AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL

WORKING GROUP 3 MEETING

Munich, 24-28 June 1996

Agenda Item 6: Air-Ground Applications SARPs

PROPOSED ATNP/2 WP -

'OVERVIEW OF FIS APPLICATION SARPS AND GUIDANCE MATERIAL'

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SUMMARY

This paper briefly outlines the development of the FIS SARPs since ATNP/1. It recommends that the attached material be included in the SARPs being developed by the ATNP.

1. INTRODUCTION

1.1 The concept of using data link as a major medium for ATS communications arose from the deliberations of the two phases of the ICAO Special Committee for Future Air Navigation Systems which met between 1985 and 1992. Flight Information Services (FIS) is one of the four early applications of an air/ground Air Traffic Management (ATM) data link system envisaged by the Automatic Dependent Surveillance Panel (ADSP), the others being Context Management (CM), Controller Pilot Data Link Communications (CPDLC) and Automatic Dependent Surveillance (ADS).

1.2 The ADSP is one of the ICAO operational Panels. It is charged with developing Operational Requirements for ATM data link applications, both air/ground and ground/ground, but it is not required to develop the necessary technical Standards and Recommended Practices (SARPS) - this responsibility has been delegated by ICAO to the Aeronautical Telecommunications Network Panel (ATNP).

1.3 The ATNP established a number of Working Groups, of which Working Group 3 was responsible for developing, inter alia, SARPS and Guidance Material (GM) for the four air/ground applications noted in paragraph 1.1 above. WG 3 convened a Subgroup specifically for the purpose of developing SARPS material for the four air/ground applications, taking into account a limited set of the funtionalities identified by the ADSP, constrained by the need to achieve early implementation of the applications by 1998, this timescale being established by the requirements of the Industry.

1.4 The proposed FIS Standards and Recommended Practices are attached at Appendix A to this paper.

2. BACKGROUND

2.1 The FIS application allows a pilot to request and receive FIS services from ground FIS systems. In a fully operational ATS data link environment, FIS is expected to be used as the main means of passing flight information (e.g. automatic terminal information (ATIS), notices to airmen (NOTAMs), meteorological aerodrome reports (METARs) and extracts from aeronautical information circulars (AICs)) to aircraft, whether in flight or on the ground.

2.2 In the initial implementation of FIS, only ATIS information will be passed. ATIS messages, their format and intent, are based on the relevant ICAO documentation, in particular Annexes 3 and 11 and Doc 4444, Procedures for Air Navigation and Rules of the Air (PANS/RAC). The format and content of the messages will be identical to the current voice based systems.

2.3 The use of data link is not as flexible as voice, and a set of rules has had to be developed indicating, for example, how a dialogue is opened and closed, and how a particular sequence of messages within a dialogue is ended. However, the intention is that this should be as automatic as possible, with an apparently seamless line of communication between end users. The extent of the automation will ultimately be the responsibility of the system designers, both from the engineering and operational aspects.

3. DISCUSSION

Development Of The FIS SARPs

3.1 In addition to the ICAO documentation noted in para 2.2 above, the main document from which the SARPs have been developed are the Draft ICAO Manual of ATS Data Link Applications, submitted to the 2nd Meeting of the ADS Panel in September 1996. This specifies operating concepts in some detail. ICAO has specified that the FIS application should conform to the ATN protocols for its data link operations.

3.2 The initial development of the SARPs centred around the requirement to replace a broadcast service with a service based on individual contact between the user (the aircraft) and the provider (the ground system). An ATIS broadcast system allows the pilot to obtain current information almost exactly when he/she wants it, and if the information becomes obtrusive, it can be switched off. If at any stage in the flight a controller detects that the aircraft is not in possession of the current information, it can easily be updated by voice.

3.3 This functionality is replicated to the extent possible by having two basic modes of operation in a data link FIS, namely a single request capability, and a ‘contract’ with the ground system, which provides updates to the aircraft as and when the information is updated by the ground. In stable conditions update rates may be virtually nil, whereas during the passage of an active front the ATIS may be updated several times per hour.

3.4 Although states would be obliged to make data link FIS information available on request, they may not wish to implement the provision of the update functionality. States might not be willing to incur the costs of implementing a complete system if they only ever intended to use certain elements of the application. In addition, they would want to be involved in a validation programme for parts of SARPs for which they would have no future need. On the basis of these arguments, therefore, the WG agreed to separate out the functionalities to enable part implementation and part validation, whilst still retaining the interoperability required by the ICAO Standards. This has led to the development of subsetting rules, and the identification of conformant configurations.

3.7 The Subgroup of Working Group 3 which has been responsible for the production of the draft FIS SARPs material has worked very closely with the relevant Working Groups of the ADSP, to ensure that the development of both the operational concepts, and the technical means of achieving them keep in step with each other. However, the ADSP is generally looking at a longer timescale

than the current ATNP initial implementation programme, and this will inevitably mean that some elements of their work has not been incorporated into the present SARPs.

Overview Of The Contents Of The Material

General

3.8 Due to the complexities of the documentation, and the repetitive nature of some of the material, none of the Air-Ground Applications SARPs are stand-alone documents. For example, there are no formal list of acronyms, definitions or references - these are all in Part 1. Likewise, conventions for expressing requirements, system performance parameters common to all air-ground applications, and the whole description of the Application Layer structure, with its finite and abstract concepts and its basis within ISO specifications, is also outwith this material.

3.9 Also, to the extent possible, the FIS SARPs are a Controlled Document. This means that, once they were initially baselined (at the WG 3/4 meeting in October 1995) all changes have been documented through defect reporting and a configuration control procedure. Some reports are little more than a one line entry, invoking near-global changes agreed by a meeting of WG 3, whereas others may be technically complex, raised by an organisation responsible for developing prototype implementations. All defect reports are reviewed by Subgroup 2, acting as a Configuration Control Board , the necessary remedial action put in place, and the results presented to WG 3 for acceptance and approval. Traceability of actions is provided by means of the Configuration Sheet at the front of the SARPs.

3.10 All the Air-Ground SARPs are produced to a standard format of eight chapters, and all chapter headings are the same. This has greatly helped the maintenance of document stability, commonality and presentation. FIS SARPs are no different in basic layout from all other air-ground applications SARPs.

Chapter 1 - Application overview

3.11 This introductory chapter gives a very brief, high level description of CPDLC, as an application enabling FIS services to be provided to a pilot via the exchange of messages between aircraft avionics and ground FIS systems.

3.11 This chapter also contains an outline description of the functions which the application provides, namely:

a. **FIS Demand Contract function**

This function allows the airborne FIS system to establish a FIS demand contract with a ground FIS system. Realisation of the contract involves the sending of a single FIS report from the ground FIS system to the aircraft, optionally after the sending of a positive acknowledgement.

b. **The FIS Update Contract function**

This function allows the airborne FIS system to establish an Update Contract with a ground FIS system. Realisation of the contract involves the sending of FIS reports from the ground FIS system to the aircraft each time the requested FIS information is modified.

c. **The Cancellation of Contracts function**

This function allows both air and ground FIS system to cancel a particular FIS update contract that is in operation.

3.12 Finally, chapter one contains a brief resume of the contents of the other chapters.

3.13 Since this chapter contains no information directly relation to the stipulation of specific Standards, it is almost entirely written as series of informative notes.

Chapter 2 - General requirements

3.14 This chapter contains information and high level requirements for the maintenance of Backward Compatibility and Error Processing. Throughout these SARPs great emphasis is placed on the end users being kept informed of the state of the system.

Chapter 3 - The Abstract Service

3.15 This chapter defines the abstract service interface for the FIS application. The FIS-Application Service Element (FIS-ASE) abstract service is described from the viewpoint of the CPDLC-air-user, the FIS-ground-user and the FIS-service-provider.

3.16 In this chapter the static behaviour, (i.e. the format) of the FIS abstract service is described. Its dynamic behaviour (i.e. how it is used) is described in chapter 7. In order to clarify some of the concepts inherent in the abstract service, an outline diagram and informative notes are provided as an introduction. There is of course no requirement to implement the FIS-ASE abstract service in a FIS product: however, it is necessary to implement the ground based and air based system in such a way that it will be impossible to detect (from the peer system) whether or not an interface has been built. This emphasises the implementation impartiality of the SARPs, which retaining the need for the provision of interoperability.

3.17 The FIS-ASE abstract service shall consist of a subset of the following services (permissible subsets are described in chapter 8), the rules and requirements of which are described in detail:

a. FIS-demand-contract service

b. FIS-update-contract service

c. FIS-report service

d. FIS-cancel-contracts service

e. FIS-cancel-update-contract service

f. FIS-user-abort service

g. FIS-provider-abort service

3.18 Each service contains a number of primitives and parameters - parameter values, where required, conforming to the Abstract Syntax Notation .One (ASN.1) syntax as given in Chapter 4.

Chapter 4 - Formal Definition of Messages

3.19 This chapter describes the contents of all permissible FIS messages through definition of the FIS ASN.1 abstract syntax. All possible combinations of message parameters and their range of values are detailed. Any messages not included in this chapter may be sent using the 'Free Text' option, subject to the restrictions outlined in para 3.3 above.

3.20 Parameter ranges and resolutions, where applicable, have been obtained from the ADSP documentation - any changes in these will be reflected in this chapter through the means of defect notes.

Chapter 5 - Protocol Definition

3.21 This chapter is effective split up into three parts - sequence diagrams for the services given in chapter 3, protocol descriptions and error handling for the FIS-Air- and Ground-ASEs, and State Tables.

3.22. The sequence diagrams define the valid sequence of primitives that are possible to be invoked during the operation of the FIS application. They show the relationship in time between the service request and the resulting indication, and, if applicable, the subsequent response and resulting confirmation. With the exception of the abort primitives, only the sequence of primitives described in the diagrams shall be permitted. (Abort primitives may interrupt and terminate any of the normal message sequences.)

3.23 In order to guarantee message sequencing in normal operations, the FIS-air-ASE and the FIS-ground-ASE shall process primitives in the order in which they are received.

3.24 The protocol descriptions and error handling part of the chapter presents requirements for the FIS-air and ground-ASEs in specific states. If no actions are described for a FIS service primitive when the ASE is in a specific state, then the invocation of that primitive shall be prohibited while the ASE is in that state. Likewise, should the unexpected happen when an ASE is in a specific state, then exception handling procedures shall apply.

3.25 The state tables are a tabular description of the protocol rules earlier in the chapter. However, if the state tables conflict with any textual statements made elsewhere in the SARPs, the textual statements take precedence.

3.26 In the state tables, the statement 'cannot occur' means that if the implementation conforms to the SARPs, it is impossible for this event to occur. If the event does occur, this implies that there is an error in the implementation. If such a situation is detected, it is suggested that the ASE aborts , giving an indication of an unrecoverable system error. The statement 'not permitted' means that the implementation must prevent this event from occurring through some local means. If the event does occur, this implies that there is likewise an error in the implementation. However, if such a situation is detected in this case, it is suggested that the ASE performs a local rejection of the request, rather than aborting the dialogue.

Chapter 6 - Communication Requirements

3.27 This short chapter specifies the use of Packed Encoding Rules (PER) to encode/decode the ASN.1 message structure, Dialogue Service requirements, including Quality of Service (QOS), and stipulates the IA5 character string used as the Application Entity qualifier for the FIS application.

3.28 In this initial version of the FIS application, there are only limited QOS requirements - these will be expected to become more strongly defined in later versions.

Chapter 7 - User Requirements

3.29 This chapter contains requirements imposed on the FIS-user concerning FIS messages and interfacing with the FIS-ASEs. It is also written in slightly less formal language. This chapter also recommends that ATIS messages follow the identical format and order of their verbal equivalents.

3.30 Only the FIS-air-user is capable of initiating the FIS-demand-contract or the FIS-update-contract service, but both the FIS-air-user and the FIS-ground-user are capable of initiating the FIS-cancel-update-contract service

Chapter 8 - Subsetting Rules

3.31 This chapter specifies conformance requirements which all implementations of the FIS protocol obey. The protocol options are tabulated, and indication is given as to whether mandatory, optional or conditional support is required to ensure conformance to the SARPs.

3.32 There are just two FIS-air-ASE and two FIS-ground-ASE conformant configurations, namely supporting the core functionality, or the core functionality plus an update capability.

4.30 These subsetting rules will permit applications to be tailored to suit individual ground implementations, commensurate with the underlying task, while still maintaining an acceptable level of interoperability.

5. RECOMMENDATION

5.1 The Panel is recommended to approve the attached FIS Standards and Recommended Practices for review by the Air Navigation Commission for inclusion into the relevant ICAO documentation.