interface
HW	Hardware
IA-5	International alphabet No. 5
ICAO	International Civil Aviation Organisation
IDS	Intrusion Detection System
IHE	IPM Heading Extension

IP	Internet Protocol
IPM	Interpersonal Message
IPS	Intrusion Protection System
ISO	International Standardisation Organisation
ITA-2	International Telegraph Alphabet No. 2
ITU	International Telecommunication Union
KDE	K-Desktop Environment
LAN	Local Area network
LAP-B	Link Access Protocol Balanced (protocol)
LCC	Life Cycle Cost
O-A, O1	Operational system, server A / server 1
O-B, O2	Operational system, server B / server 2
MCF	Message code and format
MET	Meteorological
MIN	Message identification number
MTA	Message Transfer Agent
MUX	Multiplexer
NA	Network acknowledgement indicator
NAT	North Atlantic (region)
NET	Network department
NOTOF	NOTAM office
NTP	Network Time Protocol
NTU	Network terminating unit
O/R	originator/recipient
OH	Operational handbook
OP	Operator position
openssh	Free version of the SSH connectivity tool
OPMET	Operational Meteorological Traffic
OPS	Operational/Operations
OS	Operating System
OSI	Open System for Interconnection (ISO model)
P1	X.400 protocol for communication between MTAs
P3	X.400 protocol for communication between the user agent and MTA
P7	X.400 protocol for communication between the user agent and message store
PC	Personal computer
PVC	Permanent Virtual Circuit
QA	Quality Assurance
RAM	Reliability, Availability, Mantainability
RAS	Remote Access Server/Service
RCMS	Remote Control and Monitoring System
RDP	Radar data processing (system)
RFC	Request for Comment
CADIN	Czech Aeronautical Data Interchange Network
SAT	Site Acceptance Testing
Scp	Secure copy (protocol)
SFTP, sftp	Secure File Transfer Protocol
SMI	Structure of Management Information
SMTP, smtp	Simple Message Transfer Protocol
SNMP, snmp	Simple Network Management Protocol
SSH, ssh	Secure Shell
Sshd	Secure shell daemon
SVC	Switched Virtual Circuit
SW	Software
T-A, T1	Test system, server A / server 1

T-B, T2	Test system, server B / server 2
TCP	Transfer Control Protocol (protocol)
tcpdump	Command line network analyzer for UNIX/Linux
TID	Transmission Identification
UA	User agent
VDT	Video Display Terminal
vim	Advanced text editor for UNIX/Lnux
VOLMET	In-flight meteorological information
VPN	Virtual Private Network
XDMCP	X Display Manager Control Protocol
XF	Translated-form (address or addressing scheme)
X.25	ITU recommendation
X.400	ITU recommendation
X.500	ITU recommendation

1.4 Applicable Documents

(1) ***[AMHS-TEC-M-1.4-(1)]***

All herein stated documents **shall** be applicable in their last available valid versions, including all amendments and supplements or recently discovered defects, errors or findings.

[1] Aeronautical Telecommunications, Annex 10, Volume II, 6th Edition (October 2001) including all applicable Amendments

[2] Aeronautical Telecommunications, Annex 10, Volume III, 2nd Edition (July 2007) including all applicable Amendments

[3] Technical Provisions for the Aeronautical Telecommunications Network, Doc 9705 Edition 3 including all Defect Reports, Sub-Volume III: ATS Message Handling Services

[4] Comprehensive ATN manual (CAMAL), Doc 9739, Part III, Chapter 6 ATS Message Handling Services

[5] Manual on Detailed Technical Specification for the Aeronautical Telecomunication Network (ATN) using ISO/OSI Standards and Protocols, Doc 9880, Part II (Ground-Ground Applications – Air Traffic Services Message Handling Setvices (ATSMHS), Edition 1 (2010)

[6] ATS Messaging Management Manual, ICAO EUR Doc 021, Version 10.0, (April 2014)

[7] EUROCONTROL Standard Document for ATS Data Exchange Presentation, Edition 2.1 (December 2001)

[8] ICAO COM Chart of EUR/NAT region (actual version)

[9] EUR AMHS Manual, ICAO EUR Doc 020, Version 9.0 including all applicable Appendixes and Attachments (April 2014)

[10] EUROCONTROL Specification on the Air Traffic Services Message Handling System (AMHS), Edition 2.0 (September 2009)

[11] ISO/IEC 9594-1:1993 / ITU-T X.500 (1993) Information technology — Open Systems Interconnection — The Directory: Overview of concepts, models and services.

[12] EDS specification & Documentation (EDS Test Document 1.0; EDS User Interface Manual 1.0) (April 2013)

[13] EU Commission Regulation No. 73/2010 laying down requirements on the quality of aeronautical data and aeronautical information for the single European sky (26 January 2010)

[14] Regulation (EC) No. 552/2004 of The European Parliament and of the Council on the interoperability of the European Air Traffic Management network (10 March 2004)

[15] EU Commission Regulation No. 482/2008 establishing a software safety assurance system to be implemented by air navigation service providers and amending Annex II to Regulation (EC) No. 2096/2005 (30 May 2008)

2 CURRENT SITUATION

Purpose of this chapter is to make the Tenderers familiar with current AFTN/CIDIN system and its operational environment.

Existing configuration of national environment (see Figure 1) has been existed since 2007 when AFTN/CIDIN system was installed above CADIN X.25 and CADIN IP underlying network. AFTN/CIDIN system had been supplied by GWDI California (nowadays Frequentis California).

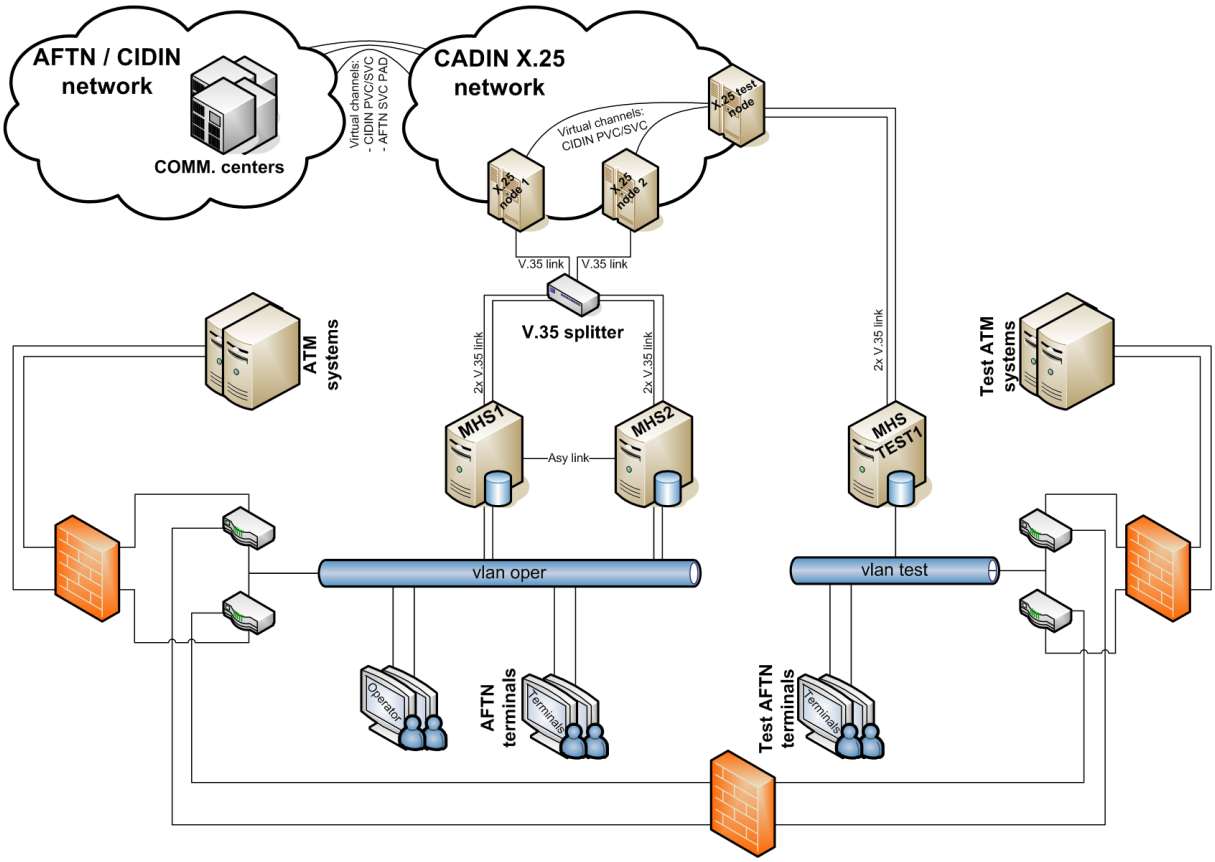

Figure 1 - Present national environment

All references mentioned in following articles 2.1 to 2.4 refer to above diagram.

2.1 AFTN/CIDIN switch

There are two different configurations of AFTN/CIDIN switch installed in Purchaser's premises.
First, identified as operational platform, fully redundant switch based on dual server architecture is used for handling of operational AFTN and CIDIN traffic. It is accompanied by eight operator positions (OP) that are connected to a dedicated LAN. In order to achieve high availability the AFTN/CIDIN switch uses two V.35 circuits connected to CADIN X.25 network via V.35 splitter. Each circuit can handle several connections including both, AFTN and CIDIN flows.

Application composes of one SW package that may run based on current configuration on either server. Standard configuration may be changed either automatically when a failure occurs, or by an operator's intervention.

Second platform is in single server configuration, interconnected with eight operator positions from operational platform and is used for various test purposes (therefore test platform), training or as the contingency system for operational system.

HW and SW are outdated; therefore the replacement is required.

2.2 Underlying network

Current AFTN/CIDIN system was designed to use X.25 connections (X.25 PVCs and SVCs, X.29 and X.32) provided by CADIN X.25 network and IP connection provided by CADIN IP network. X.25 is used only for international connections, IP is used for national connections.

Complete IP network infrastructure based on Cisco Systems technology is available for further use wherever needed. Quality of services provided by CADIN IP is fully under Purchaser's control. Further details of the network are outlined in articles hereinafter.

2.3 AFTN Users

Different type of AFTN users are served by the existing system. For AFTN international partners see figure 2.5. All other existing AFTN users are IP based. They are combination of ATM end systems and dedicated AFTN terminals.

2.4 CIDIN Partners

System includes one internal CIDIN centre (LKPR) and Test platform CIDIN centre (XKPR). Naturally, there is number of external international CIDIN centres connected to the system. Further details of the existing CIDIN partners are listed below.

CIDIN connections:

- EDDD (Frankfurt) – 2x PVC, 9,6kbps
- EPWW (Warsaw) – 1x PVC, 9,6kbps
- LOOO (Vienna) – 2x SVC, 9,6kps
- LZIB (Bratislava) – 2xSVC 9,6kbps

- XKPR (test system) – 2x SVC 9,6kbps, 2x PVC 9,6kbps

2.5 AFTN International Partners

There are two AFTN International Partners within the existing environment. These AFTN users are connected via DPN-100 asynchronous interfaces (X.3/X.28/X.29), hereinafter referred to as X.29 users.

Further details of the existing international AFTN partners are listed below.

AFTN connections:

- UKKK (Kyiv) – 1x SVC PAD, 9,6kbps
- LHBP (Budapest) – 1x SVC PAD, 9,6kbps

3 GENERAL REQUIREMENTS

Purpose of this chapter is simplified description and basic requirements for the new system which are then elaborated in details in the following chapters.

3.1 Services

(1) ***[AMHS-TEC-M-3.1-(1)]***

The new system **shall** support following basic services:

- AFTN
- AMHS
- gateway to the current AFTN/CIDIN system
  (Solution proposed by Purchaser - new system will be interconnected to the currently used AFTN/CIDIN system via AFTN line using “AFTN over IP” protocol defined in ANNEX 3 GWDI AFTN Message Switch TCP/IP Protocol for Message Exchange Interface Specification.

(2) ***[AMHS-TEC-M-3.1-(2)]***

The system **shall** support

- AFTN message switching
- AFTN users communicating over:
  - IPv4 (either TCP or UDP)
  - IPv6 (either TCP or UDP)
- AMHS users connecting over:
  - IPv4 (either TCP or UDP)
  - IPv6 (either TCP or UDP)
- AFTN/AMHS gateway
- ATS message server
- ATS message user agent connecting users over IP
- SMTP/POP3/IMAP users
- SMTPs/POP3s/IPAMS users (SSL or other secured well known type of connections)
- access to the message boxes via http/https

(3) ***[AMHS-TEC-M-3.1-(3)]***

Based upon the Eurocontrol Specification on the AMHS the system **shall** be delivered as Extended AMHS with implementation of configuration IX (see 3.3.6 in [10]) with subsets:

- Basic
- IHE (IPM Heading Extension)
- DIR (Directory)
- FTBP (File Transfer Body Part)

3.2 Users and partners

(1) ***[AMHS-TEC-M-3.2-(1)]***

As already mentioned hereinbefore the system **shall** provide connectivity with:

- AFTN users (AFTN terminals/ATM systems)
- AMHS MTAs
- AMHS users

(2) ***[AMHS-TEC-M-3.2-(2)]***

A Contractor **shall** be able to supply client applications for AFTN and AMHS as an option.

3.3 System administration

(1) ***[AMHS-TEC-M-3.3-(1)]***

The system's architecture **shall** support functionalities essential for its safe and effective administration, maintenance and monitoring. These functionalities will be used by:

- internal technical staff (H24, H8)
- internal operational staff
- external support – hotline by the Contractor (for the System)

3.4 Architecture

(1) ***[AMHS-TEC-M-3.4-(1)]***

The provided AFTN/AMHS system **shall** be designed for a civil air navigation services provider.

(2) ***[AMHS-TEC-M-3.4-(2)]***

The supply **shall** compose of Operational and Test system.

(3) ***[AMHS-TEC-M-3.4-(3)]***

The Test system **shall** be identical with the Operational system.

(4) ***[AMHS-TEC-M-3.4-(4)]***

The Operational system **shall** be fully redundant with no single point of failure.

(5) ***[AMHS-TEC-M-3.4-(5)]***

Failure of any system component **shall** not cause any loss of operational data.

(6) ***[AMHS-TEC-M-3.4-(6)]***

The system **shall** include eight operator's positions.

3.5 SAT configuration

(1) ***[AMHS-TEC-M-3.5-(1)]***

The System **shall** enable external connections on the AMHS layer. During the tests there will be connections at least to LZIB, LOWW and LHBP in order to prove system functionality.

3.6 Maintenance and support

(1) ***[AMHS-TEC-M-3.6-(1)]***

Independently of the included management positions and tools, it **shall** be possible to integrate monitoring of the system and its subcomponents into existing Purchaser's central monitoring system (CMOS) via SNMP protocol (e.g. state of HW, SW, etc.).

(2) ***[AMHS-TEC-M-3.6-(2)]***

The Contractor **shall** guarantee a 10 (ten) year system support from putting the system into service (FPA), including provision of the Hotline service (H24) and necessary spare parts.

4 FUNCTIONAL REQUIREMENTS

4.1 Core Functions (ATS Message switching Centre)

(1) ***[AMHS-TEC-M-4.1-(1)]***

The new centre **shall** fully comply with ICAO and EUROCONTROL recommendations and provisions for AFTN/AMHS centres in force at the time of signing the contract [9] [10] .

(2) ***[AMHS-TEC-M-4.1-(2)]***

The system **shall** be configurable to be able to act as an ATS message switching centre.

(3) ***[AMHS-TEC-M-4.1-(3)]***

The system **shall** be capable of performing the following basic functions:

- to handle and save AFTN/AMHS message flow,
- store and forward function
- to be able to organize messages in the order of their priority,
- to route messages,
- to check message flow,
- to store traffic data in archives,
- to make statistics of the message flow,
- to maintain a direct link with neighbouring AFTN/AMHS centres, and with subordinate AFTN and AMHS end users,
- to monitor and control the functionality of the system.

(4) ***[AMHS-TEC-M-4.1-(4)]***

The system **shall** be able to manage at least 200 users (i.e. terminals) at a time via LAN with possibility for further extension.

(5) ***[AMHS-TEC-M-4.1-(5)]***

The system **shall** support two-way AFTN/AMHS delivery, forwarding and reading acknowledgements.

(6) ***[AMHS-TEC-M-4.1-(6)]***

The system **shall** support continuous and simultaneous connection with the adjacent message handling centres.

(7) ***[AMHS-TEC-M-4.1-(7)]***

The system **shall** allow the full transition between AFTN and AMHS systems.

(8) ***[AMHS-TEC-M-4.1-(8)]***

The system **shall** be able to handle, create, edit, save, and send messages; to list, display, modify and send saved messages; to recall and handle faulty messages; and to forward corrected messages

(9) ***[AMHS-TEC-M-4.1-(9)]***

The system **shall** be able to handle queuing of the messages.

(10) ***[AMHS-TEC-M-4.1-(10)]***

The system **shall** allow the operator to remove a message from the queue and retransmit it.

(11) ***[AMHS-TEC-M-4.1-(11)]***

The system **shall** be able to repeat messages when requested, automatically or upon operator command.

(12) ***[AMHS-TEC-M-4.1-(12)]***

The system **shall** be able to synchronize input and output message sequence numbers (one channel, according to a list of channels, and on all the channels at the same time).

(13) ***[AMHS-TEC-M-4.1-(13)]***

The system **shall** be able to display the current status at channel inputs and outputs (one channel, a range of channels, all the channels).

(14) ***[AMHS-TEC-M-4.1-(14)]***

The system **shall** be able to display messages on the queuing list (one channel, a range of channels, all the channels).

(15) ***[AMHS-TEC-M-4.1-(15)]***

The system **shall** be able to display redirected circuits, redirected routing indicators and copy circuits.

(16) ***[AMHS-TEC-M-4.1-(16)]***

The system **shall** be able to display current status of each system components.

(17) ***[AMHS-TEC-M-4.1-(17)]***

The system **shall** ensure two-way message forwarding and message conversion between AFTN and AMHS.

(18) ***[AMHS-TEC-M-4.1-(18)]***

The system **shall** allow an on-line configuration of circuits as follows:

- Enabling / disabling circuit with other message handling centre, e.g. hold traffic for chosen COM centre.
- Enabling / disabling circuit with all the configured message handling centres or enabling / disabling all circuits.

(19) ***[AMHS-TEC-M-4.1-(19)]***

The system **shall** manage the queuing of messages for each channel, and shall remove from the queue and reprocess messages when its recipient is unavailable.

(20) ***[AMHS-TEC-M-4.1-(20)]***

In case of AMHS messages, the system **shall** provide a possibility for requesting acknowledgement, depending on the AFTN priority indicators or the AMHS priority.

(21) ***[AMHS-TEC-M-4.1-(21)]***

The AMHS system **shall** allow the import of the necessary address table into the AFTN/AMHS gateway. Its format shall comply with the standards in force at the time of SAT.

(22) ***[AMHS-TEC-M-4.1-(22)]***

Messages not deliverable using the defined routing and pending for transmission **shall** be stored for delivery at a later time.

(23) ***[AMHS-TEC-M-4.1-(23)]***

Sufficient storage capacity **shall** be available.

(24) ***[AMHS-TEC-M-4.1-(24)]***

Manual message handling **shall** be possible and will have priority over automatic functions.

(25) ***[AMHS-TEC-M-4.1-(25)]***

The system **shall** be able to automatically monitor the system processes, system components and user application processes.

(26) ***[AMHS-TEC-M-4.1-(26)]***

The system **shall** have GUI management, including configuration, monitoring, operational control, log viewing and message tracking.

(27) ***[AMHS-TEC-M-4.1-(27)]***

The system **shall** not lose an acknowledged message.

(28) ***[AMHS-TEC-M-4.1-(28)]***

The system **shall** not lose any messages in any case (e.g. in case of being overloaded or in the course of a switch-over).

(29) ***[AMHS-TEC-M-4.1-(29)]***

System switch-over **shall** be performed automatically, without manual hardware operation when an error is detected. It **shall not** be “Preempt and fallback to Primary” failover type, it means after faulty server is repaired it shall not automatically switch back.

(30) ***[AMHS-TEC-M-4.1-(30)]***

System **shall** enable to iniatiate switch-over based on authorized operator command.

(31) ***[AMHS-TEC-M-4.1-(31)]***

Automatic switch-over between servers (O-A and O-B, T-A and T-B) **shall** not result in a loss of data.

(32) ***[AMHS-TEC-M-4.1-(32)]***

The system **shall** generate alerts for all events that imply an abnormal situation, trigger a configuration / status change, require a configuration change or when a defined threshold is reached.

(33) ***[AMHS-TEC-M-4.1-(33)]***

The system **shall** be able to export the “*complete configuration*” related to the application to a file in a human-readable format without disturbing its operations and without impairing its performance.

(34) ***[AMHS-TEC-M-4.1-(34)]***

The system **shall** be able to export the “*complete configuration*” related to the application to a database file / XML file / etc in machine readable format without disturbing its operations and without impairing its performance

(35) ***[AMHS-TEC-M-4.1-(35)]***

The system **shall** have a find/replace capability in routing tables.

(36) ***[AMHS-TEC-M-4.1-(36)]***

The Tenderer **shall** state if the system proposed can be operated safely with the planned organisational structure (see [AMHS-TEC-M-3.3-(1)]). In particular, it shall be described how the AFTN/AMHS operator alone on duty at night will be notified of possible hardware or software problems if the Purchaser’s Central Monitoring System is not available.

(37) ***[AMHS-TEC-M-4.1-(37)]***

Messages **shall** be handled as defined in [1] and ICAO ATN SARPs (latest edition), Basic and Extended Services.

4.1.1 AFTN

(1) ***[AMHS-TEC-M-4.1.1-(1)]***

The system **shall** be configurable to exchange messages via AFTN.

(2) ***[AMHS-TEC-M-4.1.1-(2)]***

The system **shall** enable an AFTN channel setting, in which ADEXP format messages can be handled, received, forwarded and corrected.

(3) ***[AMHS-TEC-M-4.1.1-(3)]***

The system **shall** be able to process the ITA-2 and IA-5 formats and codes, and **shall** be able to automatically convert between these formats.

(4) ***[AMHS-TEC-M-4.1.1-(4)]***

It **shall** be possible to configure the length of the channel sequence number per communication partner to consist of three or of four figures.

(5) ***[AMHS-TEC-M-4.1.1-(5)]***

It **shall** be possible to configure the alignment function per communication partner to be CR-LF or CR-CR-LF

(6) ***[AMHS-TEC-M-4.1.1-(6)]***

The system **shall** enable to setup all AFTN channels, through which messages with length exceeding 64kB (e.g. ATS messages compliant to ADEXP format) can be handled, received, forwarded and corrected in the form of a single message.

(7) ***[AMHS-TEC-M-4.1.1-(7)]***

The system **shall** be able to perform the following functions:

- Forward messages automatically according to the simple or multiple address indicator, with the consideration of responsibility.
- Forward messages automatically according collective / multi-destination address indicators
- Forwarding and receiving AFTN messages via local network with TCP/IP protocol (IPv4 and IPv6).

(8) ***[AMHS-TEC-M-4.1.1-(8)]***

The AFTN messages **shall** be compliant with the relevant parts of Annex 10 [1] [2].

4.1.2 AMHS

(1) ***[AMHS-TEC-M-4.1.2-(1)]***

The system **shall** be able to send and receive binary files attached to messages.

(2) ***[AMHS-TEC-D-4.1.2-(2)]***

The delivered solution **should** include effective protection system against viruses and/or cyber-crime attacks for entire planned supported time (e.g. check the content of the attached files for viruses, ensure transparent transition of any type of attachments without any impact to the system operation).

(3) ***[AMHS-TEC-M-4.1.2-(3)]***

The AMHS messages **shall** be compliant with the [3] and [4]

(4) ***[AMHS-TEC-M-4.1.2-(4)]***

The system **shall** be able to receive acknowledgement messages of reading and delivery, and shall be able to send such messages if requested.

(5) ***[AMHS-TEC-M-4.1.2-(5)]***

The system **shall** be able to generate probes of delivery, non-delivery.

(6) ***[AMHS-TEC-M-4.1.2-(6)]***

The system **shall** be able to be subjected to the implementation of X.500 address handling as defined in [9], [10], [11] and [12].

(7) ***[AMHS-TEC-M-4.1.2-(7)]***

The system **shall** be able to connect and communicate with EDS (European Directory Service) based upon X.500 protocol group family [9] [10] [11] [12]

(8) ***[AMHS-TEC-M-4.1.2-(8)]***

The system **shall** be able to manage both the XF and the CAAS addressing modes.

(9) ***[AMHS-TEC-M-4.1.2-(9)]***

As a default setting, the system **shall** use the XF addressing mode, it means when the system receives message in CAAS it shall perform address conversion to XF automatically.

(10) ***[AMHS-TEC-M-4.1.2-(10)]***

The AMHS Routing Table **shall** be structured to allow effective administration.

(11) ***[AMHS-TEC-M-4.1.2-(11)]***

The system **shall** provide conversion between eight digit AFTN addresses and X.400 O/R Addresses.

(12) ***[AMHS-TEC-M-4.1.2-(12)]***

The system **shall** provide conversion between eight digit AFTN addresses and Directory Names.

(13) ***[AMHS-TEC-D-4.1.2-(13)]***

The system **should** use ATN directory (X.500) for address verification and capability determination.

(14) ***[AMHS-TEC-M-4.1.2-(14)]***

The system **shall** conform with X400 protocol implementation:

- able to communicate with other AMHS/X.400 systems (MTAs) using the X.400 P1 protocol and the following transport services (TP0/RFC1006/TCP/IP and TP0/RFC2126/TCP/IP)
- able to communicate with local systems using the X.400 P3 protocol and/or X.400 P7 protocol over TP0/RFC1006/TCP/IP

  (P7 - for client applications that require storage services from X.400, P3 - for client applications that provide their own reliable storage, and wish to transfer messages over X.400 without the overhead of a Message Store)

(15) ***[AMHS-TEC-M-4.1.2-(15)]***

The system **shall** conform with X500 protocol family group implementation

(16) ***[AMHS-TEC-M-4.1.2-(16)]***

The system **shall** be able to generate:

- X.400 type test messages,
- delivery messages,
- non-delivery messages,

- reports,
- probes

(17) ***[AMHS-TEC-M-4.1.2-(17)]***

The system **shall** handle application errors correctly.

(18) ***[AMHS-TEC-M-4.1.2-(18)]***

The system **shall** allow the authorized operator to:

- stop the AMHS application gracefully, with or without automatic restart, and to force the application to stop immediately if necessary,
- start the AMHS application with or without message recovery function.

(19) ***[AMHS-TEC-M-4.1.2-(19)]***

The delivery **shall** not limit by licence the maximum number of the AHMS end user terminals.

(20) ***[AMHS-TEC-M-4.1.2-(20)]***

The AFTN/AMHS UA terminal System **shall** be able to run at least 200 simultaneous terminal sessions at a total load of 20 user message transactions per second.

(21) ***[AMHS-TEC-M-4.1.2-(21)]***

The AFTN/AMHS UA terminal System **shall** provide a dedicated administrator application. The application **shall** provide at least the following services for system administrators:

- setup, editing, deletion and monitoring AFTN/AMHS UA terminal users and groups,
- setup, editing, deletion and monitoring mailboxes,
- possibility to monitor the system status and the application status,

4.1.3 AFTN/AMHS Gateway

(1) ***[AMHS-TEC-M-4.1.3-(1)]***

The system **shall** be able to provide the services of a gateway between the AFTN and AMHS/X.400 message services as defined in subvolume 3.1 of the ATN SARPs (3rd edition).

(2) ***[AMHS-TEC-M-4.1.3-(2)]***

The AFTN/AMHS gateway **shall** support XF and CAAS addressing schemes with full interoperability between these addressing schemes.

(3) ***[AMHS-TEC-M-4.1.3-(3)]***

The AFTN/AMHS gateway **shall** support the simultaneous transformation of 20 AFTN to AMHS messages per second and 20 AMHS to AFTN messages per second.

(4) ***[AMHS-TEC-M-4.1.3-(4)]***

The message transfer time within the system **shall** not exceed 1 second operating at the sustained message input rate.

(5) ***[AMHS-TEC-M-4.1.3-(5)]***

The requirements above **shall** be met for following message profile:

- average message text size: 1.500 bytes;
- minimum message text size: 100 bytes;
- maximum message text size: 64.000 bytes (see [AMHS-TEC-M-4.1.1-(6)]).

(6) ***[AMHS-TEC-M-4.1.3-(6)]***

The maximum message and message text sizes **shall** be configurable.

(7) ***[AMHS-TEC-M-4.1.3-(7)]***

It **shall** be possible to display for all messages that have been switched through the AFTN/AMHS gateway the entire message history (incoming message, journal, outgoing message(s)).

(8) ***[AMHS-TEC-M-4.1.3-(8)]***

In addition to the specifications of the ATN SARPs, the following AFTN/AMHS gateway events **shall** be logged:

- MTA-bind - successful completion,
- MTA-bind - error, and
- MTA-unbind.

(9) ***[AMHS-TEC-M-4.1.3-(9)]***

It **shall** be possible to configure AFTN priority and AMHS/X.400 priority equivalences (e.g. priority "SS" corresponding to the priority "urgent").

(10) ***[AMHS-TEC-M-4.1.3-(10)]***

The AFTN/AMHS gateway **shall** be able to transform AMHS/X.400 messages with up to 1.024 recipient addresses into a corresponding number of AFTN messages.

(11) ***[AMHS-TEC-M-4.1.3-(11)]***

The AFTN/AMHS gateway **shall** implement a reverse checking for address conversion to detect inconsistencies.

4.1.4 Client terminal software (CTS)

(1) ***[AMHS-TEC-M-4.1.4-(1)]***

CTS **shall** have a local address book.

(2) ***[AMHS-TEC-M-4.1.4-(2)]***

The AFTN / AFTN/AMHS UA terminal system **shall** be based on scalable and easily extendable client-server architecture.

(3) ***[AMHS-TEC-M-4.1.4-(3)]***

The system **shall** include the redundant Message Database and provide connectivity (internal or external) to the MTA and to an external Directory Server.

(4) ***[AMHS-TEC-M-4.1.4-(4)]***

The CTS **shall** support operation on any COTS PC hardware.

(5) ***[AMHS-TEC-D-4.1.4-(5)]***

The CTS **should** be implemented as an operating system independent application. (The CTS should run on any operating system – such as Windows 7/8 (both 32bit and 64bit), as well as LINUX based (e.g. Red Hat, Fedora, Centos) operating systems (both 32bit and 64bit) or others.

(6) ***[AMHS-TEC-D-4.1.4-(6)]***

The system **should** enable automatic CTS software deployment both for initial installation and for CTS upgrades..

(7) ***[AMHS-TEC-M-4.1.4-(7)]***

The CTS **shall** have the possibility to reconnect automatically to active system server after switch-over.

(8) ***[AMHS-TEC-M-4.1.4-(8)]***

The CTS **shall** provide an AFTN/AMHS UA terminal application for ATS messaging services with the messaging capabilities of X.400/AMHS. The AMHS UA **shall** be compatible and interoperable with Basic ATS Message Services and Extended ATS Message Services (which include file attachments and ATN Directory Services integration).

(9) ***[AMHS-TEC-M-4.1.4-(9)]***

The CTS in addition to AMHS UA application the terminal **shall** provide also an AFTN application with the same look and feel to support message exchange via AFTN or integrated within the same CTS application.

(10) ***[AMHS-TEC-M-4.1.4-(10)]***

The CTS **shall** provide the following major services and characteristics:

- creating, clearing, editing, operating, transmitting, receiving, forwarding, sorting, searching, viewing, and printing messages and probes;
- services and attributes defined by X.400 P3 and P7, which are essential for the operation of an ATS Messaging system;
- provide X.400 standard free-text messaging with the possibility of sending and receiving binary file attachments according to the Extended ATS Services;
- Directory User Agent (DUA) to access ATN Directory Server information;
- access to a static database for message validation;
- automatic software deployment superseding manual installation procedure;
- independence of the client terminal operating system;
- automatic handling of the terminal application software.
- The CTS shall support access to AMHS and AFTN mailboxes for the registered users' local and non-local networks.

(11) ***[AMHS-TEC-M-4.1.4-(11)]***

The access protocol between CTS and system servers **shall** be *SSL* based in order to secure the transmission of messages.

(12) ***[AMHS-TEC-M-4.1.4-(12)]***

The CTS **shall** parse entered data for compliance with destination capabilities before being accepted for transmission. Traffic not conforming to this requirement shall not be accepted for transmission and the 'User' shall be suitably notified.

(13) ***[AMHS-TEC-M-4.1.4-(13)]***

The CTS **shall** prevent users from sending erroneous or incomplete ATS messages.

(14) ***[AMHS-TEC-M-4.1.4-(14)]***

The CTS **shall** accept and deliver correctly formatted and addressed messages from authorised originators to one or more AFTN/AMHS UA terminal destinations, and/or to one or more destinations accessible via the AFTN/AMHS gateway.

(15) ***[AMHS-TEC-M-4.1.4-(15)]***

The CTS **shall** accept and deliver correctly formatted and addressed messages from the AFTN/AMHS gateway to one or more mailboxes on the CTS.

(16) ***[AMHS-TEC-M-4.1.4-(16)]***

The CTS **shall** enable the user to define own message templates/graphic forms with syntactic and semantic checks in order to define new message types.

(17) ***[AMHS-TEC-M-4.1.4-(17)]***

Messages **shall** be checked on correctness during the message creation process.

(18) ***[AMHS-TEC-M-4.1.4-(18)]***

When an error is detected, the particular text field within the message template **shall** be highlighted or indicated and supplemented by textual error description.

(19) ***[AMHS-TEC-M-4.1.4-(19)]***

For the user's convenience, all retrieval filters **shall** be storable and accessible via a list.

(20) ***[AMHS-TEC-M-4.1.4-(20)]***

The CTS **shall** enable delivery of confirmation/acknowledgement messages.

(21) ***[AMHS-TEC-M-4.1.4-(21)]***

The CTS **shall** enable the user to search for, recall, display, operate, and print messages that are up to 30/31 days old.

(22) ***[AMHS-TEC-M-4.1.4-(22)]***

Messages **shall** be archived for at least 30/31 days.

(23) ***[AMHS-TEC-M-4.1.4-(23)]***

The CTS **shall** provide a free-text message entry form.

(24) ***[AMHS-TEC-M-4.1.4-(24)]***

The CTS **shall** enable to define default AFTN/AMHS priority.

(25) ***[AMHS-TEC-M-4.1.4-(25)]***

The CTS **shall** provide Help functionality.

(26) ***[AMHS-TEC-M-4.1.4-(26)]***

All data including user settings and access rights **shall** be stored in the system database.

(27) ***[AMHS-TEC-M-4.1.4-(27)]***

The CTS **shall** be able to send, receive and display attachments.

(28) ***[AMHS-TEC-D-4.1.4-(28)]***

The CTS **should** check the content of the attachments for viruses when using AMHS part of Software.

(29) ***[AMHS-TEC-M-4.1.4-(29)]***

The CTS **shall** be compliant with the implementation of X.500 address handling service

(30) ***[AMHS-TEC-M-4.1.4-(30)]***

Number of CTSs **shall** not be limited by licensing policy. Purchaser will have the non-exclusive right to use the CTSs on any number of computers within own country (LKAA) or FAB CE wide (Functional Airspace block Central Europe) – country-wide / FAB CE wide software licensing policies.

4.1.5 SMTP

System **shall** convert AFTN and/or AMHS messages to emails directly and deliver these converted messages as emails to clients and vice versa. The AFTN/AMHS to/from email (SMTP) conversion module will be used only by users connected to internal closed network.

(1) ***[AMHS-TEC-M-4.1.5-(1)]***

A Tenderer **shall** describe own solution proposal with detail description of architecture and functionality.

(2) ***[AMHS-TEC-M-4.1.5-(2)]***

The system **shall** convert messages between AFTN/AMHS and e-mail (SMTP) system modules.

(3) ***[AMHS-TEC-M-4.1.5-(3)]***

The AFTN/AMHS to/from e-mail conversion fuction **shall** allow connection of 200 SMTP clients at least with possible increase by 200% in future.

4.1.6 AFTN Clients

There is no request for new AFTN clients by Purchaser. Currently running AFTN clients / ATM systems (as AFTN clients) uses the current and well defined "*AFTN over IP"* protocol.

(1) ***[AMHS-TEC-M-4.1.6-(1)]***

The system **shall** be able to communicate with currently used AFTN terminals via ***GWDI AFTN Message Switch TCP/IP protocol Message Exchange Interface*****.** The Purchaser is nowadays using "AFTN over IP" terminals connected to current AFTN/CIDIN system using this protocol – see ANNEX 3 GWDI AFTN Message Switch TCP/IP Protocol for Message Exchange Interface Specification for detailed specification.

4.2 Management Functions

This chapter will describe all management functions. By management function should be understood any function other than core function described in 4.1 . In general, management functions are functions needed for technical and operational staff to be able to operate the system and provide the services to the users.

The following
Figure 2 depicts different management functions and the relations to the operational and test system.

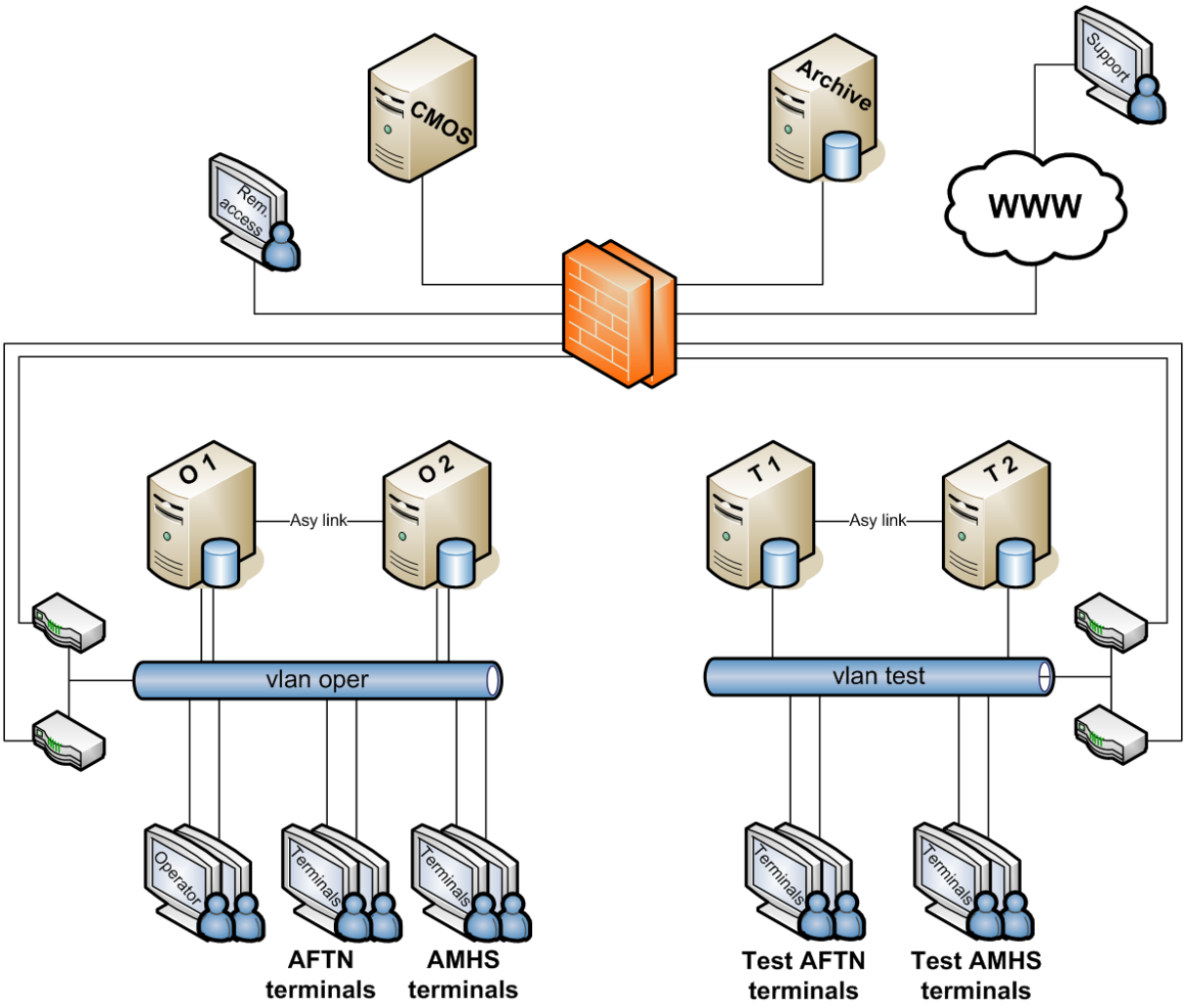

Figure 2 – Management functions description

4.2.1 System Management Principles

(1) ***[AMHS-TEC-M-4.2.1-(1)]***

The system **shall** implement a consistent system management framework for the unified management of all AFTN and AMHS components in one application and provide a system management interface that supports

- the management of the system configuration,
- the management of message handling functions,
- the management of system functions (re-initialisation, reboot, etc.),
- the monitoring, logging, retrieval, and inspection of faults and erroneous situations encountered,
- the gathering of statistics,
- the management of security and access controls.

(2) ***[AMHS-TEC-M-4.2.1-(2)]***

The principles of how the system implements a consistent system management framework in one application **shall** be specified in detail in the offer. In particular, this specification shall outline the consistent framework for the management of the different message handling

components (e.g. AFTN and AMHS/X.400 communication partners, AFTN and AMHS/X.400 message queues).

4.2.2 User Interface Principles

(1) ***[AMHS-TEC-M-4.2.2-(1)]***

The operation and control of the system and its components **shall** be provided through a state-of-the-art coloured graphical user interface (GUI), based on WIMP (windows, icons, menus, and pointers) technology and controlled by mouse and keyboard.

(2) ***[AMHS-TEC-M-4.2.2-(2)]***

All windows **shall** be subject to the control exercised by the window manager used.

(3) ***[AMHS-TEC-D-4.2.2-(3)]***

The window manager **should** offer the possibility of ergonomic customisation (for example: font size changing, window layout position saving, etc.)

(4) ***[AMHS-TEC-M-4.2.2-(4)]***

GUI User manual **shall** be provided in the offer.

(5) ***[AMHS-TEC-M-4.2.2-(5)]***

The operator **shall** have access to context-sensitive online help information upon request.

(6) ***[AMHS-TEC-D-4.2.2-(6)]***

The help information **should** be based on HTML techniques and shall include screen-shots and links to related topics for ease of reference.

(7) ***[AMHS-TEC-M-4.2.2-(7)]***

The nature of the information provided by the online help **shall** be outlined in the offer. Sample screenshots of the online help shall be provided in the offer.

(8) ***[AMHS-TEC-M-4.2.2-(8)]***

The update rate of windows providing online information (e.g. diagnosis information) **shall** be configurable per window (**shall not** be hardcoded).

(9) ***[AMHS-TEC-M-4.2.2-(9)]***

The default position and size of each window **shall** be easily adjustable individually for each user.

(10) ***[AMHS-TEC-M-4.2.2-(10)]***

The system **shall** implement syntactic and semantic checks to prevent incorrect operator input (e.g. wrong keys, invalid range of data, inconsistent data).

(11) ***[AMHS-TEC-M-4.2.2-(11)]***

The system **shall** prevent inconsistencies that result from the collision of inputs when more than one operator is active, acting with the same permissions.

(12) ***[AMHS-TEC-M-4.2.2-(12)]***

The system **shall** demand confirmation for any request that potentially impacts the operational status of the system (e.g. system shutdown).

(13) ***[AMHS-TEC-M-4.2.2-(13)]***

All operator input that potentially impacts the operational status of the system (e.g. change of routing tables, close/open circuits, etc.) **shall** be logged and available for retrieval for a configurable period of time (not less than 30/31 days).

(14) ***[AMHS-TEC-D-4.2.2-(14)]***

All other operator input that do not impacts directly the operational status of the system **should** be logged and available for retrieval for a configurable period of time (not less than 30/31 days). The tenderer shall in detail describe how many/which of the operator inputs fulfills this requirement.

(15) ***[AMHS-TEC-M-4.2.2-(15)]***

It **shall** be possible to activate system commands (e.g. system shutdown), that can be entered via the GUI, also by means of scripts.

(16) ***[AMHS-TEC-M-4.2.2-(16)]***

It **shall** be possible to schedule the execution of scripts.

(17) ***[AMHS-TEC-D-4.2.2-(17)]***

As alternative to the use of hierarchical menus, it **should** be possible to browse directly to selected objects in order to support the intuitive use of the system and efficient operation but also in order to avoid erroneous input.

(18) ***[AMHS-TEC-D-4.2.2-(18)]***

The HMI **should** provide context menus which show and allow the user to execute all actions that can be performed on a previously selected object (e.g. for a circuit: “modify”, “open/close”, “diagnostic values”, “browsing”, etc.).

4.2.3 The System Configuration Control

(1) ***[AMHS-TEC-M-4.2.3-(1)]***

The system **shall** support the configuration of the system components

(2) ***[AMHS-TEC-D-4.2.3-(2)]***

Configuration of the system components **should** be possible in an easy and user-friendly way.

(3) ***[AMHS-TEC-M-4.2.3-(3)]***

The input and modification of configuration parameters **shall** be via menus, intuitive and syntactically and semantically checked.

(4) ***[AMHS-TEC-D-4.2.3-(4)]***

The system **should** offer an “undo” function for configuration parameter changes. The parameter change history **should** be retrievable for a selectable period.

(5) ***[AMHS-TEC-M-4.2.3-(5)]***

Cross-checks among associated tables **shall** prevent the input of wrong or inconsistent information, e.g. among AFTN routing tables, AFTN/AMHS gateway tables and AMHS routing tables.

(6) ***[AMHS-TEC-M-4.2.3-(6)]***

The system **shall** provide validation of routing tables, a routing simulation tool (AFTN including AFTN/AMHS gateway) so that the routing tables can be verified

(7) ***[AMHS-TEC-M-4.2.3-(7)]***

The offer **shall** identify the system configuration parameters that can be modified and activated online and those which require a restart of the system or specific component of the system.

(8) ***[AMHS-TEC-M-4.2.3-(8)]***

At least 60% of all system configuration parameters **shall** be subject to online modification and activation.

(9) ***[AMHS-TEC-D-4.2.3-(9)]***

The majority (it means more than mandatory 60%) of all system configuration parameters **should** be subject to online modification and activation. The tenderer shall describe how many parameters are fulfilled above mandatory 60%.

(10) ***[AMHS-TEC-M-4.2.3-(10)]***

In particular, the configuration of addressing and routing information **shall** be possible through online modification.

(11) ***[AMHS-TEC-M-4.2.3-(11)]***

The system **shall** not constrain the size of the configuration (e.g. size of routing tables).

(12) ***[AMHS-TEC-D-4.2.3-(12)]***

The system **should** provide a mechanism to maintain several sets of configuration data, and to activate an appropriate configuration on operator request.

(13) ***[AMHS-TEC-M-4.2.3-(13)]***

The system **shall** provide a release-independent structure of a configuration data set so that existing data sets can be reused with new application SW releases. If any new SW release is not compatible with previous data set structure the migration tool into new structure shall be provided.

(14) ***[AMHS-TEC-D-4.2.3-(14)]***

Apart from hierarchically organized configuration menus, a configuration browsing tool **should** be provided by the system, which enables navigation between and direct access to inter-related configuration objects (e.g. AFTN routing indicator ⇔ AFTN circuit ⇔ physical interface).

(15) ***[AMHS-TEC-M-4.2.3-(15)]***

For each configuration object, the browsing tool **shall** enable direct access to the parameters and diagnostic values (where relevant) of the object in question. All modifications of the configuration **shall** be logged in an appropriate database.

(16) ***[AMHS-TEC-M-4.2.3-(16)]***

The operator's positions **shall** be able to alter the AFTN/AMHS configuration of the system. Examples are:

- AFTN circuits parameters,
- AMHS circuits parameters
- AFTN/AMHS routing configuration

(17) ***[AMHS-TEC-M-4.2.3-(17)]***

It **shall** be possible to display on the operator's positions the values of each AFTN/AMHS configuration object and the currently active table contents.

4.2.4 Control of Operating Functions

(1) ***[AMHS-TEC-M-4.2.4-(1)]***

The operator's positions **shall** be given the features to perform all required functions that are needed for the operation of the system. Examples are:

- Insertion and modification of the routing tables (circuit diversion, address modifications, ...),
- Initiating of statistics measurements,
- Opening/Closing AFTN circuits (application level),
- Opening/Closing AMHS circuits (application level),
- Retrieval of statistics values,
- Retrieval of switched traffic,
- Modification of the circuits and channels configuration,
- Modifications of routing configuration for national collection and distribution of data.

(2) ***[AMHS-TEC-M-4.2.4-(2)]***

It **shall** be possible to display the status of the traffic currently processed and related parameters such as:

- The contents of the transmission queues (number of queued messages pending for transmission per circuit and per priority),
- List of diverted circuits,
- List of diverted indicators.

(3) ***[AMHS-TEC-M-4.2.4-(3)]***

In addition to specific functions, the operator's position **shall** allow for a manual entry of messages.

4.2.5 Operator's positions

These positions are used to perform the activities related to normal operational activities such as message generation and modification, message correction, routing of individual messages, retrieval of messages and similar activities. Routing tables and other operational data management should not interfere with operational traffic handling.

(1) ***[AMHS-TEC-M-4.2.5-(1)]***

The number and locations of operator positions **shall not** be technically limited by the system. Each operator position **shall** be able to support all system management functions, this support being only restricted by the user and security management.

(2) ***[AMHS-TEC-D-4.2.5-(2)]***

The system **should** run unlimited number of operator position without any need for license.

(3) ***[AMHS-TEC-M-4.2.5-(3)]***

If licences applied the delivery **shall** include at least 8 (eight) application software licences.

(4) ***[AMHS-TEC-M-4.2.5-(4)]***

The delivery **shall** include 8 (eight) operator's positions HW (used both for connection to the Operational and/or Test Platform) which compose of:

- PC with keyboard and mouse
  - dual homing/net-teaming LAN connection
  - Sound card
  - CD/DVD drive
- At least 20" monitor
- Necessary SW with necessary licenses
- 1 (one) LAN shared printer for Operational and Test platform (see 5.3.4)

(5) ***[AMHS-TEC-M-4.2.5-(5)]***

All positions **shall** be designed for 24 hours a day 365 days a year operation.

(6) ***[AMHS-TEC-M-4.2.5-(6)]***

All these positions **shall** be used simultaneously. The simultaneous use of these positions **shall** not cause conflicts in the operation.

(7) ***[AMHS-TEC-M-4.2.5-(7)]***

Access rights **shall** be implemented in order to provide accesses to these functions to the authorised staff only by means of various security levels.

(8) ***[AMHS-TEC-M-4.2.5-(8)]***

The access to the operator's positions and execution of the system commands **shall** be logged.

(9) ***[AMHS-TEC-M-4.2.5-(9)]***

The log record **shall** contain time stamp, user name, and executed action initiated via command line, via HMI or other input/output channels.

(10) ***[AMHS-TEC-M-4.2.5-(10)]***

The positions **shall** have Human Machine Interface (HMI) working in window-like environment, using both mouse and keyboard.

(11) ***[AMHS-TEC-M-4.2.5-(11)]***

HMI **shall** be in English language.

(12) ***[AMHS-TEC-M-4.2.5-(12)]***

The operator's positions **shall** have a function for displaying and updating of all circuits actual status.

(13) ***[AMHS-TEC-M-4.2.5-(13)]***

Information, reports or alarms relating to operation **shall** be displayed on operator terminals.

(14) ***[AMHS-TEC-M-4.2.5-(14)]***

Automatic printing of separate information, reports or alarms relating to operation **shall** be done as configurable parameter.

(15) ***[AMHS-TEC-M-4.2.5-(15)]***

Reports or alarms relating to operation **shall** be logged in the system with time stamp for possible retrieval and re-printing

(16) ***[AMHS-TEC-D-4.2.5-(16)]***

The operator **should** be supported with "help" function that gives adequate support for the specific problem he/she is faced with at any moment, i.e. the help function shall be situation dependent.

(17) ***[AMHS-TEC-D-4.2.5-(17)]***

The "help" function **should** be written in easy understandable English.

(18) ***[AMHS-TEC-M-4.2.5-(18)]***

The system **shall** provide query facilities to get current status of a particular element / component, a subset of them (e.g. all Ax, all MTA, etc) or all of them.

(19) ***[AMHS-TEC-M-4.2.5-(19)]***

The system **shall** be able to print one record, selected records or all records in operator's positions tools. (e.g. routing tables, subscribers, virtual circuits configuration,)

(20) ***[AMHS-TEC-M-4.2.5-(20)]***

It **shall** be possible to execute several operator system applications on the same hardware platform in parallel (e.g. one application to operate the operational system and one

application to operate the test/contingency system run in parallel on the same physical operator position).

(21) ***[AMHS-TEC-M-4.2.5-(21)]***

The offer **shall** detail how to configure and use such parallelism.

(22) ***[AMHS-TEC-M-4.2.5-(22)]***

A failure of operator position equipment **shall** not affect the functionality of the remainder of the system.

(23) ***[AMHS-TEC-M-4.2.5-(23)]***

Data or messages in process at the failed operator position **shall** not be lost, duplicated, corrupted, or falsified in any way (it means processed data shall not be stored locally on the operator position).

(24) ***[AMHS-TEC-M-4.2.5-(24)]***

Data or messages in process **shall** be offered for processing at the remaining operator's position.

(25) ***[AMHS-TEC-M-4.2.5-(25)]***

The response time of the system for user input via the GUI **shall** be less than 2 sec. even in case of full load.

4.2.6 Monitoring

(1) ***[AMHS-TEC-M-4.2.6-(1)]***

The system **shall** have an interface to the Purchaser's central monitoring system (CMOS) to provide basic status's information about system availability.

(2) ***[AMHS-TEC-M-4.2.6-(2)]***

The interface **shall** be based on SNMPv2 protocol.

(3) ***[AMHS-TEC-M-4.2.6-(3)]***

The system **shall** be compliant with ANNEX 4 SNMP agent requirements specification.

(4) ***[AMHS-TEC-M-4.2.6-(4)]***

The Central Monitoring System **shall** be informed of all operationally relevant changes in the status of the switch equipment.

(5) ***[AMHS-TEC-M-4.2.6-(5)]***

The interface **shall** be available and its functionality shall be demonstrated by the Tenderer during acceptance test.

(6) ***[AMHS-TEC-M-4.2.6-(6)]***

The system **shall** allow connection of Purchaser's Central Monitoring System via IP.

(7) ***[AMHS-TEC-M-4.2.6-(7)]***

The system **shall** allow configuring the IP addresses where to send the SNMP traps.

(8) ***[AMHS-TEC-M-4.2.6-(8)]***

The system **shall** allow configuring whether the generated alerts shall be forwarded as SNMP traps to a set of IP addresses.

(9) ***[AMHS-TEC-M-4.2.6-(9)]***

The system **shall** have defined and implemented a MIB.

(10) ***[AMHS-TEC-M-4.2.6-(10)]***

The Tenderer **shall** provide detailed description of the MIB.

(11) ***[AMHS-TEC-M-4.2.6-(11)]***

The MIB **shall** contain the current status of all the application elements / components and the activity status (number of messages in each queue, number of errors with a remote partner, etc).

(12) ***[AMHS-TEC-M-4.2.6-(12)]***

The MIB **shall** also contain the current information related to HW and Operating System.

(13) ***[AMHS-TEC-M-4.2.6-(13)]***

Furthermore the system **shall** send a SNMP trap when:

- A message is received in working operator position (predefined by administrator)
- A message is waiting in the Destination queue (Destination queues predefined by administrator)
- An adjacent COM centre is unavailable/available

(14) ***[AMHS-TEC-M-4.2.6-(14)]***

All events **shall** be indicated online to the operator and logged in an appropriate event log.

(15) ***[AMHS-TEC-M-4.2.6-(15)]***

An event **shall** provide the following information:

- date and time of event generation,
- event type (e.g. "Routing", "Software Exception", "Command" etc.).

(16) ***[AMHS-TEC-M-4.2.6-(16)]***

Additional Event type-specific information **shall** be provided that shows the

- object concerned (e.g. a circuit),
- software module that issued the event,
- name of the operator who entered a command,
- event text (comprehensive and clear description).

(17) ***[AMHS-TEC-M-4.2.6-(17)]***

It **shall** be possible to retrieve events from the event log using at least the following message selection criteria and any combinations of them (i.e. by means of Boolean expressions)

- date and time range,
- event type(s),
- object,
- software module,
- operator name,
- event text parts (including wildcard search).

(18) ***[AMHS-TEC-M-4.2.6-(18)]***

It **shall** be possible to associate a specific alarm with an event.

(19) ***[AMHS-TEC-M-4.2.6-(19)]***

The type of alarm (visual, acoustical) **shall** be configurable.

(20) ***[AMHS-TEC-M-4.2.6-(20)]***

Individual configuration as well as activation and deactivation of alarms **shall** be provided.

(21) ***[AMHS-TEC-M-4.2.6-(21)]***

Only alarms for which the operator has been declared responsible **shall** be indicated to the operator.

(22) ***[AMHS-TEC-M-4.2.6-(22)]***

It **shall** be possible to manually acknowledge alarms and to remove the corresponding alarm indication.

(23) ***[AMHS-TEC-M-4.2.6-(23)]***

It **shall** be possible to associate with an alarm a revoking event which allows to acknowledge the alarm automatically (e.g. for a “circuit disconnect” event the “circuit connect” event.

(24) ***[AMHS-TEC-M-4.2.6-(24)]***

It **shall** be possible to define alarm revoking function/filter, in case of continuous repetitive alarms. First defined count of alarms in defined time period must be acknowledged manually by operator, another continuous repetitive alarms will be only logged and acknowledged automatically.

(25) ***[AMHS-TEC-M-4.2.6-(25)]***

An acoustical alarm **shall** sound directly at the corresponding operator position.

(26) ***[AMHS-TEC-M-4.2.6-(26)]***

A visual alarm **shall** be presented on the operator position in a way that attracts attention.

(27) ***[AMHS-TEC-M-4.2.6-(27)]***

It **shall** be possible to execute a script with each event in order to activate an external alarm system (e.g. to call a pager or to issue an SMS).

(28) ***[AMHS-TEC-M-4.2.6-(28)]***

It **shall** be possible to generate an AFTN message with each event in order to attract attention of a remote operator

(29) ***[AMHS-TEC-M-4.2.6-(29)]***

It **shall** be possible to assign to each event an event printer for automatic printout of the event.

(30) ***[AMHS-TEC-M-4.2.6-(30)]***

The system **shall** provide an interface for exporting the event log in a human-readable format.

4.2.6.1 Fault and Error Handling

(1) ***[AMHS-TEC-M-4.2.6.1-(1)]***

The system **shall** implement continuous supervision of the health state of all system components.

(2) ***[AMHS-TEC-M-4.2.6.1-(2)]***

The system **shall** implement fault and error management and **shall** log all faults and errors in an appropriate log.

(3) ***[AMHS-TEC-M-4.2.6.1-(3)]***

This log **shall** be created every day and stored to separate files with easily findable identification.

(4) ***[AMHS-TEC-M-4.2.6.1-(4)]***

This log **shall** comprise a configurable period of time (not less than one month).

(5) ***[AMHS-TEC-M-4.2.6.1-(5)]***

The system **shall** be able to automatically switchover or re-assign resources upon detection of a fault.

(6) ***[AMHS-TEC-M-4.2.6.1-(6)]***

The system **shall** be able to perform automatic re-initialization (e.g. reboot of the affected system components) upon detection of a fault.

(7) ***[AMHS-TEC-M-4.2.6.1-(7)]***

A complete re-initialization (e.g. after power failure) **shall** not take longer than 10 (ten) minutes

4.2.7 Message handling

(1) ***[AMHS-TEC-M-4.2.7-(1)]***

Messages **shall** be recorded completely when entering and when leaving the system.

(2) ***[AMHS-TEC-M-4.2.7-(2)]***

The record **shall** be held for at least 31 days, during which period the message must be retrievable and this period can be changed by system administrator.

(3) ***[AMHS-TEC-M-4.2.7-(3)]***

On-line retrieval **shall** be possible during the period of 48 hours following recording.

(4) ***[AMHS-TEC-M-4.2.7-(4)]***

Retrieval of stored messages **shall** be possible on the following keys, either on a single key or on a combination of keys :

- Input and Output Transmission Identification (TID),
- Channel Identification (CID) and time slice,
- Origin line,
- Origin Indicator and time slice,
- String of characters inside the message text,
- Time slice.
- Other ..

(5) ***[AMHS-TEC-M-4.2.7-(5)]***

It **shall** be possible to store the messages in case the delivery is not possible.

(6) ***[AMHS-TEC-M-4.2.7-(6)]***

Pending message transactions **shall** not get lost.

(7) ***[AMHS-TEC-M-4.2.7-(7)]***

It **shall** be configurable whether a re-initialization is performed or not and with or without traffic recovery (pending message transactions).

(8) ***[AMHS-TEC-M-4.2.7-(8)]***

It **shall** be possible to show the list of messages that are in store for this purpose and also to display the contents.

(9) ***[AMHS-TEC-M-4.2.7-(9)]***

It **shall** be possible to direct messages from this list to alternate destinations for delivery.

(10) ***[AMHS-TEC-M-4.2.7-(10)]***

The system **shall** conform with and be able to communicate using:

- POP3 defined by RFC 1939, RFC 2449 and RFC 1734
- IMAP defined by RFC 3501
- SMTP defined by RFC 2821

and its SSL versions

- POP3s defined by RFC 2595
- IMAPs defined by RFC 2595
- SMTPs defined by RFC 3207

4.2.7.1 ADQ regulation

In 2010 there was introduced commission regulation (EU) No. 73/2010 laying down requirements on the quality of aeronautical data and aeronautical information for the single European sky [13] – known as ADQ regulation. System will be used, among others, for transmission of messages that are part of Integrated Aeronautical Information Package (hereinafter IAIP) (for example NOTAM, SNOWTAM, PIB in text format, etc.). IAIP is controlled by the aforementioned regulation No. 73/2010.

(1) ***[AMHS-TEC-M-4.2.7.1-(1)]***

System **shall** be compliant and in accordance with the commission regulation (EU) No. 73/2010 [13]

4.2.8 Message correction

4.2.8.1 AFTN Messages

(1) ***[AMHS-TEC-M-4.2.8-(1)]***

AFTN messages originating from national subscribers **shall** be checked for correct AFTN format before their conversion to AMHS messages or before transmission to national terminals or systems.

(2) ***[AMHS-TEC-M-4.2.8-(2)]***

AFTN messages received through the AMHS network **shall** be checked for correct format before further national distribution.

(3) ***[AMHS-TEC-M-4.2.8-(3)]***

In both cases AFTN messages not being correct **shall** be delivered to the operator's positions for correction, with an indication of the message identification characteristics and of the shortcomings detected.

(4) ***[AMHS-TEC-M-4.2.8-(4)]***

The operator **shall** be able to correct the message and initiate further transmission or to request repetition of the message from either the originator or the previous relay station.

(5) ***[AMHS-TEC-M-4.2.8-(5)]***

It **shall** be possible to display the message in the complete AFTN format including "invisible characters".

(6) ***[AMHS-TEC-M-4.2.8-(6)]***

It **shall** be possible to drop the message.

(7) ***[AMHS-TEC-M-4.2.8-(7)]***

The system **shall** be able to distribute messages using one routing indicator to many subscribers.

(8) ***[AMHS-TEC-M-4.2.8-(8)]***

Collective routing indicator is an AFTN address which leads to a multiple transmission of the message to different AFTN addresses. The system **shall** be able to handle 500 and/or more (five hundred and more) different collective routing indicators.

(9) ***[AMHS-TEC-M-4.2.8-(9)]***

Multi-destination routing indicator is an AFTN address which leads to a multiple transmission of the message to different destinations. The system **shall** be able to handle 500 and/or more (five hundred and/or more) different multi-destination routing indicators.

(10) ***[AMHS-TEC-M-4.2.8-(10)]***

The message as received **shall** be stored (logged) and be available for comparison with the corrected message.

(11) ***[AMHS-TEC-M-4.2.8-(11)]***

Each message in the correction position **shall** :

- be recorded even being dropped and available for retrieval.
- contain information about further procession of the message (deletion, correction and resending)

4.2.8.2 AMHS Messages

(1) ***[AMHS-TEC-M-4.2.8.2-(1)]***

Message correction of AMHS messages **shall** be in principle similar to message correction of the AFTN messages.

4.2.8.3 Routing

For the services (AFTN, and AMHS) concerned, the routing is made according to predefined routing tables. Each service/network has its own tables.

(1) ***[AMHS-TEC-M-4.2.8.3-(1)]***

The tables containing the routing information **shall** be inserted locally at the operator's position.

A route is deemed to be declared not available if no acknowledge is received after N attempts. (N is a parameter value in the range from 1 to 10 but initially set at 5).

4.2.9 Message Logging, Retrieval and Tracing

Message retrieval in general is performed for two purposes:

- The first purpose is the repetition of messages that are not correctly delivered or are missing by the receiver. In this case, the receiver may transmit an AFTN Service message asking for repetition of the traffic.

- The second purpose is the so-called legal recording where the information is required to solve problems and occurrences to which the stored messages are related.

(1) ***[AMHS-TEC-M-4.2.9-(1)]***

The system **shall** support the requirements of message logging and retrieval for the purpose of Legal Recording and Investigation as specified in ICAO Annex 10 Volume II and ATN SARPs.

(2) ***[AMHS-TEC-M-4.2.9-(2)]***

The system **shal**l log the complete message text of each message as received by the system. This also applies to AMHS/X.400 messages received by the system.

(3) ***[AMHS-TEC-M-4.2.9-(3)]***

However, in order to be able to cope with possible future increase of AMHS/X.400 message size, it **shall** be possible to limit the size of the logged AMHS/X.400 message text by means of a configuration parameter (i.e. only the leading n bytes of the message text are to be logged).

(4) ***[AMHS-TEC-M-4.2.9-(4)]***

The message log **shall** provide a journal containing information on whether given messages and/or addressees of the messages were paused and/or diverted in the course of message processing.

(5) ***[AMHS-TEC-M-4.2.9-(5)]***

If several pausing or diversion operations were applied to a given message or its addressees the message log **shall** provide an operation history up to a reasonable depth (i.e. only the last n operations are logged).

(6) ***[AMHS-TEC-M-4.2.9-(6)]***

It **shall** be possible to retrieve messages from the message log using at least the following message selection criteria and any combinations of them (by means of the Boolean expressions "and", "or", "not"):

- incoming AFTN and AMHS/X.400 circuits,
- outgoing AFTN and AMHS/X.400 circuits,
- AFTN channel identifier in/out,
- AFTN channel sequence number in/out,
- AFTN and AMHS/X.400 priority,
- AFTN and AMHS/X.400 addressees,
- AFTN filing time,
- AFTN and AMHS/X.400 originator,
- AFTN Message text patterns (including wildcard search), it shall be possible to configure more than one text pattern and combine them by Boolean expressions ("and", "or", "not")
- AFTN Message category (configurable text patterns, which are searched within the first 16 characters of the AFTN message text), it shall be possible to configure several categories and combine them by Boolean expressions ("and", "or", "not")

(7) ***[AMHS-TEC-M-4.2.9-(7)]***

It **shall** be possible to trace the message flow (journal) of all messages processed by the system. For instance, starting with a given message received by the system, it must be possible to perform an immediate forward trace to all resulting messages transmitted by the system. This applies in particular to messages transported through the AFTN/AMHS

gateway. In particular, it shall be possible to trace directly from AMHS/X.400 messages received to the resulting AFTN messages transmitted and vice versa.

(8) ***[AMHS-TEC-M-4.2.9-(8)]***

The message log **shall** contain messages for a configurable period of not less than one month.

(9) ***[AMHS-TEC-M-4.2.9-(9)]***

The maximum period **shall** not be limited by the software and only be constrained by configuration or available system resources.

(10) ***[AMHS-TEC-M-4.2.9-(10)]***

The system **shall** use as default non-case sensitive filtering with option to use case sensitive filtering criteria.

4.2.9.1 Message Repetition

(1) ***[AMHS-TEC-M-4.2.9.1-(1)]***

The system **shall** provide means to repeat AFTN and AMHS messages from the message log. It shall be possible to select messages for repetition using the same message selection criteria and combinations as detailed in section 4.2.9 .

(2) ***[AMHS-TEC-M-4.2.9.1-(2)]***

It **shall** be possible to repeat messages to their original destinations (i.e. to the same communication partners as the messages were transmitted to before) and to reroute the messages (i.e. to input the messages into the routing process again).

(3) ***[AMHS-TEC-M-4.2.9.1-(3)]***

In order to protect communication partners from overload, the system **shall** enable the operator to control the message repetition load (e.g. by enabling the operator to issue the repetition of bulks of messages).

4.2.9.2 Message Queues

(1) ***[AMHS-TEC-M-4.2.9.2-(1)]***

The system **shall** maintain message queues for AFTN and AMHS/X.400 circuits:

- for "pending" outgoing messages, which wait for transmission,
- for "paused" outgoing messages, which are intentionally blocked in the message queue,
- for "oversized" outgoing messages, which cannot be transmitted because their length exceeds the allowed limit (only applicable for AFTN circuits),
- for "misrouted" outgoing messages, which cannot be transmitted because they are misrouted (source = destination) (only applicable for AFTN circuits),
- for "non-routable" outgoing messages, which have no valid route (only applicable for AFTN messages).

(2) ***[AMHS-TEC-M-4.2.9.2-(2)]***

For "pending", "paused", "oversized", and "misrouted" messages, the system **shall** provide separate message queues for each circuit.

(3) ***[AMHS-TEC-M-4.2.9.2-(3)]***

It **shall** be possible to inspect the message queues separately. After selection of a given message queue, the system shall display the messages contained in the message queue in an appropriate way.

(4) ***[AMHS-TEC-M-4.2.9.2-(4)]***

It **shall** be possible to display messages contained in a circuit-specific message queue depending on their processing state ("pending", "paused", "oversized", "misrouted").

(5) ***[AMHS-TEC-M-4.2.9.2-(5)]***

It **shall** be possible to select messages contained in a message queue using the same message selection criteria and combinations as detailed in section 4.2.9 . Criteria listed in 4.2.9 which are not applicable on queued messages (e.g. AFTN channel sequence number out) are not applicable for this requirement.

(6) ***[AMHS-TEC-M-4.2.9.2-(6)]***

It **shall** be possible to apply the following functions on selected messages contained in a message queue:

- diversion to a different communication partner (only AFTN),
- de-blocking of paused messages,
- discarding (regular termination of the message transaction by operator intervention),
- performing non-delivery (AMHS only),
- reprocessing/rerouting (i.e. input the messages into the routing process again),
- tracing backwards.

(7) ***[AMHS-TEC-M-4.2.9.2-(7)]***

The system **shall** provide means to configure message queue thresholds in terms of "number of messages in a message queue" and message overdue times. Message overdue times shall be configurable per AFTN or AMHS/X.400 message priority (e.g. message overdue time "10 minutes" for AMHS/X.400 message priority "urgent"). When message queue thresholds are exceeded or message overdue times are expired the system shall inform the operator about the corresponding message queue(s) by alarms.

4.2.9.3 Message Submission and Delivery

(1) ***[AMHS-TEC-M-4.2.9.3-(1)]***

The system **shall** provide an internal AFTN message creation facility (AFTN message composer) with the following features:

- menu-driven input of AFTN header (up to 21 addresses, priority, optional heading information) and message text;
- online checking mechanisms, e.g. the input of not allowed characters or character sequences shall not be possible;
- online indication of message text length;
- full syntactical message check in advance of submission

(2) ***[AMHS-TEC-M-4.2.9.3-(2)]***

The system **shall** provide an internal AMHS message creation facility (AMHS user agent) with the following features:

- menu-driven input of the elements of an AMHS ATS message fully compatible with ICAO ATN SARPs message profiles AMH21,
- online checking mechanisms, e.g. the input of not allowed characters or character sequences, shall not be possible,
- address book support,
- probes,
- full syntactical message check in advance of submission

(3) ***[AMHS-TEC-M-4.2.9.3-(3)]***

It **shall** be possible to store the input (AFTN and AMHS) under a freely definable name (template) for later reuse. Several templates shall be possible.

(4) ***[AMHS-TEC-M-4.2.9.3-(4)]***

Mailboxes **shall** be directly visible and shall indicate the number of pending messages.

(5) ***[AMHS-TEC-M-4.2.9.3-(5)]***

It **shall** be possible to configure mailboxes with visible and audible alarm attributes. It shall be possible to assign different colours to the different severity of alarms.

(6) ***[AMHS-TEC-M-4.2.9.3-(6)]***

It **shall** be possible to use mailboxes (like circuits) as destinations in the AFTN and X.400 routing tables.

(7) ***[AMHS-TEC-M-4.2.9.3-(7)]***

It **shall** be possible to directly access mailboxes for inspection (message viewer).

(8) ***[AMHS-TEC-M-4.2.9.3-(8)]***

It **shall** be possible to load a message from a mailbox into the internal AFTN message composer or AMHS user agent for further processing.

(9) ***[AMHS-TEC-M-4.2.9.3-(9)]***

It **shall** be possible to generate a reply message out of a mailbox message (destination address = originator).

4.2.9.4 AFTN Messages

(1) ***[AMHS-TEC-M-4.2.9.4-(1)]***

Retrieved messages **shall** be shown to the operator initiating the request for retrieval.

(2) ***[AMHS-TEC-M-4.2.9.4-(2)]***

The operator **shall** be able to re-transmit the message or to modify the message and transmit it after modification

(3) ***[AMHS-TEC-M-4.2.9.4-(3)]***

Retrieved messages **shall** be re-transmitted directly to one or more specified directions or positions.

4.2.9.5 AMHS messages

(1) ***[AMHS-TEC-M-4.2.9.5-(1)]***

Retrieval of stored AMHS messages **shall** be in principle similar to retrieval of the AFTN messages.

4.2.10 Statistic and archiving

(1) ***[AMHS-TEC-M-4.2.10-(1)]***

The System **shall** produce AFTN /AMHS statistics. Statistics are to be stored and retained for further investigation and evaluation.

(2) ***[AMHS-TEC-M-4.2.10-(2)]***

The statistics information **shall** be copied periodically to a backup online/offline memory device for legal storage.

(3) ***[AMHS-TEC-M-4.2.10-(3)]***

The production of statistics reports **shall** be possible as an off line function of the system.

(4) ***[AMHS-TEC-M-4.2.10-(4)]***

The processing of the statistical information and the generation and format of the statistical reports **shall** be subject of agreement. The reports will have to contain the aforementioned values.

(5) ***[AMHS-TEC-M-4.2.10-(5)]***

For the production of statistics reports, it **shall** be possible to read the information from the online/offline memory device.

(6) ***[AMHS-TEC-M-4.2.10-(6)]***

The system **shall** be able to provide information regarding the following message flow statistics:

- number of received messages,
- number of sent messages,
- number of queuing messages,
- number of corrected messages,
- number of SVC messages.

(7) ***[AMHS-TEC-D-4.2.10-(7)]***

The system **should** be able to organize the above data according to channels (circuits) and priority, in an hourly, daily, monthly, semi-annual, annual, and peak-time breakdown.

(8) ***[AMHS-TEC-D-4.2.10-(8)]***

The system **should** be able to display and filter statistical data according to the classification chosen by the operator, and to summarize filtered data:

- Summary for a chosen group of channels,
- Summary for a chosen group of data.

(9) ***[AMHS-TEC-M-4.2.10-(9)]***

The system **shall** be able to export such data in a table format that allows further use of the data.

(10) ***[AMHS-TEC-D-4.2.10-(10)]***

The system **should** be able to display the average and maximum waiting time of messages summed up.

(11) ***[AMHS-TEC-M-4.2.10-(11)]***

The system **shall** be able to analyse message flow according to the following criteria:

- Average length of messages,
- Maximum length of messages,
- Average number of repeated (recalled) messages,
- Maximum number of repeated (recalled) messages.

(12) ***[AMHS-TEC-M-4.2.10-(12)]***

According the criteria above at least these statistic indicators **shall** be provided:

Monthly statistic indicators:

- Number of data messages transmitted daily
- Average size of the data messages transmitted daily
- Maximum size of the data messages transmitted daily
- Number of data messages received daily
- Average size of the data messages received daily
- Maximum size of the data messages received daily
- Average number of destination addresses per message transmitted daily

- Average transfer time (AIRAC cycle basis)
- Number of messages rejected daily (if any)
- Overall traffic volume at the level of IP packets (daily total)
- Maximum outage duration of association between MTAs (if any)
- Cumulated outage duration of association between MTAs (if any)

Peak hour statistic indicators:

- Number of data messages transmitted during the peak hour
- Average size of the data messages transmitted during the peak hour
- Maximum size of the data messages transmitted during the peak hour
- Number of data messages received during the peak hour
- Average size of the data messages received during the peak hour
- Maximum size of the data messages received during the peak hour
- Average number of destination addresses per message transmitted during the peak hour
- Average transfer time (peak hour basis)
- Number of messages rejected during the peak hour (if any)
- Overall peak hour traffic volume at the level of IP packets

(13) ***[AMHS-TEC-M-4.2.10-(13)]***

All messagess which pass through the switch, (including system alarms, system commands etc.) **shall** be recorded and held in archive on the switch for period at least 31 days and this period can be changed by administrator. System can not allow setting such period for which the storage capacity is not sufficient. For further archive options please refer see 5.2 (25)

(14) ***[AMHS-TEC-M-4.2.10-(14)]***

System **shall** be able to store this archive on external media (CD, DVD, tapes) and offline archive server. Criteria for storing the archive are:

- Time slice (from, to)
- Type of information to record (messages, alarms, system commands history, others)

4.2.11 AMC Support (ATS Management Centre)

(1) ***[AMHS-TEC-M-4.2.11-(1)]***

The system **shall** allow the import of the AMC Domain lookup-table, XF and/or CAAS table and user lookup table via external medium (CD/DVD, USB stick, etc.)

(2) ***[AMHS-TEC-M-4.2.11-(2)]***

The system **shall** allow to activate the imported data under operator intervention without stopping the system

(3) ***[AMHS-TEC-M-4.2.11-(3)]***

The import function **shall** allow to generate and visualize a log giving all table elements, which are subject to addition/change/removal if the data will be imported and activated

5 TECHNICAL REQUIREMENTS

Purpose of this chapter is to describe in more detail requirements from technical point of view, i.e. requirements regarding operations and maintenance of the system.

5.1 Operation

(1) ***[AMHS-TEC-M-5.1-(1)]***

All delivered equipment **shall** be designed for continuous operation, 24 hours per day and 365 days a year.

(2) ***[AMHS-TEC-M-5.1-(2)]***

The offer **shall** detail the calculation of the system's predicted availability based on the Mean Time Between Failure (MTBF) and the Mean Time to Repair (MTTR) of each system component.

(3) ***[AMHS-TEC-M-5.1-(3)]***

All availability figures **shall** be calculated for the Operational system only.

(4) ***[AMHS-TEC-M-5.1-(4)]***

The predicted as well the measured availability of the system **shall** be at least 99.9%.

(5) ***[AMHS-TEC-D-5.1-(5)]***

The predicted as well the measured availability of the system **should** be greater than 99.9%.

(6) ***[AMHS-TEC-M-5.1-(6)]***

All maintenance operations, including exchange of HW components, **shall** be possible without disruption of service.

(7) ***[AMHS-TEC-M-5.1-(7)]***

The AFTN/AMHS system **shall** support the connection to two redundant mains for increased power redundancy. The two mains provided on-site may be backed by UPS and/or generators.

(8) ***[AMHS-TEC-M-5.1-(8)]***

There **shall** be no single point of failure in the system.

(9) ***[AMHS-TEC-M-5.1-(9)]***

LAN interfaces **shall** be redundantly implemented (dual-homing, net-teaming).

(10) ***[AMHS-TEC-M-5.1-(10)]***

All nodes of the system **shall** be provided with media (e.g. HDD, SSD) in redundant configuration of RAID 1 or 5, with proper monitoring of their function.

(11) ***[AMHS-TEC-M-5.1-0]***

Any equipment to be operated in the vicinity of operators **shall** be quiet (shall not produce noise exceeding 50 dBA at a distance of 1 m to the equipment).

(12) ***[AMHS-TEC-M-5.1-(12)]***

The system hardware components **shall** be new equipment.

5.2 System Design

(1) ***[AMHS-TEC-M-5.2-(1)]***

The system design **shall** be in conformity with the highest professional standards for performance and reliability.

(2) ***[AMHS-TEC-M-5.2-(2)]***

The operating system **shall** be UNIX or Linux based.

(3) ***[AMHS-TEC-M-5.2-(3)]***

The operating system **shall** have full support and service by the operating system manufacturer

(4) ***[AMHS-TEC-M-5.2-(4)]***

The operating system **shall** be supplied as the latest available software version released by manufacturer to ensure the full support can be provided as long as possible

(5) ***[AMHS-TEC-M-5.2-(5)]***

The Linux/UNIX based opearting system **should** run with SELinux function enabled.

(6) ***[AMHS-TEC-D-5.2-(6)]***

The delivered operating system **should** provide at least the following tools:

- bash
- vim
- tcpdump
- ethereal (tethereal) / Wireshark
- C compiler (e.g. gcc)

(7) ***[AMHS-TEC-M-5.2-(7)]***

The Tenderer **shall** describe in details the impact of a switch-over on the traffic transmission/reception and storage in the following cases:

- The switch-over occurs in the middle of the receipt of an incoming message,
- The switch-over occurs one second after a subscriber has transmitted the last character of its message (e.g. IA-5 'ETX' in the case of AFTN),
- The switch-over occurs in the middle of a transmission of one message,
- The switch-over occurs one second after the last character of a message has been transmitted.

(8) ***[AMHS-TEC-M-5.2-(8)]***

The cases described above **shall** be part of the acceptance test procedures.

(9) ***[AMHS-TEC-M-5.2-(9)]***

After a switch-over, all operational functions shall be retained, including those performed under supervision of the part that was switched off.

(10) ***[AMHS-TEC-M-5.2-(10)]***

Access to the AFTN/AMHS configuration (e.g. channels and circuits characteristics) and routing configuration (e.g. AFTN addressee indicators) **shall** be available as if no switch-over has occurred.

(11) ***[AMHS-TEC-M-5.2-(11)]***

The same way, switched traffic prior to the switch-over **shall** be available for retrieval and reprocessing.

(12) ***[AMHS-TEC-M-5.2-(12)]***

A restart after a complete breakdown of the system **shall** automatically take into account the configuration that was valid immediately before the breakdown and ensure correct re-transmission of traffic that was affected by the breakdown.

(13) ***[AMHS-TEC-M-5.2-(13)]***

Care **shall** be taken that the operation of the newly started system is not again affected by the cause of the breakdown.

(14) ***[AMHS-TEC-M-5.2-(14)]***

The Tenderer **shall** describe the impact of a system restart on the operation, that is:

- Time of interruption of operation,
- Impact on the incoming traffic at the moment of the breakdown,
- Impact on the outgoing traffic at the moment of the breakdown.

(15) ***[AMHS-TEC-M-5.2-(15)]***

The Tenderer **shall** describe the impact on operation when a new application software release is to be inserted and started.

(16) ***[AMHS-TEC-M-5.2-(16)]***

These actions **shall** not cause unavailability of provided AFTN, AMHS services for more than 5 (five) minutes. No data loss is acceptable.

(17) ***[AMHS-TEC-M-5.2-(17)]***

The automatic switchover between Oper_A and Oper_B (or vice versa) **shall** not exceed 1 (one) minute and **shall** not occur more than 4 (four) times a year.

(18) ***[AMHS-TEC-M-5.2-(18)]***

Traffic handling in progress at the moment of the switchover **shall** be continued by the system taking over.

(19) ***[AMHS-TEC-M-5.2-(19)]***

The testing system **shall** be able to take over the full operation of the operational system (cold standby) after necessary reconfiguration.

(20) ***[AMHS-TEC-M-5.2-(20)]***

The migration from Test to Operational platform **shall** not exceed 2 hours and **shall** not occur more than once per 5 (five) years.

(21) ***[AMHS-TEC-M-5.2-(21)]***

An adequate training **shall** be provided (if necessary, on regular basis).

(22) ***[AMHS-TEC-M-5.2-(22)]***

The Tenderer **shall** describe contingency procedure of migration from operational system to test system. (e.g. the operational system is destroyed and therefore the entire traffic shall be restored on the test system.)

(23) ***[AMHS-TEC-M-5.2-(23)]***

The contingency procedure **shall** be subject of SAT.

(24) ***[AMHS-TEC-M-5.2-(24)]***

No intervention of system administrator neither hotline support **shall** be required during first approach, i.e. H24 Purchaser's staff **shall** be able to perform the necessary steps after training. Administrator or Hotline support will be contacted when serious problem are being solved.

(25) ***[AMHS-TEC-M-5.2-(25)]***

All processed data **shall** be archived for at least 60 months due to ADQ regulation [13] Chapter II, Article 9. This is referred as an Offline archive.

(26) ***[AMHS-TEC-M-5.2-(26)]***

For this purposes Purchaser's servers (Archive server) **shall** be used.

(27) ***[AMHS-TEC-M-5.2-(27)]***

Access to the Purchaser's Archive servers **shall** be via FTP (sftp) protocol.

5.3 Architecture

5.3.1 Operational system

(1) ***[AMHS-TEC-M-5.3.1-(1)]***

The Operational system **shall** consist of two servers – Server_Oper_A and Server_Oper_B. Server Oper_A and Server_Oper_B will be located in the equipment room CST.

5.3.2 Test system

(1) ***[AMHS-TEC-M-5.3.2-(1)]***

The test system **shall** consist of two servers – Server_Test_A and Server_Test_B.

Server Test_A and Server_Test_B will be located in the equipment room CST.

The test system will be used for testing and training purposes.

5.3.3 Servers

(1) ***[AMHS-TEC-M-5.3.3-(1)]***

The servers **shall** be rack mounted and located in a standard 19" rack.

(2) ***[AMHS-TEC-M-5.3.3-(2)]***

The servers **shall** be mounted into Purchaser's racks.

(3) ***[AMHS-TEC-M-5.3.3-(3)]***

All 4 (four) servers **shall** be accompanied by 2 (two) rack-mounted local KVM switches and two rack-mounted KVM consoles (keyboard, mouse, at least 20" LCD monitor) (one will be used immediately, second used as a spare/backup – may be used in the future if system architecture will be changed and diversified

(4) ***[AMHS-TEC-D-5.3.3-(4)]***

A local console **should** be in the form of a 19" tray inside the system rack.

(5) ***[AMHS-TEC-D-5.3.3-(5)]***

The operator's positions **should** access the servers directly via application (data transfer over IP network) or via X.11 wrapped in ssh.

Note: This will allow to the Purchaser's staff to open more sessions from different PCs at a time.

(6) ***[AMHS-TEC-M-5.3.3-(6)]***

Number of operator's positions simultaneous sessions **shall** be ≥ 8.

(7) ***[AMHS-TEC-M-5.3.3-(7)(7)]***

Performance of the servers **shall** cope with at least 6 CMOS simultaneous SNMP sessions without any impact on operational status of the system.

5.3.4 Printers

(1) ***[AMHS-TEC-M-5.3.4-(1)]***

The delivered printers **shall** be able to print in quality required by the system.

(2) ***[AMHS-TEC-M-5.3.4-(2)]***

Minimal functional and performance characteristics **shall** comply to:

- Black/White Laser Jet printer
- Automatic duplexer for double-sided printing
- Print speed ≥ 15 ppm (average A4 page)
- First page finished in less than 15sec after sending a document to the printer
- Minimal resolution 600x600dpi
- Feeder tray(s) capacity ≥ 500 sheets
- Memory ≥ 32MB, extendible through industry-standard DIMM slots
- Interfaces – 1) 10/100Base-TX and 2) IEEE1284-compliant parallel or USB
- Duty cycle ≥ 50000 pages

(3) ***[AMHS-TEC-D-5.3.4-(3)]***

The delivered printers **should** be HP type.

5.4 Protocols and Interfaces

5.4.1 Connections of Operator's Positions

(1) ***[AMHS-TEC-M-5.4.1-(1)]***

The tenderer **shall** propose sufficient speed/duplex for the data exchange between Operator's position and system in order to achieve acceptable response time.

5.4.2 Connection with subscribers

Types of subscribers are:

- AFTN terminals over TCP/IP
- AFTN over TCIP/IP integrated in ATM systems
- AMHS UA over TCP/IP
- AMHS UA over TCP/IP integrated in ATM systems

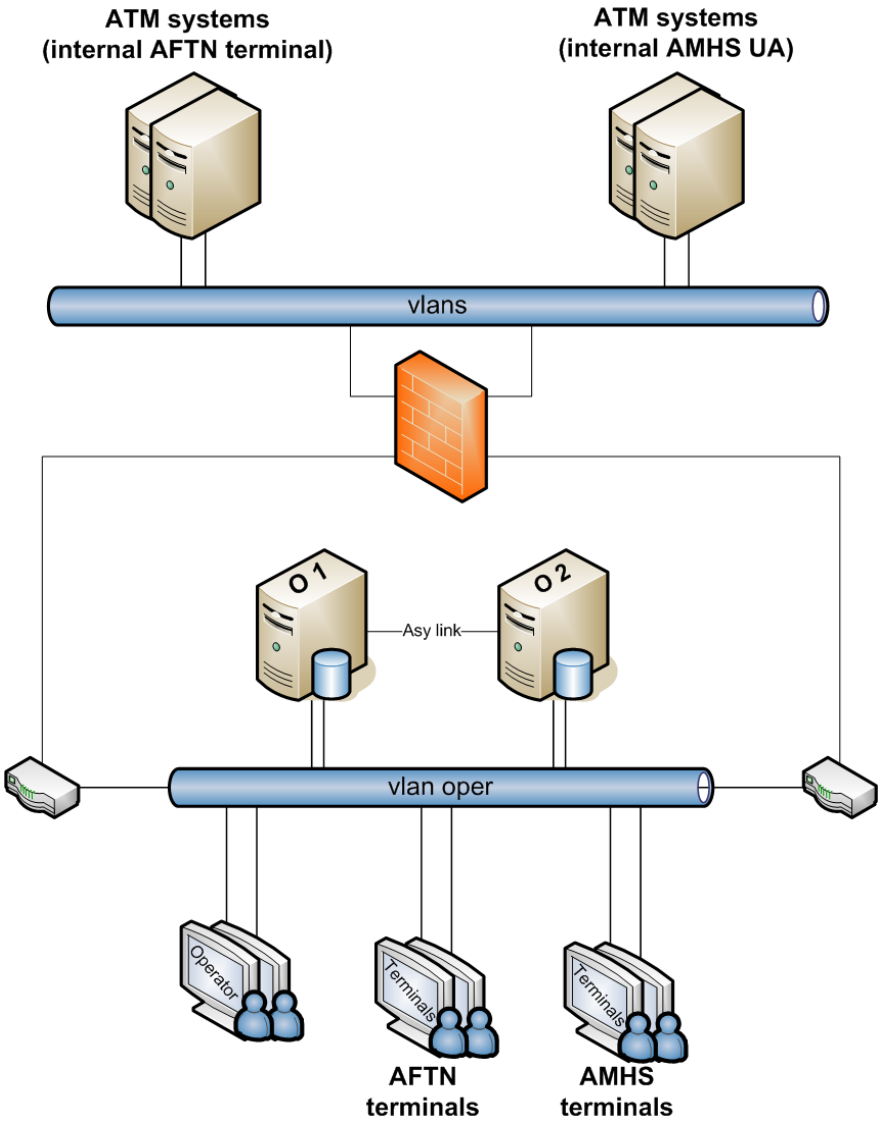

Figure 3 – Connection with subscribers

(1) ***[AMHS-TEC-M-5.4.2-(1)]***

All subscribers using TCP/IP **shall** be connected to the system via CADIN-IP network using IPv4 / IPv6 services.

5.5 Performance

(1) ***[AMHS-TEC-M-5.5-(1)]***

The system **shall** have the capacity to switch 100,000 messages (25000 incoming + 75000 outgoing) per day with provision for 50 percent growth.

(2) ***[AMHS-TEC-M-5.5-(2)]***

The traffic for the peak hour **shall** be 10 % (7500) of the daily total.

(3) ***[AMHS-TEC-M-5.5-(3)]***

The traffic for the peak 5 minutes **shall** be 25% (1875) of the peak hour.

(4) ***[AMHS-TEC-M-5.5-(4)]***

Message transit time **shall** not exceed 5 seconds during peak loading.

(5) ***[AMHS-TEC-M-5.5-(5)]***

International AFTN traffic **shall** use AMHS interconnections. There will be no international interconnections on AFTN level.

5.6 Time and time synchronization

There are 5 (five) NTP servers available via local IP network. Network gateway is also used as source for NTP signal.

(1) ***[AMHS-TEC-M-5.6-(1)]***

The system **shall** be connected to the Purchaser's Time Reference System or network gateway based on Network Time Protocol version 3 in accordance with RFC1305.

(2) ***[AMHS-TEC-M-5.6-(2)]***

The system **shall** operate with UTC time zone configured as default.

5.7 System security and Remote access

(1) ***[AMHS-TEC-M-5.7-(1)]***

Remote access, including Hotline service, to the system **shall** be based on a secure encrypted connection, at least at the level of ssh protocol version 2.0.

(2) ***[AMHS-TEC-M-5.7-(2)]***

File transfer for remote users, including Hotline service, **shall** be secured, at least at the level of sftp.

(3) ***[AMHS-TEC-M-5.7-(3)]***

Remote access to the system **shall** be available only via Purchaser's systems used specially to provide secure remote access.

(4) ***[AMHS-TEC-M-5.7-(4)]***

The system **shall** support Security Administrator role with access to system log files.

(5) ***[AMHS-TEC-M-5.7-(5)]***

All the logs shall be protected against user/technical administrator modification. Modifications **shall** be allowed but then all attempts of modification **shall** be logged.

(6) ***[AMHS-TEC-M-5.7-(6)]***

System logs (e.g. system state, user authentication, OS errors and warnings etc.) **shall** be duplicated online to an external logging system using syslog protocol and SNMP traps for security auditing purposes.

(7) ***[AMHS-TEC-M-5.7-(7)]***

User access by means of the Operational system tools and functions **shall** be validated by unique personal id/username and password.

(8) ***[AMHS-TEC-D-5.7-(8)]***

Using Radius/RSA servers of the Purchaser for authentication **should** be considered.

(9) ***[AMHS-TEC-D-5.7-(9)]***

Authentication and authorisation of data streams and data flows (e.g. connections) **should** be considered.

(10) ***[AMHS-TEC-D-5.7-(10)]***

Encryption of data streams **should** be considered.

(11) ***[AMHS-TEC-M-5.7-(11)]***

The program code version **shall** be clearly identified by version (not only date of issue), checksum of all binaries, scripts and/or other executable files.

(12) ***[AMHS-TEC-M-5.7-(12)]***

The configuration files **shall** be clearly identified whether the configuration files are used for Operational or Test system.

(13) ***[AMHS-TEC-M-5.7-(13)]***

All servers and workstation **shall** be protected against unauthorized access to its unused devices, such as CDROMs, UBS ports, LAN or CONSOLE ports (e.g. Ethernet port not used shall be disabled)

(14) ***[AMHS-TEC-M-5.7-(14)]***

Access to the I/O devices defined in ***[AMHS-TEC-M-5.7-(13)]*** **shall** be subject to the configuration due to ***[AMHS-TEC-M-4.2.11-(1)]*** request. Technical administrator or Security administrator will be responsible for enabling or disabling the I/O devices.

5.8 Purchaser's Network environment (CADIN-IP)

The new system will use the following IP network infrastructure:

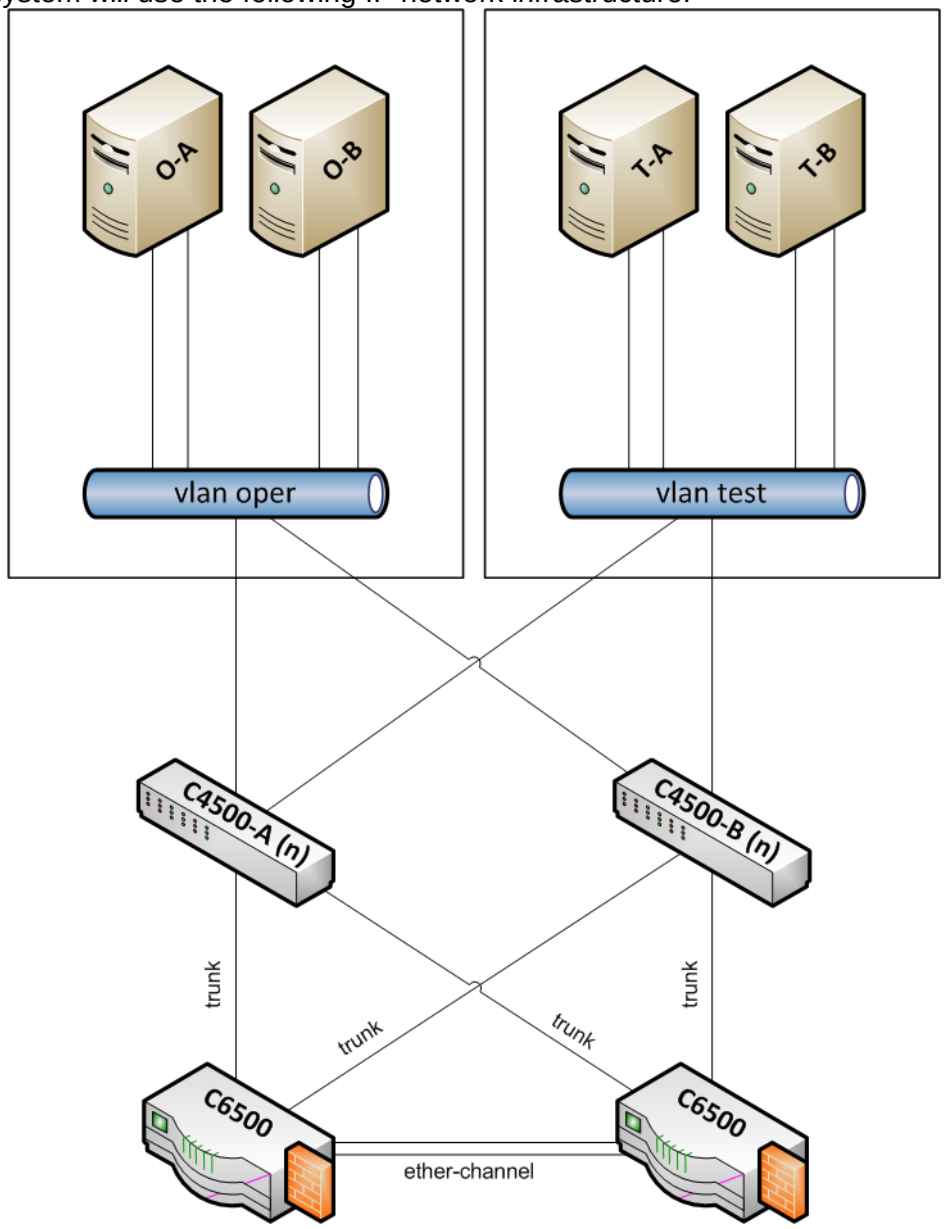

Figure 4 –Purchaser's LAN IP network

CADIN-IP network is based on Cisco Catalyst switches series and Cisco routers. CADIN-IP network consists of redundant interconnection of backbone and access switches. Backbone network is established on switches of Cisco Catalyst 6500 series. In the role of access switches the Cisco Catalyst 4500 series are used.
The entire network is designed to provide high available services and connectivity of 10/100/1000 Ethernet.

CADIN-IP network provides the following services:

- L3 interVlan routing
- Hot standby routing protocol (HSRP)
- multicast routing
- packet filtering
- network address translation

Active components of the CADIN IP will be configured in the dual-stack mode supporting both IPv4 and IPv6.

Purchaser will allocate sufficient address blocks (both IPv4 and/or IPv6) by definition of separate VLANs (Oper and Test) with access control lists.

(1) ***[AMHS-TEC-M-0-(1)]***

The offered system **shall** be integrated into the above described environment.

(2) ***[AMHS-TEC-M-0-(2)]***

Supervision and administration of all active network components supporting access level networking **shall** be integral part of the overall CADIN IP supervision and administration system and will be provided by Purchaser staff.

(3) ***[AMHS-TEC-M-0-(3)]***

The system **shall** support both IPv4 and IPv6 (dual stack – it means that system components are able to run IPv4 and IPv6 in parallel over CADIN-IP). CADIN-IP will not support nor address/protocol translation neither tunnelling.

(4) ***[AMHS-TEC-M-0-(4)]***

The Operational system **shall** communicate with Test system only through the Purchaser's firewall

(5) ***[AMHS-TEC-M-0-(5)]***

The Tenderer **shall** deliver detailed access-list rules for communications between cooperative systems, specially TCP/UDP ports and/or service names **shall** be included. Any service is not supported.

(6) ***[AMHS-TEC-M-0-(6)]***

The Operational and Test system **shall not** have access to the internet (e.g. Operational system updates, Antivirus and FW updates (if installed), etc.)

(7) ***[AMHS-TEC-M-0-(7)]***

The Tenderer **shall** present solution how the update function will be implemented.

5.9 Environmental constrains

5.9.1 General

(1) ***[AMHS-TEC-M-5.9.1-(1)]***

The Contractor **shall** be responsible for the delivery, installation and commissioning of all the equipment that is part of the tender.

(2) ***[AMHS-TEC-M-5.9.1-(2)]***

The Contractor **shall** be responsible to remove and dispose of all the wrapping and packaging material.

(3) ***[AMHS-TEC-M-5.9.1-(3)]***

All herein stated requirements **shall** be applied to any component that is part of the delivery or used during installation and testing.

5.9.2 Site Survey

(1) ***[AMHS-TEC-M-5.9.2-(1)]***

The Contractor **shall** perform a site survey prior installation in order to verify the installation conditions.

(2) ***[AMHS-TEC-M-5.9.2-(2)]***

The Contractor **shall** issue a technical installation plan which needs to be approved by the Customer representative 30days prior to installation.

5.9.3 Power supply

(1) ***[AMHS-TEC-M-5.9.3-(1)]***

All electrical equipment **shall** comply with characteristics of the power distribution.

The power supply system in the installation premises provides two independent distribution legs which are fed by central UPS units. The power distribution is of following characteristics:

Voltage	: 230 VAC ± 3%
Frequency	: 50 Hz ± 1%
Circuit breakers	: 10A, 16A (type B characteristics)

5.9.4 Heating, cooling, Air conditioning

(1) ***[AMHS-TEC-M-5.9.4-(1)]***

Equipment cooling **shall** take place by means of convection.

5.9.5 Mechanical Construction

(1) ***[AMHS-TEC-M-5.9.5-(1)]***

The mechanical construction **shall** be of a rugged design to avoid mechanical problems during the whole lifetime of the system.

(2) ***[AMHS-TEC-M-5.9.5-(2)]***

All components **shall** be easily accessible and quickly interchangeable.

5.9.6 Electrical compliance

(1) ***[AMHS-TEC-M-5.9.6-(1)]***

All equipment **shall** comply with EU directives and regulations (directives on electric equipment used in a certain voltage range ("Low Voltage Directive"), on electromagnetic compatibility ("EMC Directive") and applicable regulations on "Single European Sky".

(2) ***[AMHS-TEC-M-5.9.6-(2)]***

All electrical equipment **shall** be compatible with the Czech electrical norms according to ANNEX 1 General Technical Requirements Concerning Electrical Installations in the Czech Republic.

5.10 Components

(1) ***[AMHS-TEC-M-5.10-(1)]***

All hardware to be supplied **shall** be new, off-the-shelf and currently in production.

(2) ***[AMHS-TEC-M-5.10-(2)]***

Due to the technology progress and the expected run-time of the project, the Contractor **shall** deliver and install the “most recent” available platform from the brand proposed, for the price quoted and with a configuration (processing power, memory, disk capacity, communication adapters, etc) equal or greater than the one in the offer. It is understood by “most recent” the latest model present on the market at the actual FAT date minus the normal delivery time.

(3) ***[AMHS-TEC-M-5.10-(3)]***

The Tenderer **shall** clearly describe the platform configuration (memory size, CPU, number and capacity of disks, number and type of interfaces, CD-ROM, ...)

(4) ***[AMHS-TEC-M-5.10-(4)]***

All delivered keyboards **shall** have standard QWERTY layout.

(5) ***[AMHS-TEC-M-5.10-(5)]***

All delivered monitors **shall** be LCD, at least 20“ with minimum resolution 1600x1080.

ANNEX 1 GENERAL TECHNICAL REQUIREMENTS CONCERNING ELECTRICAL INSTALLATIONS IN THE CZECH REPUBLIC

1. Technical Conditions for the Electrical Installation

a) An isolator transformer (230/24 V, 230/48 V, or equivalent) shall be part of the delivery if any other voltage for monitoring and control than 230V (single-phase with Neutral) is used.

b) Special cables and conductors shall be part of the delivery.

c) Flexible wiring (e.g. cables or wires in tubes or conduits) with a voltage higher than 50 V shall contain an earthing wire. The outer sheath of tubes shall consist of an insulating synthetic material, whereas metallic tubes shall be equipped with an insulating spacer.

d) Mains connection of machines etc. shall be made by means of 3 cable clamps (within the Mains termination box) as follows:
   1 clamp for Phase (brown)
   1 clamp for Earth (yellow-green)
   1 clamp for Neutral (light blue)

e) All machines, etc.. and every separate wiring cabinet, pump etc.. shall further be provided with an external earthing contact.

f) Insulated wires, cables for monitoring and control circuits shall be clearly identified and separated from the mains (operative) circuits.

g) Insulated wires on metallic parts of the control panels shall be separated from this fixing point by an insulating underlayer to prevent mechanical damage to the wire.

h) The passage of wires, cables etc.. through metallic walls shall be by means of humidity resistant (mastic or other product) insulating lead-through materials.

i) The whole electrical installation shall be protected from accidental mechanical damage.

j) If the cable clamps are fixed within the case of the switchboard they shall be protected against human contact by means of an insulating material.

k) The termination box of an installation that is supplied from a low-voltage 3-phase mains shall contain five cable clamps which are marked with idents marked L1, L2, L3 (N, E).

l) Individual conductors of a 4-wire line shall have the following colours:

3 phase conductors: black or brown or 3-phase conductor combination
brown, black.

1 earthing conductor: green-yellow striped

m) Individual conductors of a 5-wire line shall have the following colours:

3 phase conductors: black or brown or grey or 3-phase conductor combination
brown, black, grey.

1 earthing conductor: green-yellow striped

1 neutral conductor: light blue

n) The following colours are stipulated for bus-bars:

- Phase bars: orange with black strips, L1, L2, L3 - 1, 2 or 3 strips at one end of the track.
- Earthing bars: green-yellow stripped.
- Neutral bar: light blue.

o) The colour of the wiring cables of the distribution cabinet shall be black.

p) Mandatory colour for the indicator lamps (signal lamps).

- green indicator: station normal, non operational/shut-down
- white indicator: station in normal operation
- yellow indicator: warning - station in abnormal operation
- red indicator: dangerous or critical situation
- blue indicator: other signals or messages.

q) Mandatory colours of the control buttons:

- button for switch-on green
- button for emergency switch-off: red
- button for switch-off: white

If the same button is used step by step for switch-on and off neither the green nor the red colours shall be used. In that case the black colour is recommended.

2. General Technical and Qualitative Conditions

a) The complete delivery shall be made in accordance with metric units. The scales of any analogue measuring devices shall also be calibrated in the metric system (SI-system).

b) All machines and facilities or parts of them, which are not resistant to corrosion, shall be provided with one basic coat of paint and two protective coatings: the colour shade will be agreed between the supplier and the purchaser later on.

c) All working surfaces shall have a protective coating. The information on a suitable means for removal of that coating shall be supplied two months before the unit assembly.

d) The safety-technical design of all machines shall be conform to Czech standards in principle.

e) All inscriptions on the machines and facilities shall be in the Czech or/and English language.

f) All lubrication points shall be marked with red colour and shall correspond with the names in the lubrication plan.

g) Distributors, control cabinets and control elements (colour of the indicator lights, control buttons, wires) shall correspond to STN 33 22 00 which is equivalent to the standard IEC 204-1-1981.

ANNEX 2 RACKS STANDARDS

Based on www.rittal.com

Network enclosures based on DK-TS8 42U, 600*2000*1000mm/ W*H*D/, RAL 7035, Steel doors perforated

Ord. Code	Name
7821730	Network enclosures DK-TS8 42U 600*2000*1000
7826605	Roof plate for cable entry for TS 600*1000
8601865	Base/Plinth component TS front 600
8601015	Base/Plinth component TS side 1000
7827201	Mounting angles, 482,6mm-19"
7827480	Depth stay for TS
8612090	TS punched section with mounting flange
8800500	Quick-fit baying clamps
7824203	Sheet steel door, vented for DK-TS 600*2000
8800040	Door catches for TS frame
8100235	Side panels, screw-fastened, for 2000*1000
8611070	Comfort handle
2468000	
2469000	Lock and push-button inserts
7063720	Component shelf, 1/2U, depth-variable (optional)
7112000	Cable shunting ring
8601100	Base/plinth baying brackets
7829110	Earth rail incl. cable harness

ANNEX 3 GWDI AFTN MESSAGE SWITCH TCP/IP PROTOCOL FOR MESSAGE EXCHANGE INTERFACE SPECIFICATION

GWDI AFTN Message Switch TCP/IP Protocol for Message Exchange Interface Specification Document (ICD)

Document Number: TCP/IP-ICD-1.2
18 June 2002

PREPARED BY:

GLOBAL WEATHER DYNAMICS, INC.
2400 Garden Road
Monterey, California 93940
U.S.A.

1. General

The GWDI AFTN message switch TCP/IP protocol for message exchange is designed to support the establishment and maintenance of a TCP/IP connection between a remote system and a GWDI AFTN Unified Message Switch (UMS) host system, and the exchange of AFTN formatted messages over that connection. This protocol is designed to be as simple as possible while providing message security and takes advantage of the fact that it is intended to be run over a fast and secure LAN or WAN. It supports a window size of 1 only and does not perform any data corruption checks. The protocol is based on a client-server paradigm where one system is the client or MASTER of the TCP connection and the other system is the connection server or SLAVE. Typically the GWDI UMS host computer system implements the server or SLAVE portion of the connection and the context of this document is written with that perspective. The protocol takes into account that there can be two GWDI UMS host computers: one of the two systems is always running as operational and supports all communication while the other system is either running as a standby or is off-line. The system as standby, or an off-line system will not accept connections. This document describes the various phases of the protocol to include the connect phase, the name exchange phase, the data transfer phase, and connection maintenance phase. In some cases the explanation of the phase may be accompanied by an example of the user data in a TCP frame.

2. TCP Frame User Data Format

byte 1	Type
byte 2	SubType
byte 3	Length1
byte 4	Length2
byte 5	Length3
byte 6	Length4
byte 7	Sequence1
byte 8	Sequence2
byte 9	Data....

Type = Type of frame

1 - Control frame
2 - Data frame

SubType = Subtype indicates the type of control frame

0 - Not Used
1 - Acknowledgment of received data frame
2 - Connection name
3 - Call accepted
4 - NAK
5 - Heartbeat
6 - Heartbeat confirmation

Length = Number of bytes of data (32 bits)
Sequence = Sequence number (16 bits)

Note: The AFTN system expects the length field to be formatted as a 4 byte Internet network integer. The UNIX system calls htonl and ntohs can be used to convert from and to the Internet format.

3. Connect Phase

The MASTER of the TCP connection, which is usually a remote system, is responsible for establishing the connection with the TCP SLAVE, which is usually running on the operational (or primary) UMS AFTN host. Only the primary AFTN system will accept a call request. The remote system must make a call to an agreed upon host address and port number. The port number is preassigned to a TCP SLAVE program executing on the operational UMS AFTN host. The integrator should confirm both the host address(es) and TCP port numbers which may be used to establish the connection. If the call from the MASTER is accepted by the SLAVE then the connection moves to the Name Exchange phase. If it is not accepted the remote system must try to call a predetermined alternate host address. If also the second call fails then the remote system must wait a few seconds (configurable) and repeat the process. (If required, the AFTN can be configured as the master so that it places the call to the remote systems.)

4. Name Exchange Phase

This phase is used to by the TCP SLAVE process on the AFTN host to determine the origin of the incoming call. The remote system (MASTER) must send a control frame which identifies a logical connection defined on the AFTN system. A control frame is a frame with the type field set to 1. The subtype is set to 2 to indicate the frame contains a connection name. The name is a string of ASCII bytes assigned by the AFTN system administrator. The string should be placed in the data section of the frame. The length of the string placed in the length field. The string does not contain a null terminator. This frame is then send to the AFTN host (SLAVE). If the connection name is known to the SLAVE, a call accepted frame will be sent from the AFTN host (SLAVE) to the remote system (MASTER). This control frame contains a subtype of 3 and a length of 0. The connection then proceeds to the data transfer phase. If the name string is unknown then the connection will be closed by the AFTN host.

The following TCP frame example illustrates a control frame sent from the MASTER remote system to the SLAVE AFTN host system identifying a connection named SIG on the SLAVE AFTN system.

MASTER -> SLAVE
Name exchange (name : SIG)

Type	01
Sub Type	02
Length 1	00
Length 2	00
Length 3	00
Length 4	03
Sequence 1	00
Sequence 1	00
Data . . .	53 (S) 49 (I) 47 (G)

The following TCP frame example illustrates the call accept frame sent from the SLAVE to the MASTER. This frame accepts the above frame which identifies the connection SIG.

SLAVE -> MASTER
Name exchange accept

Type	01
Sub Type	03
Length 1	00
Length 2	00
Length 3	00
Length 4	00
Sequence 1	00
Sequence 1	00
Data . . .	

5. Data Transfer Phase

Once a connection is established, the data transfer phase operates in a full duplex mode. Each side can send and receive data independently. To transmit a message, the text of the message is placed within the data section of a frame. No special formatting of the message is required. The message should begin with the priority and end with the last character of the text of the message. The Type of the frame is set to 2 (data frame) and the Subtype set to 0 (Not used). The number of bytes of data (message size excluding the frame header) is written into the length field. The maximum is configurable but AFTN messages usually have a limit of 2100 bytes. The sequence number is inserted and the message is transmitted. The receiver then builds an acknowledgment frame. The type field is set to 1 and the subtype is set to 1. The length is 0 and the sequence number is set to the sequence number of the received data frame. Sequence numbers should start at 0 and be incremented for each message. They will cycle back to 0 once a configurable limit is reached. Once an acknowledgment is received the sender knows the message is safe and can the send the next message. The window size is always 1 so there can be no more than 1 message outstanding at any time. If the sender fails to receive an acknowledgment within a configurable number of seconds it must assume the connection is lost and close the connection. The connection then returns to the connect phase. If the receiver is unable to accept or process a particular message it will send back a NAK. This is a control frame with a subtype of 4. It will contain one byte of data which is the reason for the rejection of the message.

The following two frames illustrate a message being transmitted from the MASTER to the SLAVE, and the acknowledgement response coming back from the SLAVE.

MASTER -> SLAVE
Data transfer

Type	02
Sub Type	00
Length 1	00
Length 2	00
Length 3	00
Length 4	53
Sequence 1	00
Sequence 1	08
Data . . .	SIG008 140146..GG EKCHYFYX..140128 EKCHTEST…TES T MESSAGE FROM MASTER TO SLAV E….

The following frame, transmitted by the SLAVE to the MASTER, illustrates the acknowledgement that the SLAVE received the data in the above message from the MASTER.

SLAVE -> MASTER

Acknowledgement of received data frame

Type	01
Sub Type	01
Length 1	00
Length 2	00
Length 3	00
Length 4	00
Sequence 1	00
Sequence 1	08

This exchange works the same way if the SLAVE sends a message which is acknowledged by the MASTER.

6. Connection maintenance

A heartbeat frame can be used by the AFTN host to protect against a failure of the TCP/IP connection which is not reported back to the application. A heartbeat frame contains a type field of 1 (control frame) and a subtype of 5 (heartbeat). The length and sequence number are set to zero (0). Heartbeats are sent at a configurable interval which is typically every 20 seconds. Once the remote system receives the heartbeat frame it responds with a heartbeat confirmation (type 1, subtype 6) frame. The AFTN and remote system both use an inactivity timer to detect transport failure. If some kind of traffic is not received in a heartbeat interval then the connection is considered lost. The TCP/IP connection is closed and the systems return to the connection phase.

The following frame, transmitted by the SLAVE to the MASTER, illustrates the acknowledgement that the SLAVE received the data in the above message from the MASTER.

SLAVE -> MASTER
Sending Heartbeat

Type	01
Sub Type	05
Length 1	00
Length 2	00
Length 3	00
Length 4	00
Sequence 1	00
Sequence 1	00

The following frame, transmitted by the MASTER to the SLAVE, illustrates the acknowledgement to the heartbeat.

MASTER -> SLAVE
Acknowledgement of heartbeat

Type	01
Sub Type	06
Length 1	00
Length 2	00
Length 3	00
Length 4	00
Sequence 1	00
Sequence 1	00

7. Disconnect Phase

If an acknowledgment is not received within a configurable (seconds) amount of time the connection will be closed. The MASTER system is normally then responsible for reestablishing the connection.

Frame format

byte 1	Type
byte 2	SubType
byte 3	Length1
byte 4	Length2
byte 5	Length3
byte 6	Length4
byte 7	Sequence1
byte 8	Sequence2
byte 9	Data....

Type = Type of frame

1 - Control frame
2 - Data frame

SubType = Subtype indicates the type of control frame

0 - Not Used
1 - Acknowledgment of received data frame
2 - Connection name
3 - Call accepted
4 - NAK
5 - Heartbeat
6 - Heartbeat confirmation

Length = Number of bytes of data (32 bits)

Sequence = Sequence number (16 bits)

Note: The AFTN system expects the length field to be formatted as a 4 byte Internet network integer. The UNIX system calls htonl and ntohs can be used to convert from and to the Internet format.

ANNEX 4 SNMP AGENT REQUIREMENTS SPECIFICATION

1. Acronyms, abbreviations and definitions

ANS CR	Air Navigation Services of the Czech Republic
ASN.1	Abstract Syntax Notation is a standard and flexible notation that describes data structures for representing, encoding, transmitting, and decoding data. It provides a set of formal rules for describing the structure of objects that are independent of machine-specific encoding techniques and is a precise, formal notation that removes ambiguities.
CADIN IP	Czech Aeronautical Data Interchange Network
CMOS	Central Monitoring System
MIB	Management Information Base. A schema, blueprint or roadmap of managed objects in a network.
OID	Object Identifier. In computer networking, an OID, in the context of the Simple Network Management Protocol (SNMP), consists of the object identifier for an object in a Management Information Base (MIB).
SNMP	Simple Network Management Protocol. A communications protocol specifically designed for the monitoring and control of computer networks.

2. System interface

For seamless integration into the CMOS system has to provide SNMP agent version 2C.

As a last resort, if the SNMP agent is not part of the system, the system must provide at least a suitable interface for external control and monitoring system, which should be suitable for creating the SNMP agent. This interface has to be fully documented.

3. Data organization

Data provided by the SNMP agent (its MIB base) must be detailed and adequately described (the best is to use ASN.1 language). Data in MIB agent base should be organized in the logical entities organized by parts of the system. Besides detail description of each subsystem, each part should be described by the scalar (not table) value in MIB database - so called status word. For example suitable could be enumerated type or bit-coded integer value.
Data in MIB base should reflect how the system is built and for each object should be selected as precise types of ASN.1 as possible. It is important to take into account that data in MIB base are used by machine and not by human and therefore each OID with unique and concise name indicate value directly.
If it is possible, it is preferred to keep following convention for the states of monitored variables / subsystem:

- 0 – Unknown
- 1 – OK
- 2 – Warning
- 3 – Alarm
- 4 – Purposely turn off (OK Off)

If any part of system fail or there are no information about it, failing branch should still exist in MIB and its values should be set to appropriate value respectively to ***u***nknown value.
In case of service reconfiguration of system should not be no changes of addresses (OID) for specific values.

The agent should be able to response on request SNMP GET and SNMP GETNEXT in accordance with appropriate documentation of SNMP protocol so, it would be possible to use utility snmpwalk or other application runs as MIB browser for obtaining data.
In case that sources data for CMOS (SNMP agents) are doubled (redundant systems), structure of MIB and values on specific OID should be the same on all redundant servers.
If the system contains more parts either identical or significantly similar it is suitable to represent data in MIB using the table. It is absolutely improper to unfold such table in to the scalar values.
The System must be connected directly or by some proxy part to data net CADIN/IP ANS CR.

4. System monitoring

If MIB base is well designed - system monitoring is sufficient only by pooling status word in MIB base in low frequency. Low frequency status word pooling is important to identify malfunctioning agent. The System CMOS is periodically requests state of values of the monitored system, which are returned in response. Frequency of request is for each system adjustable.

5. System control

Currently CMOS does not use SNMP interface for controlling. CitectSCADA software, which is based and developed on CMOS, does support controlling by SNMP. Controlling system by SNMP agent is absolutely necessary only in case that system does not have its own remote for detail controlling.

6. SNMP agent configuration

The SNMP agent detailed configuration capability is the significant advantage. Part of configuration must be security set-up, especially in case when the agent allows the control. Besides that the part of the configuration should be parameters like agent reaction times, login parameters, etc. The same requirements shall be applied for proprietary system interface, when system does not have SNMP agent.

7. Activities logging

SNMP agent should be capable of the recording of its own activity and data flows if so configured. The same applies for data flow on proprietary interface when the SNMP agent is not a part of the system. The information recorded this way makes integration in the CMOS system more easy and also are useful to trace responsibility when the system functionality is broken.