

RTCA, Inc.  
1828 L Street, NW, Suite 805  
Washington, DC 20036-5133 USA

**Interoperability Requirements for ATS  
Applications Using ARINC 622 Data  
Communications (FANS I/A Interop Standard)**

RTCA DO-258A  
Supersedes DO-258  
April 7, 2005

Prepared by: SC-189  
© 2005 RTCA, Inc.

Copies of this document may be obtained from

RTCA, Inc.

Telephone: 202-333-9439

Facsimile: 202-333-4434

Internet: [www.rtca.org](http://www.rtca.org)

Please visit the RTCA Online Store for document pricing and ordering information.

## FOREWORD

This guidance document was jointly prepared by Special Committee 189 (SC-189) and the European Organization for Civil Aviation Equipment (EUROCAE) Working Group 53 (WG-53) and approved by the RTCA Program Management Committee (PMC) on April 7, 2005.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Federal Advisory Committee and develops consensus based on recommendations on contemporary aviation issues. RTCA's objectives include, but are not limited to:

- coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;
- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity and efficiency;
- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and
- assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunications Union and other appropriate international organizations can be based.

The organization's recommendations are often used as the basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration Technical Standard Orders.

Since RTCA is not an official agency of the United States Government, its recommendations may not be regarded as statements of official government policy unless so enunciated by the U. S. government organization or agency having statutory jurisdiction over any matters to which the recommendations relate.

Currently in preview, click buy full version

This Page Intentionally Left Blank.

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	Purpose .....	1
1.2	Scope.....	2
1.3	Relationships to other documents .....	2
1.4	How to use this document.....	3
1.4.1	Mandating and Recommendation Phrases .....	3
1.4.2	Document Organization .....	4
1.4.3	Acronyms and abbreviations .....	5
1.5	References.....	6
1.5.1	General.....	6
1.5.2	Communication Service Standards .....	6
1.5.3	ATS Application Standards .....	7
1.5.4	Aircraft System Standards And Supplementary Specifications.....	7
1.5.5	ISO Standards .....	7
1.5.6	EUROCAE/RTCA standards.....	7
<b>2</b>	<b>SYSTEM DESCRIPTION .....</b>	<b>9</b>
2.1	Overview.....	9
2.1.1	AFN .....	9
2.1.2	ADS .....	10
2.1.3	CPDLC .....	10
2.1.4	ARINC 622 Data Communication.....	11
2.2	Assumptions.....	12
2.2.1	Architectural Assumptions.....	12
2.2.2	Functional Assumptions .....	14
<b>3</b>	<b>REQUIREMENTS FOR COMMUNICATION SERVICES.....</b>	<b>17</b>
3.1	Introduction .....	17
3.2	Basic Constraints .....	17
3.2.1	Model Support.....	17
3.2.2	Message Assurance.....	17
3.2.3	ACARS Uplink Block Identifiers .....	18
3.3	ANSI-1/A Message Delivery .....	18
3.3.1	Downlink Message Delivery .....	18
3.3.1.1	Downlink Message Delivery - Sequence of Events .....	19
3.3.1.2	Downlink Message Delivery - Operational Scenarios .....	19
3.3.1.3	Downlink Internetworking Function.....	19
3.3.2	Uplink Message Delivery .....	20
3.3.2.1	Uplink Message Delivery - Sequence of Events .....	21
3.3.2.2	Uplink Message Delivery Function - Operational Scenarios .....	22
3.3.2.3	Uplink Internetworking Function.....	23

3.4	ATS Provider Requirements .....	24
3.4.1	Use of Message Assurance .....	24
3.4.2	Addressing of Uplink Messages .....	24
3.4.3	Message Routing.....	25
3.5	Aircraft requirements .....	25
<b>4</b>	<b>REQUIREMENTS FOR ATS APPLICATIONS.....</b>	<b>27</b>
4.1	Introduction.....	27
4.2	ACARS Compatible System (ACS) .....	27
4.2.1	FANS-1/A deviations .....	27
4.2.2	Guidance Material.....	27
4.3	ATS Facilities Notification (AFN) .....	28
4.3.1	FANS-1/A deviations .....	28
4.3.2	Guidance Material.....	29
4.4	Application Interface for Bit-Oriented Applications .....	29
4.4.1	FANS-1/A deviations .....	29
4.4.2	Guidance Material.....	30
4.5	Automatic Dependent Surveillance (ADS).....	30
4.5.1	ADS Operation .....	30
4.5.1.1	Application Interface.....	31
4.5.1.2	Processing of Uplinks .....	32
4.5.1.3	ADSF Interfaces.....	45
4.5.1.4	Message Generation .....	46
4.5.1.5	Abnormal Connection Termination .....	63
4.5.2	Guidance material .....	64
4.5.2.1	Basic ADS Content .....	64
4.5.2.2	Flight Identification Group .....	64
4.5.2.3	Earth Reference Group.....	64
4.5.2.4	Air Reference Group.....	64
4.5.2.5	Aircraft Identification Group .....	65
4.5.2.6	Predicted Route Group.....	65
4.5.2.7	Aircraft Intent Groups .....	65
4.5.2.8	Offset path.....	65
4.5.2.9	Deviation from the active flight plan .....	65
4.5.2.10	Holding pattern .....	65
4.5.2.11	Non-compliance Notification message .....	66
4.6	Controller Pilot Data Link Communication (CPDLC) .....	66
4.6.1	Application interface.....	66
4.6.2	Connection Management .....	67
4.6.2.1	Connection Initiation.....	67
4.6.2.2	Connection Termination.....	69
4.6.2.3	Next ATC Data Authority Information Retention .....	71
4.6.3	Message Set .....	72
4.6.3.1	Message Attribute Tables.....	72
4.6.3.2	Message Presentation .....	74
4.6.3.3	Message Structure and Content.....	74

4.6.3.4	Message Encoding/Decoding	119
4.6.4	Message Header	119
4.6.4.1	Message Identification Number	119
4.6.4.2	Message Reference Number	120
4.6.5	Message Attributes	121
4.6.5.1	Urgency	121
4.6.5.2	Alert	121
4.6.5.3	Response	121
4.6.5.4	Recall	122
4.6.6	Message Handling	122
4.6.6.1	Message Elements	122
4.6.6.2	Message Data Types	123
4.6.6.3	Message Display	123
4.6.6.4	Pending Messages	123
4.6.6.5	Indicators	124
4.6.6.6	Controls	124
4.6.6.7	ATC Data Authority Determination	124
4.6.6.8	Message Errors	124
4.6.6.9	Message Latency	124
4.6.7	Guidance Material	126
4.6.7.1	Uplink Messages	126
4.6.7.2	Downlink Messages	134
4.6.7.3	Data Structures Presentation Guidance	139
4.6.7.4	CPDLC Data Structures Glossary	147
4.6.7.5	Use of Time Stamp in CPDLC Uplink Messages	157
4.6.7.6	Uplink ERROR Message Element	157
4.6.7.7	Reports	157
4.6.7.8	[position] and [routeclearance] Variable Processing	160
4.6.7.9	Message Identification Number	177
4.6.7.10	Approach procedures with 8 char identifiers	177
4.6.7.11	Use of downlink pre-formatted free text messages	178
<b>5</b>	<b>DYNAMIC FUNCTIONS/OPERATIONS</b>	<b>179</b>
5.1	Initial connection establishment	179
5.1.1	Correlation of ICAO Flight Plan with the AFN Logon	179
5.1.2	Initial CPDLC connection establishment	180
5.1.3	ADS connection establishment	181
5.1.4	Recommendations for Initial Connection Establishment	182
5.1.4.1	Message sequencing (CPDLC)	182
5.1.4.2	Correlation of CPDLC Connection Request and CPDLC Connection Confirm	182
5.1.4.3	Multiple AFN logons for an 'active' CPDLC connection	182
5.2	Connection transfer	183
5.2.1	AFN Address Forwarding	183
5.2.2	CPDLC Connection Transfer	185
5.2.3	ADS connection management	189
5.2.4	Recommendations for CPDLC connection transfer	189
5.3	Connection termination	190

5.3.1	CPDLC connection termination.....	190
5.3.1.1	Normal operations.....	190
5.3.1.2	Abnormal operations.....	190
5.3.2	ADS connection termination.....	191
5.3.2.1	Normal operations.....	191
5.3.2.2	Abnormal operations.....	191
5.4	CPDLC Messages exchange.....	191
5.4.1	Exchange Initiated by ATS.....	191
5.4.2	Exchange Initiated by Pilot.....	192
5.4.2.1	Negotiations.....	192
5.4.2.2	Abnormal Operations.....	192
5.5	ADS contracts.....	193
5.5.1	ADS reporting.....	193
5.5.2	Abnormal Operations.....	193
5.5.2.1	ADS reports ahead of schedule.....	193
5.5.3	Conditional Clearances.....	193
5.5.4	Recommendations for ADS.....	193
5.5.4.1	ADS Time-stamping.....	193
5.5.4.2	Report sequencing.....	194
5.6	Emergency Operations.....	194
<b>6</b>	<b>ALLOCATION OF INTEROPERABILITY REQUIREMENTS.....</b>	<b>195</b>

**APPENDICES**

Appendix A:	HISTORY AND TERMS OF REFERENCE OF WG-53/SC-189
Appendix B:	PROPOSED CHANGES
Appendix C:	EXAMPLE OF LOADING LINK MESSAGE ELEMENTS
Appendix D:	MEMBERSHIP
Appendix E:	IMPROVEMENT SUGGESTION FORM

## LIST OF FIGURES

Figure 2.2-1:	Generic Datalink Architecture (Communication Service Provider) .....	12
Figure 3.3-1:	Internetworking Architecture – Downlink Delivery Paths .....	20
Figure 3.3-2:	Internetworking Architecture – Uplink Delivery Paths .....	23
Figure 4.5-1:	Periodic Contract Request.....	38
Figure 4.5-2:	Event Contract Request .....	41
Figure 4.5-3:	ADS Cancel Contract Request.....	43
Figure 4.5-4:	Cancel All Contracts and Terminate Connection Request.....	43
Figure 4.5-5:	Cancel Emergency Mode Request .....	44
Figure 4.5-6:	Cancel Emergency Mode Indication.....	46
Figure 4.5-7:	Basic ADS Group (required) .....	47
Figure 4.5-8:	Flight Identification Group (on-request).....	48
Figure 4.5-9:	Earth Reference Group (on-request) .....	48
Figure 4.5-10:	Air Reference Group (on-request) .....	49
Figure 4.5-11:	Airframe Identification Group (on-request).....	49
Figure 4.5-12:	Meteorological Group (on-request) .....	50
Figure 4.5-13:	Predicted Route Group (on-request) .....	51
Figure 4.5-14:	Intermediate Projected Intent Group (on-request) .....	52
Figure 4.5-15:	Fixed Projected Intent Group (on-request) .....	53
Figure 4.5-16:	Acknowledgement Message .....	60
Figure 4.5-17:	Negative Acknowledgement Message.....	62
Figure 4.5-18:	Non-compliance Notification Message.....	63
Figure 5.1-1:	CPDLC connection establishment .....	180
Figure 5.1-2:	ADS connection establishment .....	181
Figure 5.1-3:	Multiple logons .....	183
Figure 5.2-1:	AFN Address Forwarding.....	184
Figure 5.2-2:	CPDLC Transfer (Contact or Monitor sent with the End Service).....	186
Figure 5.2-3:	CPDLC Transfer (Contact or Monitor and End Service sent as separate messages) .....	187
Figure 5.2-4:	Example of a successful CPDLC connection transfer (no ground-ground connectivity) .....	189

## LIST OF TABLES

Table 3.4-1:	Valid Label/MFI/IMI Combinations for Uplink Communications.....	25
Table 4.5-1:	ADS Input Message Parameters .....	34
Table 4.5-2:	Valid Uplink Tag Values .....	36
Table 4.5-3:	Downlink Tag Values .....	54
Table 4.5-4:	ADS Output Message Parameters.....	55
Table 4.5-5:	Figure of Merit - Minimum Position Accuracy .....	57
Table 4.5-6:	Negative Acknowledgement Reason .....	61
Table 4.6-1:	Urgency (URG) Attribute .....	72
Table 4.6-2:	Alert (ALR) Attribute .....	73
Table 4.6-3:	Response (RESP) Attribute (Uplink).....	73
Table 4.6-4:	Response (RESP) Attribute (Downlink).....	73
Table 4.6-5:	Recall (REC) Attribute (Uplink).....	74
Table 4.6-6:	Responses/Acknowledgements (Uplink) .....	126
Table 4.6-7:	Vertical Clearances (Uplink) .....	126
Table 4.6-8:	Crossing Constraints (Uplink) .....	128
Table 4.6-9:	Lateral Offsets (Uplink).....	129
Table 4.6-10:	Route Modifications (Uplink).....	130
Table 4.6-11:	Speed Changes (Uplink) .....	131
Table 4.6-12:	Contact/Monitor/Surveillance Requests (Uplink).....	131
Table 4.6-13:	Report/Confirmation Requests (Uplink).....	132
Table 4.6-14:	Negotiation Requests (Uplink) .....	133
Table 4.6-15:	Air Traffic Advisories (Uplink) .....	133
Table 4.6-16:	System Management Messages (Uplink).....	133
Table 4.6-17:	Additional Messages (Uplink) .....	134
Table 4.6-18:	Responses (Downlink).....	134
Table 4.6-19:	Vertical Requests (Downlink).....	135
Table 4.6-20:	Lateral Offset Requests (Downlink) .....	135
Table 4.6-21:	Speed Requests (Downlink).....	135
Table 4.6-22:	Voice Contact Requests (Downlink) .....	135
Table 4.6-23:	Route Modification Requests (Downlink).....	136
Table 4.6-24:	Reports (Downlink) .....	137
Table 4.6-25:	Negotiation Requests (Downlink).....	138
Table 4.6-26:	Emergency Messages (Downlink) .....	138
Table 4.6-27:	System Management Messages (Downlink).....	138
Table 4.6-28:	Additional Messages (Downlink) .....	138
Table 4.6-29:	Pre-formatted free text (Downlink) .....	139
Table 4.6-30:	Guidance for Data Structure Presentation.....	140
Table 4.6-31:	Uplink Request/Downlink Report Mapping.....	158
Table 4.6-32:	Loadable Uplink Message Elements.....	162
Table 4.6-33:	[routeclearance] Variables .....	165
Table 4.6-34:	[routeclearance] Variable Encoding Table .....	175

## 1 INTRODUCTION

This document provides the interoperability requirements (INTEROP) standard for the implementation of the ATS applications using ARINC 622 data communication, henceforth referred to as FANS-1/A (Version 1) systems.

This document was developed in accordance with the criteria for INTEROP standards set forth in RTCA DO-264/EUROCAE ED-78A, "Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications." This document represents the minimum set of interoperability requirements and allocations necessary to provide adequate assurance that the elements of the communication, navigation, and surveillance/ air traffic management (CNS/ATM) system are compatible with each other and when operating together will perform their intended function. These elements comprise the aircraft system, the air traffic service provider (ATSP) system, and the operator's provisions to use the air traffic services. The ATSP system and the operator's provisions may include third party or contracted communication services. The communications services include ACARS-compliant subnetworks and the ACARS communications service.

### 1.1 Purpose

The purpose of this document is to define the set of requirements for the interoperability aspects of FANS-1/A (Version 1) systems. It is intended for use in conjunction with a consistent safety and performance requirement standard, other INTEROP standards, and the guidelines described in DO-264/ED-78A for each approval type associated with the elements of the CNS/ATM system.

*Note 1: Based on ED-78A/DO-264, INTEROP and SPR standards provide recommendations intended for government organizations, conference of governments, or agencies having statutory jurisdiction over the use and provision of air traffic services supported by data communications. These recommendations are for use by such government organizations to enunciate official policy, related to such matters, in aeronautical information publications (AIPs), notices to airmen (NOTAMs), airplane flight manuals (AFMs), and operator specifications.*

Interoperability requirements are the minimum technical and functional requirements that provide the basis for ensuring compatibility among the various elements of the CNS/ATM system using a specific technology. These elements comprise the distributed communication services and ATS applications in the aircraft system, the communication service providers' system and the ATS Provider system.

*Note 2: This document is not intended to provide requirements to standardize operational procedures in the use of this technology. Refer to appropriate safety and performance (SPR) standards.*