Global Operational Data Link Document (GOLD)

This edition has been approved by the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) and the North Atlantic Systems Planning Group (NAT SPG)

First Edition — 14 June 2010

International Civil Aviation Organization

This document is available from the following web sites:

http://www.ispacg-cra.com

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/data_link/

This document was administered by the GOLD Ad Hoc Working Group. This group will continue to assist the participating ICAO Regional Offices in the global coordination and acceptance of future amendments. For more information, contact tom.kraft@faa.gov.

Global Operational Data Link Document (GOLD)

This edition has been approved by the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) and the North Atlantic Systems Planning Group (NAT SPG)

First Edition — 14 June 2010

International Civil Aviation Organization

AMENDMENTS

The issue of amendments is announced by the ICAO Regional Offices concerned, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS			
No.	Date applicable	Date entered	Entered by

CORRIGENDA			
No.	Date applicable	Date entered	Entered by

Table of Contents

Page

List of Figures

List of Tables

Appendices

FOREWORD.

1. Historical background

1.1 The *Global Operational Data Link Document* (GOLD) is the result of the progressive evolution of the *FANS 1/A Operations Manual*, prepared initially by the Informal South Pacific Air Traffic Services Coordinating Group (ISPACG), and the *Guidance Material for ATS Data Link Services in North Atlantic Airspace*, produced by the North Atlantic FANS Implementation Group (NAT FIG), on behalf of the North Atlantic Systems Planning Group (NAT SPG).

1.2 Each of the two founding documents provided guidance on a regional basis. However, in recognition of the need to provide globally harmonized guidance on data link operations, the GOLD became effective on 14 June 2010.

1.3 This edition, re-titled *Global Operational Data Link Document* (GOLD), provides for a comprehensive update of the guidance as well as a major reorganization of the contents of the founding documents. This includes the incorporation of performance-based specifications and associated guidance on data collection, monitoring, and analysis.

2. Scope and purpose

2.1 The GOLD provides guidance and information concerning data link aspects of aeronautical activity and is intended to facilitate the uniform application of Standards and Recommended Practices contained in Annex 2 — *Rules of the Air* and in Annex 11 — *Air Traffic Services*, the provisions in the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) and, when necessary, the *Regional Supplementary Procedures* (Doc 7030).

2.2 This guidance material is intended to maximize operational benefits in data link operations by promoting seamless and interoperable data link operations throughout the world. This edition limits itself to those data link operations that apply to the use of FANS 1/A and its applications: automatic dependent surveillance — contract (ADS-C), controller-pilot data link communications (CPDLC) and the flight management computer waypoint position reporting (FMC WPR). It also addresses the performance of the data link applications taking into consideration the transmission media used by those applications. Future editions are expected to incorporate guidance that applies to the planned expansion of ATN CPDLC in core Europe as well as the use of FANS 1/A in continental Europe.

2.3 While directed primarily at air traffic services personnel and flight crews, the following personnel should be familiar with various aspects of its contents: regulators, airspace planners, aircraft operators, dispatchers, communication service providers and radio operators, training organizations, central monitoring and reporting agencies, automation specialists at centers and radio facilities, and aircraft manufacturers and equipment suppliers.

2.4 The guidance will support the following activities:

a) the States' roles and responsibilities in relation to the following:

   1) safety regulatory oversight of air navigation services;

   2) operational authorizations, flight crew training and qualification;

   3) design approval of aircraft data link systems

b) the development of agreements and/or contractual arrangements between air traffic service providers and aircraft operators and their respective communication service providers;

c) development of operational procedures; and

d) operational monitoring, analysis, and exchange of operational data among regions, States, and communication service providers.

3. Status

This guidance may contain material that may eventually become Standards and Recommended Practices (SARPs), or PANS provisions when it has reached the maturity and stability necessary for adoption or approval. It may also comprise material prepared as an amplification of the basic principles in the corresponding SARPs, and designed particularly to assist the user in the application of the SARPs and PANS.

4. Implementation

The implementation of procedures is the responsibility of Contracting States; they are applied in actual operations only after, and in so far as, States have enforced them. However, with a view to facilitating their processing towards implementation by States, this complementary guidance material has been prepared in language which will permit direct use by air traffic services personnel and others associated with the provision of air traffic services to international air navigation.

5. Promulgation of information

Information relating to the establishment and withdrawal of and changes to facilities, services and procedures affecting aircraft operations should be notified and take effect in accordance with Annex 15 — Aeronautical Information Services.

6. References

6.1 The following references are cited in this document:

a) ICAO Annex 1 — *Personnel Licensing*

b) ICAO Annex 2 — *Rules of the Air*

c) ICAO Annex 4 — *Aeronautical Charts*

d) ICAO Annex 6 — *Operation of Aircraft – Part I — International Commercial Air Transport — Aeroplanes*

e) ICAO Annex 10 — *Aeronautical Telecommunications – Volume II* — Communication Procedures including those with PANS status

f) ICAO Annex 10 — *Aeronautical Telecommunications – Volume III* — Communication Systems

g) ICAO Annex 11 — *Air Traffic Services*

h) ICAO Annex 15 — *Aeronautical Information Services*

i) *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, ICAO Doc 4444)

j) *Regional Supplementary Procedures* (Regional SUPPs, ICAO Doc 7030)

k) *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, ICAO Doc 8400)

l) *Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services* (ICAO Doc 8585).

m) *Aircraft Type Designators* (ICAO Doc 8643)

n) *Manual on Airspace Planning Methodology for the Determination of Separation Minima* (ICAO Doc 9689)

o) *Performance-based Navigation Manual* (PBN) (ICAO Doc 9613)

p) *Manual on Required Communication Performance* (RCP) (ICAO Doc 9869)

q) *Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace* (Oceanic SPR Standard, RTCA DO-306/EUROCAE ED-122).

r) *Safety and Performance Standard for Air Traffic Data Link Services in Continental Airspace* (Continental SPR Standard, RTCA DO-290/EUROCAE ED-120, Change 1 and Change 2).

s) *Interoperability Requirements for ATS Applications Using ARINC 622 Data Communications* (FANS 1/A INTEROP Standard, RTCA DO-258A/EUROCAE ED-100A).

t) *Interoperability Requirements Standard for Aeronautical Telecommunication Network Baseline 1* (ATN B1 INTEROP Standard, RTCA DO-280B/EUROCAE ED-110B).

u) *Future Air Navigation System 1/A — Aeronautical Telecommunication Network Interoperability Standard* (FANS 1/A — ATN B1 INTEROP Standard, RTCA DO-305/EUROCAE ED-154).

8. Changes to the document

This document is maintained as a regional document in coordination with all ICAO planning and implementation regional groups (PIRGs) providing data link services within their region. Each participating PIRG establishes a mechanism for submitting and administering change proposals.

Change proposals (CPs) can be submitted by any stakeholder participating in data link operations. The stakeholder should submit a Change Proposal to their ICAO regional office (see Appendix E). The ICAO regional office will coordinate the change proposal within its own region, other regions, and ICAO HQ, to determine the acceptability of the change proposal. Once the ICAO regional office has completed coordination and the participating PIRGs accept the change proposal, the change is concluded by each of the PIRGs.

Amendments to the GOLD

Amendment	Source(s)	Subject(s)	Approved applicable
1st Edition (2010)	Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/20 – 2009) North Atlantic Systems Planning Group (NAT SPG/46 – 2010)	*Global Operational Data Link Document* (GOLD)	Applicable within participating Regions on 1 July 2010.

Chapter 1. Definitions

When the following terms are used in the present document they have the following meanings. Where the term has "(ICAO)" annotated, the term has already been defined as such in SARPs and/or PANS.

Term

AAR. The symbol used to designate air-to-air refueling.

ACARS. The symbol used to designate the aircraft communications addressing and reporting system.

ACAS. The symbol used to designate aircraft collision avoidance system. (ICAO)

ACC. The symbol used to designate area control centre. (ICAO)

ACL. The symbol used to designate ATS clearance (data link service).

ACM. The symbol used to designate ATS communications management (data link service).

ACP. The symbol used to designate actual communication performance.

ACTP. The symbol used to designate actual communication technical performance.

ADS. The symbol used to designate automatic dependent surveillance (retained for reference with non-updated documents. This term would normally be used to refer to ADS-C).

ADS-B. The symbol used to designate automatic dependent surveillance – broadcast. (ICAO)

ADS-C service. A term used to indicate an ATS service that provides surveillance information by means of the ADS-C application.

Note.— ICAO Doc 4444 does not include ADS-C in its definition for ATS surveillance system. Therefore, an ATS surveillance service does not consider those provided by means of the ADS-C application, unless it can be shown by comparative assessment to have a level of safety and performance equal to or better than monopulse SSR.

ADS-C. The symbol used to designate automatic dependent surveillance – contract. (ICAO)

Aeronautical fixed telecommunication network (AFTN). A worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics. (ICAO)

Aeronautical Information Publication (AIP). A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation. (ICAO)

Aeronautical operational control (AOC). Communication required for the exercise of authority over the initiation, continuation, diversion or termination of flight for safety, regularity and efficiency reasons. (ICAO)

Term

Aeronautical telecommunication network (ATN). A global internetwork architecture that allows ground, air-ground and avionic data subnetworks to exchange digital data for the safety of air navigation and for the regular, efficient and economic operation of air traffic services. (ICAO)

AFN. The symbol used to designate ATS facilities notification.

AFTN. The symbol used to designate aeronautical fixed telecommunication network. (ICAO)

AIDC. The symbol used to designate ATS interfacility data communications. (ICAO)

AIP. The symbol used to designate Aeronautical Information Publication. (ICAO)

Air traffic services provider (ATSP). An organization responsible for the provision of air traffic services.

Air traffic control (ATC) service. A service provided for the purpose of:

a) preventing collisions:

1) between aircraft, and

2) on the manoeuvring area between aircraft and obstructions; and

b) expediting and maintaining an orderly flow of air traffic. (ICAO)

Air traffic management (ATM). The dynamic, integrated management of air traffic and airspace including air traffic services, airspace management and air traffic flow management — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions. (ICAO)

Air traffic service (ATS). A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service). (ICAO)

Air traffic services unit (ATSU). A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office. (ICAO)

Airborne collision avoidance system (ACAS). An aircraft system based on secondary surveillance radar (SSR) transponder signals which operates independently of ground-based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR transponders. (ICAO)

Aircraft active flight plan. (See flight plan).

Aircraft address. A unique combination of 24 bits available for assignment to an aircraft for the purpose of air-ground communications, navigation and surveillance. (ICAO)

Term

Aircraft identification. A group of letters, figures or a combination thereof which is either identical to, or the coded equivalent of, the aircraft call sign to be used in air-ground communications, and which is used to identify the aircraft in ground-ground air traffic services communications. (ICAO)

Note 1.— The aircraft identification does not exceed 7 characters and is either the aircraft registration or the ICAO designator for the aircraft operating agency followed by the flight identification.

Note 2. ICAO designators for aircraft operating agencies are contained in ICAO Doc 8585.

Aircraft registration. A group of letters, figures or a combination thereof which is assigned by the State of Registry to identify the aircraft.

Note. Also referred to as registration marking.

Aircraft system availability ($A_{AIRCRAFT}$). The required probability of available capability on an aircraft with an average flight of 6 hours.

Note.— The actual aircraft system availability is computed assuming that the service is available in the relevant airspace.

AIREP. The symbol used to designate an air-report. (ICAO)

Air-report. A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting. (ICAO)

Altitude reservation (ALTRV). Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special requirements which cannot otherwise be accomplished.

ALTRV. The symbol used to designate altitude reservation.

AMC. The symbol used to designate ATS microphone check (data link service).

AMS(R)S. The symbol used to designate aeronautical mobile satellite (route) service. (ICAO)

AOC. The symbol used to designate aeronautical operational control. (ICAO)

Appropriate ATS authority. The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned. (ICAO)

Appropriate authority.

a) Regarding flight over the high seas: The relevant authority of the State of Registry.

b) Regarding flight other than over the high seas: The relevant authority of the State having sovereignty over the territory being overflown. (ICAO)

ARCP. The symbol used to designate air refueling control point. (ICAO abbreviation?)

Term

Area control centre (ACC). A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction. (ICAO)

AREX. The symbol used to designate air refueling exit point. (ICAO abbreviation?)

ARIP. The symbol used to designate air refueling initial point. (ICAO abbreviation?)

ARP. The symbol used to designate an air-report message. (See AIREP)

ATC. The symbol used to designate air traffic control. (ICAO)

ATC waypoint. A waypoint contained in Field 15 of the ICAO flight plan, or as amended by ATC.

Note.— A waypoint inserted by the flight crew for purposes of conducting flight operations such as points of no return are not ATC waypoints.

ATM. The symbol used to designate air traffic management. (ICAO)

ATN. The symbol used to designate aeronautical telecommunication network. (ICAO)

ATN B1. The symbol used to designate aeronautical telecommunication network baseline 1, as defined by RTCA DO-280B/EUROCAE ED-110B.

Note.— ATN B1 generally means that the data link system on an aircraft, the ATSU ground system, and communication service provision comply with the standard as adapted by Eurocontrol Specification on Data Link Services (EUROCONTROL-SPEC-0116). ATN B1 consists of the following data link applications:

a) Context management (CM) for data link initiation capability (DLIC); and

b) Limited CPDLC for ATS communications management (ACM), ATS clearance (ACL), and ATC microphone check (AMC).

ATS interfacility data communication (AIDC). Automated data exchange between air traffic services units, particularly in regard to co-ordination and transfer of flights. (ICAO)

ATSP. The symbol used to designate air traffic service provider.

ATS surveillance service. A term used to indicate a service provided directly by means of an ATS surveillance system. (ICAO)

ATS surveillance system. A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft.

Note.— A comparable ground-based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.

(ICAO)

Term

ATS. The symbol used to designate air traffic service. (ICAO)

ATSU. The symbol used to designate ATS unit. (ICAO, sort of)

Automatic dependent surveillance — broadcast (ADS-B). A means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link. (ICAO)

Automatic dependent surveillance — contract (ADS-C). A means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports. (ICAO)

Note.— The abbreviated term "ADS contract" is commonly used to refer to ADS event contract, ADS demand contract, ADS periodic contract or an emergency mode.

C for RCTP. The proportion of intervention messages and responses that can be delivered within the specified RCTP time for intervention.

C for $\mathbf{RCTP_{AIR}}$. The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{AIR}$ time for intervention.

C for $\mathbf{RCTP_{ATSU}}$. The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{ATSU}$ time for intervention.

C for $\mathbf{RCTP_{CSP}}$. The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{CSP}$ time for intervention.

C for $\mathbf{RSTP_{AIR}}$. The proportion of surveillance messages that can be delivered within the specified $RSTP_{AIR}$ time.

C for $\mathbf{RSTP_{ATSU}}$. The proportion of surveillance messages that can be delivered within the specified $RSTP_{ATSU}$ time.

C for $\mathbf{RSTP_{CSP}}$. The proportion of surveillance messages that can be delivered within the specified $RSTP_{CSP}$ time.

C for TRN. The proportion of intervention messages and responses that can be delivered within the specified TRN time for intervention.

CADS. The symbol used to designate centralized ADS-C system.

Call sign. The designator used in air-ground communications to identify the aircraft and is equivalent to the encoded aircraft identification.

Term

CDA. The symbol used to designate current data authority. (See ICAO definition for current data authority)

CFRS. The symbol used to designate centralized FMC waypoint reporting system.

Closed message. A message that:

a) contains no message elements that require a response; or

b) has received a closure response.

Closure response. A message containing a message element that has the ability to close another message.

CM. The symbol used to designate context management (data link application).

CNS. The symbol used to designate communications, navigation and surveillance. (ICAO)

CNS/ATM. The symbol used to designate communications, navigation and surveillance/air traffic management. (ICAO)

Compulsory reporting point. An ATC waypoint for which a position report is required by the aircraft.

Control area (CTA). A controlled airspace extending upwards from a specified limit above the earth. (ICAO)

Controller-pilot data link communications (CPDLC). A means of communication between controller and pilot, using data link for ATC communications. (ICAO)

CPDLC. The symbol used to designate controller pilot data link communications. (ICAO)

CPDLC dialogue. (See ICAO definition for “dialogue.”)

a) a single message that is a closed message; or

b) a series of messages beginning with an open message, consisting of any messages related to the original open message and each other through the use of a Message Reference Number (MRN) and ending when all of these messages are closed.

CRC. The symbol used to designate cyclic redundancy check.

CSP. The symbol used to designate communication service provider.

CTA. The symbol used to designate control area. (ICAO)

Current data authority (CDA). The designated ground system through which a CPDLC dialogue between a pilot and a controller currently responsible for the flight is permitted to take place. (ICAO)

Term

Current flight plan. (See flight plan).

D-ATIS. The symbol used to designate data link – automatic terminal information service (data link service).

DARP. The symbol used to designate dynamic airborne reroute procedure.

DCL. The symbol used to designate departure clearance (data link service).

Dialogue. A co-operative relationship between elements which enables communication and joint operation. (ICAO)

DM. The symbol used to designate downlink message.

Downlink message (DM). A CPDLC message sent from an aircraft.

DSC. The symbol used to designate downstream clearance (data link service).

Dynamic airborne reroute procedure (DARP). The procedure for executing a reroute clearance initiated by a request from AOC.

EMERG. The symbol used to designate emergency. (ICAO)

ETD. The symbol used to designate estimated time of departure or estimating departure. (ICAO)

FANS 1/A. The symbol used to designate the initial future air navigation system, as defined by RTCA DO-258A/EUROCAE ED-100A, or previous standards that defined the FANS 1/A capability.

Note.— FANS 1/A generally means that the data link system on an aircraft, the ATSU ground system, and communication service provision comply with the standard. In certain cases, specific reference is made to a particular type of FANS 1/A aircraft as follows:

a) FANS 1/A+ means that the aircraft completely complies with Revision A of the standard, which includes message latency timer; and

b) FANS 1/A ADS-C means that the aircraft complies with AFN and ADS-C applications, but does not include the CPDLC application.

FANS. The symbol used to designate future air navigation system.

FDPS. The symbol used to designate flight data processing system. (ICAO)

FIR. The symbol used to designate flight information region. (ICAO)

Filed flight plan. (See flight plan).

FL. The symbol used to designate flight level.

Term

Flight identification. A group of numbers, which is usually associated with an ICAO designator for an aircraft operating agency, to identify the aircraft in Item 7 of the flight plan.

Flight information region (FIR). An airspace of defined dimensions within which flight information service and alerting service are provided. (ICAO)

Flight level (FL). A surface of constant atmospheric pressure which is related to a specific pressure datum, 1 013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals. (ICAO)

Note 1.— A pressure type altimeter calibrated in accordance with the Standard Atmosphere:

a) when set to a QNH altimeter setting, will indicate altitude;

b) when set to QFE altimeter setting, will indicate height above the QFE reference datum;

c) when set to a pressure of 1 013.2 hPa, may be used to indicate flight levels.

Note 2.— The terms "height" and "altitude", used in Note 1 above, indicate altimetric rather than geometric heights and altitudes.

Flight plan. Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft. (ICAO)

A flight plan can take several forms, such as:

Current flight plan (CPL). The flight plan, including changes, if any, brought about by subsequent clearances. (ICAO)

Note 1.— When the word "message" is used as a suffix to this term, it denotes the content and format of the current flight plan data sent from one unit to another.

Filed flight plan (FPL). The flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes. (ICAO)

Note 2.— When the word "message" is used as a suffix to this term, it denotes the content and format of the filed flight plan data as transmitted.

Aircraft active flight plan. The flight plan used by the flight crew. The sequence of legs and associated constraints that define the expected 3D or 4D trajectory of the aircraft from takeoff to landing. (RTCA/EUROCAE)

FLIPCY. The symbol used to designate flight plan consistency (data link service).

FMC WPR service. A term used to indicate an ATS service that provides surveillance information by means of the FMC WPR application.

Note.— ICAO Doc 4444 does not include FMC WPR in its definition for ATS surveillance system. Therefore, an ATS surveillance service does not consider those provided by means of the FMC WPR application, unless it can be shown by comparative assessment to have a level of safety and performance equal to or better than monopulse SSR.

FMC WPR. The symbol used to designate flight management computer waypoint position reporting.

Term

FMC. The symbol used to designate flight management computer.

FMS. The symbol used to designate flight management system.

Figure of merit. An indication of the aircraft navigation system's ability to maintain position accuracy.

Free text message element. (usually referred to as a free text message) A message element whose content is variable, i.e. composed by the sender. The ATS provider may construct a set of preformatted free text messages to relieve controllers of the burden of repeatedly composing commonly used messages. Such a set should include an explanation as to the intended meaning of each message.

GPS. The symbol used to designate global positioning system (USA).

HF. The symbol used to designate high frequency (3-30 Mhz). (ICAO)

IATA. The symbol used to designate International Air Transport Association.

ICAO. The symbol used to designate International Civil Aviation Organization. (ICAO)

ICD. The symbol used to designate interface control document.

Lateral deviation event (LDE). A type of event that triggers an ADS-C report when the absolute value of the lateral distance between the aircraft`s actual position and the aircraft`s expected position on the aircraft active flight plan becomes greater than the lateral deviation threshold.

LDE. The symbol used to designate lateral deviation event.

Level range deviation event (LRDE). A type of event that triggers an ADS-C report when the aircraft`s level is higher than the level ceiling or the aircraft`s level is lower than the level floor.

Note.— Sometimes referred to as altitude range change event or altitude range event.

LRDE. The symbol used to designate level range deviation event.

MARSA. The symbol used to designate military assumes responsibility for separation of aircraft.

MAS. The symbol used to designate message assurance.

MASPS. The symbol used to designate minimum aviation system performance standards.

Maximum accumulated unplanned outage time (min/yr). Measured by accumulating ***only*** the duration times for unplanned outages greater than the unplanned outage duration limit during any 12-month period. The accumulation is performed separately for each relevant operational airspace or FIR.

Term

Maximum number of unplanned outages. Measured separately for each relevant operational airspace or Flight Information Region (FIR) over any 12-month period.

MEL. The symbol used to designate minimum equipment list. (ICAO)

Message. Basic unit of user information exchanged between an airborne application and its ground counterpart or between two ground applications. Messages are passed in one or more data blocks from one end user to another through different subnetworks. (ICAO)

Note.— A basic unit of user information can consist of one or more message elements.

Message closure. Providing the closure response. Irrespective of the number of elements that require a response contained in an open message, each open message will be closed by a single message element, determined by the particular mix of attributes assigned to the elements contained in the open message.

Message element. A component of a message used to define the context of the information exchanged. (ICAO)

Message element identifier. The ASN.1 tag of the ATCUplinkMsgElementId or the ATCDownlinkMsgElementId. (ICAO)

Message identification number (MIN). An integer in the range 0 to 63 (inclusive) that uniquely identifies specific uplink and downlink messages for each CPDLC connection.

MET. The symbol used to designate meteorological or meteorology. (ICAO)

Military assumes responsibility for the separation of aircraft (MARSA). Procedures between the controller and the aircraft that delegate the separation responsibility temporarily to the military authority operating the flights, thereby relieving ATC of the separation workload.

MIN. The symbol used to designate message identification number.

Minimum equipment list (MEL). A list which provides for the operation of aircraft, subject to specified conditions, with particular equipment inoperative, prepared by an operator in conformity with, or more restrictive than, the MMEL established for the aircraft type. (ICAO)

Monitored operational performance (TRN). The portion of the transaction time (used for intervention) that does not include the times for message composition or recognition of the operational response.

MRN. The symbol used to designate message reference number.

MTBF. The symbol used to designate mean time between failures.

MTTR. The symbol used to designate mean time to repair.

Term

NDA. The symbol used to designate next data authority. (See ICAO definition for next data authority.)

Next data authority. The ground system so designated by the current data authority through which an onward transfer of communications and control can take place. (ICAO)

NOTAM. A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations. (ICAO)

Open message. A message that contains at least one message element that requires a response. An open message remains open until the required response is received.

Operational communication transaction. The process a human uses to initiate the transmission of an instruction, clearance, flight information, and/or request, and is completed when that human is confident that the transaction is complete.

ORT. The symbol used to designate operational requirements table.

PANS-ATM. The symbol used to designate Procedures for Air Navigation Services — Air Traffic Management (ICAO Doc 4444). (ICAO)

PORT. The term used to designate pilot operational response time.

POS. The term used to designate ICAO position report message.

Preformatted free text message. A standardized free text message that is created and formatted automatically by the aircraft system or ground system, so that the content may be used by the message recipient's automation.

RCP. The symbol used to designate required communication performance.

RCP availability (A). The required probability that an operational communication transaction can be initiated when needed.

RCP continuity (C). The required probability that an operational communication transaction can be completed within the communication transaction time, either ET or TT 95%, given that the service was available at the start of the transaction.

RCP expiration time (ET). The maximum time for the completion of the operational communication transaction after which the initiator is required to revert to an alternative procedure.

RCP integrity (I). The required probability that an operational communication transaction is completed with no undetected errors.

Note.— Whilst RCP integrity is defined in terms of the "goodness" of the communication capability, it is specified in terms of the likelihood of occurrence of malfunction on a per flight hour basis, e.g. 10-5, consistent with RNAV/RNP specifications.

Term

RCP nominal time (TT 95%). The maximum nominal time within which 95% of operational communication transactions is required to be completed.

RCP type. A label (e.g. RCP 240) that represents the values assigned to RCP parameters for communication transaction time, continuity, availability and integrity.

RCTP. The symbol used to designate required communication technical performance.

RCTP$_{\mathbf{AIR}}$. The summed critical transit times for an ATC intervention message and a response message, allocated to the aircraft system.

RCTP$_{\mathbf{ATSU}}$. The summed critical transit times for an ATC intervention message and a response message, allocated to the ATSU system.

RCTP$_{\mathbf{CSP}}$. The summed critical transit times for an ATC intervention message and a response message, allocated to the CSP system.

Required communication performance (RCP). A statement of the performance requirements for operational communication in support of specific ATM functions. (ICAO)

Required communication technical performance (RCTP). The portion of the (intervention) transaction time that does not include the human times for message composition, operational response, and recognition of the operational response.

Required surveillance technical performance (RSTP). The technical transit time for surveillance data delivery from the time associated with the aircraft's position to when the recipient (e.g. ATSU) receives the report, but does not include the generation or processing of the report.

Required navigation performance (RNP). A statement of the navigation performance necessary for operation within a defined airspace. (ICAO)

Note.— Navigation performance and requirements are defined for a particular RNP type and/or application.

Responder performance criteria. The operational portion of the transaction time to prepare the operational response, and includes the recognition of the instruction, and message composition, e.g. flight crew/HMI for intervention transactions.

RGS. The symbol used to designate radio ground station.

RNAV. The symbol used to designate area navigation.

RNP. The symbol used to designate required navigation performance.

RSTP. The symbol used to designate required surveillance technical performance.

Term

$RSTP_{AIR}$. The overdue (OD) and nominal (DT) transit times for surveillance data from the aircraft system to the antenna.

$RSTP_{ATSU}$. The overdue (OD) and nominal (DT) transit times for surveillance data from the CSP interface to the ATSU's flight data processing system.

$RSTP_{CSP}$. The overdue (OD) and nominal (DT) transit times for surveillance data allocated to the CSP.

SARPs. The symbol used to designate Standards and Recommended Practices. (ICAO)

SATCOM. The symbol used to designate satellite communication. (ICAO)

SELCAL. The symbol used to designate selective calling system. (ICAO)

Service availability (A_{CSP}). The required probability that the communication service is available to all users in a specific airspace when desired.

Standardized free text message. A free text message format that has been agreed by the stakeholders as a message that should be used for the purpose/intent shown in this document.

Standard message element. Any message element defined by ICAO Doc 4444 that does not contain the [free text] parameter.

Surveillance availability (A). The required probability that surveillance data can be provided when needed.

Surveillance continuity (C). The required probability that surveillance data can be delivered within the surveillance delivery time parameter, either OT or DT 95%, given that the service was available at the start of delivery.

Surveillance data. Data pertaining to the identification of aircraft and/or obstructions for route conformance monitoring and safe and efficient conduct of flight.

Surveillance data delivery. The process for obtaining surveillance data.

Surveillance data transit time. The required time for surveillance data delivery.

Surveillance integrity (I). The required probability that the surveillance data is delivered with no undetected error.

Note 1.— Surveillance integrity includes such factors as the accuracy of time, correlating the time at aircraft position, reporting interval, data latency, extrapolation and/or estimation of the data.

Note 2.— Whilst surveillance integrity is defined in terms of the "goodness" of the surveillance capability, it is specified in terms of the likelihood of occurrence of malfunction on a per flight hour basis, e.g. 10-5, consistent with RCP and RNAV/RNP specifications.

Term

Surveillance nominal delivery time (DT 95%). The maximum nominal time within which 95% of surveillance data is required to be delivered.

Surveillance overdue delivery time (OT). The maximum time for the successful delivery of surveillance data after which the initiator is required to revert to an alternative procedure.

Surveillance performance. A statement of the performance requirements for operational surveillance in support of specific ATM functions.

Surveillance performance type. A label (e.g. type 180) that represents the values assigned to surveillance performance parameters for surveillance data transit time, continuity, availability and integrity.

TA. The symbol used to designate tailored arrival.

Tailored arrival (TA). A 4-dimentional (4-D) arrival procedure, based on an optimized ATC clearance, including, as necessary, vertical and/or speed restrictions, from the aircraft's current position, normally just prior to top of descent, to the designated destination runway. The TA clearance is issued via CPDLC data link message(s) to the aircraft and automatically loaded into the aircraft's 4-D trajectory guidance capability.

TRN. The symbol used to designate monitored operational performance.

UM. The symbol used to designate uplink message.

Unplanned outage duration limit (minutes). Time after the unplanned outage begins at which there is an operational impact. Measured from when an unplanned outage begins to when the ATSU receives notification that the service has been restored.

Unplanned outage notification delay (min). Notification to the ATSU of an unplanned outage. Measured from when the unplanned outage begins to when the ATSU receives notification.

Uplink message (UM). A CPDLC message sent from a ground system.

UPR. The symbol used to designate user preferred route.

VDL M0/A. The symbol used to designate VHF data link mode 0/A subnetwork.

VDL M2. The symbol used to designate VHF data link mode 2 subnetwork,

VHF. The symbol used to designate very high frequency (30-300 Mhz). (ICAO)

Vertical rate change event (VRE). A type of event that triggers an ADS-C report when the aircraft`s rate of climb or descent is greater than the vertical rate threshold.

VRE. The symbol used to designate vertical rate change event.

Term
Waypoint change event (WCE). A type of event that triggers an ADS-C report when there is a change in the next waypoint or the next plus 1 waypoint on the aircraft active flight plan.
WCE. The symbol used to designate waypoint change event.

Chapter 2. Overview of data link operations

2.1 Data link systems and operational capabilities

2.1.1 Data link systems – Interoperability

2.1.1.1 "Data link" is a generic term that encompasses different types of data link systems and subnetworks. Figure 2-1 provides an overview of a data link system, including subnetworks. It is noted that not all aircraft have satellite, VHF and/or HF data link capability. Similarly, not all CSPs have HF data link capability.

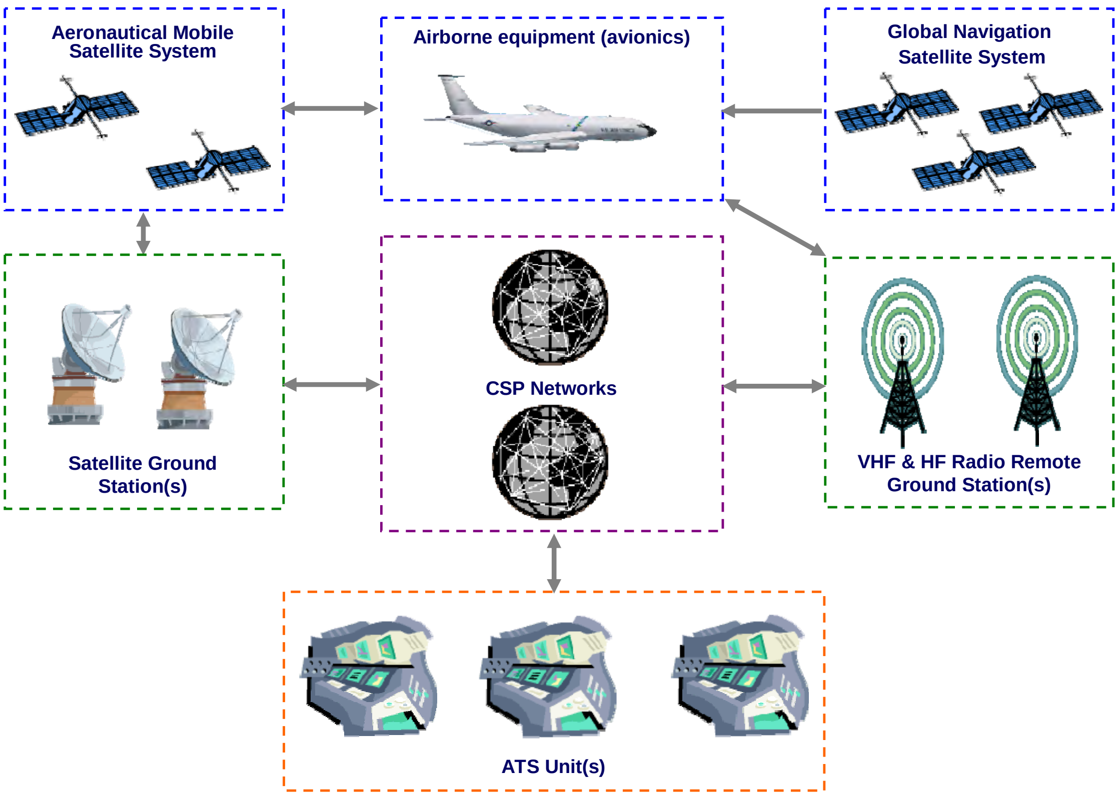


Figure 2-1. Overview of a data link system

2.1.1.2 Figure 2-2 shows different ATSU (ground) systems and aircraft systems that are interoperable. A designator is assigned to each type of ATSU and aircraft data link system. Table 2-1 provides a brief description for each designator and identifies the applicable interoperability standards. It is noted that a single aircraft or a single ATSU may employ multiple types of data link systems.

2.1.1.3 Table 2-2 provides a brief description of each type of subnetwork that supports the different data link systems and identifies the applicable interoperability standards. A designator is assigned to each type of subnetwork shown in Figure 2-1.

2.1.1.4 The applicable interoperability standards for each type of data link system and each type of subnetwork allocate requirements to the operator, the aircraft data link system, and the air traffic service provider to ensure that the aircraft system, the ground system, and subnetworks are compatible.

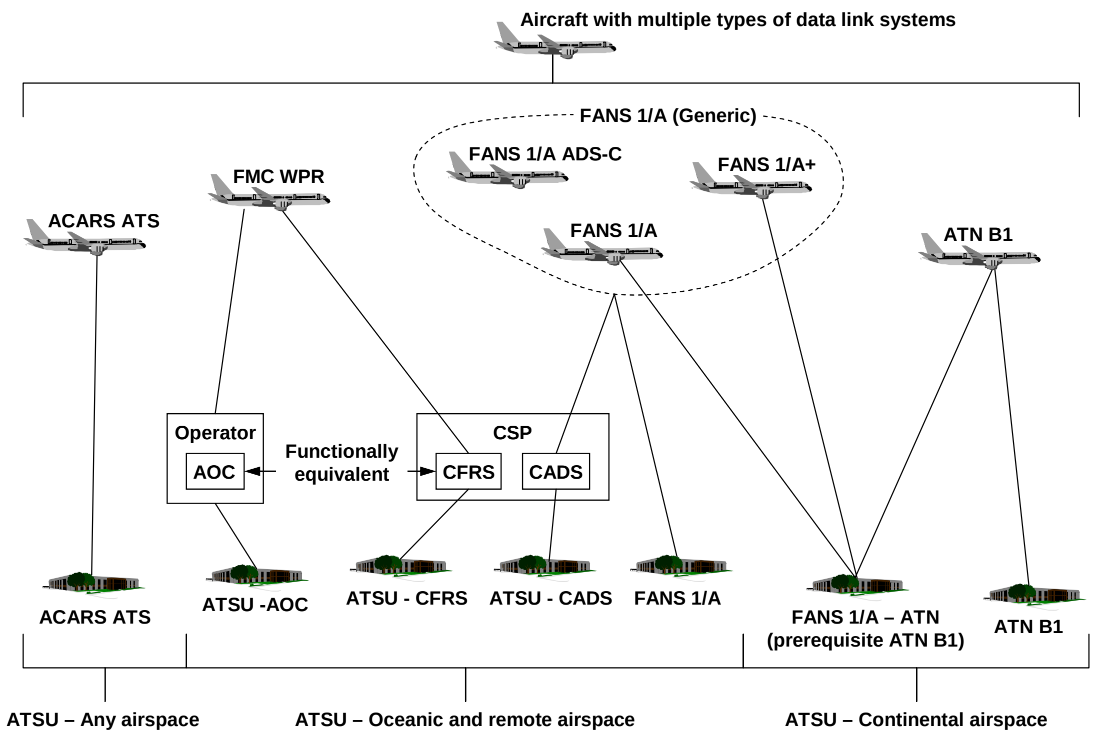


Figure 2-2. Different ATSU/aircraft interoperable connectivity

Table 2-1. Designators for aircraft and ATSU (ground) data link systems

Designator	Description of designator	Applicable interoperability standard(s)	Applicable system
ACARS ATS	ATS applications, departure clearance (DCL), oceanic clearance (OCL) and data link – automatic terminal information service (D-ATIS), supported by aircraft communications addressing and reporting system (ACARS).	a) ED-85A (DCL) b) ED-106A (OCL) c) ED-89A (D-ATIS) d) ARINC 623-3	ATSU and Aircraft
FMC WPR	Flight management computer waypoint position reporting (FMC WPR) ATS application, generates and sends waypoint position reports, supported by flight management system and ACARS.	ARINC 702A-3	Aircraft
ATSU CFRS	Communication service provider's (CSP's) centralized flight management computer waypoint reporting system (CFRS) enables ATSU to receive waypoint position reports in ICAO format from any FMC WPR aircraft.	a) ARINC 702A-3 b) CFRS Common Specification, Version 2.0, April 2004 (Available from ICAO Regional Office in Paris)	ATSU
ATSU AOC	Operator's aeronautical operational control (AOC) facility enables ATSU to receive waypoint position reports in ICAO format from the operator's FMC WPR aircraft.	a) ARINC 702A-3 b) Aeronautical fixed telecommunication network (AFTN) specifications	ATSU
ATSU CADS	CSP's centralized ADS-C system (CADS) enables an ATSU without FANS 1/A capability to receive ADS-C reports from any FANS 1/A, FANS 1/A+ or FANS 1/A ADS-C aircraft.	a) DO-258A/ED-100A, or previous versions. b) CADS Common Specification, Version 2.0, April 2004 (Available from ICAO Regional Office in Paris)	ATSU
FANS 1/A	Initial future air navigation system (FANS 1/A) ATS applications, AFN, CPDLC and ADS-C, supported by FANS 1/A over ACARS. <u>Note</u>.— *FANS 1/A typically involve communication (CPDLC), navigation (RNAV/RNP) and surveillance (ADS-C). This document refers to the FANS 1/A for the data link system, which includes the CPDLC and ADS-C applications. Refer to ICAO Doc 9613 for guidance material on navigation (RNAV/RNP) qualification and use.*	a) DO-258A/ED-100A, or previous versions. b) Boeing document D6-84207, Loading of ATC Clearances into the Flight Management System (FMS), August 2009	ATSU and Aircraft

Designator	Description of designator	Applicable interoperability standard(s)	Applicable system
FANS 1/A+	Same as FANS 1/A, except with additional features, such as the message latency timer function, described in DO-258A/ED-100A, paragraph 4.6.6.9. See also this document, paragraph 4.2.7, for procedures on its use. FANS 1/A+ - complies with Revision A of the standard (i.e., not previous versions)	a) DO-258A/ED-100A only b) Boeing document D6-84207, Loading of ATC Clearances into the Flight Management System (FMS), August 2009	Aircraft
FANS 1/A ADS-C	ATS applications, AFN and ADS-C, supported by FANS 1/A over ACARS. FANS 1/A ADS-C - complies with AFN and ADS-C applications, No CPDLC.	DO-258A/ED-100A	Aircraft
ATN B1	ATS applications, CM and CPDLC, supported by aeronautical telecommunication network – baseline 1 (ATN B1): a) Context management (CM) application for data link initiation capability (DLIC); b) CPDLC for ATS communications management (ACM), ATS clearance (ACL), and ATC microphone check (AMC), except that: 1) UM 135 CONFIRM ASSIGNED LEVEL and UM 233 USE OF LOGICAL ACKNOWLEDGEMENT PROHIBITED will not be used by the ATSU; and 2) DM 38 ASSIGNED LEVEL (level) is not required by the aircraft. *Note.— Interoperability for departure clearance (DCL), downstream clearance (DSC), data link – automatic terminal information service (D-ATIS), and flight plan consistency (FLIPCY) data link services, which are defined in DO 280B/ED 110B, are not supported.*	a) DO-280B/ED-110B b) Eurocontrol Specification on Data Link Services (EUROCONTROL-SPEC-0116)	ATSU and Aircraft
FANS 1/A - ATN	Enables ATSU with ATN B1 ground system to provide data link service to FANS 1/A aircraft.	a) ATN B1 standards are applicable and, in addition, b) DO-305/ED-154	ATSU

Table 2-2. Designators for subnetworks

Designator	Description of designator	Applicable standard(s)
VDL M0/A	Very high frequency data link – mode 0/A	ARINC 618-6 (INTEROP) for air/ground protocol
VDL M2	Very high frequency data link – mode 2	a) ICAO Annex 10, Vol III b) ICAO Doc 9776, Manual on VDL Mode 2 c) RTCA DO-224 (MASPS) d) ARINC 631-5 (INTEROP)
HFDL	High frequency data link	a) ICAO Annex 10, Vol III b) ICAO Doc 9741, Manual on HF Data Link c) RTCA DO-265 (MASPS) d) ARINC 753-3 (INTEROP)
SATCOM (Inmarsat)	Inmarsat or MT-SAT – aero classic satellite communications	a) ICAO Annex 10, Vol III b) ICAO Doc 9925, AMS(R)S Manual c) RTCA DO-270 (MASPS) d) ARINC 741P2-10 (INTEROP)
SATCOM (Iridium)	Iridium short burst data satellite communications	a) ICAO Annex 10, Vol III b) ICAO Doc 9925, AMS(R)S Manual c) RTCA DO-270, Change 1 (MASPS) d) ARINC 741P2-10 (INTEROP)

2.1.2 Data link services - RCP types and surveillance performance specifications

2.1.2.1 RTCA DO-306/EUROCAE ED-122 (Oceanic SPR) provides operational, safety and performance criteria for data link services that are applicable in oceanic and remote airspace for normal ATC communication and surveillance to support separation assurance, route conformance monitoring, reroute, and weather deviation management. These criteria include specifications for required communication performance (RCP) and surveillance performance, taking into consideration the following data link applications:

a) AFN for data link initiation capability (DLIC)

b) CPDLC for normal ATC communication

   1) RCP 240 operations

   2) RCP 400 operations

c) ADS-C for surveillance - automatic position reporting

   1) Periodic report

   2) Event report

      i) Waypoint change event report

      ii) Level range deviation event report

iii) Lateral deviation event report

iv) Vertical rate change event report

d) FMC WPR for surveillance - automatic position reporting at ATC waypoints

2.1.2.2 If the data link operation is dependent on certain performance, then the ATSP may prescribe RCP types and/or surveillance performance specifications. Table 2-3 provides examples of intended uses for which the RCP types defined in Appendix B are applicable. Table 2-4 provides examples of intended uses for which the surveillance performance specifications defined in Appendix C are applicable.

Table 2-3. Examples of applying RCP types to intended uses

RCP type	Intended uses for which the RCP type is applicable
RCP 240	When CPDLC is the normal means of communications supporting the application of 30 NM lateral separation and reduced longitudinal separation minima.
RCP 400	When a technology other than HF voice radio is the normal means of communication supporting the application of lateral separation greater than or equal to 50 NM and time-based longitudinal separation.
	When a technology other than HF voice radio is the alternative means of communication supporting the application of 30 NM lateral separation and reduced longitudinal separation minima.

Table 2-4. Examples of applying surveillance performance specifications to intended uses

Surv type	Intended uses for which the surveillance type is applicable
Type 180	When ADS-C is the normal means of surveillance supporting the application of 30 NM lateral separation and reduced longitudinal separation minima.
Type 400	When ADS-C or FMC WPR is the normal means of surveillance supporting the application of lateral separation greater than or equal to 50 NM and time-based longitudinal separation.
	When a technology other than HF voice radio provides an alternative means of surveillance, e.g. position reporting via satellite voice, supporting the application of 30 NM lateral separation and reduced longitudinal separation minima.

Note 1.— For example, satellite voice and CPDLC over the HFDL subnetwork may provide ATC communication other than by HF voice radio. Appendix B and Appendix C provide criteria only when the communication is a data link system.

2.1.2.3 Data link operations that use certain subnetworks, e.g. HFDL, or take place in subnetwork transition areas, e.g. VHF fringe coverage area, may not meet the criteria for some RCP types or surveillance specifications.

2.1.2.4 Aircraft capability that supports multiple RCP type or surveillance operations needs to include appropriate indications and/or procedures to enable the flight crew to notify ATC when aircraft equipment failures result in the aircraft's ability to no longer meet its criteria for any of the RCP types or surveillance specifications. (See Appendix B and Appendix C.)

2.1.2.5 An ATSU that supports multiple RCP type or surveillance operations needs to include appropriate indications and/or procedures to enable the controller to notify all affected aircraft when infrastructure failures result in the ground system's inability to meet its criteria for any of the RCP types or surveillance specifications.

2.1.2.6 If no RCP type or surveillance specification is prescribed for the data link operation, then any subnetwork provided in Table 2-2 is applicable, unless otherwise prescribed by airspace requirements.

2.1.2.7 RTCA DO-290/EUROCAE ED-120, Change 1 and Change 2 (Continental SPR) provides operational, safety and performance criteria for data link services that are applicable in airspace where radar services are provided, referred to as continental airspace.

2.1.2.8 While no RCP types or surveillance specifications have been developed for the data link services in continental airspace, the VDL M2 subnetwork is the only subnetwork that has been prescribed for data link services in continental airspace.

2.1.3 Operational capabilities supported by data link services

2.1.3.1 The data link system in oceanic and remote airspace, as shown in Figure 2-2, comprises a variety of ground systems that may provide data link services to FANS 1/A (generic) aircraft, FMC WPR aircraft and ACARS ATS aircraft.

2.1.3.2 The data link services improve communications and surveillance to support operational capabilities that enable:

a) Reduced separations, for example, the following reduced separations require FANS 1/A aircraft, FANS 1/A ATSU, RCP 240 and surveillance performance type 180;

1) 50 NM longitudinal separation;

2) 30 NM separation;

3) 30 NM lateral separation;

b) User preferred route (UPR) may require data link in some airspace;

c) Reroute, may require data link in some airspace, dynamic airborne reroute procedure (DARP) requires FANS 1/A aircraft and FANS 1/A ATSU;

d) Weather deviation management may require data link in reduced separation environments; and

e) Improved ATC communication, surveillance and route conformance monitoring through the use of data link may enable more efficient air traffic management and increases in airspace capacity. For example, ADS-C provides automatic surveillance capability that an ATSP may use to replace CPDLC and/or voice position reporting in airspace where the ATSP applies procedural separation.

2.1.3.3 The data link system in continental airspace, as shown in Figure 2-2, comprises a variety of ground systems that may provide data link services to ATN B1 aircraft, FANS 1/A aircraft and ACARS ATS aircraft.

Note 1.— FANS 1/A aircraft are interoperable with a FANS 1/A-ATN ATSU. However, it may not be operationally acceptable, for example, data link operations may require FANS 1/A+ aircraft (refer to Table 2-1).

Note 2.— Since FANS 1/A aircraft or FANS 1/A+ aircraft automatically switch among available subnetworks, ATSUs that provide data link service to these aircraft in continental airspace will need to manage the subnetworks that are used to ensure their use of the VDL M2 subnetwork.

2.1.3.4 The data link services provide limited ATC communications in continental airspace that support operational capabilities that enable more efficient air traffic management and increases in airspace capacity.

2.1.3.5 Table 2-5 provides an overview of the operational capabilities in oceanic/remote and continental airspace that are supported by each of the different data link systems.

Table 2-5. Types of data link systems and operations

Aircraft equipment and capability	**Airspace type/ground data link system**				
	Any airspace ACARS ATS	**Oceanic/ Remote CADS, CFRS or AOC**	**Oceanic/ Remote FANS 1/A**	**Continental ATN B1**	**Continental FANS 1/A - ATN**
ACARS ATS	Limited ATC communication • DCL or PDC • OCL Flight information • D-ATIS	N/A	N/A	N/A	N/A
FMC WPR	N/A	Surveillance • FMC WPR (CFRS or AOC)	N/A	N/A	N/A
FANS 1/A ADS-C	N/A	Surveillance • ADS-C (CADS)	Surveillance • ADS-C	N/A	N/A
FANS 1/A	N/A	Surveillance • ADS-C (CADS)	Normal ATC communication • CPDLC Surveillance • ADS-C	N/A	*(See Note)*
FANS 1/A+	N/A	Surveillance • ADS-C (CADS)	Normal ATC communication • CPDLC Surveillance • ADS-C	N/A	Limited ATC communication • CPDLC for ACM, ACL, and AMC data link services
ATN B1	N/A	N/A	N/A	Limited ATC communication • CPDLC for ACM, ACL, and AMC data link services	Limited ATC communication • CPDLC for ACM, ACL, and AMC data link services
Note.— Same as for FANS 1/A+, if operationally acceptable. FANS 1/A aircraft are interoperable, but may not be operationally acceptable in some continental airspace (refer paragraph 2.1.3.3).					

2.2 FANS 1/A data link system

2.2.1 General

2.2.1.1 The FANS 1/A (including FANS 1/A+, and FANS 1/A ADS-C defined in paragraph 2.1.1) data link system relies on the ACARS network, which is provided and maintained by various communication service providers (CSPs).

2.2.1.2 The ACARS network evolved from the need to be able to exchange messages between an aircraft and its AOC.

2.2.1.3 The ACARS network consists mainly of VHF (VDL M0/A and VDL M2) and satellite subnetworks, but also includes the HFDL subnetwork. The performance characteristics of each subnetwork varies and its use for ATC will depend on the performance required for the intended operation (refer paragraph 2.1.2).

Note 1.— There are some exceptions when the ATSU will not be able to determine if a report was not delivered, e.g. the lateral deviation event report. The ATSU does not rely solely on these reports for protecting airspace.

2.2.1.4 There are no technical provisions for the ATSU to ensure that a message has been delivered to the aircraft and is available for display to the flight crew. However, the ACARS network does support the following network acknowledgements:

a) The ATS system will receive a message assurance (MAS) success indication to an uplink message indicating that the message has been delivered to the aircraft, as shown in Figure 2-3.

Note 2.— It is possible for the uplink message to be delivered to the aircraft, but for the MAS success to not be delivered to the ATSU. Therefore, the non-receipt of MAS or receipt of MAS fail does not provide a positive indication that the uplink message was not successfully delivered to the aircraft.

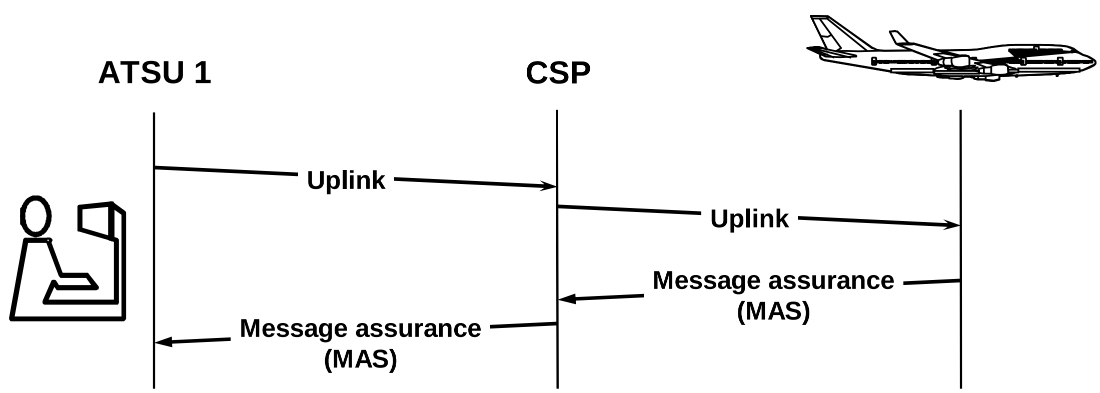


Figure 2-3. Uplink and message assurance

b) The aircraft system will receive a network acknowledgement to a downlink message indicating that the message has been delivered to the CSP system as shown in Figure 2-4.

Note 3.— Some aircraft may re-send the downlink if the network acknowledgement is not received within a system parameter. This may result in the ATSU receiving a duplicated downlink message.

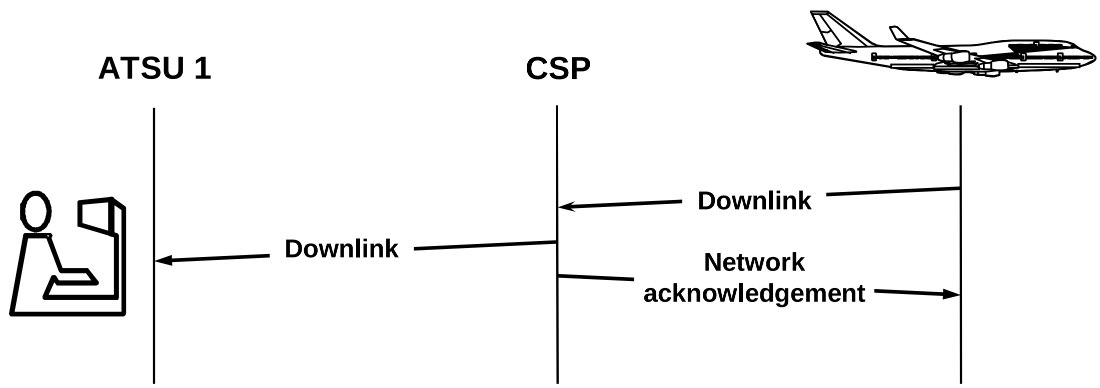


Figure 2-4. Downlink and network acknowledgement

2.2.1.5 Even though the controller does not have an indication to ensure whether or not a clearance was delivered to the aircraft, procedures are in place to mitigate the effects of non-delivery. When a clearance is sent to the aircraft, the controller continues to protect the airspace associated with the existing clearance until an appropriate operational response is received from the flight crew. If an expected operational response to a clearance is not received, the controller will initiate appropriate action to ensure that the clearance was received by the flight crew. Similarly, the controller will initiate appropriate action if an expected CPDLC and/or ADS-C report is not received.

2.2.2 ATS facilities notification (AFN) logon

2.2.2.1 Purpose of the AFN logon

2.2.2.1.1 The AFN logon is the first step in the data link process. The receipt of an AFN logon from an aircraft is performed prior to the ATSU establishing CPDLC and/or ADS-C connections. The purpose of the AFN logon is to:

a) Provide the ATSU with the data link application “context” of the aircraft, namely:

1) The ATS data link applications supported by the aircraft system (e.g. CPDLC, ADS-C), and the associated version numbers of these applications; and

2) The unique ACARS address of the aircraft.

b) Provide the ATSU with information such as the aircraft identification, aircraft registration and (optionally) the aircraft address. This information allows the ATSU to correlate the AFN logon information with its corresponding current flight plan.

Note.— An ATSU cannot establish a CPDLC connection without first completing the AFN logon.

2.2.2.2 Timing of the initial AFN logon

2.2.2.2.1 When CPDLC and/or ADS-C services are available for the flight, the flight crew initiates an AFN logon in accordance with the guidelines provided in paragraph 5.2.

2.2.2.3 The initial AFN logon

2.2.2.3.1 An initial AFN logon is needed when the aircraft does not already have an ADS-C or CPDLC connection, such as when:

a) The aircraft is preparing to depart; or

b) The aircraft will enter an area where data link services are available from an area where data link services are not available; or

c) Instructed by ATC (e.g. following a failed data link transfer).

2.2.2.3.2 To perform an initial AFN logon the flight crew enters flight-specific information (e.g. aircraft identification and aircraft registration) into the aircraft system. The flight crew also enters the four character ICAO identifier of the ATSU to which the AFN logon is to be sent.

2.2.2.3.3 To avoid an automatic rejection of the AFN logon, the flight crew ensures that the aircraft identification and aircraft registration entered into the FMS are the same as the corresponding details filed in item 7 and item 18 (preceded by REG/) of the flight plan.

Note 1: The aircraft identification entered into the FMS is either the ICAO designator for the aircraft operating agency followed by the flight identification or the aircraft registration, in accordance with ICAO Doc 4444.

Note 2.— The aircraft registration entered into the FMS can include a hyphen(-), even though the aircraft registration provided in the filed flight plan message cannot include a hyphen.

2.2.2.3.4 When the flight crew performs the AFN logon, the aircraft system transmits the logon information in an AFN CONTACT (FN_CON) message to the specified ATSU.

Note.— If the flight crew subsequently realizes that they have entered incorrect aircraft identification and aircraft registration prior to transmitting the AFN logon, they will need to reinitiate the AFN logon with a correct information.

2.2.2.4 Response to an AFN logon

2.2.2.4.1 As shown in Figure 2-5, on receipt of an AFN CONTACT (FN_CON) message, the ground system automatically responds with an AFN ACKNOWLEDGEMENT (FN_AK) to the aircraft. The FN_AK message provides information to the aircraft system concerning whether:

a) The AFN logon was "accepted" (e.g. could be correlated with a flight plan); or

b) The AFN logon was "rejected" (e.g. could not be correlated with a flight plan). This is an indication that information in the AFN logon was incorrect, or differed from the information in the flight plan. Refer to paragraph 3.1.2.1.1 for condition when an ATSU rejects a logon.

2.2.2.4.2 The FN_AK message also provides information concerning which ATS data link applications the ATSU supports.

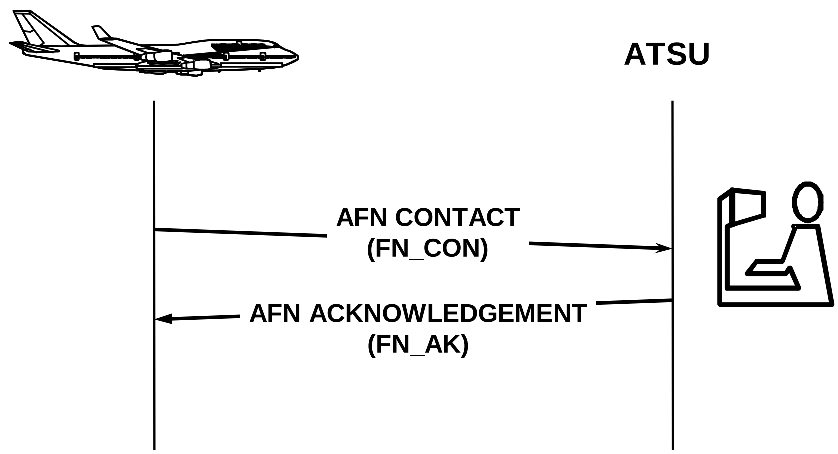


Figure 2-5. Initial AFN logon

2.2.2.4.3 If the AFN logon is rejected, the flight crew confirms that the aircraft identification and aircraft registration in the FMS matches the information provided in the flight plan and, as appropriate:

a) Makes the necessary corrections; or

b) Contacts ATC or AOC to correct the flight plan; and then.

c) Reinitiates the AFN logon.

2.2.2.5 Address forwarding AFN logon

2.2.2.5.1 An address forwarding AFN logon occurs without flight crew input when the flight is leaving one ATSU where a logon had already been completed and the flight is transferred to another ATSU. (See paragraph 2.2.3.6 for details)

Note.— The functionality associated with address forwarding can also be imitated using the AIDC FAN message. Refer to the Asia Pacific or North Atlantic ATS Interfacility Data Communications Interfacility Control Documents (AIDC ICDs) for further information.

2.2.2.6 Correlating an AFN logon with a flight plan

2.2.2.6.1 On receipt of an AFN logon, the ATSU correlates the AFN logon information with the relevant information in the flight plan held by the ATSU. This ensures that any automation associated with ADS-C reports or CPDLC messages updates the correct flight plan.

2.2.2.6.2 When making this correlation, the ground system:

a) Ensures that the aircraft identification and at least one of either the aircraft registration and/or aircraft address in the AFN logon match corresponding items in the ICAO flight plan, item 7 and item 18, preceded by REG/ and/or CODE/, respectively; and

b) Only uses the information contained within the portion of the AFN logon message that is protected by the cyclic redundancy check (CRC).

Note.— The aircraft identification in the ACARS message header is not protected by the CRC and the flight crew does not use this information to verify aircraft identification. Additionally, the format for the aircraft identification in the ACARS message header is different than the format used by the ground system. For example, the ground system uses a two alpha character ICAO designator for the operating agency followed by up to four numeric characters for the flight identification.

Example
The following example of an AFN logon indicates what information in the ACARS message the ATSU uses to correlate the AFN logon with a flight plan.
QU <ACARS "TO" address> . <ACARS "FROM" address> 010000 AFD FI AB0123/AN ST-XYZ DT QXT POR1 010000 J59A
- AFN/FMH***ABC123,.ST-XYZ,DEF456***,000002/FPOS30000E160000,0/FCOADS,01/ FCOATC,01<CRC>
The ATSU only uses the information in the CRC-protected portion of the ACARS message. In the example above, the CRC portion is highlighted, and contains the following information: • aircraft identification is ABC123 (not the AB0123 contained in the ACARS header); • aircraft registration is ST-XYZ (hyphen is removed by ATS automation per paragraph 3.1.2.1.2); and • aircraft address is DEF456.
Note.— Some ATSUs may operate a ground system that does not integrate data link capability with a flight data processing system. Under these circumstances, the ATSU will need to ensure that the logon information is available for the controller to manually cross-check the information with the details in the flight plan.

2.2.3 FANS 1/A CPDLC connection management

2.2.3.1 Purpose of a CPDLC connection

2.2.3.1.1 The purpose of a CPDLC connection is to allow the exchange of CPDLC messages between an aircraft and an ATSU. FANS-1/A aircraft can have two CPDLC connections established concurrently, each with a different ATSU. Only one of these connections can be active at any given time – the other connection is inactive.

2.2.3.2 Active and inactive CPDLC connections

2.2.3.2.1 A CPDLC connection is active if the ATSU and the aircraft can exchange CPDLC messages. The ATSU with which an aircraft has an active CPDLC connection is referred to as the current data authority (CDA).

2.2.3.2.2 A CPDLC connection is inactive if the ATSU and the aircraft cannot exchange CPDLC messages. The ATSU with which the aircraft has an inactive CPDLC connection is referred to as the next data authority (NDA).

2.2.3.2.3 An inactive connection becomes active when the active connection is terminated.

2.2.3.3 Establishing an active CPDLC connection

2.2.3.3.1 The ATSU initiates a CPDLC connection by uplinking a CPDLC CONNECTION REQUEST (CR1) to the aircraft.

2.2.3.3.2 Provided that there is not an existing CPDLC connection, the aircraft system:

a) Accepts this CR1;

b) Establishes this CPDLC connection as the active connection; and

c) Responds with a CPDLC CONNECTION CONFIRM (CC1).

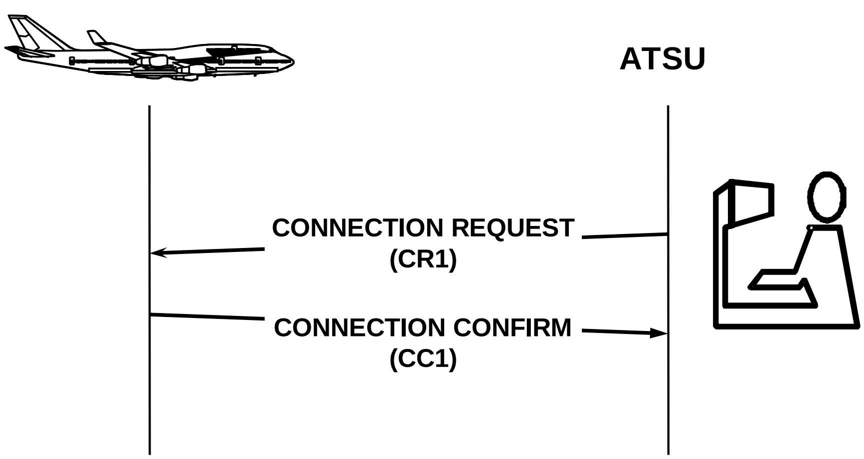


Figure 2-6. CPDLC connection sequence

2.2.3.3.3 The ATSU can establish an initial CPDLC connection only after it has successfully completed an AFN logon that was initiated by the flight crew per paragraph 2.2.2. Depending on the functionality of the ground system, the ATSU may uplink the CR1 either upon completion of the AFN logon, or at some later time (e.g. as the aircraft approaches the ATSU's airspace).

2.2.3.4 Transferring CPDLC connections

2.2.3.4.1 ATSUs manage CPDLC connections to ensure that the ATSU with control for the flight holds the active CPDLC connection, except in certain circumstances. (See paragraph 4.1.1.1). The flight crew can also terminate an inappropriate CPDLC connection. (See paragraph 5.2.5).

2.2.3.4.2 Under normal circumstances, the controlling ATSU, or current data authority, will initiate CPDLC transfers to adjacent ATSUs as the aircraft transits from one CPDLC-capable ATSU to another. These transfers are normally automatic, without flight crew action. Paragraph 2.2.3.12 provides non-standard events associated with CPDLC transfers that may require controller action per paragraph 4.1 and/or the flight crew action per paragraph 5.2.3.

2.2.3.4.3 The controlling ATSU performs the following steps to transfer a CPDLC connection to the next ATSU:

a) Notifies the aircraft of the identity of the next ATSU permitted to establish a CPDLC connection (NDA message);

b) Instructs the aircraft to initiate an AFN logon to the next ATSU (FN_CAD message); and

c) In the vicinity of the FIR boundary, terminates the CPDLC connection with the aircraft (END SERVICE message).

2.2.3.5 Next data authority notification (NDA message)

2.2.3.5.1 The purpose of the CPDLC UM 160 NEXT DATA AUTHORITY [facility designation] (NDA) message is to allow the controlling ATSU to notify the aircraft of the identity of the next ATSU authorized to establish an inactive CPDLC connection. The aircraft system will only accept a CPDLC CR1 from the ATSU specified in the [facility designation] of the NDA message.

2.2.3.5.2 The [facility designation] is the four-character ICAO identifier for the appropriate ATSU.

2.2.3.5.3 Only the current data authority can specify the next data authority.

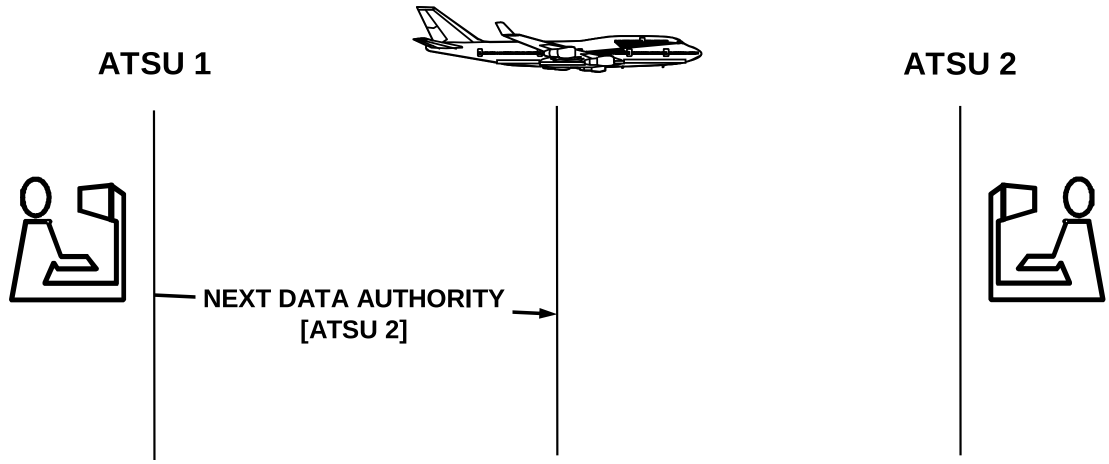


Figure 2-7. Next data authority notification

2.2.3.6 AFN logon triggered by address forwarding (FN_CAD message)

2.2.3.6.1 Address forwarding is the process whereby one ATSU instructs the aircraft system to initiate an AFN logon to another ATSU.

2.2.3.6.2 The current data authority typically initiates address forwarding to a downstream or adjacent ATSU to permit them to establish an inactive CPDLC connection and/or an ADS contract for monitoring purposes.

2.2.3.6.3 Any ATSU can initiate address forwarding by sending an AFN CONTACT ADVISORY (FN_CAD) message to the aircraft. Upon receipt, the aircraft automatically transmits an AFN logon to the ATSU whose address was included in the FN_CAD message.

2.2.3.6.4 The sequence of messages associated with address forwarding is listed in the Table 2-6, and depicted in Figure 2-8.

2.2.3.6.5 Where the functionality is available, an ATSU can imitate address forwarding by the AIDC FAN message. The AIDC FAN message contains the same information as an AFN logon, but is transmitted by one ATSU to another as depicted in Figure 2-9 using ground – ground links as a substitute for address forwarding.

Note.— Refer to the Asia Pacific AIDC ICD and North Atlantic Common Coordination ICD for more information concerning the AIDC FAN message.

2.2.3.6.6 To allow an uninterrupted transfer of the CPDLC connection at the FIR boundary, the current data authority initiates address forwarding at least 15 minutes prior to the estimate for the FIR entry position. (Refer to paragraph 3.1.2.2 and paragraph 3.1.4.8).

2.2.3.6.7 The ATSU initiating the address forwarding receives indication of successful delivery of FN_CON or FN_AK messages upon receipt of the AFN COMPLETE (FN_COMP) message.

2.2.3.6.8 The flight crew does not receive an indication as to whether or not the FN_CON or FN_AK messages have been delivered correctly. However, the flight crew receives an indication of a change to the active ATSU following a successful CPDLC connection transfer.

Table 2-6. Address forwarding messages

Message	Abbreviation	Purpose
AFN CONTACT ADVISORY	FN_CAD	Uplink message sent by an ATSU instructing an aircraft to send an FN_CON (AFN logon) to a specified ATSU.
AFN RESPONSE	FN_RESP	Downlink response sent by the aircraft to the ATSU that initiated the FN_CAD indicating an intent to send an FN_CON to the specified ATSU.
AFN CONTACT	FN_CON	AFN logon message sent by the aircraft to the specified ATSU.
AFN ACKNOWLEDGEMENT	FN_AK	Uplink response sent by the ATSU receiving the AFN logon message to the aircraft providing the status of the AFN logon attempt.
AFN COMPLETE	FN_COMP	Response sent by the aircraft to the ATSU initiating the FN_CAD providing the status of the AFN logon to the specified ATSU.

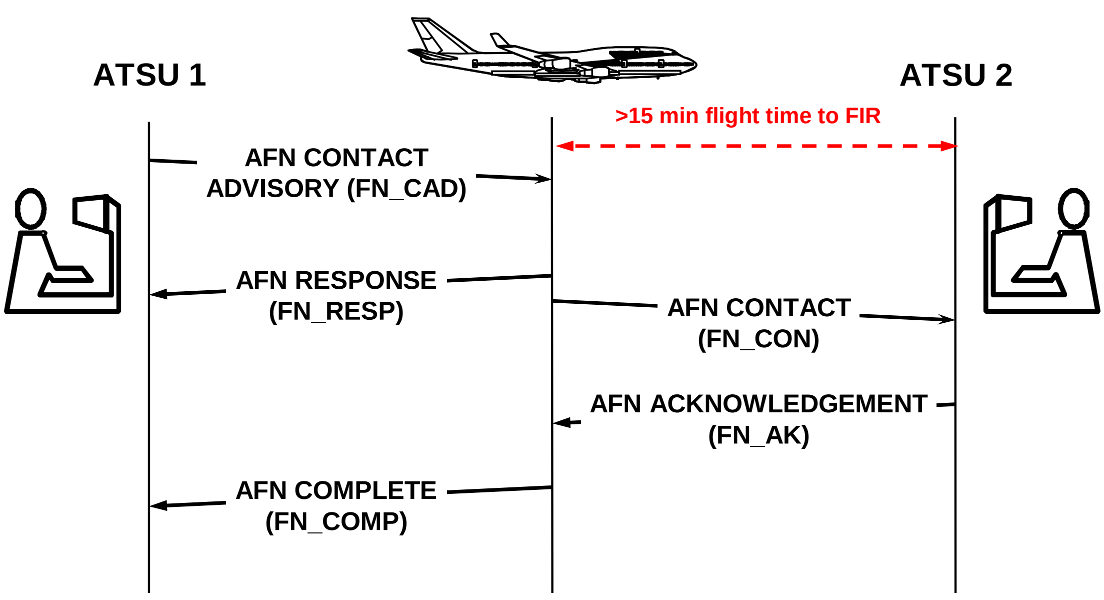


Figure 2-8. Address forwarding message sequence (Transfer between areas where data link is provided)

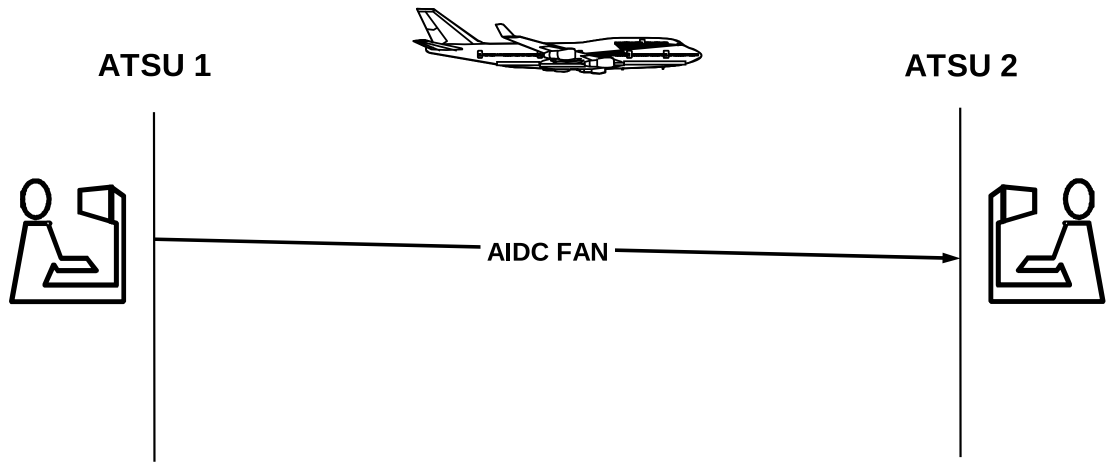


Figure 2-9. Transferring an AFN logon using the AIDC FAN message

2.2.3.7 Establishing an inactive CPDLC connection

2.2.3.7.1 The effect of receiving AFN logon information via address forwarding is the same as receiving it when the flight crew performs an initial ATN logon. However, when the next ATSU uplinks a CPDLC CR1 to establish an inactive CPDLC connection, the aircraft system follows a different set of rules to those described in paragraph 2.2.3.3.2.

2.2.3.7.2 If there is an existing CPDLC connection, on receipt of a CPDLC CR1, the aircraft system verifies that the ATSU sending the CPDLC CR1 has been specified as the next data authority. If so, the aircraft system:

a) Accepts the CPDLC CR1;

b) Establishes the connection as the inactive connection; and

c) Responds with a CPDLC CC1.

Otherwise:

d) Rejects the CPDLC CR1 by sending a DR1 message that also contains the identity of the current data authority.

2.2.3.7.3 Because the next data authority holds an inactive CPDLC connection as shown in Figure 2-10, the next data authority and the flight crew cannot exchange CPDLC messages.

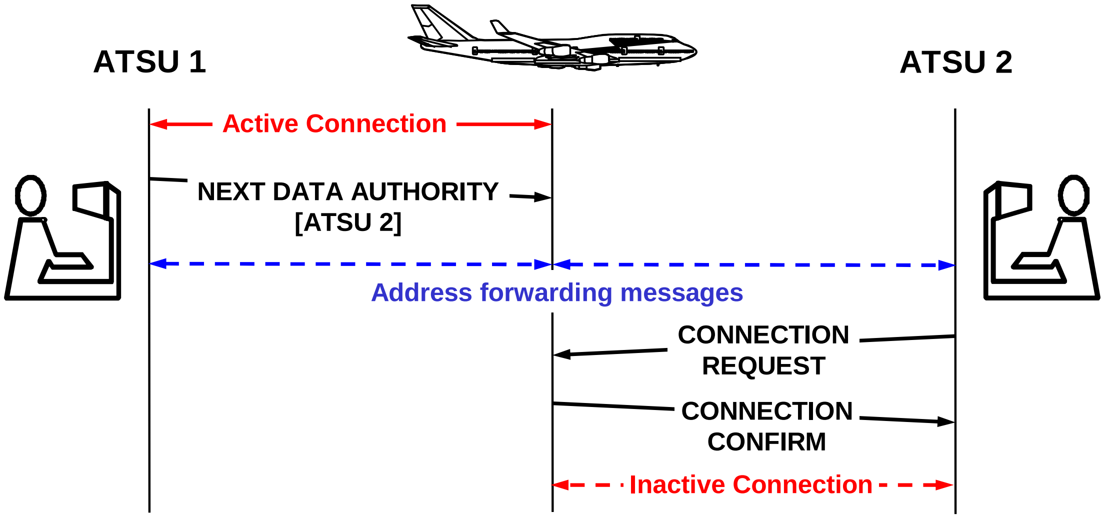


Figure 2-10. Successful attempt to establish an inactive CPDLC connection

Note.— If ATSU 1 does not establish a CPDLC connection, then some aircraft will reject a CR1 received from ATSU 2 after an FN CAD initiated communications transfer. Refer to Appendix F, paragraph F.3.

2.2.3.7.4 Figure 2-11 shows the effect of the next ATSU attempting to establish an inactive CPLDC connection when the UM 160 NEXT DATA AUTHORITY [facility designation] message has not been delivered to the aircraft (or was not sent in the first place). The aircraft system rejects the CPDLC CR1, and responds with a DR1 downlink message that also contains the identity of the ATSU with the active CPDLC connection.

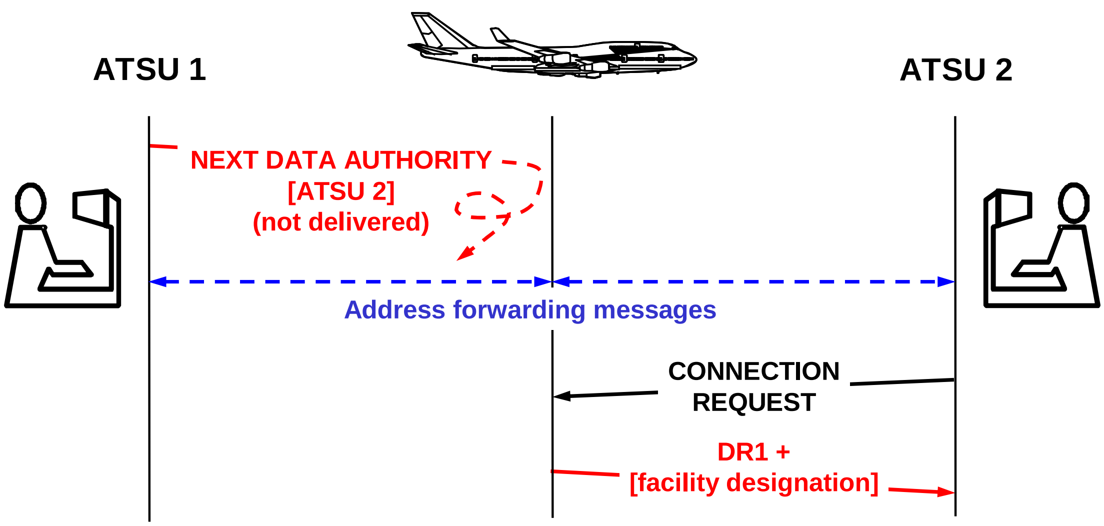


Figure 2-11. Unsuccessful attempt to establish an inactive CPDLC connection

2.2.3.8 Sequence of the NDA and FN_CAD messages

2.2.3.8.1 Some ATSUs initiate a CPDLC CR1 immediately following receipt of an AFN logon. If this CPDLC CR1 is received prior to receipt of an appropriate NDA message, the aircraft system will reject the CPDLC CR1.

2.2.3.8.2 To prevent such a rejection of the CPDLC CR1, the current data authority sends the NDA message prior to initiating address forwarding to the next ATSU (Refer to paragraph 3.1.2.2).

2.2.3.9 Terminating the active CPDLC connection (END SERVICE message)

2.2.3.9.1 Under normal conditions, the current data authority initiates the termination of the CPDLC connection by sending an UM 161 END SERVICE message to the aircraft as depicted in Figure 2-12 and Figure 2-13. On receipt of an UM 161 END SERVICE message:

a) The aircraft system will downlink a CPDLC DISCONNECT REQUEST (DR1) message. The aircraft system will consider the aircraft to be disconnected as soon as the DR1 message has been sent.

b) The current (active) CPDLC connection will be terminated, activating the inactive connection (if one exists). The next data authority becomes the current data authority and is now able to exchange CPDLC messages with the aircraft.

2.2.3.9.2 If the aircraft is entering an FIR where data link services are not available, no Next Data Authority message is uplinked, nor is the Address Forwarding process carried out. On receipt of an UM 161 END SERVICE message:

a) The aircraft system will downlink a CPDLC DISCONNECT REQUEST (DR1) message. The aircraft system will consider the aircraft to be disconnected as soon as the DR1 message has been sent

b) The current (active) CPDLC connection will be terminated, leaving the aircraft without a CPDLC connection.

c) If no NDA exists, then receipt of the END SERVICE message will leave the aircraft without a CPDLC connection.

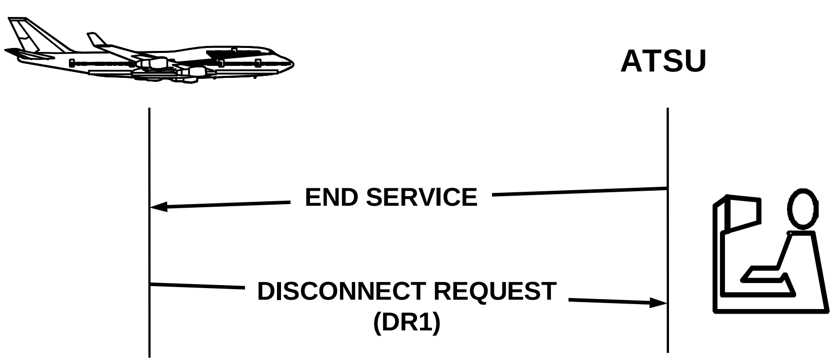


Figure 2-12. Termination of the CPDLC connection

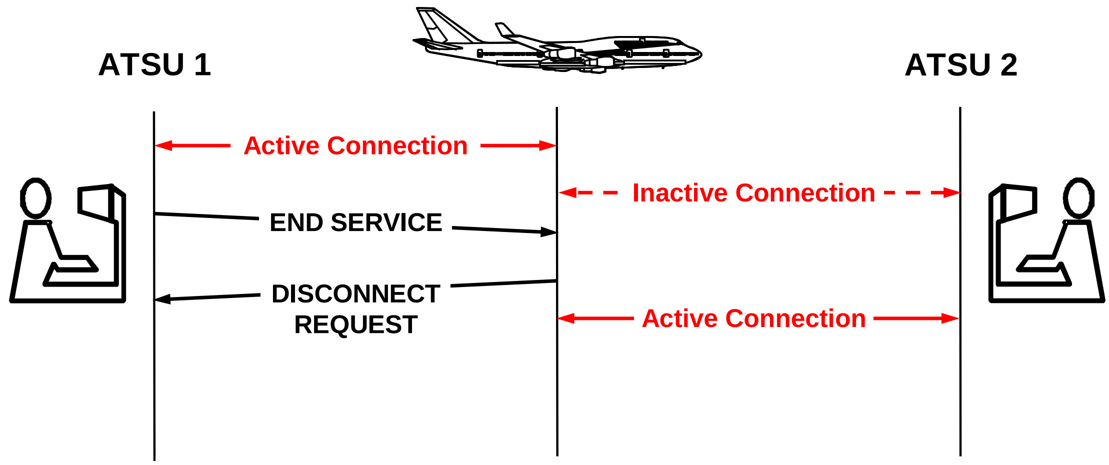


Figure 2-13. CPDLC transfer sequence of an aircraft between two ATSUs

2.2.3.9.3 The new current data authority has no indication that they have the active CPDLC connection until a CPDLC downlink is received from the aircraft (See paragraph 2.2.3.11.2).

2.2.3.9.4 Alternatively, implementation of the AIDC FCN message depicted in Figure 2-14 can be used to provide notification to the next ATSU that the previous ATSU has terminated their CPDLC connection.

Note.— Only the current data authority can terminate their CPDLC connection. If the next data authority attempts to uplink an UM 161 END SERVICE message to the aircraft, the aircraft system will reject the uplink message.

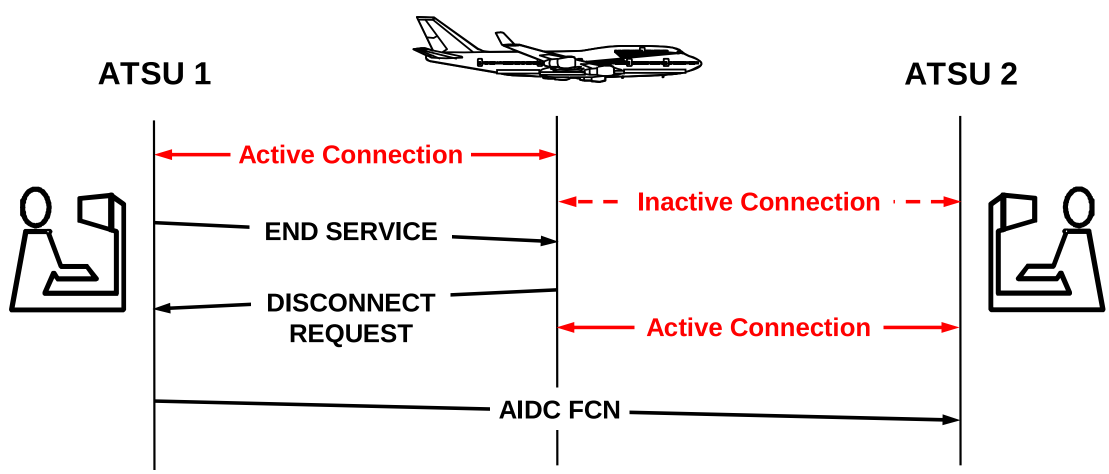


Figure 2-14. Use of the AIDC FCN message

2.2.3.9.5 A successful CPDLC transfer is dependent upon the next ATSU establishing its own CPDLC connection prior to the UM 161 END SERVICE message being received by the aircraft. Failure of the next ATSU to establish a CPDLC connection before the UM 161 END SERVICE message reaches the aircraft will leave the aircraft without CPDLC connectivity.

2.2.3.9.6 The previous ATSU will no longer be able to exchange CPDLC messages with the aircraft. The first ATSU to send a CPDLC CR1 message to the aircraft will become the current data authority, provided that an AFN logon has been completed with that ATSU.

2.2.3.9.7 The sequence of messages from the initial AFN logon to the completion of the CPDLC transfer is depicted in Figure 2-15. Figure 2-16 shows the same sequence of messages, with the AIDC FAN message being used instead of address forwarding.

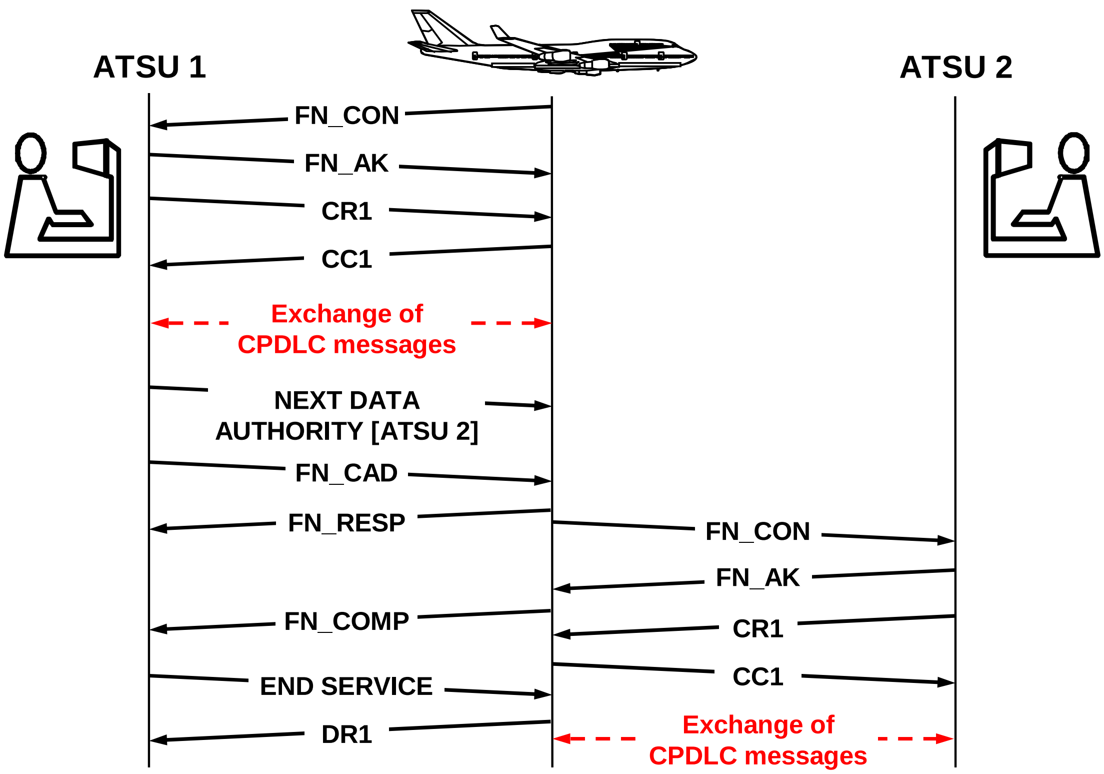


Figure 2-15. Initial AFN logon transfer of CPDLC connection using address forwarding

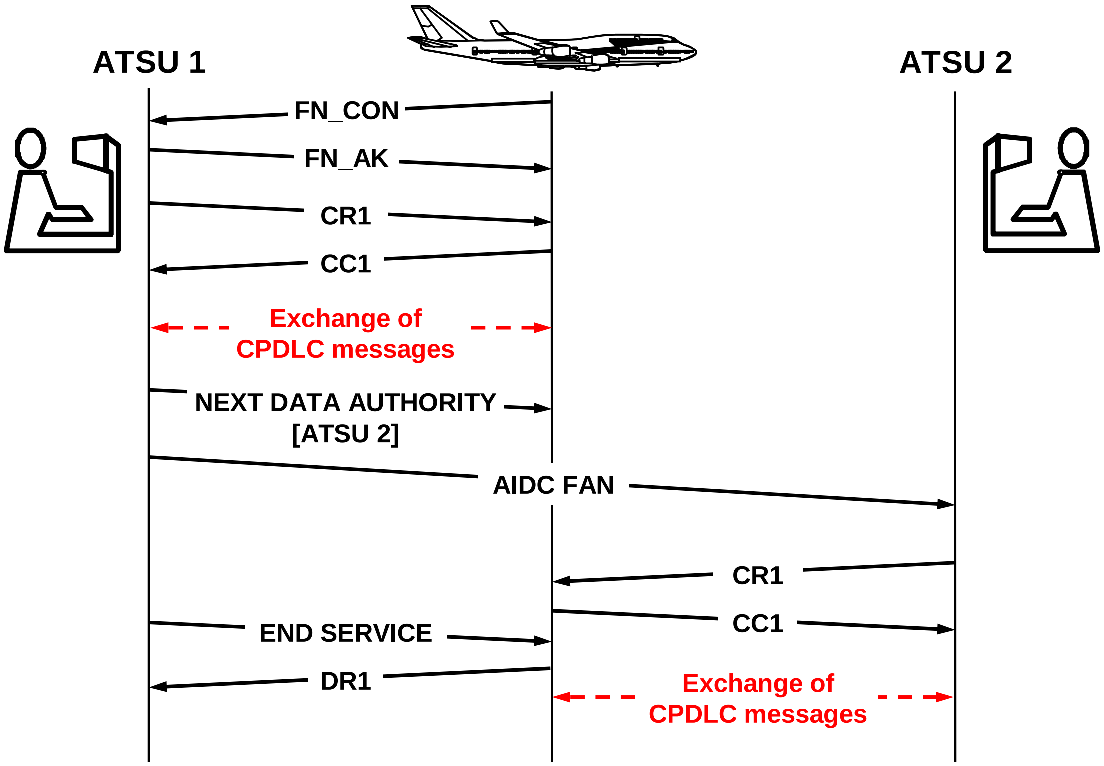


Figure 2-16. Initial AFN logon to transfer CPDLC connection using the AIDC FAN message

2.2.3.10 The CPDLC connection sequence

2.2.3.10.1 As the aircraft transits from one CPDLC-capable ATSU to another, the same CPDLC transfer process repeats itself. The cyclical nature of this process is depicted in Figure 2-17.

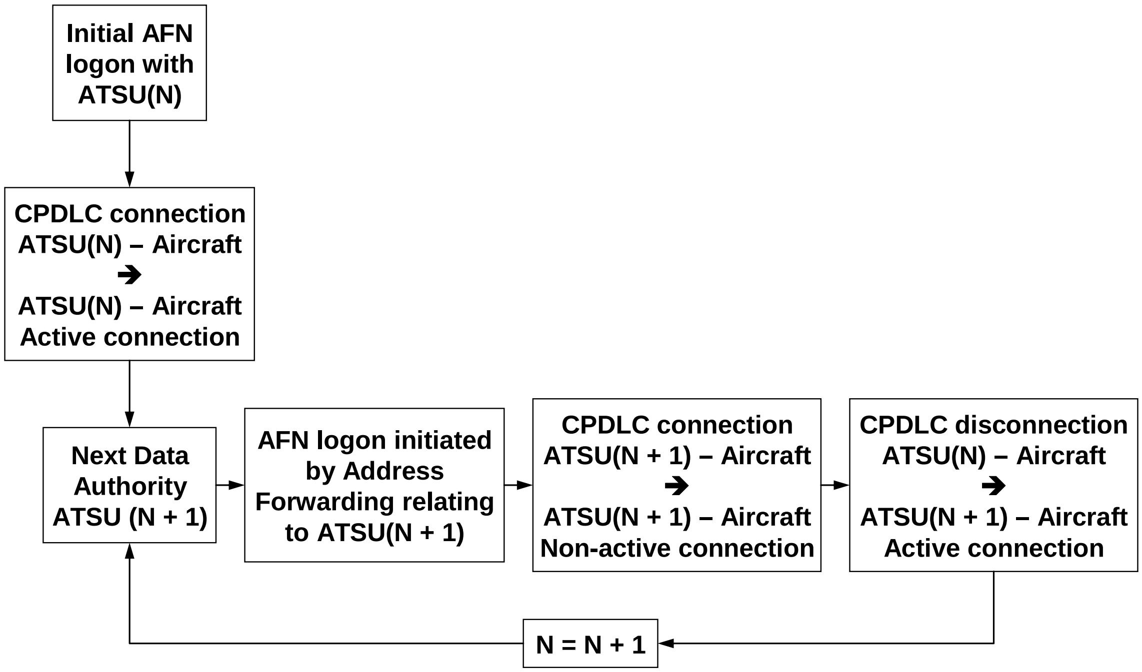


Figure 2-17. Life cycle of the CPDLC connection process

2.2.3.11 Determining an active CPDLC connection

2.2.3.11.1 CPDLC messages can only be exchanged between the aircraft and the current data authority. If the ATSU with the inactive connection uplinks a CPDLC message to the aircraft, the aircraft system rejects the message and sends DM 63 NOT CURRENT DATA AUTHORITY to the ATSU.

2.2.3.11.2 The receiving ATSU can use the following methods to confirm a CPDLC connection is active:

a) Wait until a CPDLC downlink message is received from the aircraft;

b) Send a message to the aircraft with the possibility of receiving a DM 63 NOT CURRENT DATA AUTHORITY message if the connection is inactive as shown in Figure 2-18; or

c) Wait until an AIDC FCN message for the flight is received from the transferring ATSU.

Note.— Non-receipt of a DM 63 NOT CURRENT DATA AUTHORITY message does not necessarily confirm that a CPDLC connection is active.

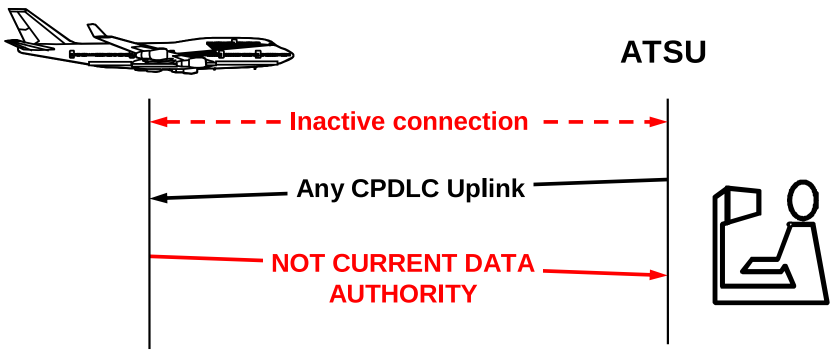


Figure 2-18. Avionics reject CPDLC uplinks sent by the ATSU with the inactive connection

2.2.3.12 Non-standard events associated with CPDLC transfers

2.2.3.12.1 Multiple NDA messages

2.2.3.12.1.1 Under normal circumstances, the current data authority sends only a single NDA message to an aircraft. Exceptions to this may include:

a) Following a re-route (e.g. due to weather) that affects the identity of the next ATSU whose airspace the aircraft will enter;

b) If the initial NDA message was not delivered to the aircraft.

2.2.3.12.1.2 When a UM 160 NEXT DATA AUTHORITY [facility designation] is received, the aircraft system replaces any previous NDA message the aircraft may have received unless the facility designation in the message is the same as the facility designation already held by the aircraft system. If the facility designation is different, the aircraft terminates any inactive CPDLC connection that an ATSU may have established.

Note.— Some aircraft types may terminate an inactive CPDLC connection even if the facility designation in NDA message is the same. See Appendix F, paragraph F.3.

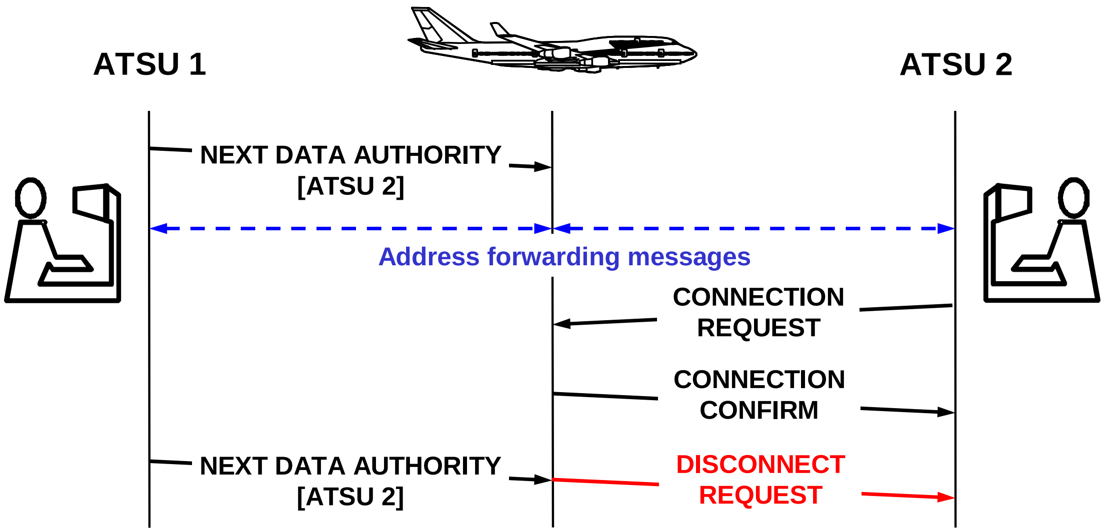


Figure 2-19. Effect of uplinking duplicate (or multiple) NDA messages

2.2.3.12.2 Amendment to the identity of the next data authority

2.2.3.12.2.1 If the identity of the next data authority changes after the transferring ATSU has already sent the initial NDA message, the transferring ATSU will need to send a new NDA message containing the identity of the (new) next ATSU. The aircraft system will replace the original NDA message with the new NDA message and will disconnect any inactive connection that an ATSU may have already established.

2.2.3.12.2.2 In Figure 2-20, the next ATSU on the aircraft's route was ATSU 2. Shortly after ATSU 1 had commenced the CPDLC transfer sequence to ATSU 2, the aircraft was re-rerouted in such a way that ATSU 3 is now the next ATSU.

2.2.3.12.2.3 Figure 2-21 shows that ATSU 1 sends a new NDA message nominating ATSU 3 as the next data authority. On receipt of this NDA message, the aircraft disconnects its CPDLC connection from ATSU 2 (if they had already established an inactive connection). In addition, ATSU 1 initiates address forwarding for the aircraft to ATSU 3.

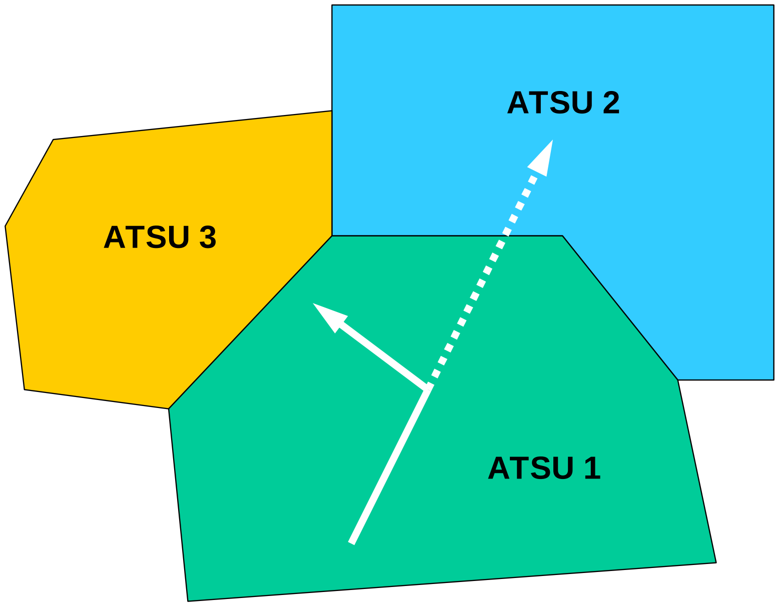


Figure 2-20. Depiction of the change in route of an aircraft

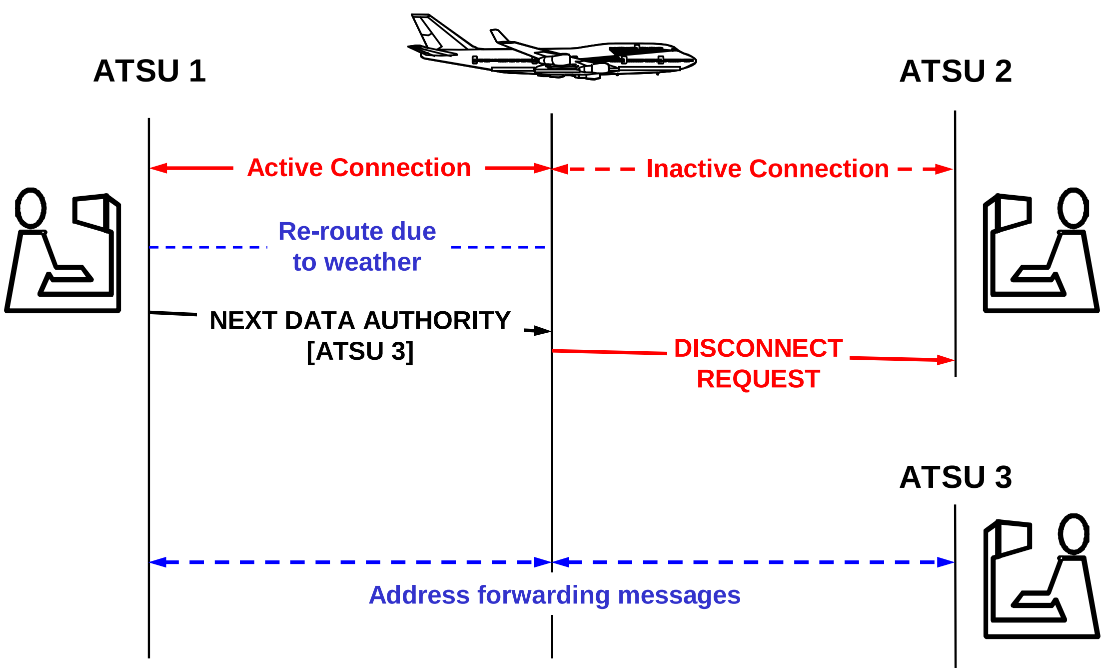


Figure 2-21. Uplinking a new NDA following a re-reroute

2.2.3.12.3 Failures of the CPDLC CR1 message

2.2.3.12.3.1 The aircraft system will reject the CPDLC CR1 message and send a message to the next ATSU containing the identity of the current data authority, as shown in Figure 2-22, when:

a) the aircraft system receives the CPDLC CR1 message from the next ATSU before the UM 160 NEXT DATA AUTHORITY [facility designation] message from the current data authority; or,

b) the aircraft system receives the UM 160 NEXT DATA AUTHORITY [facility designation] message, but the ATSU specified in it is different to the identity of the ATSU uplinking the CPDLC CR1.

2.2.3.12.3.2 The flight crew has no indication that the CPDLC CR1 has been rejected.

2.2.3.12.3.3 If the controlling ATSU sends to the aircraft another UM 160 NEXT DATA AUTHORITY [facility designation] message nominating the correct ATSU, the next ATSU will need to send a subsequent CPDLC CR1 to establish the connection, as shown in Figure 2-23.

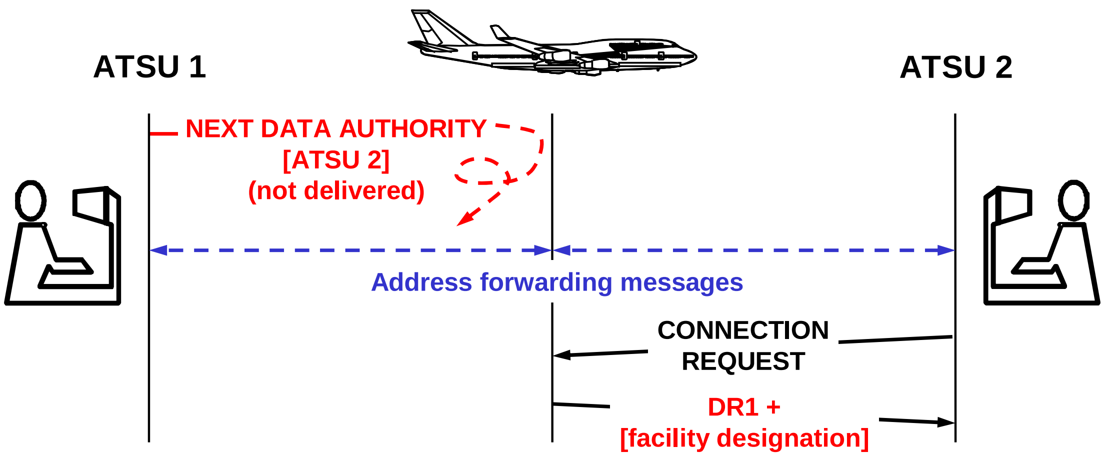


Figure 2-22. Non-delivery of the NDA message

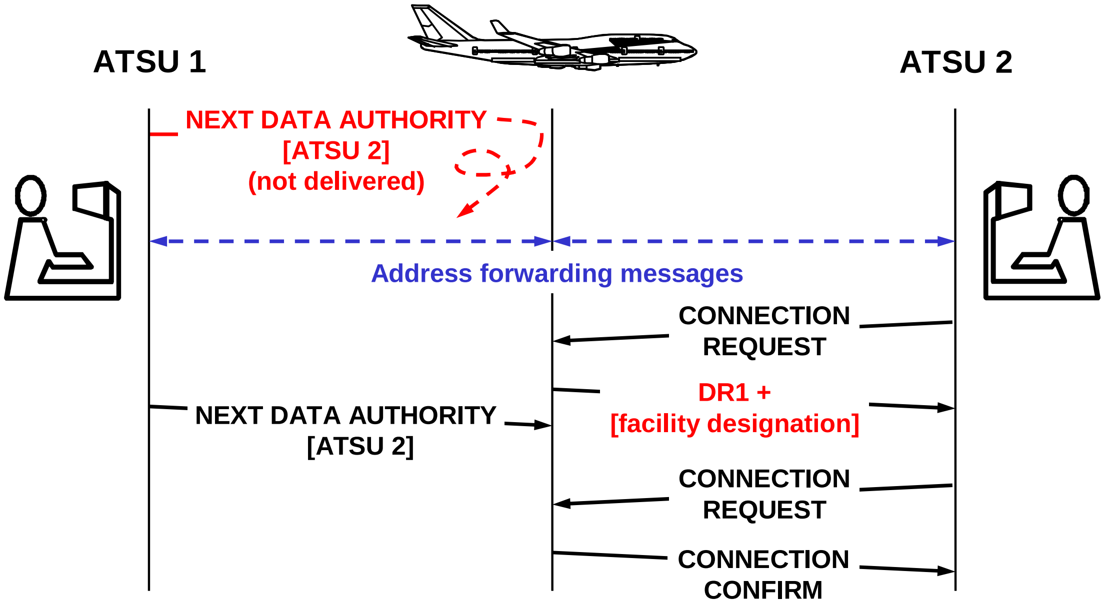


Figure 2-23. Successful CPDLC connection following a re-send of the NDA message

2.2.3.12.4 Termination of both active and inactive CPDLC connections

2.2.3.12.4.1 Normally, on receipt of an UM 161 END SERVICE message, the aircraft system will only terminate the active CPDLC connection. However, under certain circumstances, the aircraft system will terminate all CPDLC connections (active and inactive) when:

a) Any CPDLC uplink message remains open when the aircraft receives the UM 161 END SERVICE message as shown in Figure 2-24; or

b) If the UM 161 END SERVICE message element is part of a multi-element message, where none of the elements require a WILCO/UNABLE (W/U) response as shown in Figure 2-25.

Note 1.— Refer to Appendix F, paragraph F.8 for variations in aircraft processing of open uplinks at time of transfer of communications.

Note 2.— The UM 161 END SERVICE message element is not normally sent as part of a multi-element message.

Note 3.— See Appendix A for message elements that require a W/U response.

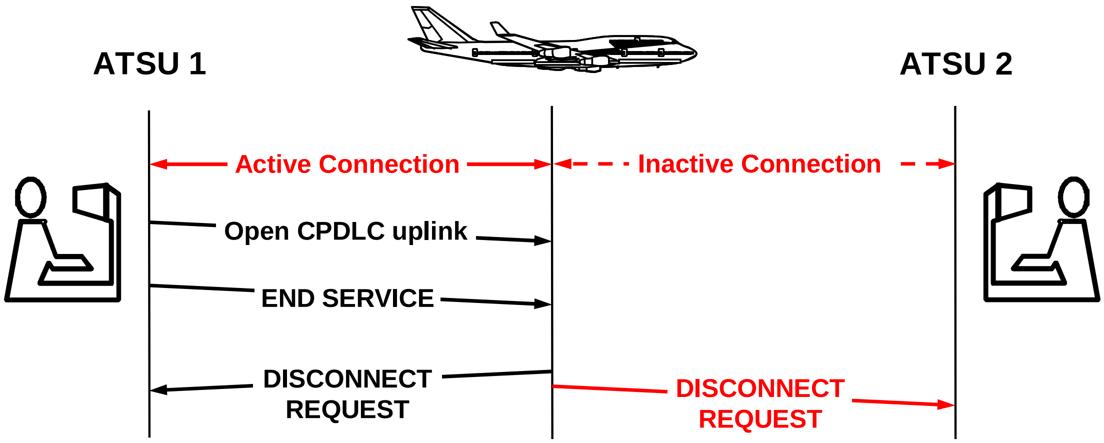


Figure 2-24. Disconnection of both active and inactive connections (open uplink)

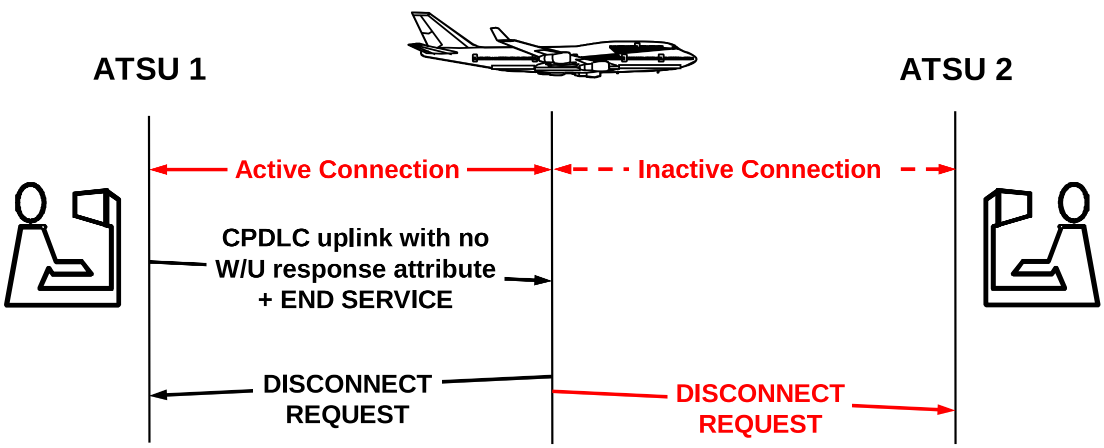


Figure 2-25. Disconnection of both active and inactive connections (CPDLC uplink contains END SERVICE message element)

2.2.4 Controller-pilot data link communications (CPDLC)

2.2.4.1 CPDLC - general

2.2.4.1.1 CPDLC is a data link application that supports the exchange of data messages directly between a controller and a flight crew.

2.2.4.1.2 CPDLC greatly improves communication capabilities in oceanic and remote airspace, especially in areas where the controller and the flight crew previously had to rely on a third party HF voice communications.

2.2.4.1.3 Generally, when a CPDLC aircraft is operating in an airspace beyond the range of VHF voice communications, CPDLC is available, and other local rules do not apply, then:

a) CPDLC will be the normal means of communication, and

b) Voice will be used as the alternative means of communication (for example, direct HF, third party HF or Satcom voice).

2.2.4.1.4 In airspace with VHF coverage, an ATSU may provide CPDLC service as a normal means of communication to alleviate frequency congestion or to enable the use of automation associated with the use of CPDLC. In such airspace, VHF voice communication is the alternative means of communication for CPDLC aircraft.

2.2.4.1.5 In addition to the benefits of the direct communications link, and depending on the specific implementation, other advantages associated with CPDLC could potentially include:

a) Allowing the flight crew to print messages;

b) Allowing messages to be stored, and reviewed as needed;

c) Reducing flight crew-input errors, by allowing the loading of information, such as route clearances or frequency change instructions, from specific uplink messages into other aircraft systems, such as the FMS or radios;

d) Allowing the flight crew to downlink a complex route clearance request, which the controller can respond to without having to manually enter a long string of coordinates;

e) Reducing flight crew workload by supporting automatically transmitted reports when a specific event, such as crossing a waypoint, occurs;

f) Reducing controller workload by providing automatic update of the flight plan when a specific downlink message (and the response to some uplink messages) is received.

2.2.4.2 CPDLC message set

2.2.4.2.1 The CPDLC message set consists of a set of message elements most of which correspond to a radiotelephony phraseology.

2.2.4.2.2 CPDLC message elements are referred to either as:

a) Uplinks (message elements that are sent to an aircraft); or

b) Downlinks (message elements that are sent by the aircraft).

2.2.4.2.3 Each message element has a number of attributes associated to it, including:

a) A message number that uniquely identifies each type of message element. Uplink message elements are prefixed UM and downlink messages prefixed with DM;

b) A response attribute that defines whether or not a response is required for a message element, and if so, what type of response is required.

Note.— Other attributes include the urgency and alert attributes to specify priority in message delivery and indication to the recipient. These attributes are currently not used.

2.2.4.2.4 The CPDLC message set including the possible responses associated with each response attribute is included in Appendix A.

2.2.4.2.5 Table 2-7 provides examples of responses that may be required for a CPDLC uplink message depending on its response attribute. See Appendix A, paragraph A.1 for a complete description of the responses associated with each response attribute.

Table 2-7. Examples of responses to CPDLC uplink messages

Response attribute	Description
W/U	A DM 0 WILCO or DM 1 UNABLE is required in response to this CPDLC uplink message element
A/N	An DM 4 AFFIRM or DM 5 NEGATIVE is required in response to this CPDLC uplink message element
R	A DM 3 ROGER is required in response to this CPDLC uplink message element
NE	A response is not required to close the uplink message even though a response may be required operationally.

2.2.4.3 CPDLC messages

2.2.4.3.1 A CPDLC message consists of either a single message element, or a combination of up to five message elements. A CPDLC message that consists of more than one message element is a multi-element message.

Note.— As a general rule, the size of a CPDLC message needs to be kept to a minimum. Refer to paragraphs 4.2.5, 4.3.4, and 5.4.1.4 for guidelines on use of multi-element messages.

2.2.4.4 Responses to CPDLC messages

2.2.4.4.1 Even though a multi-element CPDLC message may contain a number of message elements each of which requires a response, the flight crew or controller only provides a single response for the entire CPDLC message.

2.2.4.4.2 The flight crew or controller responds to a multi element message associated with the highest priority response type for the elements in the message. Table 2-8 lists the priority order to determine the highest priority response type.

Table 2-8. Priority of CPDLC responses

Priority	Response type
1	W/U
2	A/N
3	R
4	NE

2.2.4.4.3 Table 2-9 provides examples on the appropriate responses to various multi-element CPDLC uplinks.

Table 2-9. Examples of multi-element CPDLC messages

Multi-element message	(Individual) response required for each message element	(Single) response required for entire message
UM 20 CLIMB TO AND MAINTAIN FL370 UM 129 REPORT LEVEL FL370	W/U R	W/U
UM 106 MAINTAIN M083 OR LESS UM 150 CAN YOU ACCEPT FL370 AT 2200	W/U A/N	W/U
UM 147 REQUEST POSITION REPORT UM 169 ADS-C HAS FAILED	NE R	R
UM 150 CAN YOU ACCEPT FL370 AT 2200 UM 130 REPORT PASSING MINNY	A/N R	A/N

2.2.4.5 Open and closed CPDLC messages

2.2.4.5.1 A CPDLC message is open if the aircraft or ground system expects a response, and has not yet received it.

2.2.4.5.2 A CPDLC message is closed if the aircraft or ground system either:

a) does not expect a response; or

b) does expect a response and has already received it.

Note.— UM 1 or DM 2 STANDBY and UM 2 REQUEST DEFERRED do not close a CPDLC message.

2.2.4.6 CPDLC dialogues

2.2.4.6.1 Messages that are related – e.g. a CPDLC downlink request and the corresponding CPDLC uplink clearance – are CPDLC dialogues.

a) A CPDLC dialogue is open if any of the CPDLC messages in the dialogue are open;

b) A CPDLC dialogue is closed if all CPDLC messages in the dialogue are closed.

Note.— A dialogue can be technically closed, but still be operationally open. For example, when a DM 3 ROGER has been sent for a UM 129 REPORT MAINTAINING [level], the dialogue is technically closed, but not operationally closed until the ATSU receives the DM 37 MAINTAINING [level].

2.2.4.6.2 Some CPDLC dialogues may consist of a single CPDLC message.

2.2.4.6.3 Table 2-10 provides examples on the message status of various CPDLC dialogues.

Table 2-10. Examples of CPDLC message status

CPDLC message	Message status	Dialogue status
UM 30 MAINTAIN BLOCK FL330 TO FL350	OPEN	OPEN
DM 27 REQUEST WEATHER DEVIATION UP TO 15NM LEFT OF ROUTE UM 1 STANDBY	OPEN CLOSED	OPEN
DM 22 REQUEST DIRECT TO MICKY UM 2 REQUEST DEFERRED UM 74 PROCEED DIRECT TO MICKY	CLOSED CLOSED OPEN	OPEN
DM 9 REQUEST CLIMB TO FL370 UM 20 CLIMB TO AND MAINTAIN FL370 UM 129 REPORT LEVEL FL370 DM 0 WILCO	CLOSED CLOSED CLOSED	CLOSED
UM 150 CAN YOU ACCEPT [level] AT [time] DM 5 NEGATIVE	CLOSED CLOSED	CLOSED
UM 147 REQUEST POSITION REPORT	CLOSED	CLOSED
DM 37 LEVEL FL370	CLOSED	CLOSED

2.2.4.7 Message identification numbers (MIN)

2.2.4.7.1 For each CPDLC connection, the aircraft and ground systems assign every CPDLC uplink and downlink message an identifier, known as a message identification number (MIN). The MIN is an integer in the range 0 to 63 (inclusive). The ground system assigns the MIN for uplink messages, and the aircraft system assigns the MIN for downlink messages.

2.2.4.7.2 The aircraft and ground systems generally assign MINs sequentially, although this is not a technical requirement. A MIN is not re-used during a flight until all other available MINs have been used.

2.2.4.8 Message reference numbers (MRN)

2.2.4.8.1 The aircraft and ground systems assign a message reference number (MRN) to a CPDLC message when it is a response to another CPDLC message. The MRN of the response message is the same as the MIN of the corresponding CPDLC message in the dialogue.

2.2.4.8.2 The aircraft and ground systems associate corresponding CPDLC messages within a dialogue by their message identification numbers and message reference numbers.

2.2.4.8.3 This functionality ensures that the aircraft and ground systems associate a CPDLC response message with the correct CPDLC message in the dialogue.

2.2.4.8.4 Table 2-11 provides an example of a CPDLC dialogue to illustrate the way in which the aircraft and ground systems track the CPDLC messages using the MIN and MRN. In this example, the last MIN assigned by the aircraft system was 7 and by the ground system was 11.

Table 2-11. Example of CPDLC dialogue

CPDLC message	MIN	MRN	Comment
DM 6 REQUEST FL350	8		The aircraft system assigns a MIN of 8 to this message. The downlink request is open.
UM 1 STANDBY	12	8	The ground system assigns a MIN of 12 to this uplink. Because this uplink is a response to the downlink, the ground system assigns the MRN equal to the MIN of the downlink request (i.e., MRN = 8). UM 1 STANDBY is not a closure message. The status of the downlink request is open.
UM 20 CLIMB TO AND MAINTAIN FL350 UM 129 REPORT LEVEL FL350	13	8	The ground system assigns a MIN of 13 to this uplink (i.e., the ground system increments the MIN of the previous uplink message by one). Because this uplink is a response to the downlink, the ground system assigns the MRN equal to the MIN of the downlink request (i.e. MRN = 8).
DM 0 WILCO	9	13	The aircraft system assigns a MIN of 9 to this downlink (i.e., the aircraft system increments the MIN of the previous downlink message by one). Because this downlink is a response to the uplink, the aircraft system assigns the MRN equal to the MIN of the uplink (i.e., MRN = 13). DM 0 WILCO is a closure message. The status of the uplink message is closed.

CPDLC message	MIN	MRN	Comment
DM 37 LEVEL FL350	10		The aircraft system assigns a MIN of 10 to this downlink (i.e., the aircraft system increments the MIN of the previous downlink message by one). The ground system does not assign an MRN because it is not associated with an uplink message. The ground system does not respond to this downlink because it is a self-closing message.

2.2.5 Automatic dependent surveillance – contract (ADS-C)

2.2.5.1 ADS-C – general

2.2.5.1.1 ADS-C is an application that enables one or more ground systems (supporting ATS or AOC) to establish an ADS contract with an aircraft. The ADS contract instructs the aircraft system to automatically provide ADS-C reports that contain certain parameters (e.g. position, altitude, and speed) and intent information for surveillance and route conformance monitoring. Some of these parameters are mandatory, while others are optional and are defined in the ADS contract uplinked by the ground system.

2.2.5.1.2 Although the terms are similar, ADS-C and ADS-B are two different applications. ADS-C permits as many as five different ground systems to establish a contract with an aircraft. Each facility specifies to the aircraft system the information to be included in a report and the conditions on when to send it. The aircraft sends the report only to the ground system(s) that have established the contract.

Note.— In comparison, an ADS-B-capable aircraft broadcasts information equivalent to radar at a relatively high rate (i.e., one message per second), and any appropriate receiver on the ground or in another aircraft within range can receive the information.

2.2.5.2 ADS contract

2.2.5.2.1 After receiving an AFN logon, the ATSU will need to establish ADS contract(s) with the aircraft before it can receive any ADS-C reports. There are three types of ADS contracts:

a) Periodic contract;

b) Demand contract;

c) Event contract.

2.2.5.2.2 The establishment of ADS contracts is initiated by the ground system and does not require flight crew action providing that ADS-C in the aircraft system is not off. The flight crew has the ability to cancel all contracts by selecting ADS-C off and some aircraft systems allow the flight crew to cancel an ADS contract with a specific ATSU.

2.2.5.2.3 Periodic contract

2.2.5.2.3.1 A periodic contract allows an ATSU to specify:

a) The time interval at which the aircraft system sends an ADS-C report; and

b) The optional ADS-C groups that are to be included in the periodic report. Each optional group may have a unique modulus which defines how often the optional group is included with the periodic report, e.g. a modulus of five indicates that the optional group would be included with every fifth periodic report sent.

2.2.5.2.3.2 The ground system may permit the controller to alter the periodic reporting interval to allow for situations where the controller desires a longer or shorter reporting interval. The controller may select a short reporting interval, for example, during an off track deviation or an emergency.

Note.— The ATSP ensures that separation minima are applied in accordance with appropriate standards. The ground system may prevent the controller from selecting a periodic reporting interval that is longer than the minimum interval specified in the standard for the separation minima being applied.

2.2.5.2.3.3 An ATSU can establish only one periodic contract with an aircraft at any one time. A number of ATSUs can each establish their own periodic contract and specify their own conditions for the report with the same aircraft at the same time.

2.2.5.2.3.4 A periodic contract remains in place until it is either cancelled or modified. Whenever an ATSU establishes a new periodic contract, the aircraft system automatically replaces the previous periodic contract with the new one.

2.2.5.2.3.5 Arbitrarily selecting a short periodic reporting interval adds undue economic costs and unnecessarily loads the data link system.

2.2.5.2.3.6 As shown in Figure 2-26, in response to a new ADS-C periodic contract, the aircraft:

a) Sends an acknowledgement; and

b) Sends the first periodic report of the new contract

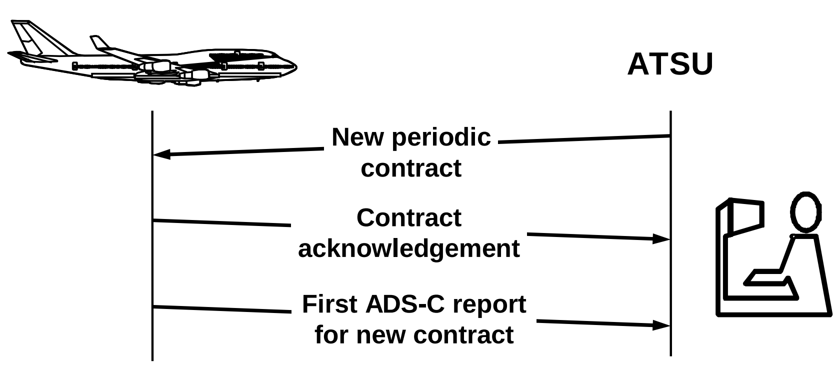


Figure 2-26. ADS-C periodic contract sequence

2.2.5.2.4 Demand contract

2.2.5.2.4.1 A demand contract allows an ATSU to request a single ADS-C periodic report. A demand contract does not cancel or modify any other ADS contracts that may be in effect with the aircraft.

2.2.5.2.5 Event contract

2.2.5.2.5.1 An event contract allows an ATSU to request an ADS-C report whenever a specific event occurs. An ATSU can establish only one event contract with an aircraft at any one time. However, the event contract can contain multiple event types. These types of optional events include:

a) Waypoint change event (WCE)

b) Level range deviation event (LRDE)

c) Lateral deviation event (LDE)

d) Vertical rate change event (VRE)

2.2.5.2.5.2 As shown in Figure 2-27, in response to a new ADS-C event contract, the aircraft separately sends an acknowledgement and then an ADS-C report(s) is transmitted only after one of the specified events occurs.

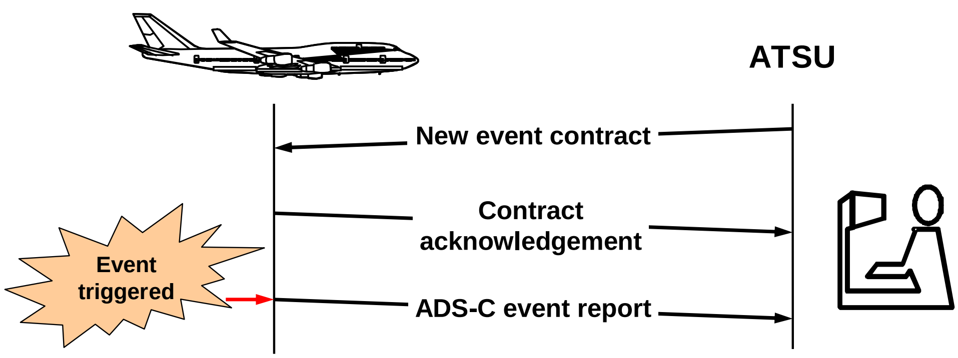


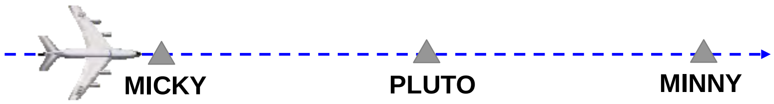
Figure 2-27. ADS-C event contract sequence

2.2.5.2.5.3 An event contract remains in effect until the ATSU cancels it or until the event(s) used to trigger the report occurs. The waypoint change event contract will trigger a report for all waypoint changes. All other event contracts will trigger a report on the first occurrence and then, if necessary, the ATSU will need to request a new contract for the particular event.

2.2.5.2.5.4 Waypoint change event (WCE)

2.2.5.2.5.4.1 The aircraft system sends a WCE report when a change occurs to the Next and/or Next + 1 waypoint in the FMS. The usual cause of this is the aircraft sequencing a waypoint.

2.2.5.2.5.4.2 As shown in Figure 2-28, when the aircraft sequences MICKY, the Next and Next + 1 waypoints contained in the FMS change. This results in sending a WCE report to all ATSUs that have an event contract containing a WCE with this aircraft.



	Next	Next + 1
Before sequencing MICKY	MICKY	PLUTO
After sequencing MICKY	PLUTO	MINNY

Figure 2-28. ADS-C waypoint change event

2.2.5.2.5.4.3 Other events that may cause the aircraft system to send a WCE report include:

a) The flight crew executing a clearance direct to a waypoint (i.e. next waypoint is changed)

b) The flight crew inserting a waypoint ahead of the aircraft (resulting in a change to the Next or Next + 1 waypoint)

c) The flight crew executing a lateral offset (resulting in a change to the Next waypoint).

2.2.5.2.5.4.4 A waypoint change event report contains the following ADS-C Groups:

a) Basic group; and

b) Predicted route group.

2.2.5.2.5.5 Level range deviation event (LRDE)

2.2.5.2.5.5.1 The ATSU specifies the LRDE by defining the lower and upper limits of the level range.

2.2.5.2.5.5.2 For example, in Figure 2-29, the LRDE has been defined with a lower limit of FL368 and an upper limit of FL372.

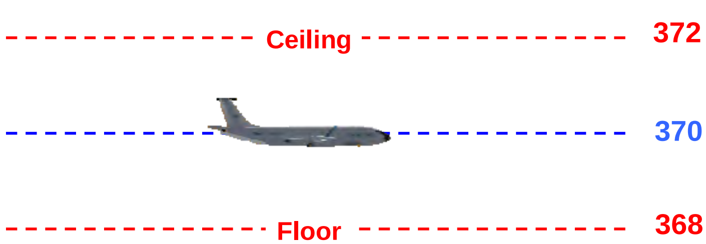


Figure 2-29. ADS-C level range deviation event

2.2.5.2.5.5.3 The aircraft system sends a LRDE report when the aircraft's flight level is outside the level range tolerances defined in the ADS-C event contract (Figure 2-30).

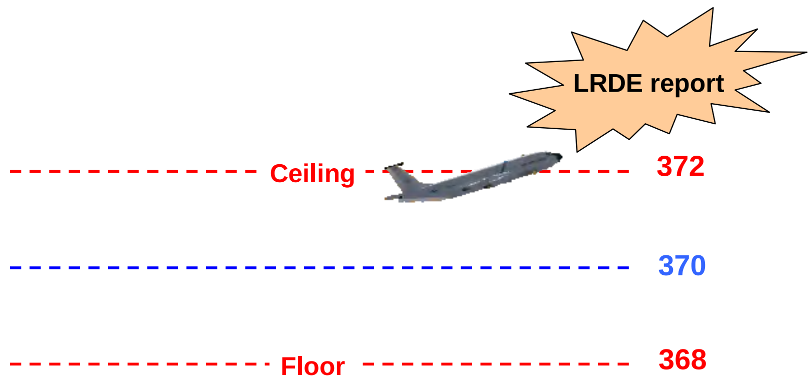


Figure 2-30. ADS-C level range deviation event report

2.2.5.2.5.5.4 Once an aircraft sends an LRDE report, it will not send another LRDE report until the ATSU establishes a new ADS-C LRDE contract.

2.2.5.2.5.5.5 An LRDE report contains the ADS-C Basic group only.

2.2.5.2.5.6 Lateral deviation event

2.2.5.2.5.6.1 The ATSU specifies the lateral deviation event by defining a maximum off track distance. It is not possible to define different distances on each side of track.

2.2.5.2.5.6.2 For example, in Figure 2-31, the lateral deviation event has been defined to be triggered for a deviation of greater than 5NM either side of track.

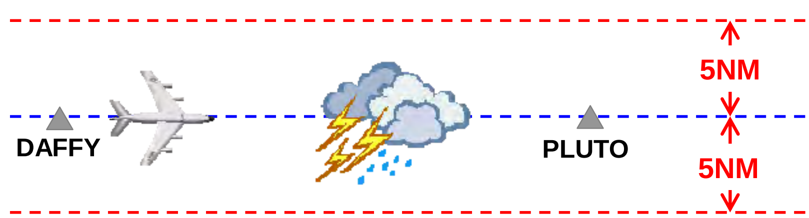


Figure 2-31. ADS-C lateral deviation event

2.2.5.2.5.6.3 The lateral deviation event is triggered when the lateral distance between the aircraft's actual position and its expected position on the aircraft active flight plan exceeds the parameter defined in the ADS-C event contract (Figure 2-32).

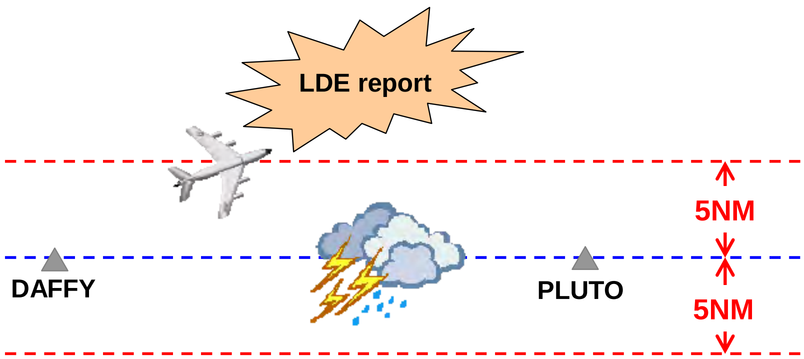


Figure 2-32. ADS-C lateral deviation event report

2.2.5.2.5.6.4 The lateral deviation event is triggered when the off track distance of an aircraft – operating in heading mode – exceeds the parameter defined in the event contract. However under certain circumstances, such as when the flight crew executes an offset that is greater than the lateral deviation event parameter, the aircraft may transmit a false lateral deviation event report.

2.2.5.2.5.6.5 As shown in Figure 2-33, after the offset has been executed, when the aircraft system compares the current position of the aircraft ① with the expected position of the aircraft on the offset path ②, the aircraft is deemed to be off track. If this off-track distance exceeds the lateral deviation parameter, the aircraft will transmit a lateral deviation event report, containing the on-track position of the aircraft.

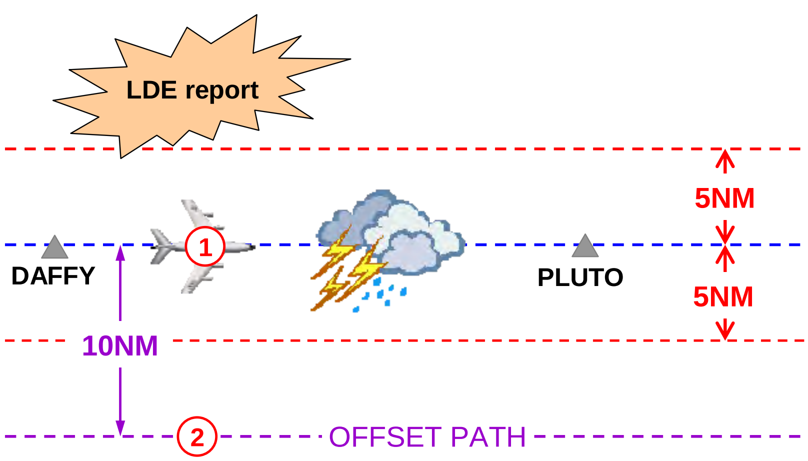


Figure 2-33. Effect of offset on ADS-C lateral deviation event report

2.2.5.2.5.6.6 As shown in Figure 2-34, LDE reports are based on deviations from the active route in the FMC. If the active route is different to the route held by the ATSU, and the aircraft remains within the lateral deviation tolerances (as defined by the ADS contract) of the active route, no lateral deviation event report will be triggered.

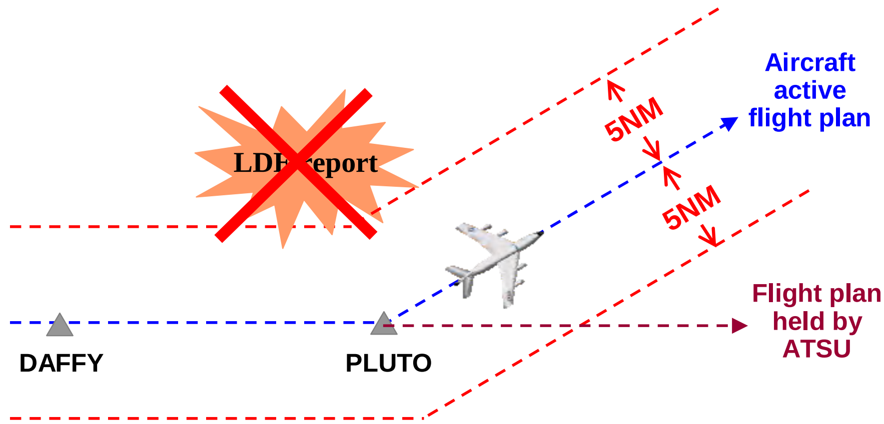


Figure 2-34. No lateral deviation event report if active route is different to route held by ATSU

2.2.5.2.5.6.7 Once an aircraft has downlinked a lateral deviation event report, no further deviations will trigger another report until the ATSU re-establishes an ADS-C event contract containing a lateral deviation event.

2.2.5.2.5.6.8 A lateral deviation event report contains the ADS-C basic group only.

2.2.5.2.5.7 Vertical rate change event (VRE)

2.2.5.2.5.7.1 Vertical rate change event is triggered in one of two ways:

a) Positive vertical rate: aircraft`s rate of climb is greater than the vertical rate threshold; or

b) Negative vertical rate: aircraft`s rate of descent is greater than the vertical rate threshold.

2.2.5.2.5.7.2 A vertical rate change event report contains the following ADS-C groups:

a) ADS-C basic group; and

b) Earth reference group.

2.2.5.2.6 Cancelling ADS contracts

2.2.5.2.6.1 Cancelling ADS contracts assists in:

a) Minimizing costs associated with unnecessary ADS-C reports;

b) Reducing congestion in the communication network

c) Ensuring that subsequent ATSUs can establish ADS contracts with the aircraft (there is a limit to the number of ADS-C connections that an aircraft can support)

2.2.5.2.6.2 The ATSU either automatically or manually cancels an ADS contract when it no longer needs ADS-C reports to avoid situations leading to congestion. The ground system cancels ADS contracts when:

a) The aircraft has crossed the FIR boundary exit position and the transferring ATSU needs no further surveillance information from the flight;

b) The ATSU has cancelled or finished the flight plan for the aircraft; or

c) The controlling authority or an adjacent ATSU needs no further surveillance information from the flight.

2.2.5.2.6.3 The flight crew may terminate ADS-C connections, which cancels ADS contracts, when exiting ADS-C service areas.

2.2.5.3 ADS-C report

2.2.5.3.1 The aircraft system sends specific aircraft data in different groups of an ADS-C report. Each group contains different types of data. An ADS-C event report contains only some of the groups, which are fixed. The ADS-C periodic report can contain any of the ADS-C groups, which the ATSU specifies in the contract request.

2.2.5.3.2 ADS-C groups include:

a) Basic group (Figure 2-35);

b) Flight identification group (Figure 2-36);

c) Earth reference group (Figure 2-37);

d) Air reference group (Figure 2-38);

e) Airframe identification group (Figure 2-39);

f) Meteorological group (Figure 2-40);

g) Predicted route group (Figure 2-41);

h) Fixed projected intent group (Figure 2-42); and

i) Intermediate projected intent group (Figure 2-43).

2.2.5.3.3 At a minimum, all ADS-C reports contain the basic group.

2.2.5.3.4 The contents of the various ADS-C groups are depicted in the following diagrams.

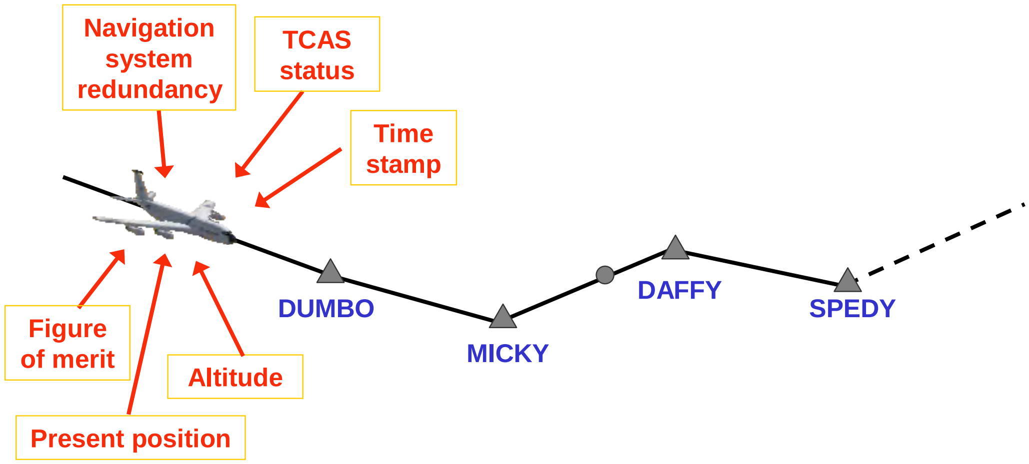


Figure 2-35. ADS-C basic group

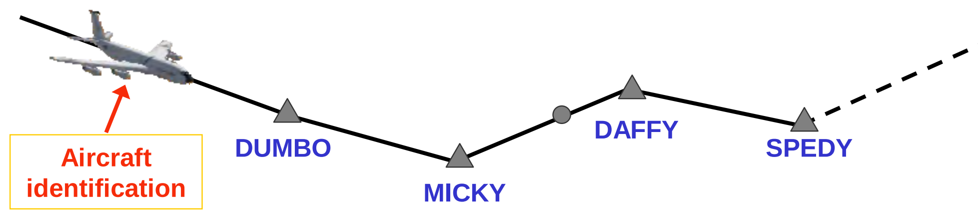


Figure 2-36. ADS-C flight identification group

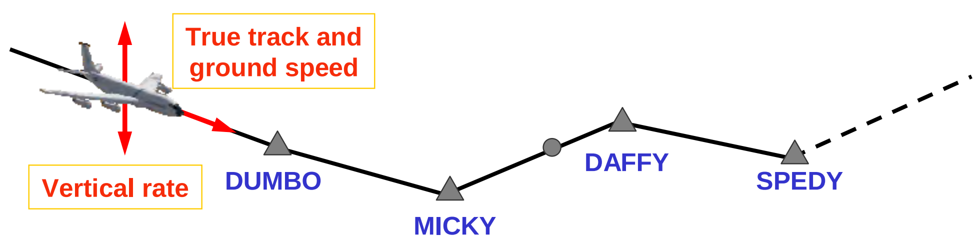


Figure 2-37. ADS-C Earth reference group

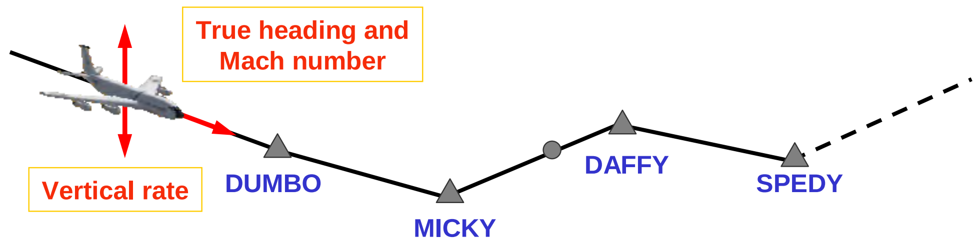


Figure 2-38. ADS-C air reference group

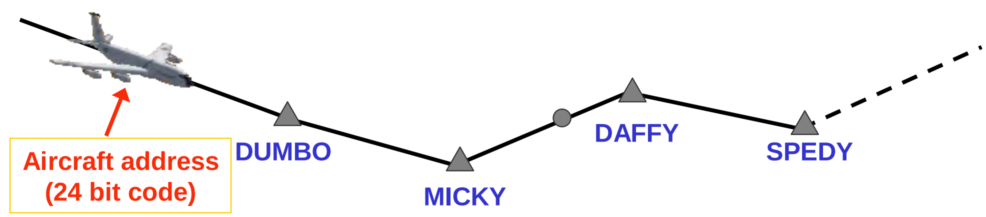


Figure 2-39. ADS-C airframe identification group

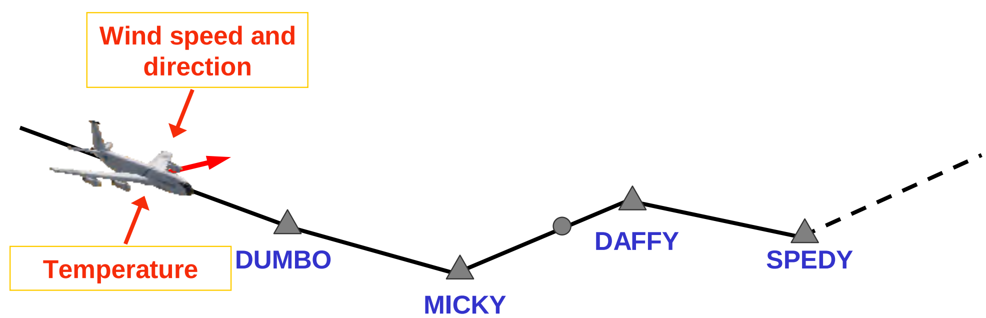


Figure 2-40. ADS-C meteorological group

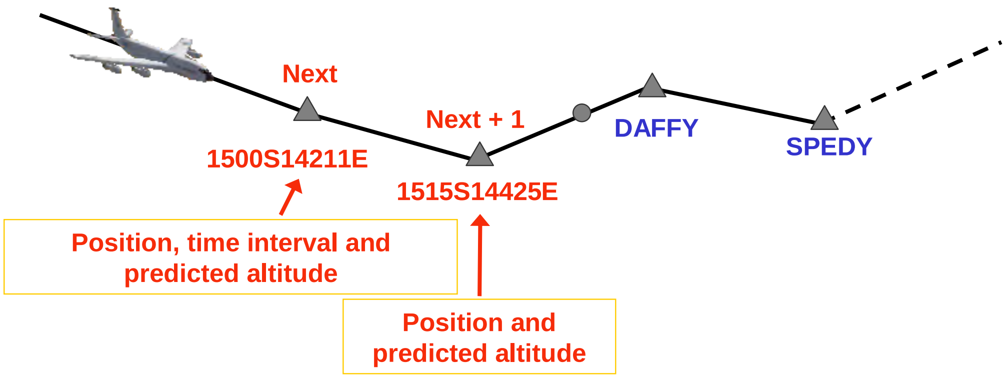


Figure 2-41. ADS-C predicted route group

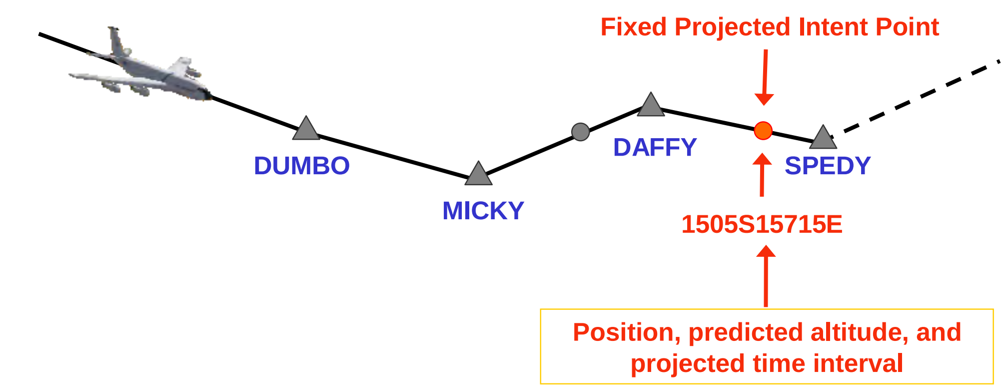


Figure 2-42. ADS-C fixed projected intent group

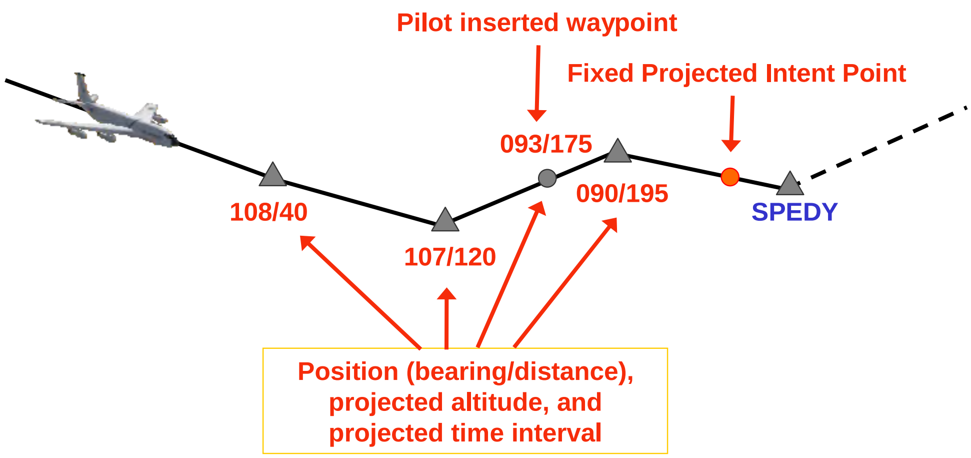


Figure 2-43. ADS-C intermediate projected intent group

Note.— Up to 10 points can be included in the intermediate projected intent group. For a point to qualify to be included in the intermediate projected intent group, the point needs to be:

a) between the current position and the fixed projected point; and

b) associated with a speed, altitude or track change.

2.2.5.4 Contents of ADS-C groups – additional information

2.2.5.4.1 The aircraft system defines the present position (in the basic group), and Next and Next + 1 information (in the predicted route group) as latitude/longitude, and defines positional information in the intermediate projected intent group as a bearing/distance from the present position in the basic group. Positional information in an ADS-C report does not contain the name(s) of waypoints.

Note.— To be eligible for reporting as an intermediate intent point, there needs to be a planned change of aircraft profile associated with the waypoint. A change in profile is defined as a change in speed, altitude, and or a change in direction greater than one degree.

2.2.5.4.2 The time stamp is expressed in seconds past the last hour

2.2.5.4.3 Estimates are expressed as estimated time intervals (in seconds) from the time stamp at the present position in the basic group.

2.2.5.5 Using ADS-C reports

2.2.5.5.1 The ATSU may use an ADS-C report for a variety of purposes. These include:

a) Establishing and monitoring of traditional time-based separation minima;

b) Establishing and monitoring of distance-based separation standards;

c) Flagging waypoints as 'overflown';

d) Updating estimates for downstream waypoints;

e) Updating the display of the ADS-C position symbol, and the associated extrapolation;

f) Generating (and clearing) alerts;

g) Generating (and clearing) ADS-C emergencies; and

h) Updating other information in the flight plan held by the ATSU.

2.2.5.5.2 Predicted route conformance

2.2.5.5.2.1 The ATSU may use information from the basic group, the intermediate intent group and the predicted route group for route conformance monitoring.

2.2.5.5.2.2 The ATSU can compare information from the predicted route group or intermediate projected intent group against the expected route in the flight plan to provide an indication to the controller when a discrepancy exists.

Note.— To prevent nuisance indications, route conformance monitoring may include tolerances, consistent with safety criteria, when comparing the reported data against the expected route (e.g. to accommodate 1 or 2 nm strategic lateral offset procedures).

2.2.5.5.2.3 A ground system supporting ATS or AOC can specify periodic and event contracts differently from other ground systems, such as:

a) Different ADS-C groups as shown in Figure 2-44;

b) Different periodic reporting interval as shown in Figure 2-45; and

c) Different types of event contracts as shown in Figure 2-46.

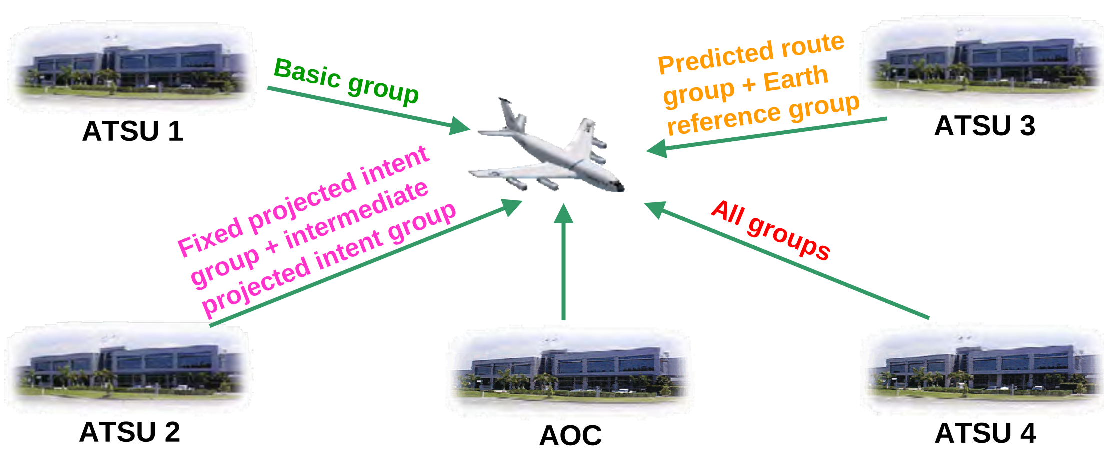


Figure 2-44. Multiple ADS periodic contracts with different groups

Figure 2-45. Multiple ADS periodic contracts with different reporting intervals

Figure 2-46. Multiple and different ADS event contracts

2.2.5.5.3 Figure of merit

2.2.5.5.3.1 The ADS-C basic report contains a figure of merit (FOM) that provides the navigational accuracy of position data in the basic report in accordance with Table 2-12.

Table 2-12. Figure of merit values

Figure of merit value	Accuracy of position	Remarks
0	Complete loss of navigational capabilities	Inability to determine position within 30 nautical miles is considered total loss of navigation. Includes the inability to associate a valid time with the position.
1	< 30 nm	Consistent with inertial navigation on long flight without updates.

Figure of merit value	Accuracy of position	Remarks
2	< 15 nm	Consistent with inertial navigation on intermediate length flight without updates.
3	< 8 nm	Consistent with inertial navigation on short length flight and beyond 50 nautical miles from VOR.
4	< 4 nm	Consistent with VOR accuracies at 50 nautical miles or less and with GPS worldwide.
5	< 1 nm	Consistent with RHO-RHO applications of ground-based DME, RNAV using multiple DME or GPS position updates.
6	< 0.25 nm	Consistent with RNAV using GPS.
7	< 0.05 nm	Consistent with augmented GPS accuracies.

2.2.5.5.4 ADS-C reporting interval

2.2.5.5.4.1 While ADS-C reporting intervals are generally referred to in whole minutes, they are not actually defined that way in the ADS contract. The required ADS-C reporting interval is uplinked to the aircraft in one byte (eight bits) of data, in accordance with Figure 2-47.

<table>
<tr><td colspan="4">Reporting Interval = (1 + Rate) x SF, where</td></tr>
<tr><td>Rate</td><td colspan="3">is the value contained in bits one to six. These six bits allow a range of values between 0 and 63.</td></tr>
<tr><td rowspan="6">SF</td><td colspan="3">is the scaling factor in bits seven and eight where:</td></tr>
<tr><td>Bit 7</td><td>Bit 8</td><td>Definition</td></tr>
<tr><td>0</td><td>0</td><td>0 seconds, used for a Demand Contract Request</td></tr>
<tr><td>1</td><td>0</td><td>1 second</td></tr>
<tr><td>0</td><td>1</td><td>8 seconds</td></tr>
<tr><td>1</td><td>1</td><td>64 seconds</td></tr>
</table>

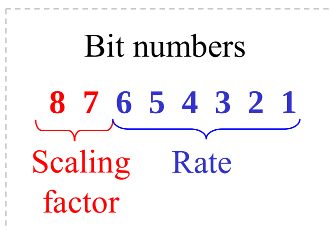


Figure 2-47. Calculation of ADS-C periodic reporting interval

2.2.5.5.4.2 For example, to establish a “40 minute” reporting interval, the SF would equal 64 seconds and the rate would equal 36. The actual reporting interval specified in the ADS contract would be 64 x (1 + 36) = 2368 seconds (39 minutes 28 seconds).

2.3 FMC WPR data link system

2.3.1 FMC WPR - general

2.3.1.1 An aircraft may have ACARS capability, but is not FANS-1/A-equipped. These aircraft can exchange data link messages with the operator’s aeronautical operational control (AOC) facility, but not with an ATSU.

2.3.1.2 The operator configures these aircraft to send ACARS position reports to their aeronautical operational control (AOC) facility for flight monitoring. Additional ground-based functionality can reformat the ACARS position report and forward it to an ATSU via AFTN as a replacement for voice position reports.

2.3.1.3 The method of delivery for the ACARS position report from an aircraft to an ATSU is referred to as flight management computer waypoint position reporting (FMC WPR).

2.3.1.4 FMC WPR provides the operator an alternative to FANS 1/A ADS-C position reporting, in cases where FANS 1/A equipage is impractical or cost prohibitive for the operator. FMC WPR is not intended to replace or delay FANS 1/A equipage.

2.3.2 Description

2.3.2.1 In some airspace, the aircraft sends the FMC waypoint position report to a central FMC waypoint reporting system (CFRS) or to the operator's AOC host computer. The CFRS or operator's AOC host computer converts the position report to a suitable format and delivers it via AFTN to appropriate ATSUs. A CFRS may also convert the report to standard AFTN format and deliver it to appropriate meteorological facilities to support weather forecasting.

2.3.2.2 In other airspace, the operator's AOC host computer converts the FMC waypoint position report to an ARP message and delivers it via AFTN to appropriate ATSUs.

Note.— Because there is no format defined, ARP formats may vary slightly between ATSUs. The CFRS or AOC host computer should support different ARP formats for different ATSUs.

2.3.2.3 Appendix E, paragraph E.1 indicates which of the above two approaches each FIR uses.

2.3.3 Position report - description

2.3.3.1 An AFN logon is not necessary to initiate FMC WPR.

2.3.3.2 An FMC WPR is a position report that:

a) consists entirely of data entered automatically by the FMS;

b) consists of data CRC protected by the FMS;

c) consists of data formatted and populated in accordance with the ARINC 702-1A; and

d) does not contain geographic coordinates in ARINC 424 format (Refer to paragraph 5.6.1.2).

2.3.3.3 An FMC WPR can be initiated automatically or manually as prescribed by flight deck procedures (Refer to paragraphs 3.2, 3.4, and 5.6.4).

2.3.3.4 An operator participating in FMC WPR ensures that:

a) The FMC WPR is generated at each ATC waypoint of a cleared route; and

b) The FMC WPR contains data only for an ATC waypoint.

2.4 ATN B1 data link system

(reserved)

Chapter 3. Administrative provisions related to data link operations

This chapter includes the prerequisites for data link operations, including service provision, operator eligibility, and flight planning.

3.1 ATSP service provision

3.1.1 ATSP system validation

3.1.1.1 The ATSP should ensure a validation process that confirms the integrity of their equipment and procedures meets system integrity requirements. This process should include:

a) A system safety assessment which demonstrates that the service provision meets the safety objectives. The ATSP should conduct a system safety assessment through a functional hazard analysis or a documented system safety case for initial implementation as well as for future enhancements. These assessments should include:

1) Identifying failure conditions;

2) Assigning levels of criticality;

3) Determining probabilities for occurrence; and

4) Identifying mitigating measures;

b) Integration test results confirming interoperability for operational use of the aircraft and ground systems; and

c) Confirmation that the ATS operation manuals are compatible with those of adjacent providers.

3.1.1.2 Following the safety assessment, the ATSP should institute measures through automation or procedures to mitigate the identified failure conditions. For example:

a) If the ATSP uses integrated measurement tools for the purpose of determining separation, they may need to publish limitations on the use of such tools for establishing and monitoring separation standards.

b) If an ATSP receives both an ADS-C and a CPDLC position report containing ETA that differ by 3 minutes or more, the controller should query the estimate received in the CPDLC position report and request confirmation of the estimate for the waypoint in question.

c) To fulfill the requirements of Annex 10, paragraph 8.2.8, the controller should be provided with automation and/or procedures to ensure that the appropriate ATC unit has established an active CPDLC connection with the aircraft. Refer to Appendix E, paragraph E.2.2 for mitigating measures for confirming current data authority.

3.1.1.3 The ATSP should ensure that it provides communication services that meet the performance specifications provided at Appendix B and Appendix C, and that the contracted CSP meets its performance allocations. The risks represented by the requirements are regarded as being minimum for the specified ATS function to maintain operational efficiency while meeting its required safety needs.

3.1.1.4 If the ATSP uses free text messages, it should include an evaluation of the effects associated with the use of free text messages in operational and system safety assessments. When the intent/use of the free text message impacts seamless operations, the ATSP should globally coordinate the free text message to define the operational contents, format, and use as a new standardized free text message. The standardized free text messages are provided in Appendix A, paragraph A.4.

a) The results of an operational assessment may conclude that a free text message needs to be pre-formatted and readily available for the flight crew or the controller because it is too workload intensive to manually enter the message. Pre-formatted free text messages should only be selected from standardized free text messages, which are appropriate for the intended use.

b) When the ATSP establishes procedures that require the controller or flight crew to use a free text message element to mimic ICAO Doc 4444 standard message elements, the ATSP should apply the following criteria:

1) The ground system should apply any range, resolution, and units of measure restrictions prior to use of the message.

2) The ground system and aircraft system should provide a human interface for message composition and recognition of free text messages consistent with operational, safety, and performance requirements associated with use of the free text message.

3) The ATSU should not use free text to mimic an ICAO Doc 4444 message element with a W/U response attribute, unless the free text is combined with a standard message element with a W/U response attribute as part of a multi-element message.

4) The ATSU should provide for operational closure of the dialogue that uses a free text message to mimic a message element with a Y response attribute.

Note.— The ground system will technically close the uplink message when it receives the appropriate response from the aircraft.

3.1.1.5 The ATSP should conduct trials with aircraft to ensure that the system meets the requirements for interoperability such as is defined for FANS 1/A in RTCA DO-258A/EUROCAE ED-100A. Refer to paragraph 2.1 for applicable interoperability standards for the different data link system.

3.1.1.6 The ATSP should develop appropriate procedures or other means to:

a) Respond to CPDLC downlink message elements defined in Appendix A. (See paragraph 3.1.4.2 for publication of unsupported downlink messages.)

b) Ensure that data are correct and accurate, including any changes, and that security of such data is not compromised.

c) Notify adjacent ATSUs of system failures, software upgrades (or downgrades) or other changes, which may impact them. Such notification procedures will normally be detailed in letters of agreement between adjacent units.

d) Ensure that the ATSU only establishes an ADS contract with aircraft for which that ATSU has direct control or monitoring responsibility.

Note.— An ATSU may need to establish ADS contracts with aircraft operating in their area of responsibility for purposes other than direct control or monitoring, e.g. testing of ground system software before operational release.

3.1.1.7 The ATSP should ensure that its controllers receive appropriate training in accordance with ICAO Annex 1 and obtain any necessary approval from the State.

3.1.2 ATC automation

3.1.2.1 AFN logon

3.1.2.1.1 To ensure that CPDLC messages are sent only to aircraft for which the ATSU has a flight plan, the ATSU should reject an AFN logon if:

a) there is no flight plan for the flight;

b) the flight plan does not contain the aircraft registration/address; or

c) the aircraft registration/address in the AFN CONTACT message does not match the aircraft registration/address in the flight plan.

3.1.2.1.2 Hyphens contained in an aircraft registration are not valid characters in the ICAO flight plan and therefore are not present in the filed flight plan. The ground system should be configured to prevent the AFN logon being rejected due to hyphens being included in the aircraft registration sent in the AFN CONTACT message, but not in the flight plan.

3.1.2.2 CPDLC and ADS-C connection management

3.1.2.2.1 To prevent rejection of the CPDLC CR1 from the receiving ATSU, the current data authority should wait for the MAS success for the NDA message or allow sufficient time for the aircraft to receive the NDA message prior to initiating address forwarding to the next ATSU.

3.1.2.2.2 To avoid interruption of data link service, the ATSU should initiate address forwarding at least 15 minutes prior to the estimate for the FIR entry position.

3.1.2.2.3 If the ground system does not receive the AFN COMPLETE message within a specified time, e.g. 15 minutes, from sending the AFN CONTACT ADVISORY message, it should provide an indication to the controller. Refer to paragraph 4.1.3 for associated controller procedures.

3.1.2.2.4 If open uplink or downlink messages exist for the aircraft, the ground system should provide indication to the controller and confirm messages are closed prior to sending the END SERVICE message.

3.1.2.2.5 When a CPDLC connection cannot be established by any ATSU, the ground system should indicate to the controller at that ATSU that no connection has been established.

3.1.2.3 Emergency message element handling

3.1.2.3.1 The ground system should provide a clear indication to the controller of downlinked messages that contain any of the message elements from the emergency message elements (see Appendix A, paragraph A.3, for the list of emergency message elements.)

3.1.2.3.2 When the ground system receives an emergency-mode ADS-C report, it should present it to the controller. If a periodic contract is active, the emergency report will be transmitted at the existing periodic interval. Otherwise, the interval will default to a value determined by the aircraft system (see Appendix F, paragraph F.10). Only the flight crew can cancel the emergency mode (see paragraph 4.7.3 for associated controller procedures).

3.1.2.4 Automated responses

3.1.2.4.1 With the exception of UM 1 STANDBY or UM 2 REQUEST DEFERRED, the ground system should assign an MRN to only one uplink message in response to a particular downlink message. If the ground system sends two separate messages with the same MRN, and neither of the messages is UM 1 or UM 2, the aircraft system will discard the second message and not display it to the flight crew.

3.1.2.4.2 The ground system should only assign a MRN to an uplink message that is responding to a downlink message with the associated MIN and the downlink message requires a response. If the ATSU sends an uplink message with a MRN and the downlink message with the associated MIN did not require a response, the aircraft system will discard the uplink message and not display it to the flight crew.

Note.— If an uplink message is discarded for the reasons described in paragraph 3.1.2.4.1 or paragraph 3.1.2.4.2, the aircraft system will send an error message to the ground system indicating that the MRN was not recognized.

3.1.2.4.3 If the ATSU receives a downlink message that they do not support, then it should send free text uplink message UM 169u MESSAGE NOT SUPPORTED BY THIS ATS UNIT rather than terminating the connection. The ATSU should not use UM 162 as the aircraft system may display SERVICE UNAVAILABLE to the flight crew, which is confusing to the flight crew.

3.1.2.4.4 ATSUs may automate the sending of the UM 161 END SERVICE message, based upon the estimated time aircraft are expected to cross CTA/FIR boundaries. Refer to paragraph 2.2.3 and paragraph 4.1 for the proper sequence and timing for sending the UM 161 END SERVICE message and associated controller procedures. Refer to paragraph 3.1.4.8 for guidance on detailing the parameters for this operation in interfacility agreements.

3.1.2.4.5 An ATSU may implement automation to support use of a message latency timer, per paragraph 4.2.7. The extent to which automation supports controller procedures that use the message latency timer is a local matter.

3.1.2.5 Abnormal cases with ADS-C

3.1.2.5.1 When more than one ADS-C report for the same waypoint (or position) are received, the ground system should update the flight data with the first report and provide an indication to the controller if there are significant discrepancies in subsequent reports.

3.1.2.5.2 When the time stamp in the basic group is determined to be invalid for the position in an ADS-C report, the ground system should not use it to update any flight data.

Note 1.— When the time stamp is invalid, the figure of merit (FOM) will be set to 0 and any value could be expected in the basic group.

Note 2.— The time stamp in the a FANS 1/A ADS-C report is provided only in minutes/seconds. Therefore, when an ADS-C report is received with a minutes/seconds greater than the current ground system minutes/second, the time stamp in the report may be related to the previous hour (possibly day/month/year). The ground system may need to determine the full time stamp, i.e., including *hours/day/month/year, for the ADS-C report when determining the validity of the time stamp with the associated position in the ADS-C report.*

3.1.2.5.3 If the aircraft is in heading select mode and the aircraft passes abeam an ATC waypoint by more than a defined distance, the FMS will not sequence this or subsequent waypoints. Consequently, the aircraft will not send an ADS-C waypoint change event report. However, if the aircraft sends an ADS-C periodic report with a predicted route group, the NEXT waypoint data in the report will continue to indicate the waypoint that was passed. As a result, the ground system could use invalid data for display of the aircraft position or extrapolating the correct route for the aircraft. Refer to paragraph 5.6.1.1 for flight crew procedures.

Note.— When the aircraft is in heading select mode, the intent and predicted route information transmitted by the aircraft will contain the next waypoint in the aircraft active flight plan regardless of the actual position and heading of the aircraft. Predicted information is based on the FMS intent, which may not necessarily reflect the intentions of the flight crew.

3.1.2.6 Satcom channel numbers in CPDLC messages. The CPDLC standard provides a [Frequencysatchannel] variable that is intended for ATSUs to send satellite voice telephone numbers in MONITOR and CONTACT messages (UM 117 to UM 122). However, the decoding of this variable varies by aircraft type. Therefore, the ATSU should not use this variable in these messages unless the ground system can determine the appropriate decoding in use by the receiving aircraft and encode the uplink accordingly.

3.1.3 Contractual considerations for CSP

3.1.3.1 The CSP should meet the performance criteria for communication services, in accordance with Appendix B and Appendix C.

3.1.3.2 For those situations when a CSP cannot continue to provide data communications, it should inform ATSPs and operators in accordance with established coordination procedures.

Note.— A CSP that holds a contract with an operator per paragraph 3.2.1.8 but not with the ATSP should notify the ATSP when such situations occur and that operator is conducting data link operations in the ATSP's airspace.

3.1.3.3 In the event of a centralized ADS-C (CADS) failure, the CSP for the CADS service should inform ATS.

3.1.3.4 In the event of a CFRS failure, the CSP for the CFRS service should inform ATS.

3.1.4 Aeronautical information, notifications, and interfacility agreements

3.1.4.1 The ATSP should notify operators of data link services using the AIP or NOTAM. Notification includes:

a) The ICAO 4-letter location indicator assigned to the FIR served by the ATSU;

b) Logon address, The logon address should preferably match the 4-letter location indicator. The ATSP should ensure that the logon address for that FIR is provided on the appropriate aeronautical charts (ICAO Annex 4);

c) Applications, including for each application; application name, version interoperability coverage, scheduled service, shutdowns, and information/alert bulletins;

d) Differences between national regulations and practices, and related ICAO SARPs and procedures;

e) Requirements for use, for example:

1) Procedures for initiation - When an ATSU is unable to accept an AFN logon sent between 15 and 25 minutes prior to either the ETD or the estimate for entering the FIR, the ATSP should publish in appropriate AIP or NOTAM the criteria for when an AFN logon will be accepted. Refer to paragraph 2.2.2.2;

2) ADS-C and CPDLC position reporting requirements;

Note.— The AIP may specify that ADS-C reports may fulfill all normal position reporting requirements. Refer to paragraph 5.6.3 for position reporting guidelines in an ADS-C environment.

3) Supporting reduced separations, reroutes, tailored arrival and associated RCP type(s); and

4) Any required functionality, such as the message latency timer provided by FANS 1/A+ aircraft (Refer to paragraph 4.2.7).

f) Flight plan form and submission requirements.

3.1.4.2 The ATSP should support all downlink message elements as defined in Appendix A, unless the ATSP publishes the differences in the appropriate regional/State supplement along with procedures for handling unsupported message elements.

Note 1.— Emergency messages, as a minimum, are displayed to the controller per paragraph 3.1.2.3.

Note 2.— When a reduced CPDLC message set is used across a group of adjoining ATSUs, the ATSP(s) need to ensure that the reduced message set is common and adequate for the applicable airspace.

3.1.4.3 An ATSP may suspend ADS-C, FMC WPR and/or CPDLC use (including trials) for the control area under its jurisdiction. Notification to affected ATSUs should be carried out in accordance with coordination requirements specified in applicable interfacility agreements.

3.1.4.4 The ATSP should issue a timely NOTAM for scheduled and/or extended outages of the ADS-C or FMC WPR service and advise the operators to conduct position reporting via CPDLC or voice communications.

3.1.4.5 When an ATSP suspends CPDLC operations or when a planned system shutdown of the communications network or the ATS system occurs, the ATSP should publish a NOTAM to inform all affected parties of the shutdown period and advise operators to use voice communications during that time. The ATSP should ensure procedures are established for the ATSU to notify flight crews by voice of any imminent loss of CPDLC service.

3.1.4.6 In the event of an unexpected outage of ADS-C service, the ATSP should establish interfacility agreements with other ATSUs concerned and issue a NOTAM if required to inform affected parties.

3.1.4.7 In the event of an unexpected outage of CPDLC service, or if an ATSU suspends CPDLC operations without prior notice, the ATSP should:

a) inform aircraft currently in communication with the ATSU of the loss of CPDLC service;

b) inform other ATSUs concerned;

c) specifically advise whether the outage also affects ADS-C service; and

d) issue a NOTAM, if required.

3.1.4.8 When one or more ATSPs provide CPDLC service with adjoining ATSUs, the ATSP(s) should establish interfacility agreements to allow the uninterrupted transfer of the CPDLC connection. The interfacility agreements should include:

a) The time at which address forwarding occurs taking into consideration any automation requirements:

b) The time at which UM 161 END SERVICE message is sent (see paragraph 3.1.2.4.4 regarding related ATC automation and paragraph 4.1 for associated ATC procedures) taking into consideration:

1) sufficient time to allow the NDA (if established) to establish an active CPDLC connection prior to the aircraft crossing the common boundary;

2) sufficient time to prevent an inappropriate active CPDLC connection from continuing with an aircraft while it is transiting airspace where CPDLC is not available.

3.1.4.9 When an ATSU will only have control of a FANS 1/A aircraft for a relatively short duration, the ATSP may establish procedures in appropriate interfacility agreements to coordinate the transfer of communications for the aircraft among the controlling and the affected ATSUs. Refer to paragraph 4.1.7.

3.1.4.10 The ATSP should establish interfacility agreements, as appropriate, to ensure that adjacent FIRs can establish ADS contracts to monitor aircraft in the vicinity of the common boundary.

3.1.4.11 When CPDLC is used to assign frequencies, the ATSP should establish the frequencies to be used by interfacility agreements.

3.1.4.12 If the message latency timer described in paragraph 4.2.7 is used, the ATSP should establish interfacility agreements, as necessary, to ensure that its use or non-use is consistent with data link operations in airspace controlled by any of the adjacent ATSUs.

3.1.5 Monitoring and data recording

3.1.5.1 The FANS 1/A CNS/ATM environment is an integrated system including physical systems (hardware, software, and communication network), human elements (the flight crew and the controller), and the related procedures.

3.1.5.2 Because of the integrated nature of the system and the degree of interaction among its components, the ATSP should establish end-to-end system monitoring in accordance with the guidelines provided in Appendix D. The guidelines aim to ensure end-to-end system integrity through post-implementation monitoring, identifying, reporting and tracking of problems, and corrective action.

Note.— The guidelines presented herein do not replace the ATS incident reporting standards and guidelines, as specified in ICAO Doc 4444, Appendix 4; ICAO Air Traffic Services Planning Manual (Doc 9426), Chapter 3; or applicable State regulations, affecting the parties directly involved in a potential ATS incident.

3.1.5.3 The ATSP and its CSP(s) should retain records for at least 30 days to allow for accident/incident investigation purposes. The ATSP and CSPs should make these records available for air safety investigative purposes on demand. These recordings should allow replaying of the situation and identifying the messages that the ATSU sent or received.

3.2 Operator eligibility

3.2.1 Operational authorization to use data link

3.2.1.1 An operator intending to use CPDLC or ADS-C service should obtain an operational authorization with the State of registry or State of the operator, if required, in accordance with their rules and means of compliance. This operational authorization should address flight crew training and qualification, maintenance, MEL, user modifiable software, service agreements with the CSP, and procedures for submitting problem reports and data to the regional/State monitoring agencies. The operator should also ensure that aircraft equipment has been approved for the intended use per interoperability standards and performance specifications, e.g. RCP 240 or RCP 400 operations, described in paragraph 2.1 and in accordance with airworthiness requirements and related means of compliance.

3.2.1.2 The operator is not required to obtain an operational authorization to use FMC WPR. However, the operator should ensure that the aircraft equipment has been approved by the State of Registry or State of the Operator for FMC WPR (e.g. meets appropriate software assurance criteria). See paragraph 3.4 for additional guidance on operational use of FMC WPR.

3.2.1.3 The operator should establish policy and procedures for flight crews and operational staff involved in data link operations, and incorporate them in appropriate operations manuals. The operations manuals should include:

a) Procedures for the data link operations taking into account the guidance provided in Chapter 5 and Chapter 6, as necessary.

b) Minimum equipment lists (MEL) modifications (if required); and

c) Flight crew and operational staff procedures, including procedures for establishing and maintaining voice communications (including any required SELCAL check(s)) with every CTA/FIR along the route of flight.

3.2.1.4 The operator should ensure the flight crews and operational staff, e.g. dispatcher receives appropriate training in accordance with Annex 1 and Annex 6 to the Convention on International Civil Aviation.

3.2.1.5 If applicable, the operator should ensure the operational staff is trained in data link operations. This training should include:

a) Description of the data link network including ACARS, AFTN and SATCOM;

b) Flight planning requirements for data link flights;

c) Implications of flights departing under minimum equipment list (MEL) relief; and

d) Implications of planned and unplanned network outages on data link operations.

3.2.1.6 From time to time aircraft manufacturers release new software which will often rectify in service issues and may add increased functionally. The operator should update their software as new releases become available to ensure best possible performance.

3.2.1.7 The operator should initially coordinate with its CSP(s) to initiate ground system configuration for its aircraft. In operations involving CFRS, to ensure FMC WPR downlinks are properly routed to the appropriate CFRS system(s), the operator should coordinate with their CSP(s) to configure for routing their FMC WPRs to the appropriate CFRS system(s).

3.2.1.8 The operator should ensure that their CSP(s) meets the performance criteria for communication services, in accordance with Appendix B and Appendix C, and notifies them and appropriate ATSPs when data communication services as prescribed for the intended operations cannot be provided..

3.2.1.9 The operator should ensure that flight operations, the flight crews and the appropriate ATSPs are notified of failures with the aircraft equipment or the operator's AOC system related to data link operations (such as when used to provide FMC WPR service to ATSPs).

3.2.1.10 The operator should provide flight operations and the flight crew with procedures, as appropriate, when the following occurs:

a) The operator is notified of data link system failures per paragraph 3.2.1.8, or

b) The AOC system or aircraft equipment fails such that the aircraft capability can no longer meet the performance specifications (Appendix B and Appendix C) prescribed for the intended operation..

3.2.1.11 The operator may be required to make special arrangements with an ATSU for the purposes of undertaking trials using ATC data link equipment.

3.2.2 Regional/State monitoring agencies

Note.— Guidelines on problem reporting and corrective action can be found at Appendix D. Contact information for the appropriate regional/State monitoring agency can be found at Appendix E.

3.2.2.1 The operator should indicate their intention to participate in data link operations by contacting the appropriate regional/State monitoring agency and providing the following information thirty days in advance:

a) operator name;

b) operator contact person; and

c) the appropriate 8-letter aeronautical fixed telecommunication network (AFTN) address(es) if the operator requires receipt of converted ADS-C waypoint change event reports or FMC waypoint position reports.

3.2.2.2 If any of the information provided in paragraph 3.2.2.1 changes,, the operator should advise the appropriate regional/State monitoring agency.

3.2.2.3 The operator should establish procedures to report to the appropriate regional/State monitoring agency any problems its flight crews and dispatchers have with data link operations.

Note.— Filing a report with regional/State monitoring agencies does not replace the ATS incident reporting procedures and requirements, as specified in ICAO Doc 4444, Appendix 1; ICAO Doc 9426, Chapter 3; or applicable State regulations affecting parties involved in a potential ATS incident.

3.3 Flight planning

3.3.1 General

3.3.1.1 When participating in data link operations, the operator should file to use these services only if the flight crew is qualified and the aircraft is properly equipped for the data link operation.

3.3.1.2 The operator should ensure that the proper information is included in the ICAO flight plan.

3.3.2 CPDLC and ADS-C

3.3.2.1 ATS systems use Field 10 (Equipment) of the ICAO flight plan to identify an aircraft's data link capabilities. The operator should insert the following items into the ICAO flight plan for FANS 1/A aircraft:

a) Field 10a (Radio communication, navigation and approach equipment); insert the letter "J" to indicate data link equipment.

b) Field 10b (Surveillance equipment); insert the letter "D" to indicate ADS-C capability.

c) Field 18 (Other Information); insert the characters "DAT/" followed by one or more letters as appropriate to indicate the type of data link equipment carried, when the letter "J" is inserted in field 10. (see table below)

Table 3-1 Indicating data link equipment in Field 18

Letter following DAT/	Type of data link equipment
S	Satellite data link
H	HF data link
V	VHF data link
M	SSR Mode S data link

3.3.2.2 The operator should ensure that the correct aircraft registration is filed in Field 18 prefixed by REG/ of the ICAO flight plan. The ATSU compares the aircraft registration of the aircraft contained in Field 18 (Other Information) of the ICAO flight plan with the aircraft registration contained in the AFN logon.

Note.— The hyphen is not a valid character to include in a flight plan. Any hyphen that may be contained in the aircraft registration needs to be omitted when including the aircraft registration in the flight plan.

3.3.3 FMC WPR

3.3.3.1 There are no additional flight planning requirements specific to participation in FMC WPR.

Note.— The aircraft identification (ACID) provided in the FMC WPR is correlated with the ID provided in the filed flight plan and will be rejected if they do not match.

3.4 FMC WPR – additional guidance

3.4.1.1 In addition to the guidelines provided in paragraph 3.2, an operator who intends to participate in FMC WPR data link operations should advise participating ATSPs of the following information at least thirty days in advance:

a) whether the FMC WPRs will be manually triggered by the flight crew or be fully automated;

b) that the necessary coordination has taken place with the CSP, in operations involving a CFRS; and

c) the aircraft type(s) and associated aircraft registration(s) of aircraft, in operations involving a CFRS, since CFRS reports can only be received from aircraft whose aircraft registration is known to the system.

3.4.1.2 The participating operator should demonstrate to the appropriate planning and implementation regional group (PIRG) that they meet the surveillance performance specifications (see Appendix C) for the provision of FMC WPRs for ATS purposes. Once this has been demonstrated, the operator will be able to participate in FMC WPR operations. Utilizing FMC WPR will be at the discretion of the operator.

3.4.1.3 An operator participating in FMC WPR should ensure that:

a) the FMC WPR is generated at each ATC waypoint of a cleared route in airspace where FMC WPR is available;

b) any waypoint uplinked to the FMS for the purposes of generating automatically initiated FMC WPRs is an ATC waypoint; and

c) the FMC WPR contains the data elements that are required for ATC, per ICAO Doc 4444.

3.4.1.4 The operator should use numeric characters in the flight identification portion (e.g. ABC123) of the aircraft identification. When use of alphabetic characters (e.g. ABC123A) in the flight identification is unavoidable, the operator should ensure the flight crew provides position reports by voice.

Note.— If the flight identification portion of the aircraft identification contains an alphabetic character (for example ABC124A or ABC324W, where 124A or 324W is the flight identification), the ground system cannot translate the IATA FI field into the ATC ACID and thus prevent the flight from participating in FMC WPR.

3.4.1.5 Early versions of Airbus software are prone to large errors in position data. Operators should ensure they have updated software before using FMC WPR.

Chapter 4. Controller and radio operator procedures

This chapter provides guidance on procedures and recommended practices for the controller and the radio operator in airspace where data link services are available.

This information is intended to assist in the development of:

a) Local procedures and associated documentation; and

b) Appropriate training programs.

Controllers should be knowledgeable in the ATC automation. Refer to paragraph 3.1.2 for guidelines for implementation of ground systems supporting data link operations.

Controllers should be knowledgeable in data link operations. Refer to Chapter 2. for an overview of data link operations.

Radio operator procedures specific to data link operations can be found in paragraphs 4.7.4 and 4.7.5.

4.1 CPDLC and ADS-C connection management and voice communication transfers

4.1.1 General

4.1.1.1 ATSUs should manage CPDLC connections, including terminating the connection when no longer needed, to ensure that the ATSU with control for the flight holds the active CPDLC connection.

4.1.1.2 An ATSU may have an active connection with an aircraft not in that ATSU's airspace:

a) When an aircraft is transiting a CPDLC serviceable FIR subject to coordination between ATSUs;

b) During the CPDLC connection transfer process;

c) Where the active connection is retained by the transferring ATSU subject to prior coordination;

d) When the aircraft is within a non-serviceable or non-CPDLC FIR and the flight crew initiates a logon to the controlling ATSU for the next FIR; or

e) In emergency circumstances.

4.1.1.3 Regardless of its connection status, an ATSU should never issue a clearance or instruction to an aircraft outside its control area unless it has been requested to do so by the ATSU in whose airspace the aircraft is operating.

4.1.2 Establish CPDLC connection

4.1.2.1 The next ATSU should establish an inactive CPDLC connection prior to the current data authority terminating the active CPDLC connection. See paragraph 2.2.3 for a description of CPDLC connection management.

4.1.3 Transferring the CPDLC connection – abnormal conditions

4.1.3.1 When the NDA delivery has not been successful, the controller should send a second NDA message. If this is also unsuccessful, the controller should then instruct the flight crew to manually terminate the CPDLC connection and then initiate an AFN logon with the subsequent ATSU. An UM 161 END SERVICE message is not needed in this case.

4.1.3.2 The controller should use the following messages via CPDLC. When using voice, use the equivalent voice phraseology:

Controller	UM 117 CONTACT [unit name] [frequency]
	UM 169am SELECT ATC COMM OFF THEN LOGON TO [facility designation]
Flight crew	DM 0 WILCO

Note 1. — The [facility designation] is the relevant four character ICAO code.

Note 2.— Instructing the flight crew to select ATC COMM OFF will result in loss of CPDLC connectivity. This procedure should only be applied approaching the FIR boundary with the next ATSU.

4.1.3.3 If the controller at the ATSU initiating the transfer receives indication that the AFN logon to the NDA is not successful, the controlling ATSU should reinitiate address forwarding with the next ATSU. The controlling ATSU should not re-send the NDA message (see paragraph 3.1.2.2 regarding related ATC automation and paragraph 2.2.3.12 for a description of non-standard events with CPDLC transfers). The controlling ATSU should:

a) Coordinate with the next ATSU, establishing clearly when or where the address forwarding will have to occur.

b) Time the AFN contact advisory to allow the next ATSU to establish an active CPDLC connection prior to the aircraft's crossing the common boundary.

4.1.3.4 If an ATSU requires confirmation that they are active center (Refer Appendix E, paragraph E.2.2) then the ATSP should develop procedures to ensure that this confirmation can be obtained if no CDPLC downlink is received from the aircraft as it crosses the common boundary. This confirmation may take the form of :

a) Receipt of a DM 3 ROGER in response to a UM 169 [free text] uplink message;

b) Receipt of a DM 48 position report in response to a UM 147 REQUEST POSITION REPORT message; or

c) Non-receipt of DM 63 NOT CURRENT DATA AUTHORITY in response to a UM 160 NDA message.

4.1.4 Termination of the CPDLC connection

4.1.4.1 The controlling ATSU should ensure that no uplink messages remain open before sending the UM 161 END SERVICE message.

4.1.4.2 If there is an indication of open uplink CPDLC messages, the controlling ATSU should:

a) uplink the free text message UM 169j CHECK AND RESPOND TO OPEN CPDLC MESSAGES; or

b) coordinate with the receiving ATSU with reference to CPDLC messages that were still open after sending the UM 161 END SERVICE message.

4.1.4.3 The controlling ATSU should respond to open CPDLC downlink messages prior to sending the UM 161 END SERVICE message.

4.1.4.4 Normally, the controlling ATSU should send the UM 161 END SERVICE message after the last position report and prior to crossing the FIR boundary. If for operational reasons the current ATSU intends to delay the CPDLC transfer until after the aircraft has passed the FIR transfer point, the controller should notify the flight crew of the intended delay with the free text message UM 169l EXPECT CPDLC TRANSFER AT [time]

Note. — The controlling ATSU needs to consider sending the UM 161 END SERVICE message in sufficient time, e.g. not less than 5 minutes prior to crossing the FIR boundary or as agreed, for the next ATSU to establish an active CPDLC connection with the aircraft.

4.1.4.5 For aircraft entering airspace where radar and air-ground VHF are available, and the aircraft will not cross the FIR boundary or enter airspace under the control of another ATSU, the current data authority does not need to send an UM 161 END SERVICE message to terminate the active CPDLC connection. In this case, the CPDLC connection may remain active until the flight is terminated. If a subsequent control sector within an ATSU does not have CPDLC capability, and local instructions do not exist to the contrary, the controller with the active CPDLC connection should not issue any clearance to the aircraft while it is under the control of another sector.

4.1.4.6 If the controller receives indication that the UM 161 END SERVICE message was unsuccessful, the controller initially should send another UM 161 END SERVICE message. If this is also unsuccessful, the controller should instruct the flight crew to terminate the CPDLC connection and logon to the next unit. The controller should use the following CPDLC free text or voice equivalent phraseology:

Controller	UM 169am SELECT ATC COMM OFF THEN LOGON TO [facility designation]
Flight crew	DM 3 ROGER

Note.— The [facility designation] is the four character ICAO code.

4.1.5 Transfer voice communications with CPDLC connection transfer

4.1.5.1 When using CPDLC to effect voice communications transfers, the current data authority should complete the voice frequency change process with the CPDLC connection transfer using the CONTACT/MONITOR message elements (UM 117 through UM 122), as shown in Figure 4-1 by:

a) Sending the MONITOR (or CONTACT) [unit name] [frequency] and then, in a separate CPDLC message, sending the UM 161 END SERVICE as soon as possible after the receipt of the DM 0 WILCO response to the MONITOR (or CONTACT) instruction; or

b) Sending the AT [position/time] MONITOR (or CONTACT) [unit name] [frequency] and then, in a separate CPDLC message, sending the UM 161 END SERVICE after the receipt of the DM 0

WILCO response to the MONITOR (or CONTACT) instruction and the aircraft is approaching the FIR boundary.

4.1.5.2 When using the CONTACT/MONITOR message elements, the current data authority should use the facility name for the [unit name] parameter.

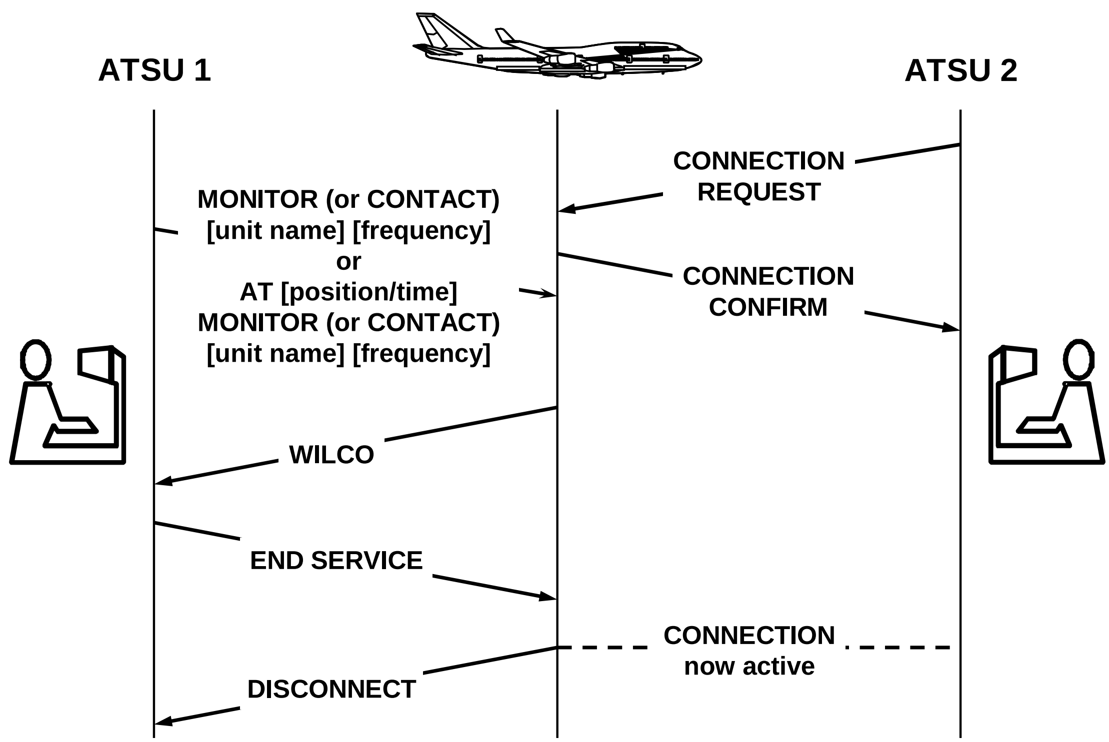


Figure 4-1. CPDLC connection transfer - separate messages

4.1.5.3 Unless otherwise agreed for individual flights per paragraph 4.1.4.4, the controlling ATSU should send the MONITOR (or CONTACT) [unit name] [frequency] prior to the UM 161 END SERVICE message element.

4.1.5.4 Since the CONTACT/MONITOR message elements listed in Table 4-1 include only one [frequency] parameter, the controller should only use these message elements when instructing the flight crew to change the primary frequency. In areas of poor radio coverage, the controller may append the free text message UM 169o SECONDARY FREQUENCY [frequency] to specify a secondary frequency.

Table 4-1. CONTACT/MONITOR message elements

UM Ref	Message element
UM 117	CONTACT [unit name][frequency]
UM 118	AT [position] CONTACT [unit name][frequency]
UM 119	AT [time] CONTACT [unit name][frequency]
UM 120	MONITOR [unit name][frequency]
UM 121	AT [position] MONITOR [unit name][frequency]
UM 122	AT [time] MONITOR [unit name][frequency]

4.1.5.5 In the FANS-1/A message set, the option of RADIO per ICAO Annex 10, Volume II, paragraph 5.2.1.7.1.2 is not a possible value for the [unit name] parameter used in CONTACT and MONITOR messages (UM 117 to UM 122). In the absence of this option, some ATSPs use CENTER to apply to an aeronautical station (RADIO). Other ATSPs use free text UM 169 to mimic the MONITOR/CONTACT instructions and indicate the facility name followed by RADIO.

4.1.6 ADS-C connection management

4.1.6.1 The ATSU should terminate ADS contracts when they are no longer needed.

4.1.6.2 When the ATS ground system receives an AFN logon message, the ATSU may initiate an ADS- C connection by establishing an ADS contract(s) with the aircraft.

4.1.6.3 The FANS 1/A system does not assign any technical priority to ADS-C connections; therefore the controlling ATSU may not be aware of other connections established with the aircraft. As a result, a procedural hierarchy controlled by the address forwarding (FN_CAD message) has been established.

4.1.6.4 Using the address forwarding process, the current controlling ATSU should allocate priority for an ADS-C connection to the next ATSU that will have air traffic control responsibility for the aircraft. The allocation of priority for ADS-C connections should be in the following order:

a) The current ATSU or current data authority;

b) The next ATSU or next data authority;

c) An ATSU requiring a connection for monitoring operations close to a boundary;

d) An AOC facility; and

e) Other miscellaneous connections.

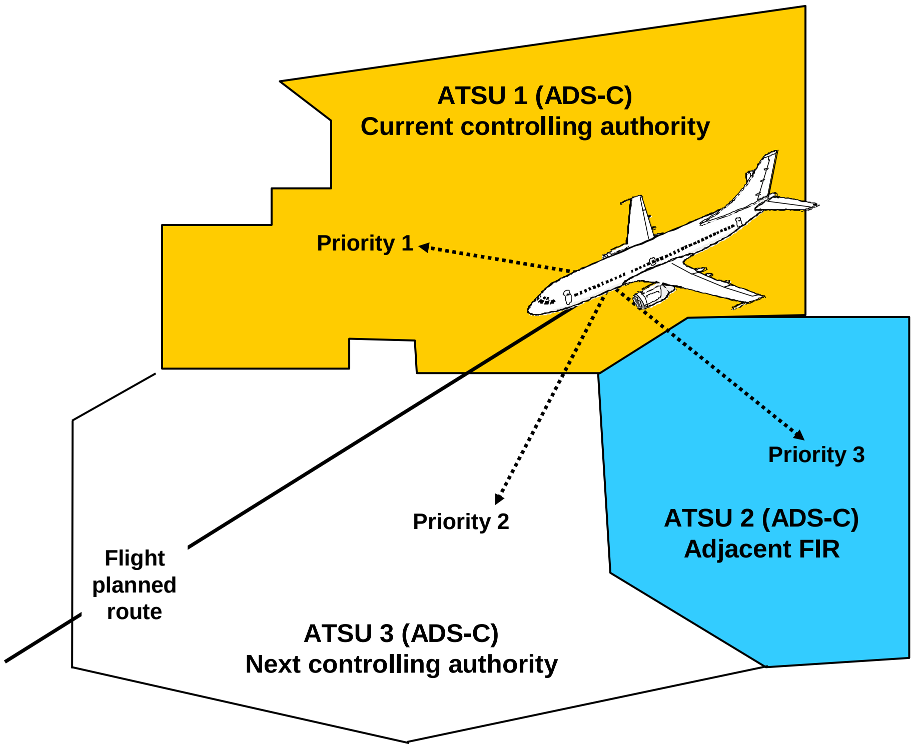


Figure 4-2. Priorities for ADS-C connections

4.1.6.5 For example, as shown in Figure 4-2, an ADS-C contract is required by ATSU 2 to monitor the aircraft's progress near the FIR boundary. To ensure that the next unit with direct control responsibility for the aircraft (ATSU 3) has priority over the ADS-C connections, ATSU 1 should initiate address forwarding to ATSU 3 prior to address forwarding to ATSU 2.

4.1.6.6 When all available ADS-C connections with a particular aircraft have been established, such as shown in Figure 4-3, any other ATSUs attempting to connect with the aircraft will receive a DISCONNECT REQUEST (DIS) message with "reason code 1" (congestion).

4.1.6.7 When DIS message is received by an ATSU that would normally have priority for an ADS-C connection, the ATSU should notify the current controlling ATSU. The controlling ATSU should resolve the situation.

4.1.6.8 The controlling ATSU has a number of options available, such as coordination with the previous ATSU or other adjacent ATSUs to determine if the existing ADS-C connections are still required or, when considered absolutely necessary, instructing the flight crew to terminate ADS-C connections per Appendix F, paragraph F.12. The latter option may terminate all current ADS contracts; therefore, the controlling authority should consider the operational effect on other ATSUs prior to employing this method.

4.1.6.9 Once all contracts have been terminated, the controlling authority should allocate priority for the connections to other ATSUs via the address forwarding process. Only ATSUs with direct control or monitoring responsibilities should re-establish contracts with the aircraft.

4.1.6.10 For example, as shown in Figure 4-3, the aircraft has allocated priority for ADS-C connections with four ATSUs and one AOC facility:

Connection:	1 - with ATSU 1 2 - with ATSU 2 3 - with the previous controlling ATSU 4 - with the AOC facility 5 - with a ground facility collecting test data

ATSU 3, the next controlling authority, is unable to establish an ADS-C connection with the aircraft due to congestion.

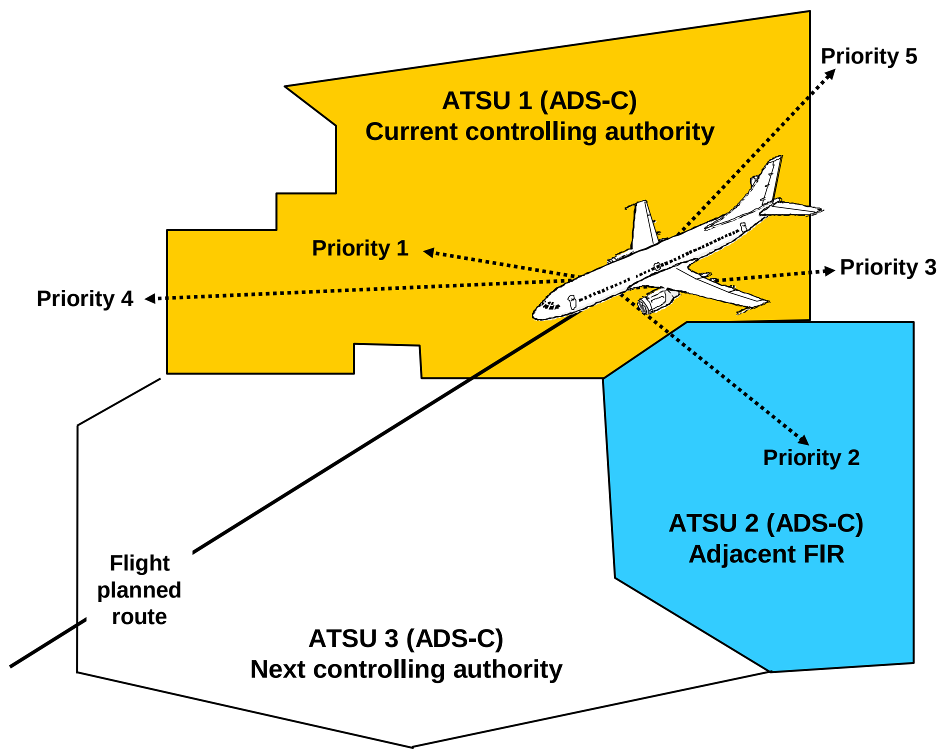


Figure 4-3. ADS-C connection not available due to congestion

4.1.7 Aircraft transiting small data link area

4.1.7.1 Connection transfer failures can be caused by controllers or systems not completing the connection transfer during a short transit time across a portion of the FIR.

4.1.7.2 If any automated transfer process will be affected by the short transit period across its FIR, then the controller should ensure that all messages are sent in the proper sequence at the correct time to successfully transfer the connections to the next ATSU (e.g. NDA, address forwarding, MONITOR/CONTACT, and UM 161 END SERVICE messages), and manually intervene, if necessary.

Note.— The receiving ATSU will need to be the current data authority (CDA) before any of these messages can be sent successfully. For example, if the receiving ATSU tries to send the NDA message prior to becoming the CDA to account for a short transit time, the aircraft system will reject the NDA. This underscores the importance of the upstream ATSU ensuring that the end service message is transmitted in time to permit the transfer to be completed before the aircraft crosses the FIR boundary. See paragraph 4.1.4.4.

4.1.7.3 When an ATSU accepts the transfer of a CPDLC connection for a short transit across its FIR, the receiving controller should ensure that any automated transfer process to the subsequent ATSU will not be impacted by the relatively short transit period across the FIR.

4.1.7.4 If the ATSU concerned requires ADS contracts to monitor the transit of the aircraft across a portion of the FIR, but the transfer of communications is not required, the controlling ATSU should send the NDA message specifying ATSU 3 as the NDA and then perform address forwarding in the order of priority described in Figure 4-4.

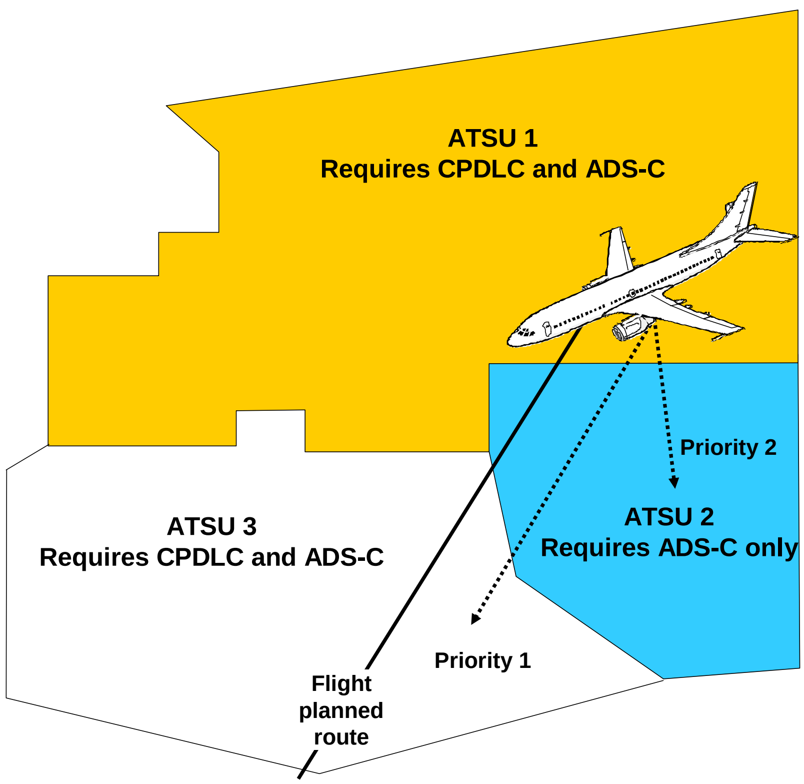


Figure 4-4. Transiting small data link area

4.1.7.5 ATSU 1 and ATSU 3 should coordinate on the connection transfer location and then ATSU 1 should initiate the END SERVICE message at that location to begin transfer of CPDLC connection at that location.

4.1.7.6 In this circumstance, the controller should inform the flight crew by appending the free text message UM 169m EXPECT NEXT CENTER [facility designation]. CONTACT WITH [facility designation] NOT REQUIRED.

Example:

Controller	UM 169m EXPECT NEXT CENTER ATSU 3. CONTACT WITH ATSU 2 NOT REQUIRED.

4.1.7.7 ATSU 1 should initiate address forwarding to ATSU 3 (priority 1) prior to initiating address forwarding to ATSU 2 (priority 2) to ensure that ATSU 3 can establish ADS contracts for monitoring the transit of the aircraft across the relevant portion of the FIR.

4.2 CPDLC – Uplinks

4.2.1 General

4.2.1.1 If the controller receives an unexpected or inappropriate response to a CPDLC uplink message or there is any misunderstanding or doubt about the intent of a CPDLC dialogue, they should initiate voice contact to clarify the meaning or intent. (see Appendix A for intent and use of CPDLC uplink and downlink message elements).

4.2.1.2 If the controller:

a) Does not receive a flight crew response to an open CPDLC uplink message within a reasonable time period and no error message has been received indicating that the message was not delivered; or

b) Receives a DM 2 STANDBY in response to an open CPDLC uplink message but does not receive a closure response within a reasonable period (e.g. 10 minutes); then

the controller should uplink UM 169j CHECK AND RESPOND TO OPEN CPDLC MESSAGES, rather than re-sending the original message. This is to avoid have multiple open messages involving the same instruction. Alternatively, the controller may use voice communication to clarify the status of the open CPDLC uplink.

4.2.1.3 If the controller receives a DM 2 STANDBY response to a message and does not receive another response within a reasonable period of time (e.g. 10 minutes) or as required, the controller should send a UM 169 [free text] inquiry rather than resend a duplicate message.

4.2.1.4 When necessary, the controller should include terms or conditions relating to a specific clearance or instruction in a single uplink message. The controller should not send separate messages. Refer to paragraph 4.2.5, for guidelines on multi-element uplink messages.

4.2.1.5 The controller should generally use standard message elements and should only use standard message elements when issuing a clearance.

Note.— The use of standard message elements will minimize the risk of input errors, misunderstandings and facilitate use by a non-native English speaking controllers and flight crews. The use of standard message elements allows the aircraft and ground systems to automatically process the information in the messages that are exchanged, which allows the flight crew to respond more quickly to a standard clearance. For example, the ground system can automatically update flight plan data for route conformance monitoring, the flight crew can automatically load clearance information into the FMS and review the clearance, and both aircraft and ground systems can associate responses to messages.

4.2.2 Use of free text

4.2.2.1 Whilst the controller should avoid the use of the free text message element, given local constraints and limitations of the data link system, its use may offer a viable solution to enhance operational capability.

4.2.2.2 The controller should only use a free text message when an appropriate standard message element does not exist and the intended use does not change the volume of protected airspace (i.e., not a clearance). Refer to paragraph 4.2.1.5 for issuing clearances.

4.2.2.3 When free text is used, the controller should use standard ATS phraseology and format and avoid nonessential words and phrases. The controller should only include abbreviations in free text messages when they form part of standard ICAO phraseology, for example, ETA.

4.2.3 Vertical clearances

4.2.3.1 The controller should precede conditional vertical clearances containing the word “AT” with UM 19 MAINTAIN [level] indicating to the flight crew to maintain their present level/altitude until the condition of the clearance is satisfied:

Controller	UM 19 MAINTAIN [level] UM 21 AT [time] CLIMB TO AND MAINTAIN [level]
Controller	UM 19 MAINTAIN [level] UM 22 AT [position] CLIMB TO AND MAINTAIN [level]
Controller	UM 19 MAINTAIN [level] UM 24 AT [time] DESCEND TO AND MAINTAIN [level]
Controller	UM 19 MAINTAIN [level] UM 25 AT [position] DESCEND TO AND MAINTAIN [level]

Note.— The potential exists for the restriction “AT” contained at the beginning of certain conditional clearances to be missed by the flight crew and consequently the clearance may be executed prematurely. Including the UM 19 MAINTAIN [level] message element will emphasize that the message contains a conditional level/altitude clearance and may prevent such clearances being executed prematurely.

4.2.3.2 If a CPDLC level report is needed, the controller should append UM 129 REPORT LEVEL [level] to the vertical clearance message element that is used to assign a single level/altitude.

Note 1.— When UM 129 REPORT LEVEL [level] is appended, the flight crew has access to the standard message element DM 37 ***MAINTAINING [level]*** *or LEVEL [altitude]. If the report request is not appended, the flight crew may not report when they are maintaining the cleared flight level.*

Note 2.— Some States may not request a CPDLC level report when using ADS-C.

Example: The controller issues a conditional clearance to a flight currently cruising at FL310 requesting climb to FL350 when the climb can not be executed until the aircraft is at MICKY. The controller appends a request for a report when level at FL350.

Controller	UM 19 MAINTAIN FL310 UM 22 AT MICKY CLIMB TO AND MAINTAIN FL350 UM 129 REPORT LEVEL FL350

4.2.3.3 The controller should not use UM 175 REPORT REACHING [level].

Note.— ICAO Doc 4444 has reserved this message element. The programmed intent of this message element was to request a report if the aircraft occupies the specified level, which occurs as the aircraft is about to level at the specified level, but also occurs if the aircraft passes through the specified level during a climb or descent. The purpose of reporting intermediate levels should be served by ADS-C.

4.2.3.4 To cancel a previously issued vertical range, i.e., block level, clearance and limit the aircraft to one specific level, the controller should issue an appropriate vertical clearance.

Example:

Controller	UM 19 MAINTAIN FL350 UM 20 **CLIMB TO FL390 or** *CLIMB TO AND MAINTAIN FL390* UM 129 **REPORT MAINTAINING FL390** or *REPORT LEVEL FL390*
Flight crew	DM 0 WILCO

Note.— The DM 0 WILCO response to the vertical clearance uplink cancels any previously issued vertical range clearance.

4.2.3.5 Depending on circumstances, the controller may use CPDLC message elements provided in Table 4-2 to issue a level restriction as either:

a) A “stand-alone” clearance; or

b) A level requirement for an interim level, when appended to another CPDLC vertical clearance.

Table 4-2. Conditional vertical clearances

UM #	Message element
UM 26	CLIMB TO REACH [level] BY [time]
UM 27	CLIMB TO REACH [level] BY [position]
UM 28	DESCEND TO REACH [level] BY [time]
UM 29	DESCEND TO REACH [level] BY [position]

Example 1: The controller clears the aircraft to climb to FL 390, and is maintaining FL 390 AT or BEFORE 2200.

Controller	UM 26 CLIMB TO REACH FL390 BY 2200

Example 2: The controller issues a requirement for an interim level. The controller clears the aircraft to climb to FL 390, and reach FL 370 (or higher) AT or BEFORE 0100.

Controller	UM 20 **CLIMB TO FL390** or *CLIMB TO AND MAINTAIN FL390* UM 26 CLIMB TO REACH FL370 BY 0100 UM 129 REPORT LEVEL FL390

Note.— A more appropriate procedure would be for the controller to use the message element UM 192 REACH [level] BY [time], defined in ICAO Doc 4444. However, this message element is not available in the FANS 1/A message set. The example includes UM 129 REPORT LEVEL FL 390 to highlight the final level intended by the clearance.

4.2.3.6 The controller should not send a vertical clearance in a CPDLC message and then subsequently send a related level restriction in a separate message. If the controller decides to add a level restriction after sending the initial clearance, they should restate the entire clearance, as presented in paragraph 4.2.3.5, Example 2.

Note.— If the controller sends the vertical clearance and the related level restriction in two separate CPDLC messages, the controller would be unintentionally amending the final cleared level of the aircraft (to FL 370) with the level restriction. The flight crew may misinterpret the two separate instructions.

Example: The following procedure is not a recommended practice. The controller does not send a vertical clearance and a related level restriction in separate messages.

~~Controller~~	~~CLIMB TO AND MAINTAIN FL390~~
~~Flight crew~~	~~WILCO~~
	~~followed by~~
~~Controller~~	~~CLIMB TO REACH FL370 BY 2200~~

4.2.3.7 If the controller is unable to approve a request to climb or descend to a particular level, but is able to approve a climb or descent to an intermediate level, then the controller should:

a) Respond to the request with UM 0 UNABLE; and

b) Issue a separate message to clear the aircraft to climb to the intermediate level.

4.2.4 Report/confirmation requests

4.2.4.1 If the controller requests the aircraft's Mach number or indicated airspeed, then the controller should use the standard message element UM 134 CONFIRM SPEED.

4.2.4.2 If a scheduled CPDLC position report is not received, the controller may request the report by uplinking message UM 147 REQUEST POSITION REPORT.

4.2.5 Creating multi-element uplink messages

4.2.5.1 The controller should minimize the use of CPDLC multi-element uplink messages and keep their size to a minimum.

4.2.5.2 The controller should only combine clearance message elements that are related into a single uplink message so the flight crew can provide a single unambiguous response.

Note.— The flight crew may misinterpret messages that contain unrelated elements or reject (DM 1 UNABLE) the entire message when the flight crew could have accepted (DM 0 WILCO) one of the elements on its own.

Example: The controller sends a multi-element uplink clearance as a single message.

Controller	UM 164 WHEN READY (or UM 177 AT PILOTS DISCRETION) UM 23 DESCEND TO AND MAINTAIN FL280 UM 129 REPORT LEVEL FL280

4.2.5.3 Two independent clearances should never be transmitted in a single message because the flight crew has no way individually respond to each clearance, if necessary, e.g. WILCO one clearance and UNABLE the other.

Example: The following is not recommended..

Controller	~~CLIMB TO AND MAINTAIN FL350~~ ~~INCREASE SPEED TO .84~~

4.2.5.4 The controller should send all elements of a dependent clearance in a single unambiguous uplink message.

Note 1.— A dependent clearance is a message consisting of more than one clearance element, where the flight crew needs to comply with each of the elements. A rejection of any of the elements, either singly or in combination, renders the entire clearance invalid.

Note 2.— Sending the elements as individual messages may compromise safety or separation if the flight crew accepts the first uplink of a dependent clearance, complies with the instruction, and then responds UNABLE to the next message when received.

Note 3.— The flight crew will respond to the multi-element uplink message with either DM 0 WILCO or DM 1 UNABLE, which applies to the entire message. The flight crew cannot respond to individual elements of a multi-element message.

Example 1: The controller sends a single multi-element uplink message containing an amended route clearance that is dependent on a vertical clearance. To eliminate any potential ambiguity, the controller carefully chose the second element to reinforce that the flight crew needs to comply with the vertical clearance prior to complying with the amend route clearance.

Controller	UM 20 CLIMB TO AND MAINTAIN FL330 UM 78 AT FL330 PROCEED DIRECT TO TUNTO UM 129 REPORT LEVEL FL330.

Example 2: The following procedure is not a recommended practice. The controller does not send the dependent clearance in a single multi-element uplink message because the message element UM 165

THEN followed by the route clearance UM 74 PROCEED DIRECT TO TUNTO is ambiguous. It does not clearly convey that the flight crew needs to complete the climb clearance prior to commencing the route clearance.

Controller	~~CLIMB TO AND MAINTAIN FL330~~ ~~THEN~~ ~~PROCEED DIRECT TO TUNTO~~

4.2.6 Weather deviations

4.2.6.1 A weather deviation clearance remains in effect until either:

a) A "back on route" report is received; or

b) The aircraft reaches a subsequent waypoint to which it has been cleared when clear of weather.

4.2.6.2 When issuing a deviation clearance, the controller should append the clearance with UM 127 REPORT BACK ON ROUTE.

4.2.6.3 When the controller issues a clearance direct to a waypoint, the controller will need to determine where the aircraft is or protect the airspace granted by the weather deviation until the aircraft sequences the waypoint to which the flight crew was cleared.

4.2.7 Message latency timer

4.2.7.1 It is possible for a CPDLC message to be excessively delayed but still be delivered to the aircraft, possibly even when that same aircraft is on a different flight. The use of the message latency timer, available on some aircraft, can provide the ATSP a means to mitigate the effects of a delayed CPDLC message that is delivered to the aircraft, and contributes to meeting the safety requirements, SR-1a and SR-9 for the ATSU, and SR-1a and SR-15 for the aircraft (Refer to Appendix B).

Note.— The ATSP considers the effects of a delayed CPDLC message in accordance with paragraph 3.1.1.1, and identifies mitigating measures. If the message latency timer is not used, the ATSP may identify other mitigating measures. For example, to mitigate the effects of a delayed CPDLC message, the ATSP may specify, in a contract or service agreement with the communication service provider, provisions that would preclude the delivery of a delayed CPDLC message to an aircraft.

4.2.7.2 An aircraft compliant with RTCA DO 258A/ED 100A, referred to as a FANS 1/A+ aircraft, has a message latency timer. To use the message latency timer on the aircraft, the ATSU ground system will need to include a valid timestamp in uplink CPDLC messages. The message latency timer monitors the time from when an ATSU sends a CPDLC message, determined from the timestamp in the uplink message, to when it is received on the aircraft and compares the calculated delay time to a pre-specified value for the [delayed message parameter]. The value can be set to an integer value from 1 to 999 seconds or the message latency timer can be switched off.

4.2.7.3 When the message latency timer is available for use, its defaulted mode can be off or set with a default value for the [delayed message parameter]. On some aircraft types, the operator can specify during maintenance, the defaulted mode of the message latency timer. Once in operation, the flight crew can change the mode of the message latency timer, which will replace the defaulted mode. If the flight crew changes the mode of the message latency timer, the aircraft system will retain that mode until the end of each active CPDLC connection or the end of the last active CPDLC connection for the flight. At that time, the aircraft system will reset the message latency timer to the defaulted mode.

4.2.7.4 When the message latency timer is available for use and an integer value for the [delayed message parameter] has been set, except when the message consists of the single message element UM 161 END SERVICE, and the calculated delay time of the CPDLC uplink message exceeds that value, the aircraft system will either:

a) Display the message to the flight crew with a delayed message indication and allow the flight crew to respond to the message with the appropriate response per the uplink response attribute, or

b) Discard the message without any indication to the flight crew and notify the ATSU with a message consisting of DM 62 ERROR [error information] and DM 67 [free text].

Note 1.— Refer to Appendix F, paragraph F.1, for availability of a FANS 1/A+ upgrade on different types of aircraft.

Note 2. The ATSU cannot rely solely on technical means to determine if the message latency timer is available for use. However, the ATSU may employ a combination of procedures and technical means to minimize sending related messages to aircraft for which the message latency timer is not available.

Note 3.— The message latency timer is available for use when the aircraft is FANS 1/A+ and the message latency timer is activated, While operators may have FANS 1/A+ aircraft, a maintenance action may be necessary to activate the message latency timer.

Note 4.— Refer to Appendix F, paragraph F.11, for the specifications of the message latency timer on different types of aircraft.

4.2.7.5 If the message latency timer is not intended to be used, the ATSP may need to:

a) Notify the operator to provide procedures to their flight crews to switch off the message latency timer; and

b) Establish procedures for the ATSU to instruct the flight crew to confirm that the message latency timer is off as described in Table 4-3. Figure 4-5 provides an overview of confirming the message latency timer on FANS 1/A+ aircraft is off. Note that while the table includes procedures for an aircraft for which the message latency timer is not available, the figure does not show these aircraft.

Table 4-3. Confirm message latency timer off – not used

<table>
<tr><th>Who</th><th colspan="2">Procedures</th></tr>
<tr><td>ATSU
1A</td><td colspan="2">When an active CPDLC connection has been established with a FANS 1/A+ aircraft or the ATSU receives from the aircraft an indication of a delayed message (refer to Table 4-4, steps 4B and 5B), the ATSU (current data authority) should uplink the [free text] message:

UM 169(New) CONFIRM MESSAGE LATENCY TIMER OFF

Note 1.— The ATSU may need to send this message in the case of re-establishing a lost active CPDLC connection.

Note 2.— Any ATSU that will hold the flight plan for a FANS 1/A+ aircraft and is not using the message latency timer may need to uplink the CPDLC free text message after an active CPDLC connection has been automatically transferred. (Refer to paragraph 4.2.7.3). If an ATSU is using the message latency timer, see paragraph 4.2.7.6.</td></tr>
<tr><td rowspan="2">Flight crew
2A</td><td>FANS 1/A+ aircraft</td><td>Message latency timer not available</td></tr>
<tr><td>The flight crew will:

a) confirm that the message latency timer is off; and

b) accept (DM 3 ROGER) the uplink [free text] message.</td><td>The flight crew will accept (DM 3 ROGER) the uplink [free text] message and append the [free text], TIMER NOT AVAILABLE.</td></tr>
<tr><td>ATSU/ controller
3A</td><td colspan="2">The DM 3 ROGER response closes the uplink message. If the ATSU receives the free text message TIMER NOT AVAILABLE, the message latency timer is not available on that aircraft.</td></tr>
<tr><td>Aircraft system
6A</td><td colspan="2">When the active CPDLC connection is transferred, the aircraft system may automatically set a pre-specified default value for the [delayed message parameter], retain the existing value, or switch the message latency timer off.

Note.— Refer to Appendix F, paragraph F.11 for the specifications on the message latency timer implemented in different types of aircraft.</td></tr>
</table>

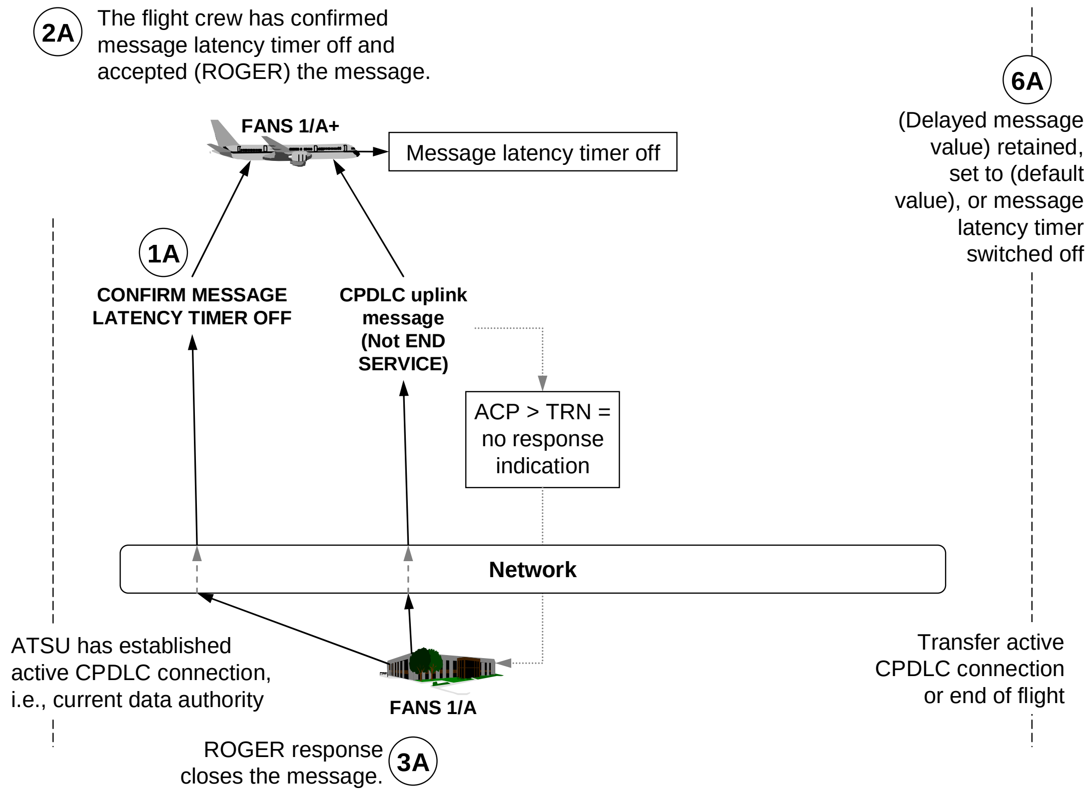


Figure 4-5. Confirm message latency timer off – not used

4.2.7.6 If the message latency timer is intended to be used, the ATSP should:

a) Prescribe the requirements for use of the message latency timer on FANS 1/A+ aircraft in appropriate documents, e.g. Regional SUPPs and/or AIPs, per paragraph 3.1.4.1, so the operator can ensure that their aircraft are properly equipped and that their training program adequately addresses its use, per paragraph 3.2.1.1.

b) Establish interfacility agreements, as necessary, with adjacent ATSUs on the use and/or non-use of the message latency timer, per paragraph 3.1.4.12.

c) Establish procedures for the ATSU to instruct the flight crew to set a value for the [delayed message parameter] as described in Table 4-4. Figure 4-6 provides an overview of using the message latency timer on FANS 1/A+ aircraft. Note that while the table includes procedures for an aircraft for which the message latency timer is not available, the figure does not show these aircraft.

Table 4-4. Using the message latency timer – set delay message value

<table>
<tr><th>Who</th><th colspan="2">Procedures</th></tr>
<tr><td>ATSU
1B</td><td colspan="2">When an active CPDLC connection has been established with a FANS 1/A+ aircraft, i.e., the message latency timer is available, the ATSU (current data authority) should uplink the [free text] message:

UM 169w SET MAX UPLINK DELAY VALUE TO [delayed message parameter] SEC

where the [delayed message parameter] is an integer value at least greater than the TRN value expressed in seconds, but not greater than 999 seconds. When multiple adjacent ATSUs use the message latency timer, the value should be standardized as much as possible via interfacility agreements per paragraph 3.1.4.12.

Note 1.— Refer to Appendix B for TRN values associated with different RCP types.

Note 2.— The ATSU may need to send this message in the case of re-establishing a lost active CPDLC connection.

Note 3.— Any ATSU that is using the message latency timer and will hold the flight plan for a FANS 1/A+ aircraft may need to uplink the CPDLC free text message after an active CPDLC connection has been established. (Refers paragraph 4.2.7.3). If an ATSU is not using the message latency timer, see paragraph 4.2.7.5.</td></tr>
<tr><td rowspan="2">Flight crew
2B</td><td>FANS 1/A+ aircraft</td><td>Message latency timer not available</td></tr>
<tr><td>The flight crew will:
a) set the value; and
b) accept (ROGER) the uplink message.</td><td>The flight crew will accept (ROGER) the uplink [free text] message and append the [free text], TIMER NOT AVAILABLE.</td></tr>
<tr><td>ATSU/ controller
3B</td><td colspan="2">The ROGER response closes the uplink message. If the ATSU receives the free text message TIMER NOT AVAILABLE, the message latency timer is not available on that aircraft.

Note.— The provision of CPDLC service to aircraft for which the message latency timer is not available is a local matter.</td></tr>
</table>

<table>
<tr><th>Who</th><th colspan="2">Procedures</th></tr>
<tr><td rowspan="3">Flight crew/ aircraft system
4B</td><td>FANS 1/A+ aircraft (flight crew)</td><td>FANS 1/A+ aircraft (aircraft system)</td></tr>
<tr><td>When the aircraft system detects a delayed CPDLC uplink message, the flight crew may receive an indication of a delayed CPDLC uplink message, in which case the flight crew will:
a) respond, appropriately, to close the message, i.e. reject all clearance and negotiation messages (DM 1 UNABLE or DM 5 NEGATIVE), or accept (DM 3 ROGER) any message that cannot be rejected;
b) when using CPDLC, send a free text message, as necessary, to provide the reason for rejecting the message, e.g. DELAYED CPDLC MESSAGE RECEIVED or NOT CONSISTENT, PLEASE RE-SEND; and
c) if deemed necessary, further advise the controller of the situation and/or request verification of ATC intent, via CPDLC or voice.</td><td>When the aircraft system detects a delayed CPDLC uplink message, the aircraft system may automatically discard the message without any indication to the flight crew and send a message containing DM 62 ERROR [error information] and DM 67 [free text] to notify the ATSU of the delayed CPDLC message.</td></tr>
<tr><td colspan="2">Note. — Refer to Appendix F, paragraph F.11 for the specifications on the message latency timer implemented in different types of aircraft.</td></tr>
<tr><td>ATSU/ controller
5B</td><td colspan="2">When a message containing the DM 62 ERROR [error information] or a flight crew response is received, the ATSU or controller should respond according to local procedures established by the ATSP to ensure that in the case of a flight crew response, the flight crew does not potentially execute a delayed clearance.</td></tr>
<tr><td>Aircraft system
6B</td><td colspan="2">When the active CPDLC connection is transferred, the aircraft system may automatically set a pre-specified default value for the [delayed message parameter], retain the existing value, or switch the message latency timer off.
Note. — Refer to Appendix F, paragraph F.11 for the specifications on the message latency timer implemented in different types of aircraft.</td></tr>
</table>

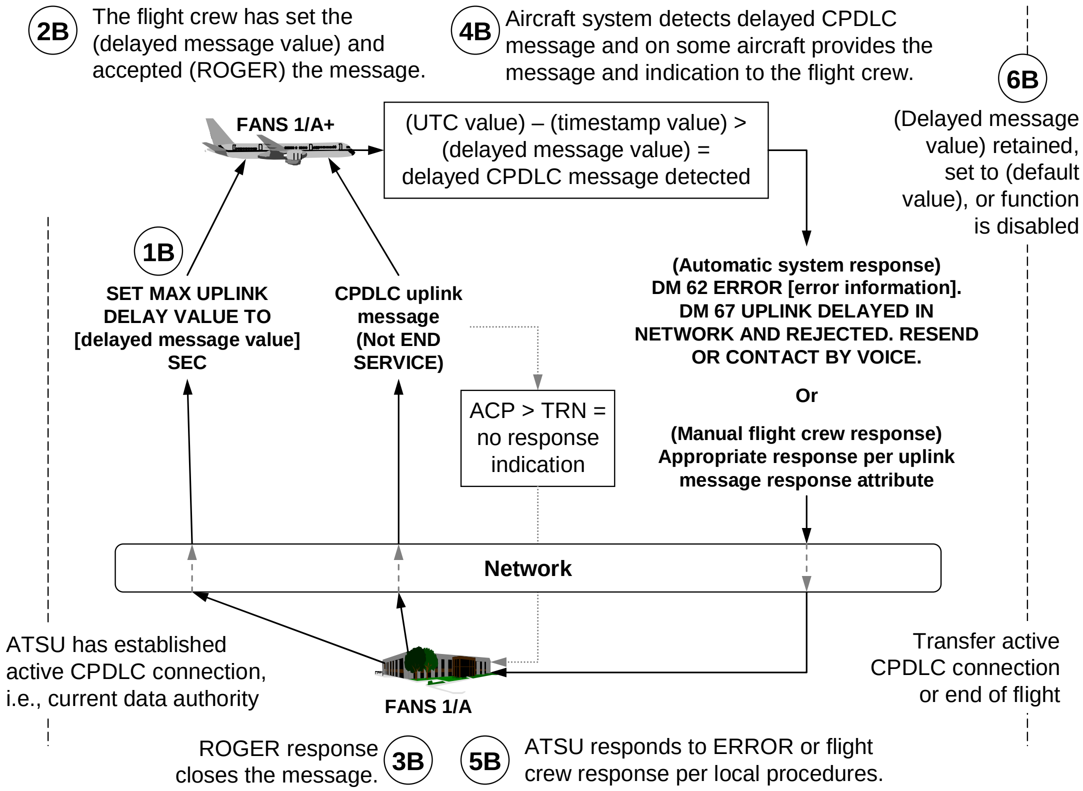


Figure 4-6. Using the message latency timer – set delay message value

4.3 CPDLC – Downlinks

4.3.1 General

4.3.1.1 The ATSU should respond to a downlink message that it does not support according to paragraph 3.1.2.4.3.

4.3.1.2 The controller should respond to an incoming request as soon as practicable to avoid receiving a duplicate request.

4.3.2 Clarifying a downlink message

4.3.2.1 In the case of a controller having any doubt as to the intent of a downlink message, or if any other ambiguity exists, the controller should seek clarification using CPDLC or voice. The controller should then respond with a CPDLC message consistent with the clarification to prevent confusion and to close the open downlink message.

4.3.3 Responses/acknowledgements

4.3.3.1 The controller should not use UM 3 ROGER or UM 4 AFFIRM to respond to a clearance request. The controller should only approve a clearance request by issuing a clearance using an appropriate message element.

4.3.3.2 When a clearance request is denied, the controller should use the element UM 0 UNABLE (not UM 5 NEGATIVE) in the uplink response. The controller should not restate the aircraft's current clearance.

4.3.3.3 When issuing negative responses to clearance requests, the controller should append a standard message element (e.g. UM 166 DUE TO TRAFFIC) to provide a reason for the non-availability of a clearance.

4.3.3.4 The controller should use the uplink UM 1 STANDBY message element to provide advice to the flight crew that their requested clearance is being assessed, but is not readily available, for example, due to traffic or delays in coordination with the next sector or ATSU.

4.3.3.5 The ATSU should not automatically or manually send a UM 1 STANDBY to unconditionally acknowledge that it received a downlink request.

4.3.3.6 If the controller sends a UM 1 STANDBY response, the controller should subsequently respond again within a reasonable period of time, e.g. 10 minutes, or as required.

Note.— The downlink message remains open. If the controller does not respond within this time, the flight crew will query the controller per paragraph 5.4.1.5.

4.3.3.7 If the controller receives a second identical CPDLC request prior to having responded to the first one, the controller should respond to both of the downlink requests in order to ensure all downlink messages are closed. Depending on the ground system, the closure response for the second request may be:

a) a re-iteration of the closure response for the first downlink request (e.g. a clearance, UM 0 UNABLE etc); or

b) some other uplink that does not contradict any previous clearance that may have been uplinked (i.e. avoid sending a clearance to one downlink request and UM 0 UNABLE to the duplicated downlink)

4.3.3.8 If a UM 1 STANDBY message had previously been uplinked when a duplicated request is received, and additional time is required before the clearance is available, the controller should respond with UM2 REQUEST DEFERRED.

Example 1:

	Dialogue 1	**Dialogue 2**
Flight crew	REQUEST CLIMB TO FL370	
Flight crew		REQUEST CLIMB TO FL370
Controller	UNABLE	
Controller		UNABLE

Example 2:

	Dialogue 1	**Dialogue 2**
Flight crew	REQUEST CLIMB TO FL370	
Flight crew		REQUEST CLIMB TO FL370
Controller	CLIMB TO AND MAINTAIN FL370	
Controller		CLIMB TO AND MAINTAIN FL370; or (for example) UM 169 CLEARANCE ALREADY SENT
Flight crew	WILCO	
Flight crew		WILCO or ROGER, as appropriate

Example 3:

	Dialogue 1	**Dialogue 2**
Flight crew	REQUEST CLIMB TO FL370	
Controller	STANDBY	
Flight crew		REQUEST CLIMB TO FL370
When more time is required until clearance is available.		
Controller		REQUEST DEFERRED
Controller	CLIMB TO AND MAINTAIN FL370	
Controller		CLIMB TO AND MAINTAIN FL370
Flight crew	WILCO	
Flight crew		WILCO

4.3.4 Responding to multi-element requests

4.3.4.1 While the flight crew is advised to avoid sending multiple clearance requests, the controller may receive a multiple clearance request in a single downlink message.

4.3.4.2 If the controller receives multiple clearance requests in a single message and can approve all clearance request elements, the controller should specifically respond to each clearance request element in the message.

Example:

Flight crew	DM 9 REQUEST CLIMB TO [level] DM 22 REQUEST DIRECT TO [position]
Controller	UM 20 CLIMB TO AND MAINTAIN [level] UM 74 PROCEED DIRECT TO [position]

4.3.4.3 If the controller receives multiple clearance requests in a single message and cannot approve any of the clearance request elements, the controller should respond with UM 0 UNABLE, which applies to all elements of the original message. The controller should not restate the aircraft's current clearance.

Example:

Flight crew	DM 9 REQUEST CLIMB TO [level] DM 22 REQUEST DIRECT TO [position]
Controller	UM 0 UNABLE

4.3.4.4 If the controller receives multiple clearance requests in a single message and can approve some of the clearance request elements, the controller should send, in a single message, UM 0 UNABLE, include a reason to remove any ambiguity and, if appropriate, information on when the clearance to that part of the request might be expected.

a) The controller may, following the UM 0 UNABLE [reason] message, send a separate CPDLC message (or messages) to respond to those elements for which they can grant the request.

b) The controller should not uplink a single message containing only the word UNABLE for the part that cannot be granted and a clearance for the part that can.

Example:

Flight crew	DM 9 REQUEST CLIMB TO [level] DM 22 REQUEST DIRECT TO [position]
Controller (provide reason using standard message element)	UM 0 UNABLE. UM 166 DUE TO TRAFFIC
Controller (separate message element)	UM 74 PROCEED DIRECT TO [position]

4.3.5 Offering alternative clearances to requests

4.3.5.1 If the clearance contained in a downlink request is not available, the controller should uplink an UNABLE to deny the request prior to issuing any subsequent clearances. The controller should not simply respond to the downlink request with the alternative clearance.

a) If an alternative clearance (intermediate level or deferred climb) is available, the controller may subsequently uplink the clearance in a separate CPDLC message.

b) If an alternative clearance that the flight crew might not be able to accept (higher level or route modification) is available, the controller should negotiate the clearance with the flight crew prior to granting it.

Example 1: The aircraft is at FL330. The controller is unable to grant the flight crew request and issues an alternative clearance.

Flight crew	DM 9 REQUEST CLIMB TO FL370
Controller	UM 0 UNABLE. UM 166 DUE TO TRAFFIC
Controller	UM 20 CLIMB TO AND MAINTAIN FL350. UM 129 REPORT LEVEL FL350

Example 2: The following procedure is not a recommended practice. The controller does not provide the correct ATC response.

Flight crew	DM 9 REQUEST CLIMB TO FL370
Controller	~~UNABLE. CLIMB TO AND MAINTAIN FL350. REPORT LEVEL FL350~~

4.4 ADS-C

4.4.1 General

4.4.1.1 ADS-C reports contain FMS information relating to the figure of merit (FOM), ACAS and the aircraft's navigational redundancy. Some automated ground systems use the FOM value received in an ADS-C report to determine whether to display the report to controllers, or to display a "high" or "low" quality ADS-C symbol.

4.4.1.2 FOM data is not required for the use of current separation standards. However, where the separation standard being applied requires specific navigational accuracy, such as RNP, the controller should rely on flight crew advice as to the extent of any navigational degradation and adjust separation accordingly.

4.4.1.3 If a flight crew inserts a non-ATC waypoint into the aircraft active flight plan, the aircraft may send a waypoint change event report, which contains information on the non-ATC waypoint in the predicted route group, as well as the intermediate and fixed projected intent groups of the report. The ATSU may receive information on the next, or the next-plus-one waypoints from that report that do not correlate with the waypoint information provided in the current flight plan or flight data record held by the ATSU. Refer to Appendix F, paragraph F.5 for FMS processing of waypoints on different aircraft types.

Note.— The flight crew normally would not insert non-ATC waypoints per paragraph 5.6.4.4..

4.4.1.4 Unless required for safety purposes, such as to monitor aircraft operating close to, but not entering the FIR, the ATSU should only establish ADS contracts for aircraft within their area of responsibility.

4.4.1.5 A controller who becomes aware of corrupt or incorrect data from an ADS-C report should establish voice contact with the aircraft concerned in order to correct the situation.

4.4.1.6 When an ATSU is using both ADS-C and CPDLC position reporting and detects a discrepancy of 2 minutes or less between the reports, the controller should reconcile the time difference.

Where the time difference is 3 minutes or more, the controller should query the estimate received in the CPDLC position report and request confirmation of the estimate for the waypoint in question.

Note.— CPDLC and ADS-C estimates received from the same aircraft for the same position may differ as a result of the ADS-C application reporting time to the second and the time reported by CPDLC application either being truncated or rounded to the nearest full minute (depending on aircraft type). The flight crew also has the ability to modify the estimate for the next position in the CPDLC position report. Any such modification will not be reflected in the ADS-C report.

4.4.1.7 Whenever an ADS-C report (either a periodic or waypoint change event report) is not received within a parameter of the expected time, the controller may initiate a demand contract request, re-establish a new periodic contract with the aircraft, or request a CPDLC or voice position report. See also paragraph 4.7.5.4.3.

4.4.1.8 If the controller becomes aware of a data link communications failure, the controller should advise affected aircraft to revert to voice position reporting in accordance with paragraph 4.7.5.

4.4.2 ADS contract - periodic

4.4.2.1 When setting a default periodic reporting interval, the ATSP should take into account requirements for the separation standard in use, conformance monitoring, traffic levels, and alerting service. Typically, default periodic contract intervals are set to satisfy the position reporting requirements of the default separation standard in use.

4.4.2.2 The ATSP should avoid arbitrarily selecting short periodic default intervals because of the economic cost to the users and the unnecessary system loading imposed by these short default intervals.

4.4.2.3 There are a number of situations where a controller or ground automation may use a reporting interval other than the default interval in the periodic contract. A change to the default interval for an aircraft may be required:

a) When the aircraft is cleared to deviate from areas of known significant weather;

b) When the application of a smaller separation standard requires a shorter periodic interval;

c) During periods of turbulence;

d) When an unauthorized deviation from the clearance is detected; or

e) When the aircraft is approaching a crossing route on which there is other traffic.

4.4.2.4 The ATSP should ensure that the periodic reporting interval in use is in accordance with the position reporting requirements of the separation standard being used. When not required for the application of separation, or other factors, the ATSP should return to a longer periodic reporting interval to reduce overall costs to the system.

4.4.2.5 The controlling ATSU should not establish ADS-C periodic reporting at an interval shorter than five minutes. An adjacent non-controlling ATSU should not establish ADS-C periodic reporting at an interval shorter than what is required for application of any reduced separation in effect for the flight.

4.4.3 ADS contract - waypoint change event

4.4.3.1 A waypoint event report will be sent at any non-compulsory reporting point and reflected in the predicted route group.

4.4.4 ADS contract - vertical range change and lateral deviation events

4.4.4.1 When the level range deviation event and lateral deviation event contracts are established, the controller will only be alerted to vertical or lateral variations that exceed the associated tolerances.

Note.— If a regular periodic report is sent as the aircraft is deviating from cleared level or route (but still within the level or lateral tolerances) the controller will still be alerted to the variation despite no event report having been sent.

4.5 Separation

4.5.1 General – ADS-C

4.5.1.1 The ATSU may use ADS-C for the application of procedural separation within a mixed environment, such as airspace where position reports are provided by a mixture of aircraft reporting by ADS-C and aircraft reporting by other means.

4.5.1.2 For example, the ATSU may use a combination of ADS-C, voice reports, radar or ADS-B information to determine separation between two or more aircraft.

4.5.1.3 When ADS-C is used for reroute conformance monitoring to support the separation, the ATSU should establish appropriate ADS contracts that specify the periodic reporting interval and tolerances on events in accordance with separation standards.

Note.— This will ensure that estimates being used for route conformance monitoring are acceptable for the separation and the controller receives an indication when the aircraft is not in conformance with its current flight plan.

4.5.1.4 The controller should advise the flight crew when the controller observes that the aircraft has deviated significantly from its cleared flight profile. The controller should take action as appropriate if the deviation is likely to affect the air traffic service being provided.

4.5.2 Vertical separation –ADS-C

4.5.2.1 Where practical, the tolerances used to determine whether a specific level is occupied by an ADS-C reporting aircraft within the airspace of a specific ATSU should be consistent with other tolerances used throughout the airspace. For example, the vertical tolerances for ADS-C should be consistent with vertical tolerances used for level adherence monitoring by other forms of surveillance, such as radar.

4.5.2.2 Where other vertical tolerances do not exist, the ATSU should apply a vertical tolerance of +/– 300 feet for ADS-C applications. However, an individual ATSU may specify in local instructions and the AIP that it uses a tolerance of not less than +/– 200 feet to provide consistency with other vertical tolerances applied within the FIR.

4.5.2.3 If displayed ADS-C level information does not satisfy the required tolerance for an individual ATSU, then the controller should advise the flight crew accordingly and request confirmation of the aircraft's level. If following confirmation of the level, the displayed ADS-C level information is still beyond the required tolerance, the controller may need to apply another method of separation or another method of determining level information.

4.5.2.4 When displayed ADS-C level information is within the specified tolerance of the expected or cleared flight level, the ATSU may use the ADS-C level information to apply vertical separation and to determine that an aircraft has reached or is maintaining a specified level.

4.5.2.5 The controller can consider that an aircraft has left a specified level when the displayed ADS-C level information indicates that the aircraft has passed the level in the required direction by more than the required tolerance.

4.5.3 Lateral separation – ADS-C

4.5.3.1 An ATSU can use ADS-C report information to automatically detect conflicts and provide indication to the controller to confirm whether or not an aircraft is within or beyond an area of lateral conflict.

4.5.3.2 When conflict detection tools are not available, the controller can determine lateral conflicts by observing the ADS-C report information and determining if the aircraft is within or outside the area of conflict.

Note.— The adequacy of the procedures used to detect lateral conflicts is a matter of the State.

4.5.4 Longitudinal separation – ADS-C

4.5.4.1 ATSUs that use approved or integrated measurement tools for the purpose of determining screen-based separation should publish in local documentation any limitations on the use of such tools for the establishment and monitoring of separation standards.

4.5.4.2 The ATSU may use ADS-C reports to establish and monitor longitudinal time and distance separation standards.

4.5.4.3 Some ground systems display an extrapolated or interpolated ADS-C symbol between the receipt of ADS-C reports. Provided that the periodic reporting interval in use is in accordance with any maximum reporting interval specified by the separation standard, the ATSU may determine separation between the extrapolated/interpolated symbols by the use of screen-based measurement tools, or by the use of automated conflict detection tools.

4.5.4.4 When the ATSU uses extrapolated or interpolated ADS-C symbols to provide separation and any doubt exists as to the integrity or validity of the information being presented, the controller should send a demand contract to update the relevant information. If doubt still exists, the controller should consider using an alternative method of separation.

4.5.4.5 The ATSU may use ground system flight data records updated by ADS-C reports in the application of appropriate time-based separation standards. Methods of determination may include reference to:

a) Estimates at waypoints;

b) Calculated estimates for positions not contained in the flight plan;

c) Screen-based measurement tools; or

d) Automated conflict detection tools.

4.5.4.6 The ATSU may use ADS-C reports for the application of appropriate longitudinal distance standards. Methods of determination may include:

a) The use of automated system tools to measure the displayed positions of two or more aircraft reporting by ADS-C;

b) Comparing the displayed position of an ADS-C aircraft with the position of another aircraft determined by an alternative form of surveillance; or

c) The use of automated conflict detection tools.

4.5.5 Using FMC WPR for position reporting

4.5.5.1 Whenever an FMC waypoint position report is overdue by more than a specific interval, as determined by ATC, the controller should take action to advise the aircraft concerned and request a voice position report. If either the flight crew or the controller notices intermittent operation, either may revert to voice reporting at any time. (The flight crew would be expected to report by voice for the remainder of the flight.)

4.5.5.2 A controller who becomes aware of corrupt or incorrect data in the FMC waypoint position report should establish voice contact with the aircraft concerned in order to correct the situation.

4.5.5.3 A controller who becomes aware of a FMC WPR service failure should advise affected aircraft to revert to voice position reporting in accordance with paragraph 4.7.5.

4.6 Alerting service

For ADS-C aircraft, the ATSU should base the provision of the alerting service on any missed scheduled report (i.e. provided by either the periodic contract or the waypoint event contract).

4.7 Emergency and non-routine procedures

4.7.1 General

4.7.1.1 The flight crew will use whatever means are appropriate, i.e. CPDLC and/or voice, to communicate during an emergency.

4.7.1.2 During an emergency, a controller would normally expect the flight crew to revert to voice communications. However, the flight crew may use CPDLC for emergency communications if it is either more expedient or if they are unable to establish voice contact.

4.7.1.3 Whilst the emergency communication may be acknowledged by CPDLC, the controller may also attempt to make voice contact with the aircraft.

4.7.1.4 The controller should follow normal emergency response procedures, as appropriate, depending on the nature of the emergency.

4.7.1.5 Refer to current ICAO procedures for standards and recommended practices on complete communications failure (CPDLC and voice).

4.7.1.6 The procedures described in the following paragraphs are relevant only to the use of CPDLC and ADS-C during an emergency.

4.7.2 CPDLC and ADS-C emergency

4.7.2.1 If the ATSU receives an ADS-C emergency report without a corresponding CPDLC emergency message, then the controller should request confirmation of the emergency in accordance with the guidelines provided in paragraph 4.7.3.

4.7.2.2 The controller should treat any CPDLC downlink message that contains an emergency message element (see Appendix A, paragraph A.3 for the list of emergency message elements) as an emergency message, with the exception of DM 80 **DEVIATING UP TO [specified distance] [direction] OF ROUTE** or *DEVIATING [distanceoffset] [direction] OF ROUTE*.

4.7.2.3 If the ATSU receives a CPDLC emergency message such as DM 56 MAYDAY MAYDAY MAYDAY or DM 55 PAN PAN PAN, with or without a corresponding ADS-C emergency report, the controller should acknowledge receipt of the CPDLC message using the most appropriate means (voice or CPDLC). If responding by CPDLC, the controller should use either of the following free text message elements (as appropriate):

a) UM 169r ROGER PAN if the downlink message contains DM 55 PAN PAN PAN; or

b) UM 169q ROGER MAYDAY if the downlink message contains DM 56 MAYDAY MAYDAY MAYDAY.

Note.— For FANS 1/A, the CPDLC emergency messages do not require a closure response. Therefore, the aircraft system will reject receipt of any technical response (i.e. including a MRN), such as the UM 3 ROGER message element.

4.7.2.4 Whilst this uplink free text message element requires a closure response (DM 3 ROGER), depending on flight crew workload and the nature of the emergency, the controller may not receive this response.

4.7.2.5 The controller should attempt to determine the nature of the emergency and ascertain any assistance that may be required.

Note.— When the ATSU receives DM 55 or DM 56, additional message elements (e.g. DM 61 DESCENDING to [level]) may be appended. Any information appended to DM 55 or DM 56 may not accurately reflect the current level/altitude, attitude, tracking information, or the intentions of the flight crew.

4.7.2.6 If CPDLC is the normal means of ATC communication for the aircraft, then the ATSU should maintain the active connection until suitable voice communication becomes available. In this case, the ATSU should not transfer the CPDLC connection to another ATSU.

4.7.2.7 If a transfer of the CPDLC connection does not occur, then the current ATSU retains the responsibility for maintaining communications with the aircraft.

4.7.2.8 The ATSU with control responsibility for the flight may choose to:

a) Shorten the ADS-C periodic reporting interval to 5 minutes; or

Note 1.— Shortening the ADS-C reporting interval reduces the period between cancellation of the ADS-C emergency and receipt of the ADS-C CANCEL EMERGENCY message.

Note 2.— Adjacent ATSUs should not shorten the ADS-C periodic reporting interval.

b) Send a demand contract request.

Note 3.— This is not required if the periodic reporting interval has been shortened – an ADS-C report will have already been triggered by the aircraft when the new periodic contract is received.

4.7.3 ADS-C emergency report without a CPDLC emergency message

4.7.3.1 When an ATSU not having control responsibility for the aircraft receives an indication of an ADS-C emergency, they should coordinate with the controlling authority to ensure that they received the emergency report (see paragraph 3.1.2.3.2 for related information).

4.7.3.2 When an ATSU having control responsibility for the aircraft receives an indication of an ADS-C emergency report without either a CPDLC emergency message or voice confirmation, then it is possible that the aircraft may be subject to unlawful interference or inadvertent activation of the ADS-C emergency mode. If a subsequent ADS-C report indicates that the aircraft is maintaining normal operations (i.e. the aircraft is operating in accordance with its clearance), the controller should confirm the ADS-C emergency using CPDLC or voice.

4.7.3.3 To check for covert or inadvertent activation of the ADS-C emergency mode using CPDLC, the controller should send the following CPDLC free text uplink. (If voice is used for confirmation, the same message text should be used in the voice transmission).

Controller	UM 169ak CONFIRM ADS-C EMERGENCY

4.7.3.3.1 If the emergency mode has been activated inadvertently, the flight crew will cancel the ADS-C emergency and advise the controller either by voice or the following CPDLC free text downlink.

Flight crew	DM 3 ROGER, then DM 67ab ADS-C RESET

4.7.3.3.2 If the aircraft continues with the ADS-C emergency mode activated, the controller should assume the aircraft is in emergency conditions and follow normal alerting procedures.

Note. The aircraft may not send the ADS-C CANCEL EMERGENCY message until the next ADS-C periodic report is due.

4.7.4 Voice communications related to data link

4.7.4.1 When CPDLC fails and the controller reverts to voice communications, the controller should consider all open messages not delivered and re-commence any dialogues involving those messages by voice.

4.7.4.2 The controller or radio operator should use the standard voice phraseology under certain conditions as indicated in Table 4-5.

Table 4-5. Voice phraseology related to CPDLC

Condition	Voice phraseology
To instruct the flight crew to manually initiate an AFN logon to the subsequent ATSU	SELECT ATC COMM OFF THEN LOGON TO [facility designation] *Note 1.— The [facility designation] is the four character ICAO code.* *Note 2.— Use this phraseology when the CPDLC transfer to an adjacent ATSU has failed.*
To advise the flight crew that the data link has failed and instruct them to continue on voice.	ATC DATA LINK FAILED. SELECT ATC COMM OFF. CONTINUE ON VOICE
To advise the flight crew prior to the commencement of a FANS 1/A data link shutdown and instruct them to continue on voice.	ATC DATA LINK WILL BE SHUT DOWN. SELECT ATC COMM OFF. CONTINUE ON VOICE.
To advise the flight crew that the transmission is being made due to a CPDLC failure	CPDLC FAILURE. *Note.— This phraseology should only be included with the first transmission made for this reason.*

Condition	Voice phraseology
To advise the flight crew of a complete ground system failure	ALL STATIONS CPDLC FAILURE [identification of station calling].
To advise the flight crew that the data link system has resumed operations	ATC DATA LINK OPERATIONAL. LOGON TO [facility designation]

4.7.5 Data link service failures

4.7.5.1 CPDLC connection failure

4.7.5.1.1 If a CPDLC dialogue is interrupted by a data link service failure, the controller should re-commence the entire dialogue by voice communication.

4.7.5.1.2 When the controller recognizes a failure of the CPDLC connection, the controller should instruct the flight crew to terminate the connection, by selecting ATC COM OFF, and then initiate another AFN logon. The controller or radio operator should use the following voice phraseology:

Controller (or radio operator)	ATC DATA LINK FAILED. SELECT ATC COMM OFF THEN LOGON TO [facility designation]
Flight crew	ROGER

Note.— The [facility designation] is the 4 character ICAO code.

4.7.5.1.3 Once the AFN logon is established, the ATS system should send a CPDLC CR1 message to re-establish the connection.

4.7.5.2 Data link service failure

4.7.5.2.1 In the event of an unplanned data link shutdown, the relevant ATSU should inform:

a) All affected aircraft using the following voice phraseology:

Controller (or radio operator)	ATC DATA LINK FAILED. SELECT ATC COMM OFF. CONTINUE ON VOICE
Flight crew	ROGER

b) The adjacent ATSUs by direct coordination; and

c) All relevant parties via the publication of a NOTAM, if appropriate.

Note.— In the event of a planned or unexpected network or satellite data service outage (e.g. ground earth station failure), the CSP will notify all ATSUs within the affected area in accordance with paragraph 3.1.3.1 so the controller can inform affected aircraft.

4.7.5.3 Planned data link shutdown

4.7.5.3.1 During the time period of a planned data link shutdown, the ATSP will advise the operators of the requirements to use voice communication procedures.

4.7.5.3.2 When advising the flight crew prior to the commencement of a planned data link shutdown, the controller should use the following CPDLC message or the radio operator should use the equivalent voice phraseology:

Controller (or radio operator, if voice)	UM 169 DATA LINK WILL BE SHUT DOWN. SELECT ATC COMM OFF. CONTINUE ON VOICE *Note 1.— The controller could optionally provide the voice frequency.*
Flight crew	DM 3 ROGER *Note 2.— The flight crew should select ATC Comm Off when the message is received.*

4.7.5.4 CPDLC or ADS-C service failure

4.7.5.4.1 Some ATSUs are not equipped with both CPDLC and ADS-C and consequently may experience a failure of either the CPDLC or ADS-C service. For ATSUs that have both CPDLC and ADS-C it is not likely that just one component will shutdown, however it is possible.

4.7.5.4.2 When the ADS-C service is shut down, the affected ATSU should inform all other affected parties of the shutdown and likely period.

4.7.5.4.3 If the CPDLC service is still available, the controller should revert to either CPDLC or voice to fulfill the position reporting requirement. The controller should then send a CPDLC message to the flight crew notifying reporting requirements using either of the following free text messages:

Controller	UM 169ao ADS-C SHUT DOWN REVERT TO CPDLC POSITION REPORTS
Flight crew	DM 3 ROGER

or

Controller	UM 169at ADS-C SHUT DOWN REVERT TO VOICE POSITION REPORTS
Flight crew	DM 3 ROGER

4.7.5.4.4 If ADS-C is still available, the controller may use voice to notify the flight crew to continue position reporting using ADS-C.

4.7.5.4.5 When an ADS-C contract cannot be established, or if ADS-C reporting from an aircraft ceases unexpectedly, if CPDLC is still available, the controller should send a CPDLC message to the flight crew, using the following free text message:

Controller	UM 169an CONFIRM ADS-C ARMED
Flight crew	DM 3 ROGER

Note.— The flight crew may have inadvertently selected ADS-C off. If ADS-C had been turned off, re-arming it will not re-initiate previous ADS contracts. The ATSU will need to establish new ADS contracts.

4.7.5.5 The controller or radio operator should use the following voice phraseology to advise the flight crew that the data link system has resumed operations.

Controller (or radio operator)	DATA LINK OPERATIONAL LOGON TO [facility designation]
Flight crew	LOGON [facility designation]

Note.— The [facility designation] is the 4 character ICAO code.

4.7.6 Using CPDLC to relay messages

4.7.6.1 When an ATSU and an aircraft cannot communicate, the controller may use CPDLC to relay messages via an intermediary CPDLC-capable aircraft. Depending on circumstances, the controller may first confirm that the CPDLC-capable aircraft is in contact with the subject aircraft, and obtain concurrence from the flight crew that they will act as an intermediary. The controller should only use free text, with the following form:

Controller	UM 169ap RELAY TO [call sign] [facilityname] [text of message to be relayed] Where: • [call sign] is expressed as the radiotelephony call sign, rather than the ICAO three letter or IATA two letter designator; • [facilityname] is expressed as the radiotelephony name, not the 4-character code; and • [text of message to be relayed] conforms to the guidelines provided paragraph 3.1.1.4 and 4.2.2, e.g. CLEARS [call sign] CLIMB TO AND MAINTAIN FL340. *Note.— The use of standard message elements is prohibited because the intermediary aircraft's FMS could be unintentionally armed.*

Example:

Controller	UM 169ap RELAY TO UNITED345 OAKLAND CLEARS UNITED345 CLIMB TO AND MAINTAIN FL340
Flight crew	DM 3 ROGER
Flight crew	DM 67ae RELAY FROM UNITED345 CLIMBING FL340

Chapter 5. Flight crew procedures

5.1 Overview

5.1.1 Operational differences between voice communications and CPDLC

5.1.1.1 Development, testing, and operational experience have highlighted fundamental differences between CPDLC and voice communications. These differences need to be considered when developing or approving flight crew procedures involving the use of CPDLC.

5.1.1.2 For example, when using voice communications, each flight crew member hears an incoming or outgoing ATS transmission. With voice, the natural ability for each flight crew member to understand incoming and outgoing transmissions for their own aircraft has provided a certain level of situational awareness among the flight crew. With CPDLC, flight crew procedures need to ensure that the flight crew has an equivalent level of situational awareness associated with understanding the content and intent of a message in the same way.

5.1.1.3 The operator should develop flight crew procedures to ensure that each flight crew member (e.g. pilot flying and pilot monitoring - communicating) independently reviews each CPDLC uplink prior to responding and/or executing a clearance that it may contain and each CPDLC downlink message prior to transmission.

5.1.1.4 An operator who uses augmented crews should ensure procedures include instructions to flight crew carrying out 'handover' briefings. The flight crew member carrying out the 'handover' briefing should thoroughly brief the 'changeover' flight crew or flight crew member on the status of ADS-C and CPDLC, including a review of stored uplink and downlink CPDLC messages.

5.1.1.5 Uplink messages require special attention to prevent the flight crew from accepting a clearance but not complying with that clearance. When ATC sends an uplink message to an aircraft that is accepted (WILCO) by the flight crew, ATC expects the flight crew to comply with the clearance. An effective method for minimizing errors for CPDLC uplink messages is for each flight crew member to read the uplinked message independently (silently) before initiating a discussion about whether and how to act on the message. Reading a message independently is a key element to ensure that each flight crew member does not infer any preconceived intent different from what is intended or appropriate. Use of this method can provide a flight crew with an acceptable level of situational awareness for the intended operations.

5.1.1.6 In a similar manner, CPDLC downlink messages should typically be independently reviewed by each applicable flight crew member before the message is sent. Having one flight crew member (e.g. the pilot monitoring) input the message and having a different flight crew member (pilot flying) review the message before it is sent promotes an adequate level of situational awareness, comparable to or better than when using voice transmissions.

5.1.1.7 The flight crew should coordinate uplink and downlink messages using the appropriate flight deck displays. Unless otherwise authorized, the flight crew should not use printer-based information to verify CPDLC messages as printers are not usually intended for this specific purpose.

Note.— Printers may be used for other purposes in CPDLC operations, such as for archiving CPDLC messages.

5.1.2 Operational authorization to use CPDLC and ADS-C

5.1.2.1 The operator needs to be authorized by the State of the Operator or State of Registry to use CPDLC and ADS-C services in accordance with paragraph 3.2.

5.1.3 When to use voice and when to use CPDLC

5.1.3.1 When operating within airspace where CPDLC is available and local ATC procedures do not state otherwise, CPDLC should be the primary means of communication. Voice should be used as the backup communication medium (e.g. direct VHF, direct HF, third party HF, Satellite voice).

5.1.3.2 While the CPDLC message set defined in Appendix A provides for ATC communications, voice may be a more appropriate means depending on the circumstances, e.g. some types of non-routine communications. Refer to paragraph 5.8 for guidelines on use of voice and data communications in emergency and non-routine situations.

5.1.3.3 During an emergency, the flight crew would normally revert to voice communications. However, the flight crew may use CPDLC for emergency communications if it is either more expedient or if they are unable to establish voice contact. Refer to paragraph 5.8.2 for guidelines on use.

5.1.3.4 The response to a CPDLC message should be via CPDLC, and the response to a voice message should be via voice.

5.1.3.5 If a conflicting CPDLC and voice clearance/instructions is received, the flight crew should obtain clarification using voice.

5.1.3.6 If the intent of an uplinked message is uncertain, the flight crew should reject (UNABLE) the message. The flight crew may use either CPDLC or voice to confirm the intent of the message.

5.1.3.7 Regardless of whether CPDLC is being used as the primary means for communication, the flight crew should continuously monitor VHF/HF/UHF guard frequency. In addition, the flight crew should continuously maintain a listening or SELCAL watch on the specified backup or secondary frequency (frequencies). On aircraft capable of two SATCOM channels, one channel may be selected to the phone number for the radio facility assigned to the current flight information region (FIR) to enable timely voice communications with ATS. The second channel may be selected to the company phone number to enable timely voice communications with company dispatch.

5.1.4 Loss of SATCOM data communications

5.1.4.1 Aircraft crew alerting systems notify the flight crew when aircraft SATCOM data link system fails. When operating CPDLC over SATCOM for primary communications and the flight crew is notified of a failure of the SATCOM system, the flight crew should notify the air traffic service unit (ATSU) of the failure. Timely notification is appropriate to ensure that the ATSU has time to assess the situation and apply a revised separation standard, if necessary.

5.2 Logon

5.2.1 General

5.2.1.1 Data link systems such as the aircraft communication addressing and reporting system (ACARS) typically establish a connection with AOC dispatch ground automation systems automatically when the system is powered.

5.2.1.2 A CPDLC connection requires a successfully completed logon before the ATSU can establish a CPDLC connection with the aircraft. Refer to paragraph 2.2.2 for an overview of the logon.

5.2.1.3 Prior to initiating the logon, the flight crew should verify the following:

a) the aircraft identification provided when initiating the logon exactly matches the aircraft identification (Item 7) of the filed flight plan;

b) the flight plan contains the correct aircraft registration in Item 18 prefixed by REG/;

c) the flight plan contains the correct aircraft address in Item 18 prefixed by CODE/, when provided; and

d) the aircraft registration provided when initiating the logon exactly matches the aircraft placard, when the flight crew manually enters the aircraft registration. Refer to Appendix F, paragraph F.1 for aircraft types that require manual entry.

5.2.1.4 If any of the items in paragraph 5.2.1.3 do not match, the flight crew will need to contact AOC or ATC, as appropriate, to resolve the discrepancy.

Note 1: The aircraft identification entered into the FMS is either the ICAO designator for the aircraft operating agency followed by the flight identification or the aircraft registration, in accordance with ICAO Doc 4444.

Note 2.— The aircraft registration entered into the FMS can include a hyphen(-), even though the aircraft registration in the flight plan message cannot include a hyphen.

Note 3.- The ATSU correlates the data sent in a logon message with flight plan data. If the data does not match, the ATSU will reject the logon.

5.2.1.5 The flight crew should then manually initiate a logon in accordance with Table 5-2 using the 4-letter FIR location indicator or, if the logon address is different, as indicated on aeronautical charts (See Figure 5-1 for example).

Note.— Often the logon address is the same as the 4-letter FIR location identifier but in some airspace a different CPDLC logon address is used. Refer to Appendix E, paragraph E.1.

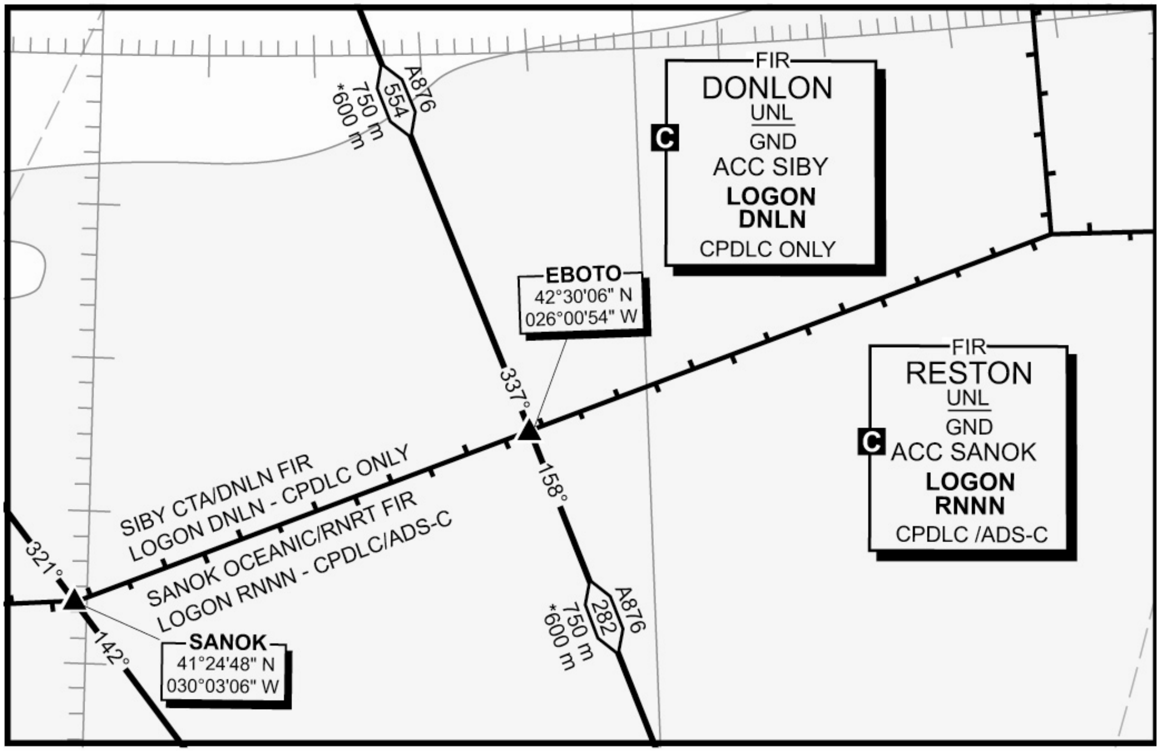


Figure 5-1. FIR designator and CPDLC logon address on en route chart

5.2.1.6 If after 10 minutes, there are no indications that the logon attempt was unsuccessful, the flight crew can assume that the system is functioning normally and that they will receive a CPDLC connection prior to entry into the FIR.

5.2.1.7 If the flight crew receives an indication that the logon attempt was unsuccessful, the flight crew should reconfirm that the logon data are correct per paragraphs 5.2.1.3 and 5.2.1.5 and reinitiate a logon.

5.2.1.8 Each time a connection is established, the flight crew should ensure the identifier displayed on the aircraft system matches the logon address for the controlling authority.

5.2.1.9 In the event of a disconnect, the flight crew should reinitiate an AFN logon to resume FANS 1/A data link operations.

5.2.1.10 The flight crew may receive a free text message from the ATSU or a flight deck indication regarding the use of the message latency timer on FANS 1/A+ aircraft. When these messages or indications are received, the flight crew should respond as described in Table 5-1 and in accordance with procedures for the specific aircraft type.

Table 5-1. Messages and indications regarding use of message latency timer

	Instruction to switch message latency timer off	
ATSU	CONFIRM MESSAGE LATENCY TIMER OFF	
Flight crew	**FANS 1/A+ aircraft**	**Message latency timer not available**
	The flight crew should: a) confirm that the message latency timer is off; and b) accept (ROGER) the uplink [free text] message.	The flight crew should accept (ROGER) the uplink [free text] message and append the [free text], TIMER NOT AVAILABLE.
	Instruction to set the maximum uplink delay value	
ATSU	SET MAX UPLINK DELAY VALUE TO [delayed message parameter] SECONDS where the [delayed message parameter] is an integer value, e.g., 360.	
Flight crew	**FANS 1/A+ aircraft**	**Message latency timer not available**
	The flight crew should: a) set the value; and b) accept (ROGER) the uplink message.	The flight crew should accept (ROGER) the uplink [free text] message and append the [free text], TIMER NOT AVAILABLE.
	Indication of delayed CPDLC uplink message (Some FANS 1/A+ aircraft only)	
ATSU/ aircraft system	(any CPDLC uplink message displayed with indication of delayed message)	
Flight crew	**Some FANS 1/A+ aircraft only**	
	The flight crew should: a) respond, appropriately, to close the message, i.e. reject all clearance and negotiation messages (UNABLE or NEGATIVE), or accept (ROGER) any message that cannot be rejected; b) when using CPDLC, send a free text message, as necessary, to provide the reason for rejecting the message, e.g., DELAYED CPDLC MESSAGE RECEIVED or NOT CONSISTENT, PLEASE RE-SEND; and c) if deemed necessary, further advise the controller of the situation and/or request verification of ATC intent, via CPDLC or voice.	

Note.— Refer to paragraph 4.2.7 for specific controller procedures. Refer to Appendix F, paragraph F.1, for availability of a FANS 1/A+ upgrade on different types of aircraft. Refer to Appendix F, paragraph F.11, for the specifications of the message latency timer on different types of aircraft.

5.2.2 When to initiate an AFN logon

5.2.2.1 When CPDLC and/or ADS-C services are available for the flight, the flight crew should initiate an AFN logon in accordance with the conditions provided in Table 5-2.

Table 5-2. Conditions for initiating logon

Condition(s)	When	Logon address of ATSU
Prior to takeoff, where permitted or required	No earlier that 45 minutes prior to ETD	Current ATSU for the FIR that the departure airport is located within
15 minutes or more prior to FIR boundary estimate	above 10,000 feet	Current ATSU for the FIR in which the aircraft is operating
Less than 15 minutes prior to FIR boundary estimate	above 10,000 feet	Next ATSU that provides CPDLC and/or ADS-C services for the FIR on that flight
Following an unsuccessful data link transfer to another ATSU (See also paragraph 5.2.3.8)	When detected by the flight crew or upon receipt of instruction from ATC	As instructed or per above

5.2.2.2 When the aircraft system/flight crew recognizes abnormal behavior of the CPDLC connection, the flight crew should terminate the connection and initiate a new AFN logon with the current ATSU.

5.2.3 Automatic transfer of CPDLC and ADS-C services between FIRs

5.2.3.1 When transferring CPDLC and ADS-C services between FIRs, the flight crew should not need to reinitiate a logon. Under normal circumstances, the current and next ATSUs automatically transfer CPDLC and ADS-C services. The transfer is seamless to the flight crew.

5.2.3.2 The flight crew should promptly respond to CPDLC uplinks to minimize the risk of an open CPDLC uplink message when transferring to the next ATSU.

Note. — *If a flight is transferred to a new ATSU with an open CPDLC message, the message status will change to ABORTED. If the flight crew has not yet received a response from the controller, the downlink request will also display the ABORTED status. Refer also to Appendix F, paragraph F.8.*

5.2.3.3 Prior to the point at which the current ATSU will transfer CPDLC and ADS-C services, the flight crew may receive a response to close any open CPDLC message.

5.2.3.4 Starting approximately 10 minutes prior to the FIR boundary, the pilot monitoring communications should look for the successful transfer from the current ATSU to the next ATSU by observing the change in the active center indication provided by the aircraft system.

5.2.3.5 Since the transfer of communications at FIR boundaries is not explicitly indicated to the receiving ATSU, the only way to confirm that it has taken place is for the aircraft and ATSU to exchange a CPDLC message. The exchange can be initiated by the crew, e.g. by transmitting a CPDLC POSITION REPORT [position report] report or some other CPDLC message, or by the ground (refer to Appendix E, paragraph E.2.2).

5.2.3.6 When notified that a new active CPDLC connection has been established, and if entering an FIR that requires the crew to send a CPDLC position report to confirm current data authority status (refer Appendix E, paragraph E.2.2), the flight crew should send a CPDLC position report without delay unless advised through a CONTACT or MONITOR instruction of a specific transfer point.

5.2.3.7 Where the normal mode is for the ground to initiate the exchange to confirm CDA (or when transmission of the required message is unduly delayed), the ATSU will initiate the process by transmitting a message requiring a response from the aircraft or flight crew.

5.2.3.8 If the automatic transfer does not occur at the FIR boundary and if leaving a FIR that requires a CPDLC position report to confirm current data authority status (refer Appendix E, paragraph E.2.2), the flight crew should:

a) send a CPDLC position report to the transferring ATSU after crossing the boundary, and then

b) if the connection is not transferred within 3 minutes after sending a CPDLC position report, the flight crew should terminate the current CPDLC connection and initiate a logon with the next ATSU.

5.2.3.9 If the automatic transfer does not occur at the FIR boundary and if leaving a FIR that does not use a CPDLC position report to confirm current data authority status the flight crew should contact the transferring ATSU by voice or CPDLC free text advising them that the transfer has failed.

5.2.4 Transfer voice communications with the CPDLC connection transfer

5.2.4.1 Prior to crossing the boundary, the active center may initiate transfer of voice communications with the CPDLC connection transfer using any of the message elements containing CONTACT or MONITOR. Refer to paragraph 4.1.5 for guidelines on the controller's use of these message elements.

5.2.4.2 A CONTACT or MONITOR uplink message instructs the flight crew to change to the specified frequency and may include a position or time for when to change to the new frequency.

a) When the flight crew receives a MONITOR uplink message, they should change to the specified frequency upon receipt of the instruction or at the specified time or position. The flight crew should not establish voice contact on the frequency.

b) When the flight crew receives a CONTACT messages, they should change to the specified frequency upon receipt of the instruction or at the specified time or position, and establish voice contact on the frequency.

Note.— If the next ATSU provides CPDLC services, the flight crew should not expect that CPDLC will be terminated or suspended once voice contact is established per receipt of a CONTACT message, unless otherwise advised per paragraph 4.1.4.6.

5.2.4.3 If the ATSU assigns a single HF frequency for backup, the flight crew should select another frequency from the same 'family' as a secondary frequency.

Note.— In areas of poor radio coverage, the controller may append the message SECONDARY FREQUENCY [frequency] to specify a secondary frequency.

5.2.5 Exiting CPDLC and ADS-C service areas

5.2.5.1 Approximately 15 minutes after exiting CPDLC and ADS-C service areas, the flight crew should ensure there are no active CPDLC or ADS-C connections. Ensuring that connections are not active eliminates the possibility of inadvertent or inappropriate use of the connections, and reduces operating costs and loading of the system.

Note.— Some ATSUs may maintain ADS contracts with an aircraft for a period of time (e.g. 15 minutes) after the aircraft has left the airspace.

Note.— The flight crew should not inadvertently select ADS-C emergency mode when selecting ADS-C OFF.

5.3 CPDLC – ATS uplinks

5.3.1 General

5.3.1.1 To ensure situational awareness is maintained, when a CPDLC uplink is received, each flight crew member should read the message independently. Once the message has been independently read, the flight crew should then discuss whether to accept or reject the message.

5.3.1.2 Due to constraints associated with use of the flight deck printer, the flight crew should read CPDLC messages using the flight deck displays.

5.3.1.3 When processing an uplink multi-element message, the flight crew should carefully refer to screen page numbers to ensure that the entire uplink has been read and understood in the correct sequence prior to responding.

Note.— An uplink multi-element message contains multiple clearances and/or instructions. It is possible for CPDLC multi-element messages to be displayed on more than one screen page.

Example:

Controller	CLIMB TO AND MAINTAIN FL350. REPORT LEAVING FL330. REPORT LEVEL FL350.
Flight crew	WILCO

5.3.1.4 If the flight crew cannot comply with any portion of a multi-element message, the flight crew will need to reject (UNABLE) the entire message, and should not execute any clearance portion of the message.

Note.— The flight crew can only provide a single response to the entire multi-element uplink message. The flight crew cannot respond to individual elements of a multi-element message.

5.3.1.5 When uplinks are accepted (WILCO), the flight crew should take appropriate actions to comply with the clearance or instruction and, if necessary, properly configure the aircraft data link system to receive subsequent uplink messages.

Note.— The flight crew may need to perform some action before another subsequent CPDLC message can be displayed or they may miss it.

5.3.1.6 The flight crew should respond to an uplink message with the appropriate response, e.g. WILCO or UNABLE, as provided in Appendix A, paragraph A.3.

5.3.1.7 When the flight crew receives a message containing only free text, or a free text element combined with elements that do not require a response, they should respond to the free text with a ROGER response before responding to any query that may be contained in the free text message element.

Example:

Controller (free text)	REPORT GROUND SPEED.
Flight crew	ROGER
Flight crew (free text)	GS 490

5.3.2 Flight crew response times for uplinked messages

5.3.2.1 System performance requirements have been established to support reduced separation standards. Specific latency times have been allocated to the technical performance, based on flight crew and controller response times. Regional/State monitoring agencies monitor performance to ensure the technical and operational components of the system meet required standards. To support RCP 240 operations (e.g. 30 nautical mile longitudinal separation) the flight crew should respond to an uplink message within one minute.

Note.— Transmission times for messages may vary for a number of reasons including the type of transmission media, network loading, or the criteria for transitioning from one media to another, e.g. VHF/Satcom. Operational response times may vary depending on workload and complexity of the instruction or clearance.

5.3.2.2 Flight crew procedures should be developed to respond to uplinks as soon as practical after they are received. For most uplinks, the flight crew will have adequate time to read and respond within one minute. However, the flight crew should not be pressured to respond without taking adequate time to fully understand the uplinked message and to satisfy other higher priority operational demands.

5.3.2.3 If the flight crew determines they will need a significant amount of time to respond to a message, they should send a STANDBY response.

5.3.2.4 If the flight crew has sent a STANDBY response, they should provide a closure response to the uplink within a reasonable period of time, e.g. 5 minutes, or as required.

Note.— The uplink message remains open. If the flight crew does not subsequently respond, the controller will query the flight crew per paragraph 4.2.1.3.

5.3.3 Conditional clearances

5.3.3.1 Conditional clearances require special attention by the flight crew. Following guidelines provided in paragraphs 5.1.1 and 5.3.1, such as each flight crew member independently reading the uplinked clearances and conducting briefings with augmented crews, should aid in reducing errors.

5.3.3.2 An operator should specify procedures to ensure that the flight crew correctly responds to conditional clearances taking into account the guidelines provided herein and any automation features provided by the aircraft systems.

5.3.3.3 An operator should ensure that their training and qualification program clearly addresses use of words "AT" or "BY" as used in conditional clearances, particularly for a non-native English speaking flight crew. Table 5-3 clarifies the intended meaning for conditional clearance message elements. (Refer also to Appendix A, paragraph A.2.)

Table 5-3. Conditional clearance clarification of vertical clearances

Message Intent	Message element
Instruction that at the specified time a climb to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that, NOT BEFORE the specified time, a climb to the specified level is to commence and, once reached, the specified level is to be maintained.* *Note 2.— Precede this message element with MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [time] CLIMB TO [level]** Or *AT [time] CLIMB TO AND MAINTAIN [altitude]*
Instruction that at the specified position a climb to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that, AFTER PASSING the specified position, a climb to the specified level is to commence and, once reached, the specified level is to be maintained.* *Note 2.— Precede this message element with MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [position] CLIMB TO [level]** Or *AT [position] CLIMB TO AND MAINTAIN [altitude]*
Instruction that at a specified time a descent to a specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that, NOT BEFORE the specified time, a descent to the specified level is to commence and, once reached, the specified level is to be maintained.* *Note 2.— Precede this message element with MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [time] DESCEND TO [level]** Or *AT [time] DESCEND TO AND MAINTAIN [altitude]*

Message Intent	**Message element**
Instruction that at the specified position a descent to the specified level is to commence and once reached the specified level is to be maintained. _Note 1_.— *Instruction that, AFTER PASSING the specified position, a descent to the specified level is to commence and, once reached, the specified level is to be maintained.* _Note 2_.— *Precede this message element with MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [position] DESCEND TO [level]** Or *AT [position] DESCEND TO AND MAINTAIN [altitude]*
Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. _Note_.— *Instruction that a climb is to commence at a rate such that the specified level is reached NOT LATER THAN the specified time.*	CLIMB TO REACH [level] BY [time]
Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. _Note_.— *Instruction that a climb is to commence at a rate such that the specified level is reached BEFORE PASSING the specified position.*	CLIMB TO REACH [level] BY [position]
Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. _Note_.— *Instruction that a descent is to commence at a rate such that the specified level is reached NOT LATER THAN the specified time.*	DESCEND TO REACH [level] BY [time]
Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. _Note_.— *Instruction that a descent is to commence at a rate such that the specified level is reached BEFORE PASSING the specified position.*	DESCEND TO REACH [level] BY [position]

5.3.4 "EXPECT" uplinks

5.3.4.1 Contrary to ICAO Doc 4444 requirements and associated guidelines provided at Appendix A, paragraph A.2, it is possible that an ATSU will uplink an unsolicited EXPECT message, such as EXPECT CLIMB AT [time], which provides advice to the flight crew of the extent of the delay before a requested level becomes available. The operator should ensure that their flight crews are trained not to execute an EXPECT message as if it were a clearance. The training should include procedures, consistent with ICAO standards, for handling EXPECT messages in the event of a total communication failure (loss of data and voice).

5.3.5 Uplinks containing FMS-loadable data

5.3.5.1 One of the safety advantages of using CPDLC is the capability to exchange route clearance messages that can be automatically loaded directly into an FMS. The flight crew can use this capability to minimize the potential for data entry errors when executing clearances involving loadable data. It also enables advanced data link operations, such as a reroute or a tailored arrival, as described in Chapter 6, which otherwise may not be possible via voice.

5.3.5.2 If a clearance is received that can be automatically loaded into the FMS, the flight crew should load the clearance into the FMS and review it before accepting (WILCO) the clearance.

5.3.5.3 The flight crew should verify that the route modification in the FMS is consistent with the clearance and the aircraft active flight plan does not contain any discontinuities.

5.3.5.4 The flight crew should reject (UNABLE) the clearance when:

a) the FMS indicates that it cannot load the clearance (e.g. partial clearance loaded or unable to load); or

Note.— The FMS checks the clearance to ensure it is correctly formatted and compatible with the FMS navigation database.

b) the FMS indicates any inconsistencies or discontinuities with the route modification that are not addressed by AIPs or local procedures.

5.3.5.5 The flight crew should use CPDLC or voice to clarify a rejected clearance due to any loading failures, route discontinuities or inconsistencies.

5.3.5.6 If the clearance loads successfully and is acceptable, the flight crew may execute an FMS route modification and accept (WILCO) the clearance.

5.4 CPDLC – ATS downlinks

5.4.1 General

5.4.1.1 Downlink messages can only be sent to the ATSU that is the active ATSU. To provide situational awareness, procedures should ensure that each flight crew member has read each downlink message before it is sent.

5.4.1.2 When the aircraft has an active CPDLC connection with an ATSU, the flight crew should downlink a clearance request only if the flight is in that ATSU's airspace.

5.4.1.3 The flight crew should use standard downlink message elements to compose and send clearance requests, CPDLC position reports, and other requested reports. Additional qualifying standard message elements, such as DUE TO WEATHER, should also be used as needed.

Note.— The use of standard message elements will minimize the risk of input errors, misunderstandings, and confusion, and facilitate use by a non-native English speaking flight crew. The use of standard message elements allows the aircraft and ground systems to automatically process the information in the messages that are exchanged. For example, the flight crew can automatically load clearance information into the FMS and review the clearance, the ground system can automatically update flight plan data for route conformance monitoring, and both aircraft and ground systems can associate responses to messages.

5.4.1.4 To avoid potential ambiguity, the flight crew should avoid sending multiple clearance requests in a single downlink message. For example, the flight crew should send separate downlink messages for REQUEST CLIMB TO [level] and REQUEST DIRECT TO [position] unless there is an operational need to combine them in a single message (i.e., the flight crew does not want to climb unless they can reroute).

5.4.1.5 If the flight crew:

a) Does not receive a controller response to an open CPDLC downlink message within a reasonable time period and no error message has been received indicating that the message was not delivered; or

b) Receives a STANDBY message in response to an open CPDLC downlink message but does not receive a closure response within a reasonable period of time, e.g. 5 minutes; then

the flight crew should send a query using one of the Negotiation Requests messages or a [free text] message rather than resending the clearance request message. This is to avoid having multiple open downlink messages for the same request. Alternatively, they may use voice communication to clarify the status of the open downlink.

Example:

Flight crew	REQUEST CLIMB TO FL350
	Reasonable period of time has passes
Flight crew	WHEN CAN WE EXPECT HIGHER ALTITUDE (or LEVEL) or WHEN CAN WE EXPECT CLIMB TO FL350

5.4.1.6 If the flight crew receives an indication of non-delivery of a downlink message, they may elect to re-send an identical message. Alternatively, they may use voice communication to clarify the status of the downlink.

5.4.2 Free text

5.4.2.1 While the flight crew should avoid the use of the free text message element, its use may offer a viable solution to enhance operational capability, given due consideration to local conditions and limitations with the use of standard message elements.

5.4.2.2 Free text messages should be used only when an appropriate standard message element does not exist.

5.4.2.3 When composing a free text message, the flight crew should use standard ATS phraseology and format and avoid nonessential words and phrases. Abbreviations should only be included in free text messages when they form part of standard ICAO phraseology, for example, ETA.

5.4.3 Unsupported messages

5.4.3.1 Whilst ATSUs should provide CPDLC service using the complete message set provided in Appendix A, some ATSUs provide a CPDLC service using a limited message set. The operator should ensure that its flight crews are aware of any unsupported downlink message elements that are described in regional or State documentation.

5.4.3.2 If the flight crew sends a downlink message containing a message element that is not supported by the ATSU, they will typically receive the uplink message, MESSAGE NOT SUPPORTED BY THIS ATS UNIT, rather than terminating the connection. If the flight crew receives this message, they should accept (ROGER) the message and use voice for the communication transaction.

5.4.4 CPDLC reports

5.4.4.1 The flight crew should ensure that they respond to CPDLC reports when appropriate.

Note.— ATSUs may send a CPDLC message that combines a REPORT instruction with a clearance. The flight crew may use automation, procedures, and/or a combination to remind them when to send the reports requested in the CPDLC message.

Example:

Controller	CLIMB TO AND MAINTAIN FL350. REPORT LEAVING FL330. REPORT LEVEL FL350.
Flight crew	WILCO

5.5 Automatic dependant surveillance – contract (ADS-C)

5.5.1 General

5.5.1.1 ADS-C allows the ATSU to receive position reports automatically from the aircraft to update the flight plan, check vertical and route conformance and provide emergency alerting.

5.5.1.2 In airspace where ADS-C services are available, the flight crew need not send position reports via voice or CPDLC, except as described in paragraph 5.6.3 or when required by AIPs or regional supplementary procedures.

5.5.1.3 When using ADS-C services, the flight crew should check to ensure ADS-C is enabled prior to initiating a logon with an ATSU.

Note.— The flight crew can switch ADS-C off, which will cancel any ADS-C connections with the aircraft. While ADS-C is disabled, the ground system will not be able to establish an ADS-C connection.

5.5.1.4 Normally, the flight crew should leave ADS-C enabled for the entire flight. However, in airspace where ADS-C services are available, if the flight crew switches ADS-C off for any reason, or they receive indication of ADS-C failure, the flight crew should advise ATC and follow alternative procedures for position reporting per paragraphs 5.6 and 5.8.4.4.

5.5.1.5 In airspace where ADS-C services are not available, the flight crew may switch ADS-C off to cancel inadvertent ADS-C connections. In such cases, the flight crew should ensure that ADS-C is enabled when re-entering airspace where ADS-C services are again available.

5.5.1.6 If ADS-C is disabled in an ADS-C environment, the ATSU may send the flight crew an inquiry per paragraph 5.8.4.5.

5.6 Position reporting

5.6.1 General

5.6.1.1 The flight crew should ensure that waypoints are sequenced correctly. If an aircraft passes abeam a waypoint by more than the aircraft FMS waypoint sequencing parameter while flying in heading selected mode, the flight crew should sequence the waypoint in the FMS by executing a track offset that is within FMS waypoint sequencing parameters or flying direct to the next relevant waypoint.

Note.— As shown in Figure 5-2, when an aircraft passes abeam a waypoint in excess of the defined sequencing parameter (refer to Appendix F, paragraph F.7) for specific aircraft types), the FMS will not sequence the active waypoint. If the flight crew does not sequence the waypoint, incorrect information will be contained in ADS-C reports, CPDLC position reports and FMC waypoint position reports – the next waypoint in these reports will actually be the waypoint that the aircraft has already passed.

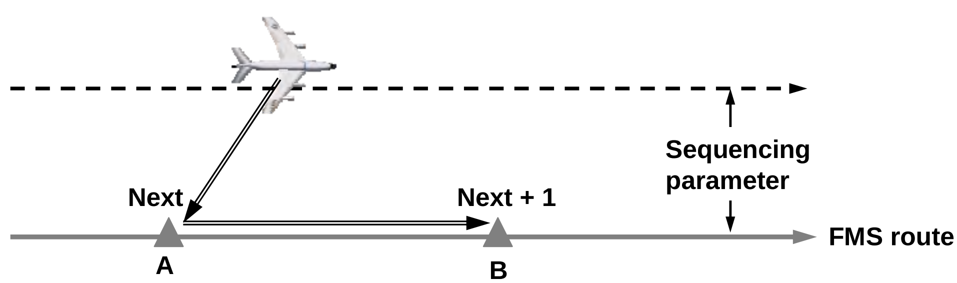


Figure 5-2. Waypoint sequencing anomaly

5.6.1.2 The flight crew should include in any CPDLC downlink message or FMC WPR, latitudes and longitudes encoded as waypoint names in the ICAO format. The flight crew should not use the ARINC 424 format.

Note 1.— ADS-C reports contain latitudes and longitudes rather than the identifier of the waypoint. Therefore, ARINC 424 waypoints do not affect ADS-C reporting.

Note 2.— ARINC 424 describes a 5-character latitude/longitude format for aircraft navigational database. (e.g. 10N40 describes a lat/long of 10N140W). This format is not an ICAO format and, therefore, the ATSU may reject any downlink message containing waypoint names in the ARINC 424 format.

5.6.2 Position reporting in a non-ADS-C environment

5.6.2.1 When ADS-C is not available, the flight crew should conduct position reporting by voice or CPDLC. When using CPDLC, the flight crew should send either automatically or manually POSITION REPORT [position report] whenever an ATC waypoint is sequenced, (or passed abeam when offset flight is in progress).

5.6.2.2 When using CPDLC for position reporting, the flight crew should ensure that the position and next position information applies only to compulsory reporting points unless requested otherwise by ATC. The ensuing significant point may be either the compulsory or non-compulsory reporting point after the next position (Refer AIREP form ICAO Doc 4444, Appendix 1).

5.6.2.3 When using CPDLC for position reporting, the flight crew should send position reports only at compulsory reporting points or on request.

5.6.3 Position reporting in an ADS-C environment

5.6.3.1 The flight crew should not insert non-ATC waypoints (e.g. mid-points) in cleared segments of the aircraft active flight plan.

Note.— If the flight crew inserts non-ATC waypoints into the aircraft active flight plan and activates the change, the aircraft system may trigger an ADS-C waypoint change event report at the non-ATC waypoint, or include information about the non-ATC waypoint in the predicted route group, as well as the intermediate and fixed projected intent groups. As a result, the ADS-C report will include information about the non-ATC waypoint, which is not expected by the ATC ground system.

5.6.3.2 When reporting by ADS-C only, the flight crew should not remove ATC waypoints even if they are not compulsory reporting points.

5.6.3.3 In an ADS-C environment, unless otherwise instructed, the flight crew should not provide voice or CPDLC position reports.

Note.— Some ATSPs require a single CPDLC position report, even when in an ADS-C environment, to provide the controlling ATSU confirmation that it is the current data authority and the only ATSU able to communicate with the aircraft via CPDLC (refer to Appendix E, paragraph E.2.2). If required by AIP or regional supplementary procedures, the flight crew will need to provide a position report when either of the following events occurs:

a) An initial CPDLC connection is established; or

b) The CPDLC connection transfer has been completed, i.e., at the associated FIR boundary entry position.

5.6.3.4 In an ADS-C environment, the flight crew should not provide revised waypoint estimates by CPDLC or voice, except under conditions in certain airspace as stipulated in Appendix E, paragraph E.2.6.

5.6.4 Position reporting using FMC WPR

5.6.4.1 The flight crew should verify the aircraft identification (ACID) is correct per filed flight plan.

5.6.4.2 When FMC waypoint position reports are manually initiated, the flight crew should send the report within 3 minutes of crossing each waypoint. If this cannot be achieved, the FMC WPR should not be triggered, but a voice report made instead.

5.6.4.3 The flight crew may assume that the estimate for the next waypoint, shown on the FMS at the time a waypoint is crossed, is the estimate transmitted to ATC in the FMC waypoint position report. If that estimate subsequently changes by more than 2 minutes, the flight crew should transmit a revised estimate via voice to the ATSU concerned as soon as possible.

5.6.4.4 The flight crew should avoid inserting non-ATC waypoints (e.g. mid-points) in route segments because as non-ATC waypoints may prevent the provision of proper ETA data in the FMS reports required for ATC purposes.

5.6.4.5 If the flight identification portion of the aircraft identification contains an alphabetic character (such as ABC132A or ABC324W, where 132A or 324W is the flight identification) the flight cannot participate in FMC WPR (see paragraph 3.4.1.4 for more information regarding this limitation). The flight crew should not use the initial contact procedures in Appendix E, paragraph E.2.1.1, but should revert to normal voice procedures.

5.7 Weather deviations and offsets

5.7.1 General

5.7.1.1 The flight crew may use CPDLC to request a weather deviation clearance or an offset clearance. The difference between a weather deviation and an offset are portrayed in Figure 5-3.

a) A weather deviation clearance authorizes the flight crew to deviate up to the specified distance at their discretion in the specified direction from the route in the flight plan.

b) An offset clearance authorizes the flight crew to operate at the specified distance in the specified direction from the route in the flight plan. A clearance is required to deviate from this offset route.

5.7.1.2 Flight crews should use the correct message element when requesting an off-route clearance.

Note.— The difference between a weather deviation and an offset affects how ATC separate aircraft.

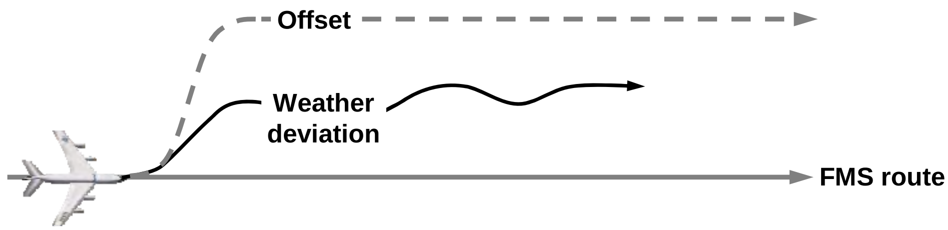


Figure 5-3. Offset and weather deviation

5.7.2 Weather deviation requests and offsets

5.7.2.1 When requesting a weather deviation or offset clearance, the flight crew should specify the distance off route with respect to the cleared route of the aircraft. If the flight crew has received a off-route clearance and then requests and receives a subsequent off-route clearance, the new clearance supersedes the previous clearance (i.e. only the most recent clearance is valid).

Example 1: As shown in Figure 5-4, the flight crew requests a weather deviation clearance to operate up to 20NM left of route. The controller issues the appropriate clearance.

Flight crew	REQUEST WEATHER DEVIATION UP TO 20NM LEFT OF ROUTE
Controller	CLEARED TO DEVIATE UP TO 20NM LEFT OF ROUTE REPORT BACK ON ROUTE
Flight crew	WILCO

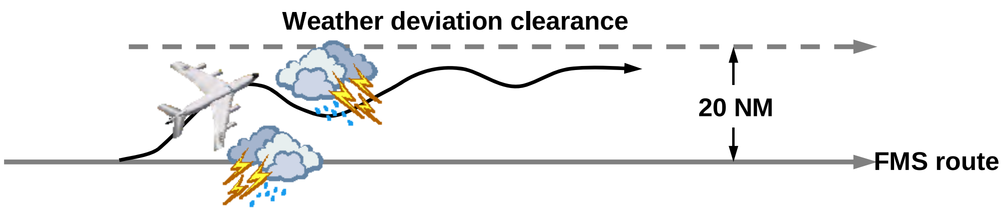


Figure 5-4. Weather deviation clearance up to 20 NM left of route

Example 2: As shown in Figure 5-5, the flight crew is operating on a weather deviation clearance up to 20 NM left of route and then requests another weather deviation clearance to operate up to a further 30NM left of route. They specify the deviation distance in the clearance request based on the cleared route rather in relation to the current weather deviation clearance. The controller issues the appropriate clearance.

Flight crew	REQUEST WEATHER DEVIATION UP TO 50NM LEFT OF ROUTE

Controller	CLEARED TO DEVIATE UP TO 50NM LEFT OF ROUTE REPORT BACK ON ROUTE
Flight crew	WILCO

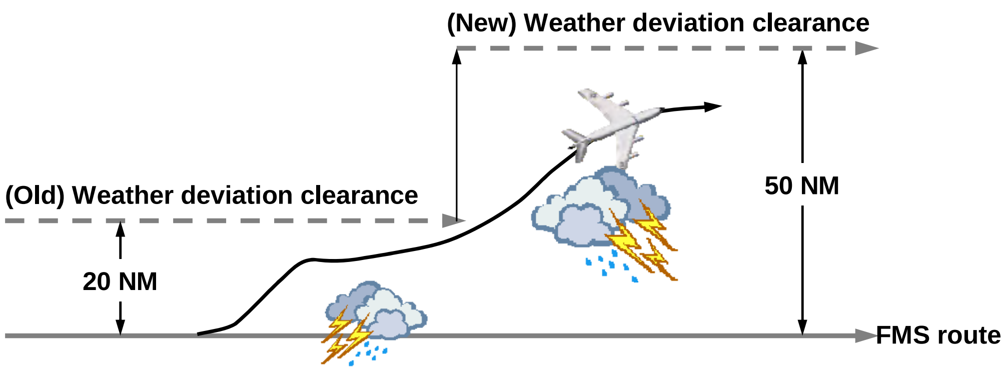


Figure 5-5. Subsequent weather deviation clearance up to 50 NM left of route

Example 3: As shown in Figure 5-6, the aircraft then requests a weather deviation clearance to operate 30NM right of route. The controller issues the appropriate clearance. The flight crew expeditiously navigates from one side of route to the other in accordance with the above clearance.

Note.— The ATSU applies the appropriate separation standards during the maneuvers.

Flight crew	REQUEST WEATHER DEVIATION UP TO 30NM RIGHT OF ROUTE
Controller	CLEARED TO DEVIATE UP TO 30NM RIGHT OF ROUTE REPORT BACK ON ROUTE
Flight crew	WILCO

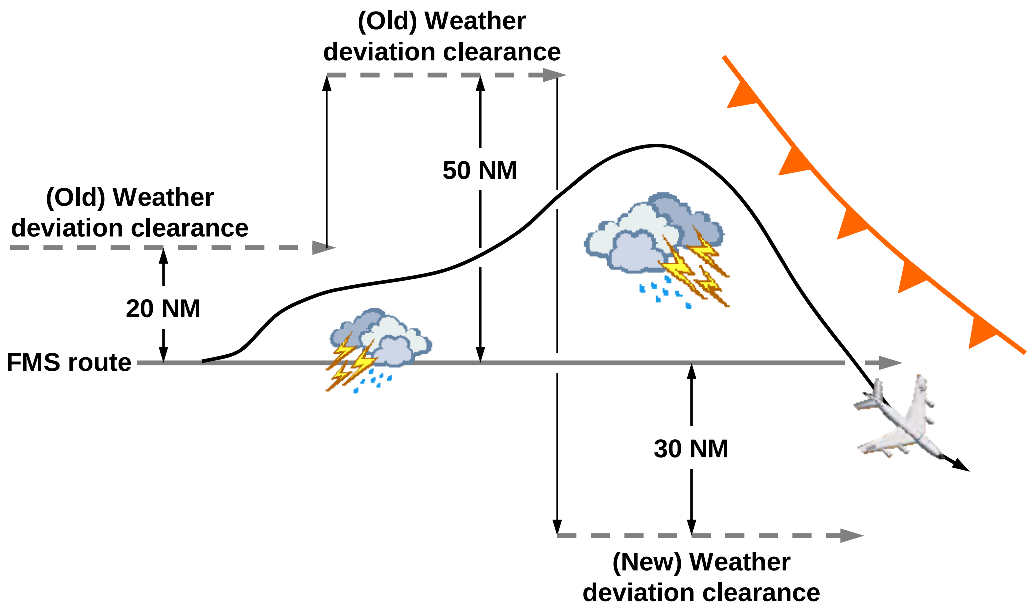


Figure 5-6. Subsequent weather deviation clearance up to 30 NM right of route

5.7.3 Deviations either side of route

5.7.3.1 There are a number of valid formats for the CPDLC [direction] variable. A number of aircraft types, however, can only request one direction (left or right) in weather deviation requests. When operating these aircraft types, the flight crew should request a deviation left and right of route using the following procedures:

a) Construct a weather deviation request for a deviation on one side of route using REQUEST WEATHER DEVIATION UP TO [specified distance] [direction] OF ROUTE; and

b) Append free text AND [specified distance] [direction] describing the distance to the other side of route.

Example: The flight crew requests a deviation left and right of route. The controller issues the appropriate clearance.

Flight crew	REQUEST WEATHER DEVIATION UP TO 20NM LEFT OF ROUTE. AND 20NM RIGHT
Controller	CLEARED TO DEVIATE UP TO 20NM EITHER SIDE OF ROUTE REPORT BACK ON ROUTE
Flight crew	WILCO

5.7.4 Reporting back on route

5.7.4.1 When the flight crew no longer needs the deviation clearance and is back on the cleared route, the flight crew should send the report BACK ON ROUTE.

a) If during the weather deviation, the flight crew receives a clearance to proceed direct to a waypoint – and the flight crew accepts (WILCO) this clearance – the aircraft is considered to be on a cleared route. Therefore, the flight crew should send the BACK ON ROUTE report after they execute the "direct to" clearance.

b) If the aircraft is off route on a weather deviation clearance and proceeding direct to a waypoint on the cleared route, the flight crew should not send the BACK ON ROUTE report until they have sequenced the waypoint on the cleared route.

Note.— If a BACK ON ROUTE report is received while the aircraft is still off-route, the incorrect information provided to ATC may affect the separation standards in use. Alternatively, the flight crew may consider requesting a clearance direct to the waypoint – on receipt of the uplink clearance, the procedure specified in item a) applies.

5.8 Emergency and non-routine procedures

5.8.1 Emergency procedures - general

5.8.1.1 In accordance with established procedures, the ATSU within whose airspace the aircraft is operating remains in control of the flight. If the flight crew takes action contrary to a clearance that the controller has already coordinated with another sector or ATSU and further coordination is not possible in the time available, then the flight crew performs this action under their emergency command authority.

5.8.1.2 The flight crew will use whatever means are appropriate, i.e. CPDLC and/or voice, to communicate during an emergency.

5.8.1.3 During an emergency, a controller would normally expect the flight crew to revert to voice communications. However, the flight crew may use CPDLC for emergency communications if it is either more expedient to do so or if they are unable to establish voice contact.

5.8.2 CPDLC and ADS-C emergency

5.8.2.1 The flight crew may use CPDLC to indicate an emergency situation or degraded operations to an ATSU by sending either a MAYDAY MAYDAY MAYDAY or PAN PAN PAN message.

5.8.2.2 The flight crew may be required to enter SOULS on BOARD during preflight preparation, prior to initiating a logon, or prior to sending the emergency message.

5.8.2.3 The flight crew should use the CPDLC emergency downlink message MAYDAY MAYDAY MAYDAY to automatically select the ADS-C function to emergency mode. The flight crew should only use ADS-C emergency mode when situations prohibit sending a CPDLC emergency message (e.g. in an ADS-C only environment).

5.8.2.4 If the flight crew inadvertently sends a CPDLC emergency downlink message or resolves the emergency situation, they should send CANCEL EMERGENCY, as soon as possible, to advise the controller and automatically set the ADS-C emergency mode to off. After sending CANCEL EMERGENCY, the flight crew should confirm the status of the flight and their intentions via either voice or CPDLC.

5.8.2.5 To check for inadvertent activation of the ADS-C emergency mode using CPDLC, the controller may send the following CPDLC free text uplink or use similar phraseology using voice communication.

Controller	CONFIRM ADS-C EMERGENCY

The flight crew should then check the status of the aircraft's ADS-C emergency mode and if the emergency mode has been activated inadvertently, the flight crew should select ADS-C emergency mode to off and advise the controller either by voice or by the following CPDLC messages.

Flight crew	ROGER, then (free text) ADS-C RESET

5.8.3 Voice communications

5.8.3.1 When CPDLC fails and the flight crew reverts to voice communications, they should consider all open messages not delivered and re-commence any dialogues involving those messages by voice.

5.8.3.2 The flight crew should use the standard voice phraseology under certain conditions as indicated in Table 5-4.

5.8.3.3 Except as provided in this paragraph 4.7.4, voice communication procedures related to data link operations are not standardized among the regions. Refer to Appendix E, paragraph E.2 for voice communication procedures for a specific region.

Table 5-4. Voice phraseology related to CPDLC

Condition	Voice phraseology
To advise ATC that the CPDLC connection is being terminated manually and logon is being initiated with the next ATSU.	CPDLC CONNECTION WITH [current ATSU] TERMINATED. LOGGING ON TO [subsequent ATSU] *Note.— The flight crew may use the ICAO four-character codes or plain language at his/her discretion.*
To advise ATC that the transmission is being made due to a CPDLC failure.	CPDLC FAILURE *Note.— This phraseology is included only with the first transmission made for this reason.*
To advise ATC that a delayed CPDLC uplink has been received.	DELAYED CPDLC MESSAGE RECEIVED *Note.— See paragraph 5.2.1.10 and Appendix F, paragraph F.11 for associated procedures.*

Condition	Voice phraseology
To advise ATC that a logon is being initiated following restoration of data link service.	LOGGING ON TO [facility designation]

5.8.4 Data link system failures

5.8.4.1 The flight crew should inform the ATSU for aircraft failure resulting in degraded performance below what is required, e.g. RCP 240, as well, e.g. Satcom failure and switch to HFDL.

5.8.4.2 When the flight crew has been notified that the data link service has shut down, they should terminate the CPDLC connection and use voice until informed by the ATSU that the data link system has resumed normal operations.

5.8.4.3 In the event of an aircraft data link system failure, the flight crew should inform the ATSU of the situation using the following voice phraseology:

Flight crew	DATA LINK FAILED. SELECTING ATC COMM OFF. CONTINUING ON VOICE
Controller	ROGER. CONTINUE ON VOICE

The flight crew should continue to use voice until the functionality of the aircraft system can be re-established.

5.8.4.4 If only the ADS-C service is terminated, then during that time period, the flight crew should conduct position reporting (via CPDLC, if available, or via voice).

5.8.4.5 If the ATSU cannot establish ADS-C contracts with an aircraft, or if ADS-C reporting from an aircraft ceases, the flight crew may have inadvertently switched ADS-C off. If CPDLC is still available and the flight crew receives the free text message CONFIRM ADS-C ARMED, they should check to ensure that ADS-C is not switched off and respond to the controller as follows:

Controller	CONFIRM ADS-C ARMED
Flight crew	ROGER

5.8.5 Using CPDLC to relay messages

5.8.5.1 When an ATSU and an aircraft cannot communicate, the controller may use CPDLC or voice to relay messages. When using CPDLC and depending on circumstances, the controller may first confirm that the CPDLC-capable aircraft is in contact with the subject aircraft, and obtain concurrence from the flight crew that they will act as an intermediary. After sending ROGER, the flight crew should only use free text to respond to the controller's uplink free text message.

Example:

Controller	Format: RELAY TO [call sign] [unit name] [text of message to be relayed] RELAY TO UNITED345 OAKLAND CLEARS UNITED345 CLIMB TO AND MAINTAIN FL340
Flight crew	ROGER
Flight crew	Format: RELAY FROM [call sign] [response parameters] RELAY FROM UNITED345 CLIMBING FL340

5.8.5.2 The flight crew should reject any uplink CPDLC message intended for relay to another aircraft that is not free text to avoid confusion.

Chapter 6. Advanced data link operations

6.1 Reroute procedures

6.1.1 General

6.1.1.1 When rerouting an aircraft, the flight crew, AOC and each ATSU should follow standardized procedures using appropriate CPDLC message elements.

6.1.1.2 The availability of new weather forecasts on long haul routes may provide the potential for economic and/or safety benefits for operators by allowing them to propose revised routes for airborne aircraft.

6.1.1.3 The flight crew may initiate a reroute request. Each ATSU along the route may initiate an amended route clearance.

6.1.1.4 For flights that cross FIR boundaries between two automated ATSUs, the ATSUs can coordinate revised route information, reducing the requirement for AOC to transmit modification messages to all the ATSUs along the route.

6.1.2 Reroute procedures – AOC initiated (DARP)

6.1.2.1 The purpose of the dynamic airborne reroute procedure (DARP) is to allow aeronautical operational control (AOC) to initiate the process for an airborne aircraft to be issued an amended route clearance by the ATSU.

6.1.2.2 These procedures should only be used where the reroute will occur in FIRs where DARP services are available (Refer to Appendix E).

Note.— DARP service requires Air Traffic Services Interfacility Data Communications (AIDC) to permit the electronic exchange of revised route information.

6.1.2.3 To be eligible for DARP, the operator will need an operational CPDLC capability. Additionally, the flight crew should downlink the route request:

a) At least 60 minutes prior to the next FIR boundary to permit AIDC messaging to take place between the affected ATSUs. This time period may be reduced between ATSUs that support AIDC CDN messaging to coordinate the modification of route information; and

b) At least 20 minutes prior to the divergence waypoint to allow processing time by the ATSU and the flight crew.

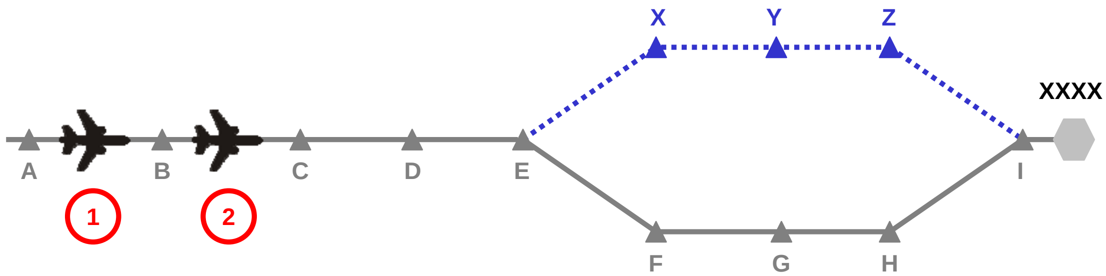
Note.— A downlink route request may be made to a new ATSU immediately after crossing the FIR boundary provided the above requirements are still met

6.1.2.4 Table 6-1 provides the procedures for an AOC initiated reroute and Figure 6-1 provides an overview of the DARP process.

Table 6-1. AOC initiated reroute procedures

Who	**Procedures**
AOC (Step 1)	a) The AOC should generate the amended route in compliance with standard UPR flight planning requirements (e.g. FIR boundary waypoints etc).
	b) The AOC ensures that the elements used to define the amended route comply with the requirements of ICAO Doc 4444. The elements that may be used to describe the amended route include: 1) Fix Names; *Note 1.— ARINC 424 fix names should not be used to define latitude and longitude.* 2) Airway Designators; *Note 2.— Where an airway designator is used it should be preceded and followed by a fix name or navaid designator that is defined on the airway described.* 3) Navaid Designators; and 4) Latitude and Longitude. *Note 3.— The ICAO requirement is that position should be defined in either whole degrees of latitude and longitude, e.g. 35S164E, or degrees and minutes for both latitude and longitude, e.g. 2513S15645E. A mixture of these formats should be avoided, e.g. 35S15725E.*
	c) The AOC uplinks the proposed route to the aircraft via ACARS.
Flight crew (Step 2)	a) Where applicable, delete any waypoints on the proposed route that have already been sequenced.
	b) Providing that the proposed route is acceptable to the flight crew, downlink the route request to the controlling ATSU using the CPDLC message element: **REQUEST CLEARANCE [route clearance]** or *REQUEST [route clearance]* where the first fix in the route clearance is the next waypoint ahead of the aircraft. *Note 4.— The route request may also contain additional information such as departure airport, destination airport, etc.* *Note 5.— Flight crew procedures should include guidance on downlinking CPDLC route clearance requests.*

Who	**Procedures**
ATSU (Step 3)	a) Where the requested clearance is available, uplink the amended route clearance to the aircraft. Example: UM 83 AT [position] CLEARED [route clearance] where [position] = [(fix1)] is the next waypoint ahead of the aircraft and [route clearance] = [(fix2) (fix3) …]. *Note 6.— The route clearance may also contain additional information such as departure airport, destination airport, etc.* *Note 7. — On occasions, other CPDLC message elements may be more appropriate than UM 83.*
	b) Where the requested clearance is not available, uplink UM 0 UNABLE and append the [reason]. Example: UM 0 UNABLE. UM 166 DUE TO TRAFFIC *Note 8.— ATSUs should not modify the intent of the route without advising the flight crew. This requirement does not apply to the removal of waypoints that have been sequenced prior to the clearance being uplinked or minor changes to the route.*
Flight crew (Step 4)	a) On receipt of a CPDLC route clearance from the ATSU, the flight crew should: 1) Load the uplink into the FMS and review the clearance. If the clearance is acceptable, respond with a DM 0 WILCO to confirm that the flight crew will comply with the clearance; or 2) Otherwise: i) Respond with DM 1 UNABLE; and ii) Continue in accordance with the current ATC clearance.
	b) Where the requested clearance is rejected by the ATSU, the flight crew should continue in accordance with the existing clearance.
	c) The flight crew should request new route data from AOC.



1	The AOC uplinks the proposed amended route "B C D E X Y Z I " to destination XXXX starting from the next point ahead of aircraft (B) and diverging from the current clearance at E. The flight crew reviews the proposed route and downlinks "REQUEST [B C D E X Y Z I]" to ATC.
2	ATC reviews the route request and uplinks the clearance "AT [C] CLEARED [D E X Y Z I]" to the aircraft using UM83. *Note.— In this example, by the time the clearance is uplinked, the aircraft has passed B and so this is not included in the clearance. Point C must also be removed from the [route clearance] parameter of UM 83 because point C is the [position] at which the reroute clearance begins.* The flight crew responds to the clearance with a WILCO.

Figure 6-1. The DARP process

6.2 Tailored arrival (TA)

6.2.1 General

6.2.1.1 The tailored arrival (TA) is a 4-dimentional (4-D) arrival procedure, based on an optimized ATC clearance, including, as necessary, vertical and/or speed restrictions, from the aircraft's current position, normally just prior to top of descent, to the designated destination runway. This optimized ATC clearance, or TA clearance, is issued via CPDLC data link message(s) to the aircraft and, upon flight crew selection, automatically loaded into the aircraft's FMS (i.e., 4-D trajectory guidance). The TA clearance generally consists of the lateral path, vertical and speed constraints, published approach procedure, and runway assignment.

6.2.1.2 This section provides guidelines and procedures for delivering and executing the TA clearance. These guidelines and procedures are intended for ATSPs that provide the TA service and participating operators.

Note. As ATSPs plan for providing the TA service throughout the world, ground system capability and geographical constraints may lead to some variations in local implementations. As experience is gained, these variations and other refinements will need to be coordinated in future amendments to the guidelines provided herein.

6.2.2 Provisions for the TA service.

6.2.2.1 The operator should establish operating and notification procedures for the flight crew and conduct training to be eligible to participate in tailored arrivals.

6.2.2.2 At each of the ATSUs involved, the ATSP should provide procedures to the controllers and conduct training for delivering and executing the TA clearance. If the flight crew from an eligible operator requests a TA clearance and the traffic situation permits, the controller should accommodate the request. All other standard operating procedures apply.

6.2.2.3 When the TA service is provided, the ATSP should:

a) Assign a TA designator to the TA clearance. The TA designator should:

1) Contain more than five letters so that it is not easily confused with a published or public procedure;

2) Relate to the geographical arrival area, e.g. PACIFIC 1; and

3) Be easy to pronounce when communicating on voice.

Note.— The flight crew and the controller use the TA designator throughout the procedure to unambiguously convey the route and vertical and speed constraints associated with the TA.

b) Define and notify operators of the TA request point as a time in minutes from the estimated top of descent (TOD) or from the airspace boundary where CPDLC service is terminated.

Note.— For example, the TA request point for the PACIFIC 1 TA at San Francisco airport is 45 minutes before the aircraft enters U.S. domestic airspace.

6.2.3 Clearance delivery and execution

6.2.3.1 Table 6-2 provides the procedures for delivering and executing a tailored arrival clearance.

Table 6-2. Tailored arrival clearance delivery and execution

Who	**Procedures**
Flight crew (Step 1)	At the TA request point, the flight crew should request a TA using the CPDLC standard free text message element: DM 67ad REQ TA [TA designator], where [TA designator] is optional. *Note 1.— When the ATSP and operators are evaluating a TA, the flight crew may include additional information such as an intended descent speed, using the format M[nn] for Mach or [nnn]KIAS for IAS. When this information is included, the controller and flight crew procedures should include message formats and intended use to avoid misunderstanding or confusion with the operational procedures.* Example 1: REQ TA PACIFIC 1. Example 2: REQ TA PACIFIC 1 M.83 Example 3: REQ TA 280KIAS
Controller (Step 2)	a) If the situation permits, the controller should uplink the TA clearance via CPDLC using: UM 169al [TA designator] UM 83 AT [position] CLEARED [route clearance] UM 19 MAINTAIN [level] Example: The controller uses the name PACIFIC 1 TA, which is unambiguous for the specific route and vertical and speed constraints. The route clearance includes lateral route, crossing restrictions, approach procedure, and runway assignment, and FL370 is the currently assigned flight level. PACIFIC 1 TA AT CINNY CLEARED [Route Clearance] MAINTAIN FL370.
	b) The controller may issue a vertical clearance after delivery of the tailored arrival clearance, without interfering with the TA clearance. In such cases, the controller should reissue the TA clearance to ensure no ambiguity.

Who	**Procedures**
Flight crew (Step 3)	a) The flight crew should load the TA clearance into the FMS and review it. If acceptable, the flight crew should activate the route in the FMS and downlink DM 0 WILCO. If unacceptable, the flight crew should downlink DM 1 UNABLE.
	b) The flight crew should select a descent speed schedule of 280kts (+/- 10kts) above 10,000ft. *Note 2.— This procedure provides additional descent profile predictability to the controllers, increasing the potential for the controllers to allow a full TA during congested periods when increased predictability is required due to other traffic. This function will eventually be replaced by ground automation which advises the optimum speed for the descent, based on the entire airspace situation at the expected time of the arrival.*
	c) If possible, the flight crew should request FMC waypoint wind and temperature data from AOC.
AOC (Step 4)	AOC should uplink cruise and descent winds to the arriving aircraft to optimize the FMS-calculated profile for the most predictable execution of that profile.
Controller (Step 5)	The controller should transfer control to the next sector and terminate CPDLC and ADS-C connections. *Note 3.— The transferring sector either manually or automatically advises the next sector that the aircraft is on a particular TA.*
Flight crew (Step 6)	The flight crew should initiate contact with the next sector on the voice communication channel with, [call sign] [TA designator] TAILORED ARRIVAL. [level].

Who	**Procedures**
Controller (Step 7)	a) The controller should advise [call sign] MAINTAIN [level]. *Note 4.— The controller has access to the uplinked lateral routing and currently assigned level/altitude on the flight strip through ATC interfacility coordination.*
	b) If the controller needs to add speed control, e.g. to increase the potential for issuing a TA clearance, the controller should advise the flight crew as soon as possible to expect a restriction. Example: [call sign] EXPECT TO DESCEND AT 260 KTS
	c) When appropriate, the controller should issue a descent clearance along the cleared route, using [TA designator] TAILORED ARRIVAL. [dest/area] ALTIMETER/QNH [nnnn] and, as necessary, include a speed or vertical restriction. Example 1: The controller does not issue a speed or vertical restriction. [call sign] DESCEND VIA PACIFIC 1 TAILORED ARRIVAL. KSFO ALTIMETER 29.92. Example 2: The controller issues a speed restriction. [call sign] DESCEND VIA PACIFIC 1 TAILORED ARRIVAL. DO NOT EXCEED 260KTS. KSFO ALTIMETER 29.92. Example 3: The controller issues a vertical restriction. [call sign] DESCEND VIA THE CATALINA 1 TAILORED ARRIVAL BUT AFTER SLI. MAINTAIN [level/altitude].
	d) The controller should transfer control to the next controller.
Flight crew (Step 8)	The flight crew should initiate contact with the next controller using: [call sign] PASSING FLIGHT LEVEL [FLnnn]/ALTITUDE [nn,nnn feet] ON THE [TA designator] TAILORED ARRIVAL. [ATIS code]. *Note 5.— Subsequent exchanges on different frequencies with the same ATSU do not require the flight crew to state the passing level/altitude.*

Who	Procedures
Controller (Step 9)	If continuation of the TA profile is acceptable to the approach controller, the controller should clear the aircraft for the approach by stating: a) [call sign] AFTER [fix name] CLEARED [approach name]; or b) [call sign] DESCEND VIA [TA designator] TAILORED ARRIVAL. CROSS [fixname] AT OR ABOVE [level/altitude]. CLEARED [approach name]; or c) DESCEND VIA THE [TA designator] TAILORED ARRIVAL. EXPECT [runway or procedure name]. Example 1: [call sign] AFTER MENLO CLEARED ILS RW28L APPROACH. Example 2: [call sign] DESCEND VIA THE FLORIDA 8 (or 9) TAILORED ARRIVAL, CROSS PABOY AT OR ABOVE 3000FT. CLEARED LOCALIZER DME RUNWAY 8L APPROACH. Example 3: [call sign] DESCEND VIA THE FLORIDA 9 TAILORED ARRIVAL. EXPECT RUNWAY 09.
Flight crew (Step 10)	If all conditions are acceptable, the flight crew should execute the cleared FMS-directed profile and apply standard approach and landing procedures.
Controller (Step 11)	a) At any time, the controller may issue alternative level/altitude, routing, or vectors and discontinue the TA to best suit traffic conditions. When the controller discontinues the TA, the controller should provide instructions including an assigned level/altitude to the flight crew. *Note 6.— The controller must include an assigned level/altitude because the flight crew does not know the minimum vectoring level/altitude nor do they know the level/altitude of other traffic.*
	b) The controller may clear the aircraft back onto the TA by stating: [call sign] CLEARED DIRECT [Waypoint on TA]. RESUME THE [TA designator] TAILORED ARRIVAL.

Chapter 7. State aircraft data link operations

7.1 General

7.1.1 The data link and voice communication requirements for CNS/ATM are being defined by international, regional, and national civil aviation authorities and are based on use of commercial communication systems. In the oceanic and remote regions, data link has seen increased use and will eventually replace voice as the primary means of communication. The military has unique requirements insofar as using CPDLC. These requirements were never considered when the CPDLC message set was being developed.

7.1.2 Many air and maritime air forces have the capability to conduct air-to-air refueling (AAR) operations. Although detailed procedures are dependent on aircraft type, mode of employment and national requirements, there is sufficient commonality for standard procedures to be developed to enhance operational interoperability. Many of these air and maritime air forces are making the transition to aeronautical data links and the use of controller pilot data link communications (CPDLC) and automatic dependent surveillance - contract (ADS-C).

7.1.3 The procedures outlined below describe the communications to be utilized by military aircraft in the attempt to promote harmonization in CPDLC and ADS-C procedures. These procedures have been developed utilizing a combination of existing CPDLC message elements and standardized free text. Standardized free text messages have been created to support these military operations in the attempt to avoid the general use of free text messages and for overall standardization. To the maximum extent possible, data link capable aircraft should adhere to procedural guidelines provided in Chapter 5 and Chapter 6.

7.1.4 The aim of this chapter is to provide a reference document covering military procedures to be used in an aeronautical data link environment. This chapter will provide guidance for the flight crew and the air traffic service provider (ATSP) to promote harmonized military AAR operations in an aeronautical data link environment and lead to a better understanding of AAR procedures and terminology.

7.2 Military assumes responsibility for separation of aircraft (MARSA)

7.2.1 Prior to commencing AAR or maneuvers with receiver aircraft, the tanker will notify ATC that the military assumes responsibility for separation of aircraft (MARSA). The tanker will use the term, MARSA, to notify ATC that the tanker and receiver aircraft are accepting the responsibility for their actions within the AAR track and the tanker is the lead of the formation. ATC controls all other traffic to preclude conflicts between civil and military traffic involved in the AAR while at the same time still controlling the tanker and receiver. The actual refueling commences at the air refueling control point (ARCP) and continues as the aircraft proceed down the refueling track. Normally, the refueling is completed prior to the aircraft reaching the air refueling exit point (AREX) point. At AREX, both aircraft need to receive ATC clearances to continue on their filed routing.

Table 7-1. MARSA initiation and termination procedures

Who	**Procedures**
Flight crew (Tanker) (Step 1)	a) The tanker can initiate MARSA after it receives clearance for the block level/altitude and, optionally, reports passing the ARCP. The tanker informs the controller that the flight crew is accepting MARSA procedures with the receiver. DM 67z ACCEPT MARSA WITH [call sign(s) of receiver aircraft] where [receiver aircraft call sign(s)] exactly matches the filed flight plan(s) for the receiver aircraft.
	b) The tanker performs MARSA with receiver aircraft.
Flight crew (Tanker and Receiver) (Step 2)	To terminate MARSA, each aircraft should first notify the controller of their assigned level/altitude. DM 37 **MAINTAINING [level]** *or LEVEL [altitude]*
Controller (to Tanker) (Step 3)	Then, when the controller receives notification that each aircraft is at its assigned level/altitude, the controller sends a free text message to terminate MARSA between the tanker and the receiver aircraft. UM 169aq MARSA TERMINATED WITH [call sign(s) of receiver aircraft] MARSA is terminated when the tanker receives notification.

7.3 Air-to-air refueling (AAR)

7.3.1 Air-to-air refueling is normally accomplished between 10,000 and 28,000 feet depending on receiver type, requiring both aircraft to descent for refueling.

7.3.2 Refueling tracks are numbered and depicted on charts in continental airspace and a few are depicted in oceanic and remote airspace. Oceanic refueling may also be conducted on non-designated tracks with an altitude reservation (ALTRV). In both cases, the refueling procedure is part of the filed flight plan. The flight plan always includes time, requested block level/altitude, air refueling control point (ARCP), air refueling initial point (ARIP), air refueling exit point (AREX) and intermediate refueling track points. If the procedure is depicted, its designation (ARxxx) is sufficient to define the track. In the oceanic environment, a refueling pattern may be part of an existing ALTRV.

7.3.3 During the refueling phase all aircraft operate within the block level/altitude and fly the route along the refueling track in the flight plan. An ADS contract may be set with any aircraft but it is only necessary with the lead tanker and needs to correspond with a filed flight plan. Additionally, any other CPDLC report (i.e. UM 130 REPORT PASSING [position], etc.) may be requested of the tanker in order to track the progress of the flight. The aircraft may or may not remain in a single formation in the block level/altitude for the remainder of the flight. There are no special CPDLC messages developed during this phase.

7.3.4 A typical air-refueling pattern is illustrated in Figure 7-1. The light green track represents the tanker's intended route to the ARCP. The light blue track is the receiver's intended route. Both aircraft file separate flight plans showing the specific aerial refueling locations. The dark blue track is the tanker's orbit and rendezvous flight paths with the dark green track depicting the AAR track. Three or more points can define the AAR track. The ARIP is the point where the receiver enters the AAR track. The ARCP is the reference point for the holding pattern where the tanker awaits the receiver. The AAR track is between the ARCP and the AREX.

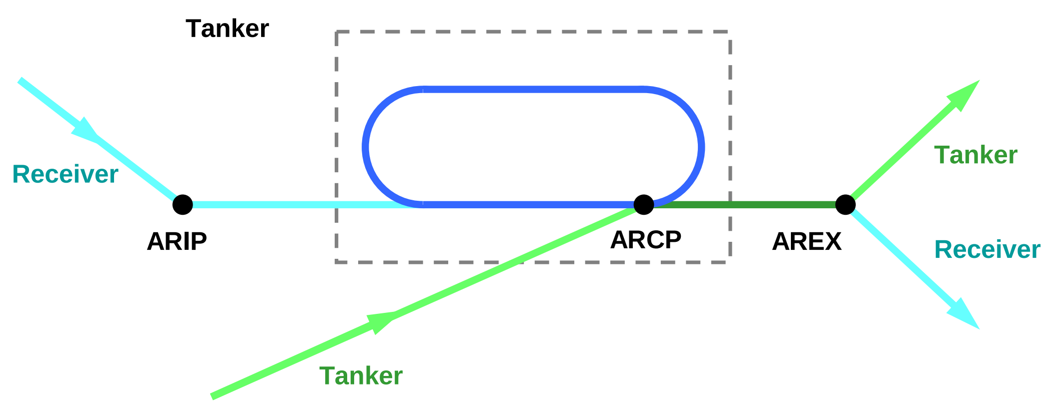


Figure 7-1. Air refueling pattern

Table 7-2. Air refueling data link procedures

Who	Procedures
Flight crew (Tanker) (Step 1)	At approximately 10 minutes from the ARCP, the tanker requests a clearance to delay at the ARCP until the rendezvous with the receiver and request a block level/altitude for air refueling. DM 25 REQUEST CLEARANCE DM 67w TO DELAY FOR AIR REFUEL AT [position] UNTIL [time] DM 7 REQUEST BLOCK [level] TO [level] Where: [position] is the ARCP as filed in the tanker's flight plan. [time] is the time the tanker expects to pass the ARCP and commence refueling along the refueling track. It is also the end of the delay time.

Who	Procedures
Controller (to Tanker) (Step 2)	a) The controller clears the tanker to delay at the ARCP, as requested. UM 169ar CLEARED TO DELAY FOR AIR REFUEL AT [position] UNTIL [time] *Note.— This message may need to be appended with a “free text” message in the event the controller needs to specify a specific area of operations or if the area to delay is different than the filed flight plan.*
	b) If block level/altitude is available, the controller issues one of the following instructions: UM 31 CLIMB TO AND MAINTAIN BLOCK [level] TO [level]; or UM 32 DESCEND TO AND MAINTAIN BLOCK [level] TO [level]; or UM 30 MAINTAIN BLOCK [level] TO [level]. Optionally, the controller may append the following: UM 180 REPORT REACHING BLOCK [level] TO [level]; and/or UM 130 REPORT PASSING [position]
	c) If the block level/altitude clearance is not available, the controller issues the following: UM 0 UNABLE UM 166 DUE TO TRAFFIC Optionally, the controller may append the following: UM 19 MAINTAIN [level], then any one of the following UM 9 or UM 10 EXPECT DESCENT AT [position/time]; or UM 7 or UM 8 EXPECT CLIMB AT [position/time]. Optionally, the controller may request a report. UM 130 REPORT PASSING [position].
Flight crew (Tanker) (Step 3)	The tanker responds to the controller instructions in accordance with the guidance provided in paragraph 2.2.4.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.

Who	Procedures
Flight crew (Tanker) (Step 4)	If ATC has instructed the aircraft to report passing the ARCP, then when the tanker crosses the ARCP, the flight crew notifies the controller that it has crossed the ARCP and has entered the air-refueling orbit. DM 31 PASSING [position]
Controller (to Tanker) (Step 5)	If block level/altitude was NOT previously available, when traffic permits, the controller issues the block level/altitude clearance for the tanker. UM 31 CLIMB TO AND MAINTAIN BLOCK [level] TO [level]; or UM 32 DESCEND TO AND MAINTAIN BLOCK [level] TO [level]; or UM 30 MAINTAIN BLOCK [level] TO [level]. Optionally, the controller may append the following: UM 180 REPORT REACHING BLOCK [level] TO [level].
Flight crew (Tanker) (Step 6)	The tanker responds to the controller instructions in accordance with the guidance provided in paragraph 2.2.4.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.
Flight crew (Tanker) (Step 7)	When the receiver approaches the ARIP, the tanker informs the controller that the flight crew is accepting MARSA procedures with the receiver. DM 67z ACCEPT MARSA WITH [call sign(s) of receiver aircraft] where [call sign(s) of receiver aircraft] exactly matches the filed flight plan(s) for the receiver aircraft.
Flight crew (Receiver(s)) (Step 8)	Prior to entering the ARIP – ARCP track, each receiver aircraft requests a level/altitude change to conduct refueling. DM 7 REQUEST BLOCK [level] TO [level]

Who	Procedures
Controller (to Receiver(s)) (Step 9)	a) If the controller has received the MARSA message from the tanker, the controller clears the receiver(s) to operate in the block level/altitude required for refueling. *Note.— If the controller did not receive the MARSA message from the tanker, the controller would UNABLE any requests from the receiver(s) until MARSA could be confirmed.* UM 31 CLIMB TO AND MAINTAIN BLOCK [level] TO [level]; or UM 32 DESCEND TO AND MAINTAIN BLOCK [level] TO [level]; or UM 30 MAINTAIN BLOCK [level] TO [level]; and UM 169as CLEARED TO CONDUCT REFUELING. Optionally, the controller may append the following: UM 180 REPORT REACHING BLOCK [level] TO [level].
Controller (to Tanker)	b) The controller clears the tanker for refueling. UM 169 CLEARED TO CONDUCT REFUELING.
Flight crew (Tanker and Receiver) (Step 10)	The tanker and receiver respond to the controller instructions in accordance with the guidance provided in paragraph 2.2.4.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.
Flight crew (Tanker and Receiver) (Step 11)	When the tanker is commencing the rendezvous with the receiver, each aircraft sends the following: DM 11 AT [position] REQUEST CLIMB TO [level]; or DM 12 AT [position] REQUEST DESCENT TO [level]; Where: [position] is the EXIT point; and [level] is the requested level for each aircraft after refueling is complete.
Flight crew (Tanker) (Step 12)	When approaching the end of refueling, the tanker notifies the controller when to expect the end of refueling. DM 67x EXPECT END OF REFUEL AT [time/position].

Who	Procedures
Controller (to Tanker and Receiver) (Step 13)	The controller issues instructions to assign different flight levels/altitudes to each of the aircraft upon completion of refueling. UM 164 WHEN READY; and UM 19 MAINTAIN [level]; and UM 129 **REPORT MAINTAINING [level]** *or REPORT LEVEL [altitude]* *Note.— Climb or descent clearances may be issued as appropriate.*
Flight crew (Tanker and Receiver) (Step 14)	a) The tanker and receiver respond to the controller instructions in accordance with the guidance provided in paragraph 2.2.4.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.
	b) When the aircraft is maintaining the assigned level, each aircraft notifies the controller. DM 37 **MAINTAINING [level]** *or LEVEL [altitude]*
Controller (to Tanker) (Step 15)	When the controller receives notification that each aircraft is at its assigned level/altitude, the controller sends a free text message to terminate MARSA between the tanker and the receiver aircraft. UM 169aq MARSA TERMINATED WITH [call sign(s) of receiver aircraft]

7.4 Formation flight data link procedures

7.4.1 Formation flying in a standard formation is usually one in which a proximity of no more than 1 mile laterally or longitudinally and within 100 feet vertically from the flight leader is maintained by each aircraft. Non-standard formations are those operating under conditions other than standard formation dimensions that the flight leader has requested and air traffic control (ATC) has approved, or when operating within an authorized ALTRV.

7.4.2 For each flight plan, the lead FANS 1/A aircraft will initiate an AFN logon at the correct time (refer to paragraph 5.2.2). Once in formation, only the lead aircraft will make position reports in accordance paragraph 5.6. Use CPDLC standard messages for level/altitude requests, routing requests (if different from what was filed), and speed or ETA requests with ATC to effect any en-route changes.

7.4.3 In the event a formation wants to break-up the formation or depart an ALTRV the aircraft desiring to break off of the formation will coordinate their departure a minimum of ten (10) minutes prior to separation with appropriate requests, and the following data link procedures will be used. Air traffic control will need separate flight plans for each flight in the event that the formation splits.

Table 7-3. Single aircraft or formation joining an ALTRV data link procedures

Who	Procedures
Flight crew	When a single aircraft or formation is joining an ALTRV, the flight crew notifies the controller of its intention to join the formation. DM 67y JOINING ALTRV [ALTRV designator] AT [time/position] Example: JOINING ALTRV CW413 AT HEMLO or JOINING ALTRV CW413 AT 1530Z

Table 7-4. Formation break-up or departure from ALTRV data link procedures

Who	Procedures
Controller	ATC responds to the request. UM 74 PROCEED DIRECT TO [position]; or UM 76 AT [time] PROCEED DIRECT TO [position];or UM 77 AT [position] PROCEED DIRECT TO [position]; or UM 79 CLEARED TO [position] VIA [route clearance]; or UM 80 CLEARED [route clearance]; or UM 83 AT [position] CLEARED [route clearance]
Flight crew	The flight crew responds to the controller instructions in accordance with the guidance provided in paragraph 2.2.4.4. DM 0 WILCO; DM 1 UNABLE; DM 3 ROGER; or DM 2 STANDBY.
Flight crew or Controller	The flight crew may further request desired level/altitude and the controller would respond with the appropriate instructions.

7.5 ADS-C reports

7.5.1 If suitably equipped, State aircraft should ensure ADS-C is armed because ADS contracts may be established by ATC. ATC will establish ADS contracts with the lead aircraft as identified in the filed flight plan.

Appendix A CPDLC message elements and standardized free text messages

This appendix contains the CPDLC message elements and standardized and preformatted free text messages for the FANS 1/A, ATN B1, and ATN B1-FANS 1/A data link systems described in paragraph 2.1.1. The CPDLC message elements are based on ICAO Doc 4444, 15th Edition.

- Section A.1 provides a CPDLC message element response requirements key;
- Section A.2 provides the CPDLC uplink message elements and intended uses;
- Section A.3 provides the CPDLC downlink message elements; and
- Section A.4 provides CPDLC standardized free text messages.

The following guidelines apply:

a) Normal text is taken from ICAO Doc 4444, e.g. message response key or message intent/use, and represents the global baseline. *Italic text* supplements the ICAO Doc 4444 guideline either as a *Note* or specific to *FANS 1/A*, *ATN B1*, or *ATN B1-FANS 1/A* data link system.

b) In cases where there is a choice for the message element or the response attribute, the first choice that appears in the row for that message element is shown in **bold text** and indicates the preferred choice, per ICAO Doc 4444, and should be used for new implementations. The second choice is shown in *italic text* and indicates legacy implementations, e.g. FANS 1/A, that are considered acceptable.

c) The following variables are considered operationally interchangeable in this document respecting range and resolution variations as defined in interoperability standards:

ICAO Doc 4444 variable	Equivalent FANS 1/A variable
[level]	[altitude] *(See Note)*
[specified distance] [direction]	[distance offset] [direction]
[departure clearance]	[predeparture clearance]
[unit name]	[icao unit name]
[code]	[beacon code]
[facility designation]	[icao facility designation]
[persons on board]	[remaining souls]

Note.— ICAO Doc 4444 notes that message elements that contain the [level] variable can be specified as either a single level or a vertical range, i.e., block level. **FANS 1/A** *only considers the [level] variable as a single level and uses message elements that are intended exclusively for specifying a vertical range, e.g. UM 30, UM 31, UM 32, UM 180, DM 7, DM 76, DM 77, etc.* **ATN B1** *uses the [level] variable to specify a vertical range and does not use the message elements intended exclusively for specifying a vertical range, except in cases where an ATN B1 ground system provides data link service to FANS 1/A aircraft.*

d) The “Data link system(s)” column indicates which system supports the message element. The cell is shaded green if they are valid messages in the ICAO Doc 4444 message set and red if they are reserved. ***N/A*** in this column indicates that none of the data link systems support the message element.

1) If a data link system supports a message element that is reserved in ICAO Doc 4444, then the cell will be red and the data link system will be highlighted in green. In these cases, the ATSPs and operators should establish procedures or automation to avoid the use of these message elements.

2) In some cases, a data link system supports a message element that is also a valid message element in ICAO Doc 4444, but its use should be avoided due to potential misinterpretation. In these cases, a note has been added to the "Message intent/use" column, and the ATSPs and operators should establish procedures or automation to avoid the use of these message elements.

Note.— The FOREWORD suggests that this guidance material may contain material that may eventually become Standards and Recommended Practices (SARPs), or PANS provisions. In particular, ICAO should strongly consider appropriate changes where experience has shown that valid message elements should be avoided, as indicated in this appendix.

A.1 CPDLC message element response requirements key

Response column	**Description**
	For uplink message
W/U	Response required. Yes Valid responses. WILCO, UNABLE, STANDBY, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, LOGICAL ACKNOWLEDGEMENT (only if required), ERROR *Note.— WILCO, UNABLE, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY and ERROR will close the uplink message.* *FANS 1/A.— WILCO, UNABLE, STANDBY, ERROR, NOT CURRENT DATA AUTHORITY.*
A/N	Response required. Yes Valid responses. AFFIRM, NEGATIVE, STANDBY, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, LOGICAL ACKNOWLEDGEMENT (only if required), ERROR *Note.— AFFIRM, NEGATIVE, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY and ERROR will close the uplink message.* *FANS 1/A.— AFFIRM, NEGATIVE, STANDBY, ERROR, NOT CURRENT DATA AUTHORITY.*

Response column	Description
R	Response required. Yes Valid responses. ROGER, UNABLE, STANDBY, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, LOGICAL ACKNOWLEDGEMENT (only if required), ERROR *Note.— ROGER, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY and ERROR will close the uplink message.* *FANS 1/A.— ROGER, STANDBY, ERROR, NOT CURRENT DATA AUTHORITY. FANS 1/A aircraft do not have the capability to send UNABLE in response to an uplink message containing message elements with an "R" response attribute. For these aircraft, the flight crew may use alternative means to UNABLE the message. These alternative means will need to be taken into consideration to ensure proper technical and operational closure of the communication transaction.*
Y	Response required. Yes Valid responses: Any CPDLC downlink message, LOGICAL ACKNOWLEDGEMENT (only if required)
N	Response required. No, unless logical acknowledgement required. Valid Responses (only if LOGICAL ACKNOWLEDGEMENT is required). LOGICAL ACKNOWLEDGEMENT, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, ERROR *FANS 1/A.— Defined "Response not required," but not used. Under some circumstances, an ERROR message will also close an uplink message.*
NE	[Not defined in ICAO Doc 4444] *FANS 1/A.— The WILCO, UNABLE, AFFIRM, NEGATIVE, ROGER, and STANDBY responses are not enabled (NE) for flight crew selection. An uplink message with a response attribute NE is considered to be closed even though a response may be required operationally. Under some circumstances, a downlink error message may be linked to an uplink message with a NE attribute.*
	For downlink messages
Y	Response required. Yes Valid responses. Any CPDLC uplink message, LOGICAL ACKNOWLEDGEMENT (only if required).
N	Response required. No, unless logical acknowledgement required. Valid responses (only if LOGICAL ACKNOWLEDGEMENT is required). LOGICAL ACKNOWLEDGEMENT, SERVICE UNAVAILABLE, FLIGHT PLAN NOT HELD, ERROR *FANS 1/A.— Aircraft do not have the capability to receive technical responses to downlink message elements with an "N" response attribute (other than LACK or ERROR for ATN B1 aircraft). In some cases, the response attribute is different between FANS 1/A aircraft and ICAO Doc 4444. As an example, most emergency messages have an "N" response attribute for FANS 1/A whereas ICAO Doc 4444 defines a "Y" response attribute for them. As a consequence, for FANS 1/A aircraft, the ATC will need to use alternative means to acknowledge to the flight crew that an emergency message has been received.*

A.2 CPDLC uplink message elements

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Responses/Acknowledgements (uplink)			
UM 0	Indicates that ATC cannot comply with the request.	UNABLE	**N** *Or* *NE*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 1	Indicates that ATC has received the message and will respond. *Note.— The flight crew is informed that the request is being assessed and there will be a short-term delay (e.g. as appropriate, given the situation, but not to exceed 10 minutes). The exchange is not closed and the request will be responded to when conditions allow.*	STANDBY	**N** *Or* *NE*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 2	Indicates that ATC has received the request but it has been deferred until later. *Note.— The flight crew is informed that the request is being assessed and a long-term delay can be expected. The exchange is not closed and the request will be responded to when conditions allow.*	REQUEST DEFERRED	**N** *Or* *NE*	FANS 1/A
UM 3	Indicates that ATC has received and understood the message.	ROGER	**N** *Or* *NE*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 4	Yes.	AFFIRM	**N** *Or* *NE*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 5	No	NEGATIVE	**N** *Or* *NE*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 235	Notification of receipt of unlawful interference message.	ROGER 7500	N	N/A (Urgent)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 211	Indicates that the ATC has received the request and has passed it to the next control authority. *FANS 1/A-ATN.— Uses FANS 1/A free text.*	REQUEST FORWARDED	N	ATN B1
UM 218	Indicates to the pilot that the request has already been received on the ground.	REQUEST ALREADY RECEIVED	N	N/A
UM 237	Indicates that the request cannot be responded to by the current unit and that it should be requested from the next unit. *FANS 1/A-ATN.— Uses FANS 1/A free text.*	REQUEST AGAIN WITH NEXT UNIT	N	ATN B1
	Vertical Clearances (uplink)			
UM 6	Notification that a level change instruction should be expected. *Note.— Avoid use of this message element due to potential misinterpretation.*	EXPECT [level]	R	FANS 1/A
UM 7	Notification that an instruction should be expected for the aircraft to commence climb at the specified time. *Note.— The controller should only use this message to respond to a flight crew request, e.g. WHEN CAN WE EXPECT …*	EXPECT CLIMB AT [time]	R	FANS 1/A
UM 8	Notification that an instruction should be expected for the aircraft to commence climb at the specified position. *Note.— The controller should only use this message to respond to a flight crew request, e.g. WHEN CAN WE EXPECT …*	EXPECT CLIMB AT [position]	R	FANS 1/A
UM 9	Notification that an instruction should be expected for the aircraft to commence descent at the specified time. *Note.— The controller should only use this message to respond to a flight crew request, e.g. WHEN CAN WE EXPECT …*	EXPECT DESCENT AT [time]	R	FANS 1/A
UM 10	Notification that an instruction should be expected for the aircraft to commence descent at the specified position. *Note.— The controller should only use this message to respond to a flight crew request, e.g. WHEN CAN WE EXPECT …*	EXPECT DESCENT AT [position]	R	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 11	Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified time. *Note.— The controller should only use this message to respond to a flight crew request, e.g. WHEN CAN WE EXPECT …*	EXPECT CRUISE CLIMB AT [time]	R	FANS 1/A
UM 12	Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified position. *Note.— The controller should only use this message to respond to a flight crew request, e.g. WHEN CAN WE EXPECT …*	EXPECT CRUISE CLIMB AT [position]	R	FANS 1/A
UM 13	(Reserved) *Note.— Avoid use of this message element, AT [time] EXPECT CLIMB TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 14	(Reserved) *Note.— Avoid use of this message element, AT [position] EXPECT CLIMB TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 15	(Reserved) *Note.— Avoid use of this message element, AT [time] EXPECT DESCENT TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 16	(Reserved) *Note.— Avoid use of this message element, AT [position] EXPECT DESCENT TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 17	(Reserved) *Note.— Avoid use of this message element, AT [time] EXPECT CRUISE CLIMB TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 18	(Reserved) *Note.— Avoid use of this message element, AT [position] EXPECT CRUISE CLIMB TO [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 19	Instruction to maintain the specified level.	MAINTAIN [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 20	Instruction that a climb to a specified level is to commence and once reached the specified level is to be maintained.	**CLIMB TO [level]** Or *CLIMB TO AND MAINTAIN [altitude]*	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 21	Instruction that at the specified time a climb to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that NOT BEFORE the specified time, a climb to the specified level is to commence and once reached the specified level is to be maintained.* *Note 2.— Precede this message element with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [time] CLIMB TO [level]** Or *AT [time] CLIMB TO AND MAINTAIN [altitude]*	W/U	FANS 1/A
UM 22	Instruction that at the specified position a climb to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that AFTER PASSING the specified position, a climb to the specified level is to commence and once reached the specified level is to be maintained.* *Note 2.— Precede this message element with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [position] CLIMB TO [level]** Or *AT [position] CLIMB TO AND MAINTAIN [altitude]*	W/U	FANS 1/A
UM 185	(Reserved)	N/A	W/U	N/A
UM 23	Instruction that a descent to a specified level is to commence and once reached the specified level is to be maintained.	**DESCEND TO [level]** Or *DESCEND TO AND MAINTAIN [altitude]*	W/U	FANS 1/A ATN B1 FANS 1/A-ATN

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 24	Instruction that at a specified time a descent to a specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that NOT BEFORE the specified time, a descent to the specified level is to commence, and once reached, the specified level is to be maintained.* *Note 2.— Precede this message element with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [time] DESCEND TO [level]** Or *AT [time] DESCEND TO AND MAINTAIN [altitude]*	W/U	FANS 1/A
UM 25	Instruction that at the specified position a descent to the specified level is to commence and once reached the specified level is to be maintained. *Note 1.— Instruction that AFTER PASSING the specified position, a descent to the specified level is to commence and once reached the specified level is to be maintained.* *Note 2.— Precede this message element with UM 19 MAINTAIN [level], to prevent the premature execution of the instruction.*	**AT [position] DESCEND TO [level]** Or *AT [position] DESCEND TO AND MAINTAIN [altitude]*	W/U	FANS 1/A
UM 186	(Reserved)	N/A	W/U	N/A
UM 26	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note. — Instruction that a climb is to commence at a rate such that the specified level is reached NOT LATER THAN the specified time.*	CLIMB TO REACH [level] BY [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 27	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a climb is to commence at a rate such that the specified level is reached BEFORE PASSING the specified position.*	CLIMB TO REACH [level] BY [position]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 28	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a descent is to commence at a rate such that the specified level is reached NOT LATER THAN the specified time.*	DESCEND TO REACH [level] BY [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 29	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance, the level specified is the assigned level which is to be maintained. *Note.— Instruction that a descent is to commence at a rate such that the specified level is reached BEFORE PASSING the specified position.*	DESCEND TO REACH [level] BY [position]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 192	Instruction that a change of level is to continue, but at a rate such that the specified level is reached at or before the specified time.	REACH [level] BY [time]	W/U	N/A
UM 209	Instruction that a change of level is to continue, but at a rate such that the specified level is reached at or before the specified position.	REACH [level] BY [position]	W/U	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 30	Instruction that a level within the defined vertical range specified is to be maintained. *FANS 1/A - ATN B1.— FANS 1/A aircraft only. ATN B1 aircraft accepts UM 19 MAINTAIN [level], where [level] is a vertical range.*	MAINTAIN BLOCK [level] TO [level]	W/U	FANS 1/A FANS 1/A-ATN
UM 31	Instruction that a climb to a level within the vertical range defined is to commence. *FANS 1/A - ATN B1.— FANS 1/A aircraft only. ATN B1 aircraft accepts UM 20 CLIMB TO [level], where [level] is a vertical range.*	CLIMB TO AND MAINTAIN BLOCK [level] TO [level]	W/U	FANS 1/A FANS 1/A-ATN
UM 32	Instruction that a descent to a level within the vertical range defined is to commence. *FANS 1/A - ATN B1.— FANS 1/A aircraft only. ATN B1 aircraft accepts UM 23 DESCEND TO [level], where [level] is a vertical range.*	DESCEND TO AND MAINTAIN BLOCK [level] TO [level]	W/U	FANS 1/A FANS 1/A-ATN
UM 34	Instruction that a cruise climb to the specified level is to commence and continue and, once reached the specified level is to be maintained. *Note.— Avoid use of this message element due to potential misinterpretation.*	CRUISE CLIMB TO [level]	W/U	FANS 1/A
UM 35	Instruction to be used in conjunction with an associated level instruction indicating that a cruise climb can commence once above the specified level. *Note.— Avoid use of this message element due to potential misinterpretation.*	**WHEN ABOVE (level) COMMENCE CRUISE CLIMB** Or *CRUISE CLIMB ABOVE [level]*	W/U	FANS 1/A
UM 219	Instruction to stop the climb at the specified level and, once reached, this level is to be maintained. The specified level will be below the previously assigned level.	STOP CLIMB AT [level]	W/U	N/A (Urgent)
UM 220	Instruction to stop the descent at the specified level and, once reached, this level is to be maintained. The specified level will be above the previously assigned level.	STOP DESCENT AT [level]	W/U	N/A (Urgent)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 36	Instruction that the climb to the specified level should be made at the aircraft's best rate.	EXPEDITE CLIMB TO [level]	W/U	FANS 1/A
UM 37	Instruction that the descent to the specified level should be made at the aircraft's best rate.	EXPEDITE DESCENT TO[level]	W/U	FANS 1/A
UM 38	Urgent instruction to immediately climb to the specified level and, once reached, the specified level is to be maintained.	IMMEDIATELY CLIMB TO [level]	W/U	FANS 1/A (Distress)
UM 39	Urgent instruction to immediately descend to the specified level and, once reached, the specified level is to be maintained.	IMMEDIATELY DESCEND TO [level]	W/U	FANS 1/A (Distress)
UM 40	(Reserved) *<u>Note</u>.— Avoid use of this message element, IMMEDIATELY STOP CLIMB AT [altitude], as it is reserved in ICAO Doc 4444.*	(Not defined)	**Y** *Or* *W/U*	FANS 1/A
UM 41	(Reserved) *<u>Note</u>.— Avoid use of this message element, IMMEDIATELY STOP DESCENT AT [altitude], as it is reserved in ICAO Doc 4444.*	(Not defined)	**Y** *Or* *W/U*	FANS 1/A
UM 171	Instruction to climb at not less than the specified rate.	CLIMB AT [vertical rate] MINIMUM	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 172	Instruction to climb at not above the specified rate.	CLIMB AT [vertical rate] MAXIMUM	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 173	Instruction to descend at not less than the specified rate.	DESCEND AT [vertical rate] MINIMUM	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 174	Instruction to descend at not above the specified rate.	DESCEND AT [vertical rate] MAXIMUM	W/U	FANS 1/A ATN B1 FANS 1/A-ATN

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 33	(Reserved) *Note.— Avoid use of this message element, CRUISE [altitude], as it is reserved in ICAO Doc 4444.*	(Not defined)	**Y** *Or* *W/U*	FANS 1/A
	Crossing Constraints (uplink)			
UM 42	(Reserved) *Note.— Avoid use of this message element, EXPECT TO CROSS [position] AT [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 43	(Reserved) *Note.— Avoid use of this message element, EXPECT TO CROSS [position] AT OR ABOVE [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 44	(Reserved) *Note.— Avoid use of this message element, EXPECT TO CROSS [position] AT OR BELOW [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 45	(Reserved) *Note.— Avoid use of this message element, EXPECT TO CROSS [position] AT AND MAINTAIN [altitude], as it is reserved in ICAO Doc 4444.*	N/A	R	FANS 1/A
UM 46	Instruction that the specified position is to be crossed at the specified level. This may require the aircraft to modify its climb or descent profile.	CROSS [position] AT [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 47	Instruction that the specified position is to be crossed at or above the specified level.	CROSS [position] AT OR ABOVE [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 48	Instruction that the specified position is to be crossed at or below the specified level.	CROSS [position] AT OR BELOW [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 49	Instruction that the specified position is to be crossed at the specified level and that level is to be maintained when reached.	CROSS [position] AT AND MAINTAIN [level]	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 50	Instruction that the specified position is to be crossed at a level between the specified levels.	CROSS [position] BETWEEN [level] AND [level]	W/U	FANS 1/A
UM 51	Instruction that the specified position is to be crossed at the specified time.	CROSS [position] AT [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 52	Instruction that the specified position is to be crossed at or before the specified time.	CROSS [position] AT OR BEFORE [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 53	Instruction that the specified position is to be crossed at or after the specified time.	CROSS [position] AT OR AFTER [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 54	Instruction that the specified position is to be crossed at a time between the specified times.	CROSS [position] BETWEEN [time] AND [time]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 55	Instruction that the specified position is to be crossed at the specified speed and the specified speed is to be maintained until further advised.	CROSS [position] AT [speed]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 56	Instruction that the specified position is to be crossed at a speed equal to or less than the specified speed and the specified speed or less is to be maintained until further advised.	CROSS [position] AT OR LESS THAN [speed]	W/U	FANS 1/A
UM 57	Instruction that the specified position is to be crossed at a speed equal to or greater than the specified speed and the specified speed or greater is to be maintained until further advised.	CROSS [position] AT OR GREATER THAN [speed]	W/U	FANS 1/A
UM 58	Instruction that the specified position is to be crossed at the specified time and the specified level.	CROSS [position] AT [time] AT [level]	W/U	FANS 1/A
UM 59	Instruction that the specified position is to be crossed at or before the specified time and at the specified level.	CROSS [position] AT OR BEFORE [time] AT [level]	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 60	Instruction that the specified position is to be crossed at or after the specified time and at the specified level.	CROSS [position] AT OR AFTER [time] AT [level]	W/U	FANS 1/A
UM 61	Instruction that the specified position is to be crossed at the specified level and speed, and the level and speed are to be maintained.	CROSS [position] AT AND MAINTAIN [level] AT [speed]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 62	Instruction that at the specified time the specified position is to be crossed at the specified level and the level is to be maintained.	AT [time] CROSS [position] AT AND MAINTAIN [level]	W/U	FANS 1/A
UM 63	Instruction that at the specified time the specified position is to be crossed at the specified level and speed, and the level and speed are to be maintained.	AT [time] CROSS [position] AT AND MAINTAIN [level] AT [speed]	W/U	FANS 1/A
	Lateral Offsets (uplink)			
UM 64	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction.	OFFSET [specified distance] [direction] OF ROUTE	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 65	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified position.	AT [position] OFFSET [specified distance] [direction] OF ROUTE	W/U	FANS 1/A
UM 66	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified time.	AT [time] OFFSET [specified distance] [direction] OF ROUTE	W/U	FANS 1/A
UM 67	Instruction that the cleared flight route is to be rejoined.	PROCEED BACK ON ROUTE	W/U	FANS 1/A
UM 68	Instruction that the cleared flight route is to be rejoined at or before the specified position.	REJOIN ROUTE BY [position]	W/U	FANS 1/A
UM 69	Instruction that the cleared flight route is to be rejoined at or before the specified time.	REJOIN ROUTE BY [time]	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 70	Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified position.	EXPECT BACK ON ROUTE BY [position]	R	FANS 1/A
UM 71	Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified time.	EXPECT BACK ON ROUTE BY [time]	R	FANS 1/A
UM 72	Instruction to resume own navigation following a period of tracking or heading clearances. May be used in conjunction with an instruction on how or where to rejoin the cleared route.	RESUME OWN NAVIGATION	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
	Route Modifications (uplink)			
UM 73	Instruction to be followed from departure until the specified clearance limit.	[departure clearance]	W/U	FANS 1/A
UM 74	Instruction to proceed directly from its present position to the specified position.	PROCEED DIRECT TO [position]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 75	Instruction to proceed, when able, directly to the specified position.	WHEN ABLE PROCEED DIRECT TO [position]	W/U	FANS 1/A
UM 76	Instruction to proceed, at the specified time, directly to the specified position.	AT [time] PROCEED DIRECT TO [position]	W/U	FANS 1/A
UM 77	Instruction to proceed, at the specified position, directly to the next specified position.	AT [position] PROCEED DIRECT TO [position]	W/U	FANS 1/A
UM 78	Instruction to proceed, upon reaching the specified level, directly to the specified position.	AT [level] PROCEED DIRECT TO [position]	W/U	FANS 1/A
UM 79	Instruction to proceed to the specified position via the specified route.	CLEARED TO [position] VIA [route clearance]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 80	Instruction to proceed via the specified route.	CLEARED [route clearance]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 81	Instruction to proceed in accordance with the specified procedure.	CLEARED [procedure name]	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 236	Instruction to leave controlled airspace.	LEAVE CONTROLLED AIRSPACE	W/U	N/A
UM 82	Approval to deviate up to the specified distance from the cleared route in the specified direction.	CLEARED TO DEVIATE UP TO [specified distance] [direction] OF ROUTE	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 83	Instruction to proceed from the specified position via the specified route.	AT [position] CLEARED [route clearance]	W/U	FANS 1/A
UM 84	Instruction to proceed from the specified position via the specified procedure.	AT [position] CLEARED [procedure name]	W/U	FANS 1/A
UM 85	Notification that a clearance to fly on the specified route may be issued. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	EXPECT [route clearance]	R	FANS 1/A
UM 86	Notification that a clearance to fly on the specified route from the specified position may be issued. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	AT [position] EXPECT [route clearance]	R	FANS 1/A
UM 87	Notification that a clearance to fly directly to the specified position may be issued. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	EXPECT DIRECT TO [position]	R	FANS 1/A
UM 88	Notification that a clearance to fly directly from the first specified position to the next specified position may be issued. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	AT [position] EXPECT DIRECT TO [position]	R	FANS 1/A
UM 89	Notification that a clearance to fly directly to the specified position commencing at the specified time may be issued. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	AT [time] EXPECT DIRECT TO [position]	R	FANS 1/A
UM 90	Notification that a clearance to fly directly to the specified position commencing when the specified level is reached may be issued. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	AT [level] EXPECT DIRECT TO [position]	R	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 91	Instruction to enter a holding pattern with the specified characteristics at the specified position and level.	**HOLD AT [position] MAINTAIN [level] INBOUND TRACK [degrees] [direction] TURNS [leg type]** Or *HOLD AT [position] MAINTAIN [altitude] INBOUND TRACK [degrees][direction] TURN LEG TIME [leg type]*	W/U	FANS 1/A
UM 92	Instruction to enter a holding pattern with the published characteristics at the specified position and level.	HOLD AT [position] AS PUBLISHED MAINTAIN [level]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 93	Notification that an onwards clearance may be issued at the specified time.	EXPECT FURTHER CLEARANCE AT [time]	R	FANS 1/A
UM 94	Instruction to turn left or right as specified on to the specified heading.	TURN [direction] HEADING [degrees]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 95	Instruction to turn left or right as specified on to the specified track.	TURN [direction] GROUND TRACK [degrees]	W/U	FANS 1/A
UM 215	Instruction to turn a specified number of degrees left or right.	TURN [direction] [degrees] DEGREES	W/U	ATN B1 FANS 1/A-ATN
UM 190	Instruction to fly on the specified heading.	FLY HEADING [degrees]	W/U	ATN B1 FANS 1/A-ATN
UM 96	Instruction to continue to fly on the current heading.	**CONTINUE PRESENT HEADING** Or *FLY PRESENT HEADING*	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 97	Instruction to fly on the specified heading from the specified position.	AT [position] FLY HEADING [degrees]	W/U	FANS 1/A
UM 221	Instruction to stop turn at the specified heading prior to reaching the previously assigned heading.	STOP TURN HEADING [degrees]	W/U	N/A (Urgent)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 98	Instruction to turn immediately left or right as specified on to the specified heading.	IMMEDIATELY TURN [direction] HEADING [degrees]	W/U	FANS 1/A (Distress)
UM 99	Notification that a clearance may be issued for the aircraft to fly the specified procedure.	EXPECT [procedure name]	R	FANS 1/A
	Speed Changes (uplink)			
UM 100	Notification that a speed instruction may be issued to be effective at the specified time.	AT [time] EXPECT [speed]	R	FANS 1/A
UM 101	Notification that a speed instruction may be issued to be effective at the specified position.	AT [position] EXPECT [speed]	R	FANS 1/A
UM 102	Notification that a speed instruction may be issued to be effective at the specified level. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	AT [level] EXPECT [speed]	R	FANS 1/A
UM 103	Notification that a speed range instruction may be issued to be effective at the specified time. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	AT [time] EXPECT [speed] TO [speed]	R	FANS 1/A
UM 104	Notification that a speed range instruction may be issued to be effective at the specified position. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	AT [position] EXPECT [speed] TO [speed]	R	FANS 1/A
UM 105	Notification that a speed range instruction may be issued to be effective at the specified level. *<u>Note</u>.— Avoid use of this message element due to potential misinterpretation.*	AT [level] EXPECT [speed] TO [speed]	R	FANS 1/A
UM 106	Instruction that the specified speed is to be maintained.	MAINTAIN [speed]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 188	Instruction that after passing the specified position the specified speed is to be maintained.	AFTER PASSING [position] MAINTAIN [speed]	W/U	N/A
UM 107	Instruction that the present speed is to be maintained.	MAINTAIN PRESENT SPEED	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 108	Instruction that the specified speed or a greater speed is to be maintained.	MAINTAIN [speed] OR GREATER	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 109	Instruction that the specified speed or a lesser speed is to be maintained.	MAINTAIN [speed] OR LESS	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 110	Instruction that a speed within the specified range is to be maintained.	MAINTAIN [speed] TO [speed]	W/U	FANS 1/A
UM 111	Instruction that the present speed is to be increased to the specified speed and maintained until further advised.	INCREASE SPEED TO [speed]	W/U	FANS 1/A
UM 112	Instruction that the present speed is to be increased to the specified speed or greater, and maintained at or above the specified speed until further advised.	INCREASE SPEED TO [speed] OR GREATER	W/U	FANS 1/A
UM 113	Instruction that the present speed is to be reduced to the specified speed and maintained until further advised.	REDUCE SPEED TO [speed]	W/U	FANS 1/A
UM 114	Instruction that the present speed is to be reduced to the specified speed or less and maintained at or below the specified speed until further advised.	REDUCE SPEED TO [speed] OR LESS	W/U	FANS 1/A
UM 115	Instruction that the specified speed is not to be exceeded.	DO NOT EXCEED [speed]	W/U	FANS 1/A
UM 116	Instruction that the aircraft's normal speed be resumed. The previously issued speed restriction(s) are cancelled.	RESUME NORMAL SPEED	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 189	Instruction that the present speed is to be changed to the specified speed.	ADJUST SPEED TO [speed]	W/U	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 222	Notification that the aircraft may keep its preferred speed without restriction. *FANS 1/A-ATN.— Uses UM 169z free text for FANS 1/A aircraft.*	NO SPEED RESTRICTION	R	ATN B1 FANS 1/A-ATN
UM 223	Instruction to reduce present speed to the minimum safe approach speed.	REDUCE TO MINIMUM APPROACH SPEED	W/U	N/A
	Contact/Monitor/Surveillance Requests (uplink)			
UM 117	Instruction that the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	CONTACT [unit name] [frequency]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 118	Instruction that at the specified position the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	AT [position] CONTACT [unit name] [frequency]	W/U	FANS 1/A
UM 119	Instruction that at the specified time the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	AT [time] CONTACT [unit name] [frequency]	W/U	FANS 1/A
UM 238	Notification that the secondary frequency is as specified. *FANS 1/A.— Uses UM 169o free text for FANS 1/A aircraft.*	SECONDARY FREQUENCY [frequency]	R	N/A
UM 120	Instruction that the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. *Note.— The flight crew is not required to check in.*	MONITOR [unit name] [frequency]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 121	Instruction that at the specified position the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. *Note.— The flight crew is not required to check in.*	AT [position] MONITOR [unit name] [frequency]	W/U	FANS 1/A
UM 122	Instruction that at the specified time the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. *Note.— The flight crew is not required to check in.*	AT [time] MONITOR [unit name] [frequency]	W/U	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 123	Instruction that the specified code (SSR code) is to be selected.	SQUAWK [code]	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 124	Instruction that the SSR transponder responses are to be disabled.	STOP SQUAWK	W/U	FANS 1/A
UM 239	Instruction that the ADS-B transmissions are to be terminated.	STOP ADS-B TRANSMISSION	W/U	N/A
UM 125	Instruction that the SSR transponder responses should include level information.	**SQUAWK MODE CHARLIE** Or *SQUAWK ALTITUDE*	W/U	FANS 1/A
UM 240	Instruction that the ADS-B transmissions should include level information.	TRANSMIT ADS-B ALTITUDE	W/U	N/A
UM 126	Instruction that the SSR transponder responses should no longer include level information.	**STOP SQUAWK MODE CHARLIE** Or *STOP ALTITUDE SQUAWK*	W/U	FANS 1/A
UM 241	Instruction that the ADS-B transmissions should no longer include level information.	STOP ADS-B ALTITUDE TRANSMISSION	W/U	N/A
UM 179	Instruction that the 'ident' function on the SSR transponder is to be actuated.	SQUAWK IDENT	W/U	FANS 1/A ATN B1 FANS 1/A-ATN
UM 242	Instruction that the "ident" function of the ADS-B emitter is to be activated. *FANS 1/A.— Uses UM 169ai free text for FANS 1/A aircraft. The free text message is considered acceptable as the intended use does not change the volume of protected airspace (i.e., not a clearance).*	TRANSMIT ADS-B IDENT	**W/U** *Or* *R (free text)*	FANS 1/A
UM 243	Instruction to report when the aircraft is clear of adverse meteorological conditions, and a clearance to regain cleared flight route can be accepted.	REPORT CLEAR OF WEATHER	W/U	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Report/Confirmation Requests (uplink)			
UM 127	Instruction to report when the aircraft is back on the cleared route.	REPORT BACK ON ROUTE	**W/U** *Or* *R*	FANS 1/A
UM 128	Instruction to report when the aircraft has vacated the specified level that has either been maintained or passed through on climb or descent. *Note.— Either a level that has been maintained, or a level passed through on climb or descent.*	REPORT LEAVING [level]	**W/U** *Or* *R*	FANS 1/A
UM 129	Instruction to report when the aircraft is in level flight at the specified level. *Note.— This message element is only to be used with single altitude clearances.*	**REPORT MAINTAINING [level]** Or *REPORT LEVEL [altitude]*	**W/U** *Or* *R*	FANS 1/A
UM 175	(Reserved) *Note.— Avoid use of this message element, REPORT REACHING [level], as it is reserved in ICAO Doc 4444.*	N/A	**W/U** *Or* *R*	FANS 1/A
UM 200	Instruction used in conjunction with a level clearance to report maintaining the level assigned.	REPORT MAINTAINING	W/U	N/A
UM 180	Instruction to report when the aircraft is within the specified vertical range.	REPORT REACHING BLOCK [level] TO [level]	**W/U** *Or* *R*	FANS 1/A
UM 130	Instruction to report when the aircraft has passed the specified position.	REPORT PASSING [position]	**W/U** *Or* *R*	FANS 1/A
UM 181	Instruction to report the present distance to or from the specified position.	REPORT DISTANCE [to/from] [position]	**Y** *Or* *NE*	FANS 1/A
UM 184	Instruction to report at the specified time the distance to or from the specified position.	AT TIME [time] REPORT DISTANCE [to/from] [position]	Y	N/A
UM 228	Instruction to report the estimated time of arrival at the specified position. *FANS 1/A.— Uses UM 169d free text for FANS 1/A aircraft.*	REPORT ETA [position]	Y DM104	FANS 1/A [free text]

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 131	Instruction to report the amount of fuel remaining and the number of persons on board.	**REPORT REMAINING FUEL AND PERSONS ON BOARD** Or *REPORT REMAINING FUEL AND SOULS ON BOARD*	**Y** *Or* *NE*	FANS 1/A (Urgent)
UM 132	Instruction to report the present position.	**REPORT POSITION** Or *CONFIRM POSITION*	**Y** *Or* *NE*	FANS 1/A
UM 133	Instruction to report the present level.	**REPORT PRESENT LEVEL** Or *CONFIRM ALTITUDE*	**Y** *Or* *NE* *DM32*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 134	Instruction to report the requested speed. *Note.— Instruction to report the present speed.* *FANS 1/A.— Uses UM 169b free text for FANS 1/A aircraft when the controller is requesting the flight crew to report the present ground speed.*	**REPORT [speed type] [speed type] [speed type] SPEED** Or *CONFIRM SPEED*	**Y** *Or* *NE* *Or* *R* *DM113*	FANS 1/A
UM 135	Instruction to confirm the currently assigned level.	**CONFIRM ASSIGNED LEVEL** Or *CONFIRM ASSIGNED ALTITUDE*	**Y** *Or* *NE* *DM38* *DM77 (TBC)*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 136	Instruction to confirm the currently assigned speed.	CONFIRM ASSIGNED SPEED	**Y** *Or* *NE*	FANS 1/A
UM 137	Instruction to confirm the currently assigned route.	CONFIRM ASSIGNED ROUTE	**Y** *Or* *NE*	FANS 1/A
UM 138	Instruction to confirm the previously reported time over the last reported waypoint.	CONFIRM TIME OVER REPORTED WAYPOINT	**Y** *Or* *NE*	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 139	Instruction to confirm the identity of the previously reported waypoint.	CONFIRM REPORTED WAYPOINT	**Y** *Or* *NE*	FANS 1/A
UM 140	Instruction to confirm the identity of the next waypoint.	CONFIRM NEXT WAYPOINT	**Y** *Or* *NE*	FANS 1/A
UM 141	Instruction to confirm the previously reported estimated time at the next waypoint.	CONFIRM NEXT WAYPOINT ETA	**Y** *Or* *NE*	FANS 1/A
UM 142	Instruction to confirm the identity of the next but one waypoint.	CONFIRM ENSUING WAYPOINT	**Y** *Or* *NE*	FANS 1/A
UM 143	The request was not understood. It should be clarified and resubmitted.	CONFIRM REQUEST	**Y** *Or* *NE*	FANS 1/A
UM 144	Instruction to report the selected (SSR) code.	CONFIRM SQUAWK	**Y** *Or* *NE*	FANS 1/A
UM 145	Instruction to report the present heading.	**REPORT HEADING** Or *CONFIRM HEADING*	**Y** *Or* *NE*	FANS 1/A
UM 146	Instruction to report the present ground track.	**REPORT GROUND TRACK** Or *CONFIRM GROUND TRACK*	**Y** *Or* *NE*	FANS 1/A
UM 182	Instruction to report the identification code of the last ATIS received.	CONFIRM ATIS CODE	**Y** *Or* *NE*	FANS 1/A
UM 147	Instruction to make a position report. *Note.— To be used if the controller does not receive a scheduled position report.*	REQUEST POSITION REPORT	**Y** *Or* *NE*	FANS 1/A
UM 216	Instruction to file a flight plan.	REQUEST FLIGHT PLAN	Y	N/A
UM 217	Instruction to report that the aircraft has landed.	REPORT ARRIVAL	Y	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 229	Instruction to report the preferred alternate aerodrome for landing.	REPORT ALTERNATE AERODROME	Y	N/A
UM 231	Instruction to indicate the pilot's preferred level. *FANS 1/A and FANS 1/A-ATN.— uses UM 169c free text for FANS 1/A aircraft.*	STATE PREFERRED LEVEL	Y *DM106*	Ocean SPR FANS 1/A [free text] ATN B1 FANS 1/A-ATN
UM 232	Instruction to indicate the pilot's preferred time and/or position to commence descent to the aerodrome of intended arrival. *FANS 1/A and FANS 1/A-ATN.— Uses UM 169aa free text for FANS 1/A aircraft.*	STATE TOP OF DESCENT	Y *DM109*	FANS 1/A [free text] ATN B1 FANS 1/A-ATN
	Negotiation Requests (uplink)			
UM 148	Request for the earliest time or position at which the specified level can be accepted.	WHEN CAN YOU ACCEPT [level]	**Y** *Or* *NE* *DM81* *DM82*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 149	Instruction to report whether or not the specified level can be accepted at the specified position.	CAN YOU ACCEPT [level] AT [position]	A/N	FANS 1/A
UM 150	Instruction to report whether or not the specified level can be accepted at the specified time.	CAN YOU ACCEPT [level] AT [time]	A/N	FANS 1/A
UM 151	Instruction to report the earliest time or position when the specified speed can be accepted.	WHEN CAN YOU ACCEPT [speed]	**Y** *Or* *NE* *DM83* *DM84*	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 152	Instruction to report the earliest time or position when the specified offset track can be accepted.	WHEN CAN YOU ACCEPT [specified distance] [direction] OFFSET	**Y** *Or* *NE* *DM85* *DM86*	FANS 1/A
	Air Traffic Advisories (uplink)			
UM 153	ATS advisory that the altimeter setting should be the specified setting.	ALTIMETER [altimeter]	R	FANS 1/A
UM 213	ATS advisory that the specified altimeter setting relates to the specified facility. *FANS 1/A-ATN.— Uses UM 169y free text for FANS 1/A aircraft.*	[facility designation] ALTIMETER [altimeter]	R	ATN B1 FANS 1/A-ATN
UM 154	ATS advisory that the radar service is terminated.	**RADAR SERVICE TERMINATED** Or *RADAR SERVICES TERMINATED*	R	FANS 1/A
UM 244	ATS advisory that the radar and/or ADS-B service is terminated. *FANS 1/A.— uses UM 169aj free text for FANS 1/A aircraft.*	IDENTIFICATION TERMINATED	R	FANS 1/A [free text]
UM 191	ATS advisory that the aircraft is entering airspace in which no air traffic services are provided and all existing air traffic services are terminated.	ALL ATS TERMINATED	R	N/A
UM 155	ATS advisory that radar contact has been established at the specified position.	RADAR CONTACT [position]	R	FANS 1/A
UM 156	ATS advisory that radar contact has been lost.	RADAR CONTACT LOST	R	FANS 1/A
UM 210	ATS advisory that the aircraft has been identified on radar and/or ADS-B at the specified position.	IDENTIFIED [position]	R	N/A
UM 193	Notification that radar and/or ADS-B identification has been lost.	IDENTIFICATION LOST	R	N/A
UM 157	Instruction that a continuous transmission is detected on the specified frequency. Check the microphone button.	CHECK STUCK MICROPHONE [frequency]	**N** *Or* *R*	FANS 1/A ATN B1 FANS 1/A-ATN (Urgent)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 158	ATS advisory that the ATIS information identified by the specified code is the current ATIS information.	ATIS [atis code]	R	FANS 1/A
UM 212	ATS advisory that the specified ATIS information at the specified airport is current.	[facility designation] ATIS [atis code] CURRENT	R	N/A
UM 214	ATS advisory that indicates the RVR value for the specified runway.	RVR RUNWAY [runway] [rvr]	R	N/A
UM 224	ATS advisory that no delay is expected.	NO DELAY EXPECTED	R	N/A
UM 225	ATS advisory that the expected delay has not been determined.	DELAY NOT DETERMINED	R	N/A
UM 226	ATS advisory that the aircraft may expect to be cleared to commence its approach procedure at the specified time.	EXPECTED APPROACH TIME [time]	R	N/A
	System Management Messages (uplink)			
UM 159	A system generated message notifying that the ground system has detected an error.	ERROR [error information]	**N** *Or* *NE*	FANS 1/A ATN B1 FANS 1/A-ATN (Urgent)
UM 160	Notification to the avionics that the specified data authority is the next data authority. If no data authority is specified, this indicates that any previously specified next data authority is no longer valid.	NEXT DATA AUTHORITY [facility designation]	**N** *Or* *NE*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 161	Notification to the avionics that the data link connection with the current data authority is being terminated.	END SERVICE	**N** *Or* *NE*	FANS 1/A
UM 162	Notification that the ground system does not support this message. *FANS 1/A.— Uses UM 169u free text for FANS 1/A aircraft.*	**MESSAGE NOT SUPPORTED BY THIS ATS UNIT** Or *SERVICE UNAVAILABLE*	**N** *Or* *NE*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 234	Notification that the ground system does not have a flight plan for that aircraft.	FLIGHT PLAN NOT HELD	N	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 163	Notification to the pilot of an ATSU identifier.	**[facility designation]** Or *[icao facility designation] [tP4+Table]*	**N** *Or* *NE*	FANS 1/A
UM 227	Confirmation to the aircraft system that the ground system has received the message to which the logical acknowledgement refers and found it acceptable for display to the responsible person. *FANS 1/A-ATN.— ATN B1 only. Not available for FANS 1/A.*	LOGICAL ACKNOWLEDGEMENT	N	ATN B1 FANS 1/A-ATN
UM 233	Notification to the pilot that messages sent requiring a logical acknowledgement will not be accepted by this ground system.	USE OF LOGICAL ACKNOWLEDGEMENT PROHIBITED	N	N/A
	Additional Messages (uplink)			
UM 164	The associated instruction may be complied with at any future time. *Note.— Intent same as UM 177 AT PILOTS DISCRETION.*	WHEN READY	**N** *Or* *NE*	FANS 1/A
UM 230	The associated instruction is to be complied with immediately.	IMMEDIATELY	N	N/A (Distress)
UM 165	Used to link two messages, indicating the proper order of execution of clearances/ instructions.	THEN	**N** *Or* *NE*	FANS 1/A ATN B1 FANS 1/A-ATN
UM 166	The associated instruction is issued due to traffic considerations.	**DUE TO [traffic type] TRAFFIC** Or *DUE TO TRAFFIC*	**N** *Or* *NE*	FANS 1/A
UM 167	The associated instruction is issued due to airspace restrictions.	DUE TO AIRSPACE RESTRICTION	**N** *Or* *NE*	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 168	The indicated communication should be ignored. *Note.— The previously sent uplink CPDLC message should be ignored. DISREGARD should not refer to a clearance or instruction. If DISREGARD is used, another element should be added to clarify which message is to be disregarded.*	DISREGARD	R	FANS 1/A
UM 176	Instruction that the pilot is responsible for maintaining separation from other traffic and is also responsible for maintaining visual meteorological conditions.	MAINTAIN OWN SEPARATION AND VMC	W/U	FANS 1/A
UM 177	Used in conjunction with a clearance/instruction to indicate that the pilot may execute when prepared to do so. *Note.— Intent same as UM 164 WHEN READY.*	AT PILOTS DISCRETION	N	FANS 1/A
UM 178	(Reserved) *Note.— Avoid use of this message element, TRACK DETAIL MESSAGE, as it is reserved in ICAO Doc 4444.*	(not defined)	**Y** *Or* *W/U*	FANS 1/A
	Free Text Normal-(uplink)			
UM 169	Normal urgency attribute, low alert attribute	[free text]	R	FANS 1/A FANS 1/A-ATN
	Free Text Distress (uplink)			
UM 170	Distress urgency attribute, high alert attribute	[free text]	R	FANS 1/A
	Free Text – Other			
UM 183	Normal urgency attribute, medium alert attribute *FANS 1/A-ATN.— ATN B1 only. Ground system uses UM 169 [free text] for FANS 1/A aircraft.*	[free text]	N	ATN B1 FANS 1/A-ATN
UM 187	low urgency, normal alert	[free text]	N	N/A
UM 194	normal urgency, low alert	[free text]	Y	N/A
UM 195	low urgency, low alert	[free text]	R	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
UM 196	normal urgency, medium alert	[free text]	W/U	ATN B1 FANS 1/A-ATN
UM 197	urgent urgency, medium alert	[free text]	W/U	N/A (Urgent)
UM 198	distress urgency, high alert	[free text]	W/U	N/A (Distress)
UM 199	normal urgency, low alert	[free text]	N	N/A
UM 201	Not used, low urgency, low alert	[free text]	N	N/A
UM 202	Not used, low urgency, low alert	[free text]	N	N/A
UM 203	normal urgency, medium alert	[free text]	R	N/A
UM 204	normal urgency, medium alert	[free text]	Y	N/A
UM 205	normal urgency, medium alert	[free text]	A/N	N/A
UM 206	low urgency, normal alert	[free text]	Y	N/A
UM 207	low urgency, low alert	[free text]	Y	N/A
UM 208	low urgency, low alert	[free text]	N	N/A

A.3 CPDLC downlink message elements

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Responses/Acknowledgements (downlink)			
DM 0	The instruction is understood and will be complied with.	WILCO	N	FANS 1/A ATN B1 FANS 1/A-ATN

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 1	The instruction cannot be complied with.	UNABLE	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 2	Wait for a reply. *Note.— The controller is informed that the request is being assessed and there will be a short term delay (within 10 minutes). The exchange is not closed and the request will be responded to when conditions allow.*	STANDBY	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 3	Message received and understood. *Note.— ROGER is the only correct response to an uplink free text message. Under no circumstances will ROGER be used instead of AFFIRM.*	ROGER	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 4	Yes. *Note.— AFFIRM is an appropriate response to an uplinked negotiation request message (e.g. UM 150 CAN YOU ACCEPT [level] at [time]).*	AFFIRM	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 5	No. *Note.— NEGATIVE is an appropriate response to an uplinked negotiation request message (e.g. UM 150 CAN YOU ACCEPT [level] at [time]).*	NEGATIVE	N	FANS 1/A ATN B1 FANS 1/A-ATN

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Vertical Requests (downlink)			
DM 6	Request to fly at the specified level.	REQUEST [level]	Y *UM0* *UM1* *UM19* *UM20* *UM23* *UM26* *UM27* *UM28* *UM29* *UM46* *UM47* *UM48* *UM159* + *UM183* *UM162* *UM211*	FANS 1/A ATN B1 FANS 1/A-ATN
DM 7	Request to fly at a level within the specified vertical range. *FANS 1/A-ATN.— FANS 1/A aircraft only. ATN B1 aircraft uses DM 6 REQUEST [level], where [level] is a vertical range.*	REQUEST BLOCK [level] TO [level]	Y	FANS 1/A FANS 1/A - ATN
DM 8	Request to cruise climb to the specified level. *Note.— Avoid use of this message element due to potential misinterpretation.*	REQUEST CRUISE CLIMB TO [level]	Y	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 9	Request to climb to the specified level.	REQUEST CLIMB TO [level]	Y *UM0* *UM1* *UM19* *UM20* *UM23* *UM26* *UM27* *UM28* *UM29* *UM46* *UM47* *UM48* *UM159* + *UM183* *UM162* *UM211*	FANS 1/A ATN B1 FANS 1/A-ATN
DM 10	Request to descend to the specified level.	REQUEST DESCENT TO [level]	Y *UM0* *UM19* *UM20* *UM23* *UM26* *UM27* *UM28* *UM29* *UM46* *UM47* *UM48* *UM159* + *UM183* *UM162* *UM211*	FANS 1/A ATN B1 FANS 1/A-ATN
DM 11	Request that at the specified position a climb to the specified level be approved.	AT [position] REQUEST CLIMB TO [level]	Y	FANS 1/A
DM 12	Request that at the specified position a descent to the specified level be approved.	AT [position] REQUEST DESCENT TO [level]	Y	FANS 1/A
DM 13	Request that at the specified time a climb to the specified level be approved.	AT [time] REQUEST CLIMB TO [level]	Y	FANS 1/A
DM 14	Request that at the specified time a descent to the specified level be approved.	AT [time] REQUEST DESCENT TO [level]	Y	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 69	Request that a descent be approved on a see-and-avoid basis. *Note.— Avoid use of this message element due to potential misinterpretation.*	REQUEST VMC DESCENT	Y	FANS 1/A
	Lateral Off-Set Requests (downlink)			
DM 15	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved.	REQUEST OFFSET [specified distance] [direction] OF ROUTE	Y	FANS 1/A
DM 16	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified position.	AT [position] REQUEST OFFSET [specified distance] [direction] OF ROUTE	Y	FANS 1/A
DM 17	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified time.	AT [time] REQUEST OFFSET [specified distance] [direction] OF ROUTE	Y	FANS 1/A
	Speed Requests (downlink)			
DM 18	Request to fly at the specified speed.	REQUEST [speed]	Y *UM0* *UM1* *UM162* *UM211* *UM55* *UM61* *UM106* *UM107* *UM108* *UM109* *UM116* *UM222* *UM159 + UM183*	FANS 1/A ATN B1 FANS 1/A-ATN
DM 19	Request to fly within the specified speed range.	REQUEST [speed] TO [speed]	Y	FANS 1/A
	Voice Contact Requests (downlink)			
DM 20	Request for voice contact.	REQUEST VOICE CONTACT	Y	FANS 1/A
DM 21	Request for voice contact on the specified frequency.	REQUEST VOICE CONTACT [frequency]	Y	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Route Modification Requests (downlink)			
DM 22	Request to track from the present position direct to the specified position.	REQUEST DIRECT TO [position]	Y *UM0* *UM162* *UM211* *UM74* *UM96* *UM190* *UM159 + UM183*	FANS 1/A ATN B1 FANS 1/A-ATN
DM 23	Request for the specified procedure clearance.	REQUEST [procedure name]	Y	FANS 1/A
DM 24	Request for a route clearance.	**REQUEST CLEARANCE [route clearance]** Or *REQUEST [route clearance]*	Y	FANS 1/A
DM 25	Request for a clearance. *Note.— Either pre-departure or route.*	**REQUEST [clearance type] CLEARANCE** Or *REQUEST CLEARANCE*	Y	FANS 1/A
DM 26	Request for a weather deviation to the specified position via the specified route.	REQUEST WEATHER DEVIATION TO [position] VIA [route clearance]	Y	FANS 1/A
DM 27	Request for a weather deviation up to the specified distance off track in the specified direction.	REQUEST WEATHER DEVIATION UP TO [specified distance] [direction] OF ROUTE	Y *UM0* *UM162* *UM211* *UM64* *UM74* *UM82* *UM96* *UM190* *UM159 + UM183*	FANS 1/A ATN B1 FANS 1/A-ATN
DM 70	Request a clearance to adopt the specified heading.	REQUEST HEADING [degrees]	Y	FANS 1/A
DM 71	Request a clearance to adopt the specified ground track.	REQUEST GROUND TRACK [degrees]	Y	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
	Reports (downlink)			
DM 28	Notification of leaving the specified level.	LEAVING [level]	N	FANS 1/A
DM 29	Notification of climbing to the specified level.	CLIMBING TO [level]	N	FANS 1/A
DM 30	Notification of descending to the specified level.	DESCENDING TO [level]	N	FANS 1/A
DM 31	Notification of passing the specified position.	PASSING [position]	N	FANS 1/A
DM 78	Notification that at the specified time, the aircraft's position was as specified.	AT [time] [distance] [to/from] [position]	N	FANS 1/A
DM 32	Notification of the present level.	**PRESENT LEVEL [level]** Or *PRESENT ALTITUDE [altitude]*	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 33	Notification of the present position.	PRESENT POSITION [position]	N	FANS 1/A
DM 34	Notification of the present speed.	PRESENT SPEED [speed]	N	FANS 1/A
DM 113	Notification of the requested speed. *FANS 1/A.— Uses free text DM 67l GS [speed] for partial intent. The flight crew notifies the controller of present ground speed, in response to UM 169b, REPORT GROUND SPEED.*	[speed type] [speed type] [speed type] SPEED [speed]	N	FANS 1/A
DM 35	Notification of the present heading in degrees.	PRESENT HEADING [degrees]	N	FANS 1/A
DM 36	Notification of the present ground track in degrees.	PRESENT GROUND TRACK [degrees]	N	FANS 1/A
DM 37	Notification that the aircraft is maintaining the specified level.	**MAINTAINING [level]** Or *LEVEL [altitude]*	N	FANS 1/A
DM 72	(Reserved) *Note.— Avoid use of this message element, REACHING [level], as it is reserved in ICAO Doc 4444.*	N/A	N	FANS 1/A
DM 76	Notification that the aircraft has reached a level within the specified vertical range.	REACHING BLOCK [level] TO [level]	N	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 38	Read-back of the assigned level.	**ASSIGNED LEVEL [level]** Or *ASSIGNED ALTITUDE [altitude]*	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 77	Read-back of the assigned vertical range. *FANS 1/A-ATN.— FANS 1/A aircraft only. ATN B1 aircraft uses DM 38 ASSIGNED LEVEL [level], where [level] is a vertical range.*	ASSIGNED BLOCK [level] TO [level]	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 39	Read-back of the assigned speed.	ASSIGNED SPEED [speed]	N	FANS 1/A
DM 40	Read-back of the assigned route.	ASSIGNED ROUTE [route clearance]	N	FANS 1/A
DM 41	The aircraft has regained the cleared route.	BACK ON ROUTE	N	FANS 1/A
DM 114	Notification that the aircraft is clear of weather and is able to accept a clearance to regain cleared flight route.	CLEAR OF WEATHER	N	N/A
DM 42	The next waypoint is the specified position.	NEXT WAYPOINT [position]	N	FANS 1/A
DM 43	The ETA at the next waypoint is as specified.	NEXT WAYPOINT ETA [time]	N	FANS 1/A
DM 44	The next plus one waypoint is the specified position.	ENSUING WAYPOINT [position]	N	FANS 1/A
DM 45	Clarification of previously reported waypoint passage.	REPORTED WAYPOINT [position]	N	FANS 1/A
DM 46	Clarification of time over previously reported waypoint.	REPORTED WAYPOINT [time]	N	FANS 1/A
DM 47	The specified (SSR) code has been selected.	SQUAWKING [code]	N	FANS 1/A
DM 48	Position report. *Note.— Reports the current position of the aircraft when the flight crew presses the button to send this message. ATC expects position reports based on this downlink message.*	POSITION REPORT [position report]	N	FANS 1/A
DM 79	The code of the latest ATIS received is as specified.	ATIS [atis code]	N	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 89	The specified ATS unit is being monitored on the specified frequency. *FANS 1/A-ATN.— FANS 1/A aircraft uses DM 67aa free text. May require to be preformatted.*	MONITORING [unit name] [frequency]	N	ATN B1 FANS 1/A-ATN
DM 102	Used to report that an aircraft has landed.	LANDING REPORT	N	N/A
DM 104	Notification of estimated time of arrival at the specified position. *FANS 1/A.— Uses free text DM 67n. Response to free text UM 169d REPORT ETA [position]*	**ETA [position] [time]** Or *[position] [time]*	N	FANS 1/A [free text]
DM 105	Notification of the alternative aerodrome for landing.	ALTERNATE AERODROME [airport]	N	N/A
DM 106	Notification of the preferred level. *FANS 1/A.— Uses DM 67m. Response to free text UM 169c STATE PREFERRED LEVEL.* *FANS 1/A – ATN.— FANS 1/A aircraft response to UM 231 STATE PREFERRED LEVEL.*	**PREFERRED LEVEL [level]** Or *FL[altitude]*	N	FANS 1/A [free text] ATN B1 FANS 1/A-ATN
DM 109	Notification of the preferred time to commence descent for approach. *FANS 1/A.— Uses DM 67v. Response to free text UM 169aa STATE TOP OF DESCENT.* *FANS 1/A – ATN.— FANS 1/A aircraft response to UM 232 STATE TOP OF DESCENT.*	**TOP OF DESCENT [time]** Or *TOD [time]*	N	FANS 1/A [free text] ATN B1 FANS 1/A-ATN
DM 110	Notification of the preferred position to commence descent for approach.	TOP OF DESCENT [position]	N	N/A
DM 111	Notification of the preferred time and position to commence descent for approach.	TOP OF DESCENT [time] [position]	N	N/A
	Negotiation Requests (downlink)			
DM 49	Request for the earliest time at which a clearance to the specified speed can be expected.	WHEN CAN WE EXPECT [speed]	Y	FANS 1/A
DM 50	Request for the earliest time at which a clearance to a speed within the specified range can be expected.	WHEN CAN WE EXPECT [speed] TO [speed]	Y	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 51	Request for the earliest time at which a clearance to regain the planned route can be expected.	WHEN CAN WE EXPECT BACK ON ROUTE	Y	FANS 1/A
DM 52	Request for the earliest time at which a clearance to descend can be expected.	**WHEN CAN WE EXPECT LOWER LEVEL** Or *WHEN CAN WE EXPECT LOWER ALTITUDE*	Y	FANS 1/A
DM 53	Request for the earliest time at which a clearance to climb can be expected.	**WHEN CAN WE EXPECT HIGHER LEVEL** Or *WHEN CAN WE EXPECT HIGHER ALTITUDE*	Y	FANS 1/A
DM 54	Request for the earliest time at which a clearance to cruise climb to the specified level can be expected.	WHEN CAN WE EXPECT CRUISE CLIMB TO [level]	Y	FANS 1/A
DM 87	Request for the earliest time at which a clearance to climb to the specified level can be expected. *FANS 1/A.— Uses preformatted free text DM 67h.*	WHEN CAN WE EXPECT CLIMB TO [level]	Y	FANS 1/A
DM 88	Request for the earliest time at which a clearance to descend to the specified level can be expected. *FANS 1/A.— Uses preformatted free text DM 67i.*	WHEN CAN WE EXPECT DESCENT TO [level]	Y	FANS 1/A
	Emergency Messages (downlink)			
DM 55	Urgency prefix.	PAN PAN PAN	**Y** *Or* *N*	FANS 1/A FANS 1/A-ATN (Urgent)
DM 56	Distress prefix.	MAYDAY MAYDAY MAYDAY	**Y** *Or* *N*	FANS 1/A FANS 1/A-ATN (Distress)
DM 112	Indicates specifically that the aircraft is being subjected to unlawful interference.	SQUAWKING 7500	N	N/A (Urgent)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 57	Notification of fuel remaining and number of persons on board.	**[remaining fuel] OF FUEL REMAINING AND [persons on board] PERSONS ON BOARD** Or *[remaining fuel] OF FUEL REMAINING AND [remaining souls] SOULS ON BOARD*	**Y** *Or* *N*	FANS 1/A FANS 1/A-ATN (Urgent)
DM 58	Notification that the pilot wishes to cancel the emergency condition.	CANCEL EMERGENCY	**Y** *Or* *N*	FANS 1/A FANS 1/A-ATN (Urgent)
DM 59	Notification that the aircraft is diverting to the specified position via the specified route due to an urgent need.	DIVERTING TO [position] VIA [route clearance]	**Y** *Or* *N*	FANS 1/A FANS 1/A-ATN (Urgent)
DM 60	Notification that the aircraft is deviating the specified distance in the specified direction off the cleared route and maintaining a parallel track due to an urgent need.	OFFSETTING [specified distance] [direction] OF ROUTE	**Y** *Or* *N*	FANS 1/A FANS 1/A-ATN (Urgent)
DM 61	Notification that the aircraft is descending to the specified level due to an urgent need.	DESCENDING TO [level]	**Y** *Or* *N*	FANS 1/A FANS 1/A-ATN (Urgent)
DM 80	Notification that the aircraft is deviating up to the deviating distance from the cleared route in the specified direction due to an urgent need. *FANS 1/A.— Notification that the aircraft is operating on an offset (including SLOP). The urgency attribute for this message element is not defined.*	**DEVIATING UP TO [specified distance] [direction] OF ROUTE** Or *DEVIATING [distanceoffset] [direction] OF ROUTE*	**Y** *Or* *N*	FANS 1/A FANS 1/A-ATN (Urgent)
	System Management Messages (downlink)			
DM 62	A system-generated message that the avionics has detected an error.	ERROR [error information]	N	FANS 1/A ATN B1 FANS 1/A-ATN (Urgent)

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 63	A system-generated denial to any CPDLC application message sent from a ground facility that is not the current data authority.	NOT CURRENT DATA AUTHORITY	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 99	A system-generated message to inform a ground facility that it is now the current data authority.	CURRENT DATA AUTHORITY	N	ATN B1 FANS 1/A-ATN (Urgent)
DM 64	Notification to the ground system that the specified ATSU is the current data authority. *FANS 1/A – ATN.— FANS 1/A aircraft uses this message.*	[facility designation]	N	FANS 1/A FANS 1/A-ATN
DM 107	A system-generated message sent to a ground system that tries to connect to an aircraft when a current data authority has not designated the ground system as the NDA. *FANS 1/A – ATN.— ATN B1 aircraft uses this message.*	NOT AUTHORIZED NEXT DATA AUTHORITY	N	ATN B1
DM 73	A system-generated message indicating the software version number. *FANS 1/A – ATN.— FANS 1/A aircraft uses this message.*	[version number]	N	FANS 1/A FANS 1/A-ATN
DM 100	Confirmation to the ground system that the aircraft system has received the message to which the logical acknowledgement refers and found it acceptable for display to the responsible person. *FANS 1/A – ATN.— ATN B1 ground systems uses alternate means, such as MAS message assurance received from FANS 1/A aircraft, to mimic LOGICAL ACKNOWLEDGEMENT.*	LOGICAL ACKNOWLEDGEMENT	N	ATN B1
	Additional Messages (downlink)			
DM 65	Used to explain reasons for pilot's message.	DUE TO WEATHER	N	FANS 1/A ATN B1 FANS 1/A-ATN

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 66	Used to explain reasons for pilot's message.	DUE TO AIRCRAFT PERFORMANCE	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 74	States a desire by the pilot to provide his/her own separation and remain in VMC.	**REQUEST TO MAINTAIN OWN SEPARATION AND VMC** Or *MAINTAIN OWN SEPARATION AND VMC*	**Y** *Or* *N*	FANS 1/A
DM 75	Used in conjunction with another message to indicate that the pilot wishes to execute request when the pilot is prepared to do so.	AT PILOTS DISCRETION	N	FANS 1/A
DM 101	Allows the pilot to indicate a desire for termination of CPDLC application with the current data authority.	REQUEST END OF SERVICE	Y	N/A
DM 103	Allows the pilot to indicate that he/she has cancelled IFR flight plan.	CANCELLING IFR	Y	N/A
DM 108	Notification that de-icing action has been completed.	DE-ICING COMPLETE	N	N/A
	Free Text – Normal (downlink)			
DM 67	Normal urgency, low alert *FANS 1/A – ATN.— FANS 1/A aircraft only. ATN B1 uses DM 98.*	[free text]	N	FANS 1/A ATN B1 FANS 1/A-ATN
	Free Text - Distress (downlink)			
DM 68	Distress urgency, high alert *Note.— Selecting any of the emergency message elements will result in this message element being enabled for the flight crew to include in the emergency message at their discretion.*	[free text]	Y	FANS 1/A
DM 90	normal urgency, medium alert	[free text]	N	N/A
DM 91	normal urgency, low alert	[free text]	Y	N/A
DM 92	low urgency, low alert	[free text]	Y	N/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 93	urgent urgency, high alert	[free text]	N	N/A (Urgent)
DM 94	distress urgency, high alert	[free text]	N	N/A (Distress)
DM 95	urgent urgency, medium alert	[free text]	N	N/A (Urgent)
DM 96	urgent urgency, low alert	[free text]	N	N/A (Urgent)
DM 97	low urgency, low alert	[free text]	N	N/A
DM 98	normal urgency, normal alert *FANS 1/A – ATN.— ATN B1 aircraft only. FANS 1/A uses DM 67.*	[free text]	N	ATN B1 FANS 1/A-ATN
	Negotiation Responses (downlink)			
DM 81	We can accept the specified level at the specified time. *FANS 1/A.— Uses preformatted free text DM 67b.*	WE CAN ACCEPT [level] AT [time]	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 115	We can accept the specified level at the specified position.	WE CAN ACCEPT [level] AT [position]	N	N/A
DM 82	We cannot accept the specified level. *FANS 1/A.— Uses preformatted free text DM 67e.*	WE CANNOT ACCEPT [level]	N	FANS 1/A ATN B1 FANS 1/A-ATN
DM 83	We can accept the specified speed at the specified time. *FANS 1/A.— Uses preformatted free text DM 67c.*	WE CAN ACCEPT [speed] AT [time]	N	FANS 1/A
DM 116	We can accept the specified speed at the specified position.	WE CAN ACCEPT [speed] AT [position]	N	N/A
DM 84	We cannot accept the specified speed. *FANS 1/A.— Uses preformatted free text DM 67f.*	WE CANNOT ACCEPT [speed]	N	FANS 1/A
DM 85	We can accept a parallel track offset the specified distance in the specified direction at the specified time. *FANS 1/A.— Uses preformatted free text DM 67d.*	WE CAN ACCEPT [specified distance] [direction] AT [time]	N	FANS 1/A

Ref #	Message Intent/Use	Message Element	Resp.	Data link system(s)
DM 117	We can accept a parallel track offset the specified distance in the specified direction at the specified position.	WE CAN ACCEPT [specified distance] [direction] AT [position]	N	N/A
DM 86	We cannot accept a parallel track offset the specified distance in the specified direction. *FANS 1/A.— Uses preformatted free text DM 67g.*	WE CANNOT ACCEPT [specified distance] [direction]	N	FANS 1/A

A.4 CPDLC standardized free text messages

A.4.1 CPDLC uplink standardized free text messages

When a free text uplink message has been received, the flight crew should respond with ROGER before responding to the message.

Ref #	Message Intent/Use	Message Element	Resp.
	Standardized Free Text Responses/Acknowledgements (uplink)		
UM 169q	Acknowledgement of receipt of a CPDLC downlink MAYDAY message. *Note.— No equivalent to ICAO Doc 4444.*	ROGER MAYDAY	R
UM 169r	Acknowledgement of receipt of a CPDLC downlinked PAN message. *Note.— No equivalent to ICAO Doc 4444.*	ROGER PAN	R
UM 169ak	Notification that an ADS-C emergency report has been received from the aircraft. *Note.— No equivalent to ICAO Doc 4444.*	CONFIRM ADS-C EMERGENCY	R
UM 169s	Notification that the CPDLC downlink request was: 1) part of the approved message set; and 2) received by the controller. The aircraft will receive any further communication about the request via voice contact with the specified unit. [unit_description] is the name of the radio facility with which the response will be communicated. *Note.— No equivalent to ICAO Doc 4444.*	REQUEST RECEIVED RESPONSE WILL BE VIA [unit_description]	R

Ref #	Message Intent/Use	Message Element	Resp.
UM 169x	Indication that the request has been received and has been forwarded on to the next ATSU. *Note.— Same intent as ICAO Doc 4444 UM 211.*	REQUEST FORWARDED	R
UM 169ab	Indicates that the request cannot be responded to by the current unit and that it should be requested from the next unit. *Note.— Same intent as ICAO Doc 4444 UM 237.*	REQUEST AGAIN WITH NEXT UNIT	R
	Standardized Free Text Route Modifications (uplink)		
UM 169al	Notification of an unambiguous tailored arrival name associated with a specific route and constraints. Used in combination with UM 83 AT [position] CLEARED [route clearance] and UM 19 MAINTAIN [level]. *Note.— No equivalent in ICAO Doc 4444.*	[TA designator]	R
	Standardized Free Text Speed Changes (uplink)		
UM 169p	Notification that a previously issued speed can be expected to be maintained until the specified position or time. *Note.— No equivalent to ICAO Doc 4444.*	EXPECT TO MAINTAIN [speed] UNTIL [time / position]	R
UM 169z	Notification that the aircraft may keep its preferred speed without restriction. *Note.— Same intent as ICAO Doc 4444 UM 222.*	NO SPEED RESTRICTION	R
	Standardized Free Text Contact/Monitor/Surveillance Requests (uplink)		
UM 169ai	Instruction that the “ident” function of the ADS-B emitter is to be activated. *Note.— Same intent as ICAO Doc 4444 UM 242.*	TRANSMIT ADS-B IDENT	R
	Standardized Free Text Report/Confirmation Requests (uplink)		
UM 169b	Instruction to report the ground speed of the aircraft. *Note.— Intent similar partially to ICAO Doc 4444 UM 134.*	REPORT GROUND SPEED	R, then DM 67l

Ref #	Message Intent/Use	Message Element	Resp.
UM 169c	Instruction to advise the preferred flight level for the flight. *Note.— Same intent as ICAO Doc 4444 UM 231*	STATE PREFERRED LEVEL	R, then DM 67m
UM 169d	Instruction to report the estimated time of arrival at the specified position. *Note.— Same intent as ICAO Doc 4444 UM 228.*	REPORT ETA [position]	R, then DM 67n
UM 169e	Instruction to notify when the specified traffic has been observed by visual contact to have passed. *Note.— No equivalent to ICAO Doc 4444.*	REPORT SIGHTING AND PASSING OPPOSITE DIRECTION [traffic description] ETP [time]	R, then DM 67o DM 67p
UM 169aa	Instruction to indicate the preferred time to commence descent to the aerodrome of intended arrival. *Note.— Same intent as ICAO Doc 4444 UM 232 for time only.*	STATE TOP OF DESCENT	R, then DM 67v
	Standardized Free text Air Traffic Advisories (uplink)		
UM 169k	Notification that a SELCAL check on the specified HF frequency should be expected. *Note.— No equivalent to ICAO Doc 4444.*	EXPECT SELCAL CHECK HF [frequency]	R
UM 169l	Notification that the CPDLC transfer process will not be completed at the FIR boundary and will be delayed until the specified time. If the CPDLC transfer is not completed by the specified time, the flight crew should manually disconnect and logon to the next center. *Note.— No equivalent to ICAO Doc 4444.*	EXPECT CPDLC TRANSFER AT [time]	R
UM 169aj	ATS advisory that the radar and/or ADS-B service is terminated. *Note.— Same intent as ICAO Doc 4444 UM 244.*	IDENTIFICATION TERMINATED	R
UM 169m	Notification that a CPDLC connection is not required by the next FIR (e.g. due to short transition time of the next FIR) and CPDLC connection will be transferred to the subsequent FIR. *Note.— No equivalent to ICAO Doc 4444.*	EXPECT NEXT CENTER [facility designation]. CONTACT WITH [facility designation] NOT REQUIRED	R

Ref #	Message Intent/Use	Message Element	Resp.
UM 169n	Notification of traffic significant to the flight. *Note.— No equivalent to ICAO Doc 4444.*	TRAFFIC IS [traffic description]	R, then, (optionally) DM 67q
UM 169o	Notification of the secondary frequency for the area. *Note.— Same intent as ICAO Doc 4444 UM 238.*	SECONDARY FREQUENCY [frequency]	R
UM 169ag	ATS advisory that normal voice communication is not available. *Note.— No equivalent to ICAO Doc 4444.*	TRY SATCOM VOICE OR RELAY THROUGH ANOTHER AIRCRAFT	R
UM 169y	ATS advisory that the specified altimeter setting relates to the specified facility. *Note.— Same intent as ICAO Doc 4444 UM 213.*	[facility designation] ALTIMETER [altimeter]	R
	Standardized Free Text System Management Messages (uplink)		
UM 169j	Instruction to check the status of CPDLC messages and to respond to unanswered uplink messages. *Note.— No equivalent to ICAO Doc 4444.*	CHECK AND RESPOND TO OPEN CPDLC MESSAGES	R
UM 169w	Instruction to set the latency timer to the specified value. *Note.— No equivalent to ICAO Doc 4444.*	SET MAX UPLINK DELAY VALUE TO [delayed message parameter] SECONDS	R
UM 169u	Notification that an element contained in a CPDLC downlink message was not part of the approved CPDLC message set. *Note.— Equivalent to ICAO Doc 4444 UM 162.*	MESSAGE NOT SUPPORTED BY THIS ATS UNIT	R
UM 169ah	Notification that an element contained in a CPDLC downlink message was not part of the approved message set. The message should be communicated by voice, i.e., radiotelephone (RTF). *Note.— No equivalent to ICAO Doc 4444.*	MESSAGE NOT SUPPORTED BY THIS ATS UNIT, CONTACT RTF	R
UM 169am	Instruction to turn the CPDLC application off and to logon to the specified ATSU.	SELECT ATC COMM OFF THEN LOGON TO [facility designation]	R
UM 169an	Instruction for the flight crew to check that the ADS-C function is armed.	CONFIRM ADS-C ARMED	R
UM 169ao	Instruction to transmit CPDLC position reports due to the failure of ADS-C.	ADS-C SHUT DOWN. REVERT TO CPDLC POSITION REPORTS	R

Ref #	Message Intent/Use	Message Element	Resp.
UM 169at	Instruction to transmit voice position reports due to the failure of ADS-C.	ADS-C SHUT DOWN REVERT TO VOICE POSITION REPORTS	R
UM 169ap	Instruction for intermediary CPDLC-capable aircraft to relay message to aircraft not in communication with ATC.	RELAY TO [call sign] [unit name] [text of message to be relayed]	R, then DM67new
	Standardized Free Text Military (uplink)		
UM 169aq	Notification that MARSA procedures with the specified aircraft have been terminated.	MARSA TERMINATED WITH [call sign(s) of receiver aircraft]	R
UM 169ar		CLEARED TO DELAY FOR AIR REFUEL AT [position] UNTIL [time]	R
UM 169as		CLEARED TO CONDUCT REFUELING	R

A.4.2 CPDLC downlink standardized free text messages

Ref #	Message Intent/Use	Message Element	Resp.
	Standardized Free Text Route Modification Requests (downlink)		
DM 67ad	Request for a tailored arrival. *Note.— No equivalent in ICAO Doc 4444.*	REQ TA [TA designator]	N
	Standardized Free Text Reports (downlink)		
DM 67k	Notification of a revised estimate for the specified position. *Note.— Intent similar to DM 43.*	REVISED ETA [position] [time]	N
DM 67l	Notification of the ground speed. *Note.— Intent partial to ICAO Doc 4444 DM 113.*	GS [speed]	N
DM 67m	Notification of the preferred level. *Note.— Same intent as ICAO Doc 4444 DM 106.*	FL[altitude]	N
DM 67n	Notification of estimated time of arrival at the specified position. *Note.— Same intent as ICAO Doc 4444 DM 104.*	[position] [time]	N

Ref #	Message Intent/Use	Message Element	Resp.
DM 67o	Notification that the flight crew has visually sighted and passed the specified traffic. *Note.— No equivalent in ICAO Doc 4444.*	[traffic identification] SIGHTED AND PASSED	N
DM 67p	Notification that the flight crew did NOT visually sight the specified traffic. *Note.— No equivalent in ICAO Doc 4444.*	[traffic identification] NOT SIGHTED	N
DM 67q	Notification that the previously described traffic has been sighted. *Note.— No equivalent in ICAO Doc 4444.*	TRAFFIC SIGHTED	N
DM 67v	Notification of the preferred time to commence descent for an approach. *Note.— Same intent as ICAO Doc 4444 DM 109.*	TOD [time]	N
DM 67aa	The specified ATSU is being monitored on the specified frequency. *Urgent urgency attribute.* *Note 1.— Airborne automation (i.e., preformatted message rather than the flight crew typing the text) may be necessary for message composition and to ensure accuracy of the message content. Consequently, not all aircraft will be equipped with such automation.* *Note 2.— Same intent as ICAO Doc 4444 DM 89.*	MONITORING [unit name] [frequency]	N
	Standardized Free Text **System Management Messages (downlink)**		
DM 67u	Notification that the delivery time of an uplink message exceeded the maximum permitted by the latency timer. The uplink message should be re-sent or communicated by other means. *Note.— No equivalent in ICAO Doc 4444.*	UPLINK DELAYED IN NETWORK AND REJECTED - RESEND OR CONTACT BY VOICE	N
DM 67ab	Notification that the ADS-C emergency mode was inadvertent and has been set to OFF. *Note.— No equivalent in ICAO Doc 4444.*	ADS-C RESET	N
DM 67ae	Notification from the intermediary CPDLC-capable aircraft that the aircraft not in communication received the instructions.	RELAY FROM [call sign] [response parameters]	N
	Standardized Free Text **Additional messages (downlink)**		
DM 67ac	Used with DM 27, indicating a request for a weather deviation on both sides of route.	AND [specified distance] [direction]	N

Ref #	Message Intent/Use	Message Element	Resp.
	Standardized Free Text Negotiation Responses (downlink)		
DM 67b	We can accept the specified level at the specified time. *Note.— Intent equivalent to ICAO Doc 4444 DM 81.*	WE CAN ACCEPT [altitude] AT [time]	N
DM 67c	We can accept the specified speed at the specified time. *Note.— Intent equivalent to ICAO Doc 4444 DM 83.*	WE CAN ACCEPT [speed] AT [time]	N
DM 67d	We can accept a parallel track offset the specified distance in the specified direction at the specified time. *Note.— Intent equivalent to ICAO Doc 4444 DM 85.*	WE CAN ACCEPT [specified distance] [direction] AT [time]	N
DM 67e	We cannot accept the specified level. *Note.— Intent equivalent to ICAO Doc 4444 DM 82.*	WE CANNOT ACCEPT [altitude]	N
DM 67f	We cannot accept the specified speed. *Note.— Intent equivalent to ICAO Doc 4444 DM 84.*	WE CANNOT ACCEPT [speed]	N
DM 67g	We cannot accept a parallel track offset the specified distance in the specified direction. *Note.— Intent equivalent to ICAO Doc 4444 DM 86.*	WE CANNOT ACCEPT [specified distance] [direction]	N
DM 67h	Request for the earliest time at which a clearance to climb to the specified level can be expected. *Note.— Intent equivalent to ICAO Doc 4444 DM 87.*	WHEN CAN WE EXPECT CLIMB TO [altitude]	N
DM 67i	Request for the earliest time at which a clearance to descend to the specified level can be expected. *Note.— Intent equivalent to ICAO Doc 4444 DM 88.*	WHEN CAN WE EXPECT DESCENT TO [altitude]	N

Ref #	Message Intent/Use	Message Element	Resp.
	Standardized Free Text Military (downlink)		
DM 67w	Request for a delay at the specified position until a specified time to rendezvous with the receiver aircraft. *Note 1.— [position] is the ARCP as filed in the tanker's flight plan. [time] is the time the tanker expects to pass the ARCP and commence refueling along the refueling track. It is also the end of the delay time.* *Note 2.— No equivalent in ICAO Doc 4444.*	TO DELAY FOR AIR REFUEL AT [position] UNTIL [time]	N
DM 67x	Notification that refueling will end at the specified time or position. *Note.— No equivalent in ICAO Doc 4444.*	EXPECT END OF REFUEL AT [time/position]	N
DM 67y	Notification that the aircraft will be joining the specified ALTRV at the specified position or time. *Note.— No equivalent in ICAO Doc 4444.*	JOINING ALTRV [ALTRV designator] AT [time/position]	N
DM 67z	Notification that the tanker will accept MARSA with the specified (receiver) aircraft. *Note.— No equivalent in ICAO Doc 4444.*	ACCEPT MARSA WITH [call sign(s) of receiver aircraft]	N

Appendix B RCP specifications

This appendix includes specifications for RCP 240 and RCP 400. These specifications support:

a) Safety oversight of air traffic service provisions and operations;

b) Agreements/contractual arrangements that air traffic service providers and aircraft operators make with their respective CSPs;

c) Operational authorizations, flight crew training and qualification;

d) Design approval of aircraft data link systems; and

e) Operational-monitoring, analysis, and exchange of operational data among regions and states.

The RCP specifications are derived mainly from a safety assessment. However, in cases where it has been determined to be beneficial, the RCP specification may include criteria to support operational efficiency and orderly flow of air traffic. In these cases, the RCP specification indicates the distinction between safety and efficiency.

The specifications provide a means of compliance, in general. Additional guidance related to service provision, aircraft approval and operational authorizations can be found in Chapter 3. Guidance and requirements on post-implementation monitoring can be found at Appendix D.

The RCP specifications include allocations for data communications. The /D designator is used to indicate the RCP allocations associated with the CPDLC application.

B.1 Terms and acronyms

Note.— The terms applied to the RCP specifications are taken from ICAO Doc 9869, First Edition, Manual on Required Communication Performance, dated 2008. Additional terms are provided, as appropriate, to clarify meaning and measurement points for the RCP allocations.

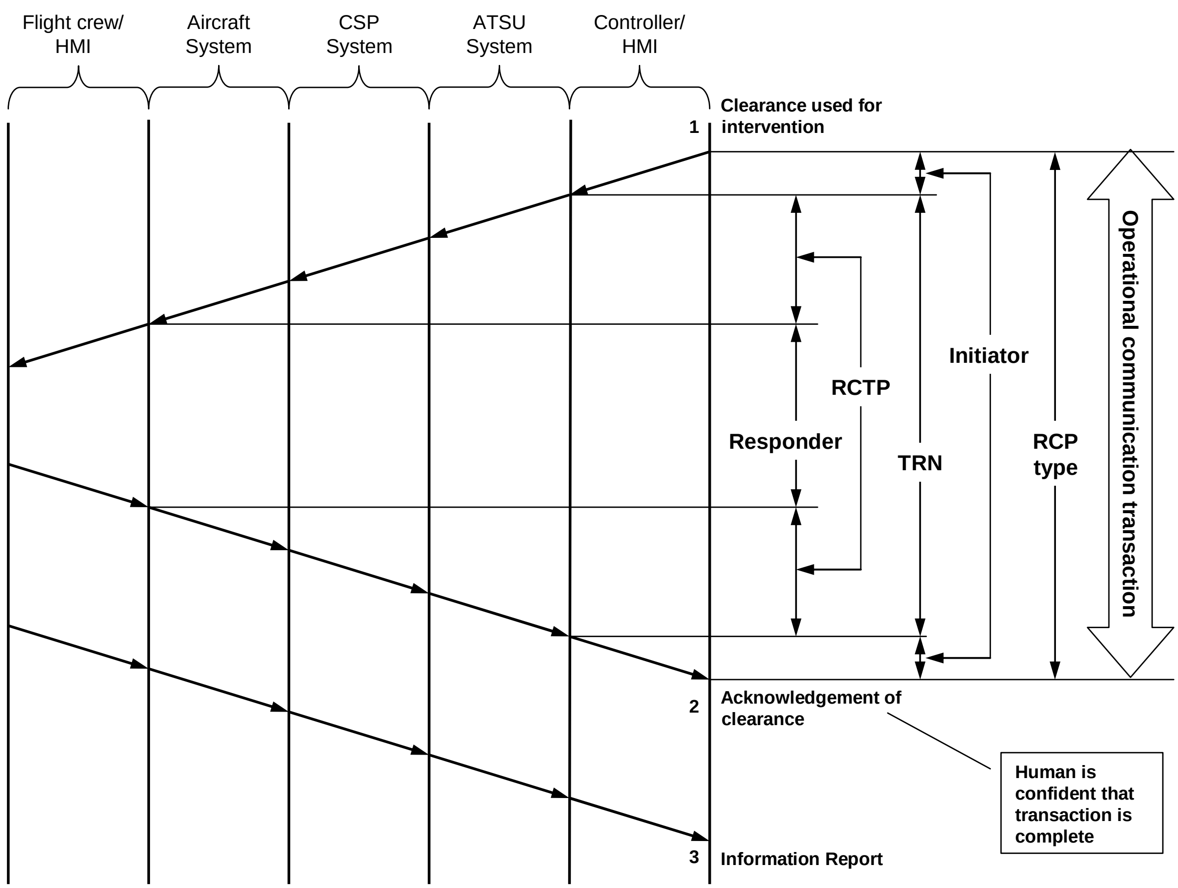
RCP specification	
Term	**Description**
Operational communication transaction	The process a human uses to initiate the transmission of an instruction, clearance, flight information, and/or request, and is completed when that human is confident that the transaction is complete.
RCP type	A label (e.g. RCP 240) that represents the values assigned to RCP parameters for communication transaction time, continuity, availability and integrity.
RCP expiration time (ET)	The maximum time for the completion of the operational communication transaction after which the initiator is required to revert to an alternative procedure.
RCP nominal time (TT 95%)	The maximum nominal time within which 95% of operational communication transactions is required to be completed.

RCP specification	
Term	**Description**
RCP continuity (C)	The required probability that an operational communication transaction can be completed within the communication transaction time, either ET or TT 95%, given that the service was available at the start of the transaction.
RCP availability (A)	The required probability that an operational communication transaction can be initiated when needed.
RCP integrity (I)	The required probability that an operational communication transaction is completed with no undetected errors. Note.— *Whilst RCP integrity is defined in terms of the "goodness" of the communication capability, it is specified in terms of the likelihood of occurrence of malfunction on a per flight hour basis, e.g. 10^{-5}, consistent with RNAV/RNP specifications.*

/D transaction time	
Term	**Description**
Monitored operational performance (TRN)	The portion of the transaction time (used for intervention) that does not include the times for message composition or recognition of the operational response.
Required communication technical performance (RCTP)	The portion of the (intervention) transaction time that does not include the human times for message composition, operational response, and recognition of the operational response.
Responder performance criteria	The operational portion of the transaction time to prepare the operational response, and includes the recognition of the instruction, and message composition, e.g. flight crew/HMI for intervention transactions.
$RCTP_{ATSU}$	The summed critical transit times for an ATC intervention message and a response message, allocated to the ATSU system.
$RCTP_{CSP}$	The summed critical transit times for an ATC intervention message and a response message, allocated to the CSP system.
$RCTP_{AIR}$	The summed critical transit times for an ATC intervention message and a response message, allocated to the aircraft system.

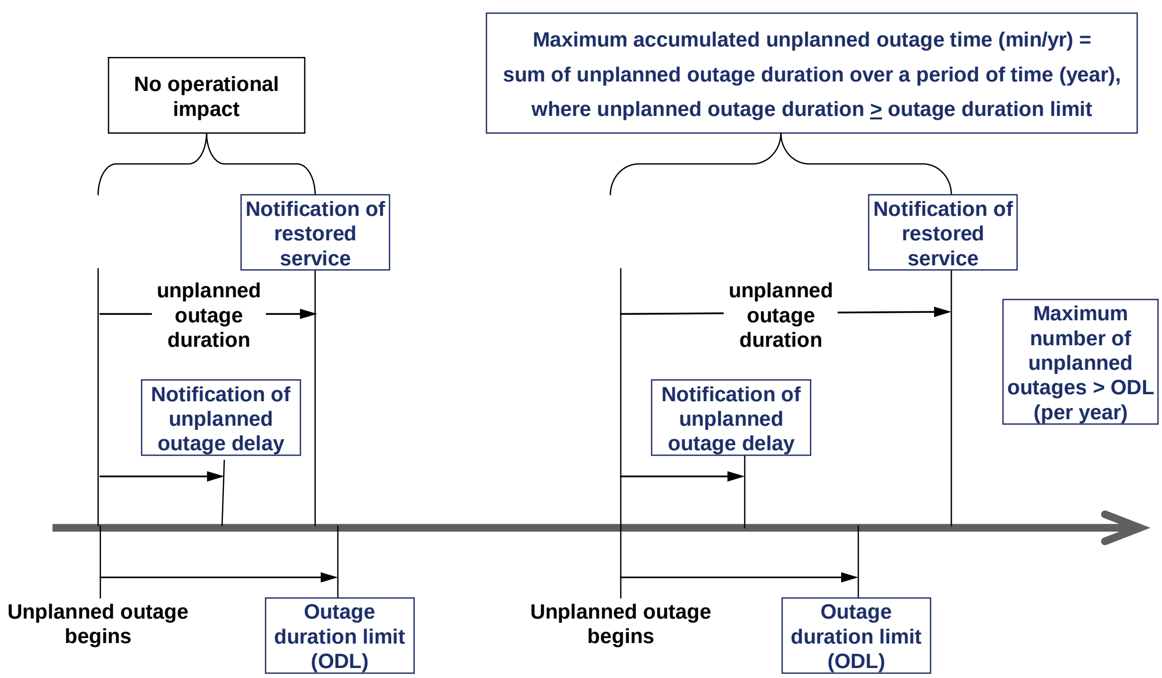
Continuity	
Term	**Description**
C for TRN	The proportion of intervention messages and responses that can be delivered within the specified TRN for intervention.
C for RCTP	The proportion of intervention messages and responses that can be delivered within the specified RCTP for intervention.

Continuity	
Term	**Description**
C for $RCTP_{ATSU}$	The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{ATSU}$ for Intervention.
C for $RCTP_{CSP}$	The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{CSP}$ for Intervention.
C for $RCTP_{AIR}$	The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{AIR}$ for Intervention.



Availability	
Term	**Description**
Service availability (A_{CSP})	The required probability that the communication service is available to all users in a specific airspace when desired..

Availability	
Term	**Description**
Unplanned outage duration limit (minutes)	Time after the unplanned outage begins at which there is an operational impact. Measured from when an unplanned outage begins to when the ATSU receives notification that the service has been restored.
Maximum number of unplanned outages	Measured separately for each relevant operational airspace or Flight Information Region (FIR) over any 12-month period.
Maximum accumulated unplanned outage time (min/yr)	Measured by accumulating ***only*** the duration times for unplanned outages greater than the unplanned outage duration limit during any 12-month period. The accumulation is performed separately for each relevant operational airspace or FIR.
Unplanned outage notification delay (min)	Notification to the ATSU of an unplanned outage. Measured from when the unplanned outage begins to when the ATSU receives notification.
Aircraft system availability (A_{AIR})	The required probability of available capability on an aircraft with an average flight of 6 hours. *Note.— The actual aircraft system availability is computed assuming that the service is available in the relevant airspace.*



B.2 RCP 240 specification

RCP Specification			
RCP type		**RCP 240**	
Airspace specific considerations			
Interoperability	Specify interoperability criteria, e.g. FANS 1/A		
ATS Function	Specify ATS function(s), e.g. applicable separation standard		
Application	Specify controller-pilot ATC communication intervention capability, e.g. CPDLC application per ICAO Doc 4444, and RTCA DO-306/EUROCAE ED-122, Annex A		
RCP parameter values			
Transaction time (sec)	**Continuity (C)**	**Availability (A)**	**Integrity (I)**
ET = 240	C(ET) = 0.999	0.999 0.9999 (efficiency)	Malfunction = 10^{-5} per flight hour
TT 95% = 210	C(TT 95%) = 0.95		
RCP monitoring and alerting criteria			
Ref	**Criteria**		
MA-1	The system shall be capable of detecting failures and configuration changes that would cause the communication service to no longer meet the RCP type for the intended function.		
MA-2	When the communication service can no longer meet the RCP type for the intended function, the flight crew and/or the controller shall take appropriate action.		
Notes			
Note 1.— Rationale for the criteria provided in this specification can be found in ICAO Annex 11, ICAO Doc 4444, ICAO Doc 9689, and RTCA DO-306/ED-122. *Note 2.— The values for transaction times are to be applied to transactions that are representative of communication capability for the controller to intervene with a specific operator, aircraft type, and aircraft identification.* *Note 3.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the RCP type, this would be considered a change in system configuration.* *Note 4.— DO 306/ED 122 specifies an availability value based on safety assessment of the operational effects of the loss of the service. The availability value herein is more stringent, based on an additional need to maintain orderly and efficient operations.*			

B.2.1 RCP 240/D allocations

The RCP 240/D allocations are applicable to the CPDLC application.

B.2.1.1 Air traffic service provider (ATSP)

RCP communication transaction time and continuity criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: ATSP**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
Transaction Time Value	240	210	Analysis, CSP contract/service agreement. See also paragraph B.2.1.2.
RCP Time Allocations			
Initiator	30	30	Analysis, simulations, safety and human factors assessments
TRN	210	180	Monitored, CSP contract/service agreement. See also paragraph B.2.1.2.
TRN Time Allocations			
Responder	60	60	Initially, by analysis, simulations, safety human factors assessments Post-implementation, monitored, estimated
RCTP	150	120	Monitored, estimated, CSP contract/service agreement. See also paragraph B.2.1.2.
RCTP Time Allocation			
$RCTP_{ATSU}$	15	10	Pre-implementation demonstration

RCP availability criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: ATSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.2.1.2, RCP 240/D allocation to CSP for RCP availability criteria.*

RCP integrity criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: ATSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level commensurate with integrity level, (compliance shown prior to operational implementation). See also RCP related safety requirement SR-26 for the ATSP. CSP contract/service agreement. See also RCP integrity criteria for CSP, paragraph B.2.1.2.

RCP monitoring and alerting criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: ATSP**
Ref:	**Criteria**	**Compliance means**
MA-1a	The ground system shall be capable of detecting ground system failures and configuration changes that would cause the communication service to no longer meet the requirements for the intended function. *Note.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the RCP type, this would be considered a change in system configuration.*	System design, implementation. CSP contract/service agreement. See also paragraph B.2.1.2, RCP availability criteria.
MA-1b	When the communication service no longer meets the requirements for the intended function, the ground system shall provide indication to the controller.	System design, implementation. CSP contract/service agreement. See also paragraph B.2.1.2, RCP availability criteria.
MA-2	When the controller receives an indication that the communication service no longer meets the requirements for the intended function (e.g. reduced longitudinal separation), the controller shall take action to resolve the situation, (e.g. apply an alternative form of separation).	System design, procedures, implementation

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: ATSP**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-1a (ATSP)	A	The ATSU shall display the indication provided by the aircraft system when a data link service request initiated by the ground system or the controller is rejected at the application layer.

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: ATSP**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-1b (ATSP)	A	The ATSU shall provide to the aircraft system an indication when it rejects a data link service request initiated by the flight crew at the application layer.
SR-2 (ATSP)	A, C	The ATSU shall indicate to the controller a detected loss of data link service.
SR-3 (ATSP)	A	Data link service shall be established in sufficient time to be available for operational use.
SR-4 (ATSP)	A, C	ATSU shall be notified of planned outage of data link service sufficiently ahead of time.
SR-5 (ATSP)	A, C	The ATSU shall indicate to the controller when a message can not be successfully transmitted.
SR-6 (ATSP)	C, I	The ATSU end system shall provide unambiguous and unique identification of the origin and destination with each message it transmits.
SR-7 (ATSP)	C, I	The ATSU shall indicate in each response to which messages it refers.
SR-8 (ATSP)	I	The ATSU shall send the route clearance information with the route clearance via data link.
SR-9 (ATSP)	C, I	The ATSU end system shall time stamp to within one second UTC each message when it is released for onward transmission.
SR-11 (ATSP)	C, I	Any processing performed by ATSU (data entry/ encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message.
SR-12 (ATSP)	C, I	The ATSU end system shall reject messages not addressed to itself.
SR-13 (ATSP)	C, I	The ATSU shall transmit messages to the designated aircraft system.
SR-14 (ATSP)	A, C, I	The ATSU system shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).
SR-15 (ATSP)	C, I	When the ATSU receives a message whose time stamp exceeds ET_{TRN}, the ATSU shall provide appropriate indication.
SR-16 (ATSP)	C, I	The ATSU shall prevent the release of clearance without controller action.
SR-17 (ATSP)	C, I	The ATSU shall prohibit operational processing by controller of corrupted messages.

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: ATSP**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-18 (ATSP)	C, I	The ATSU shall be able to determine the message initiator.
SR-19 (ATSP)	C, I	The ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU.
SR-20 (ATSP)	C, I	ATSU shall only establish and maintain data link services when the aircraft identifiers in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.
SR-21 (ATSP)	C, I	The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).
SR-23 (ATSP)	C, I	An ATSU system shall not permit data link services when there are non compatible version numbers.
SR-24 (ATSP)	C, I	The ATSU shall respond to messages in their entirety.
SR-25 (ATSP)	I	The ATSU end system shall be capable of detecting errors that would result in mis-delivery introduced by the communication service.
SR-26 (ATSP)	I	The ATSU end system shall be capable of detecting errors that would result in corruption introduced by the communication service.

B.2.1.2 Communication service provider (CSP)

Note.— The RCP allocations for the CSP are intended to aid the ATSP and the aircraft operator in the development of contracts and service agreements.

RCP communication transaction time and continuity criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: CSP**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance means**
RCTP Time Allocation			
$RCTP_{CSP}$	120	100	Contract/service agreement terms. Pre-implementation demonstration.

RCP availability criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: CSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms
Unplanned outage duration limit (min)	10	10	Contract/service agreement terms
Maximum number of unplanned outages	4	48	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	52	520	Contract/service agreement terms
Unplanned outage notification delay (min)	5	5	Contract/service agreement terms
Note.— DO 306/ED 122 specifies a requirement to indicate loss of the service. Unplanned outage notification delay is an additional time value associated with the requirement to indicate the loss to the ATS provider per the RCP related safety requirement SR-4 for the ATSP.			

RCP integrity criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: CSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Not specified	Contract/service agreement terms. Per RCP related safety requirements SR-26 for the ATSP and SR-26 for the aircraft system, the end system is required include provisions, consistent with the overall RCP integrity criteria, to mitigate the effects of errors introduced by the network. These provisions require the network to pass protected information (or data) to the end system without manipulating the protected information (or data) it passes. *Note.— In formulating contract terms with the CSP, the ATSP and/or operator may specify an integrity value and other related criteria, as appropriate, for the network, including subnetworks, that will ensure acceptable data integrity, consistent with the assumptions used to define the end system provisions, e.g. CRC or Fletcher's checksum.*

B.2.1.3 Aircraft system

RCP communication transaction time and continuity criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: Aircraft system**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
RCP Time Allocation			
Initiator	30	30	Human-machine interface capability, pre-implementation demonstration
TRN Time Allocation			
Responder	60	60	Human-machine interface capability, pre-implementation demonstration
RCTP Time Allocation			
$RCTP_{AIR}$	15	10	Pre-implementation demonstration

RCP availability criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: Aircraft system**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	N/A	0.999	Analysis, architecture, design, pre-implementation demonstration

RCP integrity criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft system**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level, e.g. Level C software, commensurate with integrity level, pre-implementation demonstration. See also RCP related safety requirement SR-26 for the aircraft system.

RCP monitoring and alerting criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft system**
Ref:	**Criteria**	**Compliance means**
MA-1a	The aircraft system shall be capable of detecting aircraft system failures or loss of air/ground communication that would cause the aircraft communication capability to no longer meet the requirements for the intended function.	System design, implementation
MA-1b	When the aircraft communication capability no longer meets the requirements for the intended function, the aircraft system shall provide indication to the flight crew.	System design, implementation

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft system**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-1a (Air)	A	The aircraft system shall provide to the ATSU an indication when it rejects a data link service request initiated by the ground system or the controller at the application layer.
SR-1b (Air)	A	The aircraft system shall display the indication provided by the ATSU when a data link service request initiated by the flight crew is rejected at the application layer.
SR-2 (Air)	A, C	The aircraft system shall indicate to the flight crew a detected loss of data link service.
SR-5 (Air)	A, C	The aircraft system shall indicate to the flight crew when a message can not be successfully transmitted.
SR-6 (Air)	C, I	The aircraft end system shall provide unambiguous and unique identification of the origin and destination with each message it transmits.
SR-7 (Air)	C, I	The aircraft system shall indicate in each response to which messages it refers.
SR-8 (Air)	I	The aircraft shall execute the route clearance per the route clearance received from the ATSU via data link.
SR-9 (Air)	C, I	The aircraft end system shall time stamp to within one second UTC each message when it is released for onward transmission.
SR-1 (Air)0	C, I	The aircraft end system shall include in each ADS-C report the time at position to within one second of the UTC time the aircraft was actually at the position provided in the report.
SR-11 (Air)	C, I	Any processing performed by aircraft system (data entry/ encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message

RCP related safety requirements			
Specification: RCP 240/D		**Application: CPDLC**	**Component: Aircraft system**
Ref	**Related RCP Parameter**	**Safety requirement**	
SR-12 (Air)	C, I	The aircraft end system shall reject messages not addressed to itself.	
SR-13 (Air)	C, I	The aircraft system shall transmit messages to the designated ATSU.	
SR-15 (Air)	C, I	When the aircraft system receives a message whose time stamp exceeds ET_{TRN}, the aircraft system shall provide appropriate indication.	
SR-16 (Air)	C, I	The aircraft end system shall prevent the release of responses to clearances without flight crew action.	
SR-17 (Air)	C, I	The aircraft system shall prohibit operational processing by flight crew of corrupted messages.	
SR-18 (Air)	C, I	The aircraft system shall be able to determine the message initiator.	
SR-19 (Air)	C, I	The aircraft system shall prohibit to the flight crew operational processing of messages not addressed to the aircraft.	
SR-21 (Air)	C, I	The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).	
SR-24 (Air)	C, I	The aircraft system shall respond to messages in their entirety or allow the flight crew to do it.	
SR-25 (Air)	I	The aircraft end system shall be capable of detecting errors that would result in mis-delivery introduced by the communication service	
SR-26 (Air)	I	The aircraft end system shall be capable of detecting errors that would result in corruption introduced by the communication service.	
SR-27 (Air)	C, I	The aircraft and/or flight crew shall ensure the correct transfer into or out of the aircraft's FMS of route data received/sent via data link that will be used to define the aircraft active flight plan.	

B.2.1.4 Aircraft operator

RCP communication transaction time and continuity criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: Aircraft operator**
Transaction Time Parameter	**ET (sec)** **C = 99.9%**	**TT (sec)** **C = 95%**	**Compliance Means**
RCP Time Allocations			
Initiator	30	30	Procedures, flight crew training and qualification in accordance with safety requirements.
TRN Time Allocations			
Responder	60	60	Procedures, flight crew training and qualification in accordance with safety requirements.
RCTP Time Allocation			
$RCTP_{AIR}$	15	10	Aircraft type design approval, maintenance, properly configured user-modifiable software, e.g. ORT
$RCTP_{CSP}$	120	100	CSP contract/service agreement. See also paragraph B.2.1.2. Pre-implementation demonstration.

RCP availability criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: Aircraft operator**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	N/A	0.999	Aircraft type design approval, maintenance, properly configured user-modifiable software, e.g. owner requirements table or airline policy file.
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.2.1.2, RCP 240/D allocation to CSP for RCP availability criteria.*

RCP integrity criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft operator**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Aircraft type design approval, establish procedures, training, and qualification to meet safety requirements. CSP contract/service agreement. See also RCP integrity criteria for CSP, paragraph B.2.1.2.

RCP monitoring and alerting criteria		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft operator**
Ref:	**Criteria**	**Compliance means**
MA-2	When the flight crew determines that the aircraft communication capability no longer meets the requirements for the intended function, the flight crew shall advise the ATC unit concerned.	Procedures, flight crew training and qualification

RCP related safety requirements		
Specification: RCP 240/D	**Application: CPDLC**	**Component: Aircraft operator**
Ref	**Related RCP Parameter**	**Safety requirement**
SR-22 (Operator)	C, I	The flight crew shall perform the initiation data link procedure again with any change of the flight identifier.
SR-24 (Operator)	C, I	The flight crew shall respond to a message in its entirety when not responded by the aircraft system.
SR-27 (Operator)	C, I	The aircraft and/or flight crew shall ensure the correct transfer into or out of the aircraft's FMS of route data received/sent via data link that will be used to define the aircraft active flight plan.

B.3 RCP 400 specification

<table>
<tr><td colspan="4">RCP Specification</td></tr>
<tr><td colspan="2">RCP type</td><td colspan="2">RCP 400</td></tr>
<tr><td colspan="4">Airspace specific considerations</td></tr>
<tr><td>Interoperability</td><td colspan="3">Specify interoperability criteria, e.g. FANS 1/A</td></tr>
<tr><td>ATS Function</td><td colspan="3">Specify ATS function(s), e.g. applicable separation standard</td></tr>
<tr><td>Application</td><td colspan="3">Specify controller-pilot ATC communication intervention capability, e.g. CPDLC application per ICAO Doc 4444, and RTCA DO-306/EUROCAE ED-122, Annex A</td></tr>
<tr><td colspan="4">RCP parameter values</td></tr>
<tr><td>Transaction time (sec)</td><td>Continuity (C)</td><td>Availability (A)</td><td>Integrity (I)</td></tr>
<tr><td>ET = 400</td><td>C(ET) = 0.999</td><td rowspan="2">0.999</td><td rowspan="2">Malfunction = 10^{-5} per flight hour</td></tr>
<tr><td>TT 95% = 350</td><td>C(TT 95%) = 0.95</td></tr>
<tr><td colspan="4">RCP monitoring and alerting criteria</td></tr>
<tr><td>Ref:</td><td colspan="3"><u>Criteria</u></td></tr>
<tr><td>MA-1</td><td colspan="3">The system shall be capable of detecting failures and configuration changes that would cause the communication service to no longer meet the RCP type for the intended function.</td></tr>
<tr><td>MA-2</td><td colspan="3">When the communication service can no longer meet the RCP type for the intended function, the flight crew and/or the controller shall take appropriate action.</td></tr>
<tr><td colspan="4">Notes</td></tr>
<tr><td colspan="4"><u>Note 1</u>.— Rationale for the criteria provided in this specification can be found in ICAO Annex 11, ICAO Doc 4444, ICAO Doc 9689, and RTCA DO-306/ED-122.
<u>Note 2</u>.— The values for transaction times are to be applied to transactions that are representative of communication capability for the controller to intervene with a specific operator, aircraft type, and aircraft identification.
<u>Note 3</u>.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the RCP type, this would be considered a change in system configuration.</td></tr>
</table>

B.3.1 RCP 400/D allocations

The RCP 400/D allocations are applicable to the CPDLC application.

B.3.1.1 Air traffic service provider (ATSP)

RCP communication transaction time and continuity criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: ATSP**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
Transaction Time Value	400	350	Analysis, CSP contract/service agreement. See also paragraph B.3.1.2.
RCP Time Allocations			
Initiator	30	30	Analysis, simulations, safety and human factors assessments
TRN	370	320	Monitored, CSP contract/service agreement. See also paragraph B.3.1.2.
TRN Time Allocations			
Responder	60	60	Initially, by analysis, simulations, safety human factors assessments Post-implementation, monitored, estimated
RCTP	310	260	Monitored, estimated, CSP contract/service agreement. See also paragraph B.3.1.2.
RCTP Time Allocation			
$RCTP_{ATSU}$	15	10	Pre-implementation demonstration

RCP availability criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: ATSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.3.1.2, RCP 400/D allocation to CSP for RCP availability criteria.*

RCP integrity criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: ATSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— RCP integrity criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.1.*	

RCP monitoring and alerting criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: ATSP**
Ref:	**Criteria**	**Compliance means**
All	*Note.— RCP monitoring and alerting criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.1.*	

RCP related safety requirements		
Specification: RCP 400/D	**Application: CPDLC**	**Component: ATSP**
Ref	**Related RCP Parameter**	**Safety requirement**
All	A, C, I	*Note.— Safety requirements related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.1.*

B.3.1.2 Communication service provider (CSP)

Note.— The RCP allocations for the CSP are intended to aid the ATSP and the aircraft operator in the development of contracts and service agreements.

RCP communication transaction time and continuity criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: CSP**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance means**
RCTP Time Allocation			
$RCTP_{CSP}$	280	240	Contract/service agreement terms

RCP availability criteria			
Specification: RCP 400/D	**Application: CPDLC**	**Component: CSP**	
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms
Unplanned outage duration limit (min)	N/A	20	Contract/service agreement terms
Maximum number of unplanned outages	N/A	24	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	N/A	520	Contract/service agreement terms
Unplanned outage notification delay (min)	N/A	10	Contract/service agreement terms

RCP integrity criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: CSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— RCP integrity criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.2.*	

B.3.1.3 Aircraft system

RCP communication transaction time and continuity criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: Aircraft system**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
RCP Time Allocation			
Initiator	30	30	Human-machine interface capability, pre-implementation demonstration
TRN Time Allocation			
Responder	60	60	Human-machine interface capability, pre-implementation demonstration
RCTP Time Allocation			
$RCTP_{AIR}$	15	10	Pre-implementation demonstration

RCP availability criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: Aircraft system**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	N/A	0.999	Analysis, architecture, design, pre-implementation demonstration

RCP integrity criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft system**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— RCP integrity criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.3.*	

RCP monitoring and alerting criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft system**
Ref:	**Criteria**	**Compliance means**
All	*Note.— RCP monitoring and alerting criteria related to RCP type 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.3.*	

RCP related safety requirements		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft system**
Ref	**Related RCP Parameter**	**Safety requirement**
All	A, C, I	*Note.— Safety requirements related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.3.*

B.3.1.4 Aircraft operator

RCP communication transaction time and continuity criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: Aircraft operator**
Transaction Time Parameter	**ET (sec) C = 99.9%**	**TT (sec) C = 95%**	**Compliance Means**
RCP Time Allocations			
Initiator	30	30	Procedural capability, flight crew training and qualification in accordance with safety requirements.
TRN Time Allocations			
Responder	60	60	Procedural capability, flight crew training and qualification in accordance with safety requirements.
RCTP Time Allocation			
$RCTP_{AIR}$	15	10	Aircraft type design approval, maintenance, properly configured user-modifiable software, e.g. ORT
$RCTP_{CSP}$	280	240	CSP contract/service agreement. See also paragraph B.3.1.2.

RCP availability criteria			
Specification: RCP 400/D	**Application: CPDLC**		**Component: Aircraft operator**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR}	N/A	0.999	Aircraft type design approval, maintenance, properly configured user-modifiable software, e.g. ORT
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph B.3.1.2, RCP 400/D allocation to CSP for RCP availability criteria.*

RCP integrity criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft operator**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— RCP integrity criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.4.*	

RCP monitoring and alerting criteria		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft operator**
Ref:	**Criteria**	**Compliance means**
All	*Note.— RCP monitoring and alerting criteria related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.4.*	

RCP related safety requirements		
Specification: RCP 400/D	**Application: CPDLC**	**Component: Aircraft operator**
Ref	**Related RCP Parameter**	**Safety requirement**
All	C, I	*Note.— Safety requirements related to RCP 400/D are the same as those related to RCP 240/D. See paragraph B.2.1.4.*

Appendix C Surveillance performance specifications

This appendix includes specifications for surveillance performance. These specifications support:

a) Safety oversight of air traffic service provisions and operations;

b) Agreements/contractual arrangements that air traffic service providers and aircraft operators make with their respective CSPs;

c) Operational authorizations, flight crew training and qualification;

d) Design approval of aircraft data link systems; and

e) Operational-monitoring, analysis, and exchange of operational data among regions and states.

The surveillance performance specifications are derived mainly from a safety assessment. However, in cases where it has been determined to be beneficial, the surveillance performance specification may include criteria to support operational efficiency and orderly flow of air traffic. In these cases, the surveillance performance specification indicates the distinction between safety and efficiency.

The specifications provide a means of compliance, in general. Additional guidance related to service provision, aircraft approval and operational authorizations can be found in Chapter 3. Guidance and requirements on post-implementation monitoring can be found at Appendix D.

The surveillance performance specifications include allocations for data communications. The /D designator is used to indicate the surveillance performance allocations associated with the ADS-C or FMC WPR application.

C.1 Terms and acronyms

Note.— The terms applied to the surveillance performance specifications are taken from ICAO Doc 9869, First Edition, Manual on Required Communication Performance, dated 2008. Additional terms are provided, as appropriate, to clarify meaning and measurement points for the RCP allocations.

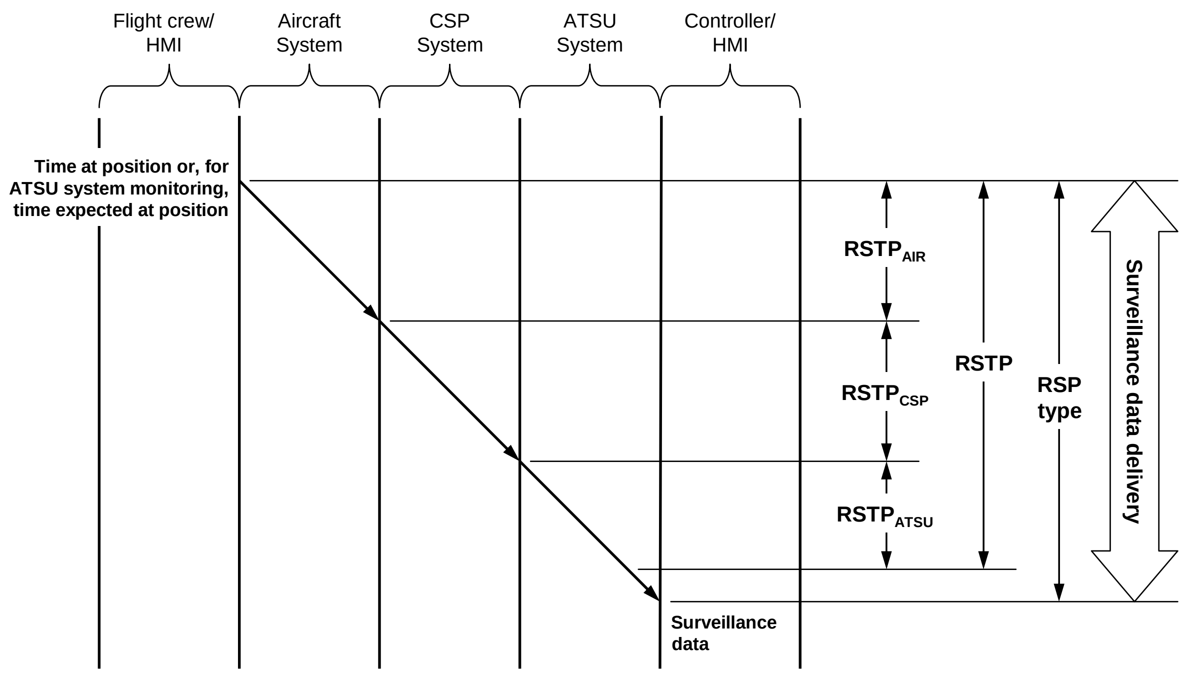
Surveillance performance specification and related terms	
Term	**Description**
ATS surveillance service	A term used to indicate a service provided directly by means of an ATS surveillance system. (ICAO)
ADS-C service	A term used to indicate an ATS service that provides surveillance information by means of the ADS-C application. *Note.— ICAO Doc 4444 does not include ADS-C in its definition for ATS surveillance system. Therefore, an ATS surveillance service does not consider those provided by means of the ADS-C application, unless it can be shown by comparative assessment to have a level of safety and performance equal to or better than monopulse SSR.*

Surveillance performance specification and related terms	
Term	**Description**
FMC WPR service	A term used to indicate an ATS service that provides surveillance information by means of the FMC WPR application. Note.— *ICAO Doc 4444 does not include FMC WPR in its definition for ATS surveillance system. Therefore, an ATS surveillance service does not consider those provided by means of the FMC WPR application, unless it can be shown by comparative assessment to have a level of safety and performance equal to or better than monopulse SSR.*
ATS surveillance system	A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft. Note.— *A comparable ground-based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.* (ICAO)
Automatic dependent surveillance — broadcast (ADS-B)	A means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link. (ICAO)
Automatic dependent surveillance — contract (ADS-C)	A means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports. Note.— *The abbreviated term "ADS contract" is commonly used to refer to ADS event contract, ADS demand contract, ADS periodic contract or an emergency mode.* (ICAO)
Surveillance data	Data pertaining to the identification of aircraft and/or obstructions for route conformance monitoring and safe and efficient conduct of flight. Note.— *In this document, surveillance data applies to ADS-C reports, CPDLC position reports and FMC waypoint position reports.*
Surveillance performance	A statement of the performance requirements for operational surveillance in support of specific ATM functions.
Surveillance performance type	A label (e.g. type 180) that represents the values assigned to surveillance performance parameters for surveillance data transit time, continuity, availability and integrity.

Surveillance performance specification and related terms	
Term	**Description**
Surveillance data delivery	The process for obtaining surveillance data. *<u>Note</u>.— In this document, the delivery is defined for the following reports:* *a) ADS-C periodic report, from the start of the periodic interval to when the ATSU receives the report. The start of the periodic interval occurs when the periodic report is sent by the aircraft/flight crew;* *b) ADS-C event reports and FMC waypoint position reports, from the time the aircraft system detects that the event has occurred to when the ATSU receives the report; and* *c) CPDLC position report, from the time at which the aircraft reported its position and when the ATSU receives the report.*
Surveillance data transit time	The required time for surveillance data delivery.
Surveillance overdue delivery time (OT)	The maximum time for the successful delivery of surveillance data after which the initiator is required to revert to an alternative procedure.
Surveillance nominal delivery time (DT 95%)	The maximum nominal time within which 95% of surveillance data is required to be successfully delivered.
Surveillance continuity (C)	The required probability that surveillance data can be delivered within the surveillance delivery time parameter, either OT or DT 95%, given that the service was available at the start of delivery.
Surveillance availability (A)	The required probability that surveillance data can be provided when needed.
Surveillance integrity (I)	The required probability that the surveillance data is delivered with no undetected error. *<u>Note</u>.— Surveillance integrity includes such factors as the accuracy of time, correlating the time at aircraft position, reporting interval, data latency, extrapolation and/or estimation of the data.*

Surveillance data transit time criteria	
Term	**Description**
$RSTP_{ATSU}$	The overdue (OD) or nominal (DT) transit time for surveillance data from the CSP interface to the ATSU's flight data processing system.
$RSTP_{AIR}$	The overdue (OD) or nominal (DT) transit time for surveillance data from the aircraft's avionics to the antenna.
$RSTP_{CSP}$	The overdue (OD) or nominal (DT) transit time for surveillance data allocated to the CSP.

Surveillance continuity criteria	
Term	**Description**
C for $RSTP_{ATSU}$	The proportion of surveillance messages that can be delivered within the specified $RSTP_{ATSU}$.
C for $RSTP_{AIR}$	The proportion of surveillance messages that can be delivered within the specified $RSTP_{AIR}$.
C for $RSTP_{CSP}$	The proportion of surveillance messages that can be delivered within the specified $RSTP_{CSP}$.



<u>Note</u>.— The terms and acronyms used to specify the criteria for surveillance availability are the same as the terms and acronyms used to specify the criteria for RCP availability. See <u>Appendix B, paragraph B.1</u>.

C.2 Surveillance performance type 180 specification

Surveillance Performance Specification					
Surveillance performance type		**180**			
Airspace specific considerations					
Interoperability	Specify interoperability criteria, e.g. FANS 1/A				
ATS Function	Specify ATS function(s), e.g. applicable separation standard				
Application	Specify the required surveillance capability. FMC WPR or, for ADS-C, specify the types of contracts required to support the ATS function, e.g. periodic contract at [nn] min, waypoint change event contract, lateral deviation event contract at [n] NM, etc.				
Surveillance parameter values					
Transit time (sec)	**Continuity (C)**		**Availability (A)**	**Integrity (I)**	
OT = 180	C(OT) = 0.999		0.999 0.9999 (efficiency) *See Note 3.*	**Navigation FOM**	*See Note 4.*
DT 95% = 90	C(DT 95%) = 0.95			**Time at position accuracy**	+/- 1 sec (UTC)
				Data integrity	Malfunction = 10^{-5} per flight hour

Surveillance monitoring and alerting criteria	
Ref	**Criteria**
MA-1	The system shall be capable of detecting failures and configuration changes that would cause the ADS-C or FMC WPR service to no longer meet the surveillance parameter values for the intended function.
MA-2	When the ADS-C or FMC WPR service can no longer meet the surveillance parameter values for the intended function, the flight crew and/or the controller shall take appropriate action.

Notes

Note 1.— Rationale for the criteria provided in this specification can be found in ICAO Annex 11, ICAO Doc 4444, ICAO Doc 9689, and RTCA DO-306/ED-122.

Note 2.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the surveillance parameter values, this would be considered a change in system configuration.

Note 3.— DO 306/ED 122 specifies an availability value based on safety assessment of the operational effects of the loss of the service. The availability value herein is more stringent, based on an additional need to maintain orderly and efficient operations.

Note 4.— The navigation figure of merit (FOM) is specified based on the navigation criteria associated with this spec. For example, if RNP 4 is prescribed, then for ADS-C surveillance service, the FOM level would need to be 4 or higher. In all cases, when the navigation capability no longer meets the criteria specified for the operation, the flight crew is responsible for reporting the non-compliance to ATC in accordance with ICAO procedures.

C.2.1 Surveillance performance type 180/D allocations

The surveillance performance type 180/D allocations can be applied to the ADS-C or FMC WPR applications.

C.2.1.1 Air traffic service provider (ATSP)

Surveillance data transit time and continuity criteria			
Specification: Type 180/D	**Application: ADS-C, FMC WPR**		**Component: ATSP**
Data Latency Parameter	**OT (sec)** **C = 99.9%**	**DT 95%(sec)** **C = 95%**	**Compliance Means**
Delivery Time Value	180	90	Analysis, CSP contract/service agreement. See also paragraph C.2.1.2.
RSTP Time Allocation			
$RSTP_{ATSU}$	5	3	Pre-implementation demonstration

Surveillance availability criteria			
Specification: Type 180/D	**Application: ADS-C, FMC WPR**		**Component: ATSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph C.2.1.2, surveillance performance type 180/D allocation to CSP for surveillance availability criteria.*

Surveillance integrity criteria		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: ATSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level commensurate with integrity level, (compliance shown prior to operational implementation). See also related safety requirement SR-26 for the ATSP. CSP contract/service agreement. See also surveillance integrity criteria for CSP, paragraph C.2.1.2.

Surveillance monitoring and alerting criteria		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: ATSP**
Ref:	**Criteria**	**Compliance means**
MA-1a	The ground system shall be capable of detecting ground system failures and configuration changes that would cause the ADS-C or FMC WPR service to no longer meet the requirements for the intended function. *Note.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the surveillance performance type, this would be considered a change in system configuration.*	System design, implementation. CSP contract/service agreement. See also paragraph C.2.1.2, surveillance availability criteria.
MA-1b	When the ADS-C or FMC WPR service no longer meets the requirements for the intended function, the ground system shall provide indication to the controller.	System design, implementation. CSP contract/service agreement. See also paragraph C.2.1.2, surveillance availability criteria.
MA-2	When the controller receives an indication that the ADS-C or FMC WPR service no longer meets the requirements for the intended function (e.g. reduced longitudinal separation), the controller shall take action to resolve the situation, (e.g. apply an alternative form of separation).	System design, procedures, implementation

Surveillance related safety requirements		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: ATSP**
Ref	**Related Surveillance Parameter**	**Safety requirement**
All	A, C, I	*Note.— Safety requirements related to surveillance performance type 180/D are the same as those related to RCP 240/D, unless otherwise modified in this table. See Appendix B, paragraph B.2.1.1.*

C.2.1.2 Communication service provider (CSP)

Note.— The surveillance performance allocations for the CSP are intended to aid the ATSP and the aircraft operator in the development of contracts and service agreements.

Surveillance data transit time and continuity criteria			
Specification: Type 180/D	**Application: ADS-C, FMC WPR**		**Component: CSP**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance means**
RSTP Time Allocation			
$RSTP_{CSP}$	170	84	Contract/service agreement terms. Pre-implementation demonstration

Surveillance availability criteria			
Specification: Type 180/D	**Application: ADS-C, FMC WPR**		**Component: CSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms
Unplanned outage duration limit (min)	10	10	Contract/service agreement terms
Maximum number of unplanned outages	4	48	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	52	520	Contract/service agreement terms
Unplanned outage notification delay (min)	5	5	Contract/service agreement terms
Note.— The surveillance availability criteria for type 180/D are the same as the for RCP 240/D. See Appendix B, paragraph B.2.1.2.			

Surveillance integrity criteria		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: CSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Not specified	Contract/service agreement terms. Per surveillance related safety requirements SR-26 for the ATSP and SR-26 for the aircraft system, the end system is required include provisions, consistent with the overall data integrity criteria, to mitigate the effects of errors introduced by the network. These provisions require the network to pass protected information (or data) to the end system without manipulating the protected information (or data) it passes. *Note.— In formulating contract terms with the CSP, the ATSP and/or operator may specify an integrity value and other related criteria, as appropriate, for the network, including subnetworks, that will ensure acceptable data integrity, consistent with the assumptions used to define the end system provisions, e.g. CRC or Fletcher's checksum.*

C.2.1.3 Aircraft system

Surveillance data transit time and continuity criteria			
Specification: Type 180/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft system**
Data Latency Parameter	**OT (sec)** **C = 99.9%**	**DT 95%(sec)** **C = 95%**	**Compliance Means**
RSTP Time Allocation			
$RSTP_{AIR}$	5	3	Pre-implementation demonstration

Surveillance availability criteria			
Specification: Type 180/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft system**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR} (probability)	N/A	0.999	Analysis, architecture, design, pre-implementation demonstration
Note.— The surveillance availability criteria for type 180/D are the same as the criteria for RCP 240/D. See Appendix B, paragraph B.2.1.3.			

Surveillance integrity criteria		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft system**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5} per flight hour	Analysis, safety requirements, development assurance level, e.g. Level C software, commensurate with integrity level, pre-implementation demonstration. See also related safety requirement SR-26 for the aircraft system.

Surveillance monitoring and alerting criteria		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft system**
Ref:	**Criteria**	**Compliance means**
MA-1a	The aircraft system shall be capable of detecting aircraft system failures or loss of air/ground communication that would cause the aircraft surveillance capability to no longer meet the requirements for the intended function.	System design, implementation
MA-1b	When the aircraft surveillance capability no longer meets the requirements for the intended function, the aircraft system shall provide indication to the flight crew.	System design, implementation

Surveillance related safety requirements		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft system**
Ref	**Related Surveillance Parameter**	**Safety requirement**
All	A, C, I	*Note.— Safety requirements related to surveillance performance type 180/D are the same as those related to RCP 240/D, unless otherwise modified in this table. See Appendix B, paragraph B.2.1.3.*

C.2.1.4 Aircraft operator

Surveillance data transit time and continuity criteria			
Specification: Type 180/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft operator**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance Means**
RSTP Time Allocation			
$RSTP_{AIR}$	5	3	Aircraft type design approval, maintenance, properly configured user-modifiable software, e.g. ORT
$RSTP_{CSP}$	170	84	CSP contract/service agreement. See also paragraph C.2.1.2. Pre-implementation demonstration.

Surveillance availability criteria			
Specification: Type 180/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft operator**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
A_{AIR} (probability)	N/A	0.999	Aircraft type design approval, maintenance, properly configured user-modifiable software, e.g. owner requirements table or airline policy file.
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms. Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph C.2.1.2, surveillance performance type 180/D allocation to CSP for surveillance availability criteria.

Surveillance integrity criteria		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft operator**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	Malfunction = 10^{-5}	Aircraft type design approval, establish procedures, training, and qualification to meet safety requirements. CSP contract/service agreement. See also surveillance integrity criteria for CSP, paragraph C.2.1.2.

Surveillance monitoring and alerting criteria		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft operator**
Ref:	**Criteria**	**Compliance means**
MA-2	When the flight crew determines that the aircraft surveillance capability no longer meets the requirements for the intended function, the flight crew shall advise the ATC unit concerned.	Procedures, flight crew training and qualification

Surveillance related safety requirements		
Specification: Type 180/D	**Application: ADS-C, FMC WPR**	**Component: Aircraft operator**
Ref	**Related Surveillance Parameter**	**Safety requirement**
All	C, I	*Note.— Safety requirements related to surveillance type 180/D are the same as those related to RCP 240/D. See Appendix B, paragraph B.2.1.4.*

C.3 Surveillance performance type 400 specification

<table>
<tr><td colspan="6">Surveillance Performance Specification</td></tr>
<tr><td colspan="3">Surveillance performance type</td><td colspan="3">400</td></tr>
<tr><td colspan="6">Airspace specific considerations</td></tr>
<tr><td>Interoperability</td><td colspan="5">Specify interoperability criteria, e.g. FANS 1/A</td></tr>
<tr><td>ATS Function</td><td colspan="5">Specify ATS function(s), e.g. applicable separation standard</td></tr>
<tr><td>Application</td><td colspan="5">Specify the required surveillance capability. FMC WPR or, for ADS-C, specify the types of contracts required to support the ATS function, e.g. periodic contract at [nn] min, waypoint change event contract, lateral deviation event contract at [n] NM, etc.</td></tr>
<tr><td colspan="6">Surveillance parameter values</td></tr>
<tr><td>Transit time (sec)</td><td>Continuity (C)</td><td></td><td>Availability (A)</td><td colspan="2">Integrity (I)</td></tr>
<tr><td>OT = 400</td><td>C(OT) = 0.999</td><td rowspan="3"></td><td rowspan="3">0.999</td><td>Navigation FOM</td><td>See <u>Note 3</u>.</td></tr>
<tr><td rowspan="2">DT 95% = 300</td><td rowspan="2">C(DT 95%) = 0.95</td><td>Time at position accuracy</td><td>+/- 1 sec (UTC)</td></tr>
<tr><td>Data integrity</td><td>Malfunction = 10^{-5} per flight hour</td></tr>
<tr><td colspan="6">Surveillance monitoring and alerting criteria</td></tr>
<tr><td>Ref</td><td colspan="5">Criteria</td></tr>
<tr><td>MA-1</td><td colspan="5">The system shall be capable of detecting failures and configuration changes that would cause the ADS-C or FMC WPR service to no longer meet the surveillance parameter values for the intended function.</td></tr>
<tr><td>MA-2</td><td colspan="5">When the ADS-C or FMC WPR service can no longer meet the surveillance parameter values for the intended function, the flight crew and/or the controller shall take appropriate action.</td></tr>
<tr><td colspan="6">Notes</td></tr>
<tr><td colspan="6"><u>Note 1</u>.— Rationale for the criteria provided in this specification can be found in ICAO Annex 11, ICAO Doc 4444, ICAO Doc 9689, and RTCA DO-306/ED-122.
<u>Note 2</u>.— If changes are made to the system capacity limits, as specified by the airspace requirements, and the changes cause the system to perform below the surveillance parameter values, this would be considered a change in system configuration.
<u>Note 3</u>.— The navigation figure of merit (FOM) is specified based on the navigation criteria associated with this spec. For example, if RNP 10 is prescribed, then for ADS-C surveillance service, the FOM level would need to be 3 or higher. In all cases, when the navigation capability no longer meets the criteria specified for the operation, the flight crew is responsible for reporting the non-compliance to ATC in accordance with ICAO procedures.</td></tr>
</table>

C.3.1 Surveillance performance type 400/D allocations

The surveillance performance type 400/D allocations can be applied to the ADS-C or FMC WPR applications.

C.3.1.1 Air traffic service provider (ATSP)

Surveillance data transit time and continuity criteria			
Specification: Type 400/D	**Application: ADS-C, FMC WPR**		**Component: ATSP**
Data Latency Parameter	**OT (sec)** **C = 99.9%**	**DT 95% (sec)** **C = 95%**	**Compliance Means**
Delivery Time Value	400	300	Analysis, CSP contract/service agreement. See also paragraph C.3.1.2.
RSTP Time Allocation			
$RSTP_{ATSU}$	30	15	Pre-implementation demonstration

Surveillance availability criteria			
Specification: Type 400/D	**Application: ADS-C, FMC WPR**		**Component: ATSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms. *Note.— For guidelines to aid in the development of the contract/service agreement with the CSP, see paragraph C.3.1.2, surveillance performance type 180/D allocation to CSP for surveillance availability criteria.*

Note.— The surveillance integrity criteria, monitoring and alerting criteria, and related safety requirements for type 400/D are the same as the criteria provided for type 180/D. See paragraph C.2.1.1.

C.3.1.2 Communication service provider (CSP)

Note.— The surveillance performance allocations for the CSP are intended to aid the ATSP and the aircraft operator in the development of contracts and service agreements.

Surveillance data transit time and continuity criteria			
Specification: Type 400/D	**Application: ADS-C, FMC WPR**		**Component: CSP**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance Means**
RSTP Time Allocation			
$RSTP_{CSP}$	340	270	Contract/service agreement terms. Pre-implementation demonstration

Surveillance availability criteria			
Specification: Type 400/D	**Application: ADS-C, FMC WPR**		**Component: CSP**
Availability parameter	**Efficiency**	**Safety**	**Compliance means**
Service availability (A_{CSP})	N/A	0.999	Contract/service agreement terms
Unplanned outage duration limit (min)	N/A	20	Contract/service agreement terms
Maximum number of unplanned outages	N/A	24	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	N/A	520	Contract/service agreement terms
Unplanned outage notification delay (min)	N/A	10	Contract/service agreement terms
Note.— The surveillance availability criteria for type 400/D are the same as the for RCP 400/D. See Appendix B, paragraph B.3.1.2.			

Surveillance integrity criteria		
Specification: Type 400/D	**Application: ADS-C, FMC WPR**	**Component: CSP**
Integrity parameter	**Integrity value**	**Compliance means**
Integrity (I)	*Note.— Surveillance integrity criteria related to Type 400/D are the same as those related to Type 180/D. See paragraph C.2.1.2.*	

C.3.1.3 Aircraft system

Surveillance data transit time and continuity criteria			
Specification: Type 400/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft system**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance Means**
RSTP Time Allocation			
$RSTP_{AIR}$	30	15	Pre-implementation demonstration

Note.— The surveillance availability, integrity and monitoring and alerting criteria, and related safety requirements for type 400/D are the same as the criteria and related safety requirements provided for type 180/D. See paragraph C.2.1.3.

C.3.1.4 Aircraft operator

Surveillance data transit time and continuity criteria			
Specification: Type 400/D	**Application: ADS-C, FMC WPR**		**Component: Aircraft operator**
Data Latency Parameter	**OT (sec) C = 99.9%**	**DT 95% (sec) C = 95%**	**Compliance Means**
RSTP Time Allocation			
$RSTP_{AIR}$	30	15	Aircraft type design approval, maintenance, properly configured user-modifiable software, e.g. ORT
$RSTP_{CSP}$	340	270	CSP contract/service agreement. See also paragraph C.3.1.2. Pre-implementation demonstration.

Note.— The surveillance availability, integrity and monitoring and alerting criteria, and related safety requirements for type 400/D are the same as the criteria and related safety requirements provided for type 180/D. See paragraph C.2.1.4.

Appendix D Post-implementation monitoring and corrective action

The ICAO Global Plan calls for the implementation of a performance based system and ICAO Annex 11 requires that data link system performance is monitored to verify that an acceptable level of safety continues to be met. Annex 11 at paragraph 2.2.7.5 states:

> "Any significant safety-related change to the ATC system, including the implementation of a reduced separation minimum or a new procedure, shall only be effected after a safety assessment has demonstrated that an acceptable level of safety will be met and users have been consulted. When appropriate, the responsible authority shall ensure that adequate provision is made for post-implementation monitoring to verify that the defined level of safety continues to be met."

Oversight of the compliance to the Annex 11 requirements is a matter for the States. However, States participate in planning and implementation regional groups (PIRGs), and most use a regional monitoring agency to facilitate monitoring activities within their respective region. The individual states/ATSPs will need to provide the data and information and analysis that will portray regional performance measures. The ATSPs, operators, CSPs, airframe manufacturers, and equipment suppliers all need to participate in reporting and resolving problems associated among the ATSPs and with aircraft.

While individual ATSP will develop the FANS 1/A data collection mechanisms, monitoring tools, and internal reporting requirements best suiting their own environment, all ATSP shall collect and maintain a database of FANS 1/A performance data using the data formats specified in this appendix. These databases will provide the means to aggregate CPDLC RCP transaction time and ADS-C surveillance transit time on a regional and global basis.

Monitoring of FANS 1/A data communications in terms of RCP and surveillance performance is an important part of the performance based system described in the ICAO global plan. To successfully achieve this performance monitoring on a global scale will require the use of a common data set. It is only through this common data set that RCP and surveillance performance data can be aggregated from an ATSP level through to a regional monitoring agency level and then to global level. This aggregation of performance data is in accordance with the guidelines provided in ICAO Doc 9883 Manual on Global Performance of the Air Navigation System.

This appendix contains the following guidance material:

a) ATSP data collection and analysis - This section defines a common data reporting format. Guidance material is included on how to obtain the required data points from the FANS 1/A ACARS messages and on the calculation of actual communication performance (ACP), actual communication technical performance (ACTP), pilot operational response time (PORT), surveillance transit time, and how they are calculated. Examples of the type of analysis that can be carried out at an ATSP level are also included. Issues regarding data filtering are discussed including guidance on how to manage this.

b) Problem reporting and resolution – This section provides guidance on the problem identification and resolution process

c) Regional performance monitoring – This section provides guidance on the monitoring of ADS-C transit time and CPDLC actual communication performance at a regional level.

D.1 ATSP data collection and analysis

Data link performance requirements for the application of reduced separation standards, as defined in ICAO Doc 4444, are contained in the RTCA DO-306/EUROCAE ED 122 Oceanic SPR standard. These requirements are specified in terms of required communications performance (RCP) and surveillance performance.

D.1.1 ATSP data collection for CPDLC application

This section provides guidance on data collection and performance measurement for the CPDLC application

D.1.1.1 Measuring CPDLC communication performance

CPDLC analysis is based on the calculation of actual communication performance (ACP) used to monitor RCP time allocation for communication transaction (TRN), actual communications technical performance (ACTP) used to monitor required communication technical performance (RCTP) time allocation, and pilot operational response time (PORT) used to monitor the responder performance criteria of the transaction.

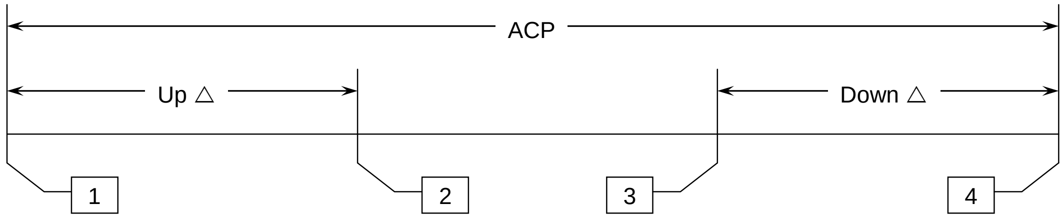
The analysis uses the measurement of transit and response times to those CPDLC uplinks that receive a single DM 0 WILCO response. Responses not measured are where an uplink receives DM 1 UNABLE, DM 2 STANDBY, DM 3 ROGER, DM 4 AFFIRM, DM 5 NEGATIVE responses. A DM 0 WILCO response following a DM 2 STANDBY is also not measured. The rationale behind this is that the critical communications requirement is provided by intervention messages when applying reduced separation standards. Incorporating other message types such as free text queries, information requests not requiring a DM 0 WILCO response, messages with DM 1 UNABLE responses, or DM 2 STANDBY responses followed by DM 0 WILCO, will skew the observed data because of the longer response times from the flight deck.

All messages with a W/U response attribute are assessed. These include communications transfer messages in addition to the typical intervention messages such as climb clearances. Data analysis has shown no significant difference in crew response between these message types and the addition of the communication transfer messages provides ATSP with a significantly greater number of data points for analysis.

To calculate ACP, the difference between the times that the uplink message is originated at the air traffic service provider (ATSP) to the time that the corresponding response downlink is received at the ATSP is used.

To calculate ACTP, the difference between the downlink's aircraft time stamp and the received time is added to half the round trip time determined by the difference between the uplink time when the message is sent from the ATSP and the receipt of the MAS response for the uplink at the ATSP ((uplink transmission time – MAS receipt)/2 + downlink time).

PORT is calculated by the difference between ACP and ACTP. Figure D- 1 illustrates these measurements.



1. Uplink Sent. This is the date/time that the CPDLC clearance was sent to the aircraft.
2. MAS Received. This is the date/time that the MAS for the CPDLC clearance was received.
3. WILCO Sent. This is the date/time that the WILCO reply is transmitted.
4. WILCO Received. This is the date/time that the WILCO reply for the CPDLC clearance was received.

The measurements (in seconds) are calculated as follows:

$$\mathrm{ACP} = (\mathrm{WILCO\_Received}) - (\mathrm{Uplink\_Sent}) \rightarrow \textbf{TRN}$$

$$\mathrm{ACTP} \cong \left(\left(\frac{\mathrm{Up}\Delta}{2} \right) + (\mathrm{Down}\Delta) \right) \rightarrow \textbf{RCTP}$$

$$\mathrm{PORT} \cong \mathrm{ACP} - \mathrm{ACTP} \rightarrow \textbf{Responder}$$

Figure D- 1. CPDLC transaction calculations

The values for ACTP and PORT are only approximations. Uplink transit times are estimated by taking half the time for the MAS response round trip. This assumption is flawed in a small percentage of cases because we know it is possible for the MAS to be received at the ATSP after the operational response is received; or for the timestamp on the operational response to be earlier than the MAS receipt time. This will happen if the CSP does not hear the network ACK from the aircraft (which is sent on uplink receipt) and resends the uplink later. The CSP receives the network ACK to this second uplink and sends the MAS to the ATSP. In the meantime, the aircraft has already responded with the operational response. ATSP will see this issue reflected in their data with crew response times with negative or extremely small values. There is no requirement to filter these small or negative response times from the measured data and all negative values are counted as 0 for graphical presentation. The time sequence diagram below in Figure D- 2 illustrates the issue.

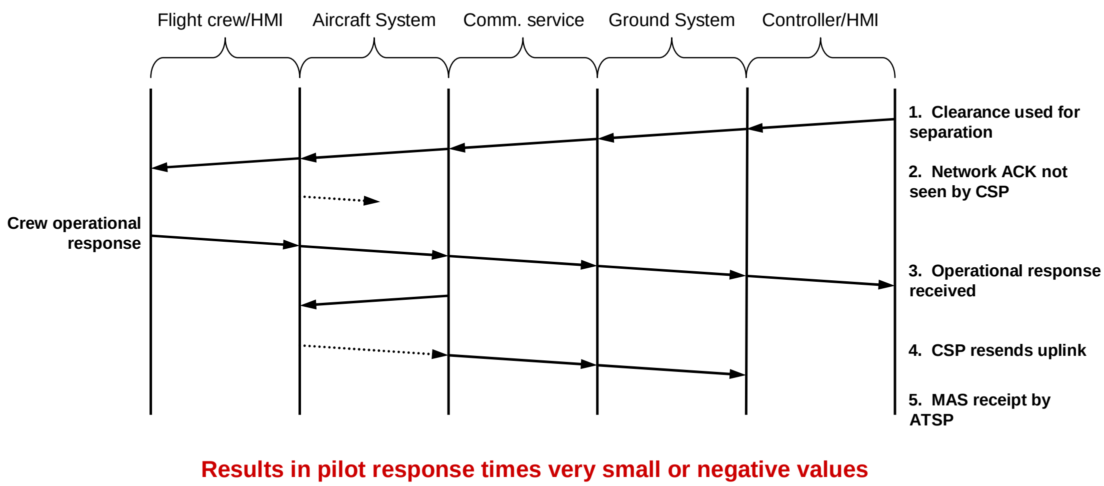


Figure D- 2 Issue with estimating uplink transit time as half MAS roundtrip

D.1.1.2 Recording the data points for each CPDLC transaction

The following data points in Table D-1 are recommended as the minimum set that should be extracted from ATSP data link system recordings to enable RCP analysis and provide sufficient information for problem analysis. This does not preclude individual ATSP from extracting additional data points for their own analysis requirements and some possibilities are listed below. To obtain these data points ATSP should note that they will require additional database information to enable the aircraft type and operator to be obtained by correlation to the aircraft registration extracted from the data link recordings. All of the other data points are extracted from either the ACARS header or the CPDLC application message.

Table D-1 CPDLC data collection points

Ref	Label	Description and/or remarks
1	ATSP	The four letter ICAO designator of the FIR, e.g. NZZO.
2	Aircraft registration	The aircraft registration in ICAO Doc 4444 Format (no hyphens, packing dots, etc.), e.g. N104UA. *Note.— Extracted from ACARS header or application message.*
3	Aircraft type designator	The ICAO aircraft type designator, e.g. B744. *Note.— Extracted from ATSP database using aircraft registration as key.*
4	Operator designator	The ICAO designator for the aircraft operating agency, e.g. UAL. *Note.— Extracted from ATSP database using aircraft registration as key.*
5	Date	In YYYYMMDD format, e.g. 20081114. *Note.— Extracted from ATSP system data recording time stamp, synchronized to within 1 second of Universal Time Coordinated (UTC).*

Ref	Label	Description and/or remarks
6	MAS RGS	Designator of the RGS that MAS downlink was received from, e.g. POR1. *Note.— This is a 3 or 4 letter designator extracted from the ACARS header DT line.*
7	OPS RGS	Designator of the RGS that the operational response was received from, e.g. AKL1. *Note.— This is a 3 or 4 letter designator extracted from the ACARS header DT line.*
8	Uplink time	The timestamp on the uplink CPDLC message sent by the ATSP in HH:MM:SS format, e.g. 03:43:25. *Note.— Extracted from ATSP system data recording time stamp, synchronized to within 1 second of UTC.*
9	MAS receipt time	The ATSP timestamp on receipt of the MAS in HH:MM:SS format, e.g. 03:43:55. *Note.— Extracted from ATSP system data recording time stamp, synchronized to within 1 second of UTC.*
10	MAS round trip time	In seconds (#9-#8), e.g. 10.
11	Aircraft FMS time stamp	In the operational response messages in HH:MM:SS, e.g. 03:44:15. *Note.— Extracted from the ATCmessageHeader timestamp in the decoded operational response message. See RTCA DO-258AEUROCAE ED-100A section 4.6.3.3.*
12	ATSP timestamp on the receipt of the operational response	In HH:MM:SS, e.g. 03:44:45. *Note.— Extracted from ATSP system data recording time stamp, synchronized to within 1 second of UTC.*
13	Operational message round trip time	From sending uplink (#8) to receipt of operational response (#12) in seconds, e.g. 80.
14	Downlink response transit time	In seconds (#12-#11), e.g. 30.
15	Uplink message elements	All uplink message element identifier preceded by U encapsulated between quotation marks with a space between each element, e.g. “U118 U80” *Note.— Extracted from the decoded operational uplink that initiated the transaction.*
16	Downlink message elements	All downlink message elements encapsulated between quotation marks with a space between each element if required, e.g. “D0” *Note.— Extracted from the decoded operational downlink.*
17	ACTP	Actual communication technical performance in seconds, e.g. 35. *Note.— Truncated to whole seconds.*

Ref	Label	Description and/or remarks
18	ACP	Actual communications performance in seconds measured as the difference between time uplink sent (#8) to operational response received (#12), e.g. 80.
19	PORT	Pilot Operational Response Time = ACP (#18) - ACTP(#17), e.g. 45. *Note.— Implementers should allow for negative values where the operational response is received before the MAS as per Figure D- 2 above. When graphing PORT negative values should be counted as 0.*

ATSP may find that the following additional data may be useful for performance analysis:

a) The aircraft call sign extracted from either the Flight Plan, e.g. ANZ123, or the AFN logon for the flight, e.g. NZ123, or the FI line in the ACARS header, e.g. NZ0123;

b) Direction of flight calculated by the flight data processor and displayed as a three figure group representing degrees true, e.g. 275; and

c) The estimated position in latitude and longitude of the aircraft when a CPDLC downlink is sent. Calculated by the flight data processor. For consistency the following formats are recommended: For latitude use “+” for North or “-” for South followed by a decimal number of degrees, e.g. -33.456732. For longitude use “+” for East or “-” for West followed by a decimal number of degrees, e.g. +173.276554.

D.1.1.3 Data record for each CPDLC transaction

If required for regional monitoring agency analysis CPDLC transaction data as described above may be sent to the regional/State monitoring agency at as a comma delimited text file. The format for each record will at minimum contain the 20 data points specified in table D-1. Using the example in the previous paragraph the data record for the transaction described above in comma delimited format is:

NZZO,N104UA,B744,UAL,20081114,POR1,AKL1,03:43:25,03:43:55,10,03:44:15,03:44:45,80,30,”U118 U80”,”D0”,35,80,45

Guidance on the type of analysis carried out at an ATSP or regional level is provided later in paragraphs D.1.3 and D.2.1.

D.1.2 ATSP data collection for ADS-C application

This section provides guidance on data collection and performance measurement for the ADS-C application.

D.1.2.1 Measuring ADS-C surveillance performance

The analysis of ADS-C performance is based on the measurement of the transit times of the ADS-C periodic and event reports between the aircraft and the ATSP ground system. This is measured as the difference between the time extracted from the decoded ADS-C basic group timestamp when the message originated from the FMS and the time the message is received at the ATSP.

D.1.2.2 Recording the ADS-C data points for each ADS-C downlink.

The following data points in Table D-2 are recommended as the minimum set that should be extracted from ATSP data link system recordings to enable an analysis of ADS-C performance and provide sufficient information for problem analysis. This does not preclude individual ATSP from extracting additional data points for their own analysis and some possibilities are listed below. To obtain all of these data points ATSP should note that they will require additional database information to enable the Aircraft Type and Airline to be obtained by correlation to the aircraft registration extracted from the data link recordings. All of the other data points are extracted from either the ACARS header or the ADS-C application message.

Table D-2 ADS-C data collection points

Ref	Label	Description and/or remarks
1	ATSP	The four letter ICAO designator for the FIR of the reporting ATSP, e.g. NZZO.
2	Aircraft Registration	The aircraft registration in ICAO Doc 4444 Format (no hyphens, packing dots, etc.), e.g. N104UA. *Note.— Extracted from ACARS header or application message.*
3	Aircraft Type Designator	The ICAO aircraft type designator, e.g. B744. *Note.— Extracted from ATSP database using aircraft registration as key.*
4	Operator Designator	The IATA designator for the aircraft operating agency, e.g. UAL. *Note.— Extracted from ATSP database using aircraft registration as key.*
5	Date	In YYYYMMDD format, e.g. 20081114. *Note.— Extracted from ATSP system data recording time stamp, synchronized to within 1 second of UTC.*
6	RGS	Designator of the RGS that ADS-C downlink was received from, e.g. POR1. *Note.— This is a 3 or 4 letter designator extracted from the ACARS header DT line.*
7	Report Type	The type of ADS-C report extracted from the ADS-C basic group report tag where tag value 7=PER, 9=EMG, 10=LDE, 18=VRE, 19=ARE, 20=WCE. As some aircraft concatenate more than one report in the same downlink extract the ADS-C report tag from each ADS-C basic group and identify them in the REP_TYPE column by using the first letter of the report type as an identifier e.g. for a concatenated report containing two ADS-C basic groups for a periodic report and a waypoint event report the field will contain PW. Where a downlink does not contain a ADS-C basic group the REP_TYPE field will be left blank.
8	Latitude	The current latitude decoded from the ADS-C basic group. The format is "+" for North or "-" for South followed by a decimal number of degrees, e.g. -33.456732.
9	Longitude	The current longitude decoded from the ADS-C basic group. The format is "+" for East or "-" for West followed by a decimal number of degrees, e.g. +173.276554.

Ref	Label	Description and/or remarks
10	Aircraft Time	The time the ADS-C message was sent from the aircraft in HH:MM:SS, e.g. 03:44:15. *Note.— Decoded from the ADS-C basic group timestamp extracted as seconds since the most recent hour. See RTCA DO-258A/EUROCAE ED-100A, section 4.5.1.4.*
11	Received Time	The ATSP timestamp on the receipt of the ADS-C message in HH:MM:SS, e.g. 03:44:45. *Note.— Extracted from ATSP system data recording time stamp, synchronized to within 1 second of UTC.*
12	Transit Time	The transit time of the ADS-C downlink in seconds calculated as the difference between #10 Aircraft Time and #11 Received Time, e.g. 30.

ATSP may find that the following additional data may be useful for performance analysis:

a) The aircraft call sign extracted from either the Flight Plan, e.g. ANZ123 or the AFN log on for the flight e.g. NZ123 or the FI line in the ACARS header, e.g. NZ0123

b) Direction of flight calculated by the ATSP flight data processor and displayed as a three figure group representing degrees true, e.g. 275.

c) ADS-C predicted position latitude and longitude and time when available. (Note: time decoded from the ADS-C predicted group where timestamp is extracted as seconds since the most recent hour. (See RTCA DO-258A section 4.5.1.4)) For consistency the following formats are recommended: For latitude use "+" for North or "-" for South followed by a decimal number of degrees, e.g. -33.456732. For longitude use "+" for East or "-" for West followed by a decimal number of degrees, e.g. +173.276554.

D.1.2.3 Data record for each ADS-C downlink

If required for regional/State monitoring agency analysis ADS-C transaction data as described above may be sent to the regional regional/State monitoring agency as a comma delimited text file. The format for each record will at minimum contain the 12 data points specified in table D-2. Using the example in the previous paragraph the data record for the transaction described above in comma delimited format is:

NZZO,N104UA,B744,UAL,20081114,POR1,PER,-33.456732,+173.276554,03:44:15,03:44:45,30

Guidance on the type of analysis carried out at an ATSP or regional level is provided later in paragraphs D.1.3 and D.2.1.

D.1.3 ATSP data analysis

To enable adequate system performance monitoring ATSP should at minimum perform a monthly analysis of CPDLC RCP and ADS-C performance data. This monitoring will verify system performance and also enable continuous performance improvement by detecting where specific aircraft or fleets are not meeting the performance standards.

While this analysis could be carried out by a regional monitoring agency, it is thought the analysis will be more efficient if done by the ATSP. It is the ATSP that will usually have the operational expertise and local area knowledge that is important when identifying problems from any data analysis. At least one region has had considerable success by using some of the regional ATSP to complete a monthly data analysis and reporting the identified problems to the regional monitoring agency for resolution.

A regional monitoring agency is best suited to manage problems reported from the ATSP analysis, and to develop actual regional performance figures from information supplied by the ATSP. Analysis by the individual ATSP will also avoid the regional monitoring agency having to manage a large quantum of data that the ATSP already holds.

D.1.3.1 Graphical analysis

It is recommended that ATSP perform a graphical analysis of the performance data gathered. This graphical analysis is useful for depicting in a readily assimilated fashion actual performance, and has proved extremely useful when identifying performance problems.

Monitoring can be completed at a number of levels and similar levels can be used for both CPDLC and ADS-C performance monitoring. The following structure is recommended:

a) Monitoring Communication Media Performance. An analysis of:

   1) Data from all aircraft via all Remote Ground Station (RGS) types.

   2) Data from all aircraft via SATCOM RGS

   3) Data from all aircraft via VHF RGS

   4) Data from all aircraft via HF RGS

   5) Data from all aircraft via HF and SATCOM RGS

Note.— The monitoring of combined HF and SATCOM data is to allow verification that the performance obtained from those aircraft using HFDL for downlinks only when SATCOM is not available does not degrade performance by an unacceptable level.

b) Monitoring Airline Fleet Performance. An analysis of:

   1) The observed performance of each type of aircraft operated by an operator:

      i) Via SATCOM

      ii) Via SATCOM + HF

      iii) Via HF

      iv) Via VHF

      v) Via All RGS

   2) Comparative analysis of the observed performance from the same type of aircraft from different operators.

Note.— When measuring CPDLC performance for a specific media type(s) then only those transactions where both the RGS for the MAS and the RGS of the operational response are from that media type would be measured. Mixed media transactions such as where the MAS is received via a VHF RGS and the operational response is via a SATCOM RGS would be excluded from a SATCOM analysis. Mixed media transactions would be counted in the SATCOM + HF, and All RGS analysis above.

D.1.3.2 Data filtering

It is important that consistent data filtering is employed to ensure that all ATSP measure against the same baseline. Raw data obtained from the ATSP recordings will include delayed transactions measured during periods of system outage and these should not be used when assessing CPDLC transaction time or surveillance data transit time. The data may also include duplicated messages which will also skew the measurements if not removed. This data should be filtered from the raw data before any performance assessment is made.

D.1.3.2.1 System Outages

The raw data should be checked for any delayed transactions observed during system outages. These delays are easily identified during outages that have been notified by the CSP, but the data should be carefully reviewed for outages that have not been notified. Delays observed from multiple aircraft where the downlinks completing the transactions are received at similar times indicate a system outage. CPDLC transactions and surveillance data delivery measurements during these outage periods should be removed. A typical outage not notified by any DSP is illustrated in Table D- 3 showing ADS-C downlink delays from 3 aircraft between 1120 and 1213.

Table D- 3. ADS-C outages not notified

Aircraft registration	Aircraft time	ATSP system time	Downlink time (Seconds)
ZK-SUI	11:55:38	12:12:52	1034
ZK-SUI	11:44:42	12:12:19	1657
ZK-SUJ	11:41:54	12:12:01	1807
ZK-SUJ	11:26:18	12:09:42	2604
ZK-SUI	11:23:21	12:08:32	2711
ZK-SUJ	11:20:34	12:07:39	2825
ZK-OKG	11:53:52	12:12:51	1139

D.1.3.2.2 Duplicated ADS-C reports

Numerous instances of duplicate ADS-C reports are observed in FANS-1/A data records. A particular report is often duplicated with the second and sometimes third record duplicated at some later time as illustrated in Table D- 4. These duplicate records will skew ADS-C surveillance data delivery measurements and should be removed.

Table D- 4. ADS-C duplicate reports

LAT_LON	Aircraft time	ATSP system time	Downlink time (Seconds)
350225S1694139E	22:29:45	22:31:04	79
350225S1694139E	22:29:45	22:34:56	311
350225S1694139E	22:29:45	22:40:05	620

D.1.3.3 CPDLC RCP analysis

Monitoring of CPDLC RCP involves an assessment of ACP, ACTP, and PORT by a graphical analysis of data using the structure outline in paragraph D.1.3.1.

D.1.3.3.1 Monitoring communications media performance

Graphs illustrating ACP and ACTP are used to assess CPDLC transaction performance through the various communications media. Since PORT is independent of media this would normally only be assessed over one media. The graphs depict measured performance against the RCP requirements at the 95% and 99.9% level and would be completed for the RCP types in use, e.g. RCP240, RCP400. An analysis is completed for:

a) Data from all aircraft via all remote ground station (RGS) types.

b) Data from all aircraft via SATCOM RGS

c) Data from all aircraft via VHF RGS

d) Data from all aircraft via HF RGS

e) Data from all aircraft via HF and SATCOM RGS

A typical graph illustrating ACTP performance constructed using a spreadsheet application is illustrated in Figure D- 3. Similar graphs are used to assess ACTP and ACP for other communications media.

Figure D- 3 graphs ACTP against the 95% 120” and 99.9% 150” requirements for RCP240 using the 16511 CPDLC transactions recorded during the period January-May 2009 in the NZZO FIR.

Data transactions used for the measurement of SATCOM, VHF, and HF ACTP and ACP are where both the MAS and operational response are received via the media being assessed. The exception to this is the assessment of combined HF and SATCOM performance where any transaction involving HF or SATCOM is used.

Similar graphs are used to assess ACTP and ACP for other communications media.

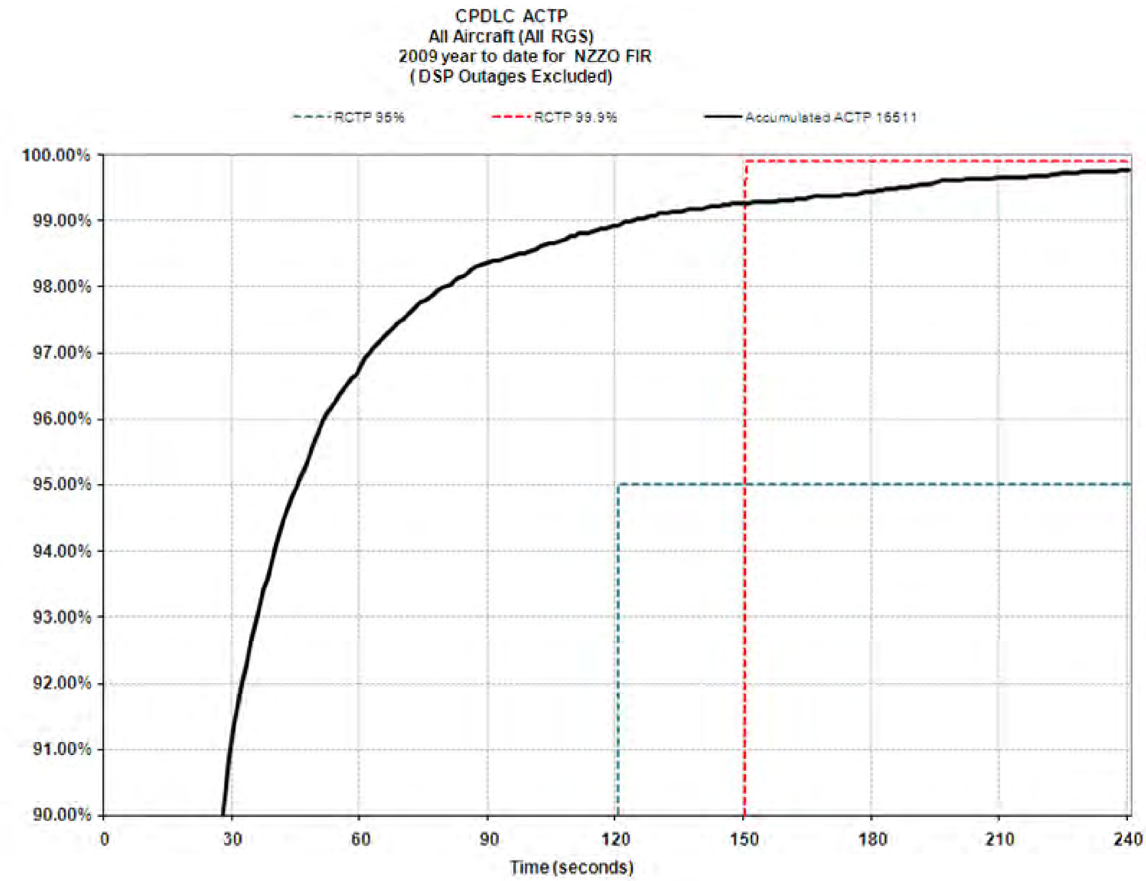


Figure D- 3. CPDLC ACTP performance

D.1.3.3.2 Monitoring Airline Fleet Performance

Graphs illustrating ACP, ACTP, and PORT can be used to monitor the performance of each aircraft type in an operator's fleet. These should be maintained on a monthly basis and can be used to observe the performance of each type when using different media such as: via SATCOM; via SATCOM + HF; via HF; via VHF; and via all RGS. The January to May 2009 SATCOM ACP analysis of the B744 fleet for an operator in the NZZO FIR is illustrated in Figure D- 4.

Figure D- 4 graphs CPDLC ACP against the 95% 180" and 99.9% 210" requirements for RCP240 using the 1888 SATCOM CPDLC transactions recorded for the fleet during the period January-May 2009. Considerable performance variation may be seen month to month and significant degradation in any month may be the result of poor performance from an individual aircraft or may be the result of routes changing month to month with varying weather patterns. These may be investigated further using an analysis of individual tails in a fleet as discussed in paragraph D.1.3.5.

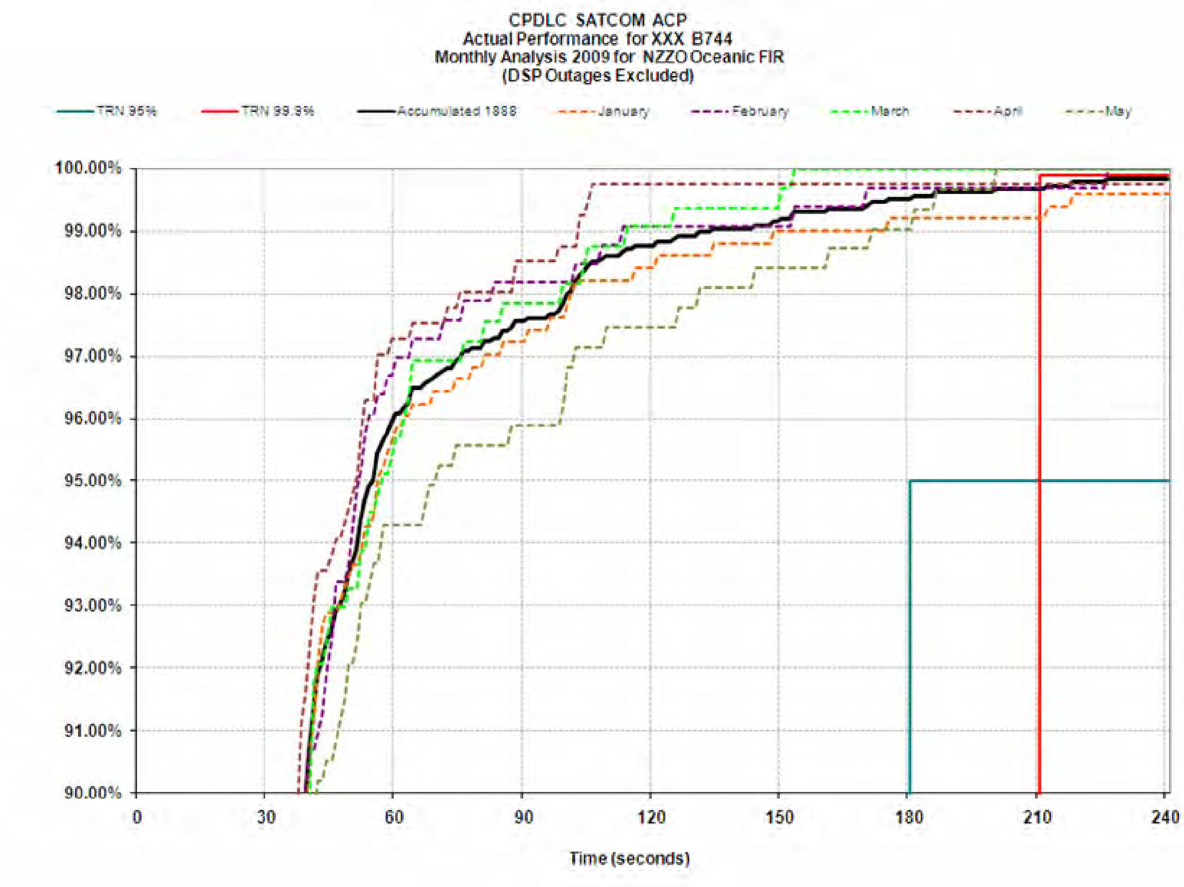


Figure D- 4. CPDLC ACP Airline XXX B744

A comparative analysis of the performance of different fleets operating in an FIR particularly of fleets of the same type is useful. Under performing fleets can be identified for further analysis and a picture of typical performance from all fleets operating in a FIR can be built up. These can be compared with the same fleets operating in other regional FIR.

Figure D-7 below graphs SATCOM ACTP for a number of fleets operating in NZZO FIR for the period January – May 2009. Significant variations in observed performance such as with operator NNN B744 when compared with operator XXX and operator GGG B744 can be flagged for further analysis as discussed in paragraph D.1.3.5.

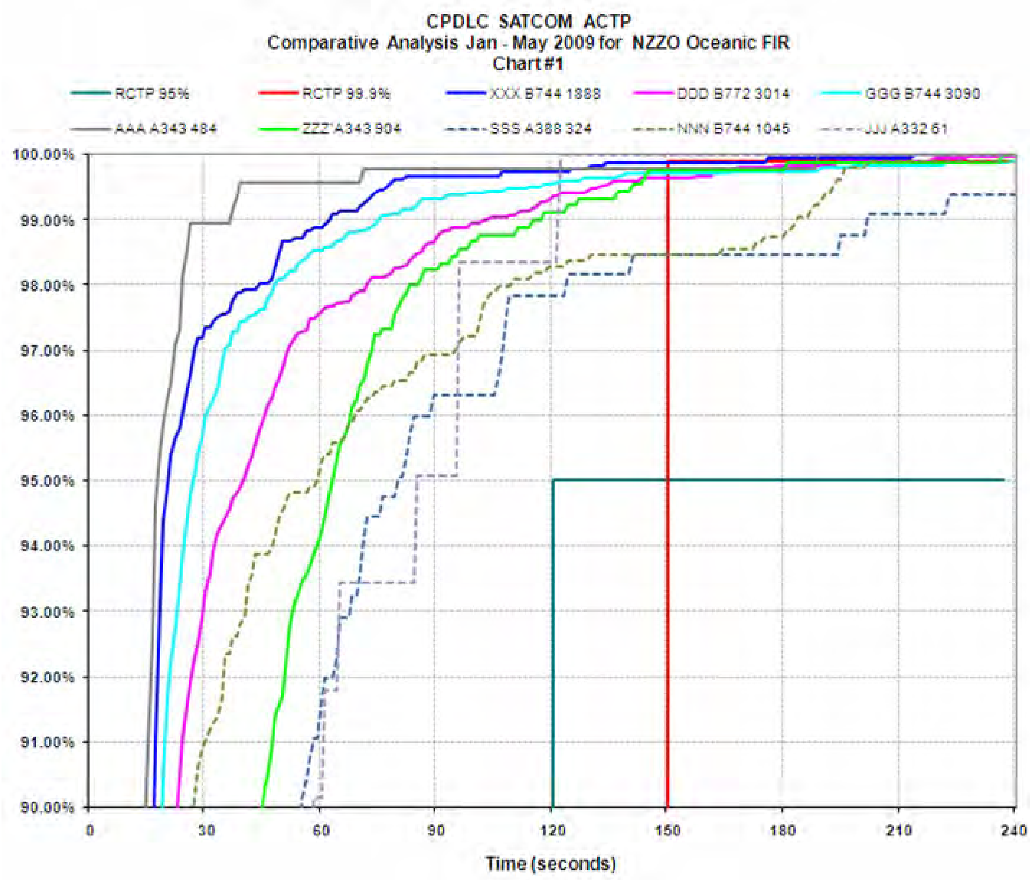


Figure D- 5. CPDLC ACTP comparative operator type performance

D.1.3.4 ADS-C surveillance data transit time analysis

Monitoring of ADS-C surveillance data transit time involves an assessment of observed delay from a graphical analysis of data using the structure outlined in paragraph D.1.3.1.

D.1.3.4.1 Monitoring communications media performance

Graphs illustrating ADS-C surveillance data transit time are used to assess performance through the various communications media. The graphs depict measured performance against the surveillance requirements at the 95% and 99.9% level. An analysis is completed for:

a) Data from all aircraft via all remote ground station (RGS) types.

b) Data from all aircraft via SATCOM RGS

c) Data from all aircraft via VHF RGS

d) Data from all aircraft via HF RGS

e) Data from all aircraft via combined HF and SATCOM RGS

A typical graph illustrating ADS-C surveillance data transit time observed from all RGS and constructed using a spreadsheet application is illustrated in Figure D- 6. Similar graphs are used to assess delay through individual communications media.

Figure D- 6 graphs ADS-C surveillance data transit time against the 95% 90-second and 99.9% 180-second requirements for the surveillance specification provided in Appendix C, paragraph C.2 using the 90235 ADS-C transactions recorded during the period January-May 2009 in the NZZO FIR. For clarity while the graph depicts accumulated performance it also depicts the high and low months observed in the year to date.

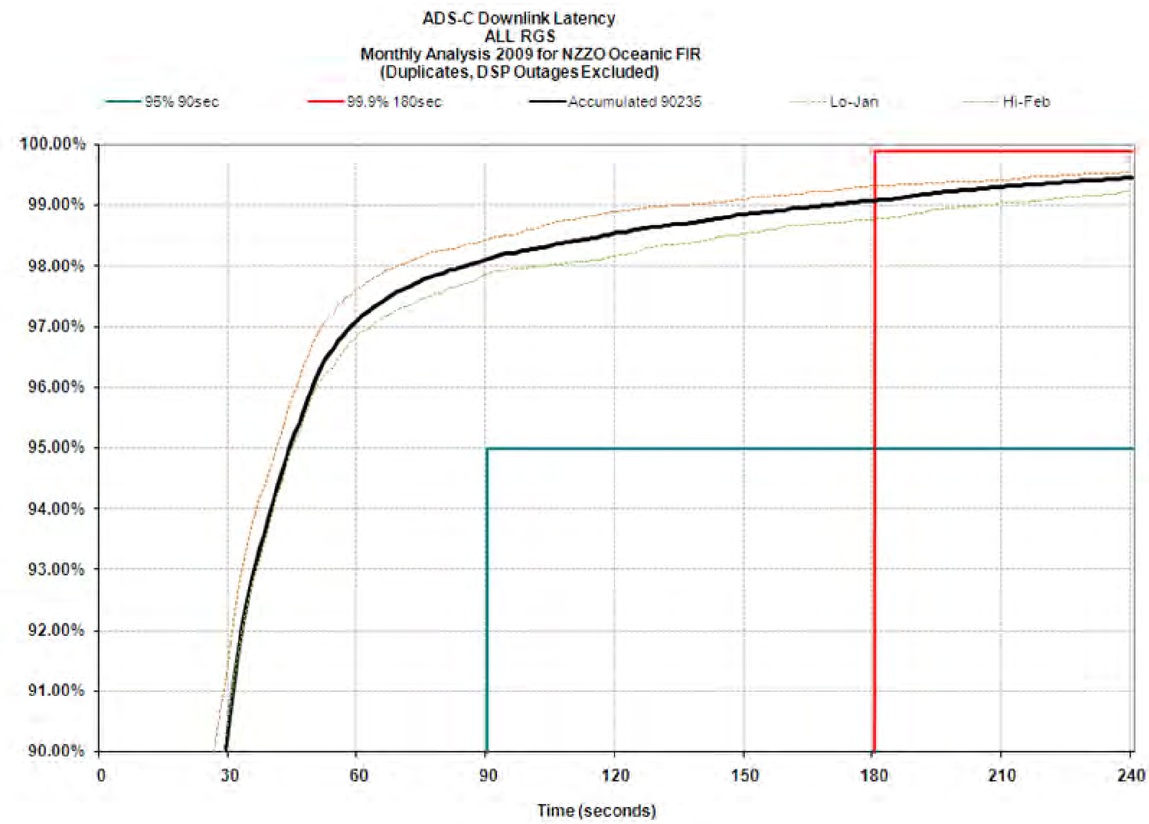


Figure D- 6. ADS-C surveillance data transit time via all RGS NZZO FIR Jan – May 2009

D.1.3.4.2 Monitoring operator fleet performance

Graphs illustrating ADS-C surveillance data transit time can be used to monitor the performance of each aircraft type in an operator's fleet. These should be maintained on a monthly basis and can be used to observe the performance of each type when using different media such as: via SATCOM; via SATCOM + HF; via HF; via VHF; and via all RGS. The January to May 2009 SATCOM delay analysis of the A343 fleet for an operator in the NZZO FIR is illustrated in Figure D- 7.

Figure D- 7 graphs ADS-C surveillance data transit time against the 95% 90-second and 99.9% 180-second requirements for surveillance performance type 180D using the 3195 ADS-C downlinks recorded for the fleet during the period January-May 2009. Considerable performance variation may be seen month to month on some fleets and significant degradation in any month may be the result of poor performance from an individual aircraft or may be the result of routes changing month to month with varying weather patterns. These may be investigated further using an analysis of individual tails in a fleet as discussed in D1.3.5 below. The fleet illustrated shows little variation between the months and for clarity only the high and low months are depicted.

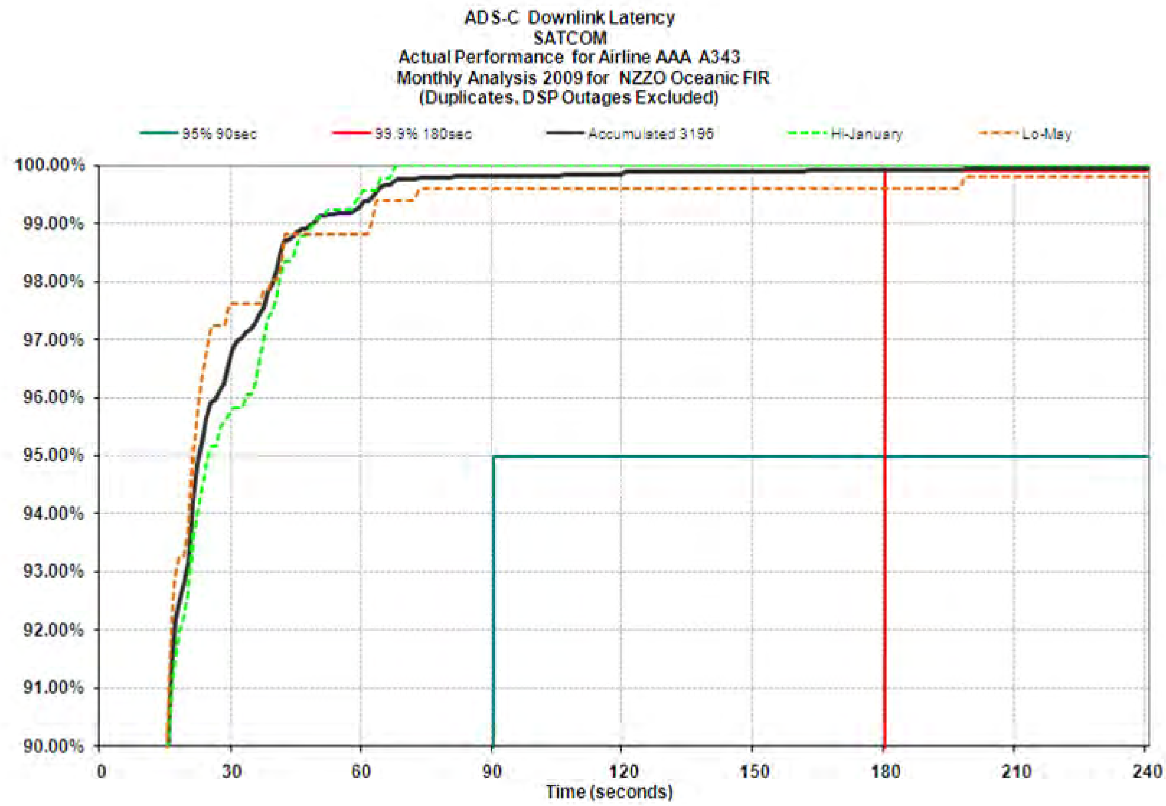


Figure D- 7. ADS-C surveillance data transit time via all RGS NZZO FIR Jan – May 2009

A comparative analysis of the performance of different fleets operating in an FIR particularly of fleets of the same type is useful. Under performing fleets can be identified for further analysis and a picture of typical performance from all fleets operating in a FIR can be built up. These can be compared with the same fleets operating in other regional FIR.

Figure D- 8 below graphs SATCOM transit times for a number of fleets operating in NZZO FIR for the period January – May 2009. Significant variations in observed performance can be flagged for further analysis as discussed in paragraph D.1.3.5.

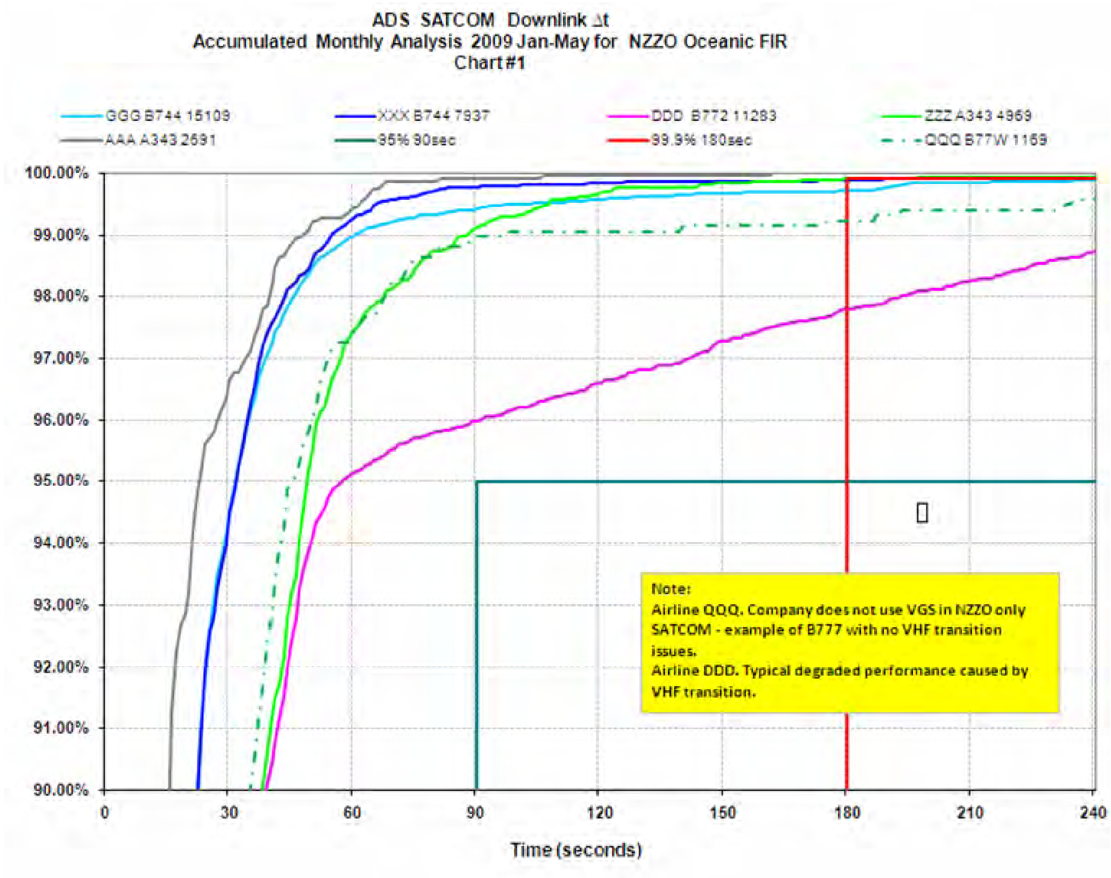


Figure D- 8. Comparative SATCOM ADS-C surveillance data transit time for different operators

D.1.3.5 Identifying poor performers

The reasons behind degraded performance are many and varied. Considerable analysis may be required before the reasons behind poor performing fleets are identified and it is difficult to provide guidance for all situations. Some analysis techniques that have been used by some ATSP with some success to identify reasons behind poor performance are provided in the following paragraphs.

On a number of occasions poor performance has been attributed to a specific aircraft in a fleet. Usually these poor-performing aircraft can be identified by the visual inspection of monthly data ordered in terms of transit time, or more accurately by graphing the monthly data for a fleet by aircraft registration.

Techniques such as graphing the positions of all delayed messages on a geographical display have identified areas for further investigation.

There are low speed (600 bps and 1200 bps) and high speed (10500 bps) data rates defined for the P, R, and T SATCOM channels. Some aircraft are capable of low speed SATCOM only. Other aircraft are capable of both high speed and low speed. However, not all aircraft that are capable of high speed operation have enabled the use of high speed SATCOM and, instead operate in low speed only. It is recommended an operator using low speed SATCOM channels change to the high speed channels where possible. Low or high speed channel use is selectable by an individual operator in the aircraft operational requirements table (ORT).

Significant performance benefits accrue with the use of the high speed channels as illustrated in the figure D-10 below.

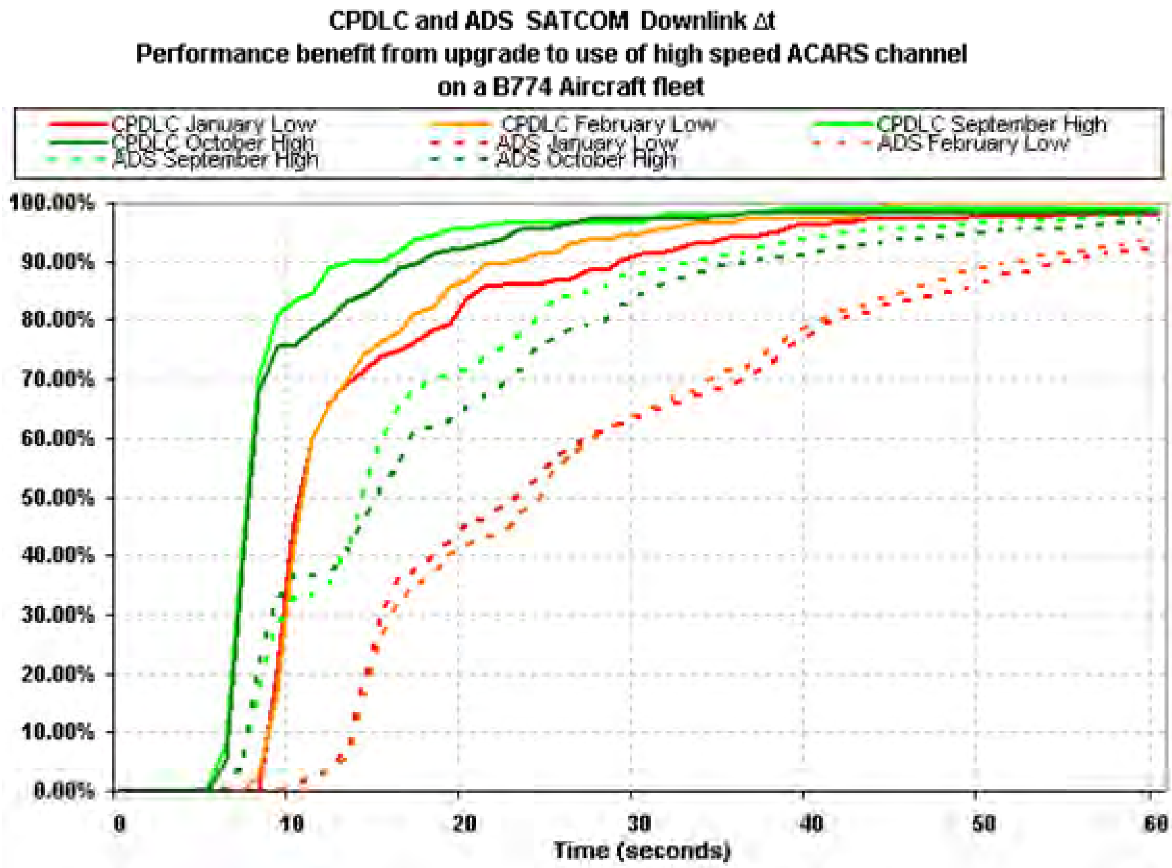


Figure D- 9. Effect of ACARS channel speed on ADS-C surveillance data transit time

An ATSP can assess ACARS channel speed use by evaluating the monthly downlink times for ADS-C reports via SATCOM. For users of high speed channels ATSP will consistently see a small percentage of reports in the 6-8 second time bands. Low speed channels users usually have very few reports less than 10 seconds.

ATSP should identify those operators using the low speed channels and stakeholders should work with those operators to achieve an upgrade to the high speed channels.

D.2 Problem reporting and resolution

D.2.1 General

The working principles in this guidance material result from the combined experience of the North Atlantic, Asia-Pacific, South American, African-Indian Ocean, and European Regions. Many regions have formed a regional monitoring agency to manage the problem reporting and resolution process.

The problem identification and resolution process, as it applies to an individual problem, consists of a data collection phase, followed by problem analysis and coordination with affected parties to secure a resolution, and recommendation of interim procedures to mitigate the problem in some instances. This is shown in the Figure D- 10.

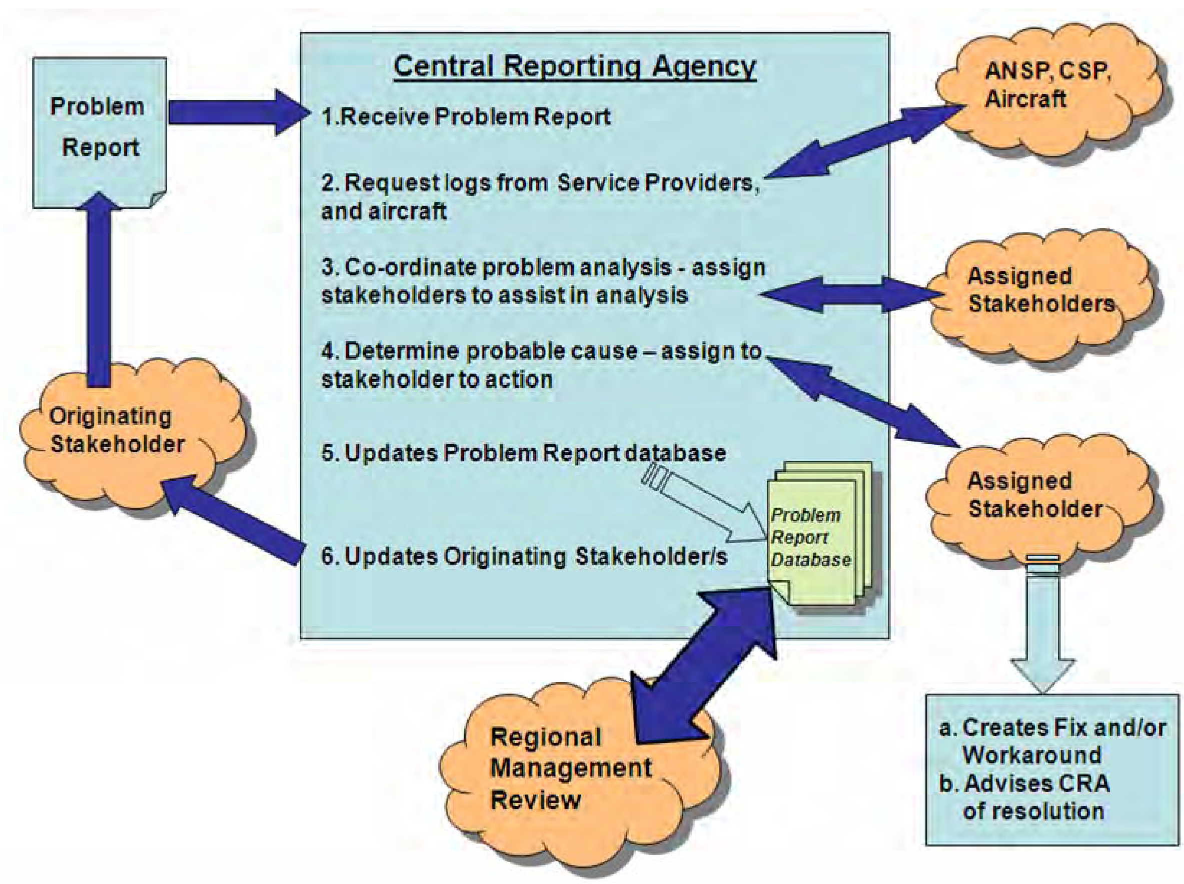


Figure D- 10. Problem reporting and resolution process

D.2.2 Problem report form

The problem identification task begins with receipt of a report from a stakeholder, usually an operator, ATS provider or CSP. Standard reporting forms should be developed and regions should investigate the use of a website to receive and store problem reports. An example of an online problem reporting form is shown in Figure D- 11. The fields used in the form are as follows:

a) Originator's Reference Number: Originators problem report reference, e.g. ANZ_2009-23;

b) Title: A short title which conveys the main issue of the reported problem, e.g. CPDLC transfer failure;

c) Date UTC: Date in YYYYMMDD format, e.g. 20090705;

d) Time UTC: Time in HHMM, e.g. 2345;

e) Aircraft registration: ICAO flight plan aircraft registration, e.g. ZKADR;

f) Aircraft identification: ICAO flight plan call sign if applicable, e.g. NZA456;

g) Flight Sector: If applicable the departure and destination airfield of the flight, e.g. NZAA-RJBB;

h) Organization: Name of the originators organization, e.g. Airways NZ;

i) Active Center: Controlling Centre at time of occurrence if applicable, e.g. NZZO;

j) Next Center: Next controlling centre at time of occurrence if applicable, e.g. NFFF;

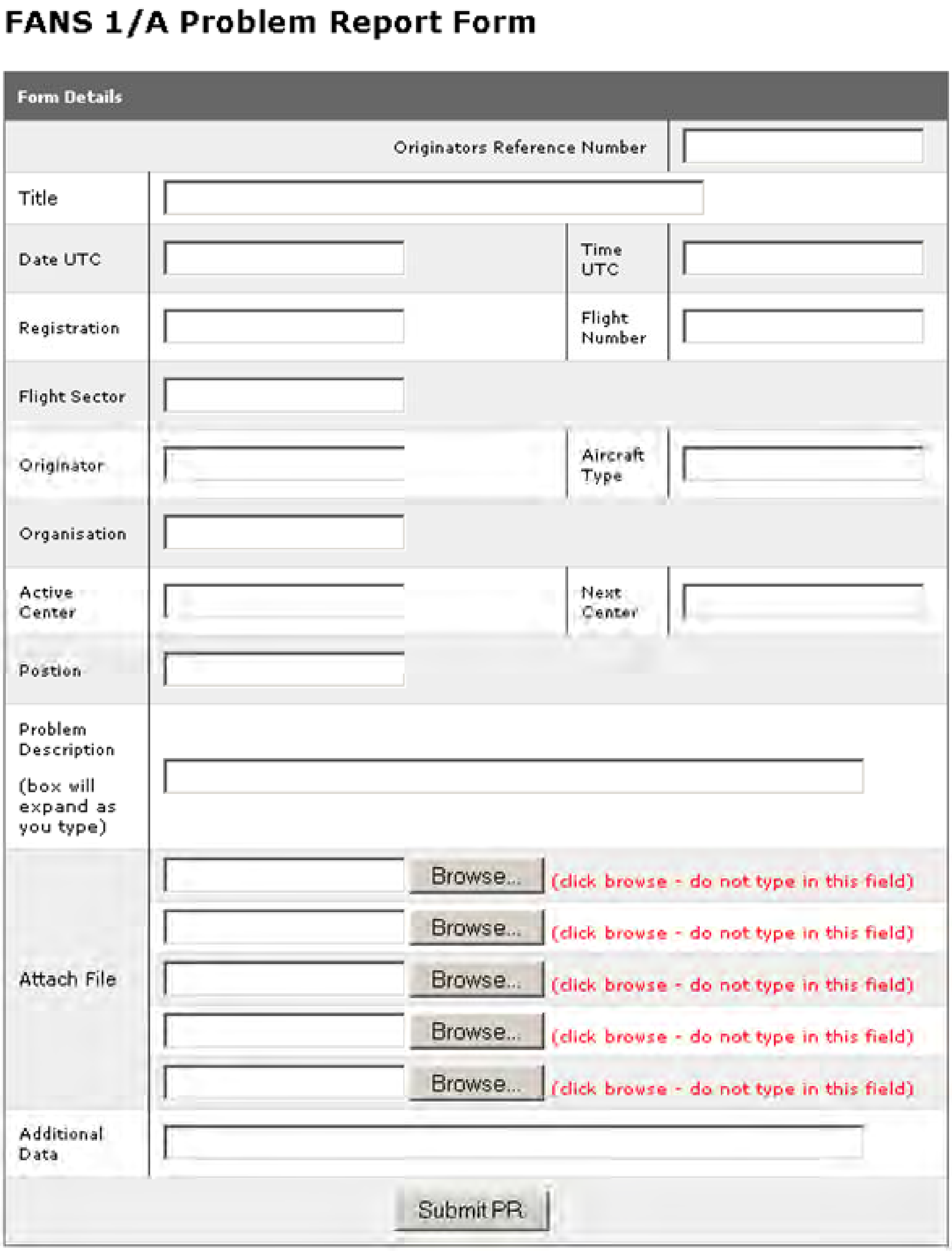
k) Position: Position of occurrence, e.g. 3022S16345E;

l) Problem Description: Detailed description of problem;

m) Attach File: Area of web page where originator and assigned stakeholders can attach data files or other detailed information such as geographic overlays; and

n) Additional Data: Area set aside for feedback from stakeholders assigned by the regional/State monitoring agency. This will includes the results of the investigation and the agreed action plan.

Note.— A number of regional monitoring agencies are developing websites to manage the problem reporting process. Website addresses and the regional monitoring agency to which they are applicable are listed in Appendix E, paragraph E.1, Table E- 3.



FANS 1/A Problem Report Form

Form Details			
		Originators Reference Number	
Title			
Date UTC		Time UTC	
Registration		Flight Number	
Flight Sector			
Originator		Aircraft Type	
Organisation			
Active Center		Next Center	
Postion			
Problem Description (box will expand as you type)			
Attach File	Browse... (click browse - do not type in this field)		
	Browse... (click browse - do not type in this field)		
	Browse... (click browse - do not type in this field)		
	Browse... (click browse - do not type in this field)		
	Browse... (click browse - do not type in this field)		
Additional Data			
	Submit PR		

Figure D- 11, Example on-line problem reporting form

D.2.3 Problem assessment

D.2.3.1 Data collection

D.2.3.1.1 The data collection phase consists of obtaining message logs from the appropriate parties (which will depend on which ATSPs and CSPs were being used and operator service contracts). Today, this usually means obtaining logs for the appropriate period of time from the CSPs involved. Usually, a log for a few hours before and after the event that was reported will suffice, but once the analysis has begun, it is sometimes necessary to request additional data, (perhaps for several days prior to the event if the problem appears to be an on-going one).

D.2.3.1.2 Additionally, some aircraft-specific recordings may be available that may assist in the data analysis task. These are not always requested initially as doing so would be an unacceptable imposition on the operators, but may occur when the nature of the problem has been clarified enough to indicate the line of investigation that needs to be pursued. These additional records include:

a) Aircraft maintenance system logs.

b) Built-In Test Equipment data dumps for some aircraft systems.

c) SATCOM activity logs.

d) Logs and printouts from the flight crew and recordings/logs from the ATS provider(s) involved in the problem may also be necessary. It is important that the organization collecting data for the analysis task requests all this data in a timely manner, as much of it is subject to limited retention.

D.2.3.2 Data analysis

D.2.3.2.1 Once the data has been collected, the analysis can begin. For this, it is necessary to be able to decode all the messages involved, and a tool that can decode every ATS data link message type used in the region is essential. These messages include:

a) AFN (ARINC 622), ADS-C and CPDLC (RTCA DO-258/EUROCAE ED-100) in a region operating FANS-1/A.

b) Context Management, ADS-C and CPDLC applications (ICAO Doc 9705 and RTCA DO-280/ED-110) in a region using ATN.

c) FIS or ARINC 623 messages used in the region.

D.2.3.2.2 The analysis of the decoded messages requires a thorough understanding of the complete message traffic, including:

a) Media management messages.

b) Relationship of ground-ground and air-ground traffic.

c) Message envelope schemes used by the particular data link technology (ACARS, ATN, etc).

D.2.3.2.3 The analyst must also have a good understanding of how the aircraft systems operate and interact to provide the ATS data link functions, as many of the reported problems are aircraft system problems.

D.2.3.2.4 This information will enable the analyst to determine a probable cause by working back from the area where the problem was noticed to where it began. In some cases, this may entail manual decoding of parts of messages based on the appropriate standard to identify particular encoding errors. It may also require lab testing using the airborne equipment (and sometimes the ground networks) to reliably assign the problem to a particular cause.

D.2.3.2.5 Once the problem has been identified, then the task of coordination with affected parties begins. The stakeholder who is assigned responsibility for fixing the problem must be contacted and a corrective action plan agreed. The stakeholder who initiated the problem report shall be provided with regular updates on the progress and resolution of the problem

D.2.3.2.6 This information (the problem description, the results of the analysis and the plan for corrective action) is then entered into a database covering data link problems, both in a complete form to allow continued analysis and monitoring of the corrective action and in a de-identified form for the information of other stakeholders. These de-identified summaries are reported at the appropriate regional management forum and made available to other regional central reporting/monitoring agencies on request.

D.2.4 Mitigating procedures – problem resolution

The regional monitoring agency's responsibility does not end with determining the cause of the problem and identifying a fix. As part of that activity, and because a considerable period may elapse while software updates are applied to all aircraft in a fleet, procedural methods to mitigate the problem may have to be developed while the solution is being coordinated. The regional monitoring agency should identify the need for such procedures and develop recommendations for implementation by the ATSPs, CSPs and operators involved.

D.3 Regional performance monitoring

This section provides guidance on periodic reporting by individual ATSP of observed system performance in their FIR that will enable regional performance metrics to be developed for the availability, CPDLC transaction time and ADS-C surveillance data transit time requirements specified in Appendix B and Appendix C.

These regional performance metrics should be made available to all interested stakeholders. The use of regional websites to enhance the distribution of these metrics should be considered. An example of such a website can be viewed at http://www.ispacg-cra.com/.

D.3.1 Periodic reporting

It is recommended that regions implement monthly performance reporting to obtain system performance metrics. These reports will provide data on observed availability, CPDLC transaction time and ADS-C surveillance data transit time as described herein.

D.3.1.1 Reporting on availability

ATSP should report on CSP notified system outages and on detected outages that have not been notified as described in paragraph D.1.3.2.1.

For each outage the following information should be reported:

a) Time of CSP outage notification: In YYYYMMDDHHMM format or "Not Notified" if no CSP notification received.

b) CSP Name: Name of CSP providing outage notification if applicable.

c) Type of outage: Report media affected SATCOM, VHF, HF, ALL.

d) Outage start time: In YYYYMMDDHHMM format

e) Outage end time: In YYYYMMDDHHMM format

f) Duration of Outage: In minutes.

As per Appendix B only outages greater than 10 minutes are reported. An example form is shown in Figure D- 12.

D.3.1.2 Reporting on CPDLC actual communications performance

ATSP should report observed ACP and ACTP for RCP240 and RCP400 for different media paths using all transactions involving a WILCO response as described in paragraph D.1.3. The media paths to report are:

a) From all aircraft via all remote ground station (RGS) types.

b) From all aircraft where both uplink and downlink are via SATCOM RGS

c) From all aircraft where both uplink and downlink are via VHF RGS

d) From all aircraft where both uplink and downlink are via HF RGS

e) From all aircraft where either uplink and downlink are via HF or SATCOM RGS

A tabular reporting format can be used to capture the observed performance at the 95% and 99.9% RCP240/400 times.

As PORT is independent of media path, this need only be reported for all RGS types. An example form is shown in Figure D- 12.

D.3.1.3 Reporting on ADS-C surveillance data transit time

ATSP should report observed ADS-C surveillance data transit time for surveillance performance type 180 and type 400 for different media paths using all downlinks as described in paragraph D.1.3. The media paths to report are:

a) From all aircraft via all Remote Ground Station (RGS) types.

b) From all aircraft where both uplink and downlink are via SATCOM RGS

c) From all aircraft where both uplink and downlink are via VHF RGS

d) From all aircraft where both uplink and downlink are via HF RGS

e) From all aircraft where either uplink and downlink are via HF or SATCOM RGS

A tabular reporting format can be used to capture the observed performance at the 95% and 99.9% surveillance performance types 180 and 400 times. An example form is shown in Figure D- 12.

Monthly Report of Datalink Performance by < ANSP Name> for < FIR Name > for <month> <year>

Section 1: Availability

CSP Notification	CSP Name	Outage Type	Start	End	Duration (Mins)
200907150005	ARINC	SATCOM	200907150001	200907150020	19
Not Notified	N/A	SATCOM	200907212233	200907212255	22
200907281515	SITA	VHF	200907281510	200907281525	15

Section 2: CPDLC

ALL RGS			SATCOM		
ACTP RCP240	120sec	98.20%	ACTP RCP240	120sec	
	150sec	100%		150sec	
ACP RCP240	180sec	98%	ACP RCP240	180sec	
	210sec	99.70%		210sec	
PORT	60sec	98%			
ACTP RCP400	260sec		ACTP RCP400	260sec	
	310sec			310sec	
ACP RCP400	320sec		ACP RCP400	320sec	
	370sec			370sec	
VHF			**HF**		
ACTP RCP240	120sec		ACTP RCP240	120sec	
	150sec			150sec	
ACP RCP240	180sec		ACP RCP240	180sec	
	210sec			210sec	
ACTP RCP400	260sec		ACTP RCP400	260sec	
	310sec			310sec	
ACP RCP400	320sec		ACP RCP400	320sec	
	370sec			370sec	
SATCOM + HF					
ACTP RCP240	120sec				
	150sec				
ACP RCP240	180sec				
	210sec				
ACTP RCP400	260sec				
	310sec				
ACP RCP400	320sec				
	370sec				

Section 3: ADS-C

ALL RGS			SATCOM		
ASP RSP180	90sec	98.80%	ASP RSP180	90sec	
	180sec	100%		180sec	
ASP RSP400	300sec		ASP RSP400	300sec	
	400sec			400sec	
VHF			**HF**		
ASP RSP180	90sec		ASP RSP180	90sec	
	180sec			180sec	
ASP RSP400	300sec		ASP RSP400	300sec	
	400sec			400sec	
SATCOM + HF					
ASP RSP180	90sec				
	180sec				
ASP RSP400	300sec				
	400sec				

Figure D- 12. Example ATSP monthly report

D.3.1.4 Reporting data to enable graphical reports

In addition to the tabular performance reporting described above regions should consider presenting performance data using graphical means. Performance graphs illustrating regional communications and surveillance performance for the different media paths can be readily obtained by aggregating spreadsheet data from individual ATSP as illustrated in Figure D- 13. This figure illustrates part of an ATSP report of actual performance for ACTP, ACP, and PORT against the RCP240 requirements for a particular media type where the number of messages received within a time is recorded at one second intervals. This type of data can be included in an ATSP monthly report to enable regional aggregation of agreed performance information to allow it to be presented in graphical form. Regions could present all or some of the data reported in tabular form per paragraphs D.3.1.2 and D.3.1.3 above in graphical form if desired. This method of reporting would also assist global aggregation.

ACTP#	ACTP%	ACP#	ACP%	CREW#	CREW%	t"
0	0.00%	0	0.00%	149	0.89%	0
0	0.00%	0	0.00%	176	1.05%	1
0	0.00%	0	0.00%	210	1.26%	2
0	0.00%	0	0.00%	322	1.93%	3
0	0.00%	0	0.00%	673	4.03%	4
0	0.00%	0	0.00%	1444	8.64%	5
1	0.01%	0	0.00%	2330	13.94%	6
29	0.17%	0	0.00%	3133	18.74%	7
988	5.91%	0	0.00%	3946	23.60%	8
3939	23.56%	0	0.00%	4731	28.30%	9
6726	40.23%	0	0.00%	5667	33.90%	10
8519	50.96%	0	0.00%	6763	40.45%	11
9566	57.22%	3	0.02%	7811	46.72%	12
10585	63.31%	13	0.08%	8794	52.60%	13
11356	67.93%	33	0.20%	9594	57.39%	14
11910	71.24%	67	0.40%	10355	61.94%	15
12401	74.18%	136	0.81%	10964	65.58%	16
12962	77.53%	232	1.39%	11483	68.69%	17
13530	80.93%	609	3.64%	11899	71.17%	18
13938	83.37%	1949	11.66%	12267	73.38%	19
14247	85.22%	3280	19.62%	12595	75.34%	20
14415	86.22%	4326	25.88%	12867	76.96%	21
14586	87.25%	5362	32.07%	13145	78.63%	22
14724	88.07%	6308	37.73%	13387	80.08%	23
14839	88.76%	7057	42.21%	13588	81.28%	24
14943	89.38%	7766	46.45%	13764	82.33%	25
15029	89.90%	8388	50.17%	13930	83.32%	26
15128	90.49%	8977	53.70%	14098	84.33%	27
15220	91.04%	9494	56.79%	14249	85.23%	28
15323	91.66%	9968	59.62%	14425	86.28%	29
15402	92.13%	10373	62.05%	14562	87.10%	30
15448	92.40%	10763	64.38%	14696	87.91%	31
15501	92.72%	11102	66.41%	14826	88.68%	32
15543	92.97%	11433	68.39%	14938	89.35%	33
15599	93.31%	11720	70.10%	15049	90.02%	34
15640	93.55%	11985	71.69%	15160	90.68%	35
15683	93.81%	12235	73.18%	15258	91.27%	36
15720	94.03%	12477	74.63%	15338	91.75%	37
15747	94.19%	12703	75.98%	15405	92.15%	38
15790	94.45%	12908	77.21%	15476	92.57%	39
15813	94.59%	13111	78.42%	15533	92.91%	40
15851	94.81%	13289	79.49%	15603	93.33%	41

16660	99.65%	16540	98.94%	16655	99.62%	200
16660	99.65%	16543	98.95%	16656	99.63%	201
16662	99.67%	16547	98.98%	16656	99.63%	202
16662	99.67%	16549	98.99%	16656	99.63%	203
16662	99.67%	16549	98.99%	16656	99.63%	204
16662	99.67%	16550	99.00%	16657	99.64%	205
16662	99.67%	16553	99.01%	16657	99.64%	206
16662	99.67%	16556	99.03%	16657	99.64%	207
16662	99.67%	16561	99.06%	16657	99.64%	208
16664	99.68%	16563	99.07%	16659	99.65%	209
16664	99.68%	16564	99.08%	16662	99.67%	210
16664	99.68%	16565	99.08%	16662	99.67%	211
16664	99.68%	16566	99.09%	16662	99.67%	212
16666	99.69%	16567	99.10%	16663	99.67%	213
16667	99.69%	16571	99.12%	16663	99.67%	214
16667	99.69%	16572	99.13%	16665	99.68%	215
16667	99.69%	16574	99.14%	16665	99.68%	216
16667	99.69%	16575	99.14%	16665	99.68%	217
16667	99.69%	16576	99.15%	16666	99.69%	218
16669	99.71%	16577	99.16%	16666	99.69%	219
16669	99.71%	16579	99.17%	16666	99.69%	220
16669	99.71%	16580	99.17%	16666	99.69%	221
16672	99.72%	16581	99.18%	16666	99.69%	222
16673	99.73%	16583	99.19%	16666	99.69%	223
16674	99.74%	16586	99.21%	16666	99.69%	224
16675	99.74%	16586	99.21%	16667	99.69%	225
16675	99.74%	16589	99.23%	16667	99.69%	226
16675	99.74%	16589	99.23%	16667	99.69%	227
16676	99.75%	16593	99.25%	16668	99.70%	228
16677	99.75%	16594	99.26%	16668	99.70%	229
16677	99.75%	16596	99.27%	16668	99.70%	230
16677	99.75%	16597	99.28%	16668	99.70%	231
16677	99.75%	16598	99.28%	16668	99.70%	232
16677	99.75%	16601	99.30%	16668	99.70%	233
16677	99.75%	16604	99.32%	16668	99.70%	234
16678	99.76%	16604	99.32%	16668	99.70%	235
16678	99.76%	16605	99.32%	16668	99.70%	236
16679	99.77%	16606	99.33%	16668	99.70%	237
16679	99.77%	16607	99.34%	16668	99.70%	238
16680	99.77%	16609	99.35%	16668	99.70%	239
16681	99.78%	16609	99.35%	16668	99.70%	240
37	0.22%	109	0.65%	50	0.30%	>240
16718	100.00%	16718	100.00%	16718	100.00%	Total

Figure D- 13. Example ATSP monthly report that will enable graphical analysis

Appendix E Regional/State-specific information

E.1 Regional and/or State information

Table E- 1 lists the flight information regions (FIRs) where data link service is provided and indicates AFN address, ATSU ACARS Address, coordinating group, CPDLC Contact or Monitor message requirements and position reporting requirements. For CPDLC, ADS-C and FMC WPR columns, O=operational, T=trial, and N=not available.

Table E- 1. Data link services by FIR

Flight Information Region (FIR)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Accra							
Algeria (Alger)	O	O	N	DAAA			
Amsterdam (Maastricht) (FL 245+)	O	N	N	EDYY		E LINK 2000+	Limited CPDLC, See paragraph 2.1 and Appendix A, reference ATN B1.
Anchorage and Anchorage Arctic (north of N63 and east of W165)	O	N	N	PAZA	ANCXFXA	IPACG FIT	CPDLC voice transfer: CONTACT PAZA CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.
Anchorage Oceanic (south of N63 and west of W165)	O	O	N	PAZN	ANCATYA	IPACG FIT	CPDLC voice transfer: CONTACT PAZA CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.
Antananarivo (Madagascar)	O	O	N	FMMM			
Atlantico (Brazil)	O	O	N	SBAO			

Flight Information Region (FIR)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Auckland Oceanic	O	O	O	NZZO	AKLCDYA	ISPACG FIT	CPDLC voice transfer: MONITOR NZZO CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary,. See paragraph E.2.2.
Bahrain							
Bangkok	O	O	O	VTBB	BKKGWXA	FIT BOB FIT SEA	Confirm CPDLC CDA: CPDLC UM 160 (NDA). See paragraph E.2.2.
Bodø	N	O	O	ENOB		NAT CNSG	
Brisbane	O	O	T	YBBB	BNECAYA	ISPACG FIT	CPDLC voice transfer: MONITOR BRISBANE CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.
Bruxelles (Maastricht) (FL 245+)	O	N	N	EDYY		E LINK 2000+	Limited CPDLC, See paragraph 2.1 and Appendix A, reference ATN B1.
Canarias	O	O	N	GCCC			
Capetown	O	O	N	FACT			
Casablanca							
Chengdu (China)	O	O	N	ZUUU	CTUGWYA		
Chennai (India)	O	O	N	VOMF	MAACAYA	FIT BOB	
Colombo	T	T	N	VCCC			Position reporting: CPDLC position report at each waypoint. *Note.— Currently trialing ADS-C and CPDLC. Primary communication via voice. Full HF reporting still required.*
Dakar Oceanic (Senegal)	O	O	N	GOOO			

Flight Information Region (FIR)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Delhi (India)	N	O	N	VIDF			
Edmonton (Canada)	N	O	N	CZEG			
Emirates							
Fukuoka	O	O	N	RJJJ	FUKJJYA	IPACG FIT	CPDLC voice transfer: CONTACT TOKYO CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.
Gander	O	O	O	CZQX	YQXE2YA	NAT CNSG	Report revised ETA: Next waypoint ETA error 3 minutes or more, use free text DM 67k REVISED ETA [position] [time]. See paragraph E.2.6.
Honiara	O	O	N	YBBB	BNECAYA		
Hannover (Maastricht) (FL 245+)	O	N	N	EDYY		E LINK 2000+	Limited CPDLC, See paragraph 2.1 and Appendix A, reference ATN B1.
Johannesburg Oceanic	O	O	N	FAJO	JNBCAYA		Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.
Kolkata (India)	O	O	N	VECF			
Kunming (China)	O	O	N	ZPPP	KMGGWYA		
Kuwait							
Lanzhou (China)	O	O	N	ZLLL	LHWGWYA		
Lisboa							
Luanda							
Magadan (Russia)	O	O	N	GDXB			
Mauritius	O	O	N	FIMM			Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.

Flight Information Region (FIR)	**CPDLC**	**ADS-C**	**FMC WPR**	**AFN address**	**ATSU ACARS Address**	**Coord Group**	**Remarks**
Melbourne	O	O	N	YMMM	MELCAYA	ISPACG FIT	CPDLC voice transfer: MONITOR MELBOURNE CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.
Mumbai (India)	O	O	N	VABF	BOMCAYA		
Nadi	O	O	N	NFFF	NANCDYA	ISPACG FIT	CPDLC voice transfer: MONITOR NFFF CENTER [frequency] Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.
Naimey (Niger)	O	O	N	DRRR			
Nauru	O	O	N	YBBB	BNECAYA		MONITOR BRISBANE CENTER [frequency]
New York	O	O	N	KZWY	NYCODYA	NAT CNSG	DO NOT use CPDLC for position reporting. Use ADS-C or voice only. SELCAL check via HF are required for all FANS connected aircraft prior to entering the CTA/FIR. DO NOT send a CPDLC position report to confirm CDA prior to, or upon crossing the FIR.

Flight Information Region (FIR)	CPDLC	ADS-C	FMC WPR	AFN address	ATSU ACARS Address	Coord Group	Remarks
Oakland	O	O	N	KZAK	OAKODYA	IPACG FIT ISPACG FIT	CPDLC voice transfer: CONTACT KSFO CENTER [frequency] *Note.— KSFO (San Francisco Radio) will provide all primary and secondary HF frequencies, and HF transfer points along the route of flight.* Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.
Reykjavik	O	O	O	BIRD	REKCAYA	NAT CNSG	Confirm CPDLC CDA: Free text uplink. See paragraph E.2.2. Report revised ETA: Next waypoint ETA error 3 minutes or more, use free text DM 67k REVISED ETA [position] [time]. See paragraph E.2.6.
Santa Maria	O	O	O	LPPO	SMACAYA	NAT CNSG	Confirm CPDLC CDA: CPDLC UM 160 (NDA). See paragraph E.2.2. Report revised ETA: Next waypoint ETA error 3 minutes or more, use free text DM 67k REVISED ETA [position] [time]. See paragraph E.2.6.
Seychelles	O	O	N	FSSS			
Shanwick	O	O	O	EGGX	PIKCPYA	NAT CNSG	Report revised ETA: Next waypoint ETA error 3 minutes or more, use free text DM 67k REVISED ETA [position] [time]. See paragraph E.2.6.
Singapore	O	O	O	WSJC	SINCDYA	FIT SEA	Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.

Flight Information Region (FIR)	**CPDLC**	**ADS-C**	**FMC WPR**	**AFN address**	**ATSU ACARS Address**	**Coord Group**	**Remarks**
Tahiti	O	O	N	NTTT	PPTCDYA	ISPACG FIT	CPDLC voice transfer: CONTACT NTTT CENTER [frequency] *Note.— A SELCAL check is required.* Confirm CPDLC CDA: One CPDLC position report at FIR boundary. See paragraph E.2.2.
Tunis							
Ujung Pandang (Makassar) (Indonesia)	T	T	N	WAAF	UPGCAYA		Position reporting: CPDLC position report at each waypoint. *Note.— Currently trialing ADS-C and CPDLC.*
Ulan Bator (Mongolia)	O	O	N	ZMUA			
Urumqi (China)	O	O	N	ZWWW			
Yangon (Myanmar)	O	O	N	VYYF			

Table E- 2 provides contact information.

Table E- 2. Contact information

Coordinating group or regional monitoring agency	Contact information
North Atlantic Communications, Navigation and Surveillance Group (NAT CNSG) FANS Central Monitoring Agency	Tim Murphy Team Leader, Engineering Operations Support Phone +44 1292 692 772 Fax +44 1292 692 640 Email: tim.murphy@nats.co.uk
NAT CNSG ICAO	Elkhan Nahmadov Phone +33 1 4641 8529 Fax +33 1 4641 8500 Email icaoeurnat@paris.icao.int
NAT CNSG Operations	Robert Simpson Operational System Requirements Phone +1(709) 651 5215 Fax +1(709) 651 5235 Email simpsonr@navcanada.ca
NAT CNSG Engineering	Tim Murphy Team Leader, Engineering Operations Support Phone +44 1292 692 772 Fax +44 1292 692 640 Email: tim.murphy@nats.co.uk
NAT CNSG Operators using ARINC as their CSP contact	Pete Grogan Phone (410) 266-2344 Fax Email PGROGAN@arinc.com
NAT CNSG Operators using SITA as their CSP contact	Kathleen Kearns Manager, AIRCOM ATC Business, North America Phone: (703) 491-0661 Fax: (703) 491-0662 e-Mail: Kathleen.Kearns@sita.aero
NAT CNSG Document Management - NAT GM	Iain C. Brown Room G.06 ScOACC Atlantic House Sherwood Road Prestwick Ayrshire KA9 2NR United Kingdom Email Iain.Brown@nats.co.uk

Coordinating group or regional monitoring agency	**Contact information**
Informal Pacific ATC Coordinating Group (IPACG) Central Reporting Agency (CRA) USA	Reed B. Sladen, IPACG/FIT Co-chair Program Operations Field Manager Oakland Air Route Traffic Control Centers Federal Aviation Administration (FAA) Tel: +1 510 745 3328 Fax: +1 510 745 3826 Email: reed.b.sladen@faa.gov
IPACG (CRASA) USA	Gordon Sandell Avionic Engineering The Boeing Company P.O. Box 3707, MC 02-98 Seattle, WA 98124-2207 – USA Fax: +1 425 707 5052 Tel: +1 425 342 4906 EM: gordon.r.sandell@boeing.com
IPACG CRA Japan	Takahiro Morishima, IPACG/FIT Co-chair Special Assistant to the Director, ATS Systems Planning Division, ATS Department, Japan Civil Aviation Bureau (JCAB) Ministry of Land, Infrastructure, Transport and Tourism Tel: +81 3 5253 8739 Fax: +81 3 5253 1663 Email: morishima-t2zg@mlit.go.jp
IPACG (CRASA) Japan	Masahisa Hayashi JCAB CRASA K-1 Building, 3rd floor, 1-6-6 Haneda Airport, Ota-ku, Tokyo 144-0041 – JAPAN Fax: +81-3-3747-1231 Tel: +81-3-3747-1231 EM: CRASA@cra-japan.org
Informal South Pacific ATC Coordinating Group (ISPACG)	Paul Radford Manager Oceanic Systems Airways New Zealand Tel: +64 9 256 8078 Fax: +64 9 275 3106 Email: paul.radford@airways.co.nz

Coordinating group or regional monitoring agency	**Contact information**
ISPACG Central Reporting Agency (CRA) and CRASA	Brad D. Cornell 787 Flight Crew Operations The Boeing Company P.O. Box 3707, MS 02-JH SEATTLE, WA 98124-2207 – USA Fax: 425 294-1076 EM: bradley.d.cornell@boeing.com SITA: FMCBOCR Tel: 425-294-6520
ISPACG Central Reporting Agency (CRA) and CRASA	Suzie NESS FMS The Boeing Company P.O. Box 3707, MS 02-RP SEATTLE, WA 98124-2207 – USA Fax: 425 342-6078 EM: suzie.ness@boeing.com SITA: FMCBOCR Tel: 425-342-6803
Informal Indian Ocean Coordinating Group (IIOCG)	Doug Scott Upper Airspace Services Manager Airservices Australia Tel: +61 7 3866 3366 Fax: +61 7 3866 3257 Email: doug.scott@airservicesaustralia.com
Bay of Bengal (BOB)	Brad D. Cornell Air Traffic Management Services The Boeing Company Tel: +1 425 266 8206 Email: bradley.d.cornell@boeing.com
South Atlantic Air Traffic Services (SAT) Central Reporting Agency (CRA)	Johnny Smit, SAT/FIT Focal Point Tel: +27 11 928 6526 Fax: +27 11 395 1045 Email: johnnys@atns.co.za
Arab Civil Aviation Commission (ACAC)	Akhil Sharma, ACAC/FIT Chair Director, Aircom Service Development SITA Tel: +44 0208 756 8339 Fax: +44 0208 756 8001
Southeast Asia ATS Coordination Group (SEACG)	

Coordinating group or regional monitoring agency	Contact information
EUROCONTROL LINK 2000+	Maastricht UAC Gustaaf Janssens Programme Manager Phone +31 43 366 1252 Email gustaaf.janssens@eurcontrol.int EUROCONTROL Martin Adnams LINK2000+ Programme Manager Phone +32 2 729 3328 Email martin.adnams@eurocontrol.int

Table E- 3. Regional monitoring agency websites available for problem reporting

Regional monitoring agency	Website URL
Informal South Pacific ATC Coordinating Group (ISPACG) and ISPACG Central Reporting Agency (CRA) and CRASA	http://www.ispacg-cra.com/

E.2 Regional and/or State differences

E.2.1 Voice communication procedures – North Atlantic Region

E.2.1.1 Flight crew – contact with aeradio

E.2.1.1.1 The integrity of the ATC service remains wholly dependent on establishing and maintaining HF or VHF voice communications with each ATSU along the route of flight. The procedures in this section are applicable only in NAT airspace and pertain only to ATS data link operations.

E.2.1.1.2 Prior to entering each NAT oceanic CTA, the flight crew should contact the appropriate aeradio station.

E.2.1.1.3 Table E- 4 provides the data link terms the flight crew should use to identify the flight. The flight crew should continue to use the data link term until either the SELCAL check has been completed or the frequency assignment has been received.

Table E- 4. Terms to identify data link capability

Term	Data link status of aircraft
“A-D-S”	Participating in ADS-C only.
“F-M-C”	Participating in FMC WPR
“C-P-D-L-C”	Participating in CPDLC and ADS-C

E.2.1.1.4 If the flight will exit the CTA into oceanic and remote airspace, on initial contact with the CTA the flight crew should:

a) not include a position report;

b) use the appropriate data link term after the aircraft call sign (see paragraph E.2.1.1.3);

c) state the name of the next CTA/FIR to be entered; and

d) request the SELCAL check.

Example 1 (initial contact from an eastbound ADS-C-only flight about to enter the Gander CTA):

GANDER RADIO, AIRLINE 123 A-D-S, SHANWICK NEXT, REQUEST SELCAL CHECK CDAB.

Example 2 (initial contact from a westbound FMC WPR flight about to enter the Santa Maria CTA):

SANTA MARIA RADIO, AIRLINE 123 F-M-C, NEW YORK NEXT, REQUEST SELCAL CHECK AFMP.

Example 3 (initial contact from an eastbound CPDLC flight about to enter the New York Data Link service area):

NEW YORK ARINC, AIRLINE 123 C-P-D-L-C, GANDER NEXT, REQUEST SELCAL CHECK CKFM.

E.2.1.1.5 If the flight will exit the CTA into continental (domestic) airspace, on initial contact with the CTA, the flight crew should:

a) not include a position report;

b) use the appropriate data link term after the aircraft call sign (see paragraph E.2.1.1.3);

c) state the track letter if operating on the organized track system;

d) state the last two fixes in the cleared route of flight if operating outside the organized track system; and

e) request the SELCAL check.

Example 1 (initial contact from an eastbound ADS-C-only flight about to enter the Shanwick CTA):

SHANWICK RADIO, AIRLINE 123 A-D-S, TRACK ZULU, REQUEST SELCAL CHECK CDAB.

Example 2 (initial contact from a westbound CPDLC flight about to enter the Gander CTA):

GANDER RADIO, AIRLINE 123 C-P-D-L-C, SCROD VALIE, REQUEST SELCAL CHECK DMCS.

Example 3 (initial contact from an eastbound FMC WPR flight about to enter the Shanwick CTA):

SHANWICK RADIO, AIRLINE 123 F-M-C, TRACK ZULU, REQUEST SELCAL CHECK CDAB.

E.2.1.1.6 Depending on which data link services are offered in the CTA and the operational status of those services, the aeradio operator will provide appropriate information and instructions to the flight crew (see paragraph E.2.1.2 for information regarding associated aeradio procedures).

E.2.1.1.7 In the event an onboard systems failure prevents CPDLC, ADS-C or FMC WPR or if any of these services is terminated:

a) if the failure/termination occurs prior to initial contact with the aeradio station, do not use the phrase "A-D-S", "C-P-D-L-C" or "F-M-C" after the aircraft call sign;

b) resume normal voice communications, including providing all subsequent position reports via voice;

c) do not inform aeradio that the service has been terminated; and

d) inform Company Operations Department in accordance with established problem reporting procedures.

E.2.1.1.8 For ADS-C & FMC WPR flights, the flight crew should not submit position reports via voice to reduce frequency congestion, unless otherwise advised by aeradio operator.

E.2.1.1.9 ADS-C flights are exempt from all routine voice meteorological reporting, however the flight crew should use voice to report unusual meteorological conditions such as severe turbulence to the aeradio station.

E.2.1.1.10 The flight crew should not ask aeradio questions regarding the status of the ADS-C connections or whether an ADS-C or an FMC WPR has been received. Should the ATSU fail to receive an expected position report, the controller will follow guidelines in paragraph 4.4.1.7 for late or missing ADS-C reports or request a voice report for a late or missing FMC waypoint position report.

E.2.1.1.11 When leaving CPDLC, ADS-C-only, or FMC WPR environment, the flight crew should comply with all communication requirements applicable to the airspace being entered.

E.2.1.1.12 If the flight crew does not receive its domestic frequency assignment by 10 minutes prior to the flight's entry into continental (domestic) airspace, the flight crew should contact aeradio and request the frequency, stating the oceanic exit fix.

E.2.1.2 Aeradio - response to initial contact

E.2.1.2.1 Aeradio operators should:

a) respond to an aircraft that identifies itself by including a data link term after the aircraft call sign by restating the data link term after the aircraft call sign (see paragraph E.2.1.1.3 for the list of data link terms); and

b) complete the SELCAL check (see paragraph E.2.1.1.4 and paragraph E.2.1.1.5 for examples of the initial contact procedures to be used by the flight crew).

E.2.1.2.2 If a flight uses the term "A-D-S" after the aircraft call sign, the aeradio operator should issue:

a) communication instruction for the next CTA/FIR; or

b) communications instructions and the frequency to contact the appropriate ATSU approaching, or over, the exit point; or

c) instructions for the flight to contact the aeradio station serving the next CTA/FIR at a time or location prior to the next CTA/FIR boundary or exit point.

E.2.1.2.3 When the CTA/FIR does not offer FMC WPR services, if a flight uses the term "F-M-C" after the aircraft call sign, the aeradio operator should advise the flight crew to make position reports by HF voice.

E.2.1.2.4 When the CTA/FIR offers FMC WPR services, if a flight uses the term "F-M-C" after the aircraft call sign, the aeradio operator should issue:

a) communication instruction for the next CTA/FIR; or

b) communications instructions and the frequency to contact the appropriate ATSU approaching, or over, the exit point; or

c) instructions for the flight to contact the aeradio station serving the next CTA/FIR at a time or location prior to the next CTA/FIR boundary or exit point.

E.2.1.2.5 When the CTA/FIR does not offer CPDLC services, if a flight uses the term "C-P-D-L-C" after the aircraft call sign, the aeradio operator should:

a) Advise the flight that ""CPDLC SERVICE NOT AVAILABLE IN (name) CTA/FIR"; and

b) Issue:

1) communication instruction for the next CTA/FIR; or

2) communications instructions and the frequency to contact the appropriate ATSU approaching, or over, the exit point; or

3) instructions for the flight to contact the aeradio station serving the next CTA/FIR at a time or location prior the next CTA/FIR boundary or exit point.

E.2.1.2.6 During CPDLC operations, if a flight uses the term "C-P-D-L-C" after the aircraft call sign, the aeradio operator should:

a) Advise the flight that "(type) FREQUENCIES WILL BE ASSIGNED VIA CPDLC"; and

b) Issue:

1) communication instructions for the next CTA/FIR; or

2) communication instructions and the frequency to contact the appropriate ATSU approaching, or over, the exit point; or

3) instructions for the flight to contact the aeradio station serving the next CTA/FIR at a time or location prior to the next CTA/FIR boundary or exit point.

E.2.1.3 Aeradio - delayed CPDLC messages

If the flight crew advises "DELAYED CPDLC MESSAGE RECEIVED", they are explaining that a CPDLC message was received late. Flight crew procedures require voice contact to verify the message status. Aeradio operators should include this notation when relaying the associated communication to ATC (see paragraph 5.2.1.10 and Appendix F, paragraph F.11 for flight crew procedures and paragraph 4.2.7 for further information regarding delayed CPDLC uplinks).

E.2.2 Confirm CPDLC current data authority

With the FANS-1/A application, an ATSP receiving a CDPLC transfer does not have confirmation they are current data authority (CDA) until a downlink is received from the aircraft. The ATSPs are unable to reach global agreement on whether this confirmation is needed, and those that require confirmation are unable to reach agreement on a common procedure to achieve this.

An ATSP that requires confirmation relies on upstream automation to transfer CPDLC connections reliably enough to give adequate safety margins and has considered the disadvantages and cost of available mitigations, the rate of occurrence of transfer failures, and the availability of HF as fallback in arriving at this conclusion.

The ATSPs that require confirmation of current authority have different means of meeting this requirement. These different means include:

a) Receiving ATSP sends an automated free-text uplink UM169 when the aircraft crosses the boundary. The aircraft response will be DM3 ROGER if the transfer was successful, otherwise the error response DM 63 NOT CURRENT DATA AUTHORITY.

b) Receiving ATSP sends UM 160 NEXT DATA AUTHORITY[facility designation] as the aircraft crosses the FIR boundary. The aircraft response will be DM 63 NOT CURRENT DATA AUTHORITY if the CPDLC transfer has not occurred.

c) Aircraft sends DM 48 POSITION REPORT either crossing the FIR boundary or when the Active Center indication on the flight deck changes to the receiving center. If the active center does not change as expected the DM48 will be sent to the transferring ATSP which will indicate that the transfer has failed.

Some regions are implementing AIDC messages that will provide the receiving ATSP with the notification that the communications transfer has completed successfully. When these messages are implemented confirmation of data authority as described above will be redundant.

Table E- 1 lists ATSP requirements for confirmation of CDA.

E.2.3 Unsupported CPDLC downlink message elements – region specific

Table E- 5 provides the CPDLC downlink message elements that are supported by a data link system but are not supported within a specific region. If the appropriate ATSU receives any of the message elements listed in this table, they will send UM 169u MESSAGE NOT SUPPORTED BY THIS ATS UNIT.

Note.— See Appendix A for CPDLC message elements that are supported by a data link system but their use should be avoided due to potential misinterpretation and should not be supported globally.

Table E- 5 Unsupported CPDLC downlink message elements – region specific

Region or State	Data link system	Unsupported downlink message elements
NAT	FANS 1/A	DM 49 WHEN CAN WE EXPECT [speed] DM 50 WHEN CAN WE EXPECT [speed] TO [speed] DM 51 WHEN CAN WE EXPECT BACK ON ROUTE DM 52 WHEN CAN WE EXPECT LOWER ALTITUDE DM 53 WHEN CAN WE EXPECT HIGHER ALTITUDE DM 54 WHEN CAN WE EXPECT CRUISE CLIMB TO [altitude] DM 67h WHEN CAN WE EXPECT CLIMB TO [altitude] DM 67i WHEN CAN WE EXPECT DESCENT TO [altitude] *Note.— The downlink messages are not supported because of potential misinterpretation of appropriate uplink responses in the event of a total communication failure. In addition to highlighted messages in Appendix A, the following uplink messages are not used in the NAT:* *UM 70 EXPECT BACK ON ROUTE BY [position]* *UM 71 EXPECT BACK ON ROUTE BY [time]* *UM 99 EXPECT [procedure name]* *UM 100 AT [time] EXPECT [speed]* *UM 101 AT [position] EXPECT [speed]*

E.2.4 Uplink message elements unsuited for NAT operations

The following uplink message elements are unsuited for NAT operations and NAT ATSPs should avoid their use.

UM 171	CLIMB AT [vertical rate] MINIMUM
UM 172	CLIMB AT [vertical rate] MAXIMUM
UM 173	DESCEND AT [vertical rate] MINIMUM
UM 174	DESCEND AT [vertical rate] MAXIMUM
UM 115	DO NOT EXCEED [speed]
UM 116	RESUME NORMAL SPEED
UM 146	REPORT GROUND TRACK
UM 182	CONFIRM ATIS CODE

E.2.5 Flight plan requirements for EUR airspace where CPDLC is available

In accordance with the EUR Regional SUPPs, for flights conducted wholly or partly in the EUR airspace where CPDLC is available (per regional supplementary procedures), and not equipped with CPDLC capabilities but which have been granted an exemption, the indicator RMK/CPDLCX shall be included in Item 18 of the flight plan.

E.2.6 Reporting requirements in NAT airspace where ADS-C is available

In the NAT Region, if the estimated time for the next position last provided to air traffic control is found to be in error by three minutes or more, the flight crew should provide a revised estimated time.

The flight crew may assume that the estimate for the next waypoint, shown on the FMS at the time a waypoint is crossed, is the estimate transmitted to ATC.

The flight crew should provide the revised estimate to the controlling ATS unit as soon as possible via voice or CPDLC using free text DM 67k REVISED ETA [position] [time]

E.2.7 Exchange of turbulence information in Fukuoka FIR

In the Fukuoka FIR, the flight crew should report moderate or severe turbulence information. Turbulence information is provided for aircraft which fly around location of observation within height difference of ±2,000ft from altitude of observation and will pass within two hours from time of observation.

The flight crew may use CPDLC for reporting and receiving moderate or severe turbulence information. For aircraft which does not have a CPDLC connection, the exchange of turbulence information is implemented by voice. The turbulence information provided to flight crews, whether by CPDLC or voice, will be the same.

E.2.7.1 Report of turbulence information by CPDLC

When reporting turbulence information via CPDLC, aircraft should downlink in the following form by free text message.

DM 67 [MOD or SEV] TURB [location of observation] [altitude of observation] [time of observation]Z

Note 1.— Aircraft should report location of observation in the following form. When observing turbulence continuously, aircraft is able to report location of observation in the following form; "[beginning location of observation] [end location of observation]".

a) FIX, e.g. "NIPPI"

b) Distance and radial from FIX, e.g. "20NM SW NIPPI"

c) Latitude and longitude, e.g. "4020N14532E"

d) When observing turbulence continuously, e.g. "RIPKI GARRY"

Note 2.— When observing turbulence while cruising, aircraft is able to report by omitting altitude of observation. When observing turbulence continuously while climbing or descending, aircraft should report altitude of observation in the following form; "[lower limit altitude of observation] [upper limit altitude of observation]", e.g. "FL330 FL350".

Note 3.— When reporting turbulence information within 5 minutes after observing, aircraft is able to report by omitting time of observation.

Examples of downlink messages:

"SEV TURB 35N160E FL330 0924Z"

"MOD TURB 20NM N ASEDA 35NM S ASEDA FL350 1152Z"

"MOD TURB NIPPI 2114Z"

"SEV TURB 3530N15451E FL370 FL390 0304Z"

"SEV TURB POXED FL320"

"MOD TURB CELIN"

E.2.7.2 Provision of turbulence information by CPDLC

When providing via CPDLC, turbulence information is uplinked in the following form by free text message:

UM 169 [MOD or SEV] TURB [location of observation] [altitude of observation] [time of observation]Z [type of aircraft]

The downlink response DM 3 ROGER should be used to acknowledge receipt of turbulence information issued.

Examples of uplink messages:

"MOD TURB NIPPI F360 0130Z B772"

"SEV TURB FM 37N160E TO 37N158E F320 0418Z A332"

"MOD TURB 20NM N ASEDA F330F350 1152Z B744"

Appendix F Operator/aircraft specific information

F.1 Data link avionics updates

Airbus A320
FANS A+ (CSB4) FANS A+ Data link Recording (CSB7)
Airbus A330, A340
FANS A (CLR3) FANS A+ (CLR4) FANS A+ Data link Recording (CLR7)
Airbus A380
FANS A+ Data link Recording (CLA3)
Boeing B747-400, 717, MD-90, MD-10, MD-11
FANS 1
Boeing B737, B747-8, B757, B767, B777, B787
FANS 1+

F.2 Verifying aircraft registration

Airbus A380
On the A380 aircraft, the flight crew cannot change the aircraft registration in the FN_CON message. The aircraft registration is provided by the aircraft system.
Airbus A320, A330, A340
These aircraft do not have an ***essential*** data source for this datum, which means that the maintenance / flight crew needs to verify that the aircraft registration used for data link comm. is correct.
Boeing B787
On the B787 aircraft, the flight crew cannot change the aircraft registration in the FN_CON message. The aircraft registration is provided by the aircraft system.
Boeing B737, B747-400, B747-8, B777, B757, B767, B717, MD90, MD10, MD11
These aircraft do not have an ***essential*** data source for this datum, which means that the flight crew needs to verify that the aircraft registration is correct.

F.3 CPDLC connection management

Remarks
If the aircraft is establishing or in the process of establishing a connection with a previously designated next data authority, and a message with a new UM 160 NEXT DATA AUTHORITY [icao facility designation] message element is received, the aircraft sends DISCONNECT REQUEST (DR1) for this connection with the next data authority.
Airbus
If the facility designation in the new UM 160 NEXT DATA AUTHORITY is the same as the facility designation that the aircraft already retains, the aircraft discards the new UM 160 NEXT DATA AUTHORITY and the connections will not be affected.
Boeing
In the above case the connection will be terminated. The only CPDLC CR1 message processed normally by FANS 1 is the first CPDLC CR1 following an AFN logon (i.e., an AFN logon initiated when no CPDLC connection exists).

F.4 Flight crew display – response and acknowledgement

Airbus A320, A330, A340, A380
In response to an uplink message that requires a closure response (DM 0 WILCO, ROGER, AFFIRM, UNABLE, NEGATIVE), the flight crew is presented with prompts corresponding to the closure responses required by DO-258A/ED-100A for the specific uplink message. EG prompts presented upon receipt of an uplink clearance are DM 0 WILCO, UNABLE, and DM 2 STANDBY.
Boeing
In response to an uplink message that requires a response element (DM 0 WILCO, ROGER, AFFIRM, UNABLE or NEGATIVE), the flight crew is presented with two prompts (Accept and Reject). If the correct response to the uplink message is affirmative (DM 0 WILCO, ROGER, or AFFIRM), then the flight crew will select the Accept prompt. If the correct response to the uplink message is negative (UNABLE or NEGATIVE), then the flight crew will select the Reject prompt. When the flight crew selects either the Accept or the Reject prompt, the FANS 1 automatically transmits the correct response (DM 0 WILCO, ROGER, AFFIRM, UNABLE, or NEGATIVE) for the corresponding message. On the FANS 1 equipped aircraft, the flight crew cannot add any other element to a positive response.

F.5 FMS processing of waypoints

Airbus A320, A330, A340, A380
The FMS cannot distinguish between ATC mandatory waypoints and waypoints inserted by the flight crew. However, the flight crew can over-write any system-determined default data contained in reports and confirm messages.

Boeing B747-400
The FMCs on the B747-400 aircraft does not distinguish between ATC mandatory waypoints and FMC sequenced waypoints for position reports. Additionally, the FANS 1 of the B747-400 aircraft does not permit the flight crew to overwrite the FMC-determined default “reported waypoint” position in downlink DM 45 - REPORTED WAYPOINT. However, the FANS 1 of the B747-400 aircraft does allow the flight crew to overwrite the FMC-determined default time (in particular, in response to uplink UM 138 -CONFIRM TIME OVER REPORTED WAYPOINT). Non-use of uplink UM 139 for B747-400 aircraft The uplink message UM 139 - Confirm reported waypoint should not be sent to B747-400 aircraft.
Boeing B737, B777, B757, B767, B717, MD90, MD10, MD11
The FMCs on these Boeing aircraft do not distinguish between ATC mandatory waypoints and FMC sequenced waypoints for position reports. However, the FANS 1 of these aircraft will allow the flight crew to overwrite the FMC-determined default “reported waypoint” position and time (Downlink element DM 45).
Boeing B787
The B787 FANS 1 can be selected to distinguish between ATC mandatory waypoints and non-mandatory waypoints for reporting the NEXT and NEXT+1 waypoints. However, the reported waypoint in a position report will always be the last sequenced waypoint, regardless of whether it is an ATC mandatory one. The FANS 1 will allow the flight crew to overwrite the FMC-determined default “reported waypoint” position and time (Downlink element DM 45).

F.6 Multiple request messages

Airbus A380
There is no network acknowledgement timer on A380 aircraft for the establishment of a connection. Once CPDLC is established, there is an ACK_DSP timer which is set as 3 min 30.
Airbus A320, A330, A340
There is no network acknowledgement timer on these Airbus aircraft for the establishment of a connection. Once CPDLC is established, there is an ACK_DSP timer which is set as follows: FANS A (CLR3) = 2 min FANS A+ (CLR4) = 3 min 30s FANS A+ DR (CLR7) = 6 min.

Boeing B747-400
If the network acknowledgement to a downlink message is not received by the B747-400 aircraft's ACARS Management Unit within a time period set in the Navigation Database or Operational Program Configuration (OPC) file, the FANS 1 closes the message and an alert is triggered to the flight crew. This alert may prompt the flight crew to re-send the message. Once back "IN COMM" the ACARS Management Unit will transmit any "queued" messages. The timer value is set to 5 minutes. If a second message is identical to the first, but with a different message identification number, and both messages have been received and responded to by the controller, the aircraft system will only recognize the message identification number of the second message. The aircraft system considers the first message to have been unsuccessful. In reply to the controller's response to the first message, the aircraft system will send an INVALID REFERENCE NUMBER ERROR. The controller's response to the second message will be processed normally. In this case, if the controller ignores the first message, the connections to both ATS systems will not be lost when an End Service message is received on board the aircraft.
Boeing B737, B747-8, B757, B767, B717, MD90, MD10, MD11
When the network acknowledgement timer expires, it just "unlocks" the request pages, so that the flight crew will be able to send another one. The time at which the network acknowledgement timer expires can be set in the Operational Program Configuration (OPC) file in the FMS. Currently, the value is set to 5 minutes.
Boeing B777, B787
This network acknowledgement timer does not apply to these aircraft.

F.7 Waypoint sequencing

Airbus A320, A330, A340, A380
Waypoint sequencing will only occur when the aircraft is within 7 NM of the aircraft active flight plan track (as modified by any parallel offset that may have been entered). Therefore ADS-C waypoint change event report and armed UM 130 REPORT PASSING message will not be transmitted automatically when the aircraft is outside these limits.
Boeing B737, B747-400, B747-8, B757, B767, B777, B787, MD90
Waypoint sequencing will only occur when the aircraft is within 21 NM of the aircraft active flight plan track (as modified by any parallel offset that may have been entered). Therefore ADS-C waypoint change event report and armed UM 130 REPORT PASSING message will not be transmitted automatically when the aircraft is outside these limits.
Boeing B717, MD10, MD11
Waypoint sequencing will only occur when the aircraft is within 7 NM of the aircraft active flight plan track (as modified by any parallel offset that may have been entered). Therefore ADS-C waypoint change event report and armed UM 130 REPORT PASSING message will not be transmitted automatically when the aircraft is outside these limits.

F.8 Open uplinks at time of transfer of communications

Boeing
If there are OPEN uplinks in the ATC LOG when the Current Data Authority initiates transfer of communication to the Next Data Authority, the FMC will allow transfer to the Next Data Authority (i.e. The avionics will not disconnect the next data authority). This allows a smooth transfer to the next Flight Information Region if there are open uplinks at the time of transfer.
Airbus A330, A340 FANS A
If there are OPEN uplinks when the Current Data Authority initiates transfer of communication to the Next Data Authority, the avionics will disconnect all CPDLC connection.
Airbus A320, A330, A340, A380 FANS A+
If there are OPEN uplinks when the Current Data Authority initiates transfer of communication to the Next Data Authority, the avionics will allow transfer to the Next Data Authority (i.e. the avionics will not disconnect the next data authority). This allows a smooth transfer to the next Flight Information Region if there are open uplinks at the time of transfer.

F.9 Variable constraints

Airbus A320, A330, A340 FANS A & FANS A+
These Airbus aircraft do not support a <space> within a [unit name] parameter.
Airbus A330, A340 FANS A+ DR, A380
These Airbus aircraft support a <space> within a [unit name] parameter.
Boeing
Boeing aircraft support a <space> within a [unit name] parameter.

F.10 ADS-C emergency report interval default

Airbus
If a periodic contract is active, the emergency reports will be transmitted at the existing periodic interval. Otherwise, the interval will default to 64 seconds.
Boeing
If a periodic contract is active, the emergency reports will be transmitted at the existing periodic interval. Otherwise, the interval will default to 304 seconds.

F.11 Message latency timer

Airbus
For Airbus aircraft entering a FIR, this function automatically sets the [delayed message parameter] to the default NONE value (i.e. there is no check of a delayed CPDLC message until the flight crew manually sets a new value). a) It is possible the flight crew may set a value for the [delayed message parameter], even if not instructed to do so. In this case, the aircraft system will reject uplink messages delayed by more than the value of the [delayed message parameter]. b) The flight crew will not see such messages. If such a message is rejected, the ATSU will receive the following downlink message: INVALID DATA UPLINK DELAYED IN NETWORK AND REJECTED RESEND OR CONTACT BY VOICE. This message will refer to the delayed CPDLC uplink message. c) If an ATSU is not using the message latency timer function and receives the above downlink, the following free text message may be sent: SET MAX UPLINK DELAY VALUE TO 999 SEC. This will minimize the possibility of subsequent uplink messages being rejected.
Boeing (all except B747-400)
For most Boeing aircraft entering a FIR, this function is automatically set to OFF with the following exceptions: a) Boeing aircraft whose CPDLC connection has been transferred will maintain the value of the [delayed message parameter], which was enabled during the previous CPDLC connection; b) Boeing 777 aircraft will maintain the value of the [delayed message parameter], which was enabled during any previous CPDLC connection, until the aircraft has landed at which time the value will be set to an operator-specified value in the aircraft's data base; and c) It is possible the flight crew may set a value for the [delayed message parameter], even if not instructed to do so.

F.12 Terminating ADS-C connections

Airbus
For Airbus aircraft: a) FANS A+ – the flight crew has the capability to turn off the ADS-C application, which will terminate all ADS-C connections, or terminate a specific ADS-C connection. b) FANS A – the flight crew has the capability to turn off the ADS-C application, which will terminate all ADS-C connections.
Boeing B787
The flight crew has the capability to turn off the ADS-C application, which will terminate all ADS-C connections, or terminate a specific ADS-C connection.

Boeing B737, B747-400, B747-8, B777, B757, B767, B717, MD90, MD10, MD11
For these Boeing aircraft, the flight crew has the capability to turn off the ADS-C application, which will terminate all ADS-C connections.

F.13 SATCOM channel format

Airbus
The Frequencysatchannel parameter is defined as being a NumericString type having the values {space, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9}.
Boeing
The Frequencysatchannel parameter is defined as being a NumericString type having the values {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}.

F.14 Transfer of ATSU

Airbus FANS-A
Whenever an FN_CAD is sent by an ATSU A which does not use CPDLC towards a new ATSU B which uses CPDLC, FANS A Airbus a/c will reject any attempt from ATSU B to make a CPDLC connection (and will trigger a DR1), until the flight crew performs a manual Logon with ATSU B.
Airbus FANS-A+
This limitation does not apply to Airbus FANS A+ aircraft.
Boeing
This limitation does not apply to Boeing aircraft.

F.15 Number of ADS-C connections

Airbus
Five ADS-C connections are available for ATS use.
Boeing B747-400
One of the ADS-C connections is reserved for operator use, and will only connect with the address specified in the aircraft's database. The other 4 connections may be used by ATSUs.
Boeing B737, B747-8, B777, B757, B767, B787, B717, MD90, MD10, MD11
Five connections are available for ATS use.

F.16 Lateral deviation events on offsets

Airbus
On all Airbus aircraft with FMS standards prior to Release 1A: When an offset is entered (or modified), the path from which lateral deviation is computed is immediately offset by the requisite distance. If a lateral deviation event contract is in place, and the deviation limit is less than the change in the offset, then an LDE report will be sent as soon as the offset is entered and executed. On all Airbus aircraft with FMS Release 1A: When an offset is entered or modified, the FMS computes a path to fly to reach the new offset. Lateral deviation is the distance the aircraft is from this path, so entry of an offset does not affect the aircraft's lateral deviation, and no LDE report will be issued as a result of an offset entry.
Boeing B747-400, B747-8, B777, B757, B767, B717, MD90, MD10, MD11
When an offset is entered (or modified), the path from which lateral deviation is computed is immediately offset by the requisite distance. If a lateral deviation event contract is in place, and the deviation limit is less than the change in the offset, then an LDE report will be sent as soon as the offset is entered and executed.
Boeing B737, B787
When an offset is entered or modified, the FMS computes a path to fly to reach the new offset. Lateral deviation is the distance the aircraft is from this path, so entry of an offset does not affect the aircraft's lateral deviation, and no LDE report will be issued as a result of an offset entry

F.17 Assigned block altitude

Airbus
Airbus aircraft can only respond to UM 135 CONFIRM ASSIGNED ALTITUDE with DM 38 ASSIGNED ALTITUDE [altitude], and not DM 77 ASSIGNED BLOCK [altitude] TO [altitude]. Assigned block levels will have to be reported with a free text message.
Boeing B777 AIMS-1
B777 aircraft with the AIMS-1 avionics (and those with AIMS-2 prior to Blockpoint v14) can only respond to UM 135 CONFIRM ASSIGNED ALTITUDE with DM 38 ASSIGNED ALTITUDE [altitude], and not DM 77 ASSIGNED BLOCK [altitude] TO [altitude]. Assigned block altitudes will have to be reported with a free text message.
Boeing B777 AIMS-2 and all other Boeing aircraft
Other Boeing aircraft (including B777 aircraft with AIMS-2 and Blockpoint v14 or later) can respond to UM 135 CONFIRM ASSIGNED ALTITUDE with either DM 38 ASSIGNED ALTITUDE [altitude], or DM 77 ASSIGNED BLOCK [altitude] TO [altitude].