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Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols

Part I — Air-Ground Applications

Approved by the Secretary General
and published under his authority

First Edition — 2010

International Civil Aviation Organization

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using ISO/OSI Standards and Protocols***
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AMENDMENTS

Amendments are announced in the supplements to the *Catalogue of ICAO Publications*; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

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TABLE OF CONTENTS

	<i>Page</i>
Foreword	(vii)
Acronyms and Abbreviations.....	(ix)
Definitions.....	(xi)
Chapter 1. Introduction	1-1
1.1 Overview	1-1
1.2 Dialogue service (DS)	1-2
Chapter 2. Context Management Application	2-1
2.1 Introduction	2-1
2.2 General requirements	2-4
2.3 The abstract service.....	2-5
2.4 Formal definitions of messages	2-25
2.5 Protocol definition.....	2-31
2.6 Communication requirements	2-85
2.7 CM-user requirements	2-86
2.8 Subsetting rules	2-100
Chapter 3. Controller-Pilot Data Link Communications Application	3-1
3.1 Introduction	3-1
3.2 General requirements	3-3
3.3 The abstract service.....	3-3
3.4 Formal definitions of messages	3-16
3.5 Protocol definition.....	3-64
3.6 Communication requirements	3-110
3.7 CPDLC-user requirements.....	3-111
3.8 Subsetting rules	3-143
Chapter 4. Flight Information Services (FIS) (to be developed)	4-1
Chapter 5. Automatic Dependent Surveillance — Contract (ADS-C) (to be developed)	5-1
Chapter 6. ATN Message Integrity Check Algorithm.....	6-1
6.1 Use of the integrity check function	6-1
6.2 Default ATN message checksum algorithm	6-1

FOREWORD

This manual amends and replaces the third edition of the *Manual of Technical Provisions for the Aeronautical Telecommunication Network (ATN)* (Doc 9705). This manual is a result of ongoing validation and operational experience gained during implementation of elements of the ATN. Amendments were reviewed at the first meeting of the Aeronautical Communications Panel (ACP) Working Group of the Whole in June 2005 and further updated at the ACP Working Group N/6 meeting held in July 2006. Relevant background material is available on the website www.icao.int/anb/panels/acp.

This manual contains the detailed technical specifications for the ATN based on relevant standards and protocols established for open systems interconnection (OSI) by the International Organization for Standardization (ISO) and the Telecommunication Standardization Sector of the International Telecommunication Union (ITU-T). A separate manual, the *Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocols* (Doc 9896), addresses detailed technical specifications for the ATN based on standards developed for the IPS by the Internet Society (ISOC). Standards and Recommended Practices (SARPs) for the ATN/IPS are contained in Annex 10 — *Aeronautical Telecommunications*, Volume III — *Communication Systems*. Where necessary and to avoid duplication of material, Doc 9896 refers to this manual.

Editorial practices in this document are as follows:

- The detailed technical specifications in this manual that include the operative verb “shall” are essential to be implemented to secure proper operation of the ATN.
- The detailed technical specifications in this manual that include the operative verb “should” are recommended for implementation in the ATN. However, particular implementations may not require this specification to be implemented.
- The detailed technical specifications in this manual that include the operative verb “may” are optional.

This manual is published in the following parts:

- Part I: Air-Ground Applications (replaces Doc 9705, Sub-volume II)
- Part II: Ground-Ground Applications — Air Traffic Services Message Handling Services (ATSMHS) (replaces Doc 9705, Sub-volume III)
- Part III: Upper Layer Communications Service (ULCS) and Internet Communications Service (ICS) (replaces Doc 9705, Sub-volumes IV and V)
- Part IV: Directory Services, Security Services and Systems Management (replaces Doc 9705, Sub-volumes I, VI, VII, VIII and IX).

Structure of Part I:

This part of Doc 9880 contains technical provisions for air-ground applications. It is structured as follows:

- Chapter 1: INTRODUCTION
 - Chapter 2: CONTEXT MANAGEMENT APPLICATION
 - Chapter 3: CONTROLLER-PILOT DATA LINK COMMUNICATIONS APPLICATION
 - Chapter 4: FLIGHT INFORMATION SERVICES (FIS) (to be developed)
 - Chapter 5: AUTOMATIC DEPENDENT SURVEILLANCE — CONTRACT (ADS-C) (to be developed)
 - Chapter 6: ATN MESSAGE INTEGRITY CHECK ALGORITHM
-

ACRONYMS AND ABBREVIATIONS

ACP	Aeronautical Communications Panel
ADM	Administration identifier
ADS	Automatic dependent surveillance
ADS-C	Automatic dependent surveillance — contract
AE	Application entity
AFI	Authority and format identifier
APDU	Application protocol data unit
ARS	Administration region selector
ASE	Application service element
ASN.1	Abstract Syntax Notation One
ATIS	Automatic terminal information service
ATN	Aeronautical telecommunication network
ATS	Air traffic services
ATSC	Air traffic service communications
CF	Control function
CM	Context management
Cnf	Confirmation
CPDLC	Controller-pilot data link communications
DLIC	Data link initiation capability
DS	Dialogue service
DSC	Downstream clearance
FIS	Flight information services
FU	Functional unit
IC	Integrity check
ICAO	International Civil Aviation Organization
ICS	Internet communications service
IDI	Initial domain identifier
IDP	Initial domain part
IEC	International Electrotechnical Commission
IFR	Instrument flight rules
Ind	Indication
IPS	Internet Protocol Suite
ISO	International Organization for Standardization
ITU-T	International Telecommunication Union — Telecommunication Standardization Sector
Km	Kilometre
Nm	Nautical mile
NSEL	Network selector
OID	Object identifier
OSI	Open systems interconnection
P/OICS	Protocol/Operational Implementation Conformance Statements
PDU	Protocol data unit
PER	Packed Encoding Rules
QOS	Quality of Service
RDF	Routing domain format
RDP	Router domain part
Req	Request

(x)

RER	Residual error rate
RFC	Request for comments
Rsp	Response
SARPs	Standards and Recommended Practices
SSO	System security object
TSAP	Transport service access point
TSEL	TSAP selector
ULCS	Upper layer communications service
UTC	Coordinated universal time
VER	Version
VMC	Visual meteorological conditions

DEFINITIONS

Abstract service interface. The abstract interface between the application entity (AE) and the application-user.

Abstract Syntax Notation One (ASN.1). Abstract Syntax Notation One is defined in ISO/IEC 8824-1. The purpose of this notation is to enable data types to be defined, and values of those types specified, without determining their actual representation (encoding) for transfer by protocols.

Addressing plan. A plan that provides common address syntax and management of global addresses for the unambiguous identification of all end and intermediate systems in accordance with the rules prescribed in ISO/IEC 7498-3 and ISO/IEC TR 10730.

Aeronautical administrative communications (AAC). Communications necessary for the exchange of aeronautical administrative messages.

Aeronautical administrative messages. Messages regarding the operation or maintenance of facilities provided for the safety or regularity of aircraft operation. Messages concerning the functioning of the ATN and messages exchanged between government civil aviation authorities relating to aeronautical services.

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.

Aeronautical passenger communication (APC). Communication relating to the non-safety voice and data services to passengers and crew members for personal communication.

Air application service element (air-ASE). An abstract part of the aircraft system that performs the communication-related functions of the application.

Air-ground application. An application that has one peer application on an aircraft and its other peer application on the ground. An air-ground application may require the use of ground-ground subnetworks.

Air traffic control (ATC) 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” when used in appropriate contexts.

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.

Air traffic control (ATC) instruction. Directives issued by air traffic control for the purpose of requiring a pilot to take specific action.

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

- a) preventing collisions:
 - 1) between aircraft; and
 - 2) on the manoeuvring area between aircraft and obstructions; and
- b) expediting and maintaining an orderly flow of air traffic.

Air traffic services (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).

Air user (air-user). The abstract part of the aircraft system that performs the non-communication-related functions of the application.

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

Aircraft flight 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 communication and which is used to identify the aircraft in ground-ground air traffic services communication.

Application. The ultimate use of an information system, as distinguished from the system itself.

Application entity (AE). Part of an application process that is concerned with communications within the OSI environment. The aspects of an application process that need to be taken into account for the purposes of OSI are represented by one or more AEs.

Application entity service interface. The interface between the application-users and the application service provider.

Application entity title. An unambiguous name for an application entity.

Application process (AP). A set of resources, including processing resources, within a real open system which may be used to perform a particular information processing activity.

Application protocol data unit (APDU). An application protocol data unit is an (N) PDU, where N refers to the application layer. An APDU is the basic unit of information exchanged between the airborne application and the ground application.

Application service. The abstract interface between the (N) service and the (N) service user, where N refers to the application layer; thus it is the boundary between the AE and the application user.

Application service element (ASE). The element in the communication system that executes the application specific protocol. In other words, it processes the application specific service primitive sequencing actions, message creation, timer management, and error and exception handling. The application's ASE interfaces only with the application's control function.

Application service element (ASE) service interface. The abstract interface through which the ASE service is accessed.

Note.— In version 1 of the ADS application, the ADS-ASE service interface coincides with the ADS-AE abstract service interface.

Application-user. That abstract part of the aircraft or ground system that performs the non-communication-related functions of the application.

ATIS application. An ATN application that supports the ATIS.

ATN application. Refers to an application that is designed to operate over ATN communication services.

ATS communication (ATSC). Communication related to air traffic services including air traffic control, aeronautical and meteorological information, position reporting and services related to safety and regularity of flight. This communication involves one or more air traffic service administrations. This term is used for purposes of address administration.

ATS message. A unit of user-data, coded in binary form, which is conveyed from an originator of the data to one or more recipients of the data. It is possible to associate a unique message identifier and a priority with each ATS message.

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

ATSC class. The ATSC class parameter enables the ATSC-user to specify the quality of service expected for the offered data. The ATSC class value is specified in terms of ATN end-to-end transit delay at 95 per cent probability.

Automatic dependent surveillance (ADS). A surveillance technique in which aircraft automatically provide, via a data link, data derived from on-board navigation and position-fixing systems, including aircraft identification, four-dimensional position and additional data as appropriate.

Automatic dependent surveillance (ADS) application. An ATN application that provides ADS data from the aircraft to the ATS unit(s) for surveillance purposes.

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

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

Automatic terminal information service (ATIS). 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.

Context management (CM) application. An ATN application that provides a logon service allowing initial aircraft introduction into the ATN and a directory of all other data link applications on the aircraft. It also includes functionality to forward addresses between ATS units.

Note.— Context management is a recognized OSI presentation layer term. The OSI use and the ATN use have nothing in common.

Control function (CF). That abstract part of the AE that performs the mapping between the ASE service primitives, the association control service element (ACSE) service primitives and other elements within the application entity.

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

Controller pilot data link communication (CPDLC) application. An ATN application that provides a means of ATC data communication between controlling, receiving or downstream ATS units and the aircraft, using air-ground and ground-ground subnetworks, and which is consistent with the ICAO phraseology for the current ATC voice communication.

Controlling ATSU (C-ATSU). The air traffic control unit exercising legal authority over the initiation, continuation, diversion or termination of flights and providing air traffic control service to controlled flights in the control area under its jurisdiction.

Current data authority. 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.

Data authority. A ground system that provides for the establishment and maintenance of a CPDLC transport connection with an aircraft. The transfer of communication from the current data authority to the next data authority is prepared prior to the actual data link switch by designating a next data authority in a specific CPDLC message.

Data link initiation capability (DLIC). A data link application that provides the ability to exchange addresses, names and version numbers necessary to initiate data link applications.

Dialogue service (DS). The lower service boundary of an ASE; the service allows two ASEs to communicate, e.g. a CM ground-ASE to communicate with a CM air-ASE.

Directory. A facility that supports on request the retrieval of address information or the resolution of application names.

Domain. A set of end systems and intermediate systems that operate according to the same routing procedures and that is wholly contained within a single administrative domain.

Downstream ATSU (D-ATSU). D-ATSU handles the coordination of the conditions of transfer for a flight from the controlling ATSU (C-ATSU) which may notify the D-ATSU of a flight's cleared profile prior to its effective transfer to the receiving ATSU (R-ATSU).

Downstream clearance (DSC). Specific clearance request by an aircraft to an ATSU that is not the controlling ATSU. The initiation of the DSC service can only be initiated by an aircraft.

Downstream data authority. A designated ground system, different from the current data authority through which the pilot can contact an appropriate ATC unit for the purposes of receiving a downstream clearance.

Emergency contract. A contract to provide ADS reports at regular intervals during an emergency situation.

End system (ES). A system that contains the OSI seven layers and contains one or more end-user application processes.

End-to-end. Pertaining or relating to an entire communication path, typically from (1) the interface between the information source and the communication system at the transmitting end to (2) the interface between the communication system and the information user or processor or application at the receiving end.

End-user. An ultimate source and/or consumer of information.

Entity. An active element in any layer which can be either a software entity (such as a process) or a hardware entity (such as an intelligent I/O chip).

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

Flight information service (FIS). A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.

Flight information service (FIS) application. An ATN application that provides to aircraft information and advice useful for the safe and efficient conduct of flight.

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

Note.— Specifications for flight plans are contained in Annex 2 — Rules of the Air. A model Flight Plan Form is contained in the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444), Appendix 2.

General communication. A category of communications that includes APC, public correspondence and other non-operational and non-administrative communication.

Ground application service element (ground-ASE). An abstract part of the ground system that performs the communication-related functions of the application.

Ground forwarding function. The capability for a ground system to forward a CPDLC message to another ground system via a CPDLC message with an indication of success, failure or non-support from the receiving ground system. This function may be invoked by the current data authority in order to avoid retransmission of a request by an aircraft by forwarding the information to the next data authority. The downstream data authority may use this function in order to relay a message to the current data authority which then performs the actual transmission to the aircraft.

Ground user (ground-user). The abstract part of the ground system that performs the non-communication-related functions of the application.

International Alphabet No. 5 (IA5). International Alphabet Number 5 defined by ITU-T.

Note.— ATN uses the “6-bit ASCII” subset of IA5, as used in SSR Mode S specifications.

Internet communications service (ICS). The Internet communications service is an internetwork architecture which allows ground, air-to-ground and avionics data subnetworks to interoperate by adopting common interface services and protocols based on the ISO/OSI reference model.

Internetwork. A set of interconnected, logically independent heterogeneous subnetworks. The constituent subnetworks are usually administrated separately and may employ different transmission media.

Internetworking protocol (IP). A protocol that performs the basic end-to-end mechanism for the transfer of data packets between network entities. In the ATN Internet communications service, the ISO/IEC 8473 internetwork protocol is used.

Interoperability. Describes the ability of the ATN to provide, as a minimum, a transparent data transfer service between end systems even though the ATN comprises various ground, air-to-ground and avionics subnetworks. The ability to interoperate between end systems can be extended to include commonality of upper layer protocols.

Long transport service access point (TSAP). Composed of the router domain part (RDP) and the short TSAP.

Lower layers. The physical, data link, network and transport layers of the OSI reference model.

Managed object. Data processing and data communication resources that may be managed through the use of the OSI management protocol.

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

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

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

Mobile subnetwork. A subnetwork connecting a mobile system with another system not resident in the same mobile platform. These subnetworks tend to use free-radiating media (e.g. VHF/UHF radio, D-band satellite or D-band secondary surveillance radar) rather than contained media (e.g. wire or coaxial cable); thus they exhibit broadcast capabilities in the truest sense.

Naming plan. A plan that provides common naming conventions and designations for the unambiguous identification of all end and intermediate systems in accordance with the rules prescribed in ISO/IEC 7498-3, ISO/IEC TR 10730 and ISO/IEC 9545.

Network addressing domain. A subset of the global addressing domain consisting of all the NSAP addresses allocated by one or more addressing authorities.

Network entity (NE). A functional portion of an internetwork router or host computer that is responsible for the operation of internetwork data transfer, routing information exchange and network layer management protocols.

Network service access point (NSAP). Point within the ISO protocol architecture at which global end-users may be uniquely addressed on an end-to-end basis.

Network service access point (NSAP) address. A hierarchically organized global address supporting international, geographical and telephony-oriented formats by way of an address format identifier located within the protocol header. Although the top level of the NSAP address hierarchy is internationally administered by ISO, subordinate address domains are administered by appropriate local organizations.

Network service access point (NSAP) address prefix. Used to identify groups of systems that reside in a given routing domain or confederation. An NSAP prefix may have a length that is either smaller than or the same size as the base NSAP address.

Network topology map. Provides an overall view of the global network connectivity and is used in path computations by the operative routing algorithm.

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

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

Open systems interconnection (OSI) protocol architecture. A set of protocols used to implement the OSI reference model.

Open systems interconnection (OSI) reference model. A model providing a standard approach to network design introducing modularity by dividing the complex set of functions into seven more manageable, self-contained, functional layers. By convention these are usually depicted as a vertical stack.

Note.— The OSI reference model is defined by ISO/IEC 7498-1.

Operational requirement. A statement of the operational attributes of a system needed for the effective and/or efficient provision of air traffic services to users.

Packed Encoding Rules (PER). Encoding rules, as defined in ISO/IEC 8825-2, that have been designed to minimize the number of bits transmitted.

Performance requirements. Requirements that define a function's characteristics, such as reliability, availability, response time, processing delay, integrity, that are necessary to meet the operational requirements for a specific application of the function.

Presentation data value (PDV). The unit of information specified in an abstract syntax, which is transferred by the OSI presentation service (ISO/IEC 8822).

Priority (P). The relative importance of a particular protocol data unit (PDU) relative to other PDUs in transit and used to allocate resources which become scarce during the transfer process.

Profile. Defines implementation conformance constraints on a set of reference specifications.

Protocol. A set of rules and formats (semantic and syntactic) that determines the communication behaviour between peer entities in the performance of functions at that layer.

Protocol data unit (PDU). (1) A unit of data transferred between peer entities within a protocol layer consisting of protocol control information and higher layer user data (i.e. service data units). (2) A unit of data specified in an (N) protocol and consisting of (N) protocol control information and possibly (N) user data, where N indicates the layer.

Protocol implementation conformance statement (PICS). A protocol implementation conformance statement enables conformance testing of protocols. As recommended by ISO/IEC 9646-2, PICS pro forma, tailored to ATN context, have been developed as ATN profile requirements list (APRLs) to provide an effective basis for conformance testing of implementations.

Quality of service (QOS). The information relating to data transfer characteristics used by various communication protocols to achieve various levels of performance for network users.

Receiving ATSU (R-ATSU). The next air traffic control unit which is in the process of accepting the control authority and communication responsibility for a flight transferred by the controlling ATSU (C-ATSU).

Runway visual range (RVR). The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

Secondary surveillance radar (SSR). A surveillance radar system which uses transmitters/receivers (interrogators) and transponders.

Security label. May indicate requirements for protection of a protocol data unit (PDU) and provide information used by network layer access control functions.

Service data unit (SDU). A unit of data transferred between adjacent layer entities, which is encapsulated within a protocol data unit (PDU) for transfer to a peer layer.

Service primitive. A function of an application service element (ASE) that is not broken down further into subfunctions and is presented as part of the abstract service interface (i.e. request, indication, response or confirmation).

Service provider. An entity at a layer that provides services to the layer above. These services are provided at service access points through the use of service primitives.

Short transport service access point (TSAP). Composed of the administrative region selector (ARS), (Optional), the location identifier (LOC), the system identifier (SYS), the network selector (SEL) and the transport selector (TSAP selector).

System application. An application supports the operation of the air-ground applications, ground-ground applications or communication services. A system application can take the form of either an air-ground application or a ground-ground application.

System level requirement. The system level requirement is a high-level technical requirement that has been derived from operational requirements, technological constraints and regulatory constraints (administrative and institutional). The system level requirements are the basis for the functional requirements and lower-level requirements.

Traffic category. A subdivision of the operational communication traffic type used to distinguish between ATS communication and aeronautical operational control (AOC).

Traffic type. A means used to distinguish different types of message traffic for the purposes of establishing communication paths to support operational and legal requirements. There are four traffic types:

- a) the operational communication traffic type, which is subdivided into the following two categories representing safety and regularity of flight communication:
 - 1) ATS communication; and
 - 2) aeronautical operational control;
- b) administrative communication, representing non-safety and regularity of flight communication sent by aircraft operating agencies and ATS administrations;
- c) general communication, representing APC, public correspondence and other non-operational and non-administrative communication; and
- d) systems management communication, representing systems management information that is critical for support of network operations.

Note.— The differentiation of traffic types is required because different data traffic may have different access to subnetworks. The traffic type is conveyed in the ATN security label of ISO/IEC 8473 and ISO/IEC 10747. It is used to qualify connectionless mode network protocol (CLNP) data packets and (inter-domain) routes according to the class of traffic that they carry. Based on this qualification, access of subnetworks is controlled by the ATN Internet communications service.

User requirements. Requirements that are allocated to the user to ensure the interoperability of the communication services and application entities.

Chapter 1

INTRODUCTION

1.1 OVERVIEW

1.1.1 General

Included in this part of Doc 9880 are technical provisions for:

- a) context management (CM);
- b) controller-pilot data link communications (CPDLC);
- c) flight information services (FIS) (in preparation);
- d) automatic dependent surveillance — contract (ADS-C) (in preparation); and
- e) ATN message integrity check algorithm.

1.1.2 Context management (CM)

1.1.2.1 The CM application allows addressing capability for data link applications. It provides the capability to establish a logon between peer ATS ground systems and ATS ground and aircraft systems. Once an appropriate connection is established, CM provides data link application information, the capability to logon to another ground system and the capability to update logon information.

1.1.2.2 The CM application needs to be considered in the context of the guidance material for the data link initiation capability (DLIC), as provided in the *Manual of Air Traffic Services Data Link Applications* (Doc 9694, Part II). The DLIC process supports addressing requirements for ATS such as CPDLC, FIS and ADS-C.

1.1.3 Controller-pilot data link communications (CPDLC)

1.1.3.1 The CPDLC application allows data link communications between controllers and pilots.

1.1.3.2 The CPDLC application provides the capability to establish, manage and terminate CPDLC dialogues between ATS ground and aircraft system peers. Once a dialogue is established, CPDLC provides for message exchange between the controller and the pilot. The CPDLC application supports a variety of operational data link services, depending upon the CPDLC message and operational procedures applied.

1.1.3.3 Also provided by the CPDLC application is the capability to establish, manage and terminate CPDLC dialogues between two ATC ground system peers for the purpose of ground-ground forwarding of a CPDLC message.

1.1.3.4 The CPDLC application includes an end-to-end protection of message integrity by an application level integrity check that also provides assurance of correct delivery.

1.1.3.5 The CPDLC application complies with the provisions in the fifteenth edition of the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444), Chapter 14 (Controller-pilot data link communications (CPDLC)) and Appendix 5 (CPDLC message set). It also complies with the provisions in Doc 9694, Part IV.

1.1.3.6 Depending upon the message subset and operational procedures applied, the CPDLC application supports a variety of operational data link services.

1.1.4 Flight information services (FIS)

(To be developed.)

1.1.5 Automatic dependent surveillance — contract (ADS-C)

(To be developed.)

1.1.6 ATN message integrity check algorithm

The integrity check algorithm may optionally be invoked by the ATN application-user specification to provide a proof of message integrity, as well as proof of delivery to an intended recipient, etc. The default ATN message checksum algorithm is discussed in Chapter 6.

1.2 DIALOGUE SERVICE (DS)

Throughout Part I, references to dialogue services (D-START, D-DATA, D-END, D-ABORT, D-P-ABORT) are references to the DS specified in Part III of this manual.

Chapter 2

CONTEXT MANAGEMENT APPLICATION

2.1 INTRODUCTION

2.1.1 Overview

This chapter is designed as follows:

- Section 2.1 — INTRODUCTION: Besides outlining the material covered in Chapter 2, this section provides a description of the functions of the CM application.
- Section 2.2 — GENERAL REQUIREMENTS: This section focuses on the CM-ASE version number and error-processing requirements.
- Section 2.3 — THE ABSTRACT SERVICE: The description of the abstract service provided by the CM application service element (CM-ASE) is contained in this section.
- Section 2.4 — FORMAL DEFINITIONS OF MESSAGES: This section contains the formal definitions of messages exchanged by CM-ASEs using Abstract Syntax Notation One (ASN.1).
- Section 2.5 — PROTOCOL DEFINITION: This section describes the exchanges of messages allowed by the CM protocol, as well as time constraints. It also provides CM-ASE protocol descriptions and state tables.
- Section 2.6 — COMMUNICATION REQUIREMENTS: The requirements that the CM application imposes on the underlying communication system are covered in this section.
- Section 2.7 — CM-USER REQUIREMENTS: This section contains requirements imposed on the user of the CM-ASE service.
- Section 2.8 — SUBSETTING RULES: The conformance requirements that all implementations of the CM protocol obey are covered in this section.

2.1.2 Description of the functions of the CM application

2.1.2.1 Logon function

2.1.2.1.1 The logon function provides a means for an aircraft and a ground system to exchange ATN application information. The logon function has two variants — secure and unsecure. Secure logons are only available to version 2 CM systems. Version 2 CM systems have the option of performing secure or unsecure logon functions.

2.1.2.1.2 The logon function can only be air-initiated. The aircraft system can use the logon function to provide an application name and version number for each air-only-initiated application, and an application name, address and version number for each application that the aircraft wishes to use that can be ground-initiated, along with flight plan information as required by the ground system. Additionally, if the aircraft is a version 2 CM, it can provide the Security Requirements parameter. This parameter will have different values depending on whether or not the logon will be requesting secure or unsecure services. Version 1 CM applications cannot provide the Security Requirements parameter. The user data in the CM-logon request is the same for both secure and unsecure services. In response, the ground provides an application name for each ground-only-initiated requested application, and an application name, address and version number for each requested application that can be air-initiated and that the ground can support. For version 2 CM, if a secure logon service is requested and is able to be supported, the response to the CM-logon request will also include additional security information as well as the Security Requirements parameter. However, a successful secure logon function does not guarantee that other applications (such as ADS, CPDLC and FIS) will be able to be run in a secure mode — that will be dependent on local security policy.

2.1.2.1.3 For version 2 CM, an “emulated version” CM-logon can also be performed. This option may be used in order to start a CM-logon service with a known earlier version ground CM application.

2.1.2.1.4 Up to a maximum of 256 applications can be supported by the logon function.

2.1.2.1.5 Each time a logon is accomplished between a given aircraft and a ground system, the latest exchanged information replaces any previous information for each indicated application.

2.1.2.1.6 The CM-logon request message provides required flight plan information, the aircraft's CM application name and address, and information for each application for which data link services are desired. For each application that can be ground-initiated, the aircraft must provide the application name, version number and address. For each application that is only air-initiated, the aircraft must provide the application name and version number.

2.1.2.1.7 The CM-logon response message provides information for the logon-indicated air-initiated applications. For each desired air-initiated application, the ground provides the application name, version number and address. For version 2 CM, if security is supported, the CM-logon response message also contains the key for each application, as well as an indication of the key's domain applicability.

2.1.2.2 Server facility query function

2.1.2.2.1 The server facility query function is only available for version 2 CM. It may be secure or unsecure. The server facility query function can only be air-initiated. The aircraft can use the server facility query function to provide application information to a ground system supporting CM server functionality. In addition, the aircraft can specify up to eight facility designations with which it wishes to perform data link services. In response, the ground provides application information for each of the facility designations specified. If secure services are supported and requested, the ground will also reply with key information and domain usage information for each application. However, a successful secure server facility query function does not guarantee that other applications (such as ADS, CPDLC and FIS) will be able to be run in a secure mode — that will be dependent on local security policy. The ground may also reply with a message saying the service is not supported or unavailable.

2.1.2.2.2 Up to a maximum of 256 applications can be supported by the server facility query function.

2.1.2.2.3 Each time a server facility query is accomplished between a given aircraft and a ground system, the latest exchanged information replaces any previous information for each indicated application.

2.1.2.2.4 The CM server facility query request message provides required flight plan information, the aircraft's CM application name and address, up to eight facility designations with which the aircraft wishes to perform data link

services, and information for each application on the aircraft for which data link services are desired. For each application that can be ground-initiated, the aircraft must provide the application name, version number and address. For each application which is only air-initiated, the aircraft must provide the application name and version number.

2.1.2.2.5 The CM server facility query response message provides application information for each of the facility designations as indicated by the server facility query request. For each application that can be air-initiated, the ground system must provide the application name, version number and address. For each application that is only ground-initiated, the ground system must provide the application name and version number. Additionally, if secure services are supported and requested, the ground system must also provide key information and domain usage applicability for each application, if available.

2.1.2.3 Server facility update function

2.1.2.3.1 The server facility update function is only available for version 2 CM, and may be secure or unsecure. This function provides a method for the ground system to update application information for up to eight facility designations. This function assumes that the server facility query function has been accomplished.

2.1.2.3.2 The CM server facility update message can provide updated ground information for up to 256 applications for each of up to eight different facilities. For each updated application, the ground provides the application's name, version number and address, if applicable. Additionally, if secure services are supported and requested, the ground system must also provide key information and domain usage applicability for each application, if available.

2.1.2.4 Update function

2.1.2.4.1 The update function provides a method for the ground system to update application information. This function assumes that the logon function has been accomplished.

2.1.2.4.2 For version 2 CM, both secure and unsecure update functions are available.

2.1.2.4.3 The CM update message can provide updated ground information for up to 256 applications. For each updated application, the ground provides the application's name, version number and address. For version 2 CM secure updates, security information for each application (key and domain usage indication) is also included. However, a successful secure update function does not guarantee that other applications (such as ADS, CPDLC and FIS) will be able to be run in a secure mode — that will be dependent on local security policy.

2.1.2.5 Contact function

2.1.2.5.1 The contact function provides a method for the ground system to request the aircraft system to initiate the logon function with a designated ground system. It is expected that the contact function will only be used when ground connectivity is not available between respective ground system applications. This function assumes that the logon function has been accomplished with the ground system initiating the contact function. The ground initiates this function with a contact request specifying the ground system with which to logon. The aircraft initiates a logon as specified in 2.1.2.1 and indicates the success or lack thereof of the logon. For version 2 CM, the contact function may be secure or unsecure. There are no differences in the user data provided by the CM-ground-user or CM-air-user; only the provision of the Security Requirements parameter is different.

2.1.2.5.2 The CM contact request message provides the ground system CM application address that the initiating ground system is requesting the aircraft to logon with.

2.1.2.5.3 The CM contact response message provides the information indicating whether or not the requested contact was successful.

2.1.2.6 Forward function

2.1.2.6.1 The forward function provides a method for a ground system to forward aircraft information received from the CM-logon function to another ground system. This function is initiated by a ground system that supports ground-ground forwarding. After an aircraft has completed a successful logon with that ground system, that ground system can then forward the aircraft CM-logon information to other ground systems. It is a one-way forwarding of information with an indication of success, failure or non-support from the receiving ground system. If the ground system receiving this CM information supports ground-ground forwarding, it can then initiate a CM update function to provide information to the aircraft for any air-initiated applications.

2.1.2.6.2 The CM-forward request message contains the information as provided in the initial logon.

2.1.2.6.3 For version 2 CM, the CM-forward function may be secure or unsecure. In addition, the version 2 CM-forward function includes the aircraft's CM version number along with the aircraft's CM-logon information.

2.1.2.7 Registration function

2.1.2.7.1 The registration function provides a method for the air and ground CM applications to make available the application name, address and version number for each application exchanged in the logon, update or forward functions to other applications or communications systems in the aircraft or on the ground.

2.1.2.7.2 For version 2 CM, registration also includes additional security functionality. For CM ground systems, this includes retrieving the key agreement public keys and domain usage information for each supported application from the directory maintaining that information, and making it available to the user of each application (such as CPDLC) as well as to the secure dialogue service (DS). For CM aircraft systems, this includes making the key agreement public keys and domain information received from a ground system available to the user of each application (such as CPDLC) as well as to the secure DS-provider. These steps are necessary in order for other secure services to be used. Additionally, local procedures may call for further directory interaction in order to retrieve information from, or submit updated information to, the directory.

2.1.2.7.3 There are no standard message exchanges for the registration function.

2.2 GENERAL REQUIREMENTS

2.2.1 CM-ASE version number

The CM-air-ASE and CM-ground-ASE version numbers shall both be set to one (basic CM functionality) or two (extended CM functionality).

Note.— The extended CM functionality provides additional capability to CM-users: it allows a CM-air-user to request information for multiple ground facilities, a CM-ground-user to give an aircraft information for multiple ground facilities, authentication and data integrity services to be performed for air-ground and ground-ground dialogues, and the requirement to obtain information from a directory.

2.2.2 Error-processing requirements

2.2.2.1 In the event of information input by the CM-user being incompatible with that which is able to be processed by the system, the CM-user shall be notified.

2.2.2.2 In the event of a CM-user invoking a CM service primitive when the CM-ASE is not in a state specified in 2.5, the CM-user shall be notified.

2.3 THE ABSTRACT SERVICE

2.3.1 Service description

2.3.1.1 An implementation of either the CM ground-based service or the CM air-based service shall exhibit external behaviour consistent with having implemented a CM-ground-ASE or CM-air-ASE, respectively.

2.3.1.2 This section defines the abstract service interface for the CM service. The CM-ASE abstract service is described from the viewpoint of the CM-air-user, the CM-ground-user and the CM service provider.

2.3.1.3 This section defines the static behaviour (i.e. the format) of the CM abstract service. Its dynamic behaviour (i.e. how it is used) is described in 2.7.

2.3.1.4 Figure 2-1 shows the CM application. The functional modules identified in the CM application are the following:

- a) the CM-user;
- b) the CM application entity (CM-AE) service interface;
- c) the CM-AE;
- d) the CM control function (CM-CF);
- e) the CM application service element (CM-ASE) service interface;
- f) the CM-ASE; and
- g) the DS interface.

2.3.1.5 The CM-user represents the operational part of the CM system. This user does not perform the communication functions but relies on a communication service provided to it via the CM-AE through the CM-AE service interface. The individual actions at this interface are called CM-AE service primitives. Similarly, individual actions at other interfaces in the communication system are called service primitives at these interfaces.

2.3.1.6 The CM-AE consists of several elements including the CM-ASE and the CM-CF. The DS interface is made available by the CM-CF to the CM-ASE for communication with the peer CM-ASE.

2.3.1.7 The CM-ASE is the element in the communication system that executes the CM-specific protocol. In other words, it takes care of the CM-specific service primitive sequencing actions, message creation, timer management, and error and exception handling.

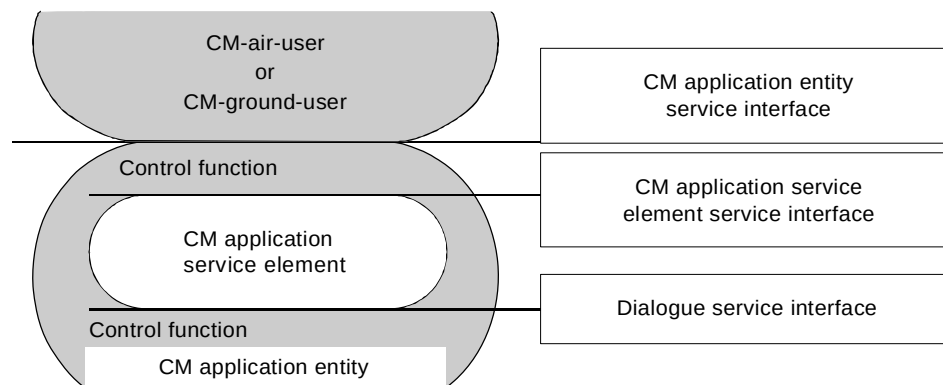


Figure 2-1. Functional model of the CM application

2.3.1.8 The CM-ASE interfaces only with the CM-CF. This CM-CF is responsible for mapping service primitives received from one element (such as the CM-ASE and the CM-user) to other elements that interface with it. The part of the CM-CF that is relevant from the point of view of the CM application, i.e. the part between the CM-user and the CM-ASE, will map CM-AE service primitives to CM-ASE service primitives transparently.

2.3.1.9 The DS interface is the interface between the CM-ASE and the part of the CM-CF underneath the CM-ASE, and provides the DS as defined in Part III of this manual.

2.3.2 The CM-ASE abstract service

2.3.2.1 There is no requirement to implement the CM-ASE abstract service in a CM product; however, it is necessary to implement the ground-based and air-based system in such a way that it will be impossible to detect (from the peer system) whether or not an interface has been built.

2.3.2.2 The CM-ASE abstract service shall consist of a subset of the following services as allowed by the subsetting rules in 2.8:

- a) CM-logon service as defined in 2.3.3;
- b) for CM version 2, CM-server-facility-query service as defined in 2.3.4;
- c) CM-update service as defined in 2.3.5;
- d) for CM version 2, CM-server-facility-update service as defined in 2.3.6;
- e) CM-contact service as defined in 2.3.7;
- f) CM-end service as defined in 2.3.8;
- g) CM-forward service as defined in 2.3.9;
- h) CM-user-abort service as defined in 2.3.10; and
- i) CM-provider-abort service as defined in 2.3.11.

2.3.2.3 For a given primitive, the presence of each parameter is described by one of the following values in the parameter tables in 2.3:

blank	not present;
C	conditional upon some predicate explained in the text;
C(=)	conditional upon the value of the parameter to the immediate left being both present and equal;
M	mandatory;
M(=)	mandatory, and equal to the value of the parameter to the immediate left; or
U	user option.

2.3.2.4 The following abbreviations are used in Chapter 2 of this manual:

Req	request; data is input by the CM-user initiating the service to its respective ASE;
Ind	indication; data is indicated by the receiving ASE to its respective CM-user;
Rsp	response; data is input by the receiving CM-user to its respective ASE; and
Cnf	confirmation; data is confirmed by the initiating ASE to its respective CM-user.

2.3.2.5 An unconfirmed service allows a message to be transmitted in one direction without providing a corresponding response.

2.3.2.6 A confirmed service provides end-to-end confirmation that a message sent by one user was received by its peer user.

2.3.2.7 An abstract syntax is a syntactical description of a parameter that does not imply a specific implementation. Only when the CM-ASE maps a parameter onto an application protocol data unit (APDU) field, or vice versa, is the abstract syntax of the parameter described by using the ASN.1 at 2.4 for this field.

2.3.3 CM-logon service

2.3.3.1 General

2.3.3.1.1 The CM-logon service allows the CM-air-user to initiate data link service. The CM-air-user provides information on each data link application for which it desires a data link service. The CM-ground-user responds indicating whether or not the CM-logon was successful, and if successful, includes information on each data link application it can support. It is a confirmed service.

2.3.3.1.2 For CM version 2 CM-logon service, the CM-air-user will set the Security Requirements parameter as required for the particular airspace. A version 2 CM-air-user may attempt either a secure or an unsecure CM-logon service. Additionally, if it is known that the peer CM ground system is an earlier version CM, then the sending CM-air-user may indicate to the CM-air-ASE that it wishes to run in a previous version mode through the Emulated Version parameter. If this parameter is used, no other version 2 CM services may be invoked with that ground system.

2.3.3.1.3 If the CM-air-ASE version number is less than or equal to the CM-ground-ASE version number, then the CM-logon service shall contain the primitives and parameters as presented in Table 2-1.

**Table 2-1. CM-logon service parameters —
air-ASE version number ≤ ground-ASE version number**

<i>Parameter name</i>	<i>Req</i>	<i>Ind</i>	<i>Rsp</i>	<i>Cnf</i>
Facility Designation	M			
Aircraft Address	M	M(=)		
CM-ASE Version Number		C		
Logon Request	M	M(=)		
Logon Response			M	M(=)
Class of Communication Service	U			
Maintain Dialogue			U	C(=)
Security Required	M	M(=)	C(=)	
Emulated Version	U			

2.3.3.1.4 If the CM-air-ASE version number is greater than the CM-ground-ASE version number, then the CM-logon service shall contain the primitives and parameters as presented in Table 2-2.

**Table 2-2. CM-logon service parameters —
air-ASE version number > ground-ASE version number**

<i>Parameter name</i>	<i>Req</i>	<i>Cnf</i>
Facility Designation	M	
Aircraft Address	M	
CM-ASE Version Number		M
Logon Request	M	
Class of Communication Service	U	
Security Required	M	
Emulated Version	U	

2.3.3.2 Facility Designation parameter

2.3.3.2.1 This parameter contains the addressed ground system's facility designation.

2.3.3.2.2 The *Facility Designation* parameter value shall conform to the abstract syntax four- to eight-character facility designation.

2.3.3.3 Aircraft Address parameter

2.3.3.3.1 The *Aircraft Address* parameter contains the ICAO 24-bit aircraft address of the aircraft initiating the CM-logon service.

2.3.3.3.2 The *Aircraft Address* parameter value shall conform to the abstract syntax of the ICAO 24-bit aircraft address.

2.3.3.4 CM-ASE Version Number parameter

2.3.3.4.1 This parameter contains the version number of the CM-ASE.

2.3.3.4.2 When provided by the CM-ASE, the *CM-ASE Version Number* parameter shall conform to an abstract integer value from 1 to 255.

2.3.3.4.3 Only if the CM-air-ASE version number is less than the CM-ground-ASE version number shall the CM-air-ASE version number be indicated to the CM-ground-user.

2.3.3.4.4 Only if the CM-air-ASE version number is greater than the CM-ground-ASE version number shall the CM-ground-ASE version number be confirmed to the CM-air-user.

2.3.3.4.5 If the CM-air-ASE version number is the same as the CM-ground-ASE version number, the *CM-ASE Version Number* parameter is not present in the indication given to the CM-ground-user or in the confirmation to the CM-air-user.

2.3.3.5 Logon Request parameter

2.3.3.5.1 The *Logon Request* parameter contains the following data:

- a) information for each data link application available on the aircraft, for which the aircraft requires data link service; and
- b) aircraft flight plan information (e.g. flight identification, aircraft destination and departure airport and time) as required by the addressed ground system.

2.3.3.5.2 The *Logon Request* parameter value shall conform to the ASN.1 abstract syntax CMLogonRequest.

2.3.3.6 Logon Response parameter

2.3.3.6.1 The *Logon Response* parameter contains information for each requested data link application for which the ground is able to provide data link service. For the CM version 2 secure CM-logon service, this parameter also contains key and domain usage information for each application.

2.3.3.6.2 For CM version 1, the *Logon Response* parameter value shall conform to the ASN.1 abstract syntax CMLogonResponse.

2.3.3.6.3 For CM version 2, the *Logon Response* parameter value shall conform to the ASN.1 abstract syntax CMSecureLogonResponse.

2.3.3.6.4 For unsecure CM version 2, no security information is provided in the CMSecureLogonResponse.

2.3.3.7 Class of Communication Service parameter

2.3.3.7.1 This parameter contains the value of the required class of communication service if specified by the CM-air-user.

2.3.3.7.2 When the *Class of Communication Service* parameter is specified by the CM-air-user, this parameter shall have one of the following abstract values: "A", "B", "C", "D", "E", "F", "G" or "H".

2.3.3.7.3 If the *Class of Communication Service* parameter is not specified by the CM-air-user, it indicates that there is no routing preference.

2.3.3.8 Maintain Dialogue parameter

2.3.3.8.1 The *Maintain Dialogue* parameter is used to indicate whether or not the requested CM dialogue is to remain open after a Logon Response.

2.3.3.8.2 Whenever a CM dialogue is kept open by the CM-ground-user, it must later be explicitly closed by the CM-ground-user.

2.3.3.8.3 This parameter is only provided by the CM-ground-user when the CM-ground-user wishes to keep the CM dialogue open.

2.3.3.8.4 If provided by the CM-ground-user, this parameter shall have the abstract value "maintain".

2.3.3.9 Security Required parameter

2.3.3.9.1 The *Security Required* parameter contains an indication of whether or not a CM version 2 requires security. It is used by the requester of the version 2 CM-logon service and is indicated to the responder. It is not used by version 1 CM.

2.3.3.9.2 If the received *Security Required* parameter is not as expected per the local security policy, the CM-ground-ASE will abort. The CM-ground-user will use the indicated *Security Required* parameter to determine whether or not to return key information to the requesting aircraft. This is necessary for the case where a ground system can provide both secure and unsecure services.

2.3.3.9.3 The value of the *Security Required* parameter provided by the CM-air-user shall be indicated to the CM-ground-user.

2.3.3.9.4 When the CM-air-user requires a secure CM-logon service, the *Security Required* parameter shall have the abstract value "secured dialogue supporting key management".

Note.— This is to give an indication to the CM-ground-user that security is to be used.

2.3.3.9.5 When the CM-air-user requires an unsecure CM-logon service or the CM-air-user is communicating with a CM version 1 ground system, the *Security Required* parameter shall have the abstract value "no security".

Note.— This is to give an indication to the CM-ground-user that security is not to be used. However, the CM-ground-user will have the ultimate decision of whether or not security is required. If security is required by the ground system but not requested by the aircraft, the aircraft may be denied data link services.

2.3.3.10 Emulated Version parameter

2.3.3.10.1 The *Emulated Version* parameter is used by a CM-air-user to indicate that the CM-air-ASE is to operate in a degraded mode, i.e. to emulate a previous CM version. If this parameter is provided, the CM-air-user must ensure that no services incompatible with the CM version emulated are invoked. This parameter is not used by version 1 CM.

2.3.3.10.2 This parameter is not normally provided for a first logon unless there is explicit *a priori* knowledge of the CM-ground-ASE version number.

2.3.3.10.3 The value supplied by the CM-air-user must be less than the actual CM-air-ASE version number.

2.3.3.10.4 If provided by the CM-air-user, this parameter shall conform to an abstract integer value from 1 to 255.

2.3.4 CM-server-facility-query service

2.3.4.1 General

2.3.4.1.1 The CM-server-facility-query service allows version 2 CM-air-users to initiate either secure or unsecure data link services with a CM server. This service is similar to a CM-logon service. However, unlike the CM-logon service, the CM-server-facility-query service does not perform version negotiation. In addition, the CM-server-facility-query service can be invoked either with or without a dialogue in place. The CM-air-user provides information on each data link application for which it desires a data link service, as well as on the facility designations of the end systems with which it wants data link service. The CM-ground-user responds indicating whether or not the CM-server-facility-query was successful, and if successful, includes information of each data link application supported by the requested facilities. It is a confirmed service. This service is not used for version 1 CM.

2.3.4.1.2 The CM-server-facility-query service shall contain the primitives and parameters as presented in Table 2-3.

Table 2-3. CM-server-facility-query service parameters

<i>Parameter name</i>	<i>Req</i>	<i>Ind</i>	<i>Rsp</i>	<i>Cnf</i>
Facility Designation	C			
Aircraft Address	C	C(=)		
Server Facility Query Request	M	M(=)		
Server Facility Query Response			M	M(=)
Class of Communication Service	U			
Maintain Dialogue			U	C(=)
Security Required	C	C(=)		

2.3.4.2 Facility Designation parameter

2.3.4.2.1 This parameter contains the addressed ground system's facility designation.

2.3.4.2.2 The *Facility Designation* parameter value shall conform to the abstract syntax four- to eight-character facility designation.

2.3.4.2.3 If a CM dialogue does not exist when a CM-air-user invokes the CM-server-facility-query request, the CM-air-user shall provide the *Facility Designation* parameter value.

Note.— The CM-server-facility-query service does not use this parameter when a CM dialogue exists.

2.3.4.3 Aircraft Address parameter

2.3.4.3.1 The *Aircraft Address* parameter contains the ICAO 24-bit aircraft address of the aircraft initiating the CM-server-facility-query service.

2.3.4.3.2 The *Aircraft Address* parameter value shall conform to the abstract syntax of the ICAO 24-bit aircraft address.

2.3.4.3.3 If a CM dialogue does not exist when a CM-air-user invokes the CM-server-facility-query request, the CM-air-user shall provide the *Aircraft Address* parameter value.

Note.— The CM-server-facility-query service does not use this parameter when a CM dialogue exists.

2.3.4.4 Server Facility Query Request parameter

2.3.4.4.1 The *Server Facility Query Request* parameter contains the following data:

- a) information for each data link application available on the aircraft, for which the aircraft requires data link service;
- b) the facility designations of up to eight facilities with which the aircraft would like to perform data link services; and
- c) aircraft flight plan information (e.g. flight identification, aircraft destination and departure airport and time) as required by the addressed ground system.

2.3.4.4.2 The *Server Facility Query Request* parameter value shall conform to the ASN.1 abstract syntax CMServerFacilityQueryRequest.

2.3.4.5 Server Facility Query Response parameter

2.3.4.5.1 The *Server Facility Query Response* parameter contains application information for each of the facilities as requested in the *Server Facility Query Request* parameter. If application information for one of the facilities is not available, then no application information is returned for that facility. If there is no access to a directory, then the reason for the lack of access will be returned (i.e. either a directory service is not supported or the service is temporarily unavailable). Additionally, if a collision occurs and preference is given to the ground system's CM service, then that condition will be indicated to the CM-air-user. The *Server Facility Query Response* parameter will contain key information only if security is supported.

2.3.4.5.2 The *Server Facility Query Response* parameter value shall conform to the ASN.1 abstract syntax CMServerFacilityQueryResponse.

2.3.4.6 Class of Communication Service parameter

2.3.4.6.1 This parameter contains the value of the required class of communication service if specified by the CM-air-user.

2.3.4.6.2 When the *Class of Communication Service* parameter is specified by the CM-air-user, this parameter shall have one of the following abstract values: "A", "B", "C", "D", "E", "F", "G" or "H".

2.3.4.6.3 If the *Class of Communication Service* parameter is not specified by the CM-air-user, it indicates that there is no routing preference.

2.3.4.7 Maintain Dialogue parameter

2.3.4.7.1 The *Maintain Dialogue* parameter is used to indicate whether or not the requested CM dialogue is to remain open after a Server Facility Query Response.

2.3.4.7.2 Whenever a CM dialogue is kept open by the CM-ground-user, it must later be explicitly closed by the CM-ground-user.

2.3.4.7.3 This parameter is only provided by the CM-ground-user when the CM-ground-user wishes to keep the CM dialogue open and a dialogue is not already in place.

2.3.4.7.4 This parameter is not used if a dialogue is already in place.

2.3.4.7.5 If provided by the CM-ground-user, this parameter shall have the abstract value "maintain".

2.3.4.8 Security Required parameter

2.3.4.8.1 The *Security Required* parameter contains an indication of whether or not a CM version 2 requires security. It is used by the requester of the CM-server-facility-query service and is indicated to the responder.

2.3.4.8.2 If the received *Security Required* parameter is not as expected in the indication primitive, the CM-ground-ASE will abort.

2.3.4.8.3 If a CM dialogue does not exist when a CM-air-user invokes the CM-server-facility-query request, the CM-air-user shall provide the *Security Required* parameter.

Note.— The CM-server-facility-query service does not use this parameter if a dialogue exists.

2.3.4.8.4 When the *Security Required* parameter is provided by the CM-air-user, the same value shall be indicated to the CM-ground-user.

2.3.4.8.5 When the CM-air-user requires a secure CM-server-facility-query service, and no previous session key has been established with the CM ground system which is to be contacted, the *Security Required* parameter shall have the abstract value "secured dialogue supporting key management".

Note.— A session key may be established with a secure CM-logon, secure CM-update, secure CM-server-facility-update, or secure CM-server-facility-query. If one of these secure services has not already been successfully performed with the ground system, then a session key needs to be established, and the “secured dialogue supporting key management” will tell the upper layers to establish a new session key. The CM-air-user does not establish the session key itself; that is handled as described in Part IV of this manual.

2.3.4.8.6 When the CM-air-user requires a secure CM-server-facility-query service, and a previous session key has been established with the CM ground system which is to be contacted, the *Security Required* parameter shall have the abstract value “secured dialogue”.

Note.— A session key may be established with a secure CM-logon, secure CM-update, secure CM-server-facility-update or secure CM-server-facility-query. If one of these secure services has already been successfully performed with the ground system, then a session key is considered to be established, and the “secured dialogue” will tell the upper layers to continue using security with the established session key. The CM-air-user does not establish the session key itself; that is handled as described in Part IV of this manual.

2.3.4.8.7 When the CM-air-user requires an unsecure CM-server-facility-query service, the *Security Required* parameter shall have the abstract value “no security”.

Note.— This is to give an indication to the CM-ground-user that security is not to be used. However, the CM-ground-user will have the ultimate decision of whether or not security is required. If security is required by the ground system but not requested by the aircraft, the aircraft may be denied data link services.

2.3.5 CM-update service

2.3.5.1 General

2.3.5.1.1 The CM-update service allows the CM-ground-user to transmit updated ground information for its applications to update previously coordinated CM-logon information. It is an unconfirmed service.

2.3.5.1.2 For CM version 2 CM-update service, the CM-ground-user will set the *Security Required* parameter as appropriate in order to perform secure or unsecure services. This parameter is not used by version 1 CM.

2.3.5.1.3 The CM-update service shall contain the primitives and parameters as presented Table 2-4.

Table 2-4. CM-update service parameters

<i>Parameter name</i>	<i>Req</i>	<i>Ind</i>
Aircraft Address	C	
Facility Designation	C	C(=)
Update Information	M	M(=)
Class of Communication Service	U	
Security Required	C	

2.3.5.2 Aircraft Address parameter

- 2.3.5.2.1 The *Aircraft Address* parameter contains the addressed aircraft's ICAO 24-bit aircraft address.
- 2.3.5.2.2 The *Aircraft Address* parameter value shall conform to the abstract syntax of the ICAO 24-bit aircraft address.
- 2.3.5.2.3 If a CM dialogue does not exist when a CM-ground-user invokes the CM-update service request, the CM-ground-user shall provide the *Aircraft Address* parameter value.

Note.— The CM-update service does not use this parameter when a CM dialogue exists.

2.3.5.3 Facility Designation parameter

- 2.3.5.3.1 This parameter contains the ground system's facility designation.
- 2.3.5.3.2 The *Facility Designation* parameter value shall conform to the abstract syntax four- to eight-character facility designation.
- 2.3.5.3.3 If a CM dialogue does not exist when a CM-ground-user invokes the CM-update service request, the CM-ground-user shall provide the *Facility Designation* parameter value.

Note.— The CM-update service does not use this parameter when a CM dialogue exists.

2.3.5.4 Update Information parameter

- 2.3.5.4.1 The *Update Information* parameter contains information on each updated data link application. For version 2 secure CM-update service, this parameter also contains key and domain usage indications for each application.
- 2.3.5.4.2 For CM version 1 or CM version 2 with no security required, the *Update Information* parameter value shall conform to the ASN.1 abstract syntax CMUpdate.
- 2.3.5.4.3 For CM version 2 with security required, the *Update Information* parameter value shall conform to the ASN.1 abstract syntax CMSecureUpdate.

2.3.5.5 Class of Communication Service parameter

- 2.3.5.5.1 This parameter contains the value of the required class of communication service if specified by the CM-ground-user.
- 2.3.5.5.2 The CM-update service does not use this parameter when a CM dialogue exists.
- 2.3.5.5.3 When the *Class of Communication Service* parameter is specified by the CM-ground-user, this parameter shall have one of the following abstract values: "A", "B", "C", "D", "E", "F", "G" or "H".

2.3.5.5.4 If the *Class of Communication Service* parameter is not specified by the CM-ground-user, it indicates that there is no routing preference.

2.3.5.6 Security Required parameter

2.3.5.6.1 The *Security Required* parameter contains an indication of whether or not secure CM-update services will be used by a version 2 CM. This parameter is not used for CM version 1.

2.3.5.6.2 When the CM-ground-user requires a secure CM-update service, and up-to-date security information has not already been established between that airborne system and the CM ground system (i.e. a current session key is not shared), the *Security Required* parameter shall have the abstract value “secured dialogue supporting key management”.

Note.— This is to give an indication to the CM-air-ASE that security is to be used. The CM-air-ASE can then make security decisions based on local security policy.

2.3.5.6.3 When the CM-ground-user requires a secure CM-update service, and up-to-date security information has already been established between that airborne system and the CM ground system (i.e. a current session key is shared), the *Security Required* parameter shall have the abstract value “secured dialogue”.

Note.— This is to give an indication to the CM-air-ASE that security is to be used. The CM-air-ASE can then make security decisions based on local security policy.

2.3.5.6.4 When the CM-ground-user requires an unsecure CM-update service, and the CM aircraft system is not version 1, the *Security Required* parameter shall have the abstract value “no security”.

Note.— This is to give an indication to the CM-air-ASE that security is not to be used. The CM-air-ASE can then make security decisions based on local security policy.

2.3.5.6.5 If a CM dialogue does not already exist between the CM ground system and CM aircraft system, and the CM aircraft system is not version 1, then when a CM-ground-user invokes the CM-update request, the CM-ground-user shall provide the *Security Required* parameter.

Note.— The CM-update service does not use this parameter if a dialogue exists.

2.3.5.6.6 When communicating with a version 1 CM aircraft, the CM-ground-user shall be prohibited from providing the *Security Required* parameter.

2.3.6 CM-server-facility-update service

2.3.6.1 General

2.3.6.1.1 The CM-server-facility-update service allows version 2 CM servers to transmit updated application information for up to eight specific facilities to update previously coordinated CM-server-facility-query information. It is an unconfirmed service and may be either secure or unsecure. This service is not used by version 1 CM.

2.3.6.1.2 The CM-server-facility-update service shall contain the primitives and parameters as presented in Table 2-5.

Table 2-5. CM-server-facility-update service parameters

<i>Parameter name</i>	<i>Req</i>	<i>Ind</i>
Aircraft Address	C	
Facility Designation	C	C(=)
Server Facility Update Information	M	M(=)
Class of Communication Service	U	
Security Required	C	

2.3.6.2 Aircraft Address parameter

2.3.6.2.1 The *Aircraft Address* parameter contains the addressed aircraft's ICAO 24-bit aircraft address.

2.3.6.2.2 The *Aircraft Address* parameter value shall conform to the abstract syntax of the ICAO 24-bit aircraft address.

2.3.6.2.3 If a CM dialogue does not exist when a CM-ground-user invokes the CM-server-facility-update service request, the CM-ground-user shall provide the *Aircraft Address* parameter value.

Note.— The CM-server-facility-update service does not use this parameter when a CM dialogue exists.

2.3.6.3 Facility Designation parameter

2.3.6.3.1 This parameter contains the ground CM server's facility designation.

2.3.6.3.2 The *Facility Designation* parameter value shall conform to the abstract syntax four- to eight-character facility designation.

2.3.6.3.3 If a CM dialogue does not exist when a CM-ground-user invokes the CM-server-facility-update service request, the CM-ground-user shall provide the *Facility Designation* parameter value.

Note.— The CM-server-facility-update service does not use this parameter when a CM dialogue exists.

2.3.6.4 Server Facility Update Information parameter

2.3.6.4.1 The *Server Facility Update Information* parameter contains information on each updated data link application.

2.3.6.4.2 The *Server Facility Update Information* parameter value shall conform to the ASN.1 abstract syntax CMServerFacilityUpdate.

2.3.6.4.3 The *Server Facility Update Information* parameter will contain key information only if security is supported.

2.3.6.5 Class of Communication Service parameter

2.3.6.5.1 This parameter contains the value of the required class of communication service if specified by the CM-ground-user.

2.3.6.5.2 The CM-server-facility-update service does not use this parameter when a CM dialogue exists.

2.3.6.5.3 When the *Class of Communication Service* parameter is specified by the CM-ground-user, this parameter shall have one of the following abstract values: "A", "B", "C", "D", "E", "F", "G" or "H".

2.3.6.5.4 If the *Class of Communication Service* parameter is not specified by the CM-ground-user, it indicates that there is no routing preference.

2.3.6.6 Security Required parameter

2.3.6.6.1 The *Security Required* parameter contains an indication of whether or not secure CM-server-facility-update services will be used.

2.3.6.6.2 When the CM-ground-user requires a secure CM-server-facility-update service, and a previous CM-logon has not been performed with the CM ground system which is to be contacted, the *Security Required* parameter shall have the abstract value "secured dialogue supporting key management".

Note.— This is to give an indication to the CM-air-ASE that security is to be used. The CM-air-ASE can then make security decisions based on local security policy.

2.3.6.6.3 When the CM-ground-user requires a secure CM-server-facility-update service, and a previous CM-logon has been performed with the CM ground system which is to be contacted, the *Security Required* parameter shall have the abstract value "secured dialogue".

Note.— This is to give an indication to the CM-air-ASE that security is to be used. The CM-air-ASE can then make security decisions based on local security policy.

2.3.6.6.4 When the CM-ground-user requires an unsecure CM-server-facility-update service, the *Security Required* parameter shall have the abstract value "no security".

Note.— This is to give an indication to the CM-air-ASE that security is not to be used. The CM-air-ASE can then make security decisions based on local security policy.

2.3.6.6.5 If a CM dialogue does not exist when a CM-ground-user invokes the CM-server-facility-update request, the CM-ground-user shall provide the *Security Required* parameter.

Note.— The CM-server-facility-update service does not use this parameter if a dialogue exists.

2.3.7 CM-contact service

2.3.7.1 General

2.3.7.1.1 The CM-contact service allows the CM-ground-user, after successful completion of a CM-logon, to request that an aircraft logon with another ground system. It is a confirmed service.

2.3.7.1.2 For CM version 2 CM-contact service, the CM-ground-user will set the Security Required parameter as appropriate in order to perform secure or unsecure services. This parameter is not used by version 1 CM.

2.3.7.1.3 The CM-contact service shall contain the primitives and parameters as presented in Table 2-6.

Table 2-6. CM-contact service parameters

<i>Parameter name</i>	<i>Req</i>	<i>Ind</i>	<i>Rsp</i>	<i>Cnf</i>
Aircraft Address	C			
Facility Designation	C	C(=)		
Contact Request	M	M(=)		
Contact Response			M	M(=)
Class of Communication Service	U			
Security Required	C			

2.3.7.2 Aircraft Address parameter

2.3.7.2.1 The *Aircraft Address* parameter contains the addressed aircraft's ICAO 24-bit aircraft address.

2.3.7.2.2 The *Aircraft Address* parameter value shall conform to the abstract syntax of the ICAO 24-bit aircraft address.

2.3.7.2.3 If a CM dialogue does not exist when a CM-ground-user invokes the CM-contact service request, the CM-ground-user shall provide the *Aircraft Address* parameter value.

Note.— The CM-contact service does not use this parameter when a CM dialogue exists.

2.3.7.3 Facility Designation parameter

2.3.7.3.1 This parameter contains the ground system's facility designation.

2.3.7.3.2 The *Facility Designation* parameter value shall conform to the abstract syntax four- to eight-character facility designation.

2.3.7.3.3 If a CM dialogue does not exist when a CM-ground-user invokes the CM-contact service request, the CM-ground-user shall provide the *Facility Designation* parameter value.

Note.— The CM-contact service does not use this parameter when a CM dialogue exists.

2.3.7.4 Contact Request parameter

2.3.7.4.1 The *Contact Request* parameter contains the facility designation for the ground system that the CM-ground-user requests the aircraft to contact.

2.3.7.4.2 The *Contact Request* parameter value shall conform to the ASN.1 abstract syntax CMContactRequest.

2.3.7.5 Contact Response parameter

- 2.3.7.5.1 The *Contact Response* parameter indicates success, or lack thereof, of the requested contact.
- 2.3.7.5.2 The *Contact Response* parameter value shall conform to the ASN.1 abstract syntax CMContactResponse.

2.3.7.6 Class of Communication Service parameter

- 2.3.7.6.1 This parameter contains the value of the required class of communication service if specified by the CM-ground-user.
- 2.3.7.6.2 When the *Class of Communication Service* parameter is specified by the CM-ground-user, this parameter shall have one of the following abstract values: "A", "B", "C", "D", "E", "F", "G" or "H".
- 2.3.7.6.3 If the *Class of Communication Service* parameter is not specified by the CM-ground-user, it indicates that there is no routing preference.

2.3.7.7 Security Required parameter

- 2.3.7.7.1 The *Security Required* parameter contains an indication of whether or not a CM-ground-user requires security. It is used by the requester of the version 2 CM-contact service. It is not used by version 1 CM.
- 2.3.7.7.2 When the CM-ground-user requires a secure CM-contact service, and a previous secure CM-logon has been performed with the CM ground system, the *Security Required* parameter shall have the abstract value "secured dialogue".

Note.— This is to give an indication to the CM-air-ASE that security is to be used. The CM-air-ASE can then make security decisions based on local security policy.

- 2.3.7.7.3 When the CM-ground-user requires an unsecure CM-contact service or if the CM-ground-user is communicating with a version 1 CM aircraft, the *Security Required* parameter shall have the abstract value "no security".

Note.— This is to give an indication to the CM-air-ASE that security is not to be used. The CM-air-ASE can then make security decisions based on local security policy.

- 2.3.7.7.4 If a CM dialogue does not exist when a CM-ground-user invokes the CM-contact request, the CM-ground-user shall provide the *Security Required* parameter.

Note.— The CM-contact service does not use this parameter when a CM dialogue exists.

2.3.8 CM-end service**2.3.8.1 General**

- 2.3.8.1.1 This service provides the capability for the CM-ground-user to terminate a CM dialogue. This service is only needed when the CM-ground-user maintains a CM dialogue during the logon process. It is an unconfirmed service.

2.3.8.1.2 Only the CM-ground-user will be capable of initiating the CM-end service.

2.3.8.1.3 The CM-end service shall contain the primitives as presented Table 2-7.

Table 2-7. CM-end service parameters

<i>Parameter name</i>	<i>Req</i>	<i>Ind</i>
<i>None</i>		

2.3.9 CM-forward service

2.3.9.1 General

2.3.9.1.1 The CM-forward service allows a CM-ground-user to forward data received in a CM-logon request to another CM-ground system. It is a confirmed service.

2.3.9.1.2 For CM version 2, the CM-forward service can be secure or unsecure. This is indicated by the CM-ground-user setting the Security Required parameter. If it is known that the peer CM ground system is an earlier version CM, then the sending CM-ground-user may indicate to the CM-ground-ASE that it wishes to run in a previous version mode through the Emulated Version parameter.

2.3.9.1.3 If the sending CM-ground-ASE version number is less than or equal to the receiving CM-ground-ASE version number, then the CM-forward service shall contain the primitives and parameters as presented in Table 2-8.

**Table 2-8. CM-forward service parameters —
sending ground-ASE version number $\leq$ receiving ground-ASE version number**

<i>Parameter name</i>	<i>Req</i>	<i>Ind</i>	<i>Cnf</i>
Called Facility Designation	M		
Calling Facility Designation	M	M(=)	
CM-ASE Version Number		C	
Forward Request	M	M(=)	
Class of Communication Service	U		
Result			M
Security Required	M		
Emulated Version	U		

2.3.9.1.4 If the sending CM-ground-ASE version number is greater than the receiving CM-ground-ASE version number, then the CM-forward service shall contain the primitives and parameters as presented in Table 2-9.

**Table 2-9. CM-forward service parameters —
sending ground-ASE version number > receiving ground-ASE version number**

<i>Parameter name</i>	<i>Req</i>	<i>Cnf</i>
Called Facility Designation	M	
Calling Facility Designation	M	
CM-ASE Version Number		M
Forward Request	M	
Class of Communication Service	U	
Result		M
Security Required	M	
Emulated Version	U	

2.3.9.2 Called Facility Designation parameter

2.3.9.2.1 The *Called Facility Designation* parameter contains the receiving ground system's facility designation.

2.3.9.2.2 The *Called Facility Designation* parameter value shall conform to the abstract syntax four- to eight-character facility designation.

2.3.9.3 Calling Facility Designation parameter

2.3.9.3.1 This parameter contains the sending ground system's facility designation.

2.3.9.3.2 The *Calling Facility Designation* parameter value shall conform to the abstract syntax four- to eight-character facility designation.

2.3.9.4 CM-ASE Version Number parameter

2.3.9.4.1 This parameter contains the version number of the CM-ground-ASE.

2.3.9.4.2 When provided by the CM-ASE, the *CM-ASE Version Number* parameter shall conform to an abstract integer value from 1 to 255.

2.3.9.4.3 Only if the sending CM-ground-ASE version number is less than the receiving CM-ground-ASE version number shall the sending CM-ground-ASE version number be indicated to the receiving CM-ground-user.

2.3.9.4.4 Only if the sending CM-ground-ASE version number is greater than the receiving CM-ground-ASE version number shall the receiving CM-ground-ASE version number be confirmed to the sending CM-ground-user.

2.3.9.4.5 If the sending CM-ground-ASE version number is the same as the receiving CM-ground-ASE version number, the *CM-ASE Version Number* parameter is not present in the indication given to the receiving CM-ground-user or in the confirmation given to the sending CM-ground-user.

2.3.9.5 Forward Request parameter

2.3.9.5.1 The *Forward Request* parameter contains information as provided in the CM-logon request. For the CM version 2 CM-forward service, this parameter also contains the aircraft's CM application version number.

2.3.9.5.2 For CM version 1, or for CM version 2 acting as a CM version 1 in emulation, the CM-forward service *Forward Request* parameter value shall conform to the ASN.1 abstract syntax CMForwardRequest.

2.3.9.5.3 For CM version 2 CM-forward service, the *Forward Request* parameter value shall conform to the ASN.1 abstract syntax CMEnhancedForwardRequest.

2.3.9.6 Class of Communication Service parameter

2.3.9.6.1 This parameter contains the value of the required class of communication service if specified by the initiating CM-ground-user.

2.3.9.6.2 When the *Class of Communication Service* parameter is specified by the CM-ground-user, this parameter shall have one of the following abstract values: "A", "B", "C", "D", "E", "F", "G" or "H".

2.3.9.6.3 If the *Class of Communication Service* is not specified by the CM-ground-user, it indicates that there is no routing preference.

2.3.9.7 Result parameter

2.3.9.7.1 The *Result* parameter indicates whether or not the information was forwarded as requested.

2.3.9.7.2 The *Result* parameter shall conform to the ASN.1 abstract syntax CMForwardResponse.

2.3.9.7.3 When the sending CM-ground-ASE version number is less than or equal to the receiving CM-ground-ASE version number, the *Result* parameter takes the abstract value "success". When the sending CM-ground-ASE version number is greater than the receiving CM-ground-ASE version number, the *Result* parameter takes the abstract value "incompatible version". When the receiving CM-ground-ASE does not support ground-ground forwarding, the *Result* parameter takes the abstract value "service not supported".

2.3.9.8 Security Required parameter

2.3.9.8.1 The *Security Required* parameter contains an indication of whether or not a CM-ground-user requires security. It is used by the sending CM-ground-user of the version 2 CM-forward service. It is not used by version 1 CM, or by a version 2 CM emulating a version 1 CM.

2.3.9.8.2 When the sending CM-ground-user requires a secure CM-forward service, the *Security Required* parameter shall have the abstract value "secured dialogue".

Note.— This is to give an indication to the peer CM-ground-ASE that security is to be used. The peer CM-ground-ASE can then make security decisions based on local security policy.

2.3.9.8.3 When the sending CM-ground-user requires an unsecure CM-forward service or is communicating with a version 1 CM ground system, the *Security Required* parameter shall have the abstract value "no security".

Note.— This is to give an indication to the peer CM-ground-ASE that security is not to be used. The peer CM-ground-ASE can then make security decisions based on local security policy.

2.3.9.9 Emulated Version parameter

2.3.9.9.1 The *Emulated Version* parameter is used by a CM-ground-user to indicate that the sending CM-ground-ASE is to operate in a degraded mode, i.e. to emulate a previous CM version. This parameter is not used by version 1 CM.

2.3.9.9.2 This parameter is not normally provided for a first forward unless there is explicit *a priori* knowledge of the receiving ground CM application version number.

2.3.9.9.3 The value supplied by the sending CM-ground-user must be less than the actual sending CM-ground-ASE version number.

2.3.9.9.4 If provided by the sending CM-ground-user, this parameter shall conform to an abstract integer value from 1 to 255.

2.3.10 CM-user-abort service

2.3.10.1 This service provides the capability for either the CM-air-user or the CM-ground-user to abort communication with its peer. This can be used for operational or technical reasons. It can be invoked at any time by an active user. Messages in transit may be lost during this operation. It is an unconfirmed service.

2.3.10.2 If the service is invoked prior to complete establishment of the dialogue, the CM-user-abort indication may not be provided. A CM-provider-abort indication may result instead.

2.3.10.3 The CM-user-abort service shall contain the primitives as presented Table 2-10.

Table 2-10. CM-user-abort service parameters

<i>Parameter name</i>	<i>Req</i>	<i>Ind</i>
<i>None</i>		

2.3.11 CM-provider-abort service

2.3.11.1 General

2.3.11.1.1 The CM-provider-abort service provides the capability for the CM service provider to inform its users that it can no longer provide the CM service. Messages in transit may be lost during this operation.

2.3.11.1.2 The CM-provider-abort service shall contain the primitives and parameters as presented Table 2-11.

Table 2-11. CM-provider-abort service parameters

<i>Parameter name</i>	<i>Ind</i>
Reason	M

2.3.11.2 Reason parameter

2.3.11.2.1 This parameter identifies the reason for the abort.

2.3.11.2.2 The *Reason* parameter value shall conform to the ASN.1 abstract syntax CMAbortReason.

2.4 FORMAL DEFINITIONS OF MESSAGES

2.4.1 Encoding/decoding rules

2.4.1.1 A CM-air-ASE shall be capable of encoding CMAircraftMessage APDUs and decoding CMGroundMessage APDUs.

2.4.1.2 A CM-ground-ASE shall be capable of encoding and decoding CMGroundMessage APDUs and decoding CMAircraftMessage APDUs.

2.4.2 CM ASN.1 abstract syntax

The abstract syntax of the CM protocol data units (PDUs) shall comply with the description contained in the ASN.1 module CMMessageSetVersion1 (conforming to ISO/IEC 8824-1), as defined hereinafter. The ASN.1 module CMMessageSetVersion1 is used by both CM version 1 and CM version 2. The change in the ASN.1 for CM version 2 is the addition of PDUs for the CM-server-facility-query and CM-server-facility-update services and security enhancements, along with the supporting new service and security elements.

CMMessageSetVersion1 DEFINITIONS ::=

BEGIN

-- This is an import of the encoding of the subject's public key from Doc 9880, Part IV, for CM Version 2

IMPORTS

atnPKI-explicit FROM ATNObjectIdentifiers { iso(1) identified-organization(3)
icao(27) atn(0) objectIdentifiers(0) } -- Defined in Doc 9880, Part IV

ECPoint FROM ATN-PKI-Explicit atnPKI-explicit -- Defined in Doc 9880, Part IV

; -- end of IMPORTS

 -- CM Message Structure

-- Aircraft-generated messages

CM AircraftMessage ::= CHOICE

```
{
  cmLogonRequest           [0]      CMLogonRequest,
  cmContactResponse        [1]      CMContactResponse,
  cmAbortReason            [2]      CMAbortReason,
  ..., -- the PDU after extensibility is CM Version 2 only
      cmServerFacilityQueryRequest [3]      CMServerFacilityQueryRequest
}
```

-- Ground-generated messages

CM GroundMessage ::= CHOICE

```
{
  cmLogonResponse          [0]      CMLogonResponse,
  cmUpdate                 [1]      CMUpdate,
  cmContactRequest         [2]      CMContactRequest,
  cmForwardRequest         [3]      CMForwardRequest,
  cmAbortReason            [4]      CMAbortReason,
  cmForwardResponse        [5]      CMForwardResponse,
  ..., -- All PDUs after extensibility are CM Version 2 only
      cmServerFacilityQueryResponse [6]      CMServerFacilityQueryResponse,
      cmServerFacilityUpdate        [7]      CMServerFacilityUpdate,
      cmSecureLogonResponse         [8]      CMSecureLogonResponse,
      cmSecureUpdate               [9]      CMSecureUpdate,
      cmEnhancedForwardRequest      [10]     CMEnhancedForwardRequest
}
```

 -- CM Message Components

AircraftFlightIdentification ::= IA5String (SIZE(2..8))

Airport ::= IA5String (SIZE(4))

APAddress ::= CHOICE

```
{
  longTsap                 [0]      LongTsap,
  shortTsap                [1]      ShortTsap
}
```

AEQualifier ::= INTEGER (0..255)

-- ATN AE-Qualifier Numeric Values are described in Doc 9880, Part IV

AEQualifierVersion ::= SEQUENCE

```
{
  aeQualifier              AEQualifier,
  apVersion               VersionNumber
}
```