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AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL

WG2/21

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Draft SV5 Validation Report

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SUMMARY

The attached paper is an updated version of the SubVolume V Validation Report. It includes the results of the French DGAC Validation Initiative (FRAVI).

The WG2 is invited to finalise this report by incorporating the results of the other Validation Initiatives.

Appendix F

Doc 9705 – Sub-Volume 5

Internet Communications Service

Validation Report

Draft Version 1.2?

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1. Introduction

Introduction

This report details the process employed and results obtained by the ATN Internet SARPs Validation Programmes that have been targeted at contributing towards the validation of the proposed 'Package-2' enhancements to the Internet Communications Service (ICS) technical provisions proposed for incorporation into the third edition of ICAO Doc 9705, Sub-Volume V.

A number of States and Organisations contributed to these validation programmes, namely:

- France – The French DGAC performed edition 3 ICS SARPs Validation Exercises from November 1999 until June 2000. This effort was mainly based on having Package 2 specific functionalities implemented and tested on the DNA End System Lower Layers and Sofréavia/Airtel ATN ProATN router, in order to verify first the correct behaviour of a Package 2 implementation and secondly the backwards compatibility between Package 2 and Package 1 implementations of the ICS SARPs.

- The United States validation efforts performed by FAA William J. Hughes Technical Center with there Aeronautical Data Link Test Bead and by MITRE/CAASD with their Aeronautical Communications Engineering Testbed (ACET)

- *tbd*

As a result of the close co-operation and collaboration between the participants the programmes have proved to be successful highlighting the significant benefits that are achievable through such common initiatives.

The main body of this document presents the consolidated validation results of all Validation Initiatives that have been undertaken within the context of the respective validation programmes which are reported in Attachments E through *tbd*. Attachment A lists the set of WG2 agreed ATN Validation Objectives (AVOs) that have been used to focus the objectives of each of the Validation Initiatives. Attachment B provides high level summary descriptions of each Validation Tools (e.g. experimental systems, analysis work, simulations) employed by the various Validation Initiatives in a common format. Attachment C summarises in table form the coverage of Validation Objectives by Validation Exercises as reported in Attachments E to *tbd*.

With respect to the main body of the document:

- Section 1 provides introductory material, a brief resume of the background to ICS enhancements to the technical provisions (i.e., proposed Doc 9705 third edition of Sub-Volume V) development process including the role of the WG2 and the ATNP Configuration Control Board (CCB), and references to key ATNP/3 related Working Papers.

- Section 2 provides a brief description of the Validation Strategy that has been adopted by WG2 and used as the basis of the Validation Programme. This section includes a definitions section (defining the precise meaning of terms such as Validation Objectives, Validation Exercises, Validation Initiatives etc.), a brief resume of the various validation methods foreseen to be employed within the context of the overall WG2 Validation Strategy, and a description of the role of the ATN Requirements Database.

- Section 3 provides the consolidated validation results of all Validation Initiatives reported in Attachments E through *tbd*. In particular it reports on SARPs text consistency, the coverage of SARPs requirements by the implementations used in the various Validation Initiatives, confidence in SARPs implementations achieving interoperability, ATN

deployment & large scale issues and finally an evaluation of the suitability of ATN characteristics and performance parameters necessary to support operational Air Traffic Management services.

- Section 4 reports on future validation work planned to be performed after the ATNP WGW.

- Section 5 documents the conclusions that have been drawn from the results of the Validation Initiatives that have been produced in terms of whether sufficient confidence has been acquired in order for the third edition of Doc 9705, Sub-Volume V to be recommended for adoption at ATNP/3.

1.1 Background

1.1.1 SARPs Development

The current ATN SARPs and the associated technical provisions for the Internet Communications Service (ICS) were published by ICAO in Amendment 73 to Annex 10 and in the first edition of Doc 9705 respectively. These documents resulted from recommendations reported out of ATNP/2 in November 1996. The configuration control board (CCB) of the ATNP subsequently, in 1999, produced an amendment 1 to Doc 9705 to correct defects found in the original document. This resulted in the 1999 re-publication of Doc 9705 as the second edition. ATNP/2 also tasked working groups with the development of enhancements to the ATN SARPs and technical provisions. WG2 has progressed the draft revisions to the ICS technical provisions through a number of iterations, which have resulted in a draft third edition of Doc 9705 Sub-Volume V. This draft Sub-Volume comprises one significant element of the total set of draft ATN technical provisions, the other elements being concerned with System Level Requirements, Air/Ground Applications, Ground/Ground Applications, Upper Layers, System Management, Directory Services and Security Services.

The draft version of the third edition of Doc 9705 Sub-Volume V was submitted to ICAO in early December 1999 in order to process the material for presentation to ATNP/3 which took place in February 2000.

The final draft version of the third edition of Doc 9705 Sub-Volume V has now been completed and will be presented to the Working Group of the Whole meeting which is scheduled in August 2000.

1.1.2 Change Control Board

The draft third edition of Doc 9705 Sub-Volume V is the result of the evolution of the first and second editions of Doc 9705. The first edition of Doc 9705 was published in 1998 and was subsequently amended and re-published as the second edition in 1999. This second edition of Doc 9705 is the baseline from which the working group has developed the draft third edition of Doc 9705.

It was recognised at ATNP/2 that a process was needed to accept defect reports against the first edition of Doc 9705 and to incorporated any necessary changes to correct agreed upon defects. In order to track reported defects and developed the necessary changes to the baseline first edition of Doc 9705, ATNP/2 created a set of formal procedures that required the operation of a “Change Control Board” (CCB). The CCB subsequently produced Amendment 1 to the first edition of Doc 9705, which has resulted in the re-publication of Doc 9705 as the second edition. The working groups have adopted the second edition of Doc 9705 (i.e., in effect the first edition with the inclusion of the Amendment 1 revisions) as the baseline from which to develop the draft third edition of Doc 9705.

1.2 Scope of the report

This Validation Report refers to the baseline ICS technical provisions which is the English version of the Second Edition of Doc 9705 Sub-Volume V. This report describes the status and results of the validation activities undertaken for the draft third edition of Doc 9705 Sub-Volume as produced by ATNP WG2. Since the draft third edition of Doc 9705 Sub-Volume V was produced as a strike-out and red-line set of changes to the baseline (i.e., English) document, this validation report applies only to the English version of the text.

1.3 References

The Validation activity has generated a set of documentation that has been reviewed within WG2. This section only contains references to ATNP Working Papers made available to Panel members at ATNP WG meetings or at ATNP/3.

Validation Exercises Specification Documents, Configuration Specifications, Detailed Validation Reports are maintained by States and Organisations in charge of Validation Initiatives. They are traceable and referenced in summary reports given in the Attachments to this report.

Ref. No.	Doc. Ref.	Title
1.	ATNP/3-WP-*x*	Proposed Doc 9705 Sub-Volume V, Third edition
2.	ATNP/3-WP-*x*	*tbd*
3.	ATNP/3-WP-*x*	*tbd*

2. Validation Strategy

The strategy employed in the validation of the draft third edition of Doc 9705 Sub-Volume V incorporates a range of techniques, methods, procedures and tools. The strategy aims to ensure the completeness and traceability of the validation process. Each element of the validation strategy contributes towards these aims.

2.1 Definitions

The **Validation Report** (i.e. this document) is the consolidation of all the Detailed Validation Reports produced as the result of **Validation Initiatives.**

A **Validation Initiative** is a particular set of **Validation Exercises** carried out by one or several States/Organisations. Details of methods, specifications, tools, infrastructure and reports are under the responsibility of these States/Organisations.

Validation Exercise is the general term for a unit of validation activity. In order to facilitate the report consolidation, all validation exercises are defined with a reference to one or several **ATN Validation Objectives (AVOs)**. Depending on the type of validation, a Validation Exercise may correspond to:

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

Validation Objectives are statements which express the various verifications and evaluations required in order to declare related part of the draft third edition of Doc 9705 Sub-Volume V as validated.. The list of objectives has been assessed by WG2 as complete for this validation process.

2.2 Validation Means and Tools

The following means have been identified, and are used in attachment D:

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

(b) Two or more independently developed 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; and

(g) analysis and inspection.

The available Validation Tools have been surveyed so as to assess their suitability for validation. In some cases, tool modifications and new tool developments have been initiated in order to guarantee the proper validation coverage. The tools have to be assessed against the Doc 9705 Subvolume V requirements to determine the coverage of the enhanced areas reflected in the draft third edition of the Doc 9705 Sub-Volume V implementation.

To ensure the traceability of the validation activities, it is important that tools used to conduct the validation exercises be properly documented. For each tool used in the validation exercises, a high level validation tool description is provided in Attachment B.

Note: these tool descriptions are not intended to be the specifications of the tools' capabilities. These details can be obtained from the contact point / supplier, as given in the tool description.

2.3 Enhanced ICS Requirements

The proposed high level functional enhancements to the baseline Sub-Volume V, Internet Communications Service, are shown in the following table. The focus of the ICS validation is on the validation of these enhancements including validation of their interoperability with implementations based on the current ICS baseline (i.e., Second Edition of Doc 9705, Sub-Volume V).

Label	**Enhancement for 2nd Edition of ICS SARPs**
ICS3-01	Requirements for mobile subnetworks to issue Join and Leave Events within given latency intervals
ICS3-02	Requirement for IS-SME to respect quarantine time before processing next Join event from mobile subnetworks having issued a Leave event

ICS3-03	Use of adaptive retransmission timers in the Connection Oriented Transport Protocol
ICS3-05 (Note 1)	Requirements for ICS-related systems management consistent with the ATN systems management concept (i.e. draft Sub-Volume 6)
ICS3-06	Requirements for enhanced IDRP security consistent with the ATN security architecture (i.e. draft Sub-Volume 8).
ICS3-07	Deletion of the ATN NSAP address compression algorithm (ACA)
ICS3-08	Suppression of re-advertisement of routes in the case of changing mobile subnetwork connectivity
ICS3-09	Conveyance of data link capability parameter in air/ground ISH PDU exchanges to signal protocol capabilities which are beyond 1st edition of Doc 9705 between air/ground and airborne routers in a backwards compatible manner
ICS3-11	Revised COTP acknowledgement (ACK) timer setting
ICS3-12 (Note 2)	Potential amendment of existing mobile SNDCF and/or development of additional mobile SNDCFs to include new subnetwork types
ICS3-13	Potential enhancements to the DEFLATE algorithm to allow for the dynamic negotiation for the use of pre-stored dictionaries
ICS3-14	Potential additional mobile SNDCF option to allow maintenance of DEFLATE history window when changing ground stations or air/ground routers respectively

Note1 : ICS3-05 will not be treated in this validation report, as it is part of SV6 validation report. SV5 only refers to SV6 to provide ICS related systems management requirements.

2.4 Validation Objectives

The ATN Validation Objectives (AVOs) agreed by WG2 are reproduced in Attachment A. The AVOs were developed under 4 major validation criteria, namely:

- Criteria 1: has the requirement been implemented ?
- Criteria 2: do ATN systems interoperate ?
- Criteria 3: does the ATN satisfy User Requirements ?
- Criteria 4: does the ATN perform well ?

Detailed definitions of each of the above criteria are provided in Attachment A. The coverage of the AVOs contributed to by Validation Exercises is given in Attachment C.

2.5 Validation Exercises

The validation exercises have been specified by various States/Organisations under their own validation initiatives. This consolidated report relies on these States/Organisations for producing Validation Exercise Specifications, Tool Specifications, Detailed Reports as appropriate. All documentation listed under each Validation Initiative Summary is accessible via the responsible State/Organisations.

2.6 Validation Initiatives

All Validation Initiatives have been summarised in Attachments E through *tbd*. The purpose of the summary is to give some insight about the work achieved, and the confidence gained under the corresponding exercises.

The summary reports are written in such a way that, in case further details are needed, the reader is provided with all the necessary references and contact points.

3. Consolidated Validation Results

3.1 Doc 9705 Sub-Volume V Third edition text consistency

The draft third edition of the Doc 9705 Sub-Volume V has been developed under the control of the ATNP WG2. The procedures enforced by the WG2 ensure that any proposed change is firstly motivated, then consistent with current draft technical provisions and finally correctly drafted before incorporation in new version. All text changes resulting from this process are traceable.

Besides this Quality Assurance process, additional verifications have been performed throughout the draft third edition of the Doc 9705 Sub-Volume V development to ensure overall consistency and correctness both internally and in reference to other Doc 9705 Sub-Volumes and base standards (e.g., ISO Documents):

- An ATNP WG2 ICS Drafting Group held in April 2000 did a complete editorial review of the draft third edition of the Doc 9705 Sub-Volume V ensuring the necessary editorial quality of the draft text. This meeting reviewed the correctness of outlines, title texts, presentation, figures and tables and internal consistency of cross-references.

- a final detailed review of the draft third edition of the Doc 9705 Sub-Volume V was made at a WG2 meeting held in Ireland in July 2000.

From the above it can be concluded that there is sufficient confidence that the draft Internet SARPs (i.e., Doc 9705 Sub-Volume V, Third Edition) are specified in an unambiguous and consistent manner.

3.2 Coverage by Implementations

The requirements contained in the draft third edition of the Doc 9705 Sub-Volume V may be divided in two categories: those pertaining to ATN systems (i.e. how systems are built), and those pertaining to the Network deployment (i.e. how ATN systems are used, how the network is managed).

Confidence has been gained in the draft third edition of the Doc 9705 Sub-Volume V pertaining to ATN systems by implementing many of these third edition enhancements in real life systems, either prototype or pre-operational systems. A coverage analysis of the requirements associated with the third edition enhancements is provided in Attachment D to this document. The focus of the validation coverage was on the enhancements proposed in the third edition of Doc 9705 Sub-Volume V as compared to the baseline second edition of the same sub-volume.

Confidence has been gained in the draft third edition of the Doc 9705 Sub-Volume V pertaining to ATN deployment by either implementing limited scale networks or by simulating them in larger configurations. A coverage analysis of the requirements associated with the third edition enhancements is provided in Attachment D to this document.

Considering that Edition 3 is only providing an upgrade of already implemented, validated and used SARPs material and on the basis of the coverage analysis provided in Attachment D, it can be concluded that the majority of the requirements associated with the third edition enhancements defined in Doc 9705 Sub-Volume V have been implemented by at least one validation tool. The implementation and validation tests of Edition 3 enhancements were performed without major difficulties, given the experience gained in building and testing Edition 1 and Edition 2 systems. This provides a sufficient level of confidence that the requirements are implementable.Furthermore, the detailed inspections of these requirements performed by ATN Systems implementors, and their positive comments provide a further good level of confidence that these requirements are implementable.

3.3 Interoperability of ATN Systems

The results of the Validation Initiatives demonstrate that ATN systems compliant with the third edition of the Doc 9705 Sub-Volume V interoperate with ATN systems compliant with any previous edition of the Doc 9705 Sub-Volume V. Although only one implementation of the third edition of the Doc 9705 Sub-Volume V compliant airborne and ground based system has been employed in these Validation Initiatives, the tests performed with this implementation in front of other first or Second edition-compliant independently developed systems, have provided further confidence in the maturity and stability of the technical provisions.

3.4 Deployment of the ATN and large scale issues

Following the confidence achieved in the draft third edition of the Doc 9705 Sub-Volume V validation work, and given the confidence we have in backwards compatibility between Edition 1, Edition 2 and Edition 3-compliant implementations, it is anticipated that the changes to ICS SARPs introduced in edition 3 will not compromise already existing deployment initiatives.

Furthermore, given the results of the early Edition 3 implementations and backwards compatibility testings, it is anticipated that the upgrade from Edition 1 or Edition 2 compliant systems to Edition 3 compliant systems will be feasible at any stage of the deployments without any constraints on the already deployed network.

3.5 Evaluation of ATN characteristics and performances

As a result of reviewing the performance achieved from the trials and prototype implementations, which to an extent are dependent upon the performance of the underlying hardware, no inherent limitations have been identified that would preclude the use of an ATN based communications infrastructure in an operational Air Traffic Management requirement meeting the performance requirements expected from the User. Indeed, with the exception of the air/ground subnetwork technology currently envisaged for incorporation into the ATN architecture (which can be viewed as the “bottle-neck”), the performance required of the network in terms of throughput of ground/ground links, router processing capacity, security and network redundancy requirements is very much a network design/capacity planning issue. It should be noted that no hard threshold has been evaluated with respect to performance that may be achieved with an ATN based system and that the validation work has concentrated on identifying whether what is considered to be an “acceptable level of performance” is achievable.

It can be concluded that an ATN compliant system has no inherent limitations that will limit its use in the support of an operational Air Traffic Management System. The performance of the system will be a function of the technology (hardware/software) on which the ATN requirements are implemented as well as the appropriate dimensioning/capacity planning of the supporting network.

4. Future work

5. Conclusion

In order to comply with the “ATN System Level Requirements” (i.e. SLRs), as defined in Ref. 2, the definition of the enhancements to the ICS incorporated in the draft third edition of the Doc 9705 Sub-Volume V has necessitated the definition of a new set of detailed requirements additional to those previously defined in the baseline edition. For practical reasons it has not been possible to conduct an exhaustive validation of all requirements. Validation is an on-going process that commenced with analysis, simulations, experimental & prototype system development and will continue as the implementation of operational ATN systems proceeds. What has been practical, however, is to conduct a range of independent validation initiatives the collective and consolidated results of which have provided a sufficient level of confidence that the ICS enhancements incorporated in the draft third edition of the Doc 9705 Sub-Volume V may be declared validated.

Based upon the above and the results of the set of validation initiatives reported in this document and its Attachments sufficient confidence has been gained to conclude that the draft third edition of the Doc 9705 Sub-Volume V are a mature basis for the upgrade or development of systems to be used in operational Air Traffic Management environment complying with stated User Requirements. It is therefore proposed that the ATN Panel endorse the recommendation in the main body of that document that the draft Internet Communications Service provisions of the ATN SARPs and the third edition of Document 9705 be adopted.

ATTACHMENT A — Validation Objectives

A.1 Approach

The validation objectives in this Attachment are classified according to the criteria which are identified for ATN validation. Criteria define why a given validation objective/exercise increases the validation level of a (set of) ATN requirements. Four criteria have been defined in this document:

- Criteria 1: has the requirement been implemented?
- Criteria 2: do ATN systems interoperate?
- Criteria 3: does the ATN satisfy User Requirements?
- Criteria 4: does the ATN perform *well*?

A.1.1 Criteria 1: has the requirement been implemented?

The Sub-Volume V Third edition technical provisions must be **implementable** in ATN systems and procedures. Evidence of this will be given by the various developments under way. Exercises are necessary to ensure that all ATN requirements have been implemented in at least two distinct implementations. The contribution of these exercises to the overall ATN Validation is: "the following ATN requirements have been implemented in development *X* by *Y*".

Candidate validation exercises to assess this criteria include:

- Analysis: review of acceptance reports, qualification reports, etc. available for the systems where requirements have been implemented.
- Experiments: limited experiments targeted at demonstrating the implementation of the requirement(s).

This Attachment does not recommend the development of experiments dedicated to the validation of this criteria. In case no evidence is found that a given (set of) requirement(s) has been implemented, its presence in Doc 9705 Sub-Volume V must be justified.

A.1.2 Criteria 2: do ATN systems interoperate?

The Sub-Volume V Third edition technical provisions must lead to **interoperable** profiles. This has been assessed up to a certain point by analysis during SARPs editing. Exercises are necessary to ensure that ATN requirements lead to implementations that interoperate.

Another issue to be considered under this criteria is the impact of choosing different sets of recommendations or options in a given interworking setup.

Lastly, it is particularly important to verify that the enhancements introduced in the third edition of the Doc 9705 Sub-Volume V do not compromise interoperability with ATN systems that have been implemented according to the baseline Doc 9705 Sub-Volume V. Under this criteria, the issue of backward interoperability with ATN systems compliant with the baseline edition is therefore to be considered.

Candidate validation exercises to assess this criteria include:

- Analysis: review of PICS

- Experiments: verification that a set of requirements lead to interoperable systems. Breakdown of this set into individual experiments depends on available platforms.

- Simulations: detailed models may be used in some specific cases to assess interoperability.

This Attachment recommends that simulation is used only for cases that cannot be demonstrated in experiments using real implementations.

A.1.3 Criteria 3: does the ATN satisfy User Requirements?

A number of System Level Requirements have been defined in the ATN SARPs and Doc 9705 Sub-Volume I. Exercises are necessary to ensure that these system level requirements are satisfied.

Candidate validation exercises to assess this criteria include:

- Experiments

- Simulations

- Analysis

A.1.4 Criteria 4: does the ATN perform *well*?

There is only minimal written criteria about the performance expectations for the ATN ICS. Yet, the properties of ATN protocols and of ATN network topologies will be an important element in the ATN evaluation.

Many performance figures that can be measured in ATN networks are relative to system performance or to data link capacity. In principle, these figures can be scaled to meet any performance target by appropriate system/network design.

Some performance figures are ATN intrinsic, e.g. average protocol overhead, and can be evaluated on experimental systems or through simulation.

Expected results is this area are not of a pass/fail nature. They provide indications on which ATN validation will be assessed.

Candidate validation exercises to assess this criteria include:

- Experiments

- Simulations

- Analysis

Experimental and simulation results should be consistent. Simulation results can be confirmed by equivalent experiments in small configurations. This is a way to assess the validity of the simulation results obtained for larger configurations.

A.2 Coverage

The set of validation objectives defined in this Attachment is meant to be complete in terms of the Sub-Volume V Third edition enhanced technical provisions coverage. Although new additional criteria and objectives could be defined, the current set is considered to provide the acceptable level of coverage. In other words, the Sub-Volume V enhancement incorporated in the third edition will be considered validated after successful verifications and executions of exercises derived from those objectives.

The details and depth of the verifications required are subject to external assessment as described below.

A.2.1 Conventions

Objectives are stated, as much as possible, in the form of sentences beginning with verbs like "verify", "show", "evaluate", etc. Being high level statements they are not meant to describe in detail the technical steps involved. In principle, one objective is expected to be refined into one or several validation exercises.

A unique reference of the form "AVO-3_nnn" is assigned to each objective. It is intended for use in exercise specifications.

AVO reference numbers do not necessarily appear as increasing consecutive numbers.

Validation objectives are presented in table format as follows:

Reference	*Objective Description*
AVO-3_nnn	Verify that ...

Where the term ‘AVO-’ identifies this as an ATN validation objective for the Third edition of Doc 9705 and the ‘nnn’ is the number assigned to the specific validation objective. When the term compliant is used in the AVO objective description without a reference to a specific version of Doc 9705 (i.e., baseline or third edition) this is to be understood to be referring to the Doc 9705 Sub-Volume V, Third edition.

A.2.2 Assessment

Normally, objectives state what is to be verified in order to derive a pass/fail verdict. However, it is not practical, nor even possible, to detail in this Attachment the exact degree and depth of verification that is required in order to declare an objective met. Similarly, this Attachment does not specify the number and type of topologies/configurations that should be tested (for an objective related to ATN routing topologies for example).

These issues are considered to be part of an assessment process, which needs to be set up in parallel with the development and execution of validation exercises. The assessment process is responsible for:

- deciding which ATN requirements can be considered as validated without any specific exercises and provide justification for it.

- deciding for each objective what is the minimum number/type of exercises that are required in order to consider the objective validated. For example: need for two distinct

implementations, the significant ATN profiles to be experimented, the combination of options to be tested, the configurations for which simulation is sufficient.

- deciding what are the ATN topologies/configurations to be investigated.
- specifying target values for ATN properties and performances.
- relating actual validation exercises/results derived from these objectives to ATN database entries.

A.3 Validation Objectives

A.3.1 Implementation of ATN systems and procedures (criteria 1)

All the following exercises are meant to be conducted through analysis of existing documentation and reports: PICS, acceptance test reports.

The expected outcome is an indication of the ATN requirements that have been successfully implemented. As a result, some coverage analysis can be derived from these exercises.

In these exercises, the term 'ATN requirements' is used to refer to mandatory requirements and to recommendations. The ATN options, as derived from PRLs, can be considered as out of the scope of these exercises. However, ATN options may be the subject of additional validation exercises to verify that they are neither needed nor "dangerous" to the ATN service when implemented.

The term 'implemented' in this context is not restricted to 'implemented in operational/avionics systems'. Prototypes and pre-operational are also capable of validating the 'implementability' of Doc 9705 Sub-Volume V technical provisions. The degree of confidence required, hence the type of implementation, is an issue for the assessment procedure to establish (see 2.4).

A.3.1.1 Ground End System

AVO-3_101	Verify that all requirements associated with Doc 9705 Sub-Volume V Third edition enhancements pertaining to ground End Systems have been implemented and demonstrated to be compliant. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-03 ICS3-11

A.3.1.2 Airborne End System

AVO-3_102	Verify that all requirements associated with Doc 9705 Sub-Volume V Third edition enhancements pertaining to airborne End Systems have been implemented and demonstrated to be compliant. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-03 ICS3-11

A.3.1.3 Ground-Ground BIS

AVO-3_103	Verify that all requirements associated with Doc 9705 Sub-Volume V Third edition enhancements pertaining to ground-ground Boundary Intermediate Systems have been implemented and demonstrated to be compliant.

	Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-06

A.3.1.4 Air-Ground BIS

AVO-3_104	Verify that all requirements associated with Doc 9705 Sub-Volume V Third edition enhancements pertaining to air-ground Boundary Intermediate Systems have been implemented and demonstrated to be SARPs compliant. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-02 ICS3-06 ICS3-07 ICS3-08 ICS3-09 ICS3-13 ICS3-14

A.3.1.5 Airborne BIS supporting IDRP

AVO-3_105	Verify that all requirements associated with Doc 9705 Sub-Volume V Third edition enhancements pertaining to airborne Boundary Intermediate Systems supporting IDRP have been implemented and demonstrated to be compliant. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-02 ICS3-06 ICS3-07 ICS3-08 ICS3-09 ICS3-13 ICS3-14

A.3.1.6 Airborne BIS without IDRP

AVO-3_106	Verify that all requirements associated with Doc 9705 Sub-Volume V Third edition enhancements pertaining to airborne Boundary Intermediate Systems not supporting IDRP have been implemented and demonstrated to be compliant. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-02 ICS3-07 ICS3-09 ICS3-13 ICS3-14

A.3.1.7 ATN Subnetworks

AVO-3_108	Verify consistency of the Mobile SNDCF provisions versus the behaviour of VDL Mode 2, AMSS, HFDL and Mode S subnetworks in the issuance of Join and Leave Events under conditions of rapid fading conditions on the r.f. link. This includes verification that Doc 9705 correctly indicates which subnetworks will need to use the enhanced features of the mobile SNDCF. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-01 ICS3-02

A.3.1.8 Routing architecture and policy

AVO-3_109	Verify that all requirements associated with Doc 9705 Sub-Volume V Third edition enhancements pertaining to routing architecture and routing policy have been implemented and demonstrated to be SARPs compliant. This includes ATN system aspects and associated procedures. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-08

A.3.2 Interoperability (criteria 2)

The ATN Internet Communications Service SARPs specify the ATN Network and Transport Layers in terms of their constituent protocols and functions. They mandate certain features, recommend others and document a wide variety of options without mapping these to real world systems (e.g. Routers and Host Computers). The large number of possible combinations of standards, recommendations and options complicates the validation process.

Within each type of ATN system defined in SARPs (ES, GG-BIS, AG-BIS, A-BIS), there are a number of possible ATN compliant solutions (called hereafter ATN Compliant Profiles). A Profile is defined as a specific choice of recommendations/options allowed by the SARPs. Validation must prove that all these possible profile solutions interoperate. When this is not the case, the ATN SARPs must be in error and cannot be validated as they stand.

Experiments will contribute to the definition of a practical number of interoperable ATN components of various types (e.g. air-ground Router, ground-ground Router, ATC Host Computer etc.) by identifying ATN Compliant Profiles for them. These Profiles will be constructed from the standards, recommendations and options specified in the ATN SARPs.

It must be noted that the focus of the validation effort is on the enhancements introduced between the pre-existing baseline Sub-Volume V technical provisions and the third edition of Sub-Volume V. However, the validation will confirm the interoperability of the third edition Sub-Volume V enhanced features with the existing baseline configuration.

Hence, interoperability objectives concentrate on the dialogue between systems and the service provided by those systems, including:

- interoperability between systems compliant with the third edition of Doc 9705, and also,

- backward interoperability between third edition compliant systems and systems that have been implemented according to the baseline Doc 9705 Sub-Volume V.

A.3.2.1 Data transfer

Data transfer exercises should investigate various transport user situations. Depending on the tool used, transport users may be:

- raw data exchanges with no relationship to ATN transport users. This data exchange type only serves the purpose of demonstrating the transport provider capabilities. It should not be used to demonstrate the ATN capability to support any specific ATN user type.

- models of ATN transport users. These data exchanges can be tailored to reflect the characteristics of real application behaviours. These models include setting of average messages length, time distribution patterns, etc.

- prototype/real applications using ATN transport service. These data exchanges can be used in demonstration of capability to support ATN user applications.

A.3.2.1.1 Default end system interworking profiles

AVO-3_201	Verify that two compliant ATN End Systems interoperate and provide Connection-Oriented Transport Service to Transport Service users. These End Systems should be configured so as to be compliant to a default third edition of Sub-Volume V ATN profile (subsequent validation exercises will investigate different profile combinations). The exercise(s) based on that objective should address: connection establishment, one-way data transfers, two-way data transfers, normal disconnection, multiple simultaneous connections. The ability to gracefully recovery from out of order TPDU delivery and changing transit delays shall be verified. COTP profiles specific to air-ground and ground-ground will be verified. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-03 ICS3-11 Note: several other experiments may have this exercise as a prerequisite. Data transfers will be used to test various network conditions and to exercise ATN systems.

A.3.2.1.2 Varying end system protocol profiles

AVO-3_202	Verify that two ATN End Systems supporting different protocol profiles (i.e., support of ATN recommendations) interoperate and provide the Transport Service. Several exercises are needed to investigate different transport and network options. The exercises should verify: Existing baseline Sub-Volume V COTP profile will successfully interoperate with a profile compliant with the third edition Sub-Volume V COTP (e.g., use of fixed vs dynamic timers algorithms). Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-03 ICS3-11

A.3.2.2 Enhancements to Mobile SNDCF

AVO-3_203	Verify that compliant airborne and air-ground BISs implementing the enhancements to the mobile SNDCF(s) to deal with changing subnetwork connectivity will interoperate. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-01 ICS3-02
AVO-3_204	Verify that a compliant airborne BIS or air-ground BIS implementing the enhancements to the mobile SNDCF(s) to deal with changing subnetwork connectivity will interoperate with a peer BIS implementing the mobile SNDCF according to the existing baseline Sub-Volume V provision. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-01 ICS3-02

A.3.2.3 Enhancements for exchange of Inter-domain routing information

AVO-3_210	Verify that ground BISs and air-ground BISs will interoperate for the secure as well as the unsecure exchange of IDRP information. The provisions to authenticate IDRP exchanges with the peer BIS across a ground-ground path will be verified. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-06
AVO-3_211	Verify that compliant airborne and air-ground BISs supporting authentication of IDRP exchanges in the air-to-ground direction will interoperate. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-06 ICS3-09
AVO-3_212	Verify that compliant airborne BISs and air-ground BISs supporting the optional mutual authentication of IDRP exchanges are each able to authenticate IDRP PDUs received from the peer BIS. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-06 ICS3-09
AVO-3_213	Verify that compliant airborne BISs and air-ground BISs supporting the option to request and to attach a security certificate to an IDRP OPEN-PDU will interoperate. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-06 ICS3-09
AVO-3_214	Verify that a compliant airborne BIS, air-ground BIS and ground BIS will interoperate for the unsecured exchange of routing information with a peer BIS implemented in accordance with the current baseline Sub-Volume V provisions. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-06 ICS3-09

A.3.2.4 Enhancement for suppression of re-advertisement of routes

AVO-3_220	Verify compliant airborne and air-ground BISs suppress the re-advertisement of routes in the case of changing mobile subnetwork connectivity. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-08
AVO-3_221	Verify that a compliant airborne or air-ground BIS supporting the mechanisms to suppress the re-advertisement of routes in the case of changing mobile subnetwork connectivity will interoperate with a peer BIS that has been implemented according to the baseline Doc 9705 Sub-

	Volume V. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-08

A.3.2.5 Enhanced signalling for protocol capabilities

AVO-3_230	Verify compliant airborne and air-ground BISs using a parameter in ISH PDU to signal protocol capabilities which are beyond first edition of Doc. 9705 will interoperate. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-09
AVO-3_231	Verify that a compliant airborne or air-ground BIS supporting the use of a parameter in ISH PDU to signal protocol capabilities which are beyond first edition of Doc. 9705 will interoperate with a peer BIS that has been implemented according to the baseline Doc 9705 Sub-Volume V. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-09

A.3.2.6 Deletion of the ATN NSAP address compression algorithm (ACA)

AVO-3_240	Verify compliant airborne and air-ground BISs will interoperate with a peer BIS that has been implemented according to the baseline Doc 9705 Sub-Volume V and supports the ACA compression mechanism. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-07

A.3.2.7 Enhanced compression mechanisms

AVO-3_250	Verify compliant airborne and air-ground BISs supporting negotiation of pre-stored Deflate dictionaries will interoperate. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-13
AVO-3_251	Verify a compliant airborne or air-ground BISs supporting negotiation of pre-stored Deflate dictionaries will interoperate with a peer BIS that has been implemented according to the baseline Doc 9705 Sub-Volume V. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-13
AVO-3_252	Verify compliant airborne and air-ground BISs supporting a mobile SNDCF option to allow maintenance of Deflate history window when changing ground stations will interoperate. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-14
AVO-3_253	Verify a compliant airborne or air-ground BISs supporting a mobile SNDCF option to allow maintenance of Deflate history window when changing ground stations will interoperate with a peer BIS that has been implemented according to the baseline Doc 9705 Sub-Volume V. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-14

A.3.3 User Requirements (criteria 3)

Only a subset of the ATN User Requirements have been selected. The main selection criteria has been that the user requirement was linked to an observable property of an ATN network or ATN topology and related to an enhanced capability offered by the third edition of Sub-Volume V as compared to the existing baseline document.

A.3.3.1 Independence from the subnetwork service interruptions

AVO-3_300	Verify the ability of the ATN service to ensure a rapid fall back to another mobile subnetwork in case of service interruption on the default mobile subnetwork, consistent with the declared ATSC traffic class supported by the default mobile subnetwork. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-01 ICS3-08
AVO-3_301	Verify that a perturbated default sub-network (experiencing fading on the r.f. channel) has no impact on the ATN service except for increase in average end-to-end transit delay and/or fall back to another mobile subnetwork. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-01 ICS3-02 ICS3-03 ICS3-11

A.3.4 ATN properties and performances (criteria 4)

This section can be viewed as a list of objectives which validates the assumed or implicit User Requirements. Other than the ATN SARPS and Doc 9705 Sub-Volume I, no other formal ICAO source document is available which states the expected technical high-level properties/performances of the ATN. Generally many of the performance characteristics of the ATN (e.g., number of mobile users to be supported) will be determined on a local or regional basis.

The assessment procedure is required to define the expected values/targets against which the ATN properties and performances will be evaluated.

Until these expected values are specified, an objective of the form "Evaluate X" should be interpreted as "Evaluate X. Verify that X is acceptable". The acceptability criteria for such a general case is:

- exercises derived from this objective do not reveal SARPs inconsistencies or gaps,
- observed performances are consistent with provision of ATN user services,
- observed performances are scaleable to future ATN configurations or ATN systems.

A.3.4.1 Enhanced provisions for the exchange of routing information

AVO-3_400	Evaluate the ground BISs and air-ground BISs capability to authenticate IDRP exchanges with the peer BIS across a ground-ground path. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-06
AVO-3_401	Evaluate the compliant airborne and air-ground BISs capability for authentication of IDRP exchanges in the air-to-ground direction. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-06 ICS3-09
AVO-3_402	Evaluate the compliant airborne BISs and air-ground BISs capability for the mutual authentication (option) for IDRP exchanges. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-06 ICS3-09
AVO-3_403	Evaluate the security information exchange and processing overhead for the secure exchange of IDRP routing information, between ground and air-ground BISs.
AVO-3_404	Evaluate the security information exchange and processing overhead for the secure exchange of IDRP routing information, between airborne and air-ground BISs.

A.3.4.2 Enhanced mobile SNDCFs

AVO-3_410	Show that compliant airborne and air-ground BISs implementing the enhancements to the mobile SNDCF(s) to deal with changing subnetwork connectivity minimise routing updates when the mobile subnetwork is experiencing rapid changes in connectivity. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-02 ICS3-08

A.3.4.3 Enhancement for suppression of re-advertisement of routes

AVO-3_420	Show compliant airborne and air-ground BISs suppress the re-advertisement of routes in the case of changing mobile subnetwork connectivity. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-08

A.3.4.5 Enhanced compression mechanisms

AVO-3_451	Evaluate the performance advantage provided by the use of a pre-stored Deflate dictionary compared to the dynamic construction of the dictionary, as per the standard Deflate mechanism specified by the baseline Doc 9705 Sub-Volume V. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-13
AVO-3_452	Evaluate the performance advantage provided by allowing the maintenance of Deflate history window when changing ground stations as compared to a Deflate algorithm that has been implemented according to the baseline Doc 9705 Sub-Volume V. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-14

A.3.4.6 Enhanced Connection Orient Transport Service mechanisms

AVO-3_460	Show the enhanced COTP provisions for dynamic re-transmission timers result in an improved ability to quickly recover to changes in transit delay by the underlying internet service or a non-uniform delay in the delivery of TPDUs. Any improvements are as compared to the capabilities of default COTP profile in the baseline Doc 9705 Sub-Volume V. Such changes in transit delay could be the result of changing subnetwork loading or a change in the mobile subnet being used. Applicable Sub-Volume V enhancements (see 2.3) are: ICS3-03
AVO-3_461	Show that the revised COTP ACK timer setting results in improved recovery from the loss of TPDUs. The loss of TPDUs resulting from changing mobile subnetwork connectivity as well as from other causes will be considered. Results are to be compared to the use of the nominal COTP ACK timer value (i.e., 20 seconds) in the baseline Doc 9705 Sub-Volume V. ICS3-11

ATTACHMENT B — High Level Validation Tool Descriptions

B.1 ProATN A/G BIS Validation Tool

Tool Identification	
Name	ProATN A/G BIS (Version 3.x and Version 2.1)
Category	**Pre-operational implementation**
Description	Pre-operational ATN air-ground BIS, ground-ground BIS, and intra-domain Level 1 and Level 2 IS. The system can emulate the behaviour of an Airborne BIS in testing environment. The system can also be configured as an ES and as a combined ES and IS. However, the End System capability is limited to the provision of the ATN lower layer services up to (including) the transport service. The Version 3.0 of the system is compliant with the draft third edition of Doc 9705 Sub-Volume V The Version 2.1 of the system is compliant with the second edition of Doc 9705 Sub-Volume V
Contact Point and/or Supplier	Supplier: Sofréavia, Airtel-ATN Contact point: Sofréavia: Mr Francis Brangier
Tool Version and Date	Version 3.0, June 2000 (a beta version is available) Version 2.1, November 1999
Supporting Hardware	SUN Workstation
Supporting Operating System and/or Software	Solaris 2.5.1
ATN Systems	☒ End System (up to the Transport service) ☒ Intra-Domain Intermediate System ☒ Ground-gorund BIS ☒ Air-ground BIS ☐ Airborne BIS ☐ Other
Protocols	☒ ISO 8073 ☒ ISO 8602 ☒ ISO 8473 ☒ ISO 9542 ☒ ISO 10747 ☒ ISO 10589 ☒ ISO 8802 SNDCF ☒ ISO 8208 SNDCF ☒ ISO 8208 Mobile SNDCF
CNS/ATM-2 Specifics	Enhancements supported: ☒ ICS3-01 ☒ ICS3-02

	☒ ICS3-03 ☒ ICS3-05 ☒ ICS3-06 (partially) ☒ ICS3-07 ☒ ICS3-08 ☒ ICS3-09 ☒ ICS3-11 ❑ ICS3-12 ☒ ICS3-13 ☒ ICS3-14
Connectivity Information: ISO 8802-2, and X.25 subnetworks, AMSS, VDL Mode 2 and Mode S	
Notes	

B.2 DGAC End System

Tool Identification	
Name	DGAC End System (Lower Layers)
Category	**Operational implementation**
Description	The DGAC End System is an End System-profiled implementation of the ATN Internet Communication Services Protocols that is operotianally used within the French CAUTRA system, and provides transport and internetworking services to CAUTRA applications. The system is compliant with the draft third edition of Doc 9705 Sub-Volume V at the exception of the support of the ATN Transport Congestion Avoidance mechanism.
Contact Point and/or Supplier	Contact point: STNA: Mrs christine Ricci Supplier: N/A (restricted use to CAUTRA)
Tool Version and Date	Version 1.3.3
Supporting Hardware	HP, Bull, and DEC workstations
Supporting Operating System and/or Software	UNIX
ATN Systems	☒ End System (up to the Transport service) ❑ Intra-Domain Intermediate System ❑ Ground-gorund BIS ❑ Air-ground BIS ❑ Airborne BIS ☐ Other
Protocols	☒ ISO 8073 ☒ ISO 8602

	☒ ISO 8473 ☒ ISO 9542 ❑ ISO 10747 ❑ ISO 10589 ☒ ISO 8802-2 SNDCF ❑ ISO 8208 SNDCF ❑ ISO 8208 Mobile SNDCF
CNS/ATM-2 Specifics	Enhancements supported (among those applicable to an End System): ☒ ICS3-03 ☒ ICS3-11
Connectivity Information: ISO 8802-2 (Ethernet and FDDI)	
Notes	

ATTACHMENT C — Coverage of Validation Objectives by Validation Exercises

C.1 List of Validation Initiatives

Initiative Name	Title	Attachment
FRAVI	French DGAC Validation Initiative	E
		F
		G

C.2 Cross Reference List

Validation Objective	Validation Initiative	Validation Exercise	Exercise Title
AVO-3_101	FRAVI	AVE_100	Non-regression tests
	FRAVI	AVE_101	Validation of the enhancements to the ATN transport protocol
AVO-3_102	FRAVI	AVE_100	Non-regression tests
	FRAVI	AVE_101	Validation of the enhancements to the ATN transport protocol
AVO-3_103	FRAVI	AVE_100	Non-regression tests
	FRAVI	AVE_210	Validation of the secure and unsecure exchange of IDRP information over a ground-ground path
AVO-3_104	FRAVI	AVE_100	Non-regression tests
	FRAVI	AVE_240	Validation of the deletion of the ACA mechanism
	FRAVI	AVE_250	Validation of the enhancements to the mobile SNDCF
	FRAVI	AVE_251	Validation of the enhancements to the mobile SNDCF (backward interoperability)
	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)
	FRAVI	AVE_210	Validation of the secure and unsecure exchange of IDRP information over a ground-ground path
	FRAVI	AVE_211	Validation of the secure and unsecure exchange of IDRP information over an air-ground path
	FRAVI	AVE_214	Validation of the IDRP security enhancements (backward interoperability)
AVO-3_105	FRAVI	AVE_100	Non-regression tests
	FRAVI	AVE_240	Validation of the deletion of the ACA mechanism
	FRAVI	AVE_250	Validation of the enhancements to the mobile SNDCF
	FRAVI	AVE_251	Validation of the enhancements to the mobile SNDCF (backward interoperability)
	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)
	FRAVI	AVE_211	Validation of the secure and unsecure exchange of IDRP information over an air-ground path
AVO-3_106	FRAVI	AVE_100	Non-regression tests

Validation Objective	Validation Initiative	Validation Exercise	Exercise Title
	FRAVI	AVE_240	Validation of the deletion of the ACA mechanism
	FRAVI	AVE_250	Validation of the enhancements to the mobile SNDCF
	FRAVI	AVE_251	Validation of the enhancements to the mobile SNDCF (backward interoperability)
	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)
AVO-3_107			
AVO-3_108			
AVO-3_109	FRAVI	AVE_100	Non-regression tests
AVO-3_201	FRAVI	AVE_101	Validation of the enhancements to the ATN transport protocol
AVO-3_202	FRAVI	AVE_101	Validation of the enhancements to the ATN transport protocol
AVO-3_203	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
AVO-3_204	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)
AVO-3_210	FRAVI	AVE_210	Validation of the secure and unsecure exchange of IDRP information over a ground-ground path
AVO-3_211	FRAVI	AVE_211	Validation of the secure and unsecure exchange of IDRP information over an air-ground path
AVO-3_212			
AVO-3_213	FRAVI	AVE_211	Validation of the secure and unsecure exchange of IDRP information over an air-ground path
AVO-3_214	FRAVI	AVE_214	Validation of the IDRP security enhancements (backward interoperability)
AVO-3_220	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
AVO-3_221	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)
AVO-3_230	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
	FRAVI	AVE_211	Validation of the secure and unsecure exchange of IDRP information over an air-ground path
AVO-3_231	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)
AVO-3_240	FRAVI	AVE_240	Validation of the deletion of the ACA mechanism
AVO-3_250	FRAVI	AVE_250	Validation of the enhancements to the mobile SNDCF
AVO-3_251	FRAVI	AVE_251	Validation of the enhancements to the mobile SNDCF (backward interoperability)
AVO-3_252	FRAVI	AVE_250	Validation of the enhancements to the mobile SNDCF
AVO-3_253	FRAVI	AVE_251	Validation of the enhancements to the mobile SNDCF (backward interoperability)
AVO-3_300	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)
AVO-3_301	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)
AVO-3_400			
AVO-3_401			
AVO-3_402			
AVO-3_403			
AVO-3_404			
AVO-3_410	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)
AVO-3_420	FRAVI	AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity
	FRAVI	AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)

Validation Objective	Validation Initiative	Validation Exercise	Exercise Title
AVO-3_451	FRAVI	AVE_250	Validation of the enhancements to the mobile SNDCF
AVO-3_452	FRAVI	AVE_250	Validation of the enhancements to the mobile SNDCF
AVO-3_460	FRAVI	AVE_101	Validation of the enhancements to the ATN transport protocol
AVO-3_461	FRAVI	AVE_101	Validation of the enhancements to the ATN transport protocol

ATTACHMENT D — Coverage of 3rd edition enhancements by initiatives

D.1 Cross Reference List

Enhancement Label	Enhancement Description	Validation Initiatives	Level of Validation
ICS3-01	Requirements for mobile subnetworks to issue Join and Leave Events within given latency intervals	FRAVI	d
ICS3-02	Requirement for IS-SME to respect quarantine time before processing next Join event from mobile subnetworks having issued a Leave event	FRAVI	d
ICS3-03	Use of adaptive retransmission timers in the Connection Oriented Transport Protocol	FRAVI	b
ICS3-05	Requirements for ICS-related systems management consistent with the ATN systems management concept (i.e. draft Sub-Volume 6)		Not applicable
ICS3-06	Requirements for enhanced IDRP security consistent with the ATN security architecture (i.e. draft Sub-Volume 8).	FRAVI (partially)	e
ICS3-07	Deletion of the ATN NSAP address compression algorithm (ACA)	FRAVI	b
ICS3-08	Suppression of re-advertisement of routes in the case of changing mobile subnetwork connectivity	FRAVI	d
ICS3-09	Conveyance of data link capability parameter in air/ground ISH PDU exchanges to signal protocol capabilities which are beyond 1st edition of Doc 9705 between air/ground and airborne routers in a backwards compatible manner	FRAVI	d
ICS3-11	Revised COTP acknowledgement (ACK) timer setting	FRAVI	b
ICS3-12	Potential amendment of existing mobile SNDCF and/or development of additional mobile SNDCFs to include new subnetwork types		Not applicable
ICS3-13	Potential enhancements to the DEFLATE algorithm to allow for the dynamic negotiation for the use of pre-stored dictionaries	FRAVI	D
ICS3-14	Potential additional mobile SNDCF option to allow maintenance of DEFLATE history window when changing ground stations or air/ground routers respectively	FRAVI	D

ATTACHMENT E — French DGAC Validation Report of ICS Enhancements Incorporated into Doc 9705 Sub-Volume V Third edition

This report presents the results of the French ATN Validation Initiative (FRAVI) that have been obtained in the period from December 1999 to June 2000. It summarises the outcomes of the validation exercises, lists the ATN Validation Objectives that have been covered, and finally expresses the level of confidence of the French DGAC on the quality and correctness of the Sub-Volume V.

E.1 Initiative Reference & Title

FRAVI: French DGAC Validation Initiative

E.2 Type

Experimentation/pre-operational implementation

E.3 Responsible State/Organisation

French DGAC

E.4 Contact Point

State/Organisation	Contact Details
French DGAC	Mrs Christine Ricci STNA/8CA 1, avenue Dr Grynfogel BP 1084 31055 Toulouse Cedex France Tel: +33 (0)5 62 14 54 82 Fax: +33 (0)5 62 14 54 02 e-mail: ricci_christine@stna.dgac.fr

E.6 References

REF1 Proposed Draft third Edition of Doc 9705 Sub-Volume 5 (10 December 99)

REF2 Proposed Doc 9705, Sub-Volume V (ICS) 3rd Edition Validation Report

REF3 FRAVI - ATN Internet SARPs Validation Plan -
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/fravplan.zip

REF4 FRAVI - AVE 100 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_100.zip

REF5 FRAVI - AVE 101 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_101.zip

REF6 FRAVI - AVE 240 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_240.zip

REF7 FRAVI - AVE 250 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_250.zip

REF8 FRAVI - AVE 251 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_251.zip

REF9 FRAVI - AVE 203 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_203.zip

REF10 FRAVI - AVE 204 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_204.zip

REF11 FRAVI - AVE 210 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_210.zip

REF12 FRAVI - AVE 211 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_211.zip

REF13 FRAVI - AVE 214 Result Report
URL: http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi/res_214.zip

E.5 Validation tools involved

The experiments are conducted on the STNA ATN test laboratory. The STNA ATN test laboratory consists of multiple SUN SOLARIS workstations running ATN software, and which can be interconnected in multiple ways through X.25 and/or Ethernet subnetworks according to the test scenarios requirements. A maximum of 4 workstations is available for validation purpose. However, for test configurations that require more than 4 systems, it is possible to run multiple instances of the ATN system software on each of the available workstations, and to interconnect each running instance of an ATN system through either real or simulated LANs, X.25 WANs and mobile subnetworks. This permits to set-up and test large network topology.

The ATN software environment consists of the version 2.1 and the beta Version 3 of the ProATN air/ground BIS software, and the version 1.3.3 of the DGAC End System.

The version 2.1 of the ProATN air/ground BIS is compliant with the second edition of Doc 9705 Sub-Volume V. This version of the system is used for testing the backward interoperability of the beta 3.0 version with ATN systems compliant with the baseline Doc 9705 Sub-Volume V.

The beta version 3.0 of the ProATNair/ground BIS is compliant with the draft third edition of Doc 9705 Sub-Volume V, at the following exception: the procedures specified for generating and verifying digital signatures and used for the authentication of the IDRP routing information have not been implemented.

The DGAC End System is an ATN End System that is operationally used within the French CAUTRA system, and provides transport and internetworking services to CAUTRA

applications. The system is compliant with the draft third edition of Doc 9705 Sub-Volume V at the exception of the support of the ATN Transport Congestion Avoidance mechanism.

E.6 Validation Period

The validation of the draft third edition of Doc 9705 Sub-Volume V spans over a period of 7 month from December 1999 to June 2000.

E.7 Objectives

E.7.1 General objectives of FRAVI

The French DGAC validation initiative mainly aims at demonstrating that:

1. the requirements of the third edition of Doc 9705 Sub-Volume V are implementable,

2. compliant ATN systems are interoperable,

3. compliant ATN systems are interoperable with ATN systems that comply with the baseline edition of Doc 9705 Sub-Volume V,

4. The draft third edition of Doc 9705 Sub-Volume V satisfies the user requirements.

The French DGAC validation initiative also covers some validation objectives related to ATN properties and performances.

E.7.2 Detailed Objectives

The overall strategy for the validation of the draft third edition of Doc 9705 Sub-Volume V has been defined by ATNP/WG2, on the basis of its past experience on the validation of the baseline edition of Doc 9705 Sub-Volume V. The starting point of the validation process is the definition by ATNP/WG2 of a common unique set of *ATN Validation Objectives (AVOs)*. AVOs are statements which express the various verifications and evaluations required in order to declare related part of the draft third edition of Doc 9705 Sub-Volume V as validated.

The following AVOs have been covered by the French DGAC validation initiative:

→ AVO-3_101, AVO-3_102, AVO-3_103, AVO-3_104, AVO-3_105, AVO-3_106, AVO-3_109

→ AVO-3_201, AVO-3_202, AVO-3_203, AVO-3_204, AVO-3_210, AVO-3_211, AVO-3_213,

→ AVO-3_214, AVO-3_220, AVO-3_221, AVO-3_230, AVO-3_231, AVO-3_240,

→ AVO-3_250, AVO-3_251, AVO-3_252, AVO-3_253

→ AVO-3_300, AVO-3_301

→ AVO-3_410, AVO-3_420, AVO-3_451, AVO-3_452, AVO-3_460, AVO-3_461

The following AVOs have not been covered by the French DGAC validation initiative:

→ AVO-3_107, AVO-3_108

→ AVO-3_212

→ AVO-3_400, AVO-3_401, AVO-3_402, AVO-3_403, AVO-3_404

E.8 Validation strategy

The principle of the initiative is first to develop an ATN system that complies with third edition of Doc 9705 Sub-Volume V, in order to demonstrate feasibility. The system is developed by a team of persons who have not participated to the production of the SARPs. This provides further level of confidence that the SARPs are unambiguous. During implementation, the STNA experts participating to the ATNP/WG2 consider any requests for clarification, or questions raised by the development team. Those issues requiring correction to the Sub-Volume V, and/or provision of additional guidance are reported to the WG2 and/or to the CCB under the form of PDRs or of Working Papers.

Once a draft 3rd edition ICS enhancement is implemented, the focus is directed on the testing of the new functionality and the coverage of the associated AVOs. The AVOs coverage is achieved through the performance of a number of ATN Validation Exercizes (AVEs) . The problems detected with the validation exercizes are reported to the WG2 and/or to the CCB under the form of "Potential 3rd Edition Defect Reports" (P3DRs) or of Working Papers. The result of each AVE is documented in a separate AVE result report made available on the ATNP archive.

The FRAVI summary report is produced on the basis of the outcomes of the implementation phase and of the AVE result reports.

E.9 Implementation status

The following table summarizes the current status of the implementation of the ICS-3 (draft third edition of Doc 9705 Sub-Volume V) enhancements on the beta version 3.0 of the ProATN air/ground BIS.

Label	**Enhancement for 3rd Edition of ICS SARPs**	**Implementation status**
ICS3-01	Requirements for mobile subnetworks to issue Join and Leave Events within given latency intervals	Completed
ICS3-02	Requirement for IS-SME to respect quarantine time before processing next Join event from mobile subnetworks having issued a Leave event	Completed
ICS3-03	Use of adaptive retransmission timers in the Connection Oriented Transport Protocol	Completed
ICS3-06	Requirements for enhanced IDRP security consistent with the ATN security architecture (i.e. draft Sub-Volume 8).	Partial Implementation (see below)
ICS3-07	Deletion of the ATN NSAP address compression algorithm (ACA)	Completed
ICS3-08	Suppression of re-advertisement of routes in the case of changing mobile subnetwork connectivity	Completed
ICS3-09	Conveyance of data link capability parameter in air/ground ISH PDU exchanges to signal protocol capabilities which are beyond 1st edition of Doc 9705 between air/ground and airborne routers in a backwards compatible manner	Completed
ICS3-11	Revised COTP acknowledgement (ACK) timer setting	Completed
ICS3-13	Potential enhancements to the DEFLATE algorithm to allow for the dynamic negotiation for the use of pre-stored dictionaries	Completed
ICS3-14	Potential additional mobile SNDCF option to allow maintenance of DEFLATE history window when changing ground stations or air/ground routers respectively	Completed

Status of the implementation of the version 3.0 of the ProATN Air-Ground BIS

At the exception of ICS3-06, all draft third edition ICS enhancements have been implemented.

The enhancement ICS3-6 has been partially implemented. The software implements all procedures and options related to the negotiation of the use of mutual or single authentications on air-ground and ground-ground IDRP connections. However the implementation of the ASVDP, AKDF , AMACP, and AMAVP procedures that are specified in Sub-Volume 8 is not planned at the moment.

E.10 Findings

No major deficiency has been identified on the ICS enhancements. The implementation of ICS3 enhancement allowed raising 13 potential defects on the third edition of of Doc 9705 Sub-Volume V. However, these defects have all been classified as "minor/clarification". Most of them are requests for clarification aiming at removing potential ambiguities from the text.

All these defects have been reported to the SubVolume V Subject Matter Expert and have been resolved by the Working Group2 by amending the draft third edition, or thanks to the production of additional Guidance Material. These defects are listed by title in the table below. The associated P3DR forms are available on the ATNP archive.

P2DR number	Title
M0020010	Processing of received Deflate Maintenance Parameter
M0020011	Issues on the concept of Subnetwork Connection Group
M0020012	Bit 0 of the ISH Data link Capability
M0020013	TP4 retransmission timer on the first RTT sample
M0020014	Valid/invalid round trip time sample in TP4
M0020015	Error condition for deflate compressor window
M0020016	Use of received security info by Airborne BIS
M0020017	Interoperability problem due to the suppression of ACA
M0020018	Interoperability with a peer BIS that does not support authentication type 2
M0020019	BIS behaviour in case of certificate path validation failure
M0020020	A/G BIS access to delivery service
M0020021	Encoding of Random Variable Parameter value
M0020022	Length of Certificate Path Parameter

An issue was raised regarding the enhancement ICS3-08 which aims at resolving the problem of the regular re-advertisement of IDRP routes that may result from changing mobile connectivity when an aircraft has more than one adjacency with the same A/G router via different mobile subnetworks. It was observed that the problem of the re-advertisement of routes was not totally solved with the changes made in the draft third edition of the SARPs. Further changes, which would allow to fix definitively the problem, were proposed in a

Working Paper presented at the ATNP/WG2 Internet Drafting Group. At the time this report is produced, these changes are still under consideration.

The implementation of the draft 3rd edition enhancements to the mobile SNDCF (ICS3_13 and ICS3_14) led the ProATN A/G BIS team to deeply investigate the mechanisms of the deflate compression. This work allowed discovering that the ProATN A/G BIS did not comply with all the baseline SARPs requirements on the Deflate, and would not be able to interoperate with baseline SARPs compliant routeurs if deflate compression is used. It was felt that the ProATN A/G BIS could not be the only router concerned by this non-conformance issue, and a document describing the problem that existed in the ProATN A/G BIS implementation was distributed to the ATN systems developers and to the WG2. The discussion of this problem is in progress.

A number of Editorial corrections were proposed, and logged in an addendum/Corrigendum to the draft third edition of Doc 9705 until their incorporation in the final draft.

Finally, the validation exercizes allowed verifying that the changes introduced in the Draft third edition of the SubVolume V enhance the performance of the ATN Internet Communications Service, taking note of the fact that the procedures for the generation and verification of digital signatures that have been standardized for the authentication of the IDRP routing information have not been implemented nor tested in this initiative.

E.11 Validation exercizes results report

E.11.1 Introduction

FRAVI consists of the 10 ATN Validation Exercizes (AVE) listed by title in the following table. These Validation Exercizes are specified in [REF3]. Each exercize comprised multiple Validation Tests. For each Validation Exercize, a separate 'AVE Result report' has been produced. These Result Reports are made available to the ATN community via the ATNP archive at the following URL

http://www.tls.cena.fr/atnp/wg2/val-Ed3/fravi

AVE name	AVE title	AVE Result report
AVE_100	Non-regression tests	REF4
AVE_101	Validation of the enhancements to the ATN transport protocol	REF5
AVE_240	Validation of the deletion of the ACA mechanism	REF6
AVE_250	Validation of the enhancements to the mobile SNDCF	REF7
AVE_251	Validation of the enhancements to the mobile SNDCF (backward interoperability)	REF8
AVE_203	Validation of the enhancements to deal with changing subnetwork connectivity	REF9
AVE_204	Validation of the enhancements to deal with changing subnetwork connectivity (backward interoperability)	REF10
AVE_210	Validation of the secure and unsecure exchange of IDRP information over a ground-ground path	REF11
AVE_211	Validation of the secure and unsecure exchange of IDRP information over an air-ground path	REF12

AVE_214	Validation of the IDRP security enhancements (backward interoperability)	REF13

The following sections provide a summary of the results of these exercizes.

E.11.2 AVE_100 results

All ProATN Air/Ground BIS non-regression tests were successfully replayed in a simulated environment with a beta version 3.0 of the ProATN Software

The ProATN A/G BIS non-regression tests allow the automatic testing of most of the different functions supported by the ProATN A/G BIS software, including its behaviour when faced to numerous different communication failure conditions, and its operation in many different network configurations.

The success of these tests gives insurance that:

1. the implementation of the draft third edition ICS enhancements within an ATN system, does not compromise the correct execution of the basic functions of that ATN system;

2. baseline edition-compliant ATN systems can be transparently replaced in an ATN network by third-edition-compliant ATN systems without negative effects.

E.11.3 AVE_101 results

This validation exercize allowed verifying that the draft third edition enhancements to the transport protocol perform well, allow interoperability with baseline edition compliant systems and contribute to provide extremely better end to end performances to the Transport Service end users.

Two minor defects were found in the draft third specification of these enhancements. These defects were reported as P3DRs to the WG2 and resolved.

E.11.4 AVE_240 results

This validation exercize allowed demonstrating that a third edition-compliant airborne (resp. air/ground) BIS is capable to interoperate with a baseline edition-compliant air-ground (resp.airborne) BIS implementing the ACA compression mechanism.

One potential backward interoperability problem was identified in the case where the X.25 fast select facility is not available over the mobile subnetwork. This problem was reported as a P3DR to the WG2 experts and has been resolved

E.11.5 AVE_250 results

This validation exercize allowed verifying that the draft third edition enhancements to the mobile SNDCF can be implemented, do not introduce interoperability problems between Edition 3 compliant systems, and enhance the level of compression achieved for mobile communications.

Areas where the draft 3rd edition of the SubVolume V was not specific enough were detected during implementation of these draft third Edition enhancements. Requests and suggestion for clarifications were issued under the form of P3DRs, and handled by the ATNP/WG2 Internet Drafting Group.

During the test, the ProATN A/G BIS was discovered to be non-conformant to the baseline SARPs with regard to the Deflate compression. It was felt that the ProATN A/G BIS could not be the only router concerned by this non-conformance issue, and a document describing the problem that existed in the ProATN A/G BIS implementation was distributed to the ATN systems developers and to the WG2. The discussion of this problem is in progress.

E.11.6 AVE_251 results

The success of this validation exercize demonstrates that the draft third edition enhancements to the mobile SNDCF do not introduce interoperability problems between Edition 3 compliant systems and baseline edition compliant systems. The issues encountered in the context of this validation exercize were the same as the ones already documented in the context of AVE_250.

E.11.7 AVE_203 results

This validation exercize focused on the validation of the draft third edition enhancements to deal with changing mobile subnetwork connectivity. Thanks to this exercize, it was demonstrated that these enhancements can be implemented, do not introduce interoperability problems between Edition 3 compliant systems and contribute to reduce the amount of routing information exchanged over the mobile subnetworks. However, as already mentioned in section 0, it was observed that a further level of optimization regarding the problem of the re-advertisement of IDRP routes over mobile subnetworks is possible and additional changes have been proposed.

One minor issue has been raised during implementation. It has been documented under the form of a P3DR on Edition 3 and has been resolved by the WG2 Internet Drafting Group.

E.11.8 AVE_204 results

This validation exercize allowed verifying that a third edition-compliant airborne (resp. air/ground) BIS, implementing the enhancements ICS-01 (for mobile subnetwork to issue Join and Leave Events within given latency intervals), ICS3-02 (for IS-SME to respect quarantine time of the Join events) and ICS3-08 (suppression of re-advertisement of routes in the case of changing mobile subnetwork connectivity) can interoperate without trouble with an air/ground BIS (resp. airborne BIS) that is compliant with the baseline edition of Doc 9705 Sub-Volume V.

The issues encountered in the context of this validation exercize were the same as the ones already documented in the context of AVE_203.

E.11.9 AVE_210 results

This success of this validation exercize gives insurance that third Edition 3 compliant BISs will interoperate without trouble on the ground for the secure exchange of IDRP information with other 3rd edition compliant BIS, as well as for the unsecure exchange of IDRP information with other BISs that do not support or use the IDRP Authentication Type 2.

It must however be noted that the authentication procedures (ASVDP, AKDF, AMACP and AMAVP) have not been implemented and tested in the context of this validation exercize. As a consequence, the enhancements for the secure exchange of IDRP information between ground BISs cannot be considered as totally validated by this validation exercise.

E.11.10 AVE_211 results

This validation exercize focused on the validation of the draft third edition procedures and options for the negotiation of the use of authentication type 2 on air-ground IDRP

connections (i.e. over mobile connection). Thanks to this exercize, it has been demonstrated that these procedures and options can be implemented, work correctly, and that Edition 3 compliant systems interoperate when these procedures and options are used.

Here again however, it must be noted that the authentication procedures (ASVDP, AKDF, AMACP and AMAVP) have not been implemented and tested in the context of this validation exercize. As a consequence, the enhancements for the secure exchange of IDRP information over mobile subnetworks cannot be considered as totally validated by this validation exercise.

Areas where the draft 3rd edition of the SubVolume V was not specific enough were detected during implementation. Requests and suggestion for clarifications were issued under the form of P3DRs, and handled by the ATNP/WG2 Internet Drafting Group.

E.11.11 AVE_214 results

This validation exercize complemented AVE_211. It allowed verifying that the draft third edition procedures and options for the negotiation of the use of authentication type 2 on air-ground IDRP connections do not introduce interoperability problems between Edition 3 compliant systems and baseline edition compliant systems.

The issues encountered in the context of this validation exercize were the same as the ones already documented in the context of AVE_211.

E.12 Conclusion

As a result of the successful incorporation of the draft third edition enhancements to the ICS SARPs into the ProATN A/G BIS, and considering the success of the validation exercizes, the STNA is in position to express its confidence regarding the quality, and the validity of the SubVolume V of the third edition of Doc 9705.

With the exception of the procedures of generation and verification of digital signatures used for the authentication of the IDRP routing information, all draft 3rd edition enhancements have been implemented, and tested. It has been verified that these enhancements do not compromise the correct execution of the baseline functions of the ATN systems, and that interoperability between ATN systems is maintained. No major deficiency has been identified.

The implementation of the enhancements and the first validation exercizes allowed the detection of some areas in the specification where clarifications were required. This resulted in the production of a number of defect reports the resolution of which is in progress. However, in general, the third edition of Doc 9705 SubVolume V was found consistent and unambiguous.

Finally, the validation exercizes allowed verifying that the changes introduced in the Draft third edition of the SubVolume V enhance the performance of the ATN Internet Communications Service, taking note of the fact that the procedures for the generation and verification of digital signatures that have been standardized for the authentication of the IDRP routing information have not been implemented nor tested in this initiative.