

AMC 20-11 Acceptable Means of Compliance for the Approval of use of Initial Services for Air-Ground Data Link in Continental Airspace

1 PREAMBLE

Controller Pilot Data Link Communications, CPDLC is identified in the ATM Strategy for the years 2000+ as an enabler for operational improvement. They reduce controller workload and increase sector capacity. Simulations show that the sector capacity is increased by 11% if 75% of all controlled flights have CPDLC data link capability. The deployment strategy of CPDLC data link services is a three-step plan:

- Pioneer support for at least the first 150 aircraft.
- Incentives mechanisms for aircraft with CPDLC capability to foster the aircraft equipage with data link capability.
- Single European Sky interoperability implementing rules on data link services.

2 PURPOSE

This AMC is for aircraft operators seeking approval to use initial data link services in continental airspace. It contains:

- a set of assumptions relating to the implementation of data link services by air navigation service providers, communications service providers, aeronautical information service providers;
- an initial basis relating to the implementation of data link services in the flight deck to guide the airworthiness certification process;
- an initial basis relating to the operational use of data link services by aircraft operators to guide the operational approval process.

3 SCOPE

3.1 This AMC is applicable to services for with the following capabilities:

- a) Data Link Initiation Capability (DLIC) enables initial contact between the aircraft and an ATC unit that supports data communications, to unambiguously identify the aircraft, and to ensure compatibility of aircraft equipage with ATC. It is a prerequisite to any other operational data link services.
- b) ATC Communication Management (ACM) provides the necessary information to the aircraft to enable transfer of frequencies for both voice and data communications, either within the same sector, between two sectors or between two ATC centres.
- c) ATC Clearances (ACL) enables uplink of a set of clearance and information messages and downlink of pilot responses and requests.
- d) ATC Microphone Check (AMC) enables the controller to send a message to data link equipped aircraft (of appropriate interoperability) to request a stuck microphone check.
- e) Departure Clearance (DCL) enables the request and the delivery of departure information and clearance.
- f) Downstream Clearance (DSC) enables the request and the delivery of clearance with a downstream ATC centre (i.e. oceanic clearance).
- g) D-ATIS enables the request and the delivery of ATIS via data link.

Note : Implementations of DCL, D-ATIS and OCL over ACARS are not the subject of this AMC. Reference should be made to other applicable JAA or EASA documents based on ED85A, ED89A and ED106A.

4 REFERENCE DOCUMENTS

4.1 Related Requirements

CS/FAR 25.1301, 25.1307, 25.1309, 25.1322, 25.1431, 25.1581, or equivalent requirements of CS 23, 27 and 29, if applicable.

AMC 20-11 Effective: 26/12/2007

Annex IV to ED Decision 2007/019/R of 19/12/2007

4.2 Related Standards and Guidance Material

ICAO	Annex 2	Rules of the Air.
	Annex 6	Operation of Aircraft, Part I - International Commercial Air Transport – Aeroplanes.
	Annex 10	Aeronautical Telecommunications - Volume II (Communications Procedures including those with PANS status).
	Annex 11	Air Traffic Services.
	Annex 15	Aeronautical Information Services.
	Doc 4444	Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM)
	Doc 8585	Designators for Aircraft Operating agencies, Aeronautical Authorities and Services.
EASA EUROCONTROL	Doc 9694	Manual of Air Traffic Services (ATS) Data Link Applications.
	AMC 25-11	Electronic Display Systems.
	LINK 2000+/PM/BASE LINE/ AGC-ORD-01	LINK Baseline, Version 1.4, November 2006 EATCHIP/ODIAC Operational Requirements for Air ground cooperative air traffic services Edition 1.0. 2 April 2001.
FAA	ESARR 4	Risk assessment and mitigation in ATM.
	AC 25-11	Electronic Display Systems.
	AC 120-70	Initial Air Carrier Operational Approval for use of Digital Communication Systems.
EUROCAE	AC 20-140	Guidelines for design approval of aircraft data communications systems.
	ED-78A	Guidelines for Approval of the Provision and Use of Air Traffic Services supported by Data communications.
	ED-92A	Minimum Operational Performance Specification for an Airborne VDL System.
	ED-112	Minimum operational performance specification for Crash protected airborne recorder systems
	ED-110B	Interoperability Requirements Standard for ATN Baseline 1 (INTEROP ATN B1).
	ED-120	Safety and Performance Requirements Standard for Initial Data Link Services In Continental Airspace (SPR IC) including change 1 and change 2.
RTCA	DO-224A	Signal-in-Space Minimum Aviation System Performance Standards (MASPS) for Advanced VHF Digital Data Communications Including Compatibility with Digital Voice Techniques.
	DO-264	Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications. (Equivalent to ED-78A)
	DO-280B	Interoperability Requirements Standard for ATN B1 (Equivalent to ED-110B)
	DO-290	Safety and Performance Requirements Standard for Air Traffic Data Link Services in Continental Airspace (Continental SPR Standard) including change 1 and change 2. (Equivalent to ED-120)
SAE	ARP 4791	Human Machine Interface on the flight deck.

5 ASSUMPTIONS

Applicants should note that this AMC is based on the following assumptions.

5.1 Air Navigation Service Provider (ANSP)

5.1.1 Air navigation service providers implement all services or a subset compliant with relevant requirements of:

- the Safety and Performance Requirements of EUROCAE standard SPR ED-120,
- and the interoperability requirements of EUROCAE standard INTEROP ED-110B.

Deviations from these standards are assessed by ANSPs. Deviations that potentially impact the airborne domain should be assessed in coordination with relevant stakeholders as per ED-78A.

5.1.2 ANSP procedures specify the actions to be taken in case of failure of data link communication.

5.2 Communications Service Provider (CSP)

5.2.1 The CSP is committed to provide communication services to ANSPs and aircraft operators with the expected Quality of Service as defined in a specific Service Level Agreement. The Service Level Agreement is bilaterally agreed between the CSP and an ANSP. The terms of reference of the Service Level Agreement are consistent with the performance requirements of the SPR ED-120 document.

5.2.2 The CSP does not modify intentionally the operational information (content and format) of messages exchanged between the ANSP and the aircraft

5.3 Aeronautical Information Service (AIS)

5.3.1 Each State publishes in its AIP/NOTAM, or equivalent notification, information related to the data link service provisions, service schedule, relevant procedures, and confirmation of compliance with EUROCAE standard SPR, ED-120 and INTEROP ED-110B.

5.3.2 The publication will comprise a list of communication service providers that may be used by aircraft operators for the Link 2000+ services, taking into account internetworking arrangements between service providers.

6 AIRWORTHINESS CONSIDERATIONS

6.1 General

6.1.1 Qualification criteria requiring coordination is provided in ED-78A.

6.1.2 The installation should be shown to meet the safety and performance requirements allocated to the aircraft as provided in SPR ED-120, and the applicable interoperability requirements INTEROP ED-110B.

6.1.3 The VDL mode 2 radio transceiver should be compliant with ED-92A.

6.1.4 The airborne ATN router should be compliant with an ATN MOPS acceptable to the certification authority. In the absence of a published generic MOPS, the applicant may propose alternative minimum performance criteria for which interoperability and testability can be demonstrated.

6.1.5 Recording of ATS messages for accident investigation will need to be implemented when required by the applicable operational rules or by national regulation.

6.2 Human-machine interface on the flight deck

6.2.1 Compatibility. The human-machine interface should be compatible with the crew interface and flight deck design of the particular aircraft in which the data communications system and applications are installed.

6.2.1.1 If multiple ATS data link applications are available to the aircraft, the crew interface and related crew procedures should be based on a common and compatible philosophy.

6.2.2 Flight deck annunciation. The data communications system should have the following annunciation capability, which should be integrated into the flight deck so as to be compatible with the overall alerting scheme of the aircraft.

6.2.2.1 Unless otherwise substantiated by means acceptable to the certification authority, an audible and visual indication should be given for each uplink ATS message intended to be displayed to the flight crew, including those messages not be displayed immediately because of lack of crew acknowledgement to an earlier ATS message. Visual alerts alone may be used for non-ATS messages

6.2.2.2 The status of the data communications system should be available to the flight crew, e.g., loss of the data communications connection with communications management unit or its equivalent.

AMC 20-11 Effective: 26/12/2007

Annex IV to ED Decision 2007/019/R of 19/12/2007

- 6.2.2.3 If message storage and/or printing capability is provided, the system should indicate when storage and/or printing is not possible.
- 6.2.2.4 Annunciation of the receipt of a message during critical flight phases (e.g., takeoff and landing) should be inhibited until after the critical flight phase. The criteria that define critical flight phases should be consistent with the particular flight deck philosophy and the particular data link services supported.
- 6.2.3 Flight deck controls. Control capability for the data communications system and applications should meet the following criteria:
 - 6.2.3.1 Means should be provided for the flight crew to activate or deactivate each of the data communication applications.
 - 6.2.3.2 Means should be provided to the aircrew to know in real time the identity of the ATS provider(s) connecting with the aircraft, and the applications involved with each connection.
 - 6.2.3.3 Means should be provided for the flight crew to acknowledge receipt of ATS messages.
 - 6.2.3.4 Means should be provided for the flight crew to list, select, and retrieve the most recent (e.g. ten) ATS messages received and sent by the flight crew during the flight segment. The status of each message, the time it was received or sent, should be accessible.
 - 6.2.3.5 Means should be provided for the flight crew to clear uplinked messages from the display. However this capability should be protected against inadvertent clearing.
 - 6.2.3.6 Means should be provided for the flight crew to create, store, retrieve, edit, delete, and send messages.
 - 6.2.3.7 If a direct interface exists between the data communications application and other computer functions, (e.g. flight planning and navigation), a means should be provided for the flight crew to activate the computer function to use the data contained in the message. The means provided should be separate from that used to acknowledge receipt of a message.
- 6.2.4 Flight deck displays. Display capability of the data communications system and applications should meet the following criteria:
 - 6.2.4.1 All messages should be displayed, without being truncated, in a format that the flight crew can comprehend without the need for translation from English into another language.
 - 6.2.4.2 The flight crew should be able to read displayed messages without leaving their seats.
 - 6.2.4.3 Except for the ATIS, messages from the ATS should be displayed without the need for flight crew action, and remain displayed until acknowledged, unless the flight crew selects another message or, in the case of a multi-function display, another display format or function. In these cases a reminder should indicate that pending messages are waiting for a response.
 - 6.2.4.4 ATS messages should be displayed so that messages are distinguishable from each other. The status of each message (i.e. source, time sent, open/closed) should be displayed together with the message.
 - 6.2.4.5 When the data communications application is sharing a display with other aircraft functions, the aircraft system should ensure appropriate priority for the information to be displayed.
 - 6.2.4.6 If a message intended for visual display is greater than the available display area and only part of the message is displayed, a visual indication shall be provided to the pilot to indicate the presence of the message remainder.
- 6.2.5 Flight deck Printer. A flight deck printer may be used as a means of storing data communications messages received or sent during the current flight. It should satisfy integrity and interface design criteria appropriate for this purpose

7 ACCEPTABLE MEANS OF AIRWORTHINESS COMPLIANCE

7.1 Airworthiness

7.1.1 When showing compliance with this AMC, the following points should be noted:

- a) The applicant will need to submit, to the Agency, a certification plan and a compliance statement that shows how the criteria of this AMC have been satisfied, together with evidence resulting from the activities described in the following paragraphs.
- b) Compliance with the certification specifications (e.g. CS 25) for intended function and safety may be demonstrated by equipment qualification, safety analysis of the interface between the communications management system and other systems, structural analyses of new antenna installations, equipment cooling verification, and evidence of a human to machine interface, suitable for ATC initial continental data link services, and taking account of the criteria of paragraph 6.
- c) The aircraft data communications system and applications should be demonstrated by end-to-end ground testing that verifies system operation interoperability and performance, either with an appropriate ATS unit, or by means of test equipment that has been shown to be representative of the actual ATS unit. The testing should verify system operation, interoperability, and performance.

Notes: 1 EUROCAE ED-78A gives guidance on test equipment for this purpose.

- 2 This limited testing assumes that the communication systems have been shown to satisfactorily perform their intended functions in the flight environment in accordance with applicable requirements.

- d) When showing compliance with CS 25.1309, consideration should be given to the possibility of unacceptable interaction between the communications management system and other essential systems.

7.1.2 To minimise the certification effort for follow-on installations, the applicant may claim credit, from the responsible authority, for applicable certification and test data obtained from equivalent aircraft installations.

7.2 Performance

Where compliance with a performance requirement cannot readily be demonstrated by a test, then the performance may be verified by an alternative method such as analysis.

7.3 Aircraft Flight Manual

7.3.1 The Normal Procedures section of the Flight Manual shall provide a statement as follows:

“The aircraft ATC data link system has been demonstrated to comply with the applicable safety and performance requirements of EUROCAE ED-120, the interoperability requirements of ED-110B and with AMC 20-11. This AFM entry does not, by itself, constitute an operational approval where such an approval is required.”

7.3.2 The following information, as applicable to the specific services approved for the aircraft, will need to be included in either the Flight Manual or other operational documents.

“The aircraft ATC data link system is intended for the following data link services:

- a) Data Link Initiation Capability (DLIC) enabling initial contact between the aircraft and an ATC unit that supports data communications, to unambiguously identify the aircraft, and to ensure compatibility of aircraft equipment with ATC. It is a prerequisite to any other operational data link services.
- b) ATC Communication Management (ACM) providing the necessary information to the aircraft to enable transfer of frequencies for both voice and data communications, either within the same sector, between two sectors or between two ATC centres.
- c) ATC Clearances (ACL) enabling uplink of a set of clearance and information messages and downlink of pilot responses and requests.
- d) ATC Microphone Check (AMC) enabling the controller to send a message to data link equipped aircraft (of appropriate interoperability) to request a stuck microphone check.

AMC 20-11 Effective: 26/12/2007

Annex IV to ED Decision 2007/019/R of 19/12/2007

- e) Departure Clearance (DCL) enabling the request and the delivery of departure information and clearance.
- f) Downstream Clearance (DSC) enabling the request and the delivery of clearance with a downstream ATC centre (i.e. oceanic clearance).
- g) D-ATIS “enabling the request and the delivery of ATIS via data link.”

7.4 Existing installations

7.4.1 The applicant will need to submit, to the responsible authority, a compliance statement, which shows how the criteria of this AMC have been satisfied for existing installations. Compliance may be supported by design review and inspection of the installed system to confirm the availability of required features, functionality and acceptable human-machine interface.

7.4.2 Where this design review finds items of non-compliance, the applicant may offer mitigation that demonstrates an equivalent level of safety and performance. Items presented by the applicant which impact safety, performance and interoperability requirements allocation will need to be coordinated in accordance with ED-78A.

8 OPERATIONAL CONSIDERATIONS

Reserved.

9 AVAILABILITY OF DOCUMENTS

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JAA documents are available from the JAA publisher Information Handling Services (IHS). Information on prices, where and how to order is available on both the JAA web site www.jaa.nl and the IHS web site www.ihs.com.

EUROCONTROL documents may be requested from EUROCONTROL, Documentation Centre, GS4, Rue de la Fusee, 96, B-1130 Brussels, Belgium; (Fax: 32 2 729 9109 or web site www.eurocontrol.int).

ICAO documents may be purchased from Document Sales Unit, International Civil Aviation Organisation, 999 University Street, Montreal, Quebec, Canada H3C 5H7, (Fax: 1 514 954 6769, e-mail: sales_unit@icao.org) or through national agencies.

FAA documents may be obtained from Department of Transportation, Subsequent Distribution Office SVC-121.23, Ardmore East Business Centre, 3341 Q 75th Avenue, Landover, MD 20785, USA.

RTCA documents may be purchased from RTCA, Incorporated, 1828 L Street, Northwest, Suite 820, Washington, D.C. 20036-4001 U.S.A. Web site: www.rtca.org.

SAE documents may be obtained from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001, USA. Telephone 1-877-606-7323 (U.S. and Canada only) or 724/776-4970 (elsewhere). Web site www.sae.org.

Appendix 1

Common Terms

Reference should be made to EUROCAE document ED-110B and ED-120 for definitions of terms.

Abbreviations

AAC	Aeronautical Administrative Communications
ACARS	Aircraft Communications Addressing and Reporting System
ACC	Area Control Centre
ACL	ATC Clearances
ACM	ATC Communication Management
ADS	Automatic Dependent Surveillance
AIP	Aeronautical Information Publication
AMC	ATC Microphone Check (service)
AMJ	Advisory Material Joint
ANS	Air Navigation Service
ARINC	Aeronautical Radio Incorporated (USA)
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSU	Air Traffic Service Unit
CAA	Civil Aviation Authority
CFR	Code of Federal Regulations
CM	Configuration (Context) Management
CMU	Communications Management Unit
CNS	Communication, Navigation and Surveillance
CNS/ATM	Communication, Navigation and Surveillance / Air Traffic Management
CPDLC	Controller Pilot Data Link Communications
CS	Certification Specifications
CSP	Communication Service Provider
D-ATIS	Data Link ATIS
DCL	Departure Clearance
DFIS	Data Link Flight Information Service (ICAO)
DLIC	Data Link Initiation Capability
DSC	Downstream Clearance
EATCHIP	European Air Traffic Control Harmonisation and Integration Programme (see EATMP)
EATMP	European Air Traffic Management Programme
ECIP	European Convergence and Implementation Plan
EFIS	Electronic Flight Instrument System
ESARR	Eurocontrol Safety Regulatory Requirements
EUROCAE	EUROpean Organisation for Civil Aviation Equipment
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration
FANS	Future Air Navigation Systems (ICAO)
FMS	Flight Management System
ICAO	International Civil Aviation Organisation
INTEROP	Interoperability
JAA	Joint Aviation Authorities
JAR-OPS	Joint Aviation Requirements- Operations
MASPS	Minimum Aircraft System Performance Specification or Minimum Aviation System Performance Standards
MCDU	Multi-purpose Control and Display Unit
MOPS	Minimum Operational Performance Specification or Minimum Operational Performance Standards
NOTAM	Notice to Airmen
OSD	Operational Services and Environment Definition
REF	Reference

AMC 20-11 Effective: 26/12/2007

Annex IV to ED Decision 2007/019/R of 19/12/2007

RTCA	RTCA Inc
SAE	Society of Automotive Engineers
SARPs	Standards and Recommended Practices (ICAO)
SATCOM	Satellite Communications
SC	Standing Committee
SLA	Service Level Agreement
SPR	Safety and Performance Requirements
VDL	VHF Digital Link
VDR	VHF Digital/Data Radio
VHF	Very High Frequency
WG	Working Group