RTCA, Incorporated
1828 L Street, Northwest, Suite 805
Washington, DC 20036-4001 USA

SAFETY AND PERFORMANCE STANDARD FOR AIR TRAFFIC DATA LINK SERVICES IN OCEANIC AND REMOTE AIRSPACE (OCEANIC SPR STANDARD)

RTCA/DO-xxx
_____, 2007

Prepared by SC-189

Copies of this document may be obtained from

RTCA, Incorporated
1828 L Street, Northwest, Suite 805
Washington, D.C. 20036-4001 U.S.A.

Telephone: 202-833-9339
Facsimile: 202-833-9434
Internet: www.rtca.org

Please contact RTCA for price and ordering information.

FOREWORD

This guidance document was jointly prepared by Special Committee 189 (SC-189) and the European Organization for Civil Aviation Equipment (EUROCAE) Working Group 53 (WG-53) and approved by the RTCA Program Management Committee (PMC) on _____, 2007.

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

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

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

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

This page intentionally left blank.

TABLE OF CONTENTS

ANNEXES

APPENDICES

LIST OF TABLES

LIST OF FIGURES

1 Introduction

This standard provides the operational, safety, and performance requirements (SPR) for the implementation of air traffic data link services in oceanic and remote airspace, referred to as Oceanic SPR Standard. It is intended to support the implementation of communication, navigation, and surveillance/air traffic management (CNS/ATM) systems in worldwide application.

This document was developed in accordance with the criteria for SPR standards set forth in RTCA DO-264/EUROCAE ED-78A, "Guidelines for Approval of the Provision and Use of Air Traffic Services (ATS) Supported by Data Communications." It provides the minimum operational, safety, and performance requirements and allocations based on the results of a coordinated requirements determination process, which includes an operational services and environment information capture, operational safety assessment (OSA), and an operational performance assessment (OPA). These requirements are necessary to provide adequate assurance that the elements of the CNS/ATM system, when operating together, will perform their intended function in an acceptably safe manner.

Figure 1-1 provides an overview of the CNS/ATM system and its elements. These elements comprise the aircraft system, the air traffic service provider (ATSP) provisions, and the operator's provisions to use the data link services. The ATSP and the operator's provisions may include third party or contracted communication services, which are considered in this standard. While the figure is conceptual and shows only one of each kind of component, the actual CNS/ATM system in any airspace typically includes multiple ATSP facilities, operators, and aircraft, all of which provide the intended operational capability to multiple operators in a mixed fleet environment.

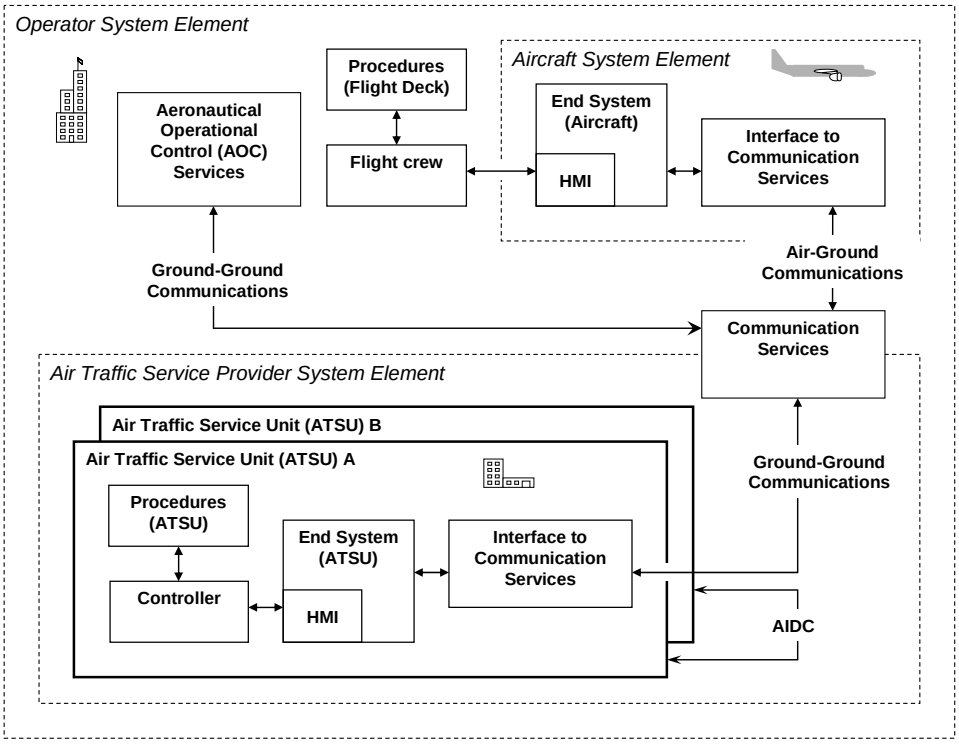

Figure 1-1: Overview of the CNS/ATM system

1.1 Purpose

This document defines and allocates the set of minimum requirements for the operational, safety, and performance aspects for implementations of air traffic data link services in oceanic and remote airspace. Allocation is done by this SPR standard to the necessary elements of the CNS/ATM system.

This SPR standard is intended for use with interoperability requirements (INTEROP) standards, and the guidelines described in DO-264/ED-78A.

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

1.2 Scope

This document provides the operational, safety, and performance requirements for data link services that support specific ATS functions in oceanic and remote airspace. Figure 1-2 provides an overview of the scope of the ATS functions and data link services as it relates to the air traffic services and communication, surveillance, and navigation components.

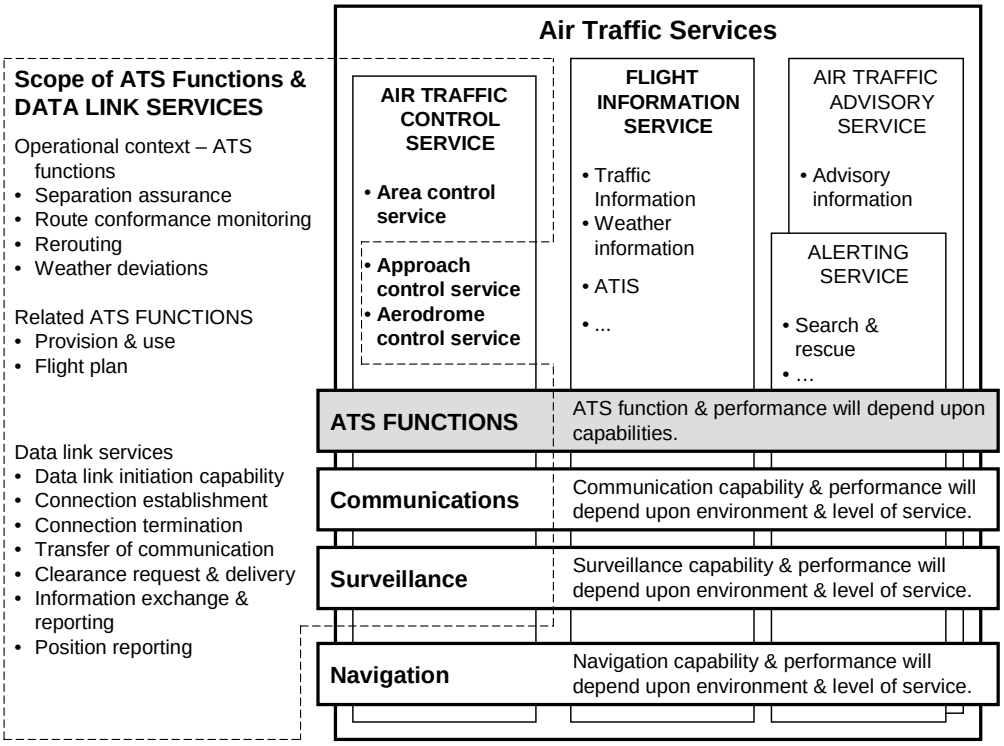

Figure 1-2: Notional relationship of ATS, ATS functions, communications, navigation and surveillance capabilities, and data link services

1.2.1 ATS functions supported by data link services

The ATS functions supported by data link services are:

a) Separation assurance (SA) at 30 NM lateral, 50 NM lateral, 30 NM longitudinal, and 50 NM longitudinal separations, while maintaining 100 NM lateral, 10/15 minute longitudinal separations, in all combinations

b) Route conformance monitoring (RCM)

c) Reroute (RR)

d) Weather deviations (WD)

1.2.2 Data link services

The data link services supporting the ATS functions are:

a) Data link initiation capability (DLIC)

b) Connection establishment (CE)

c) Connection termination (CT)

d) Transfer of communication (TC)

e) Clearance request and delivery (CRD)

f) Information exchange and reporting (IER)

g) Position reporting (PR)

Note 1: The scope is limited to the requirements for operational data link services and related ATS functions when operations, safety, and performance are relevant to the air traffic services. Assumptions for the environment and other ATS functions are stated when necessary to establish the operational, safety and performance requirements for the data link services that are within the scope of the document.

Note 2: This SPR standard is intended to provide the basis for demonstrating that an implemented system, considering its inherent design and technologies, can meet the relevant operational, safety, and performance requirements for the data link services described in this document. It is not intended to limit the use of an implementation only to the data link services and operational context defined herein. However, in cases where it is intended to support additional or define new data link services, the operational, safety and performance requirements for such operational contexts and/or new data link services will need to be established as a basis for approval qualification of the implemented systems.

Note 3: Requirements related to security are beyond the scope of this document.

Note 4: Requirements related to the recording of data communications for accident/incident investigation purposes are beyond the scope of this document.

1.3 Relationships to other documents

1.3.1 ICAO material

This SPR standard considers the operational aspects of International Civil Aviation Organization (ICAO) material. Terminology used in this standard is consistent with ICAO use.

Note: As this SPR standard is intended to be operationally oriented and not based on any particular technology, when ICAO material refers to a specific technology, this standard only considers the operational intent.

This SPR standard provides the results of operational assessments on data link services that supplement the communication equipment required by ICAO Annex 6. These data link services support, in part, the provision and use of ATS governed by ICAO Annexes 2, 10 and 11. The extent to which these data link services can support ATS is described in section 2 of this document.

1.3.2 Approval material

This SPR standard is intended to support approval of a CNS/ATM system element. It is used with INTEROP standards and, when appropriate, other SPR standards, as evidence of a coordinated requirements determination process, which is defined in ED-78A/DO-264. These standards provide the basis for qualifying the operational, safety, and performance aspects of an element of the CNS/ATM system. When qualifying, INTEROP standards are shown to be compatible with the SPR standards.

Note: Recognition of SPR and INTEROP standards and any unique characteristics or adaptation affecting operations, safety, performance, and interoperability for a specific ATS provision, aircraft type design, or operator's operation can be found in the respective AIPs, NOTAMs, AFMs, and operator's specifications.

1.3.2.1 Provisions for requirements and guidance material supporting approvals

This document uses the words "shall," and "should" as follows:

- "shall" indicates a mandated criterion; i.e., compliance is mandatory and no alternative may be applied;
- "should" indicates that although the criterion is regarded as the preferred option, alternative criteria may be applied. In such cases, alternatives should be identified in appropriate approval plans and agreement sought from the approval authority.

Note: In an approval context, the "shalls" are considered a mandated criterion if the:

- *Applicant defines this standard, in conjunction with relevant INTEROP standards, and any adaptation (Refer to RTCA DO-264/EUROCAE ED78A, paragraph 1.3.3), as the approval basis, and*

- *Approval authority accepts this approval basis.*

The approval basis defines the criteria for compliance. "Shoulds" are typically used to describe guidelines for the processes used to produce elements of the system or for meeting the mandated criterion.

1.3.2.2 Additional guidance material supporting approvals

Information on adapting an SPR standard to a specific implementation can be found in paragraph 1.3.3 of DO-264/ED-78A. Guidelines for qualifying a CNS/ATM system element to an SPR standard can be found in section 5 and section 6 of DO-264/ED-78A and ICAO Doc 9869 (for qualifying to an RCP type).

Table 1-1 provides additional guidance to ED-78A/DO-264, paragraphs 4.1.2.1.g) and 4.1.2.2.g). It includes definition of:

a) Acceptable risk for Class 3 and Class 4 operational hazards. Quantitative values are provided to support quantitative analysis, when required for approval, and to facilitate operational and engineering judgment during qualitative analyses. It is not envisaged that quantitative analysis would be required to substantiate risk mitigation for Class 4 operational hazards.

b) Relationships of a software development assurance level to a safety objective. "Development assurance level" determines the level of rigor to be applied throughout system development and qualification. For "development assurance level" of software:

   1) Refer to DO-178B/ED-12B for "failure condition categorization" and its association with aircraft "software level" and guidance for qualifying aircraft software to a "software level."

   2) Refer to ED-109/DO-278 for ATSP "software assurance level" and its association with aircraft "software level" and guidance for qualifying ATSP system software to a "software assurance level."

   3) DO-278/ED-109 is consistent with DO-178B/ED-12B.

Note 1: Table 1-1 does not consider Class 1 and Class 2 operational hazards, which have not been identified for any of the data link services defined in this standard.

Note 2: If the conditions provided in Table 1-1 are not appropriate for the intended environment, then the associated acceptable risk values are not valid. States may need to adapt acceptable risk values to local conditions based on the acceptable risk value per flight hour provided in the table.

Table 1-1: Additional guidance on acceptable risk and software considerations.

Hazard Class (See ED-78A/ DO-264, paragraph 4.1.2.1)	**Class 3**	**Class 4**
Safety Objective (See ED-78A/ DO-264, paragraph 4.1.2.1)	Remote	Probable
Acceptable Risk (average probability) (See paragraph 1.3.2.a)	$<1 \times 10^{-5}$ per flight hour Given that: 1. An ATSU accumulates an average of 1×10^{6} or more flight hours (includes flight hours only of aircraft that are filing to use the data link services) per year (8766 hours of continuous operation) and 2. The identified hazard affects only one aircraft, then the acceptable risk can be defined as: $<1 \times 10^{-3}$ per ATSU hour Given that an average of 10 or less "Class 3" data link service transactions are processed per flight hour, then the acceptable risk can be defined as: $<1 \times 10^{-6}$ per "Class 3" data link service transaction	$<1 \times 10^{-3}$ per flight hour Average probabilities per ATSU hour and per transaction are not defined.
Relationship of a software development assurance level to a safety objective (See paragraph 1.3.2.b)	A failure condition categorization of "major" for the aircraft is associated with a safety objective of "Class 3" hazards occurring no more frequently than "remote."	A failure condition categorization of "minor" for the aircraft is associated with a safety objective of "Class 4" hazards occurring no more frequently than "probable."

1.4 Document organization

This document is organized as follows:

- Section 1 provides an introduction to this SPR standard.

- Section 2 provides characteristics of oceanic and remote airspace and identifies environmental conditions and requirements related to the provision and use of data link services.

- Section 3 provides a description of the ATS functions that are supported by data link services..

- Sections 4 provides a description of the data link services, including operating methods, time sequences of communication transactions, and messages.

- Section 5 includes the results of OSA and OPA, which provide the safety and performance requirements for the data link services.

- Annex A provides operational considerations for data link applications referred by the descriptions of the data link services These operational considerations are not intended to infer any form of technology.

- Annex B provides a summary of requirements for the data link services described in this document and indicates their applicability and allocation to the operator, aircraft system, and ATSP.

- Appendix A provides a description of the conventions used in this standard. These conventions are used to provide traceability and to enable the user to adapt this standard to meet the specific need for any particular implementation.

- Appendix B provides a list of participants who contributed to the development of this SPR standard.

- Appendix C provides a history and how this document satisfies the terms of reference for SC-189/WG-53.

- Appendix D provides an improvement suggestion form.

1.5 Acronyms and glossary of terms

The terminology used in this document is consistent with the terminology of ICAO and ED-78A/DO-264. This document also contains additional terms. The following acronyms and terms are used in this document.

ACRONYMS

ACAS	Airborne Collision Avoidance System
ADS	Automatic Dependent Surveillance
AFM	Aircraft Flight Manual
AIDC	ATS Interfacility Data Communication
AIP	Aeronautical Information Publication
AOC	Aeronautical Operational Control

ACRONYMS

ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATS	Air Traffic Service
ATSP	Air Traffic Services Provider
ATSU	Air Traffic Services Unit
CDA	Current Data Authority
CNS/ATM	Communication, Navigation, and Surveillance/Air Traffic Management
CPDLC	Controller-Pilot Data Link Communications
CSP	Communication Service Provider
D-ATIS	Data Link ATIS
DCPC	Direct Controller/Pilot Communications.
EOBT	Estimated off-block time
ET	Communication transaction time
EUROCAE	European Organisation for Civil Aviation Equipment
FL	Flight Level
FOM	Figure of Merit
HMI	Human Machine Interaction
ICAO	International Civil Aviation Organization
LOCP	Loss Of Communication Process
LOS	Loss Of Service
NDA	Next Data Authority
OPA	Operational Performance Assessment
OSA	Operational Safety Assessment
QSPL	Quantitative Safety Performance Level
RCP	Required Communication Performance
RNP	Required Navigation Performance
RCTP	Required Communications Technical Performance
RTCA	RTCA, Inc.
SPR	Safety and Performance Requirements
SSR	Secondary Surveillance Radar
TRN	Monitored Performance (denotes part of operational communication transaction used to define start and end points for monitoring purposes)
UCT	Undetected Corruption of the Transaction
UIT	Unexpected Interruption of the Transaction

GLOSSARY OF TERMS	
Term	**Definition**
Acceptable risk	A quantitative value that represents the acceptable average probability threshold associated with a safety objective and provides the basis for quantitative analyses to determine that the safety objective is met.
Aeronautical Operational Control (AOC)	Communication required for the exercise of authority over the initiation, continuation, diversion or termination of flight for safety, regularity and efficiency reasons.
Airborne collision avoidance system (ACAS).	An aircraft system based on secondary surveillance radar (SSR) transponder signals which operates independently of ground-based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR transponders.
Aircraft identification	A group of letters, figures or a combination thereof which is either identical to, or the coded equivalent of, the aircraft call sign to be used in air-ground communications, and which is used to identify the aircraft in ground-ground ATS communication. Per ICAO Doc 4444-RAC/501 Part 1
Aircraft system	The aircraft system includes all sub-systems between ENTER key of flight crew's HMI and aircraft antenna.
Air traffic advisory service	A service provided within advisory airspace to ensure separation, in so far as practical, between aircraft which are operating on IFR flight plans. [ICAO]
Air traffic control clearance	Authorization for an aircraft to proceed under conditions specified by an air traffic control unit. *Note 1: For convenience, the term "air traffic control clearance" is frequently abbreviated to "clearance".* *Note 2: The abbreviated term "clearance" may be prefixed by the words "taxi", "take-off", "departure", "en-route", "approach" or "landing" to indicate the particular portion of flight to which the air traffic control clearance relates. [ICAO]*
Air traffic control instruction	Directives issued by air traffic control for the purpose of requiring a pilot to take a specific action. [ICAO]
Air traffic control service	A service provided for the purpose of: preventing collisions: between aircraft, and on the maneuvering area between aircraft and obstructions; and expediting and maintaining an orderly flow of air traffic [ICAO]

GLOSSARY OF TERMS	
Term	**Definition**
Air traffic management	The aggregation of the airborne functions and ground-based functions (air traffic services, airspace management and air traffic flow management) required to ensure the safe and efficient movement of aircraft during all phases of operations. [ICAO]
Air traffic service (ATS)	A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service). [ICAO]
Air traffic service unit	A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office. [ICAO]
Alerting service	A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required. [ICAO]
Application	The ultimate use of an information system, as distinguished from the system itself. [ICAO] *Note: In this document, the term "application" does not imply technology, but is used to express the operational intent of a set of automated algorithms automation or procedures.*
ATS function	An application of air traffic services or portions thereof that satisfies an operational need.
ATS interfacility data communication (AIDC).	Automated data exchange between air traffic services units, particularly in regard to co-ordination and transfer of flights. [ICAO]
ATS procedures	Procedures as defined in ICAO PANS-ATM.
ATS provider	An appropriate ATS authority in a given airspace.
ATSP system	The total ATS provider system including the technical system and operational procedures.
Automatic terminal information service	The automatic provision of current, routine information to arriving and departing aircraft throughout 24 hours or a specified portion thereof: Data link-automatic terminal information service (D-ATIS). The provision of ATIS via data link. Voice-automatic terminal information service (Voice-ATIS). The provision of ATIS by means of continuous and repetitive voice broadcasts. [ICAO]
Availability	The probability that an operational communication transaction can be initiated when needed. (ICAO Doc 9869)
Clearance	See air traffic control clearance

GLOSSARY OF TERMS	
Term	**Definition**
Communication Services	The delivery of data messages and/or voice between end systems.
Communication transaction time (ET)	The maximum time for the completion of the operational communication transaction after which the initiator should revert to an alternative procedure. (ICAO Doc 9869)
Continuity	The probability that an operational communication transaction can be completed within the communication transaction time. (ICAO Doc 9869)
Current Data Authority (CDA)	The designated ground system through which a CPDLC dialogue between a pilot and a controller currently responsible for the flight is permitted to take place. [ICAO PANS/ATM]
Data link application	A data link application is the implementation of data link technology to achieve specific air traffic management (ATM) operational functionalities. For example, in this context the current functionalities are DLIC, ADS, and CPDLC.
Data link service	A set of ATM-related transactions, both system supported and manual, within a data link application, which have a clearly defined operational goal. Each data link service is a description of its recommended use from an operational point of view.
Development assurance	Planned and systematic actions performed to minimize generic errors during development and implementation, and provide confidence that the system is suitable for its intended use. [DO-264/ED-78A]
Direct controller pilot communication	A form of ATC communication between the flight crew and controller in which no other human is involved in completing the operational communication process. *Note 1: For example, use of direct speech circuits, direct voice controller pilot communication, and CPDLC application are considered to be characteristic of direct controller pilot communications.* *Note 2: Definition derived from ICAO PANS/ATM and Annex 11 material.*
End System	A system that contains the human-machine interface, application processing, and is distinct from system components interfacing the communication services. *Note: This definition is modified from ED-78A/DO-264 to remove technological dependencies.*
Estimated off-block time (EOBT)	The estimated time at which the aircraft will commence movement associated with departure. [ICAO]

GLOSSARY OF TERMS	
Term	**Definition**
Eurocae	Eurocae is an international, non-profit making organisation. Membership is open to users and manufacturers in Europe of equipment for aeronautics, trade associations, national civil aviation administrations and, under certain conditions, non-European members. Its work programme is principally directed to the preparation of performance specifications and guidance documents for civil aviation equipment, for adoption and use at European and world wide levels
Flight information service	A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights. [ICAO]
Flight plan	Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft. [ICAO] A flight plan can take several forms, such as: Current flight plan (CPL). The flight plan, including changes, if any, brought about by subsequent clearances. *Note 1: When the word "message" is used as a suffix to this term, it denotes the content and format of the current flight plan data sent from one unit to another.* Filed flight plan (FPL). The flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes. *Note 2: When the word "message" is used as a suffix to this term, it denotes the content and format of the filed flight plan data as transmitted.* Repetitive flight plan (RPL). A flight plan related to a series of frequently recurring, regularly operated individual flights with identical basic features, submitted by an operator for retention and repetitive use by ATS units. Aircraft active flight plan. The flight plan used by the flight crew. The sequence of legs and associated constraints that define the expected 3D or 4D trajectory of the aircraft from takeoff to landing.
Ground-ground communications	Two-way communication among stations or locations on the surface of the earth.
Instruction	See air traffic control instruction.
Integrity	The probability of one or more undetected errors in a completed communication transaction. (Modified for clarity from ICAO Doc 9869)

GLOSSARY OF TERMS	
Term	**Definition**
Monitored Performance (TRN)	The portion of the operational communication transaction that does not include message composition or recognition of the operational response. *Note: TRN is not defined by ED78A/DO264 and has been introduced in this standard to provide practical start and end points for operational monitoring*
Next Data Authority (NDA)	The ground system so designated by the current data authority through which an onward transfer of communications and control can take place.
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)
Operator	A person, organisation or enterprise engaged in or offering to engage in an aircraft operation.
Primary ATC communications	ATC communication capability that is required for operational approval. *Note: The term "primary" is used in this standard with different forms of communication, e.g., primary direct controller pilot communication, to indicate that the form is required for operational approval.*
Quantitative safety performance level (QSPL)	A quantitative value based on the OSA results. QSPLs are used to establish values for the RCP parameters.
Required communication performance (RCP)	A statement of the performance requirements for operational communication in support of specific ATS functions. (ICAO Annex 11)
RCP type	A label (e.g., RCP 240) that represents the values assigned to RCP parameters for communication transaction time, continuity, availability, and integrity. (ICAO Annex 11)
RCP type allocations	RCP type allocation is the process of apportioning the various RCP type values to the various parts of the system. (ICAO Doc 9869)

GLOSSARY OF TERMS	
Term	**Definition**
Required communication technical performance (RCTP)	RCTP is determined for a specific RCP, where the human performance probabilities have been assessed in order to establish the RCTP, i.e., performance requirements bearing on the underlying infrastructure. (DO-264) RCTP is a statement of the performance requirements for operational communication limited to the technical communication portions of the communication process. (ICAO) RCTP=TRN-Responder RCTP is the sum of aircraft system, ATSP system, the operator's CSP and internetworking as appropriate. The first portion of RCTP starts when the message is released by the controller, the flight crew, or by an automated system on behalf of the controller or flight crew, for onward transmission. It ends when the responder receives an indication of the message. The second portion of RCTP starts when the operational reply is released by the responder or by an automated system on behalf of the pilot or controller, for onward transmission. It ends when the initiator receives an indication of the operational response.
Route Clearance	An air traffic control clearance that contains instructions to proceed via a specified route.
Supplemental ATC communication	ATC communication capability that is not required for the intended operation, but if available can be used as an alternative to the primary means in accordance with operational approval. *Note: The term "supplemental" is used in this standard with different forms of communication, e.g., supplemental data communications, to indicate that the form is not required for operational approval.*

1.6 References

The references cited in this document are listed below:

a) RTCA DO-264/EUROCAE ED-78A, Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications.

b) RTCA DO-278/EUROCAE ED-109, Guidelines for Communication, Navigation, Surveillance, and Air Traffic Management (CNS/ATM) Systems Software Integrity Assurance.

c) RTCA DO-178B/EUROCAE ED-12B, Software Considerations for Airborne Systems and Equipment Certification.

d) ICAO Annex 2 — Rules of the Air.

e) ICAO Annex 6 — Operation of Aircraft, Part I - International Commercial Air Transport – Aeroplanes.

f) ICAO Annex 10 — Aeronautical Telecommunications - Volume II (Communications Procedures including those with PANS status).

g) ICAO Annex 11 — Air Traffic Services.

h) ICAO Annex 15 — Aeronautical Information Services.

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

j) ICAO Doc 7030, Regional Supplementary Procedures.

k) ICAO Doc. 9689 — Manual on Airspace Planning Methodology for the Determination of Separation Minima.

l) ICAO Doc 9869 —Manual on Required Communication Performance (RCP).

2 Environmental considerations

This section defines the environmental considerations for oceanic and remote airspace applicable to the provision and use of data link services supporting the ATS functions described in this document. These considerations include environmental characteristics, operational requirements, and conditions to the extent necessary to:

- establish operational requirements for the data link services;
- establish mitigation strategies and related conditions for hazards identified for the data link services; and
- establish capability and performance requirements for the data link services.

2.1 Environmental characteristics

An ATS function can only be provided in an airspace if a set of capabilities and performances defining the complete CNS/ATM system is present in the airspace where it is intended to be used.

This set of capabilities and performances comprises different components: communication, navigation, surveillance, and ATM that are dependent on each other. For instance, the communication and surveillance capability and performance requirements for a given ATS function will depend on the navigation and air traffic management capability and performance requirements.

Since the navigation, surveillance, air traffic management and some communication capabilities are dictated by other standards, the characteristics are provided as environmental conditions. These conditions are based on a review of ICAO material referenced in paragraph 1.6.

Table 2-1 presents an overview of the environmental characteristics for oceanic and remote airspace that are considered in this SPR standard. The a), b), and c) designators maps the different horizontal separation types.

Table 2-1: Oceanic and remote operational environment characteristics – supported and not supported by data link services

Oceanic and remote operational environment	ATS functions not supported by data link services	ATS functions supported by data link services
Airspace characteristics		
Horizontal separation	100 nm or 60 nm lateral/15 min or 10 min longitudinal	a) 100 nm or 60 nm lateral/15 min or 10 min longitudinal b) 50 nm lateral/50 nm longitudinal c) 30 nm lateral/30 nm longitudinal
Vertical separation	RVSM	RVSM
ATS function supported by data link services		Reroute, weather deviation, route conformance monitoring (RCM), separation assurance
Operational assumptions for navigation and ATSU interface		
Navigation	INS (2 nm/hr drift)	a) INS (2 nm/hr drift rate) b) RNP 10 or RNP 4 c) RNP 4
ATSU interface	Voice – HF	Voice – HF Data – FANS-1/A (ED100A/DO258A, Transport & above) – ATN (Annex 10, Vol. 2, & ICAO Doc 9705, Transport & above)
Operational requirements for surveillance and communication		
Note 1: Refer to interoperability standards for requirements specific to the technologies used. *Note 2: See section 5 for complete safety and performance requirements applicable to data link services/applications supporting communication and surveillance. Refer to ICAO Annexes and ICAO Doc 4444 for requirements applicable to voice communication.*		
Surveillance	Procedural position reporting (approx. every 55 minutes)	a) Procedural position reporting (approx. every 55 minutes) b) ADS, 3 minutes report delivery time, waypoint change event report, periodic report at 27 min or 32 min c) ADS, report delivery time at 3 minutes, waypoint change event report, periodic report at 14 min, 5 nm lateral deviation event report

Communication	Third party voice (equivalent to RCP 400)	a) RCP 400 b), Normal communication, DCPC at RCP 240, alternative communication, third party voice (equivalent to RCP 400) c) Normal communication, DCPC at RCP 240, alternative communications, third party voice (equivalent to RCP 400)

2.2 Operational requirements related to communications and surveillance.

Table 2-2 provides the operational capability and performance requirements that relate to the communication and surveillance components, provided in Table 2-1, which supports the ATS functions described in section 3. The table also shows for each operational requirement, which data link services, described in section 4, and the data link applications, described in Annex A, are applicable in the context of the relevant ATS functions. These requirements are used as the basis for determining the safety and performance requirements (section 5) for the data link services.

Note 1: The operational capability and performance requirements were taken from ICAO Annex 2 and ICAO Doc 4444. Guidance material from ICAO Annex 11, Attachment B, and ICAO Doc 7030, Supplemental procedures for the Asia-Pacific Region were used to establish the requirement for a lateral deviation event report when applying a 30 NM lateral separation minimum. Other guidance material related to separation minima can be found at ICAO Doc 9613, ICAO Doc 9869, and ICAO Doc 9689.

Note 2: The 50NM procedural (non-ADS) separation minimum, provided in PANS/ATM, paragraph 5.4.2.6.3.1, and related communication and performance requirements are not considered in this standard, as controller workload is deemed too intensive in practical applications.

Note 3: For 50 NM and 30 NM lateral separation, the navigation requirement is RNP 10/RNP 4 and RNP 4, respectively. In all cases, the minimum communication requirement is voice communication through a third party. Direct controller/pilot communications may be desirable in certain areas, such as areas of known convective weather. The minimum surveillance requirement is the use of procedural position reports.

Note 4: "RNP [x]" is sometimes referred to as "RNAV [x]" for implementations that do not provide monitoring and alerting in non-compliant situations. In this document, the term "RNP [x]" is used consistently with the navigation requirements at the time the separation minima was established in the PANS/ATM.

Table 2-2: Operational requirements for communications and surveillance supporting 50/50 NM and 30/30 NM separation minima

Ref:	Airspace Requirement	Relationship to data link service/application
OR-1	ANNEX 2, paragraph 3.6.5.1. An aircraft operated as a controlled flight shall maintain continuous air-ground voice communication watch on the appropriate communication channel of, and establish two-way communication as necessary with, the appropriate air traffic control unit, except as may be prescribed by the appropriate ATS authority in respect of aircraft forming part of aerodrome traffic at a controlled aerodrome. Note 1: The requirement for an aircraft to maintain air-ground voice communication watch remains in effect after CPDLC has been established.	Normal means of communication for 100or 60 NM lateral/15 or 10 minutes longitudinal separation minima CRD, IER CPDLC application
OR-2	PANS/ATM, paragraph 4.11.1.1. On routes defined by designated significant points, position reports shall be made by the aircraft when over, or as soon as possible after passing, each designated compulsory reporting point, except as provided in 4.11.1.3. Additional reports over other points may be requested by the appropriate ATS unit. PANS/ATM, paragraph 4.11.1.2. On routes not defined by designated significant points, position reports shall be made by the aircraft as soon as possible after the first half hour of flight and at hourly intervals thereafter, except as provided in 4.11.1.3. Additional reports at shorter intervals of time may be requested by the appropriate ATS unit. PANS/ATM, paragraph 5.4.2.1.6. Time-based separation applied in accordance with 5.4.2.2 and 5.4.2.4 may be based on position information and estimates derived from voice reports, CPDLC or ADS.	Normal means of surveillance for 100or 60 NM lateral/15 or 10 minutes longitudinal separation minima PR, IER ADS application CPDLC application

Ref:	Airspace Requirement	Relationship to data link service/application
OR-3	PANS/ATM, paragraph 5.2.2. Degraded aircraft performance. Whenever, as a result of failure or degradation of navigation, communications, altimetry, flight control or other systems, aircraft performance is degraded below the level required for the airspace in which it is operating, the flight crew shall advise the ATC unit concerned without delay. Where the failure or degradation affects the separation minimum currently being employed, the controller shall take action to establish another appropriate type of separation or separation minimum.	Monitoring, indication, and reporting requirements for failures of communication systems CRD, IER, PR ADS application CPDLC application
OR-4	Annex 11, Attachment B, paragraph 3.4.1.e). For a 30 NM lateral separation, an ADS system in which an event contract must be set that includes a lateral deviation event report whenever a deviation from track centre line greater than 9.3 km (5 NM) occurs. Note 2: The safety assessment in this standard considers the potential loss of the lateral deviation event report as an insignificant contributor to any hazard. Further safety assessment and appropriate risk mitigation strategies would need to be put in place for implementations that rely on the lateral deviation event report for separation assurance.	Normal means of surveillance for 30 NM lateral separation minimum IER ADS application – 5 NM lateral deviation event report functionality
OR-5	PANS/ATM, paragraph 5.4.2.6.2.2. Direct controller-pilot communications shall be maintained while applying a distance-based separation minima. Direct controller-pilot communications shall be voice or CPDLC. The communication criteria necessary for CPDLC to satisfy the requirement for direct controller-pilot communications shall be established by an appropriate safety assessment.	Normal means of communication for 50 NM and 30 NM longitudinal separation minima – DCPC capability CRD, IER CPDLC application
OR-6	PANS/ATM, paragraph 5.4.2.6.4.1 (partial). Separation based on the use of ADS shall be applied so that the distance between the calculated positions of the aircraft is never less than the prescribed minimum.	Normal means of surveillance for 50 NM and 30 NM longitudinal separation minima PR ADS application

Ref:	Airspace Requirement	Relationship to data link service/application
OR-7	PANS/ATM, 5.4.2.6.2.2.1. Prior to and during the application of a distance-based separation minimum, the controller should determine the adequacy of the available communication link, considering the time element required to receive replies from two or more aircraft, and the overall workload/traffic volume associated with the application of such minima. Note 3: The capability to determine the adequacy of available communication link contributes to risk mitigation strategies for the following safety objectives: SO-1, loss of data link service SO-3, interruption of the transaction SO-4, detected late or expired message SO-7, undetected late or expired message Note 4: Whether or not the controller is involved in determining the adequacy is a local matter.	Normal means of communication for 50 NM and 30 NM longitudinal separation minima CRD, IER CPDLC continuity, availability, and integrity. Normal means of surveillance PR, IER ADS continuity, availability, and integrity.
OR-8	PANS/ATM, paragraph 5.4.2.6.4.3.2. The communication system provided to enable the application of the separation minima in 5.4.2.6.4.3 shall allow a controller, within 4 minutes, to intervene and resolve a potential conflict by contacting an aircraft using the normal means of communication. An alternative means shall be available to allow the controller to intervene and resolve the conflict within a total time of 10½ minutes, should the normal means of communication fail.	Normal mean of communication (intervention) for 50 NM and 30 NM longitudinal separation – DCPC capability CRD CPDLC transaction time value is a function of 4 min. *Note 5: Alternative means of communication is assumed to be third party voice – transaction times are assumed to be a function of 10½ min.* *Note 6: Values are at 95% probability.*

Ref:	Airspace Requirement	Relationship to data link service/application
OR-9	PANS/ATM, paragraph 5.4.2.6.4.3.3. When an ADS periodic or waypoint change event report is not received within 3 minutes of the time it should have been sent, the report is considered overdue and the controller shall take action to obtain the report as quickly as possible, normally by ADS or CPDLC. If a report is not received within 6 minutes of the time the original report should have been sent, and there is a possibility of loss of separation with other aircraft, the controller shall take action to resolve any potential conflict(s) as soon as possible. The communication means provided shall be such that the conflict is resolved within a further 7½ minutes.	Normal means of surveillance for 50 NM and 30 NM longitudinal separation – report delivery time is a function of 3 min. PR ADS periodic report, and ADS waypoint change event report 1st attempt transaction time is function of 6 minutes, using either IER ADS demand contract/report; or CPDLC request/response. *Note 7: Alternative means of communication (2nd attempt) is assumed to be third party voice – transaction times are assumed to be a function of 7½ min.* *Note 8: Values are at 95% probability.*

2.3 Environmental conditions

Table 2-3 provides specific environmental conditions relevant to the operational safety (OSA) and performance assessments (OPA) results.

Table 2-3: Environmental conditions relevant to the OSA and OPA results

Reference	Environmental Condition
C-ENV-1	In airspace where ATC data link services are used, DCPC or third party voice communication, as required by the operating rule, are available.
C-ENV-2	Surveillance enables the controller to detect aircraft deviation from the route clearance.
C-ENV-3	The airspace to which the clearance pertains is protected until the controller receives the response.
C-ENV-4	Separation minima is applied in accordance with the PANS-ATM (Doc 4444) and Part 1 of the Regional Supplementary Procedures (Doc 7030).

Reference	Environmental Condition
C-ENV-5	Aircraft are equipped with weather radar with a range of 40 NM minimum in order to provide sufficient time in the intervention buffer to revert to voice communication in case of data link communication failure.
C-ENV-6	Reduced separation standard as defined in ICAO 4444 provides sufficient time in the intervention buffer to revert to DCPC or voice communication when a current or future loss of separation is detected in case of data link communication failure.
C-ENV-7	Aircraft are flying the current flight plan according to the navigation performance required for the separation minima.
C-ENV-8	Weather deviation procedure is applied in accordance with §15-2-3 of PANS/ATM doc 4444 (14th Ed). *Note: This procedure also details the procedures to be followed when ATC clearance cannot be obtained, and deviation under the authority of the pilot-in-command is necessary in accordance with the provisions of Annex 2 § 2.3.1.*

3 Description of ATS functions

This section provides a description of the ATS functions that are supported by the data link services defined in this standard. The ATS functions are:

a) Separation assurance (SA) at 50 NM lateral, 50 NM longitudinal, 30 NM lateral, 30 NM longitudinal separations in any combination

b) Route conformance monitoring (RCM)

c) Reroute (RR)

d) Weather deviations (WD)

It also provides a description of provision and use and flight planning, which are related ATS functions, but not directly supported by the data link services.

3.1 Operational capabilities provided by data link services

Data link services are intended to provide for the following communication and surveillance capability and performance that support the ATS functions:

a) Supplemental communications, i.e., not required by operating rules. Supplemental means are characterized as follows:

   1) Used in situations where the delay or loss in operational data communications is not significant to the safety of operations. Delay or loss in operational data communications may be significant to operational usefulness of the system.

   2) Procedures are established to revert to ATC voice communications, as required by operating rules, and within acceptable time limits when data link service can no longer be provided.

   3) Required ATC communication, e.g., HF voice, has the functionality and performance to satisfy the operational capability provided by the data link services in the event of loss of those data link services.

   4) Provides sufficient integrity of operational communications to avoid the need for procedural mitigation of anomalous behavior of the system (e.g., voice read-back of the data message).

b) Primary communications, including direct controller-pilot communications. Primary means are characterized as follows:

   1) Qualified to the operational, safety, and performance requirements required for supporting the ATS function.

2) Procedures are established to revert to degraded operation within acceptable time limits when primary communications are lost and others means of communication are not adequate to perform the intended ATS functions, e.g., procedures to apply an alternative form of separation.

3) Approved for Use.

c) Primary surveillance, for example, the PR and IER data link services provide automated surveillance capability and is normally used. HF voice position reporting remains as a backup.

Data link services will provide aircraft information to the controller for communication and surveillance capability and performance.

3.1.1 Relationship of ATS functions, data link services, and data link applications to ATS procedures

Table 3-1 shows the relationship among data link services, air traffic services, and related international ATS procedures as defined in ICAO PANS-ATM. The table signifies those international ATS procedures for which the data link services described in this document were intended. States that adapt this standard to apply to international ATS procedures not indicated in the table will need to assess the applicability of the data link services to those procedures.

Table 3-1: Relationship of ATS Functions, data link services and data link applications to ICAO PANS-ATM procedures

ATS Functions, data link service, or data link application	Related Annex 11 air traffic services	Related PANS-ATM procedure
ATS Functions		
SA	ATC area control service	5, Separation methods and minima
RCM	ATC area control service	13, Automatic dependent surveillance services
RR	ATC area control service	11.4.2.2.4 Modification (chg) messages
WD	ATC area control service	11.4.2.2.4 Modification (chg) messages
Data link services		
DLIC	General	4.15, Data link initiation procedures
CE	ATC area control service	4.15, Data link initiation procedures

ATS Functions, data link service, or data link application	Related Annex 11 air traffic services	Related PANS-ATM procedure
CT	ATC area control service	10.4, Coordination in respect of the provision of air traffic control service [Includes transfer of communication]
TC	ATC area control service	8.7.5, 10.4.2.4, Transfer of communication
CRD	ATC area control service	4.5, Air traffic control clearances 4.6, Horizontal speed control instructions 4.7, Vertical speed control instructions 4.13, Presentation and updating of flight plan and control data 11, Air traffic service messages
IER	ATC area control service	4.12, Reporting of operational and meteorological information 8.8, Emergencies, hazards and equipment failures 11, Air traffic service messages 15, Procedures related to emergencies, communication failure and contingencies
PR	ATC area control service	4.11, Position reporting
Data link applications		
DLIC	ATC area control service	4.15, Data link initiation procedures
CPDLC	ATC area control service	14, Controller pilot data link communications
ADS	ATC area control service	13, Automatic dependent surveillance services
Supporting AOC applications	AOC	Not applicable

3.1.2 Data link services supporting ATS functions

Table 3-2 provides the data link services that support each of the ATS functions.

Table 3-2: Data link services supporting ATS functions

	SA	RCM	RR	WD
DLIC	X	X	X	X
CE	X	X	X	X
CT	X	X	X	
TC	X			
CRD	X	X	X	X
IER	X	X		X
PR	X	X		X

Figure 3-1 shows the dependencies among the related ATS functions and data link services. Prior to operational use of data link services in a particular airspace:

a) Operators, the State, and its ATS provider satisfy the prerequisites for the provision and use of ATS functions. Operators file flight plans indicating intent to use the data link services and ATS providers accept flight plans, per paragraph 3.1.4;

b) For data link services enabled via the CPDLC application and/or the ADS application, the flight crew and ATSU complete DLIC per paragraph 4.1; and

Note: Position reporting can be enabled via supporting AOC applications, which are not dependent on DLIC. However, other means are used to uniquely identify the aircraft and the ATSU and to determine that the aircraft equipage is compatible with the data link service provision.

c) The ATSU and flight crew take appropriate actions to provide and use the ATS functions. Environmental conditions, per section 2, are valid. The data link services that provide communication and surveillance supporting the ATS function, as per Table 3-2, are described in section 4. The safety and performance requirements for each of those data link services are established based on its operational context with the ATS function as follows:

   1) SA per paragraph 3.2,

   2) RCM per paragraph 3.3,

   3) RR per paragraph 3.4,

   4) WD per paragrapgh 3.5.

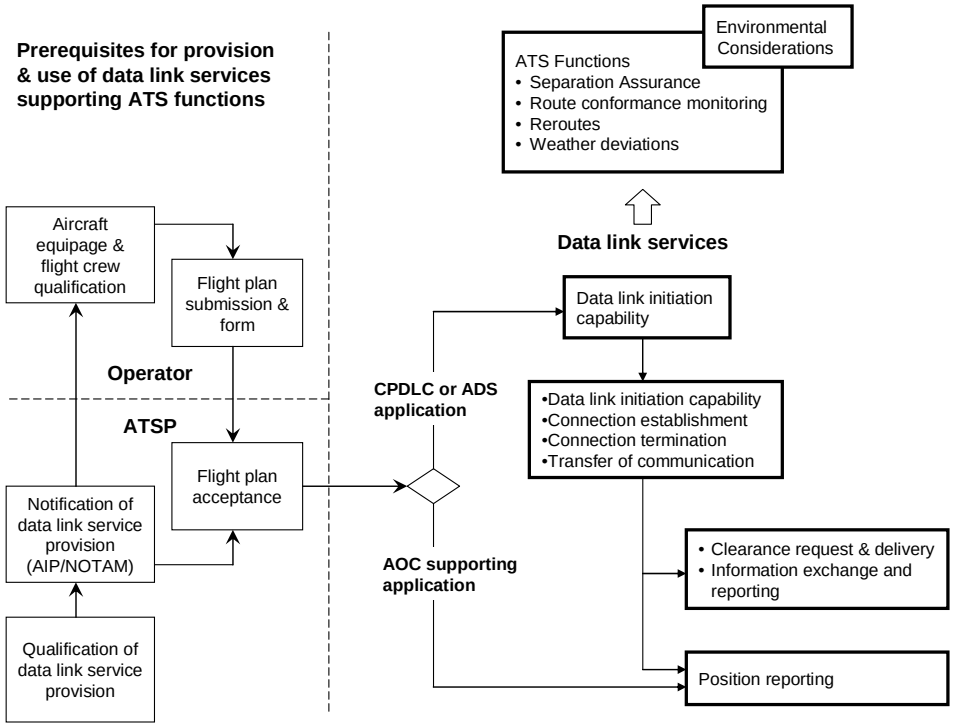

Figure 3-1: Dependency diagram of data link services

3.1.3 Provision and use

a) The ATS provider qualifies and obtains approval of the data link service for operational use.

b) The ATS provider notifies operators of data link services using the AIP or NOTAM. Notification indicates:

1) ATS facility designation, e.g., 4 character ICAO code;

2) Technology dependent parameters, as applicable, e.g., DLIC address;

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

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

5) Requirements for use, including procedures for initiation and RCP; and

6) Flight plan form and submission requirements.

Note: Data link services are provided in an environment that is consistent with the standards set forth in ICAO material as described in paragraph 1.3.1 of this document. Environments that deviate from this ICAO material will need to be assessed by the State against the criteria set forth in this standard to determine the suitability of the data link services in such environments.

c) The operator obtains information for flight planning and use of data link services from AIPs/NOTAMs and flight manuals to formulate approved operating specifications. The operator determines:

1) aircraft are properly equipped and approved for intended use of the data link services; and

2) flight crews are qualified to use the data link services.

3.1.4 Flight plan

Prior to the initiation of data link services with any aircraft, a flight plan is processed.

a) Operator prepares and submits flight plan per ICAO format. The flight plan provides relevant data for data link services:

1) Aircraft identification (Flight Id or Callsign), Field 7;

2) Aircraft data link equipment and capabilities, Field 10 & 18;

Note 1: Use of Aircraft registration (Tail Number), Field 18; Departure aerodrome, Field 13; Estimated off-block time (EOBT), Field 13; and Destination aerodrome, Field 16, may also be relevant depending on technologies used for providing the data link services.

b) ATSU is responsible for the origination of the flight and ATSUs along filed route receive, process, and accept the flight plan. ATSUs use information from the filed (accepted) flight plan to:

1) associate flight data obtained from flight crew/aircraft with flight plan information;

2) compare flight data with flight plan;

3) determine whether or not to provide the data link service based on the requirements for use per the AIP/NOTAM and flight plan/flight data comparison.

c) Flight crew operator executes the aircraft flight plan when a clearance is received from the ATSU in control.

Note 2: The aircraft flight plan data is different than the flight plan data accepted by the ATSU (e.g. due to different data format in the aircraft and on the ground). As a result, while it is intended that the data be consistent, anomalies may occur which can result in inadvertent inconsistencies. The severity of the operational effect of the inconsistencies and appropriate mitigation is provided in the OSA results, as appropriate.

Note 3: ATSUs along the filed route receive the flight plan via ATS interfacility data communication (AIDC) or other means as established by States and regional agreements.

3.2 Separation Assurance (SA)

The following separation minima or any combination are considered for SA in this section:

- 50 NM lateral separation minimum
- 50 NM longitudinal separation minimum
- 30 NM lateral separation minimum
- 30 NM longitudinal separation minimum

3.2.1 Data link services supporting SA

SA in an oceanic environment requires that aircraft meet specified minimum navigational requirements, and specified communication and surveillance requirements in order to permit the application of reduced lateral and longitudinal separation standards. Prior to providing this reduced separation, the ATSU verifies that the aircraft is properly equipped by examining its filed flight plan.

Reduced separation standards require increased navigational capabilities on the aircraft as well as enhanced communications and surveillance capabilities for both ground and aircraft systems. SA uses the clearance request and delivery (CRD) data link service, the Information exchange and reporting (IER) data link service and the position reporting (PR) data link service. DLIC and the required data communication connections are prerequisite.

PR includes current 3D position and future position and estimated time which are all used to detect a current or future loss of separation using position level, and estimate data, while degraded aircraft navigational capabilities can be detected using the ADS Figure of Merit (FOM). PR uses data from both waypoint event and periodic ADS reports. The application of 30 NM and 50NM longitudinal separation require the establishment of ADS periodic contracts at specified intervals depending on RNP type. Periodic reports not received within specified time parameters will be considered overdue and the ATSU will take action to obtain a Position Report within a specified time or revert to another standard of separation.

IER is used to monitor deviation from the cleared route using the ADS application event triggered data. For the application of the 30NM lateral separation minimum, a 5NM lateral deviation event contract is required to be established. A level range deviation event contract may be used to monitor the continued compliance of the aircraft within the appropriate level tolerance values.

CRD or voice (e.g. direct voice or third party voice) communication are used to resolve loss of separation within the intervention buffer specified for the separation standard being applied.

3.2.2 Procedure for SA

When applying a specific separation standard, the ATSU initiates the appropriate data link services per Table 3-2.

Note: Not all separation minima need to be supported by data link services. For separation minima supported by data link services, see Table 2-1.

a) The ATSU sends an ADS contract request message to the aircraft requesting as a minimum the basic and predicted ADS Position Reports (PR) (Current latitude, longitude and level and next and next +1 waypoints) with a specified periodicity.

b) The aircraft system acknowledges the ADS contract request and begins sending ADS periodic reports at the specified interval.

c) The ATSU receives ADS Position Reports and verifies that the aircraft is in conformance with its clearance and ATSU profile data used for separation.

d) For the application of a 30 NM lateral separation, The ATSU sends an additional message to the aircraft requesting Information exchange and reporting (IER), i.e., for 5 NM lateral deviation event.

Note: This will only detect situations where the aircraft is deviating from its stored flight plan such as by deliberate pilot intervention or an inadvertent autopilot mode change. It cannot detect errors in the active flight plan that make it different to the ATSU route clearance and cause Gross Navigation Errors i.e. waypoint position insertion errors and transposed waypoints sequences.

e) The aircraft system acknowledges the ADS contract request.

f) The controller receives the acknowledgment.

g) If the event occurs, the ADS Information Report is sent to the ATSU.

h) The controller receives Information Report.

i) In the case of overdue periodic report, or overdue waypoint event report if requested the ATSU sends an ADS On-Demand Position request.

j) Aircraft sends on-demand position report.

Note: An alternative form of separation would be applied if the ADS On-Demand report is not received within the appropriate time.

k) In the worst case, the controller will need to intervene to resolve an actual conflict by using voice or CRD to issuing a clearance to aircraft and may request a report/confirmation.

l) Aircrew acknowledges the clearance.

m) Aircrew reports/confirms.

3.2.3 Time sequence diagram for SA

Figure 3-2, Figure 3-3, and Figure 3-5 provide the time sequence diagrams for the periodic position report, lateral deviation report, and the demand report transactions, respectively, used for the SA procedure. Figure 3-5 provides the time sequence diagram for controller intervention transactions used for SA. When air-ground messages are exchanged, letters shown in the diagram map the steps in the procedure describes in paragraph 3.2.2.

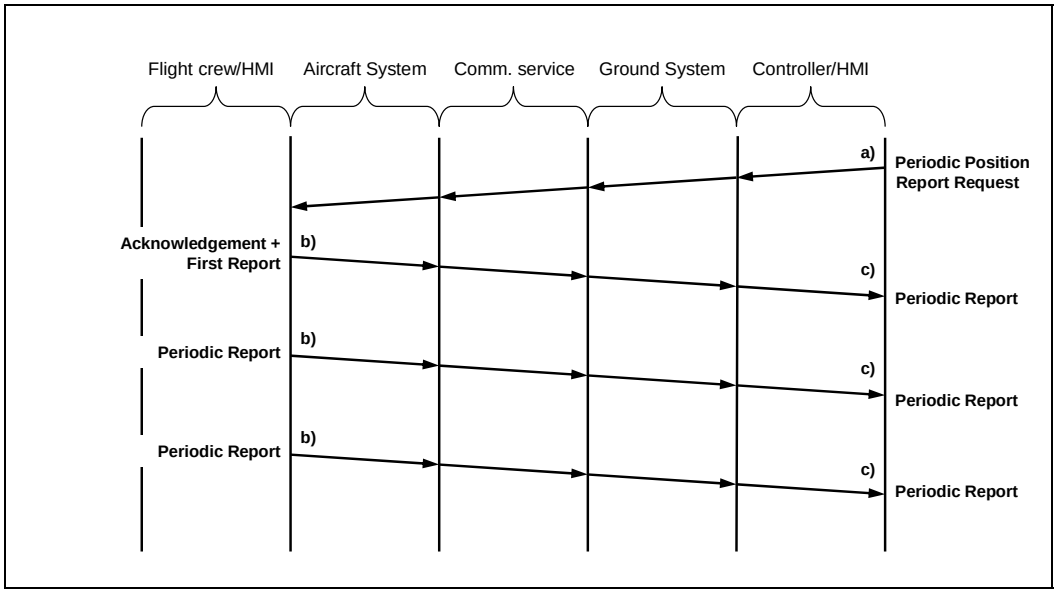

Figure 3-2: SA – periodic report transaction

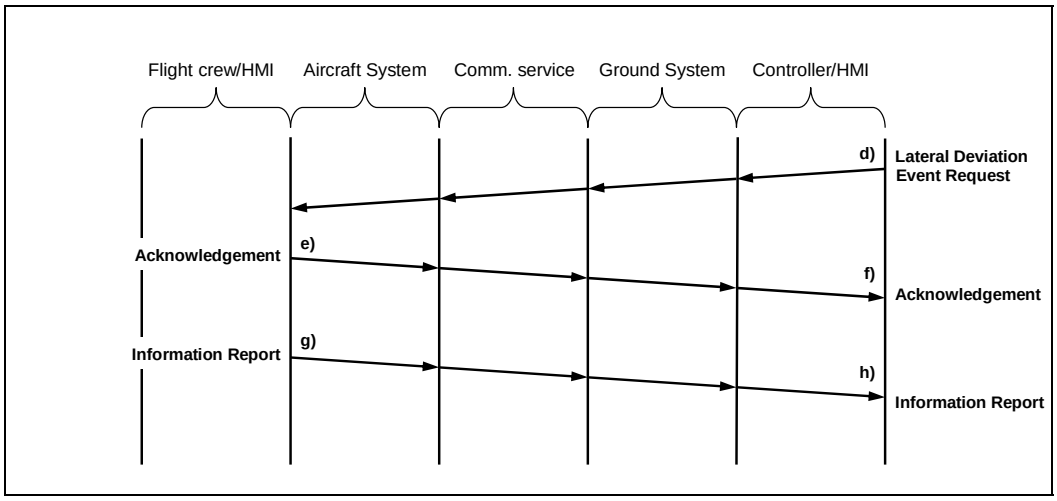

Figure 3-3: SA – lateral deviation report transaction

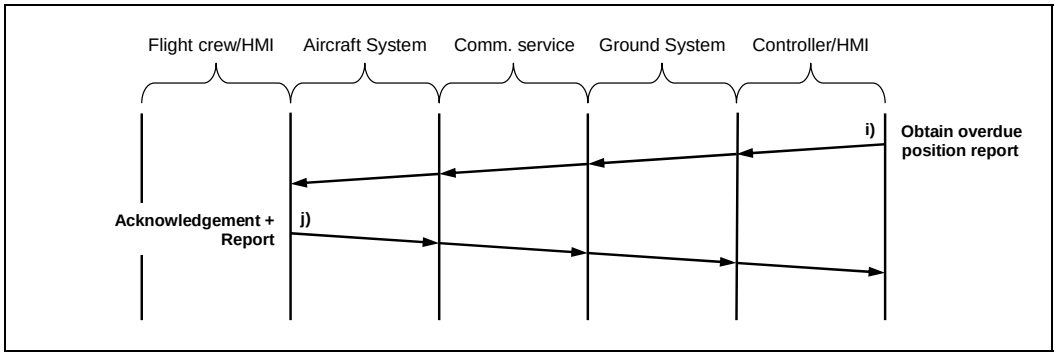

Figure 3-4: SA – on-demand report transaction

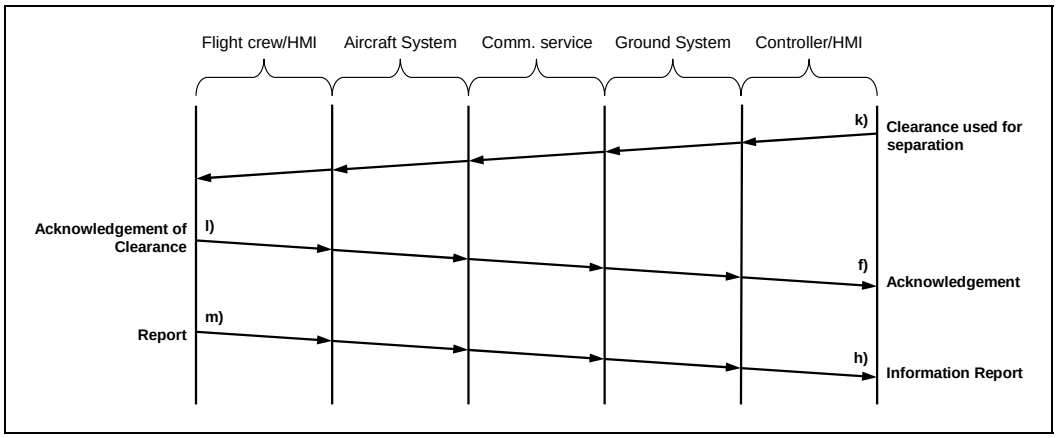

Figure 3-5: SA – controller intervention transaction

3.3 Route conformance monitoring (RCM)

3.3.1 Data link services supporting RCM

RCM describes the monitoring of an aircrafts reported position against the current flight plan by an ATSU ground system. The ATSU uses periodic aircraft position reports of current position and time, current flight level, estimated time at the next route position, and subsequent positions to monitor the aircrafts conformance with its current flight plan. In addition, the ATSU may also use ADS event reports to monitor an aircrafts conformance with its current flight plan. This process confirms that the active flight plan in the aircraft primary navigation system conforms to the ATSU current flight plan.

When using data link services for RCM, it is assumed that both DLIC and data communication connections have occurred. RCM uses PR for ADS periodic, ADS waypoint event reports, and CPDLC/AOC position reports. RCM uses IER when using ADS event reports other than waypoint events.

3.3.2 Procedure for RCM

When carrying out RCM the ATSU initiates the appropriate data link services per Table 3-2.

Note: Position reporting requirements for a particular airspace are notified in the appropriate AIP. An ATSU can mandate the CPDLC position reporting requirements and AOC FMC waypoint reporting requirements in its airspace.

a) The ATSU sends a message to the aircraft requesting the required ADS periodic and event contracts.

b) The aircraft acknowledges the contract request and begins sending periodic reports at the required interval and event reports when the event occurs.

c) The ATSU compares the received position, level data, and next and next +1 waypoint estimated data in any position report received from any source (ADS application, CPDLC application, AOC WPR), with the current flight plan. Any variance between the received position and the current flight plan, beyond local ATSU tolerances, is notified to the controller.

Note: This could vary depending on ATSU, e.g. some will monitor only a subset of the preceding data.

3.3.3 Time sequence diagram for RCM

Figure 3-6 provides the time sequence diagram for periodic report and event report transactions used for RCM procedure. When air-ground messages are exchanged, letters shown in the diagram map the steps in the procedure described in paragraph 3.3.2.

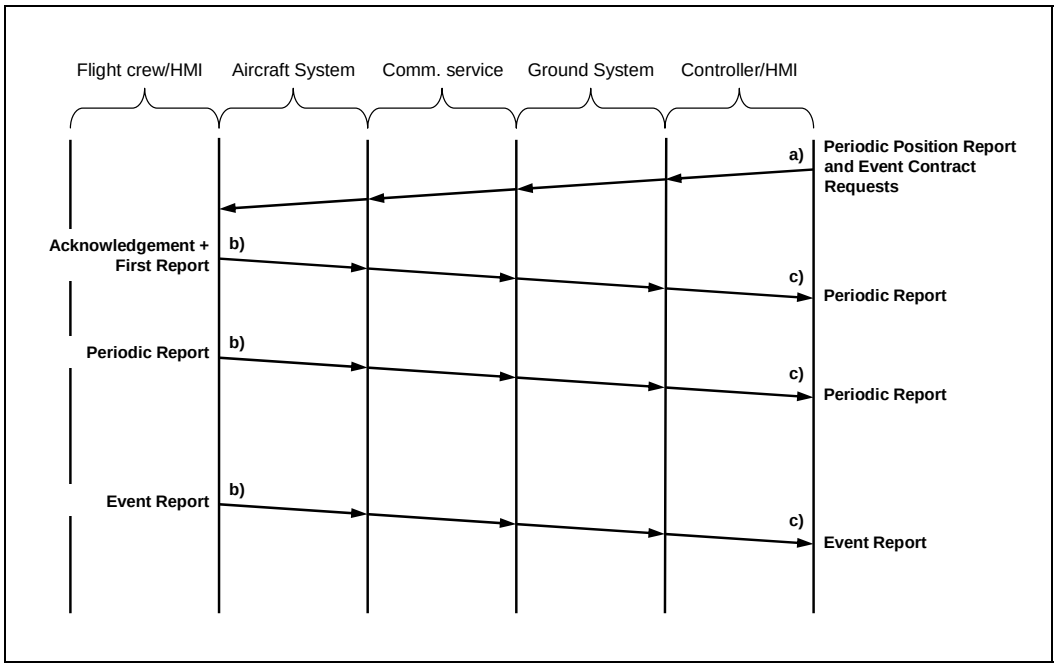

Figure 3-6: RCM – periodic report and event report transactions

3.4 Reroute (RR)

3.4.1 Data link services supporting RR

RR, as described in this document, enables a pilot to request a revised route to destination compared to current flight while in flight. RR can only be done using data link services.

This reroute request is initiated by a pilot after the aeronautical operational control (AOC) facility has computed and dispatched a revised routing to the aircraft. The AOC computes the revised route using updated meteorological forecasts received after the aircraft has departed with the aim of achieving more efficient flight routing.

The AOC will use AOC data link to provide the revised route to the aircraft. Other route changes requested by a pilot during flight are addressed through general use of CRD.

Prior to a reroute request, it is assumed that DLIC and CE have occurred. RR uses CRD.

3.4.2 Procedure for RR

The AOC facility determines from updated meteorological forecasts that a reroute will obtain benefits. The reroute changes are determined from a waypoint ahead of the aircraft that is on the current route and proceed to destination. The reroute is then uplinked to the aircraft using AOC data link.

a) The flight crew automatically loads and verifies the uplink reroute and then requests a route clearance to the ATSU.

Note: The first waypoint in a reroute request should be far enough ahead of the aircraft (normally 30 minutes) to ensure that the waypoint will not be passed before processing is complete.

b) Upon receipt of the route clearance request, the controller decides based on the location of other traffic in the area, airspace restrictions in effect, and appropriate inter-facility coordination (e.g., subsequent FIR on the route) whether or not a route clearance can be issued. The controller may optionally issue a standby.

c) If the clearance can be issued, the controller composes the route clearance message, and sends it.

d) The flight crew sends a WILCO response to the clearance.

e) The controller receives the response to confirm flight crew acceptance of the reroute.

f) If the route clearance cannot be issued, the controller denies the request by composing a clearance request denial message (e.g. UNABLE). If appropriate, explanatory information (e.g. DUE TO TRAFFIC) is added.

3.4.3 Time sequence diagram for RR

Figure 3-7 provides the request and clearance transactions used for the reroute procedure. When air-ground messages are exchanged, letters shown in the diagram map the steps in the procedure described in paragraph 3.4.2.

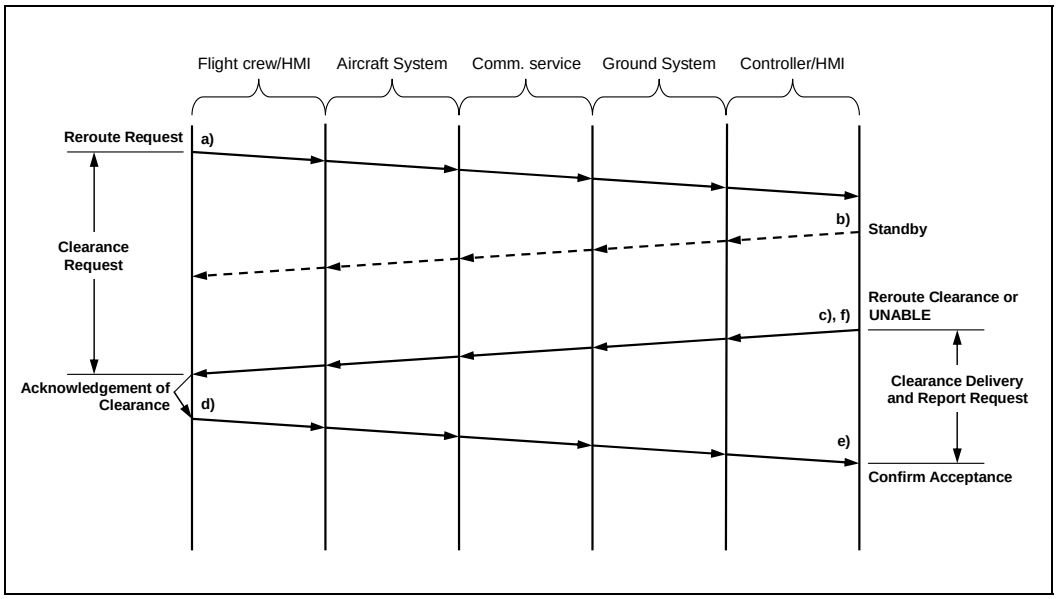

Figure 3-7: RR – request and clearance transactions

3.5 Weather deviation (WD)

3.5.1 Data link services supporting WD

WD uses CRD to enable the flight crew to request a weather deviation clearance, the controller to issue a weather deviation clearance (or deny it), and the pilot to acknowledge the clearance. WD uses IER to enable the controller to request a report back on route. When the controller receives the report, the WD is ended.

During the weather deviation procedure, the controller may request other information, such as position reports, for SA, which is addressed in paragraph 3.2.

Weather deviation procedures that use a reroute are addressed in paragraph 3.4.

3.5.2 WD procedure

Based on sensor data (e.g. weather radar), the pilot initiates the WD procedure to avoid hazardous weather

a) The flight crew requests a deviation, identifying the lateral distance (e.g. up to 50 miles) and direction of deviation (e.g. left, right, or either side of route)

b) The controller (upon receipt of the weather deviation request) decides (based on the location of other air traffic in the area and the separation standard in effect), whether or not the requested weather deviation clearance or a modified one can be issued. The controller may optionally issue a standby.

c) If the weather deviation clearance can be issued, the controller composes the weather deviation clearance message specifying the lateral extent and direction of the deviation, appends a request for a report back on route, and sends the message. At this time, the controller protects the airspace by allowing a tolerance for the aircraft from the area beginning at the original route to a virtual path at the maximum deviation granted. The aircraft may vary its route any where within this region while avoiding the weather.

d) The flight crew sends a WILCO response to the clearance.

e) The controller receives the response to confirm flight crew acceptance of the weather deviation.

f) If the weather deviation clearance cannot be issued, the controller denies the request by composing a clearance request denial message (e.g. Unable). If appropriate, explanatory information (e.g. Due Traffic) is added.

g) When the aircraft is back on route, the flight crew responds to the Report request to inform the controller.

h) The controller receives the response to confirm that the WD has ended.

Note: An ATSU should only deny a weather deviation request if it results in a loss of separation. If the aircraft deviates on captain's authority, the ATSU should provide all concerned aircraft with essential traffic information. This could be performed using IER. This is not described in the above procedure.

3.5.3 Time sequence diagram for WD

Figure 3-8 provides the time sequence diagram for the weather deviation request and clearance transactions used for the weather deviation procedure. When air-ground messages are exchanged, letters shown in the diagram map the steps in the procedure described in paragraph 3.5.2.

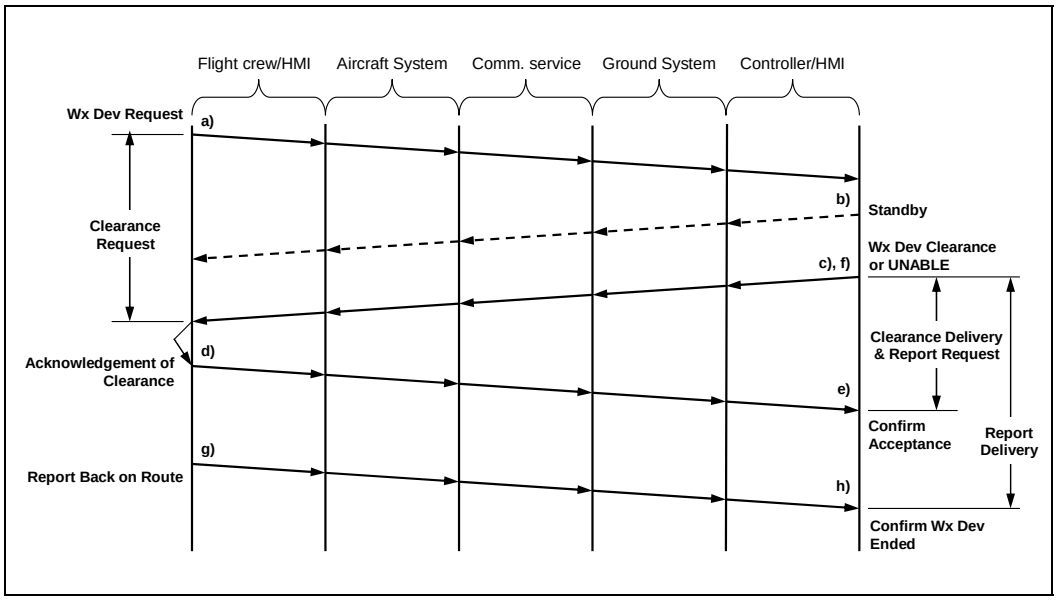

Figure 3-8: WD – request and clearance transactions

4 Description of data link services

The data link services shall be provided and used in accordance with the operating methods described in this section. Data link services include.

a) Data link initiation capability (DLIC)

b) Connection establishment (CE)

c) Connection termination (CT)

d) Transfer of communication (TC)

e) Clearance request and delivery (CRD)

f) Information exchange and reporting (IER)

g) Position reporting (PR)

The data link services are enabled through the use of data link applications. The operational considerations for these applications are provided in Annex A.

Note: In any application dialogue, the flight crew or controller must be able to terminate the application at any time due to operational necessity. When the application is terminated by either the flight crew or the controller, the other party should be notified.

4.1 Data link initiation capability (DLIC) – service description

DLIC provides the capability for the aircraft to indicate to the ground that it is available for data communication, and provide information to allow the ground ATS systems to compare the airplane against filed flight plans to validate that communication is being established with the correct information. It also indicates what data communication capabilities are available on the aircraft and provides a mechanism whereby the aircraft can be requested to declare its readiness for data communication service with the next ATSU. This data link service provides the capability to:

- Determine compatibility of aircraft and ATSP systems
- Correlate information between aircraft flight plan and filed flight plan
- Notify the data link initiation with the next ATSU.

DLIC uses two basic modes of operation:

a) Manual initiation, when, in response to pilot actions, the aircraft exchanges messages with ATSUs to declare the data link initiation with the aircraft.

b) Address forwarding, whereby the current data authority requests the aircraft to exchange messages with the next ATSU to announce the aircraft's readiness for data communications.

DLIC is a precursor to the use of CRD, IER and PR.

4.1.1 Operating method for DLIC

4.1.1.1 Operating method for manual data link initiation

Table 4-1 provides the operating method for manual data link initiation, which consists of a single transaction initiated by the aircraft.

Table 4-1: Operating method for manual initiation

Step	Operating Method
1	The aircraft sends a data link initiation message to the ATSU including: • information on each requested application for data link service, • flight plan information to allow unambiguous association of the aircraft with the flight plan information used by an ATSU.
2	The ATSU correlates data received in the data link initiation message with current flight plan.
3A	If the aircraft information received correlates with the current flight plan, and local conditions are satisfied, the ATSU sends a response to the aircraft indicating successful completion of the data link initiation message.
3B	If the aircraft information does not correlate, the ATSU sends a response to the aircraft indicating that the data link initiation was not successfully completed.
4	If the aircraft does not receive a response from the ATSU within a predetermined period of time, the aircraft system indicates to the flight crew that the data link initiation was not completed.

4.1.1.2 Operating method for address forwarding

Table 4-2 provides the operating method for address forwarding, which consists of two nested transactions, the first transaction is initiated by the ATSU.

Table 4-2: Operating method for address forwarding

Step	Operating Method
1	The requesting ATSU sends a contact "advisory" message to the aircraft with the specified address for the next ATSU

Step	Operating Method
2	Optionally, the aircraft may send a response to the requesting ATSU indicating receipt of contact "advisory" message.
3	The aircraft initiates data communication with the next ATSU per the operating method for manual initiation.
4	The aircraft sends a response to the requesting ATSU indicating success/failure of initiation with next ATSU.

4.1.2 Time sequence diagram for DLIC

4.1.2.1 Time sequence diagram for manual initiation

Figure 4-1 provides a time sequence diagram of the manual initiation transactions between the flight crew/aircraft and ATSU/controller. Numbers shown in the diagram map to steps shown in the operating method for manual initiation described in Table 4-1.

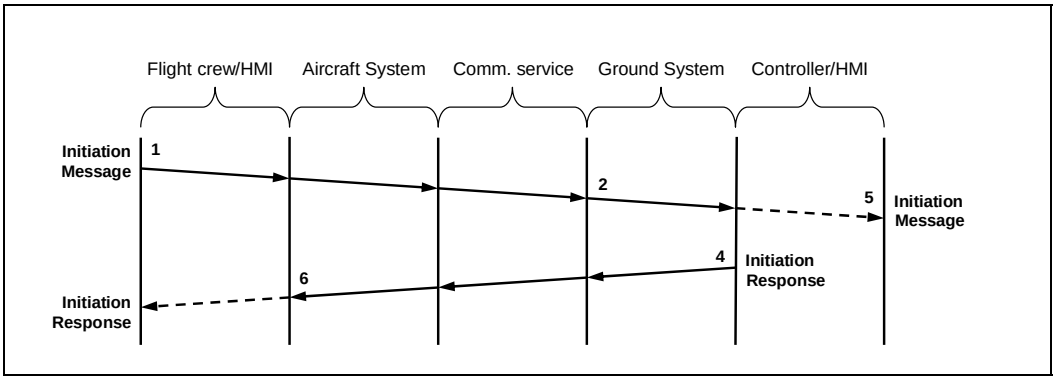

Figure 4-1: DLIC – Manual initiation transaction

4.1.2.2 Time sequence diagram for address forwarding

Figure 4-2 provides a time sequence diagram for the address forwarding transactions among the requesting ATSU/controller, the flight crew/aircraft, and the specified ATSU/controller. Numbers shown in the diagram map to steps shown in the operating method for address forwarding described in Table 4-2.

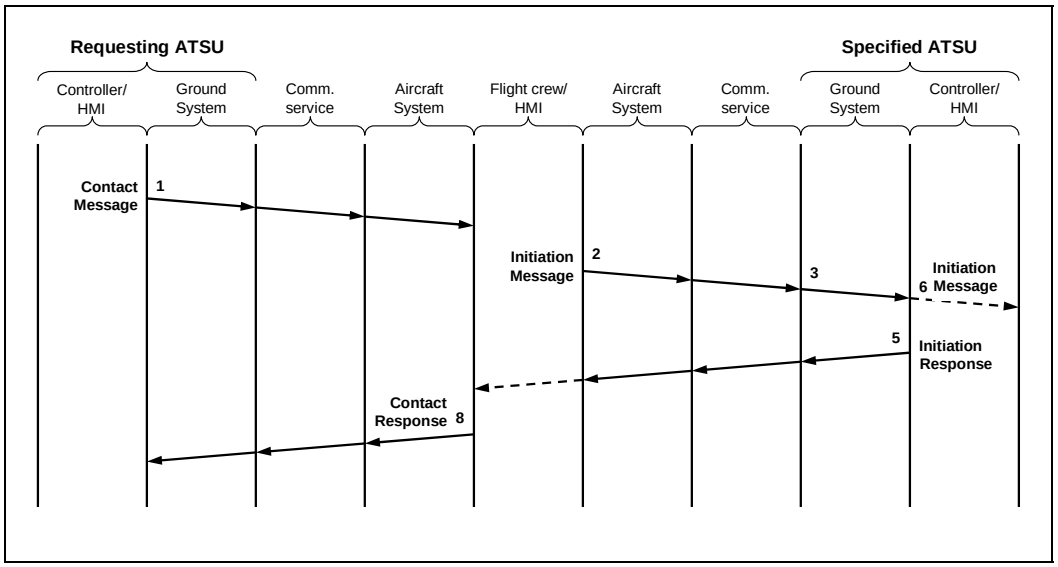

Figure 4-2: DLIC – Address forwarding transaction

4.1.3 Messages for DLIC

Table 4-3 provides the messages for the DLIC. The information required is annotated with a suffix (M) or (O). The suffix (M) indicates that the information is considered to be basic to any message of that type. The suffix (O) indicates that messages without this data are acceptable.

Note 1: All operations that existed at the time this standard was developed provide the parameters indicated with an (M). New operations may require some parameters indicated with an (O). Refer to AIPs/NOTAMs for appropriate parameter requirements for messages.

Note 2: Validation of unambiguous identification of aircraft may be limited by the unavailability of some optional parameters used to distinguish between flights (e.g., departure and destination airports and estimated time of departure).

Some of the information required is annotated with a suffix (n), indicating that one of the following notes applies:

Note 3: The aircraft identifier can be the aircraft registration, the 24-bit ICAO identifier (or both). The integrity level of this parameter needs to be commensurate with the safety objective associated with delivery of data communication messages to the wrong aircraft.

Note 4: At a minimum, the time stamp should include hours, minutes and seconds.

Table 4-3: Messages for DLIC

Message	Information Required	Response (Controller/ Pilot)
Logon/Contact	Flight identifier (M) Airplane identifier (M) (Note 3) Time stamp (M) (Note 4) Application names (M) Application versions (M)	Acknowledgement from ATSU
Acknowledge-ment	Flight identifier (M) Airplane identifier (M) (1) Time stamp (M) (Note 4) Reason code (M) Applications (M) Application Reason code (M) Originator address (M) Originator identifier (M)	None
Contact Advisory/ Request	Flight identifier (M) Airplane identifier (M) (Note 3) Time stamp (M) (Note 4) Next center address (M)	Airplane sends Logon/contact to next center, and, optionally initial contact response to current center.
Initial Contact Response	Flight identifier (M) Airplane identifier (M) (1) Time stamp (M) (Note 4) Reason code (M)	None
Contact Response/ Completion	Flight identifier (M) Airplane identifier (M) (Note 3) Time stamp (M) (Note 4) Next center address (M) Reason code (M)	None

4.2 Connection establishment (CE) – service description

CE provides the capability for an ATSU to establish a CPDLC connection and/or an ADS connection with a suitably equipped airplane, either as an active center called the Current Data Authority (CDA), or as the next center called the Next Data Authority (NDA), or as a monitoring center. CE comprises two different operating methods, one for the CPDLC

application and one for the ADS application. An ATSU may be executing either or both operating methods.

DLIC is only a necessary precursor for any data link service that uses the CPDLC application.

4.2.1 Operating method for CE

Table 4-4 provides the operating method for the CE for data link services that use the CPDLC application. The operating method for CPDLC connection establishment consists of a single transaction initiated by an ATSU. Table 4-5 provides the operating method for the CE for data link services that use the ADS application.

Table 4-4: Operating method for CE (CPDLC application)

Step	Operating Method
1	The ATSU sends a CPDLC connect request message to the aircraft.
2	The aircraft sends a CPDLC connect confirm message to the ATSU.
3A	If the aircraft does not have a CDA, then the ATSU sending the request will become the CDA. The aircraft sends a CPDLC connect confirm to the ATSU. The aircraft provides an indication to the flight crew of the CDA together with the identity of the CDA.
3B	If the aircraft already has a CDA, the aircraft system checks to see if the received message ICAO code matches the previously announced NDA address. If it matches, the ATSU sending the request will become the NDA and the aircraft system sends a CPDLC connect confirm message to the NDA . If it does not match, the aircraft system sends a disconnect request message, with the ICAO code for the CDA.
3C	If the aircraft cannot accept the CPDLC connection because it already has an active connection, and the ATSU sending the CPDLC connection request has not been designated as the NDA, then it sends a disconnect request containing the ICAO code of the CDA.

Table 4-5: Operating method for CE (ADS application)

Step	Operating Method
1	The ATSU sends an ADS connection request message to the aircraft.
2	The aircraft sends an ADS connect confirmation message to the ATSU.
3A	If the aircraft can accept the ADS request, then the ATSU sending the request will establish an ADS connection with that aircraft. The aircraft system provides indication of the ATSU to the flight crew.
3B	If the aircraft cannot accept the ADS request, then it should send a disconnect request containing the identification of the current active ATSU.

4.2.2 Time sequence diagram for CE

Figure 4-3 provides a time sequence diagram for the CPDLC and ADS connection establishment transactions between the flight crew/aircraft and ATSU/controller. Numbers shown in the diagram map to steps shown in the operating method for CE described in Table 4-4 (for CPDLC) and Table 4-5 (for ADS).

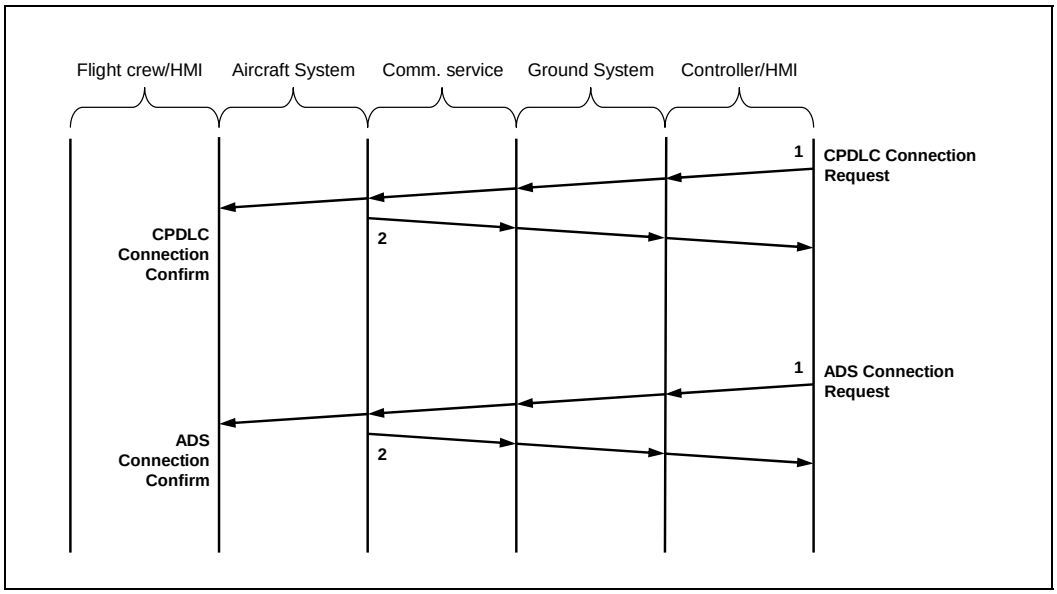

Figure 4-3: CE – transactions for CPDLC and ADS

4.2.3 Messages for CE (ADS application)

Table 4-6 provides the messages for CE. The information required is annotated with a suffix (M) or (O). The suffix (M) indicates that the information is considered to be basic to any message of that type. The suffix (O) indicates that messages without this data are acceptable.

Some of the information required is annotated with a suffix (n), indicating that one of the following note applies:

Note: The aircraft identifier can be the airplane registration, the 24-bit ICAO identifier (or both). The integrity level of this parameter needs to be commensurate with the safety requirement associated with delivery of ADS application messages to the wrong airplane.

Table 4-6: Messages for CE (ADS application)

Message	Information Required	Response
Periodic Contract Request	ADS-request Tag (M) ADS Contract Request Number (M) Reporting Interval (O) Groups desired and associated data (O)	Ack, NAK or NCN
Demand Contract Request	ADS-request Tag (M) ADS Contract Request Number (M) Groups desired and associated data (O) *Note: In FANS, the Reporting Interval is mandatory for an Demand Contract. It is used to identify a Demand Contract.*	Ack, NAK or NCN
Event Contract Request	ADS event to be set (M) ADS Contract Request Number (M)	Ack, NAK or NCN
Acknowledgement	ADS Contract Request Number (M)	none
Negative Acknowledgement	ADS Contract Request Number (M) NAK data (M)	none
NCN	ADS Contract Request Number (M) NCN Data (M)	none

4.3 Connection termination (CT) – service description

CT provides the capability for the ATSU, flight crew, or aircraft system to terminate a CPDLC or ADS connection. ATSU initiated CPDLC connection termination normally occurs when transitioning between ATSUs as part of the transfer of communication service if the next ATSU has data link capability. If the next ATSU does not have data link capability the ATSU initiates a simple connection termination. Aircraft system initiated CPDLC or ADS connection termination occurs at the end of a flight. The flight crew or the ATSU can terminate connections at anytime. The flight crew has the capability to terminate connections anytime by selecting the applications to OFF.

4.3.1 Operating method for CT

Table 4-7 provides the operating method for CT for data link services that use the CPDLC application. The operating method for CPDLC connection termination consists of a single message initiated by the flight crew/aircraft system. Table 4-8 provides the operating method for connection termination for data link services that use the ADS application.

Table 4-7: Operating method for CT (CPDLC application)

Step	Operating Method
	Transition between ATSUs.
1	The ATSU sends a CPDLC connection termination message to the aircraft.
2	The aircraft system terminates the connection and sends a connection termination confirmation message to the ATSU.
	Flight crew selected connection termination.
3	Flight crew disconnects CPDLC
4	The aircraft system terminates the connection and sends a connection termination message to the ATSU.
	End of flight connection termination
5	The aircraft system detects end of flight
6	The aircraft terminates the connection and sends a connection termination message to the ATSU.
	System connection termination
7	The aircraft terminates the connection and sends a connection termination message to the ATSU. *Note: This can be the result of exceptional events such as the trigger of the 16 minutes inactivity timer or a change of aircraft identification.*

Table 4-8: Operating method for CT (ADS application)

Step	Operating Method
	ATSU initiated connection termination
1	The ATSU sends an ADS connection termination request message to the aircraft.
2	The aircraft system terminates the connection with that ATSU and sends an ADS disconnect confirmation message to the ATSU.
	Flight crew selected connection termination.
3	Flight crew selects ADS to OFF
4	The aircraft system terminates the connection with all ATSUs and sends a connection termination message to each ATSU.
	End of flight connection termination
5	The aircraft system detects end of flight
6	The aircraft terminates all connections and sends a connection termination message to any ATSU with a connection.
	System connection termination
7	The aircraft terminates the connection and sends a connection termination message to

Step	Operating Method
	the ATSU. *Note: This can be the result of exceptional events such as the trigger of the 16 minutes inactivity timer or following the generation of three consecutive negative acknowledgments on the same connection.*

4.3.2 Time sequence diagram for CT

Figure 4-4 provides a time sequence diagram for the CPDLC connection termination transactions between the flight crew/aircraft and ATSU/controller. Numbers shown in the diagram map to steps shown in the operating method for CPDLC connection termination described in Table 4-7.

Figure 4-5 provides a time sequence diagram for the ADS connection termination transactions between the flight crew/aircraft and ATSU/controller. Numbers shown in the diagram map to steps shown in the operating method for ADS connection termination described in Table 4-8.

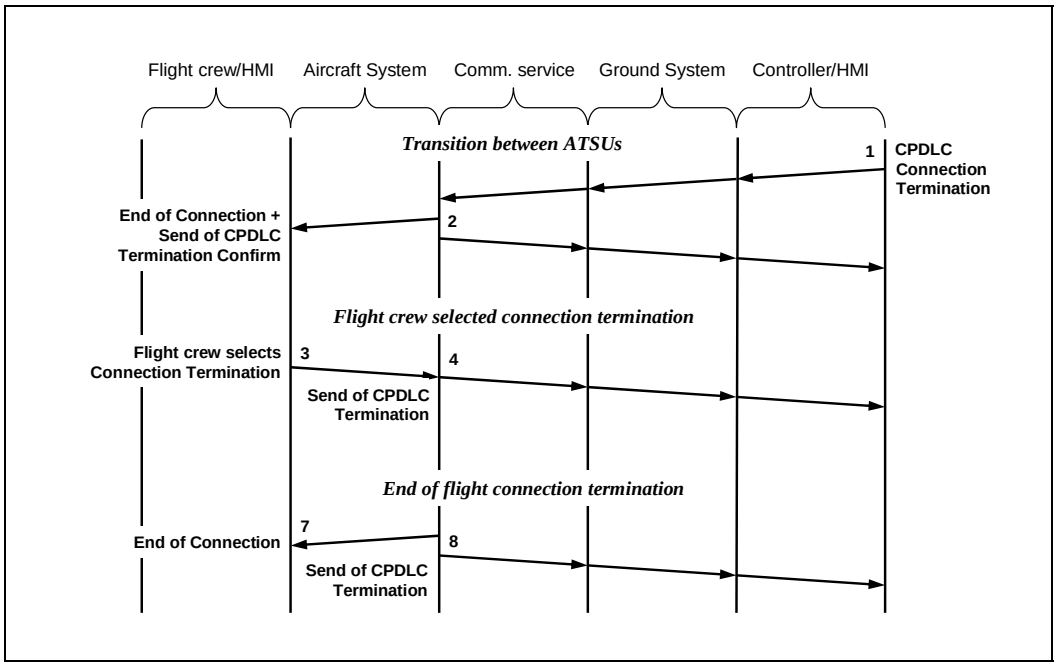

Figure 4-4: CT – transactions for CPDLC application

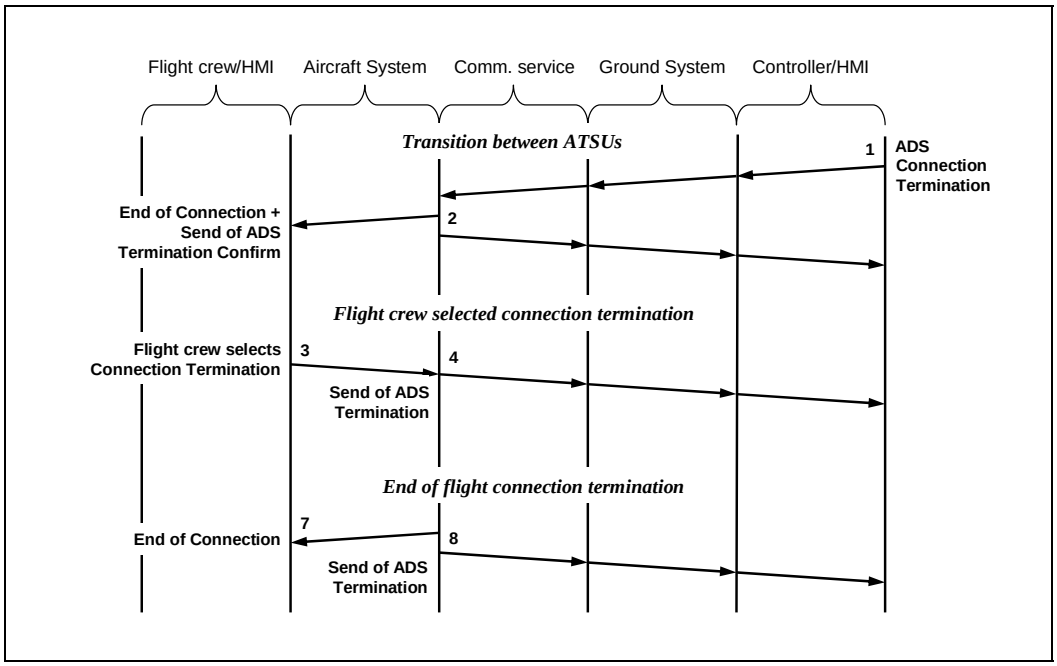

Figure 4-5: CT – transactions for ADS application

4.3.3 Messages for CT

Table 4-9 provides the messages for CT. The information required is annotated with a suffix (M) or (O). The suffix (M) indicates that the information is considered to be basic to any message of that type. The suffix (O) indicates that messages without this data are acceptable.

Table 4-9: Messages for CT

Message	Information Required	Response (Controller/ Pilot)
Connection Termination Request	Termination Request (M)	none
Connection Termination Confirmation	Termination Confirmation (M)	none
Connection Termination	Termination Confirmation (M)	none

4.4 Transfer of communication (TC) – service description

TC provides the capability to transfer the CPDLC connection from one ATSU to the next ATSU. The data link service is provided in conjunction with Address Forwarding described in the DLIC service description (see 4.1), above or Air Traffic Service Inter-facility Data Communication (AIDC).

4.4.1 Operating method for TC

Table 4-10 provides the operating method for TC that use the CPDLC application. The operating method consists of a message initiated by the ATSU currently controlling the aircraft followed by a single transaction initiated by the next ATSU. The next ATSU is informed of the correct time to initiate the single transaction via Address Forwarding or AIDC.

Table 4-10: Operating method for TC

Step	Operating Method
1	The CDA sends a message to the aircraft containing the 4 character ICAO code for the NDA.
2	The CDA sends a message to the next ATSU via Address Forwarding or AIDC. *Note 1: This can be also be accomplished procedurally, without the exchange of messages.* *Note 2: The next ATSU .follows the operating method described in paragraph 4.2.1 (repeated below).*
3	The NDA sends a CPDLC connect request message to the aircraft.
4	The aircraft system checks to see if the received message ICAO code matches the previously announced NDA address. a) If it matches, the ATSU sending the request will become the NDA and the aircraft system sends a CPDLC connect confirm message to the NDA. b) If it does not match, the aircraft system sends a disconnect request message, with the ICAO code for the CDA.
5	If the aircraft already has an active ATSU, and the ATSU sending the request has been designated the next data authority, then it will become established as the next ATSU. *Note: The ATSU currently controlling the aircraft follows the operating method described in paragraph 4.3.1 (repeated below).*
6	The CDA sends a CPDLC end service message to the aircraft.
7	The aircraft system terminates the connection and sends a disconnect request message to the CDA.
8	The aircraft system designates the NDA as the CDA.

4.4.2 Time sequence diagram for TC

Figure 4-6 provides a time sequence diagram for the TC transactions between the flight crew/aircraft and ATSU/controller. Numbers shown in the diagram map to steps shown in the operating method for TC described in Table 4-10.

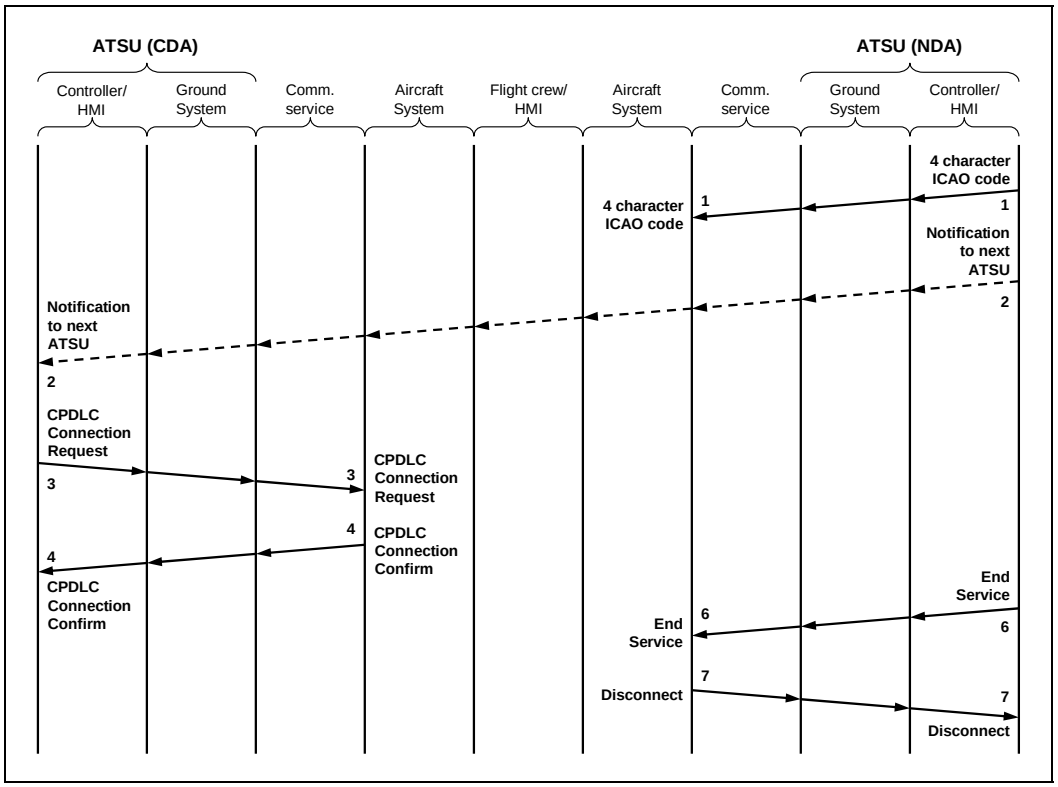

Figure 4-6: TC – transactions for CPDLC

4.4.3 Messages for TC

TC uses the CPDLC application messages indicated as TC or All shown in Table A-2 and Table A-3, which can be found at Annex A.

4.5 Clearance request and delivery (CRD) – service description

CRD provides for:

a) The flight crew to make a request to the controller for a modification to the current flight plan

b) The controller to provide responses to flight crew requests

c) The controller to provide clearances and instructions to the flight crew for air traffic control purposes, (i.e., without a flight crew request.)

CRD depends on successful completion of CE for the CPDLC application.

In all cases when a clearance or instruction message is provided, the flight crew acknowledges the message, indicating compliance, unable to comply, or if more time is needed to respond.

CRD uses the message set provided in 0 Messages are exchanged during flight between the flight crew and controller to modify the current flight plan and to maneuver the aircraft accordingly.

4.5.1 Operating method for CRD

Table 4-11 provides the operating method for CRD for the different types of transactions that use the CPDLC application. CRD exchanges messages that the flight crew uses to obtain a re-clearance in flight and modify the aircraft flight plan. This modification can be applied to any aspect (vertical, along track or cross track) of the flight plan.

Table 4-11: Operating method for CRD

Step	Operating Method
	ATC clearance or instruction (Single transaction)
A1	The controller sends a clearance or instruction to the flight crew
A2	The flight crew assesses whether they can accept the clearance and then responds with WILCO or UNABLE.
	Flight crew request not granted by the controller (Single transaction)
B1	Flight crew sends a request for flight modification.
B2	Controller responds with UNABLE.
	Flight crew request for flight modification (Multiple transactions)
C1	The flight crew sends a request for flight modification.
C2	The controller sends a clearance or instruction to the flight crew in response to the flight modification. (Completes first transaction; starts second transaction).
C3	The flight crew assesses whether they can accept the clearance and then responds with WILCO or UNABLE. (Completes second transaction).
	ATC clearance or instruction (Multiple response transaction).
D1	The controller sends a clearance or instruction to the flight crew.
D2	The flight crew responds with STANDBY (Intermediate response).
D3	At a later time, the flight crew assesses whether they can accept the clearance and then responds with WILCO or UNABLE. (Completes transaction).

Step	Operating Method
	Flight crew request for flight modification with intermediate controller response (Multiple transactions with multiple responses)
E1	The flight crew sends a request for flight modification.
E2	The controller responds with STANDBY (Intermediate response to first transaction).
E3	At a later time, the controller sends a clearance, instruction, or UNABLE to the flight crew in response to the flight modification. (Completes first transaction; starts second transaction).
E4	If clearance or instruction is issued, the flight crew assesses whether they can accept the clearance and then responds with WILCO or UNABLE. (Completes second transaction).
	Multiple ATC clearances or instructions issued at different times (Multiple transactions)
F1	Controller sends first clearance or instruction to flight crew (Starts first transaction).
F2	At a later time, controller sends second clearance or instruction to flight crew (Starts second transaction).
F3	The flight crew assesses whether they can accept the first clearance and then responds with WILCO or UNABLE (Completes first transaction).
F4	At a later time, flight crew assesses whether they can accept the second clearance and then responds with WILCO or UNABLE (Completes second transaction).
	Multiple (Complex) ATC clearances or instructions in a single transaction (Single transaction
G1	The controller sends multiple clearances and/or instructions to the flight crew in a single message
G2	The flight crew assesses whether they can accept the clearance and then responds to all clearances and/or instructions with a single WILCO or UNABLE.

Note 1: *All clearance and request transactions are closed by an appropriate response. A pilot request is closed by a clearance or UNABLE. A controller provided clearance is closed by a WILCO or UNABLE. If a data message requiring a closure response is subsequently negotiated by voice, the data message still requires a closure response message to ensure the proper synchronization of the ATSU and aircraft systems.*

Note 2: *Clearance delivery messages may be combined with a request for supplementary information related to the clearance or may contain additional information about future clearances. For example, a vertical clearance may contain a request to report when leaving the current altitude and reaching the new altitude. (CLIMB AND MAINTAIN FL290 /REPORT REACHING FL290). Another example is a hold clearance with a time to expect the next clearance (HOLD AS PUBLISHED/EXPECT FURTHER CLEARANCE AT 1320Z). These additional message elements are used for IER.*

Note 3: For the STANDBY CASE, scenario D can be inserted into scenario C or F.

4.5.2 Time sequence diagrams for CRD

Figure 4-7 provides a time sequence diagram for a flight crew request and a clearance, or instruction, involving a single transaction. Numbers shown in the diagram map to steps shown in the operating method for clearance request and delivery described in scenarios "A" and "B" of Table 4-11.

Figure 4-8 provides a time sequence diagram for a flight crew request involving multiple transactions, and an ATC clearance or instruction involving multiple responses. Numbers shown in the diagram map to steps shown in the operating method for clearance request and delivery described in scenarios "C" and "D" of Table 4-11.

Figure 4-9 provides a time sequence diagram for a flight crew request involving multiple transactions and multiple responses from the ATSU/controller. Numbers shown in the diagram map to steps shown in the operating method for clearance request and delivery described in scenario "E" of Table 4-11.

Figure 4-10 provides a time sequence diagram for multiple clearances and/or instructions at different times using multiple transactions, and multiple clearances and/or instructions at the same time using a single transaction. Numbers shown in the diagram map to steps shown in the operating method for clearance request and delivery described in scenarios "F" and "G" of Table 4-11.

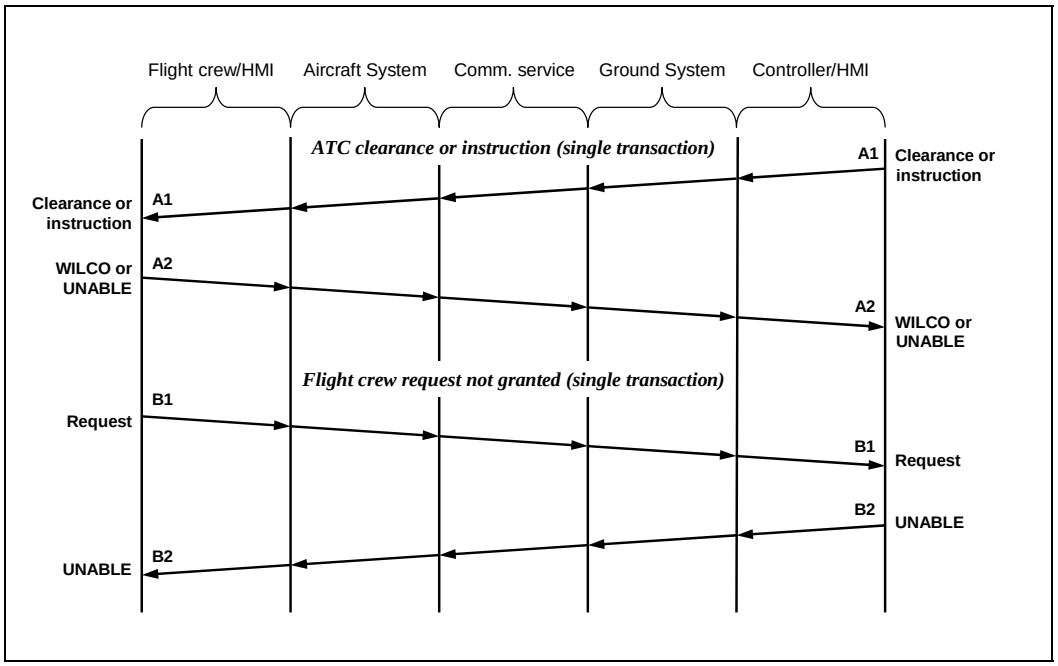

Figure 4-7: CRD – flight crew request and a clearance or instruction (single transaction)

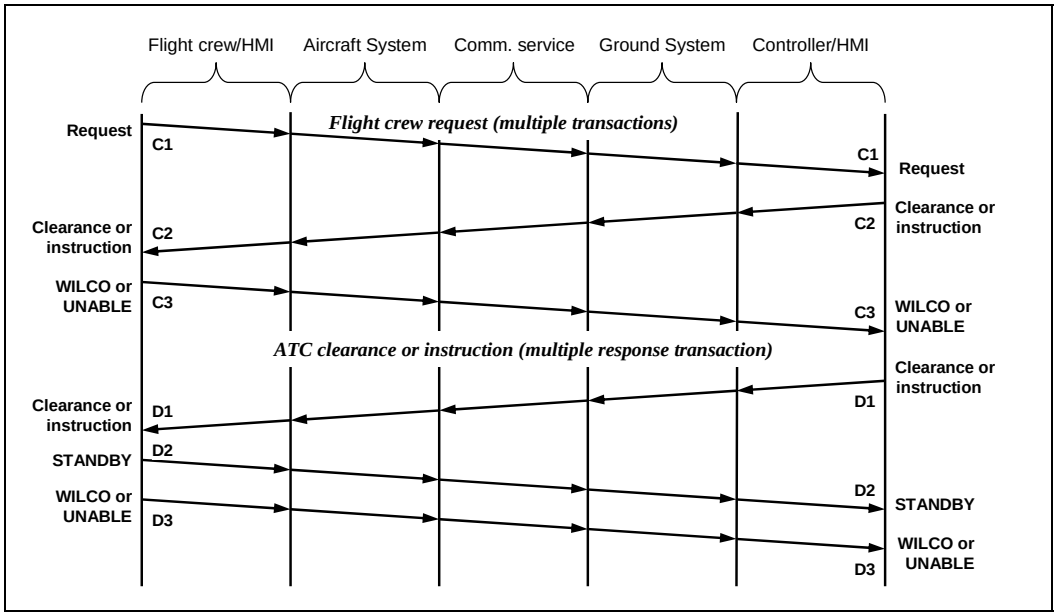

Figure 4-8: CRD – flight crew request (multiple transactions) and an ATC clearance or instruction (multiple responses)

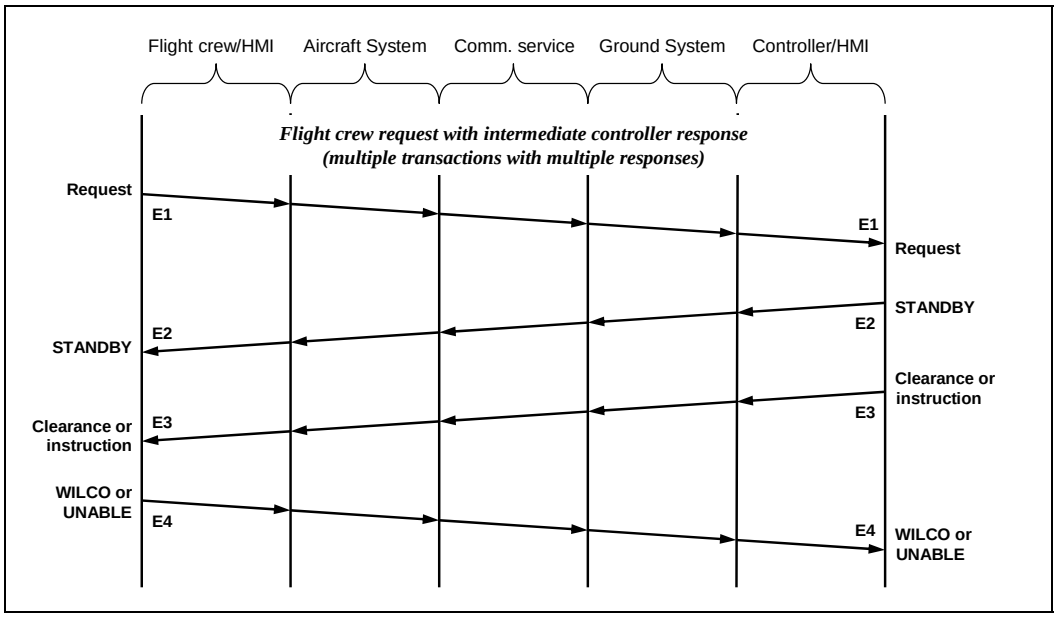

Figure 4-9: CRD – Flight crew request with intermediate controller response (multiple transactions with multiple responses)

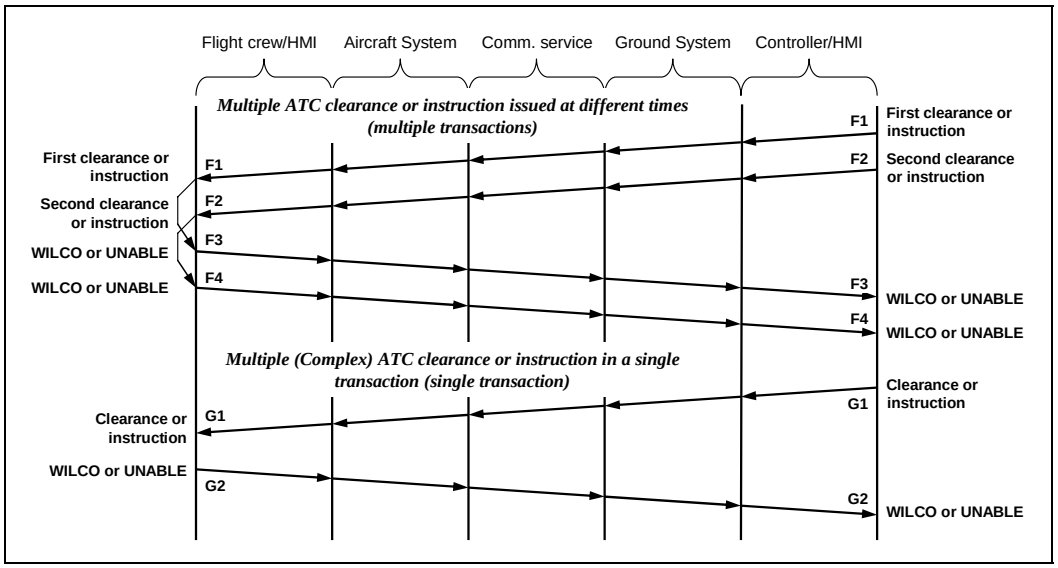

Figure 4-10: CRD – multiple clearances and/or instructions at different times (multiple transactions), and multiple clearances and/or instructions at the same time (single transaction)

4.5.3 Messages for CRD

Note: Different regions of the world use only a subset of the messages for clearance request and delivery. Refer to respective AIPs/NOTAMs for messages prescribed within any particular region.

CRD uses the CPDLC application messages indicated as CRD or All shown in Table A-2 and Table A-3, which can be found at Annex A.

4.6 Information exchange and reporting (IER) – service description

IER provides the capability for the flight crew to provide reports to the air traffic controller, and for the controller to request information. IER uses the following modes of operation:

a) Reports/confirmation messages provided by the aircrew in response to a request from the controller

b) Reports provided automatically by the aircraft avionics systems in response to a request from a ground system. The reports can be triggered periodically or as a result of a specified event.

c) Requests from the pilot for information on expected clearances, with a response issued by the controller.

d) Information provided by the controller.

IER may be provided using a number of different applications, including the ADS application or the CPDLC application.

4.6.1 Operating method for IER

Table 4-12 provides the operating method for IER for different types of transactions used for information exchange and reporting.

Table 4-12: Operating method for IER

Step	Operating Method
	Controller initiated request for information – general case
A1	The controller initiates a request to the flight crew or aircraft system for information.
A2	The flight crew or aircraft system responds with the requested information.
	Controller initiated request for information – after the occurrence of an event
B1	The controller initiates a request to the aircraft or aircraft system for information upon occurrence of an event.

Step	Operating Method
B2	The aircraft system or aircraft system acknowledges the request.
B3	The flight crew or aircraft system transmits the response to the request upon occurrence of the event.
	Flight crew initiated request for information
C1	The flight crew initiates a request (e.g. WHEN CAN WE EXPECT HIGHER ALTITUDE).
C2	The controller responds with information (e.g. EXPECT CLIMB AT 0450z).
C3	The flight crew then acknowledge receipt of the information (e.g. ROGER).

4.6.2 Time sequence diagrams for IER

Figure 4-11 provides a time sequence diagram for IER for transactions initiated by the controller. Numbers shown in the diagram map to steps shown in the operating method for information exchange and reporting described in scenario "A" and "B" of Table 4-12.

Figure 4-12 provides a time sequence diagram for IER for transactions initiated by the flight crew. Numbers shown in the diagram map to steps shown in the operating method for information exchange and reporting described in scenario "C" of Table 4-12.

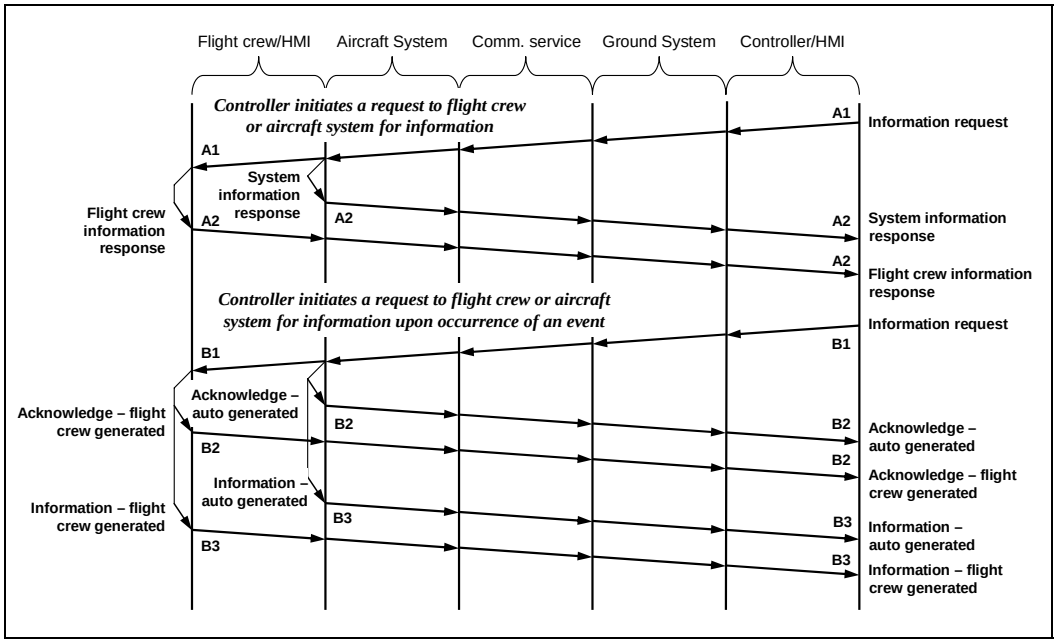

Figure 4-11: IER – controller initiated transactions

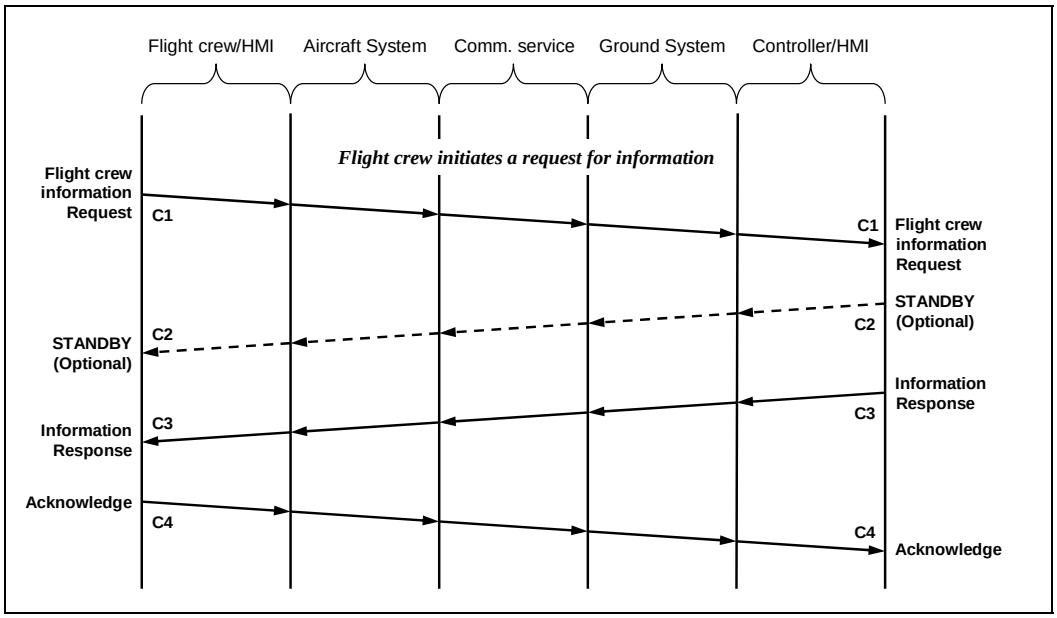

Figure 4-12: IER – flight crew initiated transactions

4.6.3 Messages for IER

IER uses the CPDLC application messages indicated as IER or All shown in Table A-2 and Table A-3, which can be found at Annex A.

4.7 Position reporting (PR) – service description

PR provides the controller with the capability to obtain position information from the aircraft, to include projected route.

Note: PR is intended only for position reports. When the aircraft sends reports associated with re-routing, these reports are sent via IER, as described in paragraph 4.6.1.

The position information is obtained either directly from the aircraft or by involving the flight crew.

PR uses two modes of operation:

a) Automatic mode, in which the position reports are sent on waypoint passage and/or change or at a specified period without manual intervention; or

b) Manual mode, in which the position reports are sent on flight crew initiation (although some aircraft systems may trigger the reports, and present them to the flight crew for transmission).

Typically, position reports are sent when passing waypoints on oceanic tracks.

PR may be provided using a number of different applications, including the ADS application, the CPDLC application, or supporting aeronautical operational control (AOC) applications.

4.7.1 Operating method for PR

Table 4-13 provides the operating method for PR for several transaction types.

Table 4-13: Operating method for PR

Step	Operating Method
	Automatic position reporting per conditions pre-established by the ATSU. (e.g., ADS application or supporting AOC applications)
A1	ATSU sends message to aircraft with specified conditions (every waypoint, at specified waypoints, or a specified periodicity).
A2	Aircraft responds to message with acknowledgement and includes first report.
A3	Aircraft provides position reports in accordance with the pre-established conditions.
	Single report (Manual or automatic via CPDLC application, or automatic via ADS application)
B1	ATSU sends message to aircraft requesting a single position report.
B2	Aircraft provides the position report.
	Unsolicited (Flight crew initiated) position report (CPDLC application or supporting AOC application.)
C1	Aircraft sends a position report to the ATSU *Note: No response from ATSU is provided.*

4.7.2 Time sequence diagram for PR

Figure 4-13 provides a time sequence diagram for PR for the different transaction types. Numbers shown in the diagram map to steps shown in the operating method for information exchange and reporting described in Table 4-13.

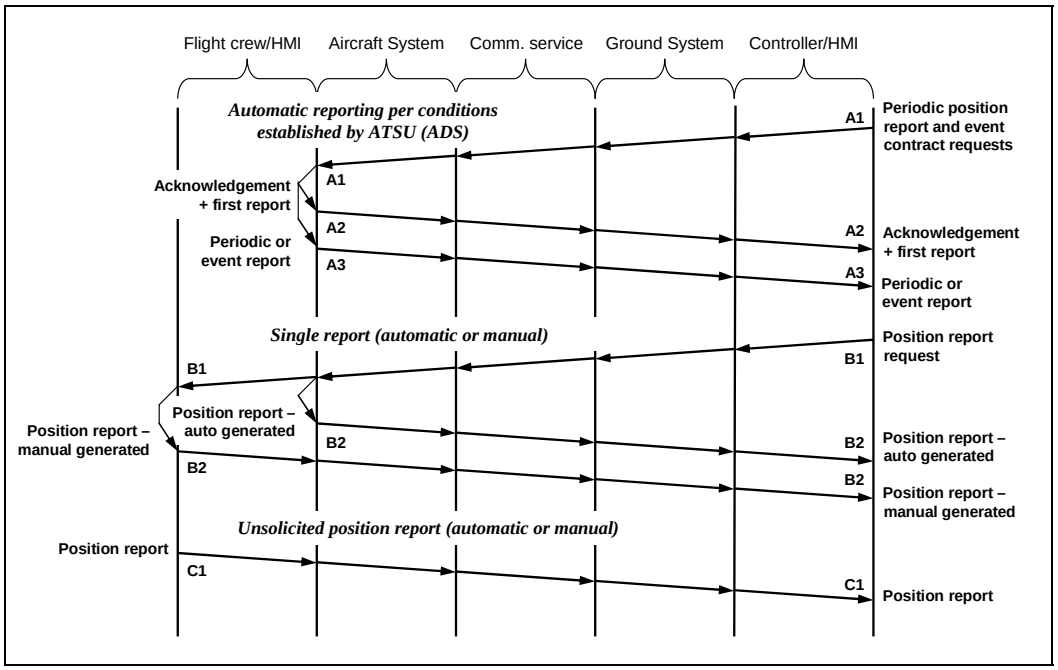

Figure 4-13: PR transactions

4.7.3 Messages for PR

4.7.3.1 Data Link applications other than the ADS application

ICAO PANS/ATM defines the data that is required in position reports when using data link applications other than the ADS application. PANS/ATM prescribes the routine air reports used to pass this operational data. These routine air reports contain the following data:

a) Section 1: Position Data

   1) Aircraft identification (callsign as per ICAO flight plan)

   2) Position

   3) Time

   4) Flight level or altitude

   5) Next position and time over

   6) Ensuing significant point.

b) Section 2: Operational Data (Optional)

1) Estimated time of arrival

2) Endurance

c) Section 3: Meteorological Information (Optional)

1) Air temperature

2) Wind direction

3) Wind speed

4) Turbulence

5) Aircraft icing

6) Humidity (If available)

ICAO PANS/ATM specify that Section 1 containing the position report data is mandatory except that elements 5) and 6) may be omitted by regional agreement. For the purposes of this standard it is assumed that the Next Position and Time over and ensuing significant point are supplied in all reports.

PR, when provided by the CPDLC application, uses DM48 to satisfy the ICAO PANS/ATM position reporting and meteorological information requirements. A request for a position report uses UM147. (Refer to Table A-2 and Table A-3, which can be found at Annex A).

PR, when provided by an AOC application, must be consistent with the data listed in Section 1 and 3 of the routine air report described above.

4.7.3.2 ADS Application

ICAO PANS/ATM requires that, when the ADS application is used to support PR, the ADS basic data block information is required from all aircraft and remaining data blocks are included as necessary. For the purposes of this standard it is assumed that Waypoint Event reports (containing the basic and projected profile data blocks), and Periodic Reports (containing the basic, and projected profile data blocks at minimum) are used. (Refer to Annex A, paragraph A.2). Meteorological information is included in periodic reports as required to satisfy the PANS/ATM reporting requirements.

5 Safety and performance requirements for the data link services

5.1 OSA results

5.1.1 Operational hazards

The analysis cover the air traffic service supported by data communication, but for the purpose of clarity and optimum work it is presented per operational sequences (so called data link service) assessed with different ATS functions. Table 5-1 provides operational hazards, their effects, environmental conditions, and classification. The hazard classification is based on the worst possible case. The analysis was based on generalized operational hazards that were applied to CRD, IER, and PR services, and their effects were assessed in the context of the ATS functions described in section 3. These operational hazards are:

- Loss of Service
- Loss of Communication Process
- Unexpected interruption of the transaction
- Detected late or expire
- Detected misdirection
- Detected corruption
- Undetected late or expired message
- Undetected misdirection of a message
- Undetected corruption of a message

Note: The CRD, IER, and PR services are dependent on DLIC, CE, CT, and TC data link services. Therefore, the effects of the failure conditions for these services would only manifest themselves in an operational hazard through the use of the CRD, IER, and PR services.

Table 5-1: Operational hazards for data link services.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
Reference # **H-CRD-1** **Description** Loss of data link service [Multiple aircraft, detected case] **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-4 C-ENV-5 C-ENV-6 C-ENV-8	Data link service is unavailable to all users. This prevents the ATSU to issue clearances to aircraft to resolve conflicts using the CRD data link service. ATSU and air crew have to revert to alternate form of communication. Two cases to consider: 1. Lack of direct controller/pilot communication could result in the aircraft not meeting the separation standard communication requirement: - Possibility of a slight reduction in safety margins and separation. - Slight increase in air crew workload due to reversion to voice communication. - Significant increase in air traffic controller workload due to reversion to voice communication for multiple data link aircraft. - Reduction in airspace capability. 2. Lack of direct controller/pilot communication could delay the issuance of a clearance used for resolving an actual loss of separation:	Not applicable.	Data link service is unavailable to all users. ATSU and aircraft are unable to use CRD for RR. Aircraft stay on the current route. No effect on operational capabilities or safety.	Data link service is unavailable to all users prior to communication. This prevents the flight crew to request a weather deviation or the controller to issue a clearance using CRD. Lack of direct controller/pilot communication could delay the issuance of weather deviation clearance: - Slight increase in air crew workload and significant increase in controller workload due to reversion to voice communication - Slight reduction in safety margin and separation due to possible increase use of deviation on Captain's Authority *Note: Interruption of transaction caused by the loss of data link service is covered by H-WD-CRD-3.*

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
	- Slight increase in sender and receiver workload due to reversion to voice communication. - Slight reduction in safety margins and separation.			
Reference # **H-CRD-2** **Description** Loss of communication process [Single aircraft, detected case]. **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-4 C-ENV-5 C-ENV-6 C-ENV-8	Data link service is unavailable for one user. This prevents the ATSU to issue clearances to this aircraft to resolve conflicts using the CRD data link service. ATSU and air crew have to revert to alternate form of communication. Two cases to consider: Lack of direct controller/pilot communication could result in the aircraft not meeting the separation standard communication requirement: - Possibility of a slight reduction in safety margins. - Slight increase in air crew and air traffic controller workload due to reversion to voice communication. 2. Lack of direct controller/pilot communication could delay the issuance of a clearance used for resolving an actual loss of separation: - Slight increase in sender and	Not applicable.	Data link service is unavailable for one user. ATSU or aircraft is unable to use CRD for RR. Aircraft stays on the current route. No effect on operational capabilities or safety.	Data link service is unavailable for one user prior to communication. This prevents the flight crew to issue request to the controller or the controller to issue a clearance using CRD data link service. Flight Crew and controller have to revert to an alternate form of communication. Lack of direct controller/pilot communication could delay the issuance of weather deviation clearance: - Slight increase in sender and receiver workload due to reversion to voice communication - Slight reduction in safety margin and separation due to possible increase use of deviation on Captain's Authority *Note: Interruption of*

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
	receiver workload due to reversion to voice communication.			*transaction caused by the loss of communication is covered by H-WD-CRD-3*
Reference # **H-CRD-3** **Description** Interruption of the transaction [Loss after initiation] **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-3 C-ENV-4 C-ENV-5 C-ENV-6 C-ENV-8	A clearance is issued to the pilot for separation. There are two cases to consider, either the air crew received the clearance or not. The worst case is when the the clearance is not received by the air crew. In this case, no response is received from pilot. Detection of the interruption is based on this lack of response. The controller has to revert to alternate form of communication: - Slight increase in sender and receiver workload due to reversion to voice communication.	Not applicable.	The data link service becomes unavailable after the aircraft or the ATSU initiates the reroute transaction. Case 1. Aircraft initiates reroute request, not received by ATSU. Slight increase in aircrew workload to resolve. Case 2. Aircraft responds to route clearance, not received by ATSU. Slight increase in air traffic controller workload to resolve non receipt of aircraft response. Case 3. ATSU issues route clearance, not received by aircraft. Slight increase in air traffic controller and air crew workload to resolve.	The data link service becomes unavailable after the flight crew initiates the weather deviation transaction. Flight Crew and controller have to revert to an alternate form of communication. Two cases to consider: a) The request is never received by the controller. b) The clearance or deny is never received by the flight crew. In either case, the worst effect is when the flight crew cannot obtain the clearance and proceeds on captain's authority.. Possibly a slight reduction in separation.
Reference # **H-CRD-4** **Description**	Responder realizes received message is late or expired; airborne or ground system presents expired message as such or discards message. Sender realizes the response is	Not applicable.	Message is not executed. Case 1. Aircraft initiates reroute request, received late by ATSU or expired. Slight increase in aircrew workload to resolve.	Responder realizes received message is late or expired; aircraft system presents expired message as such or discards message and notifies sender. The initiator realizes the

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
Detected late or expired message **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-3 C-ENV-4 C-ENV-5 C-ENV-6 C-ENV-8	overdue. Could result in a delay in resolving a conflict: - Slight increase in sender and receiver workload due to reversion to voice communication		Case 2. Aircraft responds to route clearance, received late by ATSU or expired. Slight increase in air traffic controller workload to resolve. *Case 3. ATSU issues route clearance, received late by aircraft or expired. Slight increase in air traffic controller and air crew workload to resolve.*	response is overdue. Two cases to consider: 1 – the crew still have enough time to reissue a request or to revert to voice. Slight increase in crew work load. 2 – To avoid the weather hazard, the crew take the decision to deviate on captain's authority. Case 2 is the worst. Possibly a slight reduction in separation.
Reference # **H-CRD-5** **Description** Detected misdirection of a message **Class** 4 **Environmental**	The aircraft or ATSU that was supposed to receive the message does not receive it. Another aircraft or ATSU receives an unintended messages. Could result in a delay in resolving a conflict: - Slight increase in sender and receiver workload due to reversion to voice communication. - Slight increase for the unintended sender or receiver workload.	Not applicable.	Case 1. Aircraft initiates reroute request, received by unintended ATSU. Unintended ATSU has to resolve the problem. Flight crew does not received clearance. Slight increase in aircrew and unintended ATSU workload. Case 2. Aircraft responds to route clearance, received by unintended ATSU. Unintended ATSU has to resolve the problem. Intended ATSU does not received the response Slight increase in work load for	The controller that was supposed to received the request or the aircraft that was supposed to received the clearance or deny does not receive it. Another aircraft or controller receives an unintended message. The flight crew or controller that was supposed to receive the message does not receive it. contributes to unexpected interruption of the transaction. Slight increase of workload for the unintended receiver. If sufficient time is available,

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
Conditions C-ENV-1 C-ENV-3 C-ENV-4 C-ENV-5 C-ENV-6 C-ENV-8			intended and inintended ATSU. Case 3. ATSU issues route clearance, received by unintended aircraft. Unintended and intended aircraft have to resolve. *Slight increase of work load for intended aircraft, unintended aircraft and ATSU.*	Flight Crew and controller has to reissue the request or to revert to an alternate form of communication. Two cases have to be considered: a.) The controller denies the clearance and the message was never received by the flight crew. b) The controller never receives the weather deviation request. In either case, the worst effect is when the flight crew cannot obtain the clearance and proceeds on captain's authority. Possibly a slight reduction in separation.
Reference # **H-CRD-6** **Description** Detected corruption of a message **Class** 4	The message is not used to complete the transaction. Could result in a delay in resolving a conflict: - Slight increase in sender and receiver workload due to reversion to voice communication.	Not applicable.	Message is not executed. Case 1. Aircraft initiates reroute request. It is received corrupted by ATSU. Slight increase in aircrew workload to resolve. Case 2. Aircraft responds to route clearance. It is received corrupted by ATSU. Slight increase in air traffic controller workload to resolve.	The message is not used to complete the transaction. If sufficient time is available, Flight Crew and controller have to reissue the request or to revert to an alternate form of communication. Otherwise, two cases have to be considered: a) The request is not processed by the controller.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
Environmental Conditions C-ENV-1 C-ENV-3 C-ENV-4 C-ENV-5 C-ENV-6 C-ENV-8			Case 3. ATSU issues route clearance. It is received corrupted by aircraft. Slight increase in air traffic controller and air crew workload to resolve.	b) The clearance or deny is not used by the flight crew. In either case, the worst effect is when the flight crew cannot obtain the clearance and proceeds on captain's authority. Possibly a slight reduction in separation
Reference # **H-CRD-7** **Description** Undetected late or expired message **Class** 3 **Environmental Conditions** C-ENV-2 C-ENV-3 C-ENV-4 C-ENV-7 C-ENV-8	In this case, an expired message is received. There are two cases to consider: 1. Aircraft receives the clearance correctly but the response is late. The clearance is executed. 2. Clearance to the aircraft is late: - Possibility of a significant reduction in safety margins and separation.	Not applicable.	Case 1. Controller receives late reroute request and initiates clearance, aircraft executes. No effect on operational capabilities or safety. Case2. Aircraft receives late route clearance and executes. No effect on operational capabilities or safety.	In that case, an expired message is received. There are two cases to consider: 1 - Controller receives request late and may process the deviation request that is no longer required. 2 – Crew receives the clearance or deny late. In the two cases, the worst case will be the flight crew proceeds on captain's authority. Possibly a slight reduction in separation.
Reference #	A clearance or it's response is	Not applicable.	A reroute request or its response	A request or it's clearance or

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
H-CRD-8 **Description** Undetected misdirection of a message **Class** 3 **Environmental Conditions** C-ENV-2 C-ENV-3 C-ENV-4 C-ENV-7 C-ENV-8	sent to an unintended aircraft or ATSU. There are two cases to consider: 1. Aircraft receives the clearance correctly but the response is misdirected. The clearance is executed. 2. Clearance to the aircraft is misdirected. The clearance is not executed by the intended aircraft: - Possibility of a significant reduction in safety margins and separation for both the intended and the unintended aircraft.		is sent to an unintended aircraft or ATSU. There are two cases to consider: Case 1. A reroute request is routed to the wrong ATSU who issues the clearance to the aircraft which in the worst case acts on it. Case 2. An unintended aircraft receives a route clearance and in the worst case acts on it. In both cases there is the possibility of a significant reduction in safety margins and separation.	deny is sent to an unintended controller or flight crew. There are 2 cases to consider: 1 – The request for weather deviation is sent to a wrong controller that issues a clearance to an unintended aircraft (undetected). In the worst case, the unintended aircraft deviates. 2 – The clearance or deny is sent to an unintended aircraft. The weather deviation is received by an incorrect aircraft, the flight crew for which the clearance was intended proceeds on captain's authority, the flight crew that the clearance was not intended receives an unsolicited clearance or deny. Worst case is when unintended aircraft respond and fly the weather deviation. If unintended aircraft and aircraft deviating on Captain's authority are under the same ATSU control, this can result on two aircraft in close proximity. Possibly a significant reduction in separation.
Reference #	Need to consider two cases: corruption of the clearance and	Not applicable.	Case 1. Route Clearance is corrupted. Aircraft is flying	Need to consider the following

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
H-CRD-9 **Description** Undetected corruption of a message **Class** 3 **Environmental Conditions** C-ENV-2 C-ENV-3 C-ENV-4 C-ENV-7 C-ENV-8	corruption of the response. 1. Corruption of the clearance: the pilot reacts to a clearance different from what the controller sent. The worst case is when flight crews responds and fly the incorrect clearance. 2. Corruption of the response: A WILCO is corrupted to UNABLE, which negates the controller's clearance, but the flight crew executes the clearance. Or if an UNABLE is corrupted into a WILCO, the flight crew does not execute the clearance but the controller thinks they are. From the controller's perspective, an aircraft is on an unintended flight path. For both cases, the consequences are: - Possibility of a significant reduction in safety margins and separation.		route different to that held by ATSU. Case 2. Response from aircraft is corrupted. Aircraft is flying route different to that held by ATSU. In both cases there is the possibility of a significant reduction in safety margins and separation.	cases: a) Corruption occurs in the request The controller reacts to a corrupted request. Worst case, controller grants clearance per unintended request that doesn't meet the intended request, flight crew responds UNABLE and proceeds per intended request on captain's authority. Possibly a slight reduction in separation. b) Corruption occurs in the clearance delivery. Flight crew receives a clearance different from what the controller sent. Worst case is when flight crews responds and fly the incorrect weather deviation. From the controller's perspective, an aircraft is on an unintended flight path. Possibly a significant reduction in separation. c) Corruption occurs in the flight crew response to clearance) A WILCO is corrupted to UNABLE, which negates the controller's clearance, but the flight crew executes the clearance.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
				Possibly a significant reduction in separation.
Reference # **H-IER-1** **Description** Loss of data link service [Multiple aircraft, detected case] **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	Event contract will not be available, possibly resulting in aircraft not meeting the separation standard surveillance requirement: - Possibility of a slight reduction in safety margins and separation. - Possibility of a slight increase in air crew workload due to reversion to ATC communication. - Significant increase in air traffic controller workload due to reversion to ATC communication for multiple data link aircraft.	Data link service is unavailable to all users. ATSU unable to use data link for RCM. Event reports can not be used to monitor route conformance. Possibility of a slight reduction in safety margins and separation.	Not applicable.	Not applicable.
Reference # **H-IER-2** **Description** Loss of	Event contract will not be available, possibly resulting in the aircraft not meeting the separation standard communication requirement: - Possibility of a slight reduction in safety margins.	Data link service is unavailable to one user. ATSU can not use event reports to monitor route conformance. Possibility of a slight reduction in safety margins and separation.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
communication process [Single aircraft, detected case]. **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	- Slight increase in air crew workload due to reversion to ATC communication.			
Reference # **H-IER-3** **Description** Interruption of the transaction [Loss after initiation] **Class** 4 **Environmental Conditions**	During the establishment of the event contract, it will result in the event not being setup. Another case is if the event report is not received by the ATSU. The ATSU will not be immediately notified of the event. - Possibility of a slight reduction in safety margins and separation. - Possibility of a slight increase in the controller workload to re-establish the event contract. - Slight increase in sender and receiver workload due to reversion to voice communication.	Worst case is an out of conformance event report that is not received. Possibility of a slight reduction in safety margins and separation.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
C-ENV-1 C-ENV-6 C-ENV-7				
Reference # **H-IER-4** **Description** Detected late or expired message **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	The message will be discarded by the receiver. 1. During the establishment of the event contract, this will result in the event not being setup initially. 2. The other case is when the late event report is not processed by the ATSU. Thus, the ATSU will not be immediately notified of the event. The possible effect is: - Possibility of a slight reduction in safety margins.	The ATSU is not immediately notified of an out of conformance event. Possibility of a slight increase in workload for the intended and unintended controller, and a slight reduction in safety margins.	Not applicable.	Not applicable.
Reference # **H-IER-5** **Description** Detected misdirection of a message	The message will be discarded by the receiver. During the establishment of the event contract, this could result in the event not being setup initially. The other case is when the event report is not received by the intended ATSU. The ATSU will not be immediately notified of the event. The possible effects are:	Message will be discarded by the unintended ATSU. Intended ATSU is not notified of an out of conformance event. Possibility of a slight increase in workload for the intended and unintended controller, and a slight reduction in safety margins.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
Class 4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	- Possibility of a slight reduction in safety margins. - Possibility of a slight workload increase for the intended and unintended ATSU.			
Reference # **H-IER-6** **Description** Detected corruption of a message **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	The message will be discarded by the receiver. During the establishment of the event contract, this will result in the event not being setup. The other case is when the corrupted event report is not processed by the ATSU. The possible effects are: - Possibility of a slight reduction in safety margins. - Possibility of a slight increase in the controller workload to confirm the position of the aircraft.	The message will be discarded by the receiver. Possibility of a slight reduction in safety margins and possibility of a slight increase in controller workload to verify the aircraft position.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
Reference # **H-IER-7** **Description** Undetected late or expired message **Class** 3 **Environmental Conditions** C-ENV-2 C-ENV-3 C-ENV-7	There are two cases to consider: 1. Late or expired event contract request: - Possibility of a significant reduction in safety margins and separation. 2. Late or expired event report: SA is based on stale data. - Possibility of a significant reduction in safety margins and separation.	Route conformance is based on stale data. Possibility of a significant reduction in safety margins and separation.	Not applicable.	Not applicable.
Reference # **H-IER-8** **Description** Undetected misdirection of a message **Class** 3	Need to consider two cases: the event contract is sent to wrong aircraft, or the event report is sent back to an unintended ATSU. The misdirection of the event contract acknowledgment is not considered. In the first case, the wrong aircraft will have a new event contract with the ATSU. This could replace an existing contract. The ATSU will not have a event contract with the intended	The event report is sent to an unintended ATSU. Intended ATSU does not receive an out of conformance event report. Possibility of a significant reduction in safety margins and separation.	Not applicable.	If the controller issues a weather deviation clearance, s/he will request the flight crew to report back on route to end the weather deviation clearance. Worst case is if the controller were to receive a back on route report while the flight crew were still executing the weather deviation clearance. From the controller's perspective, an aircraft is on an unintended flight path.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
Environmental Conditions C-ENV-2 C-ENV-3 C-ENV-7	aircraft: - Possibility of a significant reduction in safety margins and separation. In the second case, the intended ATSU does not receive the event report. This could increase the time needed by the ATSU to detect a loss of separation: - Possibility of a significant reduction in safety margins			Possibly a significant reduction in separation. Possible physical distress on passengers due to corrective maneuvers.
Reference # **H-IER-9** **Description** Undetected corruption of a message **Class** 3 **Environmental Conditions** C-ENV-2 C-ENV-3 C-ENV-7	This could result in: 1. no or incorrect contract being setup with the aircraft without the ATSU being aware of it. The consequence is: - Possibility of a slight reduction in safety margins. 2. the ATSU receiving incorrect position report data. In this case there are two possibilities. An in conformance position is sent as an out of conformance position report. The other possibility is when an out of conformance position report is received as an in conformance position report. The possible effects are: - Possibility of a significant reduction in safety margins and	Worst case is where an out of conformance report is corrupted to in conformance. Consequences are the possibility of a significant reduction in safety margins and separation.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
	separation.			
Reference # **H-PR-1** **Description** Loss of data link service [Multiple aircraft, detected case] **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	Periodic position report will not be available, possibly resulting in aircraft not meeting the separation standard communication requirement: - Possibility of a slight reduction in safety margins and separation. - Slight increase in air crew workload due to reversion to voice communication. - Significant increase in air traffic controller workload due to reversion to voice communication for multiple data link aircraft.	Data link service is unavailable to all users. ATSU unable to use data link for RCM. Both ATSU and aircraft revert to alternate form of communication. Significant increase in controller workload to obtain position reports from alternate source. Slight increase in Pilot workload to provide voice position reports. Possibility of a slight reduction in safety margins and separation	Not applicable.	Not applicable.
Reference # **H-PR-2** **Description** Loss of communication process [Single	Periodic position report will not be available, possibly resulting in aircraft not meeting the separation standard communication requirement: - Possibility of a slight reduction in safety margins. - Slight increase in air crew	Data link service is unavailable for one user. ATSU unable to use data link to detect the single aircraft route non-conformance. Slight increase in controller/pilot workload to obtain position reports from an alternate source.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
aircraft, detected case]. **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	workload due to reversion to voice communication.			
Reference # **H-PR-3** **Description** Interruption of the transaction [Loss after initiation] **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-6	During the establishment of the contract, it will result in the contract not being setup. Another case is when the periodic report is not received by the ATSU. The possible effects are: - Possibility of a slight reduction in safety margins. - Possibility of a slight increase in the controller workload to re-establish the periodic contract or obtain the periodic report data.	The worst case is when an out of conformance position report is not received. Slight increase in controller/pilot workload to obtain position report from an alternate source. Possibility of a slight reduction in safety margins and separation.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
C-ENV-7				
Reference # **H-PR-4** **Description** Detected late or expired message **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	The message will be discarded by the receiver. During the establishment of the contract, this will result in the contract not being setup. The other case is when the periodic report is not received in time by the ATSU. Thus, the ATSU will be missing periodic report data. The possible effects are: - Possibility of a slight reduction in safety margins. - Possibility of a slight increase in the controller workload to re-establish the periodic contract.	ATSU detects that received position report is late or expired. Ground system either presents message to the controller or discards the message. Worst case is an out of conformance report that is late or expired. Possibility of a slight reduction in safety margins and separation. Possibility of a slight increase in controller/pilot workload to obtain position report from an alternate source.	Not applicable.	Not applicable.
Reference # **H-PR-5** **Description** Detected misdirection of a message **Class**	The message will be discarded by the receiver. During the establishment of the contract, it could result in the contract not being setup. The other case is when the periodic report is not received in time by the intended ATSU. The ATSU will not be immediately notified of the event. The possible effects are: - Possibility of a slight reduction in safety margins.	The ATSU that was supposed to receive the position report does not receive it. Slight increase in controller/pilot workload to obtain position report from an alternate source. Slight increase in unintended ATSU receiver workload.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	- Possibility of a slight workload increase for the intended and unintended ATSU.			
Reference # **H-PR-6** **Description** Detected corruption of a message **Class** 4 **Environmental Conditions** C-ENV-1 C-ENV-6 C-ENV-7	The message will be discarded by the receiver. During the establishment of the contract, this will result in the contract not being setup. The other case is when the periodic report is discarded by the ATSU. The possible effects are: - Possibility of a slight reduction in safety margins. - Possibility of a slight increase in the controller workload to re-establish the event contract or confirm the periodic report.	The report is not used by the ATSU. Slight increase in controller/pilot workload to obtain position report from an alternate source.	Not applicable.	Not applicable.
Reference # **H-PR-7**	SA is based on stale data. SA uses data sent in the previous reports. This could increase the time needed by the ATSU to	Worst case is when an expired out of conformance message is received. Possibility of a significant reduction in safety	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
Description Undetected late or expired message **Class** 3 **Environmental Conditions** C-ENV-3 C-ENV-7	detect a loss of separation: - Possibility of a significant reduction in safety margins and separation.	margins and separation.		
Reference # **H-PR-8** **Description** Undetected misdirection of a message **Class** 3 **Environmental Conditions**	Need to consider two cases: the periodic contract request is sent to wrong aircraft, or the periodic report is sent back to an unintended ATSU. The misdirection of the periodic contract acknowledgment is not considered. 1. In the first case, for the periodic contract request: a) The ATSU will not have a periodic contract with the intended aircraft: - Possibility of a significant reduction in safety margins. b) The ATSU will have a new	Worst case is where an out of conformance report is sent to an unintended ATSU. Intented ATSU does not received out of conformance report. Possibility of a significant reduction in safety margins and separation.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
C-ENV-3 C-ENV-7	periodic contract with an unintended aircraft. This could replace an existing contract: - Possibility of a significant reduction in safety margins and separation. 2. In the second case, for the periodic report: a) The intended ATSU does not receive the periodic report. SA will be based on stale data. SA uses data sent in the previous reports. This could increase the time needed by the ATSU to detect a loss of separation: - Possibility of a significant reduction in safety margins. b) The unintended ATSU receives ADS reports from an aircraft not under his responsibility: - Possibility of slight increase in the controller workload.			
Reference # **H-PR-9** **Description** Undetected corruption of a	This could result in: 1. no or incorrect contract being setup with the aircraft without the ATSU being aware of it. The consequence is: - Possibility of a slight reduction in safety margins.	Worst case is where an out of conformance report is corrupted to in conformance. Consequences are the possibility of a significant reduction in safety margins and separation.	Not applicable.	Not applicable.

Hazard	Operational Effects			
	SA	**RCM**	**RR**	**WD**
message **Class** 3 **Environmental Conditions** C-ENV-3 C-ENV-7	2. the ATSU receiving incorrect position report data. In this case there are two possibilities. An in conformance position is sent as an out of conformance position report. The other possibility is when an out of conformance position report is received as an in conformance position report. The possible effects are: - Possibility of a significant reduction in safety margins and separation			

5.1.2 Safety objectives

Table 5-2 presents the safety objectives resulting from the hazard assessments. The safety objective reference corresponds to the hazard reference in Table 5-1.

Table 5-2: Safety objectives

Safety objective reference	Safety objective	Risk mitigation strategy	Hazard reference #
SO-1	The likelihood of occurrence of loss of data link service [Multiple aircraft, detected case] shall be no greater than probable.	SR-1 SR-2 SR-3 SR-4 SR-5 SR-13	H-CRD-1 H-IER-1 H-PR-1
SO-2	The likelihood of occurrence of loss of communication process [Single aircraft, detected case] shall be no greater than probable.	SR-1 SR-2 SR-3 SR-4 SR-5 SR-13	H-CRD-2 H-IER-2 H-PR-2
SO-3	The likelihood of occurrence of interruption of the transaction [Loss after initiation] shall be no greater than probable.	SR-2 SR-4 SR-5 SR-13	H-CRD-3 H-IER-3 H-PR-3
SO-4	The likelihood of occurrence of detected late or expired message shall be no greater than probable.	SR-9 SR-13 SR-14	H-CRD-4 H-IER-4 H-PR-4
SO-5	The likelihood of occurrence of detected misdirection of a message shall be no greater than probable.	SR-6 SR-7 SR-11 SR-12 SR-15 SR-17 SR-18 SR-19 SR-20 SR-21	H-CRD-5 H-IER-5 H-PR-5
SO-6	The likelihood of occurrence of detected corruption of a message shall be no greater than probable.	SR-6 SR-7 SR-10 SR-15 SR-16 SR-22 SR-23	H-CRD-6 H-IER-6 H-PR-6

Safety objective reference	Safety objective	Risk mitigation strategy	Hazard reference #
SO-7	The likelihood of occurrence of an undetected late or expired message shall be no greater than remote.	SR-9 SR-13 SR-14	H-CRD-7 H-IER-7 H-PR-7
SO-8	The likelihood of occurrence of undetected misdirection of a message shall be no greater than remote.	SR-6 SR-7 SR-8 SR-11 SR-12 SR-15 SR-17 SR-18 SR-19 SR-20 SR-21 SR-24	H-CRD-8 H-IER-8 H-PR-8
SO-9	The likelihood of occurrence of undetected corruption of a message shall be no greater than remote.	SR-6 SR-7 SR-8 SR-10 SR-15 SR-16 SR-22 SR-23 SR-25	H-CRD-9 H-IER-9 H-PR-9

5.1.3 Safety requirements

Table 5-3 presents the safety objectives resulting from the hazard assessment.

Table 5-3: Safety requirements

Safety requirement reference	Safety requirement	Safety objective reference
SR-1	An indication shall be provided to the initiator when a recipient rejects a data link service request.	SO-1 SO-2
SR-2	A detected loss of data link service shall be indicated to the controller/flight crew.	SO-1 SO-2 SO-3
SR-3	Data link service shall be established in sufficient time to be available for operational use.	SO-1 SO-2

Safety requirement reference	Safety requirement	Safety objective reference
SR-4	ATSU shall be notified of planned outage of data link service sufficiently ahead of time.	SO-1 SO-2 SO-3
SR-5	There shall be an indication to the initiator when a message cannot be successfully transmitted.	SO-1 SO-2 SO-3
SR-6	The end system shall provide unambiguous and unique identification of the origin and destination with each message it transmits.	SO-5 SO-6 SO-8 SO-9
SR-7	A response shall indicate to which messages it refers.	SO-5 SO-6 SO-8 SO-9
SR-8	The aircraft and the ATSU shall exchange via data link and process the same route information to eliminate failures/errors in the AOC data link services from contributing to the hazards identified for RR.	SR-8 SO-9
SR-9	The end system shall time stamp each message when it is released for onward transmission.	SO-4 SO-7
SR-10	Any processing (data entry/ encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message.	SO-6 SO-9
SR-11	The end system shall reject messages not addressed to itself.	SO-5 SO-8
SR-12	The initiator shall transmit messages to the designated end system.	SO-5 SO-8
SR-13	The initiating system shall indicate to the user when a required response is not received within the required time (ET_{TRN}).	SO-1 SO-2 SO-3 SO-4 SO-7
SR-14	When the end system receives a message whose time stamp exceeds ET_{TRN}, the end system shall take appropriate action based on a further safety assessment of the message content and situation. *Note: Some existing implementations discard the message. Others display it with an appropriate indication.*	SO-4 SO-7
SR-15	*The ATSU and aircraft end system shall prevent the release of clearance and operational responses without controller or flight crew action.*	SO-5 SO-6 SO-8 SO-9

Safety requirement reference	Safety requirement	Safety objective reference
SR-16	The recipient system shall prohibit operational processing of corrupted messages.	SO-6 SO-9
SR-17	The recipient shall be able to determine the message initiator.	SO-5 SO-8
SR-18	The recipient system shall prohibit operational processing of messages not addressed to the recipient.	SO-5 SO-8
SR-19	ATSU shall only establish and maintain data link services when the aircraft identifiers in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.	SO-5 SO-8
SR-20	The aircraft identifiers used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).	SO-5 SO-8
SR-21	The aircraft or flight crew shall perform the initiation data link procedure again with the applicable ATSUs when any of the flight identifiers changes.	SO-5 SO-8
SR-22	The ATSU shall not permit data link services when there are no compatible version numbers.	SO-6 SO-9
SR-23	Messages shall be responded to in their entirety.	SO-6 SO-9
SR-24	The end system shall be capable (e.g., via an integrity mechanism) of detecting errors that would result in mis-delivery or non-delivery introduced by the communication service.	SO-8
SR-25	The end system shall be capable (e.g., via an integrity mechanism) of detecting errors that would result in corruption introduced by the communication service.	SO-9

5.2 OPA results

This section provides the OPA results for the data link services, defined in section 4. The OPA results are based on an assessment of the data link services in the context of the ATS functions, defined in section 3, taking into account:

a) Operational requirements provided in paragraph 2.2; which provide the basis for establishing the time requirements, and

b) Safety objectives defined in paragraph 5.1, which provide the basis for establishing the availability, continuity, and integrity requirements.

The OPA results include performance requirements for operational communications within the framework of an RCP type, per ICAO Doc 9869. Operational communications is supported by the CRD and IER data link services. Additional performance requirements are provided for data link services used for surveillance, supported by the PR and IER data link services. The performance requirements include, where applicable, a characterization of latency (or time), availability, continuity, and integrity, whether provided within the framework of an RCP type for communications or specific to surveillance.

5.2.1 Communication and controller intervention buffer

The operational requirements provide a basis for determining the time requirements that relate to communications and surveillance elements supporting separation assurance. For time-based longitudinal separation, these requirements are based on a communication and controller invention buffer, represented by τ. The communication and controller intervention buffer allows for the possibility that, when the next distance check is obtained, it may become apparent to the controller that separation will be lost, requiring the controller to communicate with the aircraft or other aircraft in the vicinity and intervene to maintain separation assurance.

The communication and controller intervention buffer and its elements are defined in ICAO Doc 9689, Appendix 5, paragraph 5.1. It includes elements that are beyond the scope of the communication and surveillance elements. Table 5-4 provides an overview of the elements of τ, and their relationship to the communication and surveillance elements.

Table 5-4 Elements of communication and controller intervention buffer

Element of communication and controller intervention buffer, τ	Relationship to data link service
Position report delivery time	PR
Time for the controller to recognize the potential conflict and to devise an alternative means of separation	Not applicable to data link services
Time taken to communicate the instructions to the pilot Note: includes time to compose and uplink message to the pilot.	CRD IER
Time taken to communicate the instructions to the pilot (via alternative means of communication, assumed to be third party voice)	Not applicable to data link services
Time for the pilot to react and initiate an appropriate maneuver	Not applicable to data link services
Time for the aircraft to achieve a change of trajectory sufficient to ensure that a collision will be averted	Not applicable to data link services
Extra allowance	Provisional

5.2.2 Operational communication transactions and RCP type

Since the publication of DO-264/ED-78A, ICAO has issued ICAO Doc 9869, Manual on Required Communication Performance (RCP). ICAO Doc 9869 recommends the prescription of an RCP type, when a safety related change, including the implementation of a reduced separation minimum or a new procedure, are predicated on communication performance. The OPA results provided herein take into account the guidance provided ICAO Doc 9869 and, in some instances, supersede the guidance provided by DO-264/ED-78A.

The RCP type provides a framework to determine performance requirements for the CNS/ATM system providing communications in the airspace, and the monitoring, indication, and reporting requirements for failures that cause system performance to degrade below that which is required by the separation minima, per OR-3, in Table 2-2. Application of an RCP type is particularly useful in airspace that provides multiple separation minima depending on aircraft capability and performance, or when communication capabilities use technologies other than traditional technologies, such as third party HF voice communication.

An operational communication transaction is the process a human uses to send an instruction, clearance, flight information, and/or request, and is completed when that human is confident that the transaction is complete. An RCP type is a label (e.g., RCP 240) that defines a performance standard for operational communication transactions. Each RCP type denotes values for communication transaction time, continuity, availability, and integrity applicable to the most stringent operational communication transaction supporting an ATS function.

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

b) Continuity – The probability that an operational communication transaction can be completed within the communication transaction time.

c) Availability – The probability that an operational communication transaction can be initiated when needed.

d) Integrity – The probability of one or more undetected errors in a completed communication transaction.

Separation assurance is predicated on the communication performance of the CRD and IER data link services supporting communication elements of τ. The operational communication transaction for controller intervention is described in the procedure for separation assurance (paragraph 3.2) and the service description for CRD (paragraph 4.5). Controller intervention, which is considered the most stringent operational communication transaction in oceanic and remote environments, described in section 2. The CRD service provides the controller confidence that the operational communication transaction for an intervention is complete when the controller receives an acknowledgment, e.g., WILCO, of the clearance from the aircraft.

Note: The time requirements for the CRD service in a weather deviation procedure were considered. It was assumed that flight crews would request a deviation, based on a weather radar with a range of approximately 40 NM (See C-ENV-5) and other operational considerations, 5 minutes prior to reaching a weather cell. On that assumption, and allowing time for the aircraft to deviate, the flight crew would need to receive a clearance within 3 minutes from initiating the request. This time is consistent with the time required for controller intervention. It is noted that the operational hazard table provided in paragraph 5.1.1, shows appropriate environmental mitigation in the event the flight crew exercises his captain's authority to deviate. However, the frequency at which flight crews exercise Captain's authority, the number of aircraft that may be deviating at the same time in the same area of airspace, and other factors, such further reductions in separation minima, may require reconsideration of the weather deviation procedure in prescribing an appropriate RCP type for the CRD service in a weather deviation procedure.

5.2.3 Separation assurance – 50/50 NM and 30/30 NM separation minima – operational requirements related to data link services

Time requirements are provided for data link services used to support 50/50 NM and 30/30 NM separation minima. These requirements are based on the use of data link services per OR-4, OR-5, and OR-6, in Table 2-2.

5.2.3.1 Time values for communications and controller intervention buffer

The time values for the communications and controller intervention buffer can be determined from the values provided in OR-8 and OR-9, in Table 2-2 for the following scenarios:

a) 4 minutes for normal operations (95% probability) – the CRD service provides the controller the capability to intervene and resolve a potential conflict by contacting an aircraft;

b) 10½ minutes for non-normal communication operations (5% probability) – When the CRD service does not complete operational communication transactions within 3 minutes from the time the controller sent the clearance, third party voice provides an alternative means of communication for the controller to intervene and resolve the conflict;

c) 13½ minutes for non-normal surveillance operations (5% probability) – When the PR service does not deliver a normal ADS periodic or waypoint change event report within 3 minutes, the PR service also provides the controller the capability to initiate an ADS demand contract to obtain a position report. The IER service provides the controller the capability to initiate a CPDLC message to obtain a position report. Third party voice also provides the controller a capability to obtain a position report.

5.2.3.2 Allocation of time values to the elements of τ

To determine the performance requirements for the data link services supporting communication and surveillance, it will necessary to allocate the values of τ to its elements and determine which elements are related to the CNS/ATM system that provide the data link services. Table 5-5 provides the values of τ, allocates a portion of each value to each of the τ elements, and indicates which elements are related to the CRD, IER, and PR data link services.

Table 5-5: Allocation of time values to the elements of τ (normal and non-normal operations)

Scenario	**Normal communication**	**Non-normal communication**	**Non-normal surveillance**
Value of communication and controller intervention buffer, τ	**240 seconds (4 minutes)**	**630 seconds (10½ minutes)**	**810 seconds (13½ minutes)**
Allocations to elements of τ			
Element related to the PR service Position report delivery time	≤ 180 seconds *Note: Not included in value of τ.*	≤ 180 seconds *Note: Not included in value of τ.*	180 seconds *Note: Time after which the controller expected the ADS report to have been sent, and was not received.*
Time for the controller to recognize the potential conflict and to devise an alternative means of separation	30 seconds	30 seconds	Not applicable. Missing report.

Scenario	Normal communication	Non-normal communication	Non-normal surveillance
Value of communication and controller intervention buffer, τ	**240 seconds (4 minutes)**	**630 seconds (10½ minutes)**	**810 seconds (13½ minutes)**
Allocations to elements of τ			
Element related to the CRD and IER services Time taken to communicate the instructions to the pilot	Normal means of communication, DCPC (CPDLC) – 105 seconds. *Note: Controller message composition - 15 seconds; uplink 90 seconds. Normal operations assumes normal means of communication, DCPC (CPDLC) is functioning. Time for the controller to receive and recognize the response to the instruction is not included.*	195 seconds *Note: Time after which the controller initiates communication, via normal means, and receives no response. By then, the controller would have initiated communication via alternative means.*	195 seconds *Note: Time after which the controller initiates 1st attempt to obtain report, via ADS demand contract and/or CPDLC, and receives no response. By then, the controller would have initiated communication via alternative means.*
Time taken to communicate the instructions to the pilot (via alternative means of communication, assumed to be third party voice)	Not applicable	300 seconds. *Note: Time after which the controller initiates communication, via alternative means of communication, and receives no response. By then, the controller would have initiated communication with other aircraft.*	300 seconds *Note: Time after which the controller initiates 2nd attempt to obtain report, via alternative means of communication, and receives no response. By then, the controller would have initiated communication with other aircraft.*
Time for the pilot to react and initiate an appropriate maneuver	30 seconds	30 seconds	30 seconds
Time for the aircraft to achieve a change of trajectory sufficient to ensure that a collision will be averted	75 seconds	75 seconds	75 seconds
Extra allowance	0	0	30 seconds

5.2.3.3 Time requirements for operational communication transactions supporting intervention

This section provides time requirements for the CRD and IER services through the specification of an RCP 240, which is appropriate for the time values allocated to the communication elements of τ per Table 5-5.

Figure 5-1 provides an overview of the normal and non-normal operations for intervention in the ATS function context. Figure 5-2 provides an overview of the normal and non-normal operations for surveillance in the ATS function context. The figures indicate the normal and non-normal operations in the context of the communication and controller intervention buffer. RCP types for operational communication supporting intervention and surveillance are shown for the normal and alternative means of communication.

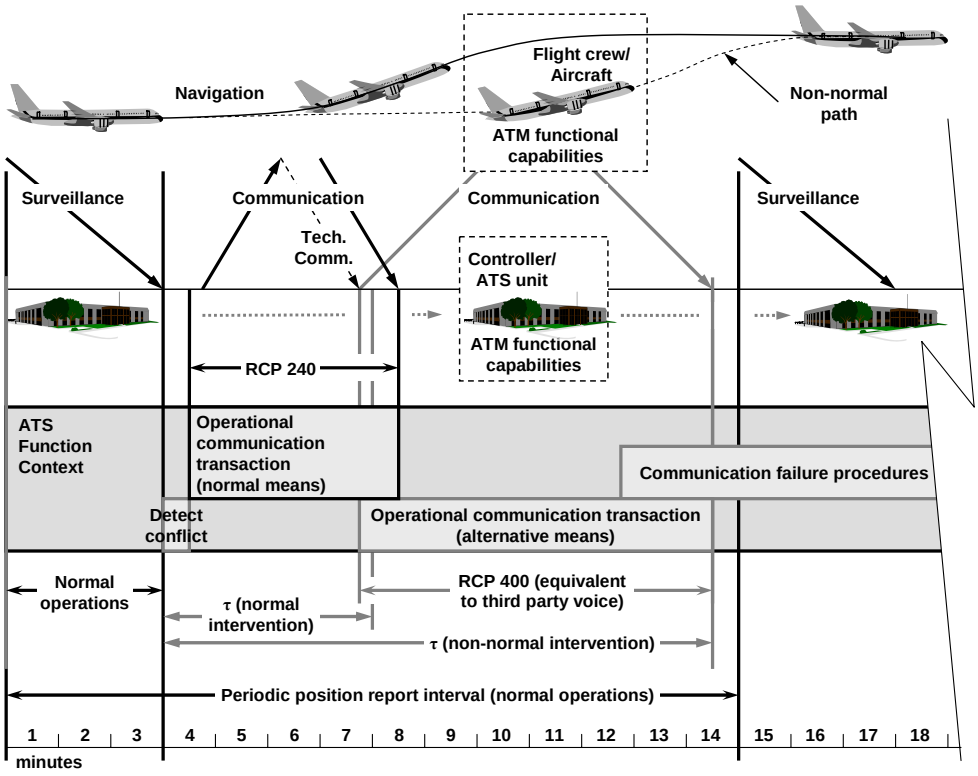

Figure 5-1: 30/30 NM separation – intervention

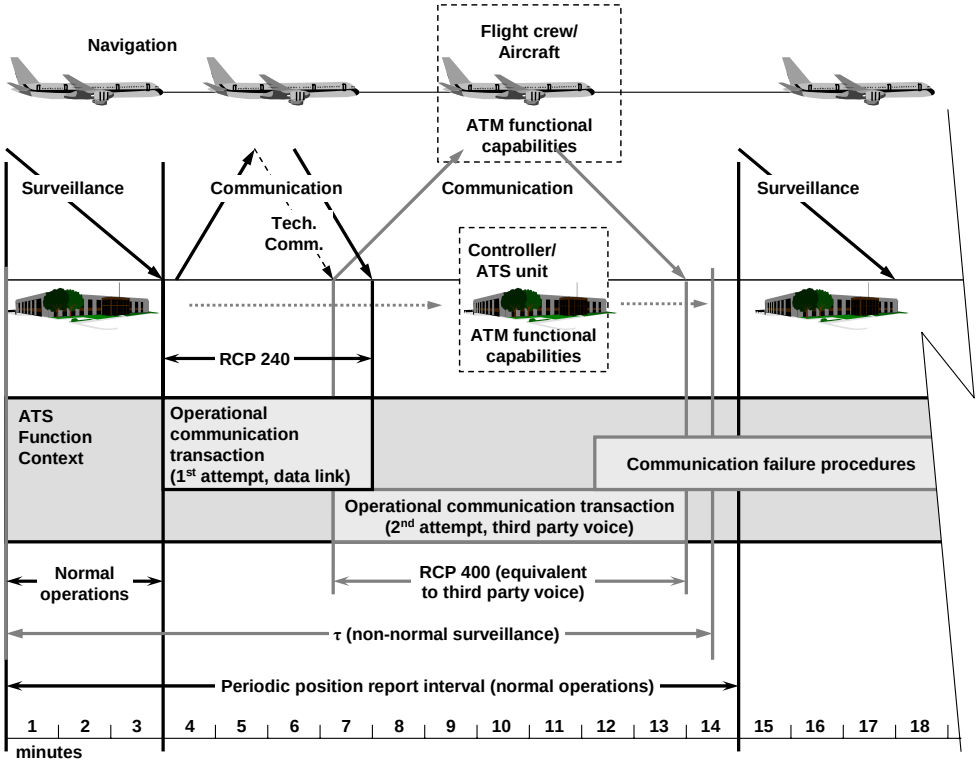

Figure 5-2: 30/30 NM separation – surveillance

Table 5-6 provides the RCP values for communication transaction time (ET) and the time for normal operations (95% of the transactions) that are required for the communications and controller intervention capability. The RCP values are the result of an assessment of the operational requirements for communications supporting the separation standards provided in PANS/ATM. Table 5-6 also provides the RCP allocations for expiration time and transaction time to the components of the CNS/ATM system. These RCP allocations are required to the extent that the statistical sum of the values meet the RCP time values. Figure 5-3 provides the relationship of the RCP type to the beginning and ending point of operational communication transaction within the communication and controller intervention buffer and the RCP time allocations to the time sequence diagram for intervention.

Table 5-6: Allocations of time values for RCP 240/D and RCP 400/D

RCP type	**RCP 240/D**		**RCP 400/D**	
Time Parameter	ET	95%	ET	95%
Time Value	240	210	400	350
RCP Time Allocations				
Initiator	30	30	30	30
TRN	210	180	370	320
TRN Time Allocations				
Responder	60	60	60	60
RCTP	150	120	310	260
RCTP Time Allocation				
Aircraft	15	10	15	10
Communication service	120	100	280	240
ATS unit	15	10	15	10

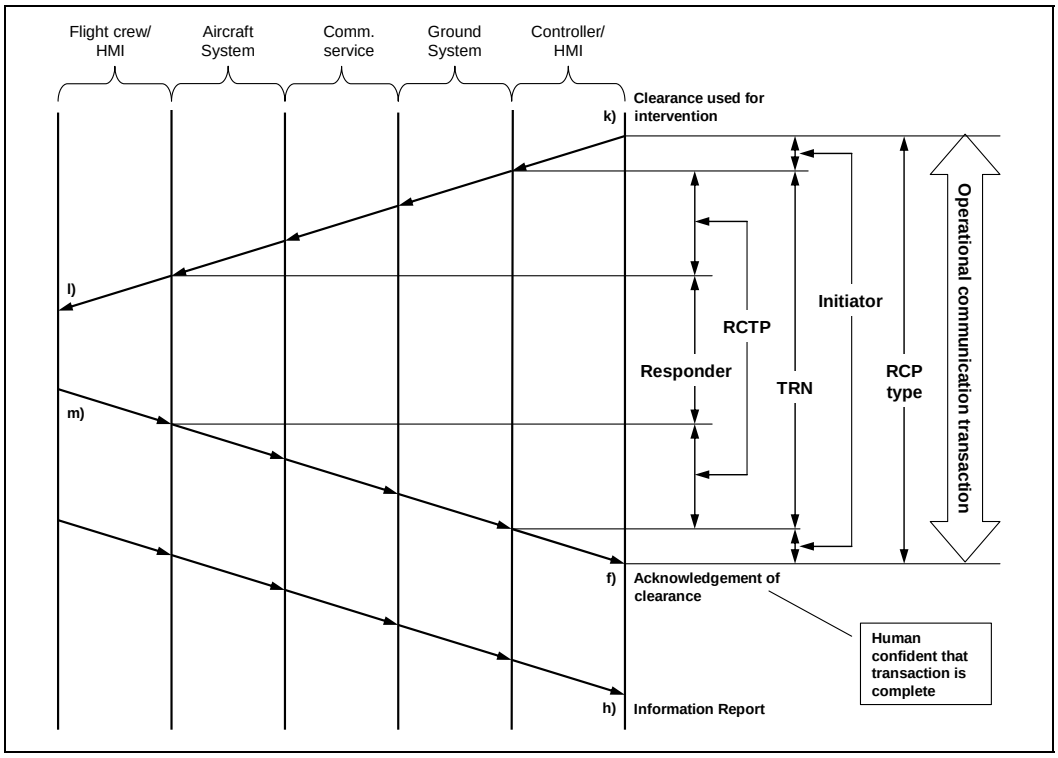

Figure 5-3: Relationship of RCP time allocations to time sequence diagram

5.2.3.4 Time requirements supporting position report delivery

Per OR-6, in Table 2-2, distance-based longitudinal separation is based on ADS. For 50 NM longitudinal separation minimum, the aircraft must automatically send a position report every 27 minutes or 32 minutes, depending on whether the aircraft has filed RNP 10 or RNP 4, respectively. For 30 NM longitudinal separation minimum, the aircraft must automatically send a position report every 14 minutes (the aircraft has filed RNP 4). Per OR-4, in Table 2-2, for 30 NM lateral separation minimum, an event contract is set and includes a lateral deviation event report whenever the aircraft deviates more than 5 NM from track centerline. This section provides the time requirements for position report delivery.

a) The PR service shall deliver position reports within 3 minutes at 95% probability for:

   1) Periodic reports, from the start of the periodic interval;

   2) Waypoint change event reports, from the estimated time the aircraft crosses the waypoint as indicated by the current flight plan; and

   3) Demand reports, from the time the demand contract was initiated by the ATSU/controller.

b) The IER service shall deliver the lateral deviation event report within 3 minutes at 95% probability from the time the aircraft system detects that the event has occurred.

5.2.4 Separation assurance – 100 NM or 60 NM lateral/15 or 10 minutes longitudinal separation minima – time requirements related to data link services

Time requirements are provided for data link services used to support 100 NM or 60 NM lateral/15 or 10 minutes longitudinal separation minima. These requirements are intended to be applied to data link services, which may be used for continuous air-ground communications and for position reporting, per OR-1 and OR-2, in Table 2-2, respectively.

5.2.4.1 Time requirements for operational communication transactions supporting intervention

The time requirements for operational communication transactions supporting intervention are established based on the time requirements applied to the alternative means of communication for the 50/50 NM and 30/30 NM separation minima provided in paragraph 5.2.3.3. However, in this case, as indicated in Figure 5-4, the communication is the normal means.

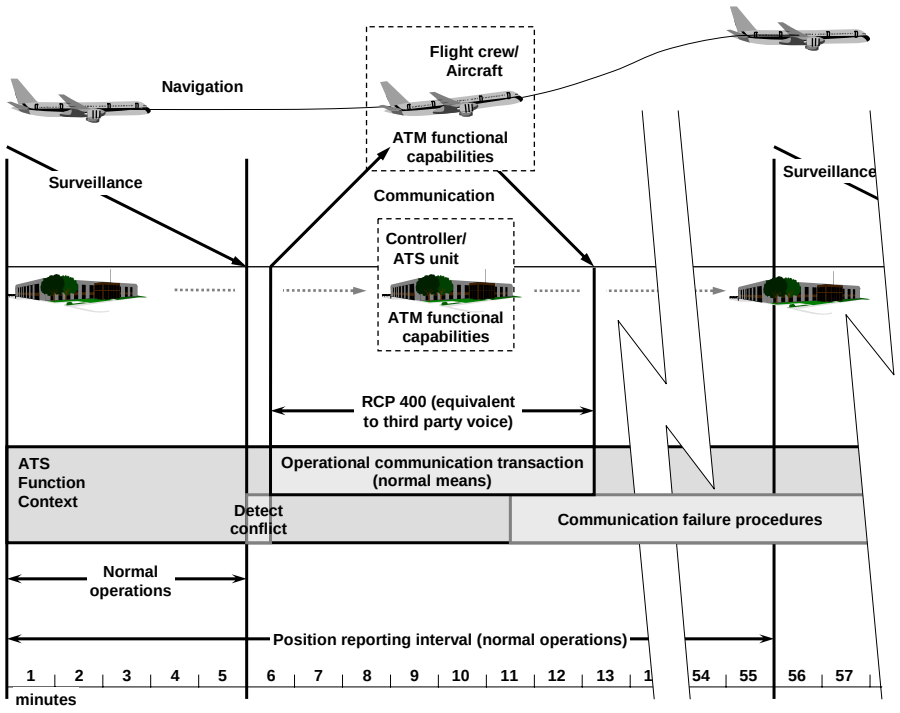

Figure 5-4 100/60 NM lateral/10/15 min longitudinal separation - intervention

5.2.4.2 Time requirements supporting position report delivery

The time requirements for position report delivery are established based on the time requirements for the 50/50 NM and 30/30 NM separation minima that are applied to the 2nd attempt to obtain a position report in a "non-normal surveillance" scenario, described in Table 5-5. This time requirement is 300 seconds (5 minutes). However, the same means used for the 2nd attempt in the "non-normal surveillance" scenario (shown in Figure 5-2) for the reduced time-based separation is the "normal operation" for this case, as shown in Figure 5-4,

The PR service shall deliver position reports within 5 minutes at 95% probability at waypoint crossings, from the estimated time the aircraft crosses the waypoint as indicated by the current flight plan.

5.2.5 Availability, continuity, and integrity requirements for data link services

The availability, continuity, and integrity requirements are provided based on OR-1, OR-5, and OR-7, per Table 2-2, and the safety objectives provided in paragraph 5.1.2.

Table 5-7 provides the availability, continuity, and integrity requirements for data link services. Values are assigned to the safety objectives provided in Table 5-2 using the criteria provided in Table 1-1. The requirements for availability and continuity are

defined as one minus the quantitative value assigned to the probabilistic term for the safety objectives associated with the parameter.

Note: The availability, continuity, and integrity requirements provided in Table 5-7 are intended to provide the criteria for operational assessments. The allocations for these parameters to the elements of the CNS/ATM system will depend on the system architecture, technology, and other design considerations. These design considerations are constrained by the safety requirements that are associated with each of the safety objectives linked to each of the parameters. The safety requirements provide the optimum allocation of requirements considering risk mitigation strategies that are shared by the elements of the CNS/ATM system. For example, Annex B allocates the safety requirements associated with the integrity parameter only to the aircraft end system and the ATSU end system; there is no allocation to the communication service element, thereby minimizing the requirements for development assurance on the software components of the communication service element.

Table 5-7: Availability, continuity and integrity requirements for data link services

Parameter	Requirement	Source information		
		Safety objective per Table 5-2	**Hazard/ qualitative term per Table 5-2**	**Quantitative value per Table 1-1**
Availability of service provision for all aircraft	0.999 [$1-10^{-3}$]	SO-1	Loss of service probable	10^{-3}
Availability of an aircraft to use the service	0.999 [$1-10^{-3}$]	SO-2	Loss of communication with an aircraft probable	10^{-3}
Continuity (C)	0.999 [$1-10^{-3}$]	SO-3 SO-4 SO-5 SO-6	Unexpected interruption of the transaction probable	10^{-3}
Integrity (I)	10^{-5}	SO-7 SO-8 SO-9	Undetected corruption of the transaction remote	10^{-5}

5.2.6 RCP types and values for parameters

Table 5-8**Error! Reference source not found.** provides the intended uses for RCP 240 and RCP 400 in this standard and the associate values to the parameters for each RCP

type. It is noted that OR-3 is directly applicable to the performance of data link services required for the ATS function and as prescribed by the RCP type.

a) Whenever, as a result of failure or degradation of the data link service is degraded below the level as prescribed by the RCP type for the ATS function, the flight crew shall advise the ATC unit concerned without delay.

b) Where the failure or degradation affects the separation minimum currently being employed, the controller shall take action to establish another appropriate type of separation or separation minimum.

Table 5-8: Values for parameters of RCP 240 and RCP 400

RCP type	Intended use	Transaction time (ET) (sec)	Continuity (C) (probability/ flight hour)	Availability (A) (probability/ flight hour)	Integrity (I) (acceptable rate/ flight hour)
RCP 240	Normal means of communication for application of 30/30 and 50/50 separation minima	240 See paragraph 5.2.3	0.999 See paragraph 5.2.5	0.999 See paragraph 5.2.5	10^{-5} See paragraph 5.2.5
RCP 400	Alternative means of communication for application of 30/30 and 50/50 separation minima	400 See paragraph 5.2.3	0.999 See paragraph 5.2.5	0.999 See paragraph 5.2.5	10^{-5} See paragraph 5.2.5
RCP 400	Normal means of communication for application of 100 NM or 60 NM lateral/15 or 10 minutes longitudinal separation minima	400 See paragraph 5.2.4	0.999 See paragraph 5.2.5	0.999 See paragraph 5.2.5	10^{-5} See paragraph 5.2.5
Note: The values for parameters of RCP types have been adjusted from those provided in ICAO Doc 9869 based on the results of the operational safety and performance assessments provided in section 5.					

Annex A: OPERATIONAL CONSIDERATIONS FOR DATA LINK APPLICATIONS

This page intentionally left blank.

Annex A OPERATIONAL CONSIDERATIONS FOR DATA LINK APPLICATIONS

A.1 CPDLC application

This annex provides a list of the messages used by the CPDLC application supporting the data link service described in section 4.

Table A-2 provides the CPDLC application uplink messages.

Table A-3 provides the CPDLC application downlink messages.

Table A-4 provides controller initiated transactions using standardized free text, UM169 or, if used to acknowledge an emergency, UM170.

Table A-5 provides standardized downlink free text messages, DM67 or, if used for an emergency, DM68.

Table A-1 provides a legend that applies to the "Response" column of the message tables provided for the CPDLC application.

Note 1: Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e., block level.

Note 2: Non-standardized free text messages have no associated message intent. The capability to send a free text message with any of the attribute combinations already used in the message set has been provided.

Table A-1: Response Legend; Permitted Responses

TYPE	Response Legend; Permitted Responses
	For uplink message
W/U	WILCO, UNABLE, STANDBY, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, ERROR
A/N	AFFIRM, NEGATIVE, STANDBY, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, ERROR
R	ROGER, UNABLE, STANDBY, NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, ERROR
N (not permitted)	NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, ERROR
NE	The WILCO, UNABLE, AFFIRM, NEGATIVE, ROGER, and STANDBY responses are not enabled for flight crew selection. However, most messages with an NE attribute require an operational response. Only the correct operational response is presented to the flight crew.

TYPE	Response Legend; Permitted Responses
	For downlink messages
Y	Response required. Appropriate response messages are provided.
N (not permitted)	NOT CURRENT DATA AUTHORITY, NOT AUTHORIZED NEXT DATA AUTHORITY, ERROR.

Table A-2: CPDLC Application Uplink Messages

UM Ref #	Message Intent/Use	Message Element	Response	Used in
	Responses/ Acknowledgments (uplink)			
UM0	Indicates that ATC cannot comply with the request.	UNABLE	N	All
			NE	All
UM1	Indicates that ATC 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.	STANDBY	N	All
			NE	All
UM2	Indicates that ATC 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.	REQUEST DEFERRED	N	All
			NE	All
UM3	Indicates that ATC has received and understood the message.	ROGER	N	All
			NE	All
UM4	Yes.	AFFIRM	N	All
			NE	All
UM5	No	NEGATIVE	N	All
			NE	All
	Vertical Clearances (uplink)			
UM6	Notification that a level change instruction should be expected.	EXPECT [level] [altitude] is interchangeable with [level]	R	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM7	Notification that an instruction should be expected for the aircraft to commence climb at the specified time.	EXPECT CLIMB AT [time]	R	IER
UM8	Notification that an instruction should be expected for the aircraft to commence climb at the specified position.	EXPECT CLIMB AT [position]	R	IER
UM9	Notification that an instruction should be expected for the aircraft to commence descent at the specified time.	EXPECT DESCENT AT [time]	R	IER
UM10	Notification that an instruction should be expected for the aircraft to commence descent at the specified position.	EXPECT DESCENT AT [position]	R	IER
UM19	Instruction to maintain the specified level.	MAINTAIN [level] For FANS 1/A, single level [altitude] is interchangeable with [level]. FANS 1/A uses UM30 for block level.	W/U	CRD
UM20	Instruction that a climb to a specified level is to commence and once reached the specified level is to be maintained.	CLIMB TO [level]	W/U	CRD
UM21	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.	AT [time] CLIMB TO [level]	W/U	CRD
		AT [time] CLIMB TO AND MAINTAIN [altitude]	W/U	CRD
UM22	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.	AT [position] CLIMB TO [level]	W/U	CRD
		AT [position] CLIMB TO AND MAINTAIN [altitude]	W/U	CRD

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM23	Instruction that a descent to a specified level is to commence and once reached the specified level is to be maintained.	DESCEND TO [level]	W/U	CRD
		DESCEND TO AND MAINTAIN [altitude] For FANS 1/A, single level [altitude] is interchangeable with [level]. FANS 1/A uses UM30 for block level.	W/U	CRD
UM24	Instruction that at a specified time a descent to a specified level is to commence and once reached the specified level is to be maintained.	AT [time] DESCEND TO [level]	W/U	CRD
		AT [time] DESCEND TO AND MAINTAIN [altitude]	W/U	CRD
UM25	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.	AT [position] DESCEND TO [level]	W/U	CRD
		AT [position] DESCEND TO AND MAINTAIN [altitude]	W/U	CRD
UM26	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance the level specified is the assigned level which is to be maintained.	CLIMB TO REACH [level] BY [time] [altitude] is interchangeable with [level]	W/U	CRD
UM27	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance the level specified is the assigned level which is to be maintained.	CLIMB TO REACH [level] BY [position] [altitude] is interchangeable with [level]	W/U	CRD

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM28	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified time. When this message element is not concatenated with another vertical clearance the level specified is the assigned level which is to be maintained.	DESCEND TO REACH [level] BY [time] [altitude] is interchangeable with [level]	W/U	CRD
UM29	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified position. When this message element is not concatenated with another vertical clearance the level specified is the assigned level which is to be maintained.	DESCEND TO REACH [level] BY [position] [altitude] is interchangeable with [level]	W/U	CRD
UM30	Instruction that a level within the defined vertical range specified is to be maintained. ATN B1 uses UM19 instead of UM30 for block level.	MAINTAIN BLOCK [level] TO [level] [altitude] is interchangeable with [level]	W/U	CRD
UM31	Instruction that a climb to a level within the vertical range defined is to commence. ATN B1 uses UM20 instead of UM31 for block level.	CLIMB TO AND MAINTAIN BLOCK [level] TO [level] [altitude] is interchangeable with [level]	W/U	CRD
UM32	Instruction that a descent to a level within the vertical range defined is to commence. ATN B1 uses UM23 instead of UM32 for block level.	DESCEND TO AND MAINTAIN BLOCK [level] TO [level] [altitude] is interchangeable with [level]	W/U	CRD
UM219	Instruction to stop the climb at the specified level and once reached this level is to be maintained. The specified level will be below the previously assigned level.	STOP CLIMB AT [level]	W/U	CRD (Urgent)

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM36	Instruction that the climb to the specified level should be made at the aircraft's best rate.	EXPEDITE CLIMB TO [level] [altitude] is interchangeable with [level]	W/U	CRD (Urgent)
UM37	Instruction that the descent to the specified level should be made at theaircraft's best rate.	EXPEDITE DESCENT TO[level] [altitude] is interchangeable with [level]	W/U	CRD (Urgent)
UM38	Urgent instruction to immediately climb to the specified level and once reached the specified level is to be maintained.	IMMEDIATELY CLIMB TO [level] [altitude] is interchangeable with [level]	W/U	CRD (Distress)
UM39	Urgent instruction to immediately descend to the specified level and once reached the specified level is to be maintained.	IMMEDIATELY DESCEND TO [level] [altitude] is interchangeable with [level]	W/U	CRD (Distress)
UM171	Instruction to climb at not less than the specified rate.	CLIMB AT [vertical rate] MINIMUM	W/U	CRD
UM172	Instruction to climb at not above the specified rate.	CLIMB AT [vertical rate] MAXIMUM	W/U	CRD
UM173	Instruction to descend at not less than the specified rate.	DESCEND AT [vertical rate] MINIMUM	W/U	CRD
UM174	Instruction to descend at not above the specified rate.	DESCEND AT [vertical rate] MAXIMUM	W/U	CRD
	Crossing Constraints (uplink)			
UM46	Instruction that the specified position is to be crossed at the specified level. This may require the aircraft to modify its climb or descent profile.	CROSS [position] AT [level] [altitude] is interchangeable with [level] For FANS 1/A, single level [altitude] is interchangeable with [level]. FANS 1/A uses UM50 for block level.	W/U	CRD
UM47	Instruction that the specified position is to be crossed at or above the specified level.	CROSS [position] AT OR ABOVE [level] [altitude] is interchangeable with [level]	W/U	CRD
UM48	Instruction that the specified position is to be crossed at or below the specified level.	CROSS [position] AT OR BELOW [level] [altitude] is interchangeable with [level]	W/U	CRD

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM49	Instruction that the specified position is to be crossed at the specified level and that level is to be maintained when reached.	CROSS [position] AT AND MAINTAIN [level] [altitude] is interchangeable with [level]	W/U	CRD
UM50	Instruction that the specified position is to be crossed at a level between the specified levels. ATN B1 uses UM46 instead of UM50 for block level.	CROSS [position] BETWEEN [level] AND [level] [altitude] is interchangeable with [level]	W/U	CRD
UM51	Instruction that the specified position is to be crossed at the specified time.	CROSS [position] AT [time]	W/U	CRD
UM52	Instruction that the specified position is to be crossed at or before the specified time.	CROSS [position] AT OR BEFORE [time]	W/U	CRD
UM53	Instruction that the specified position is to be crossed at or after the specified time.	CROSS [position] AT OR AFTER [time]	W/U	CRD
UM54	Instruction that the specified position is to be crossed at a time between the specified times.	CROSS [position] BETWEEN [time] AND [time]	W/U	CRD
UM55	Instruction that the specified position is to be crossed at the specified speed and the specified speed is to be maintained until further advised.	CROSS [position] AT [speed]	W/U	CRD
UM56	Instruction that the specified position is to be crossed at a speed equal to or less than the specified speed and the specified speed or less is to be maintained until further advised.	CROSS [position] AT OR LESS THAN [speed]	W/U	CRD
UM57	Instruction that the specified position is to be crossed at a speed equal to or greater than the specified speed and the specified speed or greater is to be maintained until further advised.	CROSS [position] AT OR GREATER THAN [speed]	W/U	CRD
UM58	Instruction that the specified position is to be crossed at the specified time and the specified level.	CROSS [position] AT [time] AT [level] [altitude] is interchangeable with [level]	W/U	CRD

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM59	Instruction that the specified position is to be crossed at or before the specified time and at the specified level.	CROSS [position] AT OR BEFORE [time] AT [level] [altitude] is interchangeable with [level]	W/U	CRD
UM60	Instruction that the specified position is to be crossed at or after the specified time and at the specified level.	CROSS [position] AT OR AFTER [time] AT [level] [altitude] is interchangeable with [level]	W/U	CRD
UM61	Instruction that the specified position is to be crossed at the specified level and speed, and the level and speed are to be maintained.	CROSS [position] AT AND MAINTAIN [level] AT [speed] [altitude] is interchangeable with [level]	W/U	CRD
UM62	Instruction that at the specified time the specified position is to be crossed at the specified level and the level is to be maintained.	AT [time] CROSS [position] AT AND MAINTAIN [level] [altitude] is interchangeable with [level]	W/U	CRD
UM63	Instruction that at the specified time the specified position is to be crossed at the specified level and speed, and the level and speed are to be maintained.	AT [time] CROSS [position] AT AND MAINTAIN [level] AT [speed] [altitude] is interchangeable with [level]	W/U	CRD
	Lateral Offsets (uplink)			
UM64	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction.	OFFSET [specified distance] [direction] OF ROUTE [direction] [distance offset] is interchangeable with [specified distance] [direction]	W/U	CRD
UM65	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified position.	AT [position] OFFSET [specified distance] [direction] OF ROUTE [direction] [distance offset] is interchangeable with [specified distance] [direction]	W/U	CRD
UM66	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified time.	AT [time] OFFSET [specified distance] [direction] OF ROUTE [direction] [distance offset] is interchangeable with [specified distance] [direction]	W/U	CRD
UM67	Instruction that the cleared flight route is to be rejoined.	PROCEED BACK ON ROUTE	W/U	CRD

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM68	Instruction that the cleared flight route is to be rejoined at or before the specified position.	REJOIN ROUTE BY [position]	W/U	CRD
UM69	Instruction that the cleared flight route is to be rejoined at or before the specified time.	REJOIN ROUTE BY [time]	W/U	CRD
UM70	Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified position.	EXPECT BACK ON ROUTE BY [position]	R	IER
UM71	Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified time.	EXPECT BACK ON ROUTE BY [time]	R	IER
UM72	Instruction to resume own navigation following a period of tracking or heading clearances. May be used in conjunction with an instruction on how or where to rejoin the cleared route.	RESUME OWN NAVIGATION	W/U	CRD
	Route Modifications (uplink)			
UM73	Instruction to be followed from departure until the specified clearance limit.	[departure clearance] [predepartureclearance] is interchangeable with [departure clearance]	W/U	CRD
UM74	Instruction to proceed directly from its present position to the specified position.	PROCEED DIRECT TO [position]	W/U	CRD
UM75	Instruction to proceed, when able, directly to the specified position.	WHEN ABLE PROCEED DIRECT TO [position]	W/U	CRD
UM76	Instruction to proceed, at the specified time, directly to the specified position.	AT [time] PROCEED DIRECT TO [position]	W/U	CRD
UM77	Instruction to proceed, at the specified position, directly to the next specified position.	AT [position] PROCEED DIRECT TO [position]	W/U	CRD
UM78	Instruction to proceed, upon reaching the specified level, directly to the specified position.	AT [level] PROCEED DIRECT TO [position] [altitude] is interchangeable with [level]	W/U	CRD

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM79	Instruction to proceed to the specified position via the specified route.	CLEARED TO [position] VIA [route clearance]	W/U	CRD
UM80	Instruction to proceed via the specified route.	CLEARED [route clearance]	W/U	CRD
UM81	Instruction to proceed in accordance with the specified procedure.	CLEARED [procedure name]	W/U	CRD
UM82	Approval to deviate up to the specified distance from the cleared route in the specified direction.	CLEARED TO DEVIATE UP TO [specified distance] [direction] OF ROUTE [direction] [distance offset] is interchangeable with [specified distance] [direction]	W/U	CRD
UM83	Instruction to proceed from the specified position via the specified route.	AT [position] CLEARED [route clearance]	W/U	CRD
UM84	Instruction to proceed from the specified position via the specified procedure.	AT [position] CLEARED [procedure name]	W/U	CRD
UM85	Notification that a clearance to fly on the specified route may be issued.	EXPECT [route clearance]	R	IER
UM86	Notification that a clearance to fly on the specified route from the specified position may be issued.	AT [position] EXPECT [route clearance]	R	IER
UM87	Notification that a clearance to fly directly to the specified position may be issued.	EXPECT DIRECT TO [position]	R	IER
UM88	Notification that a clearance to fly directly from the first specified position to the next specified position may be issued.	AT [position] EXPECT DIRECT TO [position]	R	IER
UM89	Notification that a clearance to fly directly to the specified position commencing at the specified time may be issued.	AT [time] EXPECT DIRECT TO [position]	R	IER
UM90	Notification that a clearance to fly directly to the specified position commencing when the specified level is reached may be issued.	AT [level] EXPECT DIRECT TO [position] [altitude] is interchangeable with [level]	R	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM91	Instruction to enter a holding pattern with the specified characteristics at the specified position and level.	HOLD AT [position] MAINTAIN [level] INBOUND TRACK [degrees] [direction] TURNS [leg type]	W/U	CRD
		HOLD AT [position] MAINTAIN [altitude] INBOUND TRACK [degrees][direction] TURN LEG TIME [leg type]	W/U	CRD
UM92	Instruction to enter a holding pattern with the published characteristics at the specified position and level.	HOLD AT [position] AS PUBLISHED MAINTAIN [level] [altitude] is interchangeable with [level]	W/U	CRD
UM93	Notification that an onwards clearance may be issued at the specified time.	EXPECT FURTHER CLEARANCE AT [time]	R	IER
UM94	Instruction to turn left or right as specified on to the specified heading.	TURN [direction] HEADING [degrees]	W/U	CRD
UM95	Instruction to turn left or right as specified on to the specified track.	TURN [direction] GROUND TRACK [degrees]	W/U	CRD
UM96	Instruction to continue to fly on the current heading.	CONTINUE PRESENT HEADING	W/U	CRD
		FLY PRESENT HEADING	W/U	CRD
UM97	Instruction to fly on the specified heading from the specified position.	AT [position] FLY HEADING [degrees]	W/U	CRD
UM221	Instruction to stop turn at the specified heading prior to reaching the previously assigned heading.	STOP TURN HEADING [degrees]	W/U	CRD (Urgent)
UM98	Instruction to turn immediately left or right as specified on to the specified heading.	IMMEDIATELY TURN [direction] HEADING [degrees]	W/U	CRD (Distress)
UM99	Notification that a clearance may be issued for the aircraft to fly the specified procedure.	EXPECT [procedure name]	R	IER
	Speed Changes (uplink)			
UM100	Notification that a speed instruction may be issued to be effective at the specified time.	AT [time] EXPECT [speed]	R	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM101	Notification that a speed instruction may be issued to be effective at the specified position.	AT [position] EXPECT [speed]	R	IER
UM102	Notification that a speed instruction may be issued to be effective at the specified level.	AT [level] EXPECT [speed] [altitude] is interchangeable with [level]	R	IER
UM103	Notification that a speed range instruction may be issued to be effective at the specified time.	AT [time] EXPECT [speed] TO [speed]	R	IER
UM104	Notification that a speed range instruction may be issued to be effective at the specified position.	AT [position] EXPECT [speed] TO [speed]	R	IER
UM105	Notification that a speed range instruction may be issued to be effective at the specified level.	AT [level] EXPECT [speed] TO [speed] [altitude] is interchangeable with [level]	R	IER
UM106	Instruction that the specified speed is to be maintained.	MAINTAIN [speed]	W/U	CRD
UM107	Instruction that the present speed is to be maintained.	MAINTAIN PRESENT SPEED	W/U	CRD
UM108	Instruction that the specified speed or a greater speed is to be maintained.	MAINTAIN [speed] OR GREATER	W/U	CRD
UM109	Instruction that the specified speed or a lesser speed is to be maintained.	MAINTAIN [speed] OR LESS	W/U	CRD
UM110	Instruction that a speed within the specified range is to be maintained.	MAINTAIN [speed] TO [speed]	W/U	CRD
UM111	Instruction that the present speed is to be increased to the specified speed and maintained until further advised.	INCREASE SPEED TO [speed]	W/U	CRD
UM112	Instruction that the present speed is to be increased to the specified speed or greater, and maintained at or above the specified speed until further advised.	INCREASE SPEED TO [speed] OR GREATER	W/U	CRD
UM113	Instruction that the present speed is to be reduced to the specified speed and maintained until further advised.	REDUCE SPEED TO [speed]	W/U	CRD

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM114	Instruction that the present speed is to be reduced to the specified speed or less and maintained at or below the specified speed until further advised.	REDUCE SPEED TO [speed] OR LESS	W/U	CRD
UM115	Instruction that the specified speed is not to be exceeded.	DO NOT EXCEED [speed]	W/U	CRD
UM116	Instruction that the aircraft's normal speed be resumed. The previously issued speed restriction(s) are cancelled.	RESUME NORMAL SPEED	W/U	CRD
	Contact/Monitor/Surveillance Requests (uplink)			
UM117	Instruction that the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	CONTACT [unitname] [frequency] [icaounitname] is interchangeable with [unitname]	W/U	DCI
UM118	Instruction that at the specified position the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	AT [position] CONTACT [unitname] [frequency] [icaounitname] is interchangeable with [unitname]	W/U	DCI
UM119	Instruction that at the specified time the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.	AT [time] CONTACT [unitname] [frequency] [icaounitname] is interchangeable with [unitname]	W/U	DCI
UM120	Instruction that the ATS unit with the specified ATS unit name is to be monitored on the specified frequency.	MONITOR [unitname] [frequency] [icaounitname] is interchangeable with [unitname]	W/U	DCI
UM121	Instruction that at the specified position the ATS unit with the specified ATS unit name is to be monitored on the specified frequency.	AT [position] MONITOR [unitname] [frequency] [icaounitname] is interchangeable with [unitname]	W/U	DCI
UM122	Instruction that at the specified time the ATS unit with the specified ATS unit name is to be monitored on the specified frequency.	AT [time] MONITOR [unitname] [frequency] [icaounitname] is interchangeable with [unitname]	W/U	DCI
UM123	Instruction that the specified code (SSR code) is to be selected.	SQUAWK [code] [beacon code] is interchangeable with [code]	W/U	DCI

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM124	Instruction that the SSR transponder responses are to be disabled.	STOP SQUAWK	W/U	DCI
UM125	Instruction that the SSR transponder responses should include level information.	SQUAWK MODE CHARLIE	W/U	IER
		SQUAWK ALTITUDE	W/U	IER
UM126	Instruction that the SSR transponder responses should no longer include level information.	STOP SQUAWK MODE CHARLIE	W/U	IER
		STOP ALTITUDE SQUAWK	W/U	IER
UM179	Instruction that the 'ident' function on the SSR transponder is to be actuated.	SQUAWK IDENT	W/U	IER
	Report/Confirmation Requests (uplink)			
UM127	Instruction to report when the aircraft is back on the cleared route.	REPORT BACK ON ROUTE	W/U	IER
			R	IER
UM128	Instruction to report when the aircraft has vacated the specified level that has either been maintained or passed through on climb or descent.	REPORT LEAVING [level]	W/U	IER
	Either a level that has been maintained, or a level passed through on climb or descent.	[altitude] is interchangeable with [level]	R	IER
UM129	Instruction to report when the aircraft is in level flight at the specified level.	REPORT MAINTAINING [level]	W/U	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
	Some States do not to use REPORT LEVEL [altitude] in order to avoid confusion because it does not comply with existing voice phraseology	REPORT LEVEL [altitude]	R	IER
UM180	Instruction to report when the aircraft is within the specified vertical range. To be interpreted as "Report reaching an assigned level."	REPORT REACHING BLOCK [level] TO [level] [altitude] is interchangeable with [level]	W/U	IER
			R	IER
UM130	Instruction to report when the aircraft has passed the specified position.	REPORT PASSING [position]	W/U	IER
			R	IER
UM181	Instruction to report the present distance to or from the specified position.	REPORT DISTANCE [to/from] [position]	Y	IER
			NE	IER
	Note: Same intent as PANS/ATM UM228.	UM169: REPORT ETA [position] Example - REQUEST ESTIMATE BILBO	R, then DM67: [position] [time]	IER
UM131	Instruction to report the amount of fuel remaining and the number of persons on board.	REPORT REMAINING FUEL AND PERSONS ON BOARD	Y	IER (Urgent)
			NE	IER (Urgent)
UM132	Instruction to report the present position.	REPORT POSITION	Y	IER
		CONFIRM POSITION	NE	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM133	Instruction to report the present level.	REPORT PRESENT LEVEL	Y DM32	IER
		CONFIRM ALTITUDE	NE	IER
UM134	Instruction to report the requested speed.	REPORT [speed type] [speed type] [speed type] SPEED	Y DM113	IER
	Instruction to report the present speed	CONFIRM SPEED	NE	IER
	The controller is requesting the pilot to report the present ground speed.	UM169b: REPORT GROUND SPEED	R, then DM67l: GS [speed] Example - GS 490	IER
UM135	Instruction to confirm the currently assigned level.	CONFIRM ASSIGNED LEVEL	Y DM38 DM77 (TBC)	IER
		CONFIRM ASSIGNED ALTITUDE	NE	IER
UM136	Instruction to confirm the currently assigned speed.	CONFIRM ASSIGNED SPEED	Y	IER
			NE	IER
UM137	Instruction to confirm the currently assigned route.	CONFIRM ASSIGNED ROUTE	Y	IER
			NE	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM138	Instruction to confirm the previously reported time over the last reported waypoint.	CONFIRM TIME OVER REPORTED WAYPOINT	Y	IER
			NE	IER
UM139	Instruction to confirm the identity of the previously reported waypoint.	CONFIRM REPORTED WAYPOINT	Y	IER
			NE	IER
UM140	Instruction to confirm the identity of the next waypoint.	CONFIRM NEXT WAYPOINT	Y	IER
			NE	IER
UM141	Instruction to confirm the previously reported estimated time at the next waypoint.	CONFIRM NEXT WAYPOINT ETA	Y	IER
			NE	IER
UM142	Instruction to confirm the identity of the next but one waypoint.	CONFIRM ENSUING WAYPOINT	Y	IER
			NE	IER
UM143	The request was not understood. It should be clarified and resubmitted.	CONFIRM REQUEST	Y	IER
			NE	IER
UM144	Instruction to report the selected (SSR) code.	CONFIRM SQUAWK	Y	IER
			NE	IER
UM145	Instruction to report the present heading.	REPORT HEADING	Y	IER
			NE	IER
UM146	Instruction to report the present ground track.	REPORT GROUND TRACK	Y	IER
			NE	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM182	Instruction to report the identification code of the last ATIS received.	CONFIRM ATIS CODE	Y	IER
			NE	IER
UM147	Instruction to make a position report. To be used if the controller does not receive a scheduled position report.	REQUEST POSITION REPORT	Y	PR
			NE	PR
UM216	Instruction to file a flight plan.	REQUEST FLIGHT PLAN	Y	N/A
UM217	Instruction to report that the aircraft has landed.	REPORT ARRIVAL	Y	N/A
UM229	Instruction to report the preferred alternate aerodrome for landing.	REPORT ALTERNATE AERODROME	Y	N/A
UM231	Instruction to indicate the pilot's preferred level. Note: Same intent as PANS/ATM UM231	STATE PREFERRED LEVEL	Y DM106	IER
		UM169c: STATE PREFERRED LEVEL	R, then Oceanic: DM67m: FL [altitude] Example: FL 350 Continental: DM67: PREFERRED LEVEL [level]	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
	Negotiation Requests (uplink)			
UM148	Request for the earliest time or position at which the specified level can be accepted.	WHEN CAN YOU ACCEPT [level]	Y DM81 DM82	IER
		[altitude] is interchangeable with [level]	NE	IER
UM149	Instruction to report whether or not the specified level can be accepted at the specified position.	CAN YOU ACCEPT [level] AT [position] [altitude] is interchangeable with [level]	A/N	IER
UM150	Instruction to report whether or not the specified level can be accepted at the specified time.	CAN YOU ACCEPT [level] AT [time] [altitude] is interchangeable with [level]	A/N	IER
UM151	Instruction to report the earliest time or position when the specified speed can be accepted.	WHEN CAN YOU ACCEPT [speed]	Y DM83 DM84	IER
			NE	IER
UM152	Instruction to report the earliest time or position when the specified offset track can be accepted.	WHEN CAN YOU ACCEPT [specified distance] [direction] OFFSET	Y DM85 DM86	IER
		[direction] [distance offset] is interchangeable with [specified distance] [direction]	NE	IER
	Air Traffic Advisories (uplink)			
UM153	ATS advisory that the altimeter setting should be the specified setting.	ALTIMETER [altimeter]	R	IER
UM154	ATS advisory that the radar service is terminated.	RADAR SERVICE TERMINATED	R	IER
		RADAR SERVICES TERMINATED	R	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM155	ATS advisory that radar contact has been established at the specified position.	RADAR CONTACT [position]	R	IER
UM156	ATS advisory that radar contact has been lost.	RADAR CONTACT LOST	R	IER
UM157	Instruction that a continuous transmission is detected on the specified frequency. Check the microphone button.	CHECK STUCK MICROPHONE [frequency]	N	IER (Urgent)
			R	IER (Urgent)
UM158	ATS advisory that the ATIS information identified by the specified code is the current ATIS information.	ATIS [atis code]	R	IER
	System Management Messages (uplink)			
UM159	A system generated message notifying that the ground system has detected an error.	ERROR [error information]	N	All (Urgent)
			NE	All (Urgent)
UM160	Notification to the avionics that the specified data authority is the next data authority. If no data authority is specified, this indicates that any previously specified next data authority is no longer valid.	NEXT DATA AUTHORITY [facility]	N	DCI
		[facility designation] is interchangeable with facility]	NE	DCI
UM161	Notification to the avionics that the data link connection with the current data authority is being terminated.	END SERVICE	N	DCI
			NE	DCI
UM162	Notification that the ground system does not support this message.	MESSAGE NOT SUPPORTED BY THIS ATS UNIT	N	DCI ???
		SERVICE UNAVAILABLE	NE	DCI ???

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM163	Notification to the pilot of an ATSU identifier.	[facility designation]	N	IER
		[icao facility designation] [tP4+Table]	NE	IER
	Additional Messages (uplink)			
UM164	The associated instruction may be complied with at any future time.	WHEN READY	N	CRD IER
			NE	CRD IER
UM165	Used to link two messages, indicating the proper order of execution of clearances/ instructions.	THEN	N	CRD IER
			NE	CRD IER
UM166	The associated instruction is issued due to traffic considerations.	DUE TO [traffic type] TRAFFIC	N	CRD IER
		DUE TO TRAFFIC	NE	CRD IER
UM167	The associated instruction is issued due to airspace restrictions.	DUE TO AIRSPACE RESTRICTION	N	CRD IER
			NE	CRD IER
UM168	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.*	DISREGARD	R	CRD (Urgent) IER (Urgent)
UM176	Instruction that the pilot is responsible for maintaining separation from other traffic and is also responsible for maintaining visual meteorological conditions.	MAINTAIN OWN SEPARATION AND VMC	W/U	CRD

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM177	Used in conjunction with a clearance/instruction to indicate that the pilot may execute when prepared to do so.	AT PILOTS DISCRETION	N	CRD
	Free Text Normal-(uplink)			
UM169	Normal urgency attribute, low alert attribute	[free text]	R	All
	Free Text-Standardized Report/Confirmation Requests (uplink)			
UM169b	The controller is requesting the pilot to report the present ground speed. Note: Intent similar partially to PANS/ATM UM134	REPORT GROUND SPEED	R, and then DM67l	IER
UM169c	The controller is requesting that the pilot advise the preferred flight level for the flight. Note: Same intent as PANS/ATM UM231	STATE PREFERRED LEVEL	R, and then DM67m	IER
UM169d	The controller is requesting an estimate for the specified waypoint. Note: Same intent as PANS/ATM UM228.	REPORT ETA [position] Example – REPORT ETA BILBO	R, and then DM67n	IER
UM169e	The controller is requesting that the pilot notify when the specified traffic has been seen by visual contact and passed. The level specified in the traffic description is the level being maintained by the opposite direction aircraft. Note: No equivalent to PANS/ATM.	REPORT SIGHTING AND PASSING OPPOSITE DIRECTION [traffic description] ETP [time] *The traffic description is to be inserted by the controller and shall include the aircraft identification (callsign), flight level and aircraft type. ETP = Estimated Time of Passing.* Example of the traffic description: SIA228 B747 FL370	R, and then DM67o DM67p	IER
UM169f	The controller is requesting from the pilot the time at which the aircraft will maintain the specified level. Note: No equivalent to PANS/ATM.	WHEN WILL YOU MAINTAIN FL [altitude]	R, and then DM67r	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM169g	The controller is requesting the distance from the specified position or waypoint at which the aircraft will maintain the specified level. The pilot shall include the direction from the waypoint as a cardinal point, e.g. N, NE, NW, S, SW, SE, E or W. Note: No equivalent to PANS/ATM.	AT WHAT DISTANCE [position / waypoint] WILL YOU MAINTAIN FL [altitude]	R, and then DM67s	IER
UM169h	The controller is requesting that the pilot report the radial on which the aircraft is proceeding and the distance from the specified VOR. Note: No equivalent to PANS/ATM.	REPORT RADIAL AND DISTANCE [to/from] [position]	R, and then, DM67t	IER
UM169i	The controller is requesting that the pilot makes voice contact / radio check call on the specified frequency. Note: No equivalent to PANS/ATM.	REQUEST VOICE CONTACT [frequency]	R	IER
	Free Text Instructions (uplink)			
UM169j	The controller has detected that uplink messages exist that the pilot has not yet responded to. The pilot is required to check the ATC log page and to respond to unanswered uplink messages.	CHECK AND RESPOND TO OPEN CPDLC MESSAGES Formerly, “CHECK ATC LOG PAGE FOR OPEN MESSAGES”	R	IER
	Free text Advisories (uplink)			
UM169k	The controller is notifying the pilot that a selcal check will be made on the specified HF frequency.	EXPECT SELCAL CHECK HF [frequency]	R	IER
UM169l	The controller is notifying the pilot that the CPDLC transfer process will not be completed at the FIR boundary and will be delayed until the specified time. If the CPDLC transfer is not completed by the specified time, the pilot shall manually disconnect and logon to the next center	EXPECT CPDLC TRANSFER AT [time]	R	IER

UM Ref #	Message Intent/Use	Message Element	Response	Used in
UM169m	The controller is notifying the pilot that CPDLC connection is not required by the next FIR (where the flight's transition time of that FIR is short) and CPDLC connection will be transferred to the subsequent FIR. The [ATSU name] is the relevant four character ICAO code.	EXPECT NEXT CENTER [ATSU name]. CONTACT WITH [ATSU name] NOT REQUIRED	R	IER
UM169n	The controller is notifying the pilot of traffic significant to the flight. The description will include the aircraft type and any other relevant information to assist the pilot in sighting the traffic. The pilot may respond that the traffic has been sighted.	TRAFFIC IS [traffic description]	R and then, (optionally) DM67q	IER
UM169o	The controller is notifying the pilot of the secondary HF frequency for the area.	SECONDARY HF [frequency]	R	IER
	Free Text Speed Messages (uplink)			
UM169p	The controller is notifying the pilot that a speed instruction may be issued to be effective until the specified time.	EXPECT TO MAINTAIN [speed] UNTIL [time / position]	R	IER
	Free Text Emergency Acknowledgment (uplink)			
UM169q	The controller has acknowledged receipt of a MAYDAY downlink message. The controller shall attempt to make voice contact with the pilot. The pilot should only respond with ROGER if or when able to do so. If the aircraft is inbound to an airport within the FIR, a ROGER response is not required.	ROGER MAYDAY	R	IER (Distress)
UM169r	The controller has acknowledged receipt of a PAN downlink message. The controller shall attempt to make voice contact with the pilot. The pilot should only respond with ROGER if or when able to do so. If the aircraft is inbound to an airport within the FIR, a ROGER response is not required.	ROGER PAN	R	IER (Distress)

UM Ref #	Message Intent/Use	Message Element	Response	Used in
	Free Text – NAT-specific Region (uplink)			
UM169s	standard free text message 001.	REQUEST RECEIVED RESPONSE WILL BE VIA GANDER AERADIO	R	IER
UM169t	standard free text message 002	REQUEST RECEIVED RESPONSE WILL BE VIA SHANWICK AERADIO	R	IER
UM169u	standard free text message 003	MESSAGE NOT SUPPORTED BY THIS FACILITY	R	IER
UM169v	standard free text message 007	UNABLE REQUESTED LEVEL	R	IER
UM169w	Used by the aircraft to determine the time when messages received are delayed.	SET MAX UPLINK DELAY VALUE TO XXX SEC	R	DCI
	Free Text Distress (uplink)			
UM170	Distress urgency attribute, high alert attribute	[free text]	R	CRD (Distress) IER (Distress)

Table A-3: CPDLC Application Downlink Messages

DM Ref #	Message Intent/Use	Message Element	Response	Used in
	Responses/Acknowledgments (downlink)			
DM0	The instruction is understood and will be complied with.	WILCO	N	All
DM1	The instruction cannot be complied with.	UNABLE	N	All
DM2	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.	STANDBY	N	All
DM3	Message received and understood. ROGER is the only correct response to an uplink free text message. Under no circumstances will ROGER be used instead of AFFIRM.	ROGER	N	All
DM4	Yes. AFFIRM is an appropriate response to an uplinked negotiation request message (e.g. CAN YOU ACCEPT [altitude] at [time]).	AFFIRM	N	All
DM5	No. NEGATIVE is an appropriate response to an uplinked negotiation request message (e.g. CAN YOU ACCEPT [altitude] at [time]).	NEGATIVE	N	All

DM Ref #	Message Intent/Use	Message Element	Response	Used in
	Vertical Requests (downlink)			
DM6	Request to fly at the specified level.	REQUEST [level] For FANS 1/A, single level [altitude] is interchangeable with [level].	Y UM0 UM1 UM211 UM19 UM20 UM23 UM26 UM27 UM28 UM29 UM46 UM47 UM48 UM159	CRD
DM7	Request to fly at a level within the specified vertical range. ATN B1 uses DM6 instead of DM7 for block level requests.	REQUEST BLOCK [level] TO [level] [altitude] is interchangeable with [level]	Y	CRD
DM8	Request to cruise climb to the specified level. Due to different interpretations between the various ATS units, this element should be avoided.	REQUEST CRUISE CLIMB TO [level] [altitude] is interchangeable with [level]	Y	CRD
DM9	Request to climb to the specified level.	REQUEST CLIMB TO [level] [altitude] is interchangeable with [level]	Y	CRD
DM10	Request to descend to the specified level.	REQUEST DESCENT TO [level] [altitude] is interchangeable with [level]	Y	CRD

DM Ref #	Message Intent/Use	Message Element	Response	Used in
DM11	Request that at the specified position a climb to the specified level be approved.	AT [position] REQUEST CLIMB TO [level] [altitude] is interchangeable with [level]	Y	CRD
DM12	Request that at the specified position a descent to the specified level be approved.	AT [position] REQUEST DESCENT TO [level] [altitude] is interchangeable with [level]	Y	CRD
DM13	Request that at the specified time a climb to the specified level be approved.	AT [time] REQUEST CLIMB TO [level] [altitude] is interchangeable with [level]	Y	CRD
DM14	Request that at the specified time a descent to the specified level be approved.	AT [time] REQUEST DESCENT TO [level] [altitude] is interchangeable with [level]	Y	CRD
	Lateral Off-Set Requests (downlink)			
DM15	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved.	REQUEST OFFSET [specified distance] [direction] OF ROUTE [direction] [distance offset] is interchangeable with [specified distance] [direction]	Y	CRD
DM16	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified position.	AT [position] REQUEST OFFSET [specified distance] [direction] OF ROUTE [direction] [distance offset] is interchangeable with [specified distance] [direction]	Y	CRD
DM17	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified time.	AT [time] REQUEST OFFSET [specified distance] [direction] OF ROUTE [direction] [distance offset] is interchangeable with [specified distance] [direction]	Y	CRD

DM Ref #	Message Intent/Use	Message Element	Response	Used in
	Speed Requests (downlink)			
DM18	Request to fly at the specified speed.	REQUEST [speed]	Y UM0 UM1 UM211 UM55 UM61 UM106 UM107 UM108 UM109 UM116 UM222 UM159	CRD
DM19	Request to fly within the specified speed range.	REQUEST [speed] TO [speed]	Y	CRD
	Voice Contact Requests (downlink)			
DM20	Request for voice contact.	REQUEST VOICE CONTACT	Y	IER
DM21	Request for voice contact on the specified frequency.	REQUEST VOICE CONTACT [frequency]	Y	IER
	Route Modification Requests (downlink)			
DM22	Request to track from the present position direct to the specified position.	REQUEST DIRECT TO [position]	Y UM0 UM1 UM211 UM74 UM96 UM190 UM159	CRD
DM23	Request for the specified procedure clearance.	REQUEST [procedure name]	Y	CRD

DM Ref #	Message Intent/Use	Message Element	Response	Used in
DM24	Request for a route clearance.	REQUEST CLEARANCE [route clearance]	Y	CRD
		REQUEST [route clearance]	Y	CRD
DM25	Request for a clearance. Either pre-departure or route	REQUEST [clearance type] CLEARANCE	Y	CRD
		REQUEST CLEARANCE	Y	CRD
DM26	Request for a weather deviation to the specified position via the specified route.	REQUEST WEATHER DEVIATION TO [position] VIA [route clearance]	Y	CRD
DM27	Request for a weather deviation up to the specified distance off track in the specified direction.	REQUEST WEATHER DEVIATION UP TO [specified distance] [direction] OF ROUTE [direction] [distance offset] is interchangeable with [specified distance] [direction]	Y Same as for DM22, plus UM64 UM82	CRD
DM70	Request a clearance to adopt the specified heading.	REQUEST HEADING [degrees]	Y	CRD
DM71	Request a clearance to adopt the specified ground track.	REQUEST GROUND TRACK [degrees]	Y	CRD
	Reports (downlink)			
DM28	Notification of leaving the specified level.	LEAVING [level] [altitude] is interchangeable with [level]	N	IER
DM29	Notification of climbing to the specified level.	CLIMBING TO [level] [altitude] is interchangeable with [level]	N	IER
DM30	Notification of descending to the specified level.	DESCENDING TO [level] [altitude] is interchangeable with [level]	N	IER
DM31	Notification of passing the specified position.	PASSING [position]	N	IER
DM78	Notification that at the specified time, the aircraft's position was as specified.	AT [time] [distance] [to/from] [position]	N	IER
DM32	Notification of the present level.	PRESENT LEVEL [level]	N	IER
		PRESENT ALTITUDE [altitude]	N	IER

DM Ref #	Message Intent/Use	Message Element	Response	Used in
DM33	Notification of the present position.	PRESENT POSITION [position]	N	IER
DM34	Notification of the present speed.	PRESENT SPEED [speed]	N	IER
DM113	Notification of the requested speed.	[speed type] [speed type] [speed type] SPEED [speed]	N	IER
	Note: Intent partial to PANS/ATM DM113. The pilot notifies the controller of present ground speed, in response to UM169, REPORT GROUND SPEED	DM67l: GS [speed]	N	IER
DM35	Notification of the present heading in degrees.	PRESENT HEADING [degrees]	N	IER
DM36	Notification of the present ground track in degrees.	PRESENT GROUND TRACK [degrees]	N	IER
DM37	Notification that the aircraft is maintaining the specified level.	MAINTAINING [level]	N	IER
		LEVEL [altitude]	N	IER
DM76	Notification that the aircraft has reached a level within the specified vertical range.	REACHING BLOCK [level] TO [level] [altitude] is interchangeable with [level]	N	IER
DM38	Read-back of the assigned level.	ASSIGNED LEVEL [level]	N	IER
		ASSIGNED ALTITUDE [altitude] For FANS 1/A, single level [altitude] is interchangeable with [level].	N	IER
DM77	Read-back of the assigned vertical range. ATN B1 uses DM38 instead of DM77 for block level requests.	ASSIGNED BLOCK [level] TO [level] [altitude] is interchangeable with [level]	N	IER
DM39	Read-back of the assigned speed.	ASSIGNED SPEED [speed]	N	IER
DM40	Read-back of the assigned route.	ASSIGNED ROUTE [route clearance]	N	IER
DM41	The aircraft has regained the cleared route.	BACK ON ROUTE	N	IER
DM42	The next waypoint is the specified position.	NEXT WAYPOINT [position]	N	IER

DM Ref #	Message Intent/Use	Message Element	Response	Used in
DM43	The ETA at the next waypoint is as specified.	NEXT WAYPOINT ETA [time]	N	IER
DM44	The next but one waypoint is the specified position.	ENSUING WAYPOINT [position]	N	IER
DM45	Clarification of previously reported waypoint passage.	REPORTED WAYPOINT [position]	N	IER
DM46	Clarification of time over previously reported waypoint.	REPORTED WAYPOINT [time]	N	IER
DM47	The specified (SSR) code has been selected.	SQUAWKING [code] [beacon code] is interchangeable with [code]	N	IER
DM48	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	POSITION REPORT [position report]	N	PR
DM79	The code of the latest ATIS received is as specified.	ATIS [atis code]	N	IER
DM104	Notification of estimated time of arrival at the specified position. Note: Response to UM169, REPORT ETA [position]	ETA [position][time]	N	IER
		DM67n: [position][time] Example - BILBO 0413	N	IER
DM106	Notification of the preferred level. Note: Response to UM231 or free text UM169, STATE PREFERRED LEVEL.	PREFERRED LEVEL [level]	N	IER
		Oceanic DM67m: FL [altitude] Continental: DM67: PREFERRED LEVEL [level]	N	IER

DM Ref #	Message Intent/Use	Message Element	Response	Used in
	Negotiation Requests (downlink)			
DM49	Request for the earliest time at which a clearance to the specified speed can be expected.	WHEN CAN WE EXPECT [speed]	Y	IER
DM50	Request for the earliest time at which a clearance to a speed within the specified range can be expected.	WHEN CAN WE EXPECT [speed] TO [speed]	Y	IER
DM51	Request for the earliest time at which a clearance to regain the planned route can be expected.	WHEN CAN WE EXPECT BACK ON ROUTE	Y	IER
DM52	Request for the earliest time at which a clearance to descend can be expected.	WHEN CAN WE EXPECT LOWER LEVEL	Y	IER
		WHEN CAN WE EXPECT LOWER ALTITUDE	Y	IER
DM53	Request for the earliest time at which a clearance to climb can be expected.	WHEN CAN WE EXPECT HIGHER LEVEL	Y	IER
		WHEN CAN WE EXPECT HIGHER ALTITUDE	Y	IER
DM54	Request for the earliest time at which a clearance to cruise climb to the specified level can be expected.	WHEN CAN WE EXPECT CRUISE CLIMB TO [level] [altitude] is interchangeable with [level]	Y	IER
DM87	Request for the earliest time at which a clearance to climb to the specified level can be expected.	WHEN CAN WE EXPECT CLIMB TO [level]	Y	IER
		DM67h: WHEN CAN WE EXPECT CLIMB TO [altitude] [altitude] is interchangeable with [level]	Y	IER
DM88	Request for the earliest time at which a clearance to descend to the specified level can be expected.	WHEN CAN WE EXPECT DESCENT TO [level]	Y	IER
		DM67i: WHEN CAN WE EXPECT DESCENT TO [altitude]] [altitude] is interchangeable with [level]	Y	IER

DM Ref #	Message Intent/Use	Message Element	Response	Used in
	Emergency Messages (downlink)			
DM55	Urgency prefix.	PAN PAN PAN	Y	IER (Urgent)
			N	IER (Urgent)
DM56	Distress prefix.	MAYDAY MAYDAY MAYDAY	Y	IER (Distress)
			N	IER (Distress)
DM112	Indicates specifically that the aircraft is being subjected to unlawful interference.	SQUAWKING 7500	N	N/A (Urgent)
DM57	Notification of fuel remaining and number of persons on board.	[remaining fuel] OF FUEL REMAINING AND [persons on board] PERSONS ON BOARD	Y	IER (Urgent)
		[souls on board] is interchangeable with [persons on board]	N	IER (Urgent)
DM58	Notification that the pilot wishes to cancel the emergency condition.	CANCEL EMERGENCY	Y	IER (Urgent)
			N	IER (Urgent)
DM59	Notification that the aircraft is diverting to the specified position via the specified route due to an urgent need.	DIVERTING TO [position] VIA [route clearance]	Y	IER (Urgent)
			N	IER (Urgent)
DM60	Notification that the aircraft is deviating the specified distance in the specified direction off the cleared route and maintaining a parallel track due to an urgent need.	OFFSETTING [specified distance] [direction] OF ROUTE	Y	IER (Urgent)
		[direction] [distance offset] is interchangeable with [specified distance] [direction]	N	IER (Urgent)

DM Ref #	Message Intent/Use	Message Element	Response	Used in
DM61	Notification that the aircraft is descending to the specified level due to an urgent need.	DESCENDING TO [level]	Y	IER (Urgent)
		[altitude] is interchangeable with [level]	N	IER (Urgent)
DM80	Notification that the aircraft is deviating up to the deviating distance from the cleared route in the specified direction due to an urgent need.	DEVIATING UP TO [specified distance] [direction] OF ROUTE	Y	IER (Urgent)
			N	IER (Urgent)
	System Management Messages (downlink)			
DM62	A system-generated message that the avionics has detected an error.	ERROR [error information]	N	All (Urgent)
DM63	A system-generated denial to any CPDLC application message sent from a ground facility that is not the current data authority.	NOT CURRENT DATA AUTHORITY	N	IER
DM64	Notification to the ground system that the specified ATSU is the current data authority.	[facility designation]	N	DCI
		[facility designation] is interchangeable with [icao facility designation]	N	DCI
DM73	A system-generated message indicating the software version number.	[version number]	N	???
	Additional Messages (downlink)			
DM65	Used to explain reasons for pilot's message.	DUE TO WEATHER	N	CRD IER
DM66	Used to explain reasons for pilot's message.	DUE TO AIRCRAFT PERFORMANCE	N	CRD IER

DM Ref #	Message Intent/Use	Message Element	Response	Used in
DM74	States a desire by the pilot to provide his/her own separation and remain in VMC.	REQUEST TO MAINTAIN OWN SEPARATION AND VMC	Y	CRD
		MAINTAIN OWN SEPARATION AND VMC	N	CRD
DM75	Used in conjunction with another message to indicate that the pilot wishes to execute request when the pilot is prepared to do so.	AT PILOTS DISCRETION	N	CRD
	Free Text – Normal (downlink)			
DM67	Normal urgency, low alert	[free text]	N	IER
	Free Text - Negotiation Responses (downlink)			
DM67b	We can accept the specified level at the specified time. Note: Intent equivalent to PANS/ATM DM81.	WE CAN ACCEPT [altitude] AT [time]	N	IER
DM67c	We can accept the specified speed at the specified time. Note: Intent equivalent to PANS/ATM DM83.	WE CAN ACCEPT [speed] AT [time]	N	IER
DM67d	We can accept a parallel track offset the specified distance in the specified direction at the specified time. Note: Intent equivalent to PANS/ATM DM85.	WE CAN ACCEPT [direction] [distance offset] AT [time]	N	IER
DM67e	We cannot accept the specified level. Note: Intent equivalent to PANS/ATM DM82.	WE CANNOT ACCEPT [altitude]	N	IER
DM67f	We cannot accept the specified speed. Note: Intent equivalent to PANS/ATM DM84.	WE CANNOT ACCEPT [speed]	N	IER
DM67g	We cannot accept a parallel track offset the specified distance in the specified direction. Note: Intent equivalent to PANS/ATM DM86.	WE CANNOT ACCEPT [direction] [distance offset]	N	IER

DM Ref #	Message Intent/Use	Message Element	Response	Used in
DM67h	Request for the earliest time at which a clearance to climb to the specified level can be expected. Note: Intent equivalent to PANS/ATM DM87.	WHEN CAN WE EXPECT CLIMB TO [altitude]	N	IER
DM67i	Request for the earliest time at which a clearance to descend to the specified level can be expected. Note: Intent equivalent to PANS/ATM DM88.	WHEN CAN WE EXPECT DESCENT TO [altitude]	N	IER
	Free Text - Advisories (downlink)			
DM67j	The pilot is offsetting due wake turbulence in accordance with RVSM procedures (offset will not exceed 2nm). The controller is not required to respond or issue a clearance. Note: No equivalent in PANS/ATM.	WAKE DEV [direction] Direction L or R (left or right) as appropriate	R	IER
DM67k	The pilot is advising ATC of an update a waypoint ETA. Note: No equivalent in PANS/ATM.	REVISED ETA [position] [time]	R	IER
	Free Text – Responses (downlink)			
DM67l	The pilot responds to controller free text, REPORT GROUND SPEED. Note: Intent partial to PANS/ATM DM113. The pilot notifies the controller of present ground speed	GS [speed] *Example - GS 490*	N	IER
DM67m	The pilot responds to controller free text, STATE PREFERRED LEVEL. Note: Same intent as PANS/ATM DM 106.	Oceanic: FL [altitude] Example - FL 350 Continental: DM67: PREFERRED LEVEL [level]	N	IER

DM Ref #	Message Intent/Use	Message Element	Response	Used in
DM67n	The pilot responds to controller free text, REPORT ETA [position], Note: Same intent as PANS/ATM DM 106.	[position] [time] Example - BILBO 0413	N	IER
DM67o	The pilot responds to controller free text, REPORT SIGHTING AND PASSING OPPOSITE DIRECTION [traffic description] ETP [time]. *Note: No equivalent in PANS/ATM.*	[traffic identification] SIGHTED AND PASSED Example - SIA228 SIGHTED AND PASSED	N	IER
DM67p	The pilot responds to controller free text, REPORT SIGHTING AND PASSING OPPOSITE DIRECTION [traffic description] ETP [time]. Note: No equivalent in PANS/ATM.	[traffic identification] NOT SIGHTED	N	IER
DM67q	The pilot optionally responds to controller free text, TRAFFIC IS [traffic description]. Note: No equivalent in PANS/ATM.	TRAFFIC SIGHTED	N	IER
DM67r	The pilot responds to controller free text, WHEN WILL YOU MAINTAIN FL [altitude]. Note: No equivalent in PANS/ATM.	FL [altitude] AT [time] Example - FL 350 AT 2317	N	IER
DM67s	The pilot responds to controller free text, WHEN WILL YOU MAINTAIN FL [altitude]. Note: No equivalent in PANS/ATM.	FL [altitude] AT [distance] NM [direction] [position / waypoint]	N	IER
DM67t	The pilot responds to controller free text, REPORT RADIAL AND DISTANCE [to/from] [position]. Note: No equivalent in PANS/ATM.	[radial] R [distance] NM [to/from] [position] Example - 320 R 26 NM FROM MCY	N	IER
DM67u	Used as response when a message is delayed.	UPLINK DELAYED IN NETWORK AND REJECTED - RESEND OR CONTACT BY VOICE	N	All

DM Ref #	Message Intent/Use	Message Element	Response	Used in
	Free Text – Military (downlink)			
DM67w	The tanker is requesting a clearance to delay at the ARCP until the rendezvous with the receiver. [position] is the ARCP as filed in the tanker?s flight plan. [time] is the time the tanker expects to pass the ARCP and commence refueling along the refueling track. It is also the end of the delay time.	TO DELAY FOR AIR REFUEL AT [position] UNTIL [time]; and	R	IER
DM67x	The tanker pilot is providing notification that the end of refueling is imminent. [xxxxx} may be either position or time.	EXPECT END OF REFUEL AT [xxxxx]	R	IER
DM67y	[XXXXX] can be either a point or a time Example: JOINING ALTRV CW413 AT HEMLO or JOINING ALTRV CW413 AT 1530Z	JOINING ALTRV [xxxxx] AT [xxxxx]	R	IER
DM67z	The tanker is accepting MARSA procedures with the receiver *Note: [receiver callsign] is the flight planned callsign of the receiver*	ACCEPT MARSA WITH [callsign(s) of other aircraft]	R	IER
	Free Text - Distress (downlink)			
DM68	Distress urgency, high alert	[free text]	Y	CRD (Distress) IER (Distress)

DM Ref #	Message Intent/Use	Message Element	Response	Used in
	Negotiation Responses (downlink)			
DM81	We can accept the specified level at the specified time.	WE CAN ACCEPT [level] AT [time]	N	IER
		DM67b: WE CAN ACCEPT [altitude] AT [time] [altitude] is interchangeable with [level]	N	IER
DM82	We cannot accept the specified level.	WE CANNOT ACCEPT [level]	N	IER
		DM67e: WE CANNOT ACCEPT [altitude] [altitude] is interchangeable with [level]	N	IER
DM83	We can accept the specified speed at the specified time.	WE CAN ACCEPT [speed] AT [time]	N	IER
		DM67c: WE CAN ACCEPT [speed] AT [time]	N	IER
DM84	We cannot accept the specified speed.	WE CANNOT ACCEPT [speed]	N	IER
		DM67f: WE CANNOT ACCEPT [speed]	N	IER
DM85	We can accept a parallel track offset the specified distance in the specified direction at the specified time.	WE CAN ACCEPT [specified distance] [direction] AT [time]	N	IER
		DM67d: WE CAN ACCEPT [direction] [distance offset] AT [time]	N	IER
DM86	We cannot accept a parallel track offset the specified distance in the specified direction.	WE CANNOT ACCEPT [specified distance] [direction]	N	IER
		DM67g: WE CANNOT ACCEPT [direction] [distance offset]	N	IER

Table A-4: CPDLC application controller initiated transactions using standardized free text messages

CPDLC application standardized transactions using free text (UM169, UM170)		
Transaction/message intent	**Controller**	**Pilot**
Uplink - Free Text Report/ Confirmation Requests		
The controller is requesting that the pilot notify when the specified traffic has been seen by visual contact and passed. The level specified in the traffic description is the level being maintained by the opposite direction aircraft.	REPORT SIGHTING AND PASSING OPPOSITE DIRECTION [traffic description] ETP [time] *The traffic description is to be inserted by the controller and shall include the aircraft identification (callsign), flight level and aircraft type. ETP = Estimated Time of Passing.* *Example of the traffic description: SIA228 B747 FL370*	Quick response: ROGER and then [traffic identification] SIGHTED AND PASSED *Example - SIA228 SIGHTED AND PASSED* or [traffic identification] NOT SIGHTED
The controller is requesting the pilot to report the present ground speed.	REPORT GROUND SPEED	Quick response: ROGER And then, GS [speed] *Example - GS 490*
The controller is requesting that the pilot advise the preferred flight level for the flight. *Note: Same intent as PANS/ATM UM231*	STATE PREFERRED LEVEL	Quick response: ROGER And then, FL [altitude] *Example - FL 350*
The controller is requesting an estimate for the specified waypoint. *Note: Same intent as PANS/ATM UM228.*	REPORT ETA [position] *Example - REQUEST ESTIMATE BILBO*	Quick response: ROGER Then, [position] [time] *Example - BILBO 0413*

CPDLC application standardized transactions using free text (UM169, UM170)		
Transaction/message intent	**Controller**	**Pilot**
The controller is requesting from the pilot the time at which the aircraft will maintain the specified level.	WHEN WILL YOU MAINTAIN FL [altitude]	Quick response: ROGER Then, FL [altitude] AT [time] *Example - FL 350 AT 2317*
The controller is requesting the distance from the specified position or waypoint at which the aircraft will maintain the specified level. The pilot shall include the direction from the waypoint as a cardinal point, e.g. N, NE, NW, S, SW, SE, E or W.	AT WHAT DISTANCE [position / waypoint] WILL YOU MAINTAIN FL [altitude]	Quick response: ROGER Then, FL [altitude] AT [distance] NM [direction] [position / waypoint] *Example - FL 350 AT 26 NM W IPEMA*
The controller is requesting that the pilot report the radial on which the aircraft is proceeding and the distance from the specified VOR.	REPORT RADIAL AND DISTANCE [to/from] [position]	Quick response: ROGER Then, [radial] R [distance] NM [to/from] [position] *Example - 320 R 26 NM FROM MCY*
The controller is requesting that the pilot makes voice contact / radio check call on the specified frequency.	REQUEST VOICE CONTACT [frequency]	ROGER
Uplink - Free Text Instructions		
The controller has detected that uplink messages exist that the pilot has not yet responded to. The pilot is required to check the ATC log page and to respond to unanswered uplink messages.	CHECK ATC LOG PAGE FOR OPEN MESSAGES	ROGER
The controller instructs the aircraft to set the time value to determine delayed messages.	SET MAX UPLINK DELAY VALUE TO XXX SEC	ROGER
Uplink – Free text Advisories		
The controller is notifying the pilot that a selcal	EXPECT SELCAL CHECK HF [frequency]	ROGER

CPDLC application standardized transactions using free text (UM169, UM170)		
Transaction/message intent	**Controller**	**Pilot**
check will be made on the specified HF frequency.		
The controller is notifying the pilot that the CPDLC transfer process will not be completed at the FIR boundary and will be delayed until the specified time. If the CPDLC transfer is not completed by the specified time, the pilot shall manually disconnect and logon to the next center	EXPECT CPDLC TRANSFER AT [time]	ROGER
The controller is notifying the pilot that CPDLC connection is not required by the next FIR (where the flight's transition time of that FIR is short) and CPDLC connection will be transferred to the subsequent FIR. *The [ATSU name] is the relevant four character ICAO code.*	EXPECT NEXT CENTER [ATSU name]. CONTACT WITH [ATSU name] NOT REQUIRED	ROGER
The controller is notifying the pilot of traffic significant to the flight. The description will include the aircraft type and any other relevant information to assist the pilot in sighting the traffic. The pilot may respond that the traffic has been sighted.	TRAFFIC IS [traffic description]	ROGER Then, (optionally) TRAFFIC SIGHTED
The controller is notifying the pilot of the secondary HF frequency for the area.	SECONDARY HF [frequency]	ROGER
Uplink - Free Text Speed Messages		
The controller is notifying the pilot that a speed instruction may be issued to be effective until the specified time.	EXPECT TO MAINTAIN [speed] UNTIL [time / position]	ROGER
Uplink - Free Text Emergency Acknowledgment		
The controller has acknowledged receipt of a MAYDAY downlink message. The controller shall attempt to make voice contact with the pilot. The	ROGER MAYDAY	ROGER

CPDLC application standardized transactions using free text (UM169, UM170)		
Transaction/message intent	**Controller**	**Pilot**
pilot should only respond with ROGER if or when able to do so. If the aircraft is inbound to an airport within the FIR, a ROGER response is not required.		
The controller has acknowledged receipt of a PAN downlink message. The controller shall attempt to make voice contact with the pilot. The pilot should only respond with ROGER if or when able to do so. If the aircraft is inbound to an airport within the FIR, a ROGER response is not required.	ROGER PAN	ROGER

Table A-5: CPDLC application standardized free text downlink messages (DM67, DM68)

CPDLC application standardized free text downlink messages (DM 67, DM 68)		
Transaction/message intent	**Pilot**	**Controller**
Downlink - Free Text Advisories		
The pilot is offsetting due wake turbulence in accordance with RVSM procedures (offset will not exceed 2nm). The controller is not required to respond or issue a clearance.	WAKE DEV [direction] *Direction L or R (left or right) as appropriate*	ROGER
The pilot is advising ATC of an update a waypoint ETA.	REVISED ETA [position] [time]	ROGER
The aircraft advises ATC of receiving a delayed message.	UPLINK DELAYED IN NETWORK AND REJECTED - RESEND OR CONTACT BY VOICE	N
Downlink – Response to controller free text uplinks		
The pilot responds to controller free text, REPORT SIGHTING AND PASSING OPPOSITE DIRECTION [traffic description] ETP [time].	[traffic identification] SIGHTED AND PASSED *Example - SIA228 SIGHTED AND PASSED*	N
The pilot responds to controller free text, REPORT SIGHTING AND PASSING OPPOSITE DIRECTION [traffic description] ETP [time].	[traffic identification] NOT SIGHTED	N
The pilot optionally responds to controller free text, TRAFFIC IS [traffic description],.	TRAFFIC SIGHTED	N
The pilot optionally responds to controller free text, REPORT GROUND SPEED..	GS [speed] *Example - GS 490*	N
The pilot responds to controller free text, STATE PREFERRED LEVEL. *Note: Same intent as PANS/ATM DM 106.*	FL [altitude] *Example - FL 350*	N
The pilot responds to controller free text, REPORT	[position] [time]	N

CPDLC application standardized free text downlink messages (DM 67, DM 68)		
Transaction/message intent	**Pilot**	**Controller**
ETA [position], *Note: Same intent as PANS/ATM DM 106.*	*Example - BILBO 0413*	
The pilot responds to controller free text, WHEN WILL YOU MAINTAIN FL [altitude]. *Note: No equivalent in PANS/ATM.*	FL [altitude] AT [time] *Example - FL 350 AT 2317*	N
The pilot responds to controller free text, WHEN WILL YOU MAINTAIN FL [altitude]. *Note: No equivalent in PANS/ATM.*	FL [altitude] AT [distance] NM [direction] [position / waypoint]	N
The pilot responds to controller free text, REPORT RADIAL AND DISTANCE [to/from] [position]. *Note: No equivalent in PANS/ATM.*	[radial] R [distance] NM [to/from] [position] *Example - 320 R 26 NM FROM MCY*	N
Negotiation Responses (downlink)		
We can accept the specified level at the specified time. *Note: Intent same as PANS/ATM DM81.*	WE CAN ACCEPT [altitude] AT [time]	N
We can accept the specified speed at the specified time. *Note: Intent same as DM83.*	WE CAN ACCEPT [speed] AT [time]	N
We can accept a parallel track offset the specified distance in the specified direction at the specified time. *Note: Intent same as DM85.*	WE CAN ACCEPT [direction] [distance offset] AT [time]	N
We cannot accept the specified level. *Note: Intent same as PANS/ATM DM82.*	WE CANNOT ACCEPT [altitude]	N
We cannot accept the specified speed.	WE CANNOT ACCEPT [speed]	N

CPDLC application standardized free text downlink messages (DM 67, DM 68)		
Transaction/message intent	**Pilot**	**Controller**
Note: Intent same as PANS/ATM DM84.		
We cannot accept a parallel track offset the specified distance in the specified direction. *Note: Intent same as PANS/ATM DM86.*	WE CANNOT ACCEPT [direction] [distance offset]	N
Request for the earliest time at which a clearance to climb to the specified level can be expected. *Note: Intent same as PANS/ATM DM87.*	WHEN CAN WE EXPECT CLIMB TO [altitude]	Y
Request for the earliest time at which a clearance to descend to the specified level can be expected. *Note: Intent same as PANS/ATM DM88.*	WHEN CAN WE EXPECT DESCENT TO [altitude]	Y

A.2 ADS applications

This section describes the typical ADS applications that support the data link services described in section 4. ADS applications are ATS applications in which aircraft automatically transmit, via a data link, data reports derived from the on board navigation systems. Table A-7 describes the data provided in ADS reports.

The avionics are capable of supporting contracts with at least four ATC ground systems simultaneously; they are also capable of supporting one demand, one event and one periodic contract with each ground system simultaneously.

In addition if the pilot or avionics elects, the avionics will suspend any existing periodic contract, and establishes an emergency contract with each ground system with which it has an ADS contract.

A.2.1 Demand Contract

A.2.1.1 Functional Description

This function allows the ground system to establish a demand contract with an aircraft, and then for the conditions of that contract to be realized. Realization of the contract involves the sending of a single report from an aircraft to the ground system.

Any number of demand contracts may be sequentially established with an aircraft. Basic information is sent with the report. Optionally, at the request of the ground system, other information may also be sent.

The ground system sends a demand contract request to the avionics. This contains an indication of which optional information blocks are required. The avionics then determines whether or not there are errors in the request, and if there are no errors, whether or not it is able to comply with the request. If the avionics can comply with the demand contract request it sends the report as soon as possible. If there are errors in the contract request, or if the avionics cannot comply with the request, it sends a negative acknowledgement to the ground system indicating the reason for its inability to accept the contract. If the avionics can partially comply with the request, it sends a non-compliance notification indicating those parts of the contract with which it cannot comply, and then it sends an ADS-report.

A.2.1.2 Message Descriptions

The demand contract request stipulates which of the optional information fields described in Table A-7 are to be included in the ADS report.

Each ADS-demand report always contains the basic information described in Table A-7.

Each ADS-demand report will contain the optional additional information agreed in the contract and described in Table A-7.

An ADS report can contain a positive acknowledgement indicating acceptance of the contract.

A negative acknowledgement contains an indication of the reason why the contract has not been accepted.

A non-compliance notification contains an indication of which optional information fields cannot be sent.

A.2.2 Event Contract

A.2.2.1 Functional Description

This function allows the ground system to establish an event contract with the aircraft, and then for the conditions of that contract to be realised. Realisation of the contract involves the sending of reports from the aircraft to the ground system when certain agreed events occur.

Only one event contract may exist between the ground system and avionics at any one time, but this may contain multiple event types. A set of basic information is sent with every report, and depending on the event that triggered the sending of the report, other information blocks may also be included. The contract that is agreed states the event types that are to trigger reports and also any values needed to clarify those event types.

It is possible to request one or more of the event types that are presented in Table A-6.

Acceptance of an event contract request implicitly cancels an existing event contract, if one exists.

The ground system sends an event contract request to the avionics. This contains the types of event to be reported on and the necessary parameters for that event (e.g. if the event is a level range deviation, then the upper and lower thresholds must be sent). The avionics then determines whether or not there are errors in the request, and if not, whether or not it is able to comply with the request. If the avionics can comply with the event contract request it sends a positive acknowledgement and any required baseline report. If the contracted event occurs, an ADS report is sent.

If there are errors in the event contract request, or if the avionics cannot comply with the request, it sends a negative acknowledgement to the ground system indicating the reason for its inability to accept the contract within 0.5 seconds.

If the avionics can partially comply with the request, it sends a non-compliance notification indicating those parts of the contract with which it cannot comply. If a contracted event occurs with which it can comply, an ADS-report is sent.

For lateral deviation, level range and vertical rate change, if the event occurs, some applications may send additional reports every 60 seconds while the limit(s) specified in the contract are exceeded. For all other events, a single report is sent every time the event occurs.

Table A-6: ADS event types

Event Type	Event Trigger Description	Used in
Vertical rate change.	This can be triggered in two ways. If the vertical rate threshold is positive, then the event is triggered when the aircrafts rate of climb is greater than the vertical rate threshold. If the vertical rate threshold is negative, then the event is triggered when the aircrafts rate of descent is less than the vertical rate threshold.	IER
Way-point change.	This is triggered by a change to the next way-point. This change is normally due to routine way point sequencing, but could be triggered by a way point which is not part of the ATC clearance but is entered by the pilot for operational reasons.	PR
Lateral deviation change.	This is triggered when the absolute value of the lateral distance between the aircrafts actual position and the aircrafts expected position on the active flight plan becomes greater than the lateral deviation threshold.	IER, 30 nm lateral
Level range deviation.	This is triggered when the aircrafts level becomes greater than the level ceiling or less than the level floor.	IER
Airspeed change.	This is triggered when the aircrafts airspeed differs negatively or positively from its value at the time of the previous ADS report containing an air vector, by an amount which is equal to the airspeed change threshold which is specified in the event contract request. If there has been no previous such report, one is sent immediately.	IER (Not FANS 1/A)
Ground speed change.	This is triggered when the aircrafts ground speed differs negatively or positively from its value at the time of the previous ADS report containing a ground vector, by an amount which is equal to the ground speed threshold which is specified in the event contract request. If there has been no previous such report, one is sent immediately.	IER (Not FANS 1/A)
Heading change.	This is triggered when the aircraft's heading differs negatively or positively from its value at the time of the previous ADS report containing an air vector, by an amount which is equal to the heading change threshold which is specified in the event contract request. If there has been no previous such report, one is sent immediately.	IER (Not FANS 1/A)
Extended projected profile change.	This is triggered by a change to any of the set of future way points that define the active route of flight. The number of way points covered in the contract is either defined by a time interval (i.e. any way point planned to be achieved in the next N minutes), or by number of way points (i.e. any way point in the next N).	IER (Not FANS 1/A)
FOM (Figure of Merit)	This is triggered by a change in the navigational accuracy, navigational system redundancy or airborne collision	IER (Not FANS 1/A)

Event Type	Event Trigger Description	Used in
change.	avoidance system (ACAS) availability.	
Track angle change.	This is triggered when the aircrafts track angle differs negatively or positively from its value at the time of the previous ADS report containing a ground vector, by an amount which is equal to the track angle change threshold which is specified in the event contract request. If there has been no previous such report, one is sent immediately.	IER (Not FANS 1/A)
Level change.	This is triggered when the aircrafts level differs negatively or positively from its value at the time of the previous ADS report, by an amount which is equal to the level change threshold which is specified in the event contract request. If there has been no previous such report, one is sent immediately.	IER (Not FANS 1/A)

A.2.2.2 Message Descriptions

a) The event contract request contains an indication of the events to be reported on, together with clarifying information as follows:

   1) lateral deviation change - containing the lateral deviation threshold;

   2) vertical rate change - containing the vertical rate threshold;

   3) leaving a given level range - containing the upper and lower level thresholds;

   4) way-point change - containing no further clarifying information;

   5) air speed change - containing the airspeed change threshold;

   6) ground speed change - containing ground speed change threshold;

   7) heading change - containing heading change threshold;

   8) extended projected profile change - containing either a projected time or a number of way points;

   9) figure of merit change - containing no further clarifying information;

   10) track angle change - containing the track angle change threshold;

   11) level change - containing level change range.

b) The ADS event report has the same structure as in the operation of a demand contract, containing the basic position, time and FOM data as described in Table A-7. The choice of additional optional information is made as follows:

1) if the triggering event is a vertical rate change, a lateral deviation change, a level deviation change, a ground speed change, a track angle change or a level change, then the ADS report will contain the ground vector;

2) if the triggering event is a way point change, then the ADS report will contain the projected profile;

3) if the triggering event is an air speed change or heading change, then the ADS report will contain the air vector;

4) if the triggering event is an extended projected profile change, then the ADS report will contain the extended projected profile;

5) if the triggering event is a FOM change, then the ADS report will contain no additional information other than the basic information contained in every ADS report.

6) An ADS report can contain a positive acknowledgement indicating acceptance of the contract.

7) A positive acknowledgement indicates acceptance of the contract and contains no further information.

8) A negative acknowledgement contains an indication of the reason why the contract has not been accepted.

9) A non-compliance notification contains an indication of the events which the avionics cannot detect.

A.2.3 Periodic Contract

A.2.3.1 Functional Description

This function allows the ground system to establish a periodic contract with the aircraft, and then for the conditions of that contract to be realised. Realisation of the contract involves the sending of reports from the aircraft to the ground system at regular intervals (the reporting rate).

Only one periodic contract may exist between a ground system and the avionics at any one time. A set of basic information is sent with every report. Optionally, at the request of the ground system, other information blocks may also be sent; they may only be sent at a time interval which is a multiple of the reporting rate. The contract that is agreed includes the reporting rate, the optional blocks of information to be sent and the rate at which they are to be sent. Refer to Table A-7.

The ground system sends a periodic contract request to the avionics. This contains the basic reporting rate and an indication of which optional information blocks are required and how often they are to be sent relative to the basic rate (i.e. every time, every second report, every third report etc.). The avionics then determines whether or not there are

errors in the request, and if not, whether or not it is able to comply with the request. If the avionics can comply with the periodic contract request it sends its first report , and then sends other reports at the intervals requested. If it cannot send the first report within 0.5 seconds, it sends a positive acknowledgement first to indicate its acceptance of the contract.

Acceptance of a periodic contract request implicitly cancels any existing periodic contract.

If there are errors in the periodic contract request, or if the avionics cannot accept the contract, it sends a negative acknowledgement to the ground system indicating the reason for its inability to accept the contract within 0.5 seconds.

If the avionics can partially comply with the request, it sends a non-compliance notification indicating those parts of the contract with which it cannot comply. It then sends ADS-reports at a rate with which it can comply, and containing information requested with which it can comply. Non-compliance can be caused by either inability to meet the requested reporting rate, and/or inability to supply the requested information.

A.2.3.2 Message Descriptions

The ADS periodic report has the same structure as in the operation of a demand contract, containing the basic position, time and FOM data and additional data as requested in the contract and as described in Table A-7.

An ADS report can contain a positive acknowledgement, which indicates acceptance of the contract.

A positive acknowledgement indicates acceptance of the contract and contains no further information.

A negative acknowledgement contains an indication of the reason why the contract has not been accepted.

A non-compliance notification contains an indication of which optional information fields cannot be sent, and/or indicates that the requested periodic report cannot be met.

A.2.4 Cancellation of Contracts

A.2.4.1 Functional Description

This function allows the ground system explicitly to cancel a contract that is in operation. The ground system sends a cancel contract message to the avionics. The avionics cancels the contract and acknowledges the cancellation.

Implicit cancellation occurs when a periodic contract is in place, and then the ground system establishes a new periodic contract - the first one is implicitly cancelled on the establishment of the second; similarly with event contracts. Demand contracts are

implicitly cancelled when the report is sent. There are no additional information flows associated with implicit cancellation.

The ground system may also cancel all contracts in a single cancel all contracts message. The avionics cancels all contracts and acknowledges the cancellation.

A.2.4.2 Message Descriptions

The cancel contract message contains an indication of the contract to be cancelled.

The cancel all contracts message contains no additional information.

A positive acknowledgement contains no additional information.

A.2.5 Emergency Contracts

A.2.5.1 Functional Description

This function allows the avionics to initiate an emergency contracts (either on instruction from the pilot or on its own initiative), between the avionics and all ground systems with which it has existing contracts. Realisation of the contract involves the sending of ADS emergency reports from the avionics to the ground system at regular intervals.

Any existing periodic contract is suspended pending the cancellation of the emergency contract. Initially, the emergency reporting rate is as defined by the application.

The avionics sends ADS-emergency-reports to the ground system at the emergency reporting rate.

The avionics sends ADS-emergency-reports to all ground systems with which it has event or periodic contracts.

A.2.5.2 Message Descriptions

Each ADS-emergency-report always contains the basic information as described in Table A-7.

With every fifth ADS-emergency-report, the following information is also included:

a) the aircraft address;

b) the ground vector, indicating the track, ground speed and vertical rate;

A.2.5.3 Modifying an Emergency Contract

A.2.5.4 Functional Description

This function allows the reporting rate of an emergency contract to be modified.

The ground system sends an emergency contract modification message to the avionics. The avionics modifies the reporting rate of the emergency contract, and then sends the emergency reports at the new interval. This only effects the emergency contract between the ground system making the request and the aircraft.

If the avionics is unable to change the reporting rate, the avionics will send a negative acknowledgement within 0.5 seconds.

A.2.5.5 Message Descriptions

The emergency contract modification message contains only a new reporting rate.

A negative acknowledgement will contain an indication that the reporting rate cannot be changed.

A.2.5.6 Cancellation of Emergency Contracts

A.2.5.7 Functional Description

This function allows the aircraft to cancel an emergency contract.

The avionics sends a cancel emergency contract message to the ground system and cancels the emergency contract. If there is an periodic contract in place when the emergency is cancelled, then it is reinstated. Emergency contract cancellation cancels all emergency contracts.

A.2.5.8 Message Descriptions

The cancel emergency contract message contains no information.

Table A-7: ADS Report Information

ADS Report Information					
Information	**Description of information**	**Demand**	**Event**	**Periodic**	**Emergency**
Basic Information included in all reports.					
Aircraft 3-D position	Indicates latitude, longitude, and altitude of the aircraft	Per request	For Vertical rate change, Lateral deviation, and Level range deviation, at the event trigger. (Some applications may include a continual trigger every 60 secs while exceeding the event threshold). For Way-point change, Airspeed change, Ground speed change, Heading change, Extended projected profile change, FOM change, Track angle change, Level change, once at event trigger. Some applications may use a subset of these events.	At contracted reporting interval	At the emergency contract reporting rate.
Time at position	Indicating time at which aircraft was at the reported position				
Figure of Merit (FOM)	Provides an indication of the accuracy of the positional information				
Additional Information included in some reports.					
aircraft address	ICAO 24-bit address	Per contract request	NA for event report.	Per contract request which will specifiy how often the information is to be included.	Provided every 5th report
projected profile	Indicates the position and predicted time of the next way point, and the position of the following way point;	Per contract request	If the triggering event is a way point change.	Per contract request which will specifiy how often the information is to be included.	NA

ADS Report Information					
Information	**Description of information**	**Demand**	**Event**	**Periodic**	**Emergency**
ground vector	Indicates the track, ground speed and vertical rate;	Per contract request	If the triggering event is a vertical rate change, a lateral deviation change, a level deviation change, a ground speed change, a track angle change or a level change	Per contract request which will specify how often the information is to be included.	Every 5th report
air vector	Indicates the heading, air speed and vertical rate;	Per contract request	If the triggering event is an air speed change or heading change	Per contract request which will specify how often the information is to be included.	NA
weather information	Indicates wind speed, wind direction, temperature and turbulence;	Per contract request	NA	Per contract request which will specify how often the information is to be included.	NA
short term intent	Indicates the predicted location of the aircraft at some time in the future (as indicated in the demand contract) and, for any intermediate points where level, track or speed change is predicted to occur, the projected distance, track, level and time are given;	Per contract request	NA	Per contract request which will specify how often the information is to be included.	NA
extended projected profile	Indicates the predicted position, level and time for the next several way points (as indicated in the demand contract).	Per contract request	If the triggering event is an extended projected profile change	Per contract request which will specify how often the information is to be included.	NA

ADS Report Information					
Information	**Description of information**	**Demand**	**Event**	**Periodic**	**Emergency**
Contract Status information					
positive acknowledgement	Indicates acceptance of the contract	Implied by sending of report	Upon receipt of contract request together with any required ADS report	Upon receipt of contract request together with any required ADS report	NA, an emergency contract is initiated by the aircraft..
negative acknowledgement	Indicates non-acceptance and the reason why the contract has not been accepted	Upon receipt of contract request	Upon receipt of contract request or if conditions change thereafter	Upon receipt of contract request or if conditions change thereafter	Applies to modify emergency contract
non-compliance notification	Indicates non-compliance and identifies which optional information fields cannot be sent	Upon receipt of contract request followed by partial ADS Report	Upon receipt of contract request or if conditions change thereafter	Upon receipt of contract request or if conditions change thereafter	NA, an emergency contract is initiated by the aircraft..

Annex B: ALLOCATION OF REQUIREMENTS

This page intentionally left blank.

Annex B ALLOCATION OF REQUIREMENTS

B.1 Introduction

Annex A provides:

- A summary of CNS/ATM system requirements for the data link services described in this document, and
- Indicates their applicability and allocation to each of the elements of the CNS/ATM system supporting the data link service.

Table B- 1 provides, for operational hazards, the hazard reference number, the hazard class, and associated QSPL.

Table B-2 allocates the CNS/ATM system objectives and requirements to the elements of the CNS/ATM system. In addition, safety objectives for which there is no shared risk mitigation strategy are also provided.

B.2 Operational requirements

The operational requirements are associated with the assurance that the operating methods for each of the services are met. These requirements provide the operational context, taking into account the environmental conditions, for the safety and performance requirements.

B.3 Safety Requirements

The safety requirements define the risk mitigation strategies for the safety objectives provided in Table 5-2. The safety objective indicates the level of confidence needed, as provided in Table 1-1, to show the safety requirements that define the risk mitigation strategy are met. The system element safety assessment evaluates each element of the CNS/ATM system to ensure that it satisfies its requirements to a level of confidence commensurate with the safety objective, taking into account system design and architecture, and whether the requirement is implemented in hardware, software, or procedures, including training. In cases where there is no shared risk mitigation strategy defined for a safety objective, each system element safety assessment will need to establish the requirements appropriate for the safety objective.

B.4 Performance requirements

The performance requirements represent a minimum set of parameter values that take into account safety and operational considerations. The level of confidence that these requirements are met will depend on the source of the requirement. As a minimum, the level of confidence attained is commensurate with the safety considerations associated with the requirement.

Table B- 1: : Operational hazards, hazard reference number, hazard class, and associated QSPL

Generalized Operational hazard	QSPL[HAZ]	CRD	IER	PR
Loss of Service	LOS	H-CRD-1 (4)	H-IER-1 (4)	H-PR-1 (4)
Loss of Communication Process	LOCP	H-CRD-2 (4)	H-IER-2 (4)	H-PR-2 (4)
Unexpected interruption of the transaction	UIT	H-CRD-3 (4)	H-IER-3 (4)	H-PR-3 (4)
Detected late or expire	UIT	H-CRD-4 (4)	H-IER-4 (4)	H-PR-4 (4)
Detected misdirection	UIT	H-CRD-5 (4)	H-IER-5 (4)	H-PR-5 (4)
Detected corruption	UIT	H-CRD-6 (4)	H-IER-6 (4)	H-PR-6 (4)
Undetected late or expired message	UCT	H-CRD-7 (3)	H-IER-7 (3)	H-IER-7 (3)
Undetected misdirection of a message	UCT	H-IER-8 (3)	H-IER-8 (3)	H-PR-8 (3)
Undetected corruption of a message	UCT	H-CRD-9 (3)	H-IER-9 (3)	H-PR-9 (3)

Table B-2: Allocation of CNS/ATM system requirements

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
Service Description				
Section 4	The data link services shall be provided and used in accordance with the service descriptions.	The aircraft system shall be capable to enable the use of the data link services in accordance with the service descriptions.	The ATS provider shall provide the data link services in accordance with the service descriptions.	The operator's technical system, aircraft, and procedures shall enable the flight crew to use the data link services in accordance with the service descriptions.
OSA Results				
SR-1	An indication shall be provided to the initiator when a recipient rejects a data link service request.	The aircraft system shall provide to the ATSU an indication when it rejects a data link service request initiated by the ground system or the controller. The aircraft system shall display the indication provided by the ATSU when a data link service request initiated by the flight crew is rejected.	The ATSU shall display the indication provided by the aircraft system when a data link service request initiated by the ground system or the controller is rejected. The ATSU shall provide to the aircraft system an indication when it rejects a datalink service request initiated by the flight crew.	
SR-2	A Detected loss of data link service shall be indicated to the controller/flight crew.	The aircraft system shall indicate to the flight crew a detected loss of data link service.	The ATSU shall indicate to the controller a detected loss of data link service.	
SR-3	Data link service shall be established in sufficient time to be available for operational use.		Data link service shall be established in sufficient time to be available for operational use	
SR-4	ATSU shall be notified of planned outage of data link service sufficiently ahead of time.		ATSU shall be notified of planned outage of data link service sufficiently ahead of time.	

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
SR-5	There shall be an indication to the initiator when a message cannot be successfully transmitted.	The aircraft system shall indicate to the flight crew when a message can not be successfully transmitted.	The ATSU shall indicate to the controller when a message can not be successfully transmitted.	
SR-6	The end system shall provide unambiguous and unique identification of the origin and destination with each message it transmits.	The aircraft end system shall provide unambiguous and unique identification of the origin and destination with each message it transmits.	The ATSU end system shall provide unambiguous and unique identification of the origin and destination with each message it transmits.	
SR-7	A response shall indicate to which messages it refers.	The aircraft system shall indicate in each response to which messages it refers.	The ATSU shall indicate in each response to which messages it refers.	
SR-8	The aircraft and the ATSU shall exchange via data link and process the same route information to eliminate failures/errors in the AOC data link services from contributing to the hazards identified for RR.			
SR-9	The end system shall time stamp each message when it is released for onward transmission.	The aircraft end system shall time stamp each message when it is released for onward transmission.	The ATSU end system shall time stamp each message when it is released for onward transmission.	
SR-10	Any processing (data entry/ encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message.	Any processing performed by aircraft system (data entry/ encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message	Any processing performed by ATSU (data entry/ encoding/ transmitting/ decoding/ displaying) shall not affect the intent of the message	
SR-11	The end system shall reject messages not addressed to itself.	The aircraft end system shall reject messages not addressed to itself.	The ATSU end system shall reject messages not addressed to itself.	

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
SR-12	The initiator shall transmit messages to the designated end system.	The aircraft system shall transmit messages to the designated ATSU.	The ATSU shall transmit messages to the designated aircraft system.	
SR-13	The initiating system shall indicate to the user when a required response is not received within the required time (ET_{TRN}).	The aircraft system shall be capable of indicating to the pilot when a required response is not received within the required time. (ET_{TRN}).	The ATSU system shall be capable of indicating to the controller when a required response is not received within the required time. (ET_{TRN}).	
SR-14	When the end system receives a message whose time stamp exceeds ET_{TRN}, the end system shall take appropriate action based on a further safety assessment of the message content and situation. *Note: Some existing implementations discard the message. Others display it with an appropriate indication.*	When the aircraft system receives a message whose time stamp exceeds ET_{TRN}, the aircraft system shall take appropriate action based on a further safety assessment of the message content and situation.	When the ATSU receives a message whose time stamp exceeds ET_{TRN}, the ATSU shall take appropriate action based on a further safety assessment of the message content and situation.	
SR-15	The ATSU and aircraft end system shall prevent the release of clearance and responses to clearances without controller or flight crew action.	The aircraft end system shall prevent the release of responses to clearances without flight crew action.	The ATSU shall prevent the release of clearance without controller action.	
SR-16	The recipient system shall prohibit operational processing of corrupted messages.	The aircraft system shall prohibit operational processing by flight crew of corrupted messages.	The ATSU shall prohibit operational processing by controller of corrupted messages.	
SR-17	The recipient shall be able to determine the message initiator.	The aircraft system shall be able to determine the message initiator.	The ATSU shall be able to determine the message initiator.	

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
SR-18	The recipient system shall prohibit operational processing of messages not addressed to the recipient.	The aircraft system shall prohibit to the flight crew operational processing of messages not addressed to the aircraft.	The ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU.	
SR-19	ATSU shall only establish and maintain data link services when the aircraft identifiers in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.		ATSU shall only establish and maintain data link services when the aircraft identifiers in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.	
SR-20	The aircraft identifiers used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).	The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).	The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).	
SR-21	The flight crew shall perform the initiation data link procedure again with any change of the flight identifier.			The flight crew shall perform the initiation data link procedure again with any change of the flight identifier.
SR-22	ATSUs shall not permit data link services when there are no compatible version numbers.		An ATSU system shall not permit data link services when there are non compatible version numbers.	
SR-23	Messages shall be responded to in their entirety.	The aircraft system shall respond to messages in their entirety or allow the flight crew to do it.	The ATSU shall respond to messages in their entirety.	The flight crew shall respond to a message in its entirety when not responded by the aircraft system.

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
SR-24	The end system shall [provide an integrity mechanism] be capable of detecting errors that would result in mis-delivery or non-delivery introduced by the communication service.	The aircraft end system shall [provide an integrity mechanism] be capable of detecting errors that would result in mis-delivery or non-delivery introduced by the communication service	The ATSU end system shall [provide an integrity mechanism] be capable of detecting errors that would result in mis-delivery or non-delivery introduced by the communication service	
SR-25	The end system shall [provide an integrity mechanism] be capable of detecting errors that would result in corruption introduced by the communication service.	The aircraft end system shall [provide an integrity mechanism] be capable of detecting errors that would result in corruption introduced by the communication service.	The ATSU end system shall [provide an integrity mechanism] be capable of detecting errors that would result in corruption introduced by the communication service.	
OPA Results				
Para. 5.2.6	**Non-compliance with RCP type** a) Whenever, as a result of failure or degradation of the data link service is degraded below the level as prescribed by the RCP type for the ATS function, the flight crew shall advise the ATC unit concerned without delay. b) Where the failure or degradation affects the separation minimum currently being employed, the controller shall take action to establish another appropriate type of separation or separation minimum.	The aircraft system shall be capable of identifying degradation in aircraft system performance during operations significant enough to change the ATS function level as prescribed by the RCP type. The aircraft system shall provide indication to the flight crew, during operations, when a degradation in aircraft system performance is significant enough to change the ATS function level as prescribed by the RCP type.	The ATS provider system shall be capable of identifying degradation in the data link service performance during operations significant enough to change the ATS function level, e.g., separation minima, as prescribed by the RCP type. The ATS provider system shall provide indication to the controller (or as appropriate), during operations, when a degradation in the performance of the data link services is significant enough to change the ATS function level as prescribed by the RCP type.	The flight shall notify the ATC unit concerned, when the RCP type can no longer be maintained.

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
Para. 5.2.6	**RCP 240/D (time)** Communication process time shall be 240 seconds. 95% Transaction time shall be 180 seconds. Applicable to 50/50 NM and 30/30 NM separation minima - normal means of communication using data link services. See paragraph 5.2.3.3.	See paragraph 5.2.3.3 for time allocations to the aircraft. Time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.	See paragraph 5.2.3.3 for time allocations to the ATS unit and the communication service. Time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.	See paragraph 5.2.3.3 for time allocations to the ATS unit and the communication service. When the operator uses its own communication services, time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.
Para. 5.2.6	**RCP 400/D (time)** Communication process time shall be 400 seconds. 95% Transaction time shall be 350 seconds. Applicable to: 100 NM or 60 NM lateral/15 or 10 minutes longitudinal separation minima – normal means of communication using data link services. 50/50 NM and 30/30 NM separation minima - alternative means of communication using data link services (independent of normal means). See paragraph 5.2.3.3.	See paragraph 5.2.3.3 for time allocations to the aircraft. Time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.	See paragraph 5.2.3.3 for time allocations to the ATS unit and the communication service. Time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.	See paragraph 5.2.3.3 for time allocations to the ATS unit and the communication service. When the operator uses its own communication services, time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
Para. 5.2.6	**RCP 240/D and RCP 400/D (Availability)** Availability of service provision for all aircraft shall be 0.999 probability per flight hour. Availability of an aircraft to use the service shall be 0.999 probability per flight hour. The data link system shall meet the following safety requirements: SR-1, SR-2, SR-3, SR-4, SR-5, and SR-13 Generally applicable to communication and surveillance elements using data link services supporting the ATS functions described in section 3. See paragraph 5.2.5	See allocations for safety requirements listed in the requirement description column. Safety requirement allocations shall meet design assurance level commensurate with the safety objective SO-1 and SO-2.	See allocations for safety requirements listed in the requirement description column. Safety requirement allocations shall meet design assurance level commensurate with the safety objective SO-1 and SO-2.	See allocations for safety requirements listed in the requirement description column. Safety requirement allocations shall meet design assurance level commensurate with the safety objective SO-1 and SO-2.

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
Para. 5.2.6	**RCP 240/D and RCP 400/D (Continuity)** Continuity shall be 0.999 probability per flight hour. The data link system shall meet the following safety requirements: SR-2, SR-4, SR-5, SR-6, SR-7, SR-9, SR-10, SR-11, SR-12, SR-13, SR-14, SR-15, SR-16, SR-17, SR-18, SR-19, SR-20, SR-21, SR-22, SR-23 Generally applicable to communication and surveillance elements using data link services supporting the ATS functions described in section 3. See also paragraph 5.2.5.	See allocations for safety requirements listed in the requirement description column. Safety requirement allocations shall meet design assurance level commensurate with the safety objective SO-3, SO-4, SO-5, SO-6.	See allocations for safety requirements listed in the requirement description column. Safety requirement allocations shall meet design assurance level commensurate with the safety objective SO-3, SO-4, SO-5, SO-6.	See allocations for safety requirements listed in the requirement description column. Safety requirement allocations shall meet design assurance level commensurate with the safety objective SO-3, SO-4, SO-5, SO-6.

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
Para. 5.2.6	**RCP 240/D and RCP 400/D (Integrity)** Integrity shall be 10^{-5} acceptable rate per flight hour. The data link system shall meet the following safety requirements: SR-6, SR-7, SR-8, SR-9, SR-10, SR-11, SR-12, SR-13, SR-14, SR-15, SR-16, SR-17, SR-18, SR-19, SR-20, SR-21, SR-22, SR-23, SR-24, SR-25 Generally applicable to communication and surveillance elements using data link services supporting the ATS functions described in section 3. See also paragraph 5.2.5.	See allocations for safety requirements listed in the requirement description column. Safety requirement allocations shall meet design assurance level commensurate with the safety objective SO-7, SO-8, SO-9.	See allocations for safety requirements listed in the requirement description column. Safety requirement allocations shall meet design assurance level commensurate with the safety objective SO-7, SO-8, SO-9.	See allocations for safety requirements listed in the requirement description column. Safety requirement allocations shall meet design assurance level commensurate with the safety objective SO-7, SO-8, SO-9.

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
Surveillance elements (time requirements only				
5.2.3.4	a) The PR service shall deliver position reports within 3 minutes at 95% probability for: 1) Periodic reports, from the start of the periodic interval; 2) Waypoint change event reports, from the estimated time the aircraft crosses the waypoint as indicated by the current flight plan; and 3) Demand reports, from the time the demand contract was initiated by the ATSU/controller. b) The IER service shall deliver the lateral deviation event report within 3 minutes at 95% probability from the time the aircraft system detects that the event has occurred. Applicable to 50/50 NM and 30/30 NM separation minima - normal means of communication using data link services.	See paragraph 5.2.3.3 for time allocations to the aircraft for RCP 240/D. Time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.	See paragraph 5.2.3.3 for time allocations to the ATS unit and the communication service for RCP 240/D. Time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.	See paragraph 5.2.3.3 for time allocations to the ATS unit and the communication service for RCP 240/D. When the operator uses its own communication services, time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.

CNS/ATM System Objective/Requirement		Elements of the CNS/ATM system		
Ref	**Requirement description**	**Aircraft system**	**ATS provider (ATSP) system**	**Operator**
5.2.4.2	The PR service shall deliver position reports within 5 minutes at 95% probability at waypoint crossings, from the estimated time the aircraft crosses the waypoint as indicated by the current flight plan.	See paragraph 5.2.3.3 for time allocations to the aircraft for RCP 400/D. Time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.	See paragraph 5.2.3.3 for time allocations to the ATS unit and the communication service for RCP 400/D. Time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.	See paragraph 5.2.3.3 for time allocations to the ATS unit and the communication service for RCP 400/D. When the operator uses its own communication services, time allocations may be negotiated among system elements via approval material discussed in paragraph 1.3.2.

Appendix A: CONVENTIONS USED IN THIS STANDARD

This page intentionally left blank.

Appendix A CONVENTIONS USED IN THIS STANDARD

A.1 Introduction

This appendix provides a description of the conventions used in this standard. These conventions are used to provide traceability and enable the user to adapt this standard to meet the specific need for any particular implementation.

A.2 Document traceability

Traceability is provided throughout the document to enable the user to adapt this standard to meet specific needs for any particular implementation. This traceability is provided through the use of reference labels throughout the document. Figure AP-1 provides an overview of the general flow of information throughout the document to establish the operational, safety, and performance requirements . The figure provides a reference designator for significant information at the point where the information is established. Table AP-1 provides a list of the reference designators, and indicates where the designator is assigned and where it is used.

a) The environmental characteristics (Table 2-1) and the operational requirements (Table 2-2) provide the basis for assessment of the operational context and requirements for the ATS functions (section 2) that use data link services (section 4). The data link services use data link applications for which operational considerations are provided in Annex A.

b) The safety and performance requirements (section 5) apply to the CNS/ATM system that provides the data link services. These requirements are based on an assessment of the data link services in an operational context taking into account the environmental characteristics, the ATS functions supported by the data link services, and the operational considerations for the data link applications.

c) The environmental conditions that substantiate the safety and performance requirements are provided in Table 2-3. These environmental conditions need to be valid for the airspace in which the data link services are intended.

d) The safety and performance requirements for the CNS/ATM system are allocated to the air traffic service provider system, the aircraft system, and the operator at Annex B.

Note: The performance requirements are specified either in the form of an RCP type, per ICAO Doc 9869, or without the use of conventions.

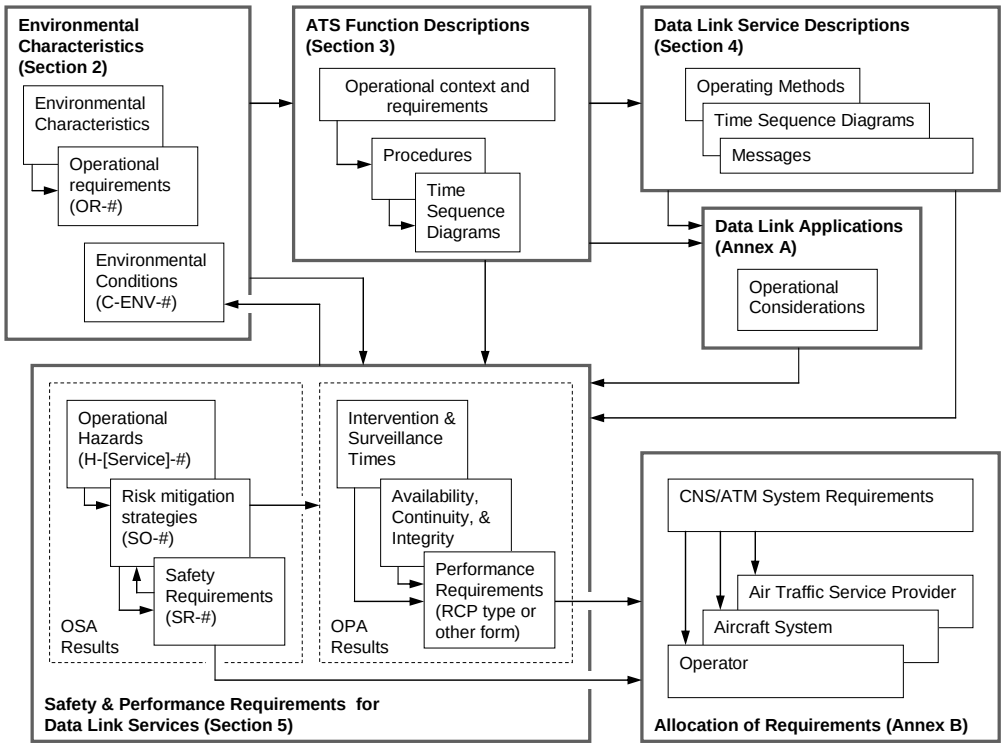

Figure AP-1: Information flows and traceability

Table AP-1 Reference designators used in this standard

Designator	Description	Assigned in	Used in
OR-[#]	Where OR = Operational Requirement and [#] is a unique integer assigned to each requirement.	Table 2-2	paragraph 5.2
C-ENV-[#]	Where C = Condition, ENV = Environment, and [#] is a unique integer assigned to each condition.	Table 2-3	Table 5-1 Table 5-7
H-[Service]-[#]	Where H = hazard, [Service] specifies the applicable data link service name, and [#] is a unique integer assigned to each hazard.	Table 5-1	Table 5-2
SO-[#],	Where SO = safety objective and [#] is a unique integer assigned to each safety objective.	Table 5-2	Table 5-3 Table 5-7
SR-[#]	Where SR = safety requirement and [#] is a unique integer assigned to each safety requirement.	Table 5-3	Table 5-2 Table B-2

A.2.1 Procedures and operating methods

This document refers to "procedure" when describing the ATS function and "operating method" when describing the data link service.

a) Procedure – lower case letters are used to denote different steps in the procedure.

b) Operating method – numbers are used to denote different steps in the operating method. If several methods are provided depending on different circumstances, the number will be preceded by an upper case letter, e.g., A1, A2, A3, … B1, B2, B3, …. If the step can result in two different outcomes, the number will be followed by an upper case letter, e.g., 1A, 1B, …

A.2.2 Time sequence diagrams

Figure AP-1 provides a description of the time sequence diagrams used throughout this document. These diagrams provide a sequential view of the transactions that are described by the ATS function descriptions in section 2 and the data link service descriptions in section 4.

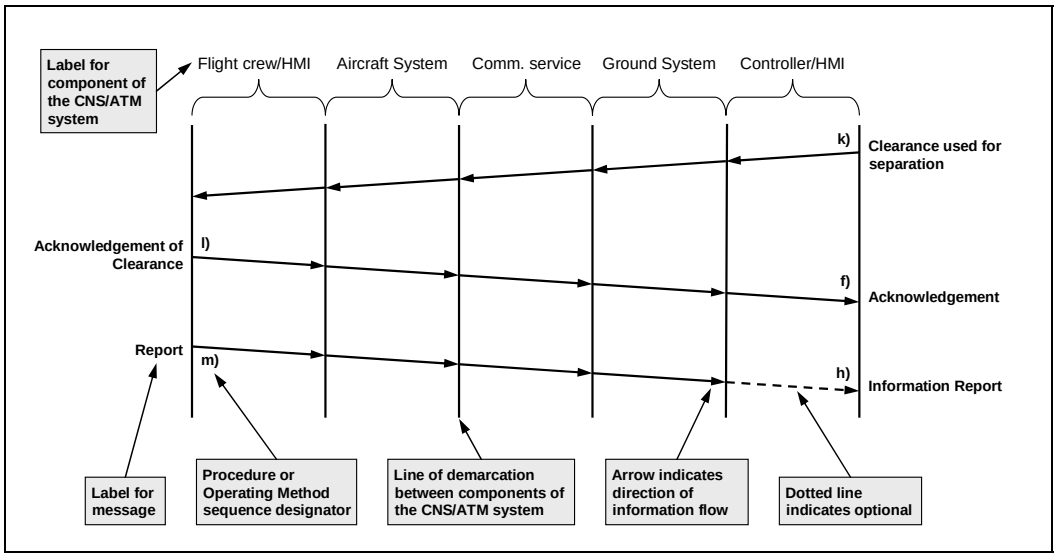

Figure AP-2 Description of time sequence diagram

Appendix B: MEMBERSHIP

This page intentionally left blank.

Appendix B MEMBERSHIP

RTCA Special Committee - 189/EUROCAE Working Group – 53
Air Traffic Services (ATS) Safety and Interoperability Requirements

Safety and Performance Requirements Standard for
Air Traffic Data Link Services In Oceanic and Remote Airspace

Chairmen:

Serge Bagieu	Airbus
Tom Kraft	Federal Aviation Administration

Members:

William Adams	Federal Aviation Administration
Kenneth Alexander	USAF
Gregg Anderson	Federal Aviation Administration
John Angermayer	MITRE
Sebastien Barjou	DGAC/CENA
Danny Bharj	EUROCONTROL
Doug Blythe	ARINC
Don Bosworth	U. S. Air Force
Suzanne Bradley	The MITRE Corporation
Christopher Brain	EUROCONTROL
Jean-Luc Brand	STNA-Altran Technologies
Willem Brondsema	EUROCONTROL
Robert Brown	Allied Pilots Association
Michael Burski	Federal Aviation Administration
Mark Cato	Air Line Pilots Association
Frank Cheshire	American Airlines
Martin Cole	NATCA
Joseph Comeaux	Air Line Pilots Association
Brian Connell	Rockwell Collins, Inc
Gregory Courbatieu	DGAC-SFACT
Thierry Courdacher	THALES ATM

Evan Darby	Federal Aviation Administration
Christophe De Meyer	EUROCONTROL/Sofréavia
Alexander Donchenko	Interstate Aviation Committee - Russia
Rosalind Dubs	Airservices Australia
Harry Eberlin	UNITECH
Stéphane Escuin	Airbus
Laurent Espeyt	Eurocontrol/alticode
Steven Fabela	NATCA
Stuart Forsyth	Helios Technology Ltd
Rafael Fortin	The Boeing Company
Joe Gerke	Dassault Falcon Jet Corporation
Stephen Giles	The MITRE Corporation
Alain Godec	SITA
Jim Grace	Rockwell Collins, Inc.
Andre Gregoire	CSSI, Inc.
Francis Grimal	EUROCAE
G. Gromov	ARUSRIRE
Jane Hamelink	Open Network Solutions
Tim Hancock	Federal Aviation Administration
Michael Harrison	Federal Aviation Administration
Peter Heldt	Federal Aviation Administration
Bruce Henry	Federal Aviation Administration
Stephen Hill	MITRE Corporation
Henk Hof	EUROCONTROL
Mike Hritz	Federal Aviation Administration
Stephen James	UK - Civil Aviation Authority
Steve Jarrett	Advanced Management Technology, Inc.
Robert Johns	Honeywell International, Inc.
Jim Johnson	Litton Industries, Inc.
David Kaplowitz	Rockwell Collins
George Kayser	Lockheed Martin Corp.
Kathleen Kearns	SITA
Robert Kerr	Honeywell International, Inc.
Todd Kilbourne	Trios Associates, Inc.
Andrea Kneeland	SITA

Konrad Koebe	Eurocontrol
Tom Kossiaras	Adsystech
Chris Kurkjian	SITA
Chuck LaBerge	Honeywell International, Inc.
Bruce Landis	Lockheed Martin Corp.
Victor Lebacqz	National Aeronautics & Space Administration
Steve Lee	The Boeing Company
Roberta Leftwich	Federal Aviation Administration
Thierry Lelievre	STNA-Altran Technologies
Peter Lemme	Ask Corporation
Olivier Lezerat	Airbus
Kent Loving	The Boeing Company
Paul Lu	Gulfstream Aerospace Corporation
Sarah MacLellan	ARINC Incorporated
Frank Mackowick	SkyComm, Inc.
Patrick Mana	EUROCONTROL
Stephane Marche	Airbus SA
Tony Martin	Smiths Industries
Roy Mattai	U. S. Air Force
Andre' Maumus	Airbus
Geoff McIntyre	Federal Aviation Administration
Rob Mead	The Boeing Company
Veronique Melet	DGAC/STNA
Robert Miller	CSSI Inc.
Tom Miller	Unitech, Inc.
Magali Millischer	DGAC/DSA/SPAE
Mary Minnix	The MITRE Corporation
J. Monso	Airbus
Gary Morton	UK - Civil Aviation Authority
Harold Moses	RTCA, Inc.
Michael Murphy	ATN Systems, Inc.
Victor Nagowski	ARINC Incorporated
David Nakamura	The Boeing Company
Mary Nakasone	The Boeing Company
Valery Nekrasov	Interstate Aviation Committee - Russia

Dung Nguyen	The Boeing Company
Ketan Nguyen	Honeywell International, Inc.
Vincent Nguyen	Federal Aviation Administration
Aileen Nii	Innovative Solutions Int'l Inc.
Roy Oishi	ARINC Inc.
Arnold Oldach	Honeywell International, Inc.
Gilles Pelletier	Adacel
Michael S. Perry	Delta Air Lines, Inc.
Frederic Picard	STNA/Sofréavia
Brett Portwood	Federal Aviation Administration
Paul Radford	Airways Corp. of New Zealand Ltd.
Rodolphe Rattier	AIRBUS/Altran Technologies
Kamel Rebai	DGAC/STNA
David Robinson	Federal Aviation Administration
Tim Rowe	UK NATS
M. Russell	UK - National Air Traffic Services
Gordon Sandell	The Boeing Company
Albert Sayadian	Federal Aviation Administration
Clark Shingledecker	NTI
Jim Simpkins	BSI
Peter Skaves	Federal Aviation Administration
Don Streeter	Federal Aviation Administration
Laurent Teissier	DGAC /STNA
Richard Thibedeau	Northrup Grumman, Inc.
Rhonda Thomas	Federal Aviation Administration
Patrick Thusius	USAF
Ronald Tornese	The MITRE Corporation
Matt Wade	Federal Aviation Administration

Appendix C: HISTORY AND TERMS OF REFERENCE OF SC-189/WG-53

This page intentionally left blank.

Appendix C HISTORY AND TERMS OF REFERENCE OF SC-189/WG-53

C.1 History

In 1996, RTCA SC-189/EUROCAE WG-53 was initially established at the request of the Informal South Pacific Air Traffic Services Coordinating Group (ISPACG). Its aim was to establish safety, performance, and interoperability standards for air traffic data link services to support implementations using FANS-1/A technology in the South Pacific. In other areas of the world, other efforts were underway to implement air traffic data link services using different technologies and implementations. These different technologies and implementations also needed safety, performance, and interoperability standards. To complete these tasks, SC-189/WG-53 cooperated with the International Civil Aviation Organization (ICAO), civil aviation authorities, regional planning groups, States, and industry, to produce guidance material, safety and performance standards (SPR), and interoperability (INTEROP) standards for the planning and implementation of air traffic data link services in oceanic, remote, and continental airspace, worldwide.

The Oceanic SPR Standard is based on experience gained from use air traffic data link services since 1995. In the South Pacific Sub-Region, air traffic data link services, using CPDLC and ADS, have enabled reduced separations, user-preferred routes, weather deviations, and reroutes for more efficient operations. In the North Atlantic, the use of automatic position reporting via ADS and FMC WPR (data link) have enabled increased traffic levels, which most likely exceeded traffic levels possible using only high frequency (HF) voice capabilities.

The Oceanic SPR Standard fulfills the original request of the ISPACG and completes the family of documents developed by SC-189/WG-53. The family of documents fulfills the terms of reference for SC-189/WG-53 and, in addition to the Oceanic SPR Standard, include:

a) RTCA DO-258/EUROCAE ED-100, FANS 1/A Interoperability Standard, Sep/2000. This document was revised in April 2005;

b) RTCA DO-264/EUROCAE ED-78A, Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications, Dec/2000;

c) RTCA DO-280/EUROCAE ED-110, ATN Baseline 1 Interoperability Standard, Jun/2002. This document was revised in July 2004; and

d) RTCA DO-290/EUROCAE ED-120, Safety and Performance Standard for Air Traffic Data Link Services in Continental Airspace (Continental SPR Standard), Apr/2004. Change 1 to this document was issued in December 2006.

C.2 Terms of Reference

The following are the Terms of Reference, which defined the work program for RTCA SC-189/EUROCAE WG-53, “Air Traffic Services Safety and Interoperability.”

Terms of Reference for SC-189/WG-53,
Air Traffic Services Safety and Interoperability Requirements (ATS SIR)

To advance Communication, Navigation, Surveillance/Air Traffic Management (CNS/ATM) concepts and support operational implementation, Special Committee (SC) 189/Working Group (WG) 53 shall develop:

a) Guidance material to define the safety, performance and interoperability requirements for air traffic services (ATS) supported by data communications

b) Guidance material to qualify related CNS/ATM systems.

The special committee/working group shall work jointly and establish close working relationships with the International Civil Aviation Organization (ICAO) panels, regional coordinating groups and other standards organizations as appropriate.

The guidance material should consist of at least the following documents to be submitted to the RTCA/EUROCAE by October 1999 for approval:

(1a) Interoperability requirements for ARINC 623 ATS applications using ACARS or ARINC 622 data communications.

(1b) Interoperability requirements for binary ATS applications using ARINC 622 data communications.

(1c) Interoperability requirements for ATS applications using ICAO ATN data communications.

(2a) Safety and performance assessment methodologies.

(2b) Safety and performance requirements for applying data communications supporting ATS.

Note: The FAA airworthiness and operational authorities intend to use these documents for advisory circulars to qualify aircraft and operations that use ATS that are supported by data communications. The FAA ATS authority intends to use these documents to establish safety and performance requirements and interoperability requirements to qualify related ground-based ATS systems and operations.

Guidance material should:

1. Recognize the international implications of the Future Air Navigation System (FANS) and CNS/ATM implementations.

2. Consider the experience gained through the initial ATS using data communications.

3. Reference existing standards, where relevant.

4. Establish interoperability requirements for ATS applications using data communications to the extent that they are consistent with limitations imposed by air traffic requirements for managing air traffic in an airspace with mixed data communications capabilities. Review, use and supersede as appropriate material from RTCA DO-212 (Automatic Dependent Surveillance), DO-219 (Two Way Data Link), and DO-223 (Context Management) in the light of experience gained from operational use of ARINC 622 based data communications. Consider the development of an interoperability requirements definition that can be generally applied to any communication protocol.

**Terms of Reference for SC-189/WG-53,
Air Traffic Services Safety and Interoperability Requirements (ATS SIR)**

5. Provide means for determining safety requirements consistent with existing hazard classification schemes, such as those developed by the EUROCAE Working Group (WG)-45 in ED-78 and the ICAO Aeronautical Telecommunication Network Panel (ATNP). The means should consider characterization of operational environments and hazards, identification of ATS, the associated communications and surveillance functions, the failure conditions, and failure condition classifications.

6. Identify (by reference where appropriate) the characteristics of the assumed CNS/ATM operational environments for ATS that use data communications. The assumed operational environments should be consistent with those defined by ATS regional coordinating groups, such as ISPACG, and ICAO operational panels, technical panels, and regional planning groups. Identify operational factors which should be considered for dynamic Aircraft Route Planning System (DARPS), both ATS-defined and Aeronautical Operational Control (AOC)-defined, single and multiple route planning to different airspace users and, in general, reduced separation minima, and specifically apply to 50 nm and 30 nm, laterally, and 50 nm and 30 nm, longitudinally.

7. Define the a) safety requirements and b) performance requirements [Note 1] for applying data communications to the air traffic services needed to meet the operational objectives identified in the assumed operational environment.

8. Allocate functional requirements for ATS data communications, in terms of a) safety requirements, b) performance requirements and c) interoperability requirements across institutional boundaries (e.g., aircraft/equipment manufacturer, ATS service providers, supporting service providers, procedures) within the context of the assumed operational environments.

9. Provide means to qualify operational aircraft systems, ground systems, and communication sub-networks to the a) safety requirements, b) performance requirements and c) interoperability requirements taking into account institutional considerations (e.g., guidelines should be delineated for the States and organizations developing the operational systems and provide means to ensure validity of assumptions across institutional boundaries).

10. Provide means to: a) track the evolution of the operational systems that provide air traffic services and b) report and resolve in-service problems among the participating States and organizations.

Additionally, the special committee should review EUROCAE ED-78 (Guidance Material for the Implementation of Data Link Based ATM Applications) and recommend changes to WG-45, as appropriate. The special committee should review associated ARINC characteristics and specifications and recommend changes to ARINC, as appropriate.

Note 1: The performance requirements being placed on the air traffic services remain consistent with performance requirements and terminology, such as RCP (Required Communication Performance), as expressed by ICAO.

C.3 Relationship of Oceanic SPR Standard to Terms of Reference

The Oceanic SPR Standard satisfies the document identified in the terms of reference under item (2b), "Safety and performance requirements for applying data communications supporting ATS," for applications of air traffic data link services in oceanic airspace. It also satisfies the guidelines under items 6, 7, and 8, in context with oceanic applications.

Many sources were used in the preparation of the Oceanic SPR Standard; however, the principal sources are noted:

a) FANS Operations Manual, Version 4, 28 September 2006.

b) Guidance Material for ATS Data Link Services in North Atlantic Airspace, Issue 14, 29 May 2006.

c) Airbus FANS A Airworthiness Approval Summary, various editions/revisions.

d) Boeing Air Traffic Services System Requirements and Objectives (ATS SR&O)., various editions/revisions.

e) Federal Aviation Administration, 17 February, 2000, FAA Advisory Circular AC120-70, "Initial Air Carrier Operational Approval for Use of Digital Communications."

f) Federal Aviation Administration, 16 August 1999, "FAA Advisory Circular AC-20-140, Guidelines for Design Approval of Aircraft Data Communications Systems."

g) ICAO Doc. 9694 — Manual of Air Traffic Services Data Link Applications.

h) RTCA DO-258A/EUROCAE ED-100A, April 2005, "Interoperability Requirements for ATS Applications Using ARINC 622 Data Communications."

Appendix D: IMPROVEMENT SUGGESTION FORM

This page intentionally left blank.

Appendix D IMPROVEMENT SUGGESTION FORM

Name: _____ Company: _____

Address: _____

City: _____ State, Province: _____

Postal Code, Country: _____ Date: _____

Phone: _____ FAX: _____

Email: _____

Document: ED-_____/DO-_____ Revision_____ Sec:_____ Page:_____ Line:_____

[ ] Documentation error (Format, punctuation, spelling)

[ ] Content error

[ ] Enhancement or refinement

Rationale (Describe the error or justification for enhancement): _

_____
_____
_____
_____

Proposed change (Attach marked-up text or proposed rewrite): _

_____
_____
_____
_____

Please provide any general comments for improvement of this document:

_____
_____
_____
_____

Return completed form to:

RTCA, Inc.
Attention: DO-
1828 L Street, Northwest, Suite 805
Washington, D. C. 20036-4001 USA
Email: info@rtca.org

OR

EUROCAE
Attention: Secretary-General ED-___
102 rue Etienne Dolet
92240 Malakoff - FRANCE
Email: eurocae@eurocae.com

This Page Intentionally Left Blank.