Airbus Flight Operations

May 2014

Getting to grips with FANS (Future Air Navigation System)

Issue IV

AIRBUS

FOREWORD

The purpose of this brochure is to provide AIRBUS aircraft operators with an overview of the CNS/ATM concept, more specifically on data link communication matters (i.e. FANS operations), and with operational details regarding AIRBUS FANS A/A+, FANS B/B+ and FANS A+B systems. The present brochure is the follow-up of the former brochure entitled "Getting to grips with FANS, issue III – April 2007" and is split into three parts:

Part I - Getting to grips with CNS/ATM
Part II - Getting to grips with FANS A/A+ in oceanic and remote areas
Part III - Getting to grips with FANS B/B+ in high-density continental areas.

This new brochure introduces the A350 equipped with FANS A+B system, the evolutions implemented in FANS A+ and FANS B+ systems since the publication of the former brochure, the AIRBUS FANS system solutions in regards with FANS Mandates.

Part I – Getting to grips with CNS/ATM introduces the CNS/ATM concept, the FANS Mandates and the AIRBUS products (i.e. FANS A/A+ and FANS B/B+, FANS A+B) derived from this concept.

Part II – Getting to grips with FANS A/A+ and Part III – Getting to grips with FANS B/B+ are two separate parts, respectively dedicated to FANS A/A+ systems and FANS B/B+ systems. They are organized exactly in the same way. To ease the reader's understanding, chapter and page numberings are preceded by A (for FANS A/A+) in Part II and B (for FANS B/B+) in Part III.

FANS A+B that is the combination of FANS A+ and FANS B+, is described respectively in part II and part III.

It has to be noticed that the present brochure deals with ATC data link communications. The reader is invited to refer to Getting to grips with data link – April 2004 for details about AOC data link communications.

Recommendations for RNP (Required Navigation Performance) and RVSM (Reduced Vertical Separation Minima) operational approval are given in the brochures "Getting to grips with modern navigation - A flight operations view" and "Getting to grips with RNP (Required Navigation Performance) with AR (Authorization Required). Whenever needed, the reader will be invited to refer to this document.

The contents of this Getting to Grips Brochure are not subject to Airworthiness Authority approval. Therefore, this brochure neither supersedes the requirements mandated by the State in which the operator's aircraft is registered, nor does it supersede the contents of other approved documentation (e.g. AFM, FCOM, MEL, etc). **If any contradiction exists between this brochure and local/national authorities regulations (or other approved documentation), the latter applies.**

Any questions with respect to information contained herein should be directed to:

AIRBUS SAS
Flight Operations Support & Services
Customer Services Directorate
1, Rond Point Maurice Bellonte, BP 33
31707 BLAGNAC Cedex – France

Fax: 33 5 61 93 29 68 or 33 5 61 93 44 65
E-mail: fltops.ops@airbus.com

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ABBREVIATIONS

AAC	Airline Administrative Communications
ACARS	Airline Communications, Addressing, and Reporting System
ACL	ATC Clearance service
ACM	ATC Communication Management service
ACR	Avionics Communication Router
ADF	Automatic Direction Finder
ADIRS	Air Data Inertial Reference System
ADNS	ARINC Data Network Service
ADS	Automatic Dependent Surveillance
ADS-B	Automatic Dependent Surveillance – Broadcast
ADS-C	Automatic Dependent Surveillance – Contract
AEEC	Airlines Electronics Engineering Committee
AES	Aircraft Earth Station
AESS	Aircraft Environment Surveillance System
AFN	ATS Facilities Notification
AFTN	Aeronautical Fixed Telecommunication Network
AIDC	ATC Inter-facility ground/ground Data Communications
AIP	Aeronautical Information Publication
AIR	Airborne Image Recorders
AMC	ATC Microphone Check service
AMI	Airline Modifiable Information
ANSP	Air Navigation Service Provider
AMU	Audio Management Unit
AOC	Airline Operations Communications (or Centre)
ARF	ACARS Router Function
ARINC	Aeronautical Radio INC
ASAP	As Soon As Possible
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSU	Air Traffic Services Unit
BFE	Buyer Furnished Equipment
BITE	Built In Test Equipment
CADS	Centralized Automatic Dependent Surveillance
CBT	Computerized Based Training
CDS	Control and Display System
CDTI	Cockpit Display of Traffic Information

CFDIU	Centralized Fault Display Interface Unit
CM	Context Management application
CMA	Context Management Application
CMC	Central Maintenance Computer
CMS	Centralized Maintenance System
CNS/ATM	Communication Navigation Surveillance/Air Traffic Management
CPDLC	Controller Pilot Data Link Communications
CPIOM	Core Processing Input/Output Module
CSD	Customer Service Director
CSP	Communication Service Provider
CSTDB	CuSTomized Data Base
CTA	Control Area
CVR	Cockpit Voice Recorder
DARP(S)	Dynamic Airborne Route Planning (System)
D-ATIS	Digital Automatic Terminal Information Service
DCDU	Data link Control and Display Unit
DFIS	Digital Flight Information Services
DGPS	Differential GPS
DL	Down Link
DLASD	Data Link Application System Document
DLIC	Data Link Initiation Capability
DM	Downlink Message
EATMS	European Air Traffic Management System
ECAM	Electronic Centralized Aircraft Monitoring
EFIS	Electronic Flight Information System
EIS	Electronic Instrument System
ERSA	En-Route Supplement Australia
EUROCAE	European Organization for Civil Aviation Equipment
EWD	Engine and Warning Display
FANS	Future Air Navigation System
FDR	Flight Data Recorder
FHA	Functional Hazard Analysis
FIR	Flight Information Region
FIS	Flight Information Services
FIT	FANS Interoperability Team
FMS	Flight Management System
FSM	Flight System Message
FWC	Flight Warning Computer
GES	Ground Earth Station
GLS	GPS Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System

HFDL	High Frequency Data Link
HFDR	High Frequency Data Radio
HMI	Human Machine Interface
ICAO	International Civil Aviation Organization
IFALPA	International Federation of Airline Pilot Associations
IMA	Integrated Modular Avionics
IMA	Integrated Modular Avionics
IOM	Input Output Module
ISPACG	Informal South Pacific ATC Coordinating Group
ITP	In Trail Procedure
KCCU	Keyboard and Cursor Control Unit
LACK	Logical ACKnowledgement
LRU	Line Replaceable Unit
LSK	Line Select Key
MAS	Message Assurance
MASPS	Minimum Aviation Systems Performance Standards
MCDU	Multifunction Control and Display Unit
MCT	Media Configuration Table
MDDU	Multi Disk Drive Unit
MFD	Multi Function Display
MMR	Multi Mode Receiver
Mode S	Radar Mode S
NAS	National Airspace System
NDA	Next Data Authority
NOTAM	NOtice To Air Men
NPA	Non Precision Approach
OCA	Oceanic Control Area
OMT	Onboard Maintenance Terminal
OPC	Operational Program Configuration
ORT	Owner Requirements Table
PACOTS	Pacific Organized Track System
PRODB	data service PROvider Data Base
RAIM	Receiver Autonomous Integrity Monitoring
RCP	Required Communications Performance
RCSM	Resident Customer Service Manager
RFC	Request For Change
RGS	Remote Ground Station
RNAV	Area Navigation
RNP	Required Navigation Performance
RPDB	Router Parameter Data Base
RSP	Required Surveillance Performance
RTCA	Requirements and Technical Concepts for Aviation

RVSM	Reduced Vertical Separation Minima
SATCOM	Satellite Communications
SCI	Secure Communication Interface
SDU	Satellite Data Unit
SIL	Service Information Letter
SITA	Société Internationale de Télécommunications Aéronautiques
SOP	Standard Operating Procedures
SOR	System Objectives and Requirements
SPOM	South Pacific Operating Manual
SPP	Soft Pin Program
SSR	Secondary Surveillance Radar
TA	Tailored Arrival
TDM	Track Definition Message
TMA	Terminal Area
TMU	Traffic Management Unit
UL	Up Link
UM	Uplink Message
V/DME	VHF/Distance Measurement Equipment
VCI	Voice Contact Instruction
VDL	VHF Data Link
VDR	VHF Data Radio
WPR	Way Point Reporting

PART I – EXECUTIVE SUMMARY

1. CNS/ATM

CNS/ATM Concept

The **CNS/ATM** concept aims to enhance the **A**ir **T**raffic **M**anagement thanks to better **C**ommunication, more precise **N**avigation, and richer **S**urveillance. Its main objectives are to increase of the airspace capacity and the flight efficiency, to reduce the aviation environmental impact, and to maintain an acceptable safety level despite an air traffic more and more dense.

- **Communication:** The datalink communication with the Controller Pilot Data Link Communications (CPDLC) provides an important change in the ATC communications. The principle of CPDLC is to use written messages between the flight crew and ATC controllers instead of voice communication.

- **Navigation:** Navigation evolved with the introduction of new procedures based on satellite system, making the aircraft procedures independent of the traditional radio Navaids.

- **Surveillance:** New surveillance techniques like Automatic Dependent Surveillance (ADS) enables a more precise tracking of aircraft, more direct routes, and a reduction of flight crew workload (no or less position reporting) in airspace out of radar coverage.

- **Air Traffic Management:** The deployment of new CNS technologies has continuously improved the ATM. Future ATM is taking shape with the arrival of new concepts like Trajectory Based Operations (TBO), Flight and Flow Information for a Collaborative Enviroment (FF-ICE), System Wide Information Management (SWIM) network.

CNS/ATM Implementation

In order to ensure a global interoperability of local and regional ATM implementations with independent planning, ICAO decided to setup a global ATM framework with the agreement of all ATM stakeholders.

- **ICAO Global Framework:** This framework is based on Aviation System Block Upgrades (ASBU). One ASBU is associated with an operational ATM improvement and is identified by its scope of applicability (i.e. airport, En-route, etc), the benefits for the ATM stakeholders in term of safety, efficiency, environment effects, cost, etc.

  Each ASBU consists of a series of modules, organized with a targeted implementation date. Block 0 is the baseline available in 2013. Blocks 1 to 3

identify new ATM features with an implementation date every 5 years (i.e. respectively 2018, 2023 and 2028). The ICAO framework is part of the ICAO Global Air Navigation Plan (GANP).

- **Single European Sky ATM research (SESAR):** SESAR is a programme launched in 2004 to renovate the ATM technologies in order to increase the European airspace capacity, improve the safety and efficiency of the ATM, reduce the flight costs and minimize the environmental impacts (noise and air). It involves all aviation stakeholders (airspace users, airports, air navigation service providers, aircraft and system manufacturers, European institutions like Eurocontrol and the European Commission). The introduction of new ATM features like 4D Trajectory, System Wide Information Management (SWIM), Collaborative Decision Making (CDM) are part of SESAR roadmap.

- **Next Generation Air Transportation System (NextGen):** To enhance the ATM, FAA launched its own programme, Next Generation Air Transportation System (NextGen), with the objectives of the increase airspace capacity, the reduction of flight costs, etc. New operational improvements are expected, including the ADS-B, new datalink applications (starting with Pre-Departure Clearance), the System Wide Information Management (SWIM), the Common Support Service for Weather (CSS –Wx), the Collaborative Air Traffic Management (CATM).

- **Other Programmes:** Other ATM programmes exist in the rest of the world, moving forward in consistency with the ICAO framework like the Collaborative Actions for Renovation of Air Traffic Systems (CARATS) in Japan.

2. ATC DATALINK: STANDARDS, PERFORMANCE, IMPLEMENTATIONS, MANDATES, SYSTEMS

ATC Datalink Standards

- **FANS operations performed over:**
  - ACARS network in oceanic and remote areas are in compliance with **FANS 1/A** standards
  - ATN in high-density continental areas are in compliance with **ATN Baseline 1** standards.

- **FANS 1/A:** For oceanic and remote areas, FANS 1/A standards based on ACARS network and availability of GPS satellites introduced a well-adapted system to ensure the three CNS functions. FANS 1/A standards are highly inspired from ICAO concept with CPDLC and ADS-C based on ACARS network.

- **ATN Baseline 1:** The ATN Baseline 1 (ATN B1) standards meet the ICAO CNS/ATM objectives. The main difference with FANS 1/A standards deals with datalink protocols, whereas ATC applications are almost identical.

- **Accommodation FANS 1/A-ATN:** In order to take benefits from investments made on FANS 1/A aircraft while ATN is deploying in Europe, studies to ensure ATN B1 ground systems can provide datalink services to FANS 1/A aircraft have been conducted. Such adaptations between the supporting ATC datalink standards (i.e. FANS 1/A and ATN Baseline 1 standards) are commonly referred to accommodation.

- **Airlines Electronic Engineering Committee (AEEC) 623:** AEEC 623 standard encompasses three ATS 623 applications: Departure Clearance (DCL), Oceanic Clearance (OCL), D-ATIS (Digital – Automatic Terminal Information Service). These 3 applications are used to receive departure clearance, oceanic clearance and ATIS information in text format through ACARS network.

- **ATN Baseline 2 (SC-214/WG-78):** EUROCAE Working Group 78 (WG78) is a joint working group with RTCA Special Committee 214 (SC214), named Standards for Air Traffic Data Communication Services. Their mission is to standardize the future Air Traffic Services (ATS) supported by datalink communications and used in different environments (continental and oceanic) and in different airspaces (Airport and En-route). These ATS will constitute the ATN Baseline 2 (ATN B2) standards. It is expected that ATN B2 includes ATS like 4D Trajectory, D-TAXI, etc.

ATC Datalink Performance

- Like Required Navigation Performance (RNP) provides performance requirements on navigation, Required Communications Performance (RCP)/Required Surveillance Performance (RSP) concept defines performance

requirements to support communication/surveillance performance based operations. For instance:

- RCP 240 defines a maximum time of 240 seconds for an ATC controller to initiate a transaction and receive the response from the flight crew
- RSP 180 defines a maximum time of 180 seconds to send a position report from the aircraft to the ground.

- When the use of datalink requires some performance on communication/surveillance, ANSPs may prescribe compliance with RCP and RSP specification in their AIPs. For operations with reduced separations (30/30), it may be requested:
  - To respect RCP 240/RSP 180 with normal means of communications (e.g. SATCOM)
  - To respect RCP 400/RSP 400 with alternate means of communications (e.g. HFDL).

ATC Datalink Implementation

- **FANS 1/A:** In the 1990's, implementation of FANS 1/A started initially over the South Pacific. The deployment of FANS 1/A is now almost worldwide thanks to the availability of ACARS network. Extension of FANS 1/A carries on at the time of writing the document.

- **ATN Baseline 1:** Implementation of ATN B1 over Europe is managed by Eurocontrol Link 2000+ programme. This deployment has started from Maastricht and its completion is expected over the European airspace by 2015 pushed by the Eurocontrol Link 2000+ mandate. Deployment of ATN B1 standard over US was initially planned and managed as CPDLC Build 1A programme. Stopped in 2001, FAA decided to switch to the deployment of FANS 1/A standard.

- **Accommodation FANS 1/A aircraft by ATN B1 centers:** Accommodation will depend on ANSP policy. ANSPs might authorize ATC centers with ATN B1 capability to accommodate FANS 1/A aircraft. Thanks to accommodation, these ATC centers will enable the provision of datalink services to FANS 1/A aircraft.

- **ATS 623:**
  - Departure CLearance (DCL) is provided in some airports distributed over the world, located in Europe and Asia.
  - Oceanic Clearance (OCL) is mainly available over the NAT.
  - Digital-Automatic Terminal Information Service (D-ATIS) is available in more than 90% of the busiest airports in the world.

- **Special Operations:** The emergence of new CNS technologies (FANS, RNP etc) enables to fly with a reduction of the minima separations (also known as

30/30 or 50/50 operations), or to apply special procedures like Dynamic Airborne Reroute procedure (DARP), Tailored Arrival (TA), In Trail Procedure (ITP).

- **ATC Datalink Performance:** RCP/RSP capability may be required for specific portions of airspace or routes by the relevant states through their AIP. Some ANSPs (located in North Atlantic and South Pacific) have started to monitor RCP/RSP but at present, there is no airspace that requires RCP/RSP compliance. It is expected that RCP/RSP will be mandatory firstly in the North Atlantic at the beginning of 2015 (i.e. RCP 240/RSP 180 for FANS 1/A operations).

ATC Datalink Mandates

- **FANS 1/A:**
  - **NAT datalink mandate** is implemented according two phases:
    - **Phase 1**: From Feb 7, 2013, for all aircraft operating between FL360 to FL390 (inclusive) on the two best tracks within the NAT Organized Track System (OTS) and crossing 30 degrees west longitude during the OTS validity period
    - **Phase 2**: From Feb 5, 2015, with the extension to specified portions of NAT Minimum Navigation Performance Specifications (MNPS) airspace.
  - **FANS routes over China:** Aircraft that intents to fly Y1, Y2, Y3 or L888 routes must be fitted with FANS 1/A.

- **ATN Baseline 1:** Implementation of ATN Baseline 1 is required over Europe. This mandate is made applicable to Air Navigation Service Providers (ANSPs) and to aircraft operating above FL 285. Here are the keys dates for aircraft operators:
  - **Jan 1, 2011**: After this date all new aircraft operating above FL 285 shall be delivered with a compliant system
  - **Feb 5, 2015**: By this date all aircraft operating above FL 285 shall have been retrofitted with a compliant system.

- **Regulations about ATC Datalink communication recording** have been published. The recorded information could be used for the investigation on flight accidents/incidents.
  - **ICAO** recommends that aircraft record datalink messages from Jan 1, 2016. For Airbus avionics systems, it is applicable to datalink initiation (AFN or CM), CPDLC, ATS 623 and ADS-C messages.
  - **FAA** requires US registered aircraft using datalink, to have onboard datalink recording capabilities from Dec 6, 2010. For Airbus avionics systems, it is applicable to CPDLC and ATS 623 messages.
  - **EASA** requires aircraft having the capability to operate datalink communications and for which the individual certificate of airworthiness

is first issued on or after Apr 8, 2014, to record datalink messages. For Airbus avionics systems, it is applicable datalink initiation (AFN or CM), CPDLC, ATS 623, ADS-C messages.

ATC Datalink systems

Airbus proposes currently the following ATC Datalink systems on its aircraft:

- **FANS A/FANS A+** over ACARS network (FANS 1/A standards) for A320, A330/A340 and A380 aircraft[1]
- **FANS B/FANS B+** over ATN network (ATN Baseline 1 standards) for A320 aircraft
- **FANS A+B** over both ACARS network (FANS 1/A standards) and ATN network (ATN Baseline 1 standards) for A350/A380 aircraft[2].

[1] FANS A is only available on A330/A340 aircraft.
[2] FANS A+B system will be available around 2015 on A380 aircraft.

FANS A+C system will be available in the future to cope with ATN Baseline 2 standards including new features like 4D Trajectory, D-TAXI, etc.

3. FANS COMPONENT DESCRIPTION

FANS Architecture

- **The airborne part:**
  - For A320/A330/A340 aircraft, the **ATSU** that manages all the communications and automatically chooses the best available medium (e.g. VHF, SATCOM and HF, in that order).
  - For A350/A380 aircraft, the **ATC applications** manage the ATC datalink functions, and the **ACR** manages the routing function (e.g. selection of the best available medium).
- **The air/ground datalink**: used to transmit AOC or ATC data to the ground through VDL mode A, VDL mode 2, SATCOM and HFDL.
- **The ground/ground datalink**: to ensure the connection to the ground parts through either satellites Ground Earth Stations (GES), VHF and HF Remote Ground Stations (RGS), air-ground processors (which route and handle the messages).
- **Communication Service Providers (CSPs)** operating with national service providers are currently interconnected to provide a global interoperability of ATS datalink applications.

FANS 1/A applications

- **ATS Facility Notification (AFN)**

Through this application, an ATC knows whether an aircraft is capable of using datalink communications. This exchange of the datalink context is needed prior to the establishment of any CPDLC or ADS-C connection.

- **Controller Pilot Data Link Communications (CPDLC)**

CPDLC is a powerful tool to sustain datalink communications between the flight crew and the ATC controller of the relevant flight region.

It is particularly adapted to such areas where voice communications are difficult (e.g. HF voice over oceans or remote part of the world), and is expected to become very convenient to alleviate congested VHF of some busy TMAs when utilized for routine dialogue (e.g. frequency transfer).

- **Automatic Dependent Surveillance- Contract (ADS-C)**

ADS-Contract is an end-to-end application that uses datalink as CPDLC. ADS-C application is hosted by ATSU (respectively ATC applications) on A320/A330/A340 (respectively A350/A380).

Through the ADS-C application, the aircraft automatically sends aircraft surveillance data to the connected ATC centers (up to 5). This is done automatically and remains transparent to the crew.

Different types of ADS-C "contracts" exist: periodic, on demand and on event.

ADS-Broadcast (ADS-B) is a transponder Mode S application that broadcasts data through the transponder aerial. This is also fully automatic and transparent to the crew. Any station equipped with a Mode S receiver is able to collect broadcasted data.

ATN B1 applications

- **Context Management (CM)**

This application provides the **Data Link Initiation Capability (DLIC)** service that is similar to the FANS 1/A AFN application and remains mandatory prior to any CPDLC connection.

- **Controller Pilot Data Link Communications (CPDLC)**

It is an application similar to the FANS 1/A CPDLC application and is restricted to non-time critical situations.

Three services are provided: the **ATC Clearance (ACL)** to communicate, the **ATC Communication Management (ACM)** service to manage the transfer between centres, and the **ATC Microphone Check (AMC)** to check that the voice frequency is not blocked.

Thanks to the **LACK**, the end user (flight crew or ATC controller) knows when the message is displayed on the recipient's screen. In addition, the introduction of operational timers imposes to answer a message in a timely manner.

Differences between FANS 1/A and ATN

The operational constraints set by the oceanic/remote and high-density airspaces are different. As such, FANS 1/A and ATN environments are differently designed. The main differences are:

- **CPDLC is the primary means of communication in FANS 1/A environments** when the aircraft is equipped with datalink systems. In ATN environment, voice will remain the primary means.

- **Protected Mode** is used only in ATN environments and guarantees that CPDLC message is always delivered to the intended receiver. Thanks to the Protected Mode, the Voice Read-Back (VRB) procedure is no more required.
- **Technical acknowledgement**: acknowledgements in FANS 1/A environments and ATN environments do not have the same meanings.
- **Message latency timer**: if the message is received after the message latency timer expires, the message becomes invalid, the content of the message having lost its relevancy. The message latency timer is based on a value uplinked by ATC (see Max Uplink Delay function) in FANS 1/A whereas it is a value fixed in avionics system in ATN environments.
- **Timers:** in ATN environments, the transmission of a message must be achieved in a limited time. In addition, flight crew and ATC controllers have a limited time to answer a message. Timers are intended to avoid any datalink dialogue remaining open for an undefined period.

4. AIRBUS FANS DESCRIPTION

A320/A330/A340 FANS architecture

- This avionics unit (ATSU) has been developed to cope with datalink communications. Its functions are:
  - To manage the HMI, the display and warning systems.
  - To enable the access to all available communications media.
  - To sustain the communications tasks.
- The FMS is a key element of the Airbus-FANS system for which:
  - It provides data to the ATSU.
  - It monitors the ATC messages and their subsequent implications.
  - It handles and processes some of the ATC messages.

Note: in FANS B/B+, the interface FMS-ATSU is limited. The FMS only provides the ATSU with the flight number, the departure and destination airports, and the aircraft position.

A320/A330/A340 Human Machine Interface

Regardless of the FANS systems (FANS A / FANS A+ or FANS B / FANS B+), the interfaces are the same on A320 and A330/A340 aircraft.

- The main crew interface used for the FANS applications is based on the two DCDUs. All ATC messages, clearances (uplink message), requests or answers (downlink messages) are displayed on the DCDU.
- In addition to the DCDU, the MCDU is mainly used to prepare a request.

A350/A380 FANS architecture

The A380 introduces new technologies. As such, its architecture is different from the ones on A320/A330/A340 aircraft. However, the basic operational principles remain exactly the same. The A350 FANS architecture is inherited from the A380 one.

Functions that were managed entirely by ATSU on A320/A330/A340 aircraft are distributed between ATC applications and ACR on A350/A380 aircraft.

- **ATC applications** ensure the management of the HMI, the display and warnings. It also manages interfaces with peripherals.
- **The Avionics Communication Router (ACR)** supports the routing function (e.g. communication protocols with ground network).

A350/A380 Human Machine Interface

A350/A380 cockpit benefits from a new design where the CDS is the key element. However, A350/A380 FANS interfaces had been designed in order to keep the same operational principles as on A320/A330/A340 aircraft.

- Uplink messages (i.e. clearances or instructions) and downlink messages (i.e. requests or responses) are received on or sent from the **ATC mailbox** located on the central screen C2 CDS on the A380 and on the upper central screen C1 CDS on the A350.
- Downlink messages are prepared from **MFD ATC COM pages** located on L3 and R3 CDS screens on the A380 and on lower central C2 CDS screen on the A350.

1. CNS/ATM

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1.1. CNS/ATM CONCEPT

In 1983, the ICAO council tasked its special committee on Future Air Navigation Systems (FANS) in order to make recommendations for the upgrade of the communications, navigation and surveillance systems. The intention was to cope with the growth of the worldwide air traffic. In 1989, based on their previous work, a second committee was created to manage the implementation of the CNS/ATM (Communication, Navigation, Surveillance / Air Traffic Management) concept. This concept was endorsed by the Tenth ICAO Air Navigation Conference in 1991.

The CNS/ATM concept implies better **C**ommunication in addition to more precise **N**avigation and richer **S**urveillance to support the improvement of the **A**ir **T**raffic **M**anagement. The objectives of the CNS/ATM concept are to:

- Increase airspace capacity
- Enhance operational efficiency
- Improve the safety level for the air traffic.

Numerous actors play a role in this global end-to-end concept, which represents a chain between the flight crew and the ATC controller. Although most of these actors are independent entities (e.g. Air Navigation Service Providers, Communication Service Providers, ATC, Airline Operational Centers, etc). The ability of all of these entities to work together is essential for the correct operation of the global system.

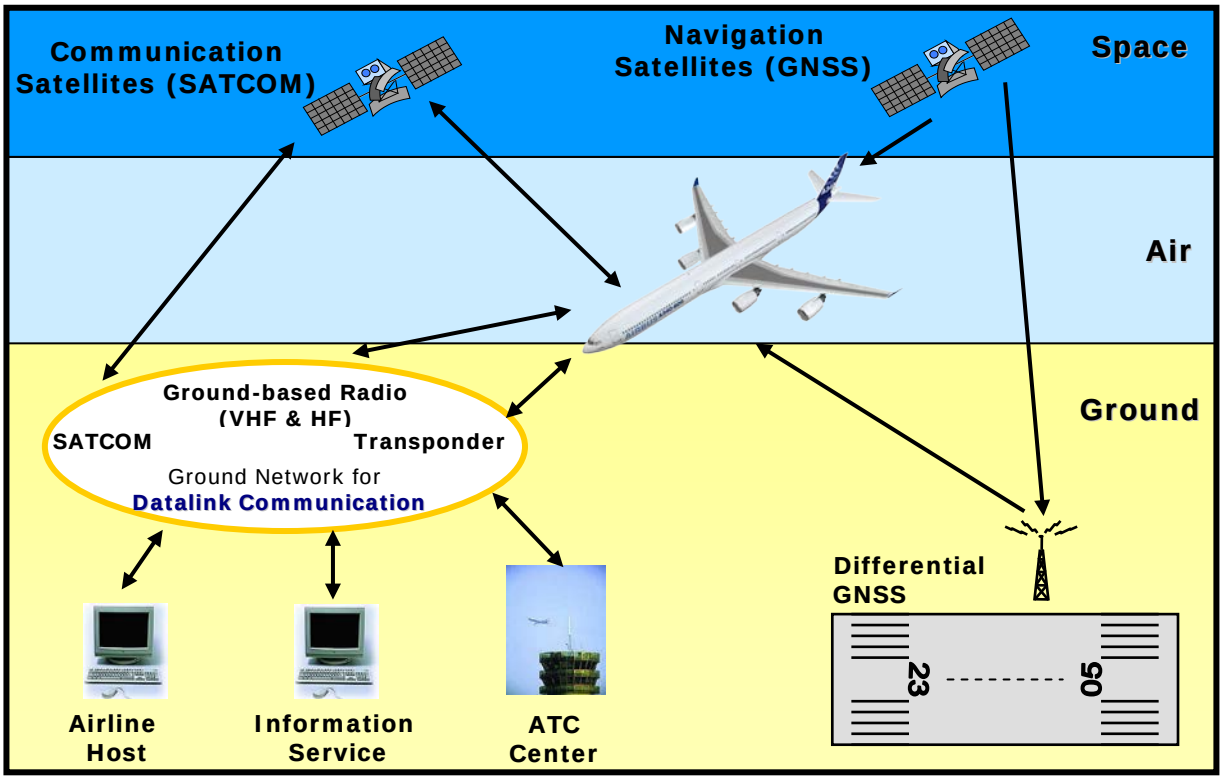

Figure 1-1
CNS/ATM concept

1.1.1. COMMUNICATION

Operationally speaking, FANS provides an important change in the way the flight crew and controllers communicate. In addition to the classical VHF and HF voice, and the more recent satellite voice, Controller Pilot Data Link Communications (CPDLC) increases the set of communication means between the flight crew and ATC controllers. The principle of CPDLC is to use written messages between the flight crew and ATC controllers that rely on datalink communications instead of voice communications.

CPDLC is a powerful tool and the primary means to sustain ATC communications in oceanic and remote areas. At the end of 2006, CPDLC became a supplementary communication means to overcome VHF congestion in some dense continental airspaces (where voice VHF media remains the primary communication means). Onboard systems display CPDLC messages to the flight crew which can also be printed.

Ground-ground communications are also part of the concept. They ensure the link and coordination between different ATC organizations (or services of the same ATC organization) and Airline Operational Centres (AOCs). AFTN, voice or AIDC (ATS Interfacility Data Communications) support these communications.

1.1.2. NAVIGATION

To fully benefit from the CNS/ATM concept, aircraft will need to have a certain level of navigation performance in terms of accuracy, availability, integrity and service continuity. Based on the Global Navigation Satellite System (GNSS), Performance-Based Navigation (PBN) is a concept used to describe technologies that are moving navigation mode from a ground-based navigation system toward onboard system capable of performance navigation. This trend involves the development of satellite-Area Navigation or RNAV procedures that are based on satellite-based navigation aids and no more on conventional radio Navaids. These procedures are more accurate and enable shorter, direct route between two given points used for en-route areas and approach as well.

Refer to the “Getting To Grips With Modern Navigation” and “Getting To Grips With RNP-AR” documents for detailed explanations (See References).

1.1.3. SURVEILLANCE

While traditional surveillance systems like Secondary Surveillance Radar (SSR) continue to be used, Automatic Dependent Surveillance (ADS) is applied for airspace out of radar coverage. ADS provides the ATC with a more precise aircraft position based on GPS data, and consequently enables to improve the traffic situation awareness.

Different types of surveillance exist:

- **In oceanic and remote airspaces** (where it is not possible to install the ground stations): when the controlled surveillance is procedural, the HF voice position reports are progressively being replaced by Automatic Dependent Surveillance-Contract (ADS-C). ADS-C enables the aircraft to automatically

send position and F-PLN intentions to up to five different ATC centers. With the possibilities offered to the ATC controllers to select the rate and mode of reporting (at specified time intervals or on the occurrence of a special event such as a heading or attitude change), ADS-C enables to reduce lateral and longitudinal separation. For more details about ADS-C, refer to Section 3.4.1.3.1 Automatic Dependent Surveillance – Contract (ADS-C)

- **In continental airspaces** (where it is possible to install the ground stations): surveillance relies on classical SSR modes A, C, S, or Automatic Dependent Surveillance-Broadcast (ADS-B) when available. ADS-B enables to transmit surveillance data from aircraft to ATC centers and other aircraft in the vicinity. Refer to Getting to Grips Surveillance for more information (see References).

1.1.4. AIR TRAFFIC MANAGEMENT

Since the beginning of the civil aviation, Air Traffic Management (ATM) is based on the same processes: ATC controllers apply conservative spacing rules to maintain a safe separation between aircraft. Due to the increasing air traffic, the fixed airspace capacity, and the environmental stakes, the current ATM organization faces challenging constraints to support airspace users operations with traditional processes. The progressive deployment of new CNS technologies helps the ATM to:

- Improve the safety with constantly increasing air traffic
- Reduce the environmental effects of air traffic
- Increase airspace capacity.

ATM will significantly change to ensure efficient and safe operations. The new ATM pattern will rely on the following pillars:

- Extensive deployment of Performance Based Navigation (PBN) procedures to optimize airport approaches profiles (Advanced RNP), the route predictability and the aircraft separation
- Trajectory Based Operations (TBO) with the free routing operations that enables to fly a route without waypoints defined by traditional navaids
- 4D Trajectory including the time constraint of the flight routes that improves the air traffic situation awareness and optimizes the airspace use
- Flight and Flow Information for a Collaborative Environment (FF-ICE) that provides a distributed flight information between airspace users and ground in order to take appropriate decision for aircraft trajectories
- System Wide Information Management (SWIM) that creates a link between all the ATM stakeholders (airspaces users, ATC controllers, airports, etc) for the distribution of meteorological and flight information.

1.2. CNS/ATM IMPLEMENTATION

Since the 1990's, the improvement of ATM over the world has been a permanent evolution thanks to the contribution of CNS advanced technologies like:

- The datalink communications between the flight crew and ATC controllers (CPDLC) that have replaced or completed the traditional voice communications
- The introduction of area navigation (RNAV) capabilities along with the global navigation satellite system (GNSS) that are now used for en-route navigation and for non-precision approaches

- The Automatic Dependent Surveillance- Contract (ADS-C), via satellite or other datalink communication, that has progressively replaced the HF voice position report to ATC, and the Automatic Dependent Surveillance- Broadcast (ADS-B) that bring more benefits than traditional surveillance based on Secondary Surveillance Radar (SSR).

Nevertheless, deployment of local and regional CNS/ATM evolutions without real worldwide harmonization may probably lead to interoperability issues. To ensure a global CNS/ATM harmonization, ICAO with the agreement of ATM stakeholders decided to setup a global framework.

1.2.1. ICAO GLOBAL FRAMEWORK

In 2008, ICAO initiated discussions with all ATM stakeholders about the possibility of a global CNS/ATM framework. In the same way, ICAO established agreements with CNS/ATM standardization organizations (e.g. EUROCAE, RTCA, ARINC, etc) for the planning of future publications of CNS/ATM Standards.
In 2011, during the Global Air Navigation Industry Symposium (GANIS), ICAO proposed a future way of working in order to ensure the interoperability and independence of the ATM solutions deployed worldwide. This way of working is based on a framework named Aviation System Block Upgrades (ASBU). An ASBU corresponds to an operational ATM improvement and is identified by the scope of applicability (i.e. airport, En-route, etc) and the benefits for the ATM stakeholders in term of safety, efficiency, environment effects, cost, etc.

Each ASBU consists of a series of modules organized into the following performance improvement areas:

- Airport operations
- Global interoperable systems and data
- Optimum capacity and flexible flights
- Efficient flight path.

An example of ASBU module is “Improved Safety and Efficiency through the Initial Application of Data Link En-route” (Reference B0-TBO) that corresponds to the implementation of an initial set of data link applications (e.g. CPDLC) for surveillance and communications in ATC.

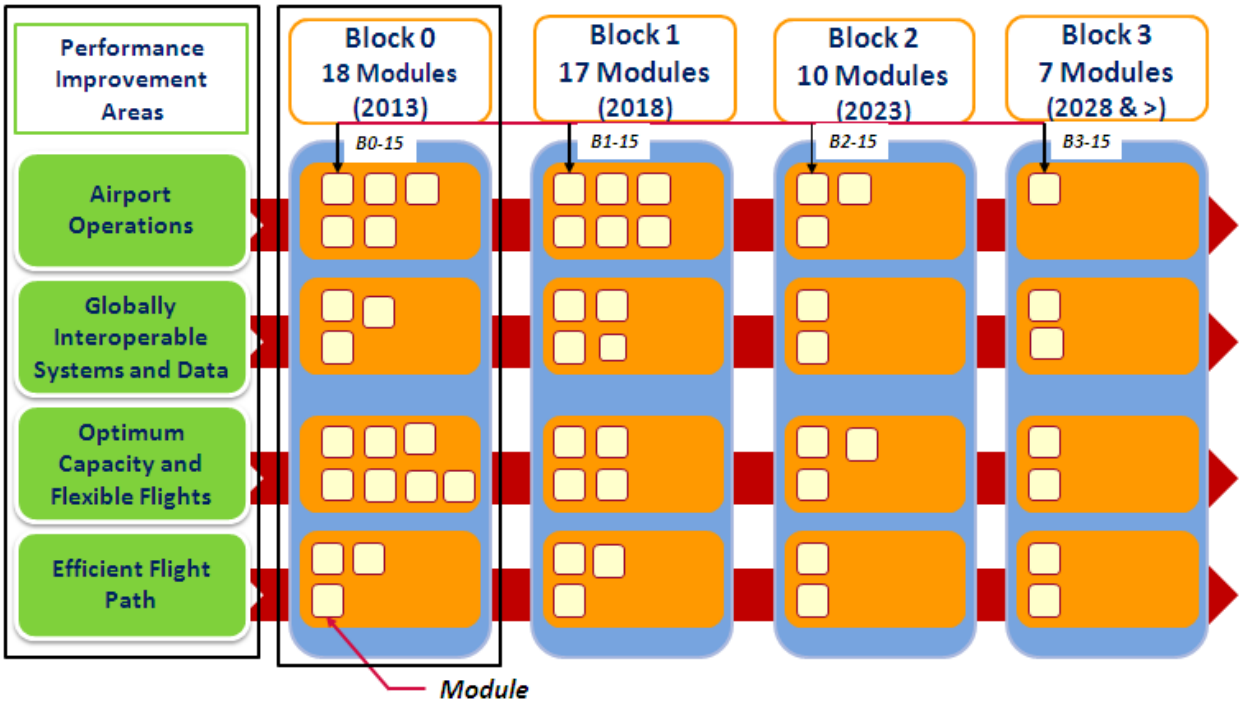

Figure 1-2
ASBU organization (Source ICAO)

The diagram above illustrates the organization of ASBU modules and their targeted implementation date (i.e. date when the operations are expected to start). Each block collects all the modules over all the performance improvement areas with the same implementation date. The block 0 is the baseline, with an implementation date in 2013. Indeed, the block 0 includes ATM capabilities already in use in many countries. The blocks 1 to 3 identify new ATM features with an implementation date every 5 years (i.e. respectively 2018, 2023 and 2028).

The ICAO framework based on ASBU is part of the ICAO Global Air Navigation Plan (GANP). ATM programmes around the world may use this framework as a ATM guidance. The ICAO GANP (2014–2016 Triennium Edition) describes the planning to ensure an harmonized ATM development over the world.

In November 2012, during the 12th Air Navigation Conference, ICAO presented the global framework with a description of the different blocks and its corresponding modules. The objective was to obtain an agreement from all ATM stakeholders (e.g. states, standardization organizations, aircraft manufacturers, etc) on:

- The need for a global framework for all ATM developments over the world
- The creation of working groups for the management of ASBU
- The content of ASBU blocks 0 and 1.

Not all airspaces require all ASBU modules. No mandate exists about the ASBU deployment plan. The module implementation timeframe depends on the specific operational environment of each country or region. ICAO Planning and Implementation Regional Group (PIRG) will support the country or region of the world in their ASBU module deployment. PIRG will ensure that all required

supporting procedures, regulatory approvals and training are set-up before starting ATM operations.

Regional and national programmes for ATM modernization (i.e. SESAR in Europe, NextGen in US, CARATS in Japan, etc) are in progress over the world. A connection exists between the planning of SESAR, NextGen, CARATS and the ICAO global framework.

For more details, please refer to ICAO website at: http://www.icao.int/.

1.2.2. SINGLE EUROPEAN SKY ATM RESEARCH (SESAR)

SESAR is a programme launched by the European commission in 2004 to renovate the architecture of the ATM. SESAR objectives are:

- To increase the European airspace capacity
- To improve the safety and efficiency of the ATM
- To reduce the costs per flight
- To minimize the environmental impacts (noise and air).

This major step in the ATM evolution will require a defragmentation of the European airspace and the development of innovative technologies such as:

- System Wide Information Management (SWIM): the intranet of the future Air Traffic Management System connecting all the ATM stakeholders for a better sharing of the ATM information (e.g. NOTAMs, AIS, airport database, flight information, etc)
- Collaborative Decision Making (CDM): based on information collected through SWIM, an improvement of the CDM process to take collective decision for trajectory changes
- 4D Trajectory based on a 4D (three spatial and time) accurate trajectory to optimize the airspace use and the traffic situation awareness
- Conflict Management and Automation with the introduction of new ATM tools that detect potential conflicts and propose resolution measures
- New Airborne Separation Modes with ASAS (Airborne Separation Assurance System) in which avionics systems will provide functions to maintain separations or spacing with other aircraft
- Network Collaborative Management and Dynamic/Capacity Balancing enabling a dynamic and flexible organization of the airspace sectors
- Airport Integration: the full integration of airport operations inside the ATM process with the gate-to-gate concept.

Deployment of the new ATM features is aligned with ICAO Global Air Navigation Plan (GANP) and follows an incremental approach based on three steps:

- Step 1 “Time-based Operations” focused on a controlled time of arrival, more use of datalink and the deployment of an initial trajectory based operations
- Step 2 “Trajectory-based Operations” enables the optimization of flight trajectory based on a better sharing of 4D trajectory information between air and ground relying on SWIM and new datalink technologies
- Step 3 “Performance-based Operations” is the last step of the implementation of a high-performance, integrated and collaborative ATM system.

For more information about SESAR operational changes and deployment plan, refer to European ATM Master Plan, at https://www.atmmasterplan.eu/.

All details about SESAR are available at: http://www.sesarju.eu/.

1.2.3. NEXT GENERATION AIR TRANSPORTATION SYSTEM (NEXTGEN)

In 2003, Federal Aviation Administration (FAA) launched its own programme to modernize the ATM processes over US airspace, taking into account the continuing increase of the traffic. This programme is called Next Generation Air Transportation System (NextGen) and its goals are the increase airspace capacity, the reduction of flight costs, etc. NextGen relies on the following operational improvements:

- Implementation of ADS-B for a better Traffic surveillance and situation awareness
- New Data Communications with the development of Pre-Departure Clearance (PDC), CPDLC messages. In the future, NextGen will go to more advanced operations such as D-TAXI, 4D Trajectory.
- System Wide Information Management (SWIM) to provide from a single source the most current ATM information (e.g. NOTAMs, Weather data, etc)
- Common Support Service for Weather (CSS–Wx) to implement a common database for the aviation weather information for all concerned users
- Collaborative Air Traffic Management (CATM) to ease the ATC controllers decisions in order to improve the flight trajectory and optimize the airspace use.

NextGen implementation plan is consistent with ICAO Global Air Navigation Plan (GANP) and is available at http://www.faa.gov/nextgen/implementation/.

All details about NextGen are available at: http://www.faa.gov/nextgen/.

1.2.4. OTHER PROGRAMMES

Other ATM programmes exist in the rest of the world, moving forward in consistency with the ICAO framework guidance and the ASBU approach (Refer to Section 1.2.1 ICAO Global Framework). For instance, evolutions of ATM in Japan are managed by the Collaborative Actions for Renovation of Air Traffic Systems (CARATS).

2. ATC DATALINK: STANDARDS, PERFORMANCE, IMPLEMENTATIONS, MANDATES, SYSTEMS

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2.1. ATC DATALINK STANDARDS

The standards for the first implementation of the ICAO CNS/ATM concept were known historically as ICAO CNS/ATM Package 1. The first step is known as ATN Baseline 1 for ATC communication. The implementation of the ICAO CNS/ATM concept affects the Air Traffic Control procedures almost worldwide by improving voice communications, generalizing data communications, satellite-based navigation and enhancing the aircraft surveillance.

Historically, ATC datalink has been operational in oceanic and remote areas first with FANS 1/A[1] standards through the existing ACARS network to cope with poor reliability of HF communications and with shortage of radar coverage. Then, the saturation of high-density airspaces led to the implementation of ATN B1 standards in these airspaces to increase their capacity.

Therefore, FANS operations performed over:

- ACARS network in oceanic and remote areas are in compliance with FANS 1/A standards
- ATN in high-density continental areas are in compliance with ATN Baseline 1 standards.

2.1.1. FANS 1/A

For oceanic and remote areas, a dedicated technology has been developed to ensure communication, navigation and surveillance according to ICAO CNS/ATM concept. Indeed, the characteristics of these regions do not allow:

- VHF and Radar antennas to cover air-controlled areas entirely
- Legacy navigation system (Inertial Reference System or IRS) to ensure precise navigation.

Therefore, the emergence of FANS 1/A standards based on ACARS network and availability of GPS satellites introduced a well-adapted system to ensure the three CNS functions. FANS 1/A standards rely on ICAO concept but do not comply with the entire ICAO specifications. Indeed, FANS 1/A standards specifications define CPDLC and ADS-C based on ACARS network which is different from ICAO specifications where CPDLC and ADS-C are based on the Aeronautical Telecommunications Network (ATN).

The benefits of FANS 1/A operations are:

- An increase of the airspace capacity thanks to the reduction of separation between airplanes
- A more reliable and effective datalink communication than HF voice
- A reduction of operating flight costs
- An higher flight safety level.

[1] FANS 1 was developed by Boeing, and FANS A by AIRBUS. The two systems have been harmonized under FANS 1/A standards.

Note that voice communications remain a backup to FANS 1/A operations in ACARS oceanic/remote environments where datalink communications have proven to be of a good reliability.

2.1.2. ATN BASELINE 1

The ATN Baseline 1 (ATN B1) standards have been developed in regard to the objectives set by the ICAO CNS/ATM package 1. ATN B1 standards rely on ATN datalink and are compliant with ICAO specifications. The main difference with FANS 1/A standards deals with datalink protocols, i.e. ACARS for FANS 1/A standards and ATN for ATN B1 standards. ATC applications are almost identical.

The benefits of ATN B1 operations are:

- A significant alleviation of congested voice channels
- A reduction of radio communication workload
- An increase of the airspace capacity
- A reduction of ATM delays
- A reduction of operating flight costs
- A higher flight safety level.

It should be noted that CPDLC in ATN high-density continental airspaces is intended as a supplementary means of communication to the use of voice communications. The decision to select either voice or CPDLC will be made by the ATC controller and/or the flight crew knowing that CPDLC are limited to non-time critical communications.

2.1.3. ACCOMMODATION FANS 1/A-ATN

In order to take benefits from investments made on FANS 1/A aircraft while ATN is deploying in Europe, studies to ensure ATN B1 ground systems can provide datalink services to FANS 1/A aircraft have been conducted. Such adaptations between the supporting ATC datalink standards (i.e. FANS 1/A and ATN Baseline 1 standards) are commonly referred to accommodation.
Due to the combination of ATC centers and aircraft capabilities, several cases may be considered:

		Aircraft datalink capabilities			
		FANS 1/A	**ATN B1**	**FANS 1/A-ATN B1***	
ATC center datalink Capabilities	**FANS 1/A**	FANS 1/A	Not supported**	FANS 1/A	**Datalink Operations**
	ATN B1	FANS 1/A (accommodation) Or Not supported	ATN B1	ATN B1	

*Aircraft compliant with both FANS 1/A and ATN B1 is also known as bilingual aircraft. Bilingual aircraft are not subject to accommodation as the type of CPDLC connection (i.e. FANS 1/A or ATN B1) is established according to the ATC center capability (i.e. FANS 1/A or ATN B1) they fly accross. The seamless CPDLC transfer of bilingual aircraft from FANS 1/A to ATN environment and vice versa is ensured thanks to the implementation of FANS 1/A-ATN interoperability standards.

**Operationally speaking, this case should be very rare as aircraft equipped with ATN B1 are designed to fly in continental areas where ATC centers have not FANS 1/A capability. If the case occurs, voice will be used for communications between flight crew and ATC controllers.

2.1.4. AEEC 623

The Airlines Electronic Engineering Committee (AEEC) 623 standard defines the application protocol for character-oriented Air Traffic Services messages that can be transmitted over the ACARS network and that are not part of FANS 1/A and ATN B1 standards.

AEEC 623 concerns the following ATS 623 applications:

- Departure Clearance (DCL): to provide automated assistance for requesting and delivering departure information and clearances
- Oceanic Clearance (OCL): to provide automated assistance for requesting and delivering an oceanic clearance prior to the oceanic airspace entry
- Digital – Automatic Terminal Information Service (D-ATIS): to provide assistance to obtain information on active terminal conditions, such as runway, approach procedure, meteorological parameters (wind, visibility, weather, clouds, runway surface conditions, etc).

Thanks to the ATS 623 applications, departure clearances, oceanic clearances and ATIS report, that are usually received via voice channel, are transmitted in a text format via ACARS. ATS 623 applications improve the equivalent services provided by the customized AOC applications as the messages no more go through the airline but directly from the ATC to the aircraft.

The operational benefits of ATS 623 applications are:

- A more reliable and effective communication by datalink than voice
- An optimization of the flight crew workload: the flight crew member reads DCL/OCL/D-ATIS message received at his convenience instead of waiting information on the voice frequency.

Note: The AEEC 623 definition of DCL, D-ATIS and OCL applications has been superseded by EUROCAE ED85A, ED89A and ED106 respectively.

2.1.5. ATN BASELINE 2 (SC-214/WG-78)

EUROCAE Working Group 78 (WG-78) is a joint working group with RTCA Special Committee 214 (SC-214), named Standards for Air Traffic Data Communication Services. Created in 2008, its role is to standardize and harmonize the future Air

Traffic Services (ATS) supported by data communications. The definition of the future ATS, based on current experience on FANS 1/A and ATN B1 operations constitutes the ATN Baseline 2 standards. WG-78/SC-214 group expects to release the ATN Baseline 2 standards in 2014.

The missions of the WG-78/SC-214 group are to:

- Establish the safety, performance and interoperability requirements for Advanced ATS supported by data communications
- Ensure that ATS are independent, as far as possible, from the technology
- Ensure that ATS are consistent with the operational improvements addressed by the Next Generation Air Transportation System (NextGen) and the Single European Sky ATM Research (SESAR) programme
- Support the implementation of aircraft systems that will operate in both continental and oceanic environments, for all types of airspaces (i.e. Airport, En-route etc).

Operationally speaking, the benefits of FANS operations based on ATN Baseline 2 are to increase the sector-based traffic capacity and to optimize the flight routing.

The ATS addressed by SC-214/WG-78 are the following ones (the list above is not exhaustive):

- Data Link Initiation Capability (DLIC): to initiate the data link communications between an aircraft and an ATC Center
- ATC Communication Management (ACM): to provide automated assistance to flight crew and ATC controllers for ATC communications transfer
- ATC CLearance (ACL): to exchange ATC Datalink instructions and clearances to allow flight crew and ATC controllers to use CPDLC messages
- ATC Microphone Check (AMC): to uplink an instruction to an aircraft to ask the flight crew to check that the aircraft is not blocking a given voice frequency/channel
- Clearance Request and Delivery (CRD): to support clearance request, delivery, response with the ATC
- Departure Clearance (DCL): to support departure clearance request, delivery and response
- Oceanic Clearance (OCL): to support oceanic clearance request, delivery and response
- Data Link Taxi (D-TAXI): to provide pre-departure and pre-arrival information related to the expected taxi route
- Information Exchange and Reporting (IER): to provide capability to report confirmation from flight crew to ATC controller or vice-versa
- Position Report (PR): to provide the ATC controller with the capability to obtain the aircraft position information from the aircraft
- In Trail Procedure (ITP): to enable flight crew to request flight level change based on ADS-B information.

For more details about ATS defined in ATN B2, please refer to FAA website at: http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/sc214/.

2.2. ATC DATALINK PERFORMANCE

The performance associated to the three "C", "N" and "S" aspects are identified under the three concepts:

- Required Communications Performance (RCP)
- Required Navigation Performance (RNP)
- Required Surveillance Performance (RSP).

Performance-Based Communication and Surveillance (PBCS) is a concept that requires the compliance of communication and surveillance capabilities by prescription of RCP/RSP. RCP/RSP define a set of performance requirements for the communication and surveillance.

Historically, FAA initially pushed the introduction of RCP/RSP concept that led to a preliminary definition in the ICAO Doc 9869 (Manual on Required Communication Performance (RCP)). ICAO Doc 9869 recommends the prescription of RCP/RSP, when a safety related change (e.g. application of a reduced separation minimum) is predicated on communication performance. Based on this initial work, RCP/RSP concept has been described in GOLD and will be moved in PBCS Manual (ICAO Doc 9869).

As part of the ATC Datalink performance, the communication performance requirements (including RCP) and surveillance performance requirements (including RSP) are described in the following chapters. For the description of RNP, refer to “Getting to Grips with RNP-AR” (see References).

2.2.1. COMMUNICATION PERFORMANCE REQUIREMENTS

Communications performance requirements are based on the following criteria:

- **RCP Expiration Time (ET):** The maximum time for the completion of the operational communication transaction after which the initiator is required to revert to an alternative procedure
- **RCP Nominal Time (TT 95%):** The maximum nominal time within which 95% of operational communication transactions is required to be completed
- **RCP Integrity:** The required probability that an operational communication transaction is completed with no undetected errors
- **RCP Availability:** The required probability that an operational communication transaction can be initiated when needed
- **RCP Continuity:** The required probability that an operational communication transaction can be completed within the communication transaction time, either ET or TT 95%, given that the service was available at the start of the transaction.

For more details about RCP, refer to GOLD – Appendix B (see References).

An operational communication transaction is an ATC instruction, clearance, flight information exchanged between the ATC controller and the flight crew. The following descriptions only deal with the time allocated for operational communication transaction.
Three levels of communication performance are defined depending on the type of operations:

	Communication Performance Levels		
	Initial Continental Performance	**RCP 240**	**RCP 400**
RCP Expiration Time (ET)	150	240	400
RCP Nominal Time (TT 95%)	80	210	350

Note 1: times are expressed in seconds.
Note 2: While RCP 240 and RCP 400 are defined for oceanic airspace, there is no RCP for datalink services in continental airspace. Communication performance required for continental airspace is defined by the term "Initial Continental Performance" (compliance to ED122/DO290).

As mentioned above, RCP 240 specifies a maximum time of 240 seconds (4 minutes) for a ATC controller to initiate a transaction with an aircraft and receive the response from the flight crew, i.e. 4 minutes for the ATC controller to solve any potential conflict by ATC communications. RCP is not linked to any specific technology of datalink communications.
The figure and tables below illustrate the time allocations on the different elements and actors involved in the transaction.

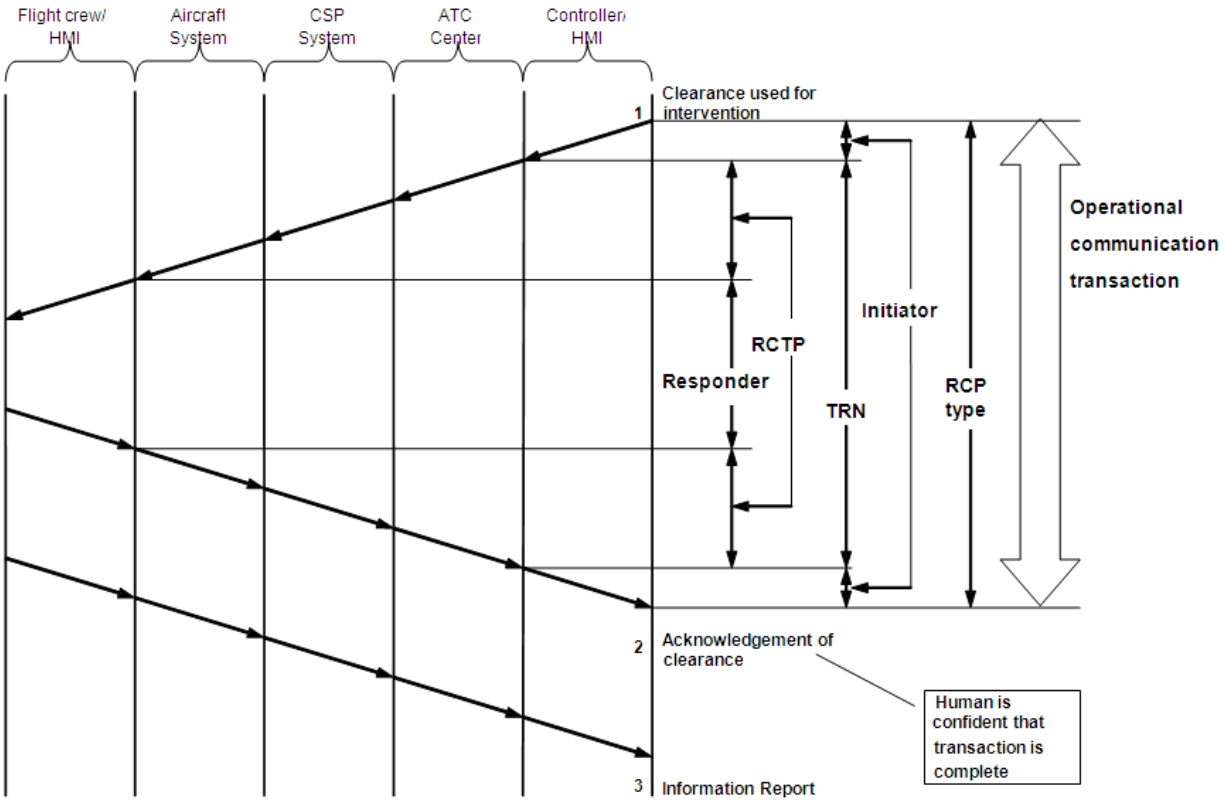

Figure 2-1
Time allocation for operational communication transaction

	Communication Performance Levels		
	Initial Continental Performance	**RCP 240**	**RCP 400**
Operational communication transaction	150	240	400
Initiator (ATC controller request preparation)	30	30	30
TRN (Communication Transaction Time)	120	210	370
RCTP (Transit Time Ground to Air And Air to Ground)	20	150	310
Responder (Flight Crew Response)	100	60	60

Note: times are expressed in seconds.

2.2.2. SURVEILLANCE PERFORMANCE REQUIREMENTS

Surveillance performance requirements are based on the following criteria:

- **RSP Overdue Delivery Time (OT):** The maximum time for the successful delivery of surveillance data after which the initiator is required to revert to an alternative procedure.
- **RSP Nominal Delivery Time (DT 95%):** The maximum nominal time within which 95% of surveillance data is required to be successfully delivered.
- **RSP Integrity:** The required probability that the surveillance data is delivered with no undetected error.
- **RSP Availability:** The required probability that surveillance data can be provided when needed.
- **RSP Continuity:** The required probability that surveillance data can be delivered within the surveillance delivery time parameter, either OT or DT 95%, given that the service was available at the start of delivery.

For more details about RSP, refer to GOLD – Appendix C (see References).

Surveillance Data are CPDLC position reports and/or ADS-C reports. They enable the identification of aircraft and/or the monitoring of the flight route. The following descriptions only deal with the time allocated for surveillance data delivery.
Two levels of surveillance performance are defined depending on the type of operations:

	Surveillance Performance Levels	
	RSP 180	**RSP 400**
RSP Overdue Delivery Time (OT)	180	400
RSP Nominal Delivery Time (DT)	90	300

Note: times are expressed in seconds.

As mentioned above, RSP 180 specifies a maximum time of 180 seconds (3 minutes) for the aircraft to send position report to the ground, i.e. 3 minutes to send an ADS-C report or CPDLC position report to the ground. RSP is not linked to any specific technology of datalink communications.

The figure and tables below illustrate the time allocations on the different elements involved in the surveillance data delivery.

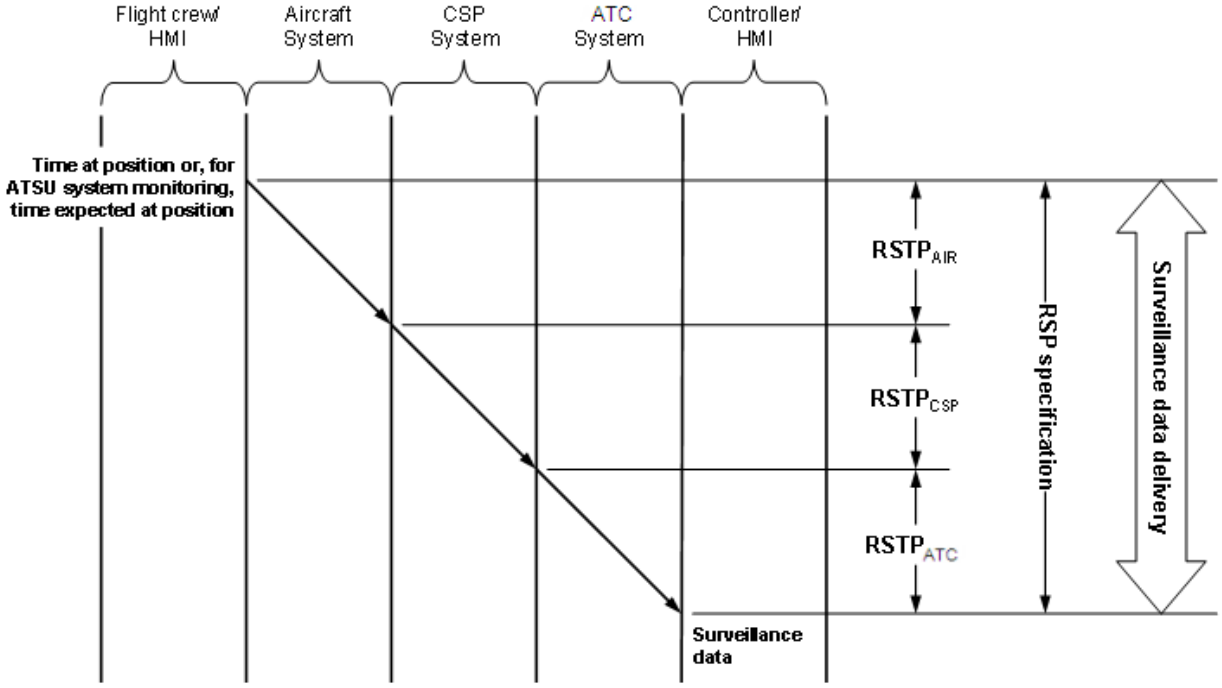

Figure 2-2
Time allocation for surveillance data delivery

	Surveillance Performance Levels	
	RSP 180	**RSP 400**
Surveillance data delivery	180	400
RSPT$_{AIR}$ (time allocated to aircraft system)	5	30
RSPT$_{CSP}$ (time allocated to Communication Service Provider system)	170	340
RSPT$_{ATSU}$ (time allocated to ground system)	5	30

Note: times are expressed in seconds.

2.2.3. APPLICATION OF COMMUNICATION AND SURVEILLANCE PERFORMANCE

When the use of datalink requires some performance on communication/surveillance, ANSPs through their AIPs may prescribe compliance to communication/surveillance performance levels. The table below provides the links between the type of ATC

datalink operations and the corresponding communication/surveillance performance levels.

ATC Datalink Operations	Communication Performance Level	Surveillance Performance Level
ATN B1	Initial Continental Performance	N/A
FANS 1/A • With normal means of communications (e.g. SATCOM), and • With following reduced separation minima: o 30 NM lateral o 30 NM or 50 NM longitudinal.	RCP 240	RSP 180
FANS 1/A • With alternate means of communications other than HF voice (e.g. HF Data Link), and • With following reduced separation minima: o 30 NM lateral o 30 NM or 50 NM longitudinal.	RCP 400	RSP 400
FANS 1/A • With following separations: o Lateral greater or equal than 50 NM o Time-based longitudinal.	RCP 400	RSP 400

2.3. ATC DATALINK IMPLEMENTATION

In the 1990's, under commercial and financial pressures airlines rapidly acknowledged benefits from CNS/ATM concept and requested for an operational system without waiting for all the required components of the concept (i.e. new ATN network). Consequently, based on the existing ACARS network, aircraft manufacturers proposed first FANS capable aircraft in mid 1990's and FANS operations based on FANS 1/A standards have started at that time. Although ACARS offers less performance than the ATN, ACARS was endorsed by the ICAO as a valuable step towards an early introduction of ATC Datalink in Air Traffic Management.

In the mid 2000's, ATN B1 has been implemented and successfully operated in Maastricht ATC center (The Netherlands since April 2004) and the aircraft manufacturers deliver first avionics systems compliant with ATN B1.

The following figure identifies the airspaces where datalink is operated for ATC purposes:

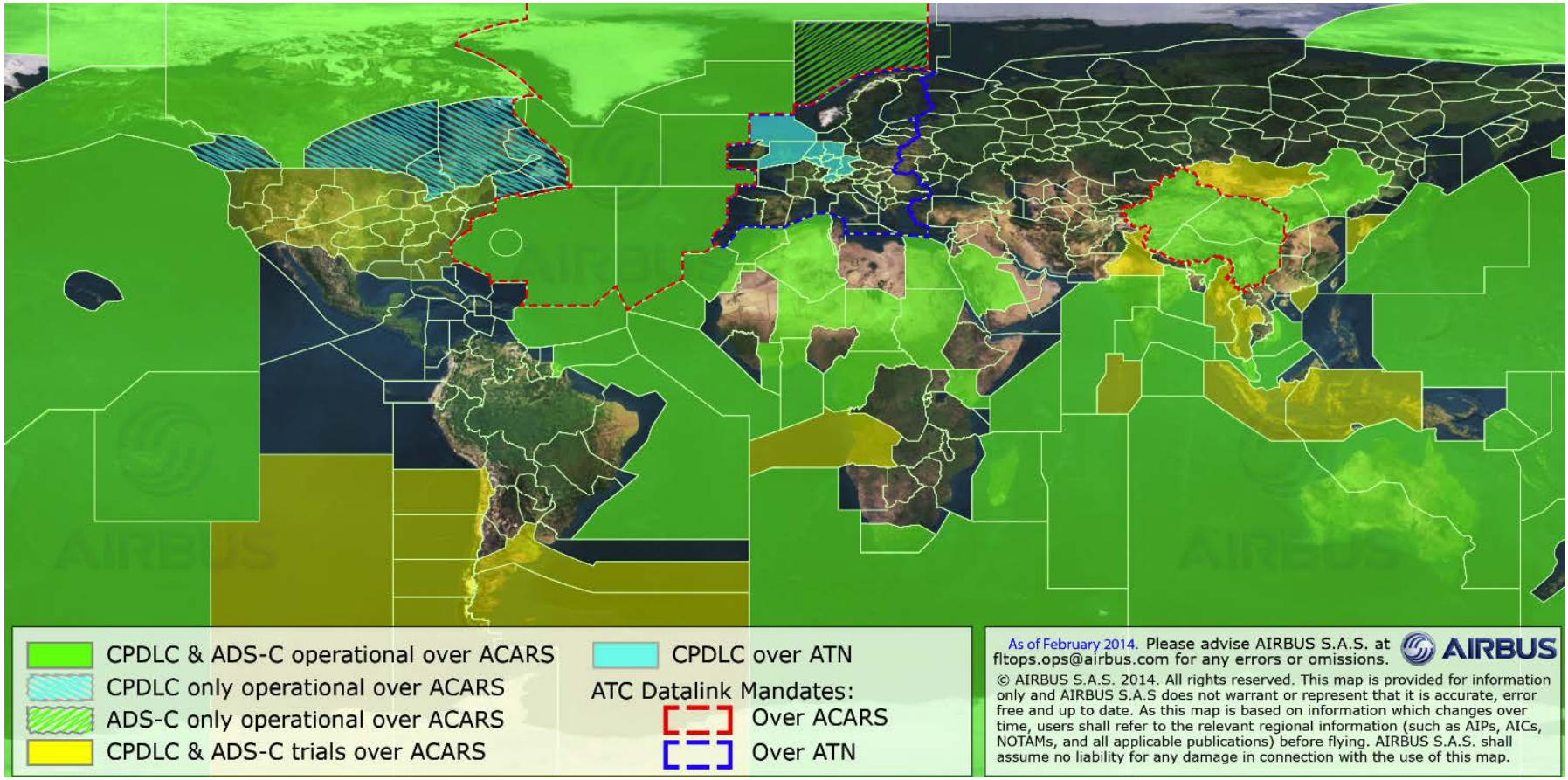

Figure 2-3
Airspaces equipped with FANS in the world as of February 2014

SITA proposes periodically an update of the list of ATS Datalink provided over the world through its website at: http://www.sita.aero/product/ats-aircom-systems-and-services. The list is available under “ATS Datalink description and location” link.

2.3.1. FANS 1/A

In the 1990’s, implementation of FANS 1/A started initially over the South Pacific. FANS 1/A services (CPDLC and ADS-C) had been made operational almost worldwide thanks to the availability of ACARS network. At the time of writing the document, the implementation of FANS 1/A services over the world carries on, for example, over the US airspace under the authority of the NextGen Data Communications Programme.

2.3.1.1. NEXTGEN DATA COMMUNICATIONS PROGRAMME

With the collaboration of the aviation industry, FAA is moving forward with NextGen Data Communications Programme (part of NextGen) to deal with the new communication evolutions. Data Communication Implementation Team (DCIT) is the team in charge of following the deployment of datalink over the US airspace. DCIT is composed of the following entities:

- Airframe and avionics manufacturers
- FAA
- US airspace users
- Industry and business groups.

NextGen Data Communications Programme faces a main challenge with the transition from the current voice communications to datalink communications between flight crew and ATC controllers. The scope of datalink operations is currently focused on FANS 1/A standards, the implementation of ATN operations being stopped (refer to Section 2.3.2.2 FAA CPDLC Build 1A programme).

The deployment of FANS 1/A is phased in 2 segments:

- **Segment 1**: Terminal and en-route services will be deployed in two separate timeframes.
  - **Terminal services**: Starting in 2012, the Departure Clearance service has been deployed using FANS 1/A standards. It constitutes a trial phase at several airports with some operators. The result of the trial phase is planned in 2015 with the demonstration of the operational capability of the datalink. Continued operational deployment involving 70 ATC towers will be phased between 2015 and 2017.
  - **En-route services**: A trial phase for FANS 1/A services is planned in 2014, involving at least one area control center and several internal sectors and covering the range of operations for en-route air traffic operations.
- **Segment 2**: An increasing level of ATC services will be trialed, going toward more advanced operations such as D-TAXI, 4D Trajectory for Datalink. The operational deployment is scheduled around 2020.

In a long-term perspective, the NextGen Data Communications Programme expects the full implementation of ATN B2 services (for the description of ATN B2 services, refer to Section 2.1.5 ATN Baseline 2 (SC-214/WG-78).

For details about FAA Data Communications Programme, refer to FAA website at: http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/datacomm/.

2.3.2. ATN BASELINE 1

At present, the deployment of ATN B1, intended for high density continental areas, is only planned in European airspace under the authority of Eurocontrol Link 2000+ programme.

2.3.2.1. EUROCONTROL LINK 2000+ PROGRAMME

The objectives of the Eurocontrol Link 2000+ programme are to plan and co-ordinate the implementation of ATN B1 standards for Air Traffic Management over European airspace. The deployment has started from Maastricht and its completion is expected over the European airspace by 2015.

For a harmonized entry into services of both ATC centers and aircraft, a progressive roadmap split into three phases has been drawn.

- **Pioneer phase:** The objective was to start ATN Baseline 1 operations with 150 aircraft over Maastricht ATC Center (The Netherlands). Almost 340 aircraft participated in this phase, thanks to the financial participation of Eurocontrol Link 2000+ programme which helped in fitting those aircraft.
- **Incentive phase:** The objective was to speed up the fitting of aircraft to ATN Baseline 1 operations as ground deployment continued. Some incentives were offered to the participating airlines. Since the beginning of 2007, first airlines have started to fly over Maastricht with ATN. This phase concluded in March 2010.
- **Mandatory phase:** Carriage of ATN Baseline 1 capable systems is mandatory from this phase (refer to Section 2.4.2.1 Eurocontrol Link 2000+ Mandate). The objective is to get 75% of the traffic capable of ATN Baseline 1 operations. ATN Baseline 1 capable aircraft will fully benefit from datalink operations in terms of delay, efficiency and air traffic service costs. However, some flight restrictions may be applied to aircraft not equipped with ATN Baseline 1 capable systems.

For more details about Link 2000+ programme, refer to Eurocontrol website at: http://www.eurocontrol.int/services/link-2000-programme.

2.3.2.2. FAA CPDLC BUILD 1A PROGRAMME

For the deployment of the full ICAO CNS/ATM concept, the FAA CPDLC programme was initially divided into three main steps: Build I, II and III. The initial implementation of ATN Baseline 1 standards over US was framed in a preliminary step named CPDLC Build 1A. The CPDLC Build 1A programme was focused on Miami area but due to budget reallocation, has been stopped since 2001. Later, FAA has decided to move forward with the implementation of FANS 1/A standard over the US

national airspace. FAA NextGen Data Communications Programme leads the FANS 1/A deployment.
For more details, refer to Section 2.3.1.1 NextGen Data Communications programme.

2.3.3. ACCOMMODATION OF FANS 1/A AIRCRAFT BY ATN B1 CENTERS

Accommodation will depend on ANSP policy. ANSPs might authorize that their ATC centers capable ATN B1 will accommodate FANS 1/A aircraft. Thanks to accommodation, these ATC centers will enable the provision of datalink services to FANS 1/A aircraft.

The accommodation will mainly rely on the conversion of FANS 1/A to ATN messages and vice versa, implemented at the ground level. After a successful logon/connection of FANS 1/A aircraft entering ATN airspace, the flight crew will be able to obtain the ATC clearances using CPDLC messages.

In order to meet the safety and performance levels required by ATN B1 standards. ANSPs could require further requirements or procedures applicable to operators for which FANS 1/A aircraft will be accommodated. These requirements will be published in their AIP. Here are some examples (not exhaustive and not systematically required by all ANSPs):

- Aircraft should be equipped with VDL Mode 2 to meet datalink performance
- The ATC controllers and flight crew might be not permitted to use CPDLC messages for transactions with safety effects (i.e. affecting the flight profile as ATC instructions that modify route profile)
- In case of CPDLC is used for safety critical instructions, following mitigations may be required:
  - Aircraft should be equipped with FANS 1/A+ (with Max Uplink Delay) to protect from the message latency. The message latency timer will be set to 40 seconds
  - The ATC could insert the flight identification to all uplink CPDLC messages and require the flight crew to check that the message was correctly addressed before executing the instruction
- When the FANS 1/A aircraft is accommodated, the ATC controller should expect that the flight crew responds within 100 seconds after the message has been received (refer to Section 3.5.6.2.2 Operational timers). If the flight crew does not reply within 100 seconds, the ATC controller might revert to voice communications and request the flight crew to terminate the CPDLC connection.

2.3.4. ATS 623

The ATS 623 applications are the following:

- **Departure Clearance (DCL)**
- **Oceanic Clearance (OCL)**
- **Digital – Automatic Terminal Information Service (D-ATIS)**.

2.3.4.1. DEPARTURE CLEARANCE (DCL)

DCL service is provided in some airports distributed over the world: most of airports in France, Germany, the Netherlands, UK, South Korea, China propose DCL service to their operators. DCL trials have started over Japanese airports (Haneda and Narita) since mid 2013.

Note: A similar service, that is the Pre-Departure Clearance (PDC) is also available. PDC enables the flight crew to request and receive departure clearance through the AOC. PDC provides means to deliver departure clearance before pushback. The PDC message can be either:

- Retrieved and printed by the operator through internet access, airline terminal facility and provided to flight crew prior to departure, or
- Received in the cockpit through datalink.

The main difference between DCL and PDC is that PDC does not require any specific aircraft system to treat the departure clearance message. PDC is only deployed over US and Canadian airports.

For more details where DCL is deployed over the world, please refer to SITA website at: http://www.sita.aero/product/ats-aircom-systems-and-services**.** The list is available under "ATS Datalink description and location" link.

2.3.4.2. OCEANIC CLEARANCE (OCL)

At the date of writing this document, OCL service is only available in Russian Oceanic center Magadan and in the North Atlantic (NAT) in the following centers: New York (US), Gander (Canada), Santa Maria (Portugal), Shanwick (UK), Reykjavik (Iceland).

2.3.4.3. DIGITAL – AUTOMATIC TERMINAL INFORMATION SERVICE (D-ATIS)

D-ATIS service is available in more than 90% of the busiest airports in the world.

For more details where D-ATIS is deployed over the world, please refer to SITA website at: http://www.sita.aero/product/ats-aircom-systems-and-services**.** The list is available under "ATS Datalink description and location" link.

2.3.5. SPECIAL OPERATIONS

2.3.5.1. REDUCED SEPARATIONS

The emergence of new CNS technologies enables to reduce the minima of lateral/longitudinal separations between aircraft. 30/30 or 50/50 operations could be applied in such cases. 30/30 (respectively 50/50) operations represents 30 NM lateral and 30 NM longitudinal separation (respectively 50 NM lateral and 50 NM longitudinal separation). To be authorized to fly reduced separations (i.e. 30 NM lateral and 30 NM or 50 NM longitudinal separation), the aircraft must have the following capabilities:

- FANS 1/A
- RCP 240 and RSP 180 (for more details, refer to Section 2.2.3 Application of Communication and Surveillance Performance).

If operators intent to fly airspaces where reduced separations are applied, it is recommended to consult the corresponding AIPs to check the aircraft equipment required.

At the time of writing this document, reduced separations such as:

- 30 NM lateral and/or longitudinal may be applied for flights in Auckland Oceanic, Brisbane, Fukuoka, Honiara, Melbourne, Nauru, New Zealand and Port Moresby FIRs
- 50 NM longitudinal shall be applied for flights in the Europe/South America corridor, i.e. Canarias (southern sector), Atlántico, Dakar Oceanic, Recife and Sal Oceanic FIRs.

2.3.5.2. DYNAMIC AIRBORNE REROUTE PROCEDURE (DARP)

DARP enables the rerouting of an aircraft in flight based on updated weather forecasts, that implies fuel/time savings and flight hazards reduction. It concerns mainly aircraft that could be affected by significant weather changes during a long flight. DARP is based on exchanges of messages between AOC, ATC centers and the aircraft.

For more details about DARP, refer to Part II - Chapter A5.8 Advanced Datalink Operations.

2.3.5.3. TAILORED ARRIVAL (TA)

TA is a 4-dimensional (4-D) arrival procedure, based on an optimized descent trajectory. TA enables to optimize the flight profile from cruise level to expected runway, taken into considerations the current conditions (i.e. traffic, weather, aircraft performance, etc). The arrival procedure consists in a route clearance received prior the top of descent (TOD), via a CPDLC message.

For more details about TA, refer to Part II - Chapter A5.8 Advanced Datalink Operations.

2.3.5.4. IN TRAIL PROCEDURE (ITP)

ITP is a new procedure enabling more frequent flight level changes in procedural airspaces (without radar coverage). For the flight level change, the ATC controller may transmit the ITP clearance by CPDLC. At the time of writing this document, ITP are trailed over Oakland FIR (US - California), Shanwick (UK), Reykjavik (Iceland). It is planned to extend ITP trails to Fidji and New Zealand FIRs.

For more details about ITP, refer to Part II - Chapter A5.8 Advanced Datalink Operations.

2.3.6. ATC DATALINK PERFORMANCE (RCP/RSP)

To support communication and surveillance performance based operations, RCP/RSP capability may be required for specific portions of airspace or routes. In such cases, the relevant States may require a RCP/RSP capability through their AIP.

At present, the RCP/RSP specifications are now completed (refer to Section 2.2 ATC Datalink Performance) but there is no airspace that require aircraft compliance with RCP/RSP. Some ANSPs (located in North Atlantic and South Pacific) have started to monitor RCP/RSP and RCP/RSP capability will be required firstly for FANS 1/A operations over North Atlantic at the beginning of 2015 (i.e. RCP 240/RSP 180).

2.4. ATC DATALINK MANDATES

2.4.1. FANS 1/A

2.4.1.1. NORTH ATLANTIC MANDATE

On Jan 4, 2012, the ICAO NAT Regional Supplementary Procedures (Regional SUPPS) has been amended to mandate FANS 1/A operations for the flights crossing over the North Atlantic (NAT) airspace.

The objectives of this mandate are to increase the airspace capacity thanks to the reduction of aircraft separation and to allow the aircraft to fly at their optimum flight level in order to lower the fuel consumed.

The NAT datalink mandate is implemented in two phases:

- **Phase 1**: From Feb 7, 2013, for all aircraft operating between FL360 to FL390 (inclusive) on the two best tracks within the NAT Organized Track System (OTS) depending on traffic conditions and other factors. The specified tracks and flight levels will be provided in the AIPs of the concerned States and daily in the NAT OTS message.

  Note: The Organized Track System (OTS) is a system of tracks in the North Atlantic MNPS airspace defined according to the meteorological conditions, every 12 hours by Gander (night time) and Shanwick Oceanic Control Centres (day time). The OTS takes into account that peak westbound traffic departs Europe in the morning, whilst eastbound traffic departs North America in the evening.

- **Phase 2**: From Feb 5, 2015, the NAT mandate will be extended to specified portions of NAT Minimum Navigation Performance Specifications (MNPS) airspace. The specified portions will be provided in the AIPs of the concerned states.

  Note: MNPS airspace (MNPSA) applied to the North Atlantic (NAT) has been designated between FL285 and FL420, between 27 degrees north and the North Pole, bounded in the east by eastern boundaries of Santa Maria Oceanic, Shanwick Oceanic and Reykjavik; in the west by the eastern boundaries of CTA Reykjavik, Gander Oceanic and New York Oceanic.

Canadian MNPS covers Arctic Control Area, Northern Control Area and portion of Southern Control Area, between FL 330 and FL 410.

All aircraft intending to fly over the NAT airspace concerned by the datalink mandate shall be fitted with FANS 1/A.
For the phase 1, non-equipped FANS 1/A aircraft will not be permitted to join or cross the specified tracks during the OTS validity period.

These rules are applicable regardless of the Certificate of Airworthiness. There is no exemption clause. The applicability on Tracks and MNPS are also published in NAT Track Messages.

For more details about the OTS and MNPS definition, please refer to Airline Operations Policy Manual at Airbus World:
https://w3.airbus.com/crs/A233_Flight_Ops_GN60_Inst_Supp/OPM_W/index_opm.htm.

2.4.1.2. CHINESE FANS ROUTES

Aircraft that intents to fly Y1, Y2, Y3 or L888 routes over Himalaya, must be fitted with FANS 1/A. Over these routes, CPDLC is used as the primary means of voice communication.
For more details, Refer to China AIP Parts 2 En-route (ENR).

2.4.2. ATN BASELINE 1

2.4.2.1. EUROCONTROL LINK 2000+ MANDATE

In order to formalize the requirements of the mandatory phase of the Eurocontrol Link 2000+ programme (Refer to Section 2.3.2.1 Eurocontrol Link 2000+ programme), the European Commission has released the Data Link Services Implementing Rules (DLS IR). DLS IR requires the implementation of ATN Baseline 1 standards over Europe. This regulation is applicable to Air Navigation Service Providers (ANSPs) and to aircraft operating above FL 285 according the following roadmap.

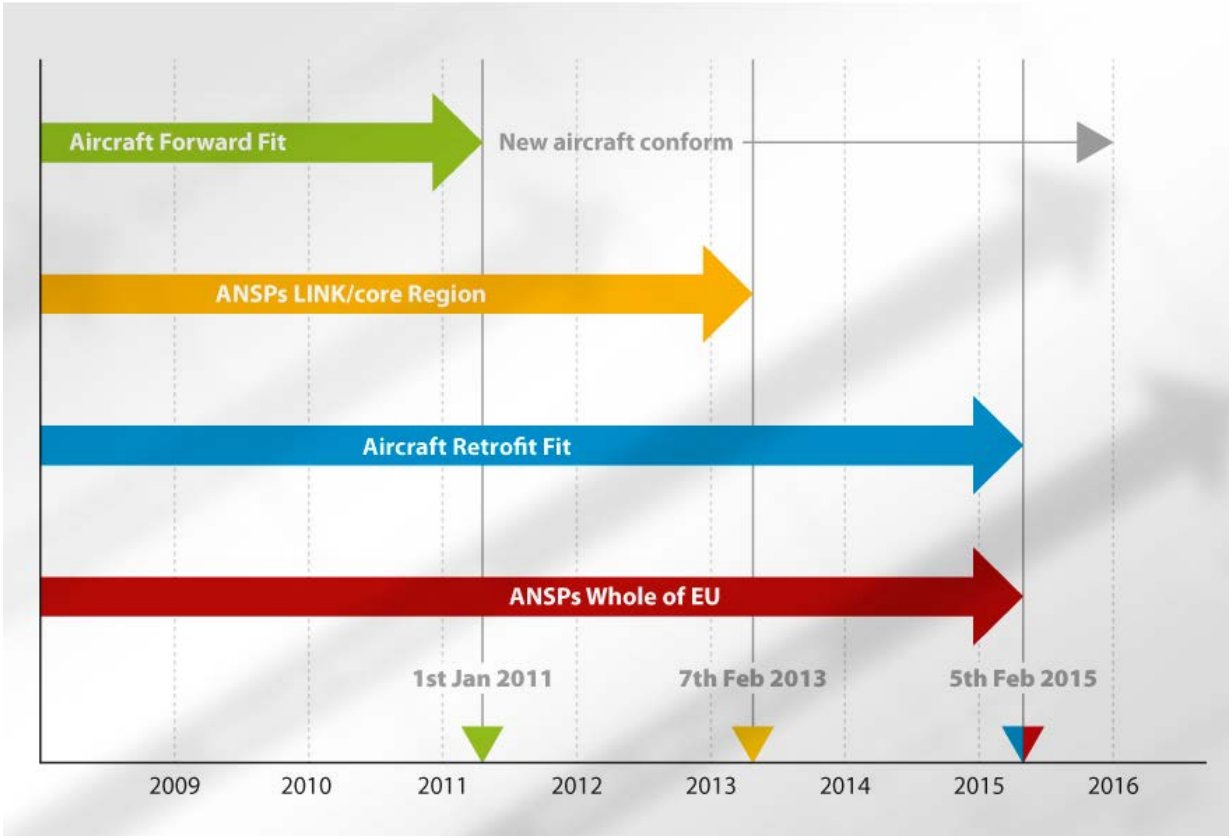

Figure 2-4
DLS IR Roadmap (source: Eurocontrol)

Here are the key milestones of the Link 2000+ mandate:

Date	Implementation Objective
Jan 1, 2011	After this date all new aircraft operating above FL 285 shall be delivered with a compliant system.
Feb 7,2013	By this date, ANSPs within the yellow region on the map (refer Figure 2-5) shall have implemented an operational compliant system.
Jan 1, 2014	New transport type State aircraft should comply with the rule if equipped with non-military data link.
Feb 5, 2015	By this date all aircraft operating above FL 285 shall be retrofitted with a compliant system.
Feb 5, 2015	By this date, ANSPs within the pink region on the map (refer Figure 2-5) shall have implemented an operational compliant system.

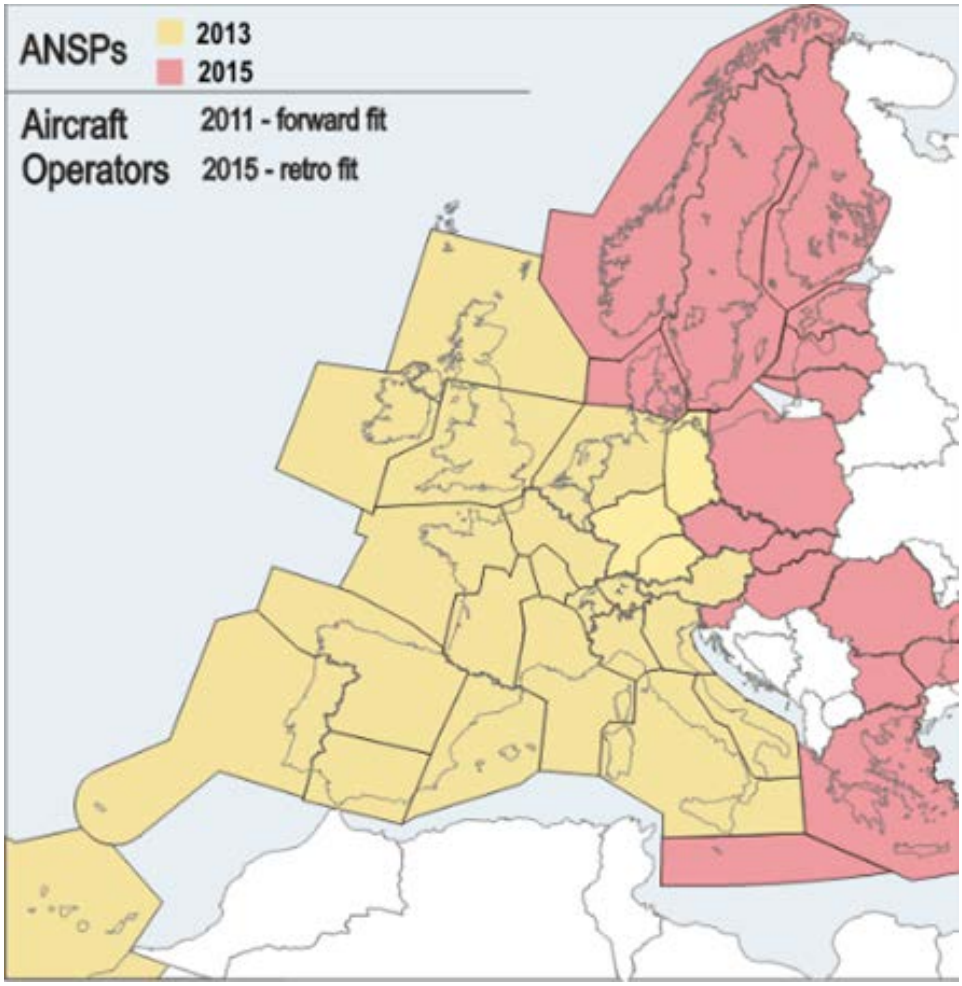

Figure 2-5
ANSPs implementation roadmap (source: Eurocontrol)

A permanent exemption to the Link 2000+ Mandate is possible for aircraft matching the following cases:

- FANS 1/A equipped aircraft with an individual certificate of airworthiness first issued before Jan 1, 2014
- Aircraft with an individual certificate of airworthiness first issued before Jan 1, 1998 and which will cease operation in the European airspace by Dec 31, 2017
- Aircraft operating flights for testing, delivery and maintenance purposes
- State aircraft.

Eurocontrol has approved a permanent exemption for the A318-112, A319CJ, A320CJ types and all A330/A340 types.

Due to the operators difficulties to respect the compliance to Link 2000+ for economic or industrial reasons, Eurocontrol asked that ANSPs do not penalize, nor restrict access to the airspace above FL 285 for aircraft that are not able to meet the retrofit date (Feb 5, 2015) until aircraft are equipped with compliant system (at the latest Dec 31, 2015).

For the A380, the following rules apply:

- A380 with an individual certificate of airworthiness first issued before Jan 1, 2014 is covered by the first exemption case described before
- A380 with an individual certificate of airworthiness issued from Jan 1, 2014 not equipped with a compliant system: ANSPs should not penalize, nor restrict access to the airspace above FL 285 for such aircraft until Dec 31, 2015.

The detailed description of the exemptions cases is available in Eurocontrol website at: http://www.eurocontrol.int/faq/link2000.

The operators have not to submit a formal request for the permanent exemptions listed here above.

For more details about Link 2000+ mandate, refer to Eurocontrol website at: http://www.eurocontrol.int/services/link-2000-programme. The full text of the datalink services implementing rule is available under the Commission Regulation No 29/2009 of Jan 16, 2009.

2.4.3. ATC DATALINK COMMUNICATION RECORDING

ICAO has adopted new requirements about the recording of the ATC datalink communications. The recorded information will be used for the investigation on flight accidents/incidents in order to recreate the sequence of events in the cockpit and will be correlated with the recorded cockpit voice communications.

Based on these new standards, the main aviation authorities (FAA, EASA) and other national authorities have published new regulations related to this topic.

2.4.3.1. ICAO DATALINK RECORDING

It is required that aircraft carries a Cockpit Voice Recorder (CVR) able to record the datalink communications. This is applicable to any aircraft:

- Using datalink communications applications and for which the individual certificate of airworthiness is first issued on or after Jan 1, 2016, or
- Which are modified on or after Jan 1, 2016 for installing the datalink communications applications.

The datalink communications applications implemented in Airbus ATC Datalink systems and concerned by ICAO regulation are:

- Datalink initiation (i.e. AFN for FANS 1/A and CM for ATN B1)
- CPDLC
- ATS 623
- ADS-C.

ICAO regulation concerning the recording of ATC datalink message is published in the ICAO Annex 6 Part I International Commercial Air Transport — Aeroplanes (Ninth Edition of July, 2010 §6.3 Flight recorders). See References.

2.4.3.2. FAA DATALINK RECORDING

The FAA datalink recording mandate requires all operators with US registered aircraft using datalink, to have onboard datalink recording capabilities from Dec 6, 2010.

The mandate implies to record all datalink messages and is applicable to any aircraft meeting the following criteria:

- The aircraft is equipped with CVR and FDR, and
- The aircraft has datalink equipment installed that uses an approved message set as defined in AC 20-160 and
    - The aircraft is manufactured on or after Dec 6, 2010, or
    - The aircraft is manufactured before Dec 6, 2010 and datalink equipment installed after Dec 6, 2010.

The datalink messages implemented in Airbus ATC Datalink systems and concerned by FAA regulation are the messages supported by CPDLC and ATS A623.

The FAA regulation concerning the recording of ATC datalink message is published in the Title 14 of the Code of Federal Regulations (14 CFR) part 121, § 121.359, part 125, § 125.227 and part 135, § 135.151 (available in FAA website at http://www.faa.gov/regulations_policies/faa_regulations/).

The FAA has issued the following document in order to provide operators with more clarifications about the implementation of the datalink recording: “FAA InFO 10016 (8/16/2010) Datalink Communications Recording Requirements – Clarification”.
Please refer to FAA website at:
http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info/all_infos/.

2.4.3.3. EASA DATALINK RECORDING

The EASA regulation requests that aircraft having the capability to operate datalink communications shall be equipped with a Cockpit Voice Recorder (CVR) able to record the datalink messages. This regulation is applicable to any aircraft for which the individual certificate of airworthiness is first issued on or after Apr 8, 2014.

The datalink messages implemented in Airbus ATC Datalink systems and concerned by EASA regulation are:

- Datalink initiation (i.e. AFN for FANS 1/A and CM for ATN B1)
- CPDLC
- ATS 623
- ADS-C.

The CVR must also record:

- Any information usable for the correlation with datalink communications recorded out of the CVR
- Time and priority of the recorded datalink messages.

The EASA regulation concerning the recording of ATC datalink message is published in the COMMISSION REGULATION (EU) No 965/2012 of 5 October 2012 (Air Operations – Part CAT) - CAT.IDE.A.195 Data link recording.

2.5. ATC DATALINK SYSTEMS PROPOSED BY AIRBUS

Airbus has developped currently the following ATC Datalink systems on its aircraft:

- The **FANS A** and **FANS A+** systems for operations based on ACARS network (FANS 1/A standards) in oceanic and remote areas
- The **FANS B** and **FANS B+** systems for operations based on ATN (ATN Baseline 1 standards) in high-density continental areas
- The **FANS A+B** system for operations based on both ACARS network (FANS 1/A standards) in oceanic and remote areas and ATN (ATN Baseline 1 standards) in high-density continental areas.

Note: Deployment of FANS 1/A standards (over ACARS) is planned over the US continental areas (US specificity).

Please note that FANS 1/A is the term used in reference to FANS in ACARS environments. ATN is used in reference to FANS in ATN environments.

FANS A/A+, FANS B/B+ and FANS A+B refer to Airbus systems.

2.5.1. FANS A/FANS A+

FANS A was the first system offered on A330/A340 aircraft in 2000. FANS A system is only certified for A330/A340. Since the FANS A+ system had been certified in:

- 2004 for A330/A340 aircraft
- 2005 for A320 aircraft
- 2007 for A380 aircraft.

FANS A+ is an enhancement of FANS A system, including new functions (e.g. indication of ADS-C connection number, Max Uplink Delay, etc) and new options (e.g. ATS 623 applications, ATC Datalink communication recording, etc). A succession of FANS A+ systems has been developed and only the latest one is available in Airbus catalog.

For more details about FANS A/A+ features, refer to Part II - Chapter A6.

2.5.2. FANS B/FANS B+

FANS B was initially offered on A320 in 2006. This system was developed in compliance with the Link 2000+ pioneer phase.

FANS B+ is an enhancement of FANS B system and has been certified at the end of 2010. FANS B+ (system for the Link 2000+ Mandate phase) replaces FANS B and is proposed on the A320. Moreover, FANS B+ comes with CPDLC Protected Mode and is fully compliant with Link 2000+ requirements (refer to Section 2.4.2.1 Eurocontrol Link 2000+ Mandate). A succession of FANS B+ systems has been developed and only the latest one is available in Airbus catalog.

Some options (e.g. ATS 623 applications, ATC Datalink communication recording, etc) are available on the FANS B+ systems.

For more details about FANS B/B+ features, refer to Part III - Chapter B6.

2.5.3. FANS A+B

FANS A+B is the combination of FANS A+ and FANS B+ systems hosted on the same platform. FANS A+B will be installed at the first A350 Entry Into Service (EIS) and will be also proposed in the near future (around 2015) on A380.

For more details:

- Refer to Part II - Chapter A6 for FANS A+ features included in FANS A+B
- Refer to Part III - Chapter B6 for FANS B+ features included in FANS A+B.

2.5.4. FANS A+C

FANS A+C system will be implemented in the future on Airbus aircraft, encompassing new enhanced ATS like the use of 4D Trajectory for Datalink, Data link Taxi (D-TAXI). These services are fully compliant with ATN B2 (EUROCAE WG-78/RTCA SC-214 standards).

2.5.5. AIRBUS FANS ROADMAP

The next roadmap presents the FANS products proposed by Airbus across its fleet.

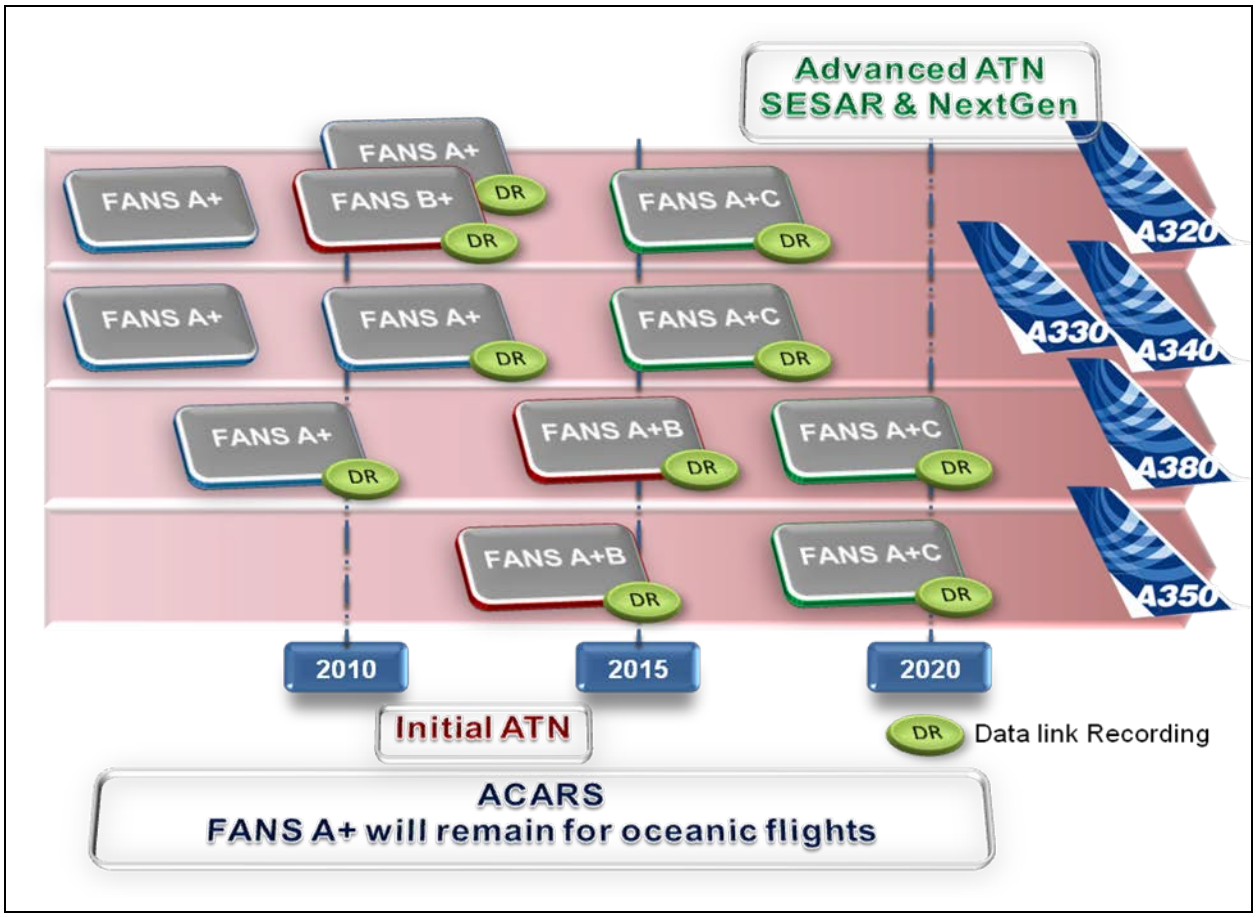

Figure 2-6
Airbus FANS Roadmap

2.5.6. WHICH FANS SYSTEMS FOR WHICH ENVIRONMENT?

Initially, datalink operations were possible in many parts of the world over the ACARS network. With the implementation of ATN Baseline 1, the datalink is now possible over ATN network in Europe. Consequently, different combinations of aircraft types with datalink networks can be imagined as decribed in the following table.

Which FANS system ...	... on which aircraft				... for which environment ?
	A320	A330/A340	A350	A380	
FANS A		ACARS: oceanic and remote*			
FANS A+	ACARS: oceanic and remote*	ACARS: oceanic and remote*		ACARS: oceanic and remote*	
FANS B	ATN: continental**				
FANS B+					
FANS A+B			Both ACARS: (oceanic and remote)* and ATN (continental)	Both ACARS: (oceanic and remote)* and ATN (continental)	

* US specificity: Deployment of FANS 1/A standards (over ACARS) is planned over the US continental areas.

**ATC applications included in FANS B/B+ systems rely on ATN network. When ATS 623 option is selected, ATS 623 applications rely on ACARS network.

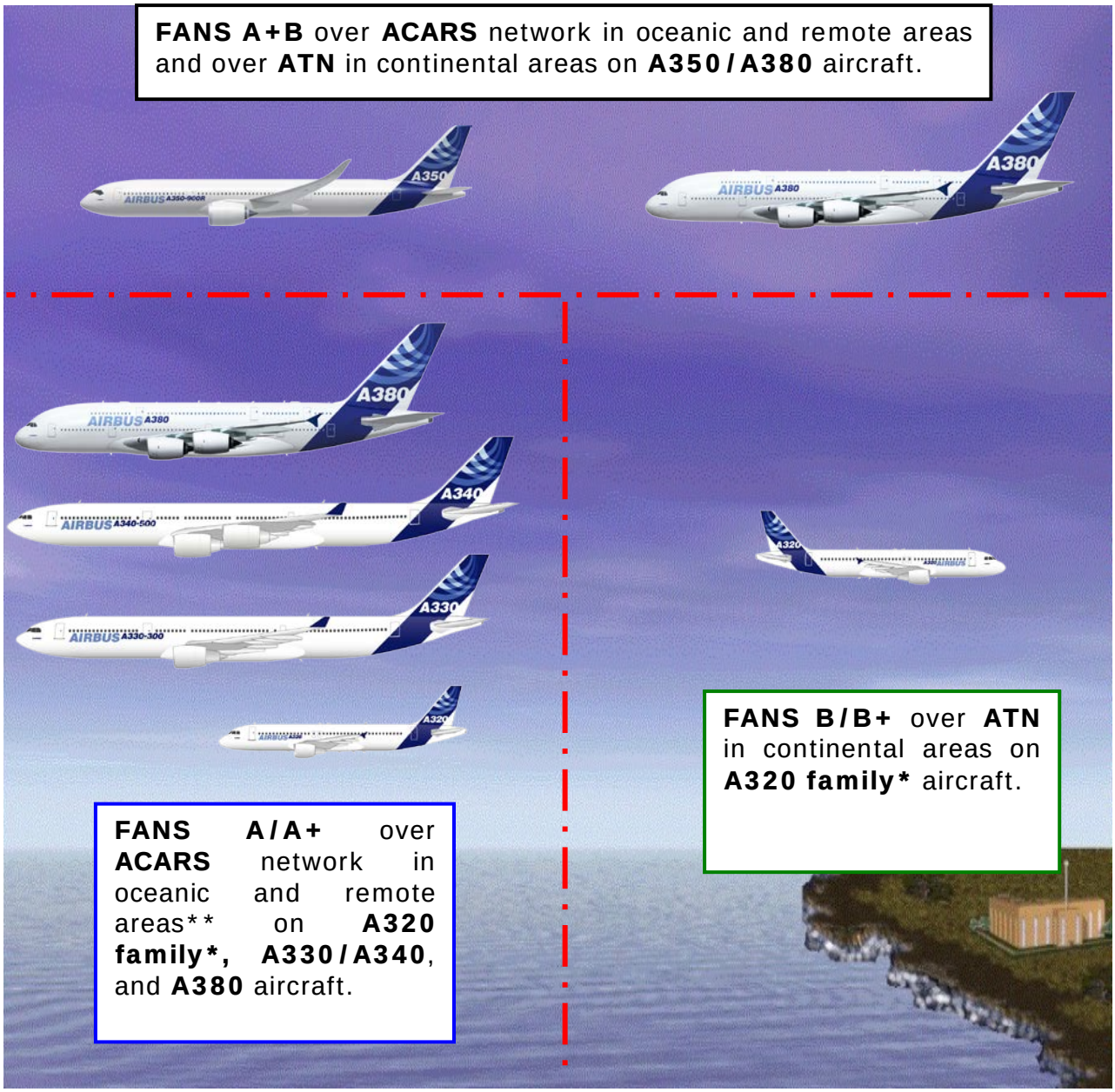

Figure 2-7
Airbus FANS products by environment

* In the whole document, A320 will be used to designate the A320 family.

2.5.7. WHICH FANS SYSTEMS FOR WHICH ATC DATALINK MANDATES?

Airbus has developed FANS systems that are solutions for the ATC datalink mandates (i.e. Link 2000+, North Atlantic and ATC Datalink communication recording). The table here below lists the Airbus FANS systems in correlation with the effective ATC Datalink mandates.

Which FANS system ? on which aircraft						Compliant with which ATC Datalink mandate ?
A320	**A330/A340**	**A350**	**A380**			
FANS B+*	Exempted*	FANS A+B	FANS A+B*	**Europe Link 2000+**		
FANS A+	FANS A/A+	FANS A+B	FANS A+	**North Atlantic**		
FANS A+** or FANS B+**	FANS A+**	FANS A+B	FANS A+	**ATC Datalink Comm. Recording**		

*A320/A330/A340/A380 are exempted under specific conditions. For more details, refer to Section 2.4.2.1 Eurocontrol Link 2000+ Mandate.

Please bear in mind…

1. CNS/ATM

CNS/ATM Concept

The **CNS/ATM** concept aims to enhance the **A**ir **T**raffic **M**anagement thanks to better **C**ommunication, more precise **N**avigation, and richer **S**urveillance. Its main objectives are to increase of the airspace capacity and the flight efficiency, to reduce the aviation environmental impact, and to maintain an acceptable safety level despite an air traffic more and more dense.

- **Communication:** The datalink communication with the Controller Pilot Data Link Communications (CPDLC) provides an important change in the ATC communications. The principle of CPDLC is to use written messages between the flight crew and ATC controllers instead of voice communication.

- **Navigation:** Navigation evolved with the introduction of new procedures based on satellite system, making the aircraft procedures independent of the traditional radio Navaids.

- **Surveillance:** New surveillance techniques like Automatic Dependent Surveillance (ADS) enables a more precise tracking of aircraft, more direct routes, and a reduction of flight crew workload (no or less position reporting) in airspace out of radar coverage.

- **Air Traffic Management:** The deployment of new CNS technologies has continuously improved the ATM. Future ATM is taking shape with the arrival of new concepts like Trajectory Based Operations (TBO), Flight and Flow Information for a Collaborative Enviroment (FF-ICE), System Wide Information Management (SWIM) network.

CNS/ATM Implementation

In order to ensure a global interoperability of local and regional ATM implementations with independent planning, ICAO decided to setup a global ATM framework with the agreement of all ATM stakeholders.

- **ICAO Global Framework:** This framework is based on Aviation System Block Upgrades (ASBU). One ASBU is associated with an operational ATM improvement and is identified by its scope of applicability (i.e. airport, En-route, etc), the benefits for the ATM stakeholders in term of safety, efficiency, environment effects, cost, etc.

  Each ASBU consists of a series of modules, organized with a targeted implementation date. Block 0 is the baseline available in 2013. Blocks 1 to 3 identify new ATM features with an implementation date every 5 years (i.e. respectively 2018, 2023 and 2028). The ICAO framework is part of the ICAO Global Air Navigation Plan (GANP).

Please bear in mind… (continued)

- **Single European Sky ATM research (SESAR):** SESAR is a programme launched in 2004 to renovate the ATM technologies in order to increase the European airspace capacity, improve the safety and efficiency of the ATM, reduce the flight costs and minimize the environmental impacts (noise and air). It involves all aviation stakeholders (airspace users, airports, air navigation service providers, aircraft and system manufacturers, European institutions like Eurocontrol and the European Commission). The introduction of new ATM features like 4D Trajectory, System Wide Information Management (SWIM), Collaborative Decision Making (CDM) are part of SESAR roadmap.

- **Next Generation Air Transportation System (NextGen):** To enhance the ATM, FAA launched its own programme, Next Generation Air Transportation System (NextGen), with the objectives of the increase airspace capacity, the reduction of flight costs, etc. New operational improvements are expected, including the ADS-B, new datalink applications (starting with Pre-Departure Clearance), the System Wide Information Management (SWIM), the Common Support Service for Weather (CSS –Wx), the Collaborative Air Traffic Management (CATM).

- **Other Programmes:** An ATM programme exists in Japan: Collaborative Actions for Renovation of Air Traffic Systems (CARATS) with the mission to modernize the Japanese Air Traffic System. CARATS will deploy new operations like Trajectory based operation, Satellite based navigation, enhanced situation awareness, collaborative decision making (CDM) …

2. ATC DATALINK: STANDARDS, PERFORMANCE, IMPLEMENTATIONS, MANDATES, SYSTEMS

ATC Datalink Standards

- **FANS operations performed over:**
  - **ACARS** network in oceanic and remote areas are in compliance with **FANS 1/A** standards
  - **ATN** in high-density continental areas are in compliance with **ATN Baseline 1** standards.

- **FANS 1/A:** For oceanic and remote areas, FANS 1/A standards based on ACARS network and availability of GPS satellites introduced a well-adapted system to ensure the three CNS functions. FANS 1/A standards are highly inspired from ICAO concept with CPDLC and ADS-C based on ACARS network.

Please bear in mind… (continued)

- **ATN Baseline 1:** The ATN Baseline 1 (ATN B1) standards meet the ICAO CNS/ATM objectives. The main difference with FANS 1/A standards deals with datalink protocols, whereas ATC applications are almost identical.

- **Accommodation FANS 1/A-ATN:** In order to take benefits from investments made on FANS 1/A aircraft while ATN is deploying in Europe, studies to ensure ATN B1 ground systems can provide datalink services to FANS 1/A aircraft have been conducted. Such adaptations between the supporting ATC datalink standards (i.e. FANS 1/A and ATN Baseline 1 standards) are commonly referred to accommodation.

- **Airlines Electronic Engineering Committee (AEEC) 623:** AEEC 623 standard encompasses three ATS 623 applications: Departure Clearance (DCL), Oceanic Clearance (OCL), D-ATIS (Digital – Automatic Terminal Information Service). These 3 applications are used to receive departure clearance, oceanic clearance and ATIS information in text format through ACARS network.

- **ATN Baseline 2 (SC-214/WG-78):** EUROCAE Working Group 78 (WG78) is a joint working group with RTCA Special Committee 214 (SC214), named Standards for Air Traffic Data Communication Services. Their mission is to standardize the future Air Traffic Services (ATS) supported by datalink communications and used in different environments (continental and oceanic) and in different airspaces (Airport and En-route). These ATS will constitute the ATN Baseline 2 (ATN B2) standards. It is expected that ATN B2 includes ATS like 4D Trajectory, D-TAXI, etc.

ATC Datalink Performance

- Like Required Navigation Performance (RNP) provides performance requirements on navigation, Required Communications Performance (RCP)/Required Surveillance Performance (RSP) concept defines performance requirements to support communication/surveillance performance based operations. For instance:
  - RCP 240 defines a maximum time of 240 seconds for a ATC controller to initiate a transaction and receive the response from the flight crew
  - RSP 180 defines a maximum time of 180 seconds to send a position report from the aircraft to the ground.

Please bear in mind… (continued)

- When the use of datalink requires some performance on communication/surveillance, ANSPs may prescribe compliance with RCP and RSP specification in their AIPs. For operations with reduced separations (30/30), it may be requested:
  - To respect RCP 240/RSP 180 with normal means of communications (e.g. SATCOM)
  - To respect RCP 400/RSP 400 with alternate means of communications (e.g. HFDL).

ATC Datalink Implementation

- **FANS 1/A:** In the 1990's, implementation of FANS 1/A started initially over the South Pacific. The deployment of FANS 1/A is now almost worldwide thanks to the availability of ACARS network. Extension of FANS 1/A carries on at the time of writing the document.

- **ATN Baseline 1:** Implementation of ATN B1 over Europe is managed by Eurocontrol Link 2000+ programme. This deployment has started from Maastricht and its completion is expected over the European airspace by 2015 pushed by the Eurocontrol Link 2000+ mandate.

  Deployment of ATN B1 over US was initially planned and managed as CPDLC Build 1A programme. Stopped in 2001, FAA decided to switch to the deployment of FANS 1/A.

- **Accommodation FANS 1/A aircraft by ATN B1 centers:** Accommodation will depend on ANSP policy. ANSPs might authorize ATC centers with ATN B1 capability to accommodate FANS 1/A aircraft. Thanks to accommodation, these ATC centers will enable the provision of datalink services to FANS 1/A aircraft.

- **ATS 623:**
  - Departure CLearance (DCL) is provided in some airports distributed over the world: most of airports in France, Germany, the Netherlands, UK, Korea, China propose DCL service to their operators. In US and Canadian airports, Pre-Departure Clearance (PDC) is deployed, providing a similar service than DCL.
  - Oceanic Clearance (OCL) is available in Russian Oceanic center Magadan and in the North Atlantic (NAT) over New York (US), Gander (Canada), Santa Maria (Portugal), Shanwick (UK), Reykjavik (Iceland).
  - Digital-Automatic Terminal Information Service (D-ATIS) is available in more than 90% of the busiest airports in the world.
  -

Please bear in mind… (continued)

- **Special Operations:** The emergence of new CNS technologies (FANS, RNP etc) allows to fly with a reduction of the minima separations (also known as 30/30 or 50/50 operations), or to apply special procedures like Dynamic Airborne Reroute procedure (DARP), Tailored Arrival (TA), In Trail Procedure (ITP).

- **ATC Datalink Performance:** RCP/RSP capability may be required for specific portions of airspace or routes by the relevant states through their AIP. Some ANSPs (located in North Atlantic and South Pacific) have started to monitor RCP/RSP but at present, there is no airspace that requires RCP/RSP compliance. It is expected that RCP/RSP will be mandatory firstly in the North Atlantic at the beginning of 2015 (i.e. RCP 240/RSP 180 for FANS 1/A operations).

ATC Datalink Mandates

- **FANS 1/A:**
  - **NAT datalink mandate** is implemented in two phases:
    - **Phase 1**: From Feb 7, 2013, for all aircraft operating between FL360 to FL390 (inclusive) on the two best tracks within the NAT Organized Track System (OTS) and crossing 30 degrees west longitude during the OTS validity period
    - **Phase 2**: From Feb 5, 2015, with the extension to specified portions of NAT Minimum Navigation Performance Specifications (MNPS) airspace.
  - **FANS routes over China:** Aircraft that intents to fly Y1, Y2, Y3 or L888 routes must be fitted with FANS 1/A.

- **ATN Baseline 1:** Implementation of ATN Baseline 1 is required over Europe. This mandate is made applicable to Air Navigation Service Providers (ANSPs) and to aircraft operating above FL 285. Here are the keys dates for aircraft operators:
  - **Jan 1, 2011**: After this date all new aircraft operating above FL 285 shall be delivered with a compliant system
  - **Feb 5, 2015**: By this date all aircraft operating above FL 285 shall have been retrofitted with a compliant system.

- **Regulations about ATC Datalink communication recording** have been published. The recorded information could be used for the investigation on flight accidents/incidents.
  - **ICAO** recommends that aircraft record datalink messages from Jan 1, 2016. For Airbus avionics systems, it is applicable to datalink initiation (AFN or CM), CPDLC, ATS 623 and ADS-C messages.

Please bear in mind… (continued)

- **FAA** requires US registered aircraft using datalink, to have onboard datalink recording capabilities from Dec 6, 2010. For Airbus avionics systems, it is applicable to CPDLC and ATS 623 messages.
- **EASA** requires aircraft having the capability to operate datalink communications and for which the individual certificate of airworthiness is first issued on or after Apr 8, 2014, to record datalink messages. For Airbus avionics systems, it is applicable datalink initiation (AFN or CM), CPDLC, ATS 623, ADS-C messages.

ATC Datalink systems

Airbus proposes currently the following ATC Datalink systems on its aircraft:

- **FANS A/FANS A+** over ACARS network (FANS 1/A standards) for A320, A330/A340 and A380 aircraft[1]
- **FANS B/FANS B+** over ATN network (ATN Baseline 1 standards) for A320 aircraft
- **FANS A+B** over both ACARS network (FANS 1/A standards) and ATN network (ATN Baseline 1 standards) for A350/A380 aircraft[2].

[1] FANS A is only available on A330/A340 aircraft.
[2] FANS A+B system will be available around 2015 on A380 aircraft.

FANS A+C system will be available in the future to cope with ATN Baseline 2 standards including new features like 4D Trajectory, D-TAXI, etc.

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3.1. FANS 1/A ARCHITECTURE

FANS 1/A uses the ACARS network to exchange data between aircraft and ground systems. This ACARS network can be accessed through satellite, HF or VHF media, and various ground networks which are inter-connected. Hence, providing the ATC/ATM services to all FANS 1/A equipped aircraft. These data communications are supported by the ACARS router integrated into ATSU (Air Traffic Service Unit) for A320/A330/A340 aircraft or by Avionics Communication Router (ACR) for A350/A380 aircraft. They manage all the communications and automatically select the best available media (for example, in the order: VHF, SATCOM and HF).

The FANS 1/A data link architecture on A320/A330/A340 aircraft is given in Figure 3-1 (except the ATSU component, this architecture is fully applicable to the A350/A380) It is made of the following components:

- The **airborne** part, with the ATSU for A320 and A330/A340 aircraft, which is a modular hosting platform that centralizes all data communications (ATC and AOC) and manages the dedicated Human Machine Interface (HMI). For A350/A380 aircraft, the airborne part is composed of the ATC applications for the management of ATC datalink functions, and of the ACR for the management of data communications.
- The **air/ground datalink** (VDL mode A or mode 2, SATCOM or HFDL) is used to transmit AOC or ATC data to the ground.
- The **ground/ground datalink**, which ensure the connection to the ground part through either:
  - Satellite Ground Earth Stations (GES) whenever VHF coverage is not available
  - VHF Remote Ground Stations (RGS) if within the line of sight of the aircraft
  - HF Remote Ground Stations (RGS) with almost worldwide coverage
  - Air-Ground processors, which route and handle the messages.

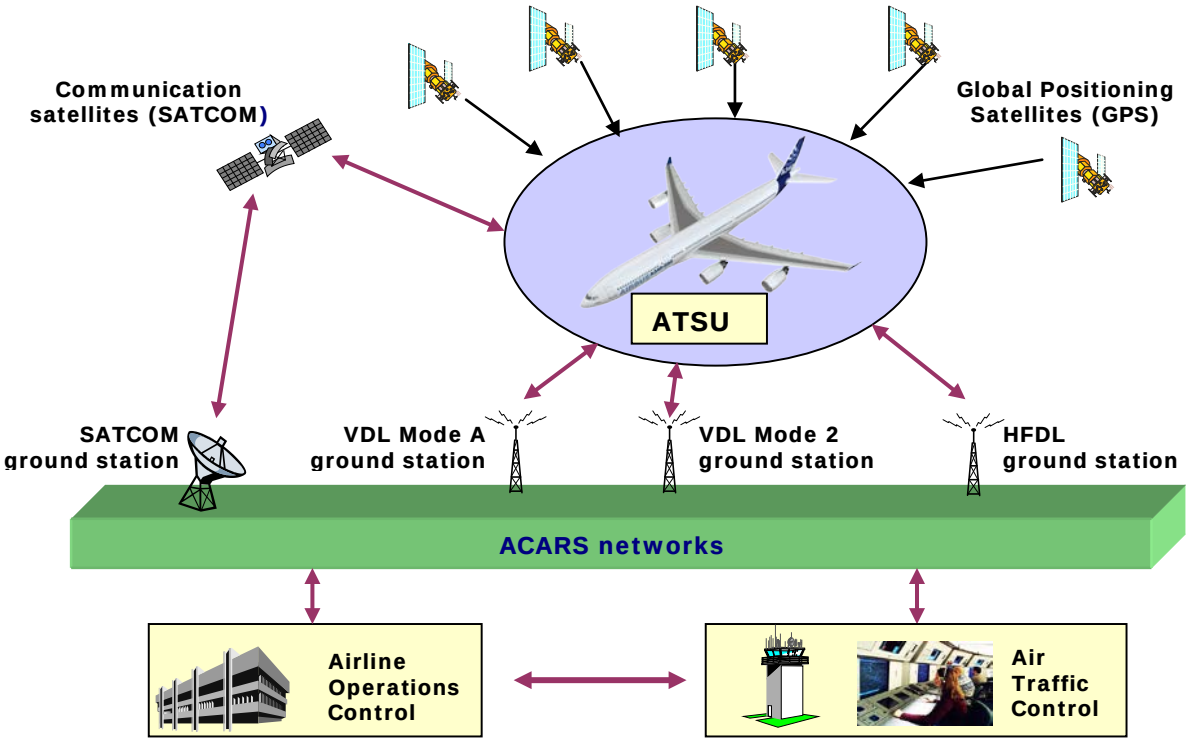

Figure 3-1
FANS 1/A architecture

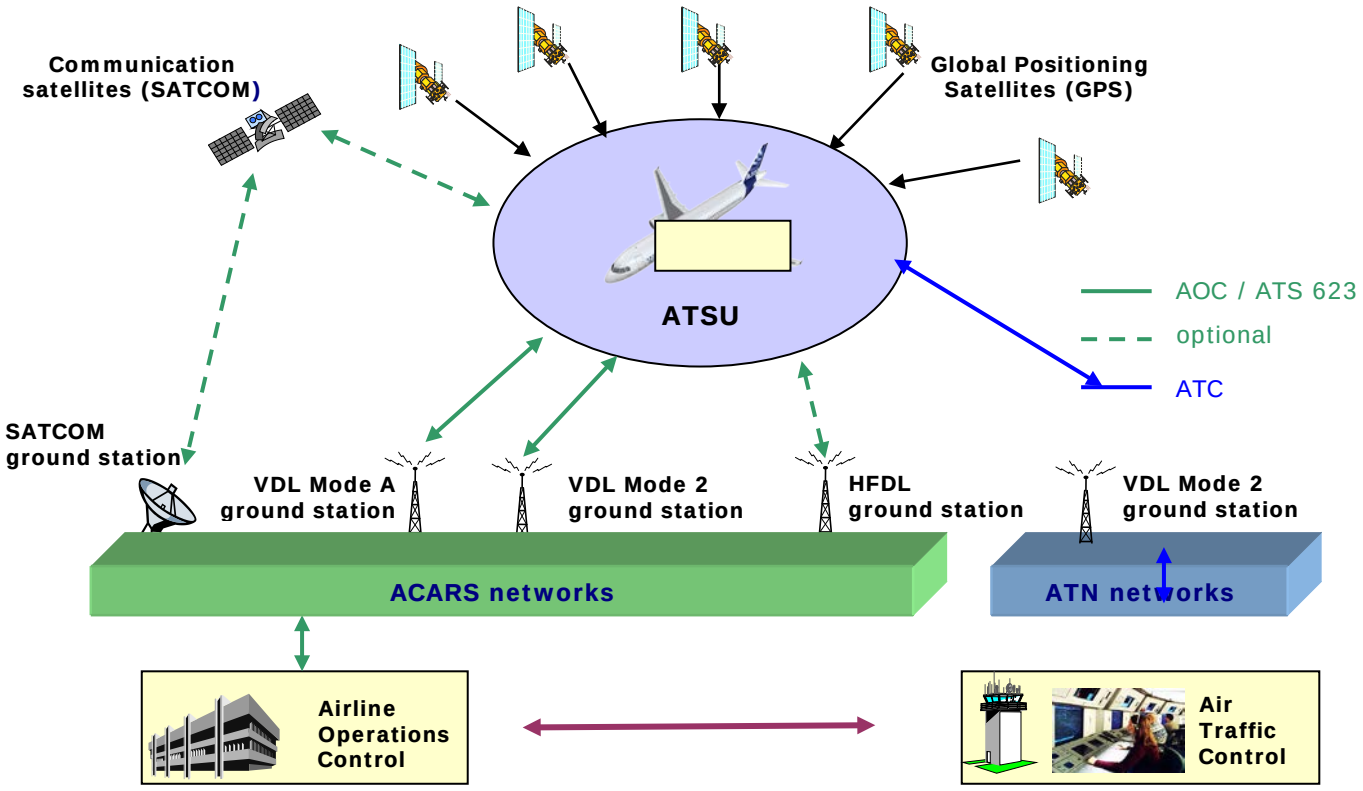

Figure 3-2
ATN architecture

3.2. ATN ARCHITECTURE

The first implementation of ATN Baseline 1 standards is limited to high-density continental airspaces where a fair VHF and SSR coverage is provided. Hence, the ATN can only be accessed through VHF media.

The ATSU router for A320 aircraft and ACR for A350/A380 aircraft still manages the data communications for either ATC, ATS 623 or AOC, as per FANS 1/A architecture. However, only VDL mode 2 is used to transmit ATC data to the ground through ATN. One of the main evolution coming with ATN architecture is that the datalink communication router (ATSU for A320 aircraft and ACR for A350/A380 aircraft) is capable to manage datalink communications over both ACARS and ATN environments. Communications over ATN are used for ATC applications and communications over ACARS, for AOC and ATS 623 applications.

The ATN architecture, detailed in Figure 3-12, is made of the following components:

- The **airborne** part, with the ATSU, which is a modular hosting platform that centralizes all data communications (ATC, ATS 623 and AOC) and manages the dedicated Human Machine Interface (HMI). For A350/A380 aircraft, the airborne part is composed of the ATC applications for the management of ATC datalink functions, and of the ACR for the management of data communications.

- The **air/ground datalink**:
  - VDL mode A/2, SATCOM or HFDL are used to transmit AOC data to the ground as per FANS A architecture. VDL mode A/2 and SATCOM are used to transmit ATS 623 data. Please notice that SATCOM and HFDL for AOC and SATCOM for ATS 623 purposes are optional in ATSU architecture,
  - Only VDL mode 2 is used to transmit ATC data to the ground for communication purposes.
- The **ground/ground datalink**, which is the same as per FANS 1/A architecture. Nevertheless, two types of network have to be considered: ACARS for AOC/ATS 623 and ATN for ATC.

3.3. DATALINK MEDIA

3.3.1. AIR/GROUND DATALINK

3.3.1.1. VHF DATALINK

3.3.1.1.1. VDL mode A

Data Link transmission over ACARS (VDL mode A) has been used for years for AOC data purpose and for FANS A.

3.3.1.1.2. VDL mode 2

The VDL mode 2 (VHF Data Link mode 2) provides improved air-ground VHF digital communication link compared to VDL mode A. VDL mode 2 is the main media used in ATN environments (FANS B/B+).

Before its implementation in ATN environments, the VDL mode 2 standard happened to be a good interim solution in ACARS environments (FANS 1/A). The datalink traffic over ACARS network continued to increase and congestion of the current ground networks was soon expected. Using VDL mode 2 was the only way to improve the current performance of datalink applications, and to increase the capacity of the ACARS network (which implies a reduction of communication charges by service providers).

This solution is known as the VDL mode 2/AOA (AOA: ACARS over AVLC: Aviation VHF Link Control). It is intended to cover the gap between the current ACARS system and the ATN capabilities.

Compared to the ATSU datalink capabilities through the ACARS networks with VDL mode A, the VDL mode 2/AOA increases the rate of data transmission from 2.4Kbits per second to 31.5Kbits per second.

Note: VDL mode 2 is a communication protocol between the aircraft and VHF ground stations of the networks of Communication Service Providers. Obviously, both the aircraft and the recipient (VHF station) must be equipped. With VDL mode 2, the messages are transmitted into packets of bits rather than in blocks of characters. This provides a gain in transmission efficiency.

- **VDL mode 2 multiple frequencies**

The communication between the aircraft and VHF ground stations is established on a VHF frequency. In order to face the increasing number of aircraft connected at the same time and maintain a good performance level, VDL mode 2 communications will rely on multiple VHF frequencies. When equipped with this new feature (available in latest FANS A+ systems and all FANS B+ systems) and when available on ground, the aircraft system will be able to tune several VHF frequencies provided by the Communication Service Provider (CSP).

3.3.1.2. SATCOM

Until SATCOM became operational, radio-communications suffered from VHF line-of-sight limitations and the unreliability and variable quality of HF. Satellite links overcome these weaknesses, being unaffected by distance or ionospheric conditions. SATCOM is thus playing a major role in the implementation of ICAO's CNS/ATM concept for Air Traffic Control in the 21st century, supporting both ADS-C and CPDLC applications over the oceanic and remote areas.

Whatever the applications (passenger services, airline operational communications or air traffic communications), the voice/data are transmitted via satellite, from the aircraft to the Ground Earth Stations (GES) and then switched through international telecommunications networks (ARINC, SITA, etc) to anywhere in the world (airline hosts, ATC centers, etc).
In 2006, only Inmarsat constellation was able to provide communication services (voice or data) to the whole globe, except to the extreme polar regions (above 72°N and below 72°S).

Note 1: All satellites of the Inmarsat-4 constellation are operational. The I-4 satellite names are as following Europe, Middle East, Africa (EMEA), Americas (AMER) for America coverage and Asia Pacific (APAC) for Asia Pacific coverage. Inmarsat is expected to increase its number of spot beams from 5 to 19 with Inmarsat-4 constellation. In the near future, Inmarsat will introduce Alphasat satellite to replace EMEA. The new Alphasat satellite will bring additional bandwidth and traffic carrying capability for busy EMEA region.

Note 2: Multifunctional Transport Satellite (MTSAT), satellites operated by Japan provides datalink services for aircraft and weather information. MTSAT 1R and MTSAT 2, two satellites launched respectively in February 2005 and early 2006 are now fully operational. Connection to MTSAT 1R or MTSAT 2 is transparent for the aircraft (the connection being performed by the GES).

Note 3: The following GES have been closed till date: Yamaguchi (March 2006), Goonhilly (February 2007), Southbury (2008).

In 2012, Airbus started the development of a new SATCOM system named Iridium SATCOM. This system will enable the datalink communications over the Iridium satellite constellation that is composed of 66 satellites and ensures a worldwide coverage from pole to pole. Iridium SATCOM is an alternate solution to Inmarsat SATCOM, providing the same quality of service but with a better avail. The first certification of Iridium SATCOM occurred on A320 in January 2014.

For FANS datalink, it must be noted that the selection and installation of Iridium SATCOM and Inmarsat SATCOM system onboard will be exclusive, as both systems provide the same service.

Refer to Part II - Appendix C for coverage maps.

3.3.1.3. HF DATA LINK (HFDL)

HF Data Link (HFDL) was certified for an AOC purpose in April 2002. HFDL was certified as a supplementary (not primary) means for an ATC purpose with the FANS A+ system.

"Supplementary" means that the FANS A+ certification process authorizes the use of HFDL only if VDL and SATCOM are operative. During the FANS A+ certification process, the demonstration of datalink performance including HFDL (measurement of message transit time between end users) was not performed for environments such as polar areas. HFDL is usable as a means of communication when VDL or SATCOM is busy (e.g. transmission of CPDLC message via SATCOM and ADS-C report via HFDL) or unavailable. In such a case, the operator should notice that HFDL performance even better than HF voice ones, are not as good as VDL or SATCOM ones. Thus, messages transmitted by HFDL may take much more time to reach the addressee than via VDL or SATCOM. Some messages may even be lost.

If the airline elects to use HFDL outside SATCOM coverage, the airline operates outside the approved certification framework of FANS A+. The airline shall submit its choice to its approval authority (Refer to the FANS A Airworthiness Approval Summary – See Part II – Appendix L).

HFDL allows data transmission at a rate of 1.8 Kbits per second. Today, ARINC is the only CSP providing HFDL. The proposed coverage is worldwide (Refer to Part II - Appendix C).

3.3.2. GROUND/GROUND COMMUNICATIONS

3.3.2.1. THE COMMUNICATION NETWORKS

Several Communications Service Providers (CSPs) ensure today the routing of ATC messages between the aircraft and the ATC Center, in addition to the AOC messages. These are growing steadily, thus raising some issues for future interoperability. Among the main ones the following may be listed:

- **ARINC:** through its so-called ADNS network, ensures the SATCOM, VHF and HFDL (High Frequency Data Link) air-ground processing through numerous GESs and RGSs.
- **SITA:** through its so-called AIRCOM system, ensures the SATCOM and VHF air-ground processing through numerous GESs and RGSs.
- **AVICOM:** this Japanese provider ensures a VHF air-ground processing within Japan

- **DATACOM:** this Brazilian provider ensures a VHF air-ground processing within Brazil region.

Both ARINC and SITA networks operate with national service providers and are currently interconnected to provide a global interoperability of ATS datalink applications. This means for instance, that an aircraft using a VHF datalink under a SITA agreement can nevertheless operate in a FANS ATC area using an ARINC contract (refer to Section 3.3.2.2 The interoperability of the networks).

Given in Part II - Appendix D is general information relative to some of these Communication Service Providers.

3.3.2.2. THE INTEROPERABILITY OF THE NETWORKS

- **ACARS network**

The network interoperability between the two main Communication Service Providers (i.e. ARINC and SITA) is a key element in the overall performance of the system, and ensures that each relevant ATC Center has access to all FANS aircraft within its region.

Switching for instance from VHF to SATCOM (or vice versa, ACARS environments only) is managed by the avionics router (module of ATSU on A320/A330/A340 and ACR on A350/A380). Such an automatic function is needed to fulfill the logic that determines the routing of any uplink message. It is transparent to both the flight crew and the ATC controller and ensures that uplink messages can be sent to the aircraft irrespective of the medium or Communications Service Providers used.

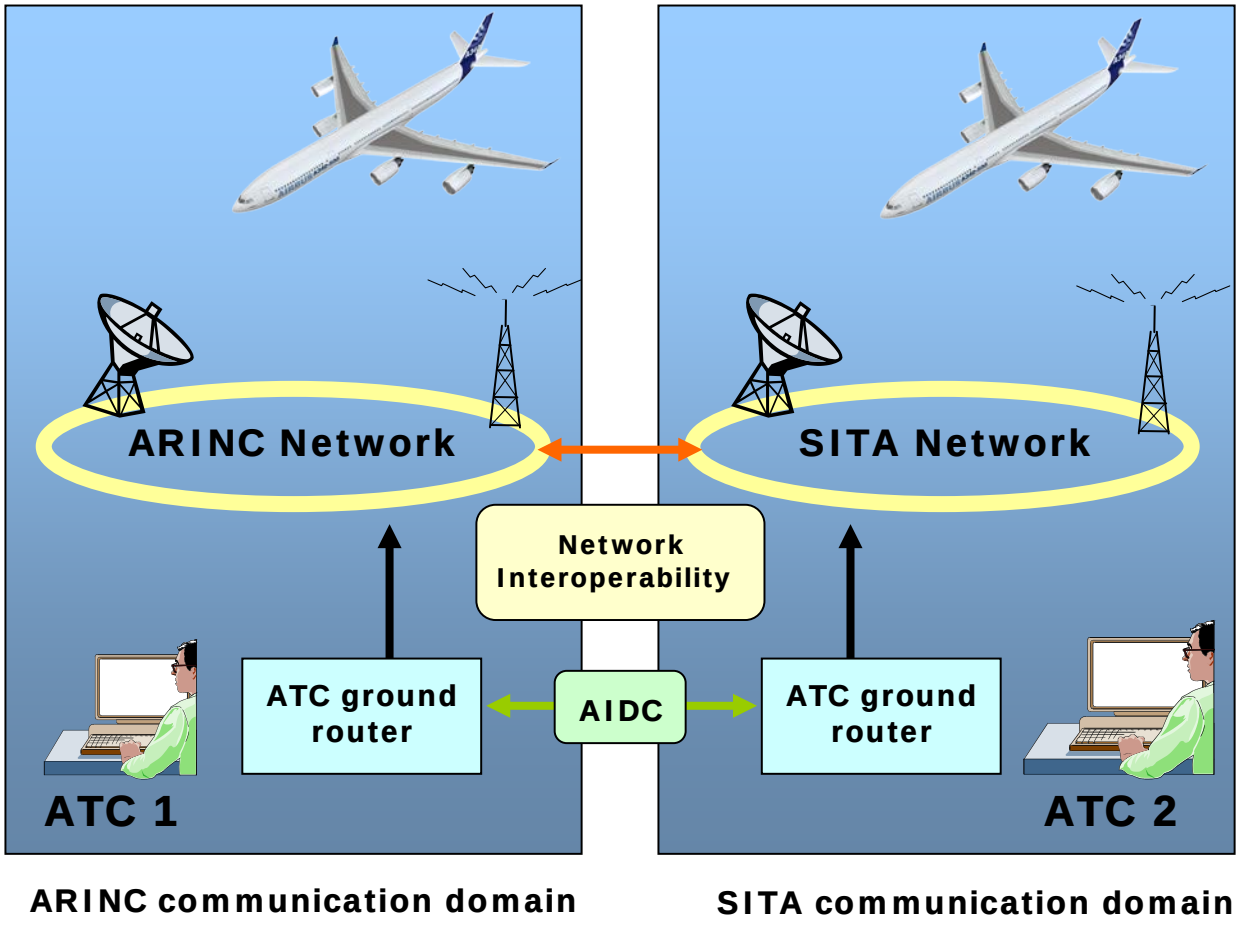

Figure 3-3
ACARS network interoperability

- **ATN network**

The same kind of feature is provided for ATN in order to ensure a seamless connection with the ground. However, in the Link 2000+ airspaces, VDL mode 2 is the unique medium used for ATC datalink purposes. ARINC and SITA are the main CSPs.

Aircraft of airlines, which contracted SITA as CSP, will be capable to connect to ATC centers that contracted ARINC as CSP thanks to the inter-connection between ARINC and SITA. The following figure illustrates a possible extension model of the network.

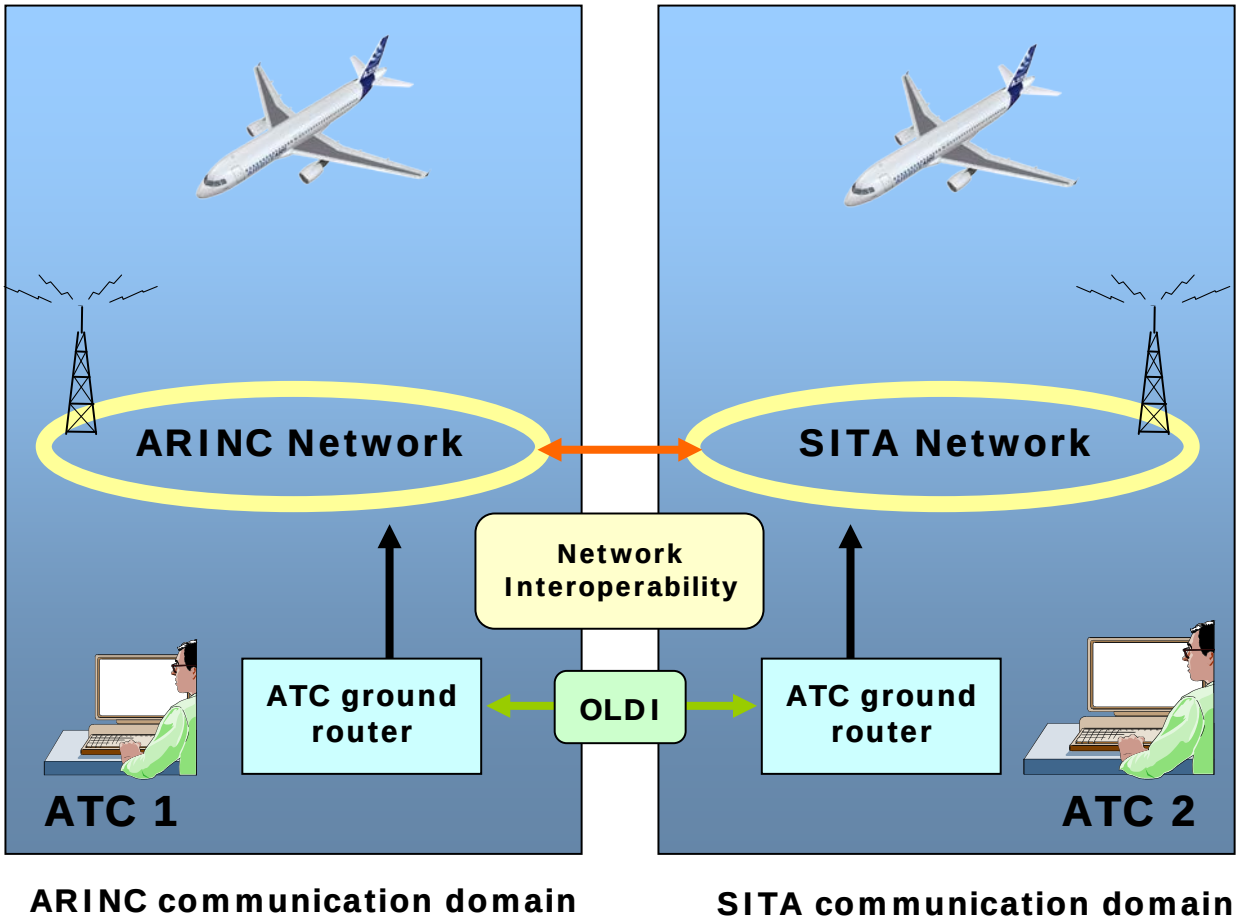

Figure 3-4
ATN network interoperability

3.3.2.3. GROUND COORDINATION

The ATS Inter-facility Data Communications (AIDC) defines the datalink between ATC centers. This link is used for notification, coordination and transfer of control. AIDC functions will be progressively introduced, as ATC centers along routes and airspaces are equipped with CNS/ATM systems. For the same purposes, Link 2000+ areas implement a variant of AIDC called the On-Line Data Interchange (OLDI).

3.3.2.4. THE AERONAUTICAL TELECOMMUNICATION NETWORK (ATN)

With FANS 1/A standards, the Air Traffic Services is based on the ACARS network, which will not be able to handle the increasing volumes of AOC and ATC communications. Therefore, a network dedicated to aeronautical communications entered into operations to act as a backbone of the ICAO's CNS/ATM concept. This Aeronautical Telecommunication Network (ATN) seamlessly connects aircraft, ATC centers, airline operations facilities and Communication Service Providers with enhanced efficiency, capability and security. For the initial implementation, the ATN connects ATC centers and will provide datalink between aircraft and ATC centers.

3.4. CNS/ATM APPLICATIONS AND SERVICES

Even if derived from the same ICAO CNS/ATM concept, applications of FANS A/A+ and FANS B/B+ systems are different as they are used according to different environments.
The following sections describe applications related to each environment.

3.4.1. AS PER ACARS NETWORK – FANS A/A+ SYSTEMS

In FANS 1/A environment, three main applications compose the datalink as described in ICAO CNS/ATM concept:

- The **ATS Facility Notification (AFN)**
- The **Controller Pilot Data Link Communication (CPDLC)**
- The **Automatic Dependent Surveillance / Contract** (**ADS-C**).

The three applications are detailed hereinafter.

3.4.1.1. ATS FACILITIES NOTIFICATION (AFN)

The AFN application enables to inform ATC of the aircraft datalink capability and characteristics. This serves to exchange the addressing information between the aircraft and the ATC Center. The AFN is a signal for the receiving ATC Center that the aircraft is about to enter the FIR and is a prerequisite to the establishment of CPDLC or ADS-C connection.

3.4.1.2. CONTROLLER PILOT DATA LINK COMMUNICATION (CPDLC)

CPDLC is a powerful application to sustain datalink communications between the flight crew and the ATC controller of the relevant flight region. CPDLC is particularly adapted to such areas where voice communications are difficult (e.g. HF voice over oceans or remote parts of the world), and became very convenient to alleviate congested VHF of some dense continental airspaces when utilized for routine dialogue (e.g. frequency transfer).

CPDLC enables flight crew and ATC controllers to communicate via datalink thanks to written messages composed of one or several elements chosen in a set of preformatted elements. Those elements are compliant with the existing ICAO voice phraseology. CPDLC messages are used for clearances, requests, reports, negotiations and other types of dialog with ATC (e.g. emergency messages, ATC transfer, frequency changes, etc).

Part II - Appendix A lists all the messages that are supported by FANS A and FANS A+ airborne and ground systems.

Advantages of CPDLC, compared to voice communications, have been discussed at length for some years. Among the main ones, CPDLC is a remedy to shortcomings of the existing systems:

- Significant reduction of the transmission time
- Suppression of the errors or misunderstandings pertaining to poor voice quality, fading, language

- Suppression of mistakenly actions on ATC messages intended for another flight
- Suppression of the tiring listening watch of the radio traffic
- Possibility for an immediate access to previously recorded messages
- Automatic loading within the FMS of route or F-PLN clearances, thus avoiding transcription errors, long and fastidious manual keystrokes.

3.4.1.3. AUTOMATIC DEPENDENT SURVEILLANCE (ADS)

ADS is the application used to support the surveillance function within the CNS/ATM concept. ADS stands for Automatic Dependent Surveillance:

- **Automatic:** it is fully transparent to the flight crew as the aircraft position is automatically transmitted to ground
- **Dependent:** it uses accurate position and velocity data from navigation systems (e.g. GNSS)
- **Surveillance:** it provides aircraft position, altitude, velocity and other data.

Two types of ADS applications exist:

- **ADS-Contract (ADS-C) application**
- **ADS-Broadcast (ADS-B) application**

These two ADS applications are quite different, as they do not rely on the same systems.

The following sections are here to help the reader in differentiating ADS-C and ADS-B. However, the rest of the document deals only with ADS-C application as part of FANS A/A+ systems.

3.4.1.3.1. Automatic Dependent Surveillance – Contract (ADS-C)

ADS-C is an application part of FANS A/A+ systems. ADS-C, like CPDLC, requires the establishment of a connection between the aircraft and a ground system. The ground system may be an ATC center or the airline host. The aircraft can have up to five ADS-C connections at the same time (see Part II - Section A5.5.2.- ADS Connection Management). Through the ADS-C connection, the ATSU (respectively ATC applications) automatically sends aircraft surveillance data to the ground systems. ADS-C benefits from the datalink range (i.e. almost worldwide).

Transmission of aircraft surveillance data (aircraft identification, aircraft position, aircraft speed, predicted route, etc) is done automatically and remains transparent to the crew.

Different types of ADS-C "contracts" exist:

- **Periodic:** data is sent at periodic time intervals, or
- **On demand:** data is sent only when asked for, or
- **On event:** data is sent whenever a specified event occurs (e.g. altitude or heading change, vertical rate change, waypoint sequencing).

These contracts are set by the ATC centers to satisfy their operational needs for surveillance, as dictated by circumstances (e.g. traffic density). The flight crew cannot modify these contracts, but the ATC controller can specify the parameters of

the contract. Optional data groups may thus be added in the contract request. At any time, an ATC Center may establish with one aircraft, ADS contracts that include one periodic and one event contract. The ATC Center may also establish with one aircraft, successive demand contracts. Whenever the ATC controller makes a modification, a new contract is set, which cancels the previous one.

Another type of contract that may be found is **the emergency mode**. When the crew activates this mode, an emergency report is sent to any ATC Center that has an ADS-C contract with the aircraft. The emergency report is sent at the same rate of the current active periodic contract if any, otherwise it is sent every 64 seconds.

Appendix B of Part II lists the various elements and groups of data of the ADS-C reports, and provides some details on the different contracts.

3.4.1.3.2. Automatic Dependent Surveillance – Broadcast (ADS-B)

ADS-B is an application of the Mode S transponder. This application automatically broadcasts aircraft surveillance data (position, altitude, speed, etc) every 0.5 second. ADS-B does not require any datalink connection as ATC and surrounding aircraft equipped with ADS-B receiver can collect these data to display the aircraft position on their traffic display without radar. Since ADS-B uses the transponder aerial, the range is limited to about 250 NM.

ADS-B enables the flight crew and the ATC controllers to get a more precise image of the traffic thanks to enriched data (e.g. GPS aircraft position) compared to TCAS data for flight crew or SSR data for ATC controllers. From a cockpit perspective, ADS-B data is displayed on the Cockpit Display of Traffic Information (CDTI) or Navigation Display (ND) for Airbus aircraft.

Unlike SSR, ADS-B works also at low altitudes and on ground. In addition, any vehicle equipped with a ADS-B emitter can be “seen” by any vehicle equipped with a ADS-B receiver, provided the emitter is in the range of the receiver.

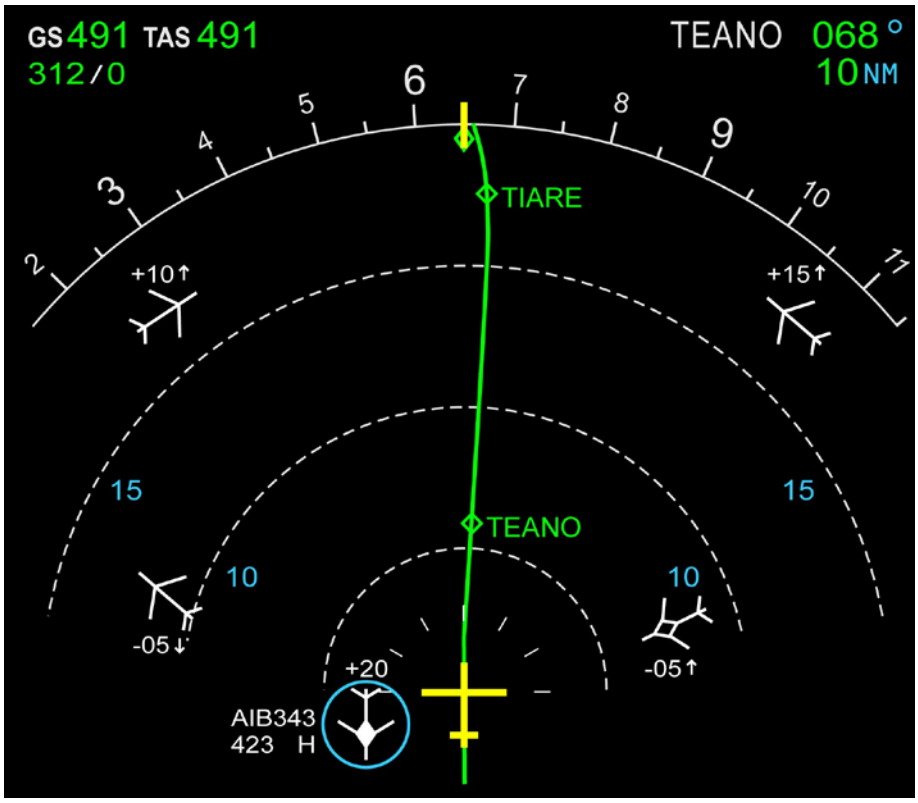

Figure 3-5
ADS-B information displayed on ND

For more details on ADS-B, refer to "Getting To Grips With Surveillance" (see References).

3.4.1.3.3. COMPARISON BETWEEN ADS-B AND ADS-C

Knowledge of ADS-B and ADS-C is vital. Hence, to understand ADS-B and ADS-C better, a comparison between them is shown in the table below.

	ADS – Broadcast	**ADS - Contract**
Operations	It is used for surveillance	It is used for procedural control
Environment	Used in high-density continental airspace	Used in oceanic and remote areas
Range	Range is 250NM from ADS-B ground receiver	Range is worldwide due to SATCOM and HF coverage.
Aircraft Avionics	Mode S Transponder is required to broadcast data and TCAS capable of ADS-B IN is required to receive data.	ATSU (A320/A330/A340) or ATC applications (A350/A380) is required to host FANS A/A+ applications capable of ADS-C.
Data transmission	Data is broadcast every 0.5 seconds.	End-to-end connection: data transmission depends on the type of contract.

3.4.2. AS PER ATN – FANS B/B+ SYSTEMS

In ATN environment, two applications are used to ensure the datalink:

- Context Management (CM) application
- Controller Pilot Data Link Communication (CPDLC) application.

In FANS B/B+, it has been introduced the notion of services provided by the applications. Each application provides some services that enable the fulfillment of operational needs of either ATC or flight crew. Details on these applications and services are provided in the following sections.

Note: ADS-C application is not implemented on FANS B/B+ systems.

3.4.2.1. CONTEXT MANAGEMENT (CM) APPLICATION

The CM Application provides the necessary information to enable datalink communication between ATS units and aircraft systems. This function will typically be initiated when an aircraft is either at the gate in the pre-departure phase of flight, or before entering a FIR supporting datalink communications.

The CM Application supports the DLIC (Data-Link Initiation Capability) Air Traffic Service.

3.4.2.1.1. Data Link Initiation Capability (DLIC) service

The DLIC service is executed prior to the first use of any other datalink application. It provides the ground with the necessary information to make datalink communications possible between the ATC controller and the aircraft:

- Aircraft 24 bits address,
- Aircraft flight identification,
- Departure/destination airport,
- Facility designation,
- As well as information about available air applications.

The DLIC Service consists of:

- The **Logon function**, which is a means of exchanging application information between an aircraft and a given ground ATC Center. It also provides flight data (flight number, FROM/TO airports, aircraft position) to that ground ATC Center. This function could be either triggered manually or automatically
- The **Contact function**, which provides a method for a ground ATC Center to request the aircraft system to initiate the logon function with another ground ATC Center, indicated in the contact request. This function is used to transfer the aircraft from one ATC Center to another and it is transparent for the flight crew. It is managed by the ground system.

3.4.2.2. CONTROLLER PILOT DATA LINK COMMUNICATION (CPDLC) APPLICATION

In ATN environment like in ACARS environment, the CPDLC application provides direct flight crew/ATC controller communication using datalink.

CPDLC supplements voice communication between an aircraft and the controlling ATC Center. The objective is to reduce flight crew and ATC controller workload, and decrease clearance delivery delays.
The CPDLC application provides a set of datalink message elements corresponding to existing ICAO phraseology used by current ATC procedures as defined in ATN Baseline 1 standards (Refer to Part III - Appendix A).

The CPDLC application supports the following services:

- ATC Clearance (ACL) service
- ATC Communication Management (ACM) service
- ATC Microphone Check (AMC) service.

These services are detailed in the sections hereinafter.

3.4.2.2.1. ATC Clearance (ACL) service

ACL is used to:

- Request clearances
- Issue clearances
- Expect clearances
- Issue requests for the current or future status of the flight
- Provide flight status notifications.

An uplink "free text" capability is provided to uplink information that does not conform to standard messages (additional information to clearances, error reasons, etc).
No downlink “free text” message is provided to flight crew. Free text downlink capability is only provided to airborne system to append information explaining preformatted error reasons.

3.4.2.2.2. Separators in DCDU message display

3.4.2.2.3. ATC Communication Management (ACM) service

Through this service, transfer from one ATC Center to another is performed. The current authority managing the aircraft with datalink communications (also known as Current Data Authority, CDA) can assign another ATC Center as the Next Data Authority (NDA) and/or instruct a frequency change with a CPDLC message. The NDA can initiate a CPDLC connection with that aircraft and then it becomes the CDA, provided that the connection with the previous CDA has been terminated.

ACM service may be used to:

- Initially establish CPDLC with an ATC Center
- Terminate CPDLC with an ATC Center
- Transfer voice communications and CPDLC from the CDA to the NDA
- Issue a change of frequency (also known as Voice Contact Instruction, VCI).

3.4.2.2.4. ATC Microphone Check (AMC) service

ATC Controllers use the AMC service to instruct the flight crew to check that they are not blocking the voice channel (i.e. stuck microphone). No acknowledgement of the instruction from the flight crew is required.

3.5. FANS 1/A AND ATN: MAIN DIFFERENCES

The following sections describe the main differences between FANS 1/A and ATN environments. Flight crew who operate both FANS A/A+ and FANS B/B+ systems should master these differences in order to properly operate any FANS systems with their distinctive features.

Knowledge of these differences is not required for flight crew who operate exclusively FANS A/A+ or FANS B/B+.

3.5.1. DATA LINK OPERATIONS

It has to be noticed that in most of the regions, the carriage of datalink systems is not mandatory in FANS 1/A environments. However, when an aircraft equipped with datalink systems is flying in FANS 1/A environment where CPDLC is serviceable, CPDLC should be used as a primary means unless otherwise specified by local rules. Voice will then be used as a backup means.

In ATN environment, the carriage of ATN Baseline 1 capable systems is required from the Mandatory phase of the Link 2000+ programme. Nevertheless, CPDLC will be considered as a supplementary means for the time being. Voice will remain the primary means of communication.

	FANS 1/A environment	ATN environment
Carriage of datalink systems	FANS A/A+ not mandatory except for some airspaces*	FANS B+ Mandatory since Link 2000+ Mandate**
CPDLC	Primary if aircraft equipped	Supplementary
Voice	Backup	Primary

* Refer to Section 2.4.1 FANS 1/A
**Refer to Section 2.4.2.1 Eurocontrol Link 2000+ Mandate

3.5.2. APPLICATION NAME EQUIVALENCE

The following table provides the equivalence between FANS A/A+ and FANS B/B+ applications as detailed in Section 3.4 – CNS/ATM applications and services.

FANS A/A+ applications	FANS B/B+ applications
AFN	CM
CPDLC	CPDLC

FANS A/A+ applications	FANS B/B+ applications
ADS-C	No equivalence

3.5.3. PROTECTED MODE

Protected Mode (PM) is specific to ATN B1 environment. Due to the likelihood that ATC instructions are delivered to the wrong aircraft, the Protected Mode (PM) has been introduced in order to prevent this risk. Coming with FANS B+ system, the PM guarantees that:

- The CPDLC message is delivered to the intended receiver, and
- The integrity of CPDLC message.

Before PM (with FANS B system), the Voice Read-Back (VRB) procedure was mandatory for ATC instructions modifying the flight profile. To ensure that the message is received by the intended aircraft, every uplink message had to be confirmed with the ATC through a Voice Read-Back. With Protected Mode (PM) this confirmation is no longer require, thus reducing the flight crew workload.

Due to the discontinuation of the Voice Read-Back (VRB) procedures from Nov 15, 2012, it is required that the aircraft are capable Protected Mode CPDLC in European airspace.

3.5.4. TECHNICAL ACKNOWLEDGEMENT: LACK/MAS

To ensure the successful delivery of a message, the system that receives the message replies with a technical acknowledgement. For ATN environments, this acknowledgement is the Logical Acknowledgement (LACK) and the Message Assurance (MAS) for FANS 1/A environments.

These constitute a major difference between ATN Baseline 1 and FANS 1/A. Indeed, these acknowledgements do not address to the same recipient. Besides, the MAS function is required whereas LACK function is not. European airspaces implement the LACK function.

3.5.4.1. IN FANS 1/A ENVIRONMENT

The MAS is the notification by the Communication Service Provider (CSP) to the ATC Center that the uplink message has been acknowledged or not by the airborne system. The MAS function is provided for uplink messages only. Refer to Figure 3-6.

As a consequence, on FANS A/A+ interface, when a message is downlinked, a SENT label is displayed once the technical acknowledgement is received from the ACARS network. It means that the message is actually sent but not necessarily displayed on the ATC controller HMI. Refer to Part II - Appendix F, G, H or I for more details.

3.5.4.2. IN ATN ENVIRONMENT

The LACK notifies the successful delivery of a message on recipient's HMI in both directions (uplink and downlink). Refer to Figure 3-7. A termination timer may be

coupled to the LACK function. Then, if the termination timer expires while no LACK is received, the datalink dialogue may be terminated (see following section).

Thanks to the LACK, the RECEIVD[2] BY ATC indication is displayed on DCDU (respectively RECEIVED BY ATC indication on ATC mailbox) once the technical acknowledgement from the ATC controller's HMI is received. Please refer to the Part III - Appendix E for more details.

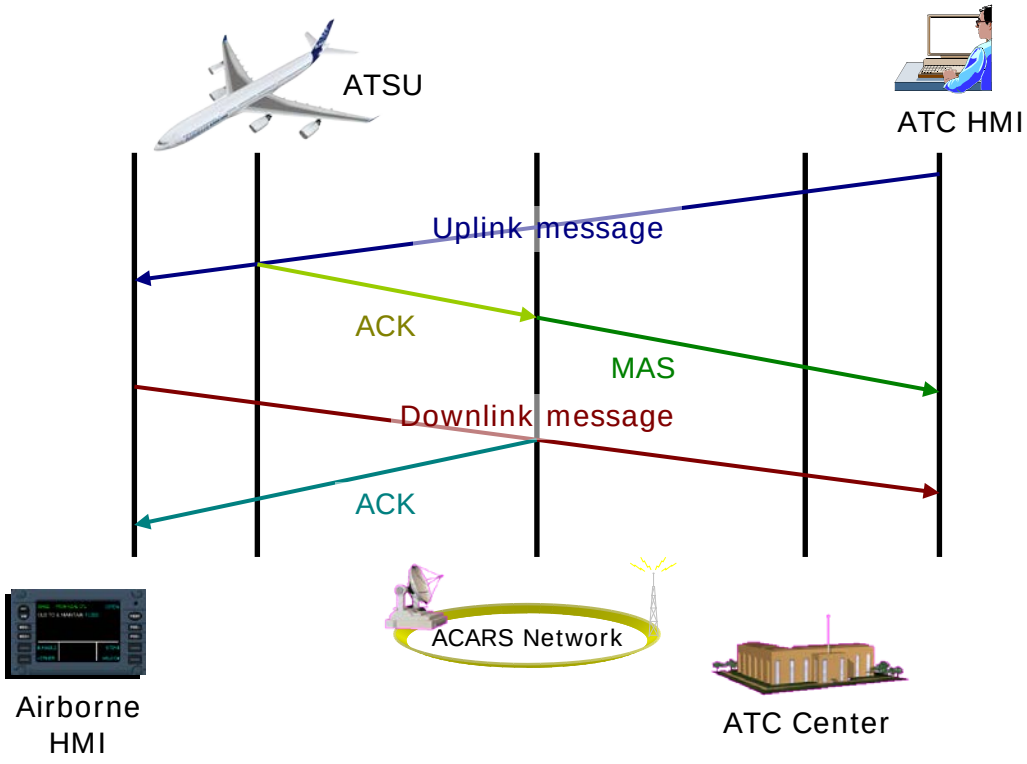

Figure 3-6
Technical acknowledgement in FANS 1/A environment

[2] One 'E' is omitted due to space restrictions imposed by the interface.

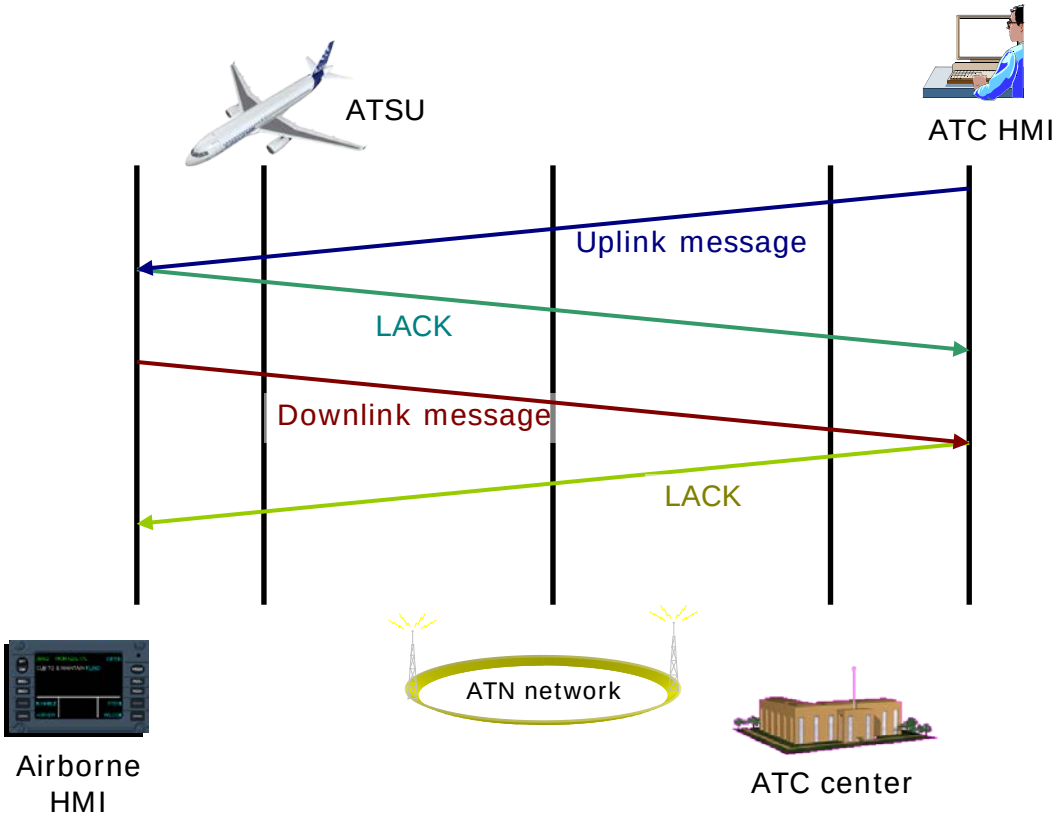

Figure 3-7
Technical acknowledgement in ATN environment

3.5.5. TIME STAMP

The time stamp is defined as the time when the message is sent.

3.5.5.1. IN FANS 1/A ENVIRONMENT

At the time when FANS A and FANS A+ systems were certified on A330/A340 aircraft, FANS 1/A standards did not require ATC centers to provide the time stamp in the message. Consequently, for the initial FANS A and FANS A+ systems on A320/A330/A340 aircraft, uplink messages are referenced according to the time of receipt onboard.
Then, the provision of the time stamp has become a common usage for all ATC centers around the world. It has been noticed that all ATC centers provide CPDLC messages with time stamp since 2009. Therefore, a HMI enhancement has been introduced in FANS A+ on A350/A380 and, to ensure a fleet consistency, this evolution has been implemented on the latest FANS A+ on A320/A330/A340. The default time information refers:

- To the time stamp if uplink messages are time-stamped.
- To the receipt time onboard if not.

Refer to Part II - Chapter A6 for more details.

3.5.5.2. IN ATN ENVIRONMENT

In ATN B1 environment, time stamp is mandatory. Consequently, FANS B/FANS B+ interface displays permanently the time stamp for uplink messages.

3.5.6. TIMERS

3.5.6.1. MESSAGE LATENCY TIMER

It is possible that a very delayed CPDLC message is still delivered to the aircraft. To overcome this problem, ATC centers and aircraft systems use the message latency timer. The message latency timer measures the difference between the timestamp and the time of receipt. If the message is received after the message latency timer expires, the message becomes invalid, the content of the message having lost its relevancy.

3.5.6.1.1. In FANS 1/A environment

The message latency timer relies on the Max Uplink Delay function. The ATC will need to instruct the flight crew to set the max uplink delay to a defined value. It is an integer value from 1 to 999 seconds.

Upon activation of the max uplink delay, the aircraft system discards the CPDLC message and automatically downlinks an error message if the calculated delay exceeds the max uplink delay value.

This feature is provided only on FANS A+ aircraft.

For more details see Part II - Section A5.4.6.12 Max Uplink Delay.

3.5.6.1.2. In ATN environment

As per ATN Baseline 1 standards, the value of the message latency timer should vary according to various connection conditions. Under certain circumstances, the timer value should be 21.6 seconds.

All stakeholders of the Link 2000+ programme including Eurocontrol identified and agreed with the irrelevancy of the variable timer principle set by the ATN Baseline 1 standards. Consequently, in the framework of the update of ATN Baseline 1 standards, some studies led to an optimal value of 40 seconds. However, the FANS B certification had been achieved before the update becomes available (expected for mid 2007). Concurrently, the Pioneer phase commenced before the optimal value has been defined.

On one hand, the Link 2000+ programme elected to a fixed value of 21.6 seconds for its Pioneer phase. On the other hand, Airbus elected to a fixed value of 60 seconds for the FANS B system. This FANS B deviation is known and accepted by Certification authorities. The Airbus policy was to avoid too many messages to be rejected due to a too much restrictive message latency timer.

For the Mandate phase, the FANS B+ package was certified with the value set to 40 seconds as prescribed by the Link 2000+ programme.

For more details see Part III- Section B5.4.8.1.3 Message latency timer.

3.5.6.2. ATN TIMERS

In ATN environment, to avoid any everlasting data link dialogue, timers are implemented. This is why time stamps are required in such environment.

Two types of timers are implemented:

- Technical response timer
- Operational timers.

3.5.6.2.1. Technical response timer

Whenever a message is sent, the recipient returns a LACK to the sender. The LACK notifies that the message has been well displayed on the recipient's interface. Refer to Section 3.5.4 – Technical acknowledgement: LACK/MAS.

Whenever a message is sent, a technical response timer is triggered. For airborne systems, the timer value is set to 20 seconds for FANS B (a Pioneer phase product) and 40 seconds for FANS B+ (a Mandate phase product). If the LACK is received after the technical response timer expires, the LACK is discarded.

Besides that, the operational response with reference to the message that has been sent is also discarded. It means that if the flight crew sends a message to the ATC and if the LACK is not received within 40 seconds, the ATC response, if any, to the message will not be displayed to the flight crew.

3.5.6.2.2. Operational timers

Operational timers are needed to avoid any datalink dialogue remaining open for an undefined time.

Therefore, the dialogue is closed:

- If an operational response is received within the timer lead-time, or
- If the timer has timed out.

As a datalink dialogue involves two end users, two operational timers are defined:

- Operational timer – Sender
- Operational timer – Responder.

According to whether the ATC controller or the flight crew sends the message, operational timer values vary.

- **Operational timer values for dialogue initiated by the flight crew**

The following figure depicts the values of operational timers when the flight crew sends a message to the ground. It means that the flight crew should expect the ATC response within 270 seconds, and that the ATC has 250 seconds after receiving the message to send his response.

If STANDBY is answered, all the operational timers (Sender and Responder) are reset.

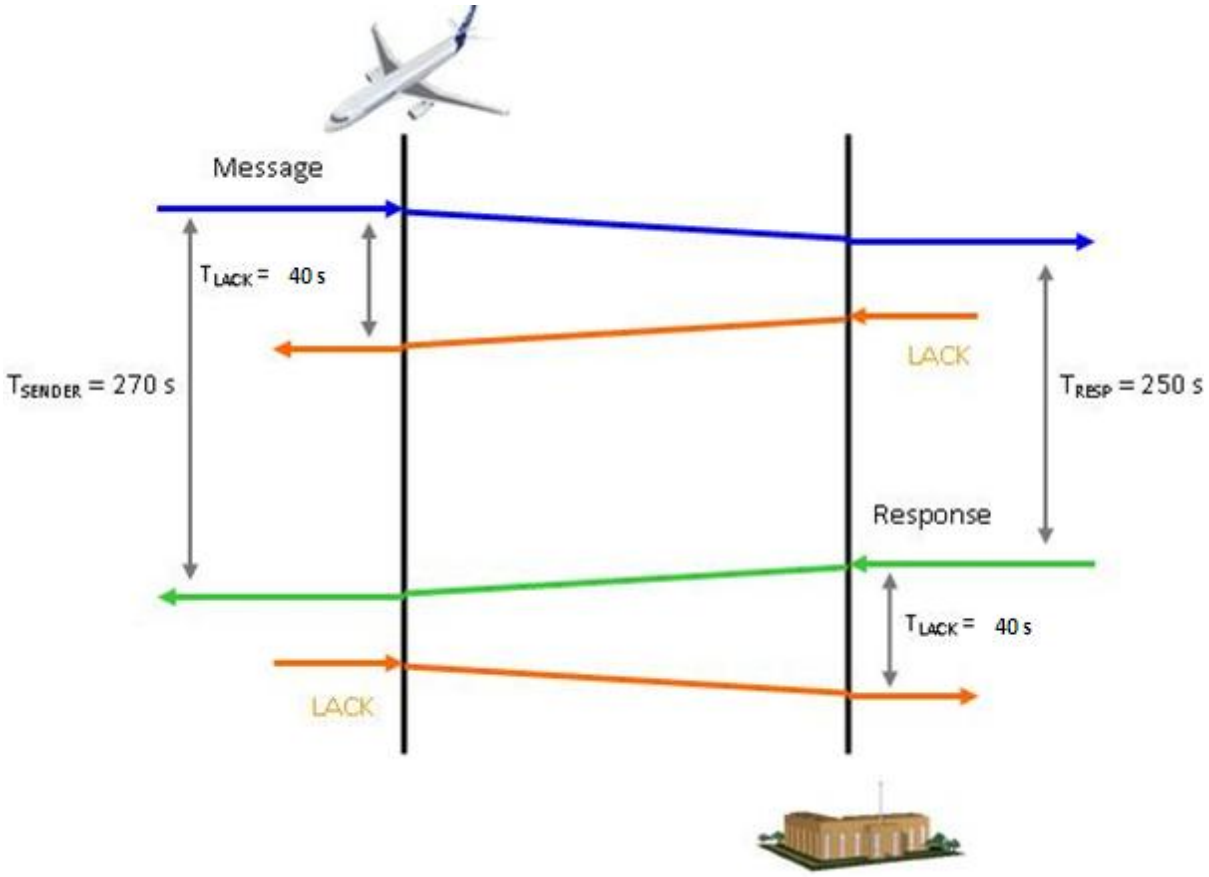

Figure 3-8
Operational timer values – Dialogue initiated by the flight crew

- **Operational timer values for dialogue initiated by the ATC**

The following figure depicts the values of operational timers when the ATC sends a message to the aircraft. It means that the ATC should expect the flight crew response within 120 seconds, and that the flight crew has 100 seconds after receiving the message to send his response.

If STANDBY is answered, then all operational timers (Sender and Responder) are reset. The STANDBY function can be triggered only once.

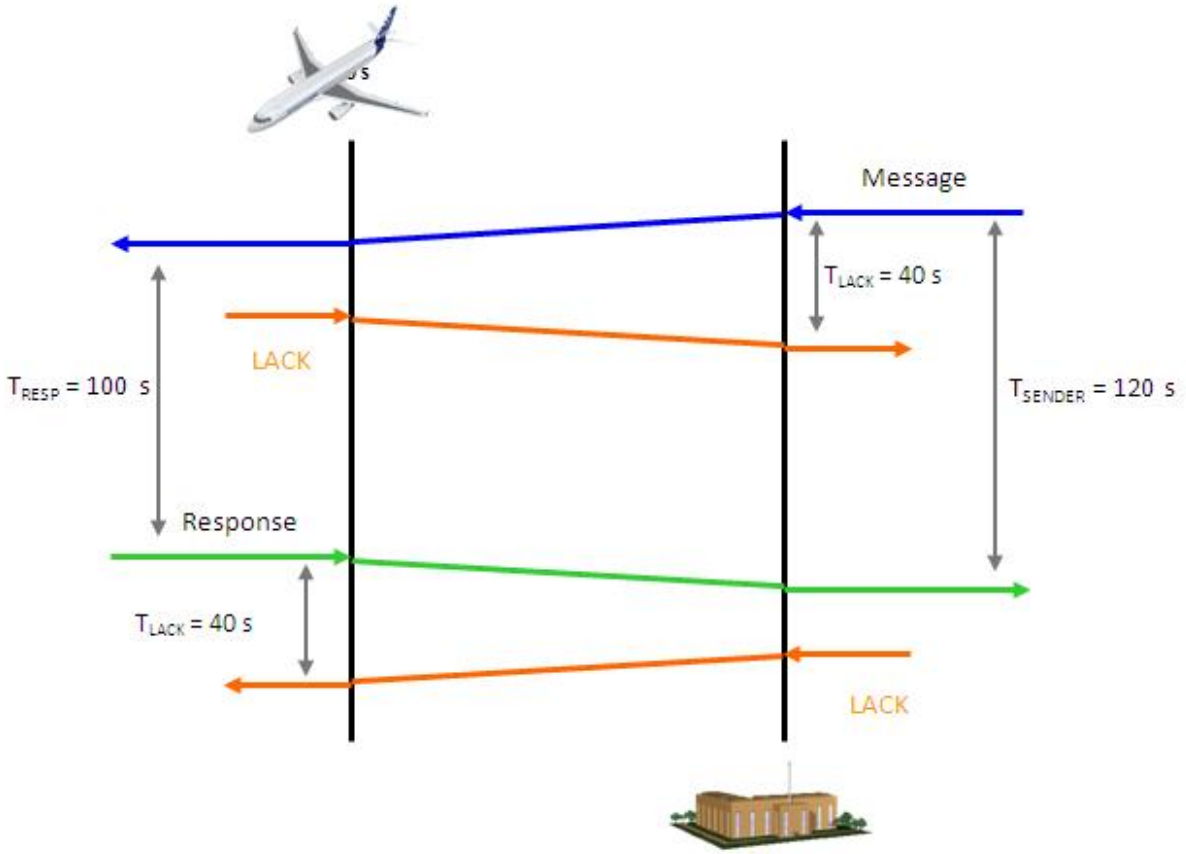

Figure 3-9
Operational timer values – Dialogue initiated by the ATC

Notice that 100 seconds are quite a short period of time to read the message, to interpret it, to check the aircraft parameters and to prepare the response, especially if a voice read-back has to be performed.

The ATN Baseline 1 standards define a 100-second timer assuming that no voice read-back is required.

As a general rule, any uplink message once received should be answered as soon as possible.

3.6. FANS ARCHITECTURE SUMMARY

The table below summarizes the previous paragraphs and provides a comparison between FANS A/A+ and FANS B/B+ systems.

System	FANS A		FANS A+	
Application	ATC***	AOC	ATC****	AOC
Environment	Oceanic and Remote**			
Network	ACARS			
Datalink Media	VDL mode A	VDL mode A/2	VDL mode A/2	VDL mode A/2
	SATCOM	SATCOM	SATCOM	SATCOM
		HFDL	HFDL*	HFDL

*Certified as a supplementary means.
**Used in Oceanic and remote but also in high-density continental over US airspace.
***ATC includes AFN, CPDLC, ADS-C applications.
****ATC includes:

- AFN, CPDLC, ADS-C applications
- ATS 623 applications if ATS 623 applications option is selected.

System	FANS B		FANS B+		
Application	ATC*	AOC	ATC**		AOC
Environment	High-density Continental				
Network	ATN	ACARS	ATN	ACARS	ACARS
Datalink Media	VDL mode 2	VDL mode A/2	VDL mode 2	VDL mode A/2	VDL mode A/2
		SATCOM		SATCOM	SATCOM
		HFDL			HFDL

*ATC includes CM and CPDLC applications.
**ATC includes:

- CM and CPDLC applications for ATN network
- ATS 623 applications for ACARS network if ATS 623 applications option is selected.

Please bear in mind…

3. FANS COMPONENT DESCRIPTION

FANS Architecture

- **The airborne part:**
  - **For A320/A330/A340 aircraft**, the **ATSU** that manages all the communications and automatically chooses the best available medium (e.g. VHF, SATCOM and HF, in that order).
  - **For A350/A380 aircraft**, the **ATC applications** manage the ATC datalink functions, and the **ACR** manages the routing function (e.g. selection of the best available medium).
- **The air/ground datalink**: used to transmit AOC or ATC data to the ground through VDL mode A, VDL mode 2, SATCOM and HFDL.
- **The ground/ground datalink**: to ensure the connection to the ground parts through either satellites Ground Earth Stations (GES), VHF and HF Remote Ground Stations (RGS) or air-ground processors (which route and handle the messages).
- **CSP** operating with national service providers are currently interconnected to provide a global interoperability of ATS datalink applications.

FANS 1/A applications

- **ATS Facility Notification (AFN)**

Through this application, an ATC knows whether an aircraft is capable of using datalink communications or not. This exchange of the datalink context is needed prior to the establishment of any CPDLC or ADS-C connection.

- **Controller Pilot Data Link Communications (CPDLC)**

CPDLC is a powerful tool to sustain datalink communications between the flight crew and the ATC controller of the relevant flight region.

It is particularly adapted to such areas where voice communications are difficult (e.g. HF voice over oceans or remote part of the world), and is expected to become very convenient to alleviate congested VHF of some busy TMAs when utilized for routine dialogue (e.g. frequency transfer).

- **Automatic Dependent Surveillance-Contract (ADS-C)**

ADS-Contract is an end-to-end application that uses datalink as CPDLC. ADS-C application is hosted by ATSU (respectively ATC applications) on A320/A330/A340 (respectively A350/A380).

Through the ADS-C application, the aircraft automatically sends aircraft surveillance data to the connected ATC centers (up to 5). This is done automatically and remains transparent to the crew.

Different types of ADS-C "contracts" exist: periodic, on demand and on event.

ADS-Broadcast (ADS-B) is a transponder Mode S application that broadcasts data through the transponder aerial. This is also fully automatic and transparent to the crew. Any station equipped with a Mode S receiver is able to collect broadcasted data.

Please bear in mind… (continued)

ATN B1 applications

- **Context Management (CM)**

This application provides the **Data Link Initiation Capability (DLIC)** service that is similar to the FANS 1/A AFN application and remains mandatory prior to any CPDLC connection.

- **Controller Pilot Data Link Communications (CPDLC)**

It is an application similar to the FANS 1/A CPDLC application and is restricted to non-time critical situations.

Three services are provided: the **ATC Clearance (ACL)** to communicate, the **ATC Communication Management (ACM)** service to manage the centre transfers, and the **ATC Microphone Check (AMC)** to check that the voice frequency is not blocked.

Thanks to the **LACK**, the end user (flight crew or ATC controller) knows when the message is displayed on the recipient's screen. In addition, the introduction of operational timers imposes to answer a message in a timely manner.

Differences between FANS 1/A and ATN

The operational constraints set by the oceanic/remote and high-density airspaces are different. As such, FANS 1/A and ATN environments are differently designed. The main differences are:

- **CPDLC is the primary means of communication in FANS 1/A environments** when the aircraft is equipped with datalink systems. In ATN environment, voice will remain the primary means.
- **Protected Mode** is used only in ATN environments and guarantees that CPDLC message is always delivered to the intended receiver. Thanks to the Protected Mode, the Voice Read-Back (VRB) procedure is no more required.
- **Technical acknowledgement**: acknowledgements in FANS 1/A environments and ATN environments do not have the same meanings.
- **Message latency timer**: if the message is received after the message latency timer expires, the message becomes invalid, the content of the message having lost its relevancy. The message latency timer is based on a value uplinked by ATC (see Max Uplink Delay function) in FANS 1/A whereas it is a value fixed in avionics system in ATN environments.
- **Timers:** in ATN environments, the transmission of a message must be achieved in a limited time. In addition, flight crew and ATC controllers have a limited time to answer a message. Timers are intended to avoid any datalink dialogue remaining open for an undefined period.

4. AIRBUS FANS DESCRIPTION

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4.1. A320/A330/A340 FANS ARCHITECTURE

The Airbus drivers in defining its system are:

- To adapt the aircraft to the various CNS-ATM environments,
- To cope with a moving FANS world,
- To minimize the burden of the airlines in their transition to CNS-ATM ,
- To introduce a user-friendly Human Machine Interface for the datalink,
- To ensure the harmonization of FANS products over Airbus family.

The FANS architecture on A320/A330/A340 aircraft can be depicted as follows.

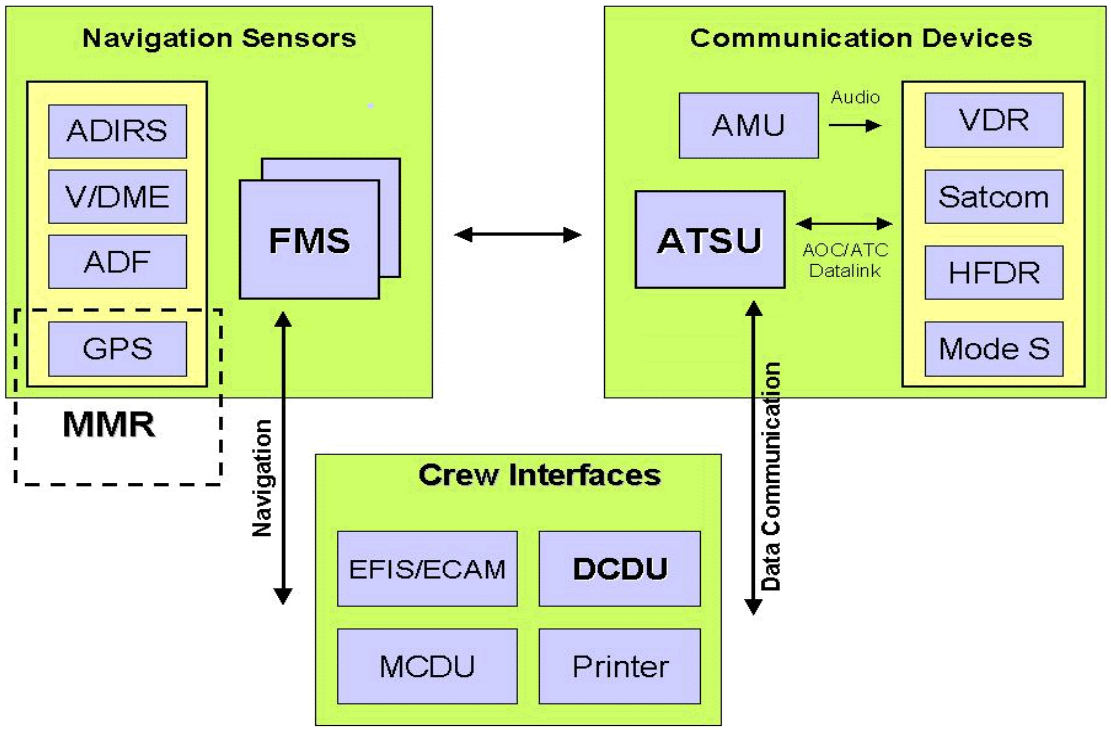


Figure 4-1
A320/A330/A340 FANS architecture

Note: In the latest FANS A+ and FANS B+ systems, there is a link between the Air Traffic Services Unit (ATSU) and the Radio Management Panel (RMP) to enable the Frequency Loading feature.

4.1.1. ATSU FOR A320/A330/A340 AIRCRAFT

The avionics unit, named Air Traffic Services Unit (**ATSU)**, has been developed to cope with datalink communications. Its functions are:

- To manage the HMI, the display and warning systems. It warns the crew of any up-coming message, displays it, and also sends the appropriate data to the peripherals
- To enable the access to all available communications media along the flight. The selection of the media is made automatically and without any flight crew action

- To sustain the communications tasks (e.g. selection of the appropriate ATC Center for datalink all along the flight).

ATSU manages all the messages (up/down link) regardless of their types (ATC clearance, ADS-C, flight crew requests, AOC, flight information). Today's ACARS functions are included in the ATSU. There is no longer a need for an ACARS management unit.

In the frame of current FANS architecture, only one ATSU is used. For later steps coming with the future FANS evolutions, Airbus will study the possibility to install two ATSUs, to cope with the objective to improve of the performance, availability and safety on datalink communications.

The ATSU is a hosting platform, which has been designed so as to take provision of all foreseen evolutions. This modularity concept for both software and hardware permits to ease a quick and dependable introduction of all the ATC datalink capability during the transition to the ultimate full FANS.

Note: It must be noted that Air Traffic Services Unit (ATSU) in Airbus and ICAO documentations have not the same meaning that could lead to confusion. In Airbus documents, the ATSU corresponds to the on-board unit installed on A320/A330/A340 aircraft while the ATSU represents an ATC center in ICAO definition.

The following figures depict the ATSU modularity concept.

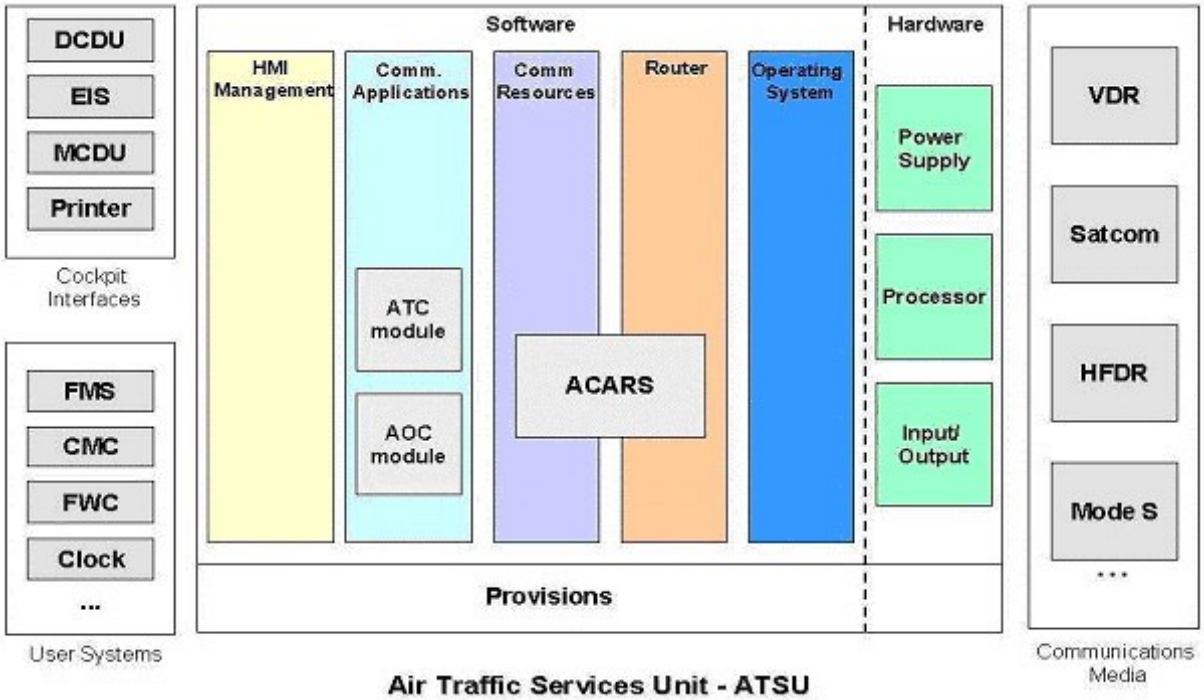


Figure 4-2
ATSU architecture for FANS A/A+ systems

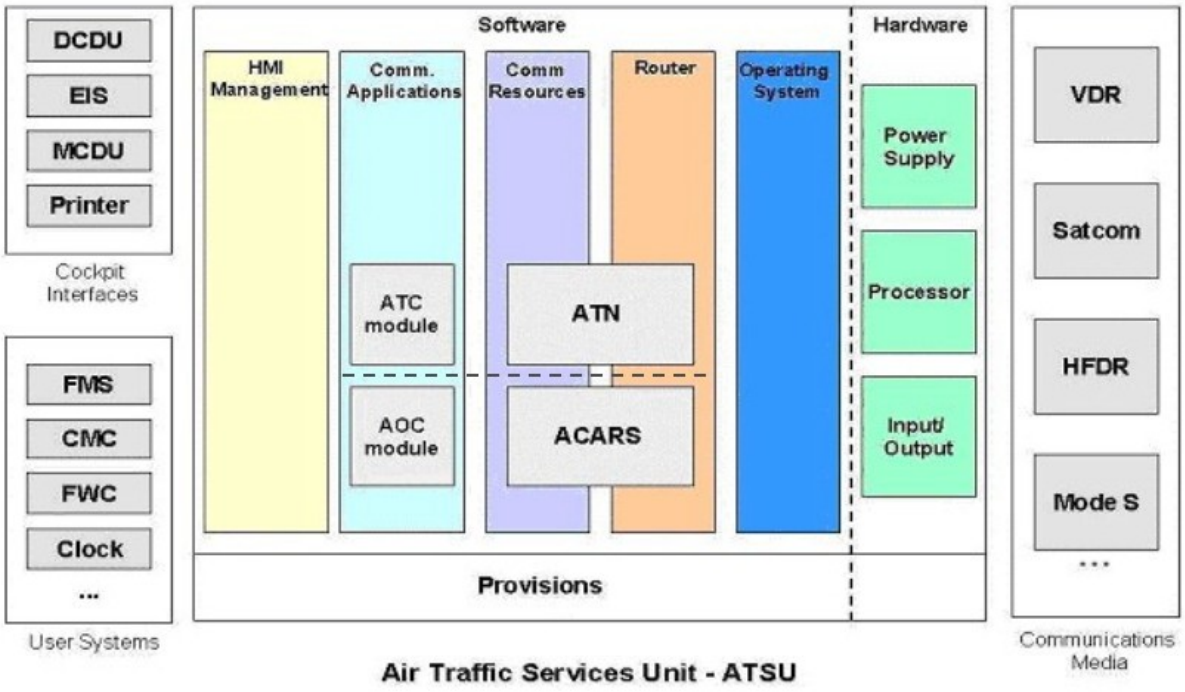


Figure 4-3
ATSU architecture for FANS B/B+ systems

4.1.2. THE NEW FMS (2ND GENERATION FMS)

The following chapter describes the role of the FMS within the FANS A operations.

The FMS[3] is a key element of the Airbus FANS system for which it ensures three main functions:

- It provides data to the ATSU.
- It monitors the ATC messages and their subsequent implications.
- It handles and processes some of the ATC messages.

The FMS can first be seen as a data provider for both ADS-C and CPDLC messages. As such, it periodically sends all the ADS-C parameters, whether for the basic group (position, altitude, cross track...), the predicted route frame or the intent group. The predicted position, altitude, speed or sequencing time for up to the next 2 waypoints of the flight plan are thus sent by the FMS to the ADS-C application of the ATSU.

Position reports messages, whether for manual CPDLC messages or for automatic ADS-C, are processed by the FMS.

The FMS monitors the ATC conditional or deferred clearances that are linked to the navigation (e.g. "AT ALCOA CLIMB TO AND MAINTAIN FL 350"). The FMS triggers the signal to warn the flight crew of the completion of the clearance.

[3] In the frame of the first release of the FANS B system, the interface between ATSU and FMS is limited. The FMS only provides the ATSU with the flight number, the departure and destination airports, and the aircraft position.

Whenever confirmation messages are received (e.g. "CONFIRM ASSIGNED SPEED") the FMS automatically proposes the answer to the flight crew. This is true for both current data (e.g. altitude, speed, route...) or target data (e.g. altitude, speed, heading...)

Route requests or route clearances are processed by the FMS. Once prepared in the secondary F-PLN, a route request is sent by the FMS to the ATSU/DCDU prior to being sent. Similarly, once a route clearance (or a re-route proposed by the AOC) is received, it is loaded into the FMS, which acknowledges or rejects this new routing. The reasons for a rejection (for instance proposed waypoint not in database) are indicated to the flight crew so that they can solve the issue. Co-ordination and exchange of F-PLN between ATC, AOC and the aircraft are processed with the FMS.

4.1.3. A320/A330/A340 CREW INTERFACES

The main crew interface used for the FANS applications is based on the two Data Communications Display Unit (DCDU), which are LCD screens dedicated to the ATC datalink messages. All ATC messages whether clearances (uplink message), requests or answers (downlink messages) are displayed on the DCDU.

The two DCDUs are located in the main deck, just above each MCDU. The retained principles for an operational use of the DCDU are described in the following sections.

In addition to the DCDU, the MCDU is mainly used to prepare a request. Once ready, the request is transferred to the DCDU for sending.

Any ATC message can also be printed on the printer, at any time.

4.2. HUMAN MACHINE INTERFACE ON A320/A330/A340 AIRCRAFT

The following figure gives a general view of an A340 cockpit with the main elements of the interface. These elements are identical for A320 family aircraft .
The Human Factors considerations were particularly addressed all along the development of this interface. From the initial capture of the operational needs at the very beginning of the design phase, to the operational flight test evaluation and certification, numerous flight crew from various origins such as flight test, training instructors and flight crews, were involved in the definition of this interface. The whole Human Factors plan, as defined and presented to the airworthiness authorities, was also applied.

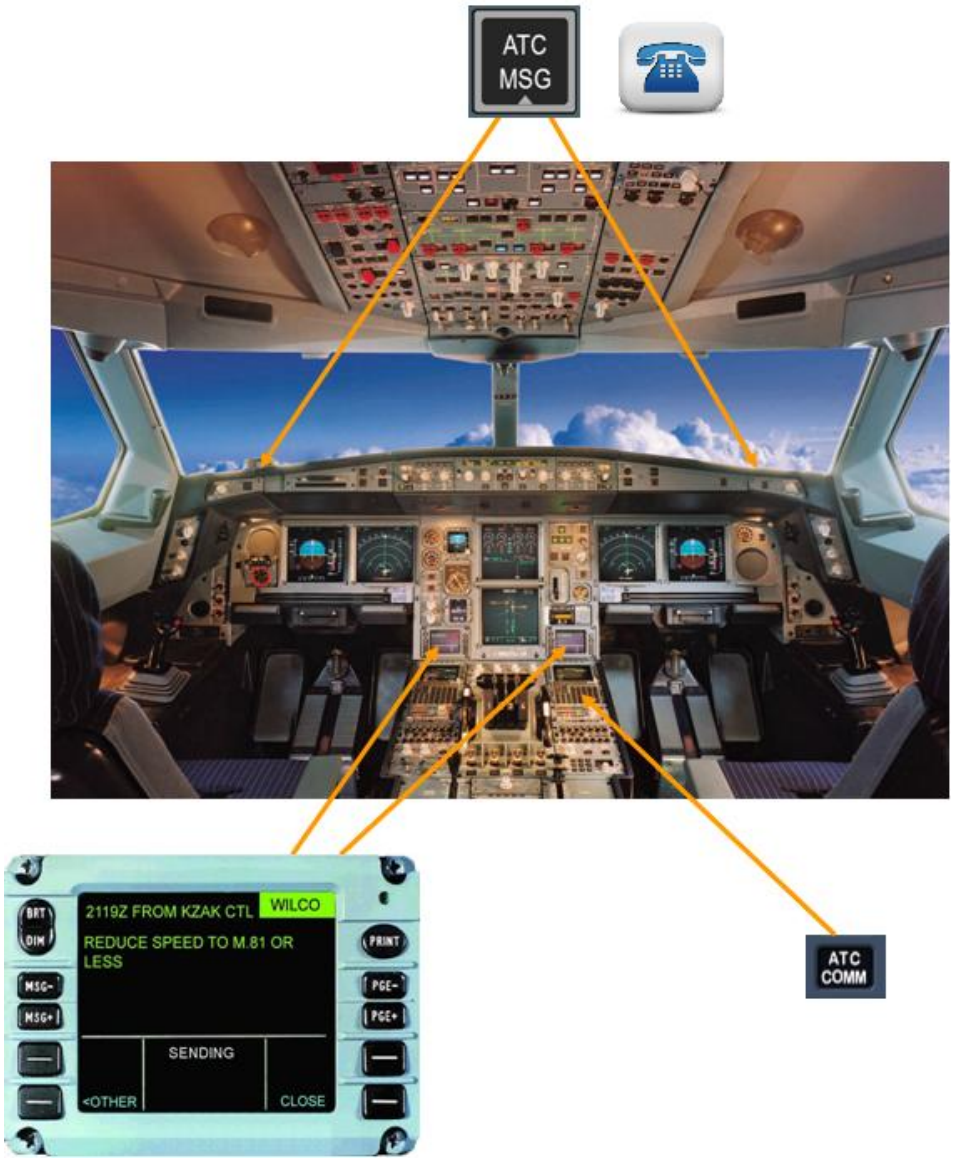


Figure 4-4
A320/A330/A340 FANS Human Machine Interfaces

The retained interface, with the two DCDUs in the core part of the cockpit, provides a minimum perturbation of the existing procedures. This enables a simple reversion to backup voice-based procedures when needed.

The DCDU provides permanent accessibility and readability for both flight crew members, that requires only limited head-down time.

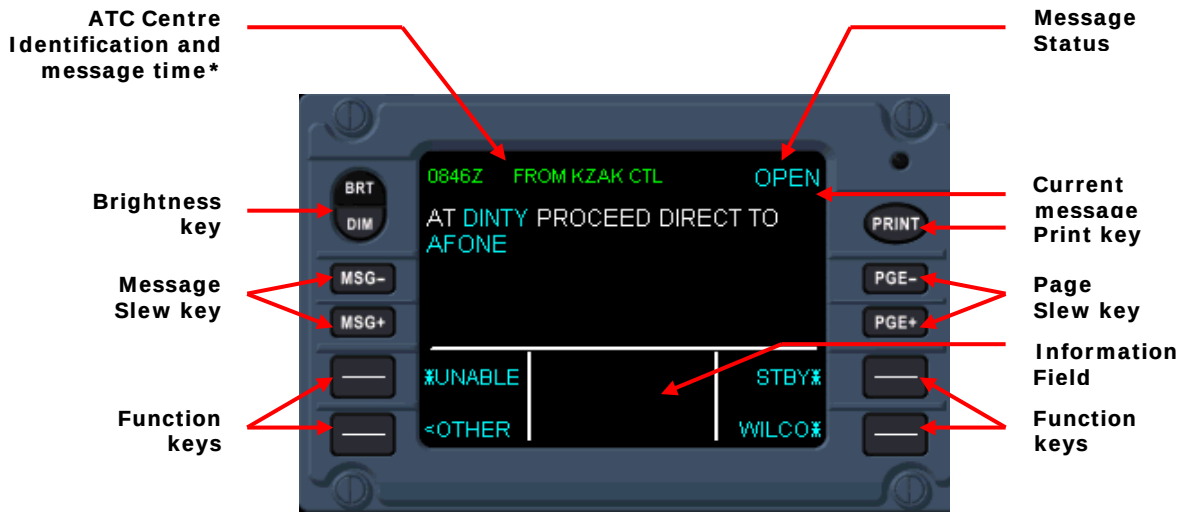


Figure 4-5
Datalink Control and Display Unit (DCDU)

*For more details about the message time, refer to Section 3.5.5 Time stamp

4.2.1. BASIC OPERATIONAL PRINCIPLES

The flight crew is alerted of an incoming message by:

- Two flashing blue ATC MSG pushbuttons on the glare shield (i.e. visual),
- A dedicated audio sound.

The alert is stopped by pressing one of these two pushbuttons or by answering the message, directly on the DCDU:

- **For normal messages**[4], the buttons flash, and the aural alert is repeated **every 15 seconds** (with the first signal delayed by 15 seconds, so as not to make useless nuisance). The message will appear on the DCDU if the screen is empty. If the screen is not empty, a flashing cue (e.g. MSG 1/2) reminds the crew of the arrival of the message.
- **For urgent messages**[5], the buttons flash, the aural alert is repeated **every 5 seconds** (with the first signal delayed by 5 seconds, so as not to make useless nuisance).The message is displayed on the DCDU regardless of the state of the screen.

Note 1: The aural alert is similar to an old telephone sound. It was elected by a great majority of the consulted flight crews.
Note 2: The alerts (i.e. aural and visual alerts) are inhibited during critical phases (i.e. take-off and landing phases).

[4] Exception: in FANS B+, for normal messages the aural alert starts 10 seconds after the reception of the message and repeats every 10 seconds.
[5] Exception: in FANS B+, for urgent messages the aural alert begins immediately after the reception of the message and repeats every 5 seconds.

To reply to a message, the flight crew either uses the standard replies proposed on the DCDU or composes a reply on a menu-page from the MCDU. After composing the message on the MCDU it is transferred to the DCDU for sending (refer to operational scenarios in appendices of Part II or Part III).

4.2.2. MAIN HMI RULES

The following lists the main principles retained for the HMI.

4.2.2.1. DCDU

- The two DCDUs are dedicated displays for datalink communications, for either type of messages (up or down link).
- Both DCDUs are identical and synchronized. Any operation on either DCDU is valid for both of them, and both DCDUs show the same display.
- A star "*" in front of a key means the key is available. Pressing a key without a star will have no effect.

4.2.2.2. MCDU

- The MCDUs are also part of the ATS datalink system. They are used to prepare downlink messages such as requests or free texts. They also provide an access to the record of messages.
- The "ATC COMM" key of the MCDU gives access to the various pages of the ATS datalink system (this key is optional while retrofitting FANS B/B+ on A320 aircraft equipped with Legacy FMS).

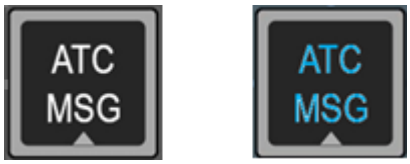
Figure 4-6 ATC MENU display in MCDU on FANS A aircraft

- "*", "<" or ">" beside a LSK means the key is available. Pressing a LSK that is not associated with one of these symbols will have no effect.

4.2.2.3. ALERT

- The alert function is triggered:
  - Each time a new uplink message arrives,
  - Whenever a deferred report or clearance expires.

- Both ATC MSG pushbuttons on the glare shield flash in cyan until the flight crew acts (either by pressing one of the pushbuttons or by answering the uplinked message on the DCDU).



4-7
ATC pushbutton
OFF (left) and ON (right)

- The specific ATC aural alert may also be activated (after 5 sec or 15 sec in FANS B and immediately or after 10 sec in FANS B+, according to the urgency of the message).

4.2.2.4. MESSAGES

- As soon as the alert is triggered, the associated ATC message may be accessed and viewed on both DCDUs.
- DCDU displays only one open message at a time.

- Messages are filled in the DCDU in a chronological order regardless of the urgency of the messages.
  - If the DCDU is empty, any message that is received is immediately displayed.
  - If the DCDU contains already some messages:
    - When a normal message is received, this message is not immediately displayed and is filled in the DCDU in a chronological order.
    - When an urgent message is received, this message is immediately displayed to draw the attention of the flight crew; but it is still filled in the DCDU in a chronological order.

Refer to Figure 4-8.

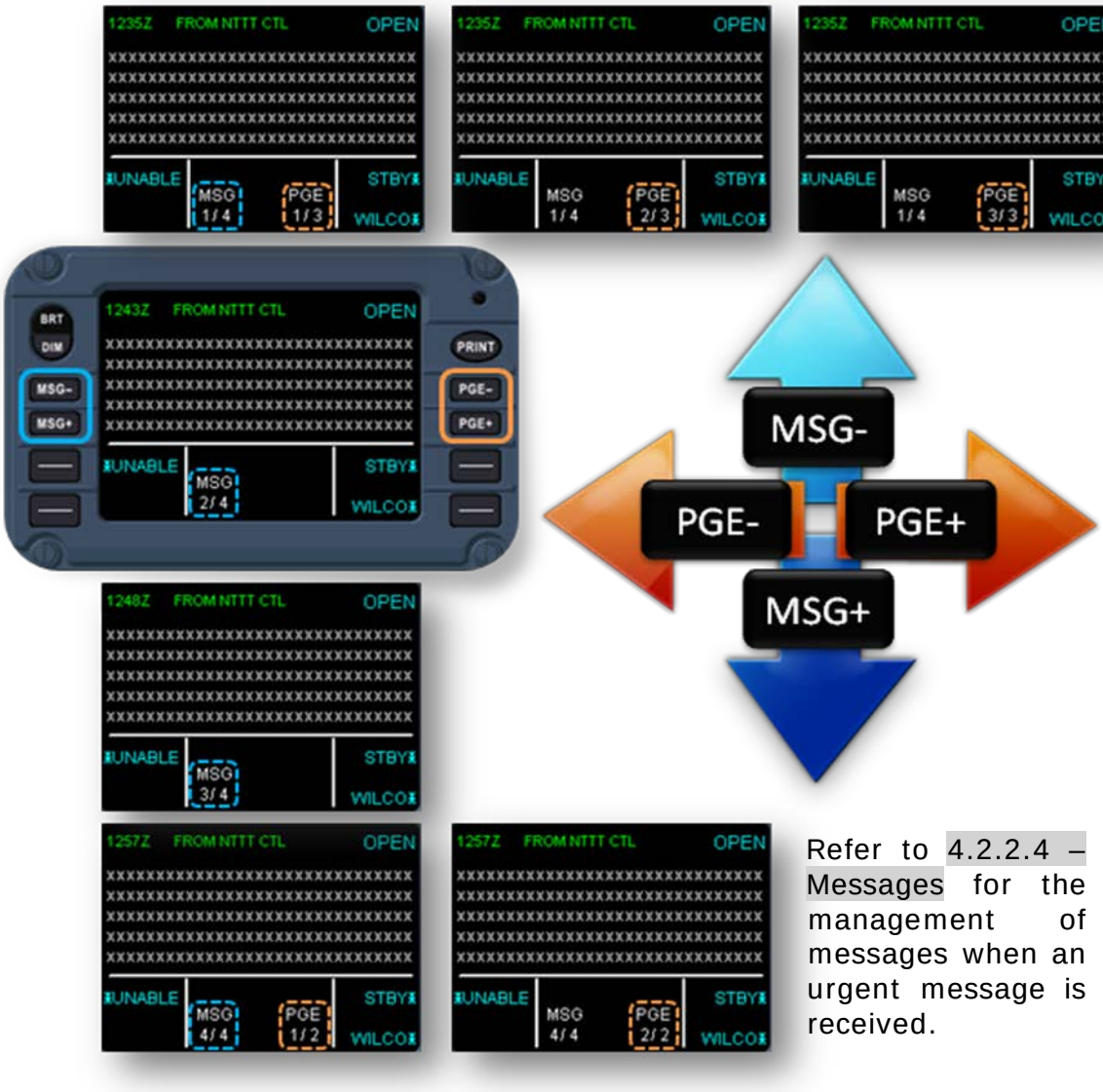
- The flight crew can transfer downlink messages (e.g. requests) from MCDU to DCDU with the transfer prompt (ATC REQ DISPL on FANS A, or ATC MSG DISPL on FANS A+, improved as XFR TO DCDU on FANS B/B+).

- In the latest FANS A+ and in FANS B+, the system will automatically close some messages in the DCDU. This rule concerns:
  - Any downlink message initiated by the flight crew
  - Any uplink message that contains no clearances.

The message is closed 5 seconds after:

- The LACK reception in the LACK regions (where the LACK is supported)
- The message sending in non-LACK region (where the LACK is not supported).

The access to messages is based on the principle described in the following figure.



Refer to 4.2.2.4 – Messages for the management of messages when an urgent message is received.

Figure 4-8
Management of messages and pages

Any next or previous page of the currently displayed message can be accessed through the DCDU keys 'PGE+' and 'PGE-' respectively.

Any next or previous message of the message queue can be accessed through the DCDU keys 'MSG+' and 'MSG-' respectively.

Note: Several scenarios are provided in appendices of Part II and III to develop the handling of both DCDU and MCDU.

4.2.2.5. PRINTER

- At any time, the flight crew can print entirely:
  - The message displayed on DCDU or MCDU
  - The message record stored in MCDU.

4.2.2.6. INTERACTIONS WITH FMS

4.2.2.6.1. FANS A/A+

The interactions between ATSU and FMS enable the following features:

- The flight crew may load an ATC flight plan or route clearance to the FMS secondary flight plan via the LOAD key of the DCDU. An indication on DCDU (e.g. LOAD OK or LOAD PARTIAL) informs the flight crew if the loading has been successful or not. Whenever this loading cannot be done entirely (for instance waypoint not in data base, runway/ILS mismatch, etc) the flight crew can access the MCDU secondary F-PLN pages to assess the reasons for the rejected parameters, and take appropriate actions.

- The FMS processes ATC messages that require navigation parameters (e.g. CONFIRM SPEED). The DCDU automatically displays an answer with the FMS data. The flight crew can nevertheless modify this message before sending it (press MODIFY soft key on DCDU to open the edition mode on MCDU).

- The FMS monitors when REPORT messages (e.g. REPORT PASSING ALCOA) are received and accepted by the flight crew. When it is time to report, the DCDU automatically displays the appropriate answer.

- The FMS monitors the conditions of deferred clearances (e.g. AT ALCOA CLB TO FL350). 30 seconds before the conditions are met, the DCDU automatically displays the message to remind the flight crew of this clearance.

4.2.2.6.2. FANS B/B+

- The initial implementation of datalink in ATN environments (e.g. Link 2000+ programme) does not require sophisticated interface with FMS. Therefore, for the first release of the FANS B/B+ systems, there is a light interaction between the FMS and ATSU. Indeed, the FMS provides the ATSU with the following parameters for initialization purposes:
  - The flight number
  - The departure and destination airports
  - The aircraft position.

4.2.2.7. COLOUR CODING

The following colour coding is used for the DCDU:

- The title is always displayed in **GREEN**.
- Uplink messages are displayed with the text in **WHITE** and the main parameters are highlighted in **CYAN**.
- Closed actions are always in **GREEN**.
- Configuration or failure requiring awareness but no immediate action is displayed in **AMBER**.
- NORMAL VIDEO is used for uplink.
- REVERSE VIDEO is used for downlink.

4.3. A350/A380 FANS ARCHITECTURE

Design drivers used for A320/A330/A340 FANS architecture reapply to the A380 FANS architecture.

The following figure shows a simplified view of the A380 architecture. For a clear and rapid overview, not all the links are represented. In the same way, not all the components are represented.

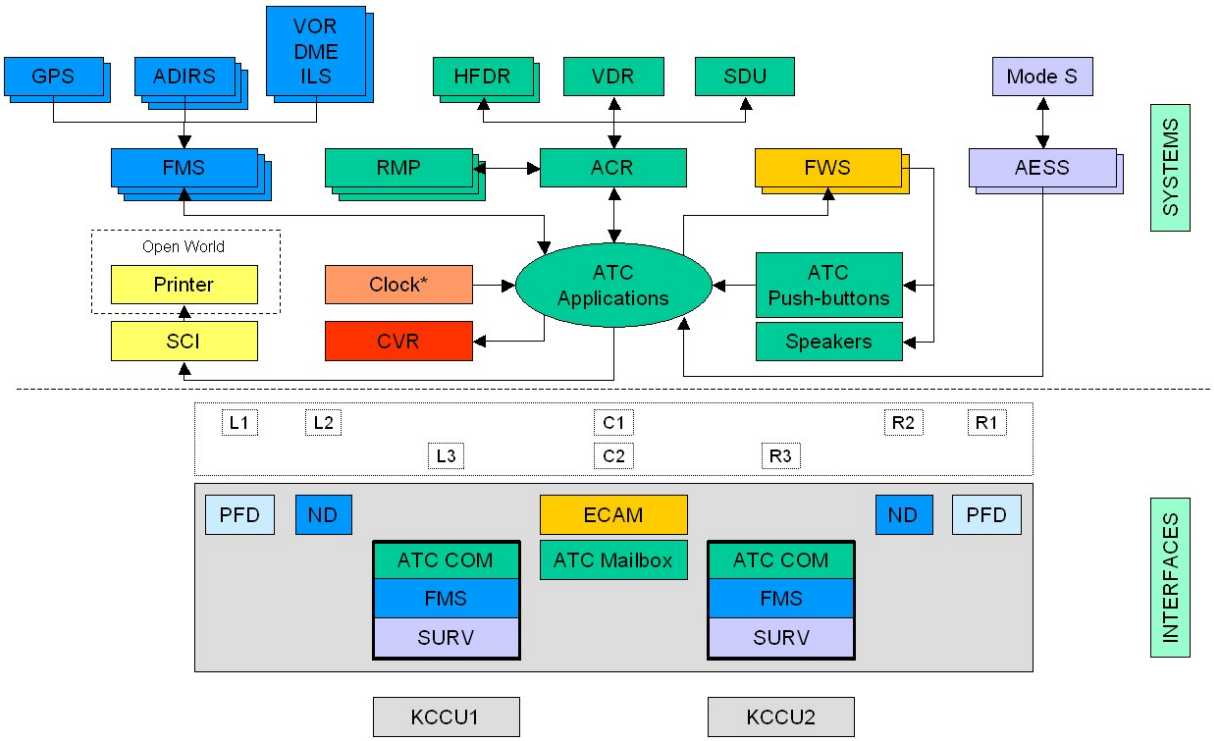


Figure 4-9
A380 FANS architecture

*The clock feeds ATC applications via IOM. Besides, as a back-up, ADIRS modules directly feed ATC applications if the clock fails to provide time information. ADIRS modules are also used as back-up if FMS fails to provide flight parameters.

The A350 FANS architecture is fully inherited from the A380, based on the two central systems (ATC/ACR), the centralized ATC mailbox and the ATC COM pages available on MFD, the ATC MSG pushbuttons. However, one noticeable difference between A350 FANS and A380 FANS remains the cockpit displays layout. The A380 ten screens layout including two Onboard Information Terminals (OITs) has been replaced by six larger screens.

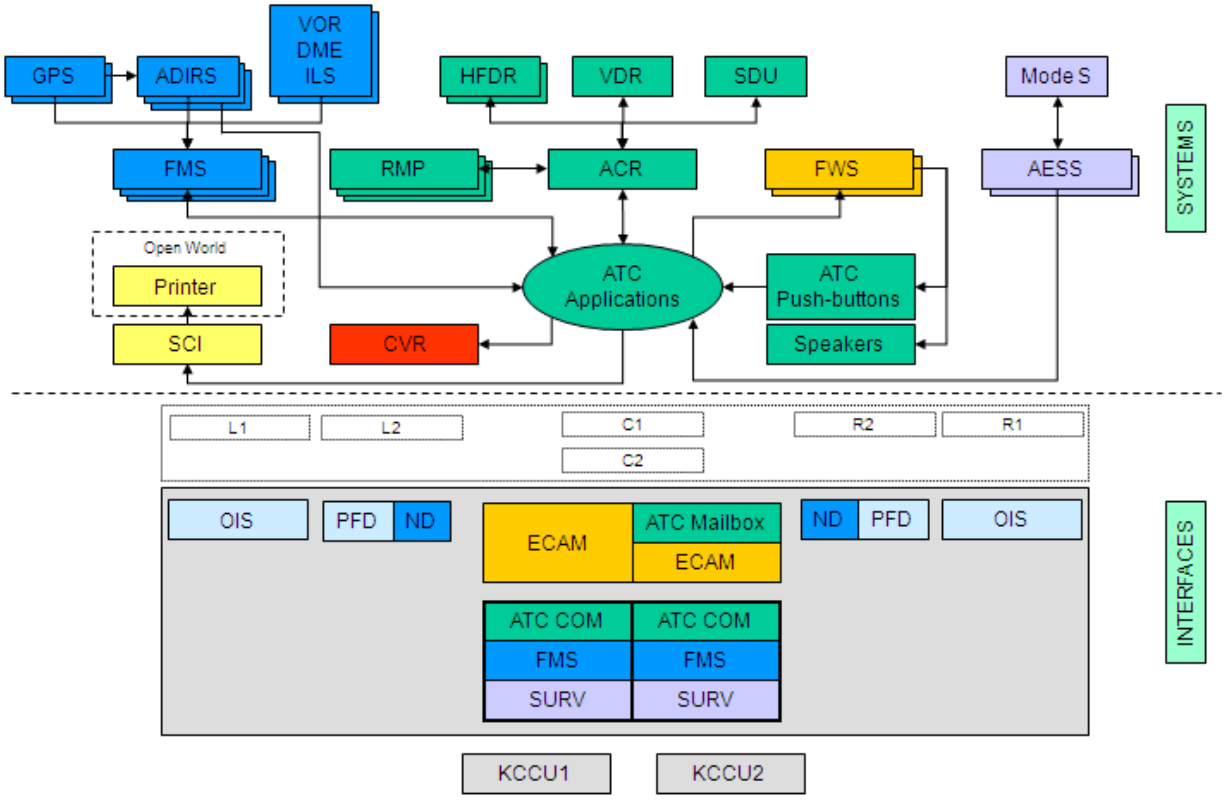


Figure 4-10
A350 FANS architecture

Note that one minor difference between A350 and A380 FANS architecture concerns the clock. ADIRS modules send periodically the clock information to ATC applications on A350 whereas the clock module feeds the ATC applications on A380.

4.3.1. ATC APPLICATIONS

In A320/A330/A340 architecture, systems are hosted by Line Replaceable Unit (LRU). The ATSU and DCDU are part of these LRUs. The A350/A380 technology replaces the LRUs by Integrated Modular Avionics (IMA). For more details, please refer to:

- A380 Flight Deck and System Briefing for Pilots - Section Avionics Networks and IMA
- A350 Flight Deck and System Briefing for Pilots - Section Avionics Network and IMA

available at:
https://w3.airbus.com/crs/A233_Flight_Ops_GN60_Inst_Supp/FlightDeck/index.htm.

Then each system is identified as an application hosted in an IMA.

Onboard the A350/A380, instead of an ATSU, the ATC datalink communications are ensured by the **ATC datalink applications**. Considering ATC datalink communications, the ATC datalink applications provide the same functions as the ATSU does:

- To manage the HMI, the display and warnings. It warns the crew of any upcoming message, displays it, and also sends the appropriate data to the peripherals
- To sustain the communications tasks (e.g. selection of the appropriate ATC Center for datalink all along the flight).

However, the **Avionics Communication Router (ACR)** on A350/A380 aircraft supports the routing function, which was integrated in the ATSU on A320/A330/A340 aircraft. The main function of ACR is to enable the access to all available communications media along the flight plan. The selection of the media is made automatically and without any flight crew action.

The routing function has been granted to a dedicated system, as many other applications require a connection to the ACARS network (e.g. AOC FMS, AOC OIS, Refuel, E-logbook, etc).

Whenever mentioned in the three parts of this document and except when specified, the term "ATC applications" refers to the onboard system in charge of ATC data links as described in this section.

4.3.2. A350/A380 CREW INTERFACES

For A380 ATC applications, the main cockpit interface is the centralized ATC mailbox. All ATC messages whether clearances (uplink message), requests or answers (downlink messages) are displayed in the ATC mailbox.

The A380 ATC mailbox is located in the main deck, just below the permanent data. The retained principles for an operational use of the mailbox are described in the following section.

In addition to the ATC mailbox, the MFD ATC pages are mainly used to prepare a request. Once ready, the request is transferred to the mailbox for sending. Pages related to FANS functions on MFD can be directly displayed thanks to the ATC COM shortcut located on KCCU.

To ensure a consistency on Airbus fleet, the A380 crew interfaces and A380 HMI principles have been reused on A350 with the ATC mailbox and the ATC COM pages on the MFD. The difference between A350 and A380 concerns the size and location of the screens that display the ATC mailbox and MFD ATC COM Pages. On A350, the ATC mailbox is located on the upper center display unit just above the ECAM and the MFD ATC Pages on the lower center display unit.

Any ATC message can also be printed at any time.

4.4. HUMAN MACHINE INTERFACE ON A350/A380 AIRCRAFT

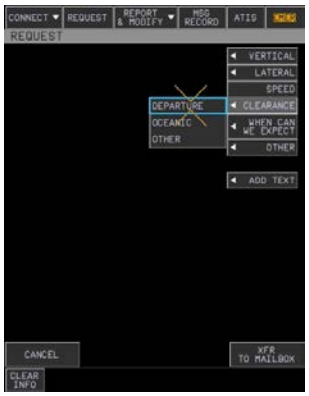
Figure 4-11
A380 FANS Human Machine Interfaces

Figure 4-12
A350 FANS Human Machine Interfaces

The figure above gives an overview of the A350/A380 cockpit with the main elements of the FANS interfaces.

As for A320/A330/A340 interfaces, a Human Factor process had been applied all along the development. The centralized mailbox ensures that both flight crew members read the same thing. Like the DCDU, the mailbox is permanently visible. Therefore the same procedures as on A320/A330/A340 aircraft are applicable. Principles of message display in terms of colour coding and reverse video are the same as for a DCDU.

The following table compares the interfaces available on A320/A330/A340 aircraft and A350/A380 aircraft, regardless of the FANS system.

Interfaces	A320/A330/A340 aircraft	A350/A380 aircraft
Aural alert when receiving a message.		
Visual alert when receiving a message.		
To receive or to send a message.		
To edit a message.		

Interfaces	A320/A330/A340 aircraft	A350/A380 aircraft
To get to ATC COM pages (via soft keys).		
To get ATC COM pages (via ATC COMM hard key) or to get ATC mailbox (via MAILBOX hard key). Note: MAILBOX key is only available on KCCU.		

4.4.1. BASIC OPERATIONAL PRINCIPLES

The basic operational principles are exactly the same as on A320/A330/A340 aircraft. Please refer to Section 4.2.1 – Basic operational principles.

4.4.2. MAIN HMI RULES

The main HMI rules are exactly the same as on A320/A330/A340 aircraft. However, the layout was adapted to the A380 cockpit. A380 cockpit components have been then reused on the A350 cockpit.

4.4.2.1. ATC MAILBOX

- The centralized ATC mailbox is the dedicated cockpit interface, whatever the type of messages (uplink or downlink messages).

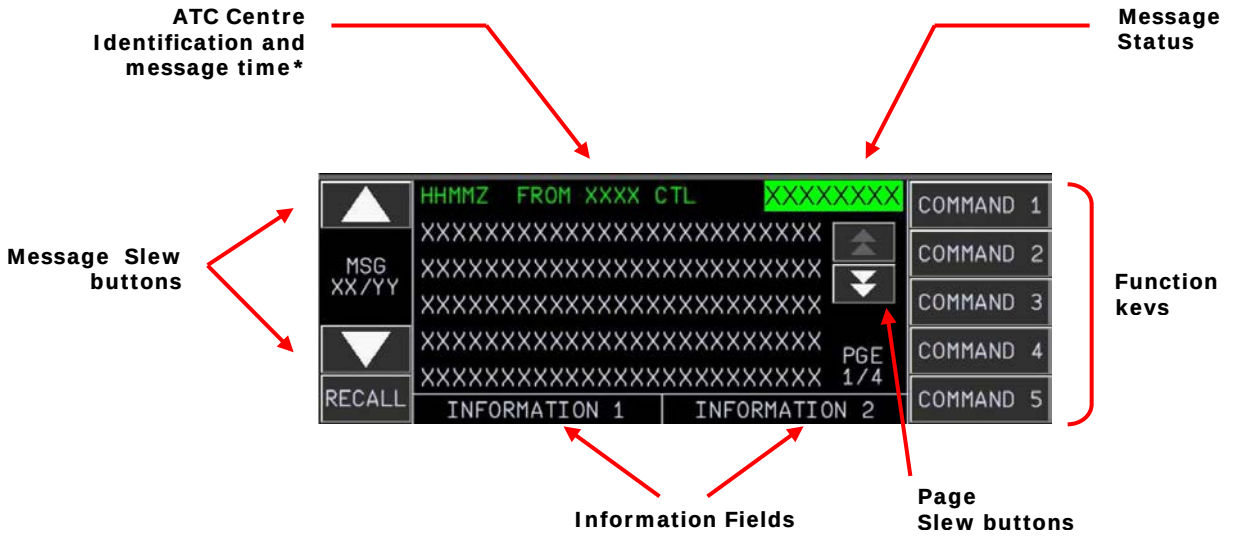


Figure 4-13
ATC mailbox

* The message time refers to:

- The time when the message had been sent from the ground if the ATC Center provides the time stamp,
- The insertion, at the end of the message, of an explicit indication (e.g. RECEIVED AT 1105Z) if the ATC center does not provide the time stamp. Refer to Part II - Chapter A6 for more details.

4.4.2.2. MFD

- ATC COM pages on MFDs are used to prepare downlink messages such as requests or free texts. They also provide an access to the record of messages.
- In FANS A+B, the set of downlink CPDLC messages available on MFD ATC COM is adapted according the type of CPDLC connection established with the ground system (i.e. FANS 1/A or ATN B1 connection). Once the CPDLC connection is established, the aircraft system will adapt the set of downlink messages (i.e. either FANS 1/A or ATN B1 messages) accessible through the ATC COM pages on MFD.

4.4.2.3. KCCU

- The ATC COM and MAILBOX keys, available on the KCCU, give respectively a direct access to the MFD ATC pages and to the ATC mailbox.

4.4.2.4. ALERT

- The alert function is triggered each time a new uplink message arrives or whenever a deferred report or clearance expires.

- Both ATC MSG pushbuttons on the glare shield flash until the flight crew acts (either by pressing one of the pushbuttons or by answering the uplinked message on the ATC mailbox).

- The specific ATC aural alert may also be activated (5 sec or 15 sec period in FANS A+ and immediately or after 10 sec in FANS A+B, according to the urgency of the message).

Note: In FANS A+B, the ATC aural alerts have been harmonized across FANS A+ and FANS B+ messages. The frequency of the ATC aural alerts applied in FANS B+ has been reused for all messages.

4.4.2.5. MESSAGES

- As soon as the alert is triggered, the associated ATC message may be accessed and viewed on the ATC mailbox.
- ATC mailbox displays only one open message at a time.

- Messages are filled in the ATC mailbox in a chronological order regardless of the urgency of the messages.
  - If the ATC mailbox is empty, any message that is received is immediately displayed.
  - If the ATC mailbox contains already some messages:
    - When a normal message is received, this message is not immediately displayed and is filled in the ATC mailbox in a chronological order.
    - When an urgent message is received, this message is immediately displayed to draw the attention of the flight crew; but it is still filled in the ATC mailbox in a chronological order.

Refer to Figure 4-14.

- The flight crew can transfer downlink messages (e.g. requests) from MFD to the ATC mailbox with the transfer prompt “XFR TO MAILBOX”.

- In FANS A+B, the system will automatically close some messages in the ATC mailbox. This rule concerns:
  - Any downlink message initiated by the flight crew
  - Any uplink message that contains no clearances.

  The message is closed 5 seconds after:
    - The LACK reception in the LACK regions (where the LACK is supported)
    - The message sending in non-LACK region (where the LACK is not supported).

The access to messages is based on the principle described in the following figure.

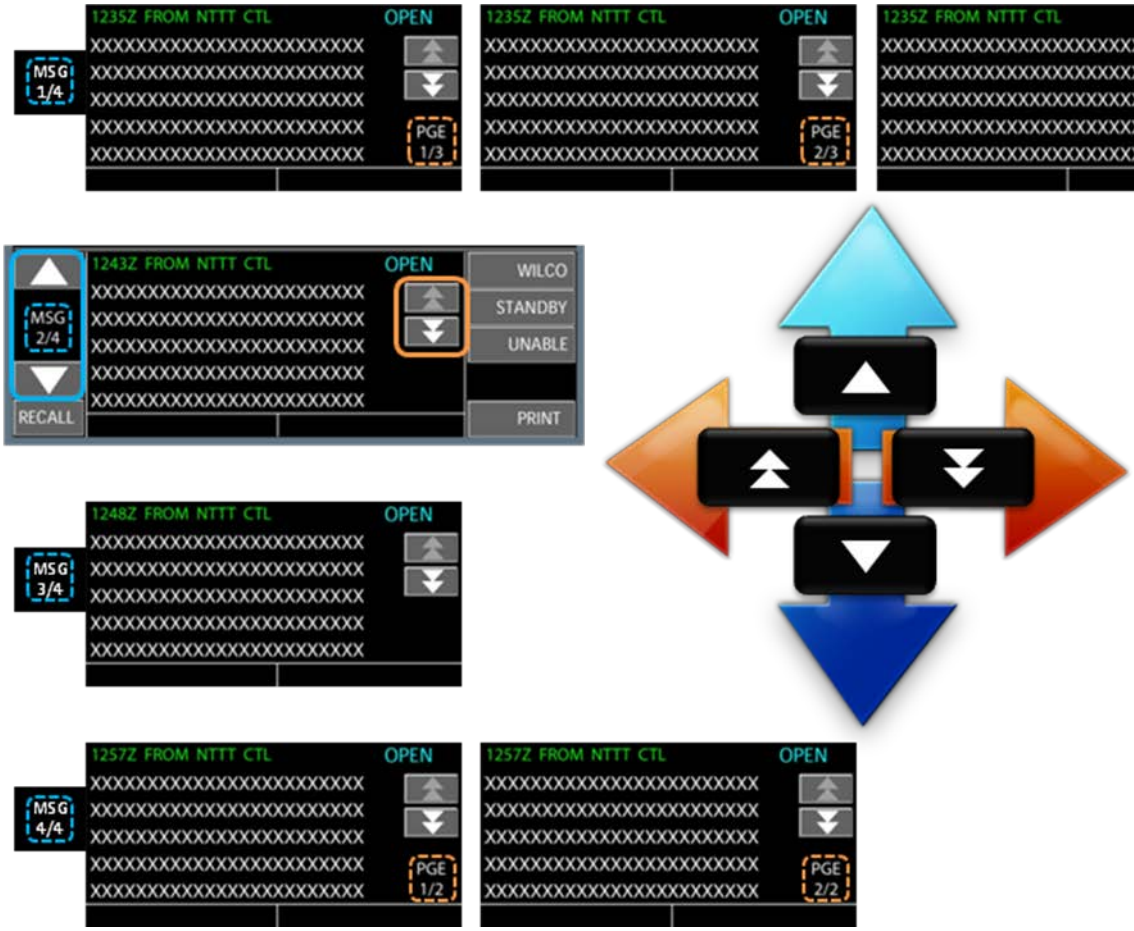


Figure 4-14
Management of messages and pages

The slew buttons either for messages or pages are displayed only when necessary.

Any next or previous page for a currently displayed message can be accessed through the page slew buttons (double arrows on the right side of the ATC mailbox).

Any next or previous message of the message queue can be accessed though the message slew buttons (single arrows on the left side of the ATC mailbox).

Note: Some scenarios are provided in appendices of Part II and III to develop the handling of both ATC mailbox and MFD ATC COM pages.

4.4.2.6. PRINTER

- At any time, the flight crew can print entirely:
  - The message displayed on ATC mailbox or MFD
  - The message record stored in MFD.

4.4.2.7. INTERACTIONS WITH FMS

The interactions between ATC applications and FMS enable the following features:

- The flight crew may load an ATC flight plan or route clearance in the secondary F-PLN of the FMS via the LOAD key of the ATC mailbox. An indication on the ATC mailbox (e.g. LOADED IN SEC3, or LOAD PARTIAL) informs the flight crew if the loading has been successful or not. Whenever this loading cannot be done entirely (for instance waypoint not in data base, runway/ILS mismatch, etc) the flight crew can access the MFD secondary F-PLN pages to assess the reasons for the rejected parameters, and take appropriate actions.

- The FMS processes ATC messages that require navigation parameters (e.g. CONFIRM SPEED). The ATC mailbox automatically displays an answer message with the FMS data. The flight crew can nevertheless modify this message before sending it (press MODIFY soft key on ATC mailbox to open the edition mode on MFD).

- The FMS activates a monitoring when REPORT messages (e.g. REPORT PASSING ALCOA) are received and accepted by the flight crew. When it is time to report, the ATC mailbox automatically displays the appropriate answer.

- The FMS monitors the conditions of deferred clearances (e.g. AT ALCOA CLB TO FL350). 30 seconds before the conditions are met, the ATC mailbox displays the message to remind the flight crew of this clearance.

4.4.2.8. COLOUR CODING

The following colour coding is used for the ATC mailbox. It is identical to the one used for the DCDU:

- The title is always displayed in **GREEN**.

- Uplink messages are displayed with the text in **WHITE** and the main parameters are highlighted in **CYAN**.

- Closed actions are always in **GREEN**.

- Configuration or failure requiring awareness but no immediate action is displayed in **AMBER**.

- NORMAL VIDEO is used for uplink.

- REVERSE VIDEO is used for downlink.

Please bear in mind…

4. AIRBUS FANS DESCRIPTION

A320/A330/A340 FANS architecture

- This avionics unit (ATSU) has been developed to cope with datalink communications. Its functions are:
  - To manage the HMI, the display and warning systems
  - To enable the access to all available communications media
  - To sustain the communications tasks.
- The FMS is a key element of the Airbus-FANS system for which:
  - It provides data to the ATSU
  - It monitors the ATC messages and their subsequent implications
  - It handles and processes some of the ATC messages.

Note: in FANS B/B+, the interface FMS-ATSU is limited. The FMS only provides the ATSU with the flight number, the departure and destination airports, and the aircraft position.

A320/A330/A340 Human Machine Interface

Regardless of the FANS systems (FANS A / FANS A+ or FANS B / FANS B+), the interfaces are the same on A320 and A330/A340 aircraft.

- The main crew interface used for the FANS applications is based on the two DCDUs. All ATC messages, clearances (uplink message), requests or answers (downlink messages) are displayed on the DCDU.
- In addition to the DCDU, the MCDU is mainly used to prepare a request.

A350/A380 FANS architecture

The A380 introduces new technologies. As such, its architecture is different from the ones on A320/A330/A340 aircraft. However, the basic operational principles remain exactly the same. The A350 FANS architecture is fully inherited from the A380 one.

Functions that were managed entirely by ATSU on A320/A330/A340 aircraft are distributed between ATC applications and ACR on A350/A380 aircraft.

- **ATC applications** ensure the management of the HMI, the display and warnings. It also manages interfaces with peripherals.
- **The Avionics Communication Router (ACR)** supports the routing function (e.g. communication protocols with ground network).

A350/A380 Human Machine Interface

A350/A380 cockpit benefits from a new design where the CDS is the key element. However, A350/A380 FANS interfaces had been designed in order to keep the same operational principles as on A320/A330/A340 aircraft.

Please bear in mind… (continued)

- Uplink messages (i.e. clearances or instructions) and downlink messages (i.e. requests or responses) are received on or sent from the **ATC mailbox** located on the central screen C2 CDS on the A380 and on the upper central screen C1 CDS on the A350.

- Downlink messages are prepared from **MFD ATC COM pages** located on L3 and R3 CDS screens on the A380 and on lower central C2 CDS screen on the A350.

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ABBREVIATIONS

AAC	Airline Administrative Communications
ACARS	Airline Communications, Addressing, and Reporting System
ACL	ATC Clearance service
ACM	ATC Communication Management service
ACR	Avionics Communication Router
ADF	Automatic Direction Finder
ADIRS	Air Data Inertial Reference System
ADNS	Arinc Data Network Service
ADS	Automatic Dependent Surveillance
ADS-B	Automatic Dependent Surveillance – Broadcast
ADS-C	Automatic Dependent Surveillance – Contract
AEEC	Airlines Electronics Engineering Committee
AES	Aircraft Earth Station
AESS	Aircraft Environment Surveillance System
AFN	ATS Facilities Notification
AFTN	Aeronautical Fixed Telecommunication Network
AIDC	ATC Inter-facility ground/ground Data Communications
AIP	Aeronautical Information Publication
AMC	ATC Microphone Check service
AMI	Airline Modifiable Information
AMU	Audio Management Unit
ANSP	Air Navigation Service Provider
AOC	Airline Operations Communications (or Center)
ARF	ACARS Router Function
ARINC	Aeronautical Radio INCorporated
ASAP	As Soon As Possible
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSP	Air Traffic Service Provider
ATSU	Air Traffic Services Unit
BFE	Buyer Furnished Equipment
BITE	Built In Test Equipment
CADS	Centralized Automatic Dependent Surveillance
CBT	Computerized Based Training
CDS	Control and Display System
CDTI	Cockpit Display of Traffic Information

CFDIU	Centralized Fault Display Interface Unit
CM	Context Management application
CMA	Context Management Application
CMC	Central Maintenance Computer
CMS	Centralized Maintenance System
CNS/ATM	Communication Navigation Surveillance/Air Traffic Management
CPDLC	Controller Pilot Data Link Communications
CPIOM	Core Processing Input/Output Module
CSD	Customer Service Director
CSP	Communication Service Provider
CSTDB	CuSTomized Data Base
CTA	Control Area
CVR	Cockpit Voice Recorder
DARP(S)	Dynamic Airborne Route Planning (System)
D-ATIS	Digital Automatic Terminal Information Service
DCDU	Data link Control and Display Unit
DFIS	Digital Flight Information Services
DGPS	Differential GPS
DL	Down Link
DLASD	Data Link Application System Document
DLIC	Data Link Initiation Capability
DM	Downlink Message
EATMS	European Air Traffic Management System
ECAM	Electronic Centralized Aircraft Monitoring
EFIS	Electronic Flight Information System
EIS	Electronic Instrument System
ERSA	En-Route Supplement Australia
EUROCAE	European Organization for Civil Aviation Equipment
EWD	Engine and Warning Display
FANS	Future Air Navigation System
FHA	Functional Hazard Analysis
FIR	Flight Information Region
FIS	Flight Information Services
FIT	FANS Inter operability Team
FMS	Flight Management System
FSM	Flight System Message
FWC	Flight Warning Computer
GES	Ground Earth Station
GLS	GPS Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HFDL	High Frequency Data Link

HFDR	High Frequency Data Radio
HMI	Human Machine Interface
ICAO	International Civil Aviation Organization
IFALPA	International Federation of Airline Flight crew Associations
IMA	Integrated Modular Avionics
IMA	Integrated Modular Avionics
IOM	Input Output Module
ISPACG	Informal South Pacific ATC Coordinating Group
ITP	In Trail Procedure
KCCU	Keyboard and Cursor Control Unit
LACK	Logical ACKnowledgement
LRU	Line Replaceable Unit
LSK	Line Select Key
MAS	Message Assurance
MASPS	Minimum Aviation Systems Performance Standards
MCDU	Multifunction Control and Display Unit
MCT	Media Configuration Table
MDDU	Multi Disk Drive Unit
MFD	Multi Function Display
MMR	Multi Mode Receiver
Mode S	Radar Mode S
NAS	National Airspace System
NDA	Next Data Authority
NOTAM	NOtice To Air Men
NPA	Non Precision Approach
OCA	Oceanic Control Area
OMT	On-board Maintenance Terminal
OPC	Operational Program Configuration
ORT	Owner Requirements Table
PACOTS	Pacific Organized Track System
PRODB	data service PROvider Data Base
RAIM	Receiver Autonomous Integrity Monitoring
RCP	Required Communications Performance
RCSM	Resident Customer Service Manager
RFC	Request For Change
RGS	Remote Ground Station
RNAV	Area Navigation
RNP	Required Navigation Performance
RPDB	Router Parameter Data Base
RSP	Required Surveillance Performance
RTCA	Requirements and Technical Concepts for Aviation
RVSM	Reduced Vertical Separation Minima

SATCOM	Satellite Communications
SCI	Secure Communication Interface
SDU	Satellite Data Unit
SIL	Service Information Letter
SITA	Société Internationale de Télécommunications Aéronautiques
SOP	Standard Operating Procedures
SOR	System Objectives and Requirements
SPOM	South Pacific Operating Manual
SPP	Soft Pin Program
SSR	Secondary Surveillance Radar
TA	Tailored Arrival
TDM	Track Definition Message
TMA	Terminal Area
TMU	Traffic Management Unit
UL	Up Link
UM	Uplink Message
V/DME	VHF/Distance Measurement Equipment
VCI	Voice Contact Instruction
VDL	VHF Data Link
VDR	VHF Data Radio
WPR	WayPoint Reporting

PART II – EXECUTIVE SUMMARY

A5. FANS A/A+ OPERATIONAL PROCEDURES

It has to be noticed that the following principles apply in ACARS oceanic and remote areas:

- **Voice and data link are used as communication means with ATC.**
- **When the aircraft is equipped with datalink systems, CPDLC is the primary means of communication in ACARS environment unless otherwise specified by local rules. Voice will be used as a backup means.**
- **Below 10,000 ft (i.e. during critical phases), voice should be used for ATC communications in order to reduce flight crew head-down time.**
- **The ATC controller and flight crew will determine the communication means (CPDLC or voice) that is the most appropriate at any given time.**

Procedures described hereafter are common to FANS A and FANS A+ systems whatever the aircraft models (A320/A330/A340/A350/A380). For FANS A+B systems, the procedures refer only to FANS A+ (i.e. FANS A+B working over ACARS).
If A350/A380 bring new evolutions and features in cockpit, they do not modify the procedures.

Pre-flight phase

- **ICAO F-PLN filling**

The CNS/ATM capabilities of the aircraft will be notified when filling in the ICAO flight plan. With the entry into force of the ICAO PANS-ATM Doc 4444 applicable from November 2012, new letter codes have been introduced.

- The **data link capability** (CPDLC and ADS-C) is notified in the **Item 10** (Equipment and capabilities). The **Item 10** is composed of two parts:
  - **Item 10(a)**: Radio Communication, Navigation and Approach Aid Equipment and Capabilities

CPDLC and RCP Capabilities	Item 10a
CPDLC FANS 1/A HFDL	J2
CPDLC FANS 1/A VDL Mode A	J3
CPDLC FANS 1/A VDL Mode 2	J4
CPDLC FANS 1/A SATCOM (INMARSAT)	J5
CPDLC FANS 1/A SATCOM (MTSAT)	J6
CPDLC FANS 1/A SATCOM (IRIDIUM)	J6

CPDLC and RCP Capabilities	Item 10a
RCP400	P1
RCP240	P2

- **Item 10(b)**: Surveillance Equipment and capabilities.

ADS-C Capabilities	Item 10b
ADS-C with FANS 1/A capabilities	D1

- The **aircraft identification** is entered in the **Item 7** of the flight plan and must contain only alphanumeric character without hyphen or symbols.
- The **aircraft registration** are still mentioned in the **Item 18** (preceded by **REG/**) of the flight plan.

The **RSP capability** (i.e. RSP 180 or RSP 400) is mentioned in the **Item 18** (preceded by **SUR/**).

- **Pre-flight checks**

Prior to departing for a FANS flight, checks must be performed by the dispatcher and flight crew to ensure that the aircraft is ready for FANS operations. The following items are recommended to be checked:

- Dispatcher checks:
  - FANS equipment availability
- Flight crew checks:
  - No ECAM alert is present on datalink systems
  - Removal of the MSG RECORD as per FCOM procedure
  - Check ADS armed as per FCOM procedure.

ATS Facilities Notification (AFN)

- The aim of the ATS Facilities Notification is to:
  - Notify the appropriate ATC center of the capabilities and specifics of the aircraft data link communication applications
  - Give the flight identification and the aircraft registration number.
- The AFN logon should be exercised between 10 and 25 minutes prior entering an airspace that provides CPDLC and/or ADS-C services
- The AFN can be initiated:
  - Manually by the flight crew, or
  - Automatically by the ATC center using the address forwarding process.

The AFN must be successfully completed prior to any connection (CPDLC or ADS-C) is being established.

CPDLC procedures

- **CPDLC Connection Establishment**
  - Once the AFN has been successfully done, the ATC center can initiate a CPDLC connection (transparent to the crew).
  - Checks are automatically done by the ATSU (respectively ATC applications) to validate or reject the connection:
    - Connection is accepted if no previous connection already exists or the ATC center corresponds to the next ATC center to control the aircraft
    - Connection is rejected in all other cases.
  - Once connection is established, the active connected ATC center is then displayed on the DCDU (respectively ATC mailbox), and on the CONNECTION STATUS page of the MCDU (respectively MFD).

- **CPDLC Connection Transfer**
  - The transfer of ATC responsibility between two ATC centers (i.e. the current ATC center and the next ATC center) requires a CPDLC connection transfer
  - The current ATC center is the Current Data Authority (CDA). The next ATC center is the Next Data Authority (NDA).
  - The CPDLC connection transfer is performed using the following sequence:
    - **Notification of identity of the NDA**: to inform the aircraft avionics (i.e. ATSU or ATC applications) that a transfer of control will be done, the CDA sends a NDA message including the identity of the NDA to the aircraft
    - **AFN Logon with the NDA**: Two methods may be used:
      - **Air-Ground address forwarding process**: the CDA instructs the aircraft system to initiate an AFN logon to the NDA (air-ground interaction)
      - **Ground-Ground address forwarding procedure**: the CDA sends to the NDA the same information than AFN Logon (ground-ground interaction)
    - **CPDLC Connection establishment with the NDA**: the NDA initiates a CPDLC connection with the CPDLC CONNECTION REQUEST message (same procedure than CPDLC Connection Establishment)
    - **CPDLC Connection termination with the CDA**: to terminate the CPDLC connection, the END SERVICE message is used.

- **CPDLC Connection Termination**
  - A CPDLC connection with one ATC center is usually terminated once this center has sent an END SERVICE message to the aircraft.

- **Failures of CPDLC connection**
  - As soon as a failure of the CPDLC connection is noticed by either the flight crew or ATC controller, voice will be used to inform the other side of the failure and to coordinate further actions.

- **Recommendations for CPDLC**
  - In ACARS environment (contrary to ATN), the flight crew and ATC controllers cannot know whether a message has been delivered to their right counterpart.
  - Free text messages like multi-elements messages should be avoided as much as possible.
  - It is recommended to erase the MSG RECORD and to check ADS is armed at the beginning of cockpit preparation before take-off.
  - Flight crew should be prompt to answer the received messages and to clean up their DCDU (respectively ATC mailbox) with the CLOSE prompt. With the latest FANS A+ system on A320/A330/A340, the message will be automatically closed from the DCDU, 5 seconds after the reception of the acknowledgement from the ground.
  - It is recommended NOT to use ARINC 424 format in the flight plan when operating FANS.
  - Flight crew should be aware of the differences between a standard clearance and a deferred clearance. The flight crew should assess if the deferred clearance is still valid before its execution.

ADS-C procedures

- **ADS-C connections Establishment / Management**
  - An ATC will establish ADS-C contracts once the AFN has been performed.
  - FANS A/A+ equipped aircraft can have up to **five ADS-C connections simultaneously**.
  - The aircraft has the capability to report to all connected ATC centers simultaneously using ADS-C.
  - Different types of ADS-C "contracts" exist:
    - **Periodic**: the data are sent at periodic time intervals.
    - **On demand**: the data are sent only when asked for.
    - **On event**: the data are sent whenever a specified event occurs.
  - Establishment of ADS-C connections and definition of ADS-C contracts type are initiated by ground systems. They are transparent to the flight crew and the transmission of ADS-C report to the ground systems as well.
  - An individual ADS-C connection may be stopped from the ground or manually by the flight crew (FANS A+ only) through the ADS-C DETAIL

page of the MCDU ATC menu (respectively MFD CONNECTION STATUS page).

- The flight crew has the possibility to switch ADS-C off, that will cancel any ADS-C connections with the aircraft. While ADS-C is off, the ground system will not be able to establish an ADS-C connection.
- **The ADS-C should not be set to off unless instructed to do so by ATC.** If the ADS-C is set to off, the ATC center can no longer be provided with ADS-C reports.
- FANS A+ provides more precise indications than FANS A:
  - The number of active ADS-C connections is displayed on DCDU (respectively ATC mailbox)
  - The status ARMED or CONNECTED of ADS-C is displayed on MCDU (respectively MFD ATC COM pages).

- **ADS-C connection Closure**
  - ADS-C contracts and connections should normally be terminated by the ground system when the:
    - The aircraft has crossed the FIR boundary and no surveillance information from the flight are required by the transferring ATC, or
    - The flight plan is no more active from the ATC point of view, or
    - No surveillance information from the flight are required by the CDA or an adjacent ATC.
- **Position reporting with ADS-C**
  - A Waypoint will not be sequenced if the position is offset by more than **7NM on Honeywell FMS2 and 5NM on Thalès FMS2** aside from this point. When an offset is flown, it is recommended that the crew keeps updating its FMS flight plan, and that it uses the FMS Offset function.
- **ADS-C Failure**
  - When a shutdown occurs the ATC controller will advise the crew of the requirements for the position reports (by voice or CPDLC).

Emergency procedures

- During an emergency, it is expected that the flight crew reverts to the voice communications. Nevertheless, CPDLC could be used if CPDLC is more efficient than voice or if voice communications are not possible.
- The emergency mode can be activated either by the flight crew or the ATC controller, and is normally cancelled by the flight crew. When selected on the MCDU ATC page (respectively MFD ATC COM pages), the ATSU (respectively ATC applications) immediately sends a report to all ATC centers that currently have contracts established with that aircraft.
- The ATC controller in charge of the flight shall acknowledge any ADS-C emergency report.
- When the flight crew cancels the emergency mode, the aircraft will send an emergency mode cancellation message to each ground station receiving the emergency mode reports.

ATS623 applications

- Pending for a greater maturity of standardized services, Airbus has decided to implement only three ATS 623 applications:
  - Departure Clearance (DCL)
  - Oceanic Clearance (OCL)
  - Digital – Automatic Terminal Information Service (D-ATIS).
- ATS 623 applications do not require a preliminary AFN procedure compared to CPDLC and ADS-C applications.
- In case similar applications have been customized through AOC (ACARS) contracts, these will no longer be available should the ATS623 package be chosen (e.g. AOC DCL or OCL will no longer be sent from a customized AOC page). However, customized AOC functions such as Pre-Departure Clearance (PDC), that is not compliant with the AEEC 623 specifications, will remain possible via ACARS.

Advanced Datalink Operations

- **Dynamic Airborne Reroute Procedure (DARP)**
  - DARP enables the rerouting of an aircraft in flight based on updated weather forecasts, that allows to save fuel/time savings and eliminate flight hazards.
  - To fulfill this procedure, a full coordination between AOC, ATC centers and aircraft is required:
    - to uplink the new flight plan revised by AOC to the aircraft
    - to negotiate the revised flight plan with ATC.
- **Tailored Arrival (TA)**
  - TA is a 4-dimentional (4-D) arrival procedure, based on an optimized ATC clearance. TA enables to replace current ATC practices based on tactical radar vectoring, by CPDLC clearance uplinked prior the top of descent (TOD).
  - The procedure is “tailored” to adapt the flight profile from cruise level to expected arrival runway to the current conditions (i.e. traffic, weather, aircraft performance, etc).
  - The main benefits are to optimize fuel consumption and reduce noise emissions.
- **In Trail Procedure (ITP)**

  ITP is a new procedure enabling more frequent flight level changes in procedural airspaces (without radar coverage). When ITP is applied, the aircraft is authorized to climb or descent using reduced minima of longitudinal separations and thus change flight level on a more frequent basis.

A6. FANS A EVOLUTIONS

A320/A330/A340 FANS A+

To improve the current FANS A system and extend the use of data link services, a new system, FANS A+, has been developed.

- **Improvements address points coming from:**
  - Operational / in service feedback from operators
  - Interoperability and standardization objectives
  - Improvement of Human Machine Interface (HMI)
  - Functional evolutions.
- **New data link services have also been added with the introduction of:**
  - **VDL mode 2**, so as to increase the capacity for ATC communications
  - **HFDL capability for ATC** (once this service is approved)
  - **ATS623** (Departure & Oceanic clearances, Digital-ATIS applications)
  - **High-speed data loading capability** (AEEC 615a)
  - **ATC Data link communication Recording** for the investigation on flight accidents/incidents
  - **Radio Frequency loading into RMP**
  - **In Trail Procedure (ITP) clearance.**

- **FANS A+ retrofit**
  - The upgrade to the latest version of FANS A+ is possible regardless of the initial aircraft configuration (i.e. ACARS MU, Pre-FANS, FANS A, or former FANS A+). The upgrade from FANS A or former FANS A+ to the latest FANS A+ version consists of a change of software only, provided it is limited to the basic features.
  - The upgrade to activate optional features (e.g. VDL Mode 2, A615A High Speed Data Loading, data link recording, frequency loading into RMP, or ITP request by CPDLC) affect the hardware.
  - Airlines are invited to report to Airbus the current avionics configuration of their fleet in order to ensure a good follow-up of FANS aircraft.

A350/A380 FANS A+

- The basic definition of the A380 encompasses the FANS A+ system and the ATS 623 applications. The A380 FANS A+ system resumes all the functions provided within the A320/A330/A340 FANS A+ system. Some novelties are also introduced considering the regulation evolutions and the new A380 technology.

- The A380 technology has introduced three main novelties:
  - New interfaces: a central and unique ATC mailbox to receive and send ATC messages, ATC COM pages on MFD to prepare and store messages. The central and unique ATC mailbox improves the cross check.

  - The maintenance functions provided by the BITE are accessible through the CMS.
  - The ACR, to which the routing function for several applications is granted, offers much more flexibility for the customization of routing policies.
  - As an option, a second ACR can be installed for an advanced reliability.

- The A350 technology is fully inherited from the A380, based on:
  - Two main modules: ATC applications/ACR
  - The central and unique ATC mailbox and ATC COM pages on MFD.

- The main difference between A350 FANS and A380 FANS remains the cockpit displays layout where the ten A380 screen layout have been replaced by six larger screens.

- A350 is the first aircraft fitted with the FANS A+B system. FANS A+B combines both FANS A+ and FANS B+ features on the same platform. FANS A+ features on A350 are derived from FANS A+ system on A380, with additional services that come from the latest FANS A+ enhancements on A320/A330/A340 such as the radio frequency loading into RMP. FANS A+B on A380 will come in the soon future (2015), including functions fully inherited from FANS A+B A350.

- FANS A+ on A380 and FANS A+B on A350/A380 and includes basically features such as:
  - Max Uplink Delay
  - Time reference for uplink messages filled with the uplink time stamp
  - ATS 623 applications: Departure Clearance (DCL), Oceanic Clearance (OCL) and Digital–Automatic Terminal Information Service (D-ATIS)
  - ATC data link communications recording.

A7. STARTING FANS A/A+ OPERATIONS

To ensure proper operations of FANS A/A+ aircraft on FANS routes, the operator needs to ensure the following steps before starting operations:

- Sign contract(s) with Communication Service Provider(s) (CSP)
- Declare aircraft to these Communication Service Provider(s)
- Declare aircraft and its FANS capability to ATC centers of the operated routes
- Configure adequately the aircraft avionics
- Obtain the operational approval.

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A5.1. INTRODUCTION

The reader will find NEW or NEW flag in the margin.

These flags identify new features introduced in the latest FANS systems.

The following chapter depicts some important and general procedures for an operational use of CNS/ATM systems. These procedures are applicable to FANS A and FANS A+ systems.

As already explained FANS routes are, and will be, regionally opened, based on the availability of ground equipment and technologies. At the beginning of FANS operations, operational procedures were defined for each region (e.g. Pacific area, Indian Ocean and Bay of Bengal).
Since early 2004, operational procedures had been standardized in the Pacific Operations Manual (POM) based on the experience gained in the Pacific region. The POM evolves in FANS 1/A Operations Manual (FOM) to be applicable worldwide except the North Atlantic. Data link operations in the North Atlantic were governed by the Guidance Material for ATS Data Link Services in North Atlantic Airspace.
End of 2009, the FOM and the NAT guidance material were merged into the Global Operational Data Link Document (GOLD – see References). GOLD is the current reference for all data link operations in any FANS 1/A airspace. Even if the operations based FANS 1/A are more and more standardized under the ICAO governance, some regional FIR specificities like the North Atlantic still exist. For details of regional FIR capabilities, refer to GOLD - Appendix E (see References).

Procedures described in the following sections are consistent with GOLD guidance and applicable worldwide except for specific regional FIR. They are common to FANS A and FANS A+ systems disregarding the aircraft models (A320, A330/A340 or A350/A380). In order to keep the educational side of this brochure, illustrations are repeated for each type of interfaces (i.e. DCDU and MCDU on A320/A330/A340 aircraft, and ATC mailbox and MFD on A350/A380). However, keep in mind that procedures and functions are identical whatever the aircraft model.

FANS A+B system on A350/A380 contains functions from FANS A+ and FANS B+ systems, coming along with additional features. With regards to FANS A+B system, only the part of the FANS A+B working over ACARS (i.e. FANS A+) is described in this chapter. The part of FANS A+B working over ATN is described in the PART III, Chapter B6.

It has to be noticed that the following principles apply in ACARS oceanic and remote areas:

- **Voice and data link are used as communication means with ATC.**
- **When the aircraft is equipped with datalink systems, CPDLC is the primary means of communication in ACARS environment unless**

otherwise specified by local rules. Voice will be used as a backup means.

- **Below 10,000 ft (i.e. during critical phases), voice should be used for ATC communications in order to reduce flight crew head-down time.**
- **The ATC controller and flight crew will determine the communication means (CPDLC or voice) that is the most appropriate at any given time.**

At any time, the aircraft shall remain under the control of only one ATC centre as per ICAO Annex 11, Chapter 3, § 3.5.1.

Note: Practical operational scenarios are provided in Appendices F, G, H and I for any procedures described in the following sections.

A5.2. PRE-FLIGHT PHASE

As for any flight, it is the commander's responsibility to ensure that flight crew FANS qualifications, aircraft and operational approval are satisfied for the intended flight.

A5.2.1. ICAO FLIGHT PLAN FILLING

The CNS/ATM capabilities of the aircraft will be notified when filling in the ICAO flight plan. A letter code has been defined for this information. With the entry into force of the ICAO PANS-ATM Doc 4444 applicable from November 2012, new letter codes have been introduced.

The data link capability (CPDLC and ADS-C) is notified **in the Item 10** (Equipment and capabilities) of the ICAO Flight Plan. The Item 10 is composed of two parts:

- **Item 10(a):** Radio Communication, Navigation and Approach Aid Equipment and Capabilities
- **Item 10(b):** Surveillance Equipment and capabilities.

10 – EQUIPMENT AND CAPABILITIES	**Item10(a) / Item 10(b)**

The data link capability is notified by two characters to be entered in the Item 10(a) as mentioned here below:

CPDLC and RCP Capabilities	Item 10a
CPDLC FANS 1/A HFDL	J2
CPDLC FANS 1/A VDL Mode A	J3
CPDLC FANS 1/A VDL Mode 2	J4
CPDLC FANS 1/A SATCOM (INMARSAT)	J5
CPDLC FANS 1/A SATCOM (MTSAT)	J6
CPDLC FANS 1/A SATCOM (IRIDIUM)	J6
RCP400	P1

CPDLC and RCP Capabilities	Item 10a
RCP240	P2

Note: When the aircraft combines several equipments, the **Item 10(a)** will cumulate the associated capabilities. Example: if the aircraft is capable both CPDLC FANS 1/A VDL Mode A (code J3) and CPDLC FANS 1/A SATCOM (INMARSAT) (code J5), the Item 10(a) will be filled with J3J5.
The ADS-C capability is notified by two characters to be entered in the **Item 10(b)** as mentioned here below:

ADS-C Capabilities	Item 10b
ADS-C with FANS 1/A capabilities	D1

The aircraft identification is entered in the **Item 7** of the flight plan and must contain only alphanumeric character without hyphen or symbols.
The aircraft registration are still mentioned in the **Item 18** (preceded by REG/) of the flight plan.
The RSP capability (RSP 180 or RSP 400) is mentioned in the **Item 18** (preceded by SUR/).
Aircraft identification and aircraft registration will be used for correlation purposes by the ATC through a comparison with the ones contained in the AFN logon (refer to Section A5.3.2 Manual AFN).

For more details about the ICAO flight plan, refer to ICAO PANS-ATM Doc 4444 (see References). EUROCONTROL has also published a leaflet providing recommendations for airlines on how to fill in the ICAO flight plan (see References).

A5.2.2. PRE-FLIGHT CHECKS

Prior to departing for a FANS A/A+ flight, checks must be performed by the dispatcher and flight crew to ensure that that the aircraft is ready for FANS operations. The following items are recommended to be checked:

- Dispatcher checks:
  - FANS equipment availability
- Flight crew checks:
  - No ECAM alert listed hereafter is present on datalink systems
    - A320/A330/A340:
      - DATALINK ATSU FAULT
      - DATALINK ATC FAULT
      - COM SATCOM DATA FAULT
      - COM VHF3 DATA FAULT
    - A350/A380:
      - COM ATC DATALINK FAULT
      - COM ADS DATALINK FAULT
      - COM DATALINK FAULT
      - COM SATCOM DATALINK FAULT
      - COM SATCOM FAULT
      - COM VHF3 DATALINK FAULT

- As mentioned in the FCOM/QRH, it is recommended to erase the MSG RECORD and to check ADS-C is armed at the beginning of cockpit preparation before take-off. Refer to FCOM:
  - A320/A330/A340: Procedures/Normal Procedures/Standard Operating Procedures/Cockpit Preparation/ATC Datalink Communication
  - A350/A380: Procedures/Normal Procedures/Standard Operating Procedures/Cockpit Preparation/MFD ATC COM.

  Note: On FANS A+B, the MSG RECORD is automatically erased on a flight identification change when the aircraft is on ground. However, this automatic removal can be deactivated through Soft Pin Program (SPP) change upon airline request.

If the data link is to be used a short time after the departure, the ATS Facilities Notification (AFN) function (described here after) may have to be completed **prior to departure.**

A5.3. ATS FACILITIES NOTIFICATION (AFN)

A5.3.1. WHY SUCH A FUNCTION?

The aim of the ATS Facilities Notification is to tell (to notify) an ATC center that your aircraft is able to sustain data link communications and that you are ready to connect. AFN intends to:

- Inform the appropriate ATC center of the capabilities and specifics of the aircraft data link communications (e.g. CPDLC and/or ADS-C available applications, ACARS address),
- Give the ATC center the flight identification and aircraft registration number to allow for a correlation with the filled flight plan.

The AFN logon should be exercised between 10 and 25 minutes prior entering an airspace that provides CPDLC and/or ADS-C services.

The AFN logon must be successfully completed prior to any CPDLC or ADS-C connection is being established. The AFN logon can be initiated:

- Manually by the flight crew (e.g. the first notification that is always manual), or
- Automatically by an ATC using the address forwarding process transparent to the crew (refer to Section A5.4.2.2 AFN logon with the NDA). If this process fails, a manual notification should be done.

The table below emphasizes the ways to initiate an AFN depending on the services provided by the *Current Data Authority* (FROM) and the *Next Data Authority* (TO).

FROM \ TO	CPDLC only	ADS only	CPDLC & ADS
CPDLC only	Automatically	Automatically	Automatically
ADS only	Manually	Manually	Manually
CPDLC & ADS	Automatically	Automatically	Automatically

A5.3.2. MANUAL AFN

When no other CPDLC or ADS-C connections have been established with a previous ATC center, the AFN logon must be exercised (e.g. prior to departure, prior to entering a data link airspace, or following a failure to re-initiate a connection) with the following sequence:

- The flight crew enters the ATC center on the NOTIFICATION page of the ATC pages on the MCDU (respectively MFD ATC COM pages)
- The flight crew sends an AFN CONTACT message (FN_CON) to the specified ATC center by selecting NOTIFY on the NOTIFICATION page of the ATC pages on the MCDU (respectively MFD ATC COM pages)
- The ATC center replies to the FN_CON by an AFN ACKNOWLEDGE (FN_AK), indicating that:
  - The AFN logon is accepted when the aircraft identification and aircraft registration filled into the FMS are correlated with an ATC flight plan, or
  - The AFN logon is rejected when the aircraft identification and aircraft registration filled into the FMS are not correlated with an ATC flight plan.

This can be monitored on the NOTIFICATION pages where the sequence NOTIFYING, NOTIFIED is displayed (refer to Figure 5-1, Figure 5-2 and Figure 5-3).

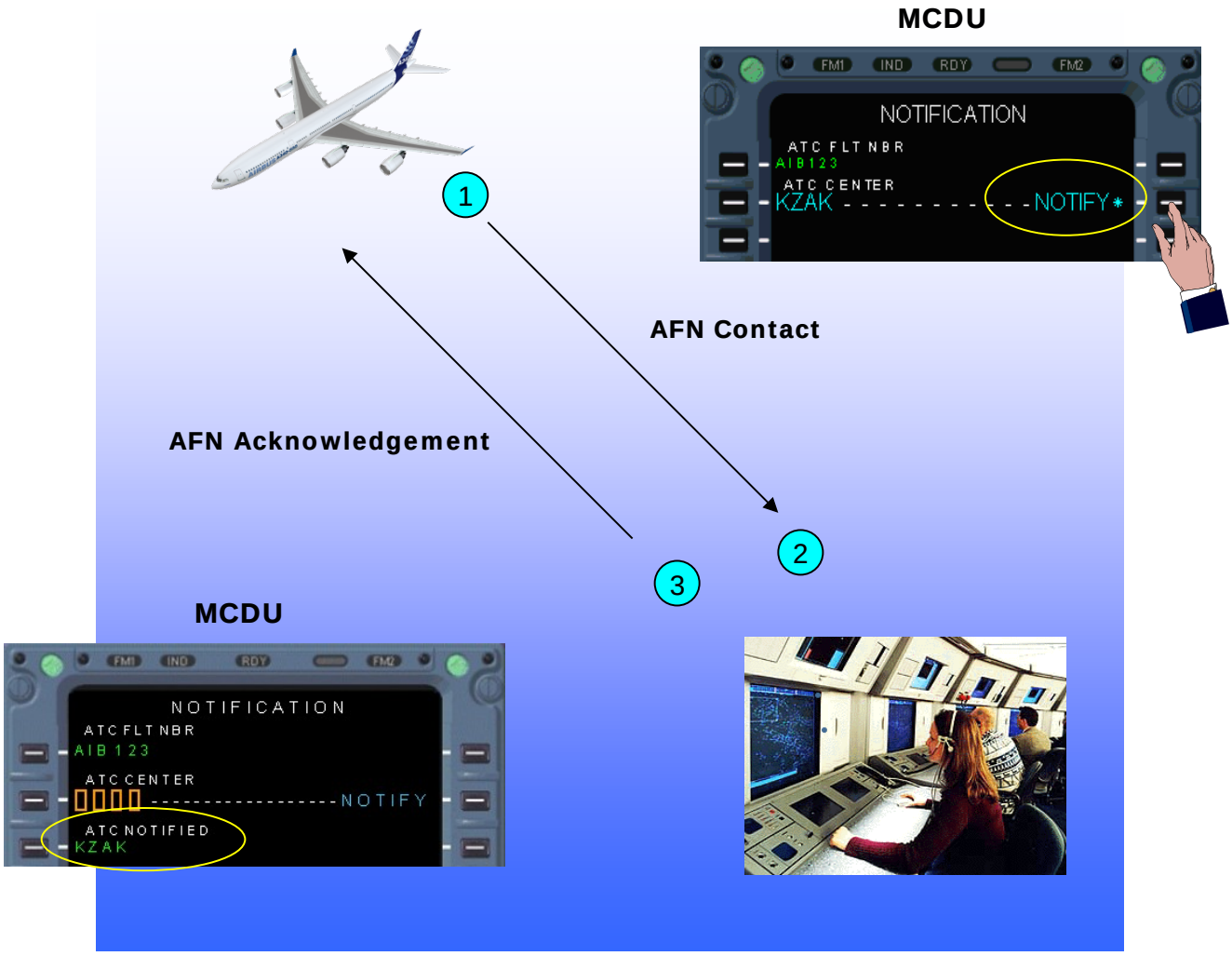


Figure 5-1
Manual notification with A320/A330/A340 interfaces

Note: The cockpit interfaces (DCDU/MCDU) provided here above are related to FANS A+. There are some minor differences of cockpit interfaces between FANS A+ and latest FANS A+ system that are described in the Part II - Appendix G – A320/A330/A340 FANS A+ operational scenarios.

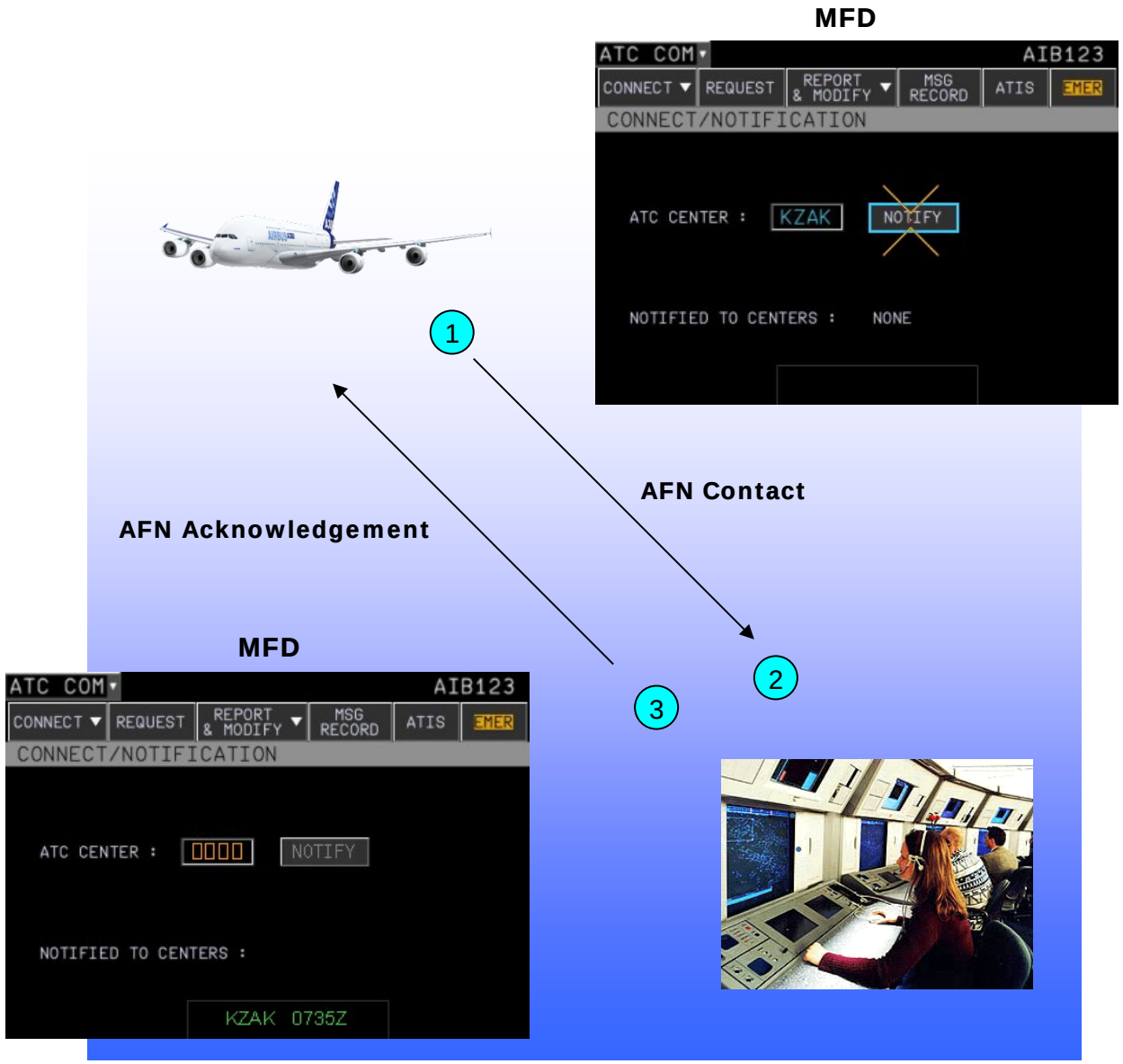


Figure 5-2
Manual notification with A380 FANS A+ interfaces

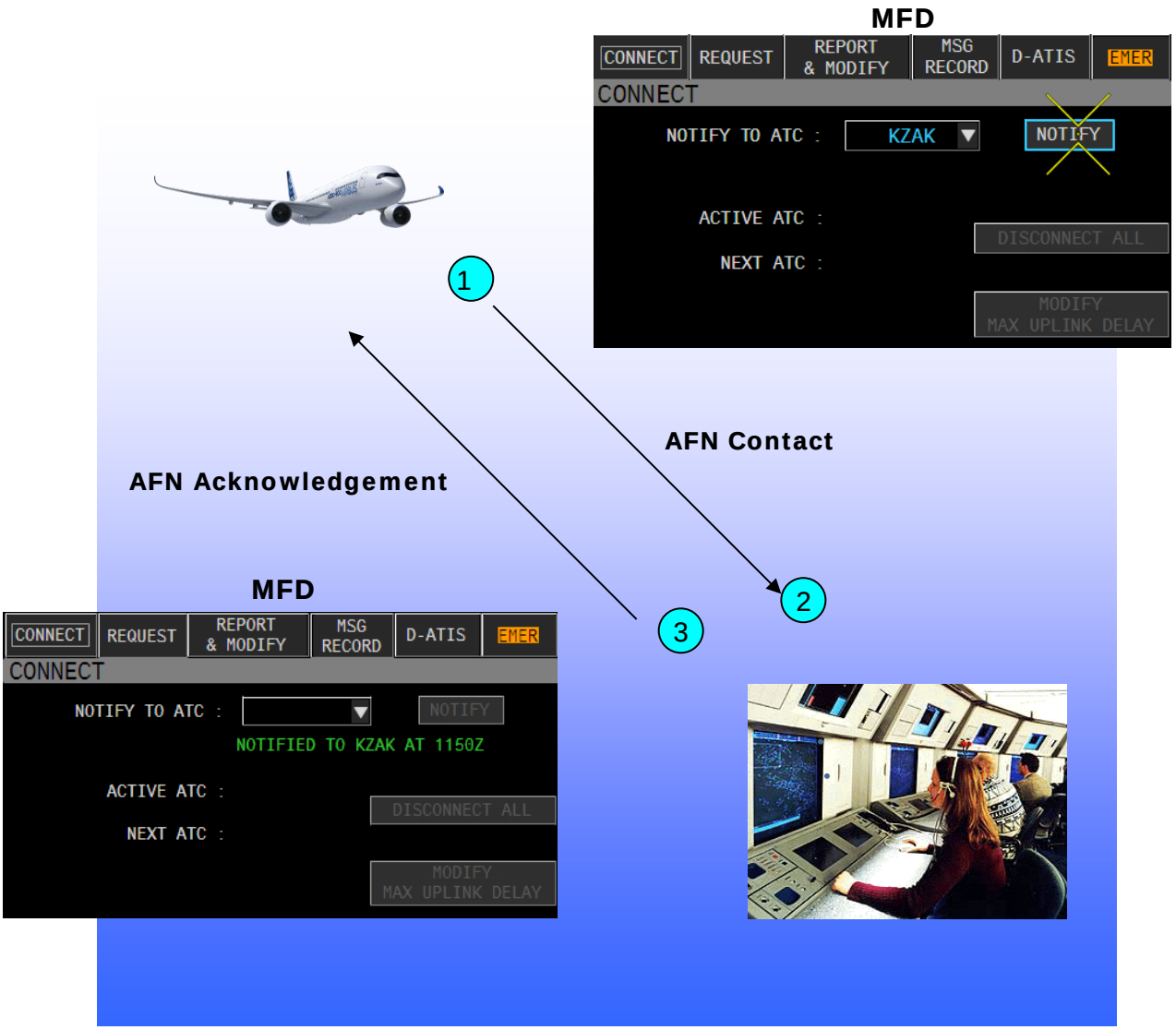


Figure 5-3
Manual notification with A350/A380 FANS A+B interfaces

Please bear in mind…

A5. FANS A/A+ OPERATIONAL PROCEDURES

It has to be noticed that the following principles apply in ACARS oceanic and remote areas:

- **Voice and data link are used as communication means with ATC.**
- **When the aircraft is equipped with datalink systems, CPDLC is the primary means of communication in ACARS environment unless otherwise specified by local rules. Voice will be used as a backup means.**
- **Below 10,000 ft (i.e. during critical phases), voice should be used for ATC communications in order to reduce flight crew head-down time.**
- **The ATC controller and flight crew will determine the communication means (CPDLC or voice) that is the most appropriate at any given time.**

Procedures described hereafter are common to FANS A and FANS A+ systems whatever the aircraft models (A320/A330/A340/A350/A380). For FANS A+B systems, the procedures refer only to FANS A+ (i.e. FANS A+B working over ACARS).
If A350/A380 bring new evolutions and features in cockpit, they do not modify the procedures.

Pre-flight phase

- **ICAO F-PLN filling**

The CNS/ATM capabilities of the aircraft will be notified when filling in the ICAO flight plan. With the entry into force of the ICAO PANS-ATM Doc 4444 applicable from November 2012, new letter codes have been introduced.

- The **data link capability** (CPDLC and ADS-C) is notified in the **Item 10** (Equipment and capabilities). The **Item 10** is composed of two parts:
  - **Item 10(a)**: Radio Communication, Navigation and Approach Aid Equipment and Capabilities

CPDLC and RCP Capabilities	**Item 10a**
CPDLC FANS 1/A HFDL	J2
CPDLC FANS 1/A VDL Mode A	J3
CPDLC FANS 1/A VDL Mode 2	J4
CPDLC FANS 1/A SATCOM (INMARSAT)	J5
CPDLC FANS 1/A SATCOM (MTSAT)	J6
CPDLC FANS 1/A SATCOM (IRIDIUM)	J6

Please, bear in mind… (continued)

CPDLC and RCP Capabilities	Item 10a
RCP400	P1
RCP240	P2

- **Item 10(b)**: Surveillance Equipment and capabilities.

ADS-C Capabilities	Item 10b
ADS-C with FANS 1/A capabilities	D1

- The **aircraft identification** is entered in the **Item 7** of the flight plan and must contain only alphanumeric character without hyphen or symbols.
- The **aircraft registration** are still mentioned in the **Item 18** (preceded by **REG/**) of the flight plan.
- The **RSP capability** (i.e. RSP 180 or RSP 400) is mentioned in the **Item 18** (preceded by **SUR/**).

- **Pre-flight checks**

Prior to departing for a FANS flight, checks must be performed by the dispatcher and flight crew to ensure that the aircraft is ready for FANS operations. The following items are recommended to be checked:

- Dispatcher checks:
  - FANS equipment availability
- Flight crew checks:
  - No ECAM alert is present on datalink systems
  - Removal of the MSG RECORD as per FCOM procedure
  - Check ADS armed as per FCOM procedure.

ATS Facilities Notification (AFN)

- The aim of the ATS Facilities Notification is to:
  - Notify the appropriate ATC center of the capabilities and specifics of the aircraft data link communication applications
  - Give the flight identification and the aircraft registration number.
- The AFN logon should be exercised between 10 and 25 minutes prior entering an airspace that provides CPDLC and/or ADS-C services
- The AFN can be initiated:
  - Manually by the flight crew, or
  - Automatically by the ATC center using the address forwarding process.

The AFN must be successfully completed prior to any connection (CPDLC or ADS-C) is being established.

A5.4. CPDLC PROCEDURES

A5.4.1. CPDLC CONNECTION ESTABLISHMENT

When the AFN logon has been successfully done (the 4-letter code of the notified ATC center is listed in the ATC NOTIFIED section on MCDU NOTIFICATION page for A320/A330/A340 aircraft or the NOTIFIED TO CENTERS section on MFD NOTIFICATION page for A350/A380 aircraft), the ATC center can initiate a CPDLC connection.

For the connection establishment, the ATC center and the aircraft follow the next sequence:

- The ATC center sends a CPDLC CONNECTION REQUEST (CR1) to initiate the CPDLC connection. The aircraft system (ATSU for A320/A330/A340 or ATC applications for A350/A380) accepts or rejects the connection:
  - Connection is accepted if no previous connection already exists or the ATC center corresponds to the next ATC center to control the aircraft
  - Connection is rejected in all other cases.
- The aircraft system (ATSU for A320/A330/A340 or ATC applications for A350/A380) replies with a:
  - CPDLC CONNECTION CONFIRM (CC1) if the connection is accepted, or
  - CPDLC DISCONNECT REQUEST (DR1) if the connection is rejected.

During this exchange, no flight crew action is required.

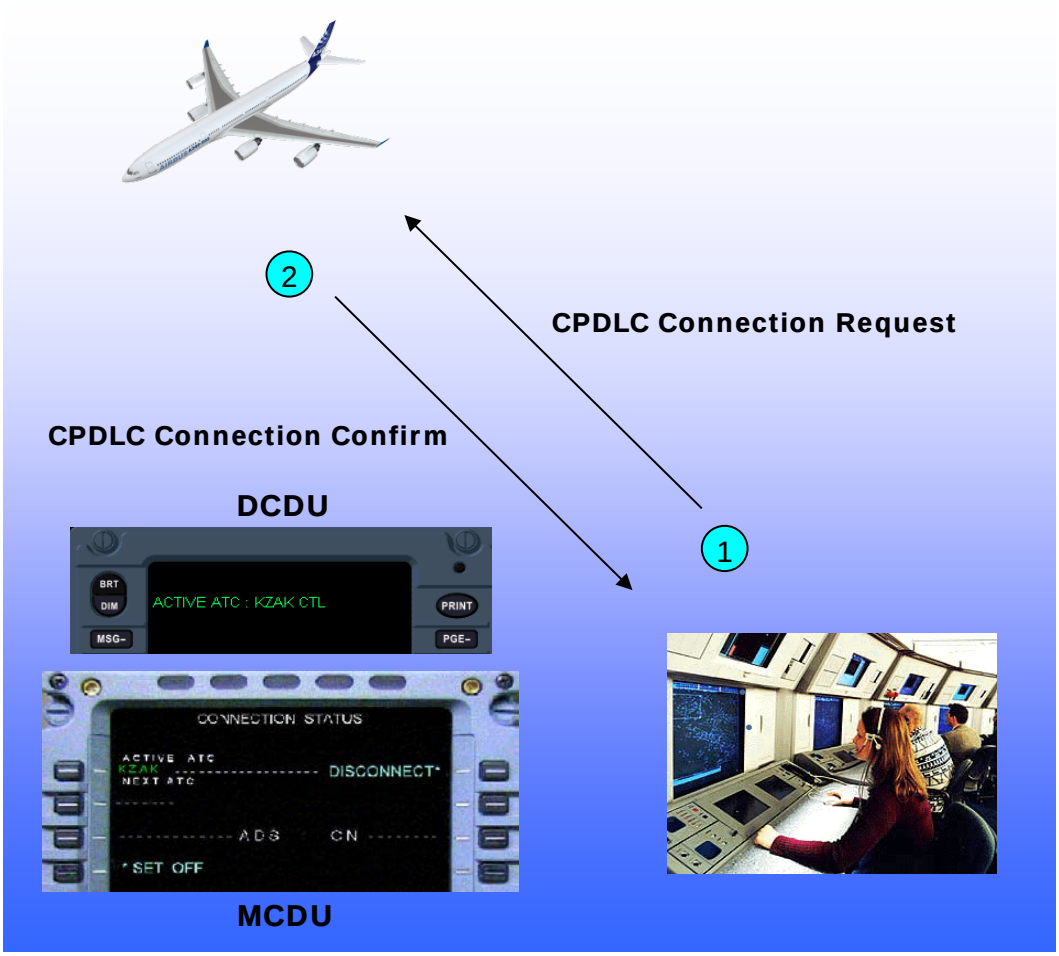


Figure 5-4
CPDLC connection establishment with A320/A330/A340 interfaces

Note: The cockpit interfaces (DCDU/MCDU) provided here above are related to FANS A+. There are some minor differences of cockpit interfaces between FANS A+ and latest FANS A+ system that are described in the Part II - Appendix G – A320/A330/A340 FANS A+ operational scenarios.

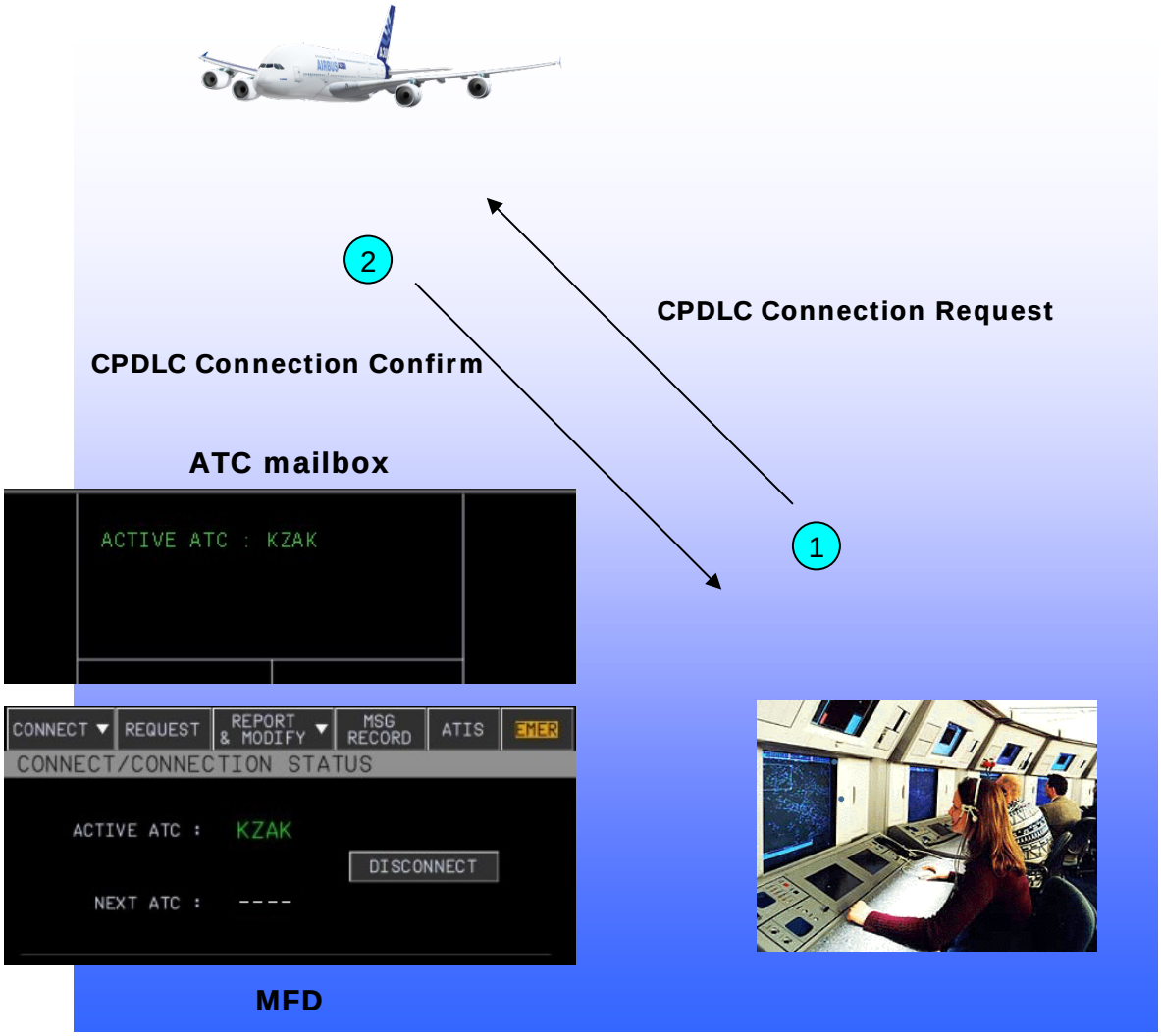


Figure 5-5
CPDLC connection establishment with A380 FANS A+ interfaces

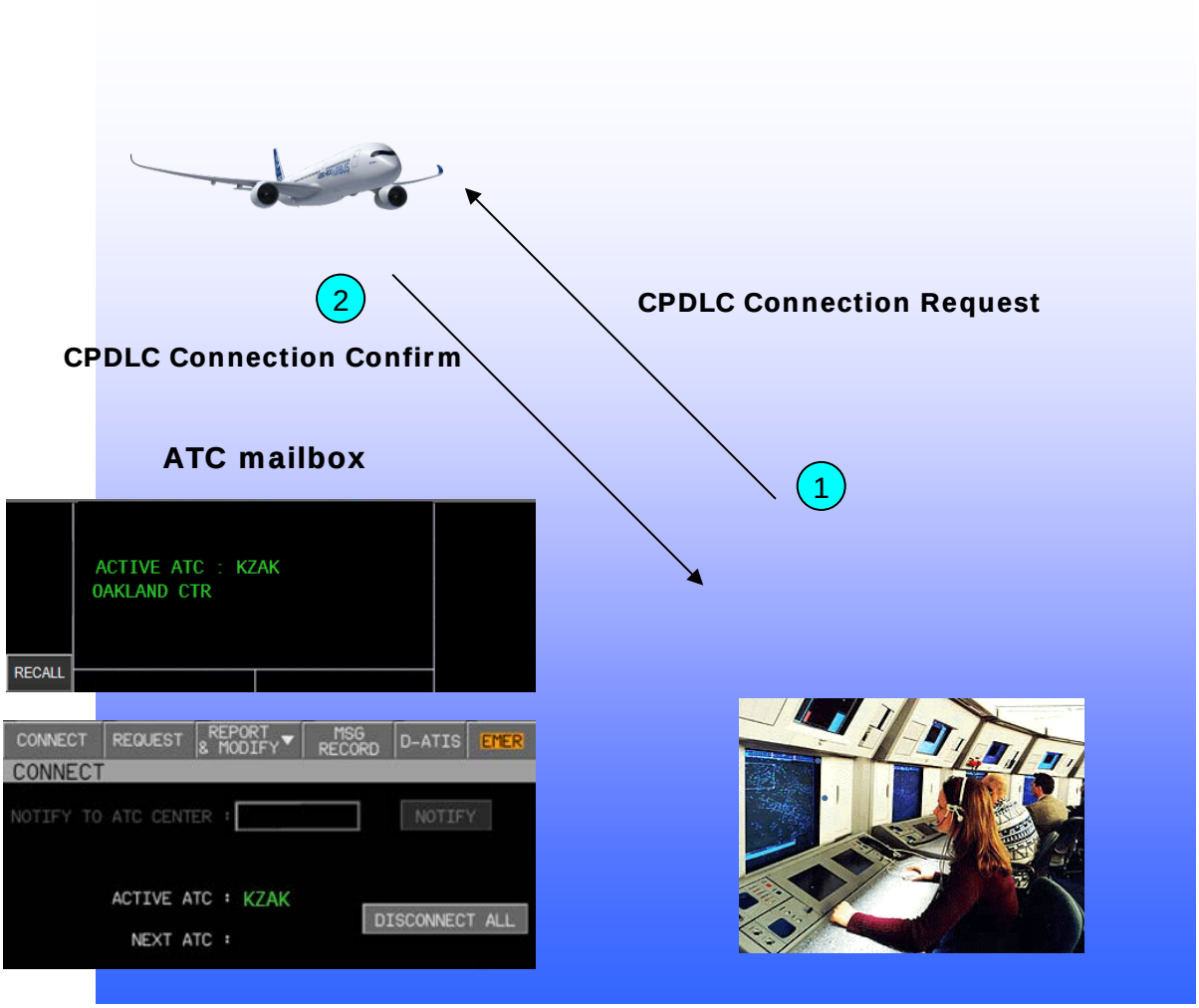


Figure 5-6
CPDLC connection establishment with A350/A380 FANS A+B interfaces

Note: The ACTIVE ATC line on the MCDU (respectively MFD) is dedicated to CPDLC connection status. When CPDLC connection has been established, the active ATC is indicated on both DCDU and MCDU (respectively ATC mailbox and MFD). The ATSU (respectively ATC applications) supports one active CPDLC connection with the current ATC center.

A5.4.2. CPDLC CONNECTION TRANSFER

The transfer of ATC responsibility between two ATC centers (i.e. the current ATC center and the next ATC center) requires a CPDLC connection transfer. Transfer from the current ATC center to the next one is usually initiated by the current ATC center.

The current ATC center is the **Current Data Authority (CDA)**.
The next ATC center is the **Next Data Authority (NDA)**.

The CPDLC connection transfer is performed using the following sequence:

- Notification of identity of the NDA
- Logon to the NDA
- CPDLC connection establishment with the NDA
- CPDLC transfer termination to the NDA.

The next chapters describe, in details, this sequence including the data link messages exchanges and the associated cockpit interfaces (for A320/A330/A340 and A350/A380). These explanations are given for a better understanding of the CPDLC connection transfer in order to properly apply the procedures with regards to the transfer, especially in case of failures.

A5.4.2.1. NOTIFICATION OF IDENTITY OF THE NDA

To inform the aircraft avionics (i.e. ATSU or ATC applications) that a transfer of control will be done, the CDA sends a NDA message including the identity of the NDA to the aircraft. The aircraft avionics (i.e. ATSU or ATC applications) will only accept CPDLC CONNECTION REQUEST (CR1) from the ATC center provided in NDA message.

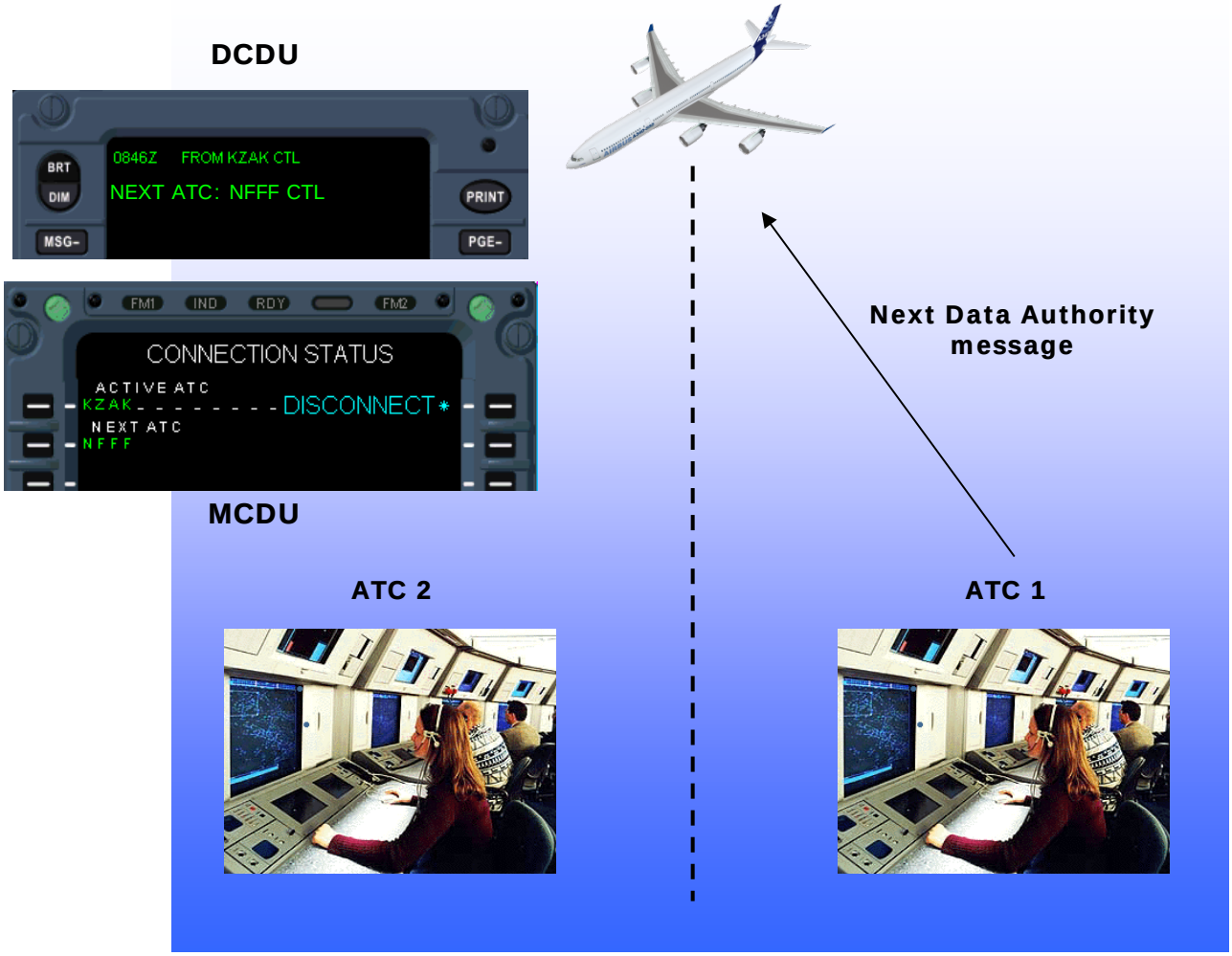


Figure 5-7
Notification of identity of the NDA with A320/A330/A340 interfaces

Note: The cockpit interfaces (DCDU/MCDU) provided here above are related to FANS A+. There are some minor differences of cockpit interfaces between FANS A+ and latest FANS A+ system that are described in the Part II - Appendix G – A320/A330/A340 FANS A+ operational scenarios.

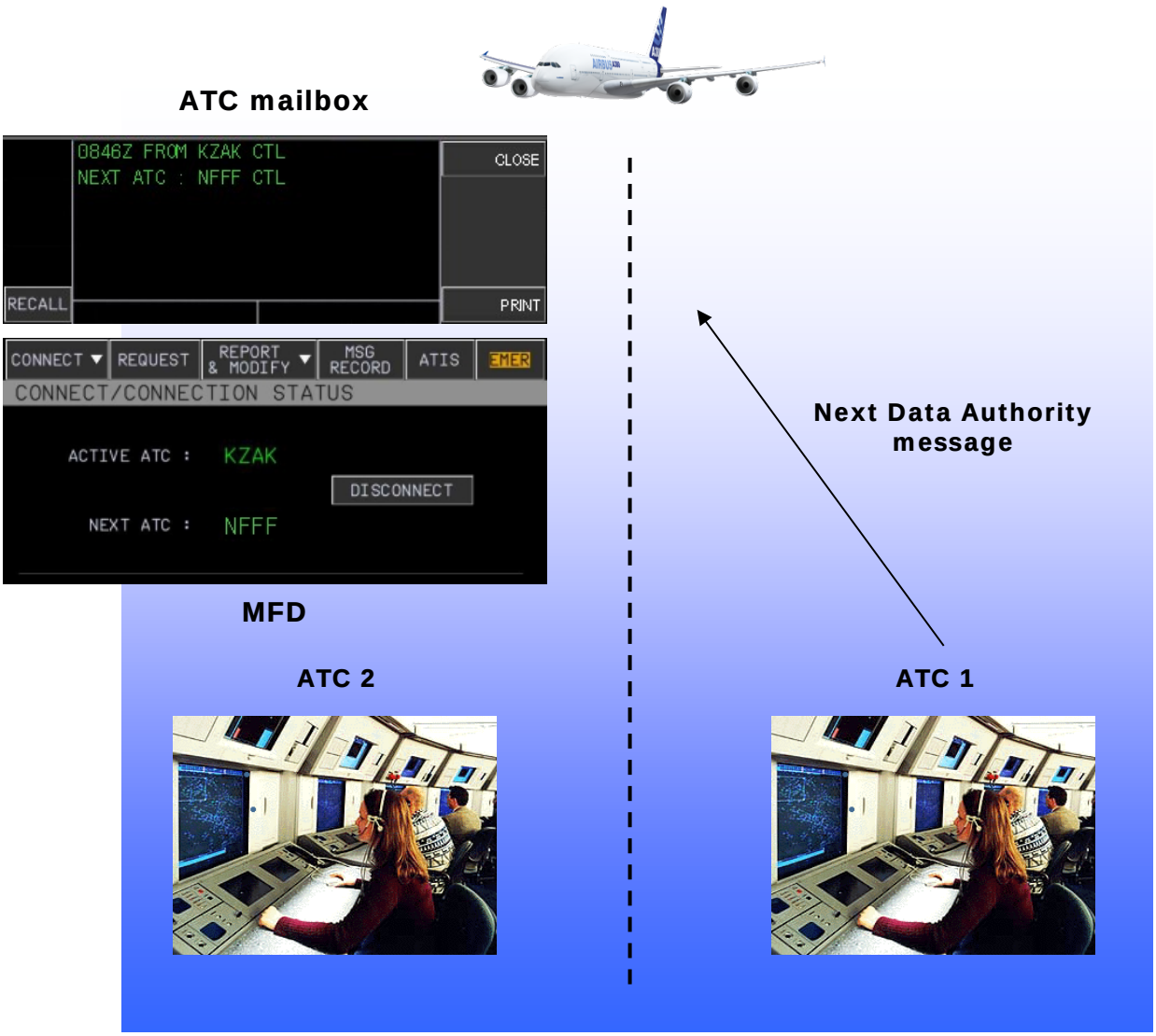


Figure 5-8
Notification of identity of the NDA with A380 FANS A+ interfaces

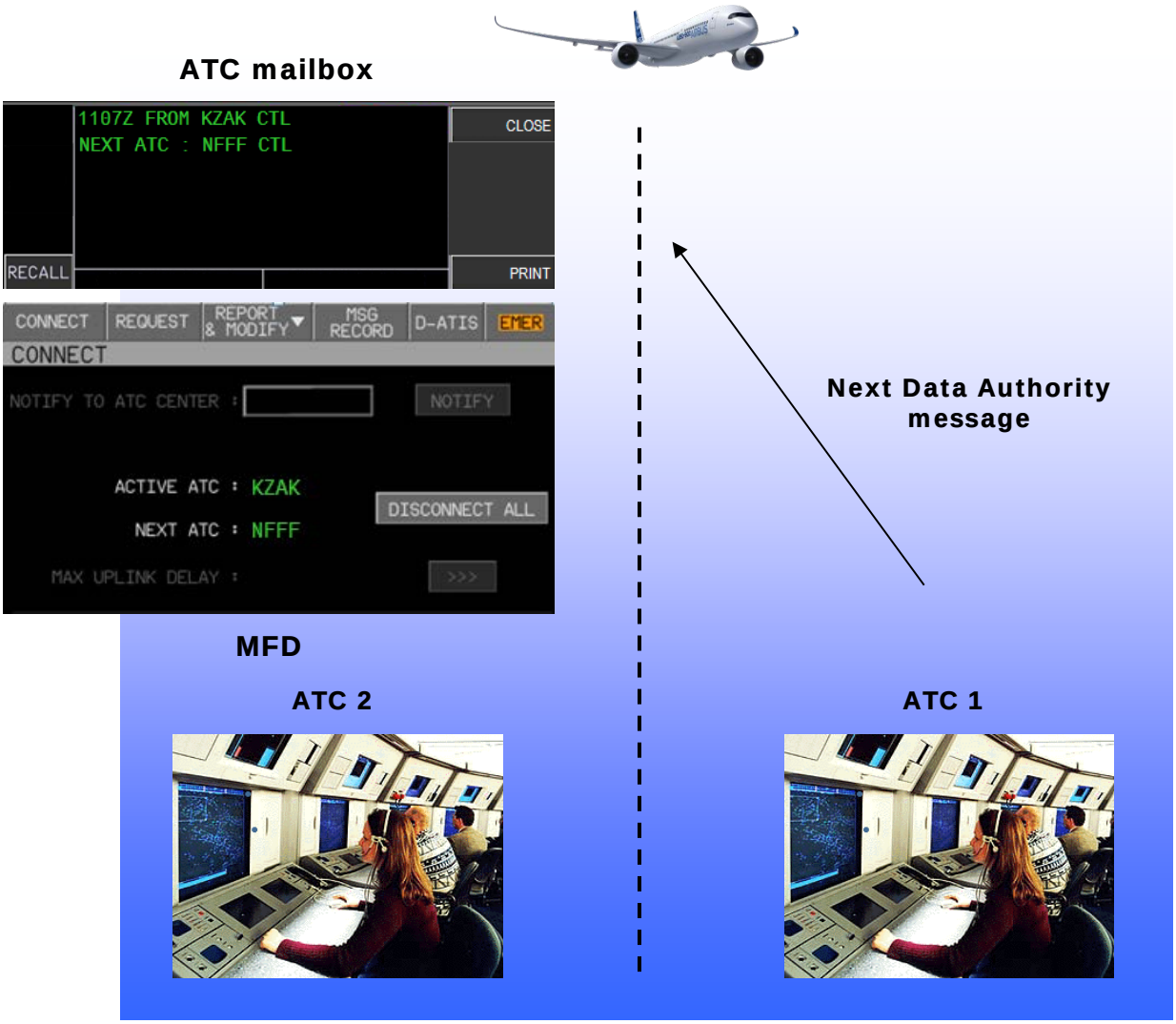


Figure 5-9
Notification of identity of the NDA with A350/A380 FANS A+B interfaces

Once the aircraft has received the identity of the NDA, an AFN Logon with the NDA is possible (see next section).

A5.4.2.2. AFN LOGON WITH THE NDA

There are two ways to proceed the AFN Logon with the NDA:

- **Air-Ground address forwarding procedure**: the CDA instructs the aircraft system to initiate an AFN logon to the NDA. The aim of the procedure is to forward the address of the NDA to the aircraft. This is a air-ground interaction. The following sequence of message exchange should be initiated by the CDA around 15 minutes prior to the estimated time at the FIR boundary.
  - The CDA sends an AFN Contact Advisory (FN_CAD) message to the aircraft to initiate an AFN Logon with the NDA
  - The aircraft acknowledges this message by sending an AFN Response (FN_RESP) message to the CDA and sends an AFN contact message to the NDA

- The NDA acknowledges the demand through an AFN Acknowledgement (FN_ AK) message
- The aircraft sends an AFN Complete (FN_COMP) message to the CDA, to inform it of the completion of the AFN Logon with the NDA

The flight crew is unaware of this sequence of message exchanges.

- **Ground-Ground address forwarding procedure**: the CDA sends to the NDA the same information than AFN Logon. This is a ground-ground interaction. To know more about ground coordination, see Part I - Section 3.3.2.3 Ground coordination.

At this stage, the NDA can initiate a CPDLC connection as described in Section A5.4.2.3 CPDLC connection establishment with the NDA.

A5.4.2.3. CPDLC CONNECTION ESTABLISHMENT WITH THE NDA

When the aircraft has established an AFN Logon with the NDA (via Air-Ground address forwarding sequence or via Ground-Ground address forwarding sequence), the NDA can initiate a CPDLC connection with the CPDLC CONNECTION REQUEST (CR1) message. For more details about the CPDLC connection, refer Section A5.4.1 CPDLC connection establishment.

As a result, the ATSU (respectively ATC applications) supports two CPDLC connections:

- One active connection with the CDA
- One passive connection with the NDA.

Consequently, the ATSU (respectively ATC applications) and NDA cannot exchange CPDLC messages as the CDA is the only authority in charge of the aircraft. The CPDLC exchanges between the aircraft and the CDA will be possible only when the CPDLC connection is transferred to the NDA (refer to next section).

A5.4.2.4. CPDLC CONNECTION TERMINATION WITH THE CDA

The CPDLC transfer to the NDA is completed when the CPDLC connection with the CDA is terminated. For the termination of the CPDLC connection, the CDA should send the END SERVICE message after the last position report and before crossing the FIR boundary (i.e. not less than 5 min before FIR boundary).
For the voice frequency transfer, the process of the CPDLC connection transfer is completed with the MONITOR (OR CONTACT) [icaounitname] [frequency] message.

Three methods may be used:
Method 1: The current ATC centre sends to the flight crew MONITOR (OR CONTACT) [icaounitname] [frequency] and END SERVICE message elements in one single uplink message.
When the flight crew sends WILCO as a response to the multi-element message, the ATSU (respectively ATC applications) disconnects the connection with the CDA. Therefore, the multi-element message should be received on-board not more than 10 minutes before the frequency transfer point. Refer to Figure 5-10 or Figure 5-11.

<u>Method 2:</u> The CDA sends to the flight crew MONITOR (OR CONTACT) [icaounitname] [frequency] and END SERVICE message elements in separate uplink messages.
The flight crew sends WILCO as a response to the MONITOR/CONTACT instruction. The current ATC centre sends the END SERVICE message immediately after the receipt of the WILCO response.

<u>Method 3:</u> the CDA center sends AT [position] (or AT [time]) MONITOR (OR CONTACT) [icaounitname] [frequency] and END SERVICE message elements in separate uplink messages.
The flight crew sends WILCO as a response to the MONITOR/CONTACT instruction. Once the WILCO response is received on ground and while the aircraft is approaching the FIR boundary, the CDA sends the END SERVICE message.

In all methods, after the receipt of the END SERVICE message, the ATSU (respectively ATC applications) disconnects the CDA and the NDA CPDLC connection becomes active. Usually, it may become active before the aircraft crosses the FIR boundary.

No flight crew action is required to make the CPDLC connection with the NDA active. However, around 10 minutes prior to the FIR boundary, the flight crew should monitor the CPDLC transfer to the NDA on the DCDU (respectively ATC mailbox). When the CPDLC transfer is successful, the default screen of the DCDU (respectively ATC mailbox) and the ACTIVE CENTER in the CONNECTION STATUS page on MCDU (respectively MFD) display the NDA as the new CDA.

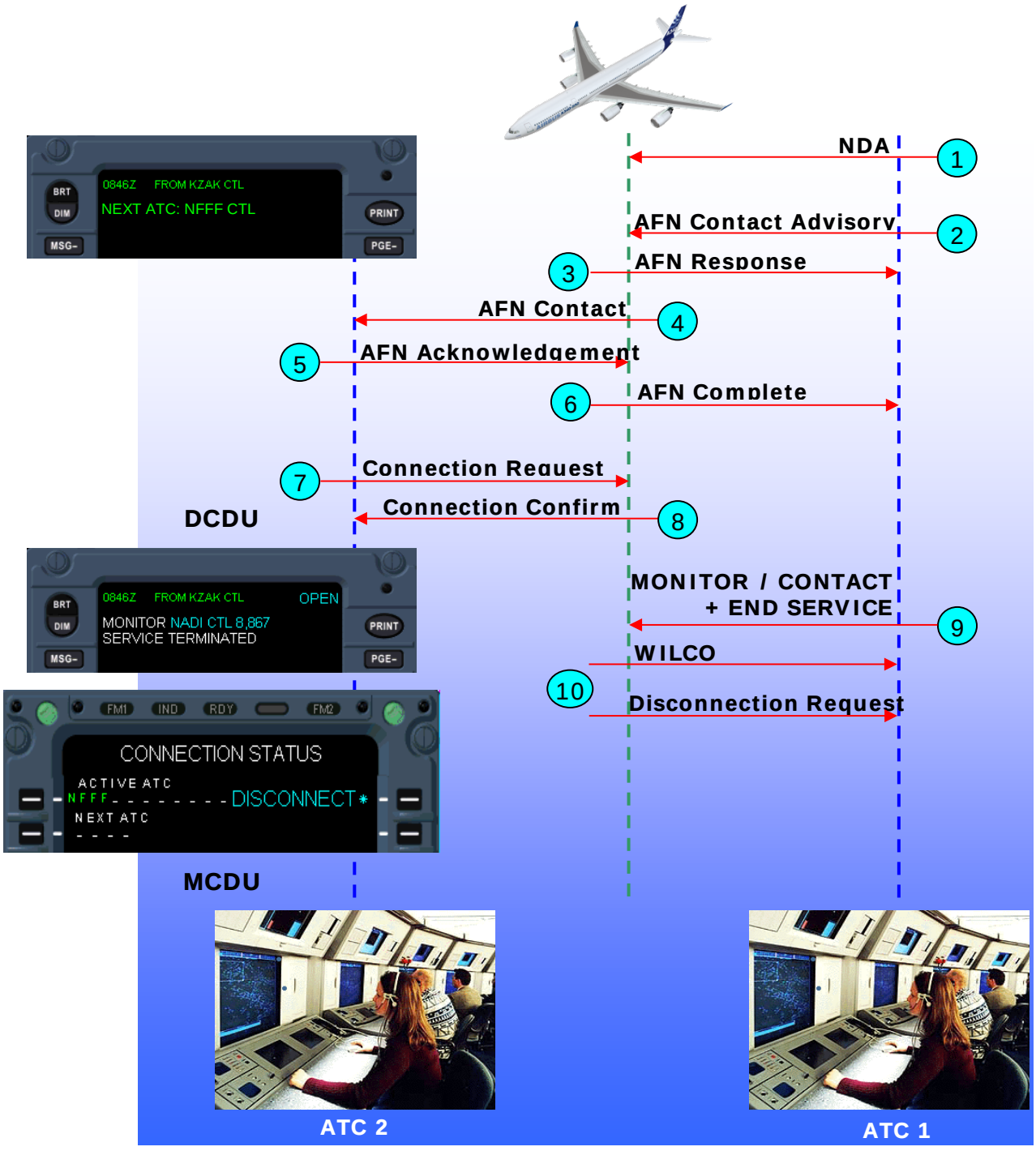


Figure 5-10
CPDLC connection transfer with A320/A330/A340 interfaces

Note: The cockpit interfaces (DCDU/MCDU) provided here above are related to FANS A+. There are some minor differences of cockpit interfaces between FANS A+ and latest FANS A+ system that are described in the Part II - Appendix G – A320/A330/A340 FANS A+ operational scenarios.

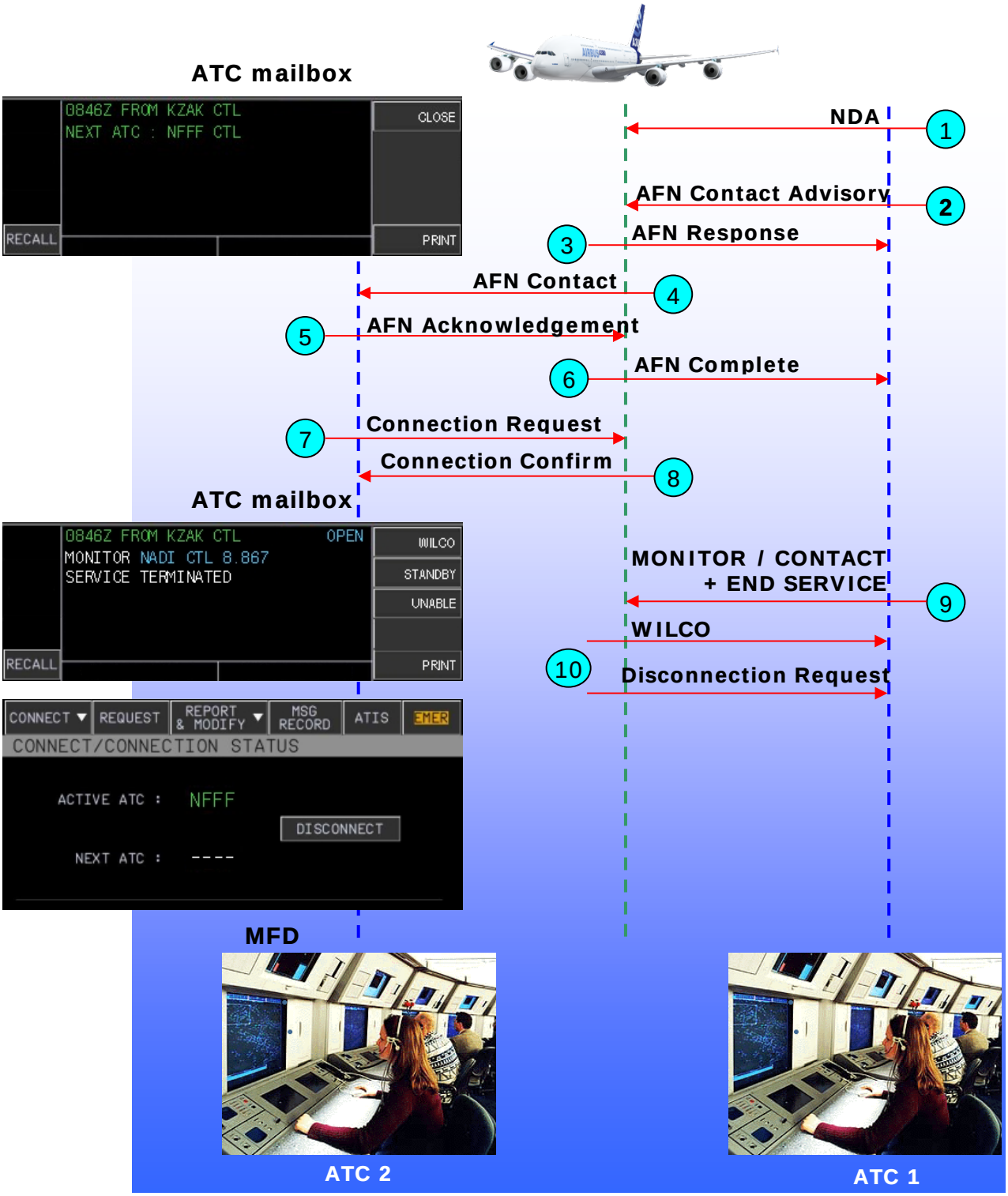


Figure 5-11
CPDLC connection transfer with A350/A380 interfaces

After a CPDLC connection transfer, the receiving ATC center has the confirmation to be the CDA only when it receives the first message from the aircraft. Some ATC center may require to get this confirmation before the reception of the first message from aircraft. Different possibilities could be used:

- The aircraft system will reply ROGER when the receiving ATC center sends a free-text uplink.

ATC Controller: UM 169 [free text] uplink message.

Flight Crew: *ROGER*

- The aircraft sends a CPDLC POSITION REPORT to the receiving ATC either
  - When crossing the FIR boundary, or
  - When the NDA becomes the CDA (i.e. ACTIVE CENTER in the CONNECTION STATUS page on MCDU or MFD), or
  - In response to an uplink REQUEST POSITION REPORT from the receiving ATC.

In cases where the receiving ATC is not the CDA, the aircraft will respond with the message “NOT CURRENT DATA AUTHORITY” to any uplink message from the receiving ATC.

For the list of ATC centers requiring confirmation of CDA, refer to GOLD - Appendix E (see References).

A5.4.3. CPDLC CONNECTION TERMINATION

A CPDLC connection with one ATC center is usually terminated once this center has sent an "END SERVICE" message to the aircraft. This message is normally sent before crossing the FIR boundary.

Under normal circumstances, the CPDLC connection should be established with the NDA before the termination of the CPDLC connection with the CDA. Two scenarios may be possible:

- If the NDA has been connected to the aircraft at the time the "END SERVICE" message is received, the termination of the CPDLC connection with the CDA is used to activate the CPDLC connection transfer to the NDA. For more details, refer to Section A5.4.2.4 CPDLC connection termination with the CDA
- If the NDA has not been connected to the aircraft at the time the "END SERVICE" message is received or if no NDA exists, the aircraft sends a CPDLC DISCONNECT REQUEST (DR1) and the CPDLC connection with the CDA is terminated. The aircraft is left without any CPDLC connection.

If any message remains open when the aircraft receives an END SERVICE message, the aircraft will close the message and:

- Disconnect all CPDLC connections on A330/A340 FANS A system
- Transfer the CPDLC connection to the NDA on FANS A+ system.

A5.4.4. ABNORMAL CASES OF TRANSFER OF CONNECTION

A5.4.4.1. NON-DELIVERY OF THE NDA

If the delivery of NDA has not been successful, the current ATC should send another NDA message.

If this tentative is also unsuccessful, the current ATC shall instruct the flight crew to:

- Manually terminate the current CPDLC connection
- Perform an AFN notification with the next ATC center.

In this case, the END SERVICE message is not required as the flight crew is instructed to disconnect the current ATC.

Either voice or CPDLC can be used for this instruction. The following phraseology is recommended:

ATC Controller: *CONTACT [icaounitname] [frequency].*
SELECT ATC COMM OFF THEN LOGON TO [icaounitname].
(Note: When via CPDLC, this last element will be free text)

Flight Crew: *WILCO*

Remarks on the phraseology
The phraseology provided in this Part II is taken from GOLD (see References). However, the used terms are not adapted to the Airbus interfaces. The phraseology is faithfully reproduced, as the ATC controller should use it.

Therefore, the following interpretations apply:

- **"Select ATC Com Off" for "Disconnect"** (i.e. DISCONNECT function in the CONNECTION STATUS page on MCDU or MFD).
- **"Logon" for "Notify"** (i.e. NOTIFY function in the NOTIFICATION page on MCDU or MFD).

To select ATC Com off, select the DISCONNECT function from the CONNECTION STATUS page on MCDU (respectively MFD).

- Selecting ATC Com off will disconnect the transferring ATC.
- Logging on to the designated ATC will allow the designated ATC to perform a CPDLC connection.

Such a procedure is initiated by the transferring ATC while approaching the FIR boundary.

A5.4.4.2. NON-DELIVERY OF THE END SERVICE

It may happen that the automatic termination of the CPDLC connection fails (e.g. the END SERVICE message is not delivered to the avionics). In that case, the ATC should resend an END SERVICE message.

If this tentative is also unsuccessful, the ATC should instruct the flight crew to

- Perform a manual disconnection (i.e. DISCONNECTION function from the CONNECTION STATUS page)
- Manually logon to the next ATC.

The voice phraseology will be:

ATC Controller: AUTOMATIC TRANSFER OF CPDLC FAILED. WHEN ENTERING [icaounitname] AREA DISCONNECT CPDLC THEN LOGON TO [icaounitname]

Flight Crew: *ROGER*

A5.4.4.3. AUTOMATIC CONNECTION TRANSFER NOT SUCCESSFUL

The CPDLC transfer may occur after the aircraft has crossed the FIR boundary. If the transfer does not happen, two scenarios could be considered:

- If the transferring ATC requires a CPDLC position report for confirmation of CDA status, the flight crew should send a CPDLC POSITION REPORT to the transferring ATC when crossing the FIR boundary. If 3 minutes after sending the CPDLC position report, the CPDLC connection transfer is still not done, the flight crew should terminate the CPDLC connection with the transferring ATC and start an AFN logon with the next ATC
- If the transferring ATC does not require a CPDLC position report for confirmation of CDA status, the flight crew should contact the transferring ATC by voice or CPDLC free text to inform that the CPDLC transfer has failed.

A5.4.5. FAILURES OF THE CPDLC CONNECTION

As soon as a failure of the CPDLC connection is noticed by either the flight crew or ATC controller, voice will be used to inform the other side of the failure and to coordinate further actions. The voice coordination will be done before any disconnection.

If a connection has been lost, a complete notification/connection procedure must be performed. The Part II - Appendix K – On-board indications in case of data link failures provides cues available in the cockpit in case of sensed failures.
The following sections provide the recommended procedures.

A5.4.5.1. CPDLC CONNECTION FAILURE

The ATC controller instructs via voice the flight crew to perform a manual disconnection followed by a notification.
The flight crew applies the ATC instructions via the MCDU (respectively MFD):

- The manual disconnection with the DISCONNECT function in the CONNECTION STATUS page
- The notification with the NOTIFY function in the NOTIFICATION page.

The voice phraseology will be:

ATC Controller: *ATC DATA LINK FAILED.*
*SELECT ATC COMM OFF THEN LOGON TO [*icaounitname*].*

Flight Crew: *ROGER*

A5.4.5.2. PLANNED DATALINK SHUTDOWN

The shutdown period should be notified through NOTAM. During the shutdown period, voice shall be used.
Prior the commencement of the shutdown period, the ATC controller instructs the flight crew to disconnect the data link and to continue on voice.
The flight crew shall terminate the data link (i.e. DISCONNECT function in the CONNECTION STATUS page on MCDU or MFD) and continue on voice.

The following phraseology (either voice or data) will be:

ATC Controller: *DATA LINK WILL BE SHUTDOWN.*
SELECT ATC COMM OFF. CONTINUE ON VOICE

Flight Crew: *ROGER*

A5.4.5.3. UNPLANNED GROUND SHUTDOWN

In the event of an unexpected shutdown of ground system, the ATC controller instructs the flight crew to disconnect the data link and to continue on voice.
The flight crew shall terminate the data link (i.e. DISCONNECT function in the CONNECTION STATUS page on MCDU or MFD) and continue on voice until the ATC controller informs the resumption of data link communications.

The voice phraseology will be:

ATC Controller: *ATC DATA LINK FAILED*
SELECT ATC COMM OFF. CONTINUE ON VOICE

Flight Crew: *ROGER*

A5.4.5.4. UNEXPECTED AVIONICS SHUTDOWN

In the event of an unexpected avionics shutdown, the flight crew shall inform the ATC controller via voice.
The flight crew shall ask the ATC controller to terminate the data link connection from the ground and shall continue on voice until the avionics resumes. Indeed, in case of ATSU failure, the flight crew is unable to terminate the connection. In case of ATC data link failure (refer to Part II - Appendix K), the flight crew should contact the ATC by voice, even if the avionics require no action.

The following voice phraseology is recommended:

Flight crew: *DATA LINK FAILED.*
SELECT ATC COM OFF. CONTINUING ON VOICE.

ATC Controller: *ROGER. CONTINUE ON VOICE.*

A5.4.5.5. CPDLC RESUMPTION

To inform the flight crew that the ground system has resumed, the ATC controller will use the following voice phraseology:

ATC Controller: *[ALL STATIONS] RESUME NORMAL CPDLC OPERATIONS.*
LOGON TO [icaounitname].

Flight Crew: *LOGON [icaounitname].*

A5.4.6. RECOMMENDATIONS FOR EXCHANGE OF CPDLC MESSAGES

This chapter depicts the various operational points for a proper understanding and use of the CPDLC system. It also provides recommendations directly based on the lessons learnt from past experiences.

A list of all the uplink and downlink messages supported by the CPDLC system is given in Part II - Appendix A.

The CPDLC messages is a set of message elements whose the content corresponds to a voice phraseology. A CPDLC message could be either:

- a single message element, or
- a multi-element message which is an addition of up to five single message elements.

A5.4.6.1. MESSAGE ACKNOWLEDGEMENT

In ACARS environment, the flight crew and ATC controllers cannot know whether a message has been delivered to their right counterpart.
For more details about the message acknowledgement, refer to Part I - Section 3.5.4 Technical acknowledgement: LACK/MAS.

A5.4.6.2. USE AND CONTEXT OF MESSAGES

- **Usual answers**

Most of the clearances can be directly answered through appropriate answer keys on the DCDU (respectively ATC mailbox). According to the recommended international rules, the 5 following closure responses may be used as appropriate: WILCO, ROGER, AFFIRM, UNABLE, NEGATIVE.
It is then important that the flight crew is fully aware of the right meaning and implications of these answers. The following lists the recognized statements for these response elements:

- **WILCO:** This downlink message tells the ATC controller that the flight crew will fully comply with the clearance/instruction contained in the associated uplink message.

- **UNABLE:** Through this either uplink or downlink message the flight crew or the ATC controller informs/is informed that the request(s) contained in the associated message cannot be complied with. If used to answer to a multi-element message (either uplink or downlink), it means that at least one of the elements cannot be complied with; therefore, the whole message is rejected, even if some elements could be accepted.

- **STANDBY:** Through this either uplink or downlink message the flight crew or the ATC controller is informed that the request is being assessed and there will be a short-term delay (within 10 minutes). The exchange is not closed and the request will be answered when conditions allow.

- **ROGER:** Through this either uplink or downlink message the flight crew or the ATC controller informs/is informed that the content of the associated message has been received and understood. ROGER shall not be used instead of AFFIRM.

- **AFFIRM:** Whether uplink or downlink, AFFIRM means YES and is an appropriate response to uplink linked message of negotiation request (e.g. CAN YOU ACCEPT FL 350 AT ALCOA?).

- **NEGATIVE:** Whether uplink or downlink, NEGATIVE means NO and is an appropriate response to uplink linked message of negotiation request (e.g. CAN YOU ACCEPT FL 350 AT ALCOA?).

- **Meaning of other messages**

  - **DISREGARD:** This uplink link message means that the previous uplink link shall be ignored. DISREGARD should not refer to an instruction or clearance. Another element shall be added to clarify that message is to be disregarded.

  - **CONFIRM:** The present parameter (e.g. position, altitude, speed...) is awaited by the ATC controller whenever CONFIRM XXXX is used. The DCDU (respectively ATC mailbox) will automatically propose to the crew an answer to the confirm message in which the current FMS target linked to the considered parameter (if any) will be filled in. Sending this answer is done directly on the DCDU (respectively ATC mailbox). Should the flight crew be not satisfied with the proposed answer, it then could modify before sending.

  - **CONFIRM ASSIGNED:** The currently assigned parameter (e.g. altitude, speed, route, etc) is awaited by the ATC controller whenever CONFIRM ASSIGNED XXXX is used.

A5.4.6.3. EXPECTED DELAYS IN RESPONDING TO CPDLC MESSAGES

Delays depend upon numerous varying factors and happen to be more or less random and unpredictable. Waiting for a better consolidation of the three availability, integrity and accuracy elements as expected with the ATN, the current FANS A performance requirements have been given for the South Pacific operations:
Downlink: An end-to-end transit delay of 60 seconds or less for 95% of delivered messages. Transit being measured as the difference in the timestamp of the ATC controller station and that of the sending action of the flight crew.

Uplink: A 120 second round trip delay on 95%. Round trip being obtained by comparing the time the up link is sent from the ATC controller system against the time the message assurance (indicating successful delivery) was received back to the ATC controller station.

As a general rule, the flight crew should respond to CPDLC messages as soon as practical after their reception. However, to support reduced separations, performance such as RCP 240 and RCP 400 require stringent constraints on the

maximum transaction time. **When operating RCP 240 or RCP 400, it is expected that the flight crew answers to the ATC controller within one minute (time measured between the display of the uplink message and the action to send the response by the flight crew)**. In the case of additional time is needed to fully read, understand and answer the ATC controller instruction, the flight crew should use the STANDBY answer.

STANDBY answer (either downlink or uplink) assumes that a further response should come within a reasonable time (i.e. 10 minutes). The message thus remains open.

- **Uplink STANDBY:** If the ATC controller does not respond within this time, the flight crew shall send an inquiry (e.g. WHEN CAN WE EXPECT CLIMB TO FL360 if the initial request was REQUEST CLIMB TO FL360). In no case, should a duplicate message be sent to avoid any confusion. Refer to Section A5.4.6.7 Duplicate messages.

- **Downlink STANDBY:** In addition, if the flight crew needs more time to assess an ATC instruction, it is recommended to use the STANDBY answer to properly assess the uplink message.

A5.4.6.4. POSITION REPORTING WITH CPDLC

Position reporting may be done either via CPDLC or via ADS-C according to the requirements of the flown airspace (Refer to AIP). ADS-C Position reporting is transparent to the flight crew. However, some requirements about ADS-C position reporting have to be known (refer to Section A5.5.3 Position reporting with ADS-C). The following sections deals with CPDLC position reporting recommendations as described in GOLD (See References).

- **General**

"Position" and "Next Position" shall only contain compulsory reporting points unless requested otherwise by ATC. This recommendation allows to send consistent position reports by either voice or data.

The "Ensuing Significant Point" may be either the compulsory or non-compulsory reporting point after the "Next Position". The table below defines words used in CPDLC position reports and give their equivalent wording in the FMS.

CPDLC Position Report wording	Definition	FMS wording
Position	Reports present position of the aircraft.	PPOS
Next Position	Reports the next reporting point.	TO
Ensuing Significant Point	Reports the ensuing significant point following the "Next Position".	NEXT

A few other important navigation points as per ICAO definitions:

	ICAO Definition
Compulsory reporting point	It is an ATC waypoint for which a position report is required by the aircraft.
ATC waypoint	A waypoint contained in the Field 15 of the ICAO flight plan, or amended by the ATC. Note: A waypoint inserted by the flight crew for purposes of conducting flight operations such as Abeam or ETOPS points are not ATC waypoints.

For more details, refer to ICAO Doc 4444 PANS-ATM (see References).

- **Downlink of position report**

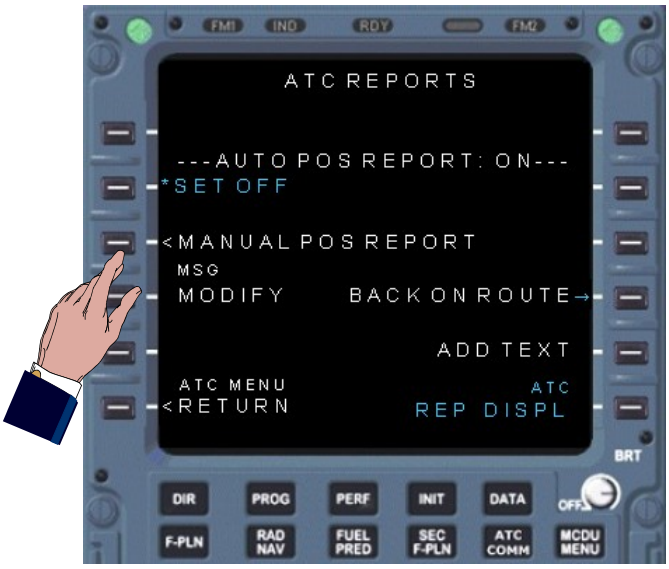
In data link airspaces where CPDLC position reports are required (e.g. data link airspaces where ADS-C is not available), the flight crew shall ensure that a CPDLC position report is sent whenever a compulsory reporting point is passed over (or passed abeam if the aircraft flies an offset). The preformatted POSITION REPORT message has to be used.

The FANS A/FANS A+ systems provide an automatic position reporting function. The ATSU (respectively ATC applications) collects the required information from FMS to fill in the preformatted position report. When a waypoint is passed over, the position report is directly displayed on DCDU (respectively ATC mailbox).

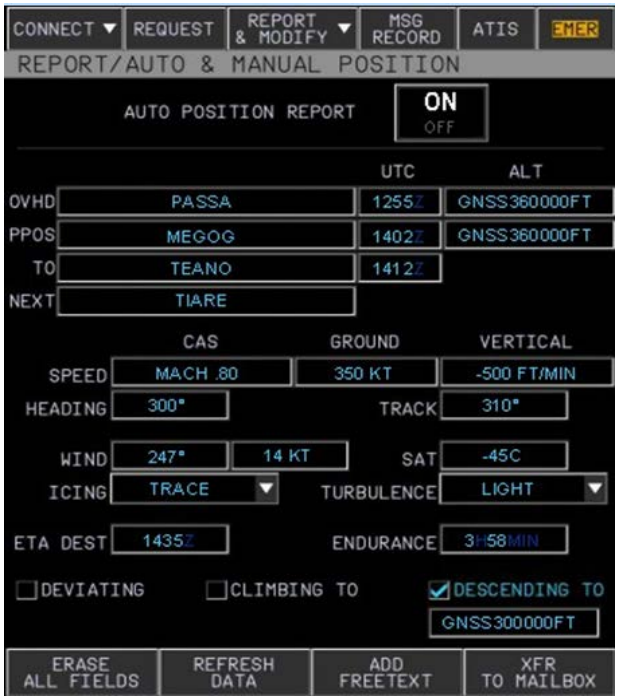
The use of this function should be preferred to manual position report where CPDLC position reporting is needed.

Prior to send the position report, the flight crew must check the accuracy of the position report content (manually or automatically generated) displayed on DCDU (respectively ATC mailbox).

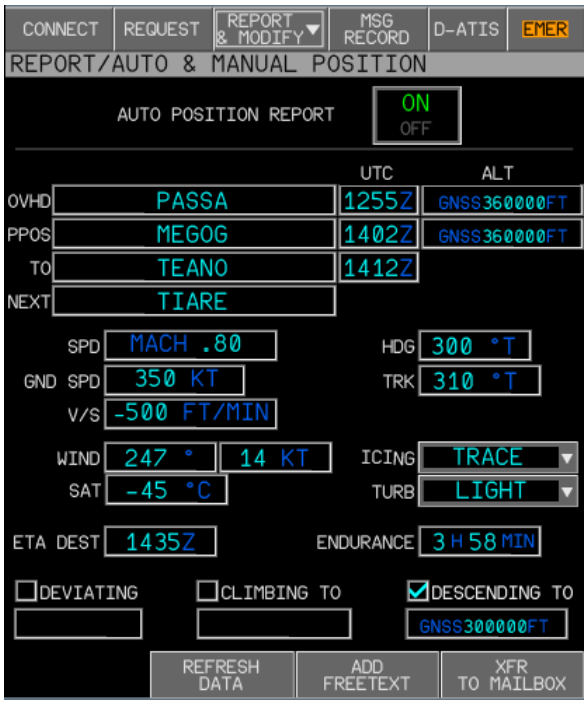
AUTO POS REPORT function and access to MANUAL POS REPORT on A320/A330/A340



AUTO POSITION REPORT function and MANUAL POSITION REPORT on A380 FANS A+



AUTO POSITION REPORT function and MANUAL POSITION REPORT on A350/A380 FANS A+B



- **First position report**

Depending on FIR requirements, the first CPDLC position report is expected to be sent:

- After the completion of the initial connection, or
- After the transfer of connection from one center to the next one, or
- When crossing a FIR boundary.

This first position report is required whether the flown FIR is ADS-C capable or not. The first position report confirms that the receiving ATC center is the Current Data Authority (CDA). For the list of ATC centers requiring confirmation of CDA by position reporting, refer to GOLD Appendix E (See References).

- **Position report at ATC waypoints only**

It is the flight crew's responsibility to ensure that position reports are only sent at compulsory reporting points. Other waypoints are of no interest to ATC.

- **Position report not received by ATC**

If the ATC controller does not receive an expected CPDLC position report, the ATC controller may explicitly request a position report with the uplink message REQUEST POSITION REPORT.

When this message is received on-board, the ATSU (respectively ATC applications) automatically collects the required information from the FMS to fill in the response. The flight crew may modify the response prepared by the ATSU if it is not satisfactory.

Refer to figures on next page.

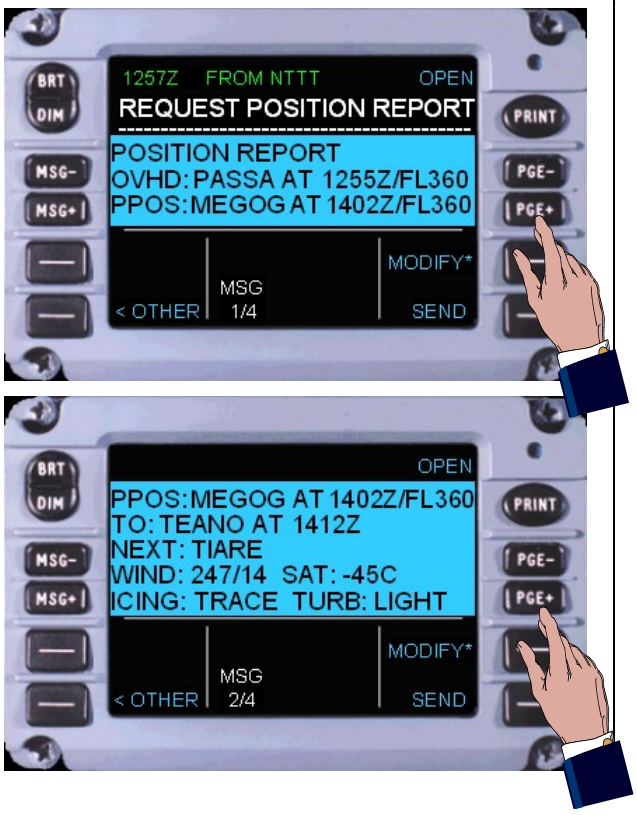
- **Position report for flexible tracks**

All waypoints published for a flexible track are considered as compulsory waypoint. However, when the flexible track follows a published ATS route, position reports are not required at any non-compulsory waypoints defined for that ATS route.

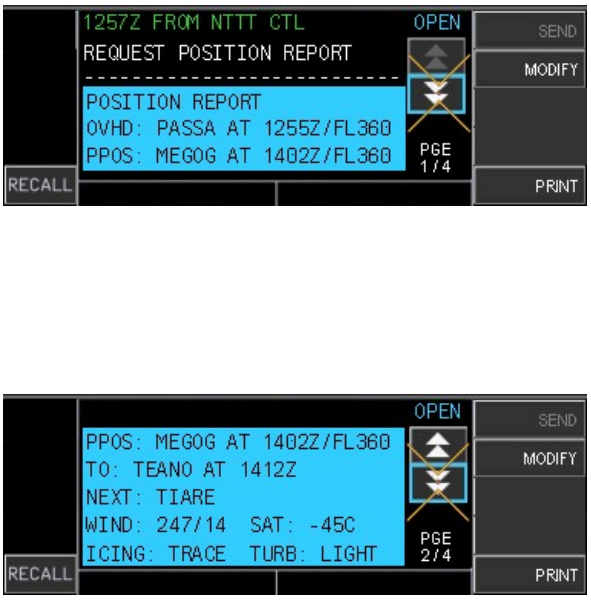
- **Sequencing Abeam waypoints**

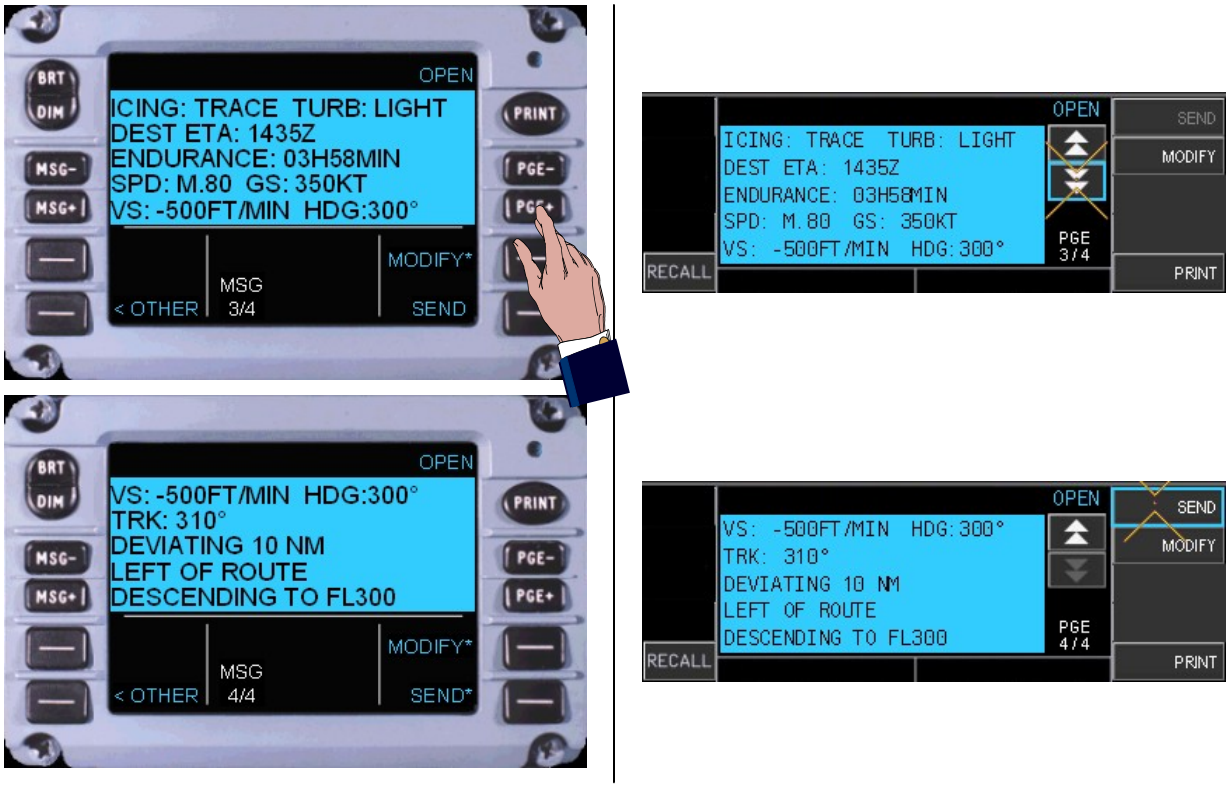
The FMS does not sequence the active waypoint when the aircraft is abeam this point by more than 7 NM on Honeywell FMS2 and 5NM on Thalès FMS2. In this case, the waypoint is not sequenced on the CPDLC report message. It is thus recommended to use the offset function of the FMS so as to send true position reports. Once again, and especially in RNP or FANS routes, updating the flight plan is highly recommended.

Position report on DCDU



Position report on MFD





- **ARINC 424 Waypoints**

In the FMS, a waypoint with full latitude/longitude is displayed in an abbreviated 7 digits format due to space constraints on the MCDU (respectively MFD). The full latitude/longitude are available, even if it is renamed (e.g. ABCD).

Since FANS A has commenced operation, some issues have been highlighted concerning Waypoints Position Reporting (WPR) to ATC centers when encoded in ARINC 424 (format used to code FMS Navigation Database, but not recognized by ground systems). The problem is that waypoints that use ARINC 424 encoding scheme, that allows latitude and longitude to be encoded in 5 characters (e.g. 7560N for N75W060), are not interpreted properly by some ground systems, that try to decode them as latitude and longitude and may end up with something completely different. The issue is limited to ATC communication (CPDLC) for reporting Ident Waypoint coded in ARINC 424.

Many ATC centers cannot accept position reports containing latitude and longitude (Latitude/Longitude) in ARINC 424 format (e.g. 4050N). Position reports containing Latitude/Longitude waypoints within these areas will be accepted in whole latitude and longitude format only. Flights unable to send position reports in whole latitude/longitude format must accomplish position reporting via HF voice.

ADS-C does not use identifiers (waypoint names), but reports the entire latitude/longitude. As well as all those that force track, speed or altitude changes and are reported as “ADS Intent points”.

Thus, as a good practice it is recommended NOT to use ARINC 424 format in the flight plan when operating FANS.

A5.4.6.5. WEATHER DEVIATION AND OFFSETS

It is possible to request a weather deviation clearance or an offset clearance with CPDLC messages.

- A weather deviation clearance permits to deviate up to a specified lateral distance and in a specified direction (left or right) from the original FMS route.
- An offset (left or right) clearance permits to fly at the specified distance and the specified direction (left or right) from the original FMS route. Refer also to recommendations in Section A5.5.5 Route offset.

Note: In the both cases (weather deviation and offset), meteorological conditions may be the reason to request the clearance in order to avoid weather cells (see figure below).

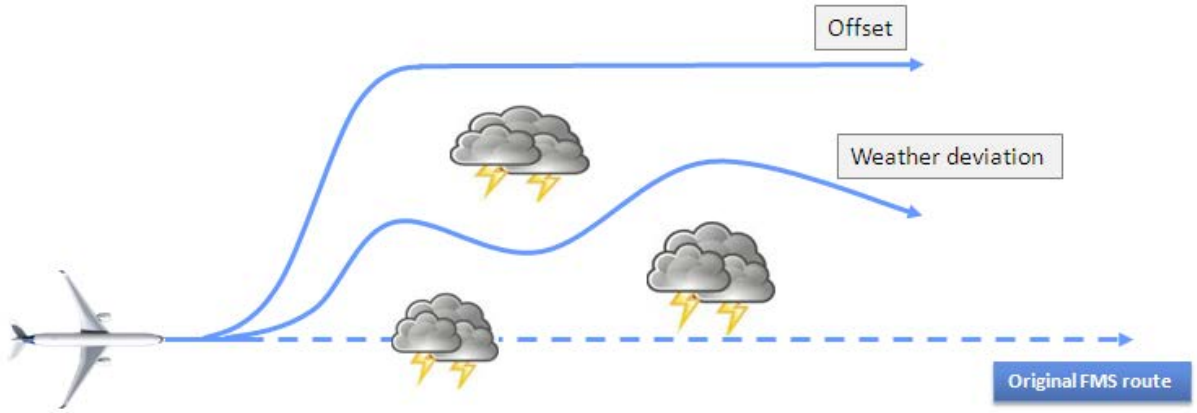


Figure 5-12
Offset and weather deviation

The flight crew should send the appropriate request for such clearance as shown in the following scenarios:

- **Weather deviation scenario**

Flight Crew: *REQUEST WEATHER DEVIATION UP TO 15 NM LEFT OF ROUTE*

ATC Controller: *CLEARED TO DEVIATE UP TO 15NM LEFT OF ROUTE*
REPORT BACK ON ROUTE

Flight Crew: *WILCO*

When the flight crew receives the ATC clearance, the aircraft is permitted to deviate from the original FMS route. The flight crew can select HDG/TRK mode to avoid the weather cells. On the ND, the flight crew can check the deviation distance with the cross track error.

A350/A380 specificity: The flight crew can access the DIR TO revision, via the interactive function of the ND. DIR TO enables to create a lateral path by inserting one or several waypoints on the ND. In this case, the NAV mode remains engaged.

When the aircraft is back on the original flight plan route, the flight crew should send the CPDLC message: BACK on ROUTE.

- **Offset clearance scenario**

  Flight Crew: *REQUEST OFFSET LEFT 10 NM OF ROUTE*

  ATC Controller: *OFFSET LEFT 10 NM OF ROUTE*
  REPORT BACK ON ROUTE

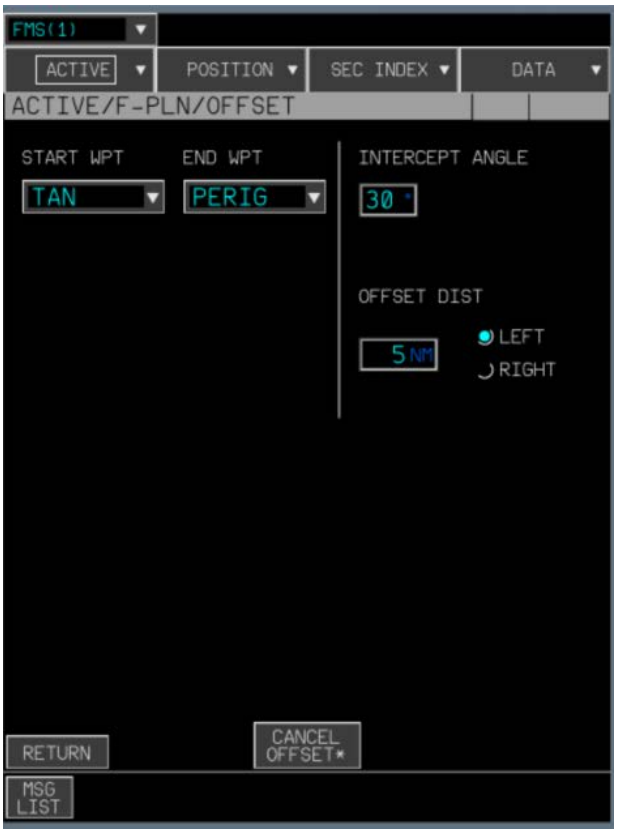
  Flight Crew: *WILCO*

After the flight crew receives the ATC clearance for deviation, they can activate the offset in the FMS.

A320/A330/A340	**A350/A380**
On the MCDU, the flight crew can define a lateral offset in a specified direction (left or right). The Lateral offset is applied from the PPOS waypoint.	On the MFD, the flight crew can define a lateral offset. The lateral offset is defined by: • Start/End waypoints • Lateral Offset distance • Direction (left or right) If the aircraft has already started to fly the offset segment when defining the offset on MFD, The default PPOS

A320/A330/A340

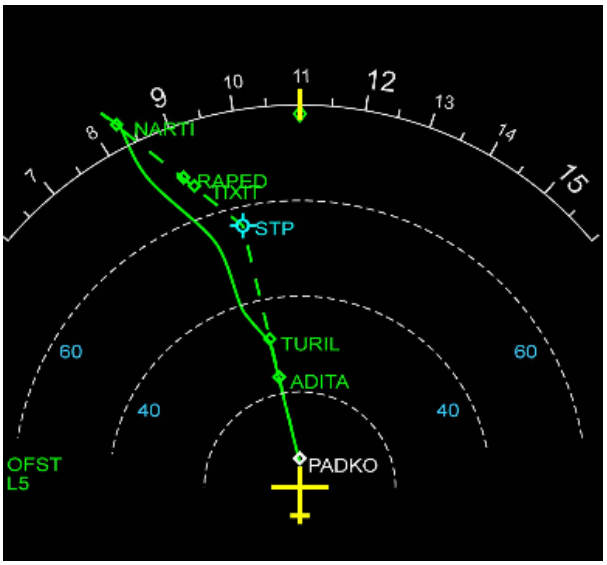
A350/A380



For all aircraft: The lateral flight guidance in NAV mode remains engaged when an offset is flown.

On the ND, the offset path is displayed as a solid line while the original path is dashed line.

When the aircraft is back on the initial flight plan route, the flight crew should send the CPDLC message: BACK on ROUTE.



A5.4.6.6. MULTI-ELEMENT MESSAGES

- A CPDLC message that consists of more than one message element is a multi-element message.
- In order to avoid ambiguity, it is highly recommended that the flight crew does not send multi-element messages.
- Flight crew should send one message per clearance element.
- Flight crew will answer either positively (WILCO or AFFIRM or ROGER depending on the nature of the message elements) or negatively (UNABLE) to a multi-element message. The response will apply to the entire message.

Note: Answering multi-elements messages is prone to misunderstanding since the answer applies to the whole message itself and cannot apply to each element individually.
It is known that the ATC should not send multi-element message with independent clearances because the flight crew cannot individually respond to each clearance (e.g. WILCO one clearance and UNABLE the other).

A5.4.6.7. DUPLICATE MESSAGES

- **General Rules**
  - Duplicate messages should be carefully avoided since they could cause ambiguity.
  - Incoming request messages should be answered as soon as practical in order to avoid duplicate messages.

- **Re-sending of a message**

In case of no answer to its request, the flight crew may elect to re-send a message. In that case, he should do this in the form of a query, not a duplicate of the first request. In the case for instance where the initial request was REQUEST CLIMB TO FL 350, the second attempt should be WHEN CAN WE EXPECT FL 350.

A5.4.6.8. USE OF FREE TEXT

The automated station of the ATC controller cannot treat free text messages as standard ATC messages. As such, no correlation between the free text and its answer can be provided. Automatic preformatted answers cannot be provided in response to a free text. Thus this increases the recipient (i.e. ATC controller or flight crew) workload, the response time and the risk of input errors.

- Free text messages should be avoided as much as possible.
- Use of free text is to be considered only when the preformatted messages do not allow for a specific message element.
- Standard ATC phraseology should be used in free text and abbreviations should be avoided.
- For time information, HHMMZ format should be used as much as possible (e.g. 1601Z).

Note: Instead of free text, it should be noted that the standardized free text and preformatted free text messages could be used when available:

- Standardized free text: it is a free text defined by a specific sequence of words. The flight crew or ATC controller should enter manually the standardized free text. These messages are available in GOLD - Appendix A (see References)
- Preformatted free text: it is a standardized free text coded in the aircraft system or in ground system. It enables an automatic composition of the free text messages most frequently used.

A5.4.6.9. CPDLC DIALOGUE CLOSURE

Among the basic assumptions and rules that have presided to the design of the CPDLC system, the closure of a message is one of the most important to be known by the crews. Open messages are prone to potential ambiguity and system issues. They should be avoided as much as possible.

Flight crew should be prompt to answer the received messages and to clean up their DCDU (respectively ATC mailbox) with the CLOSE prompt.

They should be aware of the following definitions, that apply:

- A message is open as long as an associated response is not received
- A message that needs not an answer is closed once received
- A message is closed when its associated response, other than STANDBY or REQUEST DEFERRED, is received.

If a CPDLC message requiring a closure response is negotiated by voice, the CPDLC message closure is still necessary to ensure the proper termination of the dialogue for the ground and aircraft systems.

A5.4.6.10. DCDU (RESPECTIVELY ATC MAILBOX) MANAGEMENT

From the experience gained with FANS A operations and from the outcomes of the Human Factors process, it has been noticed that when several messages are queued in DCDUs, some flight crew mix messages up when treating them. Consequently, it is strongly recommended to clear DCDUs (respectively ATC mailbox) when messages are treated. The goal is to improve message arrival awareness by keeping DCDUs (respectively ATC mailbox) clear of messages.

Particularly, a message that stays on DCDU (respectively ATC mailbox) may be hidden by an urgent message. Indeed, urgent messages have priority for the display on DCDU (respectively ATC mailbox) over normal messages. This management is compliant with industry standards. However, if this situation occurs, the flight crew may be confused when processing an open message on DCDU (respectively ATC mailbox) and that is superseded by an urgent message.

As an example, the flight crew may receive:

- A normal message CLB TO FL350 at 1503Z followed by
- An urgent message IMMEDIATELY DES TO FL320 at 1505Z.

The second message being urgent has priority for the display on DCDU (respectively ATC mailbox) over the first message. Therefore, it is likely that the flight crew will treat the urgent message first (i.e. IMMEDIATELY DES TO FL320). When closing this message, the flight crew can get confused by reading the normal message afterwards (i.e. CLB TO FL350).

The flight crew should handle this situation with care. Coordination via voice with the ATC controller may be required. For the management of messages when an urgent message is received:

- On DCDU: refer to Part I - Section 4.2.2.4 – Messages
- On ATC mailbox: refer to Part I - Section 4.4.2.5 – Messages.

When a message is sent (i.e. SENT indication is displayed), always close the message via the CLOSE soft key to clear DCDUs (respectively ATC mailbox). The RECALL soft key displays the last closed message.

NEW

With the latest FANS A+ system on A320/A330/A340, Some CPDLC messages will be automatically closed from the DCDU, 5 seconds after the reception of the acknowledgement from the ground. For more details, refer to Section A6.1.1.2.4 Auto-Closure of messages.

All exchanged messages are stored in the MSG RECORD page on MCDU (respectively MFD ATC COM pages) when they are closed.

It is recommended to erase the MSG RECORD and to check ADS is armed at the beginning of cockpit preparation before take-off (refer to Section A5.2.2 Pre-flight checks).

Erasing messages from the MSG RECORD will avoid confusion with messages from the previous flights.

A5.4.6.11. MAX UPLINK DELAY

It is possible that a very delayed CPDLC message is still delivered to the aircraft, even when the same aircraft is on a different flight. To overcome this problem, ATC centers and aircraft systems make use of the Max Uplink Delay. The Max Uplink Delay introduces a time limit used to decide whether an uplink message is still valid or not.

To use the Max Uplink Delay, two conditions are needed:

- The ATC center will need to add a valid time stamp in the uplink CPDLC messages
- The aircraft system must be FANS A+ (Max Uplink Delay feature is not implemented on FANS A).

For more details about the use of the max uplink delay, refer to:

- A320/A330/A340: Section A6.1.1.2.2 Discarding old uplink messages
- A350/A380: Section A6.2.1.2 Discarding old uplink messages.

A5.4.6.12. DEFERRED CLEARANCES

The deferred clearance is an ATC clearance that the flight crew executes when a condition is met. The condition may be:

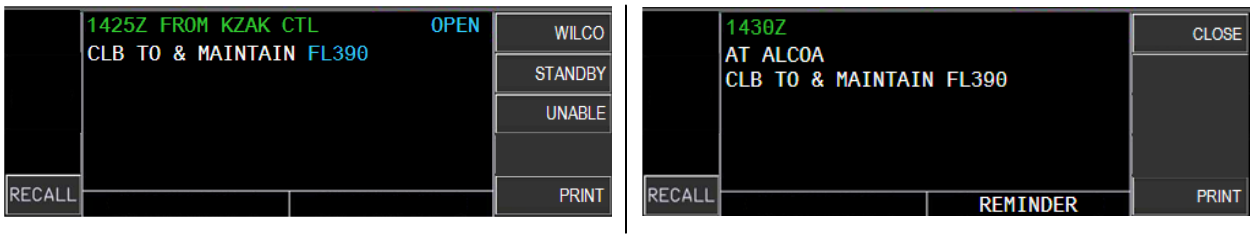
- A time, or
- A lateral condition (i.e. waypoint overfly), or
- A vertical condition (i.e. altitude).

The flight crew should execute the deferred clearance (e.g. AT ALCOA CLB TO & MAINT FL390) only when the condition is verified (e.g. aircraft is crossing ALCOA). It is different from standard clearance (e.g. CLB TO & MAINT FL390) for which the flight crew is expected to promptly execute the clearance.
The table and cockpit displays provided hereafter are given to help making the difference on DCDU (respectively ATC Mailbox) between a standard clearance and a reminder of a deferred clearance. Here are the differences on DCDU (respectively ATC mailbox):

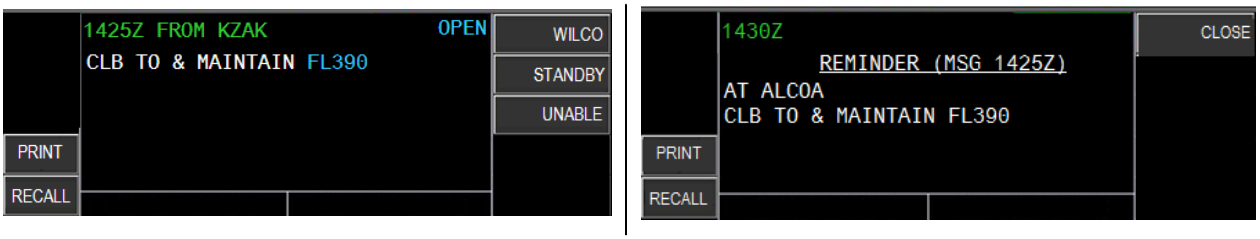
Standard Clearance	Reminder of deferred clearance
ATC Centre name is filled (e.g. FROM KZAK CTL)	Center name is empty
Information area is empty	Information area is filled with REMINDER Note: on FANS A+B, REMINDER precedes the reminder text and information area is empty
WILCO, STANDBY and UNABLE commands are available	Only CLOSE command is available
Message status is OPEN	Message status is empty
Text is displayed in white and parameters are highlighted in cyan	Message text and parameters are displayed in white

Standard and Deferred Clearances on DCDU (FANS A+)

Standard and Deferred Clearances on ATC Mailbox (FANS A+)



Standard and Deferred Clearances on ATC Mailbox (FANS A+B)



When the flight crew accepts to comply with a deferred clearance (answer WILCO), the FMS starts the monitoring of the conditions of deferred clearances. 30 seconds before the conditions are met, the DCDU (respectively ATC mailbox) automatically displays the reminder to recall the flight crew of this clearance.
The flight crew can receive and comply with a standard clearance before the reminder of the deferred clearance is displayed. Based on the principle that the last ATC clearance supersedes the previous one, the flight crew shall assess if the deferred clearance is still valid before its execution. In case of any doubt, the flight crew shall contact the ATC controller by voice to check the validity of the deferred clearance. If the deferred clearance is no more valid:

- On FANS A+B, the flight crew must cancel the current monitoring of the FMS (see below)
- On FANS A+, the flight crew must disregard the reminder of the deferred clearance.

It may happen that the flight crew accepts a deferred clearance and a change of flight crew occurs before the reminder of the deferred clearance is displayed. The new flight crew taking the responsibility of the flight must be aware of the deferred clearances in progress. To that end, during the briefing for the transfer of flight responsibility:

- On FANS A+B, the flight crews must review together the list of the current monitored messages in the MFD MONITORED MSG/LIST page
- On FANS A+, the flight crews must review together the deferred clearances previously received in the MSG RECORD page.

Cancel Monitoring on MFD (FANS A+B)

To manage the cancellation of deferred clearances, FANS A+B proposes the access to the list of the current monitored messages in the MFD MONITORED MSG/LIST page. The flight crew has the possibility to cancel separately each FMS monitoring through CANCEL MONITORING button and thus prevent the display of the reminder of the corresponding clearances.

Please bear in mind…

CPDLC procedures

- **CPDLC Connection Establishment**
  - Once the AFN has been successfully done, the ATC center can initiate a CPDLC connection (transparent to the crew).
  - Checks are automatically done by the ATSU (respectively ATC applications) to validate or reject the connection:
    - Connection is accepted if no previous connection already exists or the ATC center corresponds to the next ATC center to control the aircraft
    - Connection is rejected in all other cases.
  - Once connection is established, the active connected ATC center is then displayed on the DCDU (respectively ATC mailbox), and on the CONNECTION STATUS page of the MCDU (respectively MFD).

- **CPDLC Connection Transfer**
  - The transfer of ATC responsibility between two ATC centers (i.e. the current ATC center and the next ATC center) requires a CPDLC connection transfer
  - The current ATC center is the Current Data Authority (CDA). The next ATC center is the Next Data Authority (NDA).
  - The CPDLC connection transfer is performed using the following sequence:
    - **Notification of identity of the NDA**: to inform the aircraft avionics (i.e. ATSU or ATC applications) that a transfer of control will be done, the CDA sends a NDA message including the identity of the NDA to the aircraft
    - **AFN Logon with the NDA**: Two methods may be used:
      - **Air-Ground address forwarding process**: the CDA instructs the aircraft system to initiate an AFN logon to the NDA (air-ground interaction)
      - **Ground-Ground address forwarding procedure**: the CDA sends to the NDA the same information than AFN Logon (ground-ground interaction)
    - **CPDLC Connection establishment with the NDA**: the NDA initiates a CPDLC connection with the CPDLC CONNECTION REQUEST message (same procedure than CPDLC Connection Establishment)
    - **CPDLC Connection termination with the CDA**: to terminate the CPDLC connection, the END SERVICE message is used.

Please bear in mind…(continued)

- **CPDLC Connection Termination**
  - A CPDLC connection with one ATC center is usually terminated once this center has sent an END SERVICE message to the aircraft.

- **Failures of CPDLC connection**
  - As soon as a failure of the CPDLC connection is noticed by either the flight crew or ATC controller, voice will be used to inform the other side of the failure and to coordinate further actions.

- **Recommendations for CPDLC**
  - In ACARS environment (contrary to ATN), the flight crew and ATC controllers cannot know whether a message has been delivered to their right counterpart.
  - Free text messages like multi-elements messages should be avoided as much as possible.
  - It is recommended to erase the MSG RECORD and to check ADS is armed at the beginning of cockpit preparation before take-off.
  - Flight crew should be prompt to answer the received messages and to clean up their DCDU (respectively ATC mailbox) with the CLOSE prompt. With the latest FANS A+ system on A320/A330/A340, the message will be automatically closed from the DCDU, 5 seconds after the reception of the acknowledgement from the ground.
  - It is recommended NOT to use ARINC 424 format in the flight plan when operating FANS.
  - Flight crew should be aware of the differences between a standard clearance and a deferred clearance. The flight crew should assess if the deferred clearance is still valid before its execution.

A5.5. ADS-C PROCEDURES

A5.5.1. ADS-C CONNECTION ESTABLISHMENT

The notification procedure as described in Section A5.3– ATS Facilities Notification (AFN) is to be applied before the ATC center performs an ADS-C connection.

The ATC center will establish ADS-C contracts once the AFN has been done either manually via the MCDU (respectively the MFD ATC COM page for A350/A380) or automatically through a transfer from a previous ATC center (refer to Section A5.4.2.2 – AFN logon with the NDA).

As soon as the aircraft has been notified to the ATC Center, the ADS-C application is armed (refer to Section A5.2.2 Pre-flight checks), waiting for a possible connection.

Note: Originally, ATC Centers in NAT airspace were not all equipped with ADS-C capability. The ADS-C connection was not directly established with any of these centers, but with the ARINC Centralized ADS-C (CADS) system in Annapolis. The CADS transformed the received ADS-C reports into position reports as if received by the AERADIO operators and then transmitted to the ATC centers via AFTN (Aero Fixed Telecom Network). Today, CADS is no longer used as all of the ATC centers have the ADS-C capability and the ADS-C connection is directly established between the aircraft and the ATC centers.

- **A330/A340 FANS A**

  - ADS-C is **ON** by default. After an ATC center initiates a contract, ADS-C remains ON (refer to the examples here after).
  - In addition, there is no means for the crew to know whether or not ADS-C is operative. On the NOTIFICATION page, NOTIFIED is displayed once the notification has been done, but this does not mean that the ADS-C is operative. No information related to ADS-C connections (except the ADS-C mode either ON or OFF) is provided either on MCDU or DCDU.
  - When ADS-C is deactivated, ADS-C is in the **OFF** mode that is indicated on the MCDU.

- **A320/A330/A340 FANS A+**

In the FANS A+ system on A320/A330/A340 aircraft, the initial FANS A HMI (as described above) has been modified to improve the awareness about ADS-C connections.

- When ADS-C is activated and no ADS-C connections have been established, ADS-C is in the **ARMED** mode. ARMED is indicated on the MCDU CONNECTION STATUS page.
- When ADS-C is activated and at least one ADS-C connection has been established, ADS-C is in the **CONNECTED** mode. CONNECTED is indicated on the MCDU CONNECTION STATUS page, and the number of connections is indicated on DCDU (e.g. ADS CONNECTED (2)). The identifications of connected units are available in the MCDU ADS DETAILS page.

- When ADS-C is deactivated, ADS-C is in the OFF mode that is indicated on the MCDU CONNECTION STATUS page.
- The ADS-C system must be set to ARMED (or ON for A330/A340 aircraft equipped with FANS A system), **prior to perform an AFN notification**. This setting is the default status.
- In addition to the capability to terminate all ADS-C connections at a time, the flight crew is also able to terminate each ADS-C connection individually with FANS A+ (refer to A5.5.2 ADS-C connection management).

	A320/A330/A340			
	FANS A	FANS A+		
MCDU	ADS OFF	ADS OFF[1]	OFF	ADS MODE
	ADS ON	ADS ARMED[2]	ARMED	
	ADS ON	ADS CONNECTED	CONNECTED	
DCDU	*No information*	*No information*[2]	OFF	
	No information	*No information*[3]	ARMED	
	No information	ADS CONNECTED (X) [5]	CONNECTED	

NEW Whenever ADS is mentioned on MCDU/DCDU, the latest FANS A+ system displays:

- [1] ADS-C OFF
- [2] ADS-C ARMED
- [3] ADS-C OFF
- [4] ADS-C ARMED
- [5] ADS-C CONNECTED (X). X is the number of connected units (ATC or AOC).

- **A380 FANS A+ and A350/A380 FANS A+B**

The awareness of ADS-C connections has been improved even more on A350/A380 interfaces.

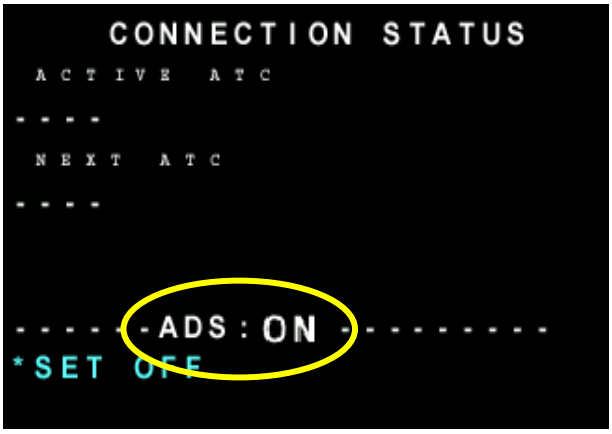
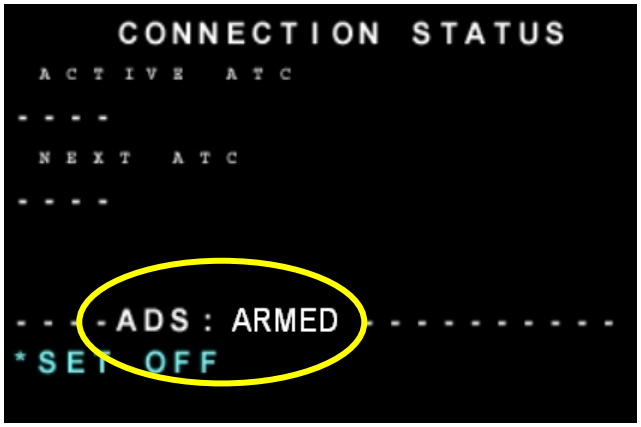
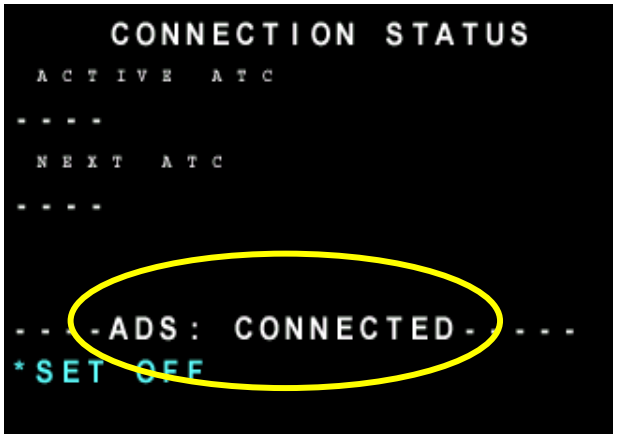
- When ADS-C is deactivated, ADS-C is in the **OFF** mode. It is indicated both on MFD CONNECTION STATUS page and on ATC mailbox (i.e. white ADS OFF indication).
- When ADS-C is activated and no ADS-C connection has been established, ADS-C is in the **ARMED** mode. ARMED is indicated on the MFD CONNECTION STATUS page.
- When ADS-C is activated and at least one ADS-C connection has been established, ADS-C is in the **CONNECTED** mode. CONNECTED is indicated with the identifications of the connected units on the MFD CONNECTION STATUS page, and the number of connections is indicated on ATC mailbox (e.g. 2 ADS CONNECTIONS).
- In addition to the capability to terminate all ADS-C connections at a time, the flight crew is able to terminate each ADS-C connection individually (refer to A5.5.2 - ADS-C connection management).
-

	A380 FANS A+	A350/A380 FANS A+B		
MFD	ADS OFF	ADS-C OFF	OFF	ADS MODE
	ADS ARMED	ADS-C ARMED	ARMED	
	ADS CONNECTED	ADS-C CONNECTED	CONNECTED	
ATC mailbox	ADS OFF	ADS-C OFF	OFF	
	No information	No information	ARMED	
	X ADS CONNECTIONS [1]	X ADS-C CONNECTIONS [1]	CONNECTED	

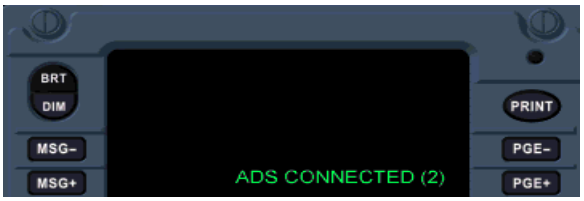
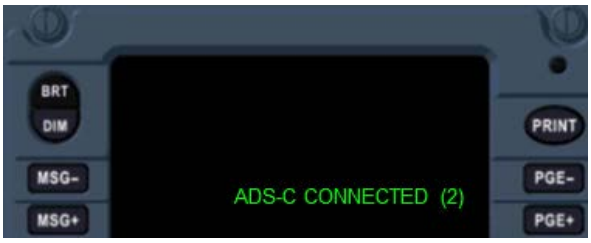
[1] X is the number of connected units (ATC or AOC).

The flight crew must terminate any ADS-C connection only when instructed by ATC.

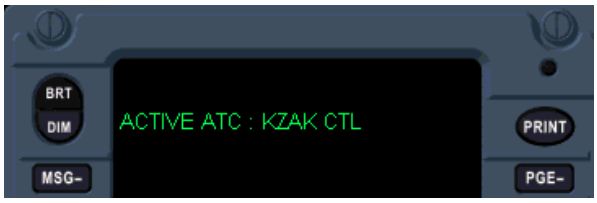
A320/A330/A340 aircraft – FANS A vs. FANS A+ MCDU

FANS A MCDU	FANS A+ MCDU
Notification done / Waiting for a connection (ADS-C or CPDLC)	
	
On the MCDU page, ADS-C status is ON. But it does not mean that ADS-C contracts have been set up. Actually, here ADS-C is just armed, waiting for contracts.	On the MCDU page, ADS-C status is ARMED. The ADS-C status is given without ambiguity.
An ADS-C connection occurred	
	
On the MCDU page, ADS-C status is still ON. But is this example, contract(s) has (have) been set up.	ADS-C status is now CONNECTED. It is explicitly indicated that the ADS-C application sends reports to at least one ATC.

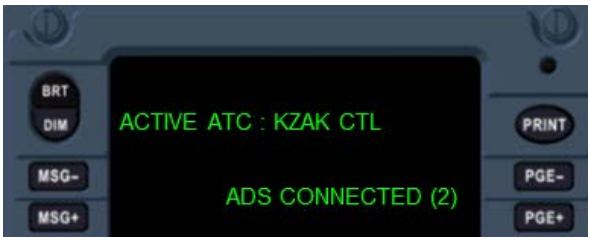
A320/A330/A340 aircraft – FANS A vs. FANS A+ DCDU

FANS A DCDU	FANS A+ DCDU
No CPDLC and No ADS-C connections	
Even if there are no connections, the CPDLC connection status is displayed.	When there are no connections, the default screen is blank.
	When the ADS is set to OFF, ADS-C OFF is displayed **NEW**
There is no CPDLC connection, but 2 ADS-C contracts have been set up.	
	
In case of ADS only, the information given by the DCDU screen can be misleading. Even if NO ACTIVE ATC is displayed, ADS-C contract could have been set up.	There is no ambiguity regarding the ADS-C status on the DCDU screen.
	
	ADS CONNECTED (2) is replaced by ADS-C CONNECTED (2) **NEW**

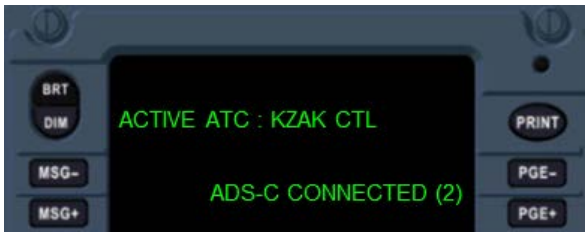
CPDLC and 2 ADS-C connections are active



DCDU is devoted to CPDLC application. No information relative to ADS-C contracts is available.

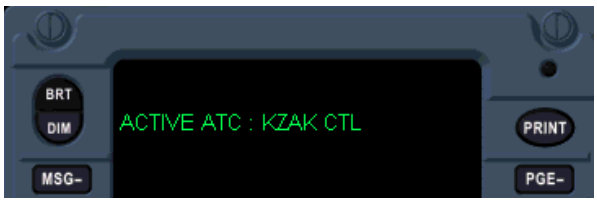


The default screen of the ATC mailbox provides information about CPDLC and ADS-C connections.

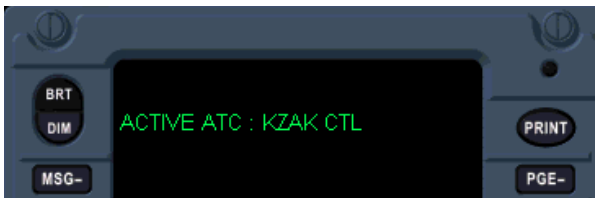


ADS CONNECTED (2) is replaced by ADS-C CONNECTED (2) NEW

A CPDLC connection exists, but no ADS-C contract has been set up.



There is no cue on actual ADS-C contracts (ADS-C is either ON or OFF).



No ADS-C contracts have been set up. (ADS-C is either OFF or ARMED).

ADS-C OFF is displayed on DCDU. NEW

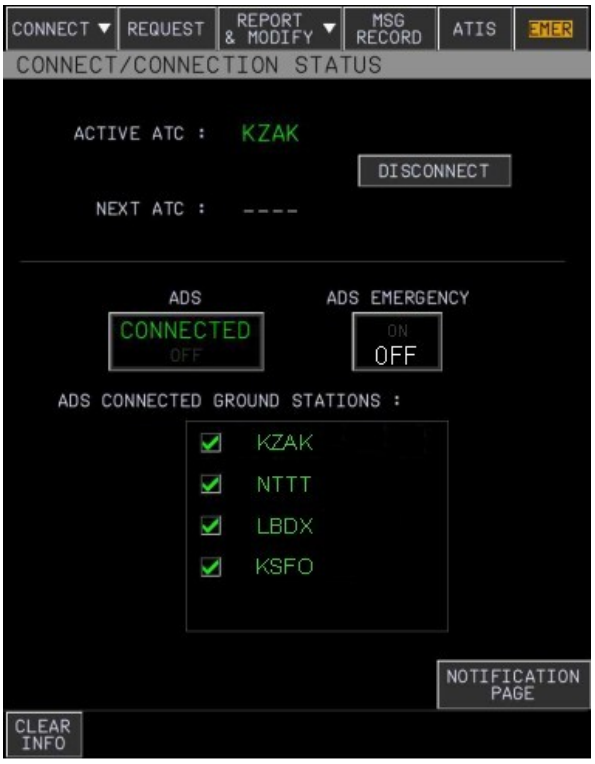
The principles used for A320/A330/A340 FANS A+ HMI apply for the A380 FANS A+ and for A350/A380 FANS A+B HMI.

A380 – FANS A+ MFD

Notification done / Waiting for a connection (ADS-C or CPDLC)

The notification has been done. The ADS-C application is ready (i.e. ARMED) to connect.

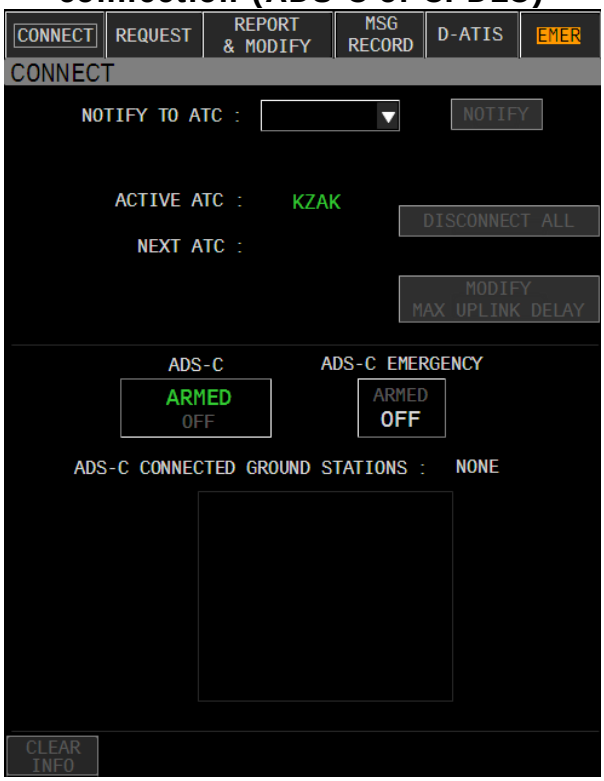
Some ADS-C connections occurred



At the first ADS-C connection, the ADS-C status becomes CONNECTED.

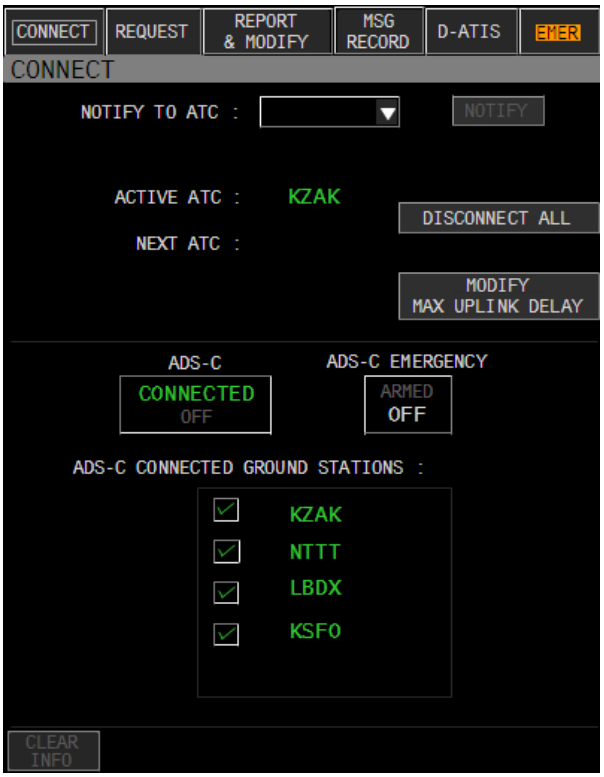
A350/A380 – FANS A+B MFD

Notification done / Waiting for a connection (ADS-C or CPDLC)



The notification has been done. The ADS-C application is ready (i.e. ARMED) to connect.

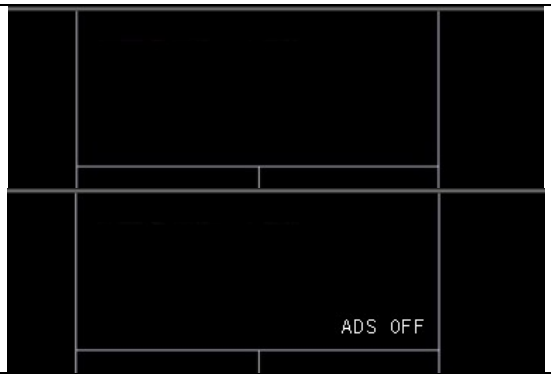
Some ADS-C connections occurred



At the first ADS-C connection, the ADS-C status becomes CONNECTED.

A350/A380 – ATC Mailbox

No CPDLC and No ADS-C connections



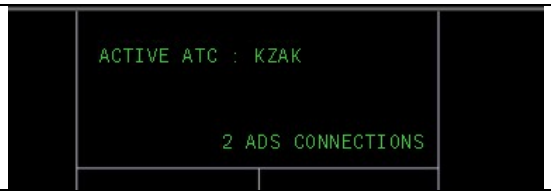
When there are no connections and ADS-C is ARMED, the default screen is black.

When there are no connections and ADS-C is OFF, the default screen displays a white ADS OFF indication.

There is no CPDLC connection, but 2 ADS-C contracts have been set up.

There is no ambiguity regarding the ADS-C status on the ATC mailbox. The number of ADS-C contracts is displayed.

CPDLC and 2 ADS-C connections are active



The default screen of the ATC mailbox provides information about CPDLC and ADS-C connections.

A CPDLC connection exists, but no ADS-C contracts have been set up.

ADS-C is ARMED but no ADS-C contracts have been set up.

The active ATC is connected for CPDLC. ADS-C is OFF. No ADS-C contracts can be established.

Regarding the status of the ADS and CPDLC connections on FANS A+B, the ATC mailbox HMI are identical to the FANS A+ ones except than “ADS” is replaced by “ADS-C”.

A5.5.2. ADS-C CONNECTION MANAGEMENT

FANS A/A+/A+B equipped aircraft can have up to five ADS-C connections. The aircraft has the capability to report to all different units (ATC or AOC) connected via ADS-C simultaneously.

The aircraft does not assign technical priority to ADS-C connections; therefore, the controlling ATC may not be aware of other connections established with the aircraft. In order to manage these connections, a procedural hierarchy controlled by the Address Forwarding process (refer to Section A5.4.2 CPDLC connection transfer) has been established.

Consequently, the current controlling authority shall allocate ADS-C connection priority to the next ATC that will take the responsibility for the aircraft. The priority for the allocation of ADS-C connections shall be in accordance with the following list (as per GOLD, see References):

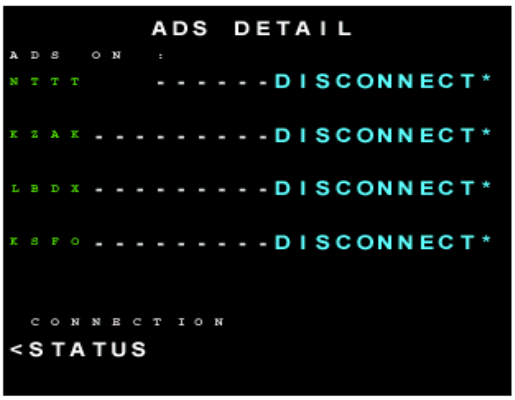
1. The Current Data Authority
2. The Next Data Authority
3. An ATC requiring a monitoring of operations close to a FIR boundary
4. Airline AOC facility
5. Other miscellaneous connections.

Note: It is to be noticed that in the A320/A330/A340 FANS A+ system, an MCDU ADS DETAIL page lists ATC centers with active ADS-C contracts. They can easily be disconnected through the appropriate right Line Select Key (LSK) of the MCDU. The ADS DETAIL page does not exist in FANS A system.

In the example given through this figure, four centers have set up ADS-C contracts. Pressing the appropriate LSK cancels the ADS-C contract established by the corresponding ATC center.

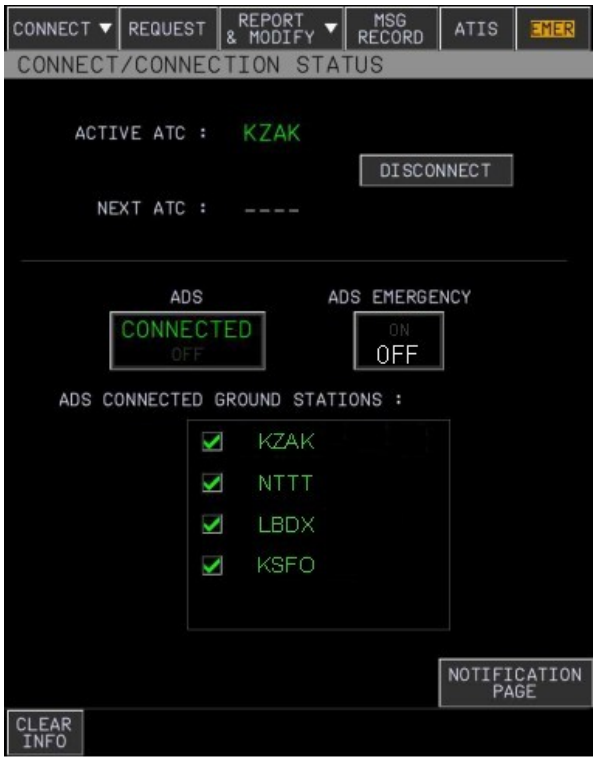
ADS-C DETAIL page on

A320/A330/A340 MCDU

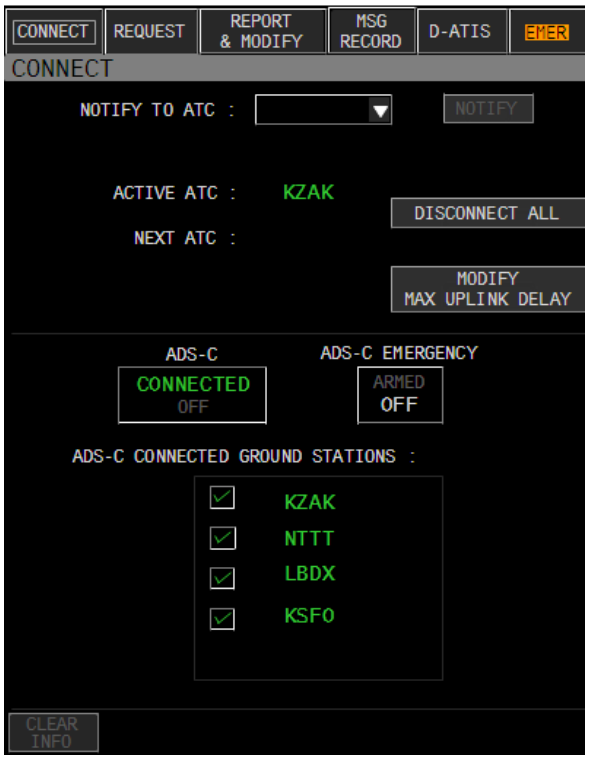


In the A380 FANS A+ and A350/A380 FANS A+B system, the same kind of feature is provided in the CONNECTION STATUS page. Just uncheck the ATC centers with which the ADS-C connection should be terminated.

CONNECTION STATUS page on A380 FANS A+ MFD



CONNECTION STATUS page on A350/A380 FANS A+B MFD



A5.5.3. POSITION REPORTING WITH ADS-C

The requirements to use either CPDLC or ADS-C for position reporting are published in the AIP of the considered FIR.

It is recommended to avoid inserting non-ATC waypoints in the route of the aircraft active flight plan. If non-ATC waypoints are inserted, the ADS-C report will include information about the non-ATC waypoint and the ATC center could not correlate the route information provided in ADS-C report with the current flight plan. This recommendation is not applicable on FANS A+B on which the non-ATC waypoints are removed from the ADS-C report. In the future, the recommendation will be erased as FANS A+B enhancement will be spread on all the A320/A330/A340/A380.

When reporting by ADS-C only, ATC waypoints should not remove from the active flight plan even if they are not compulsory reporting points.

In an ADS-C environment, the flight crew should not provide voice or CPDLC position reports except:

- If instructed by ATC controller
- When required by AIPs or regional supplementary procedures.

In an ADS-C environment, the flight crew is not required to update estimates for waypoint by CPDLC or voice expect in some airspaces mentioned in GOLD Appendix E (see References).

A5.5.4. ADS-C CONNECTION CLOSURE

An individual ADS-C connection may be terminated from the ground or manually by the crew (FANS A+ only) through the ADS DETAIL page of the MCDU ATC menu (respectively MFD CONNECTION STATUS page).

ADS-C contracts and connections should normally be terminated by the ground system when:

- The aircraft has crossed the FIR boundary and no surveillance information from the flight are required by the transferring ATC, or
- The flight plan is no more active from the ATC point of view, or
- No surveillance information from the flight are required by the CDA or an adjacent ATC.

The ADS-C should not be set to off, unless instructed to do so by ATC. If the ADS-C is set to off, the ATC center can no longer be provided with ADS-C reports.

A5.5.5. ROUTE OFFSET

The accuracy of the ADS-C intent and predicted route information is of prime importance when it is to be used by the ATC center to allow for reduced lateral and /or longitudinal separation.

If an offset is manually flown, in a Heading Select mode for instance, both the intent and predictions as sent by the FMS for ADS-C purpose may be incorrect. In normal cruise condition, a Waypoint will not be sequenced if the position is beyond **7NM on Honeywell FMS2 and 5NM on Thalès FMS2** aside from this point.

It is then recommended that the crew keeps updated its FMS flight plan, and that it uses the FMS Offset function. When an Offset is flown with the FMS, the intent and predicted route information will be provided along the offset route.

A5.5.6. ADS-C FAILURES

Some ATC centers are not equipped with both CPDLC and ADS-C applications. Therefore, a CPDLC shutdown or an ADS-C shutdown may be experienced on ground systems. In these cases, the following procedures apply.

A5.5.6.1. ADS-C SHUT DOWN

When the ADS-C is shut down, two cases may be considered:

- **The ATC center is both ADS-C and CPDLC capable**: The position reporting is still possible either through CPDLC or voice. Consequently, the ATC should instruct the flight crew to revert to one of these communication means.
- **The ATC center is only ADS-C capable**: The position reporting is still possible through voice. Consequently, the ATC should instruct the flight crew to revert to voice.

The following CPDLC free text messages should be used:

ATC Controller: ADS-C SHUT DOWN REVERT TO CPDLC POSITION REPORTS

Flight Crew: ROGER

Or:

ATC Controller: ADS-C SHUT DOWN REVERT TO VOICE POSITION REPORTS
Flight Crew: ROGER

For more details about CPDLC position report, refer to Section A5.4.6.4 Position reporting with CPDLC.

A5.5.6.2. LOSS OF ADS-C

It may happen that the flight crew has inadvertently switched ADS-C reporting off. As a consequence, the ATC is not able to establish or maintain an ADS-C contract.
In that case, the ATC may request the status of the on-board ADS-C application with the following the phraseology:
ATC Controller: CONFIRM ADS-C ARMED
Flight Crew: ROGER

A5.6. EMERGENCY PROCEDURES

For the detailed procedures, please refer to GOLD Section 5.8 (see References).

A5.6.1. GENERAL EMERGENCY PROCEDURES

During an emergency, it is expected that the flight crew reverts to the voice communications. Nevertheless, CPDLC could be used if:
- **CPDLC is more efficient than voice, or**
- **Voice communications are not possible.**

The following chapters describe ADS-C and CPDLC procedures used during an emergency.

A5.6.1.1. CPDLC EMERGENCY PROCEDURES

The flight crew should be aware of the CPDLC emergency procedures, that apply in the considered area. The emergency mode is activated from the EMERGENCY page on MCDU or MFD. In particular, they should know what can be expected from the ATC controller once the emergency mode is triggered.

The general rules usually apply:
- The ATC controller shall immediately acknowledge receipt of an emergency message, that has been sent by the flight crew (e.g. MAYDAY or PAN). Either voice or CPDLC free text will be used. If CPDLC free text is used, the flight crew will send the message through the EMERGENCY page of the MCDU ATC menu (respectively MFD EMERGENCY page). The flight crew is not required to close it through the ROGER reply.
- The ATC controller shall also attempt a voice contact after he has acknowledged an emergency message through CPDLC.
- If CPDLC is the best (or the sole) means for communications, the current ATC controller will keep the connection active to provide the assistance. In particular, no transfer (either automatic or manual) of connection will be done.

In environment without CPDLC capability (ADS-C only), the flight crew should activate the ADS-C emergency mode (Refer to Section A5.6.1.2 Activation of ADS-C emergency mode).

A5.6.1.2. ACTIVATION OF ADS-C EMERGENCY MODE

When both CPDLC and ADS-C are active, sending the MAYDAY message through CPDLC automatically switches the ground ADS-C contract to the EMERGENCY mode. The reporting rate is:

- The same as of the previous periodic contract if any, or
- Set to 64 seconds per default for other existing contracts.

Conversely, sending the CPDLC CANCEL EMERGENCY message deactivates the ADS-C EMERGENCY mode.

When only ADS-C is operating, the ADS-C EMERGENCY mode can be activated:

- For A320/A330/A340 aircraft, through the EMERG ADS function (EMERG ADS-C function in the latest FANS A+ system) from MCDU EMERGENCY page,
- For A350/A380 aircraft, through the ADS EMERGENCY function (ADS-C EMERGENCY function on FANS A+B) from MFD EMERGENCY page or from MFD CONNECTION STATUS page.

When the ADS-C emergency mode is set, the aircraft immediately sends an ADS-C report containing an emergency flag that is interpreted by all ground systems that currently have periodic or event contracts established with that aircraft.

A5.6.1.3. DEACTIVATION OF ADS-C EMERGENCY MODE

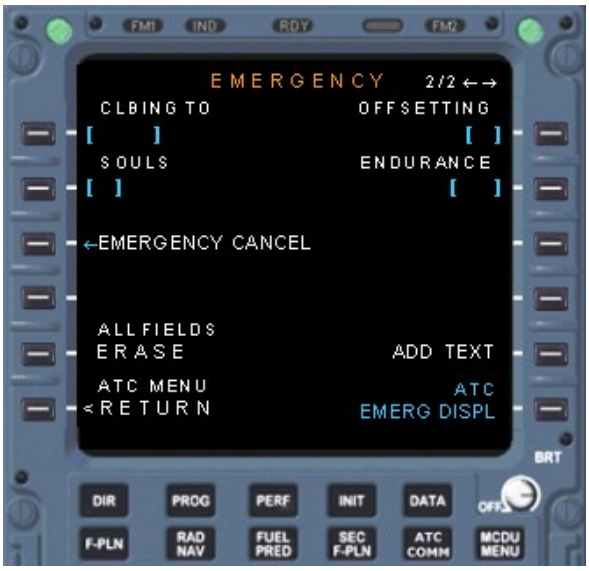
To deactivate the EMERGENCY mode (MAYDAY message and ADS-C emergency mode), the flight crew can:

- On A320/A330/A340 aircraft, send an EMERGENCY CANCEL message via CPDLC from the second EMERGENCY page on MCDU, or set the EMERG ADS to OFF (EMERG ADS-C to OFF in the latest FANS A+ system),
- On A350/A380 aircraft, send a CANCEL EMER message via CPDLC, or set the ADS EMERGENCY (ADS-C EMERGENCY on FANS A+B) to OFF from either EMERGENCY page or CONNECTION STATUS page on MFD.

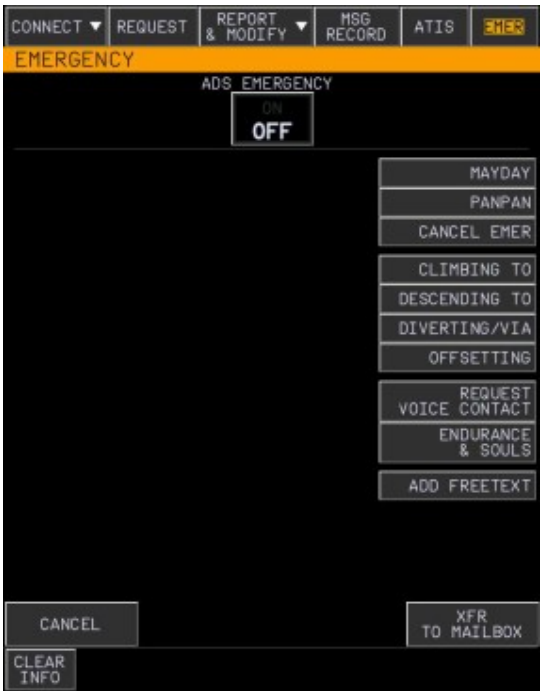
When the flight crew cancels the emergency mode, the aircraft will send an emergency mode cancellation message to each ground station receiving the emergency mode reports. The cancellation message will remove the emergency flag from the periodic contract, but the data contents will remain the same as per the emergency contract. Any previously existing data groups requested by the ground system will not be restored unless the ground system re-negotiates the periodic contract following receipt of the emergency cancellation message. Existing event contracts are unaffected by the emergency cancellation.

EMERGENCY page on A320/A330/A340 MCDU – 1/2

EMERGENCY page on A320/A330/A340 MCDU – 2/2



EMERGENCY page on A350/A380 MFD

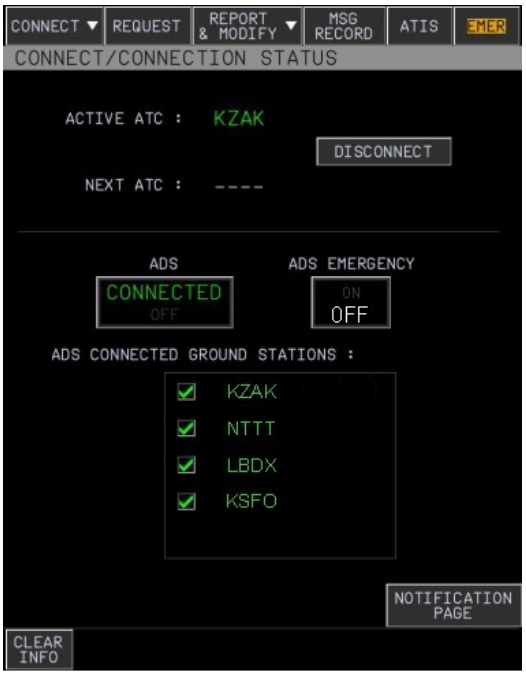


CONNECT page

on A350/A380 FANS A+B MFD

CONNECTION STATUS page

on A380 FANS A+ MFD



A5.7. ATS 623 APPLICATIONS

The ATS623 applications (Airbus implementation of AEEC623) are:

- Optional in the FANS A+ system for A320/A330/A340 aircraft
- Basic on A350/A380 aircraft.

As a first step before a greater use of data link applications, and pending to a greater maturity of standardized services, Airbus has decided to implement only three ATS623 applications:

- **Departure Clearance (DCL),**
- **Oceanic Clearance (OCL),**
- **Digital – Automatic Terminal Information Service (D-ATIS).**

Operating these applications is done with both the DCDU and the MCDU (respectively ATC mailbox and MFD). Although very similar to the current FANS A functions, differences exist and must be kept in mind:

- **ATS623 exchanges do not require a preliminary notification process (AFN) contrary to CPDLC and ADS-C applications.**
- ATS623 exchanges have been built upon voice exchanges:
  - Crew request
  - Ground clearance
  - Crew read-back
  - Ground confirmation.

  This was a requirement from the Airworthiness Authorities.

- As per AEEC 623 specifications, it is not possible to refuse an ATS 623 clearance by data link. The refusal, if any, shall be done via voice.
- No Time stamp information is available for ATS623 exchanges.

Note 1: If similar applications have been customized through AOC (ACARS) applications, these will no longer be available when ATS623 applications are installed. This means that AOC DCL or OCL will no longer be sent from a customized AOC page. Indeed, the ACARS router is able to route messages to only one software (either ATS623 or AOC). However, customized AOC functions such as Pre-Departure Clearance (PDC), that is not compliant with the AEEC 623 specifications, will remain possible through the AOC.

Note 2: ATS623 applications are not FANS applications, but are considered as such because using the DCDU/MCDU (respectively ATC mailbox and MFD) to exchange messages.

- **Usual answers**

  - **ACK (ATS 623 Departure and Oceanic clearances only):** ACK stands for Acknowledgement. This downlink message means that the flight crew has received the departure or oceanic clearance contained in the associated uplink message. An ATC confirmation should follow.

  - **REFUSE (ATS 623 Departure and Oceanic clearances only):** This is not a downlink message. As per AEEC 623 specifications, a departure or oceanic clearance cannot be refused by data link. The flight crew shall revert to voice procedure. When selecting the REFUSE option on DCDU (respectively ATC mailbox), a reminder for a reversion to voice procedure is displayed.

The following figure provides a typical scenario for a departure or oceanic clearance using the ATS623 application. The introduction of new interfaces with the A350/A380 does not modify the communication protocol. Therefore, this figure applies to the A350/A380 with ATC mailbox and MFD instead of DCDU and MCDU. Refer to Part II - Appendix I for ATS623 operational scenarios.

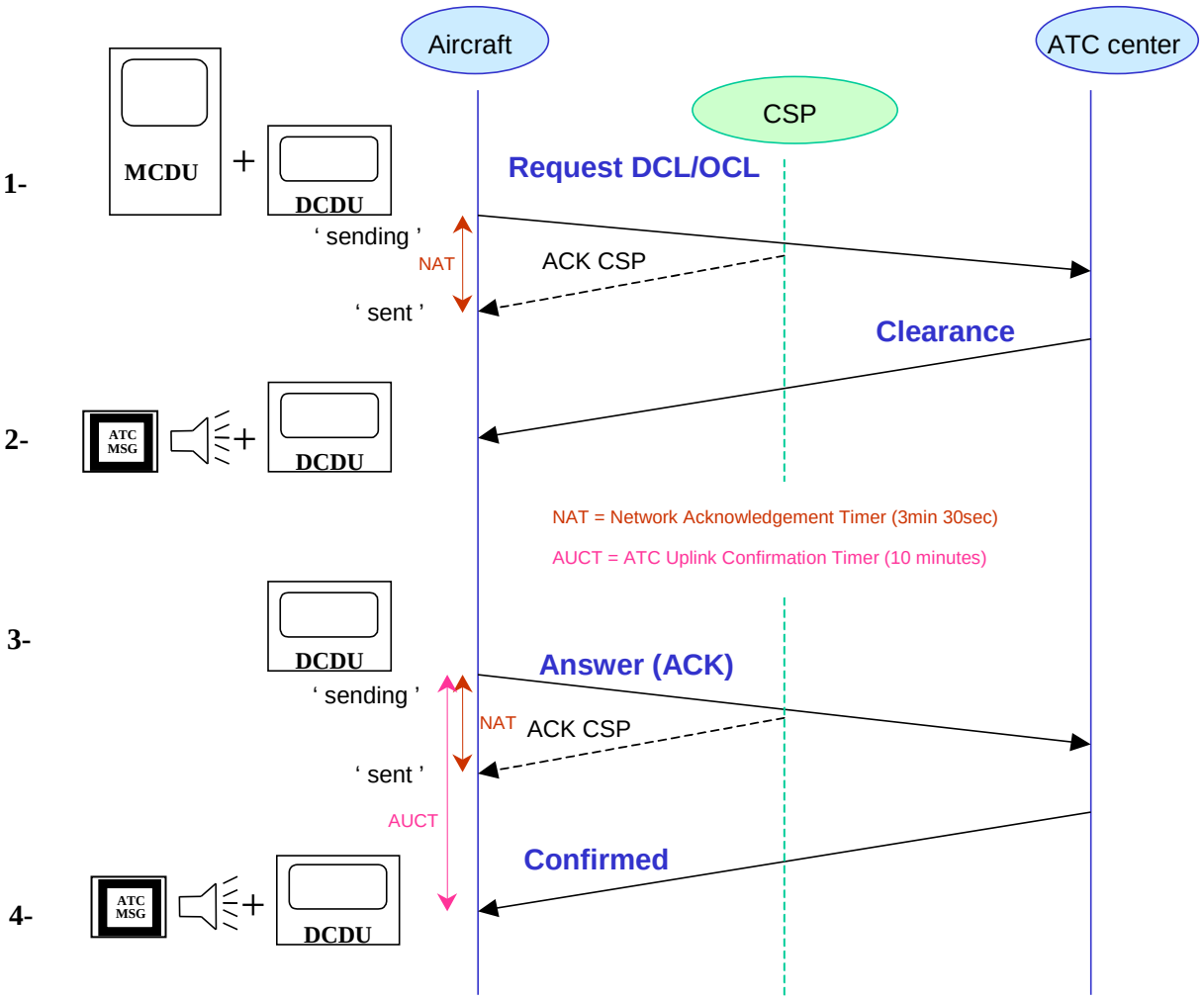


Figure 5-13
Departure/Oceanic Clearance scenario

1. **Departure/Oceanic Clearance request:** The DEPARTURE/OCEANIC CLEARANCE request is prepared on the MCDU, displayed on the DCDU and sent to the ATC center.
2. **Departure/Oceanic Clearance receipt:** An uplink clearance is received: the aural and visual warnings are activated, and the message is displayed on the DCDU.
3. **Departure/Oceanic Clearance read-back:** If the flight crew accepts the clearance, the flight crew selects the proposed ACK answer on the DCDU and sends it to the ATC center.
4. **Departure/Oceanic Clearance confirmation:** The ATC center confirms that the acknowledgement for this clearance has been received, this is displayed on the DCDU.

If the flight crew prefers to REFUSE the received clearance (step 3), then no downlink message is sent to the ATC center and this must be done by voice contact: this is indicated on the DCDU when REFUSE is selected.

Note: NAT timer is the maximum authorized time for ACK CSP reception.
AUCT timer is the maximum authorized time for the ATC Uplink Confirmation reception.

A5.8. ADVANCED DATALINK OPERATIONS

A5.8.1. DYNAMIC AIRBORNE REROUTE PROCEDURE (DARP)

DARP enables the rerouting of an aircraft in flight based on updated weather forecasts, that allows to save fuel/time and eliminate flight hazards.
For long-haul flights, when the weather conditions changes (e.g. wind updates) after the first hours of flight, the airline will have benefits to recalculate the flight plan in order to find a more optimized route for fuel and time.
Operationally speaking, DARP is initiated by the AOC and requires a good coordination between AOC, ATC centers and aircraft. This coordination is fully based on data link messages exchanges. The messages exchanges between ATC centers is done via Air Traffic Services Interfacility Data Communications (AIDC). Refer to Part I - Section 3.3.2.3 Ground coordination.
DARP relies on the use of:

- AOC data link to uplink the new flight plan revised by AOC to the aircraft
- CPDLC to negotiate the revised flight plan with ATC.

DARP procedure requires FIR with DARP services available and aircraft fitted with FANS A/FANS A+ systems.
For more details about DARP procedure, refer to Part II - Appendix E – Advanced Data link Operations.

A5.8.2. TAILORED ARRIVAL (TA)

TA is a optimized 4-dimensional (4-D) arrival procedure that consists in a ATC route clearance with altitude and/or speed restrictions. TA enables to replace current ATC procedures based on tactical radar vectoring by optimized descent trajectory cleared prior the top of descent (TOD). The ATC route clearance is received though a CPDLC message composed of the lateral path, vertical and speed constraints, published approach procedure, and selected runway. Once the flight crew accepts the ATC clearance, the FMS loads the CPDLC route, computes the arrival trajectory from the current position to the runway and manages the aircraft landing settings without additional flight crew inputs.

The arrival is “tailored” to adapt the flight profile from cruise level to expected runway to the current conditions (i.e. traffic, weather, aircraft performance, etc). The main benefits are to optimize fuel consumption and reduce noise emissions.

The A350 will be capable to fly TA procedures right from its entry into service.
For more details about TA prerequisites and procedure, refer to Part II - Appendix E – Advanced Data link Operations.

A5.8.3. IN TRAIL PROCEDURE (ITP)

ITP is a new procedure enabling more frequent flight level changes in procedural airspaces (without radar coverage). When ITP is applied, the aircraft is authorized to climb or descent using reduced minima of longitudinal separations and thus change flight level on a more frequent basis. The main benefits are to optimize fuel consumption, improve flight safety and increase the airspace capacity.
ITP uses ADS-B data and requires an ADS-B IN or ATSAW capability. ITP is described in the “Getting To Grips With Surveillance” (see References).

Please bear in mind…

ADS-C procedures

- **ADS-C connections Establishment / Management**
  - An ATC will establish ADS-C contracts once the AFN has been performed.
  - FANS A/A+ equipped aircraft can have up to **five ADS-C connections simultaneously**.
  - The aircraft has the capability to report to all connected ATC centers simultaneously using ADS-C.
  - Different types of ADS-C "contracts" exist:
    - **Periodic**: the data are sent at periodic time intervals.
    - **On demand**: the data are sent only when asked for.
    - **On event**: the data are sent whenever a specified event occurs.
  - Establishment of ADS-C connections and definition of ADS-C contracts type are initiated by ground systems. They are transparent to the flight crew and the transmission of ADS-C report to the ground systems as well.
  - An individual ADS-C connection may be stopped from the ground or manually by the flight crew (FANS A+ only) through the ADS-C DETAIL page of the MCDU ATC menu (respectively MFD CONNECTION STATUS page).
  - The flight crew has the possibility to switch ADS-C off, that will cancel any ADS-C connections with the aircraft. While ADS-C is off, the ground system will not be able to establish an ADS-C connection.
  - **The ADS-C should not be set to off unless instructed to do so by ATC.** If the ADS-C is set to off, the ATC center can no longer be provided with ADS-C reports.
  - FANS A+ provides more precise indications than FANS A:
    - The number of active ADS-C connections is displayed on DCDU (respectively ATC mailbox)
    - The status ARMED or CONNECTED of ADS-C is displayed on MCDU (respectively MFD ATC COM pages).

Please, bear in mind… (continued)

- **ADS-C connection Closure**
  - ADS-C contracts and connections should normally be terminated by the ground system when the:
    - The aircraft has crossed the FIR boundary and no surveillance information from the flight are required by the transferring ATC, or
    - The flight plan is no more active from the ATC point of view, or
    - No surveillance information from the flight are required by the CDA or an adjacent ATC.
- **Position reporting with ADS-C**
  - A Waypoint will not be sequenced if the position is offset by more than **7NM on Honeywell FMS2 and 5NM on Thalès FMS2** aside from this point. When an offset is flown, it is recommended that the crew keeps updating its FMS flight plan, and that it uses the FMS Offset function.
- **ADS-C Failure**
  - When a shutdown occurs the ATC controller will advise the crew of the requirements for the position reports (by voice or CPDLC).

Emergency procedures

- During an emergency, it is expected that the flight crew reverts to the voice communications. Nevertheless, CPDLC could be used if CPDLC is more efficient than voice or if voice communications are not possible.
- The emergency mode can be activated either by the flight crew or the ATC controller, and is normally cancelled by the flight crew. When selected on the MCDU ATC page (respectively MFD ATC COM pages), the ATSU (respectively ATC applications) immediately sends a report to all ATC centers that currently have contracts established with that aircraft.
- The ATC controller in charge of the flight shall acknowledge any ADS-C emergency report.
- When the flight crew cancels the emergency mode, the aircraft will send an emergency mode cancellation message to each ground station receiving the emergency mode reports.

ATS623 applications

- Pending for a greater maturity of standardized services, Airbus has decided to implement only three ATS 623 applications:
  - Departure Clearance (DCL)
  - Oceanic Clearance (OCL)
  - Digital – Automatic Terminal Information Service (D-ATIS).
- ATS 623 applications do not require a preliminary AFN procedure compared to CPDLC and ADS-C applications.

Please, bear in mind… (continued)

- In case similar applications have been customized through AOC (ACARS) contracts, these will no longer be available should the ATS623 package be chosen (e.g. AOC DCL or OCL will no longer be sent from a customized AOC page). However, customized AOC functions such as Pre-Departure Clearance (PDC), that is not compliant with the AEEC 623 specifications, will remain possible via ACARS.

Advanced Datalink Operations

- **Dynamic Airborne Reroute Procedure (DARP)**
  - DARP enables the rerouting of an aircraft in flight based on updated weather forecasts, that allows to save fuel/time savings and eliminate flight hazards.
  - To fulfill this procedure, a full coordination between AOC, ATC centers and aircraft is required:
    - to uplink the new flight plan revised by AOC to the aircraft
    - to negotiate the revised flight plan with ATC.
- **Tailored Arrival (TA)**
  - TA is a 4-dimentional (4-D) arrival procedure, based on an optimized ATC clearance. TA enables to replace current ATC practices based on tactical radar vectoring, by CPDLC clearance uplinked prior the top of descent (TOD).
  - The procedure is “tailored” to adapt the flight profile from cruise level to expected arrival runway to the current conditions (i.e. traffic, weather, aircraft performance, etc).
  - The main benefits are to optimize fuel consumption and reduce noise emissions.
- **In Trail Procedure (ITP)**
  - ITP is a new procedure enabling more frequent flight level changes in procedural airspaces (without radar coverage). When ITP is applied, the aircraft is authorized to climb or descent using reduced minima of longitudinal separations and thus change flight level on a more frequent basis.

A6. FANS A EVOLUTIONS

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The present chapter is divided into two parts:

- The first part is related to FANS A evolution available on A320 and A330/A340 aircraft. The evolution is identified as the FANS A+ system. The novelties are described compared to the FANS A system as of July 2000. The FANS A+ system has been available since April 2004 on A330/A340 aircraft and March 2005 on A320 aircraft. To continue the improvement of FANS A+, a latest FANS A+ system with functional evolutions have been certified in 2011.
- The second part is related to FANS A+ enhancement available on A350/A380 aircraft. FANS A+ on A380 is designed on an architecture (ATC/ACR replaced ATSU) based on new A380 technology (IMA and AFDX network). Regardless the interfaces, it is to be noticed that FANS A+ functions on A380 are the same as the ones on A320/A330/A340 aircraft, apart from a very few exceptions. These exceptions are described in this second part. FANS architecture on A350 is a legacy of A380 one with ATC/ACR applications. Moreover, A350 benefits from HMI improvements implemented with the latest FANS A+ system on A320/A330/A340.

Note 1: Whenever used, the term A320 designates the A320 family.
Note 2: The FANS A+ system and the ATS 623 applications are included in the basic definition of the A350/A380 aircraft.

A320/A330/A340 aircraft

A6.1. A320/A330/A340 FANS A+ (FANS A SYSTEM EVOLUTION)

The aim of this chapter is to list and to describe the evolutions implemented in the transition from FANS A to the FANS A+ system.
The objectives of the FANS A+ system are two-fold :

- To improve the package of FANS A services (FANS A+ basics)
- To extend the use of data link services (FANS A+ options).

Improvements address points coming from feedback from operators (e.g. ADS-C information on DCDU), interoperability and standardization objectives (e.g. addition of CPDLC elements to clarify some messages) or have been dictated by improvement of Human Machine Interface (HMI) or by functional evolutions (e.g. availability of the "LOAD" command on the DCDU, Auto-Closure of messages, Datalink Status Page enhancement, etc).

New data link services have also been added with the introduction of:

- VDL mode 2, so as to increase the capacity for ATC communications
- HFDL capability for ATC (once this service is approved)
- ATS623 applications: Departure & Oceanic clearances and Digital-ATIS
- High-speed data loading capability (AEEC 615A)
- ATC data link communication recording for the investigation on flight accidents/incidents
- Radio frequency loading into RMP
- In Trail Procedure (ITP) clearance.

These services are optional and may be chosen separately according to the airlines needs and types of operations.

A6.1.1. FANS A+ BASICS

A6.1.1.1. ENHANCEMENTS OF THE HUMAN MACHINE INTERFACE (HMI)

In the FANS A+ system, the initial FANS A HMI has been modified to provide additional information relative to:

- ADS-C/CPDLC Connections
- CPDLC Message and functions
- Data link communications status.

A6.1.1.1.1. Modifications relative to ADS-C

MCDU CONNECTION STATUS page indicates if ADS-C is either ARMED, CONNECTED or OFF (as detailed in A5.5.1 – ADS-C connection).

MCDU ADS DETAIL page lists ATC centers with active ADS-C contracts. They can easily be disconnected separately through the appropriate right Line Select Key (LSK) of the MCDU (as detailed in A5.5.2 – ADS-C connection management).

FANS A DCDU was designed for operations in an ADS-C/CPDLC environment, as it was foreseen in the CNS/ATM concept. In case of regions ADS-C only capable, the FANS A DCDU displayed the NO ACTIVE ATC indication. This message refers to the CPDLC status only, and does not mean there are no ADS-C contracts established with the aircraft. So as to improve the knowledge of the ADS-C status, an ADS-C indication has been added on the DCDU (for more details, refer to A5.5.1 – ADS-C connection).

A6.1.1.1.2. DCDU indications in case of failures

In any abnormal conditions as regards the CPDLC services, positive information is provided on the DCDU screen whenever appropriate (refer to Part II - Appendix J - On-board indications in case of data link failures).
In case of connection loss, the flight crew (through voice) must notify the current ATC of the problem and restart the CPDLC connection through the complete AFN procedure from the MCDU NOTIFICATION pages (refer to Section A5.3 - ATS Facilities Notification (AFN)).

NEW

A6.1.1.1.3. New DATALINK STATUS Page

The MCDU DATALINK STATUS page replaces the COMM STATUS page of the previous FANS A+ system. The flight crew can open this page via the ATSU DATALINK page and consult the status of the VHF3, SATCOM and HF communications media.

For each media (VHF3, SATCOM, HF), the flight crew access to:

- The status of the media: available for data link, or inoperative, or not installed

- The type of applications able to communicate via the available media(s): ATC or AOC or both ATC/AOC

The table below proposes the information presented in the MCDU DATALINK STATUS page among the different cases:

		Media concerned		
		VHF3	SATCOM	HF
Nominal case	DATA mode selected and datalink communications established	DLK AVAIL ATC/AOC[1]	DLK AVAIL ATC/AOC[1]	DLK AVAIL ATC/AOC[1]
Other cases	DATA mode selected And datalink communications lost	DLK NOT AVAIL	DLK NOT AVAIL	DLK NOT AVAIL
	VDR3 failed[2]	INOP		
	SDU failed[2]		INOP	
	HFDR 1/2 failed[2]			INOP
	VHF3 inhibited[3]	NO NETWORK		
	VOICE mode selected	VOICE		VOICE
	VDR3 not installed	NOT INSTALLED		
	SDU not installed		NOT INSTALLED	
	HFDR not installed			NOT INSTALLED

[1] Three cases are possible:

- If datalink is available for both ATC and AOC messages: ATC/AOC is displayed
- If datalink is available for ATC messages only: ATC ONLY is displayed
- If datalink is available for AOC messages only: AOC ONLY is displayed

ATC messages include ATS 623 messages when ATS623 applications are installed.

[2] Failed means that:

- The equipment (i.e. VDR, SDU, or HFDR) is inoperative, or
- The link between the ATSU and the equipment (i.e. VDR, SDU, or HFDR) is inoperative.

[3] Inhibited means that:

- The scan mask provided is empty, or

- The aircraft is flying over areas not covered by CSP specified in the scan mask.

NEW

A6.1.1.1.4. Modification of MSG RECORD

The MSG RECORD has been enhanced based on in-service feedbacks.

In-service feedbacks showed that confusion may be possible between current and old messages. To minimize this risk of confusion, a line has been introduced in the MSG RECORD to separate the set of messages of different flights. This line of separation includes the flight identification and the date (see MCDU on the right).

Note: All messages are displayed according to the chronological order starting by the most recent message treated.

If an abnormal event occurs when a message is processed, the MSG RECORD will display the message with this abnormal event:

- 'OPEN' Status and 'SEND FAILED' (see MCDU on the right),
- 'ABORT' Status and 'LINK LOST',
- 'WILCO' Status and 'MONIT FAILED',
- 'WILCO' Status and 'MONIT UNAVAIL'.

NEW A6.1.1.1.5. Improvement of NOTIFICATION page

The history of notified ATC centers is no more kept in the NOTIFICATION page.

When the AFN logon with an ATC center succeeds, the NOTIFICATION page displays, in green, the notified ATC center followed by the notification time (e.g. KZAK NOTIFIED 1213Z).

When the CPDLC connection is established with the ATC center, the information of the notified ATC center (e.g. KZAK NOTIFIED 1213Z) is cleared.

NEW

A6.1.1.1.6. New features in CONNECTION STATUS page

In the MCDU CONNECTION STATUS page, two new features have been introduced as follows:

Further to instruction of ATC Controller, the flight crew may have to terminate all CPDLC connections (active and inactive) by selecting the button "ALL ATC DISCONNECT".

Upon activation of the "SET OFF" command related to ADS-C, the flight crew will have to confirm the termination of ADS connections. The "CONFIRM SET OFF" command will be displayed for this purpose.

A6.1.1.2. IMPROVEMENTS RELATED TO THE CPDLC APPLICATION

They have been added in agreement with international FANS interoperability groups that have been working on CNS/ATM implementations in various parts of the world.

A6.1.1.2.1. Addition of information on REPORT messages

When needed, the following message elements are now automatically proposed as part of the downlink message:

- CLIMBING TO
- DESCENDING TO
- DEVIATING TO.

They are part of the Report messages, and are proposed wherever appropriate by the FMS.

A6.1.1.2.2. Discarding old uplink messages

To prevent operational misunderstanding due to delayed messages presentation (because of ACARS networks' performance), some ATC centers will ask, in the near future, the flight crew to set a maximum value for an acceptable delay. This procedure is based on the Max Uplink Delay (Refer to Section A5.4.6.11 Max Uplink Delay).

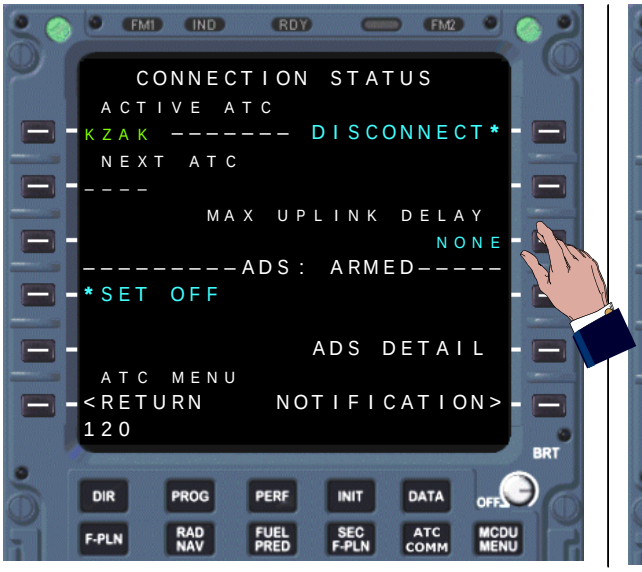
- the ATC center specifies the max uplink delay value to the flight crew

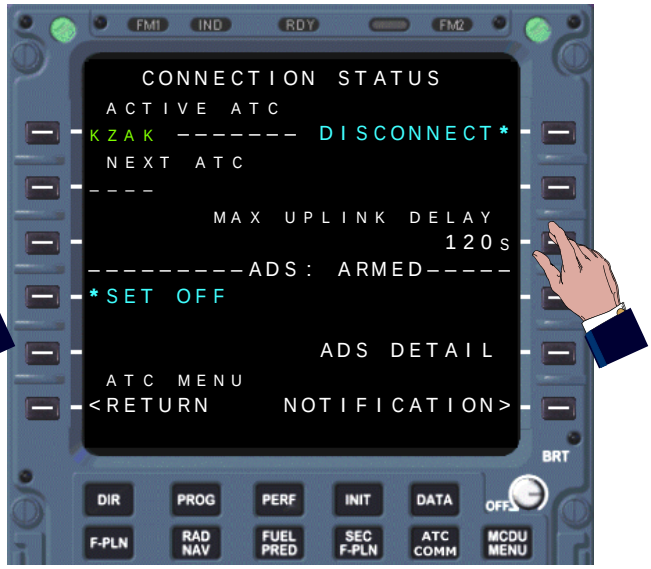
ATC Controller: *SET MAX UPLINK DELAY VALUE TO [max uplink delay value] SEC*

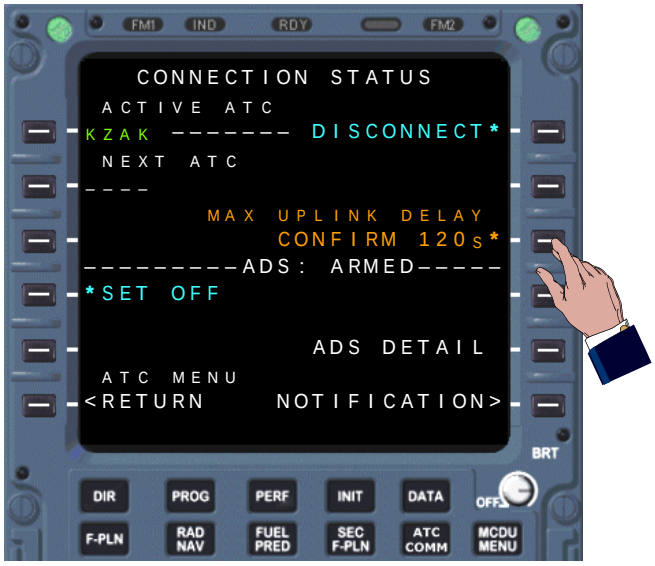
Flight Crew: *ROGER*

Note: The “SET MAX UPLINK DELAY VALUE TO [max uplink delay value] SEC” message is a free text message.

- After reception of the MAX UPLINK DELAY value from the ATC center, the flight crew has to:
  - Type the MAX UPLINK DELAY value provided by the ATC center in the scratchpad
  - Push the MAX UPLINK DELAY prompt (LSK3R) to enter the max uplink delay value in the system
  - Confirm the MAX UPLINK DELAY value.



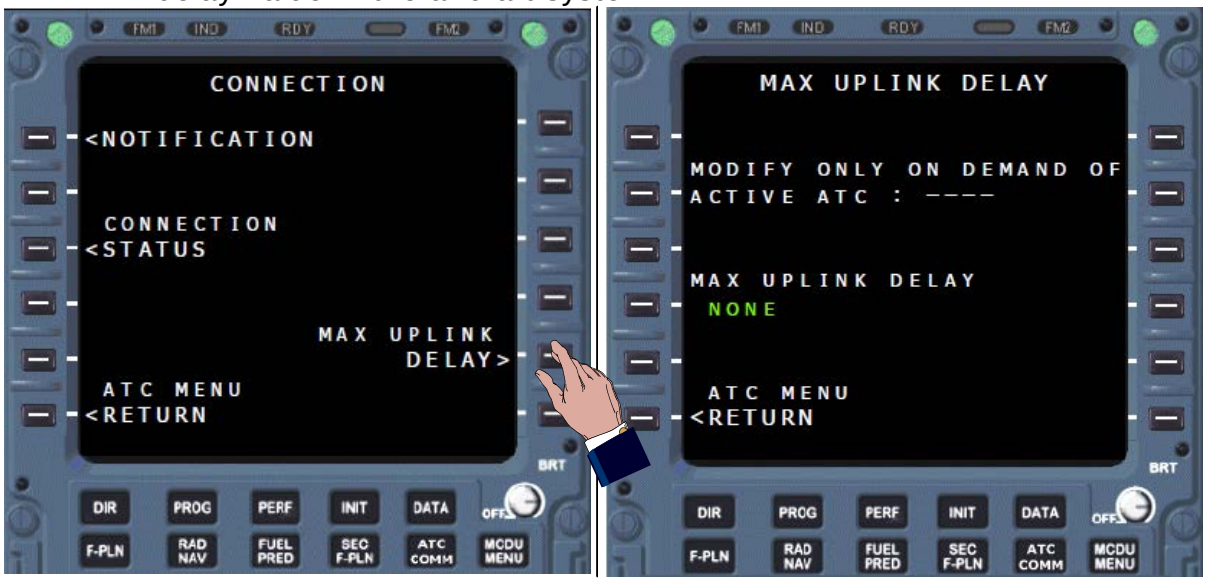




The MAX UPLINK DELAY value shall be inserted into aircraft system **on ATC request only**.

NEW Latest FANS A+ system displays the new MAX UPLINK DELAY page.

- After reception of the MAX UPLINK DELAY value from the ATC center, the flight crew has to:
  - Access to the MAX UPLINK DELAY page
  - Type the MAX UPLINK DELAY value provided by the ATC center in the MCDU scratchpad
  - Push the MAX UPLINK DELAY prompt (LSK4L) to enter the max uplink delay value in the aircraft system.



At this step, the MAX UPLINK DELAY value is defined in the aircraft system. When the aircraft receives an uplink message:

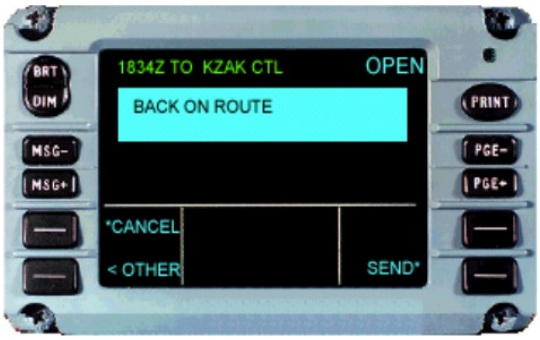
- The aircraft system calculates the time since the sending of the message (i.e. time stamp of the message)

- If this time is greater than the MAX UPLINK DELAY value, the message is considered no longer valid and the aircraft system:
  - Discards the uplink message without any indication to the flight crew
  - Send to the ATC center the message: INVALID DATA UPLINK DELAYED IN NETWORK AND REJECTED RESEND OR CONTACT BY VOICE.

A6.1.1.2.3. BACK ON ROUTE message

When weather deviation or offsets (refer to Section A5.5.5 Route offset) are flown in areas where CPDLC is the first means of communication, the BACK ON ROUTE preformatted message has been added on the MCDU ATC REPORTS page.
BACK ON ROUTE message enables to avoid the use of a free text to inform the ATC once back on the initial route.

DCDU on A320/A330/A340



MCDU on A320/A330/A340

NEW

A6.1.1.2.4. Auto-Closure of messages

Some CPDLC messages will be automatically closed (i.e. removed) from the DCDU, 5 seconds after the reception of the acknowledgement of the message from the ground. It concerns the following messages:

- Downlink messages, or
- Answer to uplink CONFIRM messages, or
- Answer to uplink NEGOTIATION messages, or
- Answer to uplink INFORMATION messages.

The “CLOSE” key will remain available on the DCDU for the other messages:

- Answer to uplink CLEARANCE messages, or
- Uplink messages that do not require a flight crew answer.

NEW

A6.1.1.2.5. New RECALL Mode

The flight crew can remove messages from DCDU display when they have been processed, by selecting the soft key CLOSE.

During 5 minutes, the last removed message can be immediately redisplayed (recalled) on the DCDU through a dedicated 'RECALL' command. RECALL MODE is displayed in information area.

5 minutes after the last removed message has been closed, the activation of RECALL command displays "RECALL EMPTY CONSULT MSG RECORD" (see DCDU on the left).

NEW

A6.1.1.2.6. Time reference in uplink message

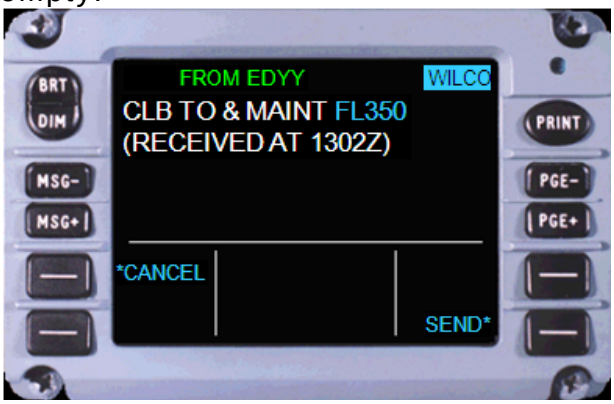
Initially, the FANS A+ system on A320/A330/A340 aircraft had been designed so as to display the time at which the message has been received on DCDU (i.e. time in the upper left corner of DCDU).

The management of the message time stamp introduced on FANS A+ A380 ATC has been implemented in the same way on FANS A+ A320/A330/A340 as shown below.

For more details about A380 ATC time stamp management, refer to Section A6.2.1.3 Time reference in uplink messages.

When the uplink message is provided with the time stamp, the time reference is displayed in the upper left corner of the DCDU.

When the uplink message is not provided with the time stamp, the time reference (i.e. time at which the message has been received) is inserted at the end of the message. The upper left corner is empty.



A6.1.1.3. COMMUNICATION SERVICE PROVIDER (CSP) WORLD MAP

In order to optimize Frequency, Media and CSP selection, an algorithm (VHF world map) lists the VHF data link service providers available in each geographical area. The ATSU router automatically selects a VHF frequency depending on the aircraft position in accordance with the scan mask entered by the airline.

The availability of a world map update is announced through a Vendor Service Information Letter (VSIL) available via the Airbus website (connection with your Airbus World login) at: https://w3.airbus.com/avionics_simulation/.

If your access to the above Airbus link is not granted, please contact: systems.support@airbus.com.

A6.1.1.4. ATSU ROUTER CUSTOMIZATION VIA LOADABLE DATABASE

Customization of the ATSU Router can be achieved through a loadable database. The ATSU router customization is possible in 2 steps:

- **Customization step 1** allows the ATSU supplier to modify the airline identification and the scan mask parameters upon customer request.
- **Customization step 2** allows ATSU supplier to modify a defined set of parameters contained in the CSP World map file.

Access to those parameters (airline identification and scan mask) on MCDU is inhibited as soon as a customized ATSU router database is loaded.

A6.1.2. FANS A+ OPTIONS

A6.1.2.1. HF DATA LINK (HFDL)

A6.1.2.1.1. HFDL for ATC purpose

HF Data Link (HFDL) is an optional function of the FANS A system that has been certified only for AOC purpose (as explained in FANS A architecture description in Part I). In the FANS A+ system, HFDL has been also certified for ATC purpose as a supplementary means of communication.

Please refer to HFDL description in Part I – Chapter 3 for more details.

As there is only one HF antenna to support the use of either HFDL or HF voice, some operational constraints exist that have to be understood. HF voice and HFDL cannot be used at the same time, and as per the international aeronautical rule (AEEC 753), HFDL is inhibited for 60 seconds whenever HF voice has been used for transmission. This 60 seconds limitation is justified by the need for a possible HF voice reply to any HF voice initiated from the aircraft. So as not to disturb this reply, HFDL is thus inhibited momentarily.

This one-minute limitation is arguable: in some poor conditions of propagation, one minute may not be sufficient. The above-mentioned rule however, recommends an inhibition in between 30 and 120 seconds. 60 seconds were chosen on Airbus aircraft.

When HFDL is used, the aircraft may be emitting for slots of 2.5 seconds every 32 seconds.

A6.1.2.2. HIGH-SPEED VHF DATA LINK – VDL MODE 2

VHF Data Link mode2 (as described in FANS A architecture description in Part I) is an optional function of the FANS A+ system that allows higher data rate than VDL mode A.

Although both the current VDL mode A and VDL mode 2 are available in the ATSU, only one of them can be used at the same time. Although mostly developed to overcome the current ACARS networks congestion, the VDL mode 2 should be used for ATC purpose. It has indeed started to be used in two ATC centers (Maastricht and Miami) and will be implemented in other ATC over the next years.

VDL mode 2 ensures a communication function, and as such is not dependent of any application. Current AOC applications can be transferred to VDL mode 2 without modification.

The figure given in Part II - Appendix C gives the current deployment of VDL mode 2 ground stations.

A6.1.2.3. WIRED HIGH SPEED DATA LOADING CAPABILITY (AEEC 615A)

The ATSU has now the capability to support wired high-speed data loading specification AEEC-615A (Ethernet loading usually called ARINC-615A), that enables airlines to save additional operating costs. This new feature reduces software data loading duration with a factor of 5 at a minimum and introduces also a full ATSU

software configuration management (including the AOC) to ease maintenance operations.

On-board high-speed data loading requires installation of:

- A dedicated plug in the avionics bay,
- A hardware modification, that consists in integrating an Ethernet module in the ATSU.

A joint utilization of a high-speed-data loading ATSU and of a SDL/PDL provides the following benefits:

- Reduced data loading time with a factor of 5 at a minimum,
- Compatible with AEEC 615-3 and AEEC 615A,
- Facilitated maintenance operation:
  - Reduce manual intervention between loadings,
  - Capacity to load customized airline configuration,
  - User-friendly data loader design,
  - Trouble shooting aids in case of loading issue.

A6.1.2.4. CLEARANCES AND DIGITAL ATIS APPLICATIONS – ATS 623

In Part II - Appendix I, a departure clearance scenario is proposed to depict the main points that are linked to the three applications.

As part of the certification, the operational conditions for a use of the ATS623 is as follows:

- Pre-flight and En-Route phases for both Departure Clearance (DCL) and Oceanic Clearance (OCL),
- All flight phases for Digital ATIS (D-ATIS),
- During takeoff and landing phases, all associated uplinks are inhibited.

They indeed are put in a buffer and are displayed once out off the inhibition phases.

Although very similar to FANS A as far as the DCDU and MCDU displays and handling are concerned, the ATS623 operations do present some differences that have to be known (refer to Section A5.7 - ATS 623 applications).

The most important point is that DCL and OCL are not true FANS A services, and as such, cannot be processed by the system in the same way as CPDLC for instance. The associated HMI (DCDU mainly) is thus slightly different, and has been adapted to take account of these differences.

It has to be noticed that D-ATIS reports are not parts of a direct dialogue between the flight crew and the ATC controller. As a consequence, D-ATIS reports are directly received into the MCDU.

NEW

A6.1.2.5. ATC DATA LINK COMMUNICATION RECORDING

With regards to new regulations on the recording of ATC data link communications (refer to Part I – Chapter 2), Airbus proposes, as an option, the ATC data link

recording capability. A new Cockpit Voice Recorder (CVR), that is compatible with the latest version of FANS A+, is required to enable this option.
This CVR records useful parameters for the description of the following events:

- Reception of uplink messages
- Sending of downlink messages
- Flight crew actions related to the sending or to the display of messages
- Focus on messages
- Storing of messages in DCDU queue
- Printing requests and printing status.

Note: Uplink and downlink messages are:

- AFN, CPDLC, ADS-C messages
- All A623 messages (DCL, OCL, D-ATIS) if the A623 applications are installed on-board.

In addition to the flight data and audio data, the ATC data link recording will be helpful to rebuild the main events occurred during the flight.

ATC Data link recording is proposed as an option of FANS A+ system on A320/A330/A340 aircraft.

NEW

A6.1.2.6. RADIO FREQUENCY LOADING INTO RMP

With the latest version of FANS A+ on A320/A330/A340 aircraft, the frequency loading into the Radio Management Panel (RMP) is an optional feature that allows the flight crew to load a frequency received by CPDLC directly into a STBY window of an RMP.
The frequency loading into the RMP reduces tuning errors and flight crew workflow. This feature requires RMP having this capability, i.e. with the LOAD key present on the RMP front panel.

On DCDU, the flight crew receives an CPDLC uplink message (i.e. MONITOR or CONTACT instruction) that includes a voice frequency.

A LOAD key on the RMP front panel illuminates in white when the frequency loading is available. Pressing the LOAD key, when it is active, downloads the frequency into the selected STBY window.

Note: The LOAD key is active only when the CPDLC message containing the frequency is displayed on DCDU and not in RECALL mode.

On DCDU, the flight crew informs the ATC controller that they comply with the instruction by sending WILCO related to the CPDLC uplink message (i.e. MONITOR or CONTACT).

NEW

A6.1.2.7. IN TRAIL PROCEDURE (ITP) BY CPDLC

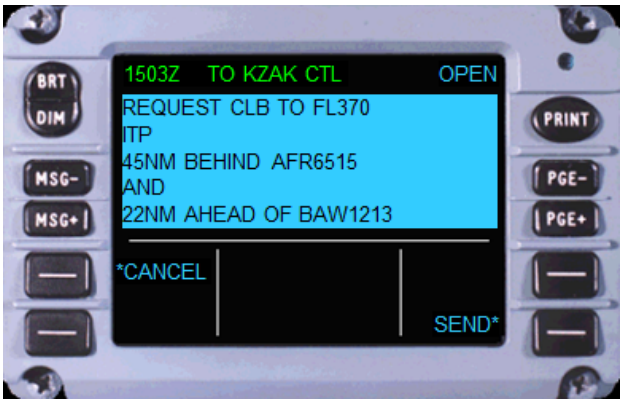
ITP is a new procedure enabling more frequent flight level changes in procedural airspaces (without radar coverage). ITP uses ADS-B data and requires an ADS-B IN or ATSAW capability. ITP is described in the “Getting To Grips With Surveillance” (see References).
To facilitate the edition of the ITP clearance request, a link between the ATSU and a TCAS capable of ATSAW ITP has been introduced.

The ITP clearance request initiated on the MCDU TCAS page (via ITP TRAFFIC LIST page) is automatically generated on DCDU by pressing the ATC REQ DISPLAY function. The ITP CPDLC request is generated from the information displayed on the MCDU ITP TRAFFIC LIST page.
The flight crew sends the ITP CPDLC request from the DCDU as usual.
ITP clearance by data link is proposed as an option of FANS A+ system on A320/A330/A340 aircraft.

In the ITP TRAFFIC LIST, the flight crew enters the requested flight level in the DESIRED FL field. Once the desired flight level is entered, the ATSAW function checks the ITP opportunity (possible or not and time) and identifies the reference Aircraft in the ITP Traffic List (ITP distance, relative position and flight identification).

The flight crew can transfer the ITP clearance to DCDU by selecting the ATC REQ DISPL key.

On DCDU, the ITP CPDLC request created with the information of the MCDU ITP TRAFFIC LIST page is displayed.
The flight crew sends the ITP CPDLC request from the DCDU as usual.



A6.1.3. FANS A+ RETROFIT

The upgrade to the latest version of FANS A+ is possible regardless of the initial aircraft configuration (i.e. ACARS MU, Pre-FANS, FANS A, or former FANS A+). The upgrade from FANS A or former FANS A+ version to the latest FANS A+ version consists of a change of software only, provided it is limited to the basic features.

The upgrade to activate optional features (e.g. VDL Mode 2, A615A High Speed Data Loading, ATC data link communications recording, radio frequency loading into RMP, or ITP request by CPDLC) affect the hardware.

For operators wishing to modify their aircraft configuration, a Request For Change (RFC) must be issued for the basic functions package (see Section A6.1.1 FANS A+ basics) as well as for any optional capabilities to be activated separately (see Section A6.1.2 FANS A+ options).

After the upgrade of FANS aircraft systems, airlines are invited to report to Airbus the current avionics configuration of their fleet in order to ensure a correct follow-up of FANS aircraft.

For more details about the FANS retrofit, operators are invited to consult the Airbus Upgrade Catalogue (Section ATA 46 – Information Systems) available at: https://w3.airbus.com/upgrade-ecatalogue/index.jsp.

For any questions about FANS retrofit, please refer to your dedicated Key Account Manager or Customer Support Director (CSD).

A350/A380 aircraft

A6.2. A350/A380 FANS A+ (ENHANCEMENT REGARDING FANS A+ ON A320/A330/A340 AIRCRAFT)

This section describes features that are available in A350/A380 FANS A+ system but not in A320/A330/A340 FANS A+ system. The A380 FANS A+ system derives from an adaptation of the A320/A330/A340 FANS A+ system to the A380 architecture. Therefore, all features available in A320/A330/A340 FANS A+ system are available in A380 FANS A+ system, except when specified.

FANS A+B system on A350/A380 contains functions from FANS A+ and FANS B+ systems with additional enhancements such as the harmonization of ATC aural alerts and the new MFD CONNECT page. This chapter deals with the FANS A+ features only with regards to FANS A+B system. To get the description of FANS B+ features available in FANS A+B system, please refer to Part III - Chapter B6.

It should be noted that all FANS A+ functions described for A320/A330/A340 aircraft (either basic or optional) are included in the basic definition of the A350/A380 aircraft. For instance, HFDL is optional on A320/A330/A340 aircraft and basic on A350/A380 aircraft. It does not apply to functions specific to A320/A330/A340 architecture such as the Wired High Speed Data Loading (ARINC 615A).

A6.2.1. FANS A+ BASICS

A6.2.1.1. CENTRAL AND UNIQUE ATC MAILBOX

The uniqueness of the ATC mailbox was validated as an efficient means to improve the flight crew's crosscheck of messages. The uniqueness naturally called for a central position of the ATC mailbox.

A6.2.1.2. DISCARDING OLD UPLINK MESSAGES

The discarding of old messages is based on the Max Uplink Delay function (Refer to Section A5.4.6.11 Max Uplink Delay). The Max Uplink Delay and the related procedure are identical to the ones on A320/A330/A340 aircraft. However, the access is different from A320/A330/A340 interfaces.

- the ATC center specifies the max uplink delay value to the flight crew

ATC Controller: *SET MAX UPLINK DELAY VALUE TO [max uplink delay value] SEC*

Flight Crew: *ROGER*

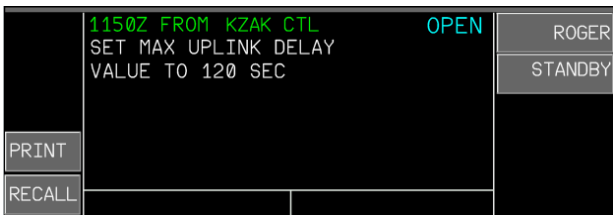
Note: The "SET MAX UPLINK DELAY VALUE TO [max uplink delay value] SEC" message is a free text message.

- After reception of the MAX UPLINK DELAY value from the ATC center, the flight crew has to:
  - Access to the MAX UPLINK DELAY page through the pull-down CONNECT menu on MFD
  - Enter the MAX UPLINK DELAY value in the aircraft system.

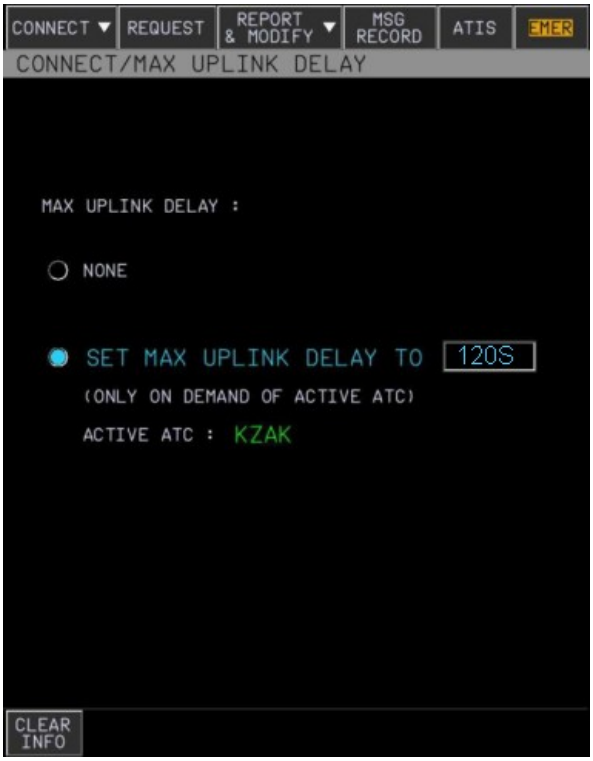
The MAX UPLINK DELAY value shall be inserted into aircraft system **on ATC request only**.

ATC Mailbox on FANS A+

ATC Mailbox on FANS A+B



MFD ATC COM on FANS A+



MFD ATC COM on FANS A+B

At this step, the MAX UPLINK DELAY value is defined in the aircraft system. When the aircraft receives an uplink message:

- The aircraft system calculates the time since the sending of the message (i.e. time stamp of the message)
- If this time is greater than the MAX UPLINK DELAY value, the message is considered no longer valid and the aircraft system:
  - Discards the uplink message without any indication to the flight crew
  - Send to the ATC center the message: INVALID DATA UPLINK DELAYED IN NETWORK AND REJECTED RESEND OR CONTACT BY VOICE.

A6.2.1.3. TIME REFERENCE IN UPLINK MESSAGES

In ATN environment, uplink messages shall be presented to flight crew with the time at which the message had been sent (i.e. time stamp). This requirement allows flight crews and ATC controllers to have the same time reference for a given messages.

In ACARS environment, there are no such requirements. Initially, the time stamp was not provided in CPDLC messages and the reception time was displayed. Today, the provision of the time stamp is a common usage for all ATC centers around the world. Since 2009, all ATC centers provide CPDLC message with time stamp.
The A380 FANS A+ was the first system to introduce a mechanism that discriminates the time stamp and the time of reception when CPDLC messages are displayed.
This mechanism has been made available to all other Airbus aircraft (A320/A330/A340/A350) with the latest FANS A+ or FANS A+B. Refer to Section A6.1.1.2.6 Time reference in uplink message.

ATC Mailbox on A350/A380

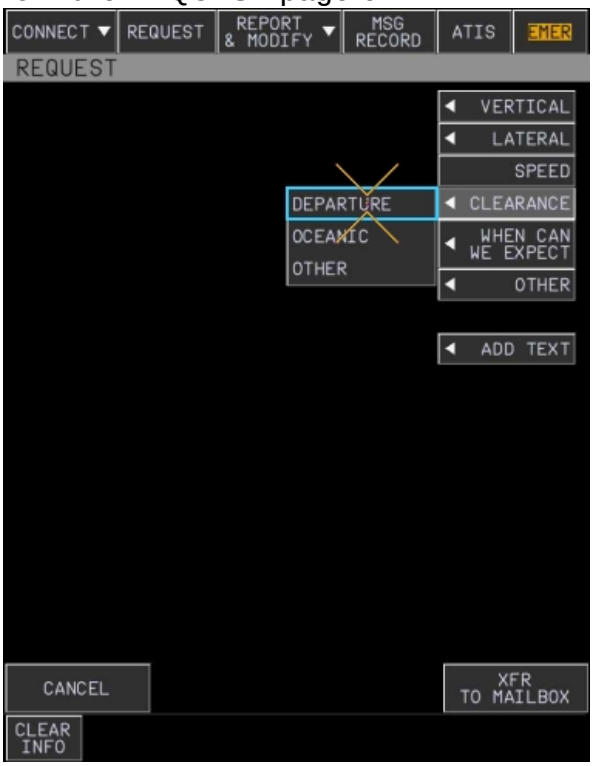
When the uplink message is provided with the time stamp, the time reference is displayed in the upper left corner of the ATC mailbox.

When the uplink message is not provided with the time stamp, the time reference (i.e. time at which the message has been received) is inserted at the end of the message. The upper left corner is empty.

A6.2.1.4. CLEARANCES AND DIGITAL ATIS APPLICATIONS – ATS 623

The ATS 623 applications are included in the basic definition of A350/A380 aircraft. The services provided are the same as on A320/A330/A340 aircraft: Departure clearance request, Oceanic clearance request and Digital ATIS (D-ATIS).

Departure clearance request and Oceanic clearance request are accessible from the REQUEST page on MFD.



The D-ATIS service is available through the ATIS page on MFD. ATIS requests for three airports may be done.

The ATIS report can be displayed on an expanded area through the triple rightward arrow. If the ATIS report cannot be displayed entirely in the allowed space, suspension points "…" are inserted at the end.

A6.2.1.5. ATC DATA LINK COMMUNICATION RECORDING

With regard to the ATC data link recording function available as an option on A320/A330/A340, the A350/A380 aircraft implement basically the same function. The CVR installed on A350/A380 have the capability to record the ATC data link communications.
To get a detailed description of the ATC Data link recording function, please refer to Section A6.1.2.5 ATC data link communication recording.

A6.2.1.6. SCAN MASK WITH ROUTING POLICIES

On A350/A380 aircraft, the Avionics Communication Router (ACR) supports the routing function. Three software/databases are part of the ACR:

- **Operational Software:** it is certified within Airbus process and provides the basic function of ACR,
- **Communication Service Provider Database (PRODB):** it is BFE and contains values for parameters of air/ground communication protocols set as

required to ensure interoperability with Communication Service Providers (CSPs). It includes only air/ground data common to the different areas of the world where the service is provided

- **Customized Database (CSTDB):** it is BFE and contains parameters that are defined upon airline choice. These parameters are specified in the terms of contracts established between the airline and the selected CSPs. The non-exhaustive list of these parameters would be the list of IATA /ICAO identification codes, the VHF CSP preference configuration, the AOC routing policies configuration, the VHF CSP world map configuration and the VHF frequencies.

As a comparison with A320/A330/A340 aircraft, the ATSU integrates this routing function.
The ACR PRODB is comparable to the Media configuration table (MCT) part of the CSP world map file of the ATSU Router Parameter Database (ATSU RPDB) except that it does not contain the VHF frequencies.

The ACR CSTDB is comparable to the ARF customization file and the CSP world map file except the MCT but with the VHF frequencies.

A6.2.1.7. DATALINK COM STATUS PAGE

The DATALINK COM STATUS page equivalent to the MCDU DATALINK STATUS on A320/A330/A340 is available on A350/A380 RMP. This page provides the status of the VHF3, SATCOM and HF communications media. The flight crew can open this page via COM STATUS button available in the RMP MENU page.

DATALINK COM STATUS on A380

DATALINK COM STATUS on A350

For each media (VHF3, SATCOM, HF), the flight crew may access to:

- The equipment status (**EQUIPT STATUS**) filled either with **VOICE**, or **DATA** or **INOP**
- The datalink communication status (**DTLNK COM STATUS**) filled with:
  - **Blank** if the associated media is either in VOICE mode or INOP, or
  - **NOT AVAIL** if the associated media is not available for datalink, or
  - **AVAIL** if the associated media is available for datalink

- The routing service status (**ROUTING SERVICE**) filled with:
  - **Blank** if no datalink communication is available with the associated media, or
  - **ACARS** if ACARS communication is available with the associated media, or
  - **HS-ACARS** if High Speed ACARS communication (i.e. VDL Mode 2) is available with the associated media.

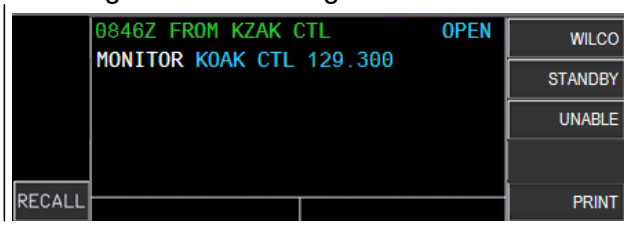
Note: The routing service status is provided on A380 only.

A6.2.1.8. RADIO FREQUENCY LOADING INTO RMP

On A350 aircraft, the frequency loading into the Radio Management Panel (RMP) is a basic feature that allows the flight crew to load a frequency received by CPDLC directly into a STBY window of an RMP.

The frequency loading into the RMP reduces tuning errors and flight crew workflow.

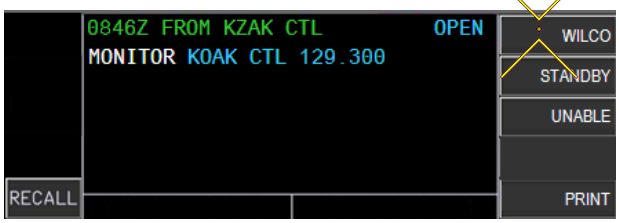
On the ATC mailbox, the flight crew receives an CPDLC uplink message (i.e. MONITOR or CONTACT instruction) that includes a voice frequency.



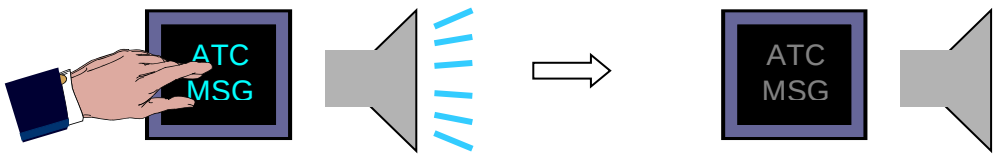
A LOAD key on the RMP front panel illuminates in white when the frequency loading is available. Pressing the LOAD key, when it is active, downloads the frequency into the selected STBY window.

The LOAD key is active only when the CPDLC message containing the frequency is open. It means that the LOAD key is inactive when the CPDLC message has been processed (i.e. WILCO is sent) or is in RECALL mode.

On the ATC mailbox, the flight crew informs the ATC controller that they comply with the instruction by sending WILCO related to the CPDLC uplink message (i.e. MONITOR or CONTACT).



A6.2.1.9. HARMONIZATION OF ATC AURAL ALERTS FREQUENCY



The ATC alert (aural and visual) is triggered each time a new uplink message arrives or whenever a deferred report or clearance expires.

On FANS A+B, the ATC aural alerts have been harmonized across FANS A+ and FANS B+ messages. The frequencies of the ATC aural alerts applied on FANS B+ has been reused for all messages (i.e. both FANS A+ and FANS B+ messages). The alert is raised:

- 10 seconds after receiving the message and repeated every 10 seconds when a normal message is received
- Immediately after receiving the message and repeated every 5 seconds when an urgent message is received.

A6.2.1.10. NEW CONNECT PAGE

On FANS A+B, the CONNECT page on MFD is a new page that is the result of the combination of the CONNECTION STATUS page and the NOTIFICATION page of A380 FANS A+.

This new page includes also the “MODIFY MAX UPLINK DELAY” button to open to the MAX UPLINK DELAY page.

A6.2.1.11. IMPROVEMENT OF THE DISPLAY OF CPDLC CONNECTION STATUS

FANS A+B inherits an improvement made in FANS B+ that affects the display of the CPDLC connection status (Refer to Part III – Chapter B6.1). The facility name of the active ATC center is added on the ATC mailbox default screen.

When the CPDLC connection becomes active, ATC mailbox displays ACTIVE ATC: [facilitydesignation] followed by [facilityname] (e.g. ACTIVE ATC: KZAK, OAKLAND CTR on the next line).

A6.2.2. FANS A+ OPTIONS

A6.2.2.1. DUAL ACR CONFIGURATION

A second Avionics Communication Router (ACR) may be installed as back up. The interface with ATC applications is adapted to the ACR configuration by Soft Pin Programming (SPP).

In a dual ACR configuration, if ACR 1 fails, ACR 2 becomes active. This ACR reconfiguration has no impact on ATC connections with the ground. Only messages queued in ACR 1 at the time of the failure are lost. Mechanisms have been implemented inside ATC applications to get aware of the message loss. When a message is lost, the ATC applications display SEND FAILED in the information area of the ATC mailbox.

Dual ACR configuration is available as an option on A350/A380. The operator can request the activation of Dual ACR configuration either through the aircraft customization process or upon Request For Change (RFC).

Please bear in mind…

A6. FANS A EVOLUTIONS

A320/A330/A340 FANS A+

To improve the current FANS A system and extend the use of data link services, a new system, FANS A+, has been developed.

- **Improvements address points coming from:**
  - Operational / in service feedback from operators
  - Interoperability and standardization objectives
  - Improvement of Human Machine Interface (HMI)
  - Functional evolutions.
- **New data link services have also been added with the introduction of:**
  - **VDL mode 2**, so as to increase the capacity for ATC communications
  - **HFDL capability for ATC** (once this service is approved)
  - **ATS623** (Departure & Oceanic clearances, Digital-ATIS applications)
  - **High-speed data loading capability** (AEEC 615a)
  - **ATC Data link communication Recording** for the investigation on flight accidents/incidents
  - **Radio Frequency loading into RMP**
  - **In Trail Procedure (ITP) clearance.**

- **FANS A+ retrofit**
  - The upgrade to the latest version of FANS A+ is possible regardless of the initial aircraft configuration (i.e. ACARS MU, Pre-FANS, FANS A, or former FANS A+). The upgrade from FANS A or former FANS A+ to the latest FANS A+ version consists of a change of software only, provided it is limited to the basic features.
  - The upgrade to activate optional features (e.g. VDL Mode 2, A615A High Speed Data Loading, data link recording, frequency loading into RMP, or ITP request by CPDLC) affect the hardware.
  - Airlines are invited to report to Airbus the current avionics configuration of their fleet in order to ensure a good follow-up of FANS aircraft.

Please, bear in mind… (continued)

A350/A380 FANS A+

- The basic definition of the A380 encompasses the FANS A+ system and the ATS 623 applications. The A380 FANS A+ system resumes all the functions provided within the A320/A330/A340 FANS A+ system. Some novelties are also introduced considering the regulation evolutions and the new A380 technology.

- The A380 technology has introduced three main novelties:
  - New interfaces: a central and unique ATC mailbox to receive and send ATC messages, ATC COM pages on MFD to prepare and store messages. The central and unique ATC mailbox improves the cross check.
  - The maintenance functions provided by the BITE are accessible through the CMS.
  - The ACR, to which the routing function for several applications is granted, offers much more flexibility for the customization of routing policies.
  - As an option, a second ACR can be installed for an advanced reliability.

- The A350 technology is fully inherited from the A380, based on:
  - Two main modules: ATC applications/ACR
  - The central and unique ATC mailbox and ATC COM pages on MFD.

- The main difference between A350 FANS and A380 FANS remains the cockpit displays layout where the ten A380 screen layout have been replaced by six larger screens.

- A350 is the first aircraft fitted with the FANS A+B system. FANS A+B combines both FANS A+ and FANS B+ features on the same platform. FANS A+ features on A350 are derived from FANS A+ system on A380, with additional services that come from the latest FANS A+ enhancements on A320/A330/A340 such as the radio frequency loading into RMP. FANS A+B on A380 will come in the soon future (2015), including functions fully inherited from A350 FANS A+B.

- FANS A+ on A350/A380 includes basically features such as:
  - Max Uplink Delay
  - Time reference for uplink messages filled with the uplink time stamp
  - ATS 623 applications: Departure Clearance (DCL), Oceanic Clearance (OCL) and Digital–Automatic Terminal Information Service (D-ATIS)
  - ATC data link communications recording.

A7.STARTING FANS A/A+ OPERATIONS

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A7.1. GENERAL

To perform FANS operations, data communication has to be ensured between the concerned Aircraft and the ATC Centers. The operator needs to ensure the following before starting FANS Operations:

1. **Sign contract(s) with Communication Service Provider(s) (CSP)**
2. **Declare aircraft to these Communication Services Providers**
3. **Declare aircraft and its FANS capability to ATC centers of the operated routes**
4. **Configure adequately the aircraft avionics**
5. **Obtain the operational approval.**

A7.2. DATA LINK: CONTRACTS AND DECLARATIONS

The air/ground datalink communications can be made through the three following communication media: VDL (mode A/Mode 2), SATCOM, HFDL.
To operate in FANS environment, i.e. on routes where AFN, ADS-C and CPDLC functions are required, it is necessary to have a contract with at least one of the major Communication Service Providers (ARINC or SITA) for SATCOM datalink, VDL and optionally HFDL.

For the establishment of the ATC data link, each individual aircraft must be declared and identified namely through its Aircraft Registration Number in Communication Service Provider (CSP) tables. This is an imperative condition to allow exchanges of ATC data link messages between an aircraft and the ATC center.

It is strongly recommended not to make spontaneous FANS testing with ATC centers when they have not been previously made aware of a given aircraft intention to operate in FANS mode. Such unscheduled testing is inconvenient for ground ATC centers, and disturbs them in their daily work.

A7.3. IMPACTS ON AIRCRAFT CONFIGURATION

Once the airline has selected the CSPs, the aircraft configuration needs to be adapted accordingly. The following avionics systems have to be configured:

- On A320/A330/A340:
  - The ATSU (Air Traffic Services Unit) scan mask for VHF Data Link,
  - The SATCOM user ORT (Owner Requirements Table) for SATCOM data link
  - The OPC Database of the FMGC
- On A350/380:
  - The ACR (Avionics Communication Router) for the customized database of routing policies
  - The SATCOM user ORT for SATCOM data link.

A7.4. GET THE OPERATIONAL APPROVAL

In complement of the FANS airworthiness approval received by Airbus, airlines that elect to use data link systems may obtain an operational approval from their national authority. To that end, some materials are available (such as FAA AC 120-70B), stating what the applicant airline may have to demonstrate.
For more details about AC 120-70B, please refer to FAA website at: http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/328168.

It is expected that the applicant airline complies with the following items:

- Aircraft configuration
- Flight crew training/qualification
- Maintenance training
- Approved operational documentation and procedures
- Complementary tests for interoperability: the applicant airline may consider tests recommended in Airbus FANS AAS.

Please bear in mind…

A7. STARTING FANS A/A+ OPERATIONS

To ensure proper operations of FANS A/A+ aircraft on FANS routes, the operator needs to ensure the following steps before starting operations:

- Sign contract(s) with Communication Service Provider(s) (CSP)
- Declare aircraft to these Communication Service Provider(s)
- Declare aircraft and its FANS capability to ATC centers of the operated routes
- Configure adequately the aircraft avionics
- Obtain the operational approval.

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APPENDIX A – LIST OF FANS A/A+ CPDLC MESSAGES WITH THEIR MEANING

Listed in this appendix are all the FANS A and FANS A+ messages supported by the CPDLC, as defined by the EUROCAE ED-100 and endorsed by the ICAO ADS panel. Additional comments provided by the ISPACG user forum are displayed in italics.

All uplink and downlink messages have been classified into operational groups. The reference number is that of the initial ED-100.

The abbreviations used for classification purpose are defined here below.

ABBREVIATIONS	CLOSURE RESPONSES
W/U	WILCO, UNABLE, will close the uplink message.
A/N	AFFIRM, NEGATIVE, will close the uplink message.
R	ROGER, will close the uplink message.
NE	WILCO, UNABLE, AFFIRM, NEGATIVE, ROGER, STANDBY, will not close the uplink message. Only the actual referenced response (time, heading, speed, etc) will close the uplink message. Remark: The response is typed through the MCDU scratch pad after having pressed the DCDU “MODIFY” key.
Y	Response required.
N	Response not required

The urgency attribute for each uplink message is given with the UM reference number as follows:

- D for Distress
- U for Urgent
- N for Normal
- L for Low.

The priority associated to the message display on DCDU (respectively ATC mailbox) is:

- Urgent if the urgency attribute of the message is Distress or Urgent
- Normal if the urgency attribute of the message is Normal or Low.

UPLINK MESSAGES

UPLINK – RESPONSES AND ACKNOWLEDGEMENTS

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
0 N	UNABLE	Indicates that ATS cannot comply with the request.	N or NE
1 N	STANDBY	Indicates that ATS has received the message and will respond. *The pilot is informed that the request is being assessed and there will be a short-term delay (within 10 minutes). The exchange is not closed and the request will be responded to when conditions allow.*	N or NE
2 N	REQUEST DEFERRED	Indicates that ATS has received the request but it has been deferred until later. *The pilot is informed that the request is being assessed and a long-term delay can be expected. The exchange is not closed and the request will be responded to when conditions allow.*	N or NE
3 N	ROGER	Indicates that ATS has received and understood the message.	N or NE
4 N	AFFIRM	Yes	N or NE
5 N	NEGATIVE	No	N or NE

UPLINK – VERTICAL CLEARANCES

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
6 L	EXPECT [altitude]	Notification that a level change instruction should be expected.	R
7 L	EXPECT CLIMB AT [time]	Notification that an instruction should be expected for the aircraft to commence climb at the specified time.	R
8 L	EXPECT CLIMB AT [position]	Notification that an instruction should be expected for the aircraft to commence climb at the specified position.	R
9 L	EXPECT DESCENT AT [time]	Notification that an instruction should be expected for the aircraft to commence descent at the specified	R

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
		time.	
10 L	EXPECT DESCENT AT [position]	Notification that an instruction should be expected for the aircraft to commence descent at the specified position.	R
11 L	EXPECT CRUISE CLIMB AT [time]	Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified time.	R
12 L	EXPECT CRUISE CLIMB AT [position]	Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified position.	R
13 L	AT [time] EXPECT CLIMB TO [altitude]	Notification that an instruction should be expected for the aircraft to commence climb at the specified time to the specified level.	R
14 L	AT [position] EXPECT CLIMB TO [altitude]	Notification that an instruction should be expected for the aircraft to commence climb at the specified position to the specified level.	R
15 L	AT [time] EXPECT DESCENT TO [altitude]	Notification that an instruction should be expected for the aircraft to commence descent at the specified time to the specified level.	R
16 L	AT [position] EXPECT DESCENT TO [altitude]	Notification that an instruction should be expected for the aircraft to commence descent at the specified position to the specified level.	R
17 L	AT [time] EXPECT CRUISE CLIMB TO [altitude]	Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified time to the specified level. *Due to different interpretations between the various ATS units, this element should be avoided.*	R
18 L	AT [position] EXPECT CRUISE CLIMB TO [altitude]	Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified position to the specified level. *Due to different interpretations between the various ATS units, this element should be avoided.*	R
19 N	MAINTAIN [altitude]	Instruction to maintain the specified level.	W/U

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
20 N	CLIMB TO AND MAINTAIN [altitude]	Instruction that a climb to the specified level is to commence and the level is to be maintained when reached.	W/U
21 N	AT [time] CLIMB TO AND MAINTAIN [altitude]	Instruction that at the specified time, a climb to the specified level is to commence and once reached the specified level is to be maintained.	W/U
22 N	AT [position] CLIMB TO AND MAINTAIN [altitude]	Instruction that at the specified position, a climb to the specified level is to commence and once reached the specified level is to be maintained.	W/U
23 N	DESCEND TO AND MAINTAIN [altitude	Instruction that a descent to the specified level is to commence and the level is to be maintained when reached.	W/U
24 N	AT [time] DESCEND TO AND MAINTAIN [altitude]	Instruction that at the specified time a decent to the specified level is to commence and once reached the specified level is to be maintained.	W/U
25 N	AT [position] DESCEND TO AND MAINTAIN [altitude]	Instruction that at the specified position a descent to the specified level is to commence and when the specified level is reached it is to be maintained.	W/U
26 N	CLIMB TO REACH [altitude] BY [time]	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified time.	W/U
27 N	CLIMB TO REACH [altitude] BY [position]	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified position.	W/U
28 N	DESCEND TO REACH [altitude] BY [time]	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified time.	W/U
29 N	DESCEND TO REACH [altitude] BY [position]	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified position.	W/U
30 N	MAINTAIN BLOCK [altitude] TO [altitude]	A level within the specified vertical range is to be maintained.	W/U
31 N	CLIMB TO AND MAINTAIN BLOCK [altitude] TO [altitude]	Instruction that a climb to a level within the specified vertical range is to commence.	W/U

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
32 N	DESCEND TO AND MAINTAIN BLOCK [altitude] TO [altitude]	Instruction that a descent to a level within the specified vertical range is to commence.	W/U
33 N	*Reserved*		
34 N	CRUISE CLIMB TO [altitude]	A cruise climb is to commence and continue until the specified level is reached.	W/U
35 N	CRUISE CLIMB ABOVE [level]	A cruise climb can commence once above the specified level.	W/U
36 U	EXPEDITE CLIMB TO [altitude]	The climb to the specified level should be made at the aircraft's best rate.	W/U
37 U	EXPEDITE DESCENT TO [altitude]	The descent to the specified level should be made at the aircraft's best rate.	W/U
38 D	IMMEDIATELY CLIMB TO [altitude]	Urgent instruction to immediately climb to the specified level.	W/U
39 D	IMMEDIATELY DESCEND TO [altitude]	Urgent instruction to immediately descend to the specified level.	W/U
40 D	IMMEDIATELY STOP CLIMB AT [altitude]	Urgent instruction to immediately stop a climb once the specified level is reached.	W/U
41 D	IMMEDIATELY STOP DESCENT AT [altitude]	Urgent instruction to immediately stop a descent once the specified level is reached.	W/U
171 N	CLIMB AT [vertical rate] MINIMUM	Instruction to climb at not less than the specified rate.	W/U
172 N	CLIMB AT [vertical rate] MAXIMUM	Instruction to climb at not above the specified rate.	W/U
173 N	DESCEND AT [vertical rate] MINIMUM	Instruction to descend at not less than the specified rate.	W/U
174 N	DESCEND AT [vertical rate] MAXIMUM	Instruction to descend at not above the specified rate.	W/U

UPLINK – CROSSING CONSTRAINTS

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
42 L	EXPECT TO CROSS [position] AT [altitude]	Notification that a level change instruction should be expected which will require the specified position to be crossed at the specified level.	R
43 L	EXPECT TO CROSS [position] AT OR ABOVE [altitude]	Notification that a level change instruction should be expected which will require the specified position to be crossed at or above the specified level.	R
44 L	EXPECT TO CROSS [position] AT OR BELOW [altitude]	Notification that a level change instruction should be expected which will require the specified position to be crossed at or below the specified level.	R
45 L	EXPECT TO CROSS [position] AT AND MAINTAIN [altitude]	Notification that a level change instruction should be expected which will require the specified position to be crossed at the specified level which is to be maintained subsequently.	R
46 N	CROSS [position] AT [altitude]	The specified position is to be crossed at the specified level. This may require the aircraft to modify its climb or descent profile.	W/U
47 N	CROSS [position] AT OR ABOVE [altitude]	The specified position is to be crossed at or above the specified level.	W/U
48 N	CROSS [position] AT OR BELOW [altitude]	The specified position is to be crossed at or below the specified level.	W/U
49 N	CROSS [position] AT AND MAINTAIN [altitude]	Instruction that the specified position is to be crossed at the specified level and that level is to be maintained when reached.	W/U
50 N	CROSS [position] BETWEEN [altitude] AND [altitude]	The specified position is to be crossed at a level between the specified levels.	W/U
51 N	CROSS [position] AT [time]	The specified position is to be crossed at the specified time.	W/U
52 N	CROSS [position] AT OR BEFORE [time]	The specified position is to be crossed at or before the specified time.	W/U
53 N	CROSS [position] AT OR AFTER [time]	The specified position is to be crossed at or after the specified	W/U

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
		time.	
54 N	CROSS [position] BETWEEN [time] AND [time]	The specified position is to be crossed at a time between the specified times.	W/U
55 N	CROSS [position] AT [speed]	The specified position is to be crossed at the specified speed and the specified speed is to be maintained until further advised.	W/U
56 N	CROSS [position] AT OR LESS THAN [speed]	The specified position is to be crossed at a speed equal to or less than the specified speed and the specified speed or less is to be maintained until further advised.	W/U
57 N	CROSS [position] AT OR GREATER THAN [speed]	The specified position is to be crossed at a speed equal to or greater than the specified speed and the specified speed or greater is to be maintained until further advised.	W/U
58 N	CROSS [position] AT [time] AT [altitude]	The specified position is to be crossed at the specified time and the specified level.	W/U
59 N	CROSS [position] AT OR BEFORE [time] AT [altitude]	The specified position is to be crossed at or before the specified time and at the specified level.	W/U
60 N	CROSS [position] AT OR AFTER [time] AT [altitude]	The specified position is to be crossed at or after the specified time and at the specified level.	W/U
61 N	CROSS [position] AT AND MAINTAIN [altitude] AT [speed]	Instruction that the specified position is to be crossed at the specified level and speed and the level and speed are to be maintained.	W/U
62 N	AT [time] CROSS [position] AT AND MAINTAIN [altitude]	Instruction that at the specified time the specified position is to be crossed at the specified level and the level is to be maintained.	W/U
63 N	AT [time] CROSS [position] AT AND MAINTAIN [altitude] AT [speed]	Instruction that at the specified time the specified position is to be crossed at the specified level and speed and the level and speed are to be maintained.	W/U

UPLINK – LATERAL OFFSETS

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
64	OFFSET [direction] [distance	Instruction to fly a parallel track to	W/U

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
N	offset] OF ROUTE	the cleared route at a displacement of the specified distance in the specified direction.	
65 N	AT [position] OFFSET [direction] [distance offset] OF ROUTE	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified position.	W/U
66 N	AT [time] OFFSET [direction] [distance offset] OF ROUTE	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified time.	W/U
67 N	PROCEED BACK ON ROUTE	The cleared flight route is to be rejoined.	W/U
68 N	REJOIN ROUTE BY [position]	The cleared flight route is to be rejoined at or before the specified position.	W/U
69 N	REJOIN ROUTE BY [time]	The cleared flight route is to be rejoined at or before the specified time.	W/U
70 L	EXPECT BACK ON ROUTE BY [position]	Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified position.	R
71 L	EXPECT BACK ON ROUTE BY [time]	Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified time.	R
72 N	RESUME OWN NAVIGATION	Instruction to resume own navigation following a period of tracking or heading clearances. May be used in conjunction with an instruction on how or where to rejoin the cleared route.	W/U

UPLINK – ROUTE MODIFICATIONS

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
73 N	[departure clearance]	Notification to the aircraft of the instructions to be followed from departure until the specified clearance limit.	W/U
74 N	PROCEED DIRECT TO [position]	Instruction to proceed directly from the present position to the specified position.	W/U

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
75 N	WHEN ABLE PROCEED DIRECT TO [position]	Instruction to proceed, when able, directly to the specified position.	W/U
76 N	AT [time] PROCEED DIRECT TO [position]	Instruction to proceed, at the specified time, directly to the specified position.	W/U
77 N	AT [position] PROCEED DIRECT TO [position]	Instruction to proceed, at the specified position, directly to the next specified position.	W/U
78 N	AT [altitude] PROCEED DIRECT TO [position]	Instruction to proceed, upon reaching the specified level, directly to the specified position.	W/U
79 N	CLEARED TO [position] VIA [route clearance]	Instruction to proceed to the specified position via the specified route.	W/U
80 N	CLEARED [route clearance]	Instruction to proceed via the specified route.	W/U
81 N	CLEARED [procedure name]	Instruction to proceed in accordance with the specified procedure.	W/U
82 N	CLEARED TO DEVIATE UP TO [direction] [distance offset] OF ROUTE	Approval to deviate up to the specified distance from the cleared route in the specified direction.	W/U
83 N	AT [position] CLEARED [route clearance]	Instruction to proceed from the specified position via the specified route.	W/U
84 N	AT [position] CLEARED [procedure name]	Instruction to proceed from the specified position via the specified procedure.	W/U
85 L	EXPECT [route clearance]	Notification that a clearance to fly on the specified route may be issued.	R
86 L	AT [position] EXPECT [route clearance]	Notification that a clearance to fly on the specified route from the specified position may be issued.	R
87 L	EXPECT DIRECT TO [position]	Notification that a clearance to fly directly to the specified position may be issued.	R
88 L	AT [position] EXPECT DIRECT TO [position]	Notification that a clearance to fly directly from the first specified position to the next specified position may be issued.	R
89 L	AT [time] EXPECT DIRECT TO [position]	Notification that a clearance to fly directly to the specified position commencing at the specified time may be issued.	R
90 L	AT [altitude] EXPECT DIRECT TO [position]	Notification that a clearance to fly directly to the specified position	R

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
		commencing when the specified level is reached may be issued.	
91 N	HOLD AT [position] MAINTAIN [altitude] INBOUND TRACK [degrees][direction] TURN LEG TIME [leg type]	Instruction to enter a holding pattern with the specified characteristics at the specified position and level.	W/U
92 N	HOLD AT [position] AS PUBLISHED MAINTAIN [altitude]	Instruction to enter a holding pattern with the published characteristics at the specified position and level.	W/U
93 L	EXPECT FURTHER CLEARANCE AT [time]	Notification that an onwards clearance may be issued at the specified time.	R
94 N	TURN [direction] HEADING [degrees]	Instruction to turn left or right as specified onto the specified heading.	W/U
95 N	TURN [direction] GROUND TRACK [degrees]	Instruction to turn left or right as specified onto the specified track.	W/U
96 N	FLY PRESENT HEADING	Instruction to continue to fly on the current heading.	W/U
97 N	AT [position] FLY HEADING [degrees]	Instruction to fly on the specified heading from the specified position.	W/U
98 D	IMMEDIATELY TURN [direction] HEADING [degrees]	Instruction to turn immediately left or right as specified onto the specified heading.	W/U
99 L	EXPECT [procedure name]	Notification that a clearance may be issued for the aircraft to fly the specified procedure.	R
178	TRACK DETAIL MESSAGE	*Message not defined.*	

UPLINK – SPEED CHANGES

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
100 L	AT [time] EXPECT [speed]	Notification that a speed instruction may be issued to be effective at the specified time.	R
101 L	AT [position] EXPECT [speed]	Notification that a speed instruction may be issued to be effective at the specified position.	R
102 L	AT [altitude] EXPECT [speed]	Notification that a speed instruction may be issued to be effective at the specified level.	R
103 L	AT [time] EXPECT [speed] TO [speed]	Notification that a speed range instruction may be issued to be	R

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
		effective at the specified time.	
104 L	AT [position] EXPECT [speed] TO [speed]	Notification that a speed range instruction may be issued to be effective at the specified position.	R
105 L	AT [altitude] EXPECT [speed] TO [speed]	Notification that a speed range instruction may be issued to be effective at the specified level.	R
106 N	MAINTAIN [speed]	The specified speed is to be maintained.	W/U
107 N	MAINTAIN PRESENT SPEED	The present speed is to be maintained.	W/U
108 N	MAINTAIN [speed] OR GREATER	The specified speed or a greater speed is to be maintained.	W/U
109 N	MAINTAIN [speed] OR LESS	The specified speed or a lesser speed is to be maintained.	W/U
110 N	MAINTAIN [speed] TO [speed]	A speed within the specified range is to be maintained.	W/U
111 N	INCREASE SPEED TO [speed]	The present speed is to be increased to the specified speed and maintained until further advised.	W/U
112 N	INCREASE SPEED TO [speed] OR GREATER	The present speed is to be increased to the specified speed or greater, and maintained at or above the specified speed until further advised.	W/U
113 N	REDUCE SPEED TO [speed]	The present speed is to be reduced to the specified speed and maintained until further advised.	W/U
114 N	REDUCE SPEED TO [speed] OR LESS	The present speed is to be reduced to the specified speed or less and maintained at or below the specified speed until further advised.	W/U
115 N	DO NOT EXCEED [speed]	The specified speed is not to be exceeded.	W/U
116 N	RESUME NORMAL SPEED	Notification that the aircraft need no longer comply with the previously issued speed restriction.	W/U

UPLINK – CONTACT//SURVEILLANCE REQUESTS

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
117 N	CONTACT [icaounitname][frequency]	The pilot is required to call the ATS facility on the specified frequency.	W/U

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

UPLINK – REPORT/CONFIRMATION REQUESTS

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
127 N	REPORT BACK ON ROUTE	Instruction to report when the aircraft is back on the cleared route.	R
128 N	REPORT LEAVING [altitude]	Instruction to report when the aircraft has left the specified level. *Either a level that has been maintained or a level passed through on climb or descent.*	R
129 N	REPORT LEVEL [altitude]	Instruction to report when the aircraft is in level flight at the specified level. *Note: To avoid confusion, Some*	R

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
		States have decided that they will not use this element	
175 N	REPORT REACHING [altitude]	Instruction to report when the aircraft has reached the specified level. *To be interpreted as "Report reaching an assigned level."*	R
180 N	REPORT REACHING BLOCK [altitude] TO [altitude]	Instruction to report when the aircraft is within the specified vertical range.	R
130 N	REPORT PASSING [position]	Instruction to report when the aircraft has passed the specified position.	R
181 N	REPORT DISTANCE [to/from] [position]	Instruction to report the present distance to or from the specified position.	NE
131 N	REPORT REMAINING FUEL AND SOULS ON BOARD	Instruction to report the amount of fuel remaining and the number of persons on board.	NE
132 N	CONFIRM POSITION	Instruction to report the present position.	NE
133 N	CONFIRM ALTITUDE	Instruction to report the present level.	NE
134 N	CONFIRM SPEED	Instruction to report the present speed.	NE
135 N	CONFIRM ASSIGNED ALTITUDE	Instruction to confirm and acknowledge the currently assigned level.	NE
136 N	CONFIRM ASSIGNED SPEED	Instruction to confirm and acknowledge the currently assigned speed.	NE
137 N	CONFIRM ASSIGNED ROUTE	Instruction to confirm and acknowledge the currently assigned route.	NE
138 N	CONFIRM TIME OVER REPORTED WAYPOINT	Instruction to confirm the previously reported time over the last reported waypoint.	NE
139 N	CONFIRM REPORTED WAYPOINT	Instruction to confirm the identity of the previously reported waypoint.	NE
140 N	CONFIRM NEXT WAYPOINT	Instruction to confirm the identity of the next waypoint.	NE
141 N	CONFIRM NEXT WAYPOINT ETA	Instruction to confirm the previously reported estimated time at the next waypoint.	NE

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

UPLINK – NEGOTIATION REQUESTS

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

UPLINK – AIR TRAFFIC ADVISORIES

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
153 N	ALTIMETER [altimeter]	ATS advisory that the altimeter setting should be the specified setting.	R

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
154 N	RADAR SERVICES TERMINATED	ATS advisory that the radar service is terminated.	R
155 N	RADAR CONTACT [position]	ATS advisory that radar contact has been established at the specified position.	R
156 N	RADAR CONTACT LOST	ATS advisory that radar contact has been lost.	R
157 U	CHECK STUCK MICROPHONE [frequency]	A continuous transmission is detected on the specified frequency. Check the microphone button.	R
158 N	ATIS [atis code]	ATS advisory that the ATIS information identified by the specified code is the current ATIS information.	R

UPLINK – SYSTEM MANAGEMENT MESSAGES

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
159 U	ERROR [error information]	A system generated message that the ground system has detected an error.	N or NE
160 L	NEXT DATA AUTHORITY [facility designation]	Notification to the avionics that the next data authority is the specified ATC Center.	N or NE
161 L	END SERVICE	Notification to the avionics that the data link connection with the current data authority is being terminated.	N or NE
162 L	SERVICE UNAVAILABLE	Notification that the ground system does not support this message.	N or NE
163 L	[icao facility designation] [tp4Table]	Notification to the pilot of an ATC center identifier.	N or NE

UPLINK – ADDITIONAL MESSAGES

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
164 L	WHEN READY	The associated instruction may be complied with at any future time.	NE
165 L	THEN	Used to link two messages, indicating the proper order of execution of clearances or instructions.	N or NE
166 L	DUE TO TRAFFIC	The associated instruction is issued due to traffic considerations.	N or NE

UM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
167 L	DUE TO AIRSPACE RESTRICTION	The associated instruction is issued due to airspace restrictions.	N or NE
168 N	DISREGARD	The indicated communication should be ignored. *The previously sent uplink CPDLC message shall be ignored. DISREGARD should not refer to a clearance or instruction. If DISREGARD is used, another element shall be added to clarify which message is to be disregarded.*	R
176 N	MAINTAIN OWN SEPARATION AND VMC	Notification that the pilot is responsible for maintaining separation from other traffic and is also responsible for maintaining Visual Meteorological Conditions.	W/U
177 L	AT PILOTS DISCRETION	Used in conjunction with a clearance or instruction to indicate that the pilot may execute when prepared to do so.	N
178	(Reserved)	(not defined) Note: Avoid use of this message element, TRACK DETAIL MESSAGE, as it is reserved in ICAO Doc 4444.	Y or W/U
169 N	[free text]	*Normal urgency attribute*	R
170 D	[free text]	*Distress urgency attribute*	R

DOWNLINK MESSAGES

DOWNLINK – RESPONSES

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
0	WILCO	The instruction is understood and will be complied with.	N
1	UNABLE	The instruction cannot be complied with.	N
2	STANDBY	Wait for a reply. *The ATC controller is informed that the request is being assessed and there will be a short term delay (within 10 minutes). The exchange is not closed and the request will be responded to when conditions allow.*	N

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
3	ROGER	Message received and understood. *ROGER is the only correct response to an uplink free text message. Under no circumstances will ROGER be used instead of AFFIRM.*	N
4	AFFIRM	Yes *AFFIRM is an appropriate response to an uplinked negotiation request message (e.g. CAN YOU ACCEPT [altitude] AT [time]).*	N
5	NEGATIVE	No *NEGATIVE is an appropriate response to an uplinked negotiation request message (e.g. CAN YOU ACCEPT [altitude] AT [time]).*	N

DOWNLINK – VERTICAL REQUESTS

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
6	REQUEST [altitude]	Request to fly at the specified level.	Y
7	REQUEST BLOCK [altitude] TO [altitude]	Request to fly at a level within the specified vertical range.	Y
8	REQUEST CRUISE CLIMB TO [altitude]	Request to cruise climb to the specified level.	Y
9	REQUEST CLIMB TO [altitude]	Request to climb to the specified level.	Y
10	REQUEST DESCENT TO [altitude]	Request to descend to the specified level.	Y
UL	**MESSAGE ELEMENT**	**MESSAGE INTENT**	**RESPONSE**
11	AT [position] REQUEST CLIMB TO [altitude]	Request that at the specified position a climb to the specified level be approved.	Y
12	AT [position] REQUEST DESCENT TO [altitude]	Request that at the specified position a descent to the specified level be approved.	Y
13	AT [time] REQUEST CLIMB TO [altitude]	Request that at the specified time a climb to the specified level be approved.	Y
14	AT [time] REQUEST DESCENT TO [altitude]	Request that at the specified time a descent to the specified level be approved.	Y

DOWNLINK – LATERAL OFFSET REQUESTS

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
15	REQUEST OFFSET [direction] [distance offset] OF ROUTE	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved.	Y
16	AT [position] REQUEST OFFSET [direction] [distance offset] OF ROUTE	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified position.	Y
17	AT [time] REQUEST OFFSET [direction] [distance offset] OF ROUTE	Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified time.	Y

DOWNLINK – SPEED REQUESTS

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
18	REQUEST [speed]	Request to fly at the specified speed.	Y
19	REQUEST [speed] TO [speed]	Request to fly within the specified speed range.	Y

DOWNLINK – VOICE CONTACT REQUESTS

DL	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
20	REQUEST VOICE CONTACT	Request for voice contact.	Y
21	REQUEST VOICE CONTACT [frequency]	Request for voice contact on the specified frequency.	Y

DOWNLINK – ROUTE MODIFICATION REQUESTS

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

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
27	REQUEST WEATHER DEVIATION UP TO [direction] [distance offset] OF ROUTE	Request for a weather deviation up to the specified distance off track in the specified direction.	Y
70	REQUEST HEADING [degrees]	Request a clearance to adopt the specified heading.	Y
71	REQUEST GROUND TRACK [degrees]	Request a clearance to adopt the specified ground track.	Y

DOWNLINK – REPORTS

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
28	LEAVING [altitude]	Notification of leaving the specified level.	N
29	CLIMBING TO [altitude]	Notification of climbing to the specified level.	N
30	DESCENDING TO [altitude]	Notification of descending to the specified level.	N
31	PASSING [position]	Notification of passing the specified position.	N
78	AT [time] [distance] [to/from] [position]	At the specified time, the aircraft's position was as specified.	N
32	PRESENT ALTITUDE [altitude]	Notification of the present level.	N
33	PRESENT POSITION [position]	Notification of the present position.	N
34	PRESENT SPEED [speed]	Notification of the present speed.	N
35	PRESENT HEADING [degrees]	Notification of the present heading in degrees.	N
36	PRESENT GROUND TRACK [degrees]	Notification of the present ground track in degrees.	N
37	LEVEL [altitude]	Notification that the aircraft is maintaining the specified level.	N
72	REACHING [altitude]	Notification that the aircraft has reached the specified level.	N
76	REACHING BLOCK [altitude] TO [altitude]	Notification that the aircraft has reached a level within the specified vertical range.	N
38	ASSIGNED ALTITUDE [altitude]	Read-back of the assigned level.	N
77	ASSIGNED BLOCK [altitude] TO [altitude]	Read-back of the assigned vertical range.	N
39	ASSIGNED SPEED [speed]	Read-back of the assigned speed.	N
40	ASSIGNED ROUTE [route clearance]	Read-back of the assigned route.	N

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
41	BACK ON ROUTE	The aircraft has regained the cleared route.	N
42	NEXT WAYPOINT [position]	The next waypoint is the specified position.	N
43	NEXT WAYPOINT ETA [time]	The ETA at the next waypoint is as specified.	N
44	ENSUING WAYPOINT [position]	The next plus one waypoint is the specified position.	N
45	REPORTED WAYPOINT [position]	Clarification of previously reported waypoint passage.	N
46	REPORTED WAYPOINT [time]	Clarification of time over previously reported waypoint.	N
47	SQUAWKING [beacon code]	The specified (SSR) code has been selected.	N
48	POSITION REPORT [position report]	Reports the current position of the aircraft when the pilot presses the button to send this message. *ATC expects position reports based on this downlink message*	N
79	ATIS [atis code]	The code of the latest ATIS received is as specified.	N

DOWNLINK – NEGOTIATION REQUESTS

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

DOWNLINK – EMERGENCY MESSAGES

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
55	PAN PAN PAN	Urgency prefix.	Y or N
56	MAYDAY MAYDAY MAYDAY	Distress prefix.	Y or N
57	[remaining fuel] OF FUEL REMAINING AND [souls on board] SOULS ON BOARD	Notification of fuel remaining and number of persons on board.	Y or N
58	CANCEL EMERGENCY	Notification that the pilot wishes to cancel the emergency condition.	Y or N
59	DIVERTING TO [position] or DIVERTING TO [position] VIA [x]	Notification that the aircraft is diverting to the specified position via the specified route.	Y or N
60	OFFSETTING [direction] [distance offset] OF ROUTE	Notification that the aircraft is deviating the specified distance in the specified direction off the cleared route and maintaining a parallel track.	Y or N
61	DESCENDING TO [altitude]	Notification that the aircraft is descending to the specified level.	Y or N
80	DEVIATING [DISTANCEOFFSET] [DIRECTION] OF ROUTE	Notification that the aircraft is deviating up to the deviating distance from the cleared route in the specified direction due to an urgent need.	Y or N

DOWNLINK – SYSTEM MANAGEMENT MESSAGES

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
62	ERROR [error information]	A system generated message that the avionics has detected an error.	N
63	NOT CURRENT DATA AUTHORITY	A system generated denial to any CPDLC message sent from a ground facility that is not the Current Data Authority.	N
64	[icao facility designation]	Notification to the ground system that the specified ATC center is the current data authority.	N
73	[version number]	A system generated message indicating the software version number.	N

DOWNLINK – ADDITIONAL MESSAGES

DM	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
65	DUE TO WEATHER	Used to explain reasons for aircraft operator's message.	N
66	DUE TO AIRCRAFT PERFORMANCE	Used to explain reasons for aircraft operator's message.	N
74	MAINTAIN OWN SEPARATION AND VMC	States a desire by the pilot to provide his/her own separation and remain in VMC.	N
75	AT PILOTS DISCRETION	Used in conjunction with another message to indicate that the pilot wishes to execute the request when the pilot is prepared to do so.	N
67	[free text]	*Normal urgency attribute*	N
68	[free text]	*Distress urgency attribute*	Y

APPENDIX B – ADS REPORT DATA

(*) on request

GROUP	PARAMETERS
Basic ADS group (Required)	• Current latitude • Current longitude • Current STD altitude • UTC Time stamp • Navigation redundancy bit: set to 1 if two or more IRS are providing valid position to the FMS, else, set to 0 • Figure of merit: level (0-7), which reflects the accuracy of the reported position • TCAS health: set to 1 if valid data, else to 0
Earth Reference Group (*)	• True Track • Ground Speed • Inertial Vertical Rate
Air Reference Group(*)	• Current True Heading • Mach • Inertial Vertical Rate
Airframe Ident Group(*)	• 24 bit ICAO code (Not provided in FANS A)
Flight Ident Group(*)	• Flight ID
Meteorological Group(*)	• Wind Speed • True Wind Direction • Static Air Temperature
Predicted Route Group(*)	• Latitude at next waypoint • Longitude at next waypoint • STD altitude at next waypoint • Estimated Time to Go (ETG) to next waypoint • Latitude at Next +1 waypoint • Longitude at Next+1 waypoint • STD altitude at Next+1 waypoint
Fixed Intent Group(*)	• Latitude of fixed projected point • Longitude of fixed projected point • STD altitude of fixed projected point • Projected time: Travel time to the fixed intent point along the active route
Intermediate Projected Intent Group(*)	• Distance: - From current a/c position to the first intermediate projected point - From the previous intermediate projected point, for the subsequent points • Track: - From current a/c position to the first intermediate projected point - From the previous intermediate projected point, for the subsequent points • STD altitude of the intermediate projected point • Projected Time: Estimated Time to Go (ETG) to the intermediate projected point

Output values of ADS message parameters

PARAMETER	VALID RANGE	DEFAULT VALUE (1)	SIGNIFICANT BITS (7)	DEFINED MSB VALUE (2)	APPROX. LSB VALUE
Latitude	±90°	(Note 3)	20 & sign	90°	0.000172°
Longitude	±180°	(Note 3)	20 & sign	90°	0.000172°
Altitude	±131,068 feet	-131,072 feet	15 & sign	65,536 feet	4 feet
Time Stamp (Note 8)	0 – 3599.875 sec	FOM = 0 (Note 9)	15	2048 sec	0.125 sec
Flight ID	Alphanumeric	Space (Note 4)	6 per character (Note 5)	N/A	N/A
Mach	0 – 4.095 mach	4.0955 mach	13	2.048 mach	0.0005 mach
Ground Speed	0 – 4095 knots	4095.5 knots	13	2048 knots	0.5 knots
Wind Speed	0 – 255 knots	255.5 knots	9	128 knots	0.5 knots
True Wind Direction	-180 - + 179.296875	Valid bit = 1 (Note 6)	8 & sign & valid	90°	0.703125°
Vertical Rate	±32,752 ft/min	-32,768 ft/min	11 & sign	16,384 ft/min	16 ft/min
Temperature	±511.75°C	-512°C	11 & sign	256°C	0.25°C
True Track Angle	-180 - +179.912°	Valid bit = 1 (Note 6)	11 & sign & valid	90°	0.08789°
True Heading	-180 - +179.912°	Valid bit = 1 (Note 6)	11 & sign & valid	90°	0.08789°
Distance	0 – 8191.750 nm	8191.875 nm	16	4096 nm	0.125 nm
ETA	0 – 16382 sec	16383 sec	14	8192 sec	1 sec
Projected Time	0 – 16382 sec	16383 sec	14	8192 sec	1 sec

NOTES:

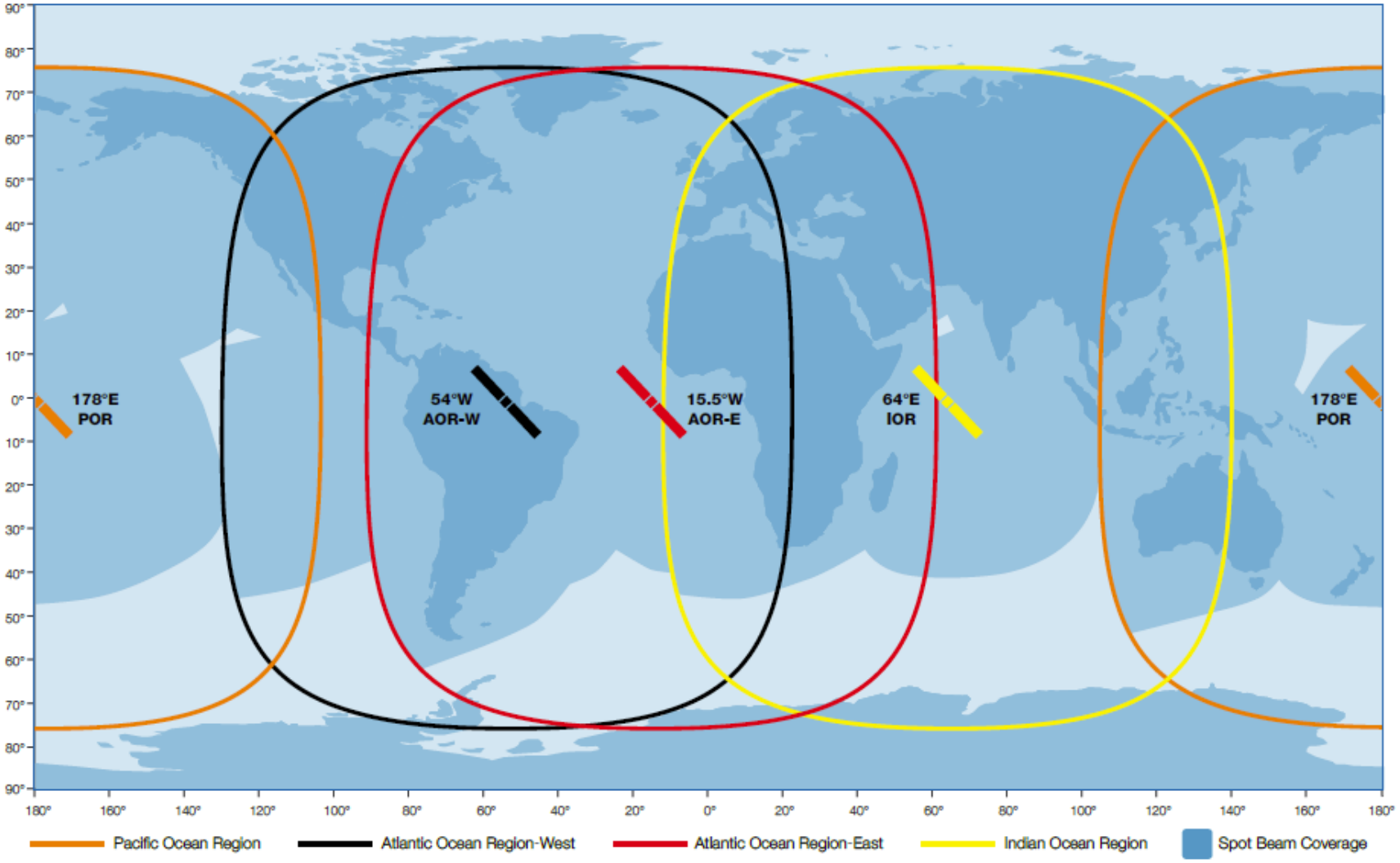
1. When no value is available or the value available to the ADS is invalid, a default value shall be inserted in the field. The values shown here reflect a coding of all "ones".
2. The value of the Most Significant Bit (MSB) is accurate by definition. The value of the Least Significant Bit (LSB) is an approximation.
3. When either the latitude or the longitude for a position is invalid, both shall be set to – 180° In the Basic ADS Group, the FOM shall also be set to 0.
4. When the Flight Identification is invalid, all characters shall be encoded as spaces. When the Flight Identification is less than eight characters, the Flight Identification shall be encoded left justified and the unused characters shall be encoded as spaces.
5. The character set for the Flight Identification Group shall be ISO 5, without the most significant bit. This allows the characters to be encoded using only six bits. Valid characters are contained in the following sets: (A..Z), (0..9) and ( ).
6. The validation of the direction parameter shall be indicated by the immediately preceding bit, where 0 = valid and 1 = invalid.
7. Signed numerical values shall be represented in two's complement notation.
8. The time stamp shall be expressed as the time elapsed since the most recent hour. Time shall be rounded, not truncated, to accurately yield the value loaded into the time stamp field.

APPENDIX C – COMMUNICATION SERVICE PROVIDERS

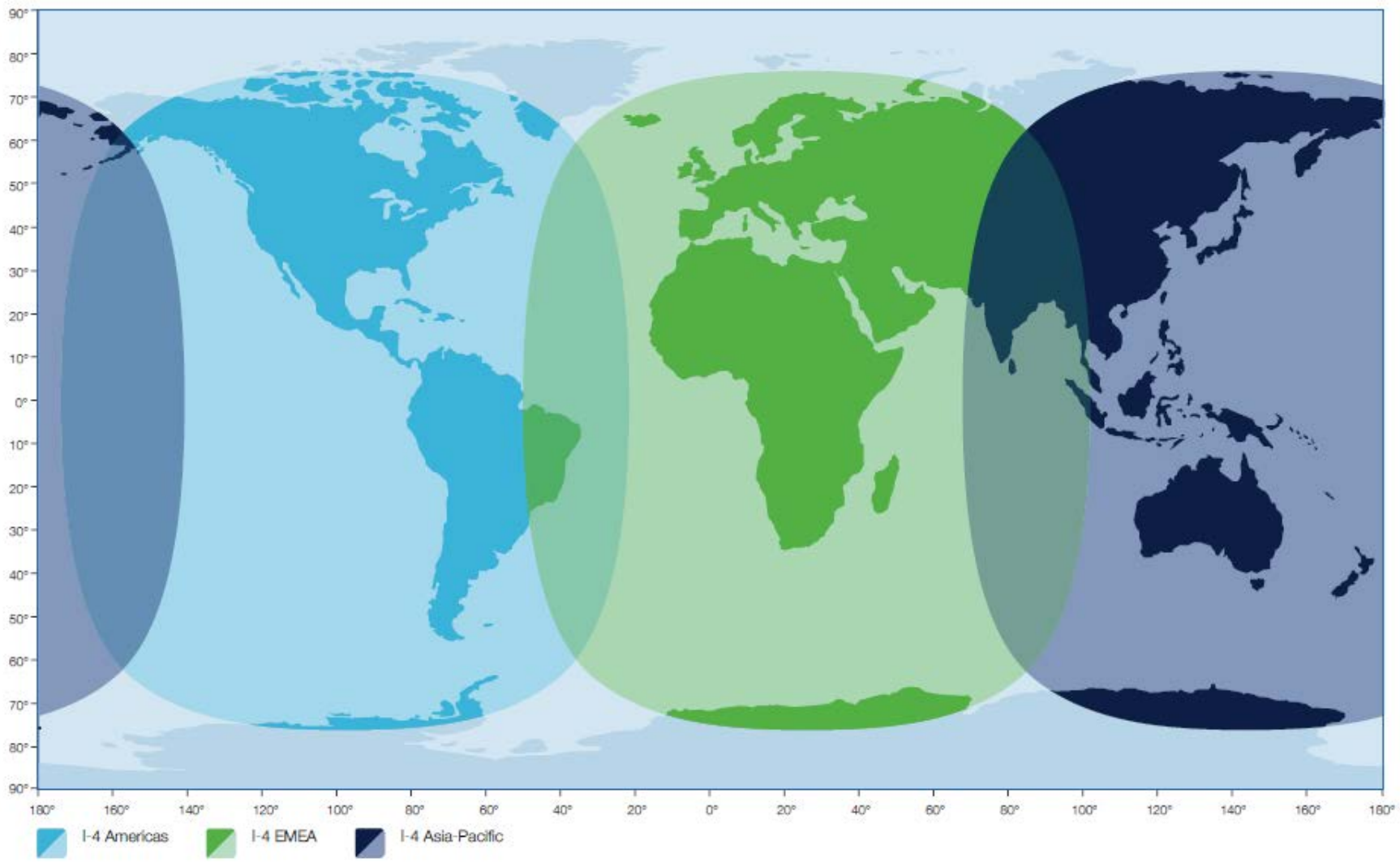
The following maps are provided with the courtesy of INMARSAT, MTSAT, ARINC and SITA.

For contact details about ARINC, SITA, INMARSAT and MTSAT, see References.

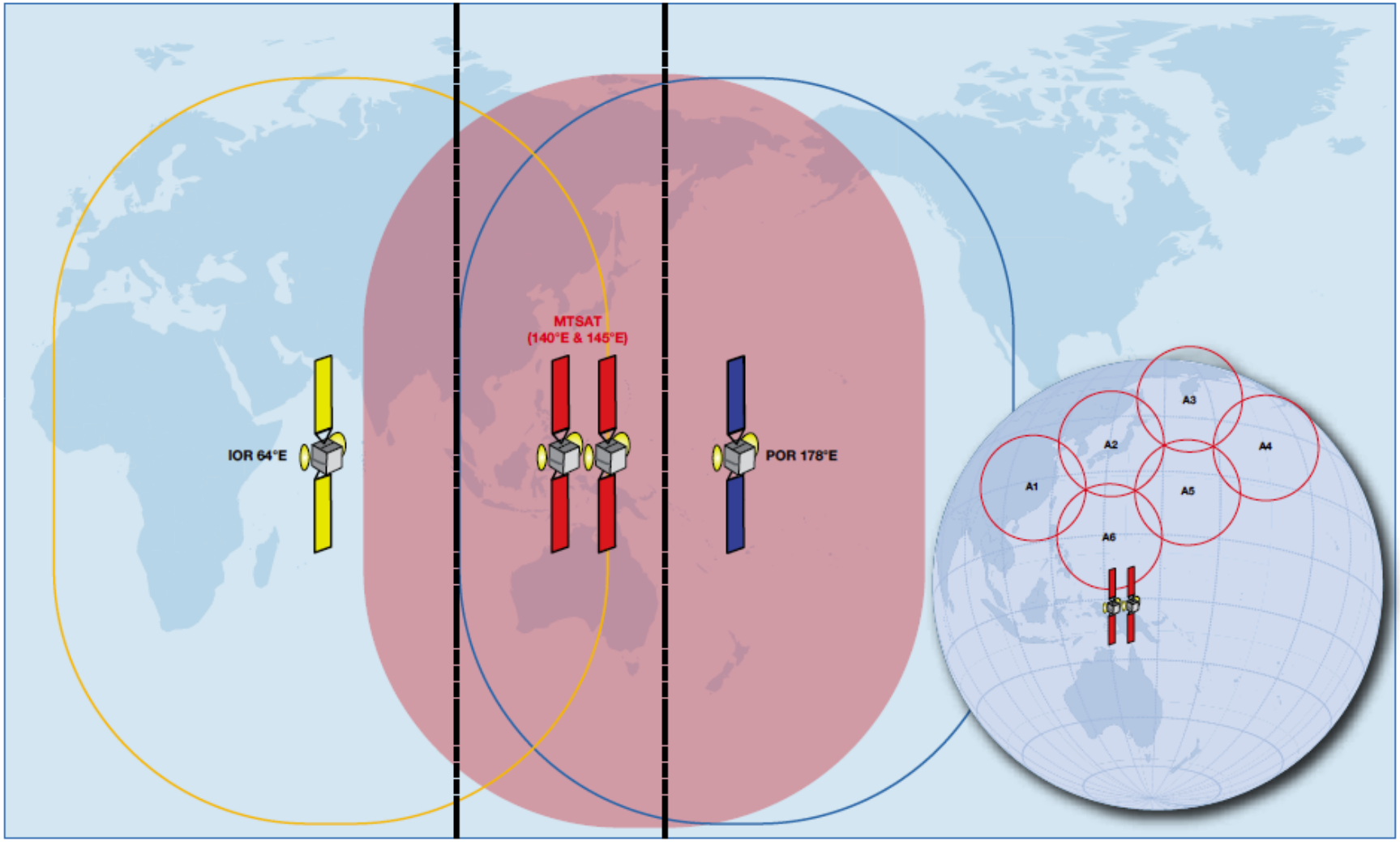
SATELLITE CLASSIC AERO INMARSAT I-3 COVERAGE (FEBRUARY 2014)



SATELLITE CLASSIC AERO INMARSAT I-4 COVERAGE (FEBRUARY 2014)

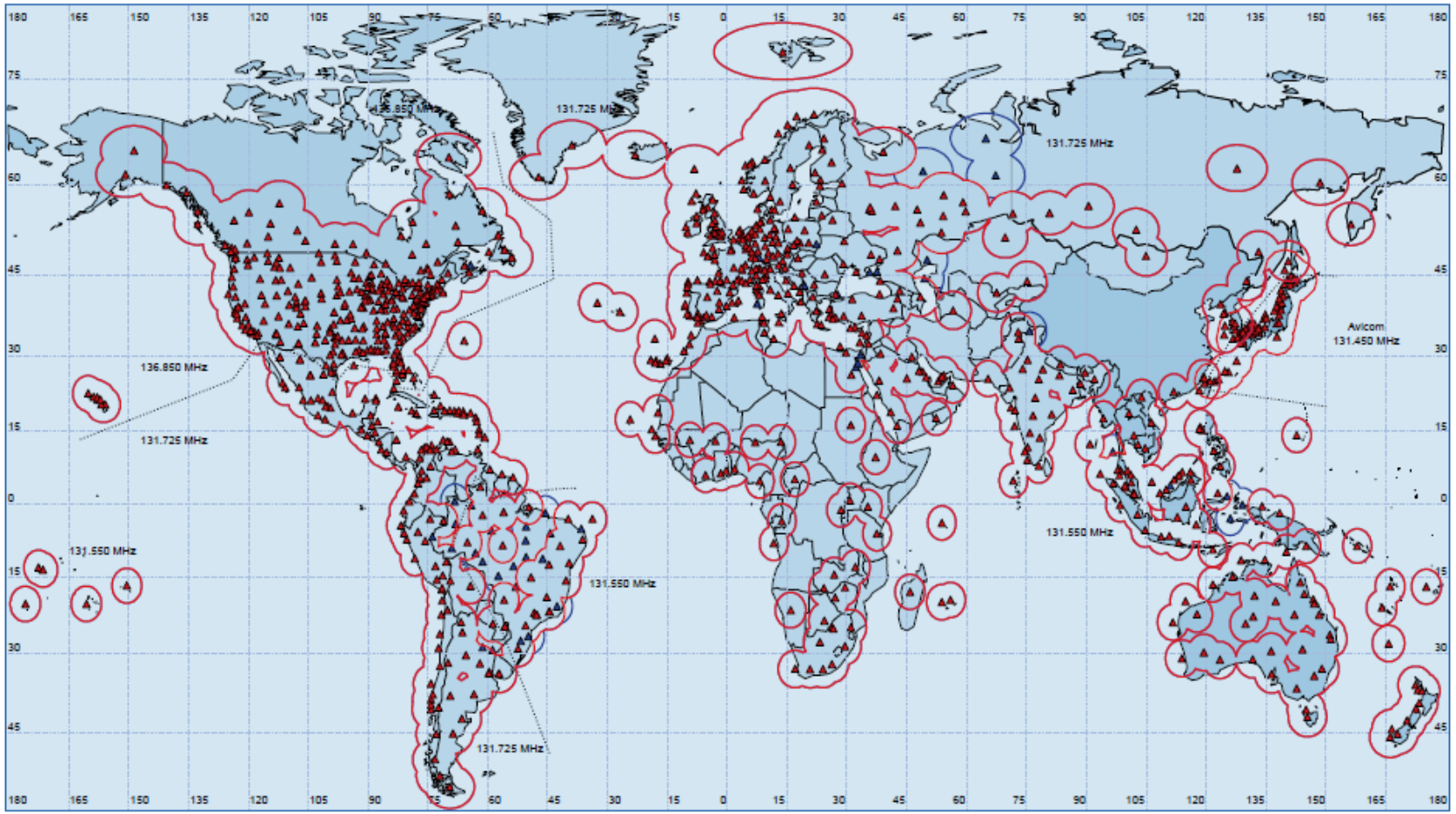


SATELLITE MTSAT COVERAGE (FEBRUARY 2014)



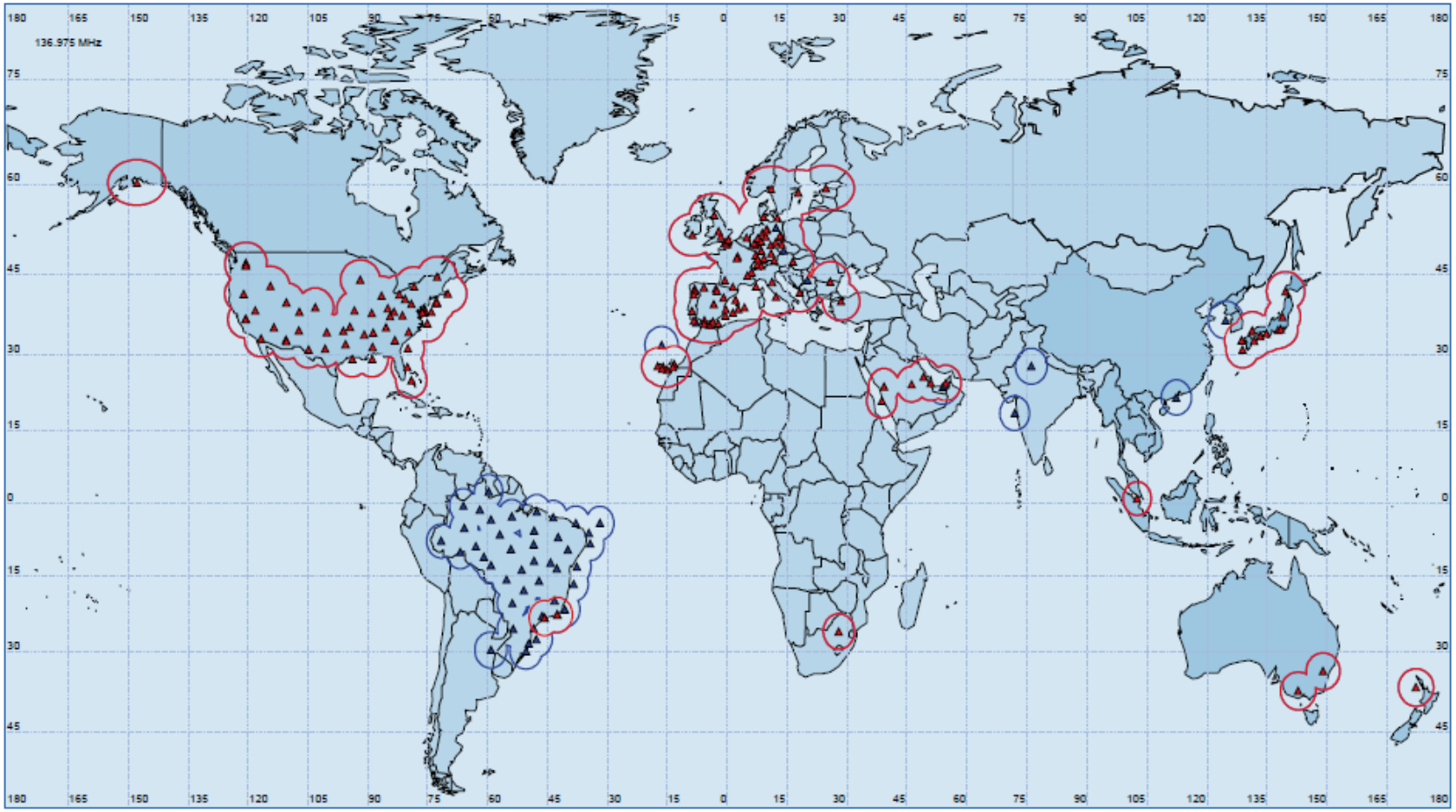
SITA - AIRCOM WORLDWIDE VHF COVERAGE (FEBRUARY 2014)

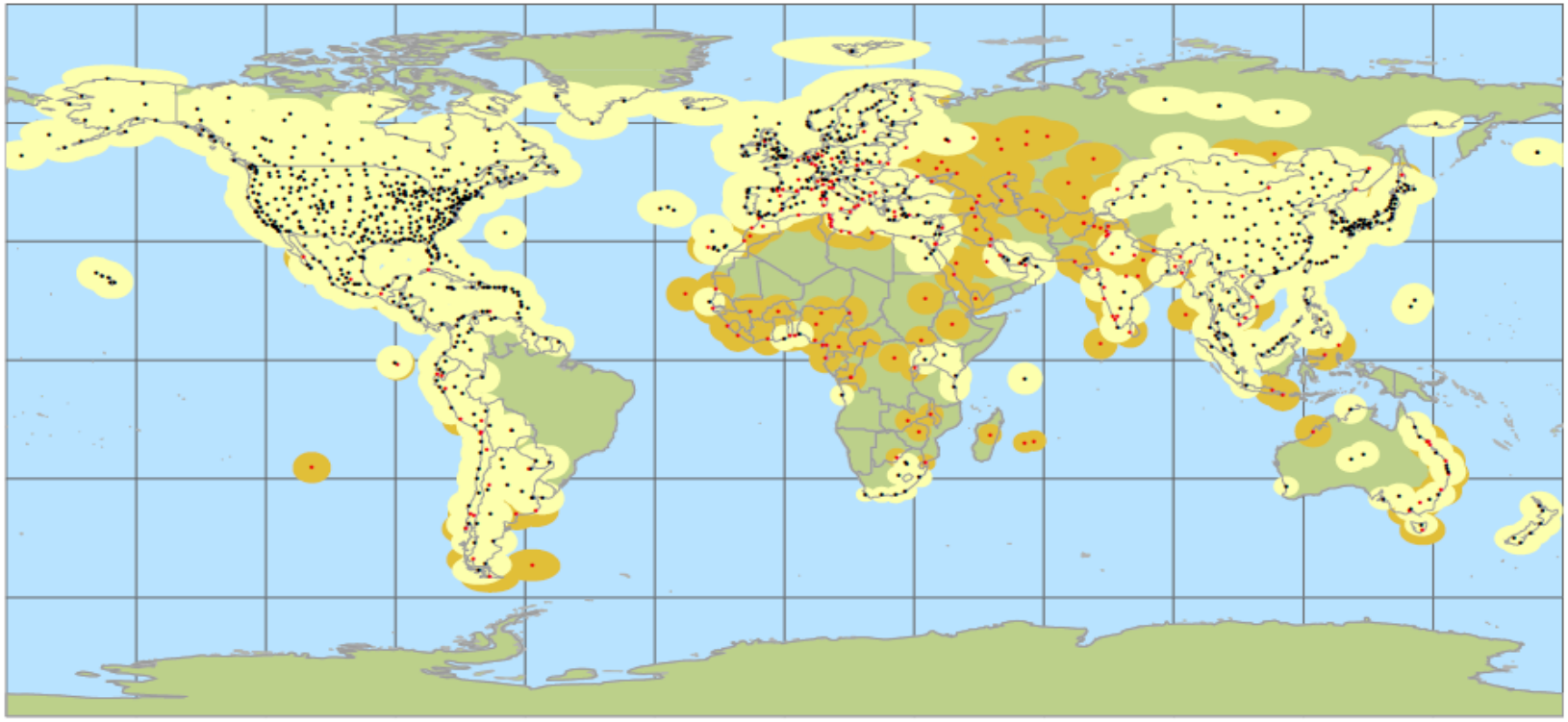
MAXIMUM COVERAGE AT 30 000 FEET ON-LINE VHF ARE IN RED, PLANNED ARE IN BLUE



SITA - AIRCOM WORLDWIDE VDL COVERAGE (FEBRUARY 2014)

MAXIMUM COVERAGE AT 30 000 FEET ON-LINE VDL ARE IN RED, PLANNED ARE IN BLUE





Notes:
The map projection is Geographic and is for representation only. Not to scale.
Terrain obstructions are not considered.

Legend:
Available for Use
Planned

ARINC VHF - World
Available for Use and Planned Coverage

Drawn By:	File Name:	Effective Date:
bsisas	world_pl.mxd	July 11, 2013

ARINC
Annapolis, MD
www.arinc.com
https://portal.arinc.net

APPENDIX D – SATCOM OPERATORS

	GES			Inmarsat satellite		Telecom provider	Service provider
	Country	Location	Code	Name	Code		
INMARSAT-3	France	Aussaguel	103	AOR-E	01	Vizada	SITA
			005	AOR-W	00		
	Norway	Eik	104	AOR-E	01	Vizada	ARINC
			002	AOR-W	00		
			301	IOR	03		
	USA	Santa Paula	202	POR	02	Vizada	ARINC
	Australia	Perth	305	IOR	03	Stratos	SITA
			202	POR	02		
MTSAT	Japan	Kobe	161	MTSAT	04	JCAB/SITA	
INMARSAT-4	Italy	Fucino	220	EMEA	06	ARINC/SITA	
	Netherlands	Burum		EMEA	06		
	USA	Paumalu	320	Americas	07		
			120	Asia Pacific	05		

APPENDIX E – ADVANCED DATALINK OPERATIONS

1. DYNAMIC AIRBORNE ROUTE PLANNING (DARP)

PREREQUISITES

The airline shall have an AOC data link capability to communicate with both the aircraft and the ATC with data link.
The airline must be able to sustain CPDLC with the appropriate ATC, and data link AOC with its operations centre.
The ATC centres providing the control of the FIR where the re-routing will be done must have CPDLC capability.

PACOTS / DARP TRACK DESIGNATIONS

PACOTS tracks still exist but many operators use them as UPR. Therefore, there are aircraft both on PACOTS and UPR. Consequently, no more strategic separations (50Nm) between aircraft can be applied.

DESCRIPTIVE DRAWING

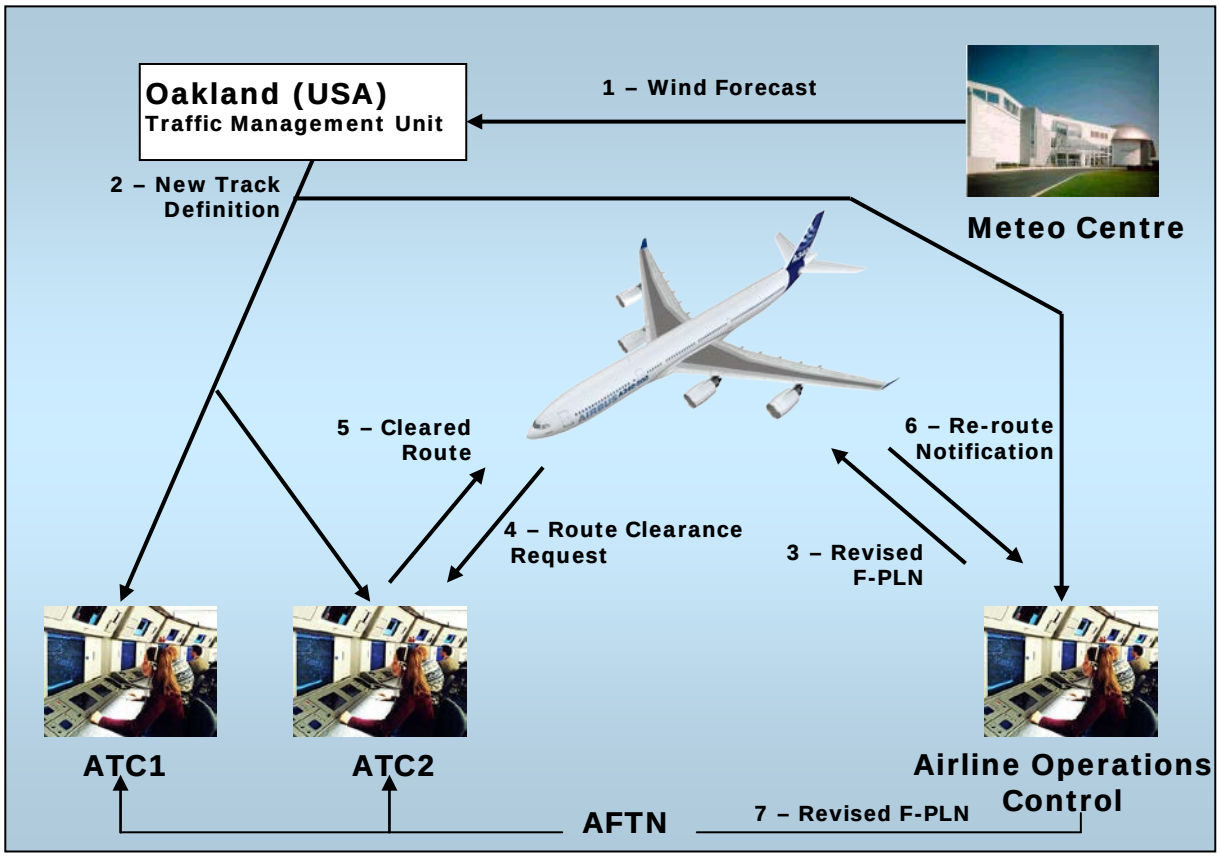
The following sequence is applied: OAKLAND

- Oakland (ZOA) receives new weather forecast and loads it in its system.
- ZOA Traffic Management Unit defines the DARP entry point on the original track, at least 90 minutes ahead of the aircraft.
- ZOA TMU (Traffic Management Unit) defines a new track based on the old route until the DARP entry point.
- ZOA TMU sends a new TDM (Track Definition Message) to all concerned ATCs.

AOC / Aircraft/ ATC

- Following the receipt of the new TDM, AOC decides whether or not to re-route.
- If re-route decided, the AOC uplinks the new route to the aircraft via ACARS.
- After evaluation of the received P-PLN, the flight crew asks for a re-route clearance.
- If the route is cleared, the ATC controller sends an ATC route clearance by CPDLC message to the flight crew.
- Once cleared, the flight crew loads and activates the re-route in the FMS. After loaded into FMS, the flight crew informs the ATC controller that the flight complies with the clearance through the WILCO answer and notifies the route change to the AOC
- The AOC transmits a Change message to the all concerned ATC (until AIDC exists).

The following drawing gives a general view of all the co-ordinated sequences that occur in a DARP phase.



Although promising this procedure has not been used very much for the time being, because it happens that the current wind models, as used by the airlines, are precise enough within the frame of the flight. Activating the DARP procedure requires a good co-ordination between all involved actors (Aircraft, AOC, ATC) . The User Preferred Route procedure (UPR) is by far preferred by the airlines.

UPR (User Preferred Route):

The wind models used by the airlines are not the same than those used by the ATC when the daily PACOTS routes are defined. Differences of up to around 15 minutes of flight time are claimed by the operators. These have been asking for the possibility to define their own routes according to the daily conditions. They file their UPR Flight Plan. These UPR procedures are currently used between Los Angeles and both Sydney and Auckland.

2. TAILORED ARRIVAL (TA)

PREREQUISITES

TA operations required that ATC center and aircraft support FANS 1/A CPDLC. It is recommended to consult the corresponding AIPs to check if the TA service is provided.
When the TA service is available, the corresponding ANSP shall provide for each TA:

- The TA designator: a five letters identifier associated to the TA clearance and used during the exchanges between the flight crew and the ATC controller
- TA request point: point determined by a time in minutes from the Top Of Descent (TOD) or from the boundary of the last FIR providing CPDLC.

TAILORED ARRIVAL PROCESS

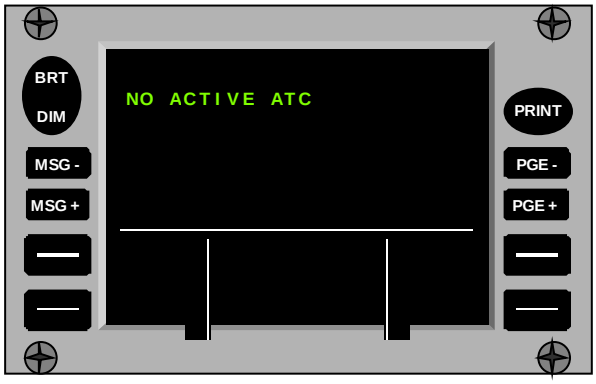
The TA procedure is executed according the following sequence.

- At the TA request point, the flight crew should request the TA clearance using a CPDLC standardized free text message. For more details about the CPDLC message, refer to GOLD – Appendix A (see References).
- If the traffic situation permits, the ATC controller should send the TA clearance using CPDLC message. TA Clearance includes the TA designator, the TA route clearance and the flight level to maintain from the current position. The TA route clearance includes lateral route, crossing constraints, approach and runway.
- Once received, the flight crew should load the TA route and activates the route in the FMS. Two cases may occur:
  - The flight crew may accept the clearance, send WILCO message to the ATC controller and activate the TA route in the FMS
  - The flight crew may reject the clearance, send UNABLE message to the ATC controller.
- Once accepted, The flight crew should:
  - Select the speed for the descent
  - If available, request weather information to the AOC in order to optimize the descent profile calculated by the FMS.
- When applicable, the ATC controller should transfer the aircraft control to the NDA and inform the NDA that the aircraft flies a TA.
- The flight crew should contact the NDA by voice and inform the assigned TA and the current level of flight.
- The ATC controller should:
  - Inform the flight crew to maintain the flight level
  - If applicable, add a speed constraint on the TA (EXPECT TO DESCEND AT [speed])
  - If applicable, add a clearance for the cleared route, using with the following phraseology: [TA designator] TAILORED ARRIVAL. [destination/area] ALTIMETER/QNH [nnnn] and, possibly, include a speed or vertical restriction.

- The ATC controller should transfer the aircraft control to the ATC controller of the NDA (approach ATC controller).
- The flight crew should contact the NDA by voice and inform the approach ATC controller with the following phraseology: PASSING FLIGHT LEVEL [level]/ALTITUDE [altitude] ON THE [TA designator] TAILORED ARRIVAL. [ATIS code].
- If the approach ATC controller accepts the TA profile, the flight crew should continue to follow the TA profile directed by the FMS, and complete the flight by the standard arrival procedure (stored in FMS) and landing.

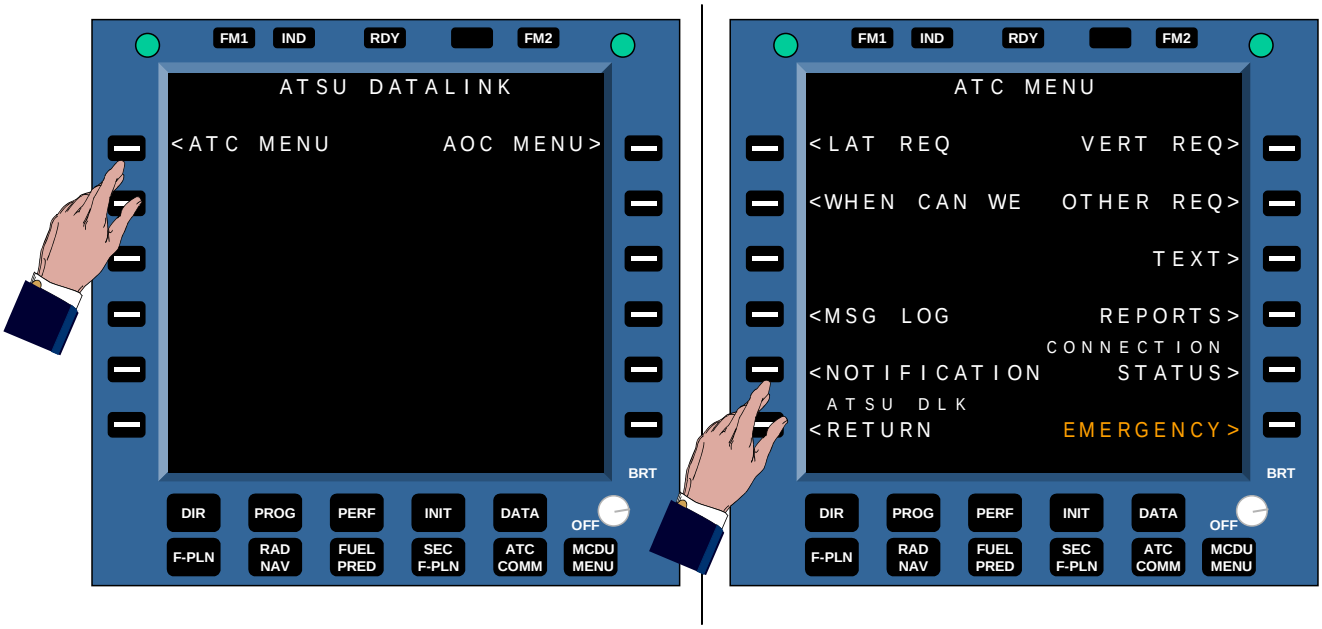
APPENDIX F – A330/A340 FANS A OPERATIONAL SCENARIOS

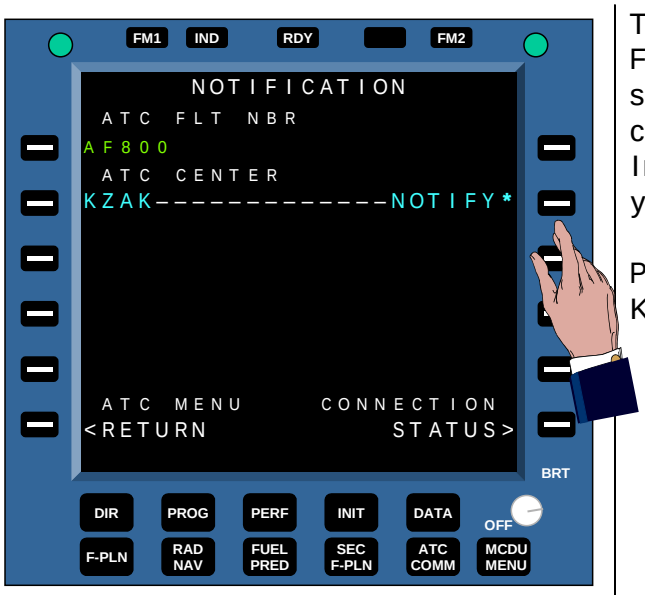
1. INITIAL NOTIFICATION



The aircraft is in flight, for a flight from Los Angeles (KLAX) to Auckland (NZAA). The first ATC for this flight is KZAK control and the crew wants to logon to it. The first step is to notify the ATC centre of the aircraft data link capability.

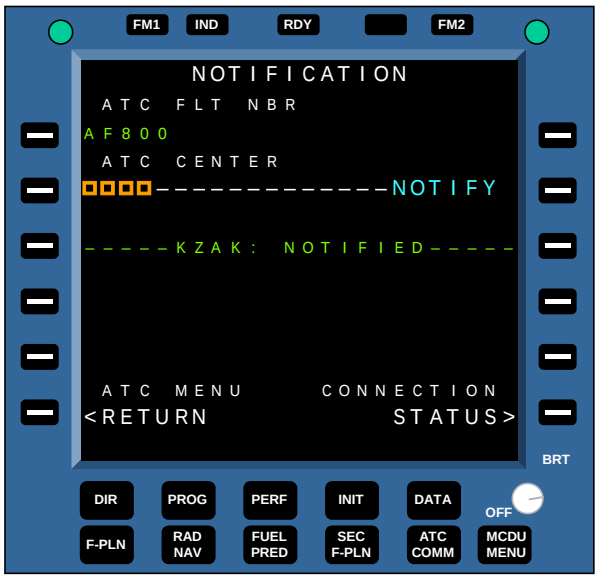
First, select the ATC Menu page on the MCDU (by pressing on the ATC COMM function key), and then select the NOTIFICATION page.



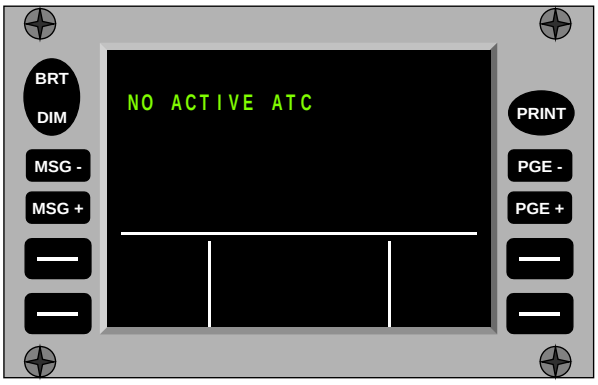


The ATC FLT NBR is provided by the FMGEC (set on the INIT page). The system has stored the last active ATC centre of the previous flight, here KZAK. In our example, this is the first ATC for your flight.

Press NOTIFY* in order to notify the KZAK ATC centre.



KZAK NOTIFIED is displayed in green. It means that the ATC has been notified of the aircraft data link capability. It does not mean that the connection has been performed.

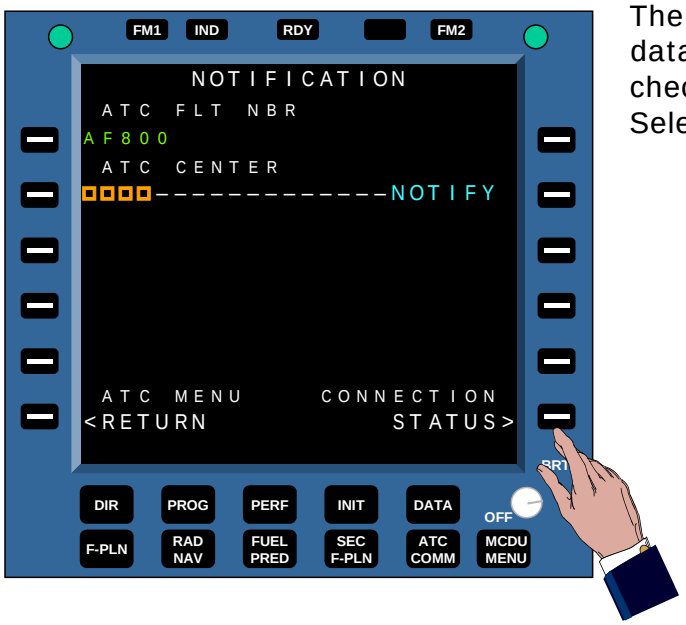


This is confirmed on the DCDU by the NO ACTIVE ATC message.

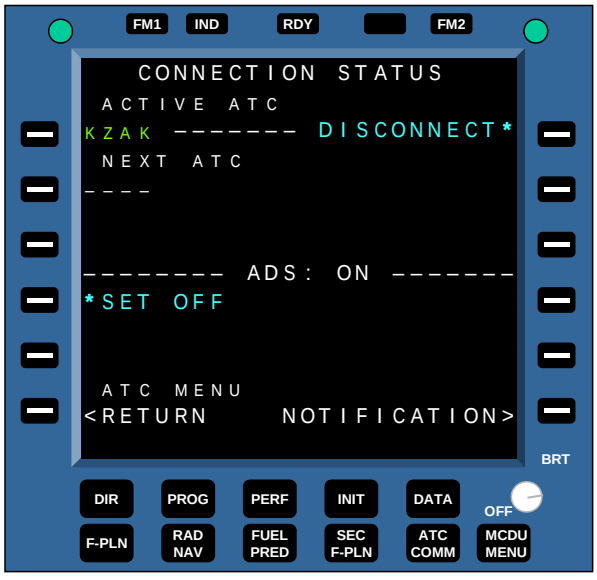
Once notified, the connection operation is initialized by the ATC at their discretion.

2. CPDLC CONNECTION

When the ATC centre initializes the CPDLC connection, the display on the DCDU changes and the active ATC is displayed on the DCDU. The ATC centre has performed the connection operation and the communication is established.



The aircraft is now able to exchange data link messages. Here is how to check the connection status:
Select the Connection Status page.



The active ATC is displayed.

Note: As a general rule, the connection should be completed 15 to 45 min before entering a CPDLC airspace.

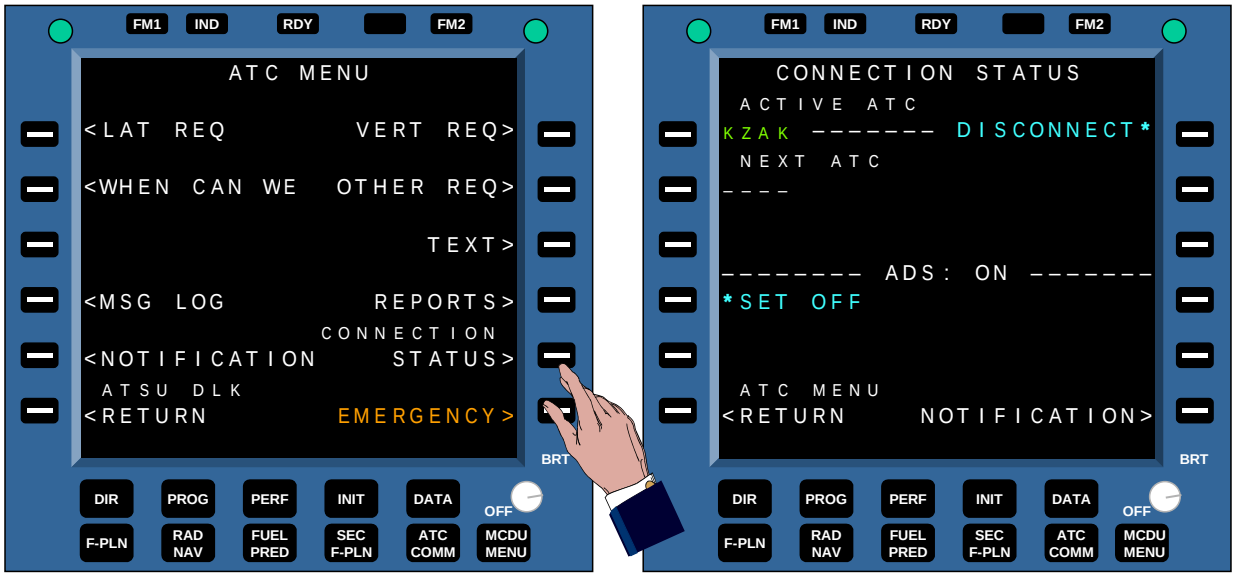
Notice also the default status of the ADS function, set to ON. This means that ADS is ready to work (armed). An ADS connection will be established as soon as an ATC will have given an ADS contract to the aircraft.

3. TRANSFER TO THE NEXT ATC

The data link communication transfer to the next ATC, also known as Next Data Authority, is initialized by the current ATC and automatically performed by the ATSU. This process is totally transparent to the crew. This is simply indicated by a SERVICE TERMINATED message sent by the ATC.

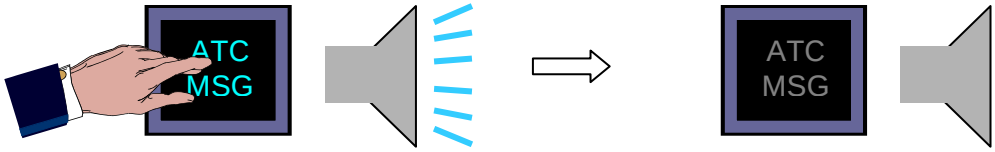
The aircraft is in cruise, close to leaving the KZAK CTL and to entering the KOAK.

On the connection status page, KZAK is the active ATC. There is no NEXT ATC.

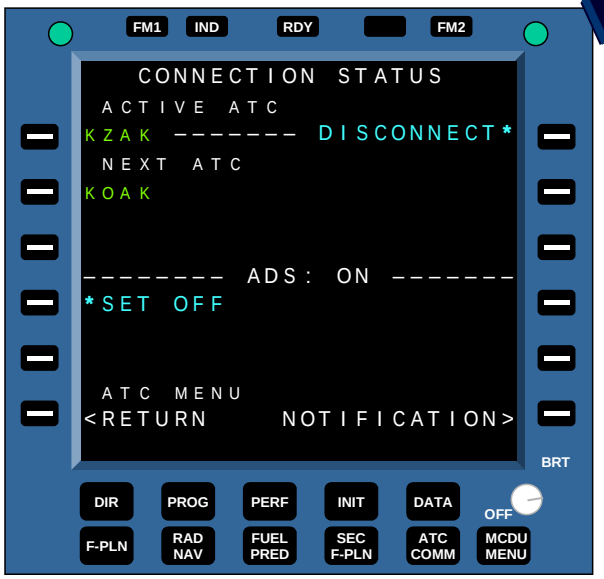


Upon reception by the aircraft of an ATC message, both ATC MSG lights flash and as it is a normal message, the first telephone ring is delayed by 15 s, then it will be repeated every 15 s until the message is acknowledged (i.e. ATC MSG push-button pressed or a key to treat the message is pressed).

Press on the ATC MSG pushbutton to extinguish the lights and stop the aural signal.



The message received from KZAK CTL is displayed on the DCDU, indicating that the next ATC is KOAK. Press the CLOSE soft key to store the message. On the connection status page, the next ATC is displayed: this is a "NO ANSWER" message.

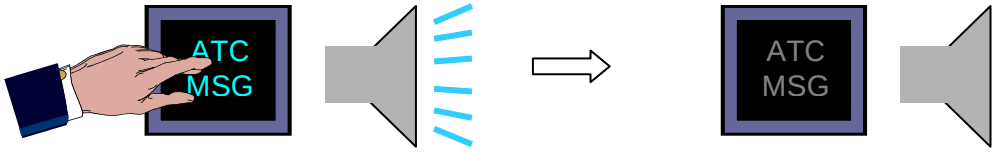


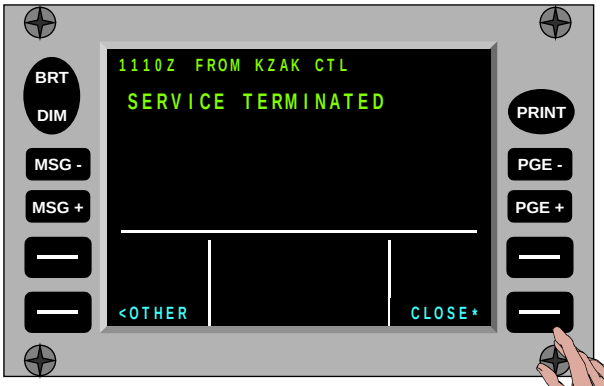
When the connection is established with the next ATC centre, the name of the next ATC centre is displayed in the MCDU CONNECTION STATUS page in the NEXT ATC field.The message is closed: the DCDU screen is cleared. The active ATC is still KZAK and will change only when KZAK terminates the connection.

The message can be recalled by pressing the RECALL soft key on the DCDU or displayed in the MSG LOG page on the MCDU.

An uplink ATC message is received: both ATC MSG lights flash and as it is a normal message, the first telephone ring is delayed by 15 s, then it will be repeated every 15 s until the message is acknowledged (i.e. ATC MSG push-button pressed or a key to treat the message is pressed).

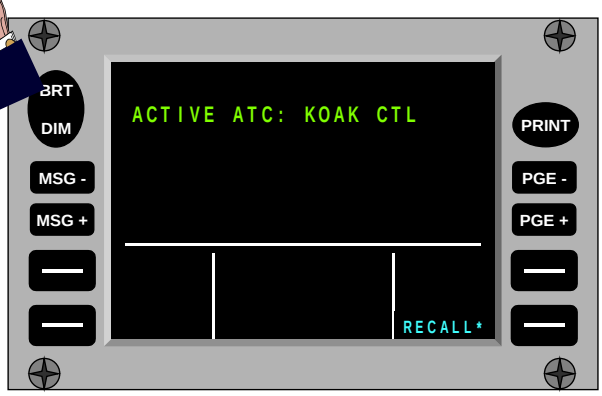
Press on the ATC MSG pushbutton to extinguish the lights and stop the aural signal.





When the new ATC centre initializes the connection, the SERVICE TERMINATED message received from KZAK CTL is displayed on the DCDU. The ATC centre has performed the logon operation and the communication is established.

Press the CLOSE soft key to store the message.



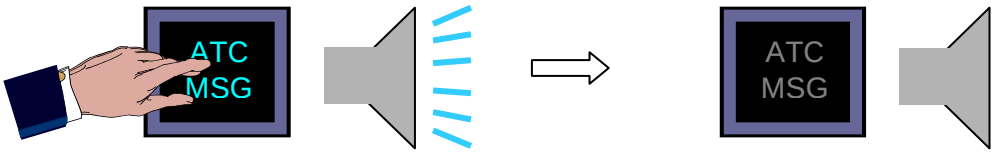
The message is closed: the DCDU screen is cleared. The new active ATC (KOAK CTL) is displayed on the DCDU.

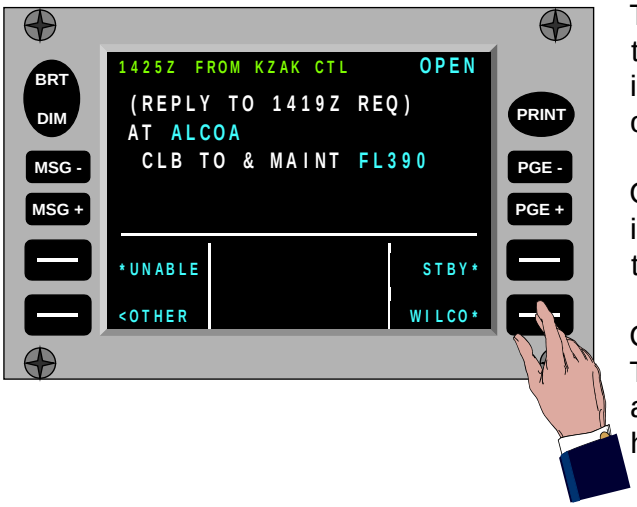
4. CLEARANCE

In this scenario the aircraft receives the answer to its previous request.

An uplink ATC message is received: both ATC MSG lights flash and as it is a normal message, the first telephone ring is delayed by 15 s, then it will be repeated every 15 s until the message is acknowledged (i.e. ATC MSG push-button pressed or a key to treat the message is pressed).

Press on the ATC MSG pushbutton to extinguish the lights and stop the aural signal.





The received message is displayed on the DCDU. On the first line, in green, the indication about the time and the issuer of the message (here, KZAK CTL).

On the second line, in white, the reply indication, including the sending time of the aircraft's request.

On the remaining lines, the ATC answer. To ease the reading, uplink messages are in white with the main parameters highlighted in cyan.

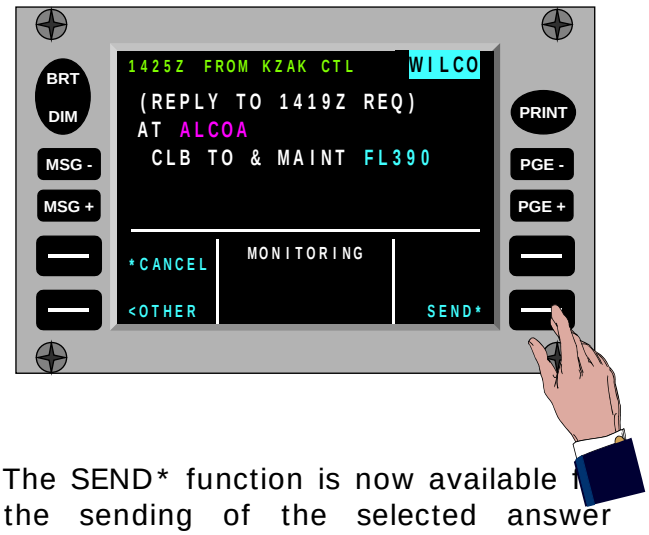
In order to reply WILCO to the message, select the WILCO soft key.

Once selected, the WILCO status is displayed in cyan inverse video on the top right corner, the parameter ALCOA turns magenta indicating that the FMS is currently monitoring the related deferred clearance. This is confirmed by the MONITORING information displayed in the information area.

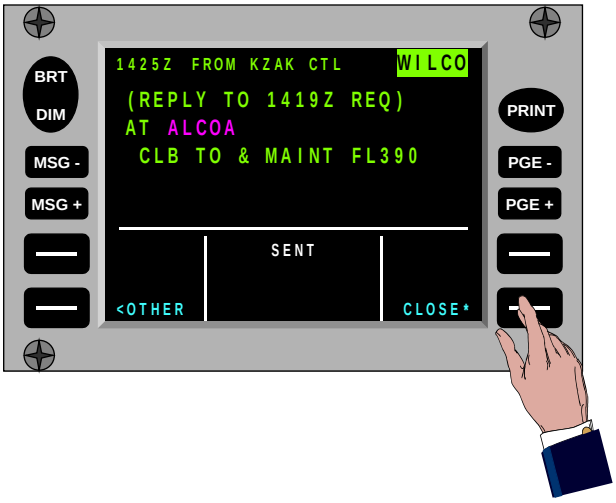
This means that when closing to ALCOA, the FMS will recall the message to remind the crew about this clearance.

Each answer selected by the crew will be displayed at this place in this manner before being physically sent.

In case of mistake, the CANCEL soft key enables the crew to cancel the current selection and to re-select another answer.



The SEND* function is now available for the sending of the selected answer (WILCO).
Press the SEND soft key.



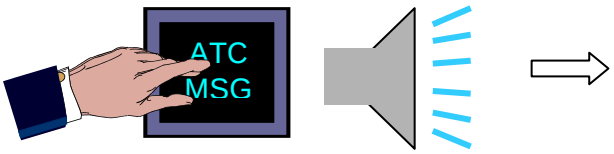
When the MONITORING process is completed, the SENDING indication is displayed in the information area, the message turns into green and the downlink response turns into green inverse video.
When the ground network receives the message, the SENT indication is displayed in the information area. The message can be closed.

Select the CLOSE soft key.

During CPDLC exchanges, the FMS processes the ATC conditional or deferred clearances that are linked to navigation. Then, when approaching a clearance condition, the FMS is able to recall messages to alert the pilots.

About 30 s before the clearance condition, the FMS automatically displays the deferred clearance text on the DCDU. This is indicated by the REMINDER information and the visual and aural alerts.

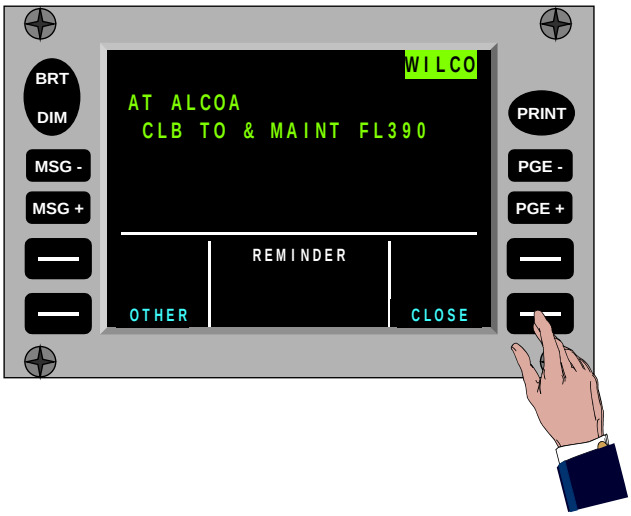
Press on the ATC MSG pushbutton to extinguish the lights and stop the aural signal.



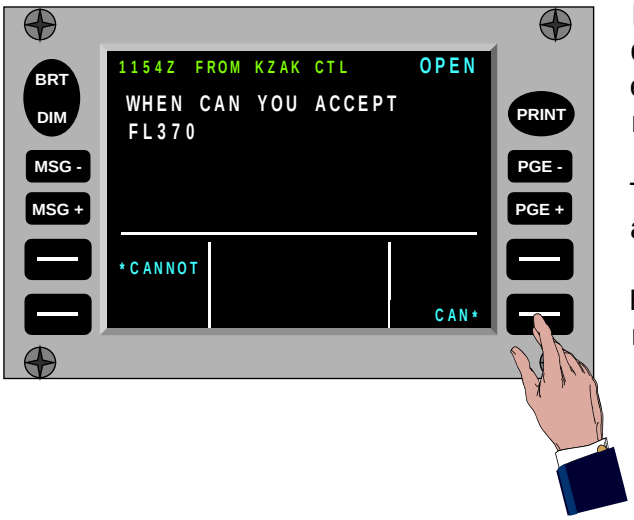
As the clearance condition is fulfilled, the clearance text is shown in green. The answer to the clearance is also displayed at the top right corner.

The time and active ATC fields at the top of the screen are no longer displayed.

Press the CLOSE soft key to store the message.



5. WHEN CAN YOU



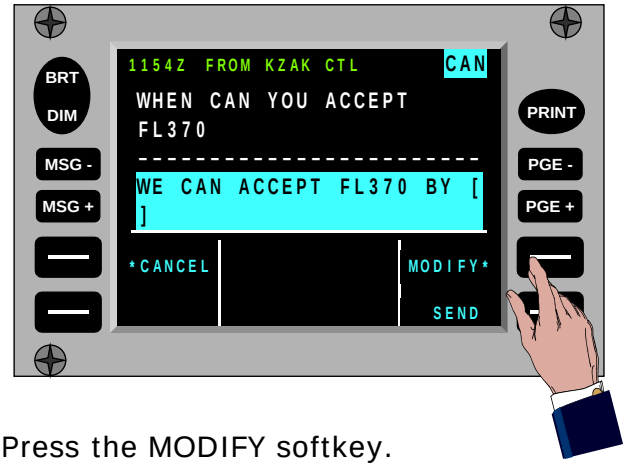
In this scenario, the ATC sends a question message containing the element “WHEN CAN YOU”. The received message s displayed on the DCDU.

The CAN and CANNOT softkeys are available.

Press the CAN soft key. The response message is automatically created.

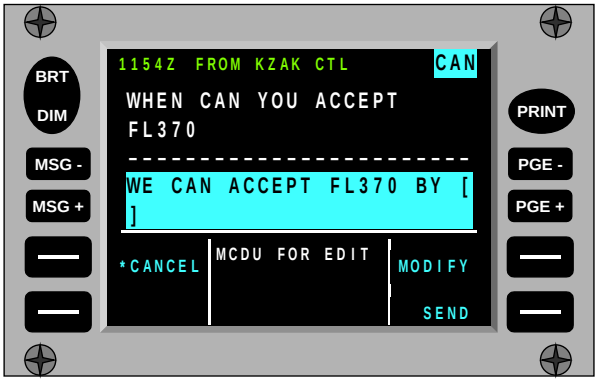
The OPEN message status is replaced by CAN status in inverse video. The text of the reply is displayed with the data field to fill in by means of the MCDU.

Now, the CANCEL and MODIFY soft keys are available. Note that the SEND function is not available, as the message is still incomplete: the user must press MODIFY in order to fill the brackets, or else CANCEL the message.

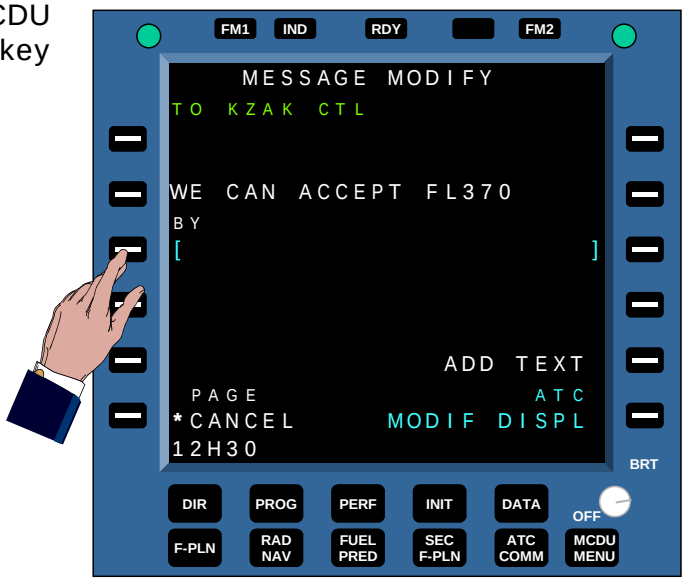


Press the MODIFY softkey.

Under the reply, the MCDU FOR EDIT indication is displayed. The MESSAGE EDITION page is called for display on the MCDU.

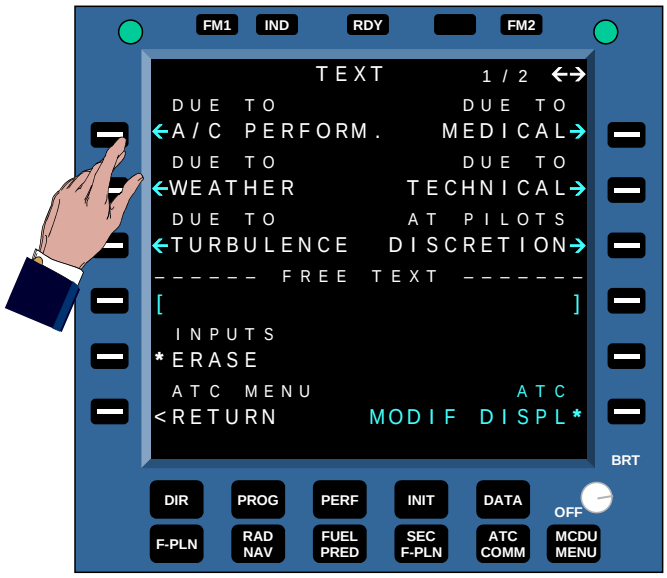


Enter the time parameter in the MCDU scratchpad and press the line key adjacent to the BY data field.

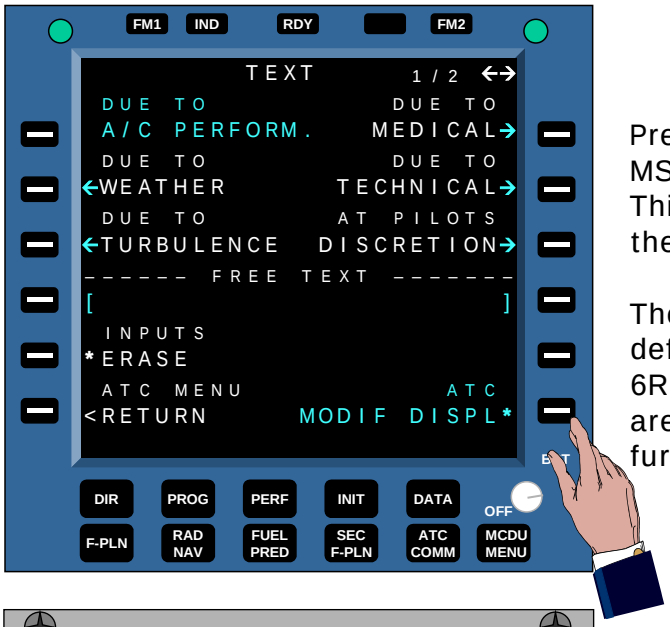


The time (foreseen to reach the flight level 370) is displayed on the MCDU.

It is possible to add free text to the reply by selecting ADD TEXT. This leads to the MCDU TEXT page:



It is possible to enter up to 4 lines of free text, or to choose one of the proposed reasons. For this example, chose the DUE TO A/C PERFORM key. The selected text is displayed in cyan.

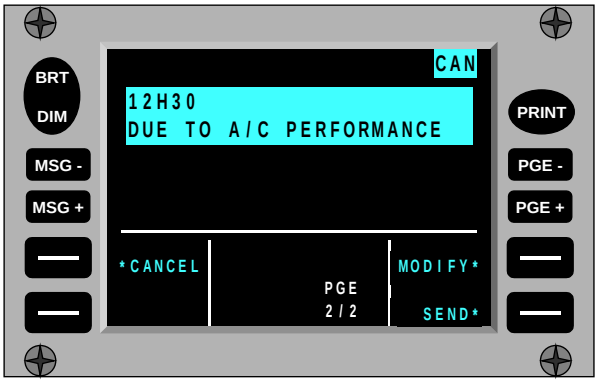


Press the line key adjacent to the ATC MSG DISPL* command on the MCDU. This displays the prepared message on the DCDU.

The MCDU page is refreshed, with the default "ATC TEXT DISPL" text in line 6R, but unavailable (no star). Options are all available again to allow for further message completion if required.

As the created message is too long to be displayed on 1 page of the DCDU, page1/2 appears on the DCDU. The SEND function is not available (no star) until all pages of the prepared message have not been visualized: press on the PAGE + softkey.

The SEND softkey is now available.
Press the SEND softkey.



Under the reply, the SENDING information is displayed TEMPORARILY.

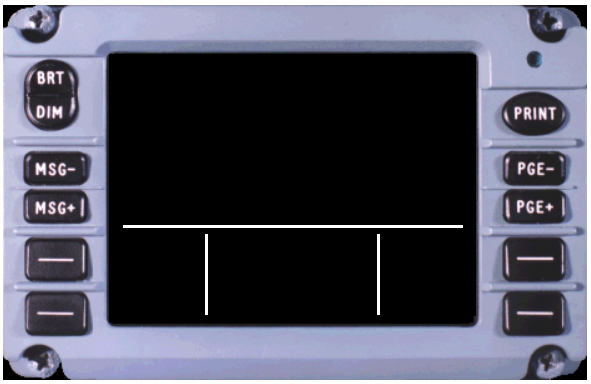
The message body changes to green once sent.

APPENDIX G – A320/A330/A340 FANS A+ OPERATIONAL SCENARIOS

When relevant differences of cockpit interfaces (DCDU/MCDU) are present between FANS A+ and latest FANS A+ system, they will be described.

1. INITIAL NOTIFICATION

The aircraft is flying from Los Angeles (KLAX) to Auckland (NZAA). The first ATC for this flight is KZAK control and the crew wants to logon to it. The first step is to notify the ATC centre of the aircraft data link capability.



First, select the ATC Menu page on the MCDU.

⇓ Interfaces on FANS A+ system ⇓

⇓ Interfaces on latest FANS A+ system⇓

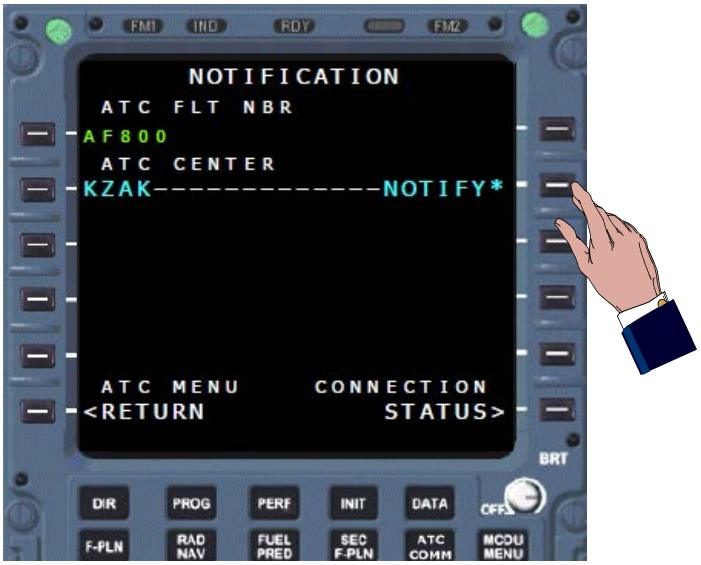
To display ATC pages, the hard key ATC COM present on MCDU can also be used.

⇓ Interfaces on FANS A+ system ⇓

⇓ Interfaces on latest FANS A+ system⇓

The ATC FLT NBR is provided by the FMS (set on the INIT page). The system has stored the last active ATC centre of the previous flight, here KZAK.

In our example, this is the first ATC for your flight. Select NOTIFY* in order to notify the KZAK ATC centre.



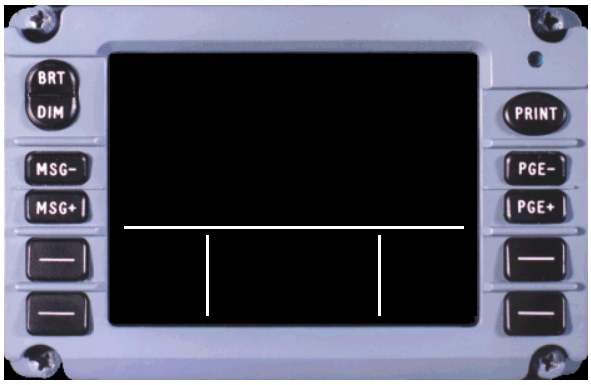
KZAK is displayed in green. It means that the ATC has been notified of the aircraft data link capability. It does not mean that the connection has been established. The connection is confirmed on DCDU by the default message ACTIVE ATC.

⇓ Interfaces on FANS A+ system ⇓

⇓ Interfaces on latest FANS A+ system⇓

The notification time is provided on latest FANS A+ system.

Once notified, the connection operation is initialized by the ATC at its discretion.



Notes:

- The last 6 notified centers can be displayed on MCDU except on the latest FANS A+ system.
- All the notification history will be deleted after each flight, 2 minutes after the engine shut down.

2. CPDLC CONNECTION

When the ATC centre initializes the CPDLC connection, the DCDU display changes, and the active ATC is displayed on DCDU. The ATC centre has performed the connection operation and the communication is established.

The aircraft is now able to exchange data link messages. Here is how to check the connection status. Select the Connection Status page.

⇓ Interfaces on FANS A+ system ⇓

⇓ Interfaces on latest FANS A+ system⇓

The active ATC is displayed.

Note: As a general rule, the connection should be completed 15 to 45 min before entering a CPDLC airspace.

⇓ Interfaces on FANS A+ system ⇓

⇓ Interfaces on latest FANS A+ system⇓

Notice also the default status of the ADS function, set to “ARMED”. This means that ADS is ready to work (ARMED: ready to accept contract with ground ATC centers).

NEW In the latest FANS A+ standard:

- The notified ATC center followed by the notification time (e.g. KZAK NOTIFIED 1213Z) is removed from the NOTIFICATION page when the CPDLC connection is established with the ATC center
- The Max Uplink Delay is available in the MAX UPLINK DELAY page, accessible from the CONNECTION page.

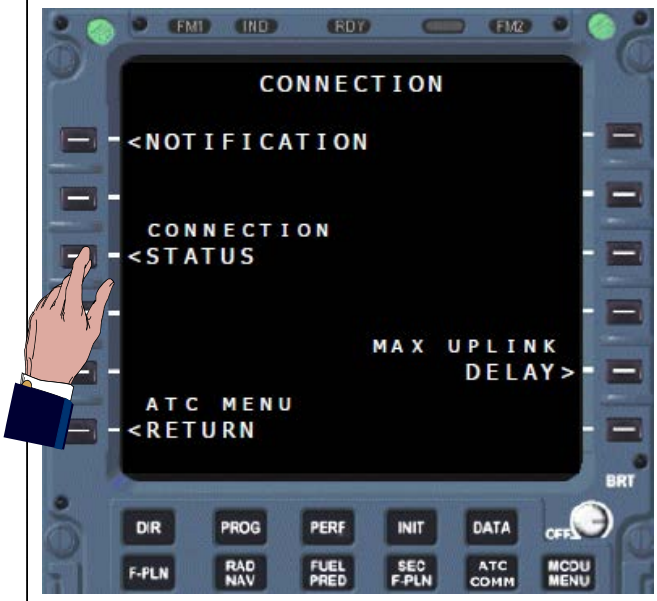
3. TRANSFER TO THE NEXT ATC

The data link communication transfer to the next ATC, also known as Next Data Authority, is initialized by the current ATC and automatically performed by the ATSU (respectively ATC applications). This process is totally transparent to the crew. This is simply indicated by a SERVICE TERMINATED message sent by the ATC.

The aircraft is in cruise. KZAK is about to transfer the aircraft to KOAK.

⇓ Interfaces on FANS A+ system ⇓

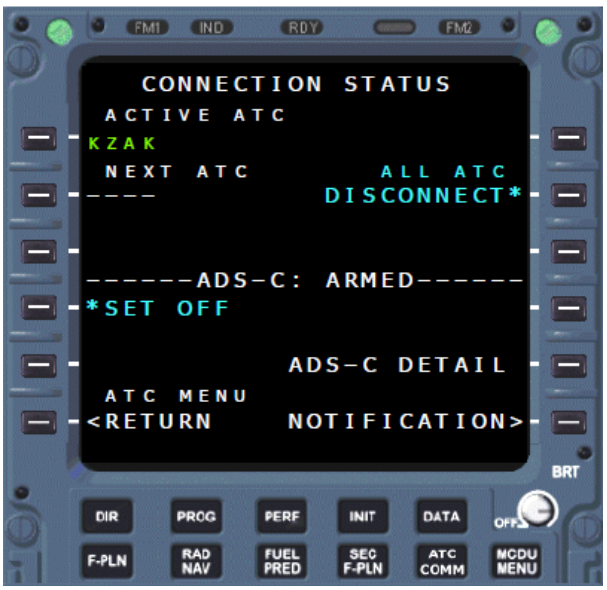
⇓ Interfaces on latest FANS A+ system⇓



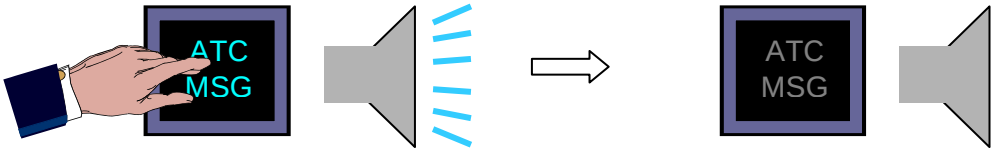
On the connection status page, KZAK is the active ATC. There is no NEXT ATC.

⇓ Interfaces on FANS A+ system ⇓

⇓ Interfaces on latest FANS A+ system⇓



Upon reception by the aircraft of an ATC message, both ATC MSG lights flash and as it is a normal message, the first telephone ring is delayed by 15 s, then it will be repeated every 15 s until the message is acknowledged (i.e. ATC MSG push-button pressed or a key to treat the message is pressed).
Press on the ATC MSG pushbutton to extinguish the lights and stop the aural signal.



The message received from KZAK is displayed on DCDU, indicating that the next ATC is KOAK. This message does not require any response. You can close the message that will be stored in the message record.

When the connection is established with the next ATC centre, the name of the next ATC centre is displayed in the MCDU CONNECTION STATUS page in the NEXT ATC field.

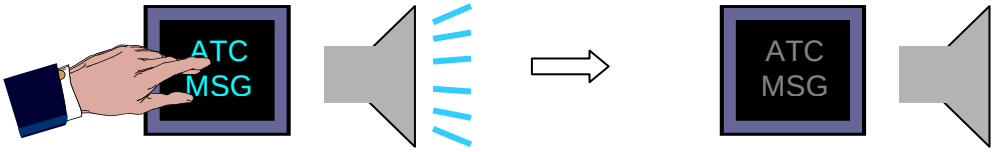
⇓ Interfaces on FANS A+ system ⇓

⇓ Interfaces on latest FANS A+ system⇓

Once the message is closed, the DCDU screen is cleared. The active ATC is still KZAK and will change only when KZAK terminates the connection.

The message (as a general rule, the last processed message) can be recalled by pressing the RECALL soft key on the DCDU or displayed in the MSG RECORD page on MCDU.

An uplink ATC message is received: both ATC MSG lights flash and as it is a normal message, the first telephone ring is delayed by 15 s, then it will be repeated every 15 s until the message is acknowledged (i.e. ATC MSG push-button pressed or a key to treat the message is pressed).
Press on the ATC MSG pushbutton to extinguish the lights and stop the aural signal.



The message CONTACT coupled with the message SERVICE TERMINATED are received from KZAK and displayed on DCDU. These messages mean that KZAK instructs t contact the next ATC centre on the given frequency and ends the data link connection when the flight crew answers the message. The NDA, which was connected in a passive mode becomes active at this time.

Press the CLOSE soft key to clear the DCDU screen and to store the message in the MSG RECORD.

Once the message is closed, the DCDU screen is cleared. The new active ATC (KOAK) is displayed on DCDU. The flight crew shall contact KOAK via voice on the given frequency.

4. CLEARANCE

In this operational scenario, the HMI corresponding to FANS A+ are identical to the ones of FANS A except that:

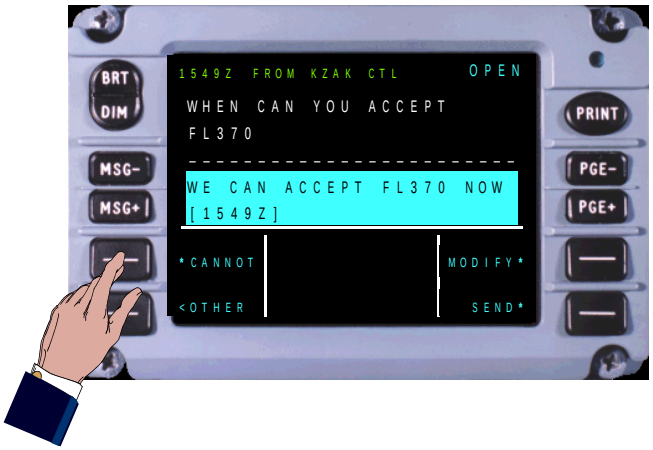
- The OTHER key has been removed on the latest FANS A+ system
- When the clearance condition is fulfilled, the clearance text is shown in white.

For the description of HMI, please refer to Part II - Appendix F – Section 4 Clearance.

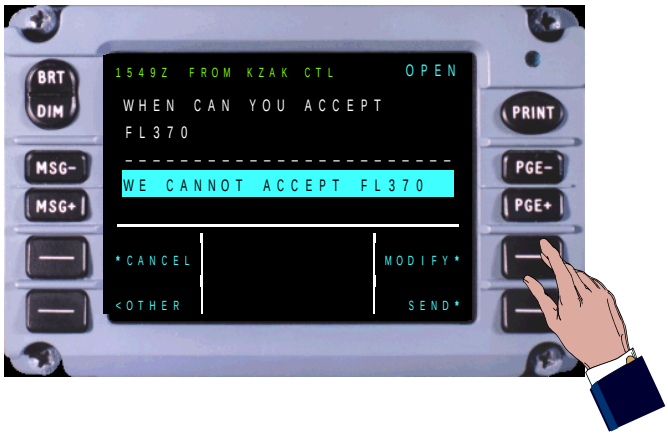
5. WHEN CAN YOU

In this scenario, the ATC sends a question message containing the element “WHEN CAN YOU”. The received message is displayed on DCDU.

Press the CANNOT soft key. The response message is automatically created. If required, the response can be modified on MCDU through the MODIFY soft key.

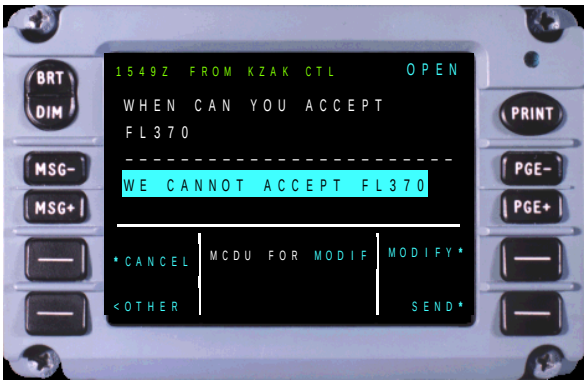


Press the MODIFY soft key.



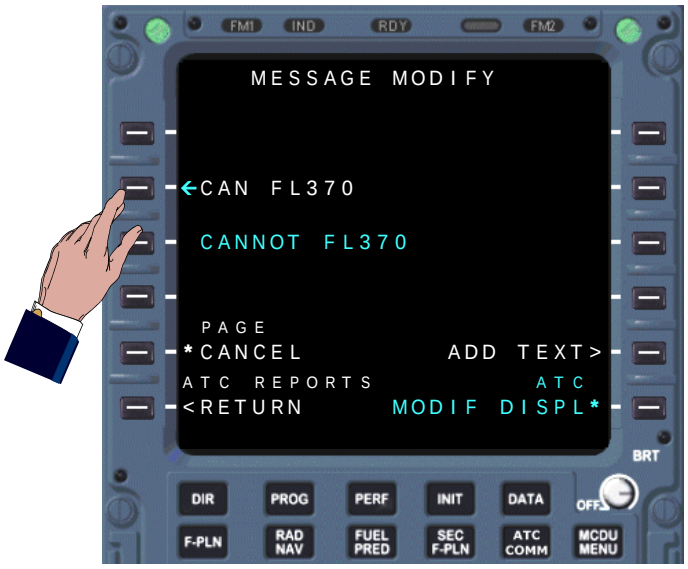
NEW The OTHER key has been removed on the latest FANS A+ system.

Under the reply, the MCDU FOR MODIF information is displayed.

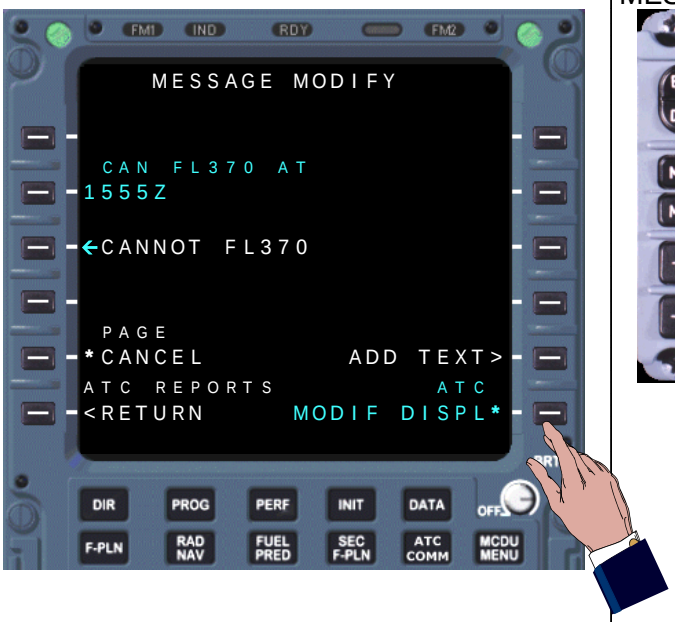


The MESSAGE MODIFY page pops up on MCDU if a page related to ATC application was previously displayed on MCDU. If not, the MESSAGE MODIFY page may be accessed manually.

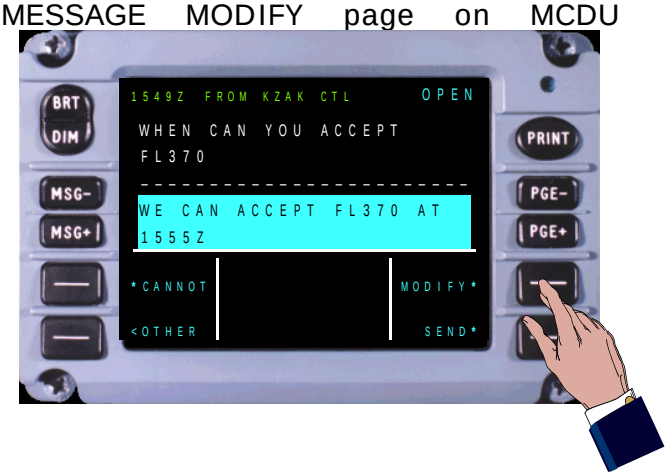
Select the positive response (e.g. CAN FL370 for A320/A330/A340 aircraft). Once selected, time may be modified.



By pressing ATC MODIF DISPL, the modification can be transferred to DCDU.

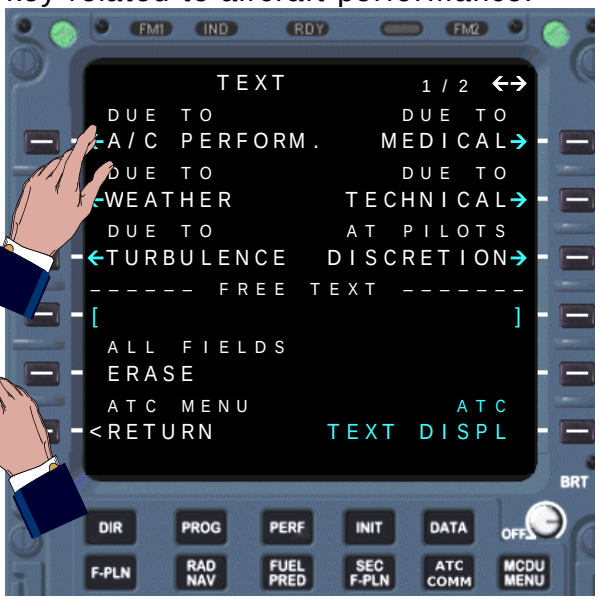


If you wish to append a text to the response, press MODIFY to call the MESSAGE MODIFY page on MCDU

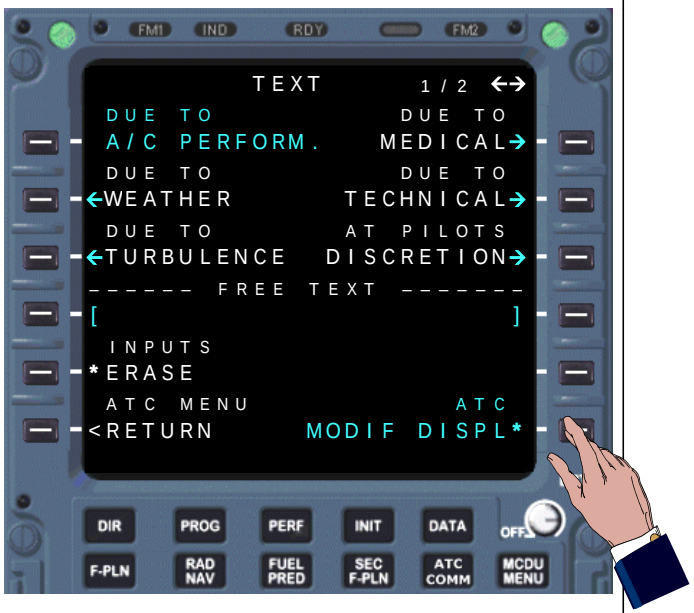


From this page, select ADD FREE TEXT.

On MCDU, some pre-formatted responses are proposed in addition to a free text line. Select the line selection key related to aircraft performance.



When finished, the message can be transferred to DCDU.



In this case, the addition of a free text requires a second page on DCDU as the five lines of the screen are already filled in. Before sending a message displayed on several pages, the flight crew has review it entirely. Scroll the message down until the last page. The SEND soft key becomes available. Press the SEND soft key.

Under the reply, the SENDING information is displayed until the acknowledgement from the ground network is received. The message body turns into green once SEND is selected.

6. MSG RECORD

Once a message is closed on DCDU, it is stored in the MSG RECORD. The storage capacity is up to 99 messages. When this limit is reached, the oldest message is deleted to store the most recent one.

Messages in the MSG RECORD are sorted in the chronological order (i.e. from the most recent message to the oldest one) with respect of sending time for downlink message and reception time for uplink messages.

On MCDU, access to MSG RECORD is via the LSK 4L from the ATC MENU page.

⇓ Interfaces on FANS A+ system ⇓

⇓ Interfaces on latest FANS A+ system⇓

Up to four messages per page are displayed on MCDU. The time, the addressee/addresser, the first line of the message and the associated response if any are provided.

To display the entire message on MCDU, select the prompt at the left side of the chosen message.

In the example below, the ATC request and the flight response are displayed. Time and ATC designator are repeated.

Select MSG RECORD ERASE function to erase the MSG RECORD on MCDU.

A confirmation is requested during 5 seconds. If the confirmation is not performed within 5 seconds, the MSG RECORD ERASE function reappears.

APPENDIX H – A350/A380 FANS A+ OPERATIONAL SCENARIOS

For FANS A+B systems, the scenarios refer only to FANS A+ (i.e. FANS A+B working over ACARS). When relevant differences of cockpit interfaces (ATC mailbox/MFD) are present between A380 FANS A+ and A350/A380 FANS A+B, they will be described.

1. INITIAL NOTIFICATION

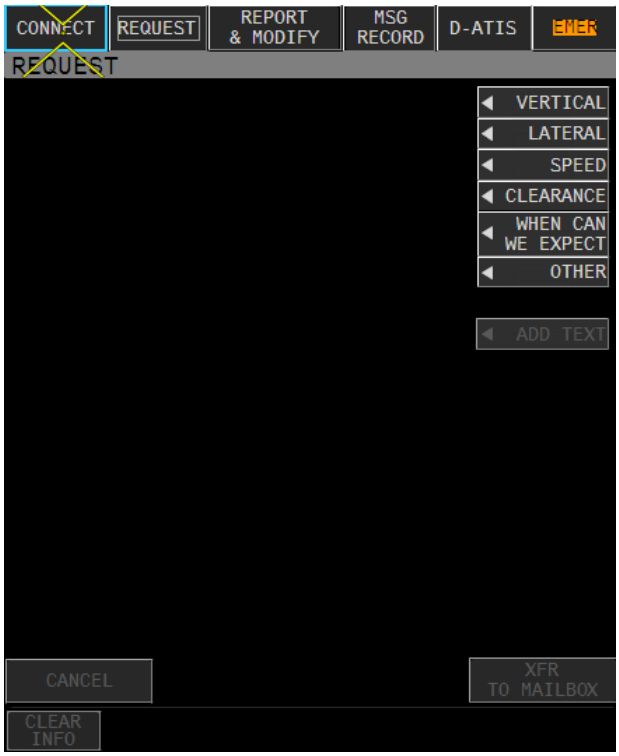
The aircraft is flying from Los Angeles (KLAX) to Auckland (NZAA). The first ATC for this flight is KZAK control and the crew wants to logon to it. The first step is to notify the ATC centre of the aircraft data link capability.

On the MFD, select in the pull-down menu the ATC COM item.

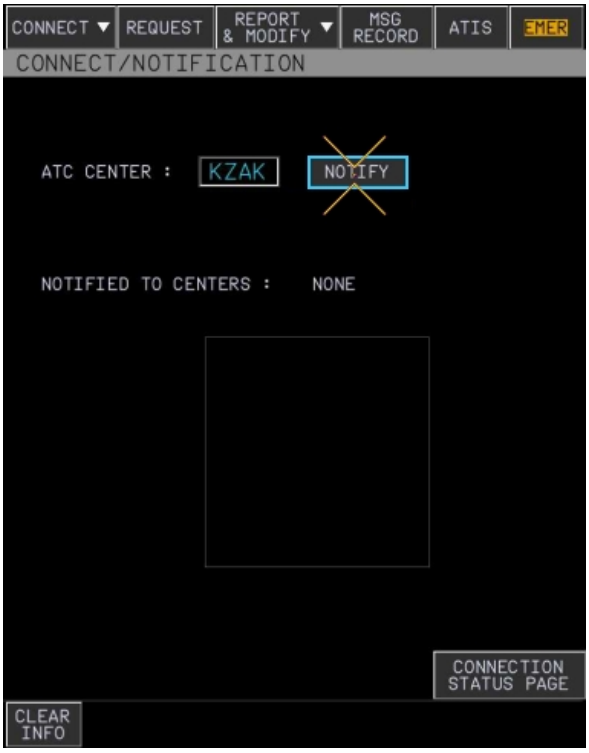
To display ATC COM pages, the hard key ATC COM can also be used on KCCU.

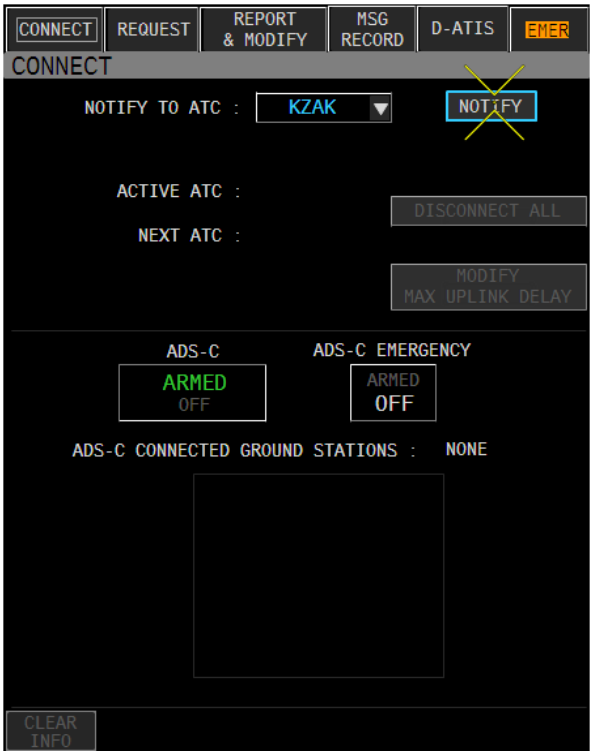
⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓



The ATC FLT NBR is provided by the FMS (set on the INIT page). The system has stored the last active ATC centre of the previous flight, here KZAK.
In our example, this is the first ATC for your flight. Select NOTIFY in order to notify the KZAK ATC centre.

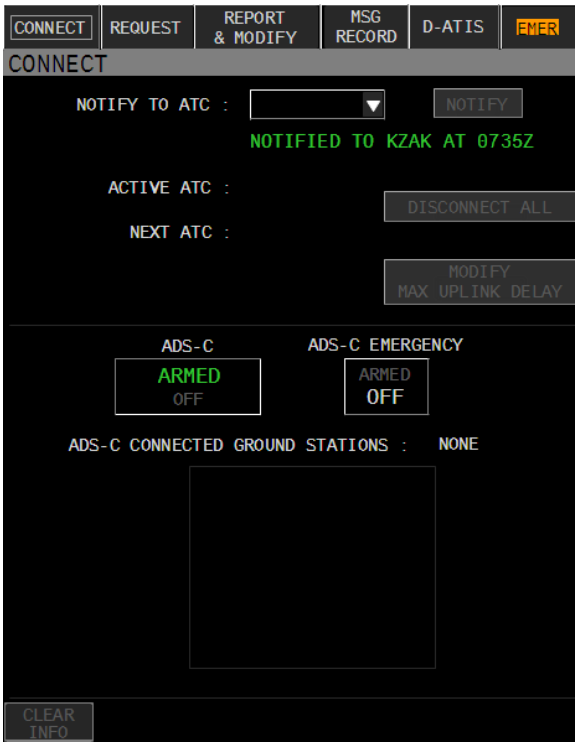




KZAK is displayed in green. It means that the ATC has been notified of the aircraft data link capability. It does not mean that the connection has been performed.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓



Notes:

- The last 6 notified centers can be displayed on A380 FANS A+ MFD.
- On A380 FANS A+, all the notification history will be deleted after each flight, 2 minutes after the engine shut down.
- The notification time is provided on MFD.

Once notified, the connection operation is initialized by the ATC at its discretion.

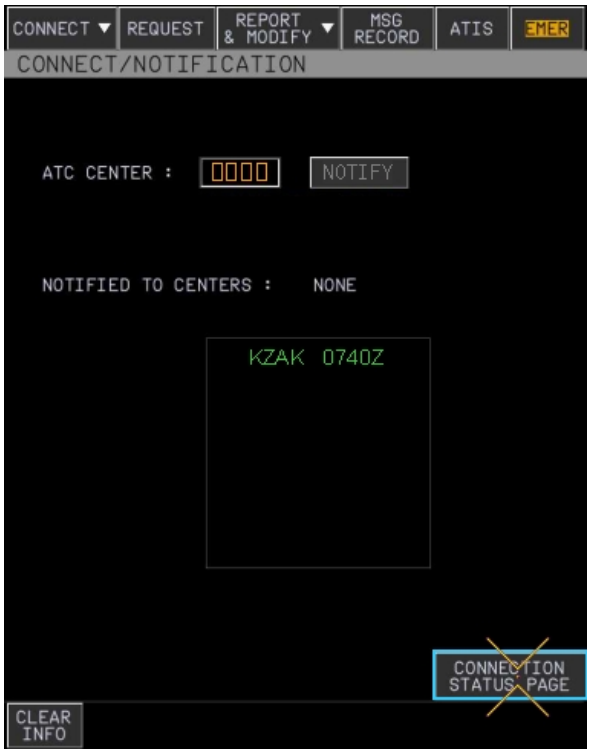
2. CPDLC CONNECTION

When the ATC centre initializes the CPDLC connection, the active ATC is displayed on the ATC mailbox. The ATC centre has performed the connection operation and the communication is established.

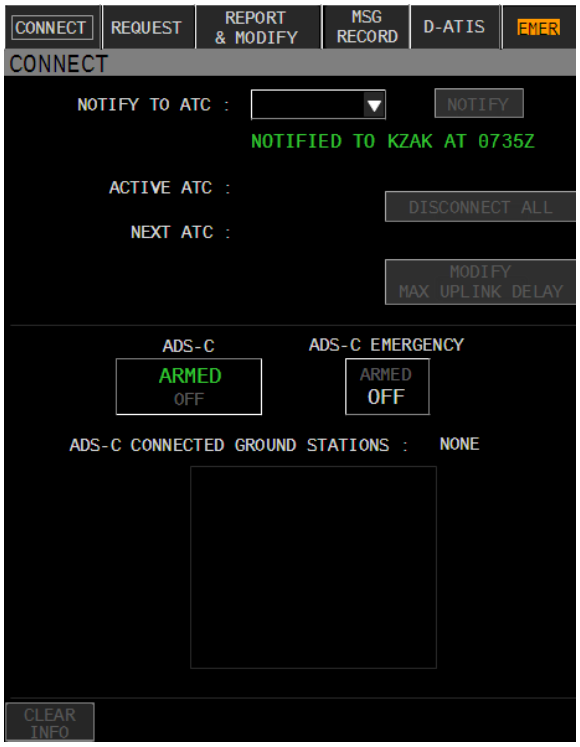
The flight crew is now able to exchange data link messages with the ATC controller. To check the CPDLC connection status:

- On A380 FANS A+, open the NOTIFICATION page and then select the CONNECTION STATUS PAGE button. Note that the CONNECT drop-down menu on MFD enables to open the CONNECTION STATUS page directly.
- On A350/A380 FANS A+B, open the CONNECT page through the CONNECT button on MFD.

⇓ Interfaces on A380 FANS A+ ⇓



⇓ Interfaces on A350/A380 FANS A+B ⇓



The active ATC is displayed.

Note: As a general rule, the connection should be completed 15 to 45 min before entering a CPDLC airspace.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

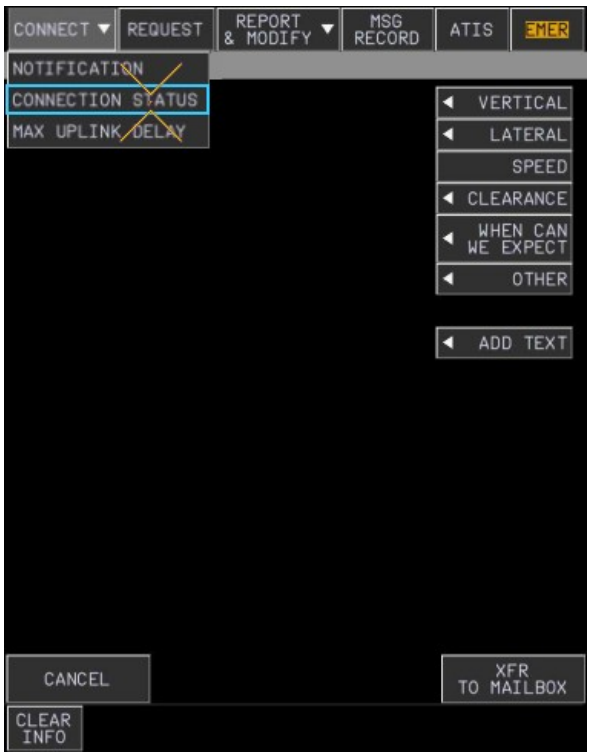
Notice also the default status of the ADS function, set to “ARMED”. This means that ADS is ready to work (ARMED: ready to accept contract with ground ATC centers).

3. TRANSFER TO THE NEXT ATC

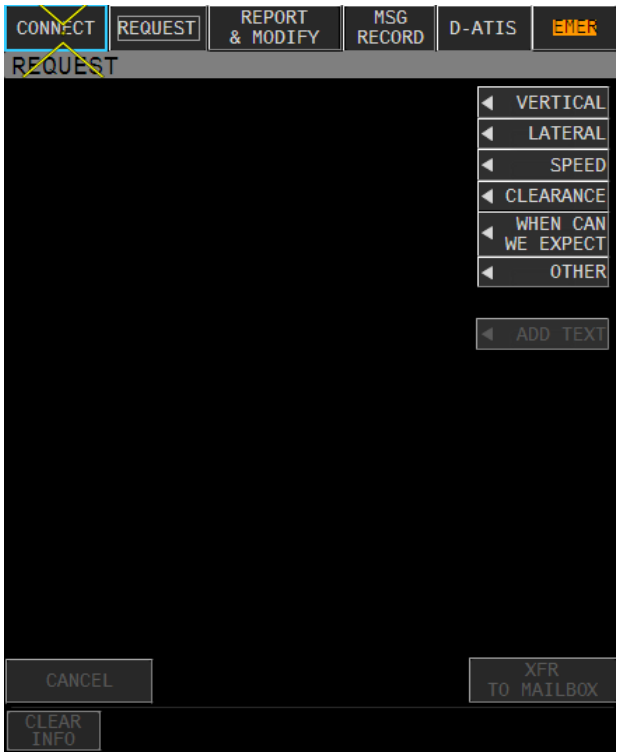
The data link communication transfer to the next ATC, also known as Next Data Authority, is initialized by the current ATC and automatically performed by the ATC applications. This process is totally transparent to the crew. This is simply indicated by a SERVICE TERMINATED message sent by the ATC.

The aircraft is in cruise. KZAK is about to transfer the aircraft to KOAK.

⇓ Interfaces on A380 FANS A+ ⇓



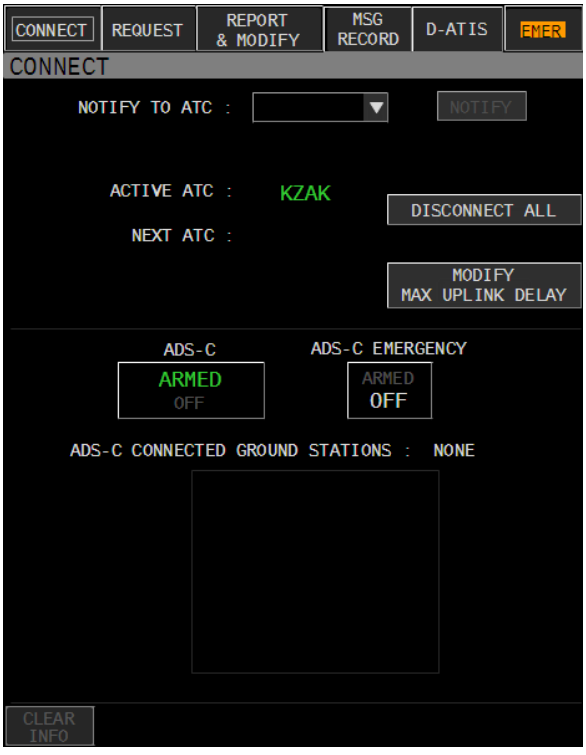
⇓ Interfaces on A350/A380 FANS A+B ⇓



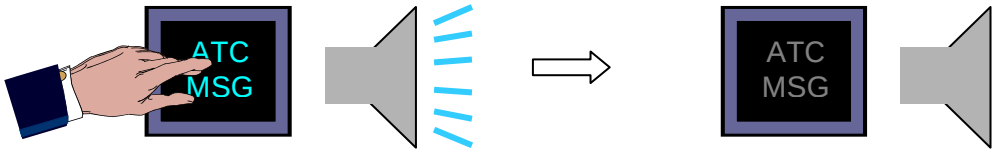
KZAK is the active ATC. There is no NEXT ATC.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓



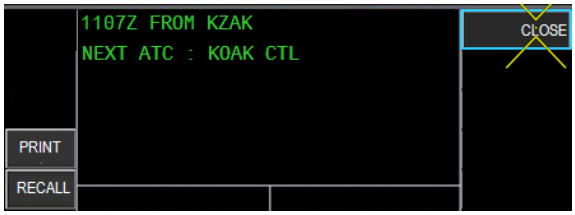
Upon reception by the aircraft of an ATC message, both ATC MSG lights flash and as it is a normal message, the first telephone ring is delayed by 15 s on A380 FANS A+ (respectively 10 s on A350/A380 FANS A+B), then it will be repeated every 15 s on A380 FANS A+ (respectively 10 s on A350/A380 FANS A+B) until the message is acknowledged (i.e. ATC MSG push-button pressed or a key to treat the message is pressed).
Press on the ATC MSG pushbutton to extinguish the lights and stop the aural signal.



The message received from KZAK is displayed on ATC mailbox, indicating that the next ATC is KOAK. This message does not require any response. You can close the message that will be stored in the message record. In the CONNECTION STATUS page on A380 FANS A+ (respectively CONNECT page on A350/A380 FANS A+B), the next ATC is displayed.

⇓ Interfaces on A380 FANS A+ ⇓

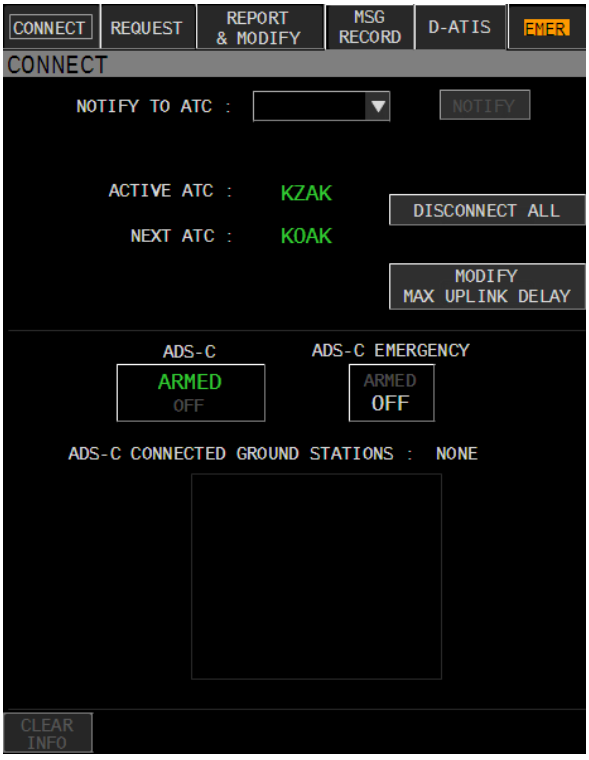
⇓ Interfaces on A350/A380 FANS A+B ⇓



When the connection is established with the next ATC centre, the name of the next ATC centre is displayed in the CONNECTION STATUS page on A380 FANS A+ (respectively CONNECT page on A350/A380 FANS A+B) in the NEXT ATC field.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

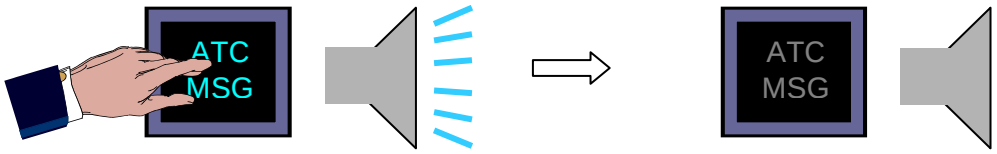


Once the message is closed, the ATC mailbox is cleared. The active ATC is still KZAK and will change only when KZAK terminates the connection.

The message (as a general rule, the last processed message) can be recalled by pressing the RECALL soft key on the ATC mailbox or displayed in the MSG RECORD page on MFD.

Upon reception by the aircraft of an ATC message, both ATC MSG lights flash and as it is a normal message, the first telephone ring is delayed by 15 sec on A380 FANS A+ (respectively 10 s on A350/A380 FANS A+B), then it will be repeated every 15 sec on A380 FANS A+ (respectively 10 sec on A350/A380 FANS A+B) until the message is acknowledged (i.e. ATC MSG push-button pressed or a key to treat the message is pressed).

Press on the ATC MSG pushbutton to extinguish the lights and stop the aural signal.



The message CONTACT coupled with the message SERVICE TERMINATED are received from KZAK and displayed on ATC mailbox. These messages mean that KZAK instructs to contact the next ATC centre on the given frequency and ends the data link connection when the flight crew answers the message. The NDA, which was connected in a passive mode becomes active at this time.

Press the CLOSE soft key to clear the ATC mailbox and to store the message in the MSG RECORD.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

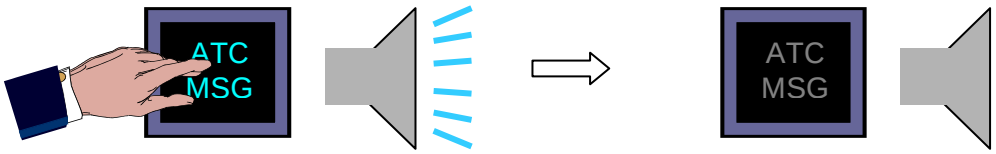
Once the message is closed, the ATC mailbox is cleared. The new active ATC (KOAK) is displayed on ATC mailbox. The flight crew shall contact KOAK via voice on the given frequency.

4. CLEARANCE

A request has been previously performed. The clearance related to this request is received.

Both ATC MSG lights flash and as it is a message of normal priority, the first telephone ring is delayed by 15 sec on A380 FANS A+ (respectively 10 sec on A350/A380 FANS A+B), then it will be repeated every 15 sec on A380 FANS A+(respectively 10 s on A350/A380 FANS A+B) until the message is acknowledged (i.e. ATC MSG push-button pressed or a key to treat the message is pressed).

Press on the ATC MSG pushbutton to extinguish the lights and stop the aural signal.



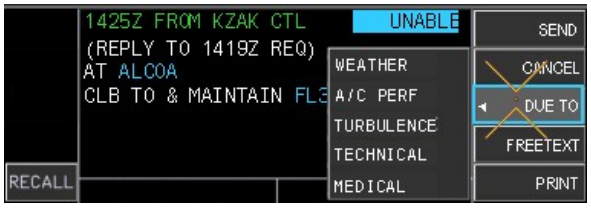
The received message is displayed on ATC mailbox.
The first line in green indicates the time at which the message has been **sent** (i.e. timestamp) and the issuer of the message. If the timestamp is not available, the time field is blank and the reception time is inserted at the end of the message.

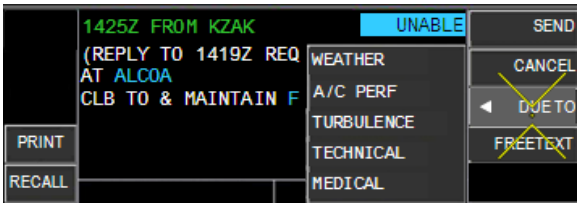
The second line in white reminds the time reference of the related request. The clearance is displayed on the following lines.

⇓ Interfaces on A380 FANS A+ ⇓

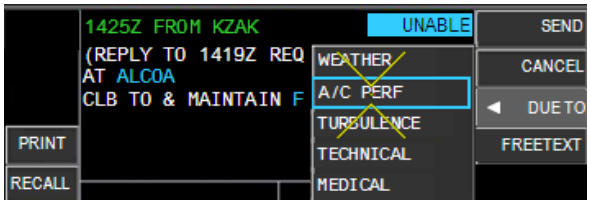
⇓ Interfaces on A350/A380 FANS A+B ⇓

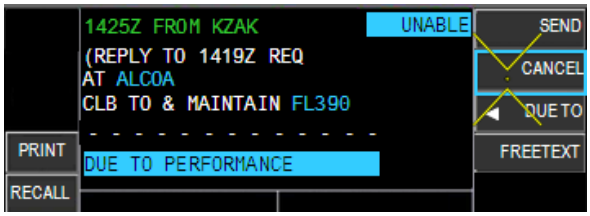
If the clearance cannot be complied with, select UNABLE. You are able to insert text to justify the refusal.
Thanks to the design of the ATC mailbox, the text can be inserted directly from the ATC mailbox.





Select the DUE TO button and select the A/C PERF option.





By selecting CANCEL, the ATC mailbox display returns to the initial state.

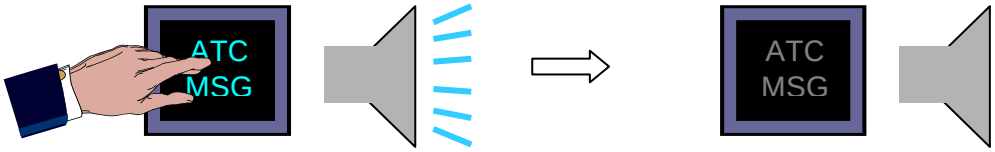
As it is a deferred clearance, sending WILCO triggers the monitoring process by the FMS. The MONITORING indication is displayed.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

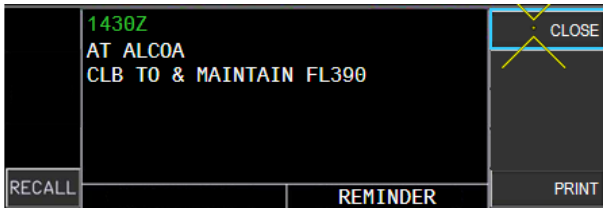
Once the monitoring process is activated, the monitoring condition is displayed in magenta. At this stage, the message can be closed.

About 30 seconds before the monitoring condition is met, the visual and aural alerts are triggered. In addition, a reminder pops up on the ATC mailbox. The reminder includes the clearance and the operational response made by the flight crew.

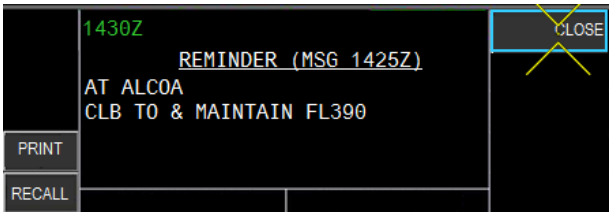


As the monitoring condition is about to be met, the clearance is entirely displayed in white. You can close the reminder.

⇓ Interfaces on A380 FANS A+ ⇓



⇓ Interfaces on A350/A380 FANS A+B ⇓

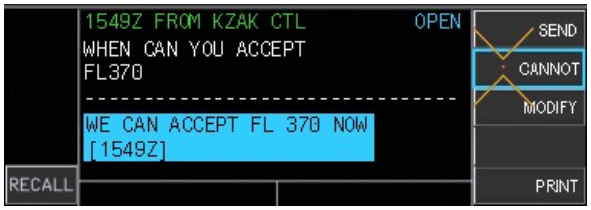


5. WHEN CAN YOU

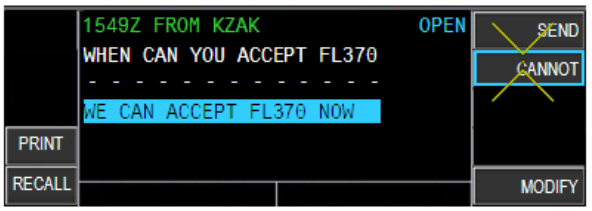
In this scenario, the ATC sends a question message containing the element “WHEN CAN YOU”. The received message is displayed on ATC mailbox.

Press the CANNOT soft key. The response message is automatically created. If required, the response can be modified on MFD through the MODIFY soft key.

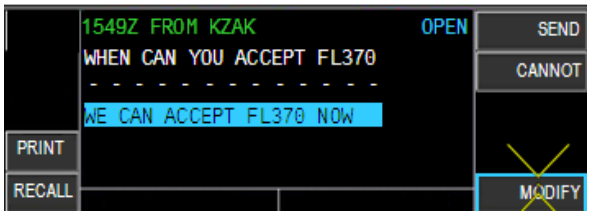
⇓ Interfaces on A380 FANS A+ ⇓



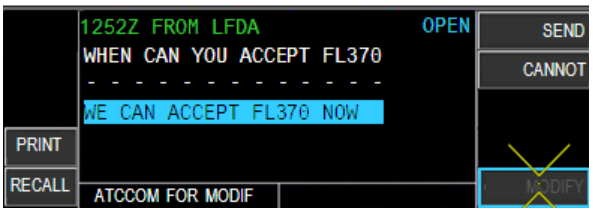
⇓ Interfaces on A350/A380 FANS A+B ⇓



Activate the MODIFY soft key.



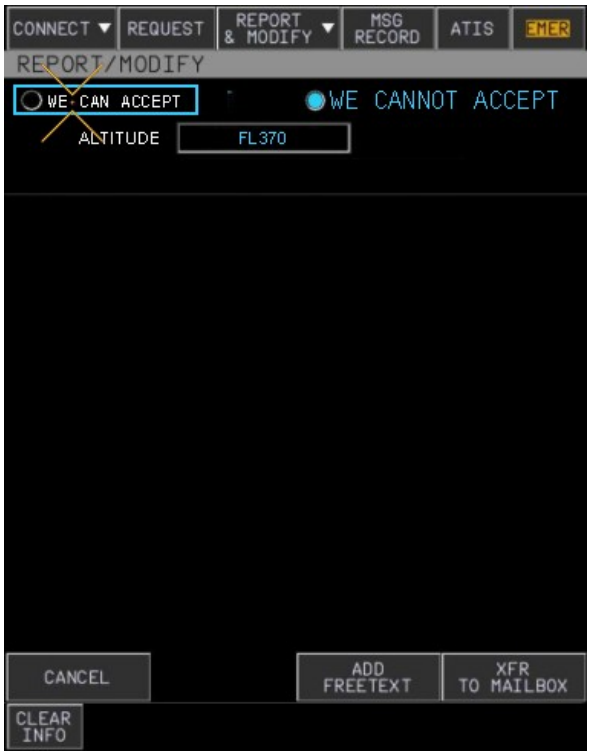
Under the reply, the MFD FOR MODIF information is displayed.



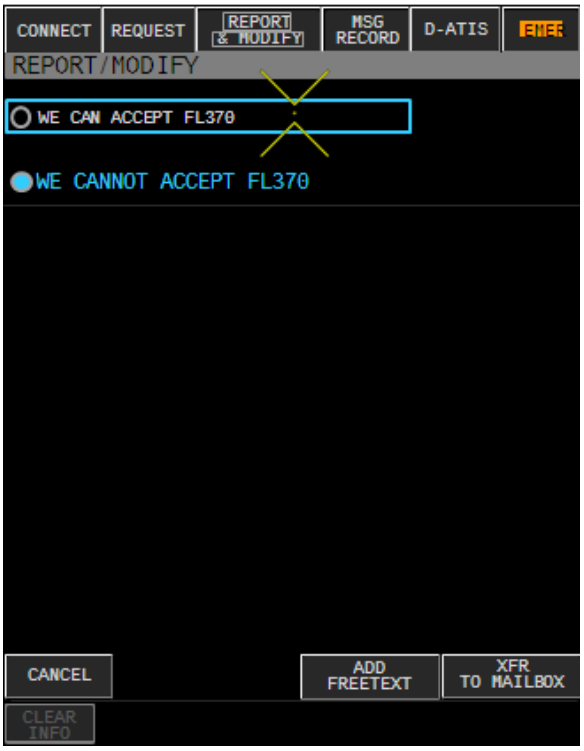
The MESSAGE MODIFY page pops up on MFD if a page related to ATC application was previously displayed on MFD. If not, the MESSAGE MODIFY page may be accessed manually.

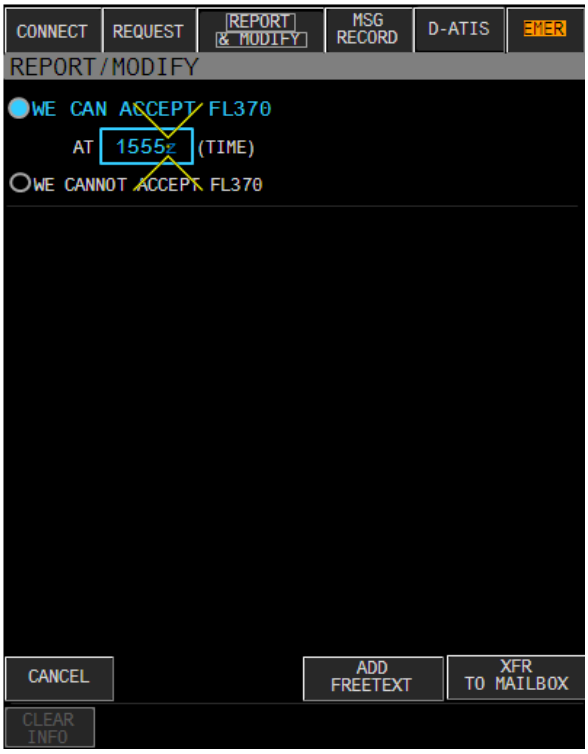
Select the positive response (WE CAN ACCEPT). Once selected, time may be modified.

⇓ Interfaces on A380 FANS A+ ⇓



⇓ Interfaces on A350/A380 FANS A+B ⇓

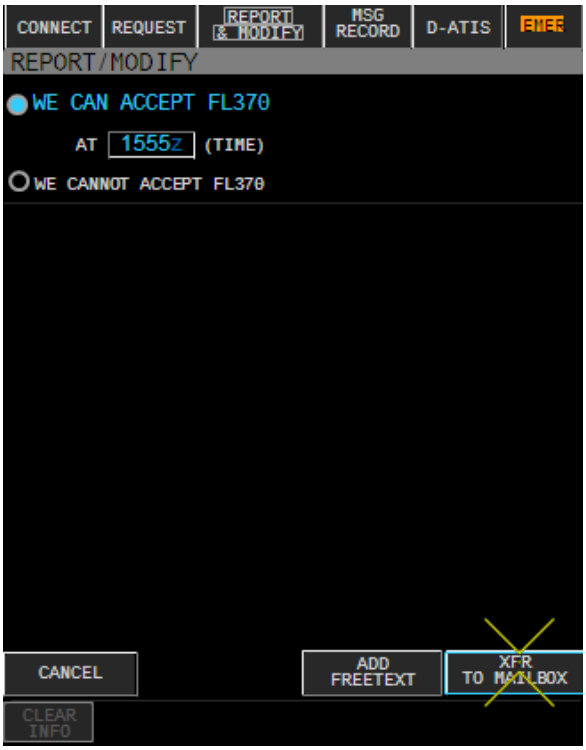




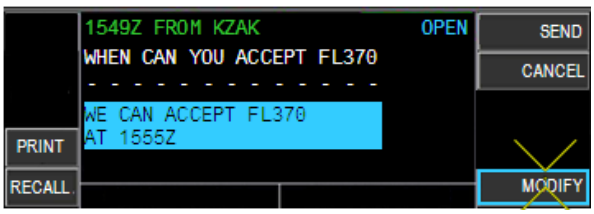
From the MFD, the transfer to the ATC mailbox is controlled with the XFR TO MAILBOX button.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

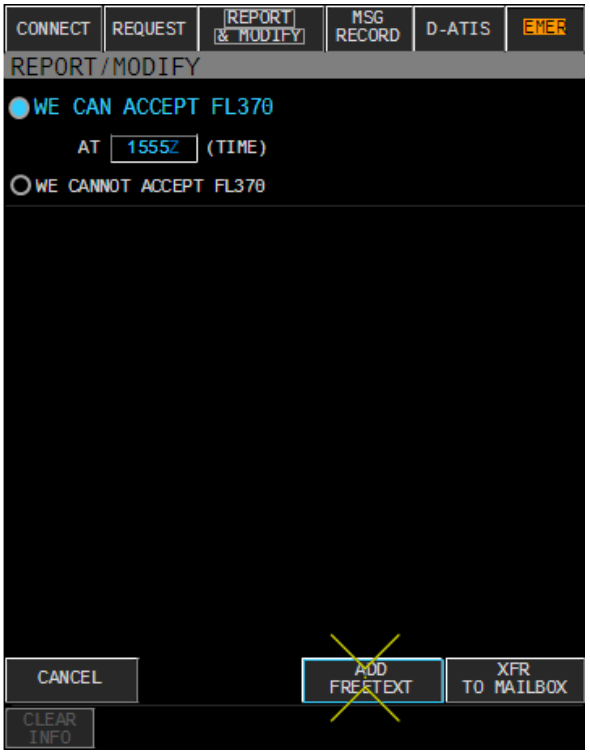


If you wish to append a text to the response, activate MODIFY to call the MESSAGE MODIFY page on MFD. From this page, select ADD FREE TEXT.

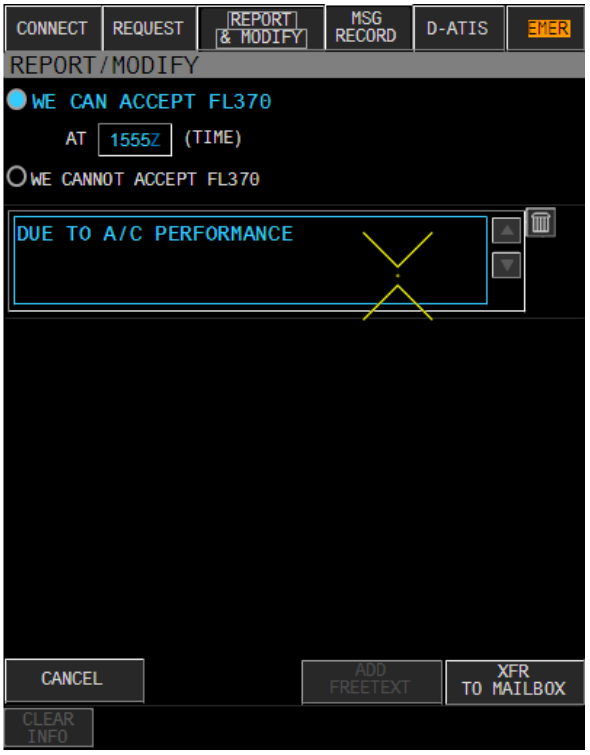


⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓



Selecting the ADD FREE TEXT button adds an edit box where text can be freely typed. It is strongly recommended to use words commonly used in aeronautic phraseology.



When finished, the message can be transferred to ATC mailbox.

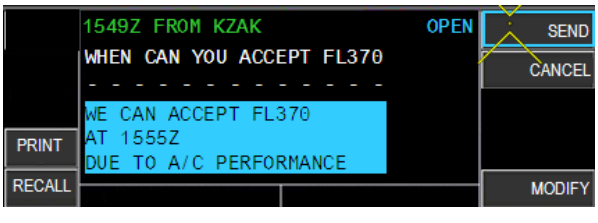
⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

In this case, the addition of a free text requires a second page on A380 ATC mailbox as the five lines of the screen are already filled in. Before sending a message displayed on several pages, it has to be entirely review. Scroll the message down until the last page. The SEND soft key becomes available. Press the SEND soft key.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓



Under the reply, the SENDING information is displayed until the acknowledgement from the ground network is received. The message body turns into green once SEND is selected.

6. MSG RECORD

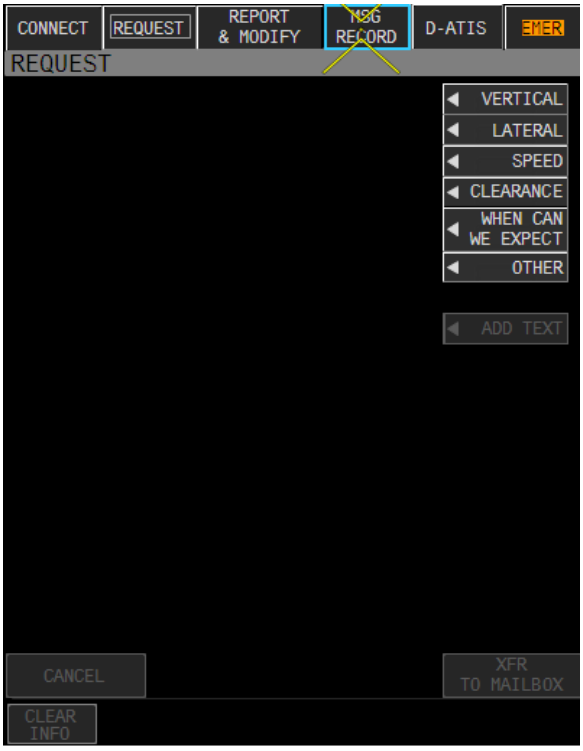
Once a message is closed on ATC mailbox, it is stored in the MSG RECORD. The storage capacity is up to 99 messages. When this limit is reached, the oldest message is deleted to store the most recent one.

Messages in the MSG RECORD are sorted in the chronological order (i.e. from the most recent message to the oldest one) with respect of sending time for downlink message and reception time for uplink messages.

On MFD, access to MSG RECORD is via the MSG RECORD button at the top of the screen.

⇓ Interfaces on A380 FANS A+ ⇓

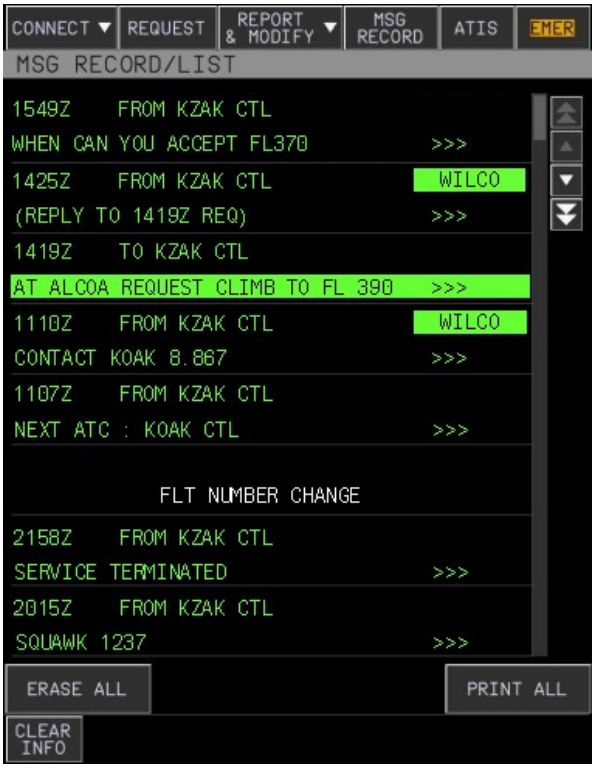
⇓ Interfaces on A350/A380 FANS A+B ⇓



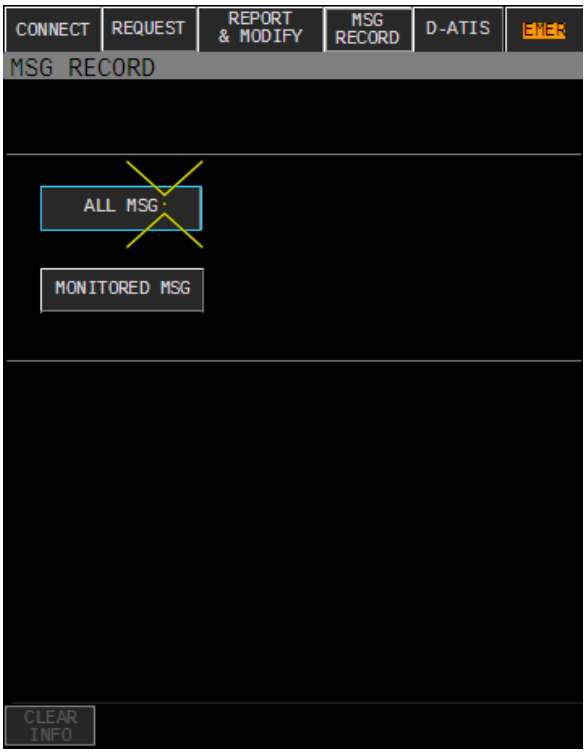
Up to eight messages per page are displayed on MFD. The time, the addressee/addresser, the first line of the message and the associated response if any are provided.

⇓ Interfaces on A380 FANS A+ ⇓

No equivalent page on A380 FANS A+



⇓ Interfaces on A350/A380 FANS A+B ⇓



If the MSG RECORD is not deleted at the end of a flight, a separator is inserted in the MFD MSG RECORD to split the messages of different flights. The separator is:

- A380 FANS A+: FLT NUMBER CHANGE
- A350/A380 FANS A+B: The flight number followed by the date of the flight.

To display the entire message on MFD:

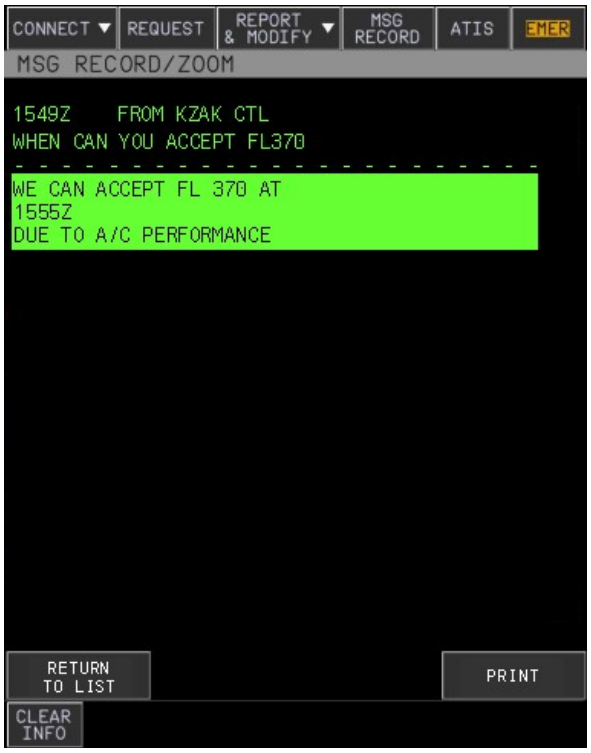
- A380 FANS A+: Select the triple rightward arrow at the right side of the chosen message
- A350/A380 FANS A+B: Select the chosen message.

⇓ Interfaces on A380 FANS A+ ⇓

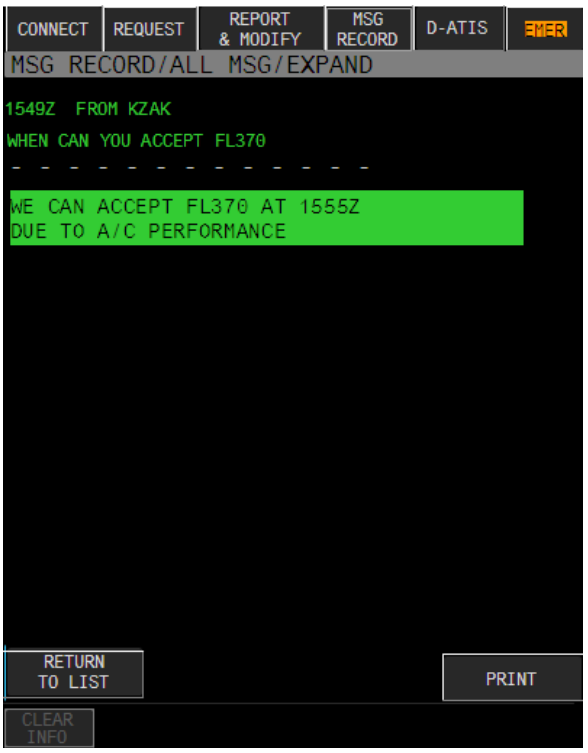
⇓ Interfaces on A350/A380 FANS A+B ⇓

In the example below, the ATC request and the flight response are displayed. Time and ATC designator are repeated.

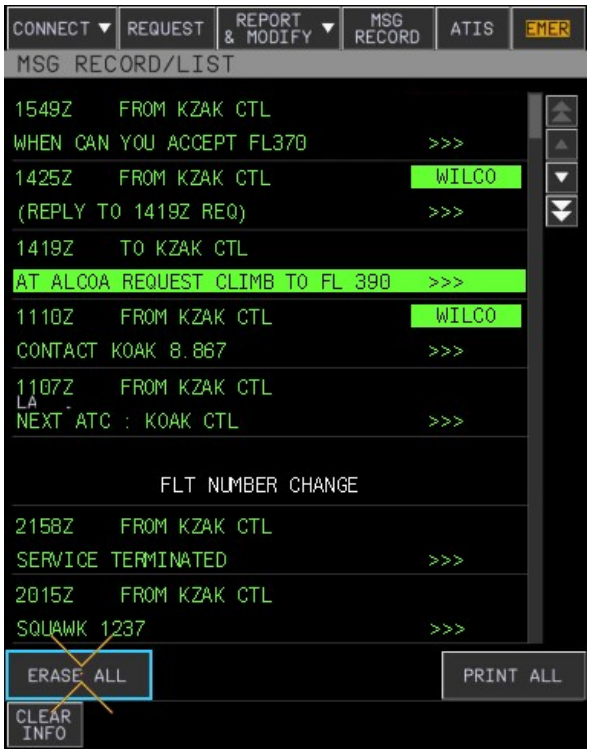
⇓ Interfaces on A380 FANS A+ ⇓

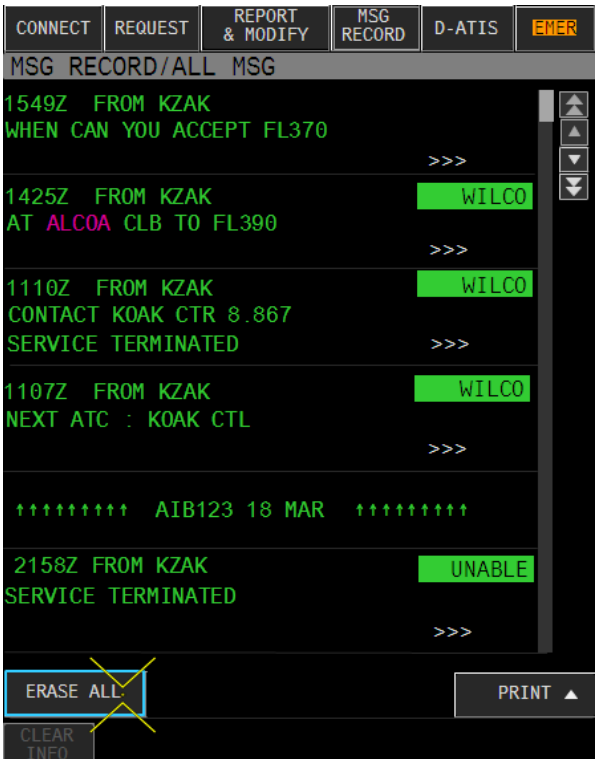


⇓ Interfaces on A350/A380 FANS A+B ⇓



Select ERASE ALL button to erase the MSG RECORD on MFD.





A confirmation pop-up is displayed.

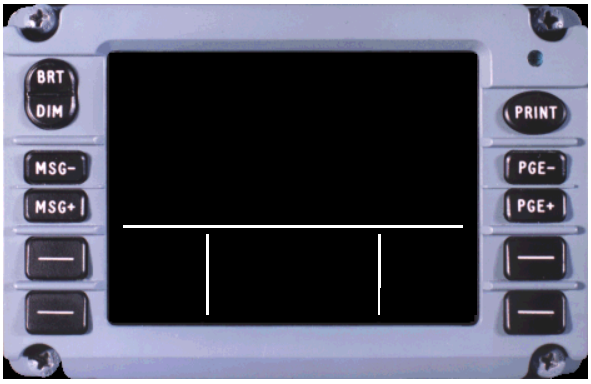
CONNECT
REQUEST
REPORT & MODIFY
MSG RECORD
ATIS
EMER
MSG RECORD/LIST
1549Z FROM KZAK CTL
WHEN CAN YOU ACCEPT FL370 >>>
1425Z FROM KZAK CTL WILCO
(REPLY TO 1419Z REQ) >>>
1419Z TO KZAK CTL
AT ALCOA REQUEST CLIMB TO FL 390 >>>
ERASE ALL MSG ?
CANCEL
CONFIRM
FLT NUMBER CHANGE
2158Z FROM KZAK CTL
SERVICE TERMINATED >>>
2015Z FROM KZAK CTL
SQUAWK 1237 >>>
ERASE ALL
PRINT ALL
CLEAR INFO

CONNECT
REQUEST
REPORT & MODIFY
MSG RECORD
D-ATIS
EMER
MSG RECORD/ALL MSG
1549Z FROM KZAK
WHEN CAN YOU ACCEPT FL370 >>>
1425Z FROM KZAK WILCO
AT ALCOA CLB TO FL390 >>>
1110Z FROM KZAK WILCO
ERASE ALL MSG ?
CANCEL
CONFIRM
AIB123 18 MAR
2158Z FROM KZAK UNABLE
SERVICE TERMINATED >>>
ERASE ALL
PRINT
CLEAR INFO

APPENDIX I – A320/A330/A340 ATS 623 OPERATIONAL SCENARIOS

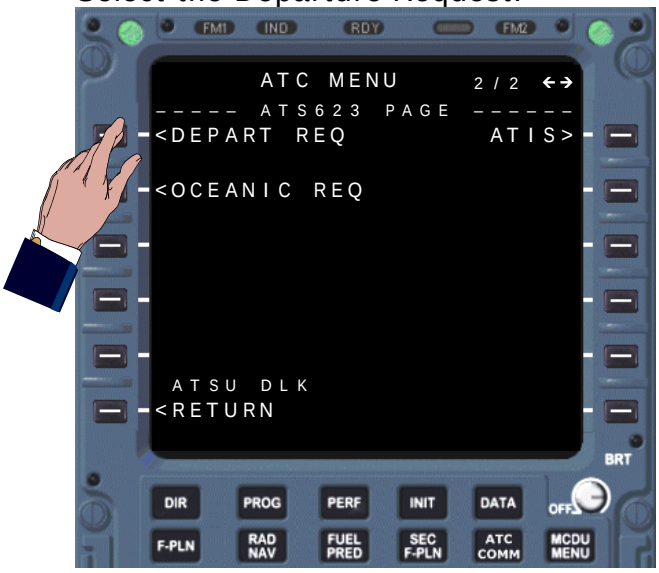
1. DEPARTURE CLEARANCE - DCL

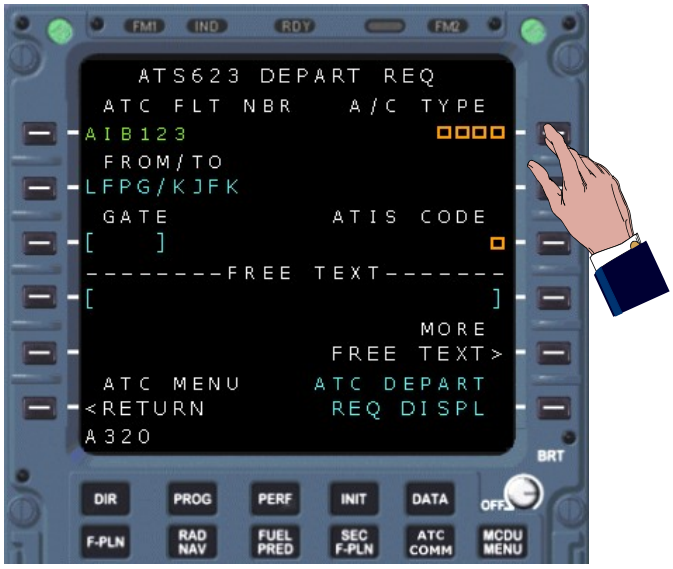
The ATS 623 applications do not require a preliminary notification process. As a consequence, a departure request may be performed even if the DCDU is blank (i.e. no active ATC is displayed).



The Departure Clearance application is an ATS 623 application: it can be reached through the ATC MENU by selecting the prompt ATSU, or directly by selecting the ATC COM hard key.

Access to ATS623 applications are provided on the second page of the ATC MENU.
Select the Departure Request.

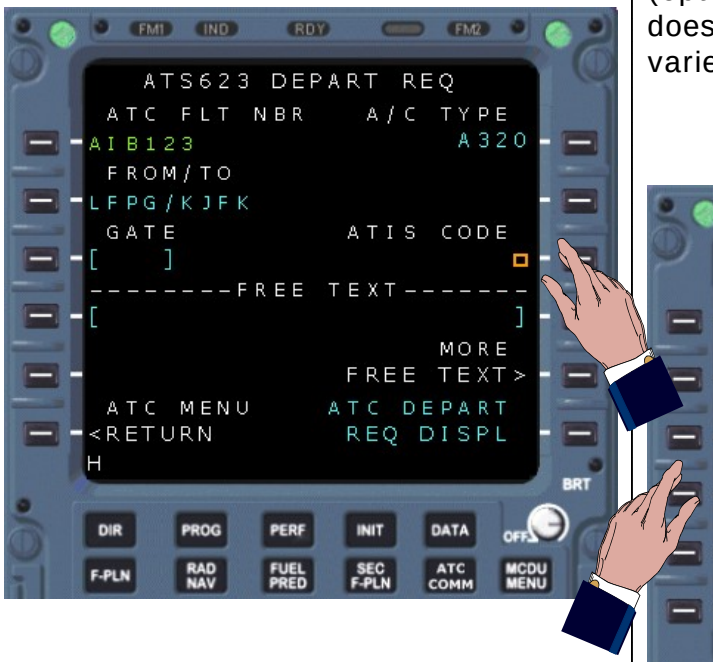




Amber boxes identify mandatory fields prior to sending the Departure Clearance request. The function REQ DISPL (to display the request on DCDU) will only be available (star displayed) when all mandatory fields are filled.
The flight number is displayed in small green font: it means that the flight number is provided by the FMS (small font) and is not modifiable (green colour).
Parameters in cyan indicate modifiable parameters. Here the system has automatically filled the origin and destination airports (taken from the FMS). These are also mandatory parameters: if they are cleared, amber boxes will appear.

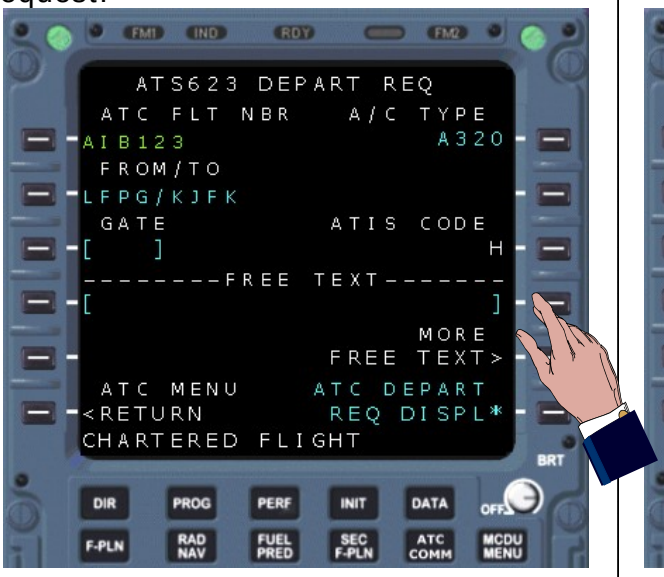
Fill in the aircraft type field. The aircraft type should be filled in accordance with the aircraft type defined in the Item 9 of the ICAO flight plan. Incorrect aircraft type in the Departure Clearance message may lead to a rejection of the request.

Enter the ATIS code.

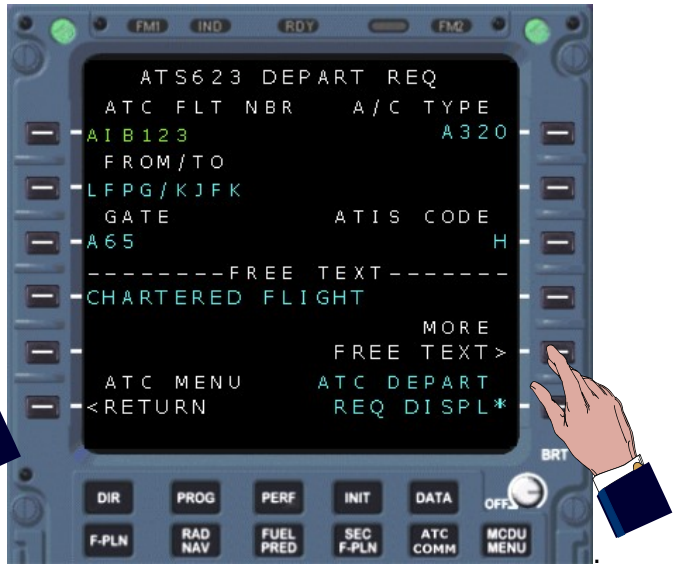


Type in the aircraft gate number (optional parameter) and insert it. It does not have a fixed format since it varies according to the region.

As all mandatory fields are completed, REQ DISPL function becomes available. A free text may be also appended to the request.



To add more free text, select the prompt MORE FREE TEXT



Three additional lines of free text can be added. The first line of free text is already displayed on this page. Type in one line of text and insert it.

The request is now completed and may be transferred to DCDU.

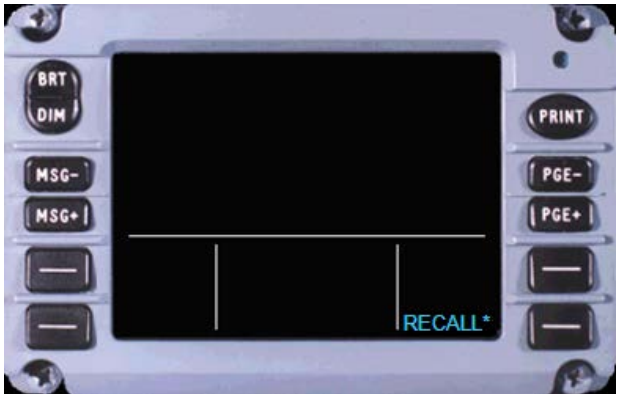
The Departure request on DCDU lies on two pages. The request cannot be sent until it has been entirely reviewed.
To review a message on several pages, scroll down with PGE+ key.

Page 2/2 is displayed and it is now possible to send the message: select SEND.

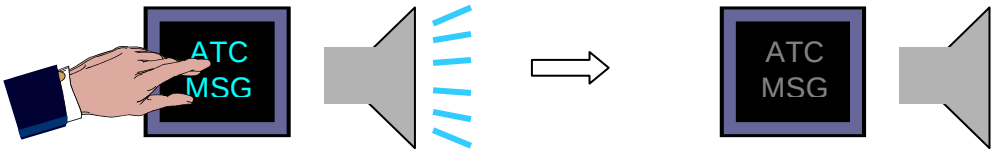
The message switches to green inverse video, indicating that is being sent. The first page is displayed, with the SENDING indication.

The SENT information indicates that the message has been received by the ground network. It is now possible to close the message. Closing the message stores it in the message log. Select CLOSE.

The default screen is displayed, and the previous message can be recalled if required.



The flashing ATC MSG pushbuttons and the aural warning (telephone ring) indicate that a message from the ATC has been received: extinguish the alert by pushing a pushbutton.

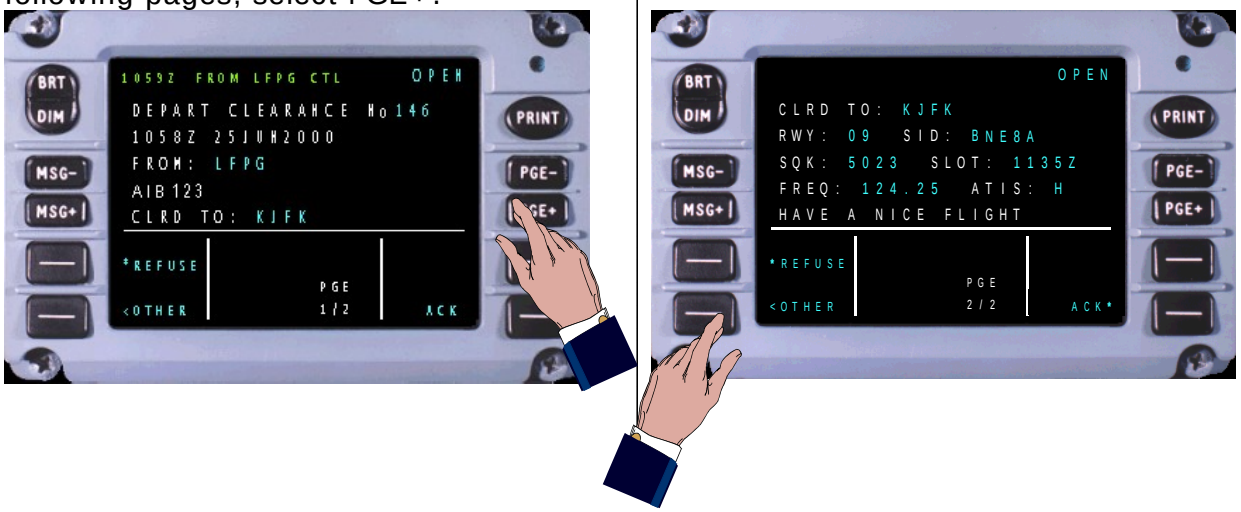


The received message is displayed on DCDU. As this new message contains several pages, "PGE 1/2" is displayed.

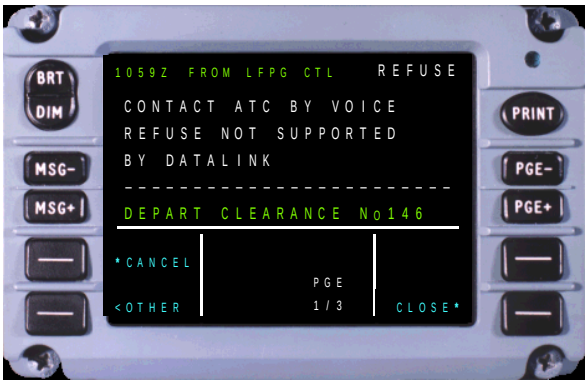
The received message is the departure clearance. Its status for the moment is OPEN because no answer has been prepared yet.

Proposed answers are REFUSE or ACK (i.e. ACKnowledge). It is not possible to select ACK before the whole clearance has been entirely read. To read the following pages, select PGE+.

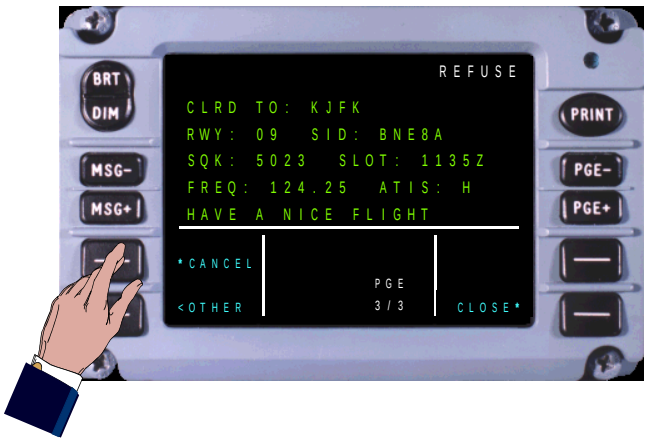
The REFUSE and ACK answers are now selectable. For this example, select REFUSE.



According to AEEC 623 protocol, the refusal is not supported by data link. Consequently, on DCDU, a reminder is inserted before the clearance. The received clearance is repeated on the following pages, in green: select PGE+ to see the clearance.



For training purposes, cancel the refusal. As no message has been sent to the ATC controller, the refusal is transparent to the ground. Select CANCEL.



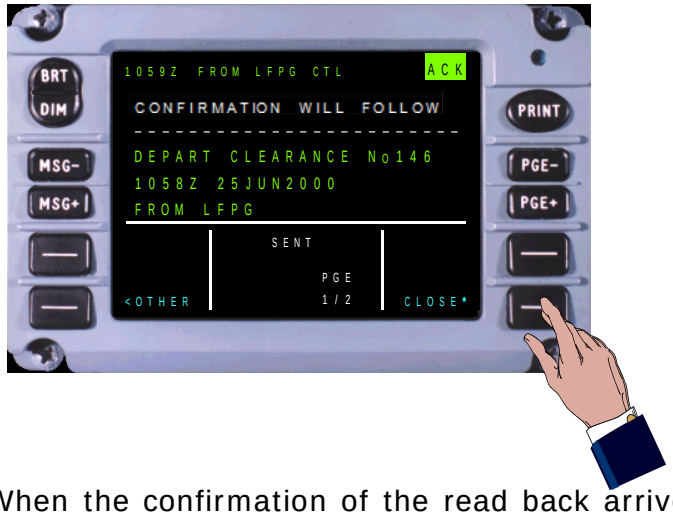
On each page of the refused clearance, the status "REFUSE" is displayed. However it is displayed in white, meaning that no downlink message has been sent.

The clearance is displayed with the 'open' status, and the ACK and REFUSE functions are proposed. To accept the clearance, select ACK.

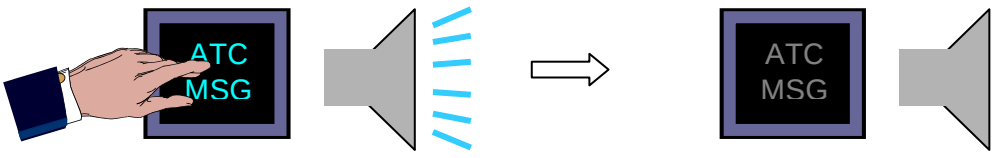
The message is displayed in the 'ACK' status. To send the Departure clearance read back, select SEND.

Temporarily the information SENDING is displayed.

When the ground service provider acknowledges reception of the message, the information 'sent' is displayed. At that time, the indication that the flight crew will receive a confirmation of its read back is displayed. Before the confirmation is received, it is highly recommended to close the message as usual.



When the confirmation of the read back arrives, it is indicated to the crew with the visual and aural alerts: extinguish the alerts by pressing the ATC MSG pushbutton.

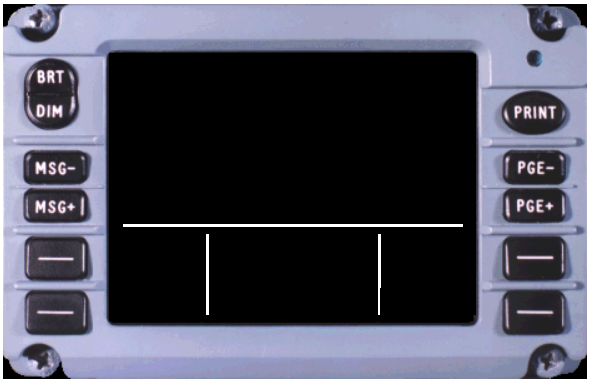


The departure clearance is confirmed. Close the message to clear the DCDU.

From an operational point of view, the flight crew shall execute the departure clearance **only** once the confirmation is received on-board.

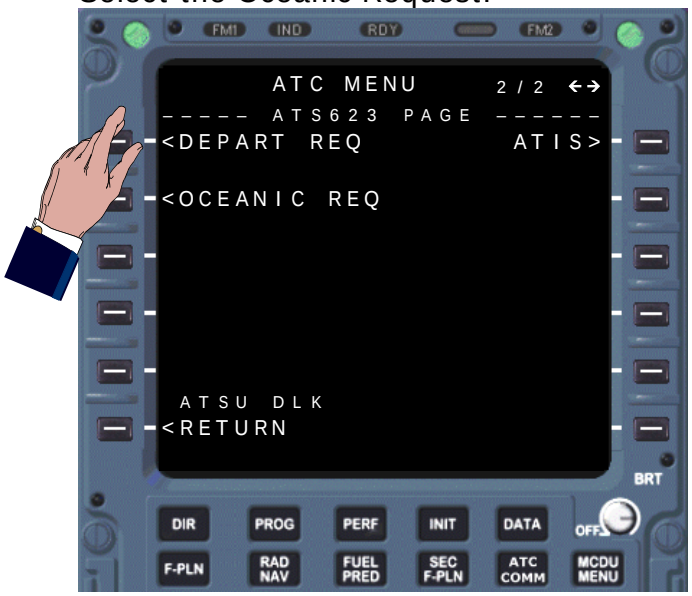
2. OCEANIC CLEARANCE - OCL

The ATS 623 applications do not require a preliminary notification process. Like the departure request, an oceanic clearance request may be performed even if the DCDU is blank (i.e. no active ATC is displayed).



The Oceanic Clearance application is an ATS 623 application: it can be reached through the ATC MENU by selecting the prompt ATSU, or directly by selecting the ATC COM hard key.

Access to ATS623 applications are provided on the second page of the ATC MENU.
Select the Oceanic Request.



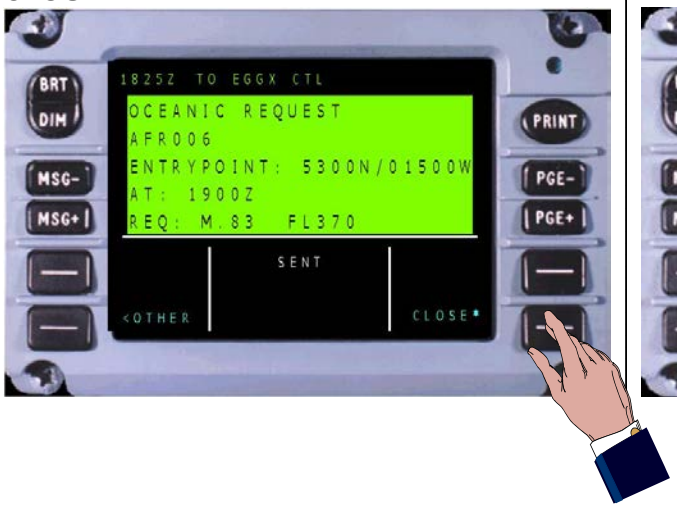
Amber boxes identify mandatory fields prior to sending the Oceanic Clearance request. The function REQ DISPL (to display the request on DCDU) will only be available (star displayed) when all mandatory fields are filled.
The flight number is displayed in small green font: it means that the flight number is provided by the FMS (small font) and is not modifiable (green colour).
Type in the required entry in the scratchpad and insert in the corresponding field.
Fill in all the fields.

As all mandatory fields are completed, REQ DISPL function becomes available. The request is now completed and may be transferred to DCDU. Select REQ DISPL. Like for the Departure Clearance, a free text may be appended to the request.

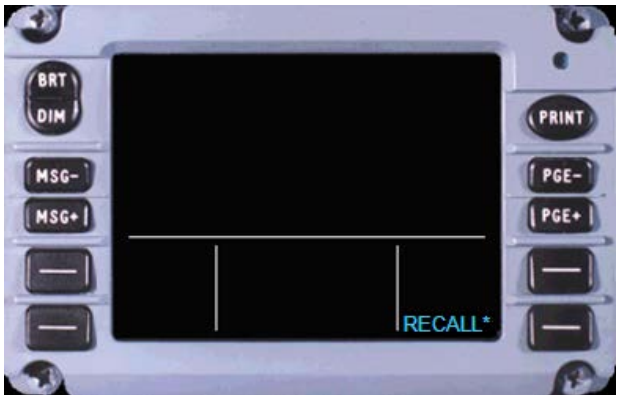
It is possible to send the message: select SEND.

The message switches to green inverse video, indicating that the request is being sent. The SENDING indication is displayed.

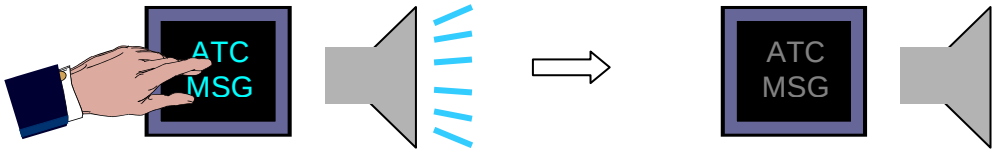
The SENT information indicates that the message has been received by the ground network. It is now possible to close the message. Closing the message stores it in the message log. Select CLOSE.



The default screen is displayed, and the previous message can be recalled if required.



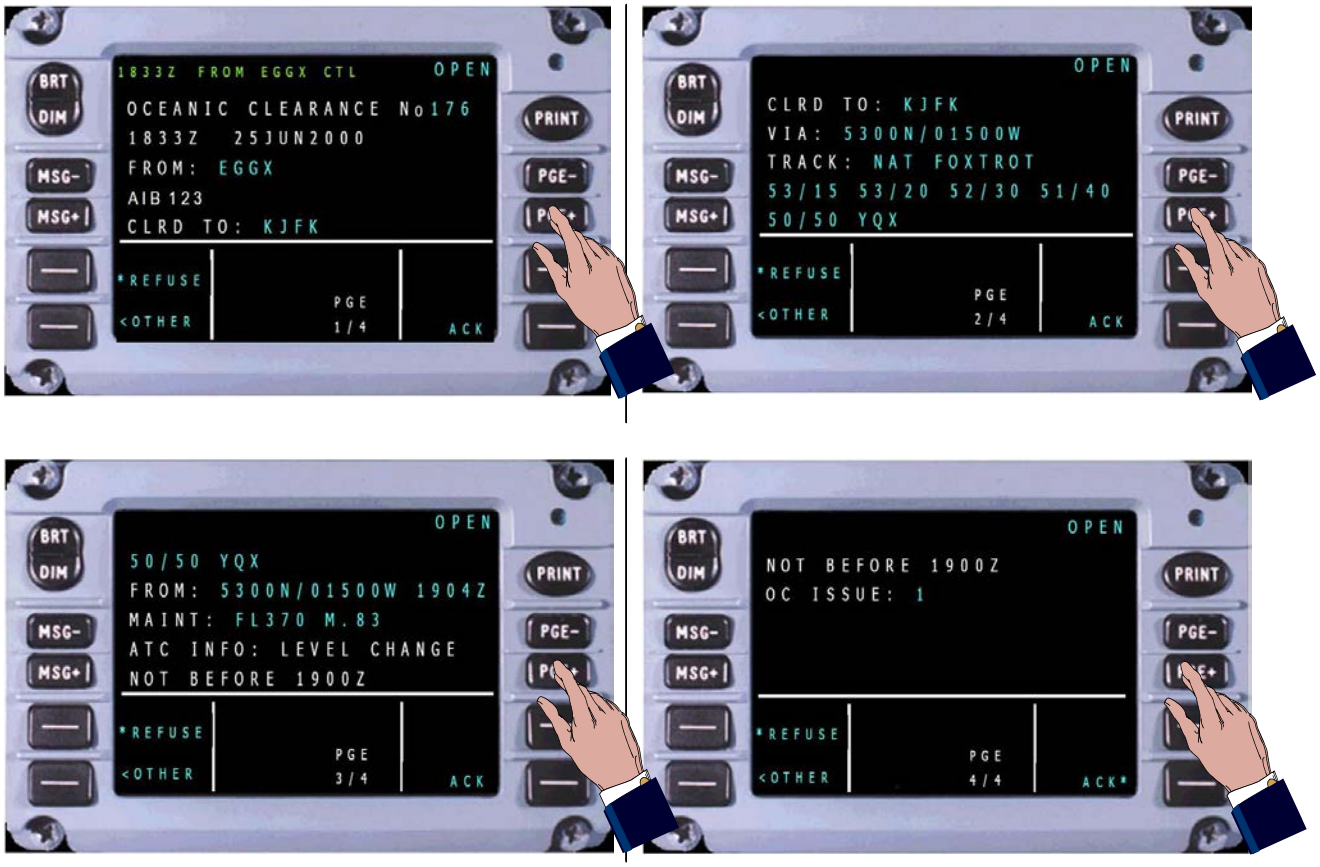
The flashing ATC MSG pushbuttons and the aural warning (telephone ring) indicate that a message from the ATC has been received: extinguish the alert by pushing a pushbutton.



The received message is the oceanic clearance. As this new message contains several pages, "PGE 1/4" is displayed.

The received message is the oceanic clearance. Its status for the moment is OPEN because no answer has been prepared yet.

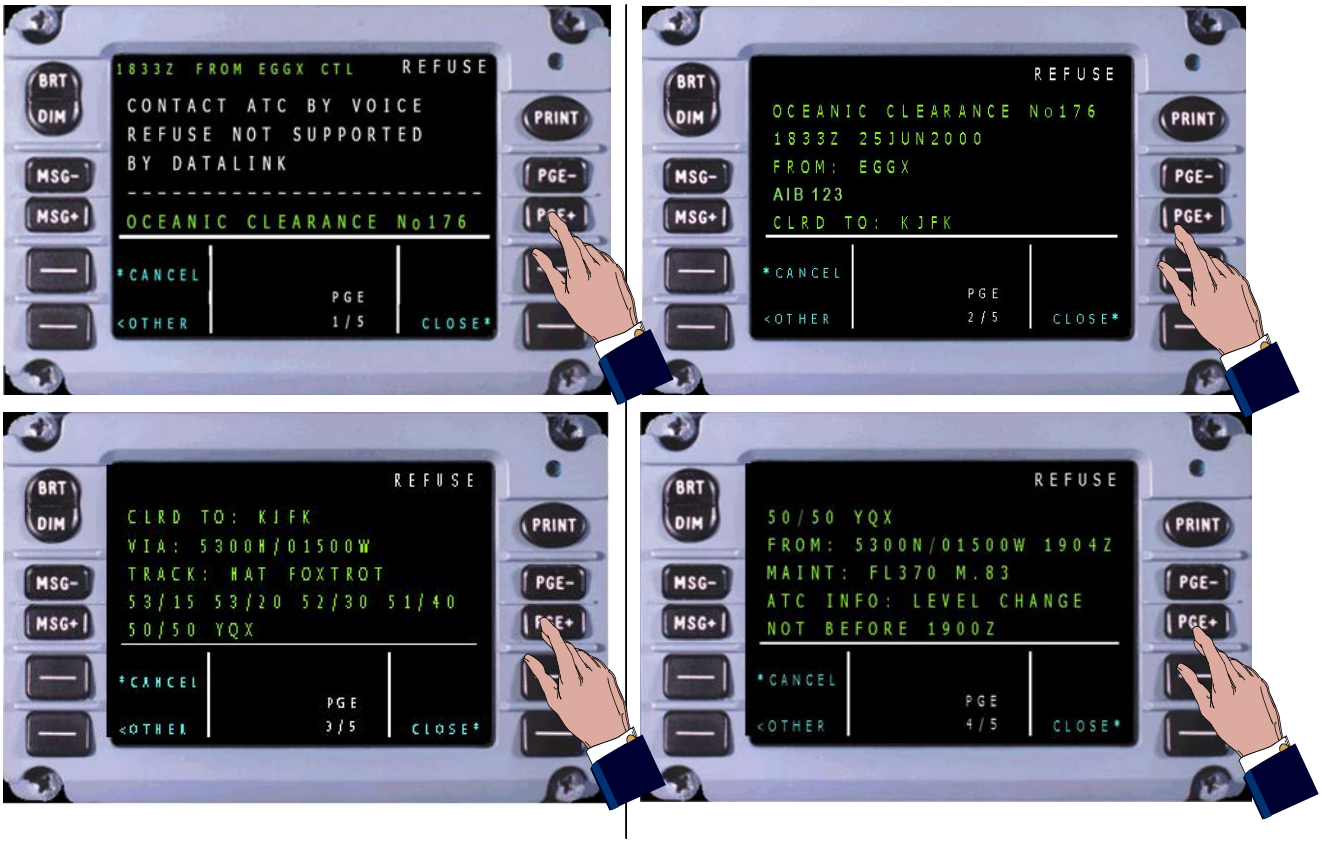
Proposed answers are REFUSE or ACK (i.e. ACKnowledge). It is not possible to select ACK before the whole clearance has been entirely read. To read the following pages, select PGE+.



The REFUSE and ACK answers are now selectable. For this example, select REFUSE.

According to AEEC 623 protocol, the refusal is not supported by data link. Consequently, on DCDU, a reminder is inserted before the clearance. The received clearance is repeated on the following pages, in green: select PGE+ to see the clearance.

On each page of the refused clearance, the status "REFUSE" is displayed. However it is displayed in white, meaning that no downlink message has been sent.



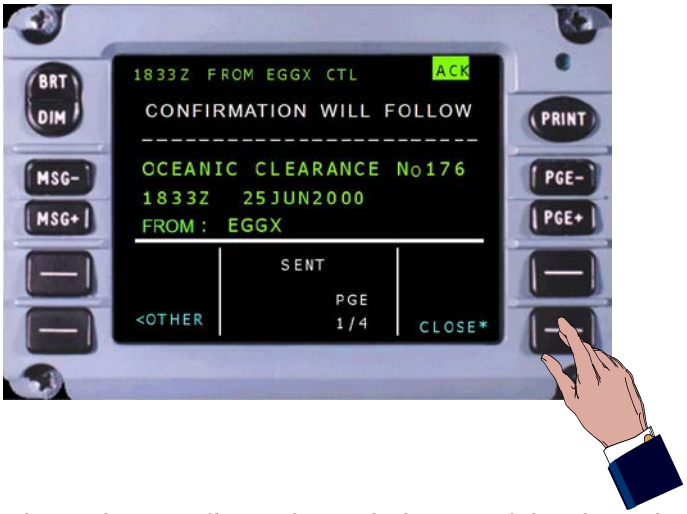
For training purposes, cancel the refusal. As no message has been sent to the ATC controller, the refusal is transparent to the ground. Select CANCEL.

The clearance is displayed with the 'open' status, and the ACK and REFUSE functions are proposed. To accept the clearance, select ACK.

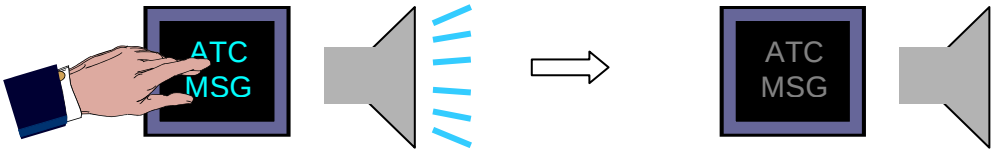
The message is displayed in the ACK status. To send the Oceanic clearance read back, select SEND.

Temporarily the information SENDING is displayed.

When the ground service provider acknowledges reception of the message, the information SENT is displayed. At that time, the indication that the flight crew will receive a confirmation of its read back is displayed. Before the confirmation is received, it is highly recommended to close the message as usual.



When the confirmation of the read back arrives, it is indicated to the crew with the visual and aural alerts: extinguish the alerts by pressing the ATC MSG pushbutton.

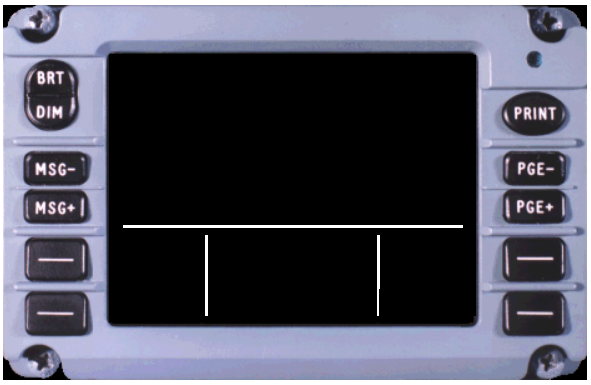


The oceanic clearance is confirmed. Close the message to clear the DCDU.

From an operational point of view, the flight crew shall execute the oceanic clearance **only** once the confirmation is received on-board.

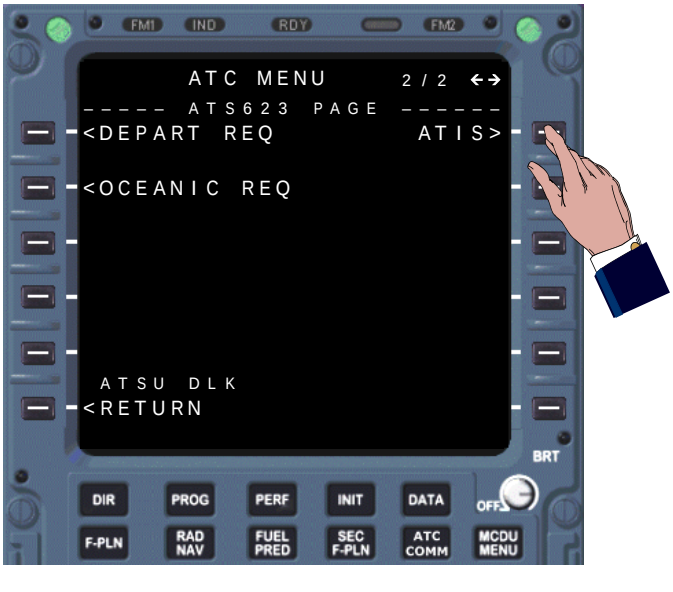
3. DIGITAL - AUTOMATIC TERMINAL INFORMATION SERVICE (D-ATIS)

The ATS 623 applications do not require a preliminary notification process. Like the departure request, a D-ATIS may be performed even if the DCDU is blank (i.e. no active ATC is displayed). One main HMI difference between D-ATIS and DCL/OCL is that D-ATIS messages are never displayed on DCDU whereas DCL/OCL messages exchanged with the ground are displayed on DCDU.



The D-ATIS application is an ATS 623 application: it can be reached through the ATC MENU by selecting the prompt ATSU, or directly by selecting the ATC COM hard key.

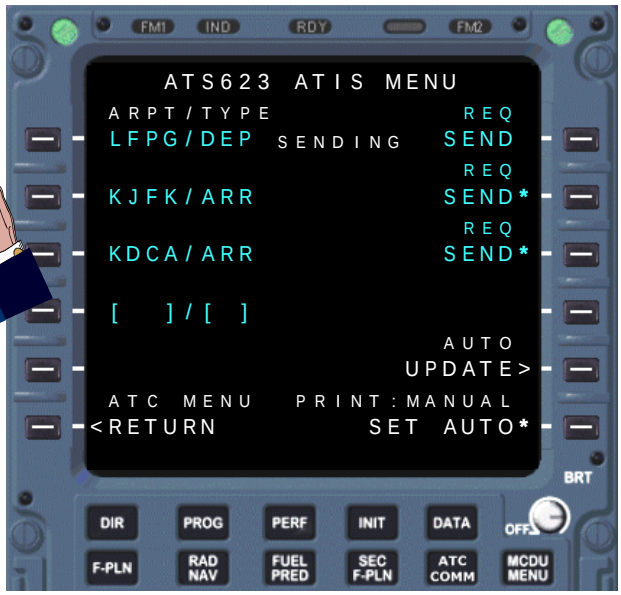
Access to ATS623 applications are provided on the second page of the ATC MENU.
Select the ATIS key.



The ATIS menu is displayed. The airports proposed by default are taken from the FMS flight plan: departure airport associated to a departure ATIS request, arrival and alternate airports associated to arrival ATIS requests. These can be overwritten. A fourth space is available for the addition of another airport and ATIS request type. Each request is by default MANUAL but they can be set to AUTO by selecting the AUTO UPDATE.

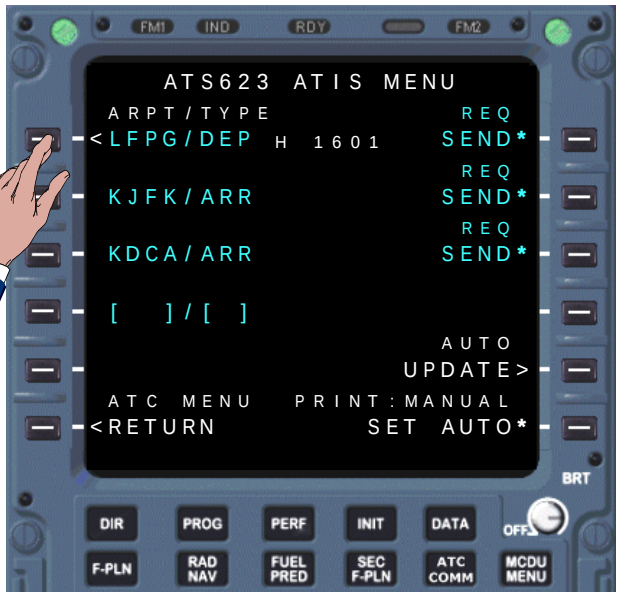
First let us request a manual ATIS for the departure airport LFPG: select REQ SEND. This is a difference between ATIS request and DCL/OCL request: the flight crew sends the ATIS request from the MCDU whereas the DCL/OCL request is sent from the DCDU.

After the selection REQ SEND, the ATIS request status is changed to SENDING.



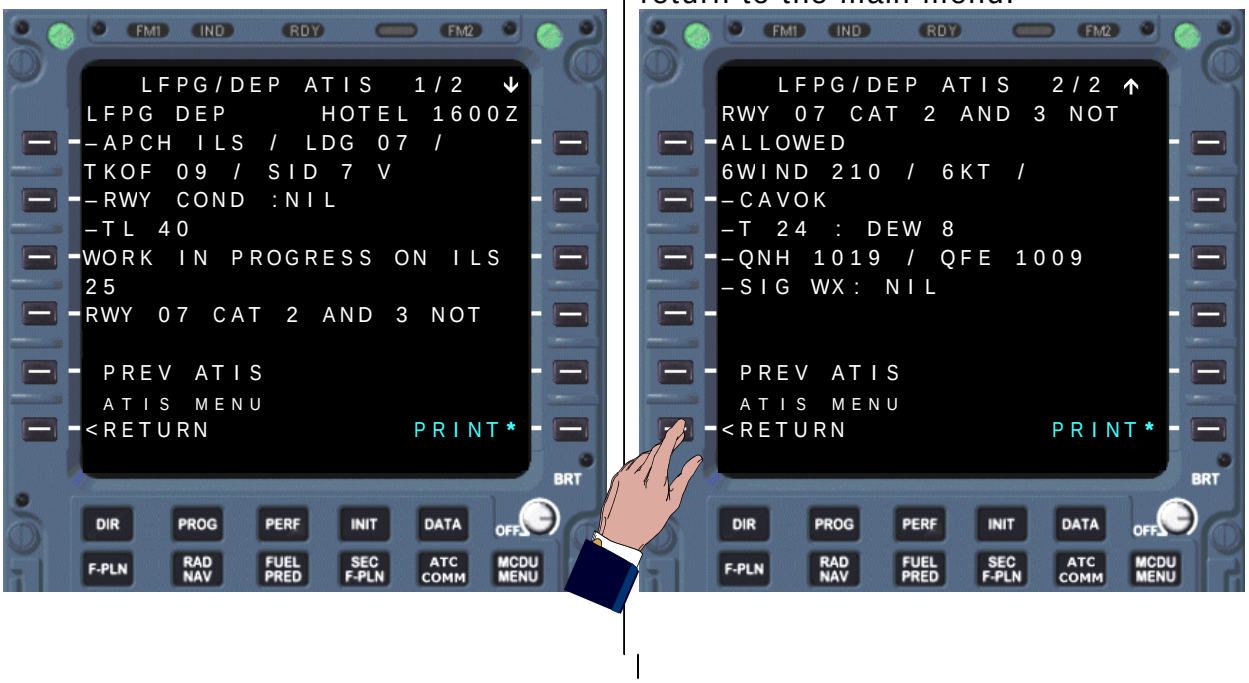
When the ground service provider acknowledges reception of the message, the information SENT is displayed

Once the ATIS report is received, its code and time of reception are displayed in front of the corresponding airport. The SEND is once again available for a new request. SELECT the airport to view the details.



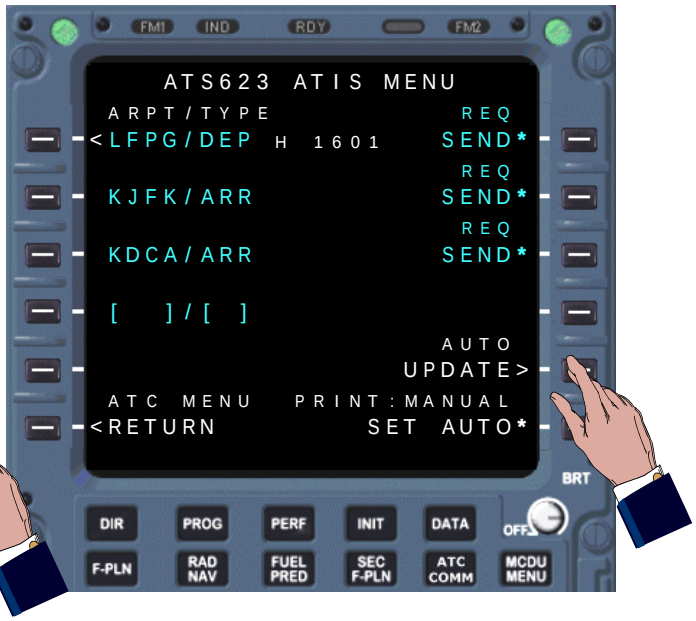
In this example, the ATIS report is displayed over 2 pages. Use the MCDU keys to go from one page to the other. The report can be printed in whole from either page.

The access to the previous ATIS report is not possible as there is no previous ATIS report. PREV ATIS is available as soon as several ATIS reports have been received. Select ATIS MENU RETURN to return to the main menu.

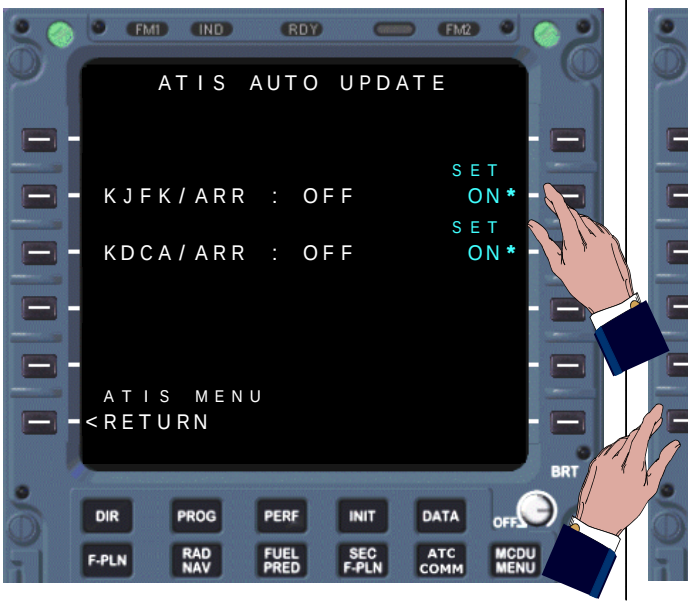


The PRINT function allows to configure the application in order to obtain an automatic printing of the ATIS report when it is received. Select SET AUTO to have all the report automatically printed upon reception.

The AUTO UPDATE function can only be requested for destination airport. Select AUTO UPDATE.



Only destination airports are proposed on the ATIS AUTO UPDATE page On the MCDU, select SET ON to activate the function. GO TO ATIS MENU TO SEND is displayed in the scratchpad, reminding that selecting the update function does not send the request.



In order to send the request, go back to the ATIS menu: select

On the MCDU the title has changed from REQ SEND to UPDATE SEND, indicating that the Update function is activated. Send the request.

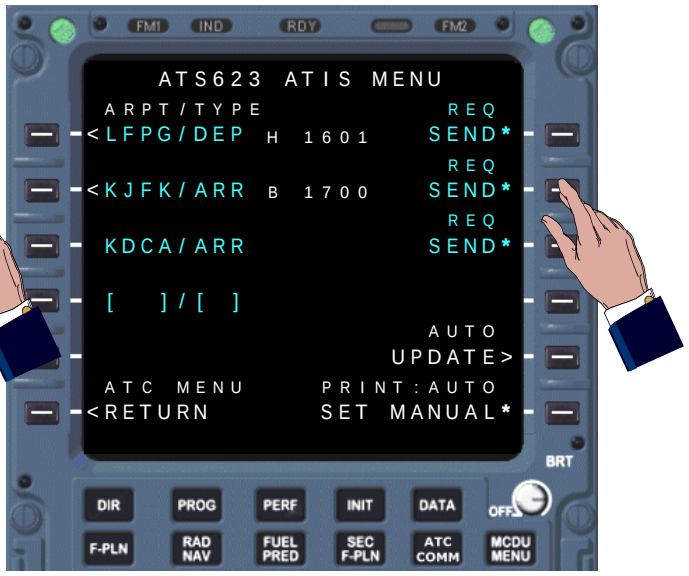
When the request has been received by the CSP, the SENDING status changes to SENT.

After the selection UPDATE SEND, the ATIS request status is changed to SENDING.

When the ATIS report is received:
-The key changes to UPDATE CANCEL, allowing to deactivate the update function
-Its code and time of reception are displayed. It can be accessed through the MCDU pages.
-As we have selected the auto print function before, this ATIS report will be automatically printed.

The flight crew can cancel the update contract by selecting UPDATE CANCEL Key. Select UPDATE CANCEL key.

The flight crew can select the REQ SEND key to request a new ATIS report.



APPENDIX J – A350/A380 ATS 623 OPERATIONAL SCENARIOS

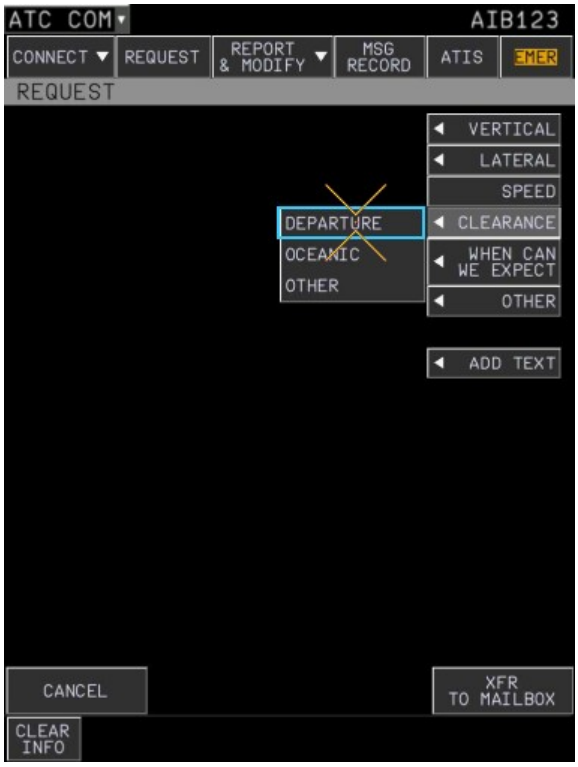
1. DEPARTURE CLEARANCE - DCL

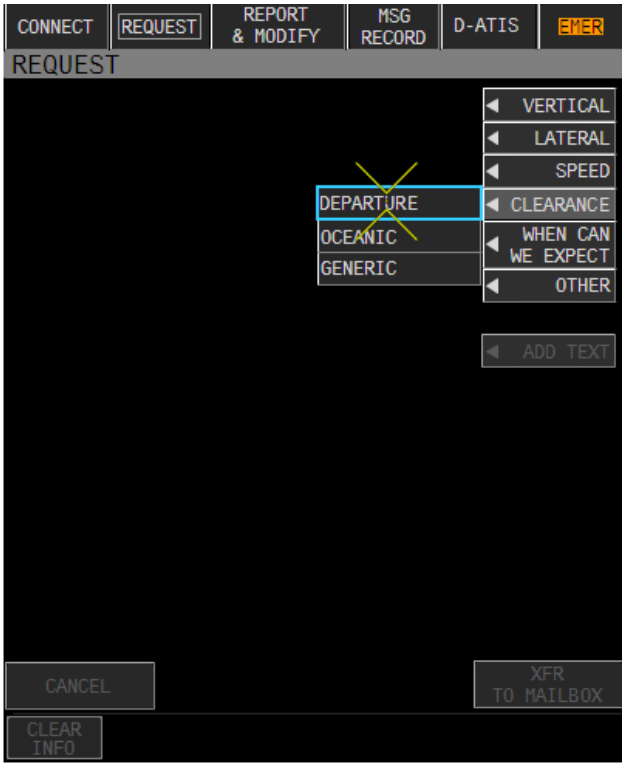
The ATS 623 applications do not require a preliminary notification process. As a consequence, a departure request may be performed even if the ATC mailbox is blank (i.e. no active ATC is displayed).

ATS 623 application is merged with CPDLC application from an HMI point of view. It means that Departure and Oceanic requests are available from the MFD ATC COM REQUEST page through the CLEARANCE pull-down menu. D-ATIS is part of dedicated MFD page ATIS on A380 FANS A+ (respectively page D-ATIS on A350/A380 FANS A+B).

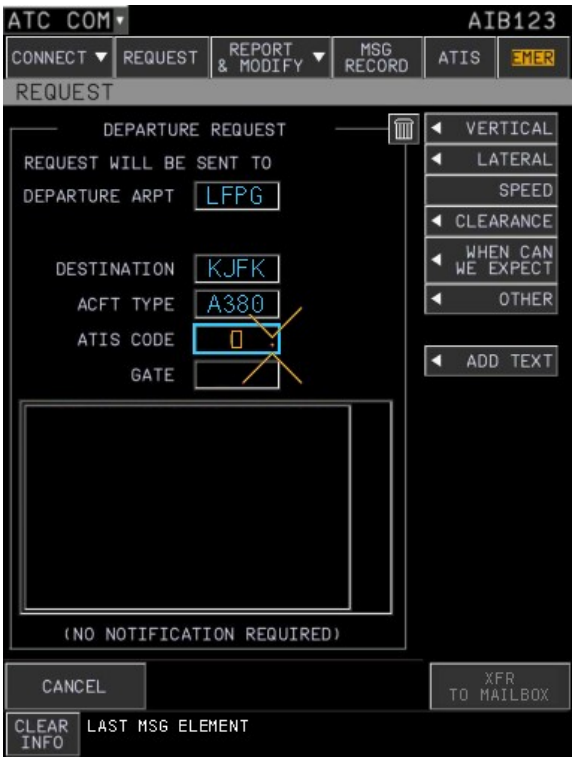
Select the Departure Request in the Clearance menu.

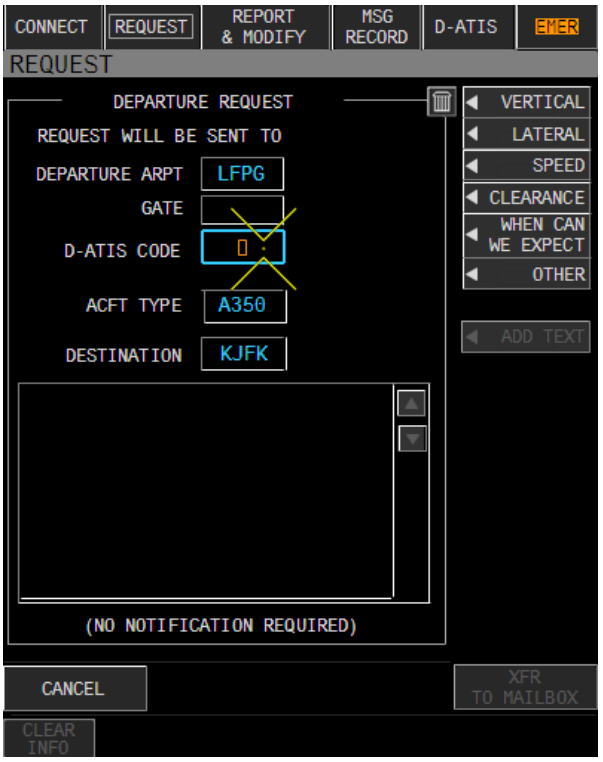
⇓ Interfaces on A380 FANS A+ ⇓ | ⇓ Interfaces on A350/A380 FANS A+B ⇓





Amber boxes identify mandatory fields prior to sending the Departure Clearance request. The XFR TO MAILBOX button is inactive (i.e. greyed) until all mandatory fields are filled.



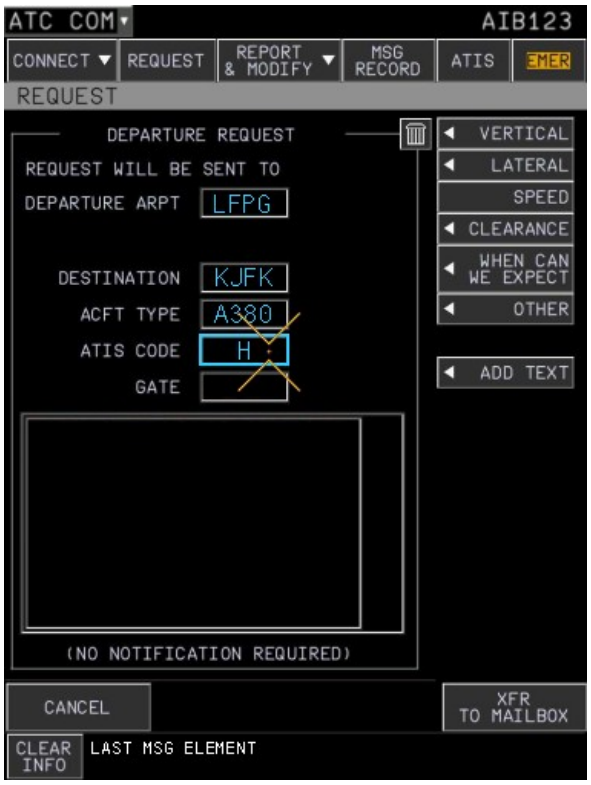


The flight number is permanently displayed in the upper right corner of the MFD. Consequently, the flight number is not repeated in this page.

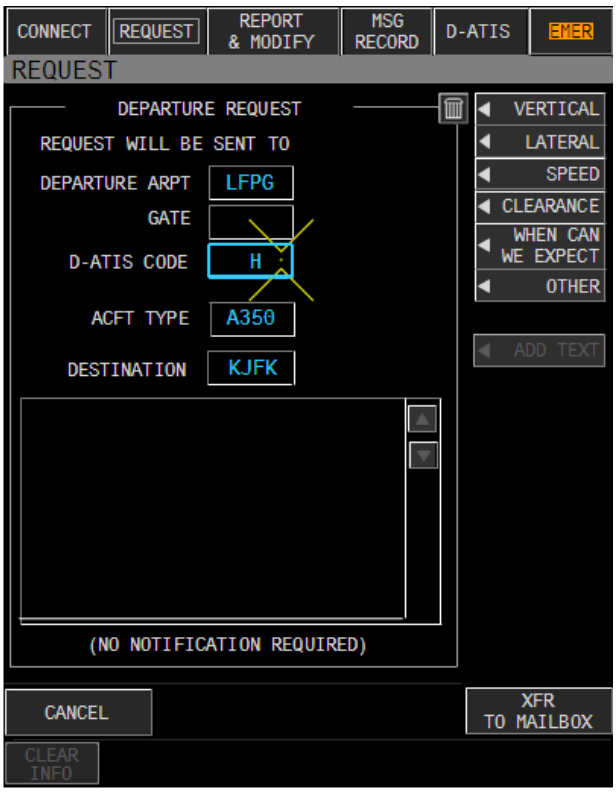
Departure and destination airports are the ones entered into the FMS. As they are mandatory, if not available, amber boxes would be displayed instead.

The aircraft type is automatically filled by the application.
Enter the ATIS code.

⇓ Interfaces on A380 FANS A+ ⇓

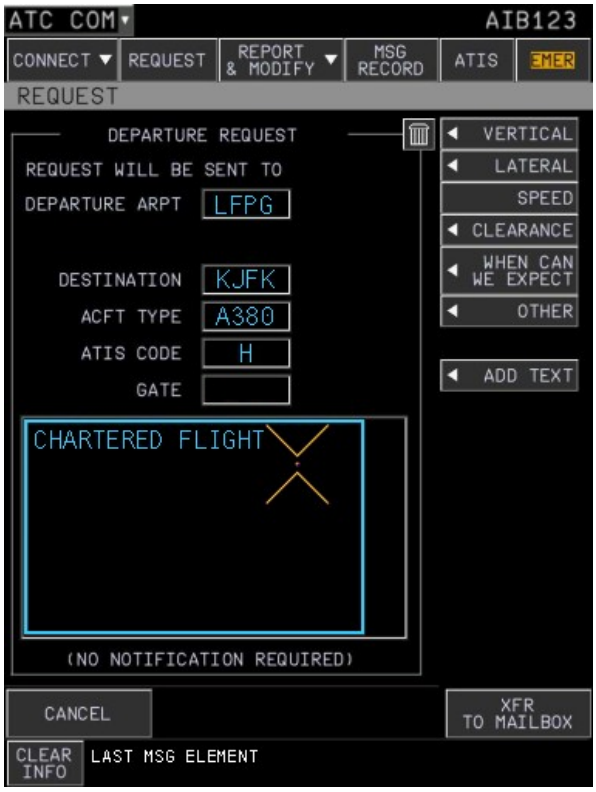


⇓ Interfaces on A350/A380 FANS A+B ⇓

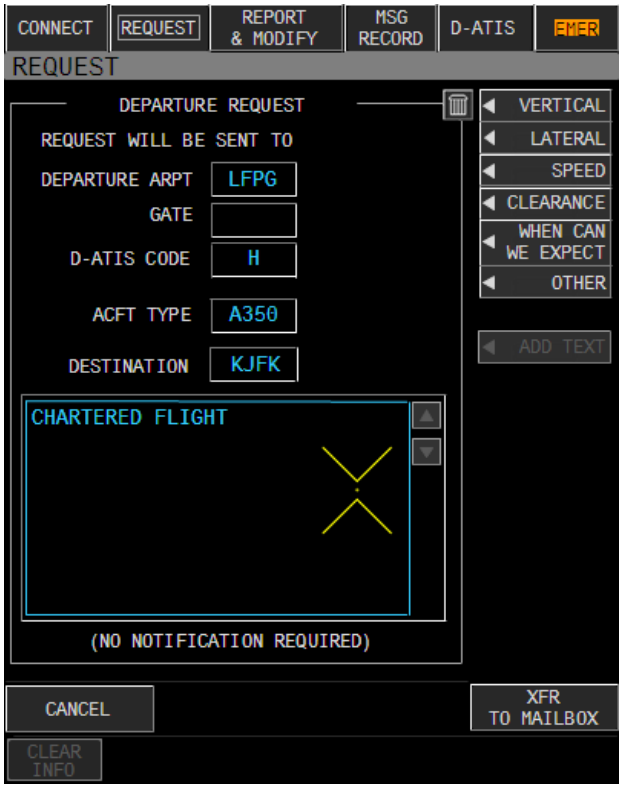


As all mandatory fields are completed, XFR TO MAILBOX function becomes available. A free text may be also appended to the request.

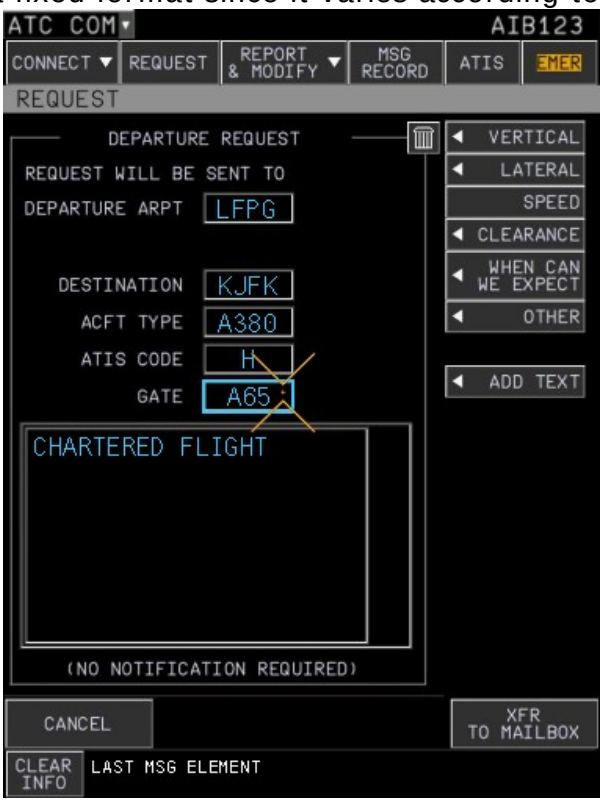
⇓ Interfaces on A380 FANS A+ ⇓

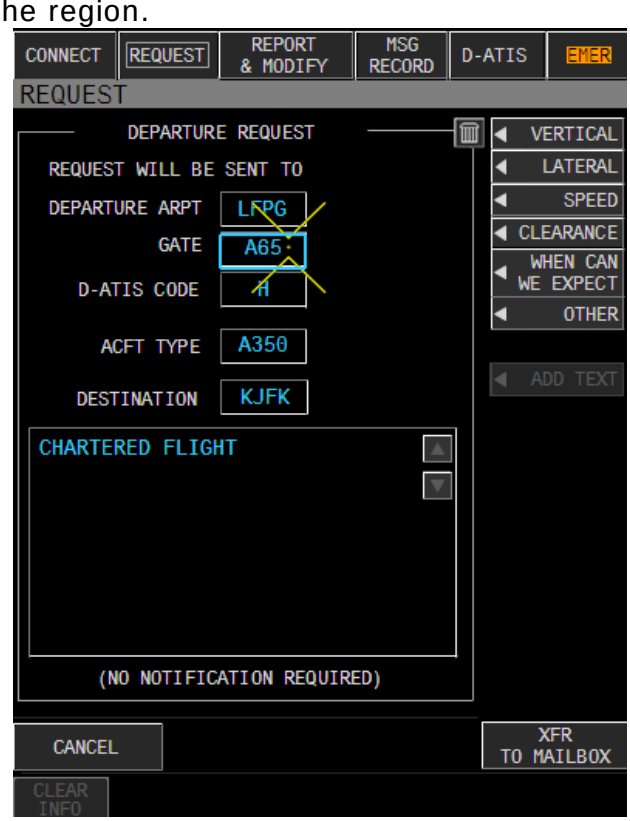


⇓ Interfaces on A350/A380 FANS A+B ⇓



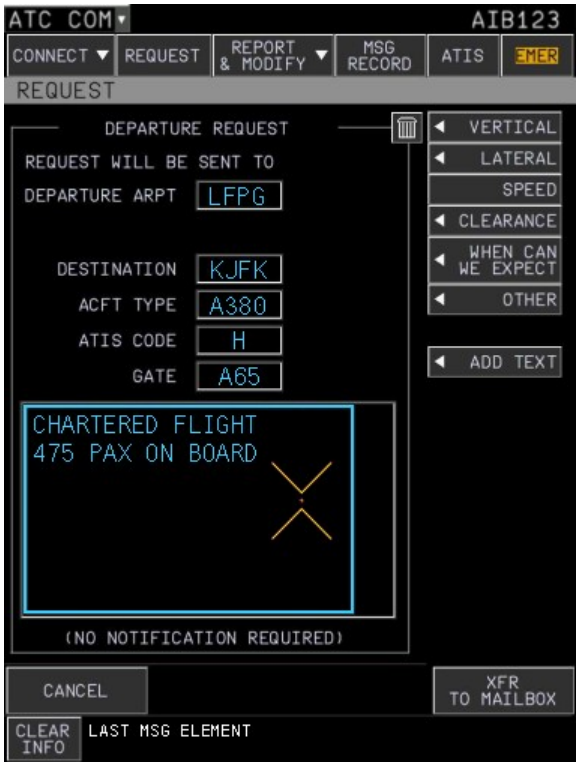
Type in the aircraft gate number (optional parameter) and insert it. It does not have a fixed format since it varies according to the region.





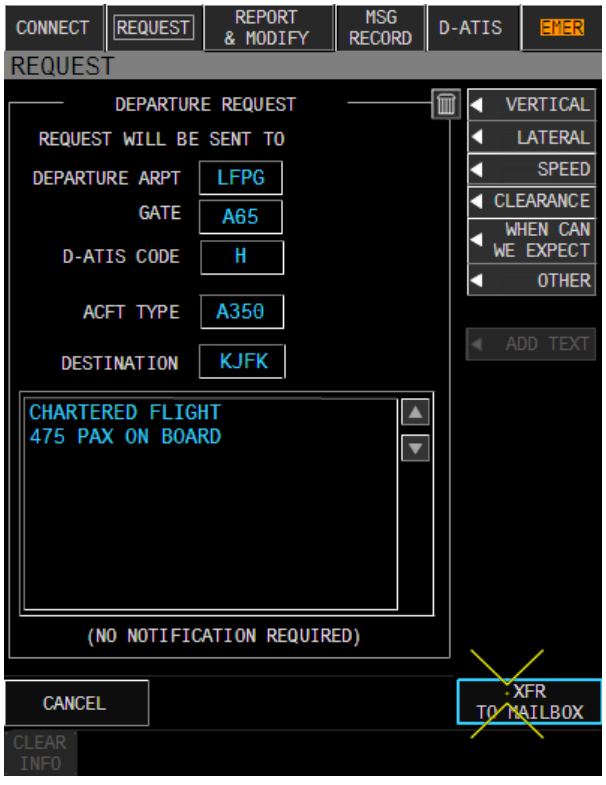
To add free text, type free text in the corresponding field is accessible on the same MFD page.

⇓ Interfaces on A380 FANS A+ ⇓



⇓ Interfaces on A350/A380 FANS A+B ⇓

The request is now completed and may be transferred to ATC mailbox.



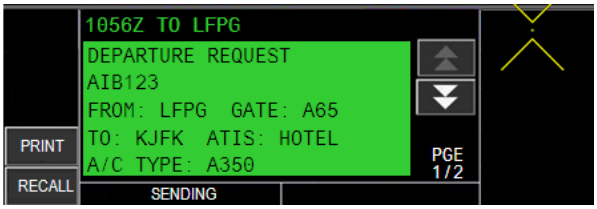
The Departure request on ATC mailbox lies on two pages.
To review a message on several pages, scroll down with button with double downward arrows.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

Page 2/2 is displayed and it is now possible to send the message: select SEND.

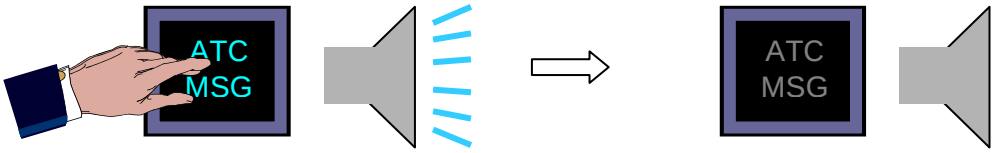
The message switches to green inverse video, indicating that is being sent. The first page is displayed, with the SENDING indication.



The SENT information indicates that the message has been received by the ground network. It is now possible to close the message. Closing the message stores it in the message log. Select CLOSE.

The default screen is displayed, and the previous message can be recalled if required.

The flashing ATC MSG pushbuttons and the aural warning (telephone ring) indicate that a message from the ATC has been received: extinguish the alert by pushing a pushbutton.



The received message is displayed on ATC mailbox. As this new message contains several pages, "PGE 1/2" is displayed.

The received message is the departure clearance. Its status for the moment is OPEN because no answer has been prepared yet.

Proposed answers are REFUSE or ACK (i.e. ACKnowledge). It is not possible to select ACK before the whole clearance has been entirely read. To read the following pages, select button with double downward arrows.

⇓ Interfaces on A380 FANS A+ ⇓

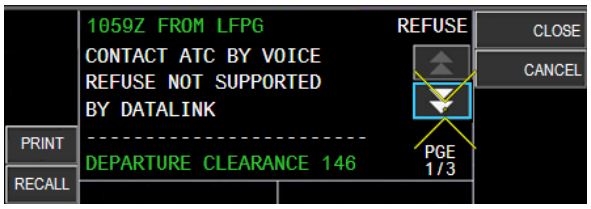
⇓ Interfaces on A350/A380 FANS A+B ⇓

The REFUSE and ACK answers are now selectable. For this example, select REFUSE.

According to AEEC 623 protocol, the refusal is not supported by data link. Consequently, on ATC mailbox, a reminder is inserted before the clearance. The received clearance is repeated on the following pages, in green: select button with double downward arrows to see the clearance.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓



On each page of the refused clearance, the status "REFUSE" is displayed. However it is displayed in white, meaning that no downlink message has been sent.

For training purposes, cancel the refusal. As no message has been sent to the ATC controller, the refusal is transparent to the ground. Select CANCEL.

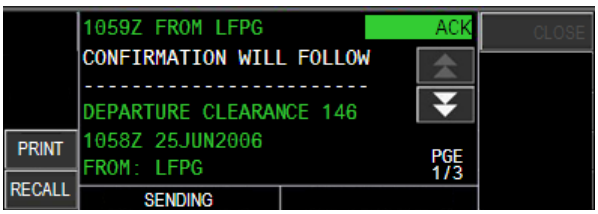
The clearance is displayed with the 'open' status, and the ACK and REFUSE functions are proposed. To accept the clearance, select ACK.

The message is displayed in the 'ACK' status. To send the Departure clearance read back, select SEND.

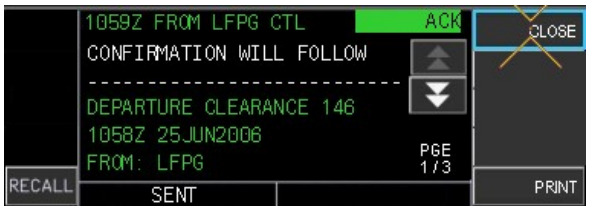
Temporarily the information SENDING is displayed.

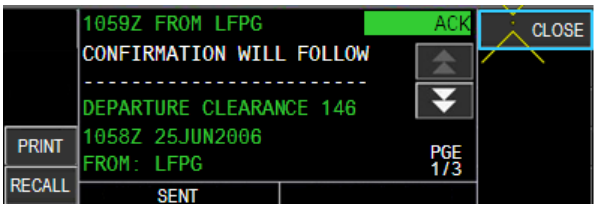
⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

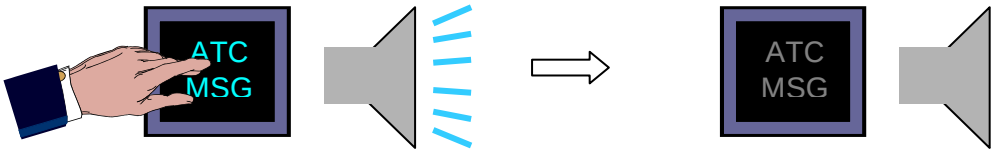


When the ground service provider acknowledges reception of the message, the information 'sent' is displayed. At that time, the indication that the flight crew will receive a confirmation of its read back is displayed. Before the confirmation is received, it is highly recommended to close the message as usual.





When the confirmation of the read back arrives, it is indicated to the crew with the visual and aural alerts: extinguish the alerts by pressing the ATC MSG pushbutton.



The departure clearance is confirmed. Close the message to clear the ATC mailbox.

> From an operational point of view, the flight crew shall execute the departure clearance **only** once the confirmation is received on-board.

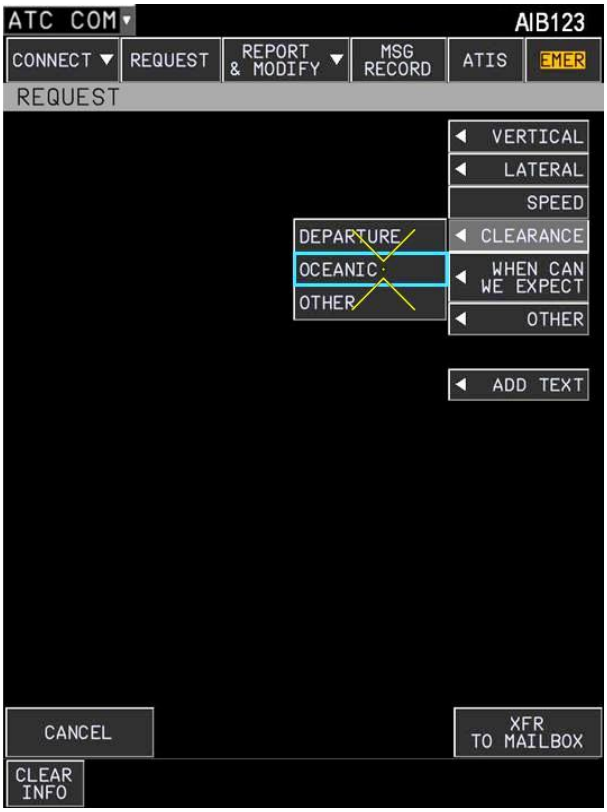
2. OCEANIC CLEARANCE - OCL

The ATS 623 applications do not require a preliminary notification process. As a consequence, an oceanic request may be performed even if the ATC mailbox is blank (i.e. no active ATC is displayed).

ATS 623 application is merged with CPDLC application from an HMI point of view. It means that Departure and Oceanic requests are available from the MFD ATC COM REQUEST page through the CLEARANCE pull-down menu. D-ATIS is part of dedicated MFD page D-ATIS on A380 FANS A+ (respectively page D-ATIS on A350/A380 FANS A+B).

Select the Oceanic Request in the Clearance menu.

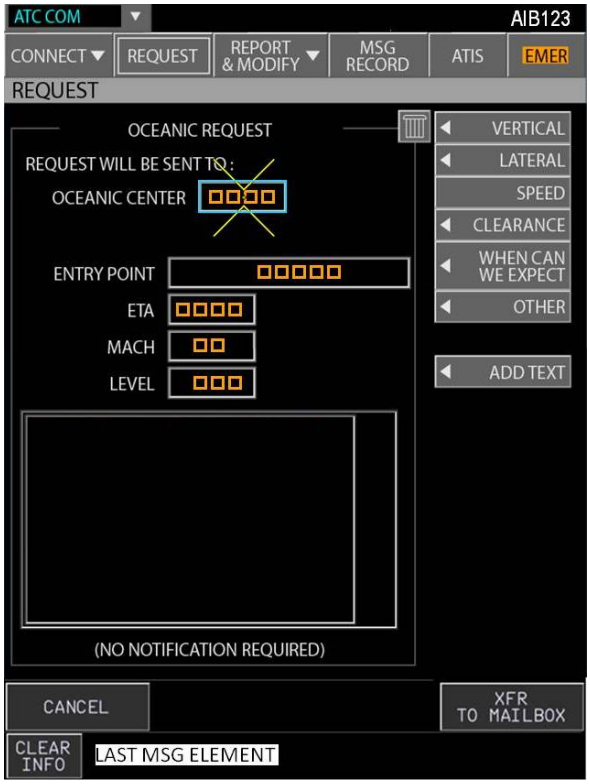
⇓ Interfaces on A380 FANS A+ ⇓

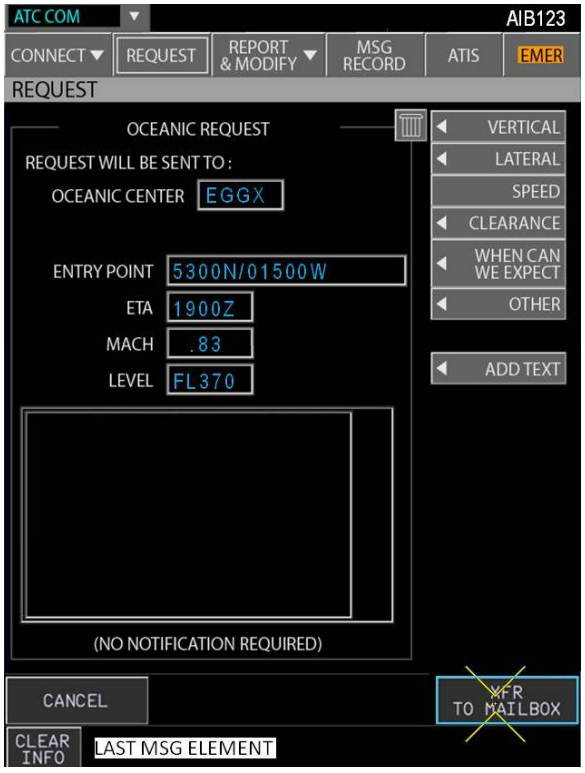


⇓ Interfaces on A350/A380 FANS A+B ⇓

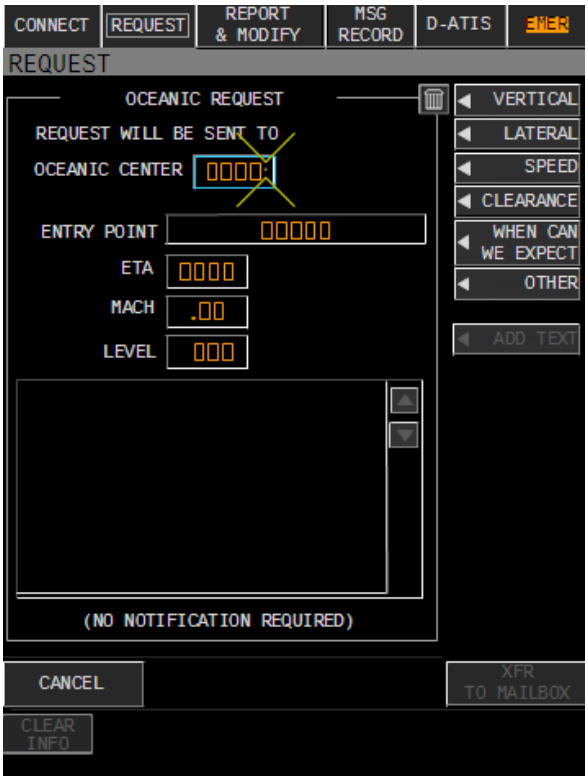
Amber boxes identify mandatory fields prior to sending the Oceanic Clearance request. The XFR TO MAILBOX button is inactive (i.e. greyed) until all mandatory fields are filled. Enter all the fields.

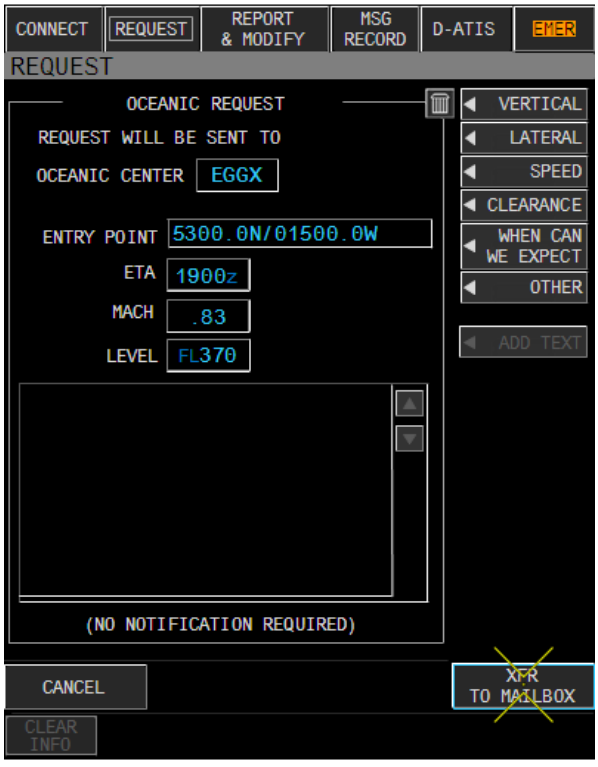
⇓ Interfaces on A380 FANS A+ ⇓





⇓ Interfaces on A350/A380 FANS A+B ⇓



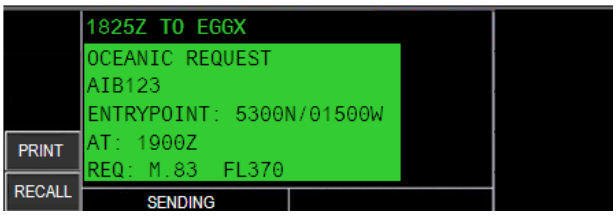


The request is now completed and may be transferred to ATC mailbox. Select XFR TO MAILBOX.

⇓ Interfaces on A380 FANS A+ ⇓

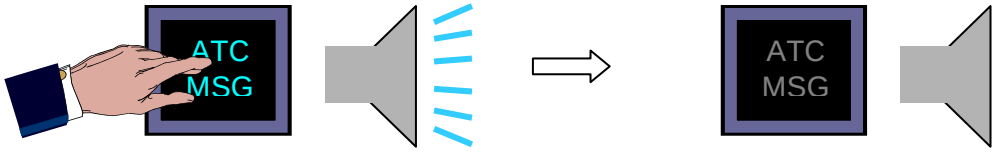
⇓ Interfaces on A350/A380 FANS A+B ⇓

The message switches to green inverse video, indicating that the request is being sent. The SENDING indication is displayed.



The SENT information indicates that the message has been received by the ground network. It is now possible to close the message. Closing the message stores it in the message log. Select CLOSE.

The flashing ATC MSG pushbuttons and the aural warning (telephone ring) indicate that a message from the ATC has been received: extinguish the alert by pushing a pushbutton.



The received message is displayed on ATC mailbox. As this new message contains several pages, "PGE 1/2" is displayed.

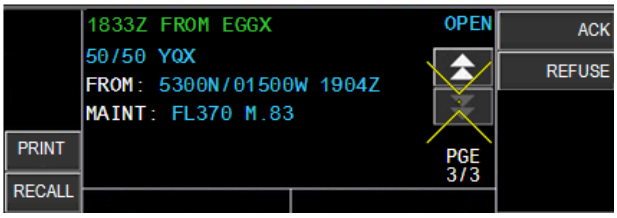
The received message is the oceanic clearance. Its status for the moment is OPEN because no answer has been prepared yet.

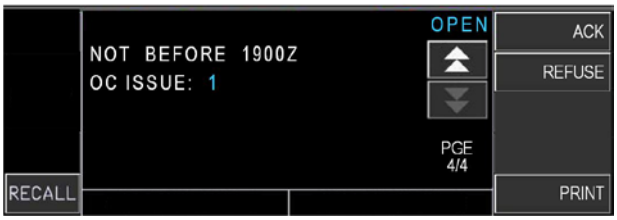
Proposed answers are REFUSE or ACK (i.e. ACKnowledge). It is not possible to select ACK before the whole clearance has been entirely read. To read the following pages, select button with double downward arrows.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

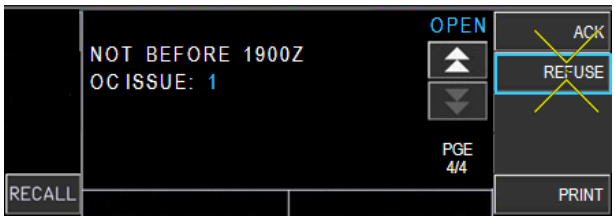
Proposed answers are REFUSE or ACK (i.e. ACKnowledge). It is not possible to select ACK before the whole clearance has been entirely read. To read the following pages, select button with double downward arrows.



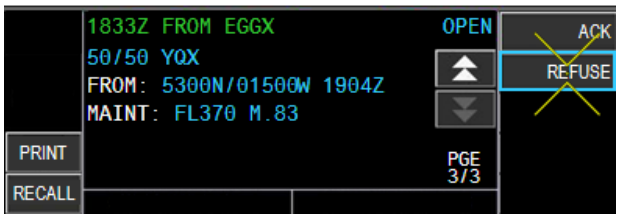


The REFUSE and ACK answers are now selectable. For this example, select REFUSE.

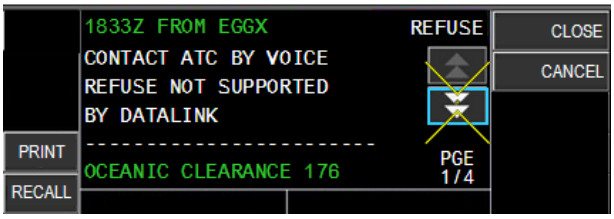
⇓ Interfaces on A380 FANS A+ ⇓



⇓ Interfaces on A350/A380 FANS A+B ⇓

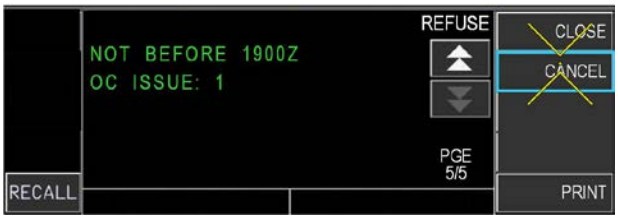


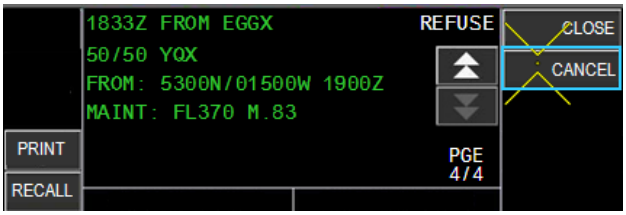
According to AEEC 623 protocol, the refusal is not supported by data link. Consequently, on ATC mailbox, a reminder is inserted before the clearance. The received clearance is repeated on the following pages, in green: select button with double downward arrows to see the clearance.



On each page of the refused clearance, the status "REFUSE" is displayed. However it is displayed in white, meaning that no downlink message has been sent.

For training purposes, cancel the refusal. As no message has been sent to the ATC controller, the refusal is transparent to the ground
Select CANCEL.





The clearance is displayed with the 'open' status, and the ACK and REFUSE functions are proposed. To accept the clearance, select ACK.

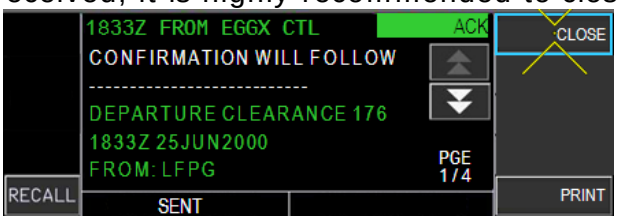
The message is displayed in the ACK status. To send the Oceanic clearance read back, select SEND.

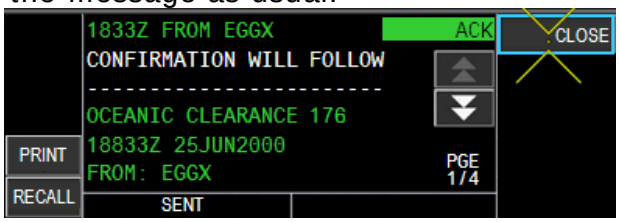
⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

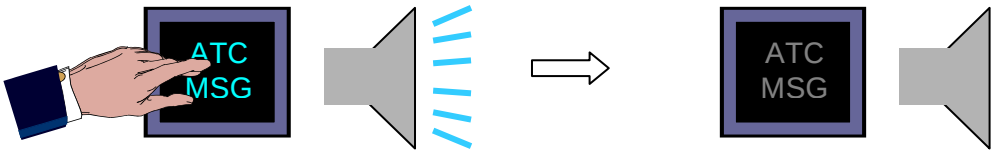
Temporarily the information SENDING is displayed.

When the ground service provider acknowledges reception of the message, the information SENT is displayed. At that time, the indication that the flight crew will receive a confirmation of its read back is displayed. Before the confirmation is received, it is highly recommended to close the message as usual.





When the confirmation of the read back arrives, it is indicated to the crew with the visual and aural alerts: extinguish the alerts by pressing the ATC MSG pushbutton.



The oceanic clearance is confirmed. Close the message to clear the ATC mailbox.

> From an operational point of view, the flight crew shall execute the oceanic clearance **only** once the confirmation is received on-board.

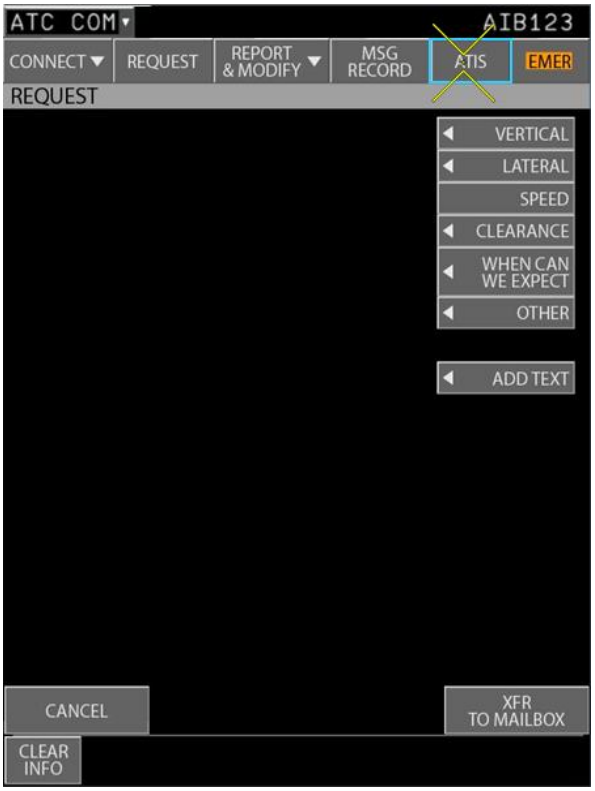
3. DIGITAL - AUTOMATIC TERMINAL INFORMATION SERVICE (D-ATIS)

The ATS 623 applications do not require a preliminary notification process. As a consequence, a D-ATIS request may be performed even if the ATC mailbox is blank (i.e. no active ATC is displayed). One main HMI difference between D-ATIS and DCL/OCL is that D-ATIS messages are never displayed on ATC mailbox whereas DCL/OCL messages exchanged with the ground are displayed on ATC mailbox.

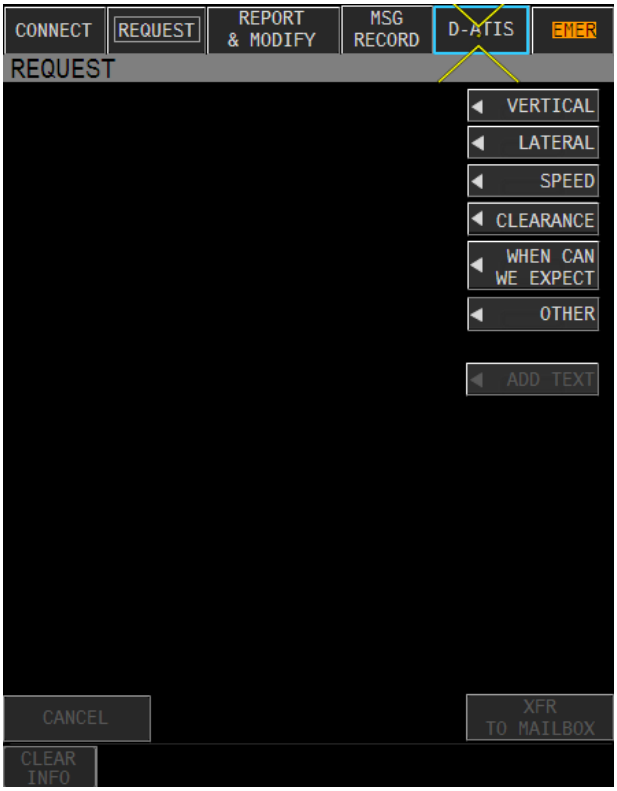
ATS 623 application is merged with CPDLC application from an HMI point of view. It means that Departure and Oceanic requests are available from the MFD ATC COM REQUEST page through the CLEARANCE pull-down menu. D-ATIS is part of dedicated MFD page ATIS on A380 FANS A+ (respectively page D-ATIS on A350 FANS A+B).

Select the ATIS page on A380 FANS A+ (respectively D-ATIS page on A350/A380 FANS A+B).

⇓ Interfaces on A380 FANS A+ ⇓



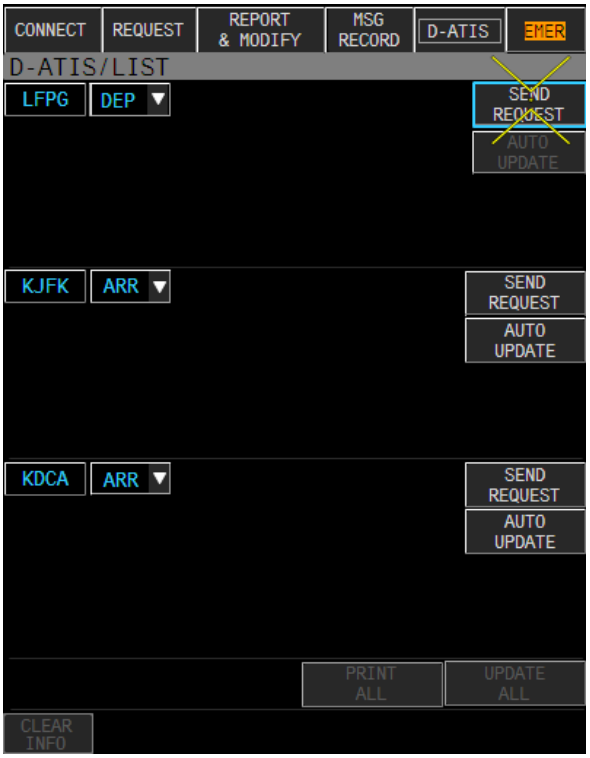
⇓ Interfaces on A350/A380 FANS A+B ⇓



The ATIS menu is displayed. The airports proposed by default are taken from the FMS flight plan: departure airport associated to a departure ATIS request, arrival and alternate airports associated to arrival ATIS requests. These can be overwritten. A fourth space is available for the addition of another airport and ATIS request type. Each request is by default MANUAL but they can be set to AUTO by selecting the AUTO UPDATE. First let us request a manual ATIS for the departure airport: select SEND REQUEST.

⇓ Interfaces on A380 FANS A+ ⇓

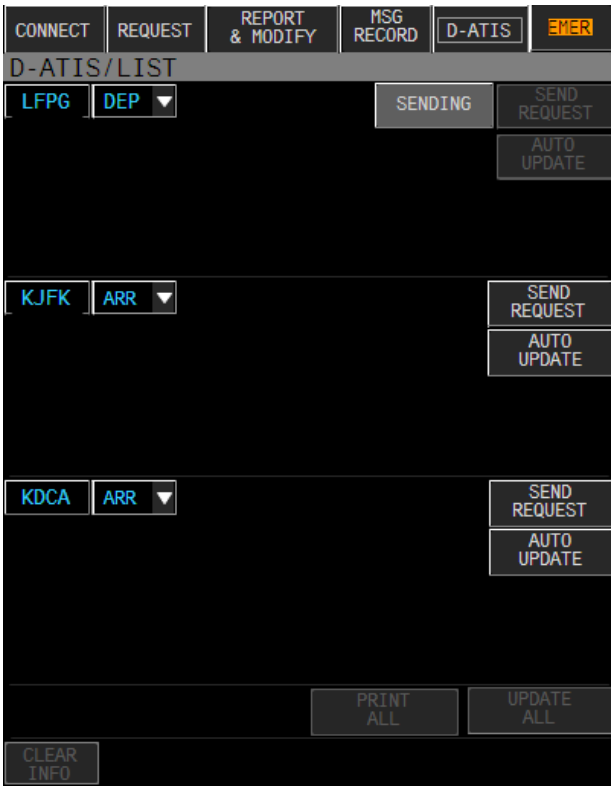
⇓ Interfaces on A350/A380 FANS A+B ⇓



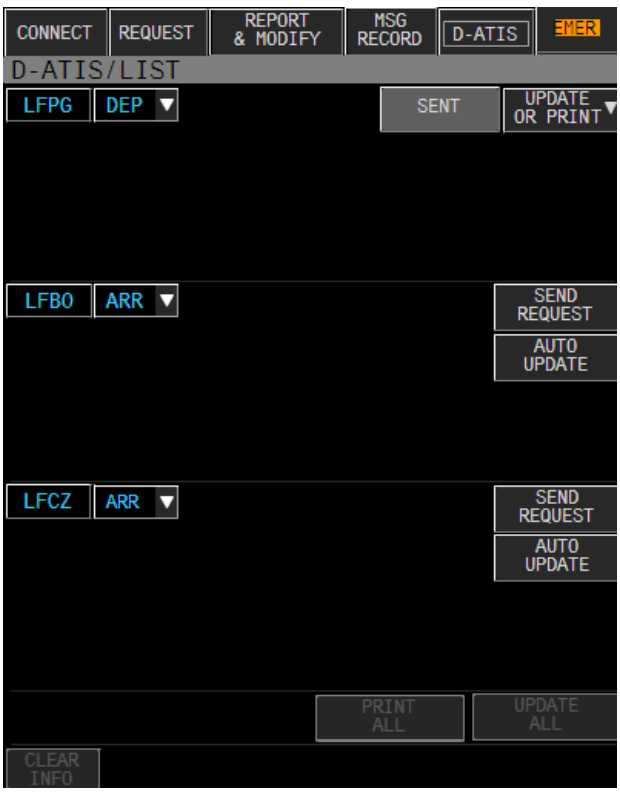
After the selection SEND REQUEST, the ATIS request status is changed to SENDING.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B ⇓

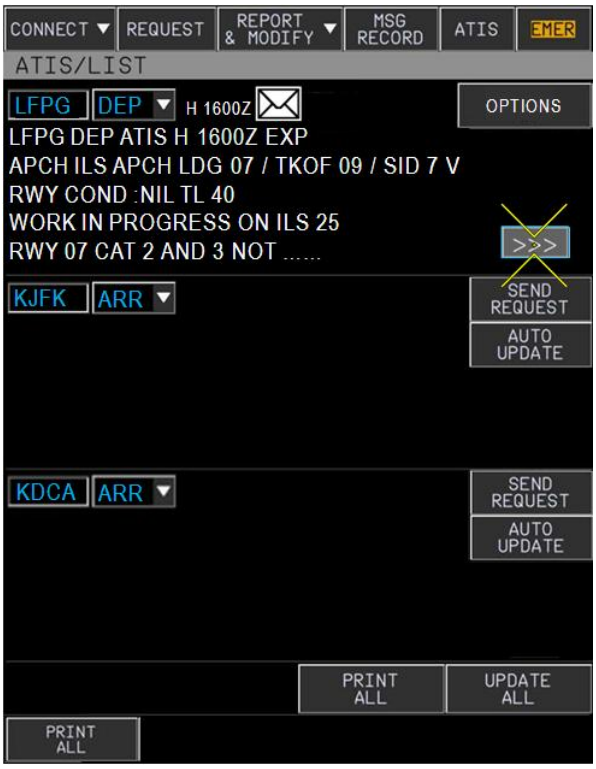


When the request has been received by the CSP, the SENDING information changes to SENT.

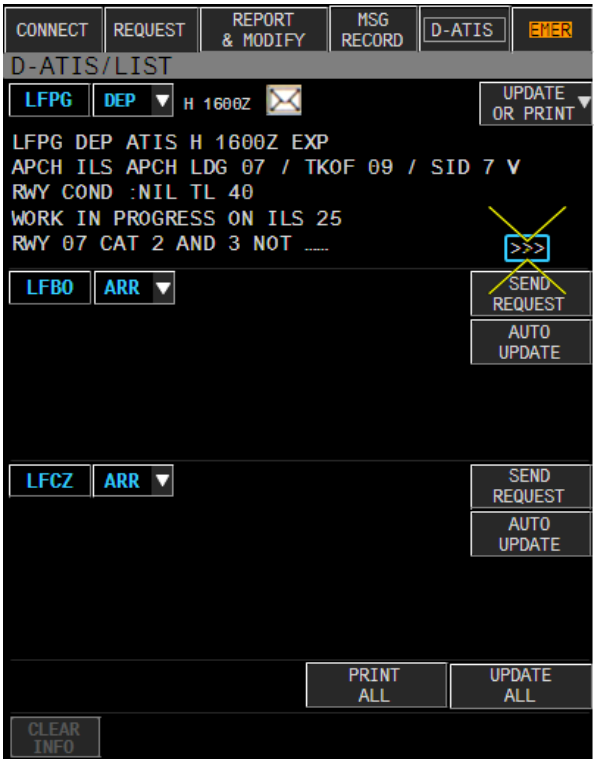


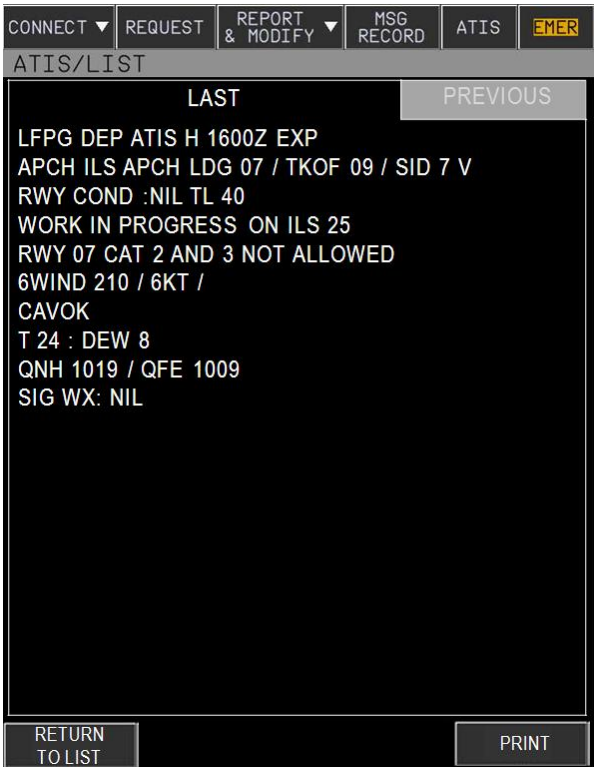
Once the ATIS report is received, a new message icon is displayed with the ATIS code and time of reception in front of the corresponding airport. A part of the ATIS message is displayed. To view the entire message, select the button with the triple rightward arrows (>>>).

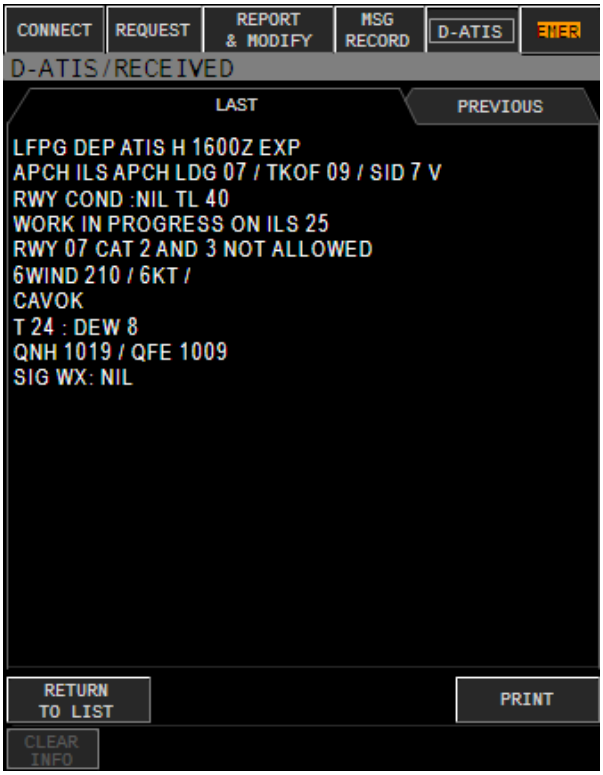
⇓ Interfaces on A380 FANS A+ ⇓



⇓ Interfaces on A350/A380 FANS A+B⇓

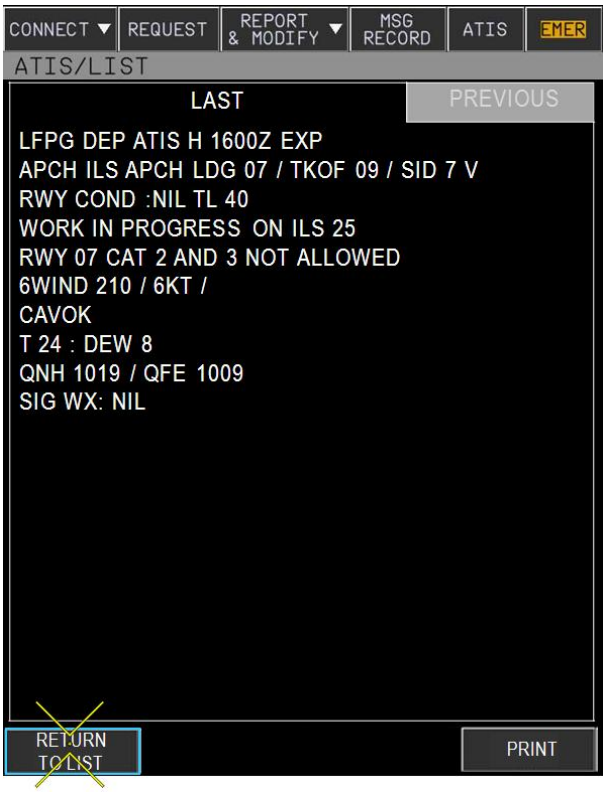




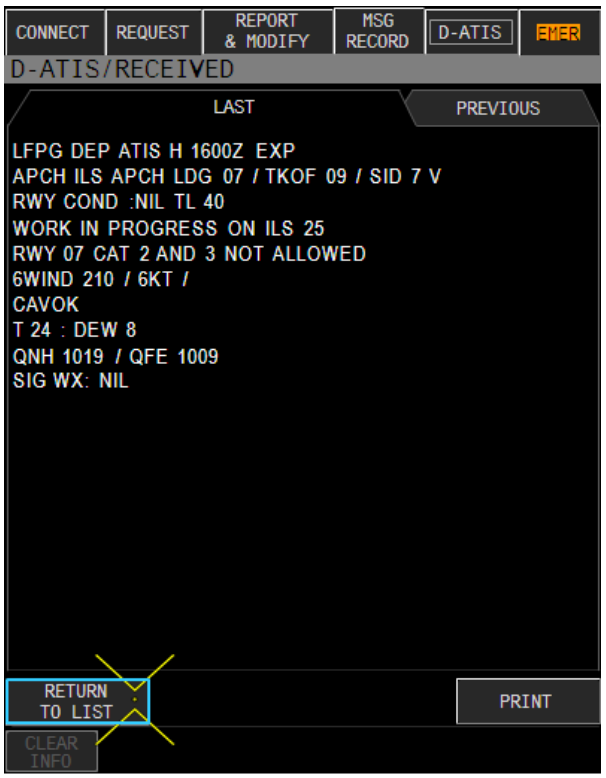


The access to the previous ATIS report is not possible as there is no previous ATIS report. PREVIOUS is available as soon as several ATIS reports have been received. Select RETURN TO LIST to return to the main menu.

⇓ Interfaces on A380 FANS A+ ⇓

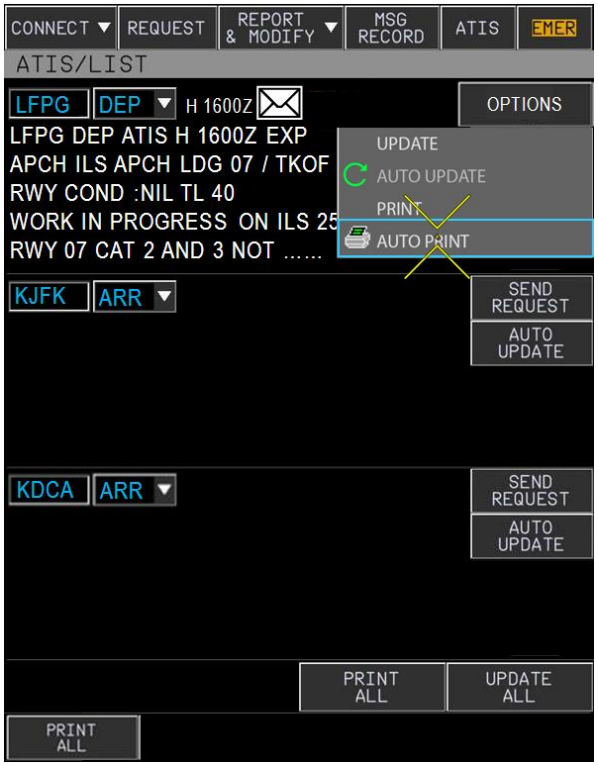


⇓ Interfaces on A350/A380 FANS A+B⇓

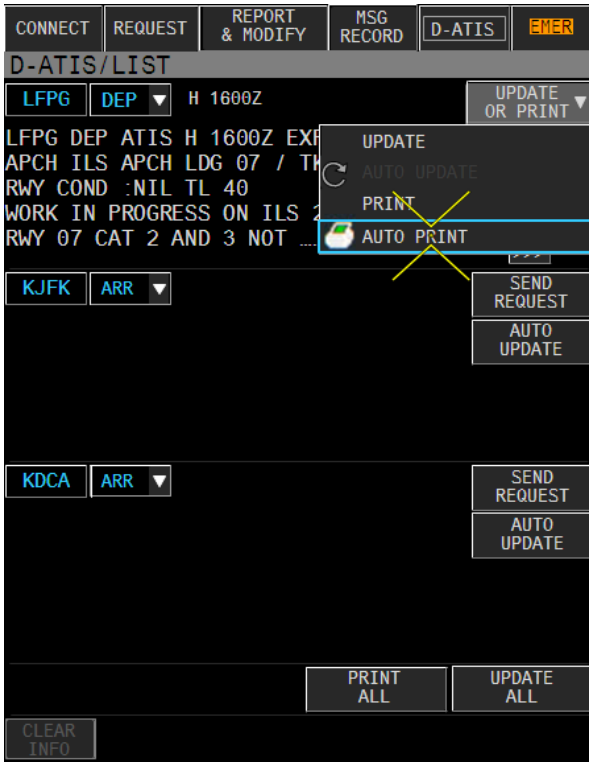


In order to obtain an automatic printing of the ATIS report when it is received, select OPTIONS on A380 FANS A+ (respectively UPDATE OR PRINT on A350/A380 FANS A+B) and then select AUTO PRINT. The AUTO PRINT icon is displayed next to the message to show that the function is enabled.

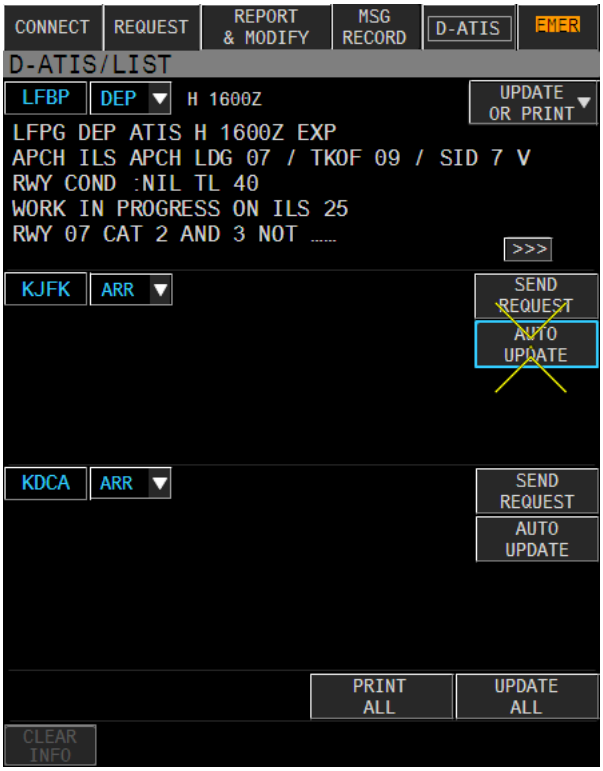
⇓ Interfaces on A380 FANS A+ ⇓



⇓ Interfaces on A350/A380 FANS A+B⇓

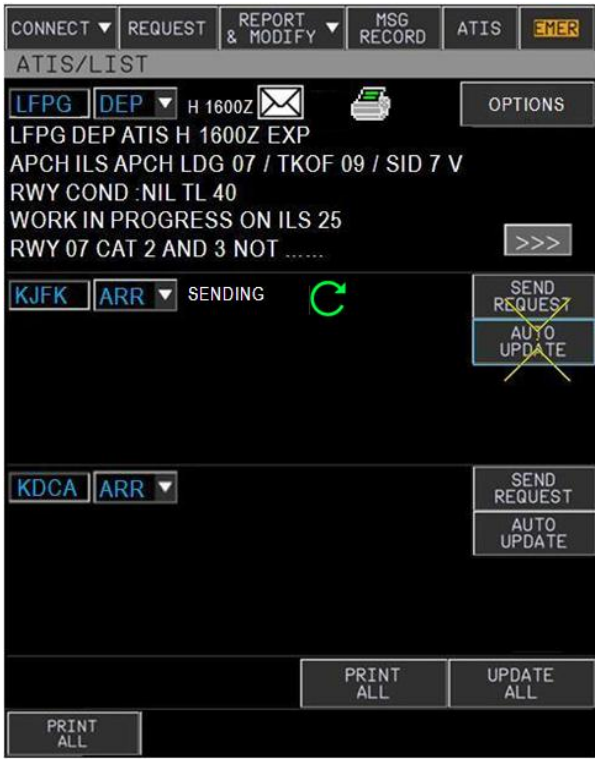


The AUTO UPDATE function can only be requested for destination airports. Select AUTO UPDATE for the corresponding airport.

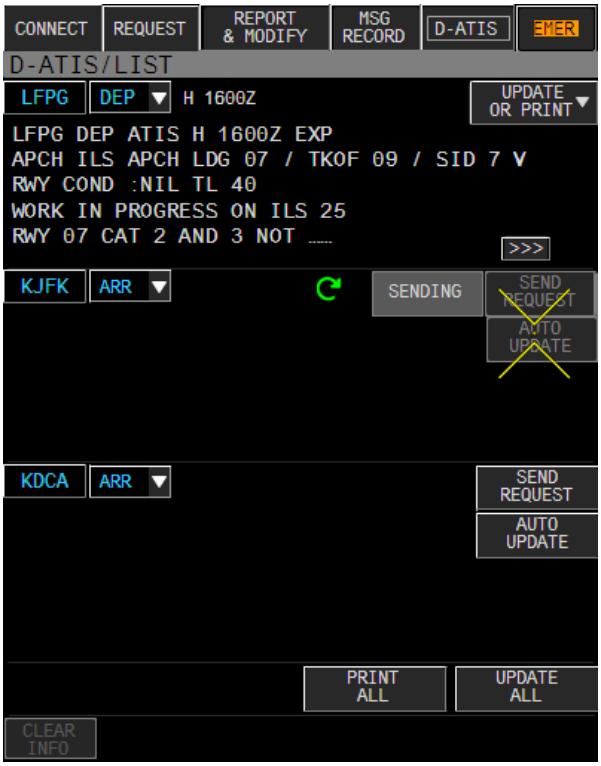


After the selection AUTO UPDATE, the ATIS request status is changed to SENDING and a circular arrow, symbol of the AUTO UPDATE status, is displayed.

⇓ Interfaces on A380 FANS A+ ⇓

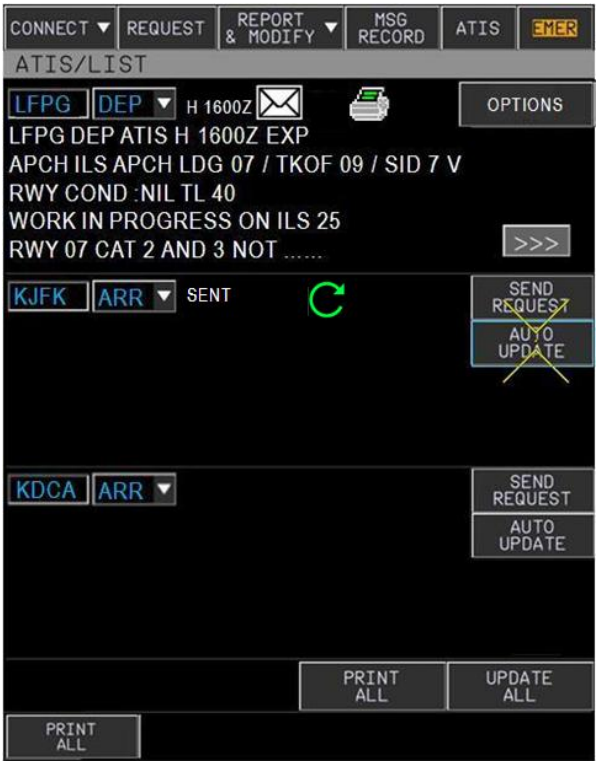


⇓ Interfaces on A350/A380 FANS A+B⇓

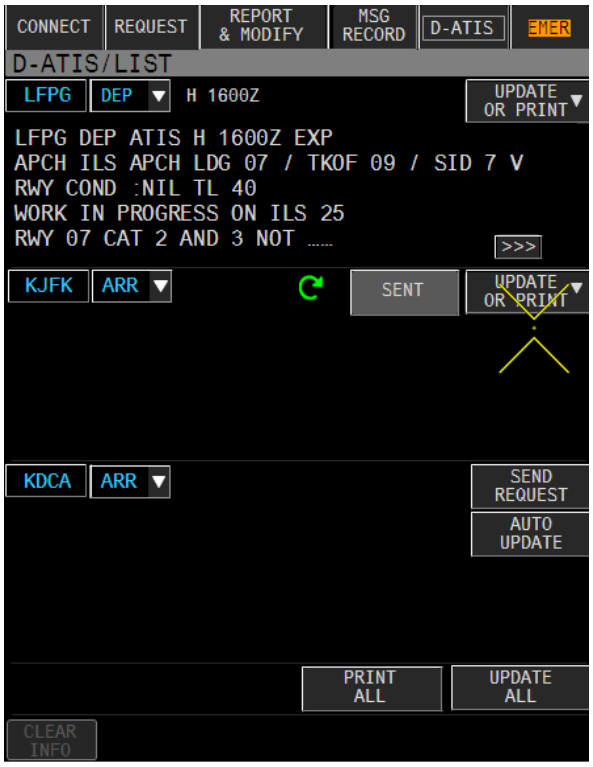


When the ground service provider acknowledges reception of the message, the information SENT is displayed.

⇓ Interfaces on A380 FANS A+ ⇓



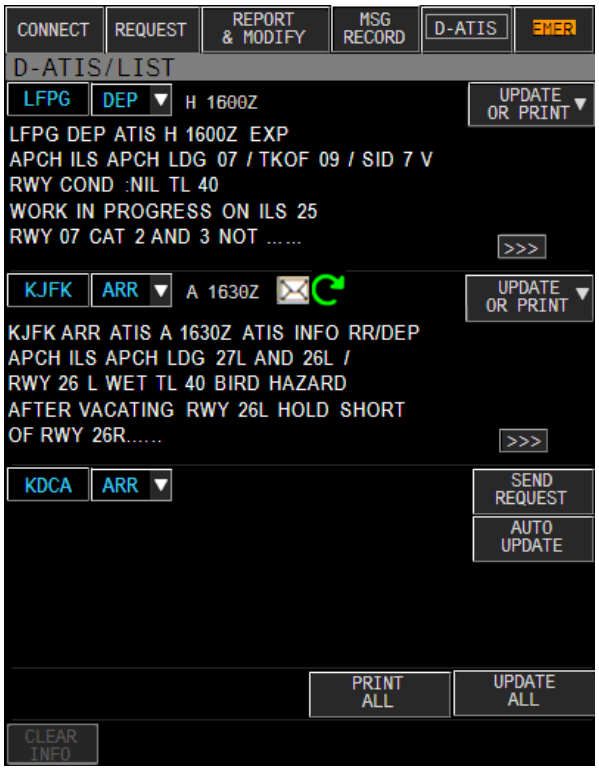
⇓ Interfaces on A350/A380 FANS A+B⇓



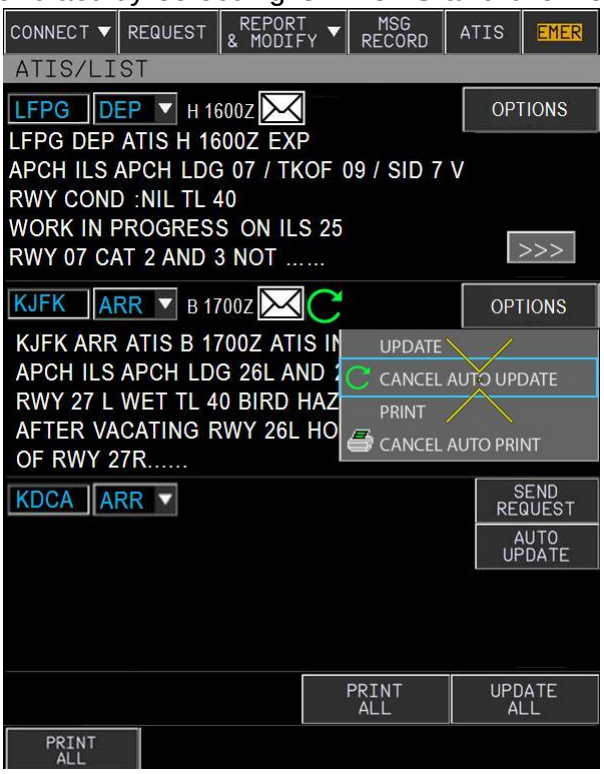
When the ATIS report is received, a new message icon is displayed with the ATIS code and time of reception in front of the corresponding airport. A part of the ATIS message is displayed. To view the entire message, select the button with the triple rightward arrows (>>>).

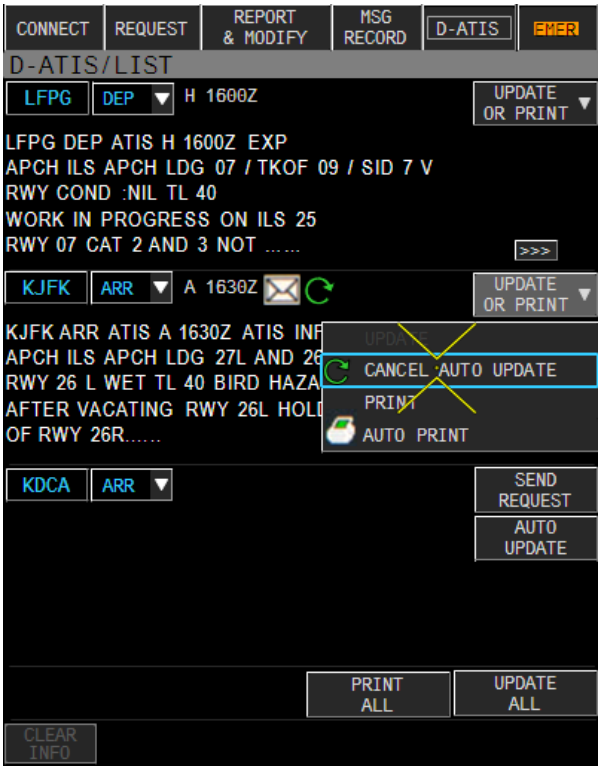
⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B⇓



Since auto print was only selected for the first airport, select OPTIONS and then PRINT if this ATIS report needs to be printed. The flight crew can cancel the update contract by selecting OPTIONS and then CANCEL AUTO UPDATE.





The circular arrow icon (symbol of the AUTO UPDATE) is removed.

⇓ Interfaces on A380 FANS A+ ⇓

⇓ Interfaces on A350/A380 FANS A+B⇓

APPENDIX K – ON-BOARD INDICATIONS IN CASE OF DATA LINK FAILURES

In case of failures, a warning is displayed on EWD or/and some indications are provided on DCDU (respectively ATC mailbox). The following sections provide the main failures that may imply the application of one of the procedures described in chapter A5.

ACARS network is used for ATC applications of FANS A/A+ systems and ATS 623 applications. This section describes the cockpit displays when there is a loss of datalink communications (i.e. ACARS) for FANS A/A+ and ATS 623 applications.

1. A320/A330/A340 AIRCRAFT

ATSU FAILURE

The ATSU is not working anymore. Data link communications between the aircraft and the ground are not available.
The ATSU failure affects both ATC and AOC applications. **The flight crew shall contact ATC by voice if any ATC was connected.**
The DATALINK ATSU FAULT caution is displayed on EWD.

A white NO DATA indication is displayed on DCDU and ATSU pages on MCDU are not available.

TEMPORARY LOSS OF DATALINK COMMUNICATIONS FOR FANS A/A+ AND ATS 623 APPLICATIONS

The air-ground communication means used for FANS A/A+ and ATS 623 applications are temporarily unavailable, but not failed (i.e. no system failure, but data link is not available). The ATSU is trying to recover the data link communications with the ground for 16 minutes.

Before contacting ATC by voice, the flight crew should wait for a period of time. After this period of time, the loss may be considered as stable. The period of time should be provided by the applicable National regulations.

ATC DATALINK STBY memo is displayed in green on EWD.
*This indication on EWD is only available for aircraft equipped with **FANS A** system.*

For **FANS A+** aircraft, some indications are provided on DCDU :

1. The system message ATC DATALINK COM NOT AVAILABLE is displayed in amber.

2. If a message (CPDLC or ATS 623) is on DCDU, the indication COM NOT AVAIL is displayed in amber in the information area. The message cannot be sent.

If the ATSU fails to recover the data link communications within 16 minutes, an abnormal ATC data link disconnection occurs. Refer to description below.

DEFINITIVE LOSS OF DATALINK COMMUNICATIONS FOR FANS A/A+ AND ATS 623 APPLICATIONS

- The air-ground communication means used for FANS A/A+ and ATS 623 applications (VDL, SATCOM and HFDL if installed) are failed, or
- The airborne datalink ATC applications are failed (AOC application may be still running).

These cases result in an **abnormal ATC data link disconnection** described in the following paragraph.

The flight crew shall contact ATC by voice.

For aircraft equipped with **FANS A or FANS A+** system, the DATALINK ATC FAULT caution is displayed on EWD.

Similarly to the ATSU failure, **if the airborne data link ATC applications are failed**, a white NO DATA indication is displayed on DCDU, and the ATC COM pages are not available.

ABNORMAL ATC DATALINK DISCONNECTION

When an abnormal ATC data link disconnection occurs, the following indications are provided.

1. The system message ATC DISCONNECTED is displayed in amber.

2. If a CPDLC message is on DCDU, the following indications are displayed : amber ABORT in the top right corner and amber LINK LOST in the information zone.

2. A350/A380 AIRCRAFT

ACR FAILURE

The ACR1 (and ACR2 if installed) is (are) not working anymore. Data link communications between the aircraft and the ground are not available.
The ACR failure affects all applications using data link (i.e. ATC, ATS 623, AOC). **The flight crew shall contact ATC by voice if any ATC was connected.**
The COM DATALINK FAULT caution is displayed on EWD.

TEMPORARY LOSS OF DATALINK COMMUNICATIONS FOR FANS A+ AND ATS 623 APPLICATIONS

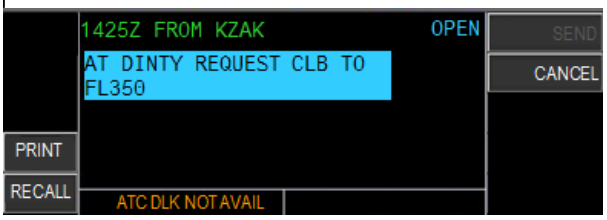
The datalink communication means defined in the routing policy for FANS A+ and ATS 623 applications are temporarily unavailable, but not failed (i.e. no system failure, but datalink is not available).

On the ATC mailbox, the following indications are displayed :
The system message ATC DATALINK COM NOT AVAIL is displayed in amber.

⇓ Interfaces on A380 FANS A+ ⇓

If a message (CPDLC or ATS 623) is on ATC mailbox, the indication COM NOT AVAIL is displayed in amber in the information area.

⇓ Interfaces on A350/A380 FANS A+B ⇓



If a message (CPDLC or ATS 623) is on ATC mailbox, the indication ATC DLK NOT AVAIL is displayed in amber in the information area.

Before contacting ATC by voice, the flight crew should wait for a period of time. After this period of time, the loss may be considered as stable. The period of time should be provided by the applicable National regulations.

The ACR is trying to recover the data link communications with the ground for 16 minutes. If the ACR fails to recover the data link communications within 16 minutes, an abnormal ATC data link disconnection occurs. Refer to description below.

DEFINITIVE LOSS OF DATA LINK COMMUNICATIONS FOR FANS A+ AND ATS 623 APPLICATIONS

The datalink communication means used for FANS A+ and ATS 623 applications are failed for the following reasons :

- The ACR1 (and ACR2 if installed) is (are) not working anymore, or
- The communications means (VHF, HF, SATCOM) are failed.

These cases result in an abnormal ATC data link disconnection described in the following paragraph.

ABNORMAL ATC DATA LINK DISCONNECTION

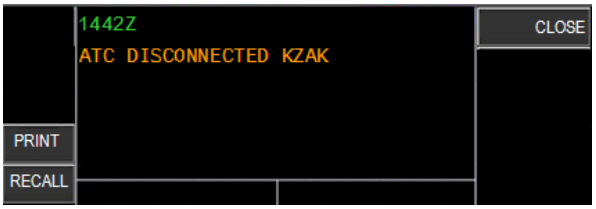
When an abnormal ATC datalink disconnection occurs, the following indications are provided.

On the ATC mailbox, the following indications are displayed:

1. The system message ATC DISCONNECTED is displayed in amber.

⇓ Interfaces on A380 FANS A+ ⇓

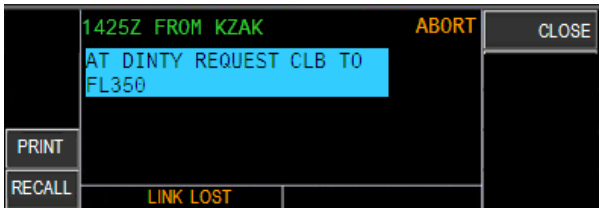
⇓ Interfaces on A350/A380 FANS A+B ⇓



ATC DISCONNECTED is followed by the ATC center name.

2. If a CPDLC message is on ATC mailbox, the following indications are displayed: amber ABORT in the top right corner and amber LINK LOST in the information zone.

⇓ Interfaces on A380 FANS A+ ⇓ | ⇓ Interfaces on A350 FANS A+B ⇓



ATC DATALINK APPLICATION FAILURE

Due to the new architecture of the A350/A380, two cases may occur :

- The on-board ATC function (including AFN, CPDLC, ADS-C, ATS 623 applications) is failed,
- The on-board ADS-C application is failed.

In any case, **the flight crew shall contact ATC by voice**.

1. The ATC function is failed (i.e. at least CPDLC application is lost).

The ADS-C application may be still available. In this case, the indication ADS DATALINK STILL AVAIL is displayed in the STATUS INFO page.

ATC COM pages on MFD and ATC mailbox are not available.

MFD

ATC mailbox

2. The ADS-C application is failed (i.e. ADS-C application is lost).

AFN, CPDLC and ATS 623 applications remain available on MFD and ATC mailbox.

In this case, position reporting should be done via CPDLC or voice as required by Operations manual or local regulations.

Note: on A350/A380 FANS A+B, ADS DATALINK FAULT is replaced by ADS-C DATALINK FAULT.

APPENDIX L – FANS A/A+/A+B AIRWORTHINESS APPROVAL SUMMARY

The purpose of this document is to describe the Communication, Navigation and Surveillance airborne capabilities required for FANS A/A+/A+B operations, and the interoperability, safety and performance requirements that have been considered for the development and airworthiness approval of the Airbus FANS A/A+/A+B avionics system that supports Air Traffic Services data-link applications. It also summarizes the main results and achievements of interoperability, safety and performance demonstrations that have been conducted by Airbus.

This document is an outcome of the FANS A/A+/A+B Airworthiness Approval process intended to be widely distributed to any party planning to make use of data communications for Air Traffic Services purposes.

This document is primarily intended for Operators, ATC Service Providers and National Aviation Authorities.

They should refer to this document when deciding on how to implement operations based on data communications for ATS purposes. It may also be used by Operators as substantiating data in order to help in obtaining operational changes.

This document contains:

- **Section 1 :** Executive summary
- **Section 2 :** A short overview of FANS A+/A+B functional evolutions in regards with the previous system (see hereafter) when exists
- **Section 3 :** A short overview of specific aircraft architecture required by FANS A+/A+B implementation
- **Section 4 :** The presentation of FANS A+/A+B airworthiness approval context by describing the Communication, Navigation and Surveillance (CNS) airborne capabilities assumed for FANS A+/A+B operations
- **Section 5 :** The listing of all industry standards considered for the development of the data-link applications, and the record of all clarifications, additions and/or deviations to those standards, applicable to the FANS A+/A+B avionics systems
- **Section 6 :** The list of all assumptions/requirements placed on the ATS Ground Systems and Communication Service Providers that must be fulfilled
- **Section 7 :** An overview of the interoperability, safety and performance demonstrations achieved during the airworthiness approval process of the FANS A+/A+B systems. This section also provides a set of flight crew procedures used as mitigation means in Safety Assessment process
- **Section 8 :** A proposal for a list of checks and verifications that Operators and ATC providers may wish to perform before starting operations

- **Section 9 :** Additional information concerning the ATSU Router Parameters' customization process.

A certification process was performed for each FANS configuration on any Airbus aircraft model. As a consequence, an Airworthiness Approval Summary is applicable to a given FANS configuration and a given aircraft model.

To a get a copy of the appropriate Airworthiness Approval Summary, please contact Airbus Support (See References) providing one of the following references:

FANS systems	Aircraft models	Airbus FANS denominations	Airworthiness Approval Summary references
FANS A	A330/A340	CLR 3	00F460P0210/C02 Issue 5
FANS A+	A320	CSB 4	00D460P0210/C02 Issue 1
		CSB 7	00D460P0210/C02 Issue 3
	A330/A340	CLR 4	00F460P0211/C02 Issue 2
		CLR 7	00F460P0211/C02 Issue 3
	A380	CLA 3	00L462Y0210/C02 Issue 2
FANS A+B	A350	CLV 1	See note 2
	A380	CLA 4	See note 2

Note 1: Refer to Part II - Appendix M for Airbus FANS denominations.
Note 2: At the time of writing the document, the references of the Airworthiness Approval Summary for A350 FANS A+B and A380 FANS A+B are not defined as the both systems are not yet certified.

APPENDIX M – FANS SYSTEMS DENOMINATIONS AND CONTENT

The following table presents the different combinations of FANS systems proposed by Airbus according the aircraft type.

	AIRBUS FANS denominations			
	A320	A330/A340	A350	A380
FANS A		CLR 3		
FANS A+	CSB 4 CSB 7	CLR 4 CLR 7		CLA 3
FANS B	CSB 5			
FANS B+	CSB 6 CSB 8			
FANS A+B			CLV 1	CLA 4

Grey Combination Aircraft/FANS system not applicable

Note 1: CSB 6 includes indeed two FANS systems: CSB 6.5 and CSB 6.6. There are some minor discrepancies between these systems that are provided in the following table.

Note 2: In the whole document, “latest FANS system” refers to:

- CSB 7/CLR 7 when applicable to FANS A+
- CSB 8 when applicable to FANS B+.

The following table presents the functions available on the different FANS systems proposed by Airbus.
For more details about the functions listed below, please refer to:

- Part II - Chapter A6 for features included in FANS A/A+.
- Part III- Chapter B6 for features included in FANS B/B+.
- Part II - Chapter A6 and Part III- Chapter B6 for features included in FANS A+B system.

	FANS A/A+				FANS B/B+			FANS A+B	
FANS features	**CLR3**	**CSB 4 CLR 4**	**CSB 7 CLR 7**	**CLA3**	**CSB 5**	**CSB 6**	**CSB 8**	**CLV 1**	**CLA 4**
FANS A/A+ applications (i.e. AFN, FANS 1/A CPDLC, ADS-C)	X	X	X	X				X	X
FANS B/B+ applications (i.e. CM, ATN B1 CPDLC)					X	X	X	X	X
ATS623 applications		O	O	X		O (see note 1)	O	X	X
VDL2		O	O	X	X	X	X	X	X
HFDL for ATC purpose		O	O	X				X	X
Wired High Speed Data Loading capability (ARINC 615A)		O	O		X	X	X		
Modifications relative to ADS-C		X	X	X				X	X
DCDU indications in		X	X						

	FANS A/A+				FANS B/B+			FANS A+B	
FANS features	**CLR3**	**CSB 4 CLR 4**	**CSB 7 CLR 7**	**CLA3**	**CSB 5**	**CSB 6**	**CSB 8**	**CLV 1**	**CLA 4**
case of failures									
New DATALINK STATUS Page			X			X	X		
Modification of MSG RECORD			X			X	X	X	X
Improvement of NOTIFICATION Page			X					X	X
New features in CONNECTION STATUS page			X					X	X
Addition of information on REPORT messages			X					X	X
Discarding old uplink messages		X	X	X				X	X
BACK ON ROUTE message		X	X	X				X	X
Auto-closure of messages			X			X	X	X	X
New RECALL mode			X			X	X	X	X
Time reference in uplink message			X	X				X	X
CSP World Map		X	X		X	X	X		
ATSU router customization via loadable database		X	X		X	X	X		

	FANS A/A+				FANS B/B+			FANS A+B	
FANS features	**CLR3**	**CSB 4 CLR 4**	**CSB 7 CLR 7**	**CLA3**	**CSB 5**	**CSB 6**	**CSB 8**	**CLV 1**	**CLA 4**
ATC datalink communication recording			O	X		O (see note 2)	O	X	X
Radio frequency loading into RMP			O			O	O	X	
ITP Clearance by CPDLC			O					X	X
Scan Mask with routing policies				X				X	X
DATALINK COM STATUS page				X				X	X
Harmonization of ATC aural alerts								X	X
New CONNECT page								X	X
Improvement of the display of CPDLC connection status						X	X	X	X
Modifications of the ATC aural alerts						X	X		
Separators in the DCDU message display							X		
Protected mode						X	X	X	X
Operational timers for dialogue initiated by the ATC						X	X	X	X

	FANS A/A+				FANS B/B+			FANS A+B	
FANS features	**CLR3**	**CSB 4 CLR 4**	**CSB 7 CLR 7**	**CLA3**	**CSB 5**	**CSB 6**	**CSB 8**	**CLV 1**	**CLA 4**
New justifications for UNABLE and REQUEST page						**X**	**X**	**X**	**X**
Inhibition of Max Uplink Delay access								**X**	**X**
Interactions between ATC applications and FMS	**X**	**X**	**X**	**X**				**X**	**X** (see note 3)
Dual ACR configuration				**O**				**O**	**O**

X Basic function available
O Function available as option
Blank Function not available
Grey Combination FANS system/FANS function not applicable

Note 1: ATS 623 applications include:
- DCL and D-ATIS applications in CSB 6.5
- DCL, OCL and D-ATIS applications in CSB 6.6.

Note 2: ATC datalink communication recording applies to the recording of:
- CM and CPDLC in CSB 6.5
- CM, CPDLC and ATS 623 applications in CSB 6.6.

Note 3: For the first version A380 FANS A+B, the FMS is capable to support:
- All interactions with FANS A+ applications
- One interaction with FANS B+ applications: the monitoring of CPDLC deferred clearance. For more details, refer to Part III – Section B.6.24 Interactions between ATC applications and FMS.

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ABBREVIATIONS

AAC	Airline Administrative Communications
ACARS	Airline Communications, Addressing, and Reporting System
ACL	ATC Clearance service
ACM	ATC Communication Management service
ACR	Avionics Communication Router
ADF	Automatic Direction Finder
ADIRS	Air Data Inertial Reference System
ADNS	Arinc Data Network Service
ADS	Automatic Dependent Surveillance
ADS-B	Automatic Dependent Surveillance – Broadcast
ADS-C	Automatic Dependent Surveillance – Contract
AEEC	Airlines Electronics Engineering Committee
AES	Aircraft Earth Station
AESS	Aircraft Environment Surveillance System
AFN	ATS Facilities Notification
AFTN	Aeronautical Fixed Telecommunication Network
AIDC	ATC Inter-facility ground/ground Data Communications
AIP	Aeronautical Information Publication
AMC	ATC Microphone Check service
AMI	Airline Modifiable Information
AMU	Audio Management Unit
AOC	Airline Operations Communications (or Center)
ARF	ACARS Router Function
ARINC	Aeronautical Radio INCorporated
ASAP	As Soon As Possible
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSU	Air Traffic Services Unit
BFE	Buyer Furnished Equipment
BITE	Built In Test Equipment
CADS	Centralized Automatic Dependent Surveillance
CBT	Computerized Based Training
CDS	Control and Display System
CDTI	Cockpit Display of Traffic Information
CFDIU	Centralized Fault Display Interface Unit
CM	Context Management application
CMA	Context Management Application

CMC	Central Maintenance Computer
CMS	Centralized Maintenance System
CNS/ATM	Communication Navigation Surveillance/Air Traffic Management
CPDLC	Controller Pilot Data Link Communications
CPIOM	Core Processing Input/Output Module
CSD	Customer Service Director
CSP	Communication Service Provider
CSTDB	CuSTomized Data Base
CTA	Control Area
CVR	Cockpit Voice Recorder
DARP(S)	Dynamic Airborne Route Planning (System)
D-ATIS	Digital Automatic Terminal Information Service
DCDU	Data link Control and Display Unit
DFIS	Digital Flight Information Services
DGPS	Differential GPS
DL	Down Link
DLASD	Data Link Application System Document
DLIC	Data Link Initiation Capability
DM	Downlink Message
EATMS	European Air Traffic Management System
ECAM	Electronic Centralized Aircraft Monitoring
EFIS	Electronic Flight Information System
EIS	Electronic Instrument System
ERSA	En-Route Supplement Australia
EUROCAE	European Organization for Civil Aviation Equipment
EWD	Engine and Warning Display
FANS	Future Air Navigation System
FHA	Functional Hazard Analysis
FIR	Flight Information Region
FIS	Flight Information Services
FIT	FANS Interoperability Team
FMS	Flight Management System
FSM	Flight System Message
FWC	Flight Warning Computer
GES	Ground Earth Station
GLS	GPS Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HFDL	High Frequency Data Link
HFDR	High Frequency Data Radio
HMI	Human Machine Interface
ICAO	International Civil Aviation Organization

IFALPA	International Federation of Airline Flight crew Associations
IMA	Integrated Modular Avionics
IOM	Input Output Module
ISPACG	Informal South Pacific ATC Coordinating Group
KCCU	Keyboard and Cursor Control Unit
LACK	Logical ACKnowledgement
LRU	Line Replaceable Unit
LSK	Line Select Key
MAS	Message Assurance
MASPS	Minimum Aviation Systems Performance Standards
MCDU	Multifunction Control and Display Unit
MCT	Media Configuration Table
MDDU	Multi Disk Drive Unit
MFD	Multi Function Display
MMR	Multi Mode Receiver
Mode S	Radar Mode S
NAS	National Airspace System
NDA	Next Data Authority
NOTAM	NOtice To Air Men
NPA	Non Precision Approach
OCA	Oceanic Control Area
OMT	On-board Maintenance Terminal
OPC	Operational Program Configuration
ORT	Owner Requirements Table
PACOTS	Pacific Organized Track System
PM	Protected Mode
PRODB	data service PROvider Data Base
RAIM	Receiver Autonomous Integrity Monitoring
RCP	Required Communications Performance
RCSM	Resident Customer Service Manager
RFC	Request For Change
RGS	Remote Ground Station
RNAV	Area Navigation
RNP	Required Navigation Performance
RPDB	Router Parameter Data Base
RSP	Required Surveillance Performance
RTCA	Requirements and Technical Concepts for Aviation
RVSM	Reduced Vertical Separation Minima
SATCOM	Satellite Communications
SCI	Secure Communication Interface
SDU	Satellite Data Unit
SIL	Service Information Letter

SITA	Société Internationale de Télécommunications Aéronautiques
SOP	Standard Operating Procedures
SOR	System Objectives and Requirements
SPOM	South Pacific Operating Manual
SPP	Soft Pin Program
SSR	Secondary Surveillance Radar
TDM	Track Definition Message
TMA	Terminal Area
TMU	Traffic Management Unit
UL	Up Link
UM	Uplink Message
V/DME	VHF/Distance Measurement Equipment
VCI	Voice Contact Instruction
VDL	VHF Data Link
VDR	VHF Data Radio
WPR	WayPoint Reporting

PART III – EXECUTIVE SUMMARY

B5. FANS B/B+ OPERATIONAL PROCEDURES

Following principles apply in ATN high-density continental airspaces:

- **Voice and data link are used as communication means with ATC. However, CPDLC is to be considered as a supplementary communication means to voice.**
- **CPDLC has to be used for non-time critical communications. The flight crew should take into account the traffic context, the end-to-end communication performance (human and system) and the recovery time for the determination of the time criticality.**
- **The use if either voice or data link is at the discretion of the flight crew and/or the ATC controller.**

Pre-flight phase

- **ICAO F-PLN filling**

The CNS/ATM capabilities of the aircraft will be notified when filling in the ICAO flight plan. With the entry into force of the ICAO PANS-ATM Doc 4444 applicable from November 2012, new letter codes will be introduced.

- The **data link capability** (CPDLC) is notified by two characters to be entered in the **Item 10(a)** (Radio Communication, Navigation and Approach Aid Equipment and Capabilities) of the ICAO Flight Plan.

CPDLC Capabilities	Item 10a
CPDLC ATN VDL Mode 2	J1

- The **aircraft identification** is entered in the **Item 7** of the flight plan and must contain only alphanumeric character without hyphen or symbols.
- The **aircraft registration** are still mentioned in the **Item 18** (preceded by **REG/**) of the flight plan.
- The **aircraft 24 bits address** is notified in the **Item 18** preceded by **CODE/**.

For aircraft exempted from Eurocontrol Link 2000+ mandate, the flight plan has to be filled with the **letter Z** in **Item 10a** and the indicator **DAT/** followed by the descriptor **CPDLCX** in **Item 18** (i.e. **DAT/CPDLCX**).

- **Pre-flight checks**

Prior to departing for a FANS B/B+ flight, checks must be performed by the dispatcher and the flight crew to ensure that the aircraft is ready for FANS operations. The following items are recommended to be checked:

- Dispatcher checks:
  - o FANS equipment availability

- Flight crew checks:
  - No ECAM alert is present on datalink systems
  - Removal of the MSG RECORD as per FCOM procedure.

Notification procedures

- The aim of the notification is to:
  - Notify the appropriate ATC center of the capabilities and specifics of the aircraft data link communication applications
  - Give the flight identification and the aircraft 24 bits address.
- When no other CPDLC connection has been established with a previous ATC center, the DLIC notification must be exercised (e.g. prior to departure, prior to entering a data link airspace).
- The DLIC notification can be initiated:
  - Manually by the flight crew, or
  - Automatically by the ATC center using the address forwarding process.

The DLIC notification must be successfully completed 10 to 30 minutes prior to entering the airspace and prior to any connection is being established.

CPDLC procedures

- **CPDLC Connection Establishment**
  - Once the **DLIC notification** has been successfully done, the ATC center can initiate a CPDLC connection (no action required from the flight crew). CPDLC messages shall only be sent when the aircraft is assumed by the ATC center (i.e. reception of the uplink message indicating the name of the ATC).
  - Checks are automatically done by the aircraft system (ATSU for A320 or ATC applications for A350/A380) to validate or reject the connection:
    - **Connection is accepted** if no previous connection already exists or, if the ATC center corresponds to the next ATC center to control the aircraft
    - **Connection is rejected** in all other cases.
  - Once connection is established:
    - For the technical connection, the active connected ATC center is then displayed on the DCDU (respectively ATC mailbox), and on the CONNECTION STATUS page of the MCDU (respectively CONNECT page of the MFD)
    - For the operational connection, an uplink message indicating the name of the current ATC (e.g. EDYY, MAASTRICHT, CENTER) is received.

- **CPDLC Connection Transfer**
  - To inform the aircraft avionics (i.e. ATSU or ATC applications) that a transfer of control will occur, the current active ATC sends a so-called **NDA message (Next Data Authority)** to the aircraft. This is the only

way for the ATSU (respectively ATC applications) to be aware of and to accept the connection with the next ATC center.

- Once a NDA message has been received, the aircraft is waiting for the connection with the next ATC center.
- Under normal circumstances the CPDLC connection should be established with the Next Data Authority prior to the connection between the aircraft and the current data authority being terminated.

- **Failures of the CPDLC connection**
  - As soon as a failure of the CPDLC connection is noticed by either the flight crew or the ATC controller, voice will be used to inform the other part of the failure and to coordinate further actions.
  - At that time, pending CPDLC messages should be considered as not delivered and the entire dialogue related to these messages should be restarted on voice.
  - If the CPDLC connection is recovered before the flight crew switched to voice communication, all dialogues involving the CPDLC outstanding messages should be recommenced via CPDLC.

- **Recommendations for CPDLC**
  - When the flight crew sends a downlink message, the DCDU (respectively ATC mailbox) displays the indication “RECEIVD BY ATC” (respectively “RECEIVED BY ATC”) in the information zone when the corresponding LACK is received.
  - When no uplink LACK (related to a downlink message) is received before the expiration of the technical response timer, the DCDU (respectively ATC mailbox) displays an amber “SEND FAILED” indication and an amber OPEN status.
  - When the flight crew sends a downlink message, the ground system automatically sends ATC TIME OUT – REPEAT REQUEST message to the aircraft if the ATC controller does not respond within 250 seconds after reception. “ATC TIME OUT – REPEAT REQUEST” is displayed on DCDU (respectively ATC mailbox).
  - When an uplink message is received, the DCDU (respectively ATC mailbox) displays “REPLY: TIME OUT” if the flight crew does not respond within 100 seconds.
  - A **Voice Read-Back** is required for any messages related to any changes of the aircraft trajectory in the framework of FANS B system. Thanks to the implementation of the **Protected Mode (PM)**, FANS B+ does not require Voice read-back. Due to the discontinuation of the **Voice Read-Back (VRB)** procedures from 15 November 2012, it is required aircraft capable **Protected Mode** CPDLC in European airspace.
  - In order to avoid ambiguity, it is highly recommended that the flight crew does not send multi-element messages.
  - The system does not allow to send downlink free text.

- It is strongly recommended to close with the CLOSE soft key any messages on DCDUs (ATC mailbox) once they are sent. Once closed, the message can be recalled via the RECALL soft key.
- It is recommended to erase the MSG RECORD to avoid confusion with messages from the previous flights.
- **The ATC or the flight crew shall revert from CPDLC to voice in the following cases:**
  - Whenever a CPDLC message is ambiguous, or
  - Whenever an operational timer related to a CPDLC message times out, or
  - Whenever an error message is replied to a CPDLC message or generated by the system, or
  - Whenever a timely execution of clearances or instructions transmitted by CPDLC is required, or
  - To correct any sent CPDLC messages including incorrect parameters.

B6. FANS B EVOLUTION

A320 FANS B+

To meet the requirements of the Link 2000+ Mandate phase, Airbus has developed the FANS B+ system.

- **Following improvements have been integrated:**
  - An **update of ATC FANS B applications** (CMA and CPDLC applications) in order to comply with ED110 rev. B
  - The **Protected Mode** that replaces the Voice Read-Back (VRB) procedure
  - **ATC data link communication recording** for the investigation on flight accidents/incidents as an option
  - **ATS623** (Departure & Oceanic clearances, Digital-ATIS applications) as an option
  - **Radio frequency loading into RMP** as an option.
- **Enhancements on HMI** have been also introduced, improving the commonalities between FANS A+ and FANS B+ HMI, like the display of the CPDLC connection status, the auto-closure of messages, the modification of ATC aural alerts frequency, the DATALINK STATUS page, etc.
- **FANS B+ retrofit**
  - FANS B+ system proposed on A320 is fully compliant with Link 2000+ mandate. The upgrade from FANS B to FANS B+ consists of a change of software only, provided it is limited to the basic features and the activation of ATS 623 applications.
  - The upgrade to activate optional features (e.g. ATC data link communication recording, radio frequency loading into RMP) affect the hardware.

- After the upgrade of FANS aircraft systems, airlines are invited to report to Airbus the current avionics configuration of their fleet in order to ensure a correct follow-up of FANS aircraft.

A350/A380 FANS B+

Regardless the interfaces, it is to be noticed that FANS B+ functions on A350/A380 are the same as the ones on A320 aircraft, apart from a very few exceptions:

- Discarding of old messages with the MAX UPLINK DELAY button is disabled for ATN CPDLC connection
- Operational timers for dialogue initiated by the ATC
- Interaction between ATC applications and FMS.

B7. STARTING FANS B/B+ OPERATIONS

To ensure proper operations of FANS B/B+ aircraft in high density continental airspaces, the operator needs to ensure the following before starting operations:

- Sign contract(s) with Communication Service Provider(s) (CSP).
- Declare aircraft to these Communication Services Providers.
- Declare aircraft and its FANS capability to ATC centers of the operated routes.
- Configure adequately the aircraft avionics.
- Obtain the operational approval.

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B5.1. INTRODUCTION

The reader will find NEW or NEW flag in the margin.

These flags identify new features introduced in the latest FANS systems.

The following chapter depicts some important and general procedures for an operational use of CNS/ATM systems.

As already explained FANS operations are and will regionally start based on the availability of ground equipment and technologies. Operational procedures are defined and published in *Flight Crew Data Link Operational Guidance in support of DLS Regulation No 29/2009*. The following procedures are based on this document as per 17 December 2012 (available at the Link 2000+ website, http://www.eurocontrol.int/articles/link-2000-library).

Note: GOLD edition 2 (2013) has been updated to incorporate datalink operations in ATN environment based on Link 2000+ guidance material.

The here-below recommendations are based on this manual. Detailed descriptions of the applications are provided in Part I.

It has to be noticed that the following principles apply in ATN high-density continental airspaces:

- **Voice and data link are used as communication means with ATC. However, CPDLC is to be considered as a supplementary means of communication to voice communications.**
- **CPDLC has to be used for non-time critical communications. The flight crew should take into account the traffic context, the end-to-end communication performance (human and system) and the recovery time for the determination of the time criticality.**
- **The flight crew and/or the ATC controller should determine the communication means (voice or datalink) that is the most appropriate at any given time.**

At any time, the aircraft shall remain under the control of only one ATC centre as per ICAO Annex 11, Chapter 3, § 3.5.1.

Note: A practical operational scenario is provided in the appendices of the Part III for any procedures described in the following sections.

B5.2. PRE-FLIGHT PHASE

As for any flight, it is the commander's responsibility to ensure that crew FANS training qualifications, aircraft and operational approval are satisfied for the intended flight.

B5.2.1. ICAO FLIGHT PLAN FILLING

The CNS/ATM capabilities of the aircraft will be notified when filling in the ICAO flight plan. With the entry into force of the ICAO PANS-ATM Doc 4444 applicable from November 2012, new letter codes have been introduced.

The data link capability (CPDLC) is notified by two characters to be entered in the **Item 10(a)** (Radio Communication, Navigation and Approach Aid Equipment and Capabilities) of the ICAO Flight Plan.

CPDLC Capabilities	**Item 10a**
CPDLC ATN VDL Mode 2	J1

The aircraft identification is entered in the **Item 7** of the flight plan and must contain only alphanumeric character without hyphen or symbols. The aircraft registration are still mentioned in the **Item 18** (preceded by **REG/)** of the flight plan.

The Aircraft 24 bits address is notified in the **Item 18** preceded by **CODE/**.

For aircraft exempted from Eurocontrol Link 2000+ mandate, the flight plan has to be filled with **the letter Z** in **Item 10a** and the indicator **DAT/** followed by the descriptor **CPDLCX** in **Item 18** (i.e. **DAT/CPDLCX).**

For more details about the ICAO flight plan, refer to ICAO PANS-ATM Doc 4444 (see References).
Eurocontrol has also published a leaflet providing recommendations for airlines to fill in the ICAO flight plan. It is available at http://contentzone.eurocontrol.int/FPL/.

B5.2.2. PRE-FLIGHT CHECKS

Prior to departing for a FANS B/B+ flight, checks must be performed by the dispatcher and the flight crew to ensure that aircraft is ready for FANS operations. The following items are recommended to be checked:

- Dispatcher checks:
  - FANS avionics equipment availability
- Flight crew checks:
  - No ECAM alert listed hereafter is present on datalink systems
    - A320:
      - DATALINK ATSU FAULT
      - DATALINK ATC FAULT
      - COM VHF3 DATA FAULT

- A350/A380:
  - COM ATC DATALINK FAULT
  - COM DATALINK FAULT
  - COM VHF3 DATALINK FAULT

- As mentioned in the FCOM/QRH, it is recommended to erase the MSG RECORD at the beginning of cockpit preparation before take-off. Refer to FCOM:
  - A320: Procedures/Normal Procedures/Standard Operating Procedures/Cockpit Preparation/ATC Datalink Communication
  - A350/A380: Procedures/Normal Procedures/Standard Operating Procedures/Cockpit Preparation/MFD ATC COM.

NEW

Note: The MSG RECORD is automatically erased on a flight identification change when the aircraft is on ground. However, in the latest A320 FANS B+ and in FANS A+B, MSG RECORD erasing is automatically done. On FANS A+B, this automatic removal can be deactivated through Soft Pin Program (SPP) change upon airline request.

If the data link is to be used a short time after the departure, the notification (described here after) will have to be completed prior to take off.
Note 1: Some figures in the following sections illustrate some exchanges via data link between the aircraft and the ATC center. In order to ease the understanding of these figures, the LACK is not illustrated even if the use of LACK is required for some regions. Refer to Part 1 section 3.6.3 – Technical Acknowledgement: LACK/MAS.

Note 2: The Context Management (CM) and Controller Pilot Data Link Communication (CPDLC) applications and their related services are described in details in Part I.

B5.3. NOTIFICATION PROCEDURES

The aim of the notification via the Data Link Initiation Capability (DLIC) service is to provide necessary information to enable data link communications. The information is transmitted through the Context Management (CM) application.

The notification should be completed between 10 and 30 minutes before entering the airspace. The appropriate time for notification is published in AIP of the concerned state.

B5.3.1. DATA LINK INITIATION CAPABILITY (DLIC) SERVICE

The DLIC service consists of two functions (Logon and Contact functions).

The **Logon function** is used for transmitting the necessary information required for flight plan correlation in the ATC ground system and CPDLC information required for the establishment of the connection. The Logon function is:

- **Manually** triggered in case of initial notification, or

- **Automatically** triggered in case of transfer from one ATC center to another.

The **Logon function** is a prerequisite to the establishment of CPDLC dialogue.

The **Contact function** provides the **Current Data Authority** (CDA) with a means to transfer an aircraft to the **Next Data Authority** (NDA). This function is transparent to the flight crew (refer to Section B5.4.2 CPDLC connection transfer).

- The ATC unit that initiates the transfer is the **Transferring ATC (T-ATC)**.
- The ATC unit that receives the aircraft is the **Receiving ATC (R-ATC)**.
- The ATC unit that uses data link and is currently responsible of the aircraft is the **Current Data Authority (CDA)**.
- The ATC unit that uses data link and is designated by the CDA for a transfer is the **Next Data Authority (NDA)**.

To guarantee the success of the Logon function, it is highly recommended to check:

- The correct **ATC center address (4 to 8 characters)** has been entered in the NOTIFICATION page
- The **aircraft identification** filled in the ATC flight plan (Item 7) matches the one displayed in the NOTIFICATION page (**use ICAO format i.e. three-letter code**, do not use IATA format i.e. two-letter code and do not insert leading zero into the flight identification)
- **Departure and destination airports** filled in the ATC flight plan and identified with their **ICAO 4-letter codes** match the ones displayed in the FMS INIT page
- The correct **aircraft 24 bits address** has been filled in the ATC flight plan (Item 18).

Note: European ATC center addresses can be found in the EUR NSAP Address Registry document published by ICAO and available at: http://www.paris.icao.int/documents_open/subcategory.php?id=48.

B5.3.1.1. MANUAL NOTIFICATION WITH LOGON FUNCTION

The initial notification is performed through the Logon function. For this purpose, enter the ICAO code of the ATC center (4 to 8 characters) in the CONNECTION ATSU DLK>NOTIFICATION page on MCDU (respectively CONNECT page of MFD ATC COM pages). By selecting NOTIFY, a **Logon request (CM_LOGON_REQUEST message)** is sent to the ground. Refer to Figure 5-1 and Figure 5-2.

As a response, the notified ATC center sends a **Logon response (CM_LOGON_RESPONSE message)** to the aircraft. On the NOTIFICATION page on MCDU (respectively CONNECT page of MFD ATC COM pages), the ATC center is then displayed as notified with the corresponding time.

From an operational point of view, a successful notification is mandatory prior to any CPDLC communications.

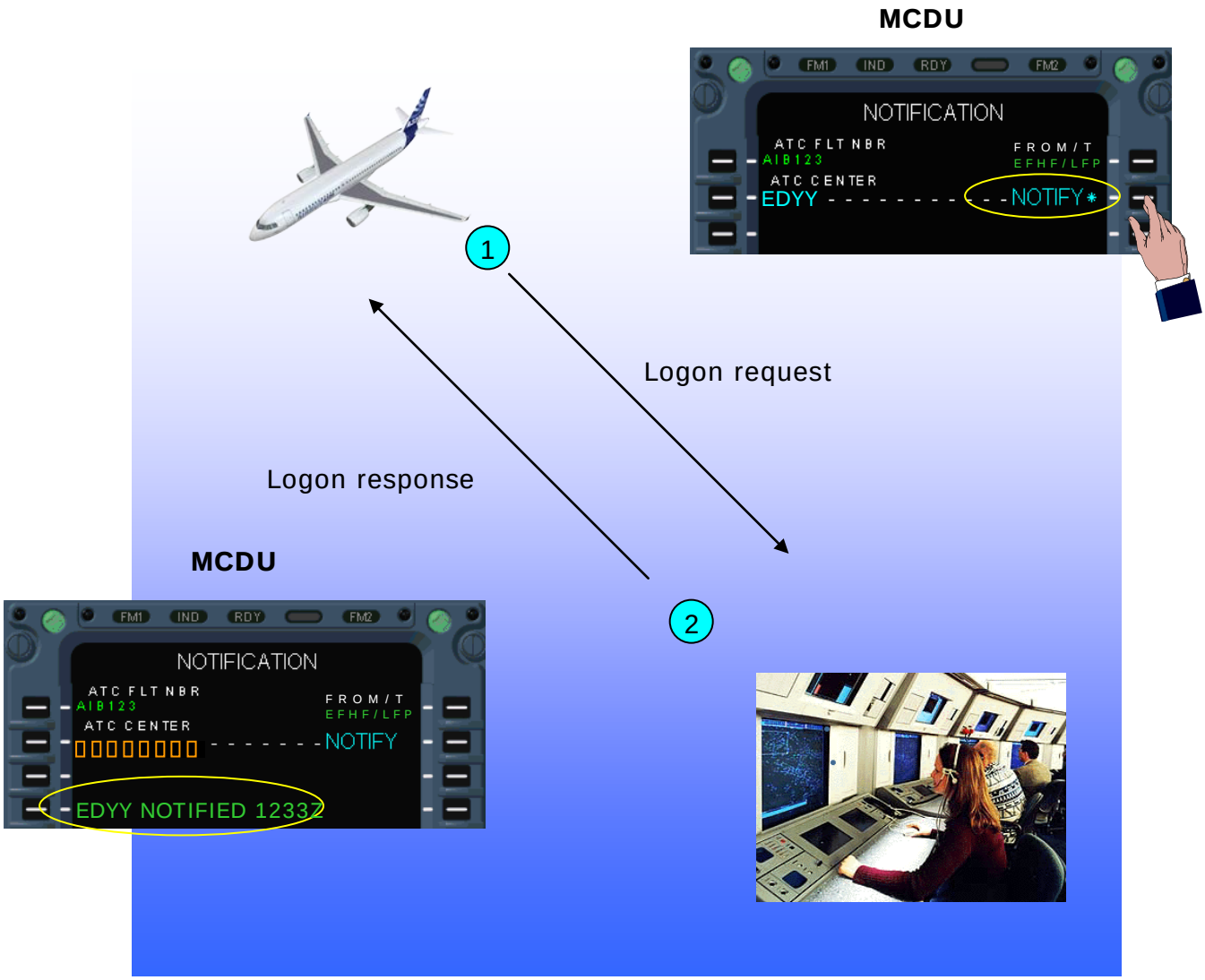


Figure 5-1
A320 Manual notification

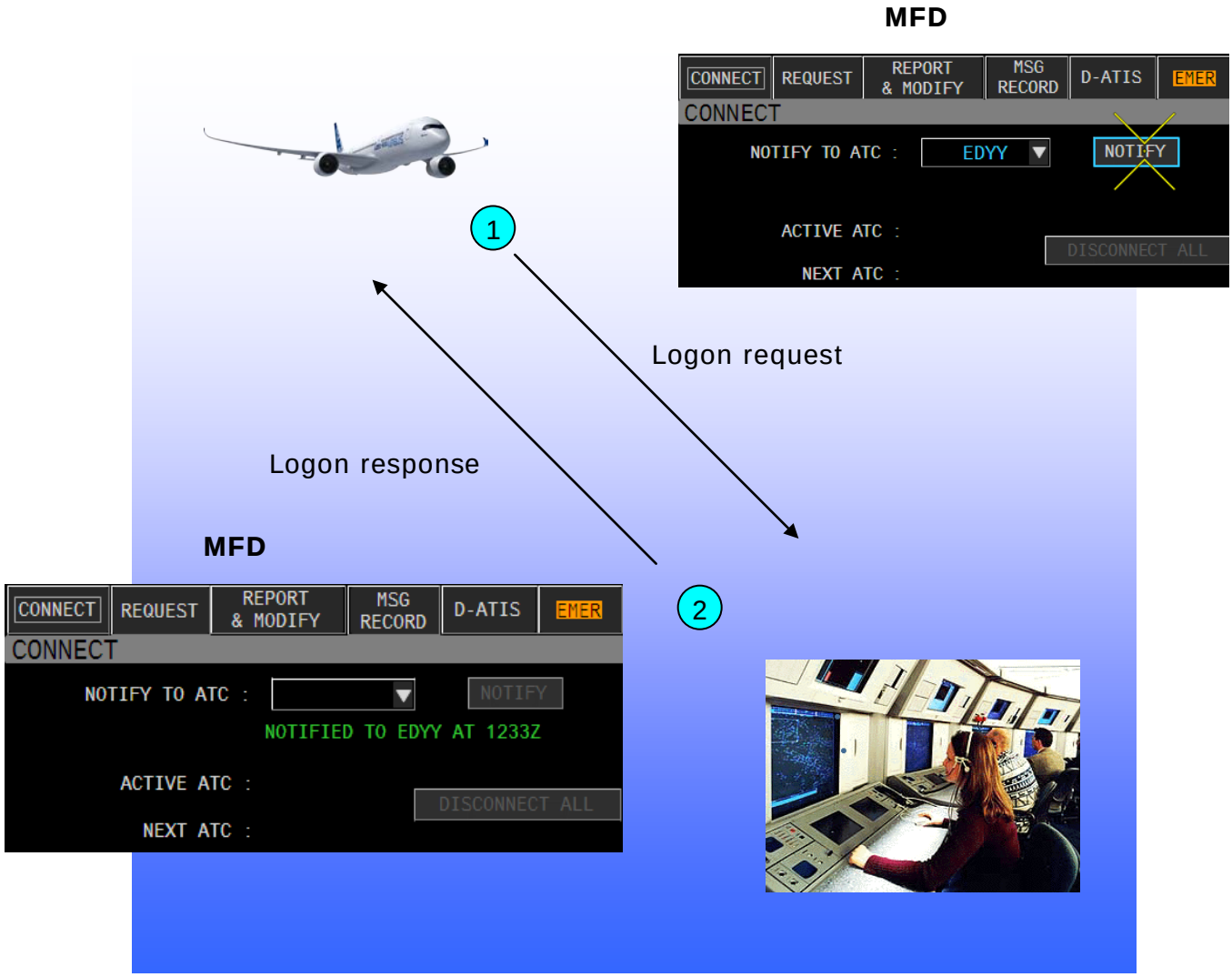


Figure 5-2
A350/A380 Manual notification

B5.3.1.2. AUTOMATIC NOTIFICATION WITH CONTACT FUNCTION

With the Contact function, the ATC center requests the aircraft to initiate the Logon function with another ATC center. Therefore, the CDA sends a Contact request (CM_CONTACT message) to the aircraft. When the aircraft receives the Contact request (CM_CONTACT message), the aircraft sends a Logon request (CM_LOGON_REQUEST message) to the NDA.

When the NDA receives the Logon request (CM_LOGON_REQUEST message), the NDA sends a Logon response (CM_LOGON_RESPONSE message) to the aircraft. To close the Contact process, the aircraft sends a Contact response (CM_CONTACT_RESPONSE message) to the CDA when the Logon response (CM_LOGON_RESPONSE message) is received. Refer to Section B5.4.2.1 Transfer between ATC centers.

The flight crew is unaware of this sequence of message exchanges.

Please bear in mind…

B5. FANS B/B+ OPERATIONAL PROCEDURES

Following principles apply in ATN high-density continental airspaces:

- **Voice and data link are used as communication means with ATC. However, CPDLC is to be considered as a supplementary communication means to voice.**
- **CPDLC has to be used for non-time critical communications. The flight crew should take into account the traffic context, the end-to-end communication performance (human and system) and the recovery time for the determination of the time criticality.**
- **The use if either voice or data link is at the discretion of the flight crew and/or the ATC controller.**

Pre-flight phase

- **ICAO F-PLN filling**

The CNS/ATM capabilities of the aircraft will be notified when filling in the ICAO flight plan. With the entry into force of the ICAO PANS-ATM Doc 4444 applicable from November 2012, new letter codes will be introduced.

- The **data link capability** (CPDLC) is notified by two characters to be entered in the **Item 10(a)** (Radio Communication, Navigation and Approach Aid Equipment and Capabilities) of the ICAO Flight Plan.

CPDLC Capabilities	Item 10a
CPDLC ATN VDL Mode 2	J1

- The **aircraft identification** is entered in the **Item 7** of the flight plan and must contain only alphanumeric character without hyphen or symbols.
- The **aircraft registration** are still mentioned in the **Item 18** (preceded by **REG/**) of the flight plan.
- The **aircraft 24 bits address** is notified in the **Item 18** preceded by **CODE/**.
- For aircraft exempted from Eurocontrol Link 2000+ mandate, the flight plan has to be filled with the **letter Z** in **Item 10a** and the indicator **DAT/** followed by the descriptor **CPDLCX** in **Item 18** (i.e. **DAT/CPDLCX**).

Please bear in mind…(continued)

- **Pre-flight checks**

Prior to departing for a FANS B/B+ flight, checks must be performed by dispatcher and flight crew to ensure that the aircraft is ready for FANS operations. The following items are recommended to be checked:

- Dispatcher checks:
  - FANS equipment availability
- Flight crew checks:
  - No ECAM alert is present on datalink systems
  - Removal of the MSG RECORD as per FCOM procedure.

Notification procedures

- The aim of the notification is to:
  - Notify the appropriate ATC center of the capabilities and specifics of the aircraft data link communication applications
  - Give the flight identification and the aircraft 24 bits address.
- When no other CPDLC connection has been established with a previous ATC center, the DLIC notification must be exercised (e.g. prior to departure, prior to entering a data link airspace).
- The DLIC notification can be initiated:
  - Manually by the flight crew, or
  - Automatically by the ATC center using the address forwarding process.

The DLIC notification must be successfully completed from 10 to 30 minutes before entering the airspace and prior to any connection is being established.

B5.4. CPDLC PROCEDURES

The CPDLC application provides a direct communication means between the ATC controller and the flight crew. Based on this application, three services are available:

- The **ATC Communication Management (ACM)** service to handle CPDLC connections (establishment, transfer, and termination),
- The **ATC Clearance (ACL)** service for the exchange of clearances and requests,
- The **ATC Microphone Check (AMC)** service to check if one aircraft is not blocking a voice channel.

> The time at which the ATC center will attempt a CPDLC connection varies according to the ATC centers. For Maastricht, the CPDLC start request is sent approximately 10 minutes before entering the airspace.

B5.4.1. CPDLC CONNECTION ESTABLISHMENT

CPDLC connection establishment is initiated by the ATC Center. Once the ATC center is indicated as notified in the MCDU NOTIFICATION page for A320 and in MFD CONNECT page for A350/A380, a CPDLC connection establishment is expected from this ATC center.

Checks are automatically done by the aircraft system (ATSU for A320 or ATC applications for A350/A380) to validate or reject the connection:

- Connection is accepted if no previous connection already exists or the ATC center corresponds the next ATC center to control the aircraft
- Connection is rejected in all other cases.

The flight crew shall only initiate CPDLC dialogue and send CPDLC messages when the ATC centre has enabled CPDLC. Any attempt to send CPDLC messages before CPDLC is enabled results in uplink error message CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST[1] displayed on DCDU (respectively ATC mailbox).

The flight crew knows that the ATC centre has enabled CPDLC when:

- The flight crew has made an initial voice contact, or
- An uplink message indicating the name of the ATC center is displayed on the DCDU (respectively ATC mailbox). For Maastricht, the message is CURRENT ATC UNIT EDYY, MAASTRICHT, CTR.

Hereinafter, a comprehensive description of the CPDLC connection establishment is provided. Since CPDLC is to be used for non-time critical en-route communications, the scenario described below relates either a transfer from a departure control to an en-route control, or a transfer from an ATC center not using CPDLC to an ATC center using CPDLC. Refer to the following figures.

[1] This is a standardized message. This message will be uplinked even if the early CPDLC attempt precedes a CPDLC connection establishment.

Bold *font is used to identify human interactions.*

1. **The flight crew sends a logon request (CM_LOGON_REQUEST message) to the Receiving ATC (R-ATC) as already described in B5.3.1.1 – Manual notification with logon function.**
2. As a response, the R-ATC sends a logon response (CM_LOGON_RESPONSE message) to the aircraft.
3. **On one hand, the Transmitting ATC (T-ATC) instructs via voice the flight crew to contact or to monitor the R-ATC on a given frequency.**
4. **The flight crew complies with the T-ATC instruction via voice while tuning the instructed frequency on the RMP.**
5. On the other hand, the R-ATC initiates the CPDLC connection through a CPDLC start request.
6. The aircraft system confirms the receipt of the CPDLC start request. **The name of the R-ATC (e.g. ACTIVE ATC: EDYY CTR on FANS B and NEXT ATC: EDYY on FANS B+) is displayed in green on DCDU (respectively ATC mailbox).**
7. **The flight crew contacts by voice (or monitor as appropriate) the R-ATC**, whereas the aircraft system notifies the R-ATC that it becomes the CDA. The technical connection is established. However, the operational connection is not yet completed. Refer to the following step.
8. **The R-ATC sends an uplink message identifying the R-ATC to the flight crew (e.g. "CURRENT ATC UNIT EDYY, MAASTRICHT, CTR").** This message confirms that the R-ATC assumes the control of the aircraft and that the CPDLC connection with the R-ATC is enabled.

The flight crew should not send any downlink message to the R-ATC until the R-ATC assumes the control of the aircraft (e.g. CURRENT ATC UNIT EDYY, MAASTRICHT, CTR). Early sending of downlink messages may results in rejection of these messages by the R-ATC. The R-ATC will send to the aircraft an error message CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST displayed on DCDU (respectively ATC mailbox).

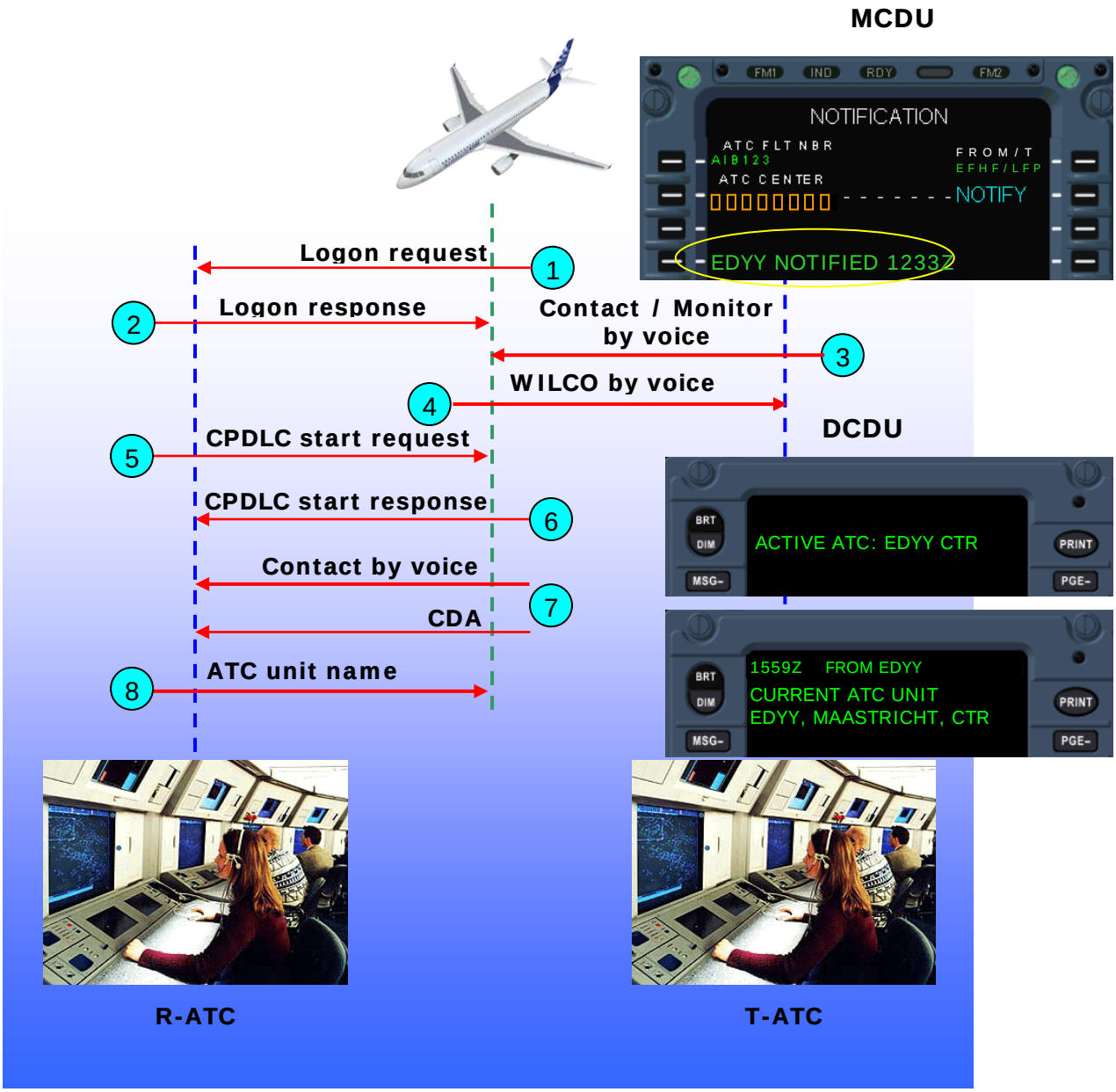


Figure 5-3
A320 CPDLC connection establishment with FANS B

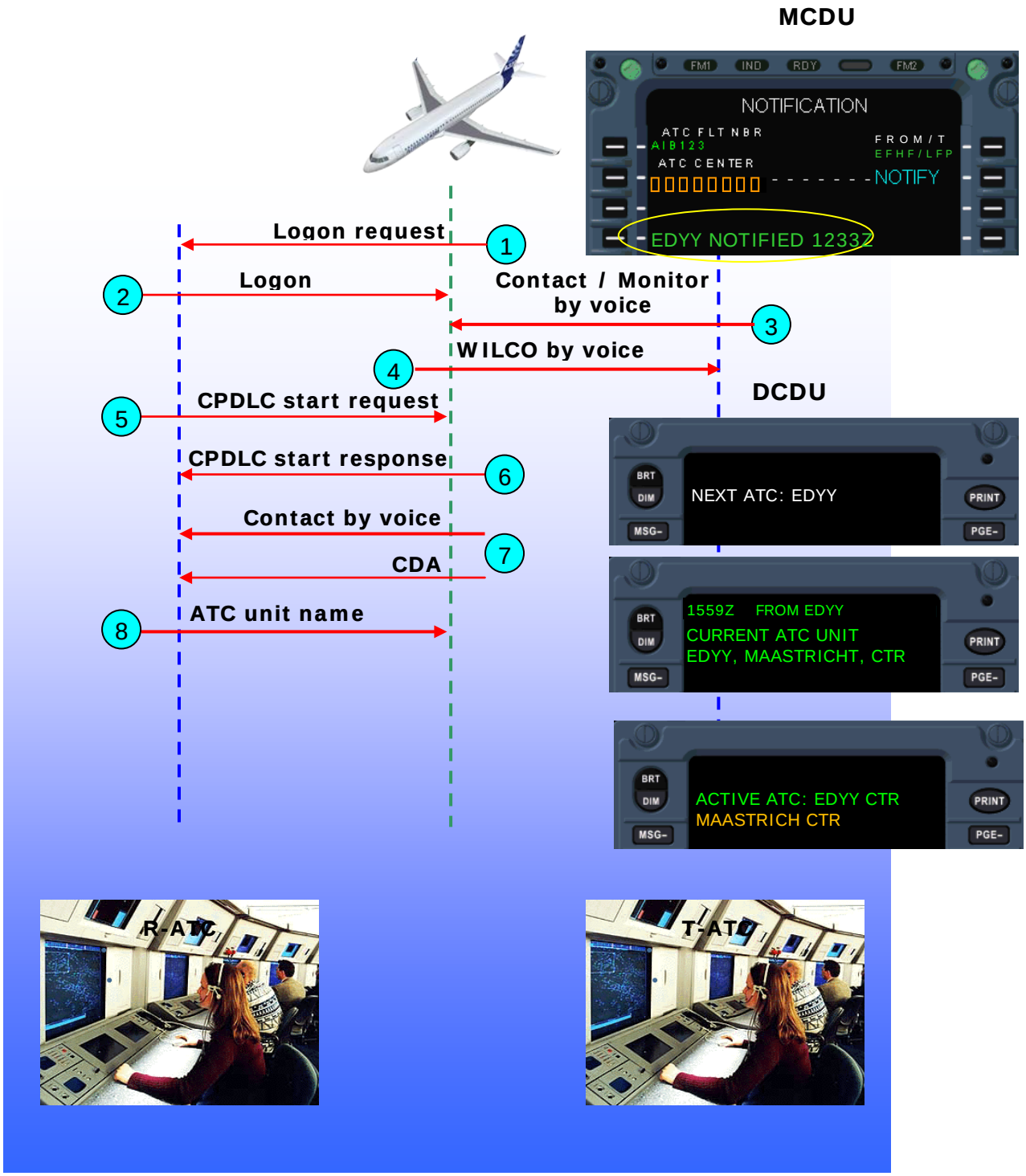


Figure 5-4
A320 CPDLC connection establishment with FANS B+

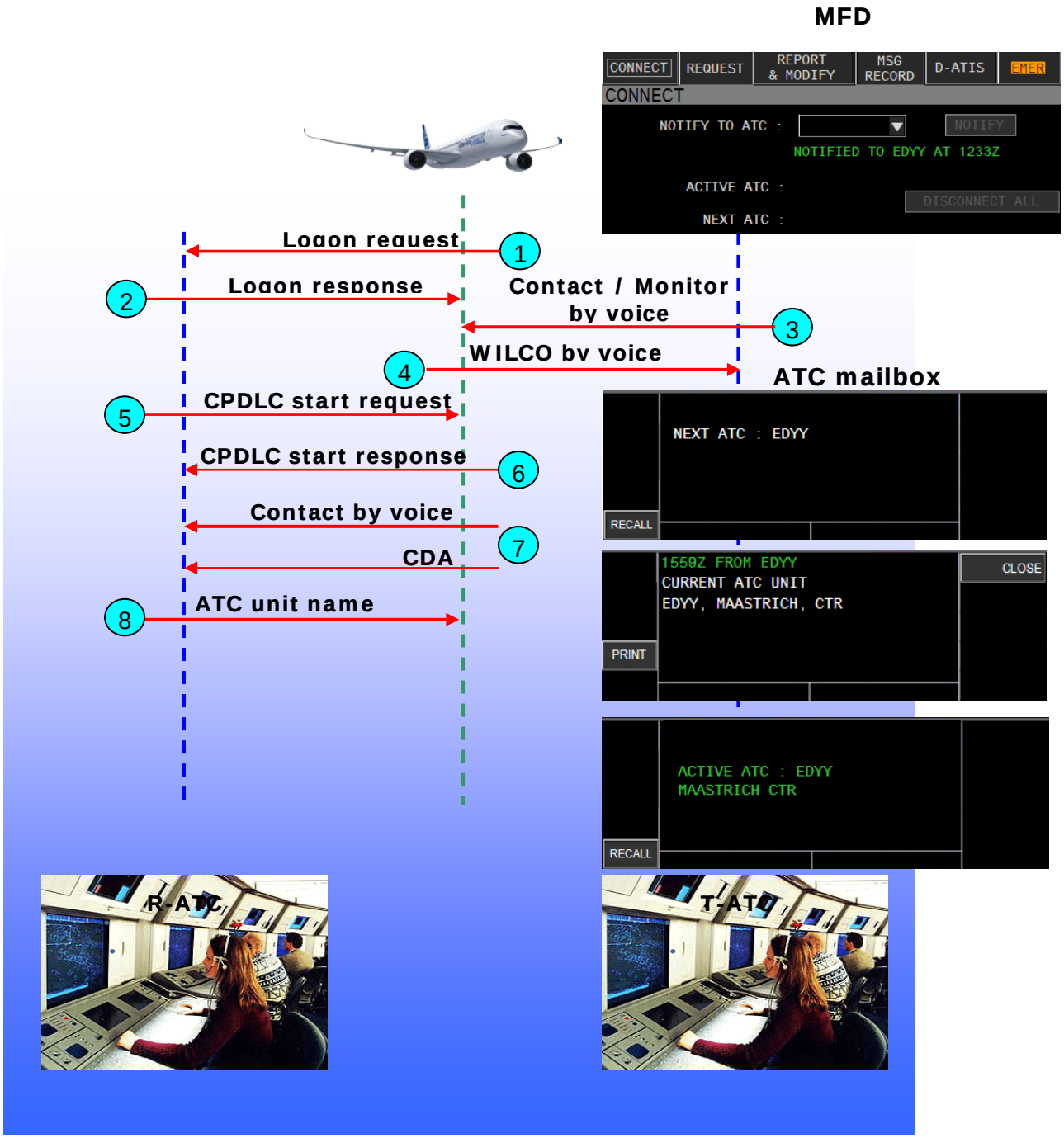


Figure 5-5
A350/A380 CPDLC connection establishment

B5.4.2. CPDLC CONNECTION TRANSFER

The following paragraphs provide a complete description of the CPDLC connection transfer mechanism.

B5.4.2.1. TRANSFER BETWEEN ATC CENTERS

Since CPDLC is intended for non-time critical en-route communications, three kinds of scenarios may occur:

Scenarios for transfer between ATC centers	
T-ATC datalink capability	**R-ATC datalink capability**
Not using CPDLC	Using CPDLC
Using CPDLC	Using CPDLC
Using CPDLC	Not using CPDLC

Voice and data link communications relative to these scenarios are detailed in the following section.

B5.4.2.1.1. Transfer from T-ATC not using CPDLC to R-ATC using CPDLC

For this scenario, two cases may occur:

- A transfer from the departure control to an en-route control, or
- A transfer between two en-route ATC centers, the first one does not use data link.

In both cases, a CPDLC connection establishment has to be performed. Refer to Section B5.4.1 CPDLC connection establishment for more details.

B5.4.2.1.2. Transfer from T-ATC to R-ATC, both using CPDLC

- **Transfer between sectors – No change of CPDLC connection**

In case of inter-sector transfers, the CPDLC connection is maintained. The procedure describes hereinafter is also valid for a frequency change within a sector. Refer to the following figures.

Bold font is used to identify human interactions.

1. **The T-ATC sends a datalink Voice Contact Instruction (VCI) to the flight crew (e.g. CONTACT EDYY 127.13).**
2. **The flight crew answers WILCO on the DCDU (respectively ATC mailbox). At this stage, no CPDLC messages should be sent to the T-ATC.** The transfer of data link is fully managed by the ground and is transparent to the flight crew.
3. **While sending the WILCO response, the flight crew tunes the assigned frequency on the RMP and contacts the R-ATC by voice.**
4. **The R-ATC sends a data link message containing its name (e.g. CURRENT ATC UNIT EDYY, MAASTRICHT, CTR) and becomes the Current Data Authority (CDA).**

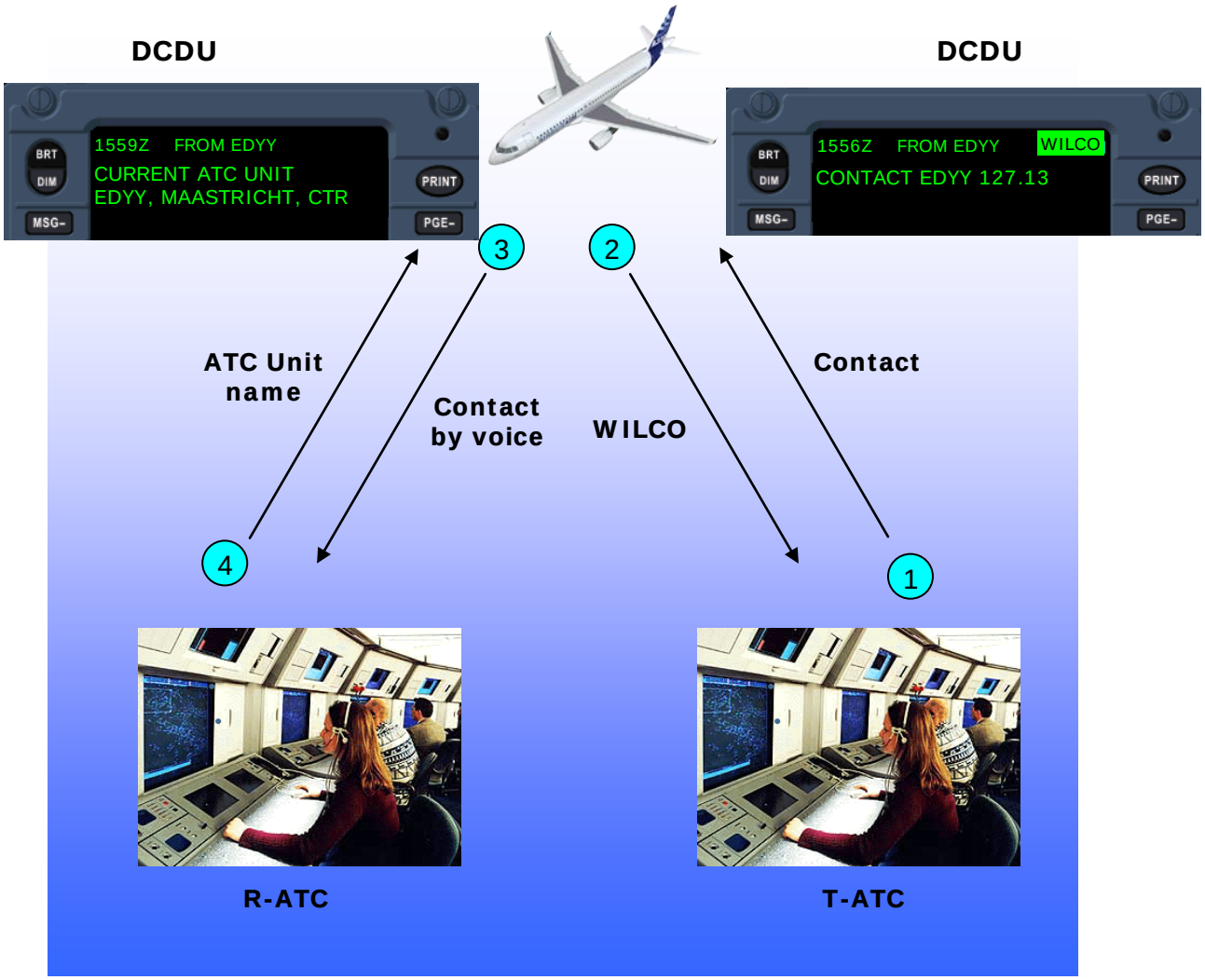


Figure 5-6
A320 Transfer between ATC sectors – No change of CPDLC connection

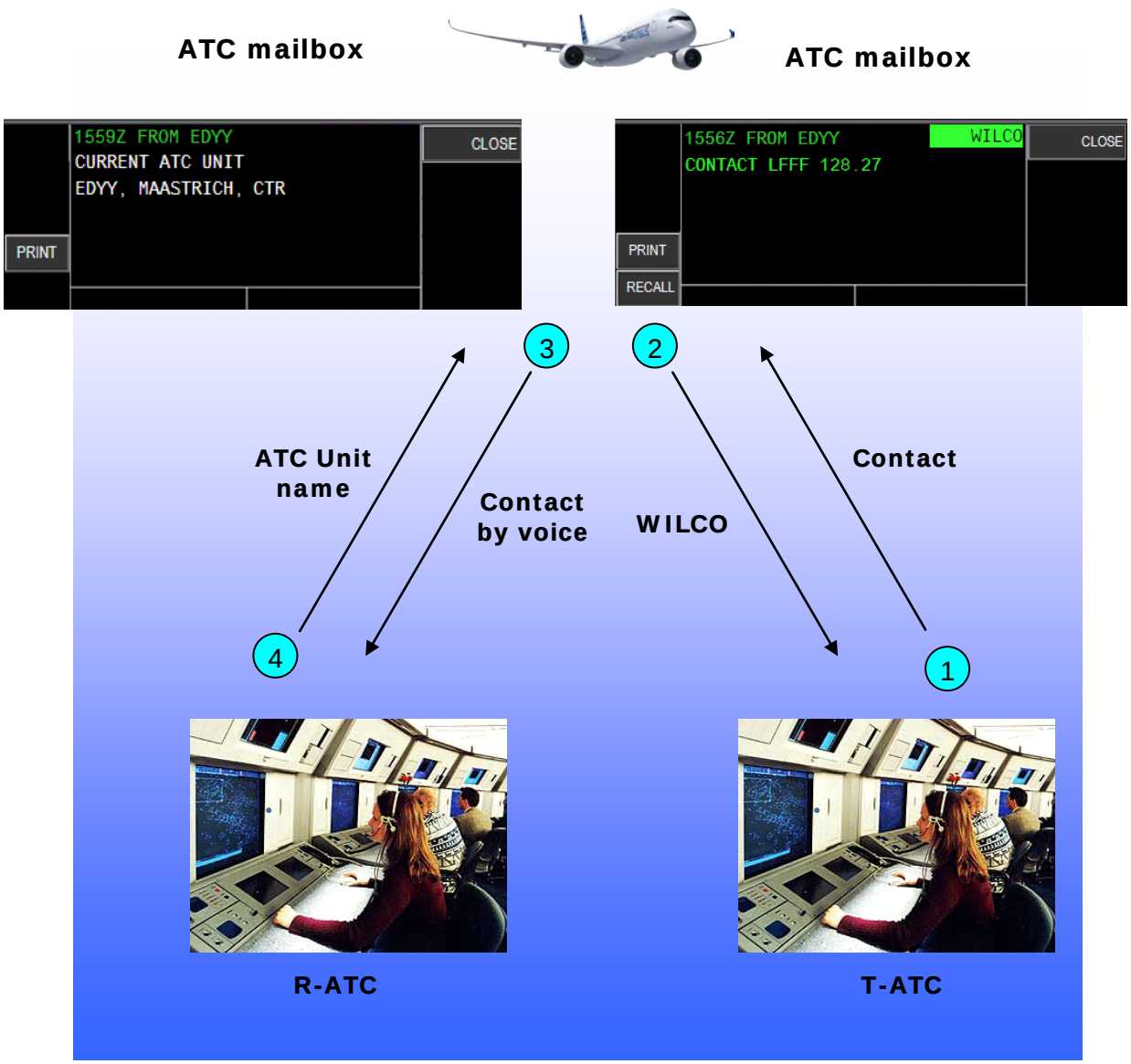


Figure 5-7
A350/A380 Transfer between ATC sectors – No change of CPDLC connection

Transfer between ATC centers – Use of DLIC Contact function

During the transfer of an aircraft from one ATC center to another, a CPDLC disconnection occurs. There are two methods to transfer the CPDLC connection:

- The ground-ground address forwarding procedure
- The transfer using the DLIC Contact function (also known as air-ground address forwarding procedure).

The ground-ground address forwarding procedure is the normal procedure. The DLIC Contact function is to be used when the ground-ground address forwarding procedure failed or is not available.

Both methods are transparent to the flight crew. Hereinafter is described the transfer process based on DLIC Contact function. Refer to the following figures.

***Bold** font is used to identify human interactions.*

1. The T-ATC sends a Contact request (CM_CONTACT message) to the aircraft system and subsequently notifies the NDA identification to the aircraft system. **A message indicating the name of the R-ATC** (e.g. NEXT DATA AUTHORITY LFFF) **is displayed on DCDU (respectively ATC mailbox)**. **This message is not applicable for the FANS B+ package**.
2. While receiving the Contact request (CM_CONTACT message) from the T-ATC, the aircraft system sends a Logon request (CM_LOGON_REQUEST message) to the R-ATC.
3. The R-ATC answers the aircraft system with a Logon response (CM_LOGON_RESPONSE message).
4. This Logon response (CM_LOGON_RESPONSE message) allows the aircraft system to send a Contact response (CM_CONTACT_RESPONSE message) to the T-ATC.
5. On one hand, after sending the logon response (CM_LOGON_RESPONSE message) to the aircraft system, the R-ATC initiates the CPDLC connection by sending a CPDLC start request.
6. The aircraft system confirms the reception of the CPDLC start request. **The name of the R-ATC (e.g. NEXT ATC: LFFF CTR) is displayed in white on DCDU (respectively ATC mailbox) underneath the ACTIVE ATC indication, and in green in the MCDU CONNECTION STATUS page (respectively MFD CONNECTION STATUS page).**
7. On the other hand, **the T-ATC sends a Voice Contact Instruction (VCI)** coupled with an instruction to end the CPDLC connection.

   When **the flight crew replies WILCO to the VCI**, a CPDLC end confirmation is appended to this response. At that stage, the CPDLC connection with the T-ATC is ended.
8. The flight crew contacts by voice the R-ATC, whereas the aircraft system notifies the R-ATC that it becomes the CDA.
9. **The R-ATC sends a uplink message identifying the R-ATC to the flight crew (e.g. CURRENT ATC UNIT EDYY, MAASTRICHT, CTR).** This message confirms that the R-ATC assumes the control of the aircraft and that the CPDLC connection with R-ATC is enabled.

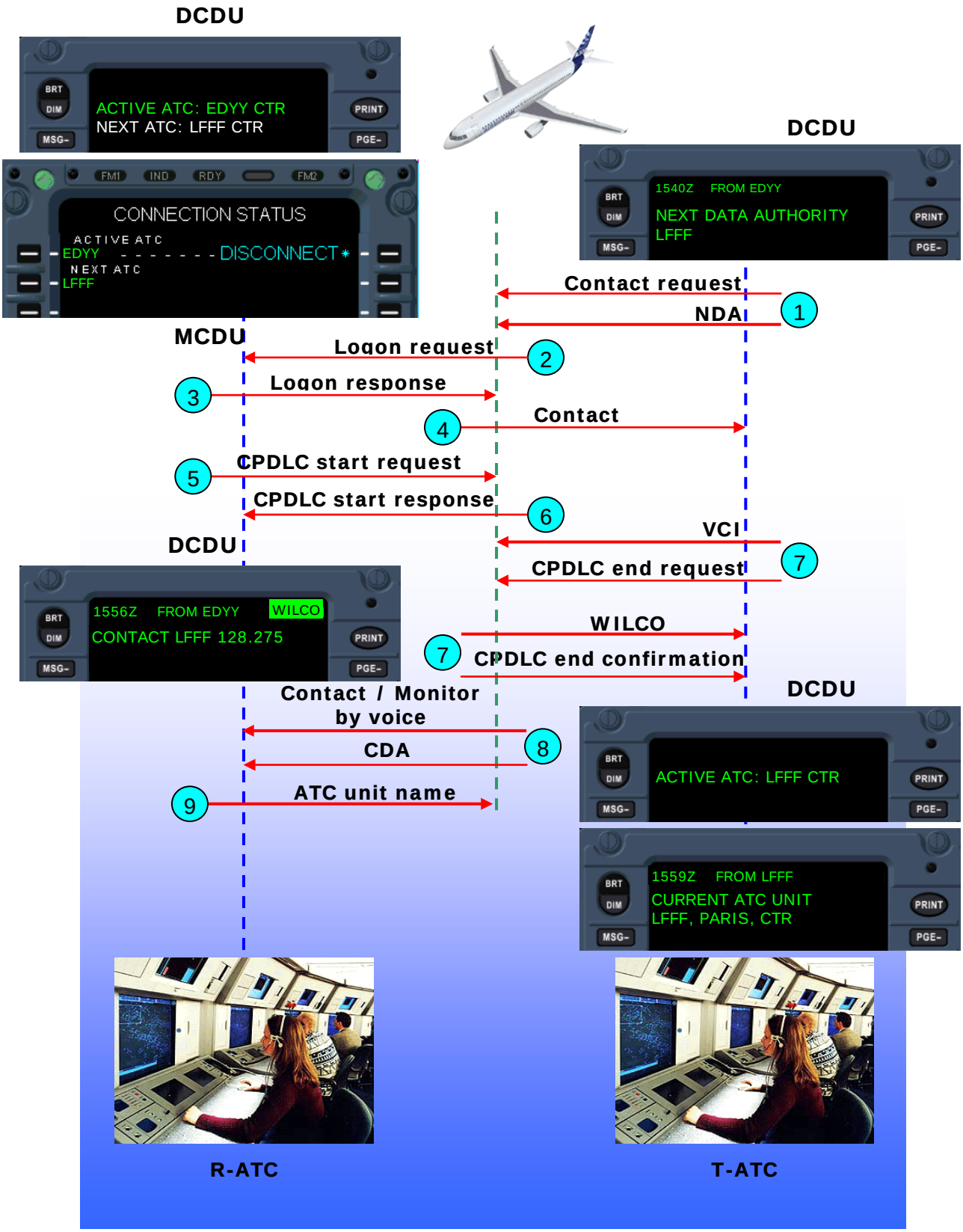


Figure 5-8
Transfer between ATC centers – Use of DLIC Contact function
(A320 with FANS B)

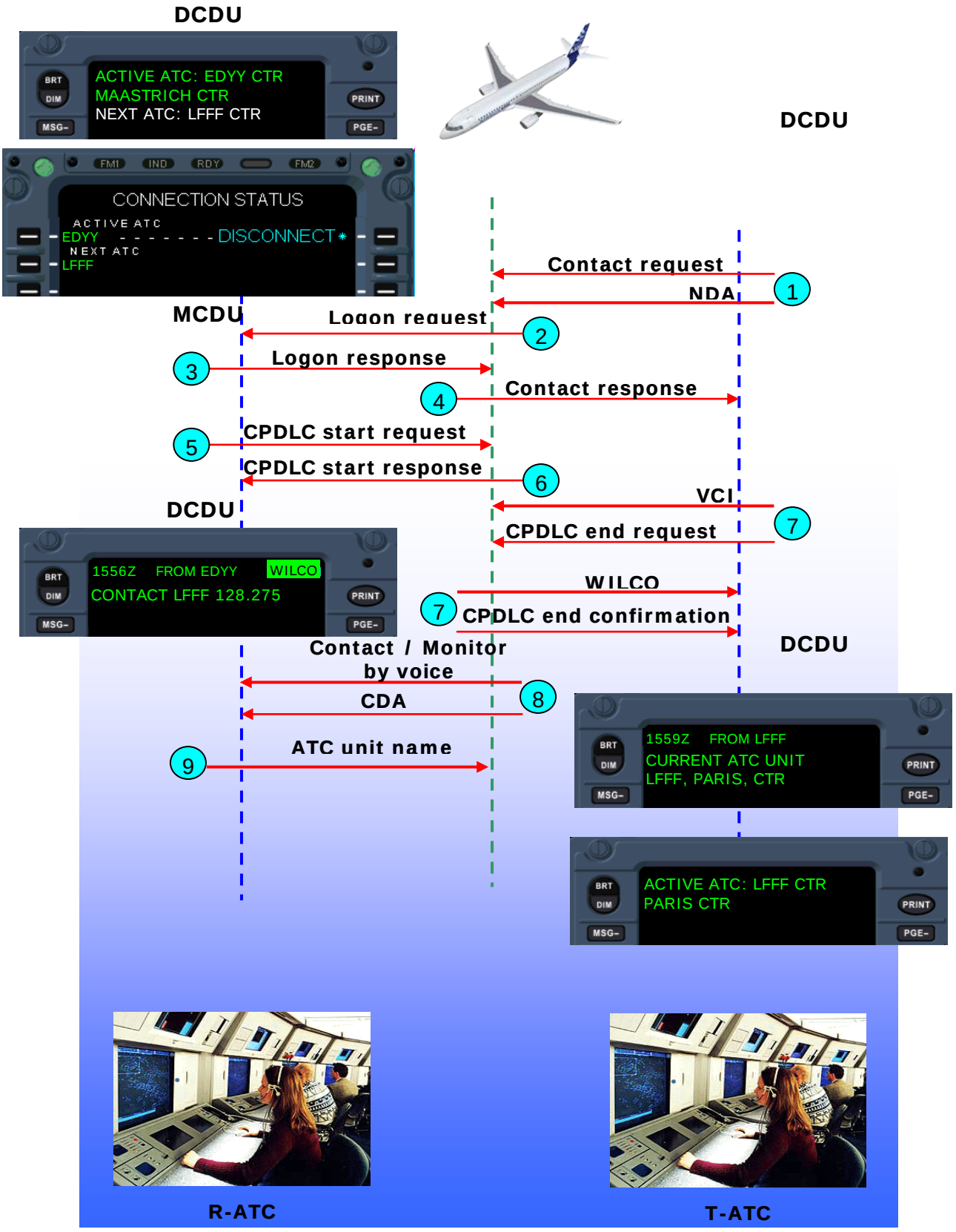


Figure 5-9

Transfer between ATC centers – use of DLIC Contact function
(A320 with FANS B+)

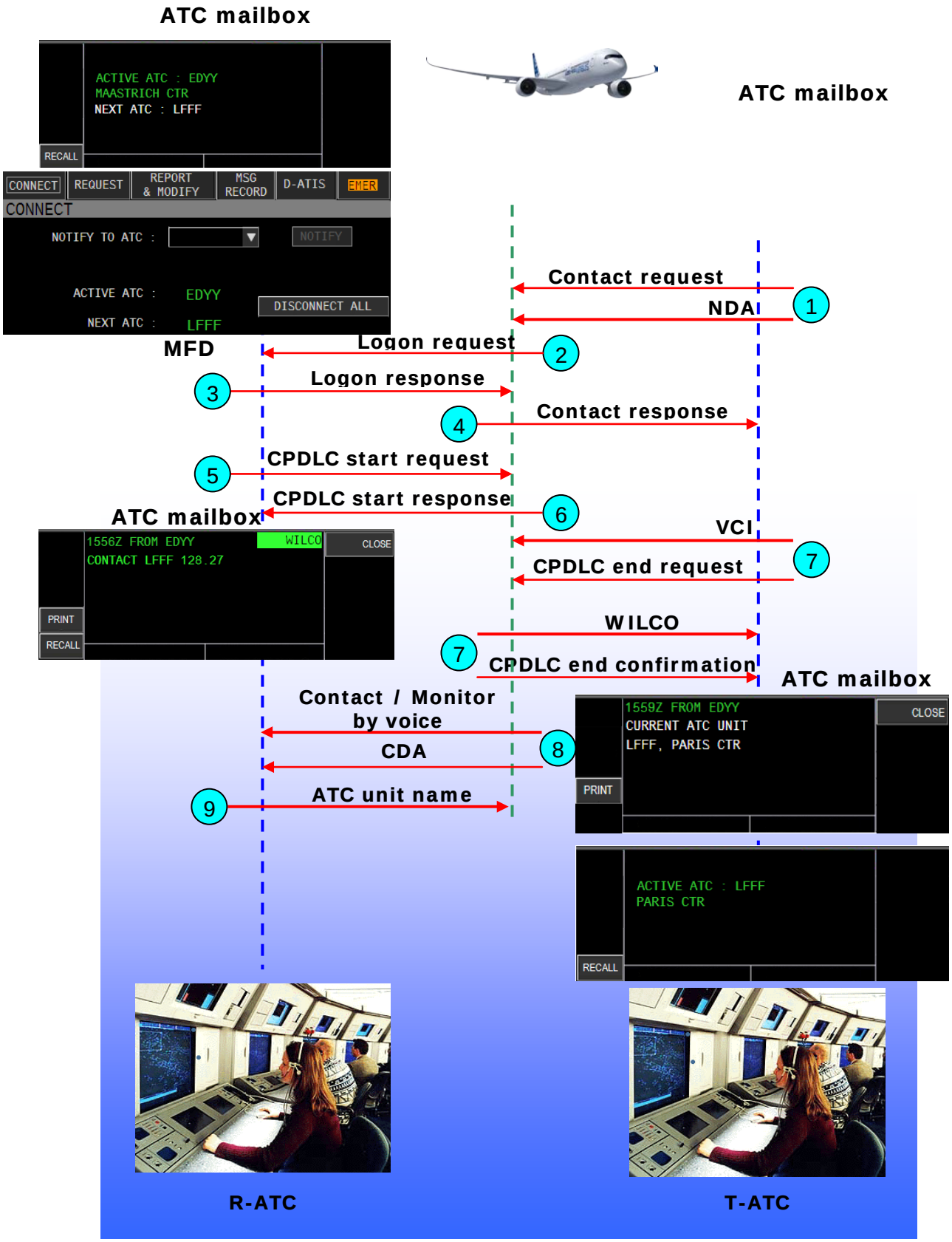


Figure 5-10

Transfer between ATC centers – Use of DLIC Contact function (A350/A380)

The flight crew should not send any downlink message to the R-ATC until the R-ATC assumes control of the aircraft (e.g. CURRENT ATC UNIT EDYY, MAASTRICHT, CTR). Early sending of downlink messages may results in rejection of these messages by the ground. The ground will send to the aircraft system an error message CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST displayed on DCDU (respectively ATC mailbox).

B5.4.2.1.3. Transfer from T-ATC using CPDLC to R-ATC not using CPDLC

For this scenario, two cases may occur:

- A transfer from the en-route control to an approach control, or
- A transfer between two en-route ATC centers, the second one does not use data link.

In both cases, a CPDLC termination has to be performed. Refer to Section B5.4.3 CPDLC termination for more details.

B5.4.2.2. ABNORMAL CASES AT THE TIME OF THE TRANSFER OF CONNECTION

Unable to contact R-ATC by voice
When the flight crew is unable to contact the R-ATC on the frequency instructed in the VCI, the flight crew shall contact the T-ATC by voice for further instructions.

B5.4.3. CPDLC TERMINATION

CPDLC connection termination is initiated by the ATC center. A CPDLC connection is terminated in two cases:

- During a transfer from one ATC center to another, both ATC centers using CPDLC, or
- During a transfer from one ATC center to another, the second ATC center does not use CPDLC.

B5.4.3.1. DURING A TRANSFER FROM ONE ATC CENTER TO ANOTHER, BOTH USING CPDLC

Please refer to Section B5.4.2.1.2 Transfer from T-ATC to R-ATC, both using CPDLC for details on the procedure.

B5.4.3.2. DURING A TRANSFER FROM ONE ATC CENTER USING CPDLC TO ANOTHER NOT USING CPDLC

Such a transfer occurs when the aircraft is transferred either:

- Between two en-route ATC centers, the R-ATC does not use CPDLC, or
- Between an en-route control and an approach control, since CPDLC is intended for non-time critical communications.

This type of transfer is detailed hereinafter. Refer to the following figures.

Bold font is used to identify human interactions.

1. **The T-ATC sends a Voice Contact Instruction (VCI)** coupled with an instruction to end the CPDLC connection.
2. When **the flight crew replies WILCO to the VCI**, a CPDLC end confirmation is appended to this response. At that stage, the CPDLC connection with the T-ATC is ended.
3. **The flight crew contacts by voice the R-ATC.**

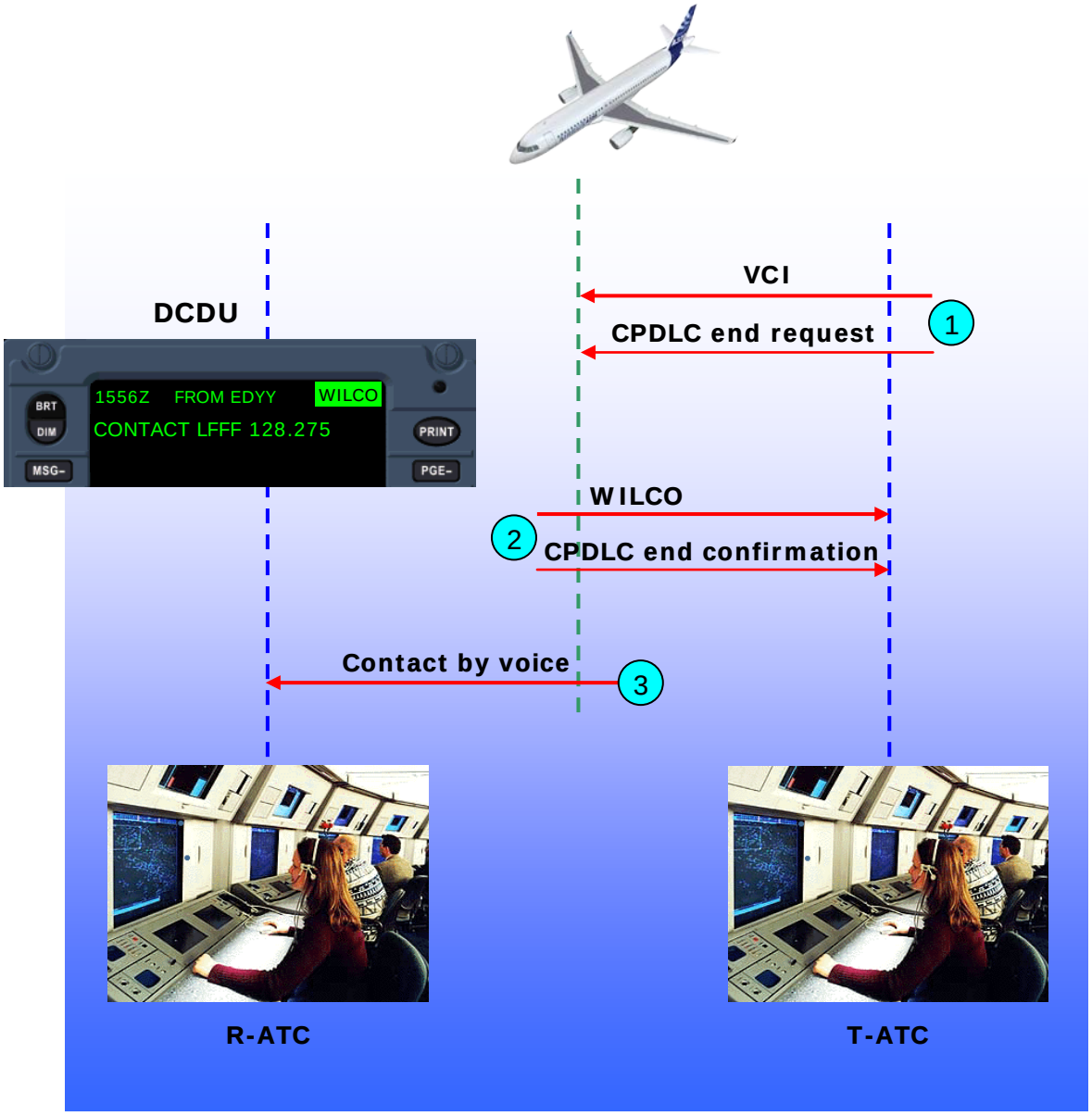


Figure 5-11
A320 CPDLC termination

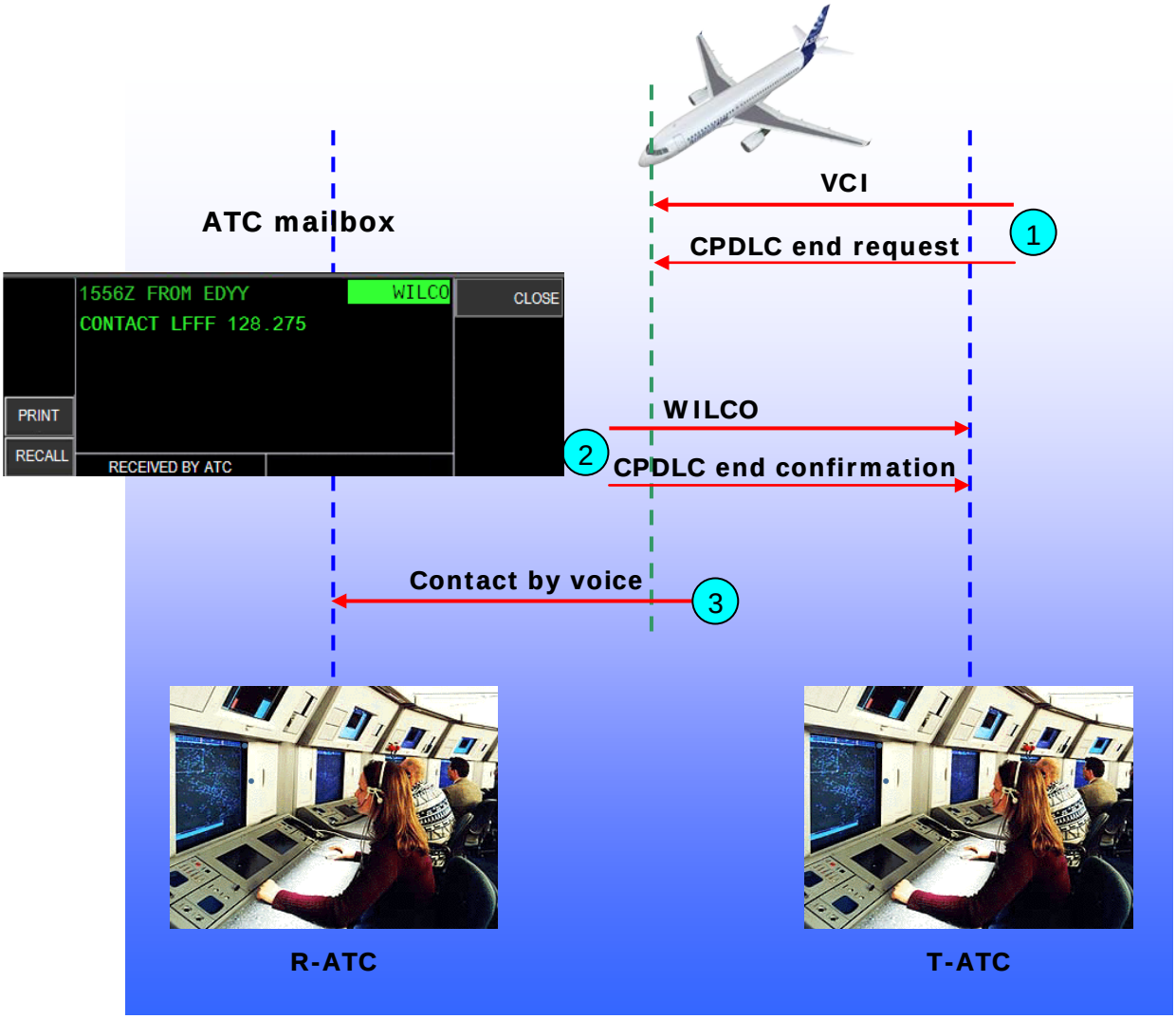


Figure 5-12
A350/A380 CPDLC termination

B5.4.3.3. OPEN DIALOGUES DURING CPDLC TERMINATION

If some dialogues remain open (initiated either by the ATC controller or the flight crew) at the time when a CPDLC end request is received onboard:

- The dialogues are maintained open if the flight crew replies UNABLE or STAND BY to the VCI,
- The dialogues are closed if the flight crew replies WILCO to the VCI.

If the ATC controller decides to transfer the aircraft with open dialogues, the ATC controller should revert to voice before the transfer. The voice communications will avoid any ambiguity caused by the open dialogues.

B5.4.4. INHIBITION OF CPDLC APPLICATION

Onboard, the system inhibits the CPDLC application when:

- The system is powered on (after power cuts or software resets), or
- The flight crew changes the flight identification in the FMS INIT A page, or
- The flight crew manually disconnects CPDLC via the CONNECTION STATUS page, or
- The last engine shuts down (end of flight), or
- The aircraft 24 bits address (A/C ICAO code) is modified on the COMM CONFIG page.

When the CPDLC application is inhibited, the system rejects any valid CPDLC connection requests (transparent for the flight crew). The system justifies the connection rejection with an error downlink message followed by a free text AIRCREW HAS INHIBITED CPDLC.

The system resumes the CPDLC application when the flight crew initiates a manual notification (whatever the result of the notification).

B5.4.5. FAILURES OF THE CPDLC CONNECTION

As soon as a CPDLC connection failure is noticed by either the flight crew or ATC controller, voice will be used to inform the other part of the failure and to coordinate further actions. The flight crew or the ATC controller should preface the information with the phrase CPDLC FAILURE.

At that time, pending CPDLC messages should be considered as not delivered and the entire dialogue related to these messages should be restarted on voice.

If the CPDLC connection is recovered before the flight crew switched to voice communication, all dialogues involving the CPDLC outstanding messages should be recommenced via CPDLC.

B5.4.6. INTENTIONAL CPDLC SHUTDOWN

If a CPDLC shutdown is planned, a NOTAM is published to inform of the shutdown period and the voice frequencies to be used.

Aircraft currently connected to the affected ATC center, are informed either by CPDLC or by voice of the CPDLC shutdown.

B5.4.7. USE OF CPDLC IN THE EVENT OF VOICE RADIO COMMUNICATION FAILURE

The voice communication remains the primary means of communication in ATN environment.

Consequently, even if a CPDLC connection exists, the flight crew shall apply all the procedures provisioned in the event of radio communication loss.

B5.4.8. RECOMMENDATIONS FOR THE EXCHANGE OF CPDLC MESSAGES

This chapter describes the various operational points for a proper understanding and use of the CPDLC system.

Lists of all the uplink and downlink messages used in ATN network are given in Part III - Appendix A.

B5.4.8.1. TO BE KNOWN

B5.4.8.1.1. Technical acknowledgement

Thanks to the ATN protocol, either the flight crew or the ATC controller gets the assurance that the sent message is displayed on the recipient's HMI. This is valid only in areas where the LACK is used.

When the flight crew sends a downlink message, the DCDU (respectively ATC mailbox) displays the indication RECEIVD[2] BY ATC (respectively RECEIVED BY ATC) in the information zone when the corresponding LACK is received.

However, there is an exception when the aircraft is transferred to another ATC. When the flight crew sends WILCO as a response to the Voice Contact Instruction (e.g. CONTACT EDYY 127.13), the ground system will not return any LACK. Therefore, the indication SENT will be directly displayed on the DCDU (respectively ATC mailbox), instead of RECEIVD BY ATC (respectively RECEIVED BY ATC).

Indeed, when the WILCO response is sent, the ATSU (respectively ATC applications) appends a disconnection request to this response. Then the T-ATC is no more connected to the aircraft.

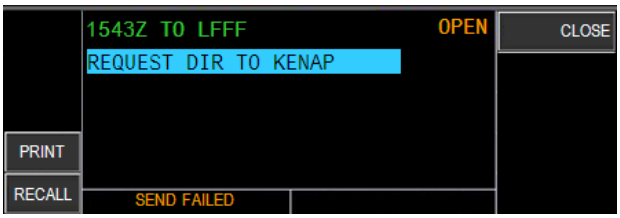
[2] One 'E' is omitted due to space restrictions imposed by the interface

B5.4.8.1.2. Technical acknowledgement not received on due time

When no uplink LACK (related to a downlink message) is received before the expiration of the technical response timer, the DCDU (respectively ATC mailbox) displays an amber SEND FAILED in the information area and an amber OPEN status in the top right corner. The flight crew shall revert to voice.

⇓ Interfaces on A320 ⇓

⇓ Interfaces on A350/A380⇓



B5.4.8.1.3. Message latency timer

For uplink messages, if the receipt time of a message reveals a difference with its timestamp greater than the message latency timer (hard coded to 60 seconds in FANS B and 40 seconds in FANS B+ system), the message is rejected and not displayed on DCDU (respectively ATC mailbox). An error message UPLINK DELAYED IN NETWORK AND REJECTED. RESEND OR CONTACT BY VOICE is then automatically downlinked to the ATC controller.

For downlink messages, the same principle may apply according to the local implementation of the ATC ground systems. If the ground systems discard delayed downlink messages, the ATC controller will not see the downlink message and the flight crew will receive the error message DOWNLINK DELAYED – USE VOICE. The flight crew shall revert to voice.

B5.4.8.1.4. Uplink error messages

The flight crew may receive some error messages from the ground system. These messages are triggered for various reasons (e.g. message not supported, multi-element messages not allowed, transfer not completed, etc). The flight crew should provide the appropriate response by applying the right procedure.

All these messages are listed in Part III - Appendix B with the appropriate procedure.

B5.4.8.2. EXPECTED DELAYS IN RESPONDING TO CPDLC MESSAGES

Delays depend on numerous varying factors. Thanks to the availability, integrity and accuracy of ATN, statistics showed that the technical round-trip delay for uplink messages are:

- Less than 2 seconds for 50 % delivered messages

- Less than 15 seconds for 95 % delivered messages
- Less than 36 seconds for 99% delivered messages.

with an average delay of 5 seconds.

The technical round trip delay measures the delay between the sending of the message from the ground system and the reception of the corresponding logical acknowledgement (LACK message) sent by the aircraft. Measures for downlink messages are not available at the time of writing the document.

- **Operational timers for dialogue initiated by the flight crew**

When the flight crew sends a downlink message requiring a response, the ATC response is expected within 270 seconds (Operational Timer Sender). At the reception of the message, the ATC controller has 250 seconds (Operational Timer Responder) to send the response. If the ATC controller answers STANDBY, the flight crew expects the final answer within further 250 seconds. Refer to Part I – Section 3.5.6 Timers for the description of operational timers.

If the Operational Timer Responder expires, a system message is sent to the aircraft and closes the dialogue. ATC TIME OUT – REPEAT REQUEST is displayed on DCDU (respectively ATC mailbox).
If the Operational Timer Sender expires, the aircraft system displays NO ATC REPLY in the information area of the DCDU (respectively ATC mailbox).

In these cases of timer expiration, reversion to voice is let at discretion of the flight crew.

- **Operational timers for dialogue initiated by the ATC controller**

When the ATC controller sends an uplink message requiring a response, the flight crew response is expected within 120 seconds (Operational Timer Sender). At the reception of the message, the flight crew has 100 seconds (Operational Timer Responder) to send the response. If the flight crew answers STANDBY, the ATC controller expects the final answer within further 100 seconds. Refer to Part I - 3.5.6 Timers for the description of operational timers.

If the Operational Timer Responder expires, the aircraft system displays “REPLY: TIME OUT” in the information area of the DCDU (respectively ATC mailbox).

If the Operational Timer Sender expires, the ATC controller is notified.

In all these cases of timer expiration, communication should revert to voice.

Considering the message transmission time on ATN network (around 5 seconds in average) in normal operations, the Operational Timer Responder (i.e. 250 seconds for dialogue initiated by the flight crew and 100 seconds for dialogue initiated by the ATC controller) should expire before the Operational Timer Sender (i.e. 270 seconds for dialogue initiated by the flight crew and 120 seconds for dialogue initiated by the ATC controller).

B5.4.8.3. RESPONDING TO CPDLC MESSAGES

B5.4.8.3.1. Media to be used

When the ATC controller or the flight crew communicates via CPDLC, the response should be via CPDLC.

When the ATC controller or the flight crew communicates via voice, the response should be via voice.

B5.4.8.3.2. Voice Read-Back/Protected Mode

In the framework of FANS B system, a Voice Read-Back is required for any messages related to any changes of the aircraft trajectory to ensure that the message is received to the intended recipient. FANS B was designed for the Pioneer phase of LINK 2000+, that did not require Protected Mode (PM).

With the implementation of the Protected Mode (PM), FANS B+ does not require voice read-back. Due to the discontinuation of the Voice Read-Back (VRB) procedures from 15 November 2012, it is required aircraft capable Protected Mode CPDLC in European airspace.

B5.4.8.3.3. Recommended answers

When responding to a CPDLC message, the flight crew shall use the responses proposed by the DCDU (respectively ATC mailbox).

B5.4.8.4. MULTI-ELEMENTS MESSAGES

- A CPDLC message that consists of more than one message element is a multi-element message.
- In order to avoid ambiguity, it is highly recommended that the flight crew does not send multi-element messages.
- Flight crew should send one message per clearance element.
- Flight crew will answer either positively (WILCO or AFFIRM or ROGER depending on the nature of the message elements) or negatively (UNABLE) to a multi-element message. The response will apply to the entire message.

Note: Answering multi-elements messages is prone to misunderstanding since the answer applies to the whole message itself and cannot apply to each element individually.

Note 1: It is known that the ATC should not send multi-element message with independent clearances because the flight crew cannot individually respond to each clearance (e.g. WILCO one clearance and UNABLE the other).

B5.4.8.5. DOWNLINK FREE TEXT

The FANS B system (a Pioneer phase product) and the FANS B+ system (a Mandate phase product) do not allow to send downlink free text.

B5.4.8.6. CPDLC DIALOGUE CLOSURE

Among the basic assumptions and rules that have presided to the design of the CPDLC system, the closure of a message is one of the most important to be known by the flight crews. Open messages are prone to potential ambiguity and system issues. They should be avoided as much as possible.

Flight crew should answer any received messages within 100 seconds (Refer to Part I - 3.5.6 Timers for the description of operational timers).

They should be aware of the following definitions, that apply:

- A message is open as long as an associated response is not received or until the operational timer – Responder expires (refer to the description of operational timers in Part I)
- A message that needs not an answer is automatically closed once received,
- A message is closed when its associated response, other than STANDBY, is received or when the operational timer – Responder expires (Refer to Part I - 3.5.6 Timers for the description of operational timers.).

B5.4.8.7. DCDU (RESPECTIVELY ATC MAILBOX) MANAGEMENT

From the experience gained with FANS A operations and from the outcomes of the Human Factors process, it has been noticed that when several messages are queued in DCDUs (respectively ATC mailbox), some flight crew mix messages up when treating them. Consequently, **it is strongly recommended to clear DCDUs (respectively ATC mailbox) when messages are treated.**

When a message is received by the ATC ground system (i.e. RECEIVD BY ATC indication displayed on DCDU or RECEIVED BY ATC displayed on ATC mailbox), always close the message via the CLOSE soft key to clear DCDUs (respectively ATC mailbox). When closed, the message can be recalled via the RECALL soft key.

B5.4.8.8. MSG RECORD MANAGEMENT

All exchanged messages are stored in the MSG RECORD page on MCDU (respectively MSG RECORD page of MFD ATC COM pages) when they are closed. It is recommended to erase the MSG RECORD to avoid confusion with messages from the previous flights. For more details, refer to Section B5.2.2 Pre-flight checks.

B5.4.8.9. REVERTING FROM CPDLC TO VOICE

The ATC or the flight crew shall revert from CPDLC to voice in the following cases:

- Whenever a CPDLC message is ambiguous.
- Whenever an operational timer related to a CPDLC message expires.
- Whenever an error message is replied to a CPDLC message or generated by the system.

- Whenever a timely execution of clearances or instructions transmitted by CPDLC is required. Clearances or instructions whose execution is expected to be within 2 or 3 minutes should be transmitted via CPDLC. If execution is expected in a shorter period, voice shall be used.
- To correct any sent CPDLC messages including incorrect parameters. When a message is sent, there is no means to cancel it. In order to avoid duplicate messages that would lead to ambiguous situations, no new CPDLC messages shall be sent to correct a previous CPDLC message.

In these cases, the ATC or the flight crew shall preface their transmission with the following sentence DISREGARD CPDLC (message content or type) MESSAGE, BREAK followed by the correction.

- For a CPDLC message requiring an operational response. It is negotiated via voice and an appropriate CPDLC closure response is sent. This ensures the proper closure of the CPDLC dialogue in accordance with the negotiation made by voice. To do so, the flight crew may be explicitly instructed to select the appropriate response, or the flight crew may wait for the operational timer to time out.

Please bear in mind…

CPDLC procedures

- **CPDLC Connection Establishment**
  - Once the **DLIC notification** has been successfully done, the ATC center can initiate a CPDLC connection (no action required from the flight crew). CPDLC messages shall only be sent when the aircraft is assumed by the ATC center (i.e. reception of the uplink message indicating the name of the ATC).
  - Checks are automatically done by the aircraft system (ATSU for A320 or ATC applications for A350/A380) to validate or reject the connection:
    - **Connection is accepted** if no previous connection already exists or, if the ATC center corresponds to the next ATC center to control the aircraft
    - **Connection is rejected** in all other cases.
  - Once connection is established:
    - For the technical connection, the active connected ATC center is then displayed on the DCDU (respectively ATC mailbox), and on the CONNECTION STATUS page of the MCDU (respectively CONNECT page of the MFD)
    - For the operational connection, an uplink message indicating the name of the current ATC (e.g. EDYY, MAASTRICHT, CENTER) is received.

- **CPDLC Connection Transfer**
  - To inform the aircraft avionics (i.e. ATSU or ATC applications) that a transfer of control will occur, the current active ATC sends a so-called **NDA message (Next Data Authority)** to the aircraft. This is the only way for the ATSU (respectively ATC applications) to be aware of and to accept the connection with the next ATC center.
  - Once a NDA message has been received, the aircraft is waiting for the connection with the next ATC center.
  - Under normal circumstances the CPDLC connection should be established with the Next Data Authority prior to the connection between the aircraft and the current data authority being terminated.

Please, bear in mind… (continued)

- **Failures of the CPDLC connection**
  - As soon as a failure of the CPDLC connection is noticed by either the crew or the ATC controller, voice will be used to inform the other part of the failure and to co-ordinate further actions.
  - At that time, pending CPDLC messages should be considered as not delivered and the entire dialogue related to these messages should be restarted on voice.
  - If the CPDLC connection is recovered before the flight crew switched to voice communication, all dialogues involving the CPDLC outstanding messages should be recommenced via CPDLC.

- **Recommendations for CPDLC**
  - When the flight crew sends a downlink message, the DCDU (respectively ATC mailbox) displays the indication “RECEIVD BY ATC” (respectively “RECEIVED BY ATC”) in the information zone when the corresponding LACK is received.
  - When no uplink LACK (related to a downlink message) is received before the expiration of the technical response timer, the DCDU (respectively ATC mailbox) displays an amber “SEND FAILED” indication and an amber OPEN status.
  - When the flight crew sends a downlink message, the ground system automatically sends ATC TIME OUT – REPEAT REQUEST message to the aircraft if the ATC controller does not respond within 250 seconds after reception. “ATC TIME OUT – REPEAT REQUEST” is displayed on DCDU (respectively ATC mailbox).
  - When an uplink message is received, the DCDU (respectively ATC mailbox) displays “REPLY: TIME OUT” if the flight crew does not respond within 100 seconds.
  - A **Voice Read-Back** is required for any messages related to any changes of the aircraft trajectory in the framework of FANS B system. Thanks to the implementation of the **Protected Mode (PM)**, FANS B+ does not require Voice read-back. Due to the discontinuation of the **Voice Read-Back (VRB)** procedures from 15 November 2012, it is required aircraft capable **Protected Mode** CPDLC in European airspace.
  - In order to avoid ambiguity, it is highly recommended that the flight crew does not send multi-element messages.
  - The system does not allow to send downlink free text.
  - It is strongly recommended to close with the CLOSE soft key any messages on DCDUs (ATC mailbox) once they are sent. Once closed, the message can be recalled via the RECALL soft key.
  - It is recommended to erase the MSG RECORD to avoid confusion with messages from the previous flights.

Please, bear in mind… (continued)

- **The ATC or the flight crew shall revert from CPDLC to voice in the following cases:**
  - o Whenever a CPDLC message is ambiguous, or
  - o Whenever an operational timer related to a CPDLC message times out, or
  - o Whenever an error message is replied to a CPDLC message or generated by the system, or
  - o Whenever a timely execution of clearances or instructions transmitted by CPDLC is required, or
  - o To correct any sent CPDLC messages including incorrect parameters.

B6.FANS B EVOLUTIONS

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The present chapter is divided into two parts:

- The first part is related to FANS B evolution available on A320. The evolution is identified as the FANS B+ system. The novelties are described compared to the FANS B system. The FANS B+ system has been available since November 2010 on A320 aircraft. To continue the improvement of FANS B+, a latest FANS B+ system with functional evolutions has been certified in 2014.
- The second part is related to FANS B+ enhancement available on A350/A380 aircraft. FANS B+ features on A350/A380 is part of the FANS A+B system designed on an architecture (ATC/ACR replace ATSU) based on IMA/AFDX technology. Regardless the interfaces, it is to be noticed that FANS B+ functions on A350/A380 are the same as the ones on A320 aircraft, apart from a very few exceptions. These exceptions are described in this second part.

B6.1. A320 FANS B+ (FANS B SYSTEM EVOLUTION)

Initially, FANS B was developed for the Link 2000+ Pioneer phase as the first step of FANS ATN concept implementation for operation in continental area. Some capabilities of FANS B system was inherited from the initial FANS A+ system on A320 such as:

- Hardware capability to support wired high-speed data loading specification AEEC-615A (Ethernet loading usually called ARINC-615A)
- ACARS router
- Communication Service Provider (CSP) world map
- ATSU router customization via loadable database.

For a detailed description of these capabilities, refer to Part II – Chapter A6.

To meet the requirements of the Link 2000+ Mandate phase, Airbus has developed the FANS B+ system. The aim of this chapter is to list and to describe the evolutions implemented in the transition from FANS B to the FANS B+ system. The objectives of the FANS B+ system are two-fold:

- To improve the package of FANS B services (FANS B+ basics)
- To extend the use of data link services (FANS B+ options).

FANS B+ integrates the following improvements:

- An update of ATC FANS B applications (CMA and CPDLC applications) in order to comply with ED110 rev. B
- The Protected Mode that replaces the Voice Read-Back (VRB) procedure used on FANS B for ATC instructions modifying the flight profile
- ATC data link communication recording for the investigation on flight accidents/incidents as an option
- The possibility to activate ATS623 applications as an option: Departure & Oceanic clearances and Digital-ATIS
- Radio frequency loading into RMP as an option.

B6.1.1. FANS B+ BASICS

B6.1.1.1. ENHANCEMENTS OF THE HUMAN MACHINE INTERFACE (HMI)

B6.1.1.1.1. Improvement of the display of CPDLC connection status

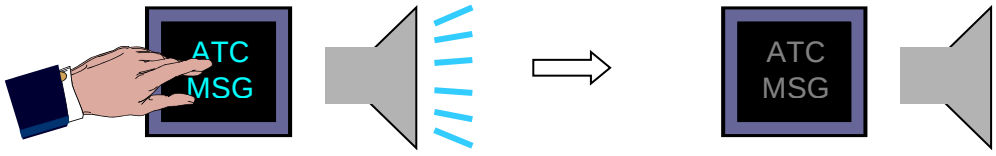
One novelty of FANS B+ is about the display of the CPDLC connection status on DCDU. The following HMI improvement has been integrated for a better flight crew awareness. DCDU default screen displays:

NEXT ATC: [facilitydesignation] when the CPDLC connection is established and not enabled.

ACTIVE ATC: [facilitydesignation] followed by [facilityname] (e.g. ACTIVE ATC: EDYY, MAASTRICH CTR on the next line) when the CPDLC connection becomes enabled.

Note: On FANS B, when the CPDLC connection is established but not enabled, the active ATC center is displayed on DCDU (e.g. ACTIVE ATC: [facilitydesignation]). The display remains unchanged when the CPDLC connection becomes enabled.
While reading ACTIVE ATC [facilitydesignation], the flight crew might think that the ATC center has assumed aircraft. Indeed the ATC center only assumes the aircraft when the CPDLC connection is enabled.

B6.1.1.1.2. Modifications of ATC Aural Alerts Frequency



The ATC alert (aural and visual) is triggered each time a new uplink message arrives or whenever a deferred report or clearance expires.

On FANS B+, the ATC aural alert frequency has been modified to be activated more quickly in comparison to FANS B. The reason is that, due to time constraints in ATN environment (the flight crew has 100 seconds to answer a request), the flight crew must be alerted more quickly. The ATC aural alert is activated:

- 10 seconds (15 seconds on FANS B) after receiving the message and repeated every 10 seconds when a normal message is received
- Immediately (5 seconds on FANS B) after receiving the message and repeated every 5 seconds when an urgent message is received.

B6.1.1.1.3. Modifications of MSG RECORD

Regarding the enhancements provided on the MSG RECORD, FANS A+ proposes the same improvements except the following feature has been inserted specifically for FANS B+:

Messages for which the flight crew failed to reply on time, are displayed with the status REPLY:TIME OUT in the MSG RECORD (see on the right).

For the description of MSG RECORD, refer to Part II – Chapter A6.

B6.1.1.1.4. New DATALINK STATUS Page

The content of the new DATALINK STATUS page is equivalent to the MCDU DATALINK STATUS page introduced in the latest FANS A+ system. The flight crew can open this page via the ATSU DATALINK page and consult the status of the VHF, SATCOM and HF communications media. As ATC applications in ATN environment relies on VHF, (SATCOM and HFDL are used for ATC applications in ACARS environment), only the status of the VHF should be considered for ATC communications in FANS B+.

For the description of DATALINK STATUS PAGE, refer to Part II – Chapter A6.

NEW

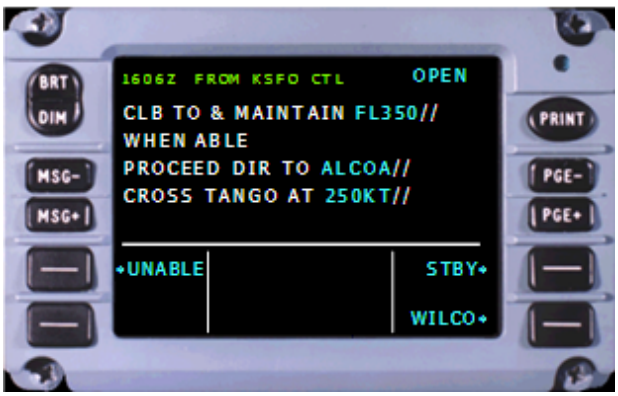
B6.1.1.1.5. Separators in DCDU message display

FANS B+ comes with a enhancement of the display of CPDLC uplink messages. When displayed on DCDU, the separator // (two slash marks) is used to improve the message legibility as follows:

- A single element message is terminated by // (two slash marks),
- Each element of a multi-element CPDLC message is terminated by // (two slash marks).

Single element message

Multi-element message



Note: No separator is inserted in the display of downlink messages.

B6.1.1.2. IMPROVEMENTS RELATED TO THE CPDLC

B6.1.1.2.1. Protected Mode

Coming with FANS B+ system, the Protected Mode ensures, in one hand, that a CPDLC message is delivered to the intended receiver from the expected sender, and in the other hand, the integrity of CPDLC message. Before PM (with FANS B system), the Voice Read-Back (VRB) procedure was mandatory for ATC instructions modifying the flight profile.

Technically speaking, the PM relies on an integrity check on the CPDLC messages. For each message (downlink or uplink), the flight identification, Aircraft 24 bits address, ATC Center designation, CPDLC version and the message checksum are attached to the message by the sender (respectively aircraft or ATC center). When the receiver (respectively ATC center and aircraft) receives the CPDLC message, the integrity of the message content and the attached information (the flight identification, Aircraft 24 bits address, ATC Center designation, CPDLC version) will be checked by the receiver. In the check fails, the message will be rejected by the receiver.

PM has no impact on the cockpit displays.

B6.1.1.2.2. Operational timers for dialogue initiated by the ATC

When the ATC sends an uplink message requiring a response, the flight crew should reply within 100 seconds. When the message requires to enter a response on the MCDU, “REPLY WITHIN xx SEC” is displayed to alert the flight crew if the remaining time is less than 30 seconds. The alert is refreshed on the MCDU every 5 seconds with the corresponding remaining time.

NEW Coming with the latest FANS B+ system, the “REPLY WITHIN xx SEC” indication is no more displayed on MCDU. For any uplink messages requiring an answer, “xx SEC for REPLY” is displayed in the information area of the DCDU when the time remaining is 30 seconds. Then, this indication is refreshed every 5 seconds.

If the flight crew does not reply to the message within the 100 seconds (whatever the FANS B+ system), the aircraft system:

- Displays “REPLY: TIME OUT” (color amber) in the information area of the DCDU
- Sends to the ATC center the message: “AIR SYSTEM TIMEOUT”.

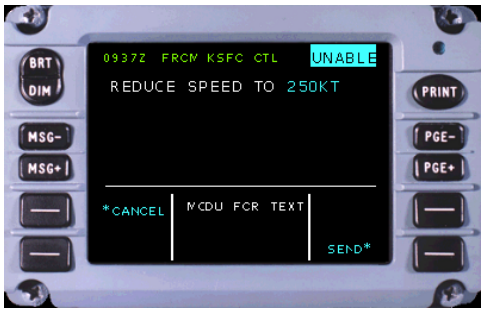
The flight crew must close the message and revert to voice communication in such situation.
Note: This is applicable for all FANS B+ systems.

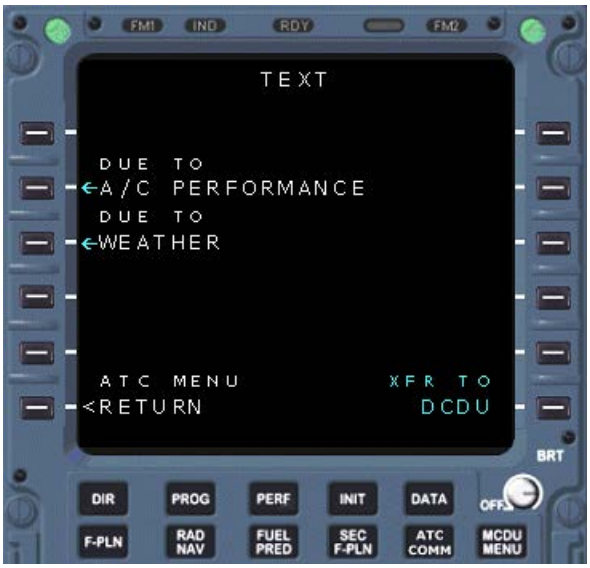
B6.1.1.2.3. New justifications for UNABLE answer and REQUEST page

FANS B+ proposes a new feature to justify an UNABLE answer. Through the TEXT menu available in the ATC MENU page, the flight crew may add one of the following new justifications to the UNABLE reply:

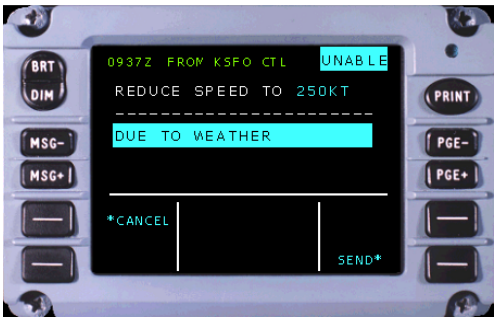
- DUE TO A/C PERFORMANCE
- DUE TO WEATHER.

When the flight crew selects UNABLE to a clearance (see DCDU below), they may select a justification on the MCDU TEXT page and add it to the response. The available justification are proposed in the TEXT page as illustrated on the right.





After selection of the justification and transfer to DCDU through "XFR TO DCDU" button, the flight crew may send the complete answer, i.e. UNABLE + DUE to WEATHER (see DCDUs below and on the right).



These new justifications have been also added in the REQUEST page of the MCDU. Through this page, the flight crew can prepare the following ATC requests:

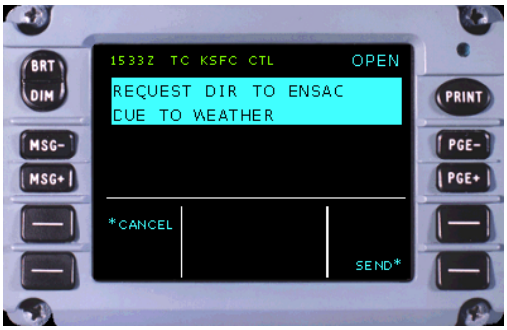
- PROCEED DIR TO [position]
- REQUEST [level]
- REQUEST [speed]

with the possibility to add the new justifications:

- DUE TO A/C PERFORMANCE
- DUE TO WEATHER.

When the flight crew wants to ask for a “DIR TO” (Direct To) clearance, they may open the REQUEST page on MCDU.

After selection of the waypoint (e.g. ENSAC), the flight crew may add a justification (e.g DUE TO WEATHER) before the transfer of the complete request to the DCDU and the sending of the message to the ATC (see DCDUs below).



B6.1.1.2.4. New RECALL Mode

The flight crew can remove messages from DCDU display when they have been processed, by selecting the soft key CLOSE.

During 5 minutes, the last removed message can be displayed again (recalled) on the DCDU through a dedicated RECALL command. “RECALL MODE” is displayed above the message in the latest FANS B+ system (see DCDU on the right).

Note: Previous FANS B/B+ systems displays “RECALL MODE” in information area.

5 minutes after the last removed message has been closed, the activation of RECALL command displays “RECALL EMPTY CONSULT MSG RECORD” (see DCDU on the left).

B6.1.1.2.5. Auto-Closure of messages

Some CPDLC messages will be automatically closed from the DCDU, 5 seconds after the reception of the acknowledgement from the ground of the message. It concerns the following messages:

- Downlink messages, or
- Answer to uplink CONFIRM messages, or
- Answer to uplink NEGOTIATION messages, or
- Answer to uplink INFORMATION messages.

For the other messages (i.e. that are not automatically closed), the “CLOSE” key will remain available on the DCDU:

- Answer to uplink CLEARANCE messages, or
- Uplink messages that do not require a flight crew answer.

B6.1.2. FANS B+ OPTIONS

B6.1.2.1. ATC DATA LINK COMMUNICATION RECORDING

With regards to new regulations on the recording of ATC data link communications (refer to Part I – Chapter 2), Airbus proposes basically the ATC data link recording

capability. A new Cockpit Voice Recorder (CVR), that is compatible with FANS B+, is required to enable this feature.

This feature, identical to the one proposed on FANS A+, proposes the recording of ATC messages managed in FANS B+ system. ATC Data link recording is proposed as an option in FANS B+ system on A320 aircraft.

For more details about the events recorded, refer to Part II – Chapter A6.

B6.1.2.2. RADIO FREQUENCY LOADING INTO RMP

Coming with FANS B+, the frequency loading into the Radio Management Panel (RMP) is an optional feature that allows the flight crew to load a frequency received by CPDLC directly into a STBY window of an RMP.

This feature, proposed as an option in FANS B+ system on A320 aircraft, is the same than the one implemented on FANS A+ (refer to Part II – Chapter A6).

B6.1.2.3. ATS 623 APPLICATIONS

The FANS B+ also offers the possibility to activate optionally the following ATS 623 applications inherited from FANS A+:

- Departure Clearance (DCL)
- Oceanic Clearance (OCL)
- Digital – Automatic Terminal Information Service (D-ATIS).

NEW In addition to the DCL and D-ATIS applications, latest FANS B+ proposes to activate the Oceanic Clearance (OCL).

It should be noticed that ATS 623 applications whatever their host system (i.e. FANS A+ or FANS B+) rely on the ACARS network contrary to ATC applications of FANS B/B+ system that communicates through ATN. Nevertheless, ATS 623 applications integrated in FANS B+ uses VDL mode A/2 and SATCOM whereas ATS 623 applications in FANS A+ and FANS A+B may also use HFDL media in addition to VDL mode A/2, SATCOM.

For more details about ATS 623 applications, refer to Part II – Chapter A.5.

B6.1.3. FANS B+ RETROFIT

FANS B+ system proposed on A320 is fully compliant with Link 2000+ mandate (refer to Part I – Chapter 2) that targets the implementation of ATN Baseline 1 standards over Europe. The upgrade from FANS B to FANS B+ consists of a change of software only, provided it is limited to the basic features and the activation of ATS 623 applications.

The upgrade to activate optional features (e.g. ATC data link communication recording, radio frequency loading into RMP) affect the hardware.

For operators wishing to modify their aircraft configuration, a Request For Change (RFC) must be issued for the basic functions package (see Section B6.1.1 FANS B+ Basics) as well as for any optional capabilities to be activated separately (see Section B6.1.2 FANS B+ options).

After the upgrade of FANS aircraft systems, airlines are invited to report to Airbus the current avionics configuration of their fleet in order to ensure a correct follow-up of FANS aircraft.

For more details about the FANS retrofit, operators are invited to consult the Airbus Upgrade Catalogue (Section ATA 46 – Information Systems) available at: https://w3.airbus.com/upgrade-ecatalogue/index.jsp.

For any questions about FANS retrofit, please refer to your dedicated Key Account Manager or Customer Support Director (CSD).

B6.2. A350/A380 FANS B+ (ENHANCEMENT FANS B+ ON A320 AIRCRAFT)

This section describes FANS B+ features that are available in A350/A380 FANS A+B. The A350/A380 FANS B+ features derives from an adaptation of the A320 FANS B+ to the A350/A380 architecture. Therefore, all FANS B+ functions described for A320 aircraft (either basic or optional) are included in the basic definition of the A350/A380 aircraft.

To get the description of FANS A+ features available in FANS A+B system, please refer to PART II - Chapter A6.

B6.2.1. INHIBITION OF MAX UPLINK DELAY ACCESS

The discarding of old messages is based on the message latency timer (refer to Section B5.4.8.1.3 Message latency timer). When a CPDLC connection with an ATN center is active, the message latency timer is fixed to 40 seconds. On the MFD CONNECT page, the “MODIFY MAX UPLINK DELAY” button is disabled, the MAX UPLINK DELAY value being not modifiable in ATN environment.

The button “MODIFY MAX UPLINK DELAY” comes from the FANS A+ system and is not present in A320 FANS B+.

Note: The MAX UPLINK DELAY value is inserted by the flight crew on ATC request only with FANS A+.

B6.2.2. OPERATIONAL TIMERS FOR DIALOGUE INITIATED BY THE ATC

When the ATC sends an uplink message requiring a response, the flight crew should reply within 100 seconds. To inform the flight crew of the delay to answer, “REPLY WITHIN 30S” is displayed in the information area of the ATC mailbox when the time remaining is 30 seconds. Then, “REPLY WITHIN xxS” is refreshed every 5 seconds when the time remaining is above 10 seconds and every 1 second when the time remaining is less than 10 seconds.

Note: On A320 FANS B+, “xx SEC for REPLY” is refreshed every 5 seconds when the time remaining is less or equal to 30 seconds.

B6.2.3. AUTO-CLOSURE OF MESSAGES

Some CPDLC messages will be automatically closed from the ATC mailbox, 2 seconds after the reception of the acknowledgement from the ground of the message. It concerns the following messages:

- Downlink messages, or
- Answer to uplink CONFIRM messages, or
- Answer to uplink NEGOTIATION messages, or
- Answer to uplink INFORMATION messages.

For the other messages (i.e. that are not automatically closed), the “CLOSE” key will remain available on the ATC mailbox:

- Answer to uplink CLEARANCE messages, or
- Uplink messages that do not require a flight crew answer.

B6.2.4. INTERACTION BETWEEN ATC APPLICATIONS AND FMS

Contrary to A320 FANS B/B+, interface between FMS and ATC applications has been enriched for FANS B+ messages on A350/A380. This interface enables to activate the following features:

- On A350:
  - Loading of CPDLC clearances into FMS
  - Monitoring of CPDLC deferred clearances
  - Filling of CPDLC CONFIRM requests with FMS parameters
- On A380: Monitoring of CPDLC deferred clearances.

Note: For the first version A380 FANS A+B, the FMS is only capable to support the monitoring of CPDLC deferred clearance among the list of possible interactions. It is expected to extend to all features in the future version in order to have the same interactions between FMS and ATC applications on both A350 and A380 aircraft.

The following chapters here below provide the cockpit interfaces of such functions. For more details about these features, refer to Part I - Section 4.4.2.7 Interactions with FMS.

B6.2.4.1. LOADING OF CPDLC CLEARANCES INTO FMS

A CPDLC loadable clearance is a ATC clearance that could be loaded by the flight crew into FMS.

When a loadable clearance is received from the ground and displayed in the ATC mailbox, the flight crew may load the clearance into the secondary flight plan FMS using the LOAD->SEC3 key.
Note: LOAD->SEC3 key is not available in RECALL mode.

The result of the FMS loading (indication LOADED IN SEC3) is displayed in the information area ATC mailbox. In case of rejected or partial loading, "LOAD REJECTED" or "LOAD PARTIAL" is displayed.

The flight crew should evaluate the effects of the clearance on the flight plan thanks to the FMS flight plan information the MFD FMS page and the flight path on ND. When the decision is made, the flight crew should send the appropriate answer to the ground (i.e. WILCO, STANDBY or UNABLE).

Loadables clearances are the following messages:

UM	MESSAGE
UM51	CROSS [position] AT [time]
UM52	CROSS [position] AT OR BEFORE [time]
UM53	CROSS [position] AT OR AFTER [time]
UM79	CLEARED TO [position] VIA [routeclearance]
UM80	CLEARED [routeclearance]

B6.2.4.2. MONITORING OF CPDLC DEFERRED CLEARANCES

A CPDLC deferred clearance is an ATC clearance that the flight crew should execute when the conditions of the clearance are met.

When a deferred clearance is received from the ground and displayed in the ATC mailbox, the FMS will monitor the clearance if the flight crew accept it (i.e. send WILCO to the ground).

The result of the FMS monitoring (FMS MONITORING) is displayed in the information area ATC mailbox. After sending the WILCO answer, the parameter (e.g. AZER) is displayed in MAGENTA to indicate that the FMS is currently monitoring this parameter.

30 seconds before the clearance condition is satisfied:

- The ATC alert (aural and visual) is activated as for a normal message
- The ATC mailbox displays a reminder message in white.

Note: If the FMS monitoring fails, ATC mailbox displays “MONIT FAILED”, “MONIT LOST”, or “MONIT NOT AVAIL” according the cause of the failure.

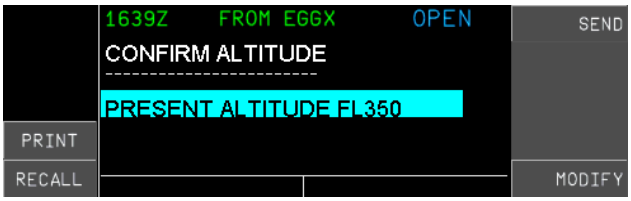
Deferred clearance is the following message:

UM	MESSAGE
UM78	AT [level] PROCEED DIR TO [position]

B6.2.4.3. FILLING OF CPDLC CONFIRM REQUESTS WITH FMS PARAMETERS

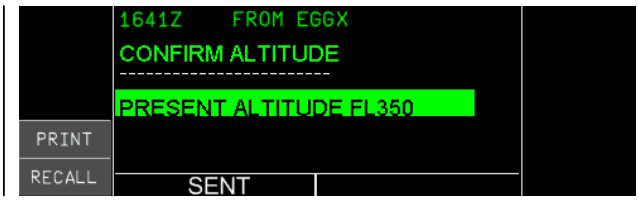
When a confirm message (e.g. CONFIRM ALTITUDE) is received from the ground and displayed in the ATC mailbox, the ATC mailbox displays “WAIT FOR SYS DATA” in the information area.
Note: After 5 seconds, this message is replaced by “NO SYS DATA” is no FMS data is received.

When the FMS information is received, the ATC mailbox displays the proposed answer. MODIFY key is available in case of the flight crew needs to update manually the data on the MFD.



By selecting SEND, the flight crew will

SEND the answer to the ground.



CONFIRM requests are the following messages:

UM	MESSAGE
UM133	REPORT PRESENT LEVEL
UM135	CONFIRM ASSIGNED LEVEL
UM231	STATE PREFERRED LEVEL
UM232	STATE TOP OF DESCENT

Please bear in mind…

B6. FANS B EVOLUTION

A320 FANS B+

To meet the requirements of the Link 2000+ Mandate phase, Airbus has developed the FANS B+ system.

- **Following improvements have been integrated:**
  - An **update of ATC FANS B applications** (CMA and CPDLC applications) in order to comply with ED110 rev. B
  - The **Protected Mode** that replaces the Voice Read-Back (VRB) procedure
  - **ATC data link communication recording** for the investigation on flight accidents/incidents as an option
  - **ATS623** (Departure & Oceanic clearances, Digital-ATIS applications) as an option
  - **Radio frequency loading into RMP** as an option.
- **Enhancements on HMI** have been also introduced, improving the commonalities between FANS A+ and FANS B+ HMI, like the display of the CPDLC connection status, the auto-closure of messages, the modification of ATC aural alerts frequency, the DATALINK STATUS page, etc.
- **FANS B+ retrofit**
  - FANS B+ system proposed on A320 is fully compliant with Link 2000+ mandate. The upgrade from FANS B to FANS B+ consists of a change of software only, providked it is limited to the basic features and the activation of ATS 623 applications.
  - The upgrade to activate optional features (e.g. ATC data link communication recording, radio frequency loading into RMP) affect the hardware.
  - After the upgrade of FANS aircraft systems, airlines are invited to report to Airbus the current avionics configuration of their fleet in order to ensure a correct follow-up of FANS aircraft.

A350/A380 FANS B+

Regardless the interfaces, it is to be noticed that FANS B+ functions on A350/A380 are the same as the ones on A320 aircraft, apart from a very few exceptions:

- Discarding of old messages with the MAX UPLINK DELAY button is disabled for ATN CPDLC connection
- Operational timers for dialogue initiated by the ATC
- Interaction between ATC applications and FMS.

B7.STARTING FANS B/B+ OPERATIONS

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B7.1. GENERAL

To perform FANS operations, data communication has to be ensured between the concerned Aircraft and the ATC Centers. The operator needs to ensure the following before starting FANS Operations:

1. **Sign contract(s) with Communication Service Provider(s) (CSP)**
2. **Declare aircraft to these Communication Services Providers**
3. **Declare aircraft and its FANS capability to ATC centers of the operated routes**
4. **Configure adequately the aircraft avionics**
5. **Obtain the operational approval.**

B7.2. DATA LINK: CONTRACTS AND DECLARATIONS

The air/ground data link communications can be made through the three following communication media: VDL (VDL Mode/Mode 2), SATCOM and HFDL.

The following medias are certified for the corresponding type of communications:

- VDL Mode 2 to sustain ATC data link communications in ATN environment
- VDL Mode A/2, SATCOM and HFDL to sustain AOC communications
- VDL Mode A/2 and SATCOM to sustain ATS 623 communications.

To operate in ATN environment, it is necessary to have a contract with at least one of the major Communication Service Providers (ARINC or SITA) for VDL.

For the establishment of the ATC data link, each individual aircraft must be declared and identified namely through its Aircraft Registration Number in Communication Service Provider (CSP) tables. This is an imperative condition to allow exchanges of ATC data link messages between an aircraft and the ATC center.

It is strongly recommended not to make spontaneous FANS testing with ATC centers when they have not been previously made aware of a given aircraft intention to operate in FANS mode. Such unscheduled testing is indeed inconvenient for ground ATC centers, and disturbs them in their daily work.

B7.3. IMPACTS ON AIRCRAFT CONFIGURATION

Once the airline has selected the CSPs, the aircraft configuration needs to be adapted accordingly. The following avionics systems have to be configured:

- On A320:
  - The ATSU (Air Traffic Services Unit) scan mask for VHF Data Link
  - The SATCOM user ORT (Owner Requirements Table) for SATCOM data link

Note: Based on Airbus service, the airline has the possibility to keep the database of Context Management Application (CMA) addresses loaded in the ATSU up to date.

- On A350/A380:
  - The ACR (Avionics Communication Router) for the customized database of routing policies
  - The Airbus ATC Addressing Database (A3DB)
  - The SATCOM user ORT for SATCOM data link.

B7.4. GET THE OPERATIONAL APPROVAL

At the time of writing this document, EASA does not require that the operators to complete the airworthiness certification process by an operational approval for datalink operations in continental airspace. Nevertheless, operators shall adapt their Operations Manual in accordance with EU-OPS 1.180 and obtain the approval of this manual by their national authority which will be equivalent than getting an operational approval. To that end, some materials are available (such as FAA AC 120-70B), stating what the applicant airline may have to comply with.
For more details about AC 120-70B, please refer to FAA website at: http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/328168.

It is expected that the applicant airline complies with the following items:

- Aircraft configuration
- Flight crew training/qualification
- Maintenance training
- Approved operational documentation and procedures
- Complementary tests for interoperability: the applicant airline may consider tests recommended in Airbus FANS AAS.

Please bear in mind…

B7. STARTING FANS B/B+ OPERATIONS

To ensure proper operations of FANS B/B+ aircraft in high density continental airspaces, the operator needs to ensure the following before starting operations:

- Sign contract(s) with Communication Service Provider(s) (CSP).
- Declare aircraft to these Communication Services Providers.
- Declare aircraft and its FANS capability to ATC centers of the operated routes.
- Configure adequately the aircraft avionics.
- Obtain the operational approval.

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APPENDIX A – LIST OF FANS B/B+ CPDLC MESSAGES WITH THEIR MEANING

Messages specific to FANS B+ system are shaded.

The urgency attribute for each uplink message is given with the UM reference number as follows:

- D for Distress
- U for Urgent
- N for Normal
- L for Low.

The priority associated to the message display on DCDU (respectively ATC mailbox) is:

- Urgent if the urgency attribute of the message is Distress or Urgent
- Normal if the urgency attribute of the message is Normal or Low.

1. UPLINK MESSAGES

CATEGORY	UM	MESSAGE	DESCRIPTION
CONFIRM REQUEST	UM133 N	REPORT PRESENT LEVEL	Instruction to report the present level.
	UM135 N	CONFIRM ASSIGNED LEVEL	Instruction to confirm and acknowledge the currently assigned level.
	UM231 L	STATE PREFERRED LEVEL	Instruction to indicate the pilot's preferred level.
	UM232 L	STATE TOP OF DESCENT	Instruction to indicate the pilot's preferred time and/or position to commence descent to the aerodrome of intended arrival.
NEGOTIATION	UM205 N	[free text]	
OPEN NEGOTIATION	UM148 N	WHEN CAN YOU ACCEPT [level]	Request for the earliest time at which the specified level can be accepted
INFORMATION	UM6 L	EXPECT [level]	Notification that a level change instruction should be expected.

CATEGORY	UM	MESSAGE	DESCRIPTION
	UM203 N	[free text]	
	UM213 N	[facility designation] ALTIMETER [altimeter]	ATS advisory that the specified altimeter setting relates to the specified facility
	UM222 L	NO SPEED RESTRICTION	Notification that the aircraft may keep its preferred speed without restriction.
STANDARD CLEARANCE	UM19 N	MAINTAIN [level]	Instruction to maintain the specified level.
	UM20 N	CLIMB TO [level]	Instruction that a climb to a specified level is to commence and once reached the specified level is to be maintained.
	UM23 N	DESCEND TO [level]	Instruction that a descent to a specified level is to commence and once reached the specified level is to be maintained.
	UM26 N	CLIMB TO REACH [level] BY [time]	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified time.
	UM27 N	CLIMB TO REACH [level] BY [position]	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified position.
	UM28 N	DESCEND TO REACH [level] BY [time]	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified time.
	UM29 N	DESCEND TO REACH [level] BY [position]	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified position.

CATEGORY	UM	MESSAGE	DESCRIPTION
	UM46 N	CROSS [position] AT [level]	Instruction that the specified position is to be crossed at the specified level. This may require the aircraft to modify its climb or descent profile.
	UM47 N	CROSS [position] AT OR ABOVE [level]	Instruction that the specified position is to be crossed at or above the specified level.
	UM48 N	CROSS [position] AT OR BELOW [level]	Instruction that the specified position is to be crossed at or below the specified level.
	UM51 N	CROSS [position] AT [time]	Instruction that the specified position is to be crossed at the specified time.
	UM52 N	CROSS [position] AT OR BEFORE [time]	Instruction that the specified position is to be crossed at or before the specified time.
	UM53 N	CROSS [position] AT OR AFTER [time]	Instruction that the specified position is to be crossed at or after the specified time.
	UM54 N	CROSS [position] BETWEEN [time] AND [time]	Instruction that the specified position is to be crossed at a time between the specified times.
	UM55 N	CROSS [position] AT [speed]	Instruction that the specified position is to be crossed at the specified speed and the specified speed is to be maintained until further advised.
	UM61 N	CROSS [position] AT AND MAINTAIN [level] AT [speed]	Instruction that the specified position is to be crossed at the specified level and speed, and the level and speed are to be maintained.
	UM64 N	OFFSET [specified distance] [direction] OF ROUTE	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction.

CATEGORY	UM	MESSAGE	DESCRIPTION
	UM72 N	RESUME OWN NAVIGATION	Instruction to resume own navigation following a period of tracking or heading clearances. May be used in conjunction with an instruction on how or where to rejoin the cleared route.
	UM74 N	PROCEED DIRECT TO [position]	Instruction to proceed directly from its present position to the specified position.
	UM75 N	WHEN ABLE PROCEED DIRECT TO [position]	Instruction to proceed, when able, directly to the specified position.
	UM78 N	AT [level] PROCEED DIRECT TO [position]	Instruction to proceed, upon reaching the specified level, directly to the specified position.
	UM79 N	CLEARED TO [position] VIA [route clearance]	Instruction to proceed to the specified position via the specified route.
	UM80 N	CLEARED [route clearance]	Instruction to proceed via the specified route.
	UM81 N	CLEARED [procedure name]	Instruction to proceed in accordance with the specified procedure.
	UM82 N	CLEARED TO DEVIATE UP TO [specified distance] [direction] OF ROUTE	Approval to deviate up to the specified distance from the cleared route in the specified direction.
	UM92 N	HOLD AT [position] AS PUBLISHED MAINTAIN [level]	Instruction to enter a holding pattern with the published characteristics at the specified position and level.
	UM94 N	TURN [direction] HEADING [degrees]	Instruction to turn left or right as specified on to the specified heading.
	UM96 N	CONTINUE PRESENT HEADING	Instruction to continue to fly on the current heading.
	UM106 N	MAINTAIN [speed]	Instruction that the specified speed is to be maintained.

CATEGORY	UM	MESSAGE	DESCRIPTION
	UM107 N	MAINTAIN PRESENT SPEED	Instruction that the present speed is to be maintained.
	UM108 N	MAINTAIN [speed] OR GREATER	Instruction that the specified speed or a greater speed is to be maintained.
	UM109 N	MAINTAIN [speed] OR LESS	Instruction that the specified speed or a lesser speed is to be maintained.
	UM111 N	INCREASE SPEED TO [speed]	The present speed is to be increased to the specified speed and maintained until further advised.
	UM112 N	INCREASE SPEED TO [speed] OR GREATER	The present speed is to be increased to the specified speed or greater, and maintained at or above the specified speed until further advised.
	UM113 N	REDUCE SPEED TO [speed]	The present speed is to be reduced to the specified speed and maintained until further advised.
	UM114 N	REDUCE SPEED TO [speed] OR LESS	The present speed is to be reduced to the specified speed or less and maintained at or below the specified speed until further advised.
	UM116 N	RESUME NORMAL SPEED	Notification that the aircraft need no longer comply with the previously issued speed restriction.
	UM123 N	SQUAWK [code]	Instruction that the specified code (SSR code) is to be selected.
	UM171 N	CLIMB AT [vertical rate] MINIMUM	Instruction to climb at not less than the specified rate.
	UM172 N	CLIMB AT [vertical rate] MAXIMUM	Instruction to climb at not above the specified rate.
	UM173 N	DESCEND AT [vertical rate] MINIMUM	Instruction to descend at not less than the specified rate.
	UM174 N	DESCEND AT [vertical rate] MAXIMUM	Instruction to descend at not above the specified rate.

CATEGORY	UM	MESSAGE	DESCRIPTION
	UM179 N	SQUAWK IDENT	Instruction that the 'ident' function on the SSR transponder is to be actuated.
	UM190 N	FLY HEADING [degrees]	Instruction to fly on the specified heading
	UM196 N	[free text]	
	UM215 N	TURN [direction] [degrees]	Instruction to turn a specified number of degrees left or right.
VOICE CONTACT INSTRUCTION	UM117 N	CONTACT [unitname] [frequency]	Instruction that the ATS unit with the specified ATS unit name is to be contacted on the specified frequency.
	UM120 N	MONITOR [unitname] [frequency]	Instruction that the ATS unit with the specified ATS unit name is to be monitored on the specified frequency.
WITHOUT ANSWER	UM0 N	UNABLE	Indicates that ATC cannot comply with the request.
	UM1 N	STANDBY	Indicates that ATC has received the message and will respond.
	UM3 N	ROGER	Indicates that ATC has received and understood the message.
	UM4 N	AFFIRM	Yes.
	UM5 N	NEGATIVE	No
	UM157 U	CHECK STUCK MICROPHONE [frequency]	Instruction that a continuous transmission is detected on the specified frequency. Check the microphone button.
	UM159 U	ERROR [error information]	A system generated message notifying that the ground system has detected an error.

CATEGORY	UM	MESSAGE	DESCRIPTION
	UM160 L	NEXT DATA AUTHORITY [facility]	Notification to the avionics that the specified data authority is the NDA. If no data authority is specified, this indicates that any previously specified NDA is no longer valid.
	UM162 L	SERVICE UNAVAILABLE	Notification that the ground system does not support this message.
	UM165 L	THEN	Used to link two messages, indicating the proper order of execution of clearances/ instructions.
	UM183 N	[free text]	
	UM211 N	REQUEST FORWARDED	Indicates that the ATC has received the request and has passed it to the next control authority.
	UM227 N	LOGICAL ACKNOWLEDGMENT	Confirmation to the aircraft system that the ground system has received the message to which the logical acknowledgment refers and found it acceptable for display to the responsible person.
	UM233 N	USE OF LOGICAL ACKNOWLEDGMENT PROHIBITED	Notification to the pilot that messages sent requiring a logical acknowledgment will not be accepted by this ground system.
	UM237 N	REQUEST AGAIN WITH NEXT UNIT	Indicates that the dialogue with the ATC center is closed and that the flight crew has to send the request to the next ATC center.

2. DOWNLINK MESSAGES

FANS B CATEGORY	DM	MESSAGES	DESCRIPTION
REQUEST	DM6	REQUEST [level]	Request to fly at the specified level
	DM18	REQUEST [speed]	Request to fly at the specified speed.
	DM22	REQUEST DIRECT TO [position]	Request to track from the present position direct to the specified position.
OPEN NEGOTIATION	DM81	WE CAN ACCEPT [level] AT [time]	We can accept the specified level at the specified time.
	DM82	WE CANNOT ACCEPT [level]	We cannot accept the specified level.
REPORT RESPONSE	DM32	PRESENT LEVEL [level]	Notification of the present level.
	DM38	ASSIGNED LEVEL [level]	Read-back of the assigned level.
	DM89	MONITORING [unitname] [frequency]	Notification of the ATC facility frequency to monitor.
	DM106	PREFERRED LEVEL [level]	Notification of the preferred level.
	DM109	TOP OF DESCENT [time]	Notification of the preferred time to commence descent for approach.
RESPONSE MESSAGE	DM0	WILCO	The instruction is understood and will be complied with.
	DM1	UNABLE	The instruction cannot be complied with.
	DM2	STANDBY	Wait for a reply.
	DM3	ROGER	Message received and understood.
	DM4	AFFIRM	Yes.
	DM5	NEGATIVE	No.
SYSTEM MANAGEMENT MESSAGE	DM62	ERROR [error information]	A system-generated message that the avionics has detected an error.

FANS B CATEGORY	DM	MESSAGES	DESCRIPTION
	DM63	NOT CURRENT DATA AUTHORITY	A system-generated denial to any CPDLC message sent from a ground facility that is not the CDA.
	DM98	[free text]	
	DM99	CURRENT DATA AUTHORITY	A system-generated message to inform a ground facility that it is now the CDA
	DM100	LOGICAL ACKNOWLEDGMENT	Confirmation to the ground system that the aircraft system has received the message to which the logical acknowledgment refers and found it acceptable for display to the responsible person.
	DM107	NOT AUTHORIZED NEXT DATA AUTHORITY	A system-generated message sent to a ground system that tries to connect to an aircraft when a CDA has not designated the ground system as the NDA.
ADDITIONAL MESSAGES	DM65	DUE TO WEATHER	A message element added to response or request to explain reasons or contraints.
	DM66	DUE TO AIRCRAFT PERFORMANCE	A message element added to response or request to explain reasons or contraints.

APPENDIX B – UPLINK ERROR MESSAGES

Extracts from the Flight Crew Data Link Guidance for Link 2000+ Services v5.0 (as of 17 DEC 2012).

Available at :
http://www.eurocontrol.int/link2000/public/standard_page/specific_docs.html

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The messages below are standard messages that the flight crew may receive in case an error occurs. For each message, the appropriate procedure is provided.

1. DOWNLINK MESSAGE REQUEST REJECTED – SEND (NUMBER) ELEMENTS MAX

Description:
The ground system receives a message that contains more message elements than it can support in a message.
Ex: The flight crew sends a combined message (REQUEST level, REQUEST heading, DUE TO WEATHER) and the ground system accepts only a maximum of two message elements.

Note: *It is a local choice of the ground system to reject downlink messages containing more than 1, 2 or 3 message elements or to accept up to 5 message elements.*

Procedure:
The flight crew may resend the request in the form of separate messages, or make the request/s by voice.

2. (DIALOGUE TYPE) NOT AVAILABLE AT THIS TIME – USE VOICE

Description:
The ground system receives a downlink message that is discarded because the associated dialogue type is disabled. Dialogue type is one of the following: LEVEL, HEADING, SPEED, ROUTE REQUEST, FREE TEXT, DOWNLINK MESSAGE.

Procedure:
The flight crew should make the request by voice.

3. ELEMENT COMBINATION REJECTED – USE VOICE

Description:
The ground system receives a concatenated downlink message that it does not support, (invalid element combination, or at least one message element is not supported, or invalid element order).

Note: *Whether a combination of message elements is valid or not, is determined through local choice of the ground system. Examples of obvious invalid combinations: request climb to + request descend to, WILCO + UNABLE, etc.*

Procedure:
The flight crew may resend the message/request in the form of separate messages, or make the request/s by voice.

4. TOO MANY (DIALOGUE TYPE) REQUESTS – EXPECT ONLY ONE REPLY

Description:
Dialogue type is one of the following: LEVEL, HEADING, SPEED, ROUTE.
The ground system receives a downlink request, and there is an existing open downlink request containing the same type and it discards the second request.
Ex: The flight crew sends two successive CLIMB TO requests and the ground system discards the second one.

Procedure:
The flight crew should be aware that only one downlink request for a single type will be presented to the ATC controller, and that this open dialogue must be closed before a second request of that type may be treated.

5. (DIALOGUE TYPE) REQUEST REJECTED – REPLY TO (DIALOGUE TYPE) UPLINK FIRST

Description:
Dialogue type is one of the following: LEVEL, HEADING, SPEED, ROUTE.
The ground system receives a downlink request, and there is an existing open uplink containing the same type. The downlink request is discarded.

Note: *Ground systems only accept one data link exchange of a given type at the same moment. This means that if e.g. a CLIMB TO [level] clearance has been sent, a REQUEST DESCEND TO [level] request will be rejected until the flight crew has responded to the clearance.*

Procedure:
The flight crew must respond to the uplink before being able to send a downlink request of this type. For example, if CLIMB TO [altitude] has been received, the flight crew must answer WILCO or UNABLE before being able to send REQUEST CLIMB TO [altitude].

6. TOO MANY CPDLC REQUESTS – USE VOICE

Description:
The ground system receives a downlink request, and discards a message because the maximum number of open operational dialogues with the aircraft is exceeded and there is no pending uplink message.

Note: *The total number of data link exchanges with an aircraft may be limited by some ground systems. This means that further requests will be rejected. If there are only downlink requests, the flight crew cannot do anything about it. If there is at least one uplink expecting a response, the flight crew can respond to that clearance first to enable reception of a* downlink request.

Procedure:
The flight crew should make the request/s by voice

7. CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST

Description:
Until CPDLC is enabled, the ground system rejects any downlink message; except DM99 (CURRENT DATA AUTHORITY), DM89 (MONITORING), DM62 (ERROR), and DM62 concatenated with DM98 (ERROR + Free text).

Note: *This error case is related to a situation of transfer of communications (voice and data). Ground systems check that certain conditions are met before enabling communications between ATC controllers and flight crew. These conditions are usually at least:*

- *The flight is expected at that moment in the ATC sector*
- *The message DM99 has been received. DM99 (CURRENT DATA AUTHORITY) informs the ground that the aircraft is ready to conduct CPDLC with the current ATC.*
- *Satisfaction of local conditions, e.g. ASSUME input*

When the conditions to enable CPDLC have been met, the ground system will accept the CPDLC messages received from the aircraft.

Procedure:
The flight crew cannot use data link now, but when CPDLC is enabled, a CPDLC message is uplinked and displayed to the flight crew, indicating the name and function of the current ATC unit.

8. ATC TIME OUT – REPEAT REQUEST

Description:
Upon expiry of the timer-responder, the ground system automatically sends an error message in response to the downlink message request.

Note: *The timer-responder is a timeout on the ground that is triggered on reception of a downlink request. Upon expiry, the ground system will send an error in response to the flight crew request and inform the ATC controller.*

Procedure:
The flight crew should repeat the request/s by voice.

9. DOWNLINK DELAYED – USE VOICE

Description:
The ground system receives a message and discards the message because it contains a timestamp that is older than the allowed limit.

Procedure:
The flight crew should revert to voice.

10. DOWNLINK TIMESTAMP INDICATES FUTURE TIME

Description:
The ground system receives a message timestamp that indicates a future time greater than 2 seconds from the current time.

Procedure:
The flight crew should revert to voice.

11. SERVICE UNAVAILABLE

Description:
The ground system receives a downlink message that it does not support, whether or not the message contains a message reference number, and discards the received message.
Note: Text 'SERVICE UNAVAILABLE' is just an ICAO intention. The text 'MESSAGE NOT SUPPORTED BY THIS ATS UNIT' is displayed in the aircraft.

Procedure:
The flight crew should revert to voice.

12. FREE TEXT MESSAGE TOO LARGE – USE VOICE

Description:
The ground system receives a downlink free text message element containing more than 80 characters, and the system cannot support the number of characters in a free text message element, and discard the received message.

Procedure:
The flight crew should revert to voice.

Note1: *The flight crew should not use "Free text" if a relevant CPDLC message already exists for the situation.*
Note2: *Ground systems may not accept downlinked free text messages, or may not display them to the ATC controller.*

13. CPDLC MESSAGE FAILED – USE VOICE

Description:
A CPDLC downlink message is received that results in an error, that is not already covered in the ATN SARPs, and the ground system discards the message.

Procedure:
The flight crew should revert to voice.

14. INVALID USE OF FREE TEXT MESSAGE – CONTACT ATC

Description:

The ground system does not support a message containing a free text message element because the message does not also contain the DM62 ERROR *(error information*) message element and discards the message.

Procedure:
The flight crew should revert to voice.

15. RADAR TRACKING TERMINATED – TERMINATING CPDLC

Description:
The ground system decides to terminate a CPDLC connection with an aircraft because it has lost radar data, the ground system terminates the CPDLC connection.

Procedure:
The flight crew should revert to voice.

16. CPDLC FOR (DIALOGUE TYPE) FAILED – USED VOICE

Description:
Dialogue type is one of the following: LEVEL, HEADING, SPEED, ROUTE.
The ground system receives a downlink message containing a dialogue type that it does not support and discards the message.

Procedure:
The flight crew should revert to voice.

17. MESSAGE DOES NOT CONTAIN FACILITY NAME

Description:
The ground system receives a downlink message that contains the *unitname* data type, but rejects the message because it does not also contain the *facilityname* data type and discards the message.

Procedure:
The flight crew should revert to voice.

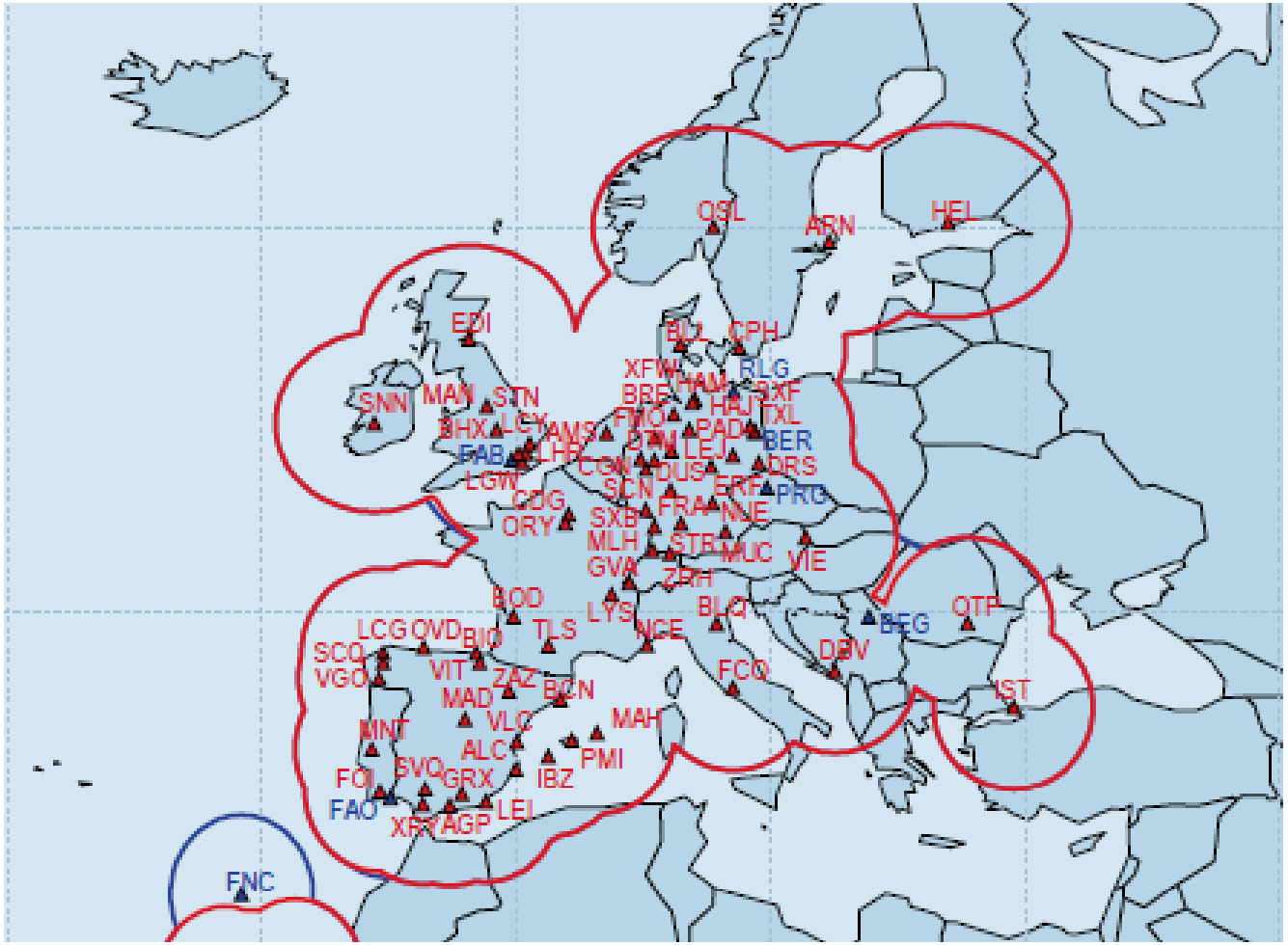
APPENDIX C – COMMUNICATION SERVICE PROVIDERS

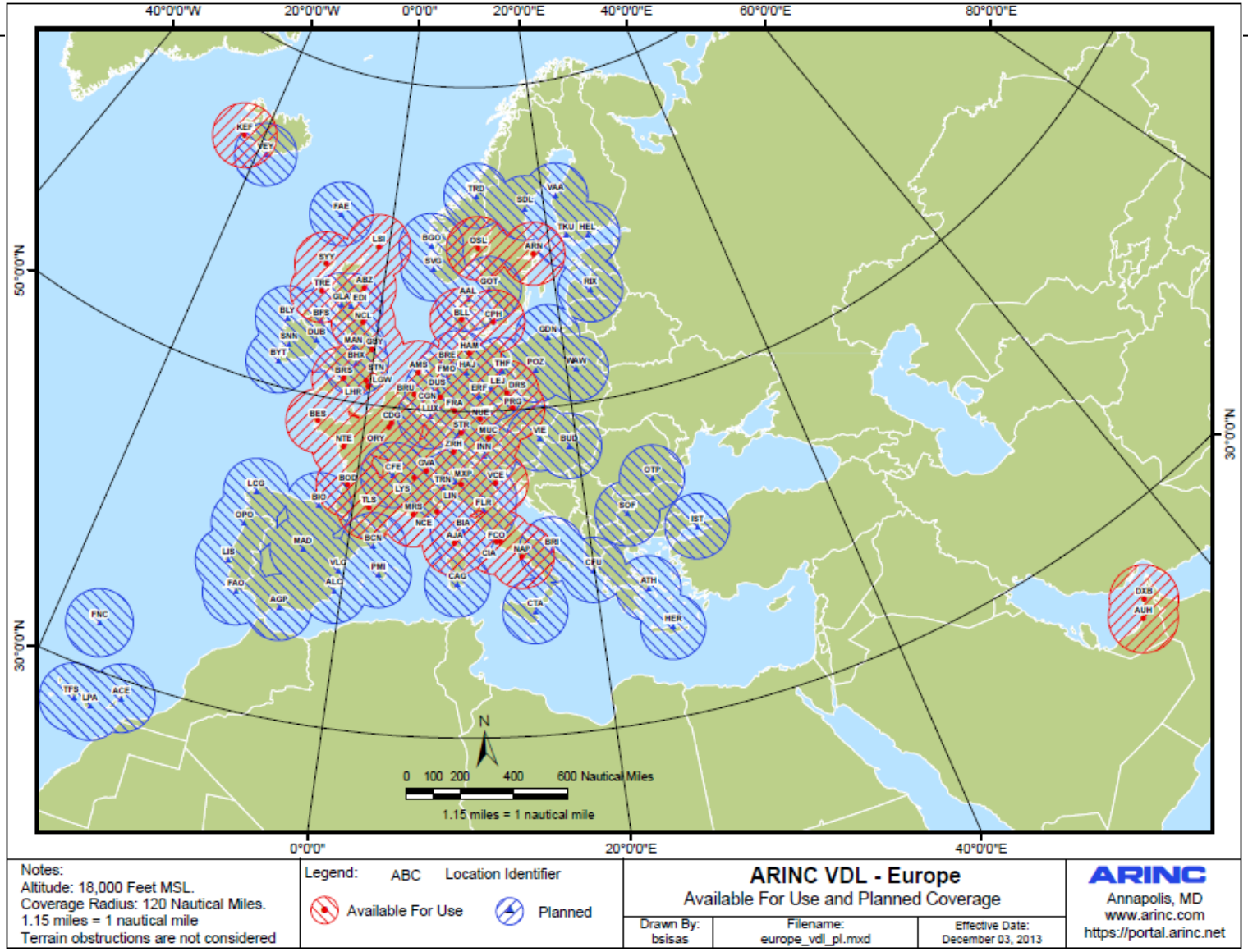
The following maps are provided with the courtesy of SITA and ARINC.

For contact details about and SITA and ARINC, see References.

SITA – VDL MODE 2 COVERAGE – EUROPE

MAXIMUM COVERAGE AT 30 000 FEET ON-LINE VDL ARE IN RED, PLANNED ARE IN BLUE




40°0'0"W
20°0'0"W
0°0'0"
20°0'0"E
40°0'0"E
60°0'0"E
80°0'0"E
50°0'0"N
30°0'0"N
N
0 100 200 400 600 Nautical Miles
1.15 miles = 1 nautical mile
Notes:
Altitude: 18,000 Feet MSL.
Coverage Radius: 120 Nautical Miles.
1.15 miles = 1 nautical mile
Terrain obstructions are not considered
Legend: ABC Location Identifier
Available For Use
Planned
ARINC VDL - Europe
Available For Use and Planned Coverage
Drawn By: bsisas
Filename: europe_vdl_pl.mxd
Effective Date: December 03, 2013
ARINC
Annapolis, MD
www.arinc.com
https://portal.arinc.net

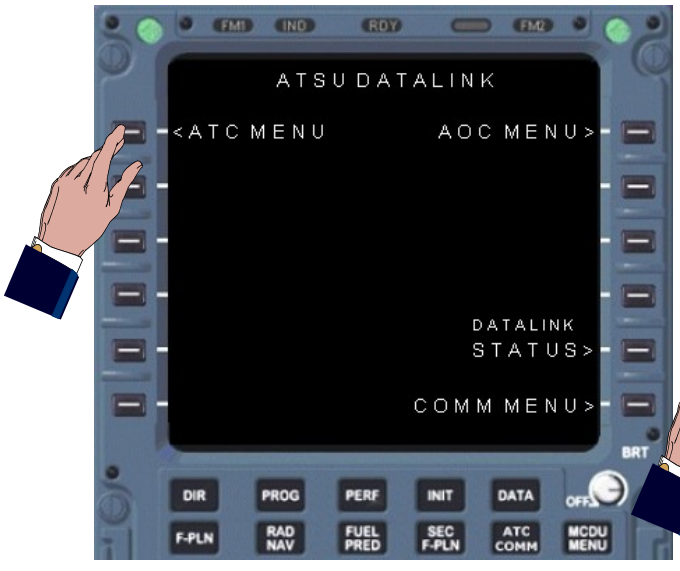
APPENDIX D – A320 FANS B OPERATIONAL SCENARIOS

1. INITIAL NOTIFICATION

The aircraft is flying from Helsinki – Malmi, Finland (EFHF) to Paris – Charles De Gaulles, France (LFPG). The first ATC using data link for this flight is Maastricht UAC, The Netherlands (EDYY) and the flight crew wants to notify it.

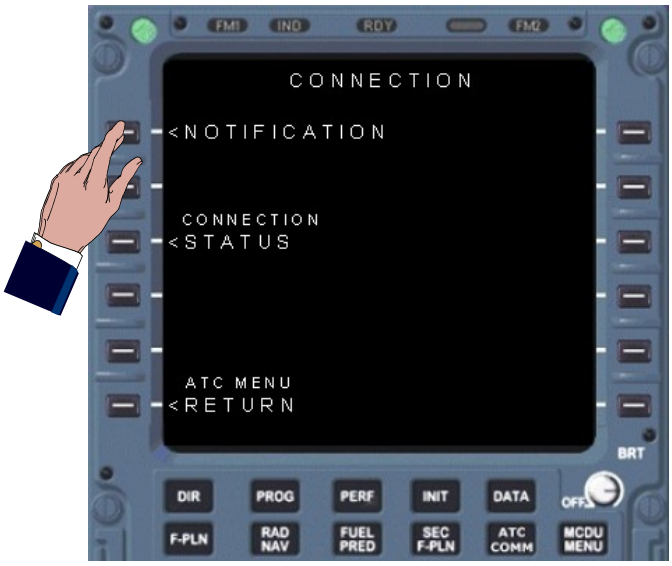
The notification shall be done 10 to 30 minutes before entering the airspace. Refer to AIP.

Select the ATC MENU prompt on MCDU.



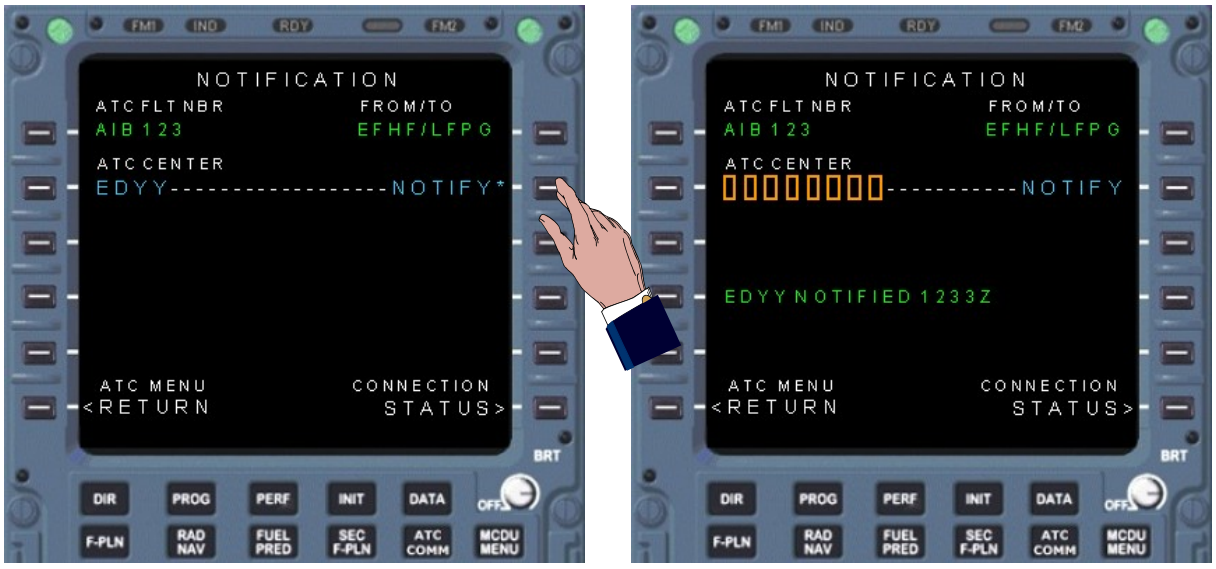
Then, select the CONNECTION prompt.

Select the NOTIFICATION prompt.



The ATC flight number and the FROM/TO airports are directly acquired from the FMS. The ATC flight number shall match the one declared on the ATC flight plan, as it is used to correlate the aircraft to the ATC flight plan.
Enter the ATC centre identification (4 to 8 characters).

Notify the ATC centre by selecting the 2R key. Once the ATC centre has been notified, the notification time is indicated underneath. At this stage, the connection is initialised at ATC controller's discretion.



Note : Once the CPDLC connection is established, the notification indication (e.g. EDYY NOTIFIED 1233Z) disappears.

2. CPDLC CONNECTION

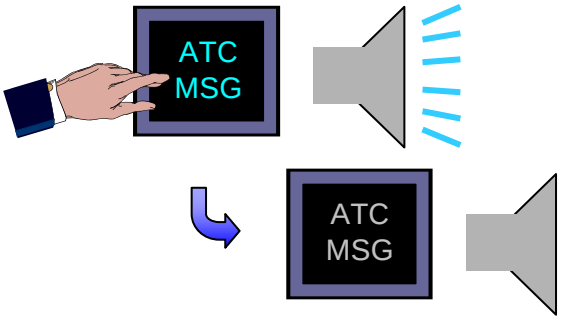
Once the notification is completed, the ATC will establish a CPDLC connection. The time at which it will be established varies according to the airspace.

Few minutes later, the first uplink message that clearly identifies the ATC centre to which the aircraft is connected is received.

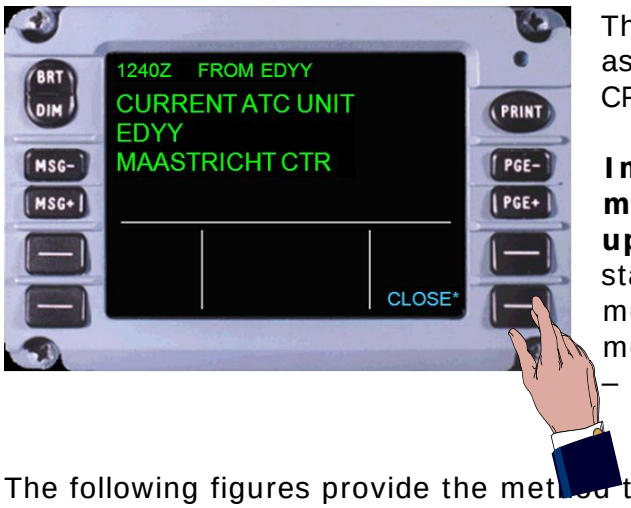
Press the ATC MSG pus-button to switch the light off and to stop the aural signal.

Once the CPDLC connection is established, the ATC centre identification is displayed on the default screen of the DCDU.

From a technical point of view, the CPDLC connection is established. However, from an operational point of view, the ATC centre does not assume the aircraft yet.



Note :
For normal messages, the aural signal is delayed by 15 seconds and then repeated every 15 seconds until the receipt of the message is acknowledged (i.e. ATC MSG push-button is switched off or a key to treat the message is pressed).
For urgent messages, the aural signal is delayed by 5 seconds and then repeated every 5 seconds until the receipt of the message is acknowledged (i.e. ATC MSG push-button is switched off or a key to treat the message is pressed).



This message confirms that the ATC centre assumes the aircraft. Close the message. CPDLC communication may start.

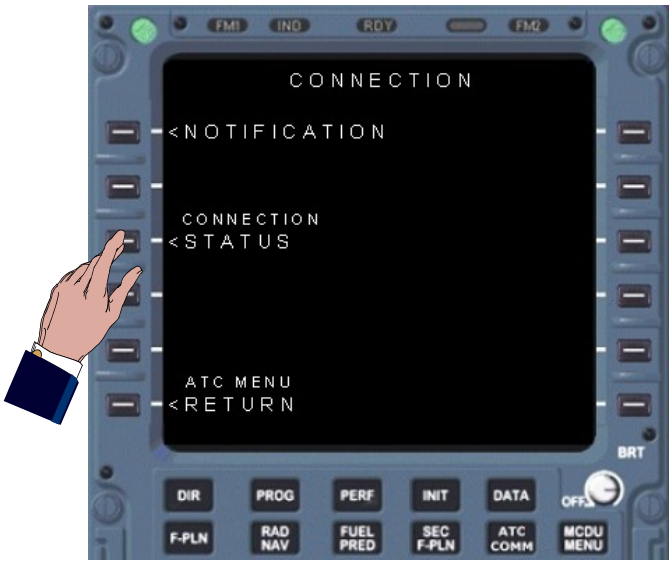
Important : Do not send any downlink messages until you have received this uplink message. Otherwise, the ground station will discard any early downlink messages and will reply with an error message CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST.

The following figures provide the method to check the connection status.

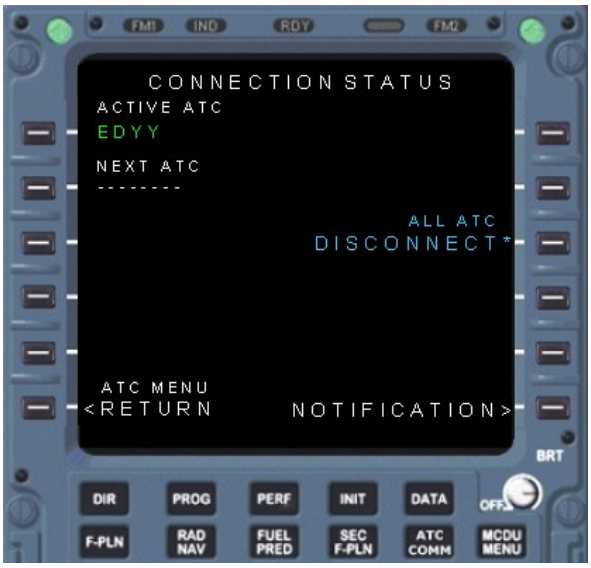
From the ATC MENU page on MCDU, go to the CONNECTION page, and then

On ATC request, you can disconnect the connected ATC centres (here the

select the CONNECTION STATUS prompt.

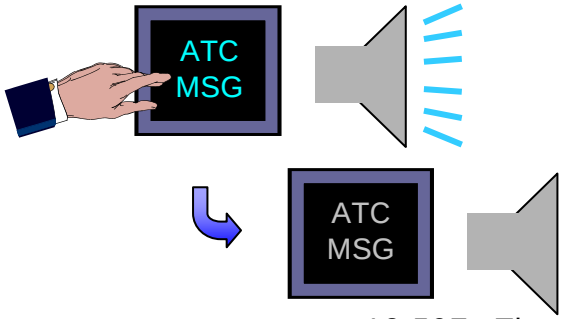


ACTIVE ATC) with the 3R key of the CONNECTION STATUS page.



3. RECEPTION OF AN ATC INSTRUCTION

The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.



The message was sent at 12.59Z. The ATC instructs to climb and to reach FL370 at 13.10Z.

If aircraft performance allow doing so, select WILCO.

The selected response is displayed in the upper right corner. Select SEND to physically send the message.

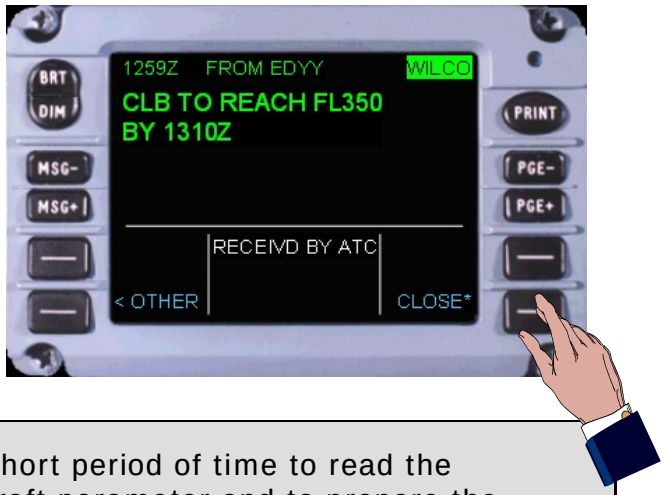
Once the SEND key is pressed, the message turns into green and a

Thanks to the ATN architecture, you know when the message is displayed on

SENDING indication appears in the informationa area.

the ATC controller screen. The indication RECEIVD BY ATC appears on DCDU.

Close the message to free the DCDU screen.

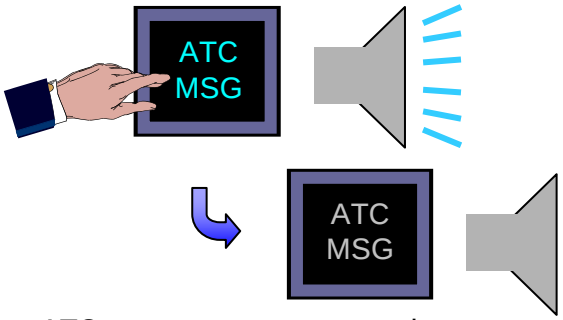


Remember that 100 seconds are quite a short period of time to read the message, to interpret it, to check the aircraft parameter and to prepare the response, especially if a voice read-back has to be performed.

The ATN Baseline 1 standards define a 100-second timer assuming that no voice read-back is required.

Any uplink message once received on-board should be answered promptly.

4. UPLINK MESSAGE IS NOT ANSWERED ON TIME



The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.

The ATC requests to report the present level. You may have noticed that the SEND key is not available. Indeed, to be able to send a response, you should first edit the response with the EDIT key.

Notice that no STBY function is provided as per ATN Baseline 1 standards.

If for any reasons, you did not reply within 100 seconds, an amber REPLY: TIME OUT indication appears.

For the CPDLC application, the dialogue is closed. You can only close the message.

As per procedure, you should revert to voice in order to properly close the dialogue from the operational point of view.

Your voice transmission should start as follows : DISREGARD CPDLC REPORT PRESENT LEVEL MESSAGE, BREAK. Continue as appropriate in compliance with standards aeronautical phraseology.

Once the voice transmission is finished, close the message.

If you need to recall the last closed message, press the RECALL key from the default DCDU screen.

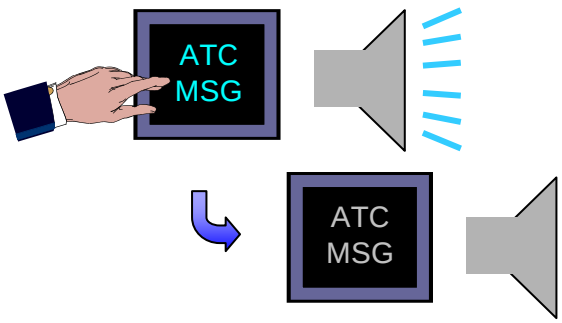
5. TRANSFER TO THE NEXT ATC

The transfer to the next ATC, also called Next Data Authority (NDA), is initialised by the current ATC. From the airborne perspective, the ATSU automatically manages the transfer. Therefore, the transfer is transparent to the crew.

The flight crew knows that the transfer procedure starts when the Voice Contact Instruction and the uplink message identifying the NDA are received.

For the following figures, it is assumed that the aircraft is about to transit from the EDYY airspace to the LFFF airspace.

The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.

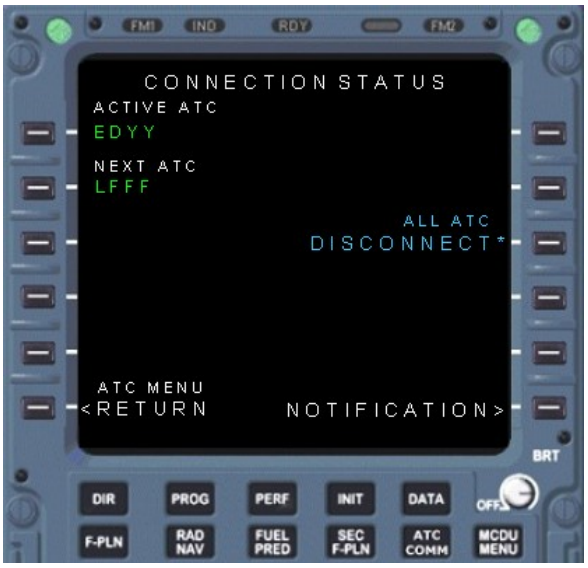


The current ATC, EDYY, informs you that LFFF is the next ATC that will be responsible of your aircraft.

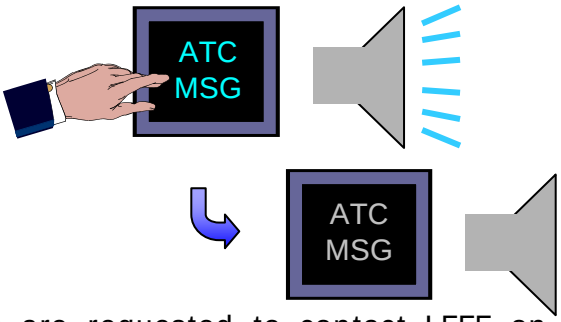
Close the message.

When LFFF starts the connection process (i.e. CPDLC start request), the default DCDU screen appears as follows. You are still under the authority of EDYY. LFFF will take over soon.

On MCDU CONNECTION STATUS page, you can also check that LFFF is the NEXT ATC.



The ATC sent the Voice Contact Instruction. Press the ATC MSG push-button to switch the light off and to stop the aural signal.



You are requested to contact LFFF on 128.275. Select WILCO.

Select SEND.

As a CPDLC disconnection with EDYY occurs while replying to this message, the ATC ground station does not send any technical acknowledgement back to the aircraft. Consequently, the SENT indication appears instead of RECEIVD BY ATC.

Close the message.

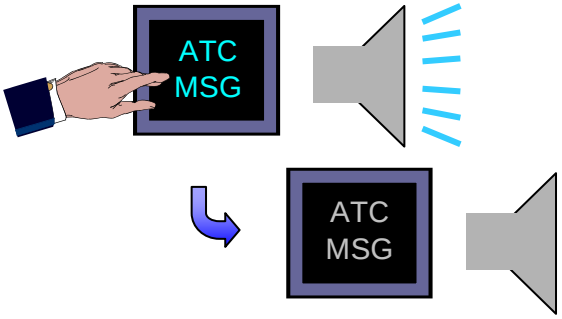
The aircraft confirms that LFFF is the Current Data Authority by sending a downlink CDA message to LFFF ground station. The ground station replies with a technical acknowledgement. At the receipt of this acknowledgement, the default DCDU screen becomes as shown.

The aircraft is now disconnected from EDYY. The establishment of the CPDLC connection with LFFF is almost completed.

As soon as you have replied WILCO to the Voice Contact Instruction, contact LFFF by voice on the instructed frequency.

The new ATC, LFFF, sent an initial uplink message that clearly identifies the ATC centre to which the aircraft is connected.

Press the ATC MSG push-button to switch the light off and to stop the aural signal.

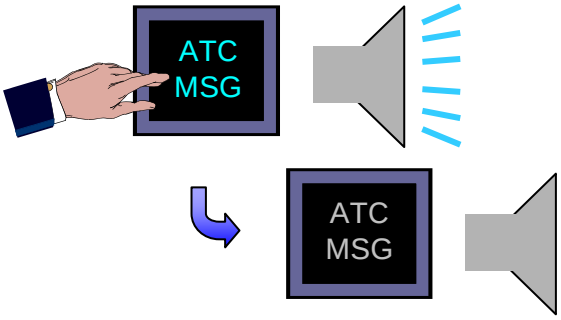


This message confirms that the ATC centre assumes the aircraft. The establishment of the CPDLC connection is completed. CPDLC communication may start. Close the message.

Important : Do not send any downlink messages until you have received this uplink message. Otherwise, the ground station will discard any early downlink messages and will reply with an error message CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST.

6. OPEN NEGOTIATION

You are now under the authority of LFFF. The ATC sent an uplink message.



Press the ATC MSG push-button to switch the light off and to stop the aural signal.

This is an open negotiation. On receiving this type of message, the ATSU proposes a default response.

If you do not agree with the proposal, select EDIT.

If no page from the ATC application was displayed on MCDU, you should call the ATC MENU page, then select the EDIT prompt.

The MCDU MENU light is flashing, reminding you to do so.

The MCDU FOR EDIT indication appears

The EDIT page allows modifying the response. You can either modify the time or refuse the negotiation.

You have checked that the aircraft cannot fly the FL370. Then select the CANNOT option and transfer the response to the DCDU.

Send the response.

Once the message is received by the ATC, close the message.

7. NO RESPONSE FROM ATC

You would like to request a direct leg to KENAP. To this end, select the REQUEST page on MCDU.

Edit your request.

Once finished, transfer it to DCDU.

Once the request is received by the ATC, do not forget to close the message. By systematically clearing the DCDU, you avoid any mix-up you may encounter if you have queued the messages.

At this time, you should expect a response within 270 seconds. The ATC controller has 250 seconds to answer your request.

If the ATC controller fails to answer within this period, the ground system sends a time-out advisory.

Per procedure, revert to voice. Your voice transmission should start as follows: DISREGARD CPDLC REQUEST MESSAGE, BREAK. Continue as appropriate in compliance with standard aeronautical phraseology.

Once the transmission is finished, close the message.

Send the request.

Under certain circumstances, the time-out advisory sent by the ground system may not reach the aircraft. Therefore, the ATSU displays a time-out indication NO ATC REPLY in amber on DCDU.

The NO ATC REPLY indication is alternatively displayed with a white REMINDER indication.

Proceed to a voice procedure as described above.

8. MSG RECORD

The ATSU records up to 99 messages (either uplink or downlink). When this limit is reached, the latest message overwrites the oldest message.

Note: the time-out advisory received from the ground is not store in the MSG RECORD as it is just a means to properly close the CPDLC dialogue, without any particular operational interest.

From the ATC MENU page, display the message record by selecting the MSG RECORD prompt.

You can scroll up or scroll down if the message record cannot be displayed in once page.

For each message, the timestamp, the corresponding ATC, the first line of the message and the response if any are displayed.

Select the left prompt to display the entire content of a message.

The PRINT function allows printing either the whole message record or one single message (to that end, call for display the message to print).

Select the MSG RECORD ERASE function to erase the message record. You should confirm within 5 seconds. If not, the MSG RECORD ERASE function is reset.

As mentioned in the FCOM/QRH, it is recommended to erase the MSG RECORD at the beginning of cockpit preparation before take-off. Refer to FCOM: Procedures/Normal Procedures/Standard Operating Procedures/Cockpit Preparation/ATC Datalink Communication.

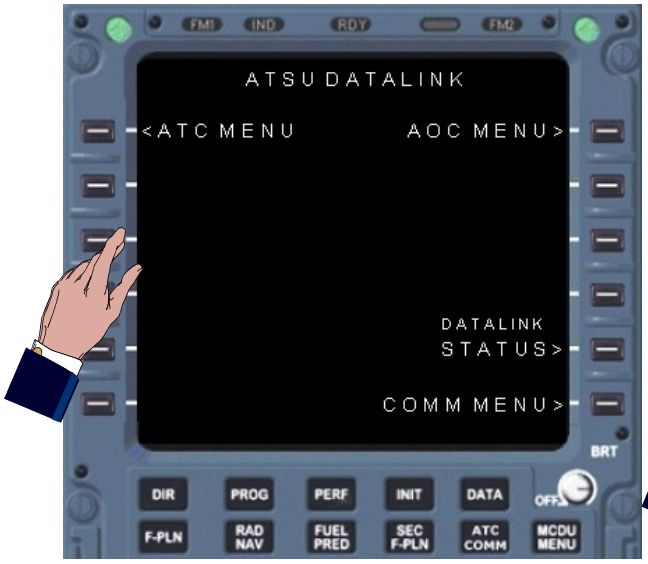
APPENDIX E – A320 FANS B+ OPERATIONAL SCENARIOS

When relevant differences of cockpit interfaces (DCDU/MCDU) are present between FANS B+ and latest FANS B+ system, they will be described.

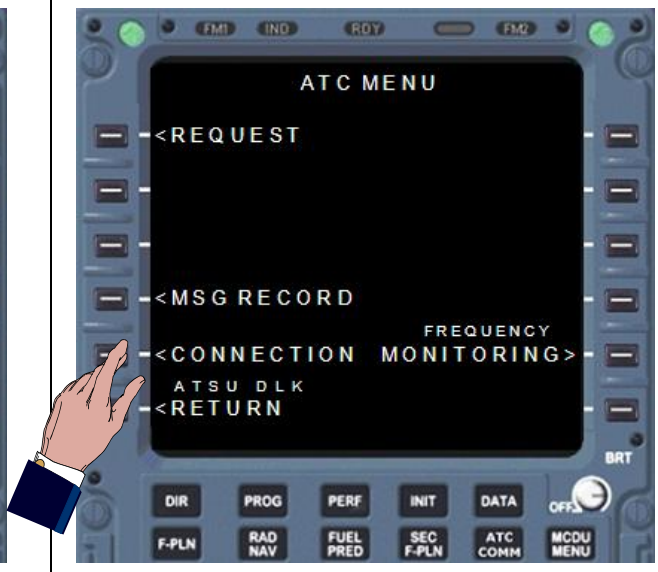
1. INITIAL NOTIFICATION

The aircraft is flying from Helsinki – Malmi, Finland (EFHF) to Paris – Charles De Gaulles, France (LFPG). The first ATC using data link for this flight is Maastricht UAC, The Netherlands (EDYY) and the flight crew wants to notify it.

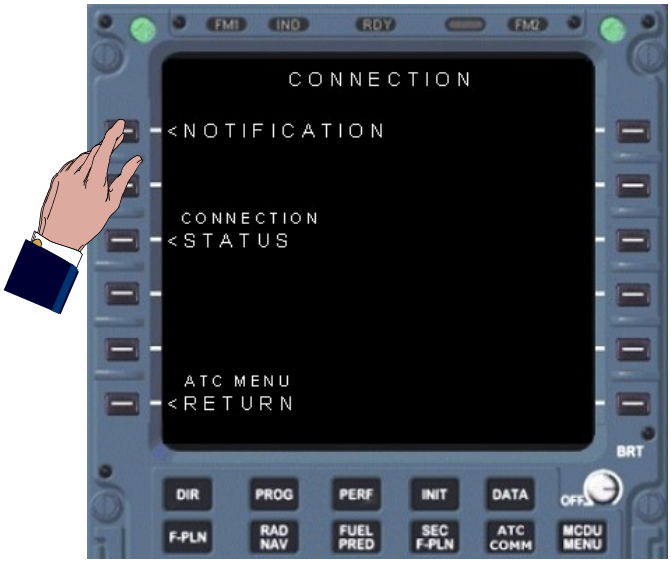
The notification shall be done 10 to 30 minutes before entering the airspace. Refer to AIP.



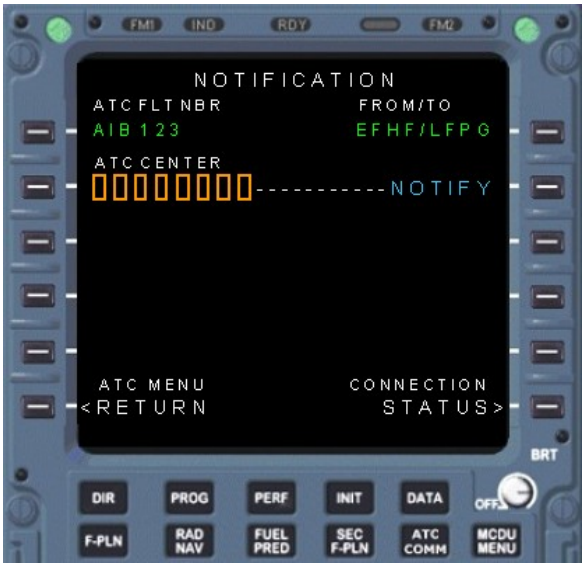
Select the ATC MENU prompt on MCDU.



Then, select the CONNECTION prompt.



Select the NOTIFICATION prompt.



The ATC flight number and the FROM/TO airports are directly acquired from the FMS. The ATC flight number shall match the one declared on the ATC flight plan, as it is used to correlate the aircraft to the ATC flight plan.
Enter the ATC centre identification (4 to 8 characters).

Notify the ATC center by selecting the 2R key. Once the ATC center has been notified, the notification time is indicated underneath. At this stage, the CPDLC connection is initialized at ATC controller's discretion.

Note : Once the CPDLC connection is established, the notification indication (e.g. EDYY NOTIFIED 1233Z) disappears.

2. CPDLC CONNECTION

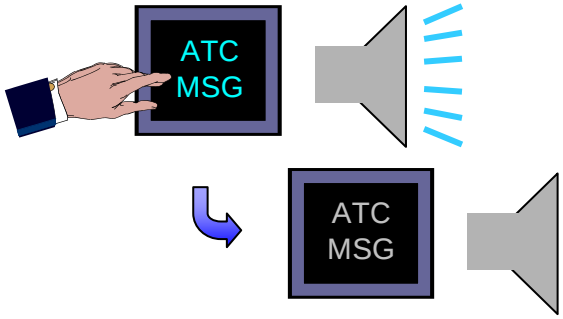
Once the notification is completed, the ATC will establish a CPDLC connection. The time at which it will be established varies according to the airspace.

Once the CPDLC connection is established, the ATC centre identification is displayed on the default screen of the DCDU.

From a technical point of view, the CPDLC connection is established. However, from an operational point of view, the ATC centre does not assume the aircraft yet.

Few minutes later, the first uplink message that clearly identifies the ATC centre to which the aircraft is connected is received.

Press the ATC MSG push-button to switch the light off and to stop the aural signal.



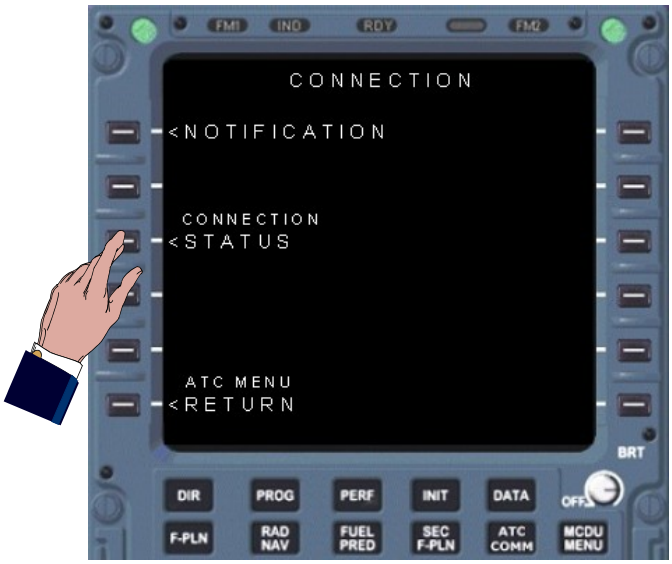
Note :
For normal messages, the aural signal is delayed by 10 seconds and then repeated every 10 seconds until the receipt of the message is acknowledged (i.e. ATC MSG push-button is switched off or a key to treat the message is pressed).
For urgent messages, the aural signal is started immediately and then repeated every 5 seconds until the receipt of the message is acknowledged (i.e. ATC MSG push-button is switched off or a key to treat the message is pressed).

This message confirms that the ATC centre assumes the aircraft. Close the message. CPDLC communication may start.

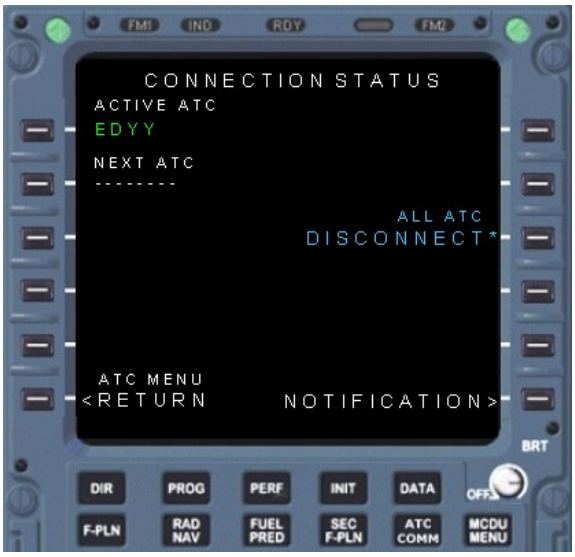
Important : Do not send any downlink messages until you have received this uplink message. Otherwise, the ground station will discard any early downlink messages and will reply with an error message CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST.

When the above message has been closed, the Active ATC is displayed as the default screen on the DCDU.

The following figures provide the method to check the connection status.



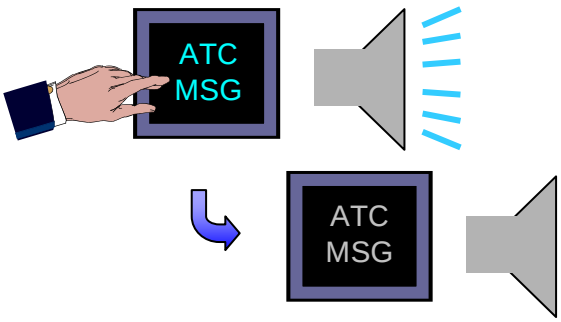
From the ATC MENU page on MCDU, go to the CONNECTION page, and then select the CONNECTION STATUS prompt.



On ATC request, you can disconnect the connected ATC centres (here the ACTIVE ATC) with the 3R key of the CONNECTION STATUS page.

3. RECEPTION OF AN ATC INSTRUCTION

The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.



The message was sent at 12.59Z. The ATC instructs to climb and to reach FL370 at 13.10Z.

If aircraft performance allow doing so, select WILCO.

The selected response is displayed in the upper right corner. Select SEND to physically send the message.

Thanks to the ATN architecture, you know when the message is displayed on the ATC controller screen. The indication RECEIVD BY ATC appears on DCDU.

Close the message to free the DCDU screen.

Once the SEND key is pressed, the message turns into green and a SENDING indication appears in the informationa area.

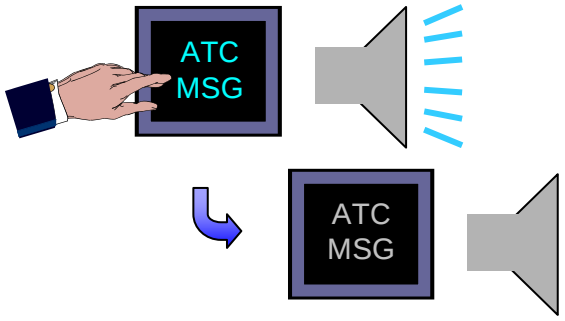
The ATN Baseline 1 standards define a 100-second timer.

Remember that 100 seconds are quite a short period of time to read the

message, to interpret it, to check the aircraft parameter and to prepare the response.

Any uplink message once received on-board should be answered promptly.

4. UPLINK MESSAGE IS NOT ANSWERED ON TIME



The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.

⇓ Interfaces on FANS B+ system ⇓

The "xx SEC for REPLY" indication is not displayed in FANS B+ system.

The ATC requests to report the present level. You may have noticed that the SEND key is not available. Indeed, to be able to send a response, you should first edit the response with the EDIT key.

Notice that no STBY function is provided as per ATN Baseline 1 standards.

⇓ Interfaces on latest FANS B+ system⇓

When the ATC sends an uplink message requiring a response, the flight crew should reply within 100 seconds. "xx SEC for REPLY" is displayed in the information area of the DCDU when the time remaining is 30 seconds. Then, this indication is refreshed every 5 seconds.

If for any reasons, you did not reply within 100 seconds, an amber REPLY: TIME OUT indication appears.

For the CPDLC application, the dialogue is closed. You can only close the message.
As per procedure, you should revert to voice in order to properly close the dialogue from the operational point of view.

Your voice transmission should start as follows : DISREGARD CPDLC REPORT PRESENT LEVEL MESSAGE, BREAK. Continue as appropriate in compliance with standards aeronautical phraseology. Once the voice transmission is finished, close the message.

If you need to recall the last closed message, press the RECALL key from the default DCDU screen.

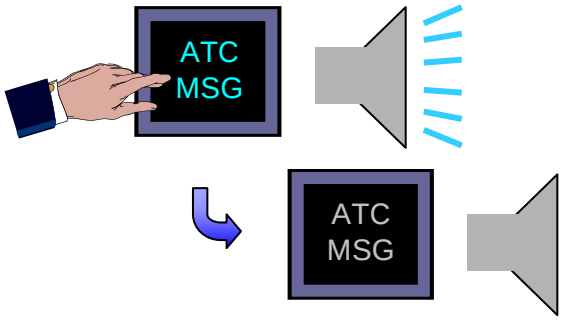
5. TRANSFER TO THE NEXT ATC

The transfer to the next ATC, also called Next Data Authority (NDA), is initialized by the current ATC. From the airborne perspective, the ATSU automatically manages the transfer. Therefore, the transfer is transparent to the crew.

The flight crew knows that the transfer procedure starts when the Voice Contact Instruction is received and the NDA is identified on the default DCDU.

For the following figures, it is assumed that the aircraft is about to transit from the EDYY airspace to the LFFF airspace.

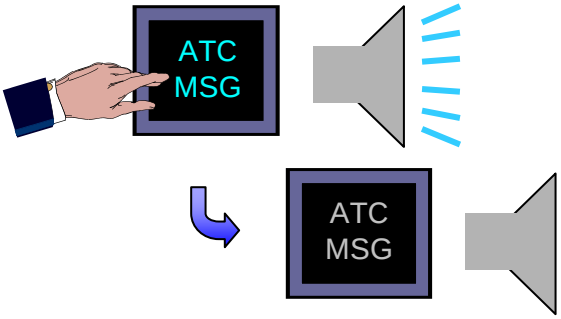
The ATC sends an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.



When LFFF starts the connection process (i.e. CPDLC start request), the default DCDU screen appears as follows. You are still under the authority of EDYY. LFFF will assume soon the aircraft.

On MCDU CONNECTION STATUS page, you can also check that LFFF is the NEXT ATC.

The ATC sends the Voice Contact Instruction. Press the ATC MSG push-button to switch the light off and to stop the aural signal.



You are requested to contact LFFF on 128.275. Select WILCO.

Select SEND.

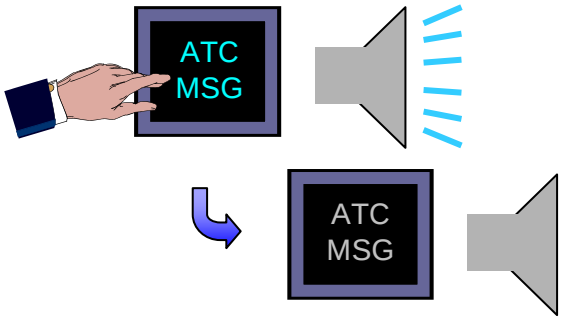
As a CPDLC disconnection with EDYY occurs while replying to this message, the ATC ground station does not send any technical acknowledgement back to the aircraft. Consequently, the SENT indication appears instead of RECEIVD BY ATC.

The aircraft confirms that LFFF is the Current Data Authority by sending a downlink CDA message to LFFF ground station. The ground station replies with a technical acknowledgement. At the receipt of this acknowledgement, the default DCDU screen becomes as shown.

The aircraft is now disconnected from EDYY. The establishment of the CPDLC connection with LFFF is almost completed.
As soon as you have replied WILCO to the Voice Contact Instruction, contact LFFF by voice on the instructed frequency.

The new ATC, LFFF, sends an initial uplink message that clearly identifies the ATC centre to which the aircraft is connected.

Press the ATC MSG push-button to switch the light off and to stop the aural signal.



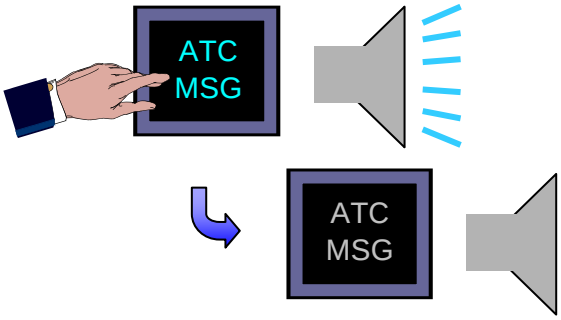
This message confirms that the ATC centre assumes the aircraft. The CPDLC connection with LFFF is enabled. DCDU displays the name of the active ATC (e.g. ACTIVE ATC: LFFF followed by PARIS CTR on the next line). CPDLC communication may start. Close the message.

Important: Do not send any downlink messages until you have received this uplink message. Otherwise, the ground station will discard any early downlink messages and will reply with an error message CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST.

6. OPEN NEGOTIATION

You are now under the authority of LFFF. The ATC sent an uplink message.

Press the ATC MSG push-button to switch the light off and to stop the aural signal.



This is an open negotiation. On receiving this type of message, the ATSU proposes a default response.

If you do not agree with the proposal, select EDIT.

The MCDU FOR EDIT indication appears

If no page from the ATC application was displayed on MCDU, you should call the ATC MENU page, then select the EDIT prompt.

The MCDU MENU light is flashing, reminding you to do so.

The EDIT page allows modifying the response. You can either accept the request NOW or AT (TIME), or reject it by selecting CANNOT.

You have checked that the aircraft cannot fly the FL370. Then select the CANNOT option and transfer the response to the DCDU.

Send the response.

Once the message is received by the ATC, the message will close itself after 5 seconds.

7. MSG RECORD

The ATSU records up to 99 messages (either uplink or downlink). When this limit is reached, the latest message overwrites the oldest message.

Note: the time-out advisory received from the ground is not stored in the MSG RECORD as it is just a means to properly close the CPDLC dialogue, without any particular operational interest.

From the ATC MENU page, display the message record by selecting the MSG RECORD prompt.

For each message, the timestamp, the corresponding ATC, the first line of the message and the response if any are displayed.

You can scroll up or scroll down if the message record cannot be displayed in one page.
Select the left prompt to display the entire content of a message.

Note: A line including the flight identification and the date is present to separate the set of messages of different flights.

The PRINT function allows printing either the whole message record or one single message (to that end, call to display the message to print).

Select the MSG RECORD ERASE function to erase the message record.

The flight crew should confirm within 5 seconds. If not, the erasing of the MSG RECORD is cancelled.

As mentioned in the FCOM/QRH, it is recommended to erase the MSG RECORD at the beginning of cockpit preparation before take-off. Refer to FCOM: Procedures/Normal Procedures/Standard Operating Procedures/Cockpit Preparation/ATC Datalink Communication.

APPENDIX F – A350/A380 FANS B+ OPERATIONAL SCENARIOS

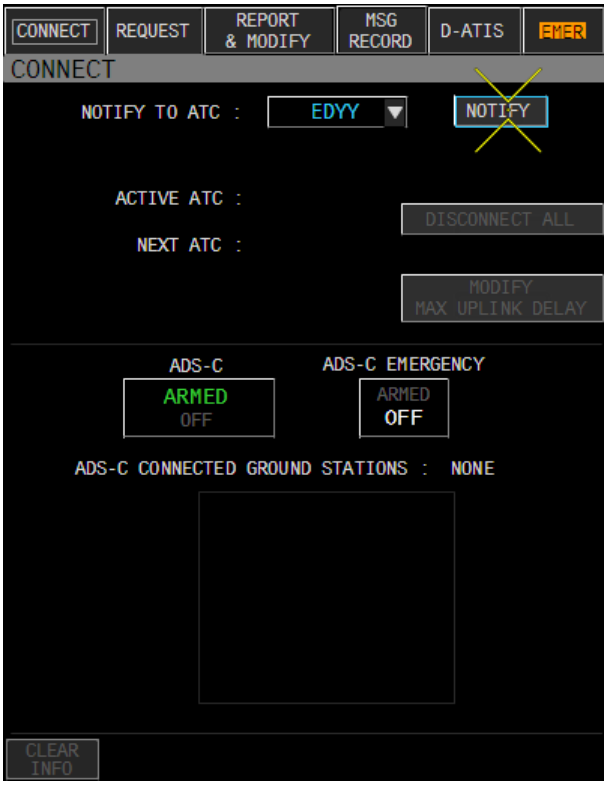
1. INITIAL NOTIFICATION

The aircraft is flying from Helsinki – Malmi, Finland (EFHF) to Paris – Charles De Gaulles, France (LFPG). The first ATC using data link for this flight is Maastricht UAC, The Netherlands (EDYY) and the flight crew wants to notify it.

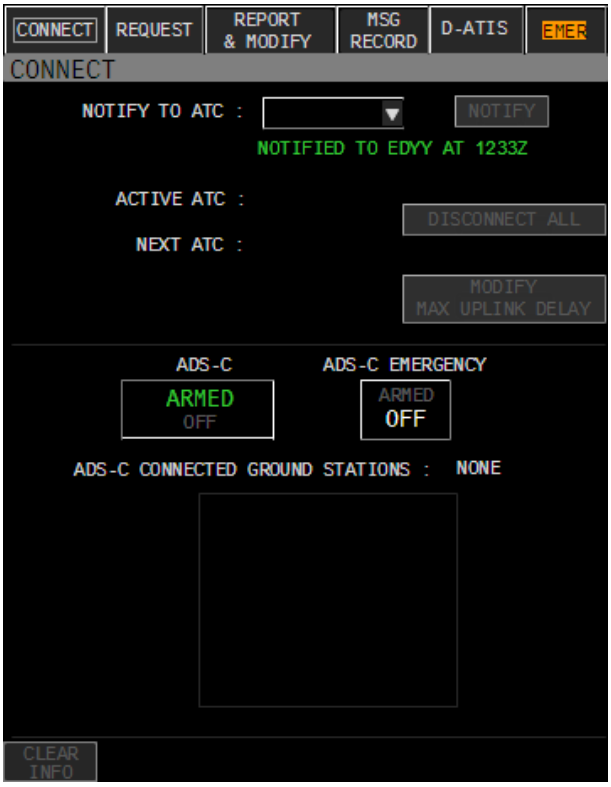
The notification shall be done 10 to 30 minutes before entering the airspace. Refer to AIP.

On the MFD, select in the pull-down menu the ATC COM item.
To display ATC COM pages, the hard key ATC COM can also be used on KCCU.

Select the CONNECT button of the MFD ATC COM page.



Enter the ATC center identification (4 to 8 characters) and select NOTIFY.

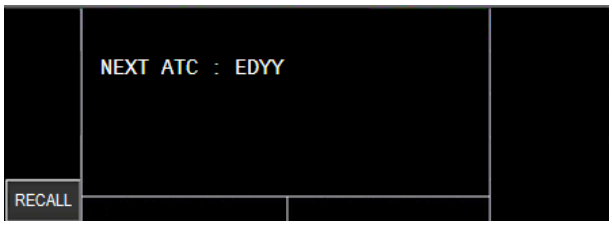


The notification time is provided on MFD.

EDYY is displayed in green. It means that the ATC has been notified about the aircraft data link capability. It does not mean that the CPDLC connection has been established. The CPDLC connection is established on ATC mailbox when the message ACTIVE ATC is displayed. Once the CPDLC connection is established, the notification indication (e.g. EDYY NOTIFIED 1233Z) disappears.

2. CPDLC CONNECTION

Once the notification is completed, the ATC will establish a CPDLC connection. The time at which it will be established varies according to the airspace.

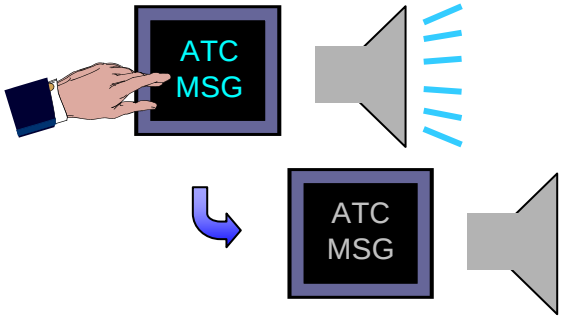


Once the CPDLC connection is established, the ATC centre identification is displayed on the default screen of ATC mailbox.

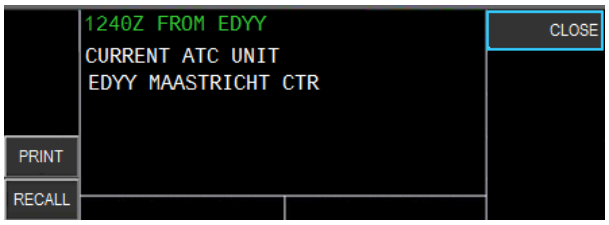
From a technical point of view, the CPDLC connection is established. However, from an operational point of view, the ATC centre does not assume the aircraft yet.

Few minutes later, the first uplink message that clearly identifies the ATC centre to which the aircraft is connected is received.

Press the ATC MSG push-button to switch the light off and to stop the aural signal.

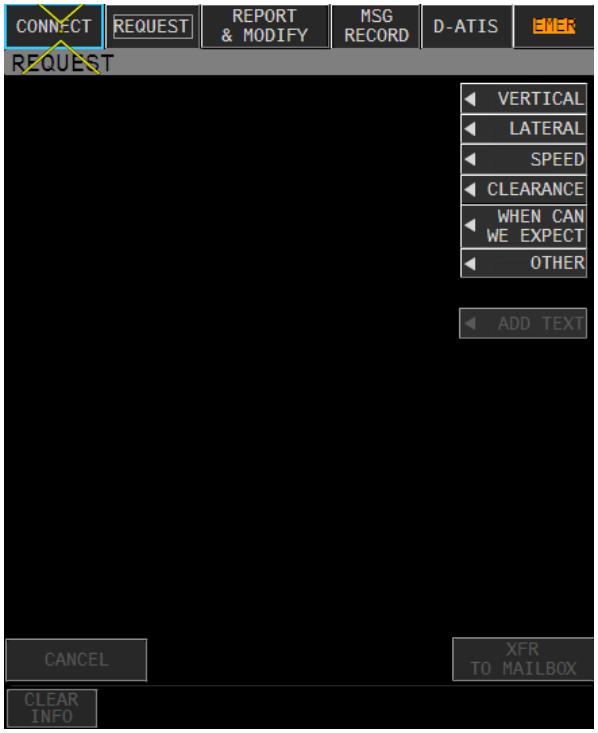


Note :
For normal messages, the aural signal is delayed by 10 seconds and then repeated every 10 seconds until the receipt of the message is acknowledged (i.e. ATC MSG push-button is switched off or a key to treat the message is pressed).
For urgent messages, the aural signal is started immediately and then repeated every 5 seconds until the receipt of the message is acknowledged (i.e. ATC MSG push-button is switched off or a key to treat the message is pressed).

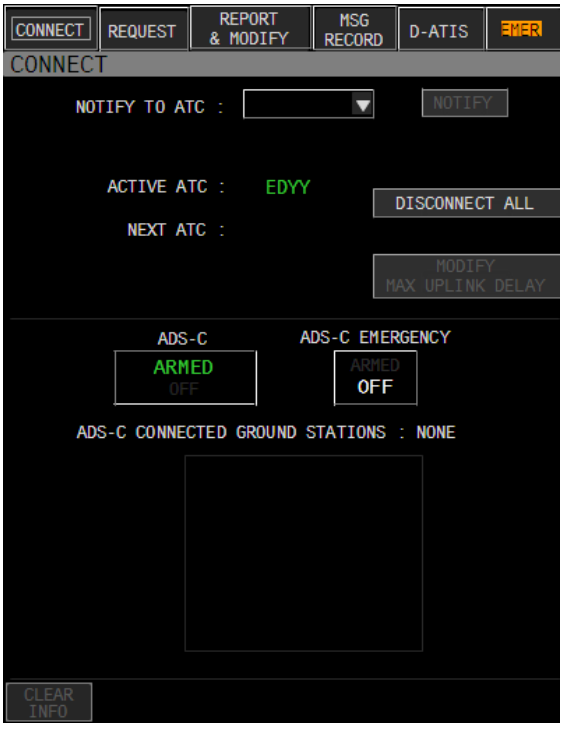


This message confirms that the ATC centre assumes the aircraft. Close the message. CPDLC communication may start.
Important : Do not send any downlink messages until you have received this uplink message. Otherwise, the ground station will discard any early downlink messages and will reply with an error message CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST.
When the above message has been closed, the Active ATC is displayed as the default screen on the DCDU.

The following figures provide the method to check the connection status.



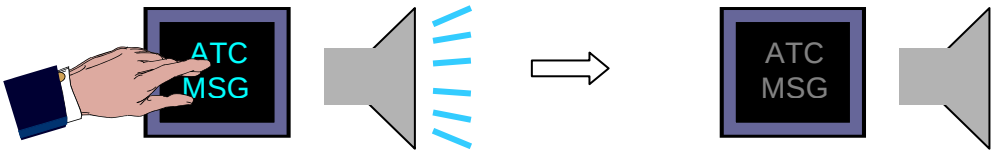
On the MFD, select the CONNECT button on MFD. To display ATC COM pages, the hard key ATC COM can also be used on KCCU.

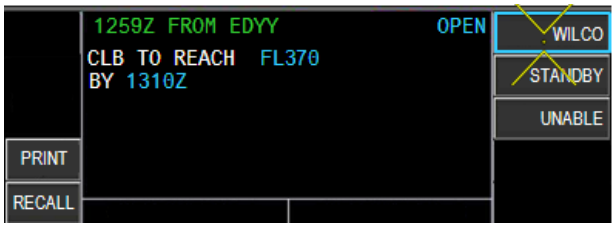


On ATC request, you can disconnect the connected ATC centres (here the ACTIVE ATC) with the DISCONNECT ALL button of the CONNECT page.

3. RECEPTION OF AN ATC INSTRUCTION

The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.





The message was sent at 12.59Z. The ATC instructs to climb and to reach FL370 at 13.10Z.

If aircraft performance allow doing so, select WILCO.

The selected response is displayed in the upper right corner. Select SEND to physically send the message.

Once the SEND key is pressed, the message turns into green and a SENDING indication appears in the information area.

Thanks to the ATN architecture, you know when the message is displayed on the ATC controller screen. The indication RECEIVED BY ATC appears on ATC mailbox.
Close the message to free the ATC mailbox screen.

The ATN Baseline 1 standards define a 100-second timer.

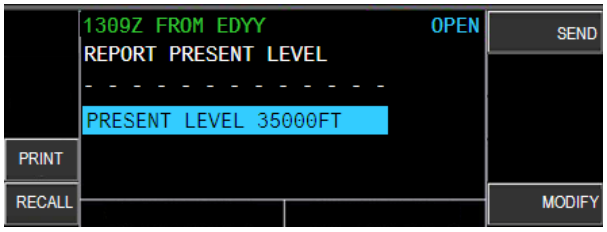
Remember that 100 seconds are quite a short period of time to read the message, to interpret it, to check the aircraft parameter and to prepare the response.

Any uplink message once received on-board should be answered promptly.

4. UPLINK MESSAGE IS NOT ANSWERED ON TIME

The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.

The ATC requests to report the present level. You may have noticed that the SEND key is not available. The ATC mailbox displays “WAIT FOR SYS DATA” in the information area.



When FMS data are received, the present level (35000 FT) is updated in the ATC mailbox and the SEND key is now available.
Notice that no STBY function is provided as per ATN Baseline 1 standards.

When the ATC sends an uplink message requiring a response, the flight crew should reply within 100 seconds. “REPLY WITHIN 30S” is displayed in the information area of the ATC mailbox when the time remaining is 30 seconds. Then, this indication is refreshed every 5 seconds time remaining is above 10 seconds and every 1 second when the time remaining is less than 10 seconds.

If for any reasons, you did not reply within 100 seconds, an amber REPLY: TIME OUT indication appears.
For the CPDLC application, the dialogue is closed. You can only close the message.
As per procedure, you should revert to voice in order to properly close the dialogue from the operational point of view.

Your voice transmission should start as follows : DISREGARD CPDLC REPORT PRESENT LEVEL MESSAGE, BREAK. Continue as appropriate in compliance with standards aeronautical phraseology. Once the voice transmission is finished, close the message.

If you need to recall the last closed message, press the RECALL key from the default ATC mailbox screen.

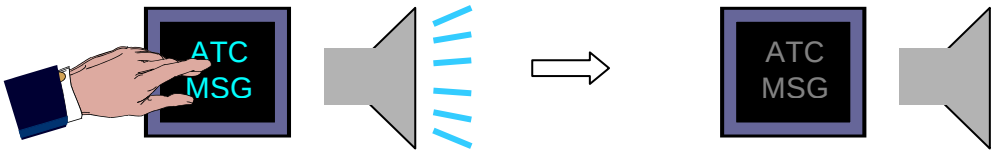
5. TRANSFER TO THE NEXT ATC

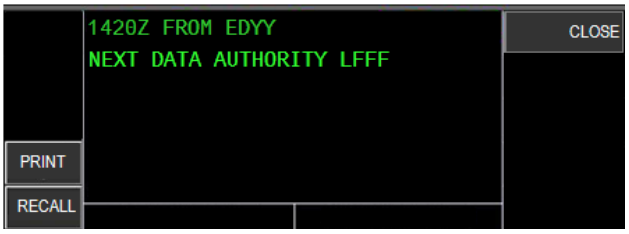
The transfer to the next ATC, also called Next Data Authority (NDA), is initialized by the current ATC. From the airborne perspective, the ATSU automatically manages the transfer. Therefore, the transfer is transparent to the crew.

The flight crew knows that the transfer procedure starts when the Voice Contact Instruction is received and the NDA is identified on the default DCDU.

For the following figures, it is assumed that the aircraft is about to transit from the EDYY airspace to the LFFF airspace.

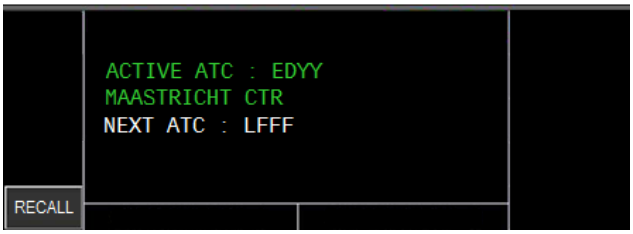
The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.





The current ATC, EDYY, informs you that LFFF is the next ATC that will be responsible of your aircraft.

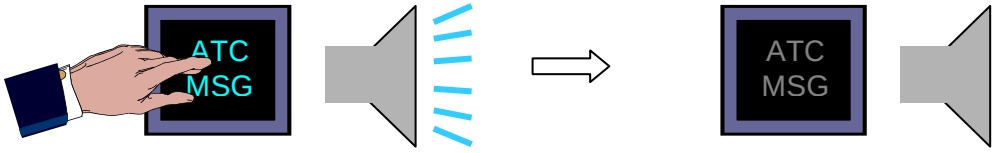
Close the message.

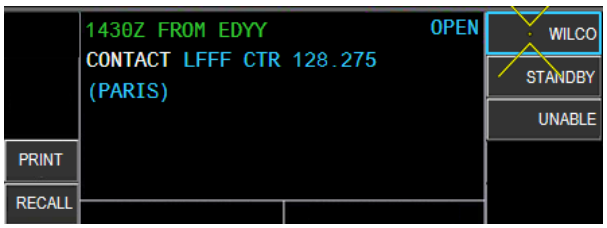


When LFFF starts the connection process (i.e. CPDLC start request), the default DCDU screen appears as follows. The aircraft is still under the authority of EDYY. LFFF will assume the aircraft soon.

On MFD CONNECT page, you can also check that LFFF is the NEXT ATC.

The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.



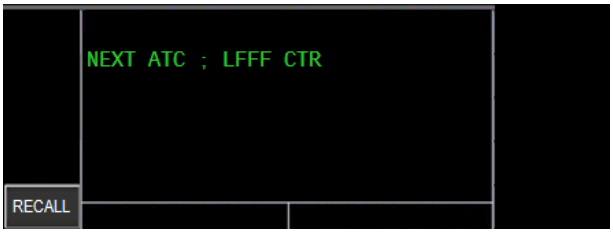


You are requested to contact LFFF on 128.275. Select WILCO.

Select SEND.

As a CPDLC disconnection with EDYY occurs while replying to this message, the ATC ground station does not send any technical acknowledgement back to the aircraft. Consequently, the SENT indication appears instead of RECEIVED BY ATC.

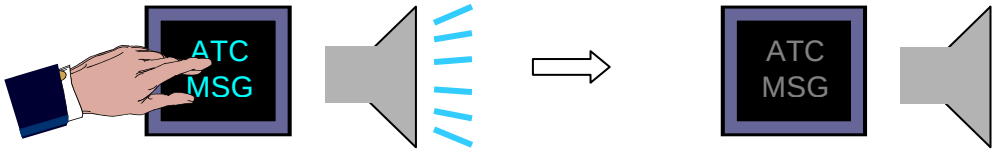
The aircraft confirms that LFFF is the Current Data Authority by sending a downlink CDA message to LFFF ground station. The ground station replies with a technical acknowledgement. At the receipt of this acknowledgement, the default ATC mailbox screen becomes as shown.

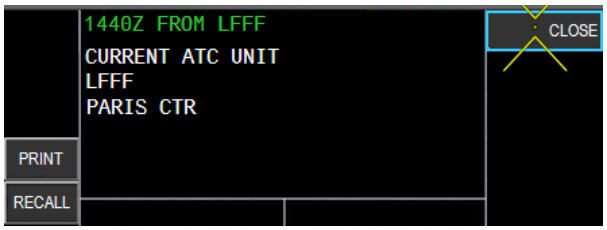


The aircraft is now disconnected from EDYY. The establishment of the CPDLC connection with LFFF is almost completed.

As soon as you have replied WILCO to the Voice Contact Instruction, contact LFFF by voice on the instructed frequency. The new ATC, LFFF, sent an initial uplink message that clearly identifies the ATC centre to which the aircraft is connected.

The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.



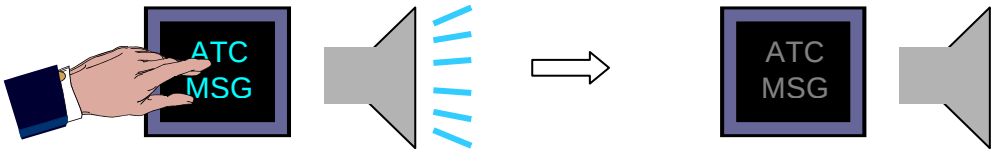


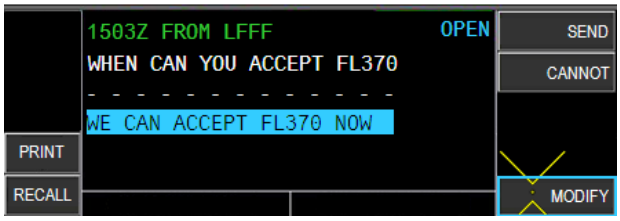
This message confirms that the ATC centre assumes the aircraft. The CPDLC connection with LFFF is enabled. ATC mailbox displays the name of the active ATC (e.g. ACTIVE ATC: LFFF followed by PARIS CTR on the next line). CPDLC communication may start. Close the message.

Important: Do not send any downlink messages until you have received this uplink message. Otherwise, the ground station will discard any early downlink messages and will reply with an error message CPDLC TRANSFER NOT COMPLETED – REPEAT REQUEST.

6. OPEN NEGOTIATION

You are now under the authority of LFFF.
The ATC sent an uplink message. Press the ATC MSG push-button to switch the light off and to stop the aural signal.



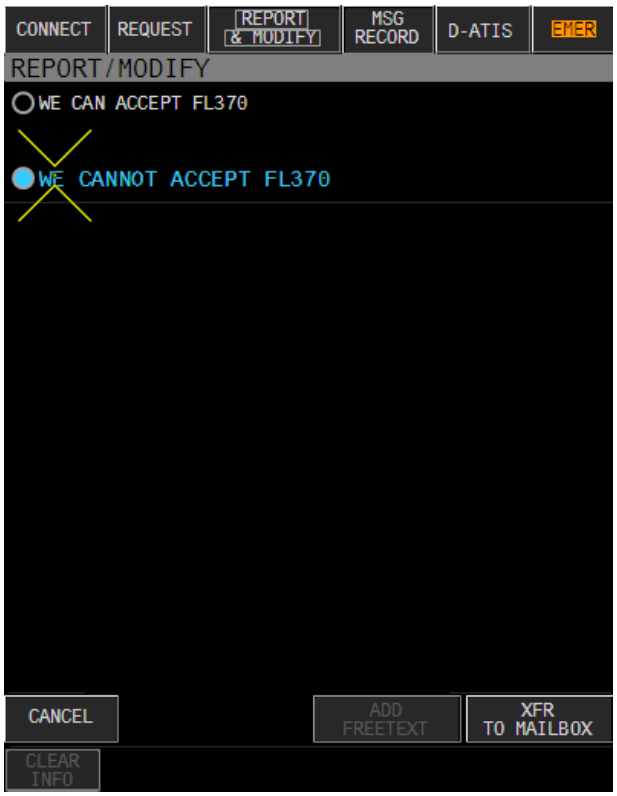


This is an open negotiation. On receiving this type of message, the ATC applications propose a default response.

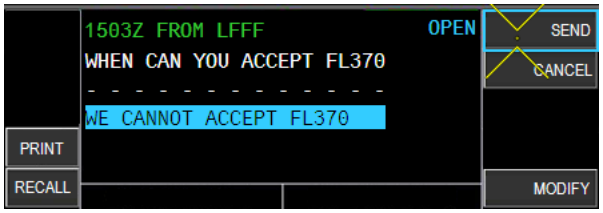
If you do not agree with the proposal, select MODIFY.

The EDIT page allows modifying the response. You can either accept the request, or reject it by selecting CANNOT.

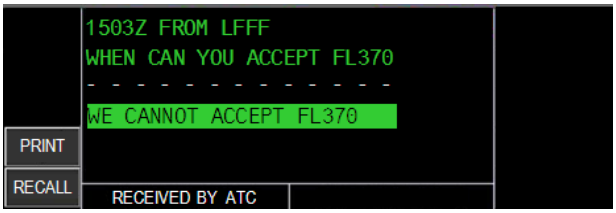
You have checked that the aircraft cannot fly the FL370. Then select the CANNOT option and transfer the response to the ATC mailbox by selecting "XFR TO MAILBOX".



Send the response.

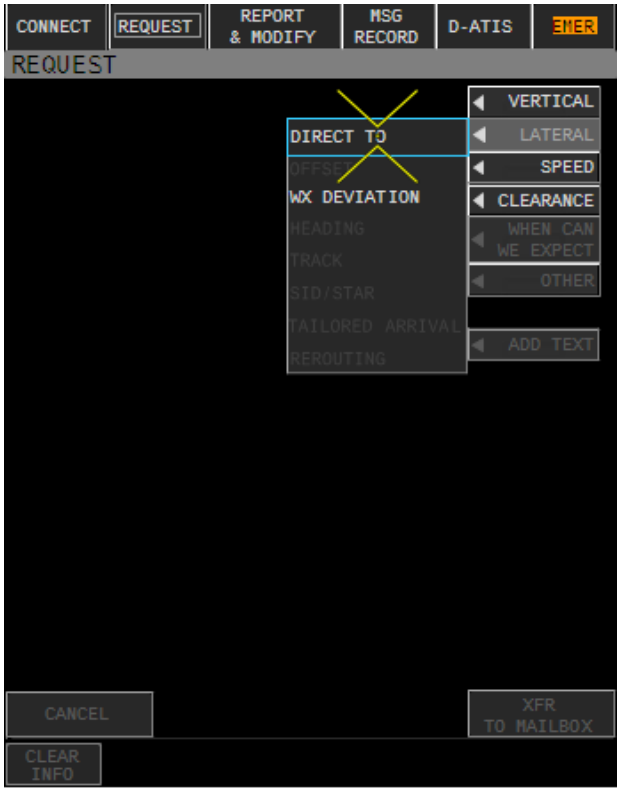


Once the message is received by the ATC, the message will close itself after 5 seconds.

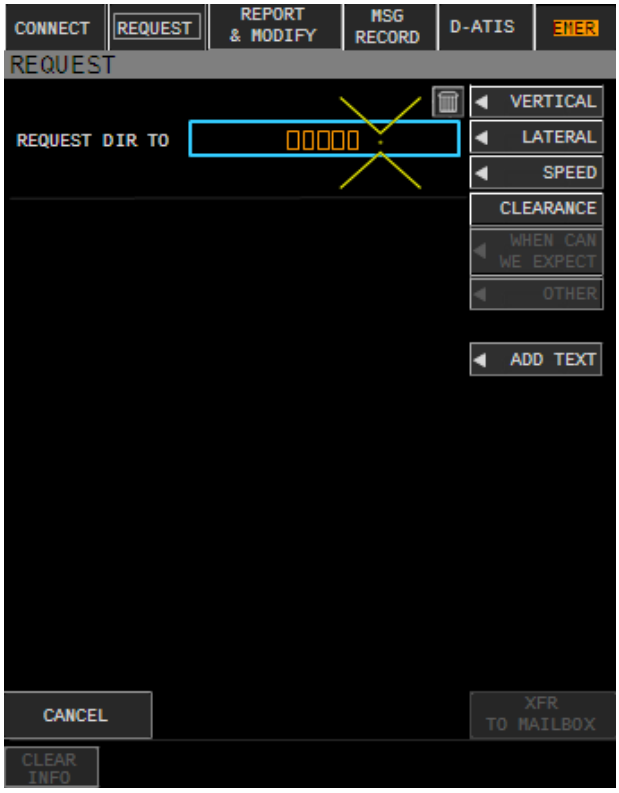


7. NO RESPONSE FROM ATC

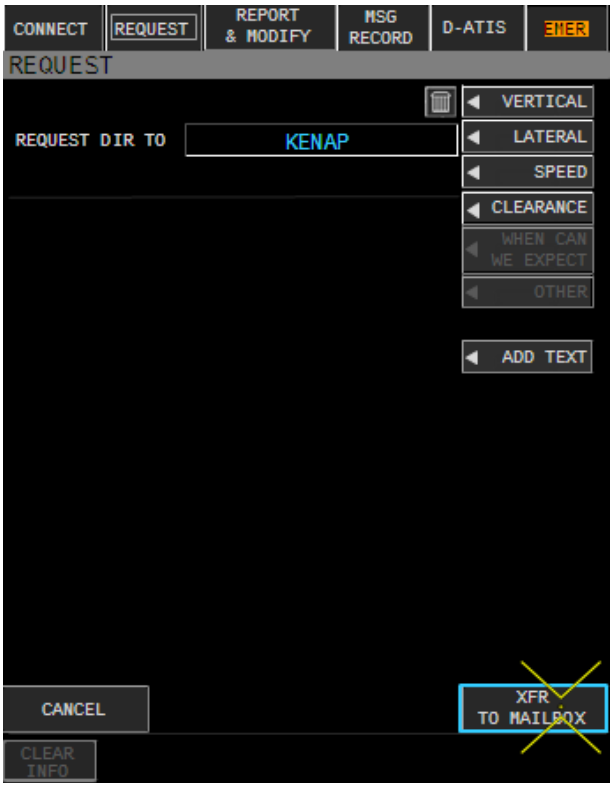
You would like to request a direct leg to KENAP. To this end, select the MFD REQUEST page and the DIRECT TO key in LATERAL menu.



Edit your request.



Once finished, transfer it to ATC mailbox.



If the ATC controller fails to answer within this period, the ground system sends a time-out advisory.

Per procedure, revert to voice. Your voice transmission should start as follows: DISREGARD CPDLC REQUEST MESSAGE, BREAK. Continue as appropriate in compliance with standard aeronautical phraseology. Close the message.

Under certain circumstances, the time-out advisory sent by the ground system may not reach the aircraft. Therefore, the ATC applications display a time-out indication NO ATC REPLY in amber on ATC mailbox.

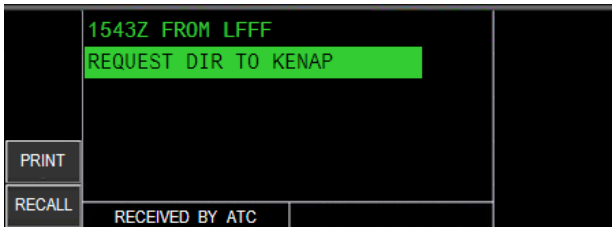
The NO ATC REPLY indication is alternatively displayed with a white REMINDER indication.

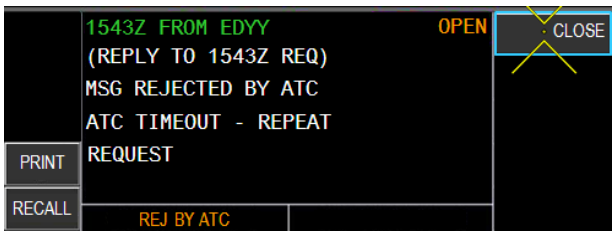
Proceed to a voice procedure as described above. The ATC applications will close the message after 5 seconds.

Send the request.

Once the message is received by the ATC, the aircraft system will close the message after 5 seconds.

At this time, you should expect a response within 270 seconds. The ATC controller has 250 seconds to answer your request.





8. MSG RECORD

The ATC applications record up to 99 messages (either uplink or downlink). When this limit is reached, the latest message overwrites the oldest message.

Note: the time-out advisory received from the ground is not stored in the MSG RECORD as it is just a means to properly close the CPDLC dialogue, without any particular operational interest.

From the MFD ATC COM page, display the message record by selecting the MSG RECORD key.

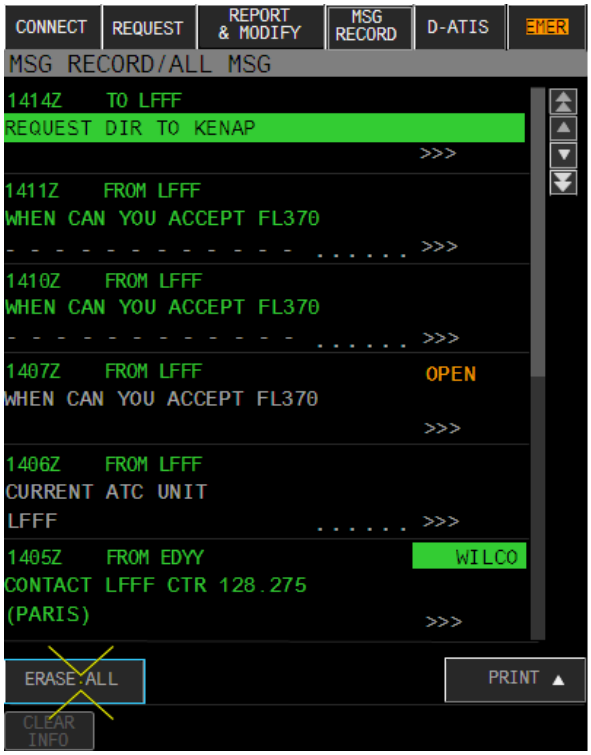
For each message, the timestamp, the corresponding ATC, the first line of the message and the response if any are displayed.

You can scroll up or scroll down if the message record cannot be displayed in one page.

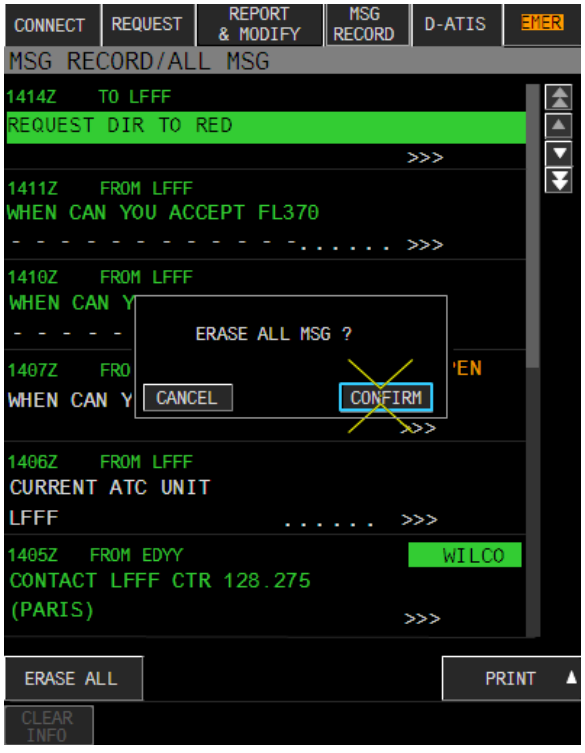
Select the message to display its entire content.

The PRINT function allows printing either the whole message record or one single message (to that end, call for display the message to print).

Select ERASE ALL to erase the message record.



The flight should confirm the erasing of the MSG RECORD.



As mentioned in the FCOM/QRH, it is recommended to erase the MSG RECORD at the beginning of cockpit preparation before take-off. Refer to FCOM: Procedures/Normal Procedures/Standard Operating Procedures/Cockpit Preparation/ATC Datalink Communication.

APPENDIX G – ON-BOARD INDICATIONS IN CASE OF DATA LINK FAILURES

In case of datalink communications failures, a warning is displayed on EWD or/and some indications are provided on DCDU (respectively ATC mailbox). The following sections provide the main failures that may imply the application of one of the procedures described in chapter A5.

ATC applications of FANS B/B+ systems rely on ATN network while the ACARS network is used for ATC applications of FANS A/A+ systems and ATS 623 applications. Two independent cases will be considered:

- Loss of datalink communications (i.e. ACARS) for FANS A/A+ and ATS 623 applications
- Loss of datalink communications (i.e. ATN) for FANS B/B+ applications.

This section describes the cockpit displays when there is a loss of datalink communications for FANS B/B+ applications. Regarding the impact on cockpit displays in case of loss of datalink communications for FANS A/A+ and ATS 623 applications, refer to Part II - Appendix K.

1. A320 AIRCRAFT

ATSU FAILURE

The ATSU is not working anymore. Data link communications between the aircraft and the ground are not available.
The ATSU failure affects both ATC and AOC applications. **The flight crew shall contact ATC by voice if any ATC was connected.**
The DATALINK ATSU FAULT caution is displayed on EWD.

A white NO DATA indication is displayed on DCDU and ATSU pages on MCDU are not available.

TEMPORARY LOSS OF DATALINK COMMUNICATIONS FOR FANS B/B+ APPLICATIONS

The air-ground communication means used for FANS B/B+ applications are temporarily unavailable, but not failed (i.e. no system failure, but data link is not available). The ATSU is trying to recover the data link communications with the ground for 6 minutes.

The flight crew shall contact ATC by voice.

Some indications are provided on DCDU:

1. The system message ATC DATALINK COM NOT AVAILABLE is displayed in amber.

2. If a CPDLC message is displayed on DCDU, the indication NO ATC DLK is added in amber in the information area. The flight crew message cannot send (the SEND key is not available anymore).

If the ATSU fails to recover the datalink communications within 6 minutes, an abnormal ATC datalink disconnection occurs. Refer to description below.

DEFINITIVE LOSS OF DATALINK COMMUNICATIONS FOR FANS B/B+ APPLICATIONS

- The air-ground communication means used for FANS B/B+ applications (VDL) are failed, or
- The airborne datalink ATC applications are failed (ATS 623 and AOC applications may be still running).

These cases result in an **abnormal ATC data link disconnection** described in the following paragraph.

The flight crew shall contact ATC by voice.

The DATALINK ATC FAULT caution is displayed on EWD.

Similarly to the ATSU failure, **if the airborne datalink ATC applications are failed**, a white NO DATA indication is displayed on DCDU, and the ATC COM pages are not available.

ABNORMAL ATC DATALINK DISCONNECTION

When an abnormal ATC data link disconnection occurs, the following indications are provided.

1. The system message ATC DISCONNECTED is displayed in amber.

2. If a CPDLC message is on DCDU, the following indications are displayed : amber ABORT in the top right corner and amber LINK LOST in the information zone.

2. A350/A380 AIRCRAFT

ACR FAILURE

The ACR1 (and ACR2 if installed) is (are) not working anymore. Data link communications between the aircraft and the ground are not available.
The ACR failure affects all applications using data link (i.e. ATC, AOC, and AAC). **The flight crew shall contact ATC by voice if any ATC was connected.**
The COM DATALINK FAULT caution is displayed on EWD.

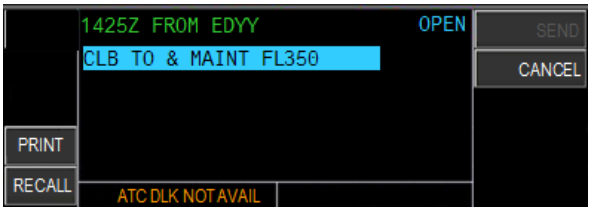
TEMPORARY LOSS OF DATALINK COMMUNICATIONS FOR FANS B+ APPLICATIONS

The datalink communication means defined in the routing policy for FANS B+ applications are temporarily unavailable, but not failed (i.e. no system failure, but datalink is not available).

The flight crew shall contact ATC by voice.

On the ATC mailbox, the following indications are displayed :

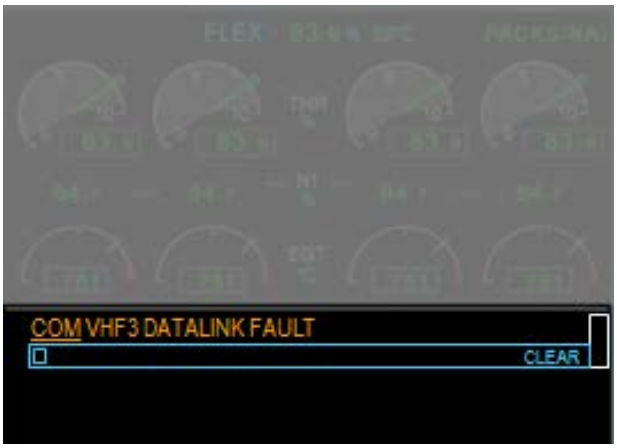
1. The system message ATC DATALINK COM NOT AVAIL is displayed in amber.



2. If a CPDLC message is on ATC mailbox, the indication ATC DLK NOT AVAIL is displayed in amber in the information area.

The ACR is trying to recover the data link communications with the ground for 6 minutes. If the ACR fails to recover the data link communications within 6 minutes, an abnormal ATC data link disconnection occurs. Refer to description below.

DEFINITIVE LOSS OF DATA LINK COMMUNICATIONS FOR FANS B+ APPLICATIONS



The air-ground communication means used for FANS B+ applications are failed for the following reasons :

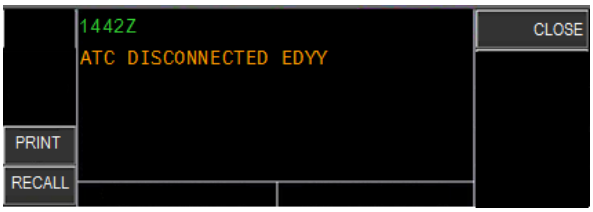
- The ACR1 (and ACR2 if installed) is (are) not working anymore, or
- The communications means VHF are failed.

These cases result in an abnormal ATC data link disconnection described in the following paragraph.

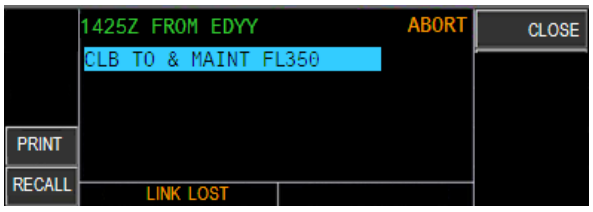
ABNORMAL ATC DATA LINK DISCONNECTION

When an abnormal ATC data link disconnection occurs, the following indications are provided.

On the ATC mailbox, the following indications are displayed:



1. The system message ATC DISCONNECTED is displayed in amber, followed by the ATC center name.



2. If a CPDLC message is on ATC mailbox, the following indications are displayed: amber ABORT in the top right corner and amber LINK LOST in the information zone.

ATC DATALINK APPLICATION FAILURE

The flight crew shall contact ATC by voice.

The ATC function is failed.
ATC COM pages on MFD and ATC mailbox are not available.

ATC mailbox

MFD

APPENDIX H – FANS B/B+ AIRWORTHINESS APPROVAL SUMMARY

The purpose of this document is to describe the Communication, Navigation and Surveillance airborne capabilities required for FANS B/B+ operations, and the interoperability, safety and performance requirements that were considered for the development and the airworthiness approval of the Airbus FANS B/B+ avionics system that supports Air Traffic Services data link applications. It also summarizes the main results and achievements of interoperability, safety and performance demonstrations that were conducted by Airbus.

This document is an outcome of the FANS B airworthiness approval process intended to be widely distributed to any party planning to make use of data communications for Air Traffic Services purposes.

This document is primarily intended for operators, ATC service providers and national aviation authorities.

They should refer to this document when deciding on how to implement operations based on data communications for ATS purposes. It may also be used by operators as substantiating data in order to help in obtaining operational changes.

This document contains:

- **Section 1:** Introduction,
- **Section 2:** A brief description of the FANS B/B+ systems,
- **Section 3:** A short overview of specific aircraft architecture required by FANS B/B+ implementation,
- **Section 4:** A presentation of FANS B/B+ airworthiness approval context by describing the Communication, Navigation and Surveillance (CNS) airborne capabilities assumed for FANS B/B+ operations,
- **Section 5:** A listing of all industry standards considered for the development of the data link applications, and the record of all clarifications, additions and/or deviations to those standards, applicable to the FANS B/B+ avionics systems,
- **Section 6:** A list of all assumptions/requirements placed on the ATS ground systems and Communication Service Providers that must be fulfilled,
- **Section 7:** An overview of the interoperability, safety and performance demonstrations achieved during the airworthiness approval process of the FANS B/B+ systems. This section also provides a set of flight crew procedures used as mitigation means in the safety assessment process,
- **Section 8:** A proposal for a list of checks and verifications that operators and ATC providers may wish to perform before starting operations,
- **Section 9:** Additional information concerning the ATSU router parameters' customisation process.

A certification process was performed for each FANS configuration on any Airbus aircraft model. As a consequence, an Airworthiness Approval Summary is applicable to a given FANS configuration and a given aircraft model.

To a get a copy of the appropriate Airworthiness Approval Summary, please contact Airbus Support (See References) providing one of the following references:

FANS configurations	Aircraft models	Airbus FANS denominations	Airworthiness Approval Summary references
FANS B	A320	CSB 5	00D460P1210/C02 Issue 1
FANS B+	A320	CSB 6.5	00D460P0214/C02 Issue 3
		CSB 6.6	
		CSB 8	

Note 1: Refer to Part II - Appendix L for FANS A+B Airworthiness Approval Summary references.
Note 2: Refer to Part II - Appendix M for Airbus FANS denominations.

EXTERNAL REFERENCES

REF 1 **ICAO Documents**:

- **Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)**, Doc 4444, Fifteenth Edition, 2007:

http://legacy.icao.int/eshop/

- **Amendment 1 of ICAO Doc 4444 PANS-ATM**, which implements a new ICAO flight plan format from 15 Nov 2012. The implementation status of this new format is available for airspace users and Air Navigation Service Providers at:

http://www2.icao.int/en/FITS/Pages/home.aspx

- **ICAO Annex 6 Operation of Aircraft, Part I International Commercial Air Transport-Aeroplane**, Ninth Edition, 2010

http://legacy.icao.int/eshop/

- **Global Operational Data link Document (GOLD),** Edition 2, 26 Apr 2013

http://www.paris.icao.int/documents_open/search.php

- **EUR NSAP Address Registry**, Version 3.0, 2013

http://www.paris.icao.int/documents_open/search.php

REF 2 **EASA Documents**:

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

http://www.easa.europa.eu/agency-measures/docs/agency-decisions/2007/2007-019-R/Annex%204%20to%20Decision%202007-019-R%20-%20(New%20AMC%2020-11).pdf

REF 3 **RTCA/EUROCAE Documents**:

- **Data-link Application System Document (DLASD) for the "Departure Clearance" Data-link Service** (EUROCAE ED-85A).
- **Data-link Application System Document (DLASD) for the "ATIS" Data-link Service** (EUROCAE ED-89A).
- **Data-link Application System Document (DLASD) for the "Oceanic Clearance" Data-link Service** (EUROCAE ED-106A).
- **Minimum Aviation System Performance Specification for CNS/ATM Message Recording Systems** (EUROCAE ED-93).
- **Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace** (Oceanic SPR Standard, RTCA DO-306/EUROCAE ED-122).

- **Safety and Performance Standard for Air Traffic Data Link Services in Continental Airspace** (Continental SPR Standard, RTCA DO-290/EUROCAE ED-120, Change 1 and Change 2).
- **Interoperability Requirements for ATS Applications Using ARINC 622 Data Communications** (FANS 1/A INTEROP Standard, RTCA DO-258A/EUROCAE ED-100A)**.**
- **Interoperability Requirements Standard for Aeronautical Telecommunication Network Baseline 1** (ATN B1 INTEROP Standard, RTCA DO-280B/EUROCAE ED-110B)**.**
- **Future Air Navigation System 1/A — Aeronautical Telecommunication Network Interoperability Standard** (FANS 1/A — ATN B1 INTEROP Standard, RTCA DO-305/EUROCAE ED-154)**.**

REF 4 **ARINC Documents**:

- **ARINC 618-6 (INTEROP) for air/ground protocol**
- **ARINC 622**
- **ARINC 623-3**

AIRBUS REFERENCES

REF 5 All **Getting to Grips** brochures are available at: https://w3.airbus.com/crs/A233_Flight_Ops_GN60_Inst_Supp/GRIPS/GripMenu.htm:

- **Getting to Grips with Modern Navigation, Issue 5 – Jun 2004**
- **Getting to Grips with RNP-AR, Issue 2 – Feb 2009**
- **Getting to Grips with Surveillance, Issue 1 – May 2009**

AIRBUS TRAINING

REF 6 **Airbus CBT** are the following ones:

AIRBUS A320/A330/A340 FANS CBT: All Aircraft COMMON FLIGHT CREW COURSES/Future Air Navigation System (FANS): Pre-FANS, FANS A, FANS A+, FANS B, FANS B+ systems.

AIRBUS A380 FANS CBT: A380 FLIGHT CREW COURSES/STANDARD TRANSITION COURSE

SUPPORT

REF 7 **AIRBUS WORLD Support**:
For any problems related to your access to Airbus World, please contact the Airbus World Support:

Tel: +33 5 67 19 11 00 **E-Mail:** airbusworld@airbus.com

Airbus World homepage: http://www.airbusworld.com

REF 8 **AIRBUS FANS Support**:
For any problems related to FANS operations, please contact:

E-Mail: fltops.ops@airbus.com

For any problems related to FANS technical issue, please contact "Airbus Customer Support". Refer to email addresses provided in "Get M&E Support" page under http://www.airbusworld.com

REF 9 **Eurocontrol Link 2000+ support**:
For any questions related to Link 2000+ programme, please contact:

E-Mail: link2000@eurocontrol.int

REF 10 **Rockwell Collins Support**:

For the questions related to ACR A380 customization, please contact:

E-Mail: CollinsRCF-ACR380Custo@rockwellcollins.com

REF 11 **INMARSAT**

For the questions related to INMARSAT Aeronautical global coverage and spot beams:

E-Mail: customer_care@inmarsat.com

REF 12 **MTSAT**

For the questions related to MTSAT Aeronautical global coverage and spot beams (SITA ensures the customer support as it is the exclusive Communication Service Provider for MTSAT communications):

E-Mail: aircom.customer.support@sita.aero

REF 13 **ARINC**
Please refer to the website that includes the ARINC contact details:
http://www.arinc.com/resources/contact/

REF 14 **SITA**
Please refer to the website that includes the SITA contact details:
http://www.sita.aero/content/contact-map