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AERONAUTICAL TELECOMMUNICATION NETWORK PANEL

WORKING GROUP 1 (System Planning and Concepts)

Joint SubGroup on Systems Management

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Validation Report for ATN Systems Management

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SUMMARY

This is the proposed Validation Report for the ATN Systems Management provisions proposed for ATNP/3. This report presents the results of the validation and implementation programmes that have been undertaken by various States and Organisations, which apply to the Systems Management provisions in Sub-Volume 6 of the ATN Technical Provisions. It summarises the validation results and analyses them against a set of high-level validation objectives (VOs).

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1. INTRODUCTION

1.1 Scope

Since the publication of the first edition of the Manual of Technical Provisions for the Aeronautical Telecommunication Network (ATN) (ICAO Doc. 9705), there has been ongoing work to specify the requirements for ATN Systems Management (SM). The resulting specifications add new functionality, and hence new technical provisions, which need to be validated before publication by ICAO.

The additions have been designed for backwards compatibility and interoperability with the first and second editions of Doc 9705, and this compatibility also needs to be validated.

1.2 Background

The ATN SM provisions have been progressed by WG1/JSG-SM. This section summarises the history of their development and provides traceability between different evolutions of the provisions.

1.2.1 Development of SM Technical Provisions

The recent change history of the ATN SM technical provisions is summarised in the following table.

Table 1.1. ATNP SV6 Change History

Revision	Description	Affected Parts	Date
0.1	Initial outline for SG3 review	All	07/10/97
0.2	Minor updates from WG3/SG3 Toulouse meeting. Presented at WG3-11 Redondo Beach, October 1997	All	24/10/97
1.0	First substantive version. Input to WG3-12, Rio de Janeiro, March 1998	All	March 1998
1.1	Updated working draft incorporating editing instructions from WG3-12. Input to WG3-13, Utrecht, June 1998	All	June 1998
1.2	Updated working draft reflecting discussions of JSG-SM. SARPs and GM split into 2 documents. All Convergent MIB layer MOs moved to Guidance. Input to ATNP WG and JSG/SM meetings, Honolulu, January 1999	All	December 1998
1.3	Post Honolulu. Restructuring to better reflect two CMIP profiles. Fig 6.1-1 from CONOPS.	All	March 1999
1.4	Post Palo Alto and Naples meetings. General recommendations from Fault, Performance, Accounting and Security analysis WPs. Naming from JSG WP12-05 (F Picard). Cross-domain MIB from JSG WP12-04 (S Tamalet).	All	July 1999

Revision	Description	Affected Parts	Date
1.5	Post Toulouse meeting July 99. 6.4 split into two – 6.4 now is only comms profile, new 6.5 is AOM 2x (management functions). Security MOs removed. Application recommendations from WP13-06rev (P Tupitza). AMHS MOs from WP13-10rev (J-M Vacher). XMIB structure revised.	All	August 1999
1.6	Post Toulouse meeting September 99. XMIB structure re-thought. Access control removed from scope. Various updates after JSG review. Profiles renamed. D-START mappings clarified. Input to ATNP WG meetings in Gran Canaria.	Fig 6.1-1, 6.1.5.8, 6.1.5.9, 6.1.6, 6.3.1, 6.3.2, 6.4.1, 6.4.2, 6.4.3, 6.5.1.7, 6.6.1.1, 6.6.2.1, 6.6.3-7, 6.7	September 1999
3_01	Conversion from Word to WordPerfect. Input to JSG-SM meeting in Sterling VA. Updated atnBIS/ES and AMHS XMIB definitions. Numerous editorial updates resulting from ongoing review, GDMO syntax check (by hand) and comments received from Gran Canaria meetings.	All	November 1999
3_02	Output from JSG-SM Sterling meeting. GDMO definitions completed and compiled. XMIB chapter restructured.	6.6	November 1999
3_03	Post-Sterling updates resulting from GDMO compilation results, optionality, and reorganisation of XMIB chapter.	All	November 1999

1.3 Dependencies on External Standards

The SM provisions incorporate by reference a number of standards and profiles produced by accredited international standards bodies. A potential advantage of using ISO/IEC or ITU-T standards is that they are pre-validated, i.e. studied and approved by national standards bodies, implemented and interoperability demonstrated between independent implementations. To benefit from such pre-validation, the validation status of each referenced standard needs to be verified. For each referenced external standard, the following points must be answered:

- What is the status of the standard (committee draft, draft or fully ratified)?
- Do implementations exist?
- Has interoperability been demonstrated?
- Are there any outstanding defect reports?

- Are the references to the standard sufficiently precise (version number, amendments and defect reports included)?

Note.— The international standards and profiles for OSI systems management, which are used as the basis for ATN management, are numerous, and there are many complex cross-references between them. The first list of references is to standards directly referenced by the SV6 provisions. It is then necessary to consider the standards which are in turn referenced from these direct references.

Standards referred to in Sub-Volume 6 are:

ISO/IEC 10040 Information technology – Open Systems Interconnection – Systems Management: Overview

ISO/IEC 9595 CMIS

ISO/IEC 9596-1 CMIP

ISO/IEC 9072-1 ROSE service

ISO/IEC 9072-2 ROSE protocol

ISO/IEC 8649 ACSE service

ISO/IEC 8650 Amd 1 ACSE protocol

ISO/IEC 8822 Presentation service

ISO/IEC 8823-1 Amd 1 Presentation protocol

ISO/IEC 8824 ASN.1 notation

ISO/IEC 8825-1 Basic encoding rules

ISO/IEC 8825-2 ASN.1 Packed Encoding Rules

ISO/IEC 8326 Session service

ISO/IEC 8327 Session protocol

ISO/IEC 10164-4 Information technology – Open Systems Interconnection – Systems Management: Alarm reporting

ISO/IEC 10164-5 Information technology – Open Systems Interconnection – Systems Management: Event Report Management Function

ISO/IEC 10164-6 Information technology – Open Systems Interconnection – Systems management: Log control function

ISO/IEC 10164-7 Information technology – Open Systems Interconnection – Systems management: Security Audit Trail function

ISO/IEC 10165-1 Information technology – Open Systems Interconnection – Structure of management information: Management information model

ISO/IEC 10165-2 Information technology – Open Systems Interconnection – Structure of management information: Definition of management information

ISO/IEC 10165-4 Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects (GDMO)

ISO/IEC 10165-5 Information technology – Open Systems Interconnection – Structure of management information: Generic management information

ISO/IEC 10165-6 Information technology – Open Systems Interconnection – Structure of management information: Requirements and guidelines for implementation conformance statement proformas associated with OSI management

ISO/IEC 10747

ISO/IEC 11588-8 Information technology – Message handling systems (MHS) management: Message Transfer Agent management

ISO/IEC ISP12060-1 Information technology – International Standardised Profiles - OSI Management – Management Functions – Part 1: AOM211 – General management capabilities

ISO/IEC ISP12060-4 Information technology – International Standardised Profiles - OSI Management – Management Functions – Part 4: AOM221 – General event report management

ISO/IEC ISP12060-5 Information technology – International Standardised Profiles - OSI Management – Management Functions – Part 5: AOM231 – General log control

ISO/IEC ISP12060-9 Information technology – International Standardised Profiles - OSI Management – Management Functions – Part 9: AOM24322

ISO/IEC ISP 11183-1 Information technology – International Standardised Profiles AOM1n OSI Management – Management Communications – Part 1: Specification of ACSE, Presentation and Session protocols for the use by ROSE and CMISE

ISO/IEC ISP 11183-2 Information technology – International Standardised Profiles AOM1n OSI Management – Management Communications – Part 2: CMISE/ROSE for AOM12 - Enhanced Management Communications.

ITU-T Recommendation X.500 Directory

ITU-T Recommendation M.3100 TMN: Generic Network Information Model

Standards and profiles referred to indirectly include:

ISO/IEC ISP 12059-0 Information technology – International Standardised Profiles - OSI Management – Common information for Management Functions – Part 0: Common definitions for management function profiles

ISO/IEC 10164-8 Information technology – Open Systems Interconnection – Systems management: Security Alarm Reporting function

ISO/IEC 10164-9 Information technology – Open Systems Interconnection – Systems management: Objects and attributes for access control

1.3.1 ASN.1/PER

The Packed Encoding Rules (ISO 8825-2) are assumed to be stable. It is proposed not to validate this standard any further in this effort.

[Editor's Note.— To be completed for all other referenced standards]

2. HIGH LEVEL VALIDATION OBJECTIVES

At the lowest level of validation, every technical provision clause ("shall" and "should" statement) is validated for correctness, consistency, lack of ambiguity and lack of duplication. This is typically done as an integral stage of implementation. This validation report concentrates instead on high-level validation objectives. Each validation objective is categorised as:

- System Level Validation Objective (SVO), relating to the system level requirements which are based on operational requirements within the ICAO Draft Manual of ATS Data link Applications, or elsewhere.
- Functional Validation Objective (FVO), relating to the functional characteristics described in the Technical Provisions.
- Technical Validation Objective (TVO), relating to the technical details in the Technical Provisions

The following Table lists the high level validation objectives adopted for the ATN Systems Management provisions.

Table 2.1. Validation Objectives

VO	Description
SVO 1	To determine which System Level Requirements are satisfied by the functional descriptions in combination with the user requirements and recommended practices.
SVO 2	To determine if the ATN specifications are mutually consistent and that backwards compatibility is achieved.
FVO 1	To determine if the functional descriptions are compatible with the technical requirements.
FVO 2	To determine if the user requirements and recommended practices are compatible with the technical requirements.
FVO 3	To determine if the technical provisions are complete.
FVO 4	To determine if the technical provisions are unambiguous.
FVO 5	To determine if the technical provisions are consistent.
FVO 6	To determine if there are redundant technical provisions, i.e. requirements which would have no effect if removed. *Note: This VO should be interpreted to mean that there are no requirements that are not necessary for the defined functionality, or to achieve migration to future functionality. It is not meant to eliminate possible duplicated statements of requirement that are known to exist.*
FVO 7	To determine if provision has been made to ensure that the technical provisions are implementation independent.
TVO 1	To determine if the protocol description supports the stated end to end services.
TVO 2	To determine if the protocol description has any unacceptable behaviour
TVO 3	To determine if the abstract service interface parameters are mapped appropriately to PDU fields and/or communication service interface parameters, and vice versa.

VO	Description
TVO 4	To determine if protocol errors in the peer application entity are correctly handled.
TVO 6	To determine if the APDUs are correctly specified.
TVO 7	To determine if provision for QOS management has been addressed.
TVO 8	To determine if provision for future migration has been addressed.
TVO 9	To determine if efficiency requirements have been addressed, e.g. minimising size of data transfer, appropriate maintenance of dialogue.
TVO 10	To determine that the functionality described in the technical provisions is implementable.
TVO 11	To determine that independent implementations built in accordance with the technical provisions will be able to interoperate.

2.1 Grouping of Requirements

For the validation of the ATN SM requirements, the following functional groups of requirements have been identified:

a) "Standard" CMIP profile over ATN ICS

b) "Efficient" CMIP profile over ATN ULCS

c) Recommendations for intra-domain management

d) Security provisions

e) General event and log management

f) Cross-Domain Management Information base (X-MIB)

g) Naming and Addressing

Each of these groupings ("high-level requirements") is made up of an identified set of low-level requirements ("shall" clauses) and recommendations ("should" clauses).

3. VALIDATION MEANS

The following generic means of validation have been identified, and are used in Table 4.1.

a) Two or more independently developed interoperating implementations validated by two or more states/organisations.

b) Two or more independently developing interoperating implementations validated by one state/organisation.

c) One implementation validated by more than one state/organisation.

d) One implementation validated by one state/organisation.

e) Partial implementation validated by one or more state/organisation.

f) Simulation, analysis using tools e.g. ASN.1 compiler, modelling tools.

g) Analysis and inspection.

4. FUNCTIONAL VALIDATION ACHIEVED BY STATES AND ORGANISATIONS

The following table summarises the validation activities that have completed to date. The letters in the table correspond to the validation means given in section 3.

Note.— In the present draft, the matrix is incomplete. It will continue to be updated as the validation programmes listed in section 5 progress.

Table 4.1. Validation Activities Summary

Group	ATNP/WG1/JSG-SM	CENA CHARME	FAA
"Standard" CMIP profile over ATN ICS	g)		
"Efficient" CMIP profile over ATN ULCS	g)	e)	
Recommendations for intra-domain management	g)		
Security provisions	g)		
General event and log management	g)		
Cross-Domain Management Information base (X-MIB)	f)		f)
Naming and Addressing	g)		

5. SUMMARY OF ACTIVITIES SUPPORTING VALIDATION

5.1 Paper Studies

The “Efficient” CMIP profile specified in SV6 is ATN-specific, and does not therefore benefit from the external validation of international standardisation. To offset these concerns, a study was performed by STNA in France to assess the compatibility between the ULCS and the protocol support required by CMIP. It was concluded that:

“There is no objection to the integration of the System Management Application (SMA) within the ICAO-specified ATN Upper Layer Architecture.”

Ref: ATNP/WG1/SG3/WP04-12 System Management Application (SMA) – the Fast MIP Option, F Picard (February 1998)

5.2 Use of Tools by JSG-SM

The ATNP joint subgroup on Systems Management (JSG-SM) made use of a COTS tool when produding the GDMO definition of the Cross-Domain Management Information Base (XMIB). See 5.4.2. for details. This ensured that the GDMO and associated ASN.1 definitions in Sub-Volume 6 are syntactically complete and correct. In fact, section 6.6 (XMIB specification) incorporates the text file generated by the COTS GDMO compiler, and should therefore be capable of being imported directly into similar tools for use in implementation projects.

5.3 CENA CHARME project

The objectives of CHARME are to provide the French DGAC with:

a) an ATN platform for data-link experiments on Package-1 applications,

b) a base for the prototyping of future air/ground data-link applications,

c) an infrastructure for the validation of some of the ATN Package-2 features, with a priority on: security services, naming and addressing extension, system management related to security, and key management mechanisms by CM ASE.

The CHARME developments consist of commercial off the shelf (COTS) products, and CENA-originated components. The COTS components are: the CO Session and Presentation layers, an ASN.1 compiler and associated PER runtime libraries, and the development environment for the CENA components. This COTS environment provides testing and integration facilities, and proved to enable the porting of CHARME components to various hardware platforms and operating systems. CENA developments for CHARME include: the CL Session, Presentation and CO/CL Application layers, together ASEs issued from OSI (CO/CL ACSE/Ed 2, ROSE, CMISE) or ICAO Package-1 specifications (ADS, ADS Report Forwarding, CM, CPDLC, and FIS). APIs are provided for each ASE, and for the Dialogue Service.

CHARME has successfully been integrated with the ProATN air-ground BIS, and an implementation of the ATN Transport Layer. This integration resulted in:

a) a Package-1 connection oriented full ATN stack,

b) a Package-2 connection oriented, and connectionless ATN stack (complete up to the Dialogue service).

The Package-2 stack includes the ATN ASEs, ROSE and CMISE for system management, and the Security ASO for upper-layers security.

CHARME is part of the simulated data-link infrastructure of CENA, which includes:

a) simulated sub-networks (Mode S, AMSS and VDL mode 2) access, real sub-network access (X.25 WAN, LAN) and loop-back facilities.

b) air traffic simulator, cockpit simulator and pseudo-pilot interface,

c) experimental ground control facilities.

The following CHARME developments are completed:

a) a full package 1 connection oriented ATN stack: CO Session and Presentation layers, ACSE and Dialogue control function, together with APIs,

b) CO and CL Session and Presentation layers,

c) ROSE and CMISE ASEs integrated in Package 1 upper-layers.

For CENA's ATN activities, the on-going CHARME developments are:

a) CO/CL package 2 dialogue control function, which should be finished before mid-99,

b) Security ASO for upper-layers security, which should be finished during the third quarter of 99.

Future CHARME activities should address:

a) System management for the management of security,

b) Prototyping activities (X.500),

c) Future ATN applications (e.g. CM server).

5.4 FAA Validation Activities

The FAA currently has two programs underway for the validation of the enhancements to Doc. 9705.

The FAA Technical Center with the assistance of the Mitre Corporation has a project underway to implement and test the security changes. The FAA Technical Center is modifying its ATN router to incorporate the security mechanisms added to Doc. 9705, Sub-Volume 5. This security work will include work in using the ATN directory for the purpose of testing certificate retrieval. Mitre will also be involved in testing the security modifications and in providing assistance in implementing the ATN directory.

The FAA AND-370 organisation has a project underway to modify the previously developed prototype implementations of the applications and ULCS to incorporate the enhancements. These implementations will be available for interoperability testing with other organisations. This validation project is also implementing the ATN directory services for validation purposes. The validation project is also planning to implement the ATN system management enhancements.

The current **Validation Exercise** corresponds to the following validation activities:

- an Analysis case, e.g. document inspection, case study, etc.
- an Experiment with prototype and/or pre-operational systems

This validation activity provides the approved 'applicable' validation methods:

Rigorous prototyping of a limited-scale ATN, a rigorous implementation for detailed validation of protocol requirements and operations, and with the goal of discovery of aspects

of the draft third edition of the Doc 9705 Sub-Volume VI that may lead to implementation difficulties.

5.4.1 Validation Objectives

The FAA ONS validation exercise mainly aims at demonstrating that:

1. the requirements of the third edition of Doc 9705 Sub-Volume VI Cross Domain Management Information Base (XMIB) are implementable,
2. the GDMO definitions provided by Sub-Volume VI are syntactically correct,
3. the containment and inheritance relationships of the Cross Domain Management Information Base are feasible, correct and complete.

5.4.2 Validation Tool Description

SolsticeTM TMN Agent Toolkit 2.0 is the COTS validation tool selected by the FAA. It offers a complete CMIP Development Environment for TMN Agent Development and runtime products like CMIP and OSI. It includes core agent functions and standard methods for agent/managed object communication.

It hides much of the complexity of the XMP, and XOM APIs, and provides core agent functions and standard methods for agent/object communications.

The Solstice TMN Agent Toolkit comprises the following tools

- A GDMO compiler, which generates an agent skeleton. The compiler reads standard GDMO input files, and outputs C-structures and skeleton callback functions that can be linked with the core agent. In case of error, the compiler generates helpful error messages.
- A core agent, which contains a library of functions common to all CMIP agents. These include all CMIP requests (get, set, action, create, delete, cancel-get), scoping and filtering, linked replies, event report generation, and association handling. The core agent manages a MIB, to which it provides synchronous and asynchronous access.

System Requirements

The initial validation activities were completed on a platform including:

- SPARC™ platform with 64 MB of memory minimum.
- Solaris™ 2.5 and 2.5.1 operating environments for SPARC systems.
- CMIP™

5.4.3 Initial Validation Results

5.4.3.1 Validation Period

The validation of the Cross Domain Management Information Base (XMIB) spans a period of 2 months from October through November, 1999.

Within this period, the following activities were accomplished:

1. Selection of the validation tool by the FAA that would best accomplish the validation objections of the project.
2. The importation of the XMIB managed object definitions into the tool.

3. The validation tests of the managed object definitions and containment/inheritance relationships between them.

5.4.3.2 Results

At the time this report is presented to ATNP/3, the FAA validation initiative is in progress, and still planned to be completed by June 2000. A number of experiments remain therefore to be conducted to complete coverage of the high level ATN Validation Objectives. Refer to Future Validation Work below for a high-level description of remaining validation activities.

Completed validation activities include:

1. Syntactic validation of the XMIB GDMO/ASN.1 definitions.
2. Semantic validation of the XMBI GDMO/ASN.1 definitions.
3. Validation of conformant containment relationships between the defined managed objects.

5.4.4 Future Validation Work

Future validation work by the FAA will focus on incorporating the validated XMIB managed objects into ATN agents.

Future validation activities include:

1. Validating the correctness and un-ambiguity of the agent and agent actions.
2. Validating the selected SMFs.
3. Validating the interoperability, across domains, of the ATN agent and Cross Domain Management Information Base.

6. DEFECT REPORT SUMMARY

The table below gives a summary of the defect reports raised during the validation programme.

7. RESULTS AND ANALYSIS

7.1 SVO 1

To determine which System Level Requirements are satisfied by the functional descriptions in combination with the user requirements and recommended practices.

System Level requirements for SM relate to the monitoring and maintenance of the Quality of Service provided to ATSC applications, and as such have a direct bearing on Performance Management. Other system level requirements have been derived from a top-down analysis of requirements for Fault, Performance, Accounting and Security management. As determined by inspection, all the system level requirements relevant to ATN SM are satisfied by the provisions of Sub-Volume 6 as presented. (g)

7.2 SVO 2

To determine if the ATN specifications are mutually consistent and that backwards compatibility is achieved.

There are no back-compatibility issues for the SM protocols, as this is new functionality introduced in SV6. For other requirements, such as CLNP support of ECHO and Error PDUs, care has been taken to ensure compatibility with Doc 9705 Amd 1 provisions. (g)

Study and implementation of the ATN SM service and protocol has ensured that they have been specified in a manner consistent with other ATN application and ULCS specifications. (g, d)

It is noted that care has been taken to minimise the impact of the naming and addressing enhancements on existing implementations. (g, d)

7.3 FVO 1

To determine if the functional descriptions are compatible with the technical requirements.

The functional descriptions in Sub-Volume 6 were directly derived from a top-down analysis of the requirements for Fault, Configuration, Accounting, Performance and Security management functions. Traceability has been maintained from the functional descriptions (which currently reside in the draft Guidance material for SV6) and the technical requirements expressed in the Sub-Volume. In addition, the requirements for ATN performance from ADSP have been used a basis for the top-down analysis of Performance Management. (g)

7.4 FVO 2

To determine if the user requirements and recommended practices are compatible with the technical requirements.

The “User Requirements” correspond to the requirements at the CMISE service boundary. Inspection has shown that all user requirements result in appropriate protocol requirements. (g)

7.5 FVO 3

To determine if the technical provisions are complete.

Test compilation has shown that the XMIB definition is complete.

Reference is made to the ISO-standard CMIP protocol for the “Full CMIP” communications profile, for which numerous COTS implementations exist. Implementation has shown that the FastMIP communications profile is well-specified. (e)

7.6 FVO 4

To determine if the technical provisions are unambiguous.

Test compilation has shown that the XMIB definition is unambiguous.

Implementation has shown that the FastMIP communications profile is well-specified. (e)

7.7 FVO 5

To determine if the technical provisions are consistent.

Test compilation has shown that the XMIB definition is consistent.

Implementation has shown that the FastMIP communications profile is well-specified. (e)

7.8 FVO 6

To determine if there are redundant technical provisions, i.e. requirements which would have no effect if removed.

Note: This VO should be interpreted to mean that there are no requirements that are not necessary for the defined functionality, or to achieve migration to future functionality. It is not meant to eliminate possible duplicated statements of requirement that are known to exist.

(Pending results of implementation projects)

7.9 FVO 7

To determine if provision has been made to ensure that the technical provisions are implementation independent.

(Pending results of implementation projects and interoperability testing)

7.10 TVO 1

To determine if the protocol description supports the stated end to end services.

The CMIP protocol is an ISO standard, which is known to support the CMIS services in numerous COTS implementations.

The ability of the XMIB to support the required cross-domain services is yet to be determined.

7.11 TVO 2

To determine if the protocol description has any unacceptable behaviour

(Pending results of implementation projects and interoperability testing)

7.12 TVO 3

To determine if the abstract service interface parameters are mapped appropriately to PDU fields and/or communication service interface parameters, and vice versa.

The CMIP protocol is an ISO standard, which is known to support the CMIS services in numerous COTS implementations.

7.13 TVO 4

To determine if protocol errors in the peer application entity are correctly handled.

The CMIP protocol is an ISO standard, which is known to support the CMIS services in numerous COTS implementations.

7.14 TVO 6

To determine if the APDUs are correctly specified.

7.15 TVO 7

To determine if provision for QOS management has been addressed.

7.16 TVO 8

To determine if provision for future migration has been addressed.

7.17 TVO 9

To determine if efficiency requirements have been addressed, e.g. minimising size of data transfer, appropriate maintenance of dialogue.

ASN.1 Packed Encoding rules are invoked to minimise the size of data transferred for the Air-Ground profile. The Air-Ground profile also makes use of the Efficiency enhancements provides by the ULCS for the Session, Presentation and ACSE. (g)

7.18 TVO 10

To determine that the functionality described in the technical provisions is implementable.

"Full CMIP" has been implemented in numerous COTS products. The "FastMIP" profile (CMIP encoded in PER over the ULCS Dialogue Service) has been implemented by CENA. The XMIB has been test compiled.

No Manager or Agent implementations have yet been constructed to make use of the XMIB.

7.19 TVO 11

To determine that independent implementations built in accordance with the technical provisions will be able to interoperate.

(Pending results of implementation projects and interoperability testing)

8. CONCLUSIONS

It is concluded that the technical provisions for ATN Systems Management are not yet sufficiently validated for inclusion in ICAO Doc. 9705. However, validation programmes in progress should rectify this situation in the medium term.