

**International Civil Aviation Organization
UNDP/ICAO Regional Project RLA/98/003
Transition to the CNS/ATM Systems in the CAR/SAM Regions**

**Second Meeting/Workshop of ATM Authorities and Planners
(Lima, Peru, 14 to 18 May, 2001)**

Item 2: Final implementation of RNAV routes UT 780, UT 795 and UT 799 and analysis of new pre-operational trials and demonstrations in said routes

Non-critical ATS applications using the ACARS protocol

(presented by the Secretariat)

Summary

This working paper contains information about the implementation of data links in the CAR/SAM Regions. In this respect, an analysis is made of the potential implementation of non-critical ATM applications using the ACARS protocol, as defined in ARINC specification 628, and of the possibility of considering plans for conducting pre-operational tests to assess the corresponding operational benefits to be derived from the use of such data links.

References:

- CAR/SAM Regional Plan for the implementation of CNS/ATM systems
- CAR/SAM FASID
- ARINC specifications 618, 623 and 622.

1. Introduction

1.1. Aeronautical data links are deemed necessary for the implementation of digital data communications foreseen in the CNS/ATM system concept. In this sense, ICAO has developed a network architecture called ATN to meet end-to-end communication requirements between ATM applications. The ATN network architecture is based on the ISO OSI open system model. For the aeronautical mobile service, several data link technologies have been standardised by ICAO, and particularly for VHF data link (VDL), three modes have been established, namely Mode 2, Mode 3 and Mode 4. There are also other ATN-compatible sub-networks, such as the AMSS and the HFDDL.

1.2. For future use of these data links, various ATM applications have been defined, such as CPDLC, ADS, FIS (D-ATIS), CM, and others for management and safety purposes. Application requirements *vis-*

à-vis the ATN system and quality of service (QOS) are defined in Annex 10, Vol. III. Applications previously regulated by ICAO are bit-oriented applications.

1.3. The ACARS was developed for the airlines many years ago by the aviation industry. Subsequently, other applications were added to this network, which was primarily oriented to the OOOI application. However, with the global adoption of the CNS/ATM system concept, airlines have expressed their desire that ATS applications be supported through the ACARS. Currently, there are two recognized data link providers (DSP), ARINC and SITA, which operate a broad ACARS network with VHF air-ground and satellite (SATCOM) links.

1.4. Taking advantage of this meeting of ATM authorities and planners, this working paper has been prepared in coordination with IATA with the purpose of studying the advisability of testing non-critical ATM applications using ACARS, as part of the CNS/ATM initiatives to be agreed by the meeting/workshop.

2. Analysis

2.1. The ACARS protocol, as defined in ARINC application 618, is a character-oriented protocol. ARINC specification 623 defines the text formats of ATS applications which can be transmitted by data link through the ACARS. The message context and format in these character-oriented applications contained in ARINC specification 623 are not consistent with bit-oriented applications.

2.2. Bit-oriented ATM applications require a greater end-to-end functionality which cannot be provided by the ACARS network. In the absence of ATN-compatible local area networks in avionics, ARINC developed ARINC specification 622 which, among other functionalities, provides for the conversion from a bit-oriented application to a text message format for transmission through the ACARS, by means of an ACARS convergence function (ACF) that resides in end systems such as the FMS. This is the solution applied in the FANS 1/A systems currently used by many airlines in the North Atlantic and the PAC Region. The CAR/SAM Regional Plan for the Implementation of the CNS/ATM envisions the FANS 1/A as the transition system to the CNS/ATM environment, but its implementation at regional level could be very expensive and surpassed by ATN-compatible avionics systems already being developed.

2.3. According to IATA, 70% of the fleet that carries out international flights in the CAR/SAM Regions is equipped with ACARS and only 6 aircraft have FANS 1/A systems. In this respect, and taking advantage of ACARS-compatible avionics, other ICAO Regions have already considered implementing non-critical ATS applications using data link through the ACARS in order to alleviate air traffic control workload. These applications include Pre-Departure Clearance (PDC) and Automatic Terminal Information Services (ATIS), both documented in ARINC specification 623.

3. Implementation of data links through the ACARS

3.1. According to information available at the Secretariat, some administrations in the region have been in contact with ARINC to implement data links through the ACARS for character-oriented applications. Brazil is the only State in the region that operates an ACARS network and may be considered as a data link provider (DSP). Its system, called DATACOM, is connected to the SITA ACARS system and provides AOC service to 28 airlines through 18 VHF remote stations (RGS). Brazil is completing the implementation of a gateway that will give DATACOM users access to OPMET and AIS information, and is also planning the future implementation of PDC and D-ATIS applications.

3.2. From the point of view of regional planning, functions such as CLRD (traffic clearance delivery service) and ATIS are recommended for many ATS units in Table CNS 2A of the CAR/SAM FASID. These functions could be implemented with data links and could have a functionality similar to the PDC and D-ATIS, as long as operational service quality requirements are met.

3.3. The implementation of data links through the ACARS for non-critical ATC applications requires an ACARS data link provider. This data link provider should furnish end-to-end service for PDC and ATIS applications, using the message structure defined in ARINC specification 623.

3.4. There could be more than one alternative regarding potential data link providers and technical solutions, which might even include AFTN connections as part of the data link. However, from the operational point of view, the important thing is to meet service quality requirements related to:

- a. the mechanisms foreseen to ensure data integrity; and
- b. end-to-end message transit time.

3.4.1. To ensure a), protocols should be available to check for and correct errors. For example, X.25 networks could perform this function.

3.4.2. As to transit time, Annex 10, Vol III, Chapter 3-ATN, paragraph 3.4.7, shows in Tabla 3-1 a quality of service (95% probability) for ATS communications (ATSC) going from class A (reserved), B - 4,5 seconds to H- 100 seconds, that is, at worst, end-to-end message transit time should be 100 seconds. It is also important to ensure message integrity.

3.5. ARINC y SITA are expected to attend the meeting, and they could provide information about the possibilities and technical-institutional arrangements for the implementation of ATIS and PDC applications using the ACARS, as well as of other applications contemplated in ARINC specification 623.

4. **Conclusion**

4.1. At present, there are no concrete plans in the CAR/SAM Regions for the implementation of the data links recommended in the CAR/SAM FASID to support ATM applications for the aeronautical mobile service. It is quite likely that the States will begin planning for this implementation in parallel to the planning by the aeronautical industry for the implementation of ATN-compatible local area networks in avionics. In this sense, VDL Mode 2 seems to be the most likely candidate.

4.2. This notwithstanding, it is possible that non-critical ATM applications specified by ARINC, such as ATIS and PDC, may use the ACARS network and the corresponding avionics available in 70% of the aircraft fleet. In this sense, it would be advisable to discuss proposals by providers of data links with ACARS protocol in the light of possible operational benefits and cost-benefit studies, and to document this matter for the next meeting of the ATM/CNS Subgroup to be held in July this year. To this end, it is important to consider service quality operational requirements, and some direction could be defined based on that stated in paragraph 3.4.2 above.

4.3. On the other hand, it is important to note that the possibility of implementing non-critical ATS applications using the ACARS calls for prior pre-operational testing, and that there should be States willing to conduct such tests.

5. **Suggested action**

5.1. The meeting is invited to consider the information contained in this working paper and to analyse the potential implementation of non-critical ATM applications as defined in ARINC specification 628, such as PDC and ATIS, using the ACARS protocol, as well as the possibility of contemplating plans for conducting pre-operational tests to assess the corresponding operational benefits that may be derived from the use of data links through the ACARS.

5.2. In the light of the conclusions reached on 5.1 above, the meeting is expected to bring this matter to the attention of the first meeting of ATM/CNS Subgroup.