Guidance Material
for
ATS Data Link Services
in
North Atlantic Airspace

VERSION 18
Effective Date 7 November 2008

Foreword

This guidance material pertains to Air Traffic Services (ATS) data link operations in the North Atlantic (NAT) Region. These operations include Flight Management Computer Waypoint Position Reporting (FMC WPR) and Future Air Navigation Systems (FANS) Automatic Dependant Surveillance Waypoint Position Reporting (ADS WPR) and Controller Pilot Data Link Communications (CPDLC).

The material contained in this document is for guidance. Regulatory material relating to aircraft operations is contained in relevant ICAO Annexes, PANS ATM (ICAO Doc 4444), Regional Supplementary Procedures (ICAO Doc 7030/4), State regulations, State AIPs and current NOTAM.

The North Atlantic FANS Implementation Group (NAT FIG) produces this document on behalf of the North Atlantic Systems Planning Group (NAT SPG). Content is proposed and verified for technical accuracy by the NAT FIG then reviewed and approved by the North Atlantic Implementation Management Group (NAT IMG).

This document incorporates previous editions of guidance material that pertained to various NAT ATS data link services. To assist the editing of this document and to ensure the currency and accuracy of future editions, comments, suggestions, updates and corrections should be sent to the editor at the following:

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Change Record

Changes introduced with Version 18.0 Note that the version has changed from 15 to 18 in line with the NAT FIG meeting number.	
Paragraph(s)/Section(s)	**Explanation(s)**
Acronyms	
Amended	Reference to FANS 1/A
Contacts	
Change of contact details	
Introduction	
1.2.6 amended 1.5.5 amended	Reference CPDLC Phases removed. Phase 4 operations commenced January 2008.
Trials and Operations	
2.1.2 amended 2.1.3 amended 2.3.1 amended 2.5.1 amended 2.5.2 amended 2.5.3 deleted 2.5.4 deleted 2.9 amended	Removal of 'operations.' Removal of 'operations.' Operational trials of FANS 1/A ADW WPR completed. Operational trials of CPDLC completed. Phase 4 Full NAT implementation. References to phases removed.
Responsibilities	
3.1.14 inserted	Operator authorisation requirements
Procedures	
4.2.3 amended 4.2.4 to 4.2.9 re-numbered 4.3.8 amended 4.3.9 amended 4.3.10 amended 4.7.1 amended 4.10.2 amended 4.10.4 amended 4.10.5 amended 4.10.6 amended	Original 4.2.3 deleted. Previously 4.2.4 Previously 4.2.5 Flights no longer required to make voice reports unless otherwise advised. Removal of 'VOICE REPORTS NOT REQUIRED' instruction. Removal of 'or CPDLC.' Inclusion of 'confirm their ADS is armed.' 'VOICE REPORTS NOT REQUIRED' instruction removed. 'VOICE REPORTS NOT REQUIRED' instruction removed. 'VOICE REPORTS NOT REQUIRED' instruction removed. Removal of 'non-phased.' 'VOICE REPORTS NOT REQUIRED' instruction removed.
CPDLC	
5.7.2 5.7.5 amended 5.17.5 inserted	Removal of 'For FANS-1/A aircraft.' Will replaced with May. Removal of initial CPDLC implementation. Clarification of 'AT' & ' BY' message elements.
5.20.1 amended	Procedures to respond to all downlink message elements, and removal of 'unsafe.'

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Paragraph(s)/Section(s)	**Explanation(s)**
5.20.4 deleted	
ATC Automation	
6.3.2 amended 6.7.1 6.8 amended	Change of text. Change from 'unsafe' to not used in the NAT. Table updated. Unsupported uplink messages updated.
NAT Preformatted Freetext CPDLC Messages	
	Removal of references to Phases 1, 2, 3.
NAT FANS CPDLC Message Set	
8.3 amended	Removal of references to Phases 1, 2, & 3. Update of message elements in various tables.
FMC WPR Test Success Criteria	
10 amended	Success criteria modified to reflect end of trial phase.
GA FMC WPR Test Success Criteria	New section.
Performance Based Guidance Material for Communications	New section.
Guidance Material for End-to-End Performance Monitoring of ATS Communications Services for NAT	New section.

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Acronyms

ACARS	Aircraft Communications Addressing and Reporting System
ACC	Area Control Centre
ADS	Automatic Dependent Surveillance
ADS WPR	Automatic Dependent Surveillance Waypoint Position Reporting
AFN	ATS Facilities Notification
AFTN	Aeronautical Fixed Telecommunication Network
AIP	Aeronautical Information Publication
AOC	Airline Operational Communications
ARP	Air Report Message
ATC	Air Traffic Control
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Services
ATSU	Air Traffic Services Unit
CADS	Centralised ADS
CDA	Current Data Authority
CFRS	Central FMC Waypoint Reporting System
CMU	Communications Management Unit
CNS/ATM	Communications, Navigation and Surveillance/Air Traffic Management
CPDLC	Controller Pilot Data Link Communication
CTA	Control Area
DM	Downlink Message
DSP	Data link Service Provider
EMG	Emergency Message
FANS	Future Air Navigation Systems
FANS 1/A	FANS 1/A, as defined by DO258A / ED100A
FCMA	FANS Central Monitoring Agency
FDPS	Flight Data Processing System
FFE	FANS Front End
FIR	Flight Information Region
FL	Flight Level
FMC	Flight Management Computer
FMC WPR	Flight Management Computer Waypoint Position Reporting
FMS	Flight Management System
GPS	Global Positioning System
HF	High Frequency
ICAO	International Civil Aviation Organisation
ICD	Interface Control Document
MAS	Message Assurance
MEL	Minimum Equipment List
MET	Meteorological
MIN	Message Identification Number
MNPS	Minimum Navigation Performance Standards
MRN	Message Reference Number
MU	(ACARS) Management Unit
NAT	North Atlantic
NAT FIG	North Atlantic Future Air Navigation Systems Implementation Group
NAT IMG	North Atlantic Implementation Management Group

NAT SPG	North Atlantic Systems Planning Group
NDA	Next Data Authority
OCA	Oceanic Control Area
ORD	Operational Requirements Document
OTS	Organised Track System
PANS ATM	Procedures for Air Navigation Services - Air Traffic Management (ICAO Doc 4444)
POS	ICAO Position Report Message
SARPS	Standards and Recommended Practices
SELCAL	Selective Calling System
SITA	Société Internationale de Télécommunications Aéronautiques
UM	Uplink Message
VHF	Very High Frequency
WPR	Waypoint Position Reporting

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1 Introduction

1.1 Background and Requirement

1.1.1 At NAT SPG/33, June 1997, (Summary of Discussions, paragraph 2.3.29), the decision was made to accommodate FANS 1/A equipped aircraft within the North Atlantic (NAT) Region with the stipulation that the end goal remained Standards and Recommend Practices (SARPS) compliant systems using the Aeronautical Telecommunications Network (ATN).

1.1.2 Support for the use of the implementations of Future Air Navigation Systems (FANS 1/A) aircraft capabilities in the NAT Region is based on:

an awareness of FANS 1/A deployment in aircraft fleets;

an understanding of the airspace users' and Air Traffic Services (ATS) providers' business needs and expectations;

the need to gain operational and technical experience with ATS data link communications and;

the need to help alleviate concerns of the possibility of deterioration or shortfall of High Frequency (HF) communications performance due to the forecast increase in NAT traffic.

1.1.3 Users have identified a desire to increase the applications supported by FANS 1/A equipage already existing and planned for their fleets.

1.1.4 System benefits can be realised by utilising systems other than HF voice to provide position reports to ATS providers.

1.1.5 Many operators routinely receive Flight Management Computer (FMC) position information as part of Airline Operational Communications (AOC) data from their flights.

1.1.6 Support for utilising FMC Waypoint Position Reporting (WPR) is based upon:

a) Automatic Dependant Surveillance (ADS) activation not being practical for all aircraft;
b) the business needs and expectations of airspace users and ATS providers;
c) the desire to gain some of the operational improvements that would accrue from ADS WPR; and the need to help alleviate concerns of the possibility of deterioration or shortfall of HF communications performance due to the forecast increase in air traffic.

1.2 Operational Concepts

1.2.1 A mixed aircraft equipage environment will continue to exist for many years. Mandatory FANS 1/A or FMC WPR aircraft equipage is currently not envisaged for the NAT Region.

1.2.2 Initial ATS trial use of FANS 1/A data link in NAT airspace consisted of ADS WPR. Its performance and usefulness have been confirmed and it is currently in the operational phase in all NAT Oceanic Control Areas/Flight Information Regions (OCA/FIRs) (see 1.5 for a detailed description of NAT ADS airspace).

1.2.3 The use of FMC WPR is not intended to replace or delay ADS equipage, but is intended to give operators an alternative, in cases where the cost of ADS would be prohibitive.

1.2.4 For the purposes of being considered suitable for NAT Trials or Operations, a FMC WPR is a position report that:

a) consists entirely of data entered automatically by the Flight Management System (FMS);
b) consists of data CRC protected by the FMS;
c) consists of data formatted and populated in accordance with the ARINC 702-1A specification;
d) is composed and processed by avionics certified to Level C;
e) contains an H1 label and the appropriate sub-label (FMC, FML or FMD); and
f) does not contain geographic coordinates encoded as per ARINC specification 424.

1.2.5 FMC WPR's can be automatically initiated without flight crew action or manually initiated by the flight crew.

1.2.6 CPDLC implementation in the Shanwick, Gander, Reykjavik and Santa Maria NAT FIRs is no longer considered a trial.

1.2.7 CPDLC implementation in the New York OCA is an operational implementation of a system already in use by the FAA in other airspace.

1.2.8 The backup system for CPDLC, FMC WPR and ADS WPR is voice radio.

1.2.9 The use of HF data link for FANS 1/A ATS messages is not approved at this time.

1.3 System Description - FANS 1/A

1.3.1 An ATS Facilities Notification (AFN) Logon to a specific Air Traffic Services Unit (ATSU) must be completed before a CPDLC connection or ADS contract can be established. The AFN Logon provides the ATSU's ground system with the aircraft information required to support FANS 1/A data link applications and to positively identify the aircraft from a communications standpoint within the system (see 2.7 for more information regarding AFN Logon and 4.2 for related procedures).

1.3.2 ADS and CPDLC communications will be provided through the FANS 1/A network. This network is provided by Data link Service Providers (DSP's) and carries FANS 1/A communications between aircraft and ATSU's. An interface to the FANS 1/A network may be provided by a FANS Front End (FFE) process. Provider States may choose to build gateway functionality into their own Flight Data Processing Systems (FDPS's).

1.3.3 For ADS WPR operations, there are no modifications required to existing ATS FDPS's. Instead, front-end processors are used by some ATSU's to support the ADS functionality. The front-end processor:

a) permits the application of ADS WPR contracts;

b) alerts the FDPS that an aircraft is transmitting emergency ADS reports; and

c) allows periodic contracts to request meteorological information at defined intervals.

1.3.4 The ADS front-end processor translates ADS WPR's to Position (POS) messages as defined in the NAT Common AERADIO Communications Interface Control Document (ICD). Similarly, any ADS emergency messages are converted to Emergency (EMG) messages as defined by the same ICD. These messages are forwarded to the ATS facility via the Aeronautical Fixed Telecommunication Network (AFTN) or other appropriate communications path. ADS periodic position reports which contain Meteorological (MET) information are converted to an Air Report (ARP) message as defined in ICAO Document 4444 (Procedures for Air Navigation Services – Air Traffic Management) and forwarded directly to the appropriate MET service provider via the AFTN. It is important to note that, from a system evaluation perspective, the FANS 1/A integrity checking will only apply between the aircraft avionics and the front-end processor.

1.3.5 The FANS 1/A system does not provide for end-to-end message assurance. Therefore, there can be no guarantee provided by the ground system or the avionics that a CPDLC message has been delivered to the controller or flight crew. However:

a) the ATS system will receive a network acknowledgment (MAS Message Assurance) to an uplink message indicating that the message has been delivered to the aircraft's Aircraft Communications Addressing and Reporting System (ACARS) Management Unit (MU) or the Communications Management Unit (CMU);

b) the avionics will receive a system acknowledgment to a downlink message indicating that the message has been delivered to the DSP's system; and

c) the crew is advised when system acknowledgement from the DSP is received.

1.4 System Description - FMC WPR

1.4.1 When received by a DSP, an FMC WPR will be routed to the Central FMC Waypoint Reporting System (CFRS). The CFRS will convert the WPR to the AFTN POS format and send it to the appropriate Area Control Centres (ACC's). CFRS will use geographic filtering to determine the appropriate ACC's.

1.4.2 An AFN Logon is not required to initiate FMC WPR.

1.4.3 It is impossible for the ground system to properly associate FMC WPR's with the flight if the flight number contains an alphabetic character (for example ABC124A or ABC324W). Such flights cannot participate in FMC WPR.

1.4.4 Certain pre-FANS Airbus avionics configurations should not participate in FMC WPR because they are prone to large errors in position data. This can be rectified with a software upgrade. For further advice operators should contact Airbus.

1.5 Airspace

1.5.1 NAT ADS Airspace consists of the following areas:

a) Gander OCA
b) Shanwick OCA
c) Reykjavik OCA
d) Santa Maria OCA
e) Bodø OCA
f) New York OCA

1.5.2 FANS 1/A ADS WPR is in the Operational Phase in NAT ADS Airspace.

1.5.3 NAT CPDLC Airspace consists of the following areas:

a) Gander OCA
b) Shanwick OCA
c) New York OCA
d) Reykjavik OCA
e) Santa Maria OCA

1.5.4 A non-phased, fully operational implementation of CPDLC services, as further described in 2.6 is provided in the New York Data Link service area.

1.5.5 Phase 4 CPDLC operations commenced concurrently in Gander, Reykjavik, Shanwick and Santa Maria, on the 17th of January 2008.

1.5.6 NAT FMC WPR Airspace consists of the following areas:

a) Gander OCA
b) Shanwick OCA
c) Reykjavik OCA
d) Santa Maria OCA
e) Bodø OCA

2 Trials and Operations – General

2.1 Participation Requirements

2.1.1 In order to participate in trials and subsequent operations, Operators must be in possession of the appropriate approval(s) issued by the State of Registry or the State of the Operator.

2.1.2 Operators must indicate their intention to participate in trials by contacting the FANS Central Monitoring Agency (FCMA) and providing the following information:

a) requested ATS data link services;

b) Operator name;

c) Operator contact person;

d) aircraft type(s) and associated registration(s);

e) whether the option of updating the FMC time using the GPS time has been installed for the particular aircraft involved; and

f) anticipated start date of participation.

2.1.3 Operators who intend to participate in FANS 1/A trials must also provide assurance to the FCMA that operational approval has been obtained in accordance with FAA AC 120-70 and the associated Operational Approval Information Package, or, if it exists, equivalent material.

2.1.4 Operators who intend to participate in FMC WPR trials or operations must:

a) advise whether the FMC WPR's will be manually triggered by the flight crew or be fully automated;

b) confirm that the necessary coordination has taken place with the DSP; and

c) Ensure that the registrations of aircraft new to the trial are notified at least 30 days in advance, since reports can only be received from aircraft whose registrations are known to the system

2.1.5 Operators who intend to participate in FMC WPR operational trials must successfully complete a pre-operational trial (see 2.4.1 for information regarding FMC WPR pre-operational trials).

2.1.6 Operators who require receipt of converted ADS or FMC reports must provide the appropriate 8-letter Aeronautical Fixed Telecommunication Network (AFTN) address(es).

2.1.7 Operators are requested to advise the FCMA of any changes to the information provided.

2.1.8 The FCMA will forward information obtained through 2.1.2 to participating ATS and Radio Communication providers.

2.1.9 To avoid logons being rejected and to ensure FANS 1/A downlinks are properly routed, each participating airline must co-ordinate with its DSP or DSP's to initiate FANS 1/A ground system configuration, applicable to the NAT Region, for its aircraft. Please note that this configuration process is applicable to all current FANS 1/A applications, and need not be repeated to participate in CPDLC operations if the aircraft has already been configured to participate in ADS operations in the NAT Region.

2.1.10 To ensure FMC WPR downlinks are properly routed to the CFRS systems of both ARINC and SITA, participating Operators must coordinate with their DSP's to configure for routing their FMC WPR's to both CFRS systems.

2.1.11 Certain pre-FANS Airbus avionics configurations should not participate in FMC WPR because they are prone to large errors in position data. This can be rectified with a software upgrade. For further advice operators should contact Airbus.

2.2 The NAT FANS Central Monitoring Agency

2.2.1 The NAT FANS Central Monitoring Agency (NAT FCMA) will be jointly managed by Canada and the United Kingdom and will report to the NAT IMG with respect to FANS implementation, trials and operations.

2.2.2 It will receive and process routine and ad-hoc data and problem reports from end users and interested parties to perform the following functions:

a) Monitor and report communications performance, availability, and problems, with respect to requirements.

b) Develop and promulgate forms, specifications, and procedures required for reporting of problems and routine data.

c) Monitor and report message traffic statistics.

d) Co-ordinate end-to-end system functionality, performance, and interoperability.

e) Co-ordinate in order to diagnose and resolve system problems.

f) Co-ordinate the development of ground system navigation databases.

g) Report ATSUs' FANS capabilities with respect to trials and operational requirements for the Region. Receive advisories of same from ATS providers.

h) Co-ordinate with similar agencies for other airspaces.

i) Collect notices of service disruptions, restorations, and major system changes. Correlate the information same to problems reported.

2.2.3 To avoid unnecessary and costly duplication, the NAT FCMA will also collect and evaluate problem reports and technical data and create and maintain a participation database for FMC WPR in the NAT.

2.3 Conduct of ADS WPR Operations

2.3.1 The operational trials of FANS 1/A ADS WPR have been completed.

2.3.2 There is a possibility that various abnormal cases could exist in the provision of ADS WPR. During the FANS 1/A trials, the following characteristics were noted.

a) Non-ATC waypoints
Aircraft will occasionally send reports with non-ATC waypoints as reporting points, NEXT waypoint, and NEXT+1 waypoint. The front-end processor could convert these to POS messages and forward them to the ACC. If necessary, ATC will verify a position report through voice communication (see 4.4.1 for related flight crew procedures).

b) Receipt of multiple copies of an ADS report
When multiple copies of an ADS report are received, the front-end processor will log all copies but will process only the one received first, discarding all others.

c) Discarding old ADS reports
When the front-end processor receives an ADS report that is more than N (a local system parameter) minutes old, according to its position time stamp, it will log the message and discard it without providing any data to other systems and without further processing.

d) Discarding erroneous met reports
Met Reports from aircraft that are known to generate erroneous Met data will be discarded.

2.3.3 When the front-end processor receives an emergency-mode ADS report, it will convert the report to an EMG Message and transmit it immediately to the ACC for presentation to a Controller. If a periodic contract is active, the emergency reports will be transmitted at the existing periodic rate. Otherwise, the rate will default to 304 seconds for Boeing aircraft or 64 seconds for Airbus aircraft. Only the pilot can cancel the emergency mode (see 4.7.4 and 4.7.5 for associated ATC procedures).

2.4 Conduct of FMC WPR Operations

2.4.1 The operational trials of FMC WPR have been completed. FMC WPR is in the Operational Phase in participating OAC's.

2.4.2 Each Operator must demonstrate that they meet the success criteria (see section 10) for the provision of FMC WPR's for ATS purposes. Once this has been demonstrated with one NAT region ATS provider, the Operator will be able to participate in FMC WPR operations. Utilising FMC WPR will be at the discretion of the operator.

2.5 Conduct of Phased CPDLC Operational Trials

2.5.1 The operational trials of CPDLC operations have been completed. CPDLC operations are in the Operational Phase 4 in Shanwick, Gander, Reykjavik and Santa Maria FIRs.

2.5.2 Phase 4 – Full NAT Implementation

2.5.2.1 With the exception of those messages deemed unsafe by ICAO, all downlink elements will be supported. NAT ANSPs shall develop appropriate procedures to respond to all received downlink message elements.

2.5.2.2 NAT ANSPs will not provide information regarding when or where a flight can expect to climb or descend, due to potential misunderstanding that such a message constitutes a clearance.

2.6 New York CPDLC Implementation

2.6.1 The approach described in this section is applicable to the implementation of CPDLC services in the New York Data Link service area (see 1.5 for airspace descriptions).

2.6.2 CPDLC service will utilise the message sets contained in sections 7 and 8. In the New York Data Link service area, first preference for position reports is ADS WPR, followed by CPDLC (ensuring that geographic coordinates are not encoded as per ARINC specification 424), followed by HF voice. Operators should note that voice reports are required unless otherwise advised.

2.6.3 Unless otherwise advised, additional AFN Logon to initiate ADS services with other NAT OCA's is not required, once an Active CPDLC connection is established with KZWY.

2.7 AFN Logon

2.7.1 See 4.2 for procedures related to AFN Logons.

2.7.2 The AFN addresses applicable in the NAT region are:

Gander OCA	CZQX
Shanwick OCA	EGGX
Reykjavik OCA	BIRD
Santa Maria OCA	LPPO
New York OCA	KZWY
Bodø OCA	ENOB

2.7.3 An AFN Logon to a specific AFN address must be completed before a CPDLC connection or ADS contract can be established. The AFN Logon provides ground systems with the aircraft information required to support FANS 1/A data link applications and to positively identify the aircraft from a communications standpoint within the system.

2.7.4 An AFN Logon is not required to initiate FMC WPR.

2.7.5 The AFN Logon associates the aircraft's call sign with its registration. The FANS network uses the registration as the destination address for CPDLC messages and ADS contracts for each aircraft. ATS personnel usually use aircraft call signs to identify flights. The AFN Logon allows this practice to continue, since the ground system will uniquely identify the pairing of call sign (used by ATS personnel) and aircraft registration (required by the FANS network).

2.7.6 In order to establish an ADS or CPDLC connection, the following aircraft information is required:

a) aircraft identification/call sign/flight identification, as shown in the ATC Flight Plan;

b) registration, as shown in the ATC Flight Plan; and

c) ADS and/or CPDLC application availability and version number.

2.7.7 This information is obtained from an AFN Contact Message from the aircraft. The AFN Contact Message is:

a) the result of an AFN Logon initiated manually by the pilot; or

b) initiated automatically by an AFN Contact Advisory uplinked by a transferring facility.

2.7.8 The AFN Logon will be rejected if:

a) the aircraft registration/call sign pairing does not match the pairing contained in the flight plan;

b) there is no aircraft registration included in the flight plan;

c) there is no flight plan in the ATS system for that flight;

d) the specified ATSU has implemented a process to allow CPDLC connections only with approved Operators and the subject flight is not approved, or

e) a flight logs on more than 30 minutes before the Reykjavik boundary when entering from a domestic FIR. Hyphens contained in an aircraft registration must not be entered into the ICAO flight plan form. The aircraft registration included in the AFN Contact message cannot be altered by the flight crew, and may contain hyphens. Ground systems should, however, be configured so as 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.

2.8 FANS Connections

2.8.1 FANS 1/A equipped aircraft can have up to five ADS connections established, each with a different ground facility. All ADS connections have equal status within the avionics.

2.8.2 All ground facilities seeking an ADS contract with a specific aircraft, without having direct control or monitoring requirements for that aircraft (e.g. a ground facility requesting an ADS connection for test purposes) must co-ordinate with the appropriate controlling authority and the Operator, prior to the departure of the flight.

2.8.3 FANS 1/A equipped aircraft can have up to two CPDLC connections established, each with a different ground facility. Only one connection can be Active (see 5.4.2 for more information regarding Active and Inactive connections).

2.9 Reference Guide to NAT Data Link Services

OCA/FIR (AFN Logon)	ADS	CPDLC	FMC WPR
Reykjavik (BIRD)	Yes	Yes	Yes
All CPDLC messages will be accepted. Initial contact with Aeradio - in accordance with 4.3			
Santa Maria (LPPO)	Yes	Yes	Yes
All CPDLC messages will be accepted. Initial voice contact with Aeradio - in accordance with 4.3.			
Shanwick (EGGX)	Yes	Yes	Yes
All CPDLC messages will be accepted. Initial contact with Aeradio - in accordance with 4.3.			
Gander (CZQX)	Yes	Yes	Yes
All CPDLC messages will be accepted. Initial contact with Aeradio - in accordance with 4.3.			
Bodø (ENOB)	Yes	No	Yes
Flights in the Bodø FIR should not have an Active Center unless they have completed AFN Logon to a subsequent FIR in accordance with 4.2.4 or the previous ATSU is maintaining their CPDLC connection in accordance with 4.6.3. Initial contact with Aeradio - in accordance with in accordance with 4.3.			
New York (KZWY)	Yes	Yes	No
All CPDLC messages will be accepted. Initial contact with Aeradio - in accordance with 4.3.			

3 Responsibilities

3.1 Aircraft Operator

3.1.1 Operators should assess operational requirements, establish policy and procedures, and incorporate them in appropriate company documents.

3.1.2 Advisory information should be distributed within the flight operations department to ensure that all personnel concerned are aware of:

a) FMC WPR concepts and any necessary programs for the introduction of FMC WPR for ATC purposes (this is especially important for those fleets that require manual initiation of FMC WPR downlinks);

b) FANS 1/A concepts and any necessary programs for the introduction of CPDLC; or

c) FANS 1/A concepts and any necessary programs for the introduction of ADS WPR.

3.1.3 Company Operations Manuals and other documentation for ADS WPR, FMC WPR or CPDLC should include:

a) crew procedures;

b) pilot responsibility for establishing and maintaining voice communications (including a SELCAL check) with every OCA along the route of flight; and

c) Minimum Equipment Lists (MEL) modifications (if required).

3.1.4 Operators participating in ADS WPR should ensure that all personnel concerned are aware of ADS functionality, including normal and emergency operations.

3.1.5 Because there are differences in the avionics supporting CPDLC and ADS, Operators should advise flight crews of the flight deck indications resulting from logon for the purpose of ADS only.

3.1.6 Operators wishing to participate in FMC WPR must successfully complete a pre-operational test (see 2.4.2 for information regarding FMC WPR pre-operational tests). Until this has been done, operators shall ensure that flight crews do not identify themselves as “F-M-C” during initial contact with aeradio.

3.1.7 Operators participating in FMC WPR should ensure that:

a) FMC WPR’s are generated at each ATC waypoint of a cleared route in FMC WPR airspace;

b) any waypoints uplinked to the FMS for the purposes of generating automatically initiated FMC WPR’s consist solely of ATC waypoints; and

c) the FCMA is notified thirty days in advance of the registrations of all aircraft that are intended to participate in FMC WPR, including any aircraft to be added to the operation subsequently.

3.1.8 When aware of any FMC WPR or ADS WPR systems failure, Operators should advise concerned crews to revert to voice communications at the next scheduled reporting point.

3.1.9 Whenever possible, Operators should avoid the use of flight numbers that contain alphabetic characters by flights participating in FMC WPR. For example, avoid the use of flight numbers such as ABC124A or ABC324W. The use of such flight numbers results in the FMC WPR not being associated with the flight (see 1.4.3 for more information regarding this technical problem).

3.1.10 Operators should inform the FCMA of any pilot reported problems associated with FMC WPR, ADS WPR or CPDLC (see Contacts, page 3).

3.1.11 Filing a report with the FCMA 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.

3.1.12 Operators participating in FANS 1/A operations should ensure that the proper information is included in the ATC Flight plan (see 4.1.1 for flight planning requirements).

3.1.13 It is the responsibility of the Operator to ensure that only crews trained in CPDLC avail themselves of FANS services.

3.1.14 Operators are required to obtain a data link authorisation with the State of registry in accordance with their rules and means of compliance (such as FAA AC 120-70a). This operational authorisation should address flight crew training and qualification, maintenance, MEL, user modifiable software, service agreements with CSP, and procedures for submitting problem reports and data to the central reporting/monitoring agencies, FCMA for the NAT Region. It should also ensure that aircraft equipment has been approved for the intended use, e.g. RCP 240 or RCP 400 operations, in accordance with airworthiness requirements and related means of compliance (such as FAA AC 20-140).

3.2 Data Link Service Provider

3.2.1 For those situations where service providers cannot continue to provide data link communications, they will inform ATS and Airline Operations in accordance with established coordination procedures.

3.2.2 In the event of a Centralised ADS (CADS) failure, the CADS provider should inform ATS.

3.2.3 In the event of a CFRS failure, the CFRS service provider should inform ATS.

3.3 ATS Provider

3.3.1 An ATS provider may suspend ADS WPR, FMC WPR and/or CPDLC (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 inter-unit agreements.

3.3.2 For scheduled and/or extended outages of the ground component of the ADS or FMC WPR system, a NOTAM shall be issued. During such outages, position reports will be required via voice communications.

3.3.3 When an ATS provider suspends CPDLC operations or when a planned system shutdown of the communications network or the ATS system occurs, the ATS provider should publish a NOTAM to inform all affected parties of the shutdown period. During this time period, voice communications will be used. Aircraft currently in communication with the ATC unit should be informed by voice of any imminent loss of CPDLC service.

3.3.4 In the event of an unexpected ground system ADS outage, ATS should:

a) inform other ATS units concerned; and

b) issue a NOTAM, if required.

3.3.5 In the event of an unexpected ground system CPDLC outage, or in the event that an ATSU suspends CPDLC operations without prior notice, the ATSU should:

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

b) inform other ATS units concerned;

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

d) issue a NOTAM, if required.

3.3.6 ATS providers who offer CPDLC services should develop procedures to ensure the END SERVICE message is sent (see 6.5 regarding related ATS automation and **Error! Reference source not found.** for related information):

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

b) in sufficient time to prevent an inappropriate Active CPDLC connection from continuing with an aircraft while it is transiting non-CPDLC airspace; and

c) in accordance with inter-unit coordination requirements contained in applicable Agreements.

4 Procedures

4.1 Flight Planning

4.1.1 ATS systems use Field 10 (Equipment) of the standard ICAO flight plan to identify an aircraft's data link capabilities. To facilitate the eventual migration to a standardised Communications Navigation Surveillance/Air Traffic Management (CNS/ATM) system, and in keeping with the flight planning provisions as specified in the ICAO Doc. 4444 (PANS-ATM), Operators should insert the following items into the ICAO flight plan form for FANS 1/A equipped 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 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)

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

Indicating data link equipment in Field 18

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

4.2 AFN Logon

4.2.1 See 2.7 for general information regarding AFN Logon and the list of AFN addresses applicable in the NAT region.

4.2.2 When initialising the FMC, it is essential to ensure that the aircraft identification matches the one displayed in the filed ATC flight plan. If a flight crew becomes aware that they have provided incorrect flight identification data for the AFN Logon, they shall immediately terminate FANS and re-logon with a correct identification.

4.2.3 15 to 45 minutes prior to entering NAT ADS airspace (15 to 25 minutes in the case of Reykjavik) the flight crew should initiate an AFN Logon. For flights departing from airports adjacent to, or underlying NAT ADS Airspace, the pilot should logon prior to departure (see 1.5 for a description of NAT ADS airspace).

4.2.4 If entering a CPDLC OCA/FIR from adjacent airspace where no CPDLC connections or ADS contracts have been established, the flight crew should initiate AFN Logon to the CPDLC ATSU between 15 and 45 minutes (15 to 25 minutes in the case of Reykjavik) prior to entering the CPDLC OCA/FIR (see 1.5 for a description of NAT CPDLC airspace). Flight crews should note that standard ATS procedures require that when an ATSU is in communication with a flight under the control of another ATSU, no clearances or instructions are given to that flight without the appropriate coordination between the ATSUs.

4.2.5 The flight crew initiates the first AFN Logon. After completing the logon procedure, the aircraft system will send an AFN CONTACT message to the specified ground system. The ground system will automatically acknowledge this message, completing the transaction. For this reason, some ATSUs will not establish a CPDLC connection immediately after AFN Logon but will delay the connection until the flight is close to the OCA/FIR boundary.

4.2.6 If, after initiating an AFN Logon, the Active Centre does not match the AFN address specified during the Logon, the flight crew should attempt another log-on. If the Active centre remains incorrect, CPDLC should be disconnected and the flight should continue with voice communications.

4.2.7 Once an AFN Logon is completed to any of the NAT ATSU's, ground systems will transfer and manage the various connections required for FANS services as the aircraft traverses the NAT OCA's and FIR's served by the various ATSU's. These transfers are initiated and completed automatically, without action by the flight crew.

4.2.7.1 The ATS ground system will accept the ATS Facilities Notification (AFN) Contact from the aircraft and generate an AFN Acknowledgement. The AFN Acknowledgement will indicate that ADS is supported.

4.2.7.2 When the ATS ground system receives an AFN log-on message, it will use the received information to immediately initiate an ADS waypoint event contract request to the aircraft.

4.2.7.3 When the ATS ground system initiates an ADS waypoint event contract request, it may also initiate any required ADS MET Data contract request (i.e. a contract for periodic reporting of the Meteorological Group data with a typical reporting period of 30 minutes).

4.2.7.4 When the aircraft has exited ADS Airspace, the ATS ground system will terminate ADS reporting.

4.2.8 The life cycle of a CPDLC connection is described in 5.3.

4.2.9 In the event of an abnormal disconnect from the FANS 1/A network, another manually initiated AFN Logon will be required in order to resume FANS 1/A data link operations.

4.3 Flight Crew - Contact with Aeradio

4.3.1 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.

4.3.2 Prior to entering each NAT oceanic CTA, the pilot shall contact the appropriate aeradio station.

4.3.3 The following data link terms should be used to identify the flight:

Term	Data link status of aircraft
"A-D-S"	Participating in ADS WPR only
"F-M-C"	Participating in FMC WPR
"C-P-D-L-C"	Participating in CPDLC (including CPDLC **and** ADS)

Flight crews should continue to use the data link term until either the SELCAL check has been completed or the frequency assignment has been received.

4.3.4 If the flight will exit the CTA into oceanic airspace, on initial contact with the CTA the pilot shall:

1. not include a position report;
2. use the appropriate data link term after the aircraft call sign (see 4.3.3 above);
3. state the name of the next OCA/FIR to be entered; and
4. request the SELCAL check.

Example 1 (initial contact from an eastbound ADS-only flight about to enter the Gander OCA):
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 OCA):
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.

4.3.5 If the flight will exit the CTA into domestic airspace, on initial contact with the CTA, the pilot shall:

1. not include a position report;
2. use the appropriate data link term after the aircraft call sign (see 4.3.3 above);
3. state the track letter if operating on the Organised Track System (OTS);
4. state the last two fixes in the cleared route of flight if operating outside the OTS; and
5. request the SELCAL check.

Example 1 (initial contact from an eastbound ADS-only flight about to enter the Shanwick OCA):
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 OCA):
GANDER RADIO, AIRLINE 123 C-P-D-L-C, SCROD VALIE, REQUEST SELCAL CHECK DMCS.

Example 3 (initial contact from an eastbound FMC flight about to enter the Shanwick OCA):
SHANWICK RADIO, AIRLINE 123 F-M-C, TRACK ZULU, REQUEST SELCAL CHECK CDAB.

4.3.6 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 4.10 for information regarding associated aeradio procedures).

4.3.7 In the event an onboard systems failure prevents CPDLC, ADS WPR 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.

4.3.8 To reduce frequency congestion crews of ADS & FMC WPR flights should not be required to submit position reports via voice unless otherwise advised by aeradio operator.

4.3.9 ADS WPR flights, are exempt from all routine voice meteorological reporting, however reports of unusual meteorological conditions such as severe turbulence should be made by voice to the aeradio station. CPDLC should not be used for meteorological reports unless voice contact cannot be established.

4.3.10 Flight crews should not ask aeradio questions regarding the status of the ADS connections or whether an ADS WPR or an FMC WPR has been received. Should ATC fail to receive an expected ADS WPR or FMC WPR, they will request a voice report.

4.3.11 When leaving NAT airspace, flight crews should comply with all communication requirements applicable to the airspace being entered.

4.3.12 If no domestic frequency assignment has been received by 10 minutes prior to the flight’s entry into domestic airspace, the flight crew should contact aeradio and request the frequency, stating the oceanic exit fix.

4.4 Flight Crew - ADS WPR

4.4.1 Flight crews should not insert non-ATC waypoints (e.g. mid-points) in cleared oceanic flight legs, as it will result in transmission of unwanted ADS reports. Non ATC waypoints may prevent the provision of proper ETA data in the ADS reports required for ATC purposes.

4.4.2 The 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 ADS report. If that estimate subsequently changes by three minutes or more, a revised estimate shall be transmitted via voice to the ATS unit concerned as soon as possible.

4.5 Flight Crew - FMC WPR

4.5.1 When FMC WPR's are manually initiated, this should be done 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.

4.5.2 The 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 ADS report. If that estimate subsequently changes by three minutes or more, a revised estimate shall be transmitted via voice to the ATS unit concerned as soon as possible.

4.5.3 Flight crews should avoid inserting non-ATC waypoints (e.g. mid-points) in cleared oceanic flight legs, as non-ATC waypoints may prevent the provision of proper ETA data in the FMC reports required for ATC purposes.

4.5.4 If the flight number contains an alphabetic character (such as ABC132A or ABC324W) the flight cannot participate in FMC WPR and the flight crew should not use the term "F-M-C" during contact with aeradio (see 1.4.3 for more information regarding this technical problem). Flight crews should not use the initial contact procedures in 4.3, but should revert to normal voice procedures.

4.6 Flight Crew – CPDLC

4.6.1 Flight crews should be aware of the information presented in part 5, which relates to the technical aspects of CPDLC functionality.

4.6.2 If an AFN Logon is rejected:

a) check whether the aircraft identification/call-sign/flight ID in the FMC matches the aircraft identification/call-sign/flight ID provided in the flight plan and make corrections if necessary; and

b) check whether the aircraft registration matches the aircraft registration provided in the flight plan, and arrange for the flight plan to be modified, if necessary.

4.6.3 CPDLC transfers to adjacent ATSUs offering CPDLC services should be automatic. Normally, the transfer will occur at or shortly before crossing the OCA/FIR boundary. When the ATSU intends the transfer to take place after the OCA/FIR boundary, preformatted freetext message 006 will be uplinked (see section 7 for the list of NAT preformatted freetext messages). When a flight does not receive preformatted freetext message 006 and crosses an OCA/FIR boundary without the Active Center changing to reflect the transfer, flight crews should manually disconnect and logon to the appropriate ATSU.

4.6.4 When exiting a CPDLC OCA/FIR into a non-CPDLC OCA/FIR flight crews should expect the Active Centre to terminate the CPDLC connection, leaving the aircraft with no CPDLC connectivity. Normally, the transfer will occur at or shortly before crossing the OCA/FIR boundary. When the ATSU intends the transfer to take place after the OCA/FIR boundary, preformatted freetext message will be uplinked 006 (see section 7 for the list of NAT preformatted freetext messages). When a flight does not receive preformatted freetext message 006 and crosses an OCA/FIR boundary without the CPDLC connection being terminated, flight crews should manually disconnect. Crews should follow the direction at 4.2.4 if entering a subsequent CPDLC OCA/FIR.

4.6.5 Unless otherwise instructed, flight crews should revert to voice communications while transiting non-CPDLC OCA/FIRs. Crews should note that an active CPDLC connection may be established with the next CPDLC OCA/FIR well before entering that OCA/FIR. Such connections should not be utilised except in highly unusual or emergency situations.

4.6.6 Where CPDLC-related voice communications are required, flight crews should utilise the appropriate phraseology as detailed in section 9 below.

4.6.7 Flight crews should be aware of paragraph 5.7.1 concerning END SERVICE. For this reason, it is important to respond to uplink messages promptly and appropriately, particularly when approaching an FIR boundary. It should be noted that if any uplink messages are open when the END SERVICE message is sent, the CPDLC connection to the CDA will be terminated and the CPDLC connection to the NDA may be terminated.

4.6.8 If unable to continue using CPDLC, flight crews should revert to voice procedures. If possible, all open messages should be closed, regardless of any associated voice communications. These responses should be consistent with the voice communication, in order to prevent confusion.

4.6.9 The flight crew should initiate voice contact to clarify the meaning or intent if an unexpected or illogical response is received to a CPDLC downlink message. In the event of receiving a CPDLC clearance which is not clearly understood, the message should be rejected and an UNABLE response sent. The intent of the message should then be confirmed by voice.

4.6.10 It is possible for multi-element CPDLC messages to be displayed on more than one screen page. Crews should carefully refer to screen page numbers to ensure that elements have been read in the proper order. Printing and reading the entire CPDLC message prior to responding may be an appropriate technique to avoid missing any message elements.

4.6.11 In the event a CPDLC uplink is received with the notation UPLINK DELAY EXCEEDED, the flight crew should:

a) REJECT the message (sends a NEGATIVE or UNABLE response);

b) advise, via voice, “DELAYED CPDLC MESSAGE RECEIVED”; and

c) request verification of ATC intent.

Note: this paragraph is applicable only to Boeing aircraft for which the CODKC latency time function has been implemented - 777 AIMS 1 BP-03, 777 AIMS 2, 777 BP05, 737-600, 700, 800 & 900, 747-400 (Pegasus 3), 757 (Pegasus 3) and 767 (Pegasus 3).

4.6.12 In the event a CPDLC uplink is received with the notation UPLINK DELAY EXCEEDED, and the flight crew is unable to establish voice contact, they should:

a) REJECT the message (this sends a NEGATIVE or UNABLE response); and

b) send the following freetext message: DELAYED CPDLC MESSAGE RECEIVED; or

c) (for Boeing 777 aircraft) include the following reject reason: NOT CONSISTENT, PLEASE RE-SEND.

4.6.13 Flight crews should be aware of the technical aspects and associated procedures regarding emergency CPDLC downlink messages (detailed in 5.19).

4.6.14 Flight crews should be aware of the technical aspects and associated procedures regarding altitude assignment via CPDLC (detailed in 5.17).

4.6.15 Flight crews should be aware of the information in 5.20 regarding the meaning of the freetext message 'MESSAGE NOT SUPPORTED BY THIS UNIT.'

4.7 ATC - ADS WPR

4.7.1 Whenever an ADS WPR is overdue by more than an interval, as determined by ATC, a controller shall action to advise the aircraft concerned, confirm their ADS is armed, and–request a voice position report. If the pilot or the controller notices intermittent operation, either may elect to revert to voice reporting at any time. (Flight crews would be expected to terminate ADS and resume voice reporting for the remainder of the NAT crossing.)

4.7.2 A controller who becomes aware of corrupt or incorrect data shall initiate action to establish voice contact with the aircraft concerned in order to correct the situation.

4.7.3 If the controller is advised, or becomes aware of, a data link communications failure, aircraft concerned shall be advised as necessary to revert to voice position reporting.

4.7.4 When an ADS emergency message is received, the controller with control responsibility for the aircraft shall request confirmation of the emergency through voice communications with the aircraft (see 2.3.3 for related information).

4.7.5 When a controller not having control responsibility for the aircraft receives an ADS emergency report, he/she shall co-ordinate with the controlling authority to ensure that the emergency report has been received (see 2.3.3 for related information).

4.8 ATC - FMC WPR

4.8.1 Whenever an FMC WPR is overdue by more than a specific interval, as determined by ATC, a controller must take action to advise the aircraft concerned and request a voice position report. If either the pilot or the controller notices intermittent operation, either may revert to voice reporting at any time. (Crews would be expected to report by voice for the remainder of the NAT crossing.)

4.8.2 A controller who becomes aware of corrupt or incorrect data shall initiate action to establish voice contact with the aircraft concerned in order to correct the situation.

4.8.3 If the controller is advised, or becomes aware of, a data link communications failure, aircraft concerned shall be advised as necessary to revert to voice position reporting.

4.9 ATC – CPDLC

4.9.1 Controllers should be aware of the information presented in part 5, which relates to the technical aspects of CPDLC functionality.

4.9.2 Where CPDLC-related voice communications are required, utilise the appropriate phraseology as detailed in part 9.

4.9.3 When CPDLC fails and communications revert to voice, all open messages should be considered not delivered and any dialogues involving those messages should be re-commenced by voice.

4.9.4 Controllers should initiate voice contact to clarify the meaning or intent if an unexpected or inappropriate response is received to a CPDLC uplink message (see 5.9.5 for details regarding appropriate responses to clearance messages).

4.9.5 Controllers should immediately revert to voice communications if at any time it appears that there is a misunderstanding about the intent of a CPDLC dialogue. If possible, all open messages should be closed, regardless of any associated voice communications. These responses should be consistent with the voice communication, in order to prevent confusion.

4.9.6 Up to five message elements can be sent within the same message, but the number of elements should be kept to a minimum (see 4.6.10 for related information). Messages should not include ATC clearances or instructions that are not dependent on one another. Misunderstanding could result if only part of such a message could be complied with.

4.9.7 If the controller becomes aware that the AFN Logon to the NDA is not successful, the controller should instruct the aircraft to manually initiate an AFN Logon with the next ATSU (see part 8 for the appropriate voice phraseology). Do not re-send the NDA message (see section 6 regarding related ATS automation).

4.9.7.1 Coordinate with the next ATSU, establishing clearly when or where the aircraft will be instructed to initiate AFN Logon with that unit.

4.9.7.2 The AFN Logon instruction should be timed to allow the next ATSU to establish an Active CPDLC connection prior to the aircraft's crossing the common boundary. Note that this process will terminate the current CPDLC connection.

4.9.8 Controllers should not include any other message element with the END SERVICE message (see 5.7.3. and 5.7.4 for information related to the effect of including other message elements with the END SERVICE message).

4.9.9 Controllers should send appropriate responses to any received downlink messages prior to sending the END SERVICE message (see 5.7.1 for related information).

4.9.10 If an NDA was established, controllers should coordinate with that ATSU regarding any CPDLC uplink messages that were open at the time the END SERVICE message was sent (5.7.2 for related information).

4.9.11 Controllers should be aware of the technical aspects related to delayed CPDLC uplink messages (detailed in 5.16.1 .They should be particularly aware of the required ATS responses (detailed in 5.16.2.3, 5.16.2.4, 5.16.4.2 and 5.16.4.3), the associated flight crew procedures (detailed in 4.6.11 and 4.6.12) and the associated aeradio procedures (detailed in 4.11).

4.9.12 Controllers should be aware of the technical aspects and associated procedures regarding the receipt of emergency CPDLC downlink messages (detailed in 5.19).

4.9.13 Controllers should be aware of the technical aspects and associated procedures regarding altitude assignment via CPDLC (detailed in 5.17).

4.9.14 Controllers receiving reports of turbulence or other meteorological conditions by CPDLC should forward the details, as necessary, in accordance with local instructions.

4.10 Aeradio - Response to Initial Contact

4.10.1 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 4.3.3 for the list of data link terms); and

b) complete the SELCAL check (see 4.3.4 and 4.3.5 for examples of the initial contact procedures to be used by flight crews).

4.10.2 If a flight uses the term “A-D-S” after the aircraft call sign, the aeradio operator should:

1. Issue:
   a) communication instruction for the next OCA/FIR; or
   b) communications instructions and the frequency to contact the appropriate ATS unit approaching, or over, the exit point; or
   c) instructions for the flight to call the aeradio station serving the next OCA/FIR at a time or location prior to the next OCA/FIR boundary or exit point.

4.10.3 **When the OCA/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 pilot to make position reports by HF voice.

4.10.4 **When the OCA/FIR offers FMC WPR services**, if a flight uses the term “F-M-C” after the aircraft call sign, the aeradio operator should:

1. Issue:
   a) communication instruction for the next OCA/FIR; or
   b) communications instructions and the frequency to contact the appropriate ATS unit approaching, or over, the exit point; or
   c) instructions for the flight to call the aeradio station serving the next OCA/FIR at a time or location prior to the next OCA/FIR boundary or exit point.

4.10.5 **When the OCA/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:

1. Advise the flight that
   ““CPDLC SERVICE NOT AVAILABLE IN (name) OCA/FIR”;

2. Issue:
   a) communication instruction for the next OCA/FIR; or
   b) communications instructions and the frequency to contact the appropriate ATS unit approaching, or over, the exit point; or
   c) instructions for the flight to call the aeradio station serving the next OCA/FIR at a time or location prior the next OCA/FIR boundary or exit point.

4.10.6 During CPDLC operations, if a flight uses the term “C-P-D-L-C” after the aircraft call sign, the aeradio operator should:

1. Advise the flight that;
   “(type) FREQUENCIES WILL BE ASSIGNED VIA CPDLC”; and

2. Issue:
   a) communication instructions for the next OCA/FIR; or
   b) communication instructions and the frequency to contact the appropriate ATS unit approaching, or over, the exit point; or
   c) instructions for the flight to call the aeradio station serving the next OCA/FIR at a time or location prior to the next OCA/FIR boundary or exit point.

4.11 Aeradio - Delayed CPDLC Messages

4.11.1 If a 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 must include this notation when relaying the associated communication to ATC (see 4.6.11 for flight crew procedures and 4.6.11 for further information regarding delayed CPDLC uplinks).

5 CPDLC

5.1 Definition of terms

An example exchange between a flight and the ground is included after this section, to further illustrate the meaning of these terms.

Message element – a portion of a message. Each message element is assigned a particular set of attributes that determine:
a) its priority;
b) whether it will close other message elements;
c) which other message elements are suitable responses; and
d) whether it requires a closure response and, if so, which other message elements are able to close it.

Defined message element – a message element whose content and format are pre-determined. A defined message element may require specified information to be inserted, but the rest of the content is not variable. Because of this, defined message elements make automatic processing possible.

Freetext message element (usually referred to as a freetext message) – a message element whose content is variable, i.e. composed by the sender. ATS providers may construct a set of preformatted freetext 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.

Message – an individual uplink or downlink CPDLC communication, made up of one or more message elements (maximum of five).

Downlink message – a CPDLC message sent from an aircraft.

Uplink message – a CPDLC message sent from a ground system.

Preformatted Freetext message – a freetext message that is "pre-composed".

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.

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

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.

Closed message – a message that:
a) contains no message elements that require a response; or
b) has received a closure response.

CPDLC 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 Message Reference Numbers (MRNs) and ending when all of these messages are closed.

5.2 Example Exchange

This example exchange serves to further illustrate the meaning of some CPDLC terms and related concepts. The boldface identification numbers refer to specified uplink or downlink message elements, which are listed in the tables contained in part 8. Message Identification Numbers (MINs) and Message Reference Numbers (MRNs) are further explained in 5.11, and 5.12.

Downlink: Request FL350 MIN = 8	This message consists of one defined message element, **DM6**, into which the requested altitude has been inserted. This message element requires a response. Because of this, the message is open. Because there is an open message, this CPDLC dialogue is still open.
Uplink: STANDBY MRN = 8 MIN = 12	This message consists of one defined message element, **UM1**. This element does not require a response. The MRN links this response to the request (MIN = 8). Because STANDBY will not close a message, the downlink message is still open. Because there is an open message, this dialogue is still open.
Uplink: CLIMB TO AND MAINTAIN FL350. REPORT LEVEL FL350. MRN = 8 MIN = 13	This message consists of two defined message elements, **UM20** and **UM129**, into which a specified level has been inserted. The MRN links this message to the associated downlink request (MIN = 8). This message closes the associated downlink. This message contains two message elements that require a response; therefore, it is an open message. The response that will close this message is the WILCO or UNABLE response to the clearance message element. Because there is an open message, this dialogue is still open.
Downlink: WILCO MRN = 13 MIN = 9	This message consists of one defined message element, **DM0**. This message element does not require a response; therefore, this is a closed message. The MRN links this message to the associated uplink clearance (MIN = 13) This element closes the associated uplink message. Because all messages are now closed, this dialogue is now closed.
Downlink: LEVEL FL350 MIN = 11	This message consists of one defined message element, **DM37**, into which the altitude was inserted by the aircraft system. In FANS 1 aircraft, the altitude in the report is taken from the altitude specified in the uplink message element (**UM129**) and cannot be changed by the pilot. In FANS A or FANS A+ aircraft, the altitude in the report can be changed by the pilot. Downlink reports do not contain MRNs. This message element does not require a response; therefore, this is a closed message. Because there are no open messages, this dialogue is now closed.

5.3 Life Cycle of a CPDLC Connection

5.3.1 AFN Logon (see 2.7 for general information regarding AFN Logon and for the AFN addresses applicable to the NAT region; see 4.2 for procedures regarding AFN Logon)

1. When the flight crew completes the procedure to logon, the aircraft system sends an AFN CONTACT message to a specified ATSU.
2. The ATSU responds with an AFN ACKNOWLEDGEMENT message.
3. AFN Logon is complete.

5.3.2 Establishing the first CPDLC connection

1. The specified ATSU (see 5.3.1 above) sends a CONNECTION REQUEST message to the aircraft.
2. The aircraft responds automatically with a CONNECTION CONFIRM message.
3. The first CPDLC connection is established; this ATSU is the Current Data Authority (or the Active Centre); this connection is an Active connection.
4. CPDLC messages may now be exchanged between the aircraft and the Current Data Authority (CDA).
5. Some ATSUs will establish a CPDLC connection immediately after AFN Logon, however others may wait until the flight is about to enter their airspace before sending the CONNECTION REQUEST. Avionics may display a “Connecting” message during this period.

5.3.3 The Next Data Authority

1. The CDA informs the avionics of the Next Data Authority (Next Centre) by sending the NDA message.
2. The CDA also sends an AFN CONTACT ADVISORY message to the aircraft, providing the avionics with the information required for AFN Logon for the purposes of establishing a CPDLC connection with the Next Data Authority (NDA).
3. The aircraft system responds to the CDA with an AFN RESPONSE message, then sends an AFN CONTACT message to the NDA.
4. The NDA responds to the aircraft system with an AFN ACKNOWLEDGEMENT message.
5. The aircraft system sends an AFN COMPLETE message to the CDA; this advises the CDA that the AFN Logon to the NDA has been satisfactorily completed.

5.3.4 Establishing a second CPDLC connection

1. The NDA sends a CONNECTION REQUEST message to the aircraft.
2. The aircraft responds with a CONNECTION CONFIRM message.
3. At this point there are two CPDLC connections established: the Active CPDLC connection with the CDA and the Inactive CPDLC connection with the NDA.
4. CPDLC messages can only be exchanged with the CDA.

5.3.5 Terminating the active CPDLC Connection (see 5.6 for more information related to the responsibilities of the CDA)

1. At the appropriate time, the CDA sends the END SERVICE message to the aircraft to initiate termination of its Active CPDLC connection.
2. The aircraft responds with a DISCONNECT message, immediately terminating the Active CPDLC connection.
3. The Inactive CPDLC connection becomes Active; the ATSU which was the NDA becomes the CDA.

4. The ATSU that has just become the CDA may now exchange CPDLC messages with the aircraft. The previous CDA can no longer exchange CPDLC messages with the aircraft.
5. If no NDA was nominated, the aircraft will no longer have CPDLC connectivity. The previous CDA can no longer exchange CPDLC messages with the aircraft. The first ATSU to send a CONNECT REQUEST message to the aircraft will become the CDA, as long as an AFN Logon has been completed with that ATSU.

5.4 Establishing a CPDLC Connection

5.4.1 After a flight has completed an AFN Logon, each CPDLC connection is initiated by an ATSU sending the CONNECTION REQUEST message. This may be sent immediately or delayed until the flight is about to enter the ATSU's airspace. The connection is established when the CONNECTION CONFIRM message is subsequently received from the aircraft.

5.4.1.1 If there is no existing connection, and an AFN Logon to the ATSU has been completed, the avionics will accept this connection as the Active connection. The ATSU with the Active CPDLC connection is the CDA.

5.4.1.2 If there is an existing connection, the avionics will check that the initiating ATSU has been established as the NDA. If so, the avionics will accept this connection as the Inactive connection.

5.4.1.3 In all other situations, the avionics will reject the connection request.

5.4.2 A CPDLC connection established between an aircraft and an ATSU is either Active or Inactive.

5.4.2.1 CPDLC messages can be exchanged when a connection is Active.

5.4.2.2 CPDLC messages cannot be exchanged when a connection is Inactive.

5.4.2.3 FANS 1/A aircraft can have two CPDLC connections established, each with a different ATSU. Only one of these connections can be Active at any given time. An Inactive connection becomes Active as soon as the Active connection is terminated.

5.4.2.4 Once a CPDLC connection is established, subsequent CPDLC connections to adjacent OCA's/Fir's will be initiated by each ATSU, as the aircraft transits from one CPDLC OCA to the other.

5.5 Next Data Authority

5.5.1 The ATSU holding the Active CPDLC connection with the aircraft is the CDA.

5.5.2 The only other ATSU that can establish a CPDLC connection with the aircraft while an Active CPDLC connection exists, is the Next Data Authority (NDA).

5.5.3 The CDA establishes the NDA by sending an NDA message to the aircraft. The avionics must receive the NDA message prior to receiving a connection request message from the NDA; otherwise the connection request will be rejected.

5.5.4 The CPDLC connection held by the NDA is Inactive. This connection becomes Active when the NDA becomes the CDA.

5.6 Terminating the Active CPDLC Connection

5.6.1 Under normal conditions, the CDA initiates the CPDLC connection termination sequence by sending an END SERVICE uplink message (see also 5.3.5).

5.6.2 In response to an END SERVICE message:

a) The avionics will downlink a DISCONNECT message. The avionics will consider the aircraft to be disconnected from the CDA as soon as the DISCONNECT message is sent.
b) The Active CPDLC connection will be terminated, which will cause the Inactive CPDLC connection (if established) to become the Active CPDLC connection.
c) The NDA (if any) will now become the CDA and be able to exchange CPDLC messages with the aircraft.

5.6.3 It is the responsibility of the CDA to either (see 4.9.9 and 4.9.10 for related ATS procedures):

a) ensure that no uplink messages remain open before sending the END SERVICE message; or
b) coordinate with the NDA with reference to messages which were open when the END SERVICE message was sent.

5.7 Cautions with the END SERVICE Message

5.7.1 If any **downlink** messages remain open when the aircraft receives an END SERVICE message, the avionics will abort these messages and terminate the CPDLC connection with the CDA. This will not affect the sequence of events reference the CPDLC connection with the NDA as detailed in 5.6.2.

5.7.2 If any **uplink** messages remain open when the aircraft receives an END SERVICE message, the avionics will abort these messages and terminate the CPDLC connections with the CDA. The CPDLC connection with the NDA may also be terminated; in this case, the aircraft must complete another AFN Logon in order to establish an active CPDLC connection with the ATSU that was nominated as the NDA.

5.7.3 If an END SERVICE message is included as part of a multi-element message, and none of those elements requires a WILCO response, the avionics will terminate the Active CPDLC connection.

5.7.4 If an END SERVICE message is included as part of a multi-element message and at least one of those elements requires a WILCO response and:

a) WILCO is sent, the connection with the CDA will be terminated, and the connection with the NDA (if any) will become Active;
b) UNABLE is sent, the END SERVICE message will be ignored; the Active connection with the CDA will not be terminated and the NDA will continue to have an Inactive connection; or
c) STANDBY is sent, the END SERVICE message will be ignored; the Active connection with the CDA will not be terminated and the NDA will continue to have an Inactive connection.
   1. If WILCO is sent subsequently, the connection with the CDA will be terminated, and the connection with the NDA (if any) will become Active; or

2. If UNABLE is sent subsequently, the END SERVICE message will continue to be ignored; the Active connection with the CDA will not be terminated and the NDA will continue to have an Inactive connection.

5.7.5 The END SERVICE message will generally be sent alone.

5.8 Non-delivery of END SERVICE

5.8.1 In unusual circumstances, the END SERVICE message may not trigger the disconnection sequence, or the END SERVICE message may not reach the aircraft.

5.8.2 If the controller becomes aware that such a situation has occurred, the flight crew should be instructed via voice to terminate the connection.

5.8.3 If the flight crew becomes aware that such a situation has occurred, they should advise ATC via voice and manually disconnect from the current ATSU.

5.8.4 In order to resume FANS 1/A data link operations, the flight crew will have to initiate an AFN Logon to the appropriate AFN address.

5.9 CPDLC Messages – General

5.9.1 Where possible, use defined message elements rather than freetext messages. Instructions which modify the flight profile should not be sent using freetext (see 5.14 for more information regarding the use of freetext).

5.9.2 Uplink clearances or instructions should not include message elements that are not dependent on one another. Message elements cannot be responded to separately; the WILCO or UNABLE applies to the entire message. Confusion could result if only part of a clearance or instruction could be complied with.

5.9.3 Downlink requests should not include message elements that are not dependent on one another. Since any response applies to the entire message, confusion could result if only part of the request could be granted. Additionally, if independent requests are included in separate messages, only those that cannot be approved will receive an UNABLE response.

5.9.4 Up to five message elements can be sent within the same message, but the number of elements should be kept to a minimum.

5.9.5 ATC clearances should always receive either a STANDBY, WILCO or UNABLE response. Any other response will result in a voice contact for clarification.

5.9.6 Sending duplicate CPDLC messages could result in misunderstandings or having open messages remaining in the CPDLC connection at the time of transfer to the NDA (see 5.7.1 and 5.7.2 for information related to the effects of sending END SERVICE when there are open messages). If a response is not received in a reasonable amount of time, make inquiries via voice, rather than re-sending the message. This would not apply if an error message indicating non-delivery had been received. In that instance, re-sending the message or using voice would be at the discretion of the pilot or controller concerned.

5.10 Open and Closed Messages

5.10.1 Each message element has, as part of its attributes, the type(s) of response(s) required, if any.

5.10.2 A message that does not contain a message element that requires a response is a closed message.

5.10.3 An open message contains at least one message element that requires a response. Once the response is received, the message becomes closed. Although an acceptable response for some message elements, STANDBY will not close a message.

5.10.4 A CPDLC dialogue consists of a series of messages beginning with an open message and ending when all messages in the dialogue have been closed.

5.11 Message Identification Numbers

5.11.1 During each CPDLC connection, every uplink and downlink message will be assigned a unique Message Identification number (MIN). The MINs for uplink messages will be assigned by the ground system, and those for downlink messages by the avionics.

5.11.2 MINs should be assigned sequentially to each uplink message within each CPDLC connection by the ground system. Some, but not all, avionics systems will assign MINs to downlink messages sequentially. MINs are not associated with particular message elements, only with a particular message sent by either the ground system or the avionics during each CPDLC connection.

5.12 Message Reference Numbers

5.12.1 Message Reference Numbers (MRNs) are directly related to MINs.

5.12.2 When responding to a message, the MIN from that message is included, re-labeled as the MRN. This relates responses to the messages that prompted them.

5.12.3 It is the responsibility of each system to correctly pair off the response with the related original message in order to close a dialogue (see 6.4.1 for information regarding related ATS automation).

5.13 Defined Message Elements

5.13.1 The defined message elements, intended for use in NAT CPDLC operations, are provided in section 8. The use of defined message elements:

a) allows for the possibility of automatic message processing;

b) allows for the possibility of systems providing a menu of appropriate responses to particular message elements, thereby reducing workload and the probability of inappropriate responses;

c) reduces the probability of input errors; and

d) reduces the probability of misunderstandings.

5.14 Freetext Messages

5.14.1 The non-essential use of freetext messages by ATC and flight crews is strongly discouraged.

5.14.2 Uplink freetext messages require that the flight crew send DM3 ROGER prior to responding to the content of the message. For that reason, among others, ATC clearances should not be issued using freetext.

5.14.3 Except for messages containing DM68 (see 8.1 - emergency downlink message elements) downlink freetext messages do not require a closure response. Responses to non-distress freetext messages should not include MRNs (see 6.4.1 for information relating to ATS automation and MRNs).

5.14.4 When a freetext message is required, standard ATC phraseology and format should be used.

5.14.5 Non-essential words and phrases should be avoided. Abbreviations should only be included in freetext messages when they form part of standard ICAO phraseology.

5.14.6 ATSUs may develop lists of preformatted freetext messages, defining their intent. Efforts have been made to develop a common list for use within NAT CPDLC airspace. This list can be found in section 7.

5.15 CPDLC Dialogue Interruption

5.15.1 If a CPDLC dialogue is interrupted by a system shutdown, the entire dialogue should be re-commenced via voice communication.

5.16 Delayed Uplink Messages

5.16.1 A CPDLC function has been implemented in some aircraft. This function identifies whether an uplink message has been received more than XXX seconds after it was sent, where XXX is either a default maximum delay value or a value set by the flight crew. At present, it is not possible to identify the relatively small number of aircraft with this function. To avoid confusion, flight crews will not normally be instructed to set a maximum delay value.

5.16.2 For Airbus aircraft entering a NAT FIR, this function should automatically be re-set to OFF whenever the Current Data Authority changes to a NAT ATSU.

5.16.2.1 It is possible a flight crew may set a maximum delay value, even if not instructed to do so. In this case, the avionics will reject uplink messages that are received after the maximum delay time.

5.16.2.2 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 include a link to the delayed uplink message.

5.16.2.3 If an ATSU receives the above downlink, the following freetext message should be sent: SET MAX UPLINK DELAY VALUE TO 999 SEC. This will minimise the possibility of subsequent uplink messages being rejected. If this message is also rejected, the instruction should be provided via voice.

5.16.2.4 The delayed uplink may be re-sent or the flight contacted via voice, at the controller's discretion.

5.16.3 For most Boeing aircraft entering a NAT FIR, this function should be automatically be set to OFF with the following exceptions:

a) Boeing 777 (AIMS 1 and AIMS 2) aircraft have a default maximum delay value of 360 seconds;

b) all Boeing aircraft whose CPDLC connection has been transferred in accordance with 5.3.4 to 5.3.5 will maintain any maximum delay value enabled during the previous CPDLC connection;

c) Boeing 777 (AIMS 1 and AIMS 2) aircraft will maintain the last maximum delay value enabled during any previous CPDLC connection, until the aircraft has landed; and

d) it is possible the flight crew may set a maximum delay value, even if not instructed to do so.

5.16.4 For Boeing aircraft with this function ON, uplink messages received after the maximum delay time will be displayed to the flight crew, beneath the following text: UPLINK DELAY EXCEEDED.

5.16.4.1 Flight crews should follow the procedures detailed in 4.6.11 or 4.6.12 if a delayed uplink message is received.

5.16.4.2 If an ATSU is advised that a delayed CPDLC message has been received, the following freetext uplink message should be sent: SET MAX UPLINK DELAY VALUE TO 999 SEC. This will minimise the possibility of subsequent uplink messages being rejected. If this message is also rejected, the instruction should be provides via voice.

5.16.4.3 Controllers should be aware of the flight crew procedures detailed in 4.6.11 and 4.6.12 and, at their discretion, re-send the delayed uplink or clarify the situation via voice (see 4.11 for related aeradio procedures).

5.17 Altitude Messages

5.17.1 UM129 REPORT LEVEL [level] will be appended to every altitude clearance where a single level is assigned.

5.17.2 UM175 REPORT REACHING [level] should not be used to determine when an aircraft is level at the specified level. The programmed intent of this message element is 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.

5.17.3 UM119 MAINTAIN [level] will be included as the first message element in messages containing conditional altitude clearance message elements (see UM21, UM22, UM24 and UM25). Including this message element will emphasize that the message contains a conditional altitude clearance and may prevent such clearances being executed prematurely.

5.17.4 In the event that ATC is not able 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:

a) ATC will respond to the request with UM0, UNABLE and

b) Issue a separate message to clear the aircraft to climb to the intermediate level.

5.17.5 Flight crews shall pay special attention to the intended meaning of Uplink Vertical Clearance message elements that contain words "**AT**" or "**BY**" (refer to section 8.3). Operational experience has shown that those message elements are most likely to be misunderstood by flight crews. Flight crews that do not have English as their native language may be especially open to error since the words "**AT**" or "**BY**" may have a different meaning in their native language. It is therefore of utmost importance that flight crews know the meaning of the words "**AT**" and "**BY**" in CPDLC communications. The following table clarifies the intended meaning for these message elements.

5.17.6 **Clarification of Uplink Messages Elements.**

UM #	Message Element	Message Intent	Response
21	AT [time] CLIMB TO AND MAINTAIN [altitude]	Instruction that **AT or AFTER** the specified time, a climb to the specified level is to commence and once reached the specified level is to be maintained.	W/U
22	AT [position] CLIMB TO AND MAINTAIN [altitude]	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	W/U
24	AT [time] DESCEND TO AND MAINTIN [altitude]	Instruction that **AT or AFTER** the specified time, a descent to the specified level is to commence, and once reached, the specified level is to be maintained.	W/U
25	AT [position] DESCEND TO AND MAINTAIN [altitude]	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.	W/U
26	CLIMB TO REACH [altitude] BY [time]	Instruction that a climb is to commence at a rate such that the specified level is reached **AT or BEFORE** the specified time.	W/U
27	CLIMB TO REACH [altitude] BY [position]	Instruction that a climb is to commence at a rate such that the specified level is reached **BEFORE PASSING** the specified position.	W/U
28	DESCEND TO REACH [altitude] BY [time]	Instruction that a descent is to commence at a rate such that the specified level is reached **AT or BEFORE** the specified time.	W/U
29	DESCEND TO REACH [altitude] BY [position]	Instruction that a descent is to commence at a rate such that the specified level is reached **BEFORE PASSING** the specified position.	W/U

5.18 Route Messages

5.18.1 Any uplink or downlink element containing route information should not contain geographic coordinates encoded as per ARINC specification 424. Some coordinates encoded in this format could be mistaken for entirely different coordinates.

5.19 Emergency Messages

5.19.1 It is expected that, in an emergency, flight crews will immediately revert to voice communications. This does not preclude crews from using CPDLC for emergency communications if unable to establish voice contact.

5.19.2 Any downlink message that contains an emergency message element (see 8.1 for the list of emergency message elements) should be treated as an emergency message.

5.19.3 In the event that a controller receives an emergency downlink message he/she should take immediate action to confirm the status and intentions of the aircraft via voice.

5.19.4 Upon receipt of an emergency downlink message, the controller shall indicate to the aircraft that the message was received by:

a) responding with preformatted freetext message 004: ROGER PAN if the message contains **DM55** PAN PAN PAN;
b) responding with preformatted freetext message 005: ROGER MAYDAY if the message contains **DM56** MAYDAY MAYDAY MAYDAY; or
c) responding with UM3 ROGER if the message contains **DM57**, **DM58**, **DM59**, **DM60** or **DM61**.

5.19.5 If an emergency downlink message is inadvertently sent, the flight crew should send DM58 CANCEL EMERGENCY as soon as practicable. After sending DM58, the flight crew should confirm their status and intentions via voice.

5.19.6 Once an emergency downlink message is received, controllers will consider the aircraft to be in an emergency state until confirmed otherwise via voice contact with the flight crew.

5.19.7 Controllers should be aware that altitude information included with DM55 or DM56 may not be reliable. In some cases, this information is included automatically and may not accurately reflect the current altitude or attitude of the aircraft nor the intentions of the flight crew.

5.20 Unsupported Messages

5.20.1 NAT ANSPs shall develop appropriate procedures to respond to all received downlink message elements. Message elements which are not used in the NAT Region are considered "unsupported message elements."

5.20.2 Except for emergency messages (see 6.3 for more information regarding the handling of emergency messages), any CPDLC downlink that contains an 'unsupported message' element is an 'unsupported message.' If such a message is

received by the ground system, the message may not be presented to controllers at some ATSUs.

5.20.3 If an 'unsupported downlink message' is received, the following preformatted freetext message will be uplinked to the flight crew: MESSAGE NOT SUPPORTED BY THIS UNIT. If a flight crew receives this freetext, it means that the CPDLC downlink contained at least one message element that is not supported.

5.21 SatCom Channel Numbers in CPDLC Contact Messages

5.21.1 Airbus and Boeing aircraft use different encoding for the [Frequencysatchannel] variable in CPDLC monitor and contact messages e.g. UM 117, 118 and 119. Air Traffic Controllers are reminded not to use these messages until their systems have been modified to encode the messages in the format appropriate to the type of aircraft to which the message is being sent.

5.21.2 Air Traffic Service Providers are recommended to consider modifying their systems in this respect, in the light of the results from the Sat Voice Trials which are to take place in the NAT. It is recommended that, where practicable, messages with this parameter are disabled to prevent their inadvertent use until such modifications are complete.

6 ATC Automation

6.1 AFN Logon

6.1.1 To ensure that CPDLC messages are sent only to aircraft for which the ATSU has a complete flight plan, an AFN Logon should be rejected if:

a) the aircraft registration in the AFN CONTACT message does not match the aircraft registration in the flight plan;
b) the flight plan does not contain the aircraft registration; or
c) there is no flight plan in the FDPS for the flight.

6.1.2 Hyphens contained in an aircraft registration should not be entered into the ICAO flight plan form. Ground systems should be configured so as 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.

6.1.3 The Shanwick system will be configured to reject AFN Logons from flights that have not been issued oceanic clearances and from westbound flights that will proceed into or transit the Madrid FIR.

6.1.4 Some ATSUs may implement processes to allow CPDLC connections only with approved Operators or aircraft registrations. If implemented, these processes will result in the AFN Logon being rejected, unless the Operator or aircraft registration is approved.

6.2 AFN Complete

6.2.1 It is recommended that ATSUs implement a time parameter of 20 minutes maximum between the sending of the AFN CONTACT ADVISORY message and the receipt of the AFN COMPLETE message.

6.2.2 If the AFN COMPLETE message is not received within the time parameter, the controller should be alerted (see 4.9.7 for information regarding related ATS requirements).

6.3 Emergency Message Element Handling

6.3.1 Ground systems should be configured so as to provide a clear indication to controllers of downlinked messages that contain any of the message elements from the Emergency Message Set (see 8.1 for the list of emergency message elements).

6.3.2 CPDLC operators should be aware of the following:

a) It is not possible for Boeing aircraft to send **DM56** MAYDAY MAYDAY MAYDAY without also sending **DM48** POSITION REPORT [position report]; and
b) It is not possible for B777 aircraft to send **DM55** PAN PAN PAN without also sending **DM48**.

6.4 Automated Responses

6.4.1 Ground systems should be configured so as to automatically respond to requests for re-clearance with:

a) preformatted freetext message 001 or 002 as appropriate (see 7 for a list of NAT freetext messages).

6.4.2 Any downlink message that contains at least one message element that technically requires a response is a message that technically requires a response.

6.4.3 With the exception of UM1 STANDBY, only one uplink message in response to a particular downlink message should have a MRN. If two uplink messages are sent with the same MRN, and neither of those messages is UM1 STANDBY, the second message will be discarded by the avionics and not displayed to the flight crew.

6.4.4 If an uplink message is sent with a MRN and the downlink message with the associated MIN did not technically require a response, the uplink message will be discarded by the avionics and not displayed to the flight crew.

6.4.5 If an uplink message is discarded for the reasons described in 6.4.3 or 6.4.4 above, an error message will be sent to the ground system advising that the MRN was not recognised.

6.4.6 Ground systems should be configured such that uplink messages will have MRNs only if the uplink message is responding to a downlink message that technically requires a response.

6.4.7 Ground systems should be configured such that only one uplink message, other than UM1 STANDBY, will have the MRN that associates it with a particular downlink message.

6.5 Sending the END SERVICE Message

6.5.1 ATSUs may automate the sending of the END SERVICE message, based upon the estimated time aircraft are expected to cross OCA/FIR boundaries.

6.5.2 The parameters for this operation should be detailed in inter-unit Agreements (see 3.3.6 for related ATS provider responsibilities).

6.6 Message Variables

6.6.1 Different standards have been applied to the encoding and display of satellite telephone numbers, which could result in the incorrect number being displayed in the cockpit. For this reason, ground systems should not allow the [Frequencysatchannel] data element to be used for uplinking satellite telephone numbers in MONITOR and CONTACT messages (UM117 to UM122).

6.7 Unsupported Message Uplink

6.7.1 The following uplink message elements are not used in the NAT (new text) and should not be enabled in NAT CPDLC implementations:

UM #	Message Element
6	EXPECT [altitude]
11	EXPECT CRUISE CLIMB AT [time]
12	EXPECT CRUISE CLIMB AT [position]
13	AT [time] EXPECT CLIMB TO [altitude]
14	AT [position] EXPECT CLIMB TO [altitude]
15	AT [time] EXPECT DESCENT TO [altitude]
16	AT [position] EXPECT DESCENT TO [altitude]
17	AT [time] EXPECT CRUISE CLIMB TO [altitude]
18	AT [position] EXPECT CRUISE CLIMB TO [altitude]
33	CRUISE [altitude]
42	EXPECT TO CROSS [position] AT [altitude]
43	EXPECT TO CROSS [position] AT [altitude] OR ABOVE
44	EXPECT TO CROSS [position] AT [altitude] OR BELOW
45	EXPECT TO CROSS [position] AT AND MAINTAIN [altitude]
70	EXPECT BACK ON ROUTE BY [position]
71	EXPECT BACK ON ROUTE BY [time]
85	EXPECT [route clearance]
86	AT [position] EXPECT [route clearance]
87	EXPECT DIRECT TO [position]
88	AT [position] EXPECT DIRECT TO [position]
89	AT [time] EXPECT DIRECT TO [position]
90	AT [altitude] EXPECT DIRECT TO [position]
99	EXPECT [procedure name]
100	AT [time] EXPECT [speed]
101	AT [position] EXPECT [speed]
102	AT [altitude] EXPECT [speed]
103	AT [time] EXPECT [speed] TO [speed]
104	AT [position] EXPECT [speed] TO [speed]
105	AT [altitude] EXPECT [speed] TO [speed]

110	MAINTAIN [speed] TO [speed]
115	DO NOT EXCEED [speed]n
116	RESUME NORMAL SPEED
146	CONFIRM GROUND TRACK
171	CLIMB AT [vertical rate] MINIMUM
172	CLIMB AT [vertical rate] MAXIMUM
173	DESCEND AT [vertical rate] MINIMUM
174	DESCEND AT [vertical rate] MAXIMUM
178	[deleted]
182	CONFIRM ATIS CODE

7 NAT Preformatted Freetext CPDLC Messages

Freetext uplink messages remain open until the receipt of **DM3** ROGER.

It is expected that other NAT provider states will develop messages similar to 001 and 002 for use in their airspace when needed.

Message #	Message Text	Message Intent
001	REQUEST RECEIVED RESPONSE WILL BE VIA GANDER AERADIO	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 Gander aeradio.
002	REQUEST RECEIVED RESPONSE WILL BE VIA VOICE COMMUNICATION	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 Shanwick aeradio.
003	MESSAGE NOT SUPPORTED BY THIS UNIT	The CPDLC downlink message was not part of the approved message set.
004	ROGER PAN	The controller received **DM55** PAN PAN PAN.
005	ROGER MAYDAY	The controller received **DM56** MAYDAY MAYDAY MAYDAY.
006	EXPECT CPDLC TRANSFER AT [time]	The controller is notifying the pilot that the CPDLC transfer process will be delayed until the specified time. If the CPDLC transfer is not completed by the specified time, the pilot shall manually disconnect and logon to the next centre if appropriate.
007	MESSAGE CONTAINS ELEMENT NOT SUPPORTED BY THIS UNIT. MESSAGE REJECTED.	Used by Reykjavik to indicate that part of a downlinked message was not part of the approved set.
008	DOWNLINK <abbreviated downlink message> NOT SUPPORTED BY THIS UNIT	Used by Reykjavik to indicate which element in a message is not part of the approved message set.
009	MESSAGE REJECTED	Used by Reykjavik to indicate that the un-supported message has been rejected.
010	REPEAT VIA VOICE	Used by Reykjavik to indicate that voice should be used to repeat the rejected message.

Nat Preformatted Freetext Messages - continued

011	TRY SATCOM VOICE OR RELAY THROUGH ANOTHER AIRCRAFT	Used by Reykjavik to indicate the action to take in response to a rejected request for voice contact message.
012	MESSAGE NOT SUPPORTED BY THIS FACILITY, CONTACT RTF	Used by Santa Maria to indicate that the downlink message was not part of the approved message set. The message should be passed by voice.

8 NAT FANS CPDLC Message Set

8.1 Emergency Message Elements

Emergency downlink messages do not require a response as part of their attributes. However, emergency downlink messages will receive a response, in order to assure the flight crew that the message has been received, as described in paragraph 5.19.4. See 6.3 regarding related ATS automation.

If any of the downlink message elements from this table are sent, flight crews should send **DM58** CANCEL EMERGENCY once the situation has been resolved.

DM #	Message Element
55	PAN PAN PAN
56	MAYDAY MAYDAY MAYDAY
57	[remaining fuel] OF FUEL REMAINING AND [souls on board] SOULS ON BOARD
58	CANCEL EMERGENCY
59	DIVERTING TO [position] or DIVERTING TO [position] VIA [route]
60	OFFSETTING [direction] [distance offset] OF ROUTE
61	DESCENDING TO [level]
68	*freetext – selecting any of the above message elements will result in this element being enabled for the flight crew to include in the emergency message at their discretion.*

8.2 Response Requirements Key

Type	Closure Responses
W/U	WILCO, UNABLE, will close the uplink message.
A/N	AFFIRM, NEGATIVE, will close the uplink message.
R	ROGER, will close the uplink message.
NE	Most messages with an NE attribute require an operational response. Only the correct operational response is presented to the pilot. The uplink message is considered to be closed on sending and does not require a response to close the dialogue. The WILCO, UNABLE, AFFIRM, NEGATIVE, ROGER, and STANDBY responses are not enabled for pilot selection.
Y	Response required.
N	Response not required
Note: Under some circumstances, an ERROR message will also close an uplink message.	

8.3 Uplink Message Elements

Uplink Responses and Acknowledgements

UM #	Message Element	Message Intent	Response
0	UNABLE	Indicates that ATS cannot comply with the request.	NE
1	STANDBY	Indicates that ATS has received the message and will respond. *The pilot 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.*	NE
2	REQUEST DEFERRED	Indicates that ATS has received the request but it has been deferred until later. *The pilot 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.*	NE
3	ROGER	Indicates that ATS has received and understood the message.	NE
4	AFFIRM	Yes.	NE
5	NEGATIVE	No.	NE

Uplink Vertical Clearances

UM #	Message Element	Message Intent	Response
19	MAINTAIN [altitude]	Instruction to maintain the specified level.	W/U
20	CLIMB TO AND MAINTAIN [altitude]	Instruction that a climb to the specified level is to commence and the level is to be maintained when reached.	W/U
21	AT [time] CLIMB TO AND MAINTAIN [altitude]	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.	W/U

Uplink Vertical Clearances -continued

UM #	Message Element	Message Intent	Response
22	AT [position] 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.	W/U
23	DESCEND TO AND MAINTAIN [altitude]	Instruction that a descent to the specified level is to commence and once reached the specified level is to be maintained.	W/U
24	AT [time] DESCEND TO AND MAINTAIN [altitude]	Instruction that at the specified time, a descent to the specified level is to commence and once reached the specified level is to be maintained.	W/U
25	AT [position] DESCEND TO AND MAINTAIN [altitude]	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.	W/U
26	CLIMB TO REACH [altitude] BY [time]	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 element is not combined with another vertical clearance the altitude specified is the assigned level.*	W/U
27	CLIMB TO REACH [altitude] BY [position]	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 element is not combined with another vertical clearance the altitude specified is the assigned level.*	W/U
28	DESCEND TO REACH [altitude] BY [time]	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 element is not combined with another vertical clearance the altitude specified is the assigned level.*	W/U
29	DESCEND TO REACH [altitude] BY [position]	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 element is not combined with another vertical clearance the altitude specified is the assigned level.*	

Uplink Vertical Clearances - continued

UM #	Message Element	Message Intent	Response
30	MAINTAIN BLOCK [altitude] TO [altitude]	A level within the specified vertical range is to be maintained.	W/U
31	CLIMB TO AND MAINTAIN BLOCK [altitude] TO [altitude]	Instruction that a climb to a level within the specified vertical range is to commence.	W/U
32	DESCEND TO AND MAINTAIN BLOCK [altitude] TO [altitude]	Instruction that a descent to a level within the specified vertical range is to commence.	W/U
34	CRUISE CLIMB TO [altitude]	Instruction that a cruise climb to the specified level is to commence and continue and, once reached, the specified level is to be maintained. [getting this detail from pans 4444]	W/U
35	CRUISE CLIMB ABOVE [altitude]	Instruction to be used in conjunction with an associated level instruction indicating that a cruise climb can commence once above the specified level	W/U
36	EXPEDITE CLIMB TO [altitude]	The climb to the specified level should be made at the aircraft's best rate.	W/U
37	EXPEDITE DESCENT TO [altitude]	The descent to the specified level should be made at the aircraft's best rate.	W/U
38	IMMEDIATELY CLIMB TO [altitude]	Urgent instruction to immediately climb to the specified level.	W/U
39	IMMEDIATELY DESCEND TO [altitude]	Urgent instruction to immediately descend to the specified level.	W/U
40	IMMEDIATELY STOP CLIMB AT [altitude]	Urgent instruction to immediately stop a climb once the specified level is reached.	W/U
41	IMMEDIATELY STOP DESCENT AT [altitude]	Urgent instruction to immediately stop a descent once the specified level is reached.	W/U
50	CROSS [position] BETWEEN [altitude] AND [altitude]	Instruction that the specified position is to be crossed at or before the specified time.	W/U
171	CLIMB AT [vertical rate] MINIMUM	Instruction to climb at not less than the specified rate.	W/U
172	CLIMB AT [vertical rate] MAXIMUM	Instruction to climb at not above the specified rate.	W/U
173	DESCEND AT [vertical rate] MINIMUM	Instruction to descend at not less than the specified rate.	W/U
174	DESCEND AT [vertical rate] MAXIMUM	Instruction to descend at not above the specified rate.	W/U

Uplink Crossing Constraints

UM #	Message Element	Message Intent	Response
46	CROSS [position] AT [altitude]	The specified position is to be crossed at the specified level. This may require the aircraft to modify its climb or descent profile.	W/U
47	CROSS [position] AT OR ABOVE [altitude]	The specified position is to be crossed at or above the specified level.	W/U
48	CROSS [position] AT OR BELOW [altitude]	The specified position is to be crossed at or below the specified level.	W/U
49	CROSS [position] AT AND MAINTAIN [altitude]	Instruction that the specified position is to be crossed at the specified level and that level is to be maintained when reached.	W/U
51	CROSS [position] AT [time]	The specified position is to be crossed at the specified time.	W/U
52	CROSS [position] AT OR BEFORE [time]	The specified position is to be crossed at or before the specified time.	W/U
53	CROSS [position] AT OR AFTER [time]	The specified position is to be crossed at or after the specified time.	W/U
54	CROSS [position] BETWEEN [time] AND [time]	Instruction that the specified position is to be crossed at a time between the specified times.	W/U
55	CROSS [position] AT [speed]	The specified position is to be crossed at the specified speed and the specified speed is to be maintained until further advised.	W/U
56	CROSS [position] AT OR LESS THAN [speed]	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.	W/U
57	CROSS [position] AT OR GREATER THAN [speed]	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.	W/U
58	CROSS [position] AT [time] AT [altitude]	The specified position is to be crossed at the specified time and the specified level.	W/U
59	CROSS [position] AT OR BEFORE [time] AT [altitude]	The specified position is to be crossed at or before the specified time and at the specified level.	W/U
60	CROSS [position] AT OR AFTER [time] AT [altitude]	The specified position is to be crossed at or after the specified time and at the specified level.	W/U
61	CROSS [position] AT AND MAINTAIN [altitude] AT [speed]	Instruction that the specified position is to be crossed at the specified level and speed and the level and speed are to be maintained.	W/U
62	AT [time] CROSS [position] AT AND MAINTAIN [altitude]	Instruction that at the specified time the specified position is to be crossed at the specified level and the level is to be maintained.	W/U
63	AT [time] CROSS [position] AT AND MAINTAIN [altitude] AT [speed]	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.	W/U

Uplink Lateral Offsets

UM #	Message Element	Message Intent	Response
64	OFFSET [direction] [distance offset] OF ROUTE	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction.	W/U
65	AT [position] OFFSET [direction] [distance offset] OF ROUTE	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.	W/U
66	AT [time] OFFSET [direction] [distance offset] OF ROUTE	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.	W/U
67	PROCEED BACK ON ROUTE	The cleared flight route is to be rejoined.	W/U
68	REJOIN ROUTE BY [position]	The cleared flight route is to be rejoined at or before the specified position.	W/U
69	REJOIN ROUTE BY [time]	The cleared flight route is to be rejoined at or before the specified time.	W/U
72	RESUME OWN NAVIGATION	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.	W/U

Uplink Route Modifications

UM #	Message Element	Message Intent	Response
73	[predepartureclearance]	Message will not be used	W/U
74	PROCEED DIRECT TO [position]	Instruction to proceed directly from the present position to the specified position.	W/U
75	WHEN ABLE PROCEED DIRECT TO [position]	Instruction to proceed, when able, directly to the specified position.	W/U
76	AT [time] PROCEED DIRECT TO [position]	Instruction to proceed, at the specified time, to the specified position.	W/U
77	AT [position] PROCEED DIRECT TO [position]	Instruction to proceed, at the specified position, directly to the next specified position.	W/U
78	AT [altitude] PROCEED DIRECT TO [position]	Instruction to proceed, upon reaching the specified level, directly to the specified position.	W/U
79	CLEARED TO [position] VIA [route clearance]	Instruction to proceed to the specified position via the specified route.	W/U
80	CLEARED [route clearance]	Instruction to proceed via the specified route. (3)	W/U
81	CLEARED [procedure name]	Instruction to proceed in accordance with the specified procedure.	W/U

Uplink Route Modifications - continued

82	CLEARED TO DEVIATE UP TO [direction] [distance offset] OF ROUTE	Approval to deviate up to the specified distance from the cleared route in the specified direction.	W/U
83	AT [position] CLEARED [route clearance]	Instruction to proceed from the specified position via the specified route.	W/U
84	AT [position] CLEARED [procedure name]	Instruction to proceed from the specified position via the specified procedure.	W/U
91	HOLD AT [position] MAINTAIN [altitude] INBOUND TRACK [degrees] [direction] TURN LEG TIME [leg type]	Instruction to enter a holding pattern with the specified characteristics at the specified position and level.	W/U
92	HOLD AT [position] AS PUBLISHED MAINTAIN [level]	Instruction to enter a holding pattern with the published characteristics at the specified position and level.	W/U
93	EXPECT FURTHER CLEARANCE AT [time]	Notification that an onwards clearance may be issued at the specified time.	R
94	TURN [direction] HEADING [degrees]	Instruction to turn left or right as specified on to the specified heading.	W/U
95	TURN [direction] GROUND TRACK [degrees]	Instruction to left or right as specified on to the specified track.	W/U
96	FLY PRESENT HEADING	Instruction to continue to fly on the current heading.	W/U
97	AT [position] FLY HEADING [degrees]	Instruction to fly on the specified heading from the specified position.	W/U
98	IMMEDIATELY TURN [direction] HEADING [degrees]	Instruction to turn immediately left or right as specified on the specified heading.	W/U
178	TRACK DETAIL MESSAGE	*Message not defined.*	

Uplink Speed Changes

UM #	Message Element	Message Intent	Response
106	MAINTAIN [speed]	The specified speed is to be maintained.	W/U
107	MAINTAIN PRESENT SPEED	Instruction that the present speed is to be maintained	W/U
108	MAINTAIN [speed] OR GREATER	The specified speed or a greater speed is to be maintained.	W/U
109	MAINTAIN [speed] OR LESS	The specified speed or a lesser speed is to be maintained.	W/U
110	MAINTAIN [speed] TO [speed]	Instruction that a speed within the specified range is to be maintained.	W/U
111	INCREASE SPEED TO [speed]	The present speed is to be increased to the specified speed and maintained until further advised.	W/U
112	INCREASE SPEED TO [speed] OR GREATER	The present speed is to be increased to the specified speed or greater and maintained at or above the specified speed until further advised.	W/U

Uplink Speed Changes - continued

UM #	Message Element	Message Intent	Response
113	REDUCE SPEED TO [speed]	The present speed is to be reduced to the specified speed and maintained until further advised.	W/U
114	REDUCE SPEED TO [speed] OR LESS	The present speed is to be reduced to the specified speed or less and maintained at or below the specified speed until further advised.	W/U
115	DO NOT EXCEED [speed]	Instruction that the specified speed is not to be exceeded.	W/U
116	RESUME NORMAL SPEED	Instruction that the aircraft's normal speed be resumed. The previously issued speed restriction(s) are cancelled.	W/U

Uplink Contact/Monitor/Surveillance Requests

UM #	Message Element	Message Intent	Response
117	CONTACT [icaounitname] [frequency]	The pilot is required to call the ATS facility on the specified frequency.	W/U
118	AT [position] CONTACT [icaounitname] [frequency]	At the specified position the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	W/U
119	AT [time] CONTACT [icaounitname] [frequency]	At the specified time the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	W/U
120	MONITOR [icaounitname] [frequency]	The pilot is required to monitor the ATS facility on the specified frequency. The pilot is not required to check in.	W/U
121	AT [position] MONITOR [icaounitname] [frequency]	At the specified position the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. The pilot is not required to check in.	W/U
122	AT [time] MONITOR [icaounitname] [frequency]	At the specified time the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. The pilot is not required to check in.	W/U
123	SQUAWK [beacon code]	The specified code (SSR code) is to be selected.	W/U
124	STOP SQUAWK	The SSR transponder responses are to be disabled.	W/U
125	SQUAWK ALTITUDE	The SSR transponder responses should include level information.	W/U
126	STOP ALTITUDE SQUAWK	The SSR transponder responses should no longer include level information.	W/U
179	SQUAWK IDENT	The "ident" function on the SSR transponder is to be actuated.	W/U

Uplink Report/Confirmation Requests

UM #	Message Element	Message Intent	Response
127	REPORT BACK ON ROUTE	Instruction to report when the aircraft is back on the cleared route.	R
128	REPORT LEAVING [altitude]	Instruction to report when the aircraft has left the specified level. *Either a level that has been maintained, or a level passed through on climb or descent.*	R
129	REPORT LEVEL [altitude]	Instruction to report when the aircraft is in level flight at the specified level.	R
175	REPORT REACHING [altitude]	Instruction to report when the aircraft has reached the specified level. *This element is not be used to determine when an aircraft is in level flight at the specified level.*	R
180	REPORT REACHING BLOCK [altitude] TO [altitude]	Instruction to report when the aircraft is within the specified vertical range.	R
130	REPORT PASSING [position]	Instruction to report when the aircraft has passed the specified position.	R
181	REPORT DISTANCE [to/from] [position]	Instruction to report the present distance to or from the specified position.	NE
131	REPORT REMAINING FUEL AND SOULS ON BOARD	Instruction to report the amount of fuel remaining and the number of persons on board.	NE
132	CONFIRM POSITION	Instruction to report the present position.	NE
133	CONFIRM ALTITUDE	Instruction to report the present level.	NE
134	CONFIRM SPEED	Instruction to report the present speed.	NE
135	CONFIRM ASSIGNED ALTITUDE	Instruction to confirm and acknowledge the currently assigned level.	NE
136	CONFIRM ASSIGNED SPEED	Instruction to confirm and acknowledge the currently assigned speed.	NE
137	CONFIRM ASSIGNED ROUTE	Instruction to confirm and acknowledge the currently assigned route.	NE
138	CONFIRM TIME OVER REPORTED WAYPOINT	Instruction to confirm the previously reported time over the last reported waypoint.	NE
139	CONFIRM REPORTED WAYPOINT	Instruction to confirm the identity of the previously reported waypoint.	NE
140	CONFIRM NEXT WAYPOINT	Instruction to confirm the identity of the next waypoint.	NE
141	CONFIRM NEXT WAYPOINT ETA	Instruction to confirm the previously reported estimated time at the next waypoint.	NE

Uplink Report/Confirmation Requests - continued

UM #	Message Element	Message Intent	Response
142	CONFIRM ENSUING WAYPOINT	Instruction to confirm the identity of the next plus one waypoint.	NE
143	CONFIRM REQUEST	The request was not understood. It should be clarified and resubmitted.	NE
144	CONFIRM SQUAWK	Instruction to report the currently selected transponder code.	NE
145	CONFIRM HEADING	Instruction to report the present heading.	NE
146	REPORT GROUND TRACK	Instruction to report the present ground track.	Y
147	REQUEST POSITION REPORT	Instruction to make a position report. *To be used if the controller does not receive a scheduled position report.*	Y
182	CONFIRM ATIS CODE	Instruction to report the identification code of the last ATIS received.	Y

Uplink Negotiation Requests

UM #	Message Element	Message Intent	Response
148	WHEN CAN YOU ACCEPT [altitude]	Request for the earliest time at which the specified level can be accepted.	NE
149	CAN YOU ACCEPT [altitude] AT [position]	Instruction to report whether or not the specified level can be accepted at the specified position.	A/N
150	CAN YOU ACCEPT [altitude] AT [time]	Instruction to report whether or not the specified level can be accepted at the specified time.	A/N
151	WHEN CAN YOU ACCEPT [speed]	Request for the earliest time at which the specified speed can be accepted.	NE
152	WHEN CAN YOU ACCEPT [direction] [distance] OFFSET	Request for the earliest time at which the specified offset track can be accepted.	NE

Uplink Air Traffic Advisories

UM #	Message Element	Message Intent	Response
153	ALTIMETER [altimeter]	ATS advisory that the altimeter setting should be the specified setting.	R
154	RADAR SERVICES TERMINATED	ATS advisory that the radar service is terminated.	R
155	RADAR CONTACT [position]	ATS advisory that radar contact has been established at the specified position.	R
156	RADAR CONTACT LOST	ATS advisory that radar contact has been lost.	R
157	CHECK STUCK MICROPHONE [frequency]	A continuous transmission is detected on the specified frequency. Check the microphone button.	R
158	ATIS [atis code]	ATS advisory that the ATIS information identified by the specified code is the current ATIS information.	R

Uplink System Management Messages

UM #	Message Element	Message Intent	Response
159	ERROR [error information]	A system generated message that the ground system has detected an error.	NE
160	NEXT DATA AUTHORITY [facility designation]	Notification to the avionics that the next data authority is the specified ATSU.	NE
161	END SERVICE	Notification to the avionics that the data link connection with the current data authority is being terminated.	NE
162	SERVICE UNAVAILABLE	Notification that the ground system does not support this message.	NE
163	[icao facility designation] [tp4Table]	Notification to the pilot of an ATSU identifier.	NE

Uplink Additional Messages

UM #	Message Element	Message Intent	Response
164	WHEN READY	The associated instruction may be complied with at any future time.	NE
165	THEN	Used to link two messages, indicating the proper order of execution of clearances/instructions.	NE
166	DUE TO TRAFFIC	The associated instruction is issued due to traffic considerations.	NE
167	DUE TO AIRSPACE RESTRICTION	The associated instruction is issued due to airspace restrictions.	NE
168	DISREGARD	The indicated communication should be ignored. *The previously sent uplink CPDLC message shall be ignored. DISREGARD should not refer to a clearance or instruction. If DISREGARD is used, another element shall be added to clarify which message is to be disregarded.*	R
176	MAINTAIN OWN SEPARATION AND VMC	Notification that the pilot is responsible for maintaining separation from other traffic and is also responsible for maintaining Visual Meteorological Conditions.	W/U
177	AT PILOTS DISCRETION	Used in conjunction with a clearance or instruction to indicate that the pilot may execute when prepared to do so.	N
169	[freetext]	*Normal urgency attribute.*	R
170	[freetext]	*Distress urgency attribute.*	R

8.4 Downlink Message Elements

Downlink Responses and Acknowledgements

DM #	Message Element	Message Intent	Response
0	WILCO	The instruction is understood and will be complied with.	N
1	UNABLE	Indicates that the pilot cannot comply with the request.	N
2	STANDBY	Wait for a reply. *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.*	N
3	ROGER	ROGER *is the only correct response to an uplink freetext message. Under no circumstances will* ROGER *be used instead of* AFFIRM.	N
4	AFFIRM	Yes. AFFIRM *is an appropriate response to an uplinked negotiation request*.	N
5	NEGATIVE	No. NEGATIVE *is an appropriate response to an uplinked negotiation request.*	N

Downlink Vertical Requests

DM #	Message Element	Message Intent	Response
6	REQUEST [altitude]	Request to fly at the specified level.	Y
7	REQUEST BLOCK [altitude] TO [altitude]	Request to fly at a level within the specified vertical range.	Y
8	REQUEST CRUISE CLIMB TO [altitude]	Request to cruise climb to the specified level. *Due to different interpretations between the various ATS units, this element should be avoided.*	Y
9	REQUEST CLIMB TO [altitude]	Request to climb to the specified level.	Y
10	REQUEST DESCENT TO [altitude]	Request to descend to the specified level.	Y
11	AT [position] REQUEST CLIMB TO [altitude]	Request that at the specified position a climb to the specified level be approved.	Y

Downlink Vertical Requests - continued

DM #	Message Element	Message Intent	Response
12	AT [position] REQUEST DESCENT TO [altitude]	Request that at the specified position a descent to the specified level be approved.	Y
13	AT [time] REQUEST CLIMB TO [altitude]	Request that at the specified time a climb to the specified level be approved.	Y
14	AT [time] REQUEST DESCENT TO [altitude]	Request that at the specified time a descent to the specified level be approved.	Y

Downlink Lateral Offset Requests

DM #	Message Element	Message Intent	Response
15	REQUEST OFFSET [direction] [distance] OF ROUTE	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved.	Y
16	AT [position] REQUEST OFFSET [direction] [distance] OF ROUTE	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified position.	Y
17	AT [time] REQUEST OFFSET [direction] [distance] OF ROUTE	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified time.	Y

Downlink Speed Requests

DM #	Message Element	Message Intent	Response
18	REQUEST [speed]	Request to fly at the specified speed.	Y
19	REQUEST [speed] TO [speed]	Request to fly within the specified speed range.	Y

Downlink Voice Contact Requests

DM #	Message Element	Message Intent	Response
20	REQUEST VOICE CONTACT	Request for voice contact.	Y
21	REQUEST VOICE CONTACT [frequency]	Request for voice contact on the specified frequency.	Y

Downlink Route Modification Requests

DM #	Message Element	Message Intent	Response
22	REQUEST DIRECT TO [position]	Request to track from the present position direct to the specified position.	Y
23	REQUEST [procedure name]	Request for the specified procedure clearance.	Y
24	REQUEST [route clearance]	Request for a route clearance.	Y
25	REQUEST CLEARANCE	Request for either a pre-departure or route clearance.	Y
26	REQUEST WEATHER DEVIATION TO [position] VIA [route clearance]	Request for a weather deviation to the specified position via the specified route.	Y

Downlink Route Modification Requests - continued

DM #	Message Element	Message Intent	Response
27	REQUEST WEATHER DEVIATION UP TO [direction] [distance offset] OF ROUTE	Request for a weather deviation up to the specified distance off track in the specified direction.	Y

Downlink Reports

DM #	Message Element	Message Intent	Response
28	LEAVING [altitude]	Notification of leaving the specified level.	N
29	CLIMBING TO [altitude]	Notification of climbing to the specified level.	N
30	DESCENDING TO [altitude]	Notification of descending to the specified level.	N
31	PASSING [position]	Notification of passing the specified position.	N
78	AT [time] [distance] [to/from] [position]	At the specified time, the aircraft's position was as specified.	N
32	PRESENT ALTITUDE [altitude]	Notification of the present level.	N
33	PRESENT POSTION [position]	Notification of the present position.	N
34	PRESENT SPEED [speed]	Notification of the present speed.	N
35	PRESENT HEADING [degrees]	Notification of the present heading in degrees.	N
37	LEVEL [altitude]	Notification that the aircraft is maintaining the specified level.	N
72	REACHING [altitude]	Notification that the aircraft has reached the specified level.	N
76	REACHING BLOCK [altitude] TO [altitude]	Notification that the aircraft has reached a level within the specified vertical range.	N
38	ASSIGNED ALTITUDE [altitude]	Read-back of the assigned level.	N
77	ASSIGNED BLOCK [altitude] TO [altitude]	Read-back of the assigned vertical range.	N
43	NEXT WAYPOINT ETA [time]	The ETA at the next waypoint is as specified.	N
44	ENSUING WAYPOINT [position]	The next plus one waypoint is the specified position.	N
45	REPORTED WAYPOINT [position]	Clarification of previously reported waypoint passage.	N
46	REPORTED WAYPOINT [time]	Clarification of time over previously reported waypoint.	N

Downlink Reports - continued

DM #	Message Element	Message Intent	Response
47	SQUAWKING [beacon code]	The specified (SSR) code has been selected.	N
48	POSITION REPORT [position report]	Reports the current position of the aircraft when the pilot presses the button to send this message. ATC expects position reports based on this downlink message.	N
80	DEVIATING [direction] [distance offset] OF ROUTE	Notification that the aircraft is deviating from the cleared route by the specified distance in the specified direction.	N

Downlink Negotiation Requests

Use of these messages should be avoided since the corresponding uplink messages will not be used by NAT ANSP's (see 6.7)

DM #	Message Element	Message Intent	Response
49	WHEN CAN WE EXPECT [speed]	Request for the earliest time at which a clearance to the specified speed can be expected.	Y
50	WHEN CAN WE EXPECT [speed] TO [speed]	Request for the earliest time at which a clearance to a speed within the specified range can be expected.	Y
51	WHEN CAN WE EXPECT BACK ON ROUTE	Request for the earliest time at which a clearance to regain the planned route can be expected.	Y
52	WHEN CAN WE EXPECT LOWER ALTITUDE	Request for the earliest time at which a clearance to descend can be expected.	Y
53	WHEN CAN WE EXPECT HIGHER ALTITUDE	Request for the earliest time at which a clearance to climb can be expected.	Y
54	WHEN CAN WE EXPECT CRUISE CLIMB TO [altitude]	Request for the earliest time at which a clearance to cruise climb to the specified level can be expected.	Y

Downlink Emergency Messages - see 8.1 Emergency Message Elements

Downlink System Management Messages

DM #	Message Element	Message Intent	Response
62	ERROR [error information]	A system generated message that the avionics has detected an error.	N
63	NOT CURRENT DATA AUTHORITY	A system generated denial to any CPDLC message sent from a ground facility that is not the Current Data Authority.	N
64	[ICAO facility designation]	Notification to the ground system that the specified ATSU is the current data authority.	N
73	[version number]	A system generated message indicating the software version number.	N

Downlink Additional Messages

DM #	Message Element	Message Intent	Response
65	DUE TO WEATHER	Used to explain reasons for aircraft operator's message.	N
66	DUE TO AIRCRAFT PERFORMANCE	Used to explain reasons for aircraft operator's message.	N
74	MAINTAIN OWN SEPARATION AND VMC	States a desire by the pilot to provide his/her own separation and remain in VMC.	N
75	AT PILOTS DISCRETION	Used in conjunction with another message to indicate that the pilot wishes to execute the request when the pilot is prepared to do so.	N
67	[freetext]	*Normal urgency attribute.*	N
67b	WE CAN ACCEPT [altitude] AT [time]	We can accept the specified level at the specified time.	N
67c	WE CAN ACCEPT [speed] AT [time]	We can accept the specified speed at the specified time.	N
67d	WE CAN ACCEPT [direction] [distance offset] AT [time]	We can accept the specified parallel track offset the specified distance in the specified direction at the specified time.	N
67e	WE CANNOT ACCEPT [altitude]	We cannot accept the specified level.	N
67f	WE CANNOT ACCEPT [speed]	We cannot accept the specified speed.	N
67g	WE CANNOT ACCEPT [direction] [distance offset]	We cannot accept the specified parallel track offset the specified distance in the specified direction.	N
67h	WHEN CAN WE EXPECT CLIMB TO [altitude]	Request for the earliest time at which a clearance to climb to the specified level can be expected. Use of this message should be avoided since the corresponding uplink message will not be used by NAT ANSP's (see 6.8)	N
67i	WHEN CAN WE EXPECT DESCENT TO [altitude]	Request for the earliest time at which a clearance to descend to the specified level can be expected. Use of this message should be avoided since the corresponding uplink message will not be used by NAT ANSP's (see 6.8)	N
68	[freetext]	*Distress urgency attribute.*	Y

9 CPDLC Voice Phraseologies

The phrase “CPDLC” is spoken as “see-pee-dee-ell-see”.

The phrase “ADS” is spoken as “ay-dee-ess”.

ATC Phraseology

To instruct flight crews to manually initiate Logon to the subsequent ATSU:

SELECT ATC COM OFF THEN LOGON TO [ATSU name]

Note: Use the ICAO four character code when identifying the ATSU.

Note: Use this phraseology when the NDA message delivery or address forwarding is unsuccessful or when the END SERVICE message does not terminate the CPDLC connection.

To inform aircraft that the FANS 1/A data link has failed:

DATA LINK FAILED. SELECT ATC COM OFF. CONTINUE ON VOICE.

To advise aircraft prior to the commencement of a FANS 1/A data link shutdown:

DATA LINK WILL BE SHUT DOWN. SELECT ATC COMM OFF. CONTINUE ON VOICE.

To advise 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.

To advise of a complete ground system failure:

ALL STATIONS CPDLC FAILURE [identification of station calling].

Pilot Phraseology

To advise ATC that the CPDLC connection is being terminated manually:

CPDLC CONNECTION WITH [current ATSU] TERMINATED. CONNECTING WITH [subsequent ATSU].

Note: The pilot may use the ICAO four-character codes or plain language at his/her discretion.

To advise 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.

To advise a delayed CPDLC uplink has been received:

DELAYED CPDLC MESSAGE RECEIVED.

Note: See 4.6.11 for associated procedures.

10 FMC WPR Test Success Criteria

The table below defines the minimum values to be met and verified. This does not prevent the ATS service providers from negotiating more constraining contractual requirements with their communication service providers if it is thought necessary.

In order to be accepted for FMC WPR, the operators must demonstrate that they can provide FMC waypoint position reports that meet the following criteria.	
1.	**95% of required HF voice Waypoint Position Reports (WPR) that are received from flights that participate, shall be accompanied by FMC WPR's that meet the following requirements:** (Affected ATS units will evaluate trials results and will judge acceptability for operation in the OCA for which they are responsible.
a)	Each FMC report shall be received by the ATC automation within 5 minutes of the aircraft's arrival at the waypoint, as per the reported ATA.
b)	Each FMC report shall contain all data elements that are required for ATC, as per ICAO Doc 4444.
c)	Aircraft Ident (ACID) shall be correct as per filed flight plan.
d)	Reported Position, ATA, Altitude, NEXT Position, ETA, and Ensuing Position data shall be accurate in the following respects, when compared with the corresponding data in any accompanying HF voice WPR's, after accounting for any apparent errors in the HF voice data. *i) Small position discrepancies (up to 2 miles lateral), which can be caused by offsets, shall be discounted.* *ii) Named waypoints shall be reported as such, rather than as lat/long coordinates.* *iii) Altitude discrepancies due to climbs or descents in progress shall be discounted.* *iv) One-minute ATA discrepancies, which can be caused by FMC rounding versus truncating, shall be discounted.* v) Two-minute, or smaller, ETA discrepancies, which can be caused by rounding/truncating differences, and by crew methods of adjusting FMC data when making voice reports, shall be discounted.
2.	**50% of FMC messages shall be received within three minutes of the aircraft's arrival at the waypoint, as per the reported ATA.**
3.	**99% of FMC ATA's shall agree with HF voice ATA's with an error of not more than 1 minute.** **100% of FMC ATA's shall agree with HF voice ATA's with an error of not more than 2 minutes.** However, apparent ATA errors in HF voice WPR's shall be discounted.
4.	**FMC ETA's shall reliably predict ATA's, as accurately as do HF voice ETA's.** Expressing the requirement in engineering terms: The Root-Mean-Square error ('error' being 'ETA minus subsequent ATA') of FMC ETA's shall not exceed that of HF voice ETA's. Investigated errors in HF voice WPR's shall be discounted.

FMC WPR Test Success Criteria - continued

5.	**Fewer than 2% of FMC reports shall be duplicates.**
6.	**Extraneous FMC reports shall be sufficiently few so as to satisfy local requirements**.
7.	**Participating flights (except for those of Boeing 777 aircraft with software prior to BLOCK.01) shall provide for FMC- -derived ARP messages with accurate Wind and Temperature data, to MET facilities as appropriate for each FIR.**
8	**Before a participating ANSP allows aircraft to use FMC instead of HF reporting, they shall ensure that the quality of FMC WPR's is adequate for purposes of ATC in their own FIR (and therefore adequate for purposes of downstream forwarding).**

11 GA ADS WPR Test Success Criteria

The table below defines the minimum values to be met and verified. This does not prevent the ATS service providers from negotiating more constraining contractual requirements with their communication service providers if it is thought necessary.

	Success Criteria
1	**94% of required HF voice Waypoint Position Reports (WPR) that are received from flights that participate, shall be accompanied by ADS WPR's that meet the following requirements:**
	(Affected ATS units will evaluate trials results and will judge acceptability for operation in the OCA for which they are responsible. Consideration shall be given to what improvements can be expected in human and technical factors soon after the operational trial is implemented.)
a)	Each ADS report shall be received by the ATC automation within 5 minutes of the aircraft's arrival at the waypoint, as per the reported ATA.
b)	Each ADS report shall contain all data elements that are required for ATC, as per ICAO Doc 4444.
c)	Aircraft Ident (ACID) shall be correct as per filed flight plan.
d)	Reported Position, ATA, Altitude, NEXT Position, ETA, and Ensuing Position data shall be accurate in the following respects, when compared with the corresponding data in any accompanying HF voice WPR's, after accounting for any apparent errors in the HF voice data.
	i) Small position discrepancies (up to 2 miles lateral), which can be caused by offsets, shall be discounted.
	ii) Altitude discrepancies due to climbs or descents in progress shall be discounted.
	iii) One-minute ATA discrepancies, which can be caused by FMC rounding versus truncating, shall be discounted.
	iv) Two-minute, or smaller, ETA discrepancies, which can be caused by rounding/truncating differences, and by crew methods of adjusting FMC data when making voice reports, shall be discounted.
2	**50% of ADS messages shall be received within three minutes of the aircraft's arrival at the waypoint, as per the reported ATA.**

	Success Criteria – continued
3	**98% of ADS ATA's shall agree with HF voice ATA's with an error of not more than 1 minute.**
	100% of ADS ATA's shall agree with HF voice ATA's with an error of not more than 2 minutes.
	However, apparent ATA errors in HF voice WPR's shall be discounted.
4	**ADS ETA's shall reliably predict ATA's, as accurately as do HF voice ETA's.**
	Expressing the requirement in engineering terms:
	The Root-Mean-Square error ('error' being 'ETA minus subsequent ATA') of FMC ETA's shall not exceed that of HF voice ETA's.
	Investigated errors in HF voice WPR's shall be discounted.
5	**Fewer than 3% of ADS reports shall be duplicates.**
6	**Extraneous ADS reports shall be sufficiently few so as to satisfy local requirements**.
	Affected ATS units will evaluate trials results, and will judge acceptability in consideration of what improvements can be expected in human and technical factors soon after the operational trial is implemented.
	The subsequent operational trial will put controllers in the loop in real time, to recommend further improvements to geographical filtering.
7	**Participating flights shall provide ADS derived ARP messages with accurate Wind and Temperature data, to MET facilities as appropriate for each FIR.**

12 Performance Based Guidance Material for Communications

12.1 Application

12.1.1 Each State should ensure that the ANSPs provide communication services that meet the RCP type, and that contracted CSP's meet their RCP allocations for each oceanic area control centre (OACC) and the flights it serves. The risks represented by the requirements are regarded as being minimum for the specified ATS function to maintain operational efficiency and meets the safety needs.

12.2 Purpose

12.2.1 The requirements herein are intended to support operational and safety requirements as traffic grows, and as horizontal separation minima are reduced. Reduced longitudinal separations will require air traffic control to become more tactical, supported by enhanced intervention capability. The performance requirements will be subject to validation and change as safety risks are further analysed, as monitoring is enhanced, and as operational experience is gained.

12.2.2 The requirements herein are intended to provide meaningful benchmarks for reference to safety oversight, initial qualification, and continued operational performance monitoring.

12.3 Relationship to standards documents

12.3.1 The requirements herein are based on the RTCA DO-306/EUROCAE ED-122 Safety and Performance Standard for Air TrafficData Link Services in Oceanic and Remote Airspace (Oceanic SPR Standard), which includes a supporting safety and performance assessments for existing separation standards provided in ICAO Doc 4444.

12.3.2 Whereas DO-306/ED-122 specifies an Availability value based on safety assessment of the operational effects of the loss of the service, the Availability requirement herein is more stringent, based on an additional need to maintain orderly and efficient operations.

12.3.3 Whereas the DO-306/ED-122 specifies a requirement to indicate loss of the service, an additional time value was associated with the requirement to indicate the loss to the ANSP.

12.4 Performance parameters and meanings

The following are RCP parameter definitions taken from DO-306/ED-122, which are consistent with the ICAO Doc 9869, Manual On Required Communications Performance, and augmented by derived meanings that pertain to the different parts of the end-to-end service.

12.4.1 Meanings for communication supporting intervention and surveillance

Intervention - 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. (ICAO Doc 9869)

Surveillance – position report delivery

- Periodic report, from the start of the periodic interval. The start of the periodic interval occurs when the periodic report is sent by the aircraft/flight crew;
- Waypoint change event report, from the actual time the aircraft crosses the waypoint or is abeam the waypoint;
- Lateral deviation event report, from the time the aircraft system detects that the event has occurred
- Vertical deviation event report, from the time the aircraft system detects that the event has occurred

12.4.2 Communication transaction time - The maximum time for the completion of the operational communication transaction after which the initiator should revert to an alternative procedure.

Position report delivery time – The maximum time for the delivery of a position report from the aircraft to the ANSP.

Meanings for the end-to-end service -

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

- Required Communication Technical Performance (RCTP) – The technical portion of the operational communication transaction (used for intervention) that does not include message composition, operational response, and recognition of the operational response times.

Meanings for the aircraft –

- $RCTP_{AIR}$ for Intervention – The critical transit times for an ATC intervention message from the aircraft's antenna to the flight crew's indication of receipt of the message and from sending the message to the aircraft's antenna.

- $RCTP_{AIR}$ for Surveillance – The critical transit time for a position report from the aircraft's avionics to the antenna.

Meanings for communications service –

- $RCTP_{CSP}$ for Intervention – The summed critical transit times for an ATC intervention message and a response message, allocated to the CSP's.

- $RCTP_{CSP}$ for Surveillance – The critical transit time for a position report allocated to the CSP's.

12.4.3 Continuity - The probability that an operational communication transaction or position report delivery can be completed within the communication transaction time.

Meanings for the end-to-end service -

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

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

Meanings for the aircraft -

- The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{AIR}$ for Intervention.

- The proportion of position reports that can be delivered within the specified RCTPAIR for Surveillance.

Meanings for communications service –

- The proportion of intervention messages and responses that can be delivered within the specified $RCTP_{CSP}$ for Intervention.

- The proportion of position reports that can be delivered within the specified RCTPCSP for surveillance.

12.4.4 Availability – The probability that an operational communication transaction or position report delivery can be initiated when needed.

Meaning for communications service – Total outage proportion of communications service for any given observation period. An outage is an interval during which a

communications service fault prevents the Continuity requirement from being met or service from being initiated, affecting multiple aircraft.

12.4.5 Integrity - The probability of one or more undetected errors in a completed communication transaction or position report delivery. (Modified for clarity from ICAO Doc 9869).

12.5 RCP 400/D Specification

12.5.1 Per DO-306/ED-122, this specification is applicable to data communication.

12.5.2 The end-to-end service shall meet or better these performance parameter values

RCP type	RCP 400	
TRN	370	320
RCTP	310	260
Continuity	0.999	0.95
Integrity	10-5	

The aircraft shall meet or better these performance parameter values:

RCP type	RCP 400	
RCTPAIR for intervention ..(seconds antenna-HMI-antenna]	15	10
RCTPAIR for surveillance (seconds avionics-antenna]	30	15
Continuity	0.999	0.95
Aircraft equipage availability	0.999	

The communications service shall meet or better these performance parameter values:

RCP type	RCP 400	
RCTPCSP for intervention [seconds ATC-aircraft-ATC]	280	240
RCTPCSP for surveillance [seconds aircraft-ATC]	340	270
Continuity	0.999	0.95
Service Availability1	0.999	
Mean time between failures2 (MTBF) [days]	15	
Maximum outage [minutes]	30	
Outage indication delay 3 [minutes]	10	

Notes:

1 – Service Availability of 0.999 implies no more than 9 hours of total outage time in any 12-month period.

2 – A failure is any outage of more than 20 minutes affecting 5 or more aircraft within an OAC's airspace. Failures causing outages for multiple OAC's are not counted more than once.

MTBF of 15 days implies no more than 24 failures in any 12-month period.

3 – After an outage begins, indication delay is the time before the communications service provides ATC automation with a positive indication that there is an outage.

12.6 RCP 240/D Specification

12.6.1 Per DO-306/ED-122, this specification is applicable to data communication.

12.6.2 The end-to-end service shall meet or better these performance parameter values:

RCP type	RCP 240	
TRN ..[seconds ATC HMI-aircraft-ATC HMI]	210	180
RCTP --[seconds ATC HMI-aircraft HMI & aircraft HMI-ATC HMI]	150	120
Continuity	0.999	0.95
Integrity	10-5	

The aircraft shall meet or better these performance parameter values:

RCP type	RCP 240	
RCTPAIR for intervention ..(seconds antenna-HMI-antenna]	15	10
RCTPAIR for surveillance (seconds avionics-antenna]	5	3
Continuity	0.999	0.95
Aircraft equipage availability	0.999	

The communications service shall meet or better these performance parameter values:

RCP type	RCP 240	
RCTP for Intervention [seconds ATC-aircraft-ATC]	120	100
RCTP for surveillance [seconds aircraft-ATC]	170	84
Continuity	0.999	0.95
Service Availability1	0.9999	
Mean time between failures2 (MTBF) [days]	90	
Maximum outage [minutes]	15	
Outage indication delay 3 [minutes]	5	

Notes:

1 – Service Availability of 0.9999 implies no more than 50 minutes of total outage time in any 12-month period for orderly and efficient operations. DO-306/ED-122 requires 0.999 for safety.

2 – A failure is any outage of more than 10 minutes affecting 5 or more aircraft within an OAC's airspace. Failures causing outages for multiple OAC's are not counted more than once. MTBF of 90 days implies no more than four failures in any 12-month period.

3 – After an outage begins, indication delay is the time before the communications service provides ATC automation with a positive indication that there is an outage.

12.7 Monitoring and Alerting

12.7.1 While aircraft, operators and air traffic service provision may be qualified for a specific RCP type operation, failures may occur which may cause degradation in the performance of the service to something below that which is required by the intended operation. In such cases, real time monitoring and alerting may be necessary to provide indication to the flight crew and/or controller. The monitoring and alerting criteria are yet to be defined.

12.8 Applicability of RCP specifications

12.8.1 Applicability to data link communications

Per DO-306/ED-122RCP types, in conjunction with suitable navigation performance, are deemed to match the needs for safe, orderly and efficient operations as follows.

RCP type	Satisfies requirements as
RCP 240	Normal means of communication for application of 30 NM lateral separation and reduced longitudinal separation minima
RCP 400	Alternative means of communication for application of 30 NM lateral separation and reduced longitudinal separation minima
RCP 400	Normal means of communication for application of lateral separation greater than or equal to 50 NM and time-based longitudinal separation

12.8.2 Applicability to voice communications.

End-to-end voice communications performance required for a given ATC application would be the same as for data link in the same application. However, one link in the end-to-end chain would be very different: Instead of the CSP domain for data link there would be the pilot and ground voice operator and their data displays and keyboard interfaces to their avionics and ATC automation. Regarding RCP240 it would not be possible for a human-to-human-to-machine link to meet the CSP performance requirements. In fact the same is true for RCP400, which in order to support safety improvements specifies integrity and availability well above the level of existing voice communications.

12.8.3 Fallback from data link to voice communications

In evaluating the suitability of voice as a fallback arrangement for a data link service outage it must be borne in mind that controllers might be unable to cope with the workload imposed by DCPC voice – data link and third-party voice share the characteristic of presenting data in a format lending itself to processing by FDPS's without any controller intervention.

From a practical point of view a suitable backup for data link communications arrangement may therefore be required to be either voice through a third-party (implying a need to retain sufficient voice communications operators to carry traffic during failures) or an independent backup data link system.

13 Guidance Material For End-To-End Performance Monitoring Of ATS Communications Services For North Atlantic Airspace

13.1 Background

13.1.1 The North Atlantic FANS Implementation Group (NAT FIG), of the NAT System Planning Group (NAT SPG), has established specific performance requirements for data link systems that support ATS communications and surveillance (CPDLC and ADS-C) in the Region. Those requirements are specified in the GUIDANCE MATERIAL FOR ATS DATA LINK SERVICES IN NORTH ATLANTIC AIRSPACE. The introduction of guidance material for Required Communication Performance (RCP) has added to the monitoring requirements for ATSP's. To ensure that those requirements would be met, there was a need to develop guidance material for end-to-end monitoring of performance against them. A ready model for that was the GUIDANCE MATERIAL FOR END-TO-END SAFETY AND PERFORMANCE MONITORING OF AIR TRAFFIC SERVICE (ATS) DATA LINK SYSTEMS IN THE ASIA/PACIFIC REGION. The guidance material here was based on that document, much of the detail copied verbatim. However many substantial changes were necessary, to account for differences between the APAC and NAT airspaces and the organisations and existing terms of reference of the ICAO groups and agencies serving them.

13.2 ICAO Requirement to carry out performance monitoring

13.2.1 Annex 11, at 2.26.5, 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."

13.2.2 ATS data link applications, such as ADS and CPDLC, are being used increasingly in support of separation and will be use in support of reduced separation minima. Accordingly, it is necessary to provide the monitoring to those data link services, as required by Annex 11. Data link services comprise both a technical and an operational element. This Guidance Material, which provides a structure and methodology for monitoring, applies only to the technical element.

13.2.3 The requirement for on-going monitoring after implementation is based on several factors, including both degradation of performance with time and changes to equipment which may occur, either through modification or under renewal programmes. A major impetus for increased monitoring has been the unanticipated closure of many Ground Earth Stations (GES) around the globe, resulting in loss of dual-GES redundancy in the NAT Region and elsewhere. That has caused grave concern within the NAT System Planning Group (NAT SPG) as to the continuous availability of data link communications for supporting safe and orderly ATS operations in the Region.

13.3 Purpose of Guidance Material

13.3.1 The purpose of this guidance material is to:

- Promote a globally standardised approach for ATS data link communications performance monitoring.
- Promote regional monitoring as opposed to merely per-State monitoring, in order to maximise efficient use of resources including expertise, and to enable a broader shared view of performance.
- Promote the sharing of performance information across regions.
- Provide detailed guidance on the requirements for operating the FANS Central Monitoring Agency (FCMA).

13.4 Role of the NAT FANS Implementation Group (FIG)

13.4.1 The role of the FIG regarding monitoring is to address technical and operational problems affecting the transit of data link aircraft through international airspace. To do this it must oversee the end-to-end monitoring process to ensure the data link system meets, and continues to meet its performance requirements.

13.4.2 The specific tasks of the FIG in that regard are (from the FIG Terms Of Reference):

1. to develop the methodology for the FANS implementation process including harmonization of implementation activities, monitoring requirements*, reporting functions and arrangements among its members for use and distribution of FANS related data*
…
3. to evaluate FANS end to end performance
4. to establish and oversee configuration management for the implementation of FANS systems for the NAT Region
…
7. to implement and administer FANS performance/problem monitoring and reporting system

13.5 FCMA Role and Resources

13.5.1 Work must be done on a daily basis for the NAT FIG to fulfill its role. The FCMA is required to do the daily monitoring, coordination, testing and problem research tasks for the FIG.

13.5.2 Recognising safety oversight responsibilities regarding the implementation and continued use of ATS data link systems, the following apply:

a) States should ensure that the FCMA has the required tools and personnel with the technical skills and experience to carry out the required functions.

b) States should ensure that the agency is adequately funded to carry out its required functions.

13.5.3 The Terms Of Reference for the FCMA are:

The NAT FANS Central Monitoring Agency (FCMA) will be jointly managed by Canada and the United Kingdom and will report to the NAT IMG with respect to FANS implementation, trials and operations.

It will receive and process routine and ad-hoc data and problem reports from end users and interested parties to perform the following functions:

1 *Monitor and report communications performance, availability, and problems, with respect to requirements.*

2 *Develop and promulgate forms, specifications, and procedures required for reporting of problems and routine data.*

3 *Monitor and report message traffic statistics.*

4 *Co-ordinate end-to-end system functionality, performance, and interoperability.*

5 *Co-ordinate in order to diagnose and resolve system problems.*

6 *Co-ordinate the development of ground system navigation databases.*

7 *Report ATSUs' FANS capabilities with respect to trials and operational requirements for the Region. Receive advisories of same from ATS providers.*

8 *Co-ordinate with similar agencies for other airspaces.*

9 *Collect notices of service disruptions, restorations, and major system changes. Correlate the information same* to problems reported.

13.5.4 FCMA Resource Requirements

i. To be effective, the FCMA must have adequate resources and tools. Level of effort depends on the complexity of the traffic being monitored. There are several factors that affect complexity from an ATS monitoring standpoint such as organisation of the airspace, variety in operating procedures, number of aircraft operators, number of airborne equipment variants, number of air traffic service providers, number of ground equipment variants and number of communication service providers.

ii. Coordination is an important part of the FCMA work. In the pursuit of problem resolution, action item resolution, monitoring and testing, many issues arise that require coordination among the various stakeholders. The FCMA has a primary responsibility to provide this coordination function as delegated by the FIG. Coordination with similar agencies in other regions is also important, particularly to expand the information database on problems and trends. An incident may appear to be an isolated case, but the collation of similar reports from different regions might indicate an area that needs more detailed examination.

iii. The following table shows FCMA tasks and the associated resource requirements.

FCMA Task	Resource Requirement
• **Manage any data confidentiality agreements as required**	Access to legal services Technical expertise
• **Develop and administer problem report process:** • **De-identify all reports prior to publication** • **Keep the identified reports for processing** • **Request audit data from communication service providers** • **Assign responsibility for problem resolution where possible** • **Analyse the data** • **Identify trends**	Problem reporting data base Decode capability for ATS data link messages logs and flight data link message traces from CSP's
• **Administer and monitor an informal end-to-end configuration process.**	Technical expertise
• **Report to the FIG**	Technical expertise

13.6 Working Principles for the FCMA

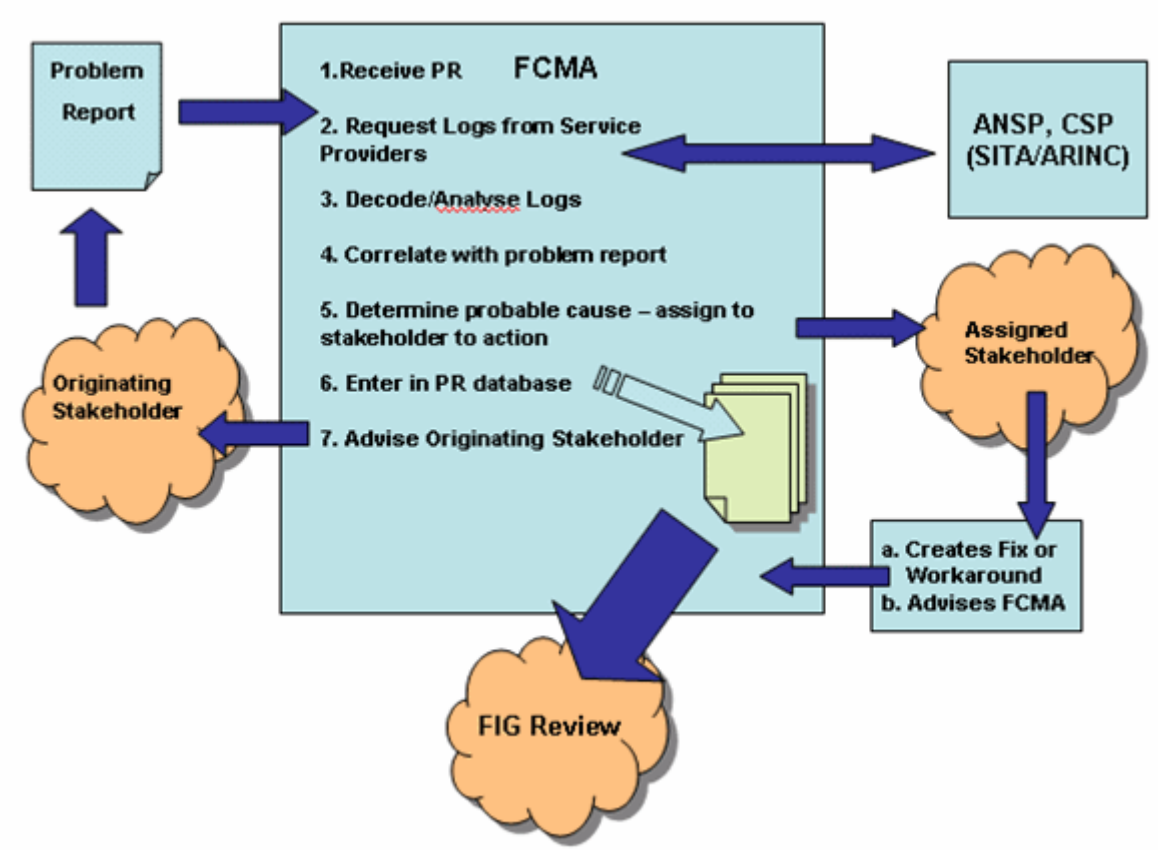
13.6.1 Confidentiality Agreements

i. Confidentiality of information is an established principle for problem reporting, and so reports must be de-identified before being made accessible to other agencies. However, it is necessary for the FCMA to retain the identity of the original reports so that problem resolution and follow-up action can be taken.

ii. The FCMA may initiate and maintain confidentiality agreements with each entity providing problem reports, to the extent required by each. In many cases an entity will have a requirement for confidentiality in one case, but not in another, so it is often more expeditious to address confidentiality on a case-by-case basis.

13.6.2 Problem Identification and Resolution

i. 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 diagram below.



ii. The problem identification task begins with receipt of a report from a stakeholder, usually an operator, ATS provider or communication service provider. If the person reporting the problem has included sufficient information, then data collection can begin. If not, additional data may have to be requested from the person reporting the problem.

iii. The data collection phase consists of obtaining message logs from the appropriate parties (which will depend on which service providers were being used and operator service contracts). This usually means obtaining logs for the appropriate period of time from the communication service providers 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).

iv. Additionally, some airplane-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:

- Aircraft maintenance system logs.
- Built-In Test Equipment data dumps for some airplane systems.
- SATCOM activity logs.

v. 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 organisation collecting data for the analysis task requests all this data in a timely manner, as much of it is subject to limited retention.

vi. 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:

- AFN (ARINC 622), ADS and CPDLC (RTCA DO-258/EUROCAE ED-100)
- ARINC 623 messages used in the region.

vii. The analysis of the decoded messages requires a thorough understanding of the complete message traffic, including:

- Media management messages.
- Relationship of ground-ground and air-ground traffic.
- Message envelope schemes used by the particular data link technology (ACARS).

viii. 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 airplane system problems.

ix. 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.

x. 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.

xi. 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 then forwarded to other regional FCMA's .

13.6.3 Mitigating Procedures

i. The FCMA 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 FCMA should identify the need for such procedures and provide information to support their development for implementation by the service providers and operators involved.

13.6.4 Routine Data Link Performance Reporting

i. An important part of data link safety performance is the measurement of the end-to-end performance. This should, of course, be carried out prior to implementation of new separation minima, but should continue on a regular basis to give assurance that the safety requirements continue to be met. Data link performance assessment is based on the RCP parameters and values in the Performance Based *Guidance Material for Communications* and ATS providers should provide the FCMA with regular measurements of these parameters. It is essential that a common format is used by all ATS providers when supplying their data to the FCMA to simplify the task of creating regional performance assessments.

ii. The FCMA will use the information supplied by ATS providers to produce a performance assessment against the established data link requirements for the region. These requirements are set according to the separation minima being applied, and so may differ within different areas according to usage.

iii. The FCMA performance assessment should be made available to the NAT FIG for their evaluation of system performance against the minimum values defined in the *Performance Based Guidance Material for communications*.

iv. ADS round-trip times are normally measured as the time between sending a contract request and receiving the associated Acknowledgement (ACK) or Message Assurance (MAS) message. CPDLC round-trip times are normally determined from the ATSU end-system time stamps for transmission of the uplink message and reception of the associated MAS.

v. ADS and CPDLC downlink one-way times are defined by the difference between the aircraft time stamp and the ASTU end-system reception time stamp.

vi. ADS and CPDLC success rates are only available for uplink messages. The success rate is expressed as the percentage of messages that receive a successful ACK or MAS within a specified time.

vii. CPDLC Actual Communications Performance (ACP) used for monitoring the RCP TRN is determined by the difference between the time stamp on the CPDLC uplink from the ATSU requiring a Wilco/Unable response to reception of the associated downlink from the aircraft.

Note. When monitoring RCP only those transactions requiring a WILCO/UNABLE response are assessed in order to provide the best modeling of the performance of a CPDLC message used for intervention in a reduced separation scenario.

viii. CPDLC Actual Communications Technical Performance (ACTP) used for monitoring RCTP is determined by the measurement of the difference between the time stamp on the CPDLC uplink and the reception of the corresponding MAS divided by two plus the associated CPDLC downlink time defined by the difference between the aircraft time stamp and the ATSU end-system reception time stamp.

ix. CPDLC Crew Performance is determined by the difference between ACP and ACTP for the same transaction.

13.6.5 Configuration Monitoring

i. A variety of technical systems are involved in the data link process and changes, particularly to software and software parameters, are not infrequent; any change may have an impact on the overall performance of the data link. It is therefore important that the FCMA is kept informed of each change of configuration of each system including aircraft systems. With this information it is often possible to identify changes that lead to improvements or deteriorations in the data link performance or that may be associated with particular problems.

ii. All ATS providers, communication service providers, aircraft operators and avionics suppliers should therefore report all system configuration changes to the FCMA. The FCMA will then maintain a database of configuration changes for each system or sub-system. It is not necessary for the FCMA to know the details of changes, but where a change is expected to affect performance, information on the likely effect should be provided.

13.6.6 New Procedures and Improved Performance Requirements

i. The FCMA may recommend new end-to-end data link system performance requirements, either to accommodate new operational procedures, or to enable better monitoring, or to take account of recognised problems.

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