

**International Civil Aviation Organization (ICAO)
Aeronautical Telecommunication Network Panel (ATNP)
Working Group 3**

*Rio de Janeiro - Brasil
16-20 March 1998*

Agenda Item 9: CNS/ATM-1 and FANS-1/A Accommodation,
Transition & System Compatibility

Issues raised by experience from FANS 1 operations

(Presented by Gregg Anderson, FAA)

(Prepared by Tom Kraft, FAA)

Summary

This working paper provides descriptions of various issues that have been identified as a result of experienced gained from FANS 1 operations in the South Pacific. The paper provides a description of the issue and recommendations for solutions. This paper invites the ATNP WG 3 to consider these issues and recommendations and to assess any impact on the ATN SARPS and guidance material.

1.0 Introduction

This working paper provides a summary of some issues that have been raised by experience from FANS 1 operations. The issues in this working paper are the views of subgroup 1 of RTCA SC-189/EUROCAE WG-53 and the issue will be further assessed at the 5th joint meeting of SC-189/WG-53, 15-19 June 1998, in the United Kingdom. This paper invites the ATNP WG3 to consider the recommendations. The US representatives are willing to provide the considerations of the ATNP WG3 to the SG1 of SC-189/WG-53. This paper also invites ATNP WG 3 to assess the impact on ATN SARPS, guidance material, including accommodation of FANS 1/A, if any.

2. Lack of Priority for ADS Connections

The avionics implementing the ADS function will process ADS connections on a first come, first serve basis. When the number of connections requested exceeds the number of connections available the last in connection request will be denied with an ARINC 622 disconnect request with a reason code 1. There is no technical restriction on which facilities may initiate an ADS connection request, ATS or AOC.

Different possibilities exist which could be recommended to ensure that the ATS in control is not denied an ADS connection to the aircraft such as:

- a) The ground ATS in control of an aircraft is expected to use ground/ground communications to coordinate ADS connections terminations in the event that its connection is denied.
- b) Alternatively the ATS in control can request the aircraft to terminate all ADS contracts by voice or a CPDLC free text message.
- c) Letters of agreement or Regional ICAO procedures may operationally rule the rights to initiate an ADS connection to an aircraft.

3. Impact on Performance of AOC and ATS Sharing of Data Link Resources

The AOC application data including flight plan and wind data are transmitted over the same data link as ATS application data for ADS, CPDLC and other proposed applications. The interaction of these data has impact on data link performance. Application data priorities influence performance. The effect of multi-block messages must also be considered.

4. Time stamping of CPDLC messages

FANS 1/A added a field 'Time stamp' to the message header defined in DO-219. DO-219 change 1 defined this time stamp as optional.

Time stamping in downlink CPDLC messages has been made an operational requirement by some ATS providers. Therefore FANS 1/A avionics will always provide that information.

Regarding time stamp in uplink CPDLC messages, no requirement on ATS ground systems has been identified. Current cockpit interface design is based on the assumption that the time at which the message was generated by the ATS system may not be available. Consequently, an uplink CPDLC message will be displayed (to the crew) with the time at which it arrived in the avionics.

The same applies to time stamps in AFN messages.

For ADS, time stamp is mandatory in downlink messages and not provided in uplink messages.

5. Message Assurance (MA) and Logical Response

FANS-1's lack of provision for an optional downlink MA, or preferably a full uplink and downlink FSM/LACK capability, is an interoperability and transition issue for proposed European operations.

Logical Responses ("LACK + ERROR" or "LAM" in CNS/ATM-1 and "Flight System Message" in ARINC 623) are an integral part of the European operational concept for datalink, and are a validated operational requirement for at least the initial period of datalink operations.

Further information on this requirement, and its validation, are available upon request.

PETAL-II therefore fully supports the recent request by IFALPA for MAs to downlink messages, and proposes that SC189/WG53:

- a) endorse IFALPA's request for an MA capability to the AEEC, to influence on-going discussions.
- b) examine the use of FSM, or extend the use of MA, to provide a true Logical Response capability in both the uplink and downlink direction (i.e. introduce a true Logical Response message in place of or in addition to the MA, or provide for the MA to be triggered by the receiving application rather than the underlying communications management systems).

6. Mandatory Data Elements in ATN CMA and FANS 1/A AFN

We understand that the European Flight Data Processing Systems (FDPS) require the following data elements to correlate datalink addresses with ground held flight plans:

- a) Flight ID (the flight's callsign, as filed in Field 7 of the ICAO flight plan);
- b) Departure aerodrome;
- c) Destination aerodrome;
- d) Estimated Off Blocks Time.

For the purposes of this paper, it is sufficient to say that there is no currently agreed mechanism for replacing these elements, and their use for flight plan correlation can be expected to continue for the foreseeable future. Failure to recognize this fact, and to provide the corresponding data at log-on, will delay the operational implementation of air/ground datalink.

The ATN Context Management application allows **optional** use of fields 'b' - 'd', above. FANS-1/A's AFN does **not** allow use of the elements 'b' - 'd', and does not clearly mandate use of **ICAO** Flight IDs.

SC189/WG53 Subgroup 1 is proposing that:

- a) data elements 'b' through 'd', inclusive, be made mandatory for CNS/ATM-1 CMA.
- b) data elements 'b' through 'd', inclusive, be made mandatory for FANS-1/A.
- c) the term 'Flight ID' be standardized for use in all ATM applications as the ICAO Flight ID, as filed in Field 7 of the ICAO flight plan.

7. AFN Change to Support Ground System and Aircraft System Common Application Version Number Negotiation

When new application version numbers are introduced in the aircraft and the ground ATS systems the AFN log on process in the aircraft and ground systems must accommodate a version recognition and negotiation process to arrive at a common version number. The reality is that simultaneous transition of all aircraft and ground systems will not occur.

8. FANS 1/A Flight Plan Waypoint Sequencing When Flying Off Track

Currently, when aircraft are flying an offset, normal waypoint sequencing algorithms provided in flight management systems on aircraft are not operationally the same. As a result, certain ADS data provided to the controller may be different. For operational scenarios where aircraft are deviating from the active enroute flight plan for weather avoidance, normal waypoint sequencing should occur for crosstrack deviations up to 50 nautical miles.

Propose guidance material for future aircraft implementations to meet a common operational requirement as follows:

The aircraft RNAV function should sequence enroute waypoints in the active flight plan, and transmit the appropriate ADS waypoint event report, when passing the normal extension from the active go-to waypoint at lateral crosstrack deviation distances up to 50 nautical miles.

9. Adoption of FANS-1/A Connection Initiation Procedures During Transition Period

In FANS-1/A, CPDLC (TWDL) connections are initiated by ground systems (i.e. the CPDLC connection request is sent by the ATS facility, and confirmed by the aircraft).

In ATN, CPDLC connections can be initiated by **either** the air or ground systems (i.e. the CPDLC connection request can be sent by either the ATS facility or the aircraft), and a mainstream operational proposal recommends that the aircraft initiates the request.

If guidance is not published on ATN systems, the potential exists for:

- a) interoperability problems for “dual stack” ground systems, which could be asked to request connections for FANS-1/A systems, and await requests from ATN aircraft.
- b) potential interoperability problems for “single stack” ATN airborne and ground systems, which could simply wait for the other partner to request a connection, or could require additional logic for the airborne and ground systems to deal with, for example, crossing connection requests.

Both the above situations can be expected to intrude on controller and aircrew procedures, and increase costs for e.g. training and systems, thereby reducing overall benefits and use.

SC189/WG53 Subgroup 1 proposes that:

- a) The FANS-1/A connection process be established as an international standard for at least the FANS-

1/A & ATN transition period, to ease the operational transition problems surrounding transfer of communications and abnormal modes.

- b) Ground systems should routinely initiate CPDLC connection requests, and in an ATN environment ground systems should have priority (i.e. in the case of crossing requests, ground systems would reject an airborne request; aircraft systems will always accept ground requests).

NOTE: This recommendation does not apply to the ATN Downstream Clearance service (i.e. CPDLC with an ATS facility other than the Current Data Authority), currently required as always requiring air-initiation.

10. Common CPDLC Message Elements During Transfer of CPDLC Authority

ATN & FANS-A/1 Compatibility Issue:

FANS-1/A requires use of the End Service CPDLC element (uplink element 161) to transfer CPDLC authority (Current Data Authority) from one ATS Unit to another. This element is contained in the ICAO Manual and ATN SARPS with an operational intent equating to the above function.

To remove a potential interoperability problem, and to ensure that the defined operational element is used rather than technical messages with no defined intent (e.g. CPDLC_end_request), ATN ground systems should use element 161 during the transfer of communications process.

189/53 SG-1 recommends that all CPDLC ground systems, regardless of the technical infrastructure involved comply with the following:

Uplink element 161 shall be used by a CDA, either concatenated to or in place of, element 117 to end CPDLC services between the CDA and an aircraft.