AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL

WORKING GROUP 3 MEETING

Munich, 24-28 June 1996

Agenda Item 6: Air-Ground Applications SARPs

GENERIC AIR/GROUND SARPS VALIDATION OBJECTIVES

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SUMMARY

This paper outlines the generic validation objectives (VOs) developed by SG 2 for a/g SARPs, indicates the relationship between the VOs and the chapters in the documents, and gives an example of this relationship through extraction of 'shall' statements from the FIS material.

1. INTRODUCTION

1.1 Initial work on the development of a validation programme for air-ground SARPs is based on guidance given by Working Group 3 (WG 3) at their Banff and Brussels meetings. This material identified three levels of validation objectives, System, Functional and Technical. In addition, the ADSP had significantly revised the draft ICAO Manual of ATS Data Link Applications, which provides many of the Operational Requirements forming the basis of the SARPs, and which influence the validation objectives generally.

2. SYSTEM LEVEL REQUIREMENTS

2.1 It is possibly not an ATNP task to define the detailed system level requirements for the air-ground applications - in theory this is an ADSP task. For example, in ADS, is the setting up of contracts a systems level requirement, or is it surveillance generally that is the system requirement? At the functional level, it could be implementation of the contracts types, and at the third level, the technical level, all individual 'shalls' and 'shoulds'. In addition there would need to be an over all 'end to end' system requirement, to be validated at the highest level. Validation of SARPs should include a demonstration that they should meet both operability and interoperability capabilities.

2.2 However, certainly until the ADSP/2 meeting in September 1996, all that would be available from ADSP would be ORs, and ATNP WGs have developed systems requirements as a means of

implementing the ORs technically. There are problems in deriving specific ORs, and finding a focal point for them in the new version of the ADSP Manual. It may be that every 'will' statement in the Manual constituted a potential OR. Compilation of a 'wills' list from the ADSP Manual would at least allow some reasonable comparison to be made between ORs and required system functionality.

3. DEVELOPMENT OF VALIDATION OBJECTIVES

3.1 For the air-ground applications, the Validation Objectives (VOs) should be application independent, and should apply to all the air/ground SARPs.

3.2 Validation should be able to provide answers to the follow questions -

a. Does 'it' do what is wanted? (where 'it' may be a system, a specific functionality or a technical statement)

b. Does it not do what is not wanted?

- No lock ups

- No unexpected behaviour

c. Does it do it the best way?

- Efficiency

- Extensibility

- Backwards compatible.

d. Can deficiencies/alternatives/restrictions be identified?

3.3 In developing VOs, it is possible to consider a form of 'validation matrix', with rows -

- What functionality supported?

- Does each function work?

- Can future versions be made backward compatible?

- Is the Dialogue Service (DS) used properly?

- Is the message coding efficient?

and columns -

- Backwards compatibility

- Error Processing

- Abstract Service

- ASN.1

- Sequencing Rules

- Timers

- Protocols

- Exception Handling

- Encoding

- Dialogue Service Requirements

- Forward contracts

- User requirements.

3.4 Inspection of this matrix helped determine the validation objectives. Three levels of VOs, at System, Functional and Technical level, have been defined as follows, (where 'xxx' stands for CMA, ADS, CPDLC or FIS, unless otherwise qualified):

a. **At System level** -

SVO 1: To determine which ORs within the ADSP draft ICAO Manual of ATS Data Link Applications are satisfied by the functional descriptions and/or user requirements and Recommended Procedures of the xxx SARPs. (At a user level these ORs should be satisfied by Chaps 1 and 7 of the SARPs.)

SVO 2: To determine that if the CM, ADS, CPDLC and FIS air/ground applications are mutually consistent, e.g. version numbers are assigned so that they can be carried by CM

b. **At Functional level** -

FVO 1: To determine if the functional descriptions of the xxx SARPs are satisfied by the technical requirements identified in the xxx SARPs. (This implies that the requirements in Chapters 1 and 7 will be met by the contents of Chapters 2 - 6.)

FVO 2: To determine if the user requirements and recommended practices are consistent with the technical requirements.

FVO 3: To determine if the xxx SARPs are complete.

FVO 4: To determine if the xxx SARPs are unambiguous.

FVO 5: To determine if the xxx SARPs are consistent.

FVO 6: To determine if there are requirements in the SARPS which would have no effect if removed.

FVO 7: To determine if provision has been made to ensure that the SARPs are implementation independent. (This should be done by an independent organisation.)

c. **At Technical level** -

TVO 1: To determine if the protocol description supports the end-to-end services.

TVO 2: To determine if the protocol description has any unacceptable behaviour (e.g. livelocks, deadlocks or improper states etc.)

TVO 3: To determine if ASI parameters are mapped appropriately to PDU fields and/or DSI parameters, and vice versa.

TVO 4: To determine if the protocol errors in the peer AE are correctly handled.

TVO 5: To determine if the SARPs are consistent with the Upper Layer Architecture, e.g. use of the Dialogue Service, application of the Control Function etc.

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

3.5 It was felt that the functional objectives should be split additionally to take account of these which were general (possibly almost generic to SARPs), and those which applied to one or more specific applications. The final proposed version of the VOs is listed at Appendix A .

3.6 The SG would not wish to be seen as a design authority. Efficiency is likely to be difficult to validate (the use of PER versus BER, perhaps? Both could be used, but PER is much more efficient in terms of speed of transfer etc.) Similar concepts are stated in Annex 10 without any exceptions being filed.

3.7 It is recognised that, as far as industry is concerned, there is a major difference between SARPs and System validation. Validation of the SARPs is ensuring interoperability and safety of independently implemented systems, whereas validation of a system is ensuring the conformance of that system to the SARPs.

3.8 Regarding the validation of the air-ground SARPs, and the consideration of matching 'shall' statements to VOs, the following points must be considered:

a. Each 'shall' must map to at least one validation objective.

b. Guidance will need to be given to indicate how validation objectives can be met

c. Validation criteria should only be over that functionality to which air/ground applications relate.

d. 'Shall' implies 'shall only'

3.9 The ORs have not yet been extracted form the ADSP Manual, but this will be done.

4. APPLICATION OF VALIDATION OBJECTIVES TO SARPS MATERIAL

4.1 The question of mapping VOs to 'shall' statements or vice versa depends on whether a top-down or bottom-up philosophy will be adopted. However, based on industrial advice, it would appear that validation testing will be done on the basis of 'shalls', rather than on VOs. The SG has developed a paper, where all the 'shall' statements in the FIS SARPs have been extracted, and matched to VOs. This is attached at Appendix B

4.2 As a result of this work, a generic mapping diagram has been developed, which indicates which chapters of the SARPs were mainly concerned with specific VOs. This is attached at Appendix C to this paper.

5. CONCLUSION

5.1 This paper indicates how the Validation objectives for the Air-Ground SARPs have been derived, and also sets out point which could be considered as part of a generic consideration of Validation of all part of the ATN SARPs.

5.2 It is important to remember that validation is not just seen as an altruistic technical exercise by those taking part in the programme, but that they seek active benefits for the work being done. In many cases this work is being done as part of an implementation evaluation programme, or the development of pre-prototype equipment. Validation objectives must be realistic, and related to the real world.

Appendix A

AIR GROUND SARPS - VALIDATION OBJECTIVES

System

SV01: To determine which ORs within ICAO draft manual of ATS data link applications are satisfied by the functional descriptions in combination with the user requirements of the XXX SARPs.

SV02: To determine if the CM, ADS, CPDLC and FIS applications are mutually consistent e.g. version numbers are assigned so they can be carried by CM.

Functional (Specific)

FV01: To determine if the functional descriptions of the XXX SARPs are satisfied by the technical requirements identified in the XXX SARPs.

FV02: To determine if the user requirements and recommended practices are consistent with the technical requirements.

Functional (General)

FV03: To determine if the XXX SARPs are complete.

FV04: To determine if the XXX SARPs are unambiguous.

FV05: To determine if the XXX SARPs are consistent.

FV06: To determine if there are any requirements in the SARPs which would have no effect if removed.

FV07: To determine if provision has been made to ensure that SARPs are implementation independent.

Technical

TV01: To determine if the protocol description supports the end-to-end services.

TV02: To determine if the protocol description has any unacceptable behaviour (e.g. deadlocks, livelocks, invalid states, etc.).

TV03: To determine if ASI parameters are mapped appropriately to PDU fields and/or DSI parameters and vice versa.

TV04: To determine if protocol errors in the peer AE are correctly handled.

TV05: To determine if the SARPs are consistent with the ULA, e.g. use of the dialogue service, application control function, etc.

TV06: To determine if the APDUs are correctly specified.

TV07: To determine if provision for QOS management has been addressed.

TV08: To determine if provision for future migration has been addressed.

TV09: To determine if efficiency requirements have been addressed, e.g. minimise size of data transfer, appropriate maintenance of dialogue.

Appendix B

MAPPING OF SARPS REQUIREMENTS TO VALIDATION OBJECTIVES - FIS

Appendix C

GENERIC VALIDATION OBJECTIVE TO SARPS CHAPTER MAPPING