getting to grips with

FANS

AIRBUS INDUSTRIE

Flight Operations Support - Customer Services Directorate

Getting to grips with FANS

A Flight Operations View

AIRBUS INDUSTRIE

Note

Should any deviation appear between the information provided in this brochure and that published in the applicable AFM, MMEL and FCOM, the information set forth in these documents shall prevail at all times.

FANS

Future Air Navigation System

Aircraft upgrade of : **C**ommunication **N**avigation **S**urveillance (CNS)

To allow for efficient : **A**ir **T**raffic **M**anagement (ATM)

Airbus product : **AIM-FANS**

(Airbus Interoperable Modular-FANS)

STEP 1 : **FANS A**

• Air Traffic Services Data link based on ACARS (ARINC 622) network

STEP 2 : **FANS B**

• Introduction of ATN (Aeronautical Telecommunication Network)

• ICAO approved (CNS/ATM-1 standards)

STEP 3 : **FULL FANS**

• "Free Flight" concept supported

ACARS	Arinc Communication Addressing & Reporting System
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
AEEC	Airlines Electronics Engineering Committee
AFN	ATS Facility Notification
AIDC	ATC Inter-Facility Ground/Ground data communications
AIM-FANS	Airbus Interoperable Modular- Future Air Navigation System
AMU	Audio Management Unit
AOC	Airline Operations Communications (or Centre)
ARINC	Aeronautical Radio INC
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSU	Air Traffic Services Unit
CDTI	Cockpit Display of Traffic Information
CFDIU	Centralised Fault Display Interface Unit
CNS/ATM	Communications Navigation Surveillance/Air Traffic Management
CPDLC	Controller Pilot Data link Communications
DARP(S)	Dynamic Airborne Route Planning (System)
DCDU	Data Communications Display Unit
DFIS	Digital Flight Information Services
DGPS	Differential GPS
DL	Down Link
DSP	Data Service Providers (or Processor)
EATMS	European Air Traffic Management System
ECAM	Electronic Centralised Aircraft Monitoring
EFIS	Electronic Flight Information System
EUROCAE	European Organisation for Civil Aviation Equipment
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
GES	Ground Earth Station
GNSS	Global Navigation Satellite System
GLS	GPS Landing System
GPS	Global Positioning System
HFDL	High Frequency Data Link
HFDR	High Frequency Data Radio
HMI	Human Machine Interface
ICAO	International Civil Aviation Organisation
IFALPA	International Federation of Airline Pilot Associations
ISPACG	Informal South Pacific ATC Co-ordinating Group
MASPS	Minimum Aviation Systems Performance Standards
MCDU	Multifunction Control and Display Unit
MDDU	Multi Disk Drive Unit
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
PACOTS	Pacific Organised Track System
RAIM	Receiver Autonomous Integrity Monitoring
RCP	Required Communications Performance
RGS	Remote Ground Station
RNAV	Area Navigation
RNP	Required Navigation Performance
RSP	Required Surveillance Performance
RTCA	Requirements and Technical Concepts for Aviation
RVSM	Reduced Vertical Separation Minima
SATCOM	Satellite Communications
SITA	Société Internationale de Télécommunications Aéronautiques
SOP	Standard Operating Procedures
SOR	System Objectives and Requirements
SPOM	South Pacific Operating Manual
SSR	Secondary Surveillance radar
TDM	Track Definition Message
TMA	Terminal Area
TMU	Traffic Management Unit
UL	Up Link
V/DME	VHF/Distance Measurement Equipment
VDL	VHF Data Link
VDR	VHF Data Radio

FOREWORD

The purpose of this brochure is to provide Airbus Industrie aircraft operators with the agreed interpretations of the currently applicable CNS/ATM (i.e. FANS) regulations.

The intent is thus to provide guidance material on CNS/ATM operations, which satisfy airworthiness requirements in order for an airline to obtain operational approval from its national operational authorities.

All recommendations conform to the current regulatory requirements and are intended to assist the operators in maximising the cost effectiveness of their operations.

The content of this first edition is limited to the FANS A system, which is in use at the date of publication (Step 1, ref. p3). Future editions will include information on further systems, e.g. ATN (or CNS/ATM-1; Step 2, ref.p3) based systems and ADS-B, once these are certified and there are definite plans to introduce them in some areas.

As detailed hereafter, CNS/ATM is a global system concept, which is based on global navigation, communications and automatic dependent surveillance systems.
Although FANS air spaces or routes are usually defined in terms of all the three C, N and S aspects, this brochure mainly addresses the data link Communications and Automatic Dependent Surveillance issues only. Recommendations for RNP (Required Navigation Performance) and RVSM (Reduced Vertical Separation Minima) operational approval are given in the RNP/RVSM document - A flight operations view - (reference: AI/ST-F 945.0415/99). Whenever needed, the reader will be invited to refer to this document.

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

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1. INTRODUCTION

1.1 Historical background

In 1983 the ICAO council tasked its special committee on Future Air Navigation Systems (FANS) to make recommendations to upgrade the communications, navigation and surveillance systems so as to cope with the evolution of the world wide air traffic. In 1989, based on the previous work, a second committee was created aiming at the implementation of the CNS/ATM (Communication, Navigation, Surveillance / Air Traffic Management) concept. This concept was endorsed by the Tenth Air Navigation Conference in 1991. It is mainly built on satellite technology and digital communications and aims at increasing the air space capacity, enhancing the operational flexibility and global safety of the air traffic.

1.2 CNS/ATM Global Concept

The CNS/ATM acronym states what is behind its concept. Increasing the airspace capacity, enhancing the operational efficiency while ensuring the best safety level of the air traffic cannot be done without a combined use of the air and ground elements. Numerous actors play in this global end-to-end concept, which can be seen as a chain linking a pilot and a controller. Although most of these actors are independent entities (e.g. Air Traffic Services organisations, communication service providers or ATC) the proper interoperability of all of them is the key factor for the right operation of the system.

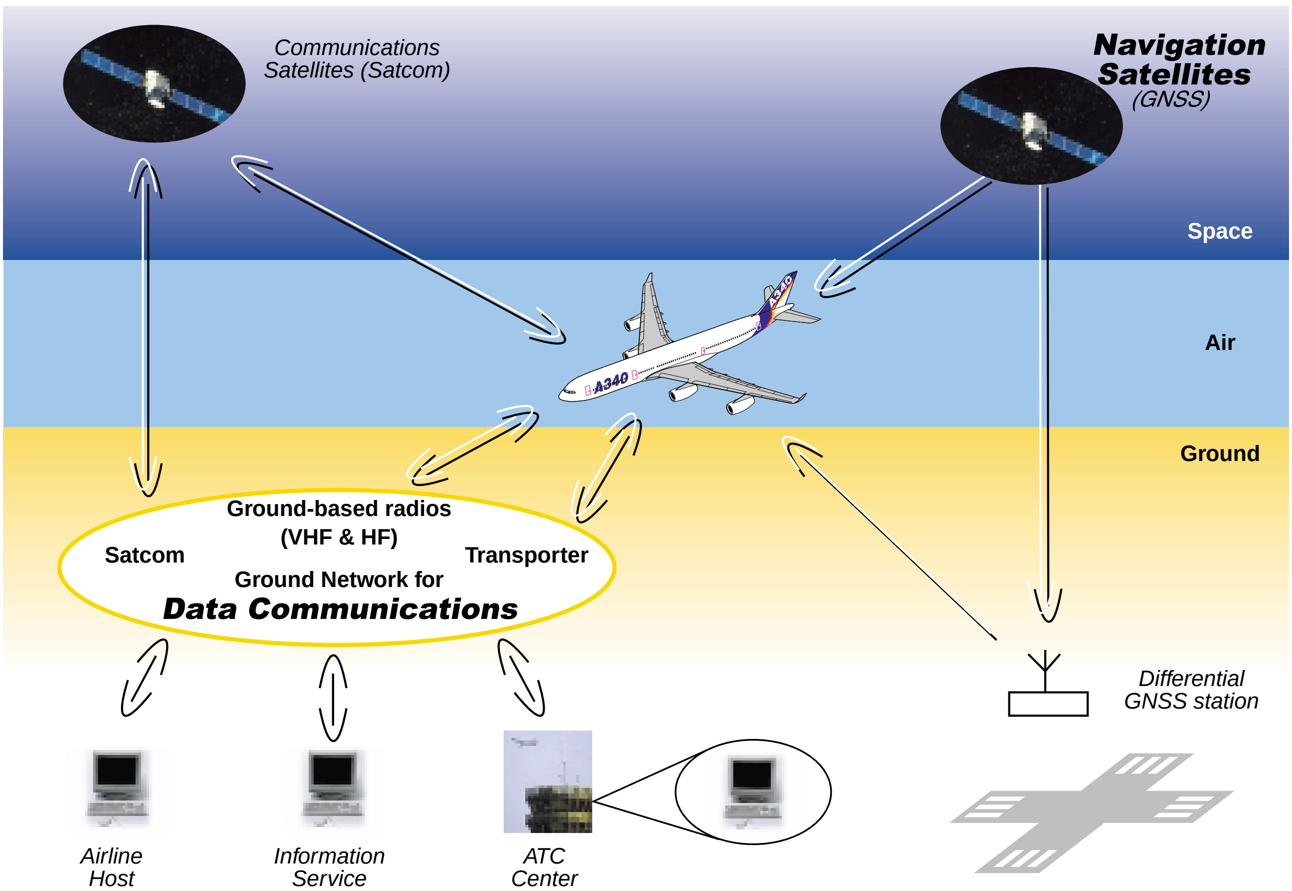


Figure 1

1.3 Communications

Operationally speaking, the biggest change provided by FANS is the way pilot and controllers communicate. In addition to the classical VHF and HF voice, and to the more recent satellite voice, digital CPDLC (Controller Pilot Data Link Communications) will now become the primary means to communicate.
CPDLC is a powerful means to sustain ATC communications in oceanic or remote areas first, and it is expected to become, in a near future, an additional tool to overcome VHF congestion in some busy TMAs.
On board, CPDLC messages are displayed to the crew on the dedicated DCDU (Data Communication Display Unit) screens. They can also be printed.

Ground-ground communications are also part of the concept. They serve to link and to co-ordinate in between different ATC service organisations (or services of the same ATC) and AOC (Airline Operational Centre). AFTN (Aeronautical Fixed Telecommunications Network), voice or AIDC (ATS Interfacility Data Communications) ensure these communications.

Under commercial and financial pressures, the airlines have asked for FANS benefits without waiting for complete availability of all the appropriate tools (such as a better Aeronautical Telecommunications Network: the ATN). That is why FANS A operations have already started using the existing communications networks and protocols (ACARS / ARINC 622) which are of less performance than the ATN, but were endorsed by the ICAO as a valuable step towards an early introduction of ATM applications.

1.4 Navigation

Refer to the RNP/RVSM - A flight operations view -document for detailed explanations.

FANS routes or air spaces are associated with a given RNP (Required Navigation Performance) value. This RNP is a statement on the navigation performance accuracy necessary for operation in this air space. It is defined by the relevant ATS of the concerned area. In the South Pacific region, for instance, flying a LAX/SYD FANS route requires the RNP 10 capability.

1.5 Surveillance

Different types of surveillance may be found. Wherever radar coverage is possible, SSR modes A and C are still used. Mode S is expected to be used in such areas where traffic densities are high enough to warrant it.

In oceanic and remote FANS air spaces, procedurally controlled surveillance is progressively replaced by Automatic Dependent Surveillance, which allows the aircraft to automatically send position data and F-PLN intents to up to four different ATC centres. It is expected that there will be no need for HF voice reporting any longer. With the possibilities offered to the 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 is expected to allow for reduced lateral and longitudinal separation.

1.6 Air Traffic Management

Under this term is grouped a large set of methods to improve the management of all the parts of the air traffic, e.g. traffic flow management, strategic (long term) and tactical (short term) control or air traffic services. New methods are developed and progressively implemented to provide greater airspace capacity to cope with the large increase of air traffic demand. A close co-operation of ATS, crews and airline operational centres, is expected to be reached through data communications, and automated sharing of real-time information. CPDLC, ADS and AOC/ATC inter-facility link are some of the tools used to support new ATM methods such as Collaborative Decision Making (CDM). The aim of CDM is to enable the corresponding actors (crews, controllers and airline operations) involved in ATM system, to improve mutual knowledge of the forecast/current situations, of each other constraints, preferences and capabilities, so as to resolve potential problems.

2.1 The FANS A system

Pending ATN availability, the current FANS A step is based on agreed (ARINC AEEC 622) protocols and utilises already deployed aeronautical data communications networks. These ACARS networks can be accessed through either satellite or VHF media, and various ground networks are inter-connected to provide the ATC/ATM services to all FANS A equipped aircraft. These data communications are supported by the aircraft's ATSU (Air Traffic Service Unit), which manages all the communications and automatically chooses the best available medium (for example VHF or Satcom).

The Air-Ground data link architecture is given in figure 2. It is made of the following components:

- The airborne part, with the ATSU, which is a modular hosting platform that centralises all data communications (ATC and AOC) and manages the dedicated Human Machine Interface (HMI).
- The communications networks, 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
  . Air-Ground processors, which route and handle the messages

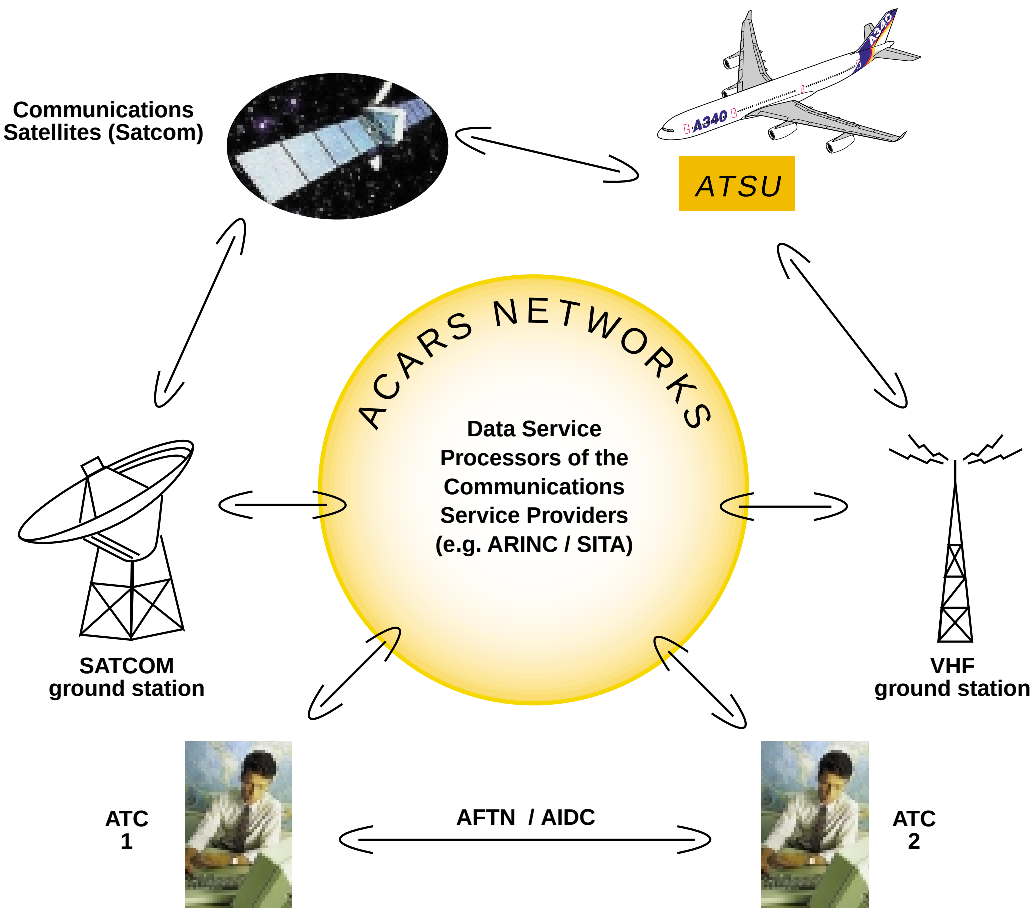


Figure 2

2.2 The data link communications networks

Several communications service providers, in addition to the AOC messages, ensure today the routing of ATC messages between the aircraft and the ATC centre. These are growing steadily, thus raising some issues for future interoperability. Among the main ones the following may be listed:

- INMARSAT: covers the space segment through its satellite constellation, which is accessed by numerous GES operators (most of them being sub-contracted)
- 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

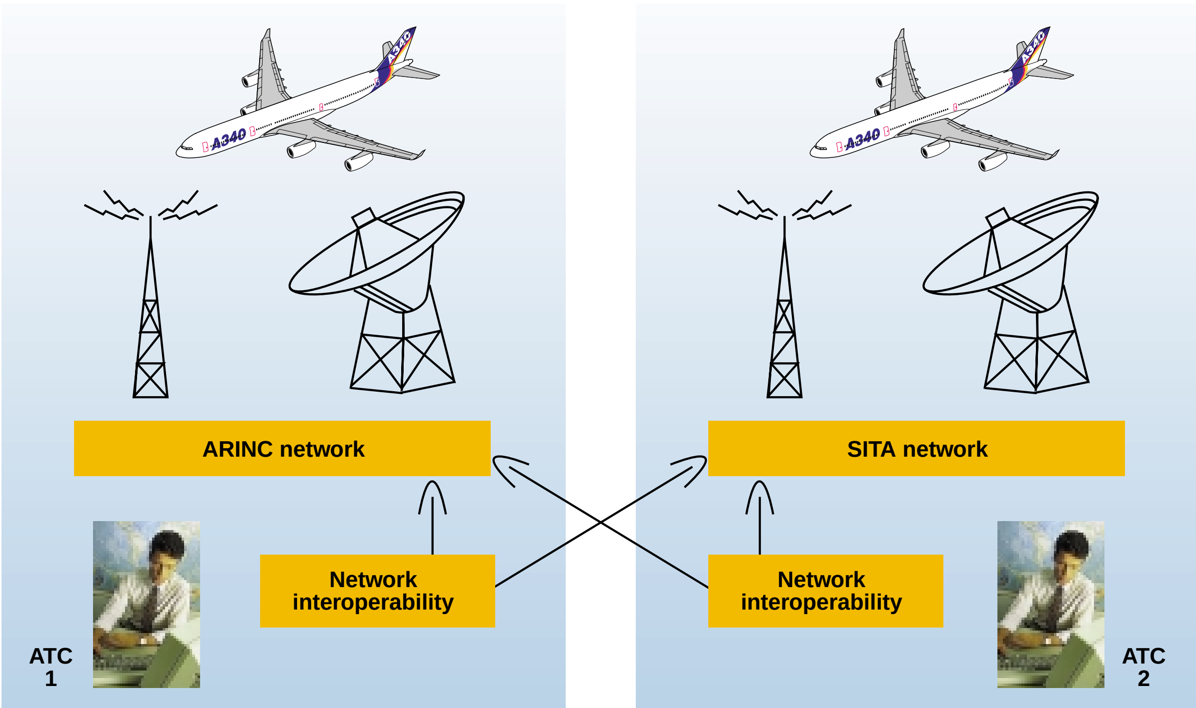
Both ARINC and SITA networks operate with national service providers and are currently interconnected to provide a global interoperability of ATS data link applications. This means for instance, that an aircraft using a VHF data link under a SITA agreement can nevertheless operate in a FANS ATC area using an ARINC contract (Refer to § 2.3).

Given in appendix D is general information relative to some of these service providers.

2.3 The interoperability of the networks

The interoperability between the Data Service Processors of the two main communications service providers (ARINC and SITA) is a key element in the overall performance of the system, and ensures that each relevant ATC centre has access to all FANS aircraft within its region.

Whenever there is a switching for instance from VHF to Satcom (or vice versa), the ATSU sends a Medium Advisory (MA) message to the DSP indicating the status of the communications with each medium. Such an automatic function is needed to fulfil the logic that determines the routing of any uplink message. It is transparent to both the pilot and the controller and ensures that uplink messages can be sent to the aircraft irrespective of the medium or communications service providers used.



ARINC communication domain

SITA communication domain

Figure 3

2.4 The ATS Facility Notification (AFN)

Through this application, an ATC knows whether an aircraft is capable of using data link communications. This serves to exchange the address information between the aircraft and the ATC centre.
This exchange of the data link context is needed prior to any CPDLC or ADS connection.
The AFN log on is initiated by the pilot to notify the ATC of its data link capability and characteristics.
Whenever there is no automatic transfer of control from one ATC centre to another, the active one may request the pilot to make a log on procedure to the next centre.

2.5 CPDLC general description

CPDLC is a powerful tool to sustain data link communications between a pilot and the 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 utilised for routine dialogue (e.g. frequency transfer).

CPDLC consists in the exchange of messages, which can be formed by the use of individual (or combination) elements chosen within a set of internationally agreed preformatted ATC ones. These elements are in agreement with the existing ICAO phraseology, and serve to exchange nominal clearances, requests, reports, negotiations or miscellaneous ATCinformation (e.g. emergency notifications, transfer of ATC centre or frequency). Appendix A lists all the messages (around 180) that are supported by FANS A airborne and ground systems.

Advantages and drawbacks of CPDLC 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.

The following points however must be well understood and will have to be underlined in training:

- handling of CPDLC messages requires time:
  - reading and interpreting a written clearance was found to be less immediate than hearing the same one.
  - preparing and sending a request through the combination of the MCDU and DCDU is longer than directly using the mike.
- the party line is lost (the pilot can no longer listen to the surrounding transmissions)

2.6 AOC data link communications

Part of these new collaborative aspects emerging through the use of data link communications, AOC communications can now be used for negotiating F-PLN re-routes directly with the ATC and to uplink them to the aircraft FMS.

2.7 AIDC communications

The ATS Inter-facility Data Communications (AIDC) defines the data link between ATC centres. This link is used for notification, co-ordination and phases for transfer of control. AIDC functions will be progressively introduced as ATC centres along routes and air spaces are equipped with CNS/ATM systems.
This is not an aircraft issue.

2.8 Navigation

Refer to the RNP/RVSM document - A flight operations view - for description of the navigation chapter. RNP definition and objectives are detailed there together with the FANS A navigation capabilities of the Airbus Industrie aircraft.
The ATC centres define the RNP criteria to be fulfilled prior to the utilisation of their FANS routes. RNP 10 is the current requirement for oceanic FANS air spaces.

2.9 Automatic Dependent Surveillance (ADS)

Through the ADS application, the ATSU automatically sends aircraft surveillance data to the connected ATC centres (up to 4). This is done automatically and remains transparent to the crew. These are air-ground downlink messages. Different types of ADS "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 (e.g. altitude or heading change, vertical rate change, waypoint change)

In the FANS A system, the ADS is based on these contracts, which are set by the ATC centres to satisfy their operational needs for surveillance, as dictated by circumstances (e.g. traffic density). The crew cannot modify these contracts, but the controller can. And so can he specify the parameters of the contract. Optional data groups may thus be added in the contract request. Obviously, at anyone ATC centre, only one contract may exist at any one time, and whenever a modification is asked by the controller, a new contract is set, which cancels the previous one.
Another type of contract may be found: the emergency mode. When the crew activates this mode, the data are automatically sent at a high rate (every 2 minutes), independently of the previous contract.
Appendix B lists the various elements and groups of data of the ADS messages, and provides some details on the different contracts.

Based on these contracts, directly addressed between an ATC centre and a given aircraft, ADS is then usually called ADS-C (where C stands for Contract), or ADS-A (where A stands for Addressed). Both these designations are equivalent.
In a future step, the aircraft are expected to have the capability to broadcast their positions and intents not only to the ground, but also to other aircraft in their vicinity. Trials of this ADS-B (B stands for Broadcast) have already started. Associated with Cockpit Display of Traffic Information (CDTI), ADS-B is intended to be an enabler to free flight concepts.

2.10 Performance Requirements

2.10.1 General

The requirements for operation in a specified airspace may be defined in terms of each of the three "C", "N" and "S" aspects.
As such, the three concepts of Required Navigation Performance (RNP), Required Communications Performance (RCP) and Required Surveillance Performance (RSP) are all parts of a general CNS/ATM performance concept and are complementary.

They all address the functionality and performance of the system for their relevant aspect and may be defined in terms of availability, accuracy and integrity.
Each of these three performance requirements is independent of the technologies used to ensure either of the three Navigation, Communications or Surveillance functions.

2.10.2 RNP (Required Navigation Performance)

The RNP concept is fully described in the "RNP/RVSM" document - A flight operations view - document.

2.10.3 RCP (Required Communication performance)

The RCP concept defines the end to end communications performance which is required to operate in a specified airspace or under specified procedures of operation. It is determined by the relevant authorities for the considered area, taking account of various parameters such as targets level of safety, separation assurance criteria or functional hazard analysis. Human factors considerations are also taken into account to reflect the human performance to complete an exchange of communication by initiating a reply.
The RCP is independent of the technology used and is applicable to both voice and data communications.

It is now commonly agreed upon that the prime parameter in assessing the technical performance of the communications, is the delay experienced by the exchange of data between the end users (e.g. pilot / controller).
According to the latest work of the RTCA/EUROCAE groups, the following terms have been defined to characterise the RCP statement:

- Delay: is a measure of the time required for an information element to transit between two identifiable points.
- Integrity: is expressed as the probability of an undetected system-induced failure of message transmission (i.e. undetected message error, wrong address, lost message transmission).
- Availability: is the ratio of actual operating time to specified operating time.

When such a concept is endorsed by the relevant airworthiness authorities and is applicable to some CNS/ATM operations, it is intended that further details will be added in this chapter to help the airline in defining its operational context.

2.10.4 RSP (Required Surveillance Performance)

The RSP concept, at the time of this edition, is not mature enough to be described here. It is intended that further editions give here the expected level of information to help the airline in defining its operational criteria.

3. AIM-FANS DESCRIPTION

3.1 General: The need for flexibility

Air spaces greatly vary from one part of the world to another: some are already congested (e.g. Europe region at some peak hours) whereas others are still relatively empty (e.g. Pacific Ocean). The requirements to change the way we operate in such different areas are not the same.
Implementing the latest technologies, which are now available to support these awaited changes, cannot be done without the involvement of numerous parties. States, ATS providers, communications service providers are affected in the same way as airlines, airframers or avionics equipment manufacturers.
That is why the CNS-ATM concept can only be developed regionally or even on a route by route basis.

The Airbus Industrie forecast for future CNS-ATM implementation envisions three main phases:

- On a short term basis, FANS 1/A routings are being opened (e.g. Europe / Asia through the Bay of Bengal, Australia / South Africa in complement to the current operative Pacific area).

- On a mid term basis (2003- 2008), ICAO SARPS-compliant ATN development should allow FANS B to spread around the world, thus enabling a full-performance data link. Regions of low traffic density may plan to then leapfrog the FANS 1/A step and go directly to FANS B. The potential economic benefits however, lie mainly in the high traffic density areas for which FANS B is designed.

- On a long term basis (starting around 2008), a generalisation of FANS B is expected, since the search for the best economic benefits and the tremendous increase of traffic should then lead to a world-wide generalisation of this concept. Other operational concepts and technologies, such as ADS-B, are expected to come into service.

The two following figures summarise these three awaited steps:

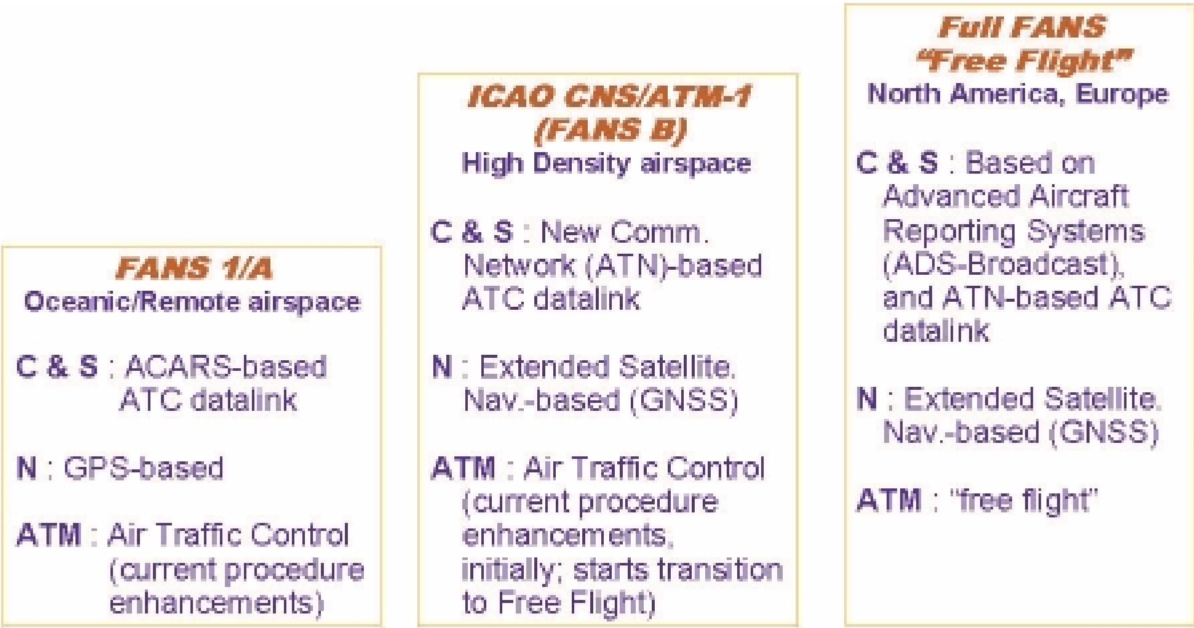


Figure 4

	pre-FANS from 1998	**FANS A** from 2000 **(A330/A340 only)**	**FANS B** from 2003
Navigation	FMS GPS optional	FMS GPS	FMS GNSS
Communication & Surveillance	ACARS networks ATSU for **AOC** only	ACARS networks ATSU for **ATC + AOC**	ATN network ATSU for **ATC + AOC** (ATC per ICAO definition)

Figure 5

It is considered that FANS 1/A, FANS B and non-FANS environments will co-exist for many years. The aircraft's ability to go seamlessly from one environment to another is a fundamental asset, which was one of the prime design objectives of the Airbus Industrie architecture.
Further extensions to FANS B, such as free flight concepts (as described either in the NAS - US National Air Space - program or mentioned in the EATMS - European Air Traffic Management System - operational concept for instance), are also already considered: the provisional capacity for data broadcast operations (e.g. ADS-B) have been secured in the proposed system (mode S extended squitter, VDL mode 4)
Longer term philosophy aiming at defining whether or not and to which extent, the crew will be responsible for their own separation is beyond the scope of the aircraft manufacturers alone.

As a conclusion to this brief overview of the implications of CNS-ATM we can say that the transition to this new way of operating requires both flexibility and growth capability. For the airplane, flexibility is the essential requirement:

- Flexibility to grow as the CNS-ATM concept evolves
- Flexibility to adapt to inevitable unforeseen developments of the environment
- Flexibility to operate in mixed ATC environments

But flexibility requires computer power. This was tackled right from the beginning with the AIM-FANS (Airbus Interoperable Modular -FANS) avionics package: indeed, the power and flexibility of a dedicated communications unit (the ATSU) combined with the power of a new FMS.

3.2 AIM-FANS architecture

The Airbus objectives in defining its system are:

- To adapt the aircraft to the various CNS-ATM environments
- To cope with a moving FANS world
- To minimise the burden of the airlines in their moving to CNS-ATM
- To introduce a user-friendly Human Machine Interface for the data link
- To ensure the Airbus family concept

The following figure shows the architecture used.

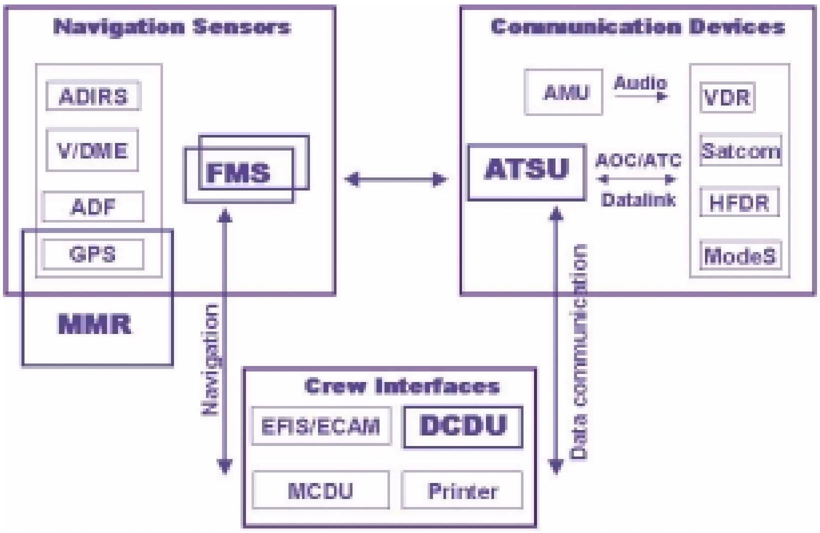


Figure 6

3.2.1 The ATSU

This new avionics unit (Air Traffic Services Unit) has been developed to cope with data link 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 (current and future). The selection of the media is made automatically and without any pilot action.
- To sustain the communications tasks (e.g. selection of the appropriate ATC centre for data link all along the flight).

Part of this, is the management of all the messages (up/down link) whatever their types (ATC clearance, ADS, pilot 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 FANS A and B, only one ATSU is used. But for later steps, two ATSUs can be installed, dealing with all the expected evolutions, as aircraft operation and safety become more dependent on data link communications.

Furthermore, to answer the airlines' expectations, Airbus Industrie have committed to be responsible for the responsiveness and quality of their entire FANS system. Just like the Flight Warning System for example, the ATSU becomes an essential equipment for the flight safety, and thus must be controlled accordingly throughout its design realisation and implementation on board.

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 data link capability during the transition to the ultimate full FANS.

The following figure depicts the modularity concept of the ATSU.

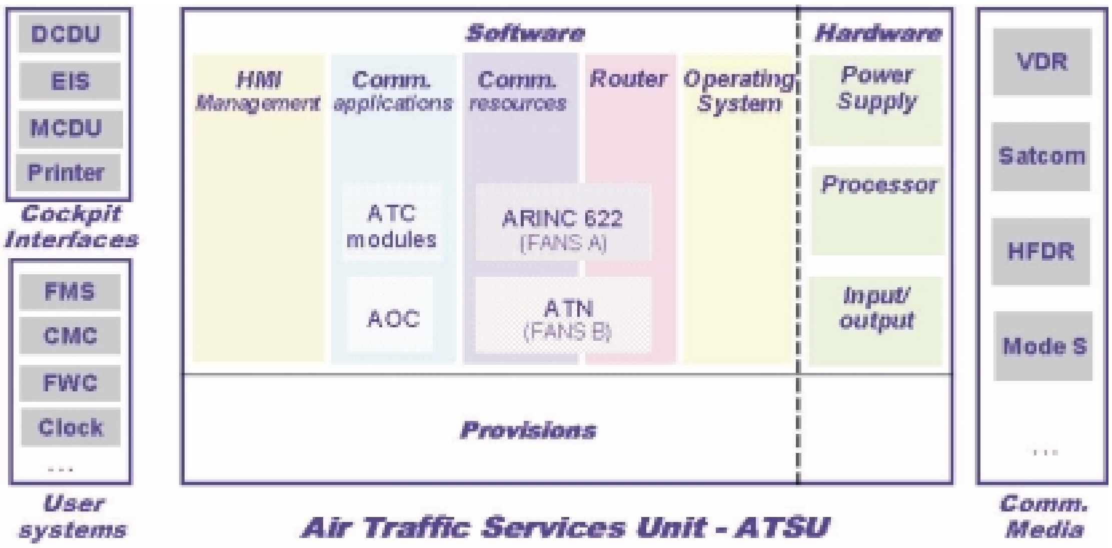


Figure 7

3.2.2 The new FMS (2nd generation FMS)

An overall description of the new FMS functions can be found in the FCOM volume 4 (FMGS Pilot's guide). The following chapter describes the role of the FMS within the FANS A operations.

The FMS is a key element of the AIM-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 and CPDLC messages. As such, it periodically sends all the ADS 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 20 waypoints of the flight plan are thus sent by the FMS to the ADS application of the ATSU.

Position reports messages whether for manual CPDLC messages or for automatic ADS 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”). It triggers the signal to warn the pilot of the completion of the clearance.
Whenever confirmation messages are received (e.g. “CONFIRM ASSIGNED SPEED”) it automatically proposes the answer to the pilot. 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 pilots so that they can solve the issue. Co-ordination and exchange of F-PLN between ATC, AOC and the aircraft is processed with the FMS.

3.2.3 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 data link 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 chapter.

In addition to the DCDU, the MCDU is mainly used to prepare a request.
Any ATC message can also be printed on the printer, at any time.

3.3 Human Machine Interface

The following figures give a general view of the cockpit with the main elements of the interface.
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 pilots from various origins such as flight test, training instructors and airline pilots, were involved in the definition of this interface. The whole Human Factors plan, as defined and presented to the airworthiness authorities, was also applied.

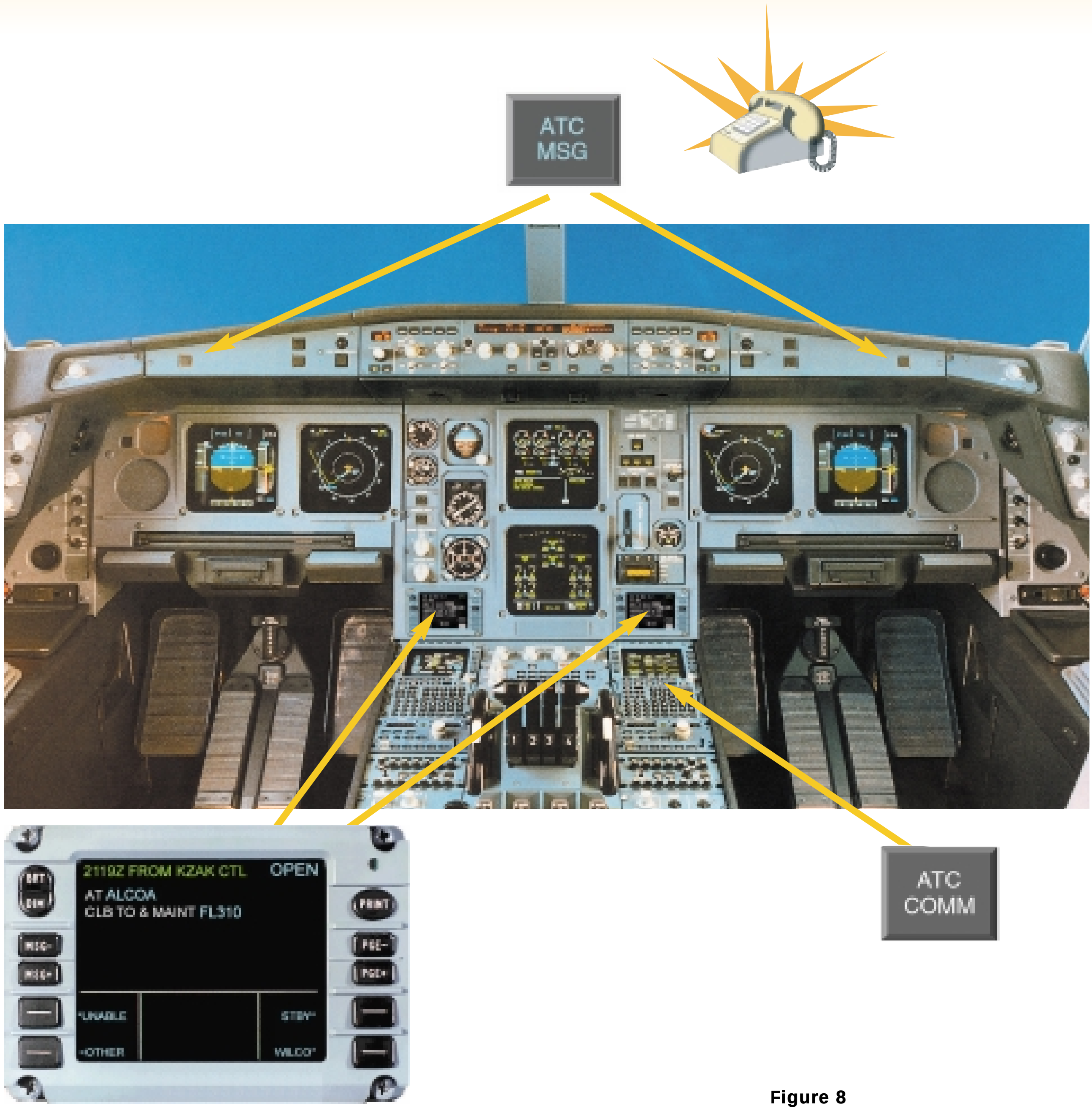


Figure 8

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

Colour coding and/or reverse video on the DCDU have been used to differentiate between titles, text, main parameters in the text, uplink or downlink messages.

The DCDU provides for full time accessibility and readability for both crew, which requires only limited head-down time.

3.3.1 Basic operational principles

The flightcrew is alerted to an incoming message by means of a flashing blue «ATC MSG» light in two pushbuttons on the glareshield (i.e. visual), as well as by 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 the buttons flash, and the audio signal is repeated about every 15 seconds (with the first signal delayed by 15 seconds, so as not to multiply audio warnings). 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 the buttons flash, the audio signal is repeated about every 5 seconds, and the message is displayed on the DCDU regardless of the state of the screen.

Note: The audio sound is similar to a telephone sound. It was elected by a great majority of the consulted pilots.

To reply to a message, the flightcrew either uses the standard replies 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.

3.3.2 Main HMI rules

The following lists the main principles retained for the HMI:

a) DCDU

- The two DCDUs are the compulsory data link communications focal point for either type of messages (up or down link).

- It is recommended to keep both DCDUs without anything displayed. This, to allow for an immediate display of a new message. Consequently, it will be recommended to clean up the screens whenever a message has been completely treated and does no longer require to be displayed.

- Both DCDUs are identical, are interconnected and have the same displays. Any operation on either DCDU is valid for both of them.

b) MCDU

- The MCDUs are also part of the ATS data link system. They are used to prepare the request type of messages or free text messages. They also provide for an access to the file of the stored messages.

- The “ATC COMM” key of the MCDU gives access to the various pages of the ATS data link system

c) **Alert**

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

- Both the “ATC MSG” pushbuttons on the glareshield are lighted and flash until a positive action of the crew (either by pressing one of the pushbuttons or by answering the uplinked message on the DCDU) is done to stop the alert.

- The specific ATC audio sound may also be activated (15 sec delay)

d) **Messages**

- As soon as the alert is triggered, the associated ATC message may be accessed and viewed on both DCDUs. It is automatically displayed (whether the screens of the DCDUs are free or not) if it is an “urgent” or “distress” message.

- Request messages can be brought to the DCDU as soon as the crew has activated the corresponding command (“ATC REQ DISPL”).

- Pending messages can be brought (one at a time) to the DCDU by the crew who can review them in the order they want.

- The crew can (and is recommended to do so) clean up the DCDU through a specific function key (“CLOSE”) once the displayed message has been entirely treated.

e) **Printer**

- A print function is available on the DCDU to print the currently displayed message in whole. This can be done at any time.

- It is recommended to print long messages (e.g. F-PLN clearance) or reports.

f) **FMS/DCDU interface**

- An ATC F-PLN can be loaded in the secondary F-PLN of the FMS. This is done through the “LOAD” key of the DCDU. The crew is kept aware of the result of this loading by an indication located on the DCDU (e.g. ”LOAD OK”, or “LOAD PARTIAL”). Whenever this loading cannot be done entirely (for instance waypoint not in data base, runway/ILS mismatch,..) the pilots can access the MCDU secondary F-PLN pages to assess the reasons for the rejected parameters, and take appropriate actions.

- ATC messages requiring navigation parameters (e.g. “Confirm speed”) are processed by the FMS. An answering message is automatically proposed on the DCDU with the FMS value. The crew can nevertheless modify this message before being sent.

- A monitoring process is launched by the FMS whenever “Report” messages are received (e.g. “Report Passing...”). The message is automatically recalled and the answer is proposed on the DCDU, once it is time to report.

- A monitoring process is launched by the FMS whenever deferred or conditional clearances (e.g. “AT ALCOA CLB TO FL350”) are received. 30 seconds before it expires, the message is triggered again to remind the crew of this clearance.

g) ADS

- ADS reports are automatically sent to the ground without any possibility for the crew to either see or modify them.

- A CPDLC emergency message (e.g. “MAY DAY”) automatically activates the ADS emergency mode.

h) Colour coding

The following colour coding philosophy 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

- Normal video is used for uplink

- Reverse video is used for downlink

- Closed actions are always in green

3.3.3 Examples of use

The following figures give two typical examples of use for up and downlink messages.

Clearance case: “Reduce speed to M 0.81 or less”

Figure 9

Pilot selects WILCO

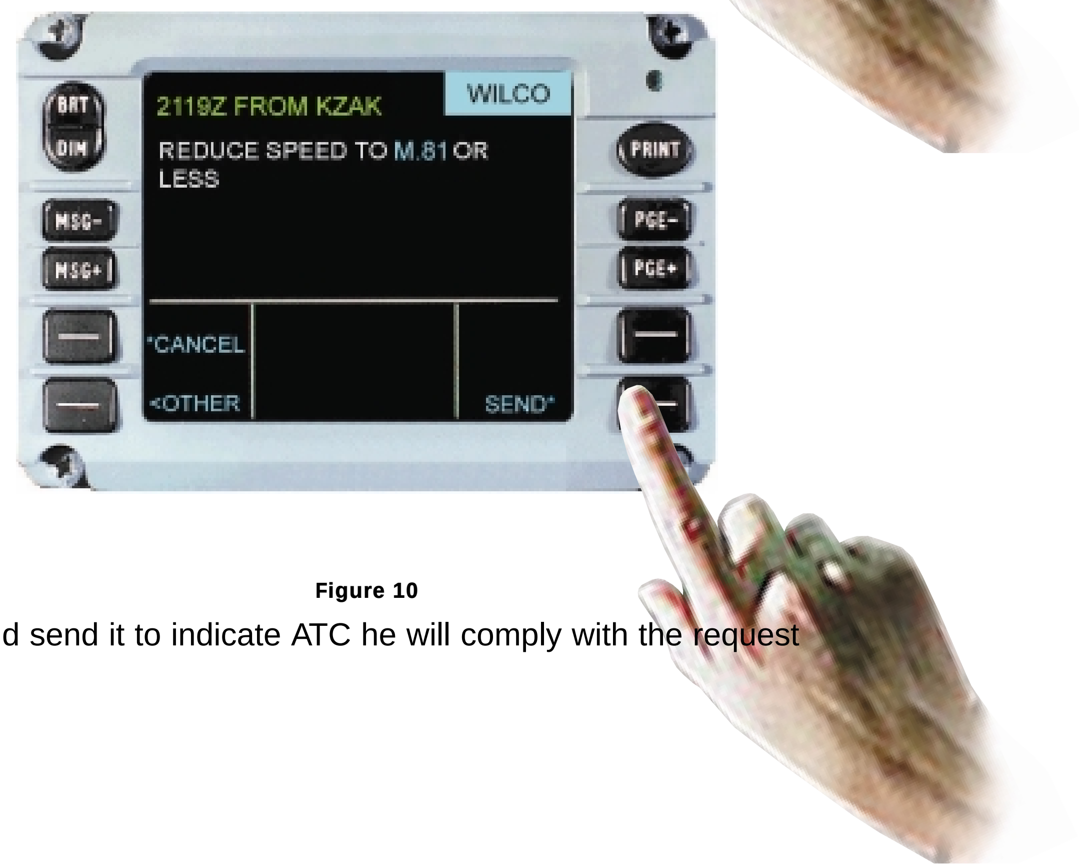


Figure 10

…and send it to indicate ATC he will comply with the request

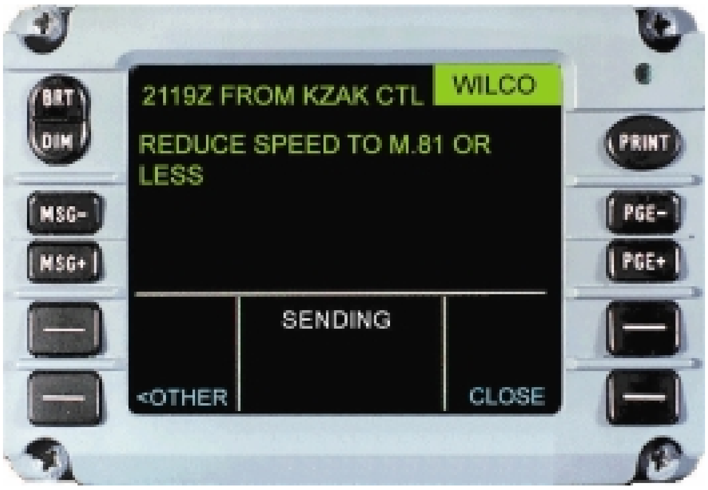


Figure 11

…message is being sent

Figure 12

- Message has been sent (acknowledge received from service provider)
- Pilot clears the screen

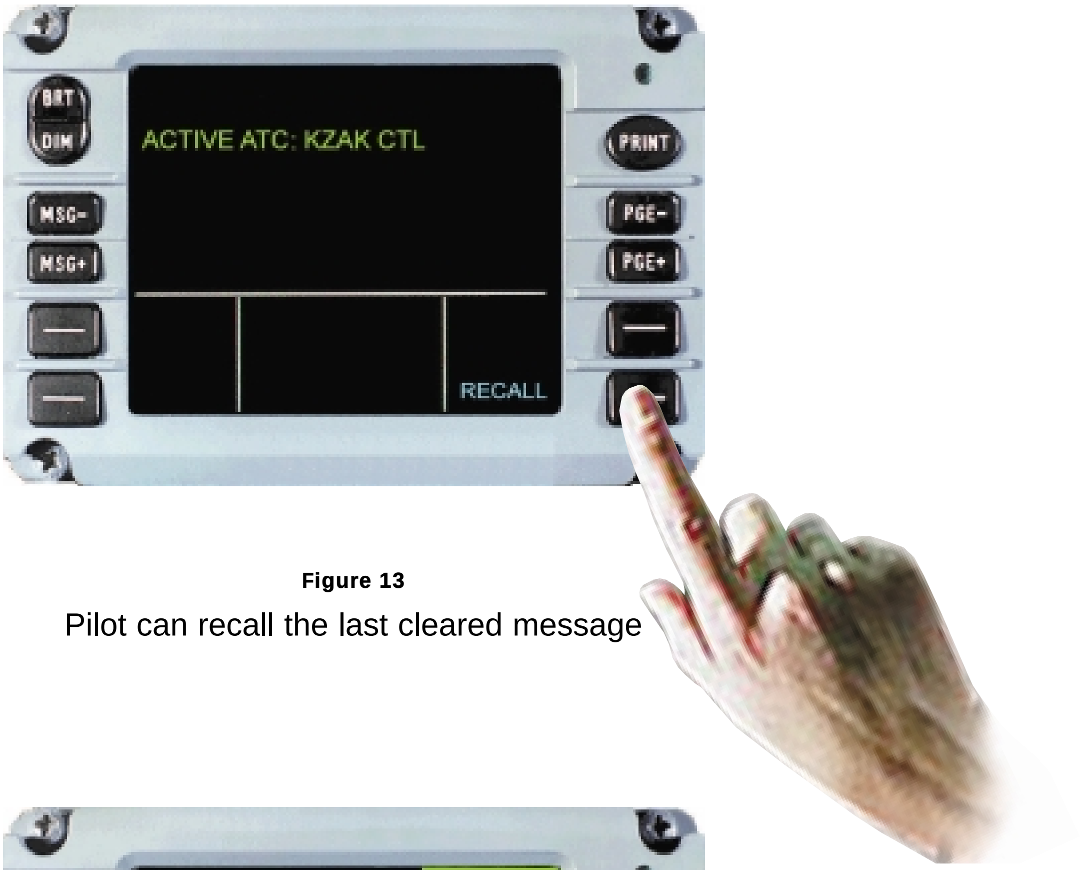


Figure 13

Pilot can recall the last cleared message

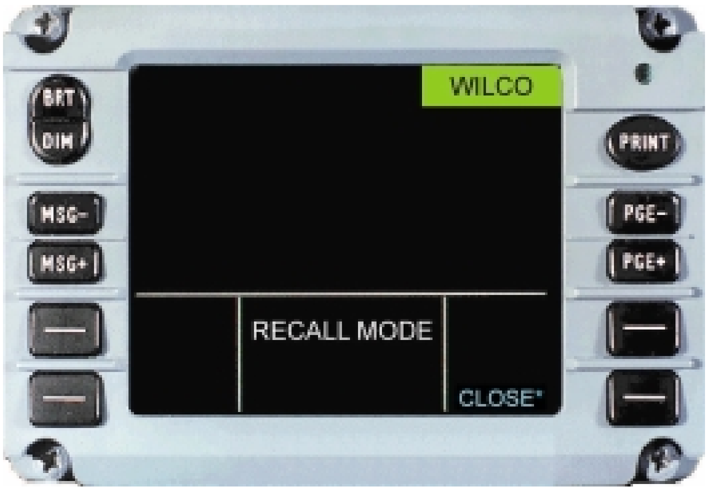


Figure 14

Last cleared message appears

b) Request case: Pilot requests climb at a given FL at a given waypoint (FL310 at ALCOA)

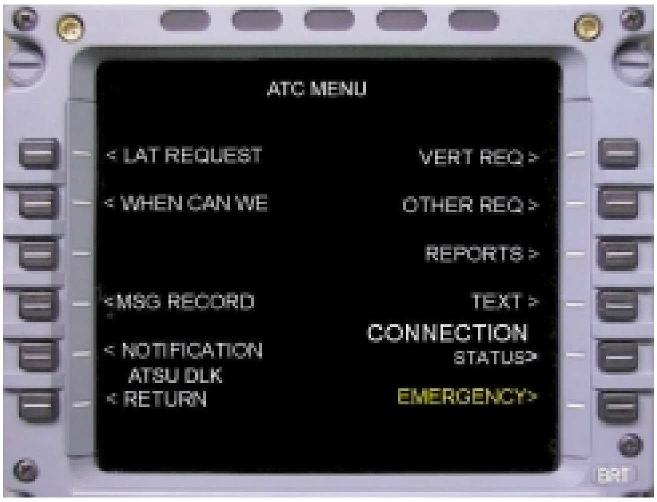


Figure 15

Pilot selects VERT REQ to access the ATC VERT REQ page of the MCDU

Figure 16

He prepares the request message

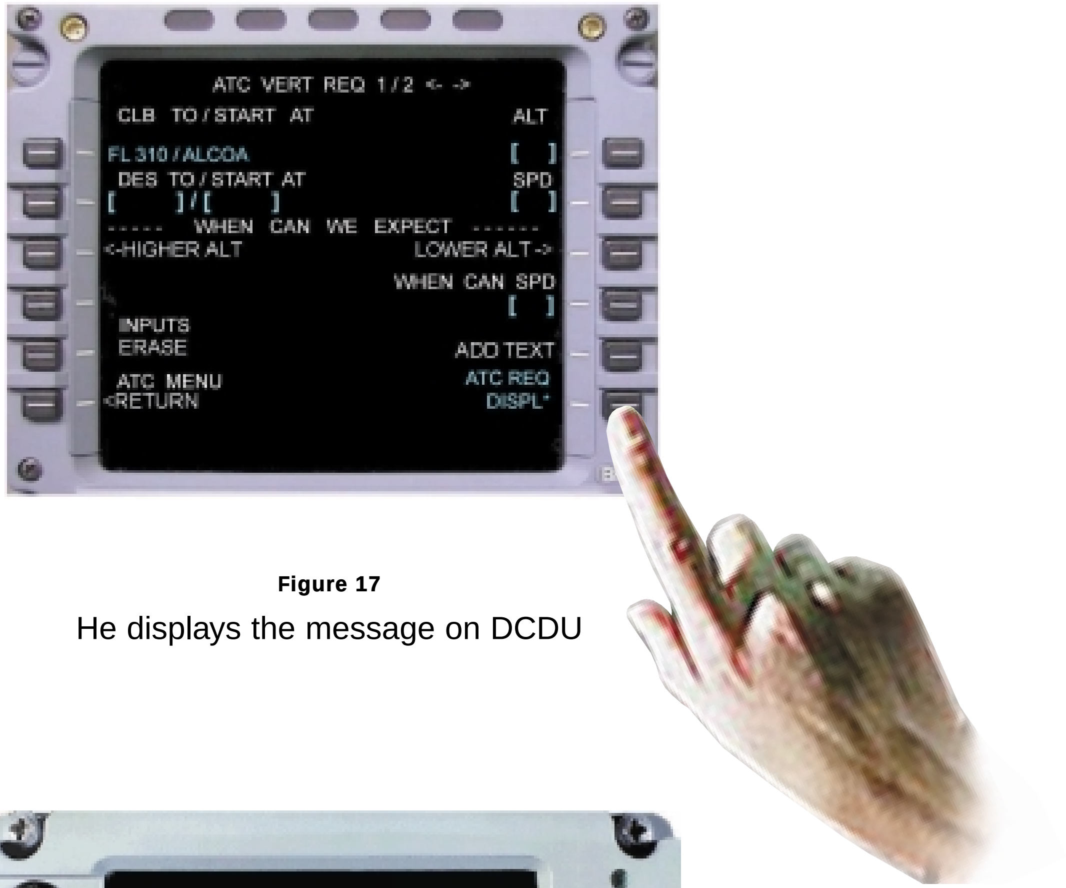


Figure 17

He displays the message on DCDU

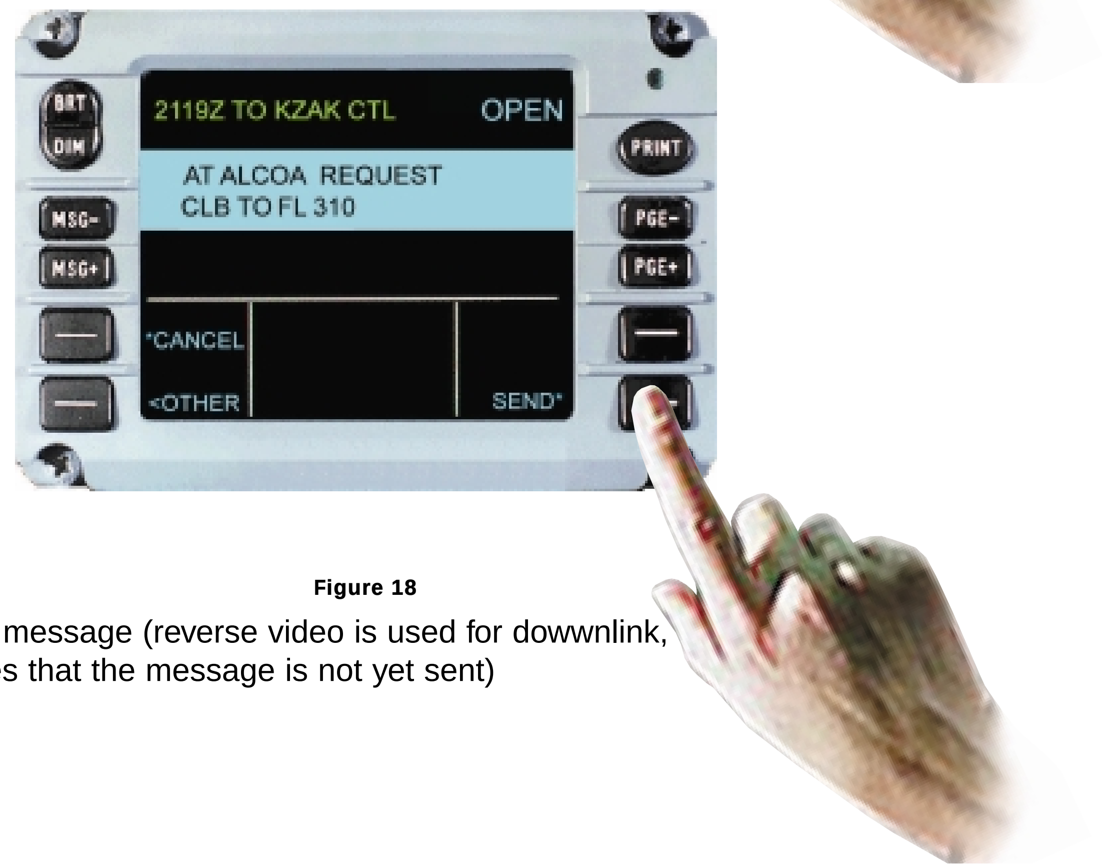


Figure 18

The pilot reads the message (reverse video is used for dowwnlink, blue colour indicates that the message is not yet sent)

Figure 19

Green colour indicates that the message is sent

4. OPERATIONAL PROCEDURES

4.1 Introduction

The following chapter depicts some important and general procedures for an operational use of CNS/ATM systems.
As already explained FANS routes are, and will be, regionally opened, based on the availability of ground equipment and technologies. As such, operational procedures will reflect the specifics of the considered areas, which may cause operating differences between various regions.

FANS 1/A operations have been experienced in the South Pacific region for 1995, and CPDLC has been used on a daily basis since then.
The ICAO Informal South Pacific ATC Co-ordinating Group (ISPACG) has been tasked to co-ordinate these regional trials and to define and implement procedures to allow for a safe and efficient operations of new ATS applications for FANS equipped aircraft.
Under the ISPACG authority, the South Pacific Operating Manual (SPOM) was written to define procedures and rules to be used by the airlines, their crews, the ATC and their controllers.

Following more than 4 years of leadership and unique experience in an operational environment, most of the SPOM procedures have been recognised as a basis for further CNS/ATM implementations.
The here-below recommendations are based on this document.

4.2 Pre-flight phase

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

• *ICAO F-PLN filing*:

The CNS/ATM capabilities of the aircraft will be notified when filing in the ICAO flight plan.
A letter code has been defined for this information.
The data link capability is notified by a letter "J" to be entered in the field 10 (Equipment).
The letter "D" is also entered in the surveillance part of that field, if ADS is available. The other capabilities are given in the field 18 (Other Information) under the DAT/ information.

10 - EQUIPMENT

J	**/**	**D**

18 - OTHER INFORMATION

DAT / S V

In this example, the data link is ensured by both Satellite and VHF, and ADS is available. The following code is used:

- **S**...........Satellite data link
- **H**...........HF data link
- **V**...........VHF data link
- **M**...........SSR Mode S data link

If RNP is expected, field 18 will also mention: NAV/RNP. (Refer to RNP/RVSM - A flight operations view - document)
The **aircraft registration** is also to be notified in the Field 18. This will be used for correlation purposes by the ATC through a comparison of it with the one contained in the AFN logon (see here-after).

• *Pre-flight checks*

Prior to departing for a FANS flight, the crew will check that the required equipment is operative. The following items are recommended to be included in those checks:

- GPS availability
- UTC time settings
- RNP capability
- Data link communications availability

If the data link is to be used a short time after the departure, the ATS Facilities Notification (AFN) function (described here after) will have to be completed prior to take off. As a general rule, it is worth noting that the AFN logon should be completed 30 to 45 minutes before entering the CPDLC/ADS air space.

4.3 AFN (ATS Facilities Notification) LOGON

• *Why such a function?*

The aim of the ATS Facilities Notification is to tell (notify) an ATC centre that your aircraft is able to sustain digital communications and that you are ready to connect. It is thus twofold:

- To inform the appropriate ATC centre of the capabilities and specifics of the aircraft data link communications (e.g. CPDLC and/or ADS available applications, ACARS address)
- To give the ATC centre the flight identification and aircraft registration number to allow for a correlation with the filed flight plan.

The AFN must be successfully completed prior to any connection is being established.

• *First AFN logon*

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

To this end, the pilot sends a first AFN CONTACT message (FN_CON). This is done through the NOTIFICATION page of the ATC pages on the MCDU, when the crew enters the ICAO 4 letter code of the ATC centre and the automatic exchange of messages between the ground and the aircraft is correctly done. The ATC centre replies to the FN_CON by an AFN ACKNOWLEDGE (FN_ACK).
This can be monitored on the NOTIFICATION pages where the sequence “NOTIFYING”, “NOTIFIED” is displayed. (See here below pictures)
This AFN procedure is more or less transparent to the crew, but must be understood.

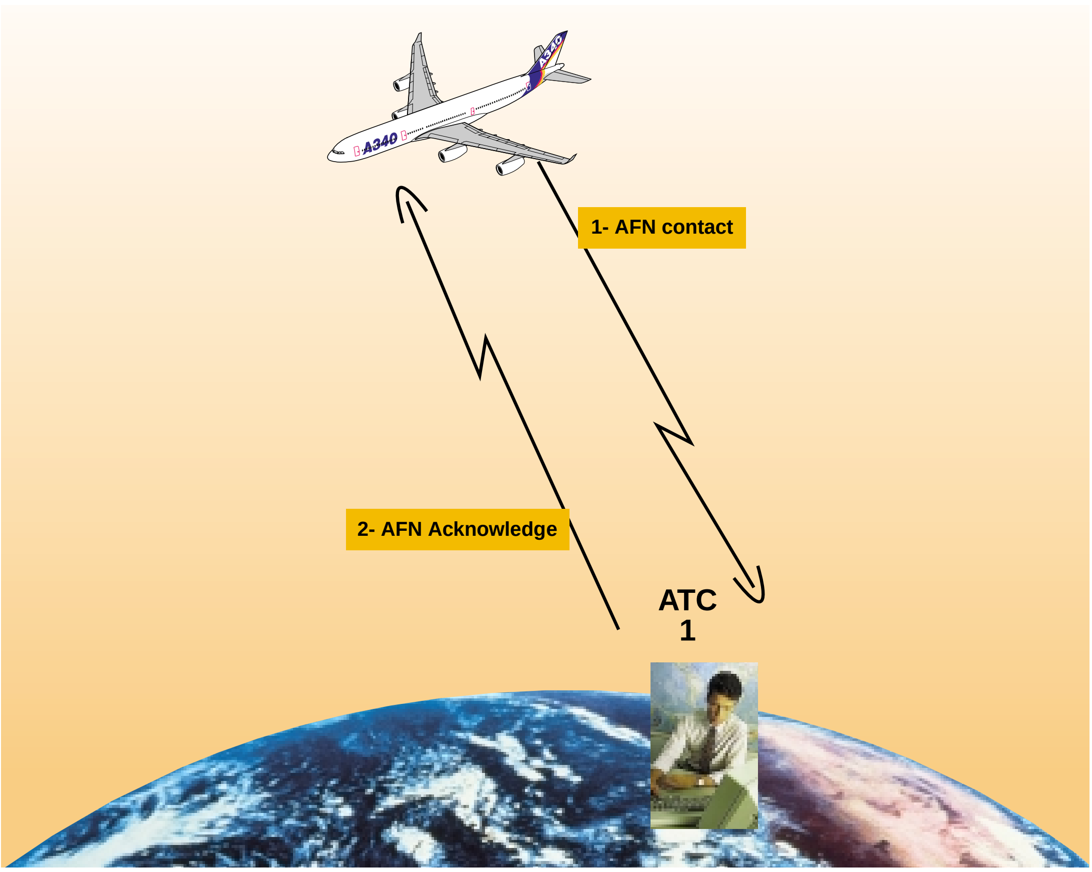


Figure 20

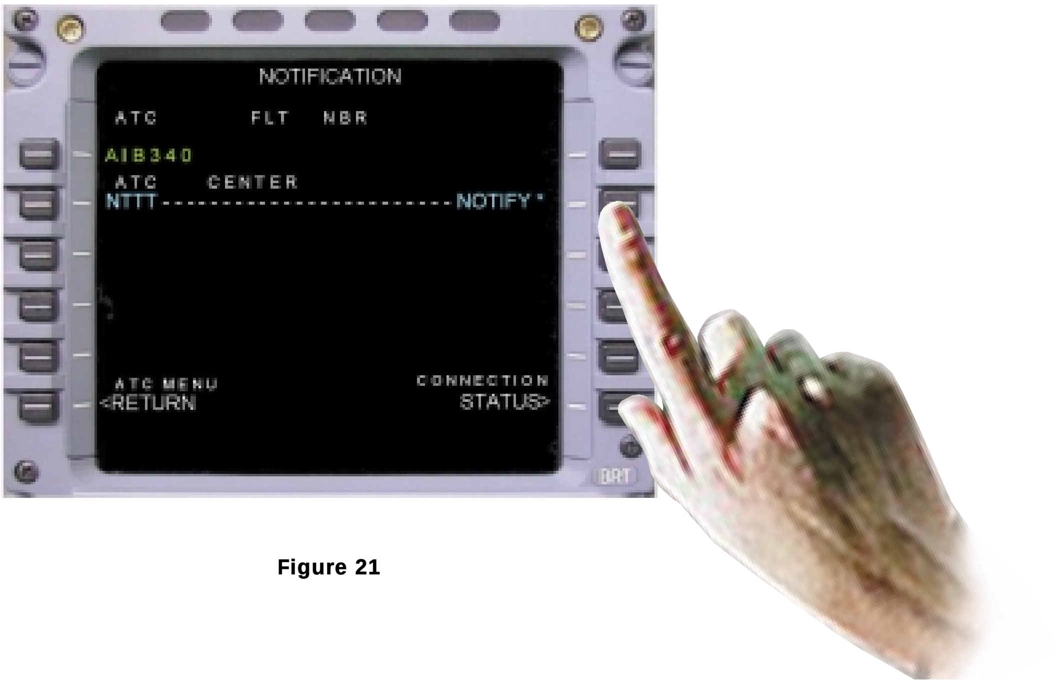


Figure 21

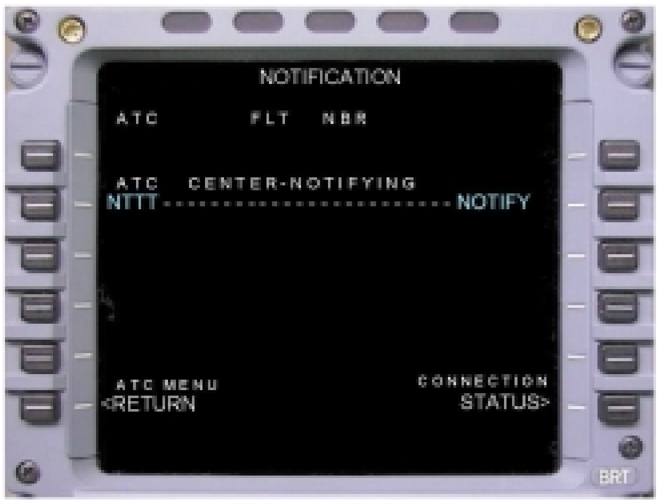


Figure 22

Figure 23

4.4 CPDLC COMMUNICATIONS

4.4.1 CPDLC connection

Once the AFN has been successfully done, the ATC centre can initiate a CPDLC connection.
Here also, an exchange of two messages (CONNECTION REQUEST and CONNECTION CONFIRM) occurs between the ground and the aircraft to initiate the connection. But this is transparent to the crew.

Checks are automatically done by the ATSU to validate or reject the connection:

- Connection is accepted if no previous connection already exists
- Connection is accepted if it is relative to the next data link ATC to control the aircraft
- Connection is rejected in all other cases

Once connection is established and active, the active connected ATC centre is then displayed on the DCDU, and on the CONNECTION STATUS page of the MCDU. CPDLC exchange of messages can be done normally.

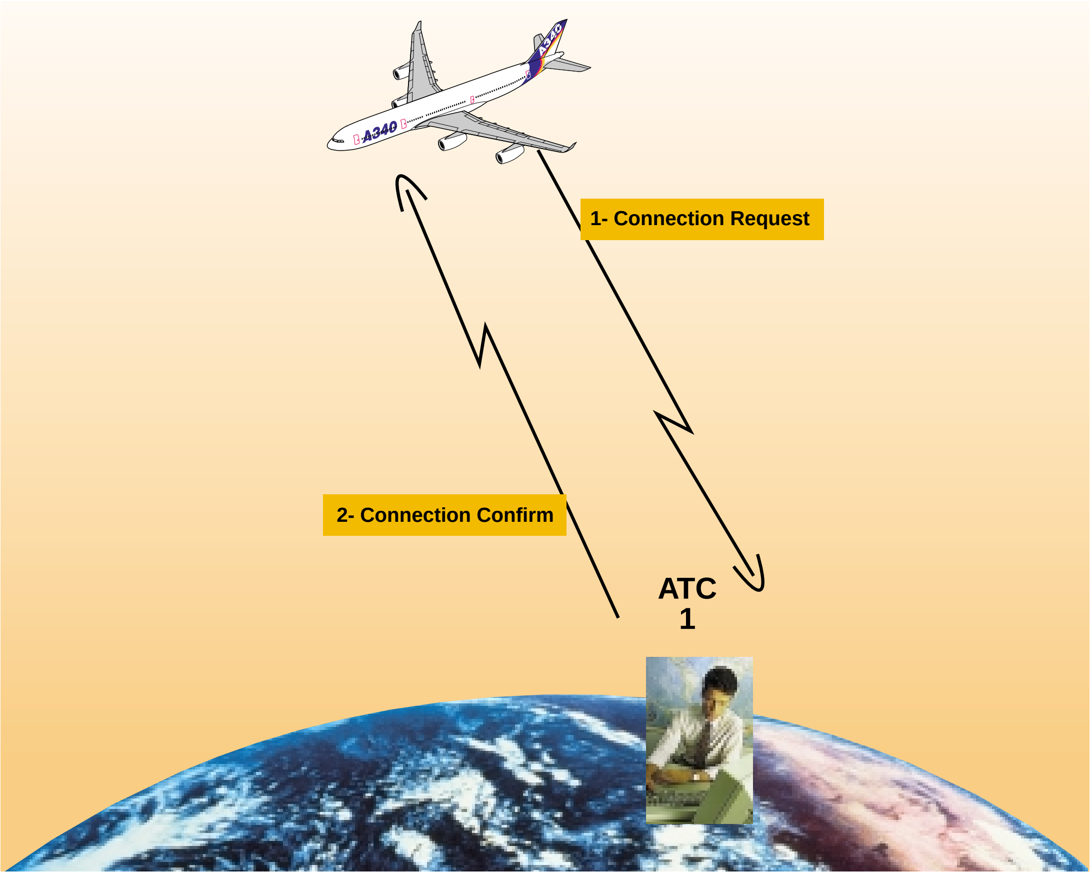


Figure 24

Figure 25

4.4.2 Failures of the CPDLC connection

As soon as a failure of the CPDLC connection is noticed by either of the flight crew member or ground controller, voice will be used to inform the other part of the failure and to co-ordinate further actions.

Once a connection has been lost, a complete LOGON procedure (AFN + Connection) must re-apply.

The following procedures are recommended:

Failure detected by the controller

- The controller, through a voice system, tells the crew to switch off his data link system, and to reinitialise it.
- The crew access to the MCDU ATC pages and re-initialises the connection through the complete AFN from the NOTIFICATION pages.

Failure detected by the aircraft

- The pilot, through voice, notifies the controller of the problem.
- He restarts the CPDLC connection through the complete AFN from the NOTIFICATION pages

4.4.3 CPDLC shutdown

The following procedures should be followed whenever a shutdown occurs:

Planned shutdown:

- It should be notified through NOTAM
- Voice is to be used

Unplanned shutdown, notified by the ground:

- The controller, through voice, informs the crews of the shutdown using the following phraseology: “CPDLC shutdown. Select ATC Com Off. Continue on voice”
- The pilot acknowledges: ”Select ATC com off. Continue on voice”
- The pilot continues on voice until further ATC notification.

Unplanned shutdown, notified by the crew:

- The crew notifies the controller of the shutdown through the voice phraseology: ”CPDLC shutdown. Select ATC com off. Continue on voice”
- The controller acknowledges: “ Roger. Continue on voice”.

In all the three above cases, ATC / AOC co-ordination is recommended.

CPDLC Resumption

Once CPDLC can be resumed, the following voice phraseology applies:

- The controller, through voice, announces: ”CPDLC operational. Logon to (ATC XXXX)
- The pilot answers: “Logon to XXXX”

4.4.4 Notification of Transfer to the next data link ATC

The two following paragraphs are described for a thorough explanation of the retained mechanisation. They can be left aside in a first reading.
The active data link ATC is usually called the **Data Authority**.
The next data link ATC is usually called the **Next Data Authority** (NDA).

Nominal case

To inform the aircraft avionics (i.e. ATSU box) that a transfer of control will be done, the current active ATC sends a so-called NDA message to the aircraft. This is the only way for the ATSU to be aware of and to accept the connection with the next ATC centre.
Once a NDA message has been received, the aircraft is waiting for the connection with the next ATC centre.

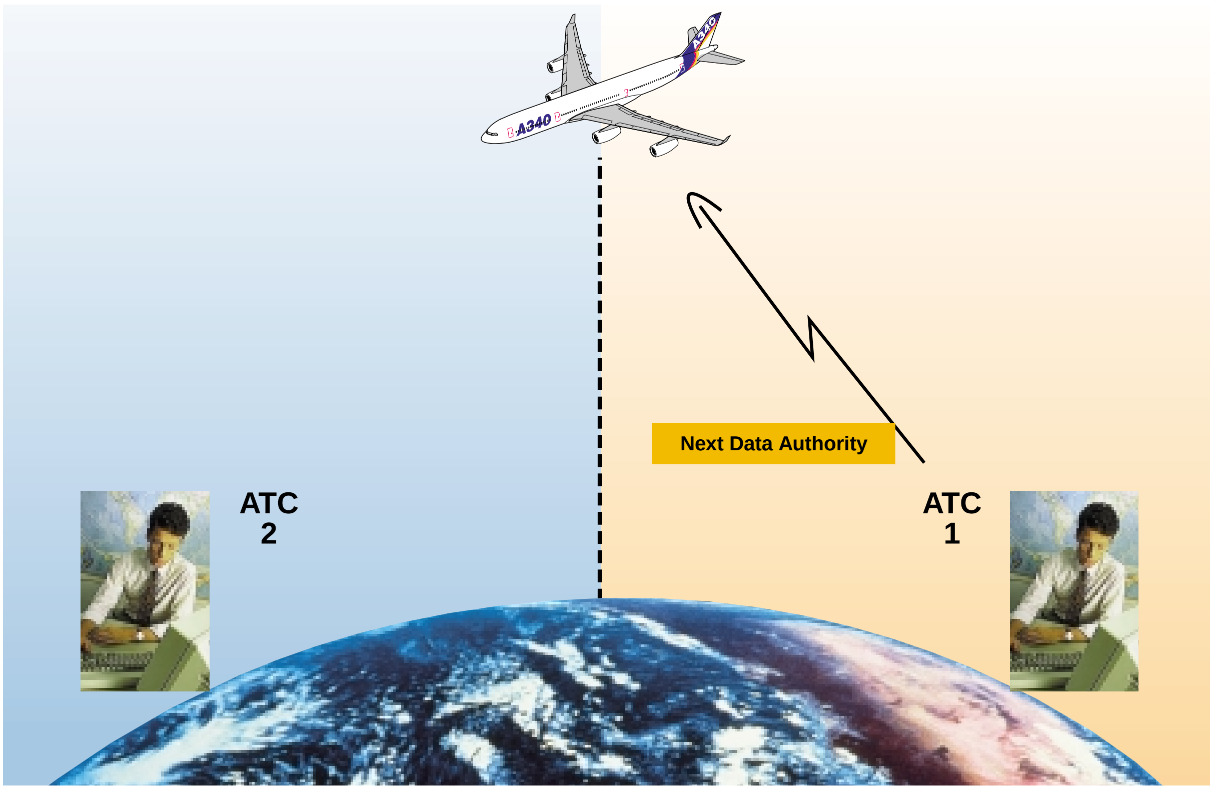


Figure 26

Abnormal cases

If the NDA message has not been received by the aircraft at the time when the next ATC centre tries to connect, this connection attempt is rejected. This is transparent to the crew.

Whenever the controller of the transferring ATC knows the NDA message has not been delivered, he will ask the crew for a manual AFN logon with the next centre. Either voice or CPDLC can be used for this. The following phraseology is recommended:

- Controller: " Contact (ATCXXXX). Frequency YYYYY. Select ATC com off then logon to ATCXXXX"
- Pilot: "WILCO. Select ATC com off, then logon to ATCXXXX".

If CPDLC is used, the sentence (Select ATC com off. Logon to ATCXXXX) will be sent through free text.

4.4.5 ATC Automatic transfer through address forwarding

Transfer from one data authority to the next one is usually done automatically and **remains totally transparent to the crew.**_
The following explanations are nevertheless given for a better understanding of the failure cases and their associated procedures.
The aim of the address forwarding is to forward the address of the next ATC to the aircraft avionics.

Automated procedures for an automatic transfer

The following sequence of message exchange should be initiated by the first ATC around 30 minutes prior to the estimated time at the FIR boundary. The crew is unaware of this exchange.

- The first ATC sends an AFN Contact Advisory message to the a/c
- The aircraft acknowledges this message and sends an AFN contact message to the next ATC
- This second ATC acknowledges the demand through an FN_ ACK message
- The aircraft sends an AFN Complete (FN_COMP) message to the first ATC, to inform it of the completion of the AFN

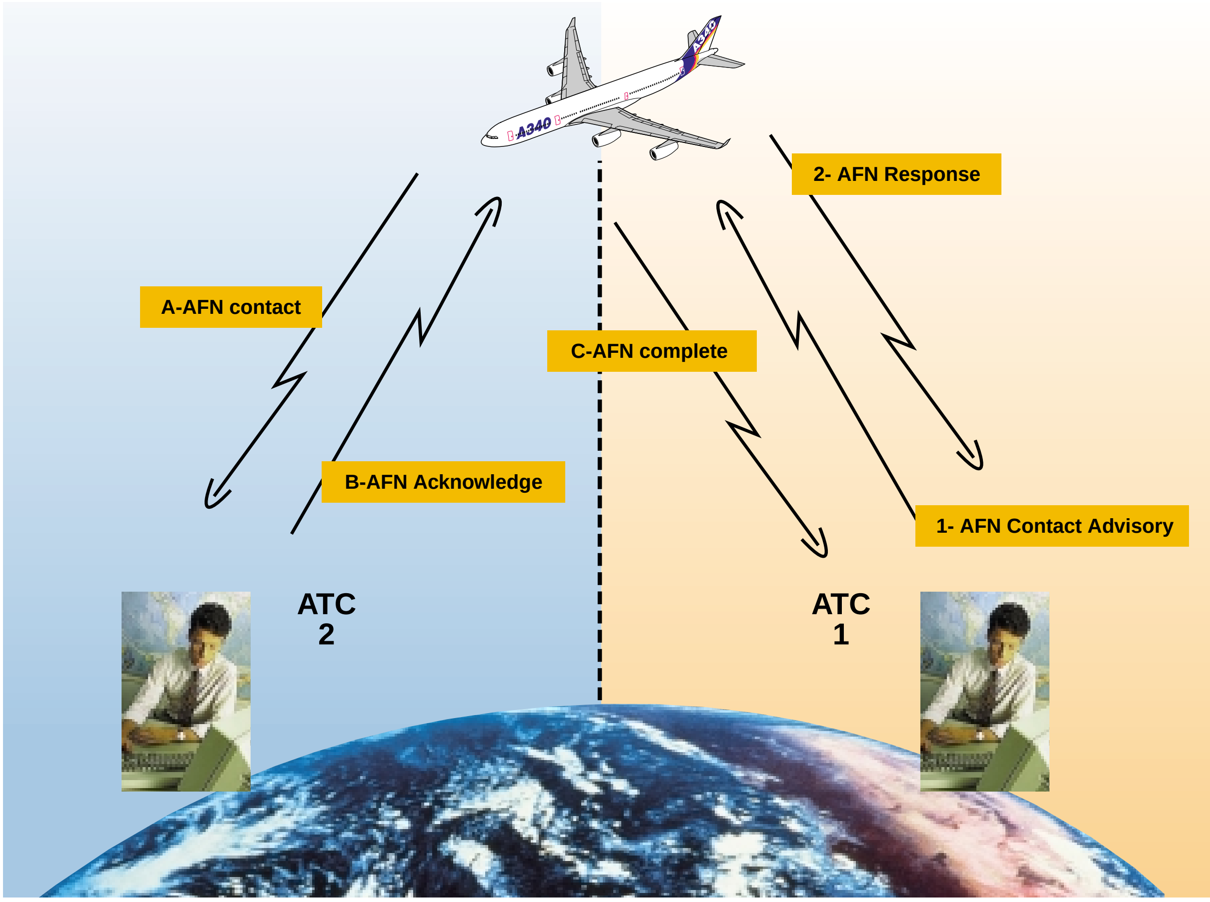


Figure 27

Abnormal cases

Whenever the previous exchanges are not successful, a manual connection is to be done. The controller of the first ATC will ask the crew to manually send an AFN logon to the next ATC.
The following phraseology is recommended:

- Controller: " Contact (ATCXXXX). Frequency YYYYY. Select ATC com off then logon to ATCXXXX"
- Pilot: "WILCO. Select ATC com off, then logon to ATCXXXX".

If CPDLC is used, the sentence (Select ATC com off. Logon to ATCXXXX) will be sent through free text.

4.4.6 End of service and CPDLC transfer of connection

A CPDLC connection with one ATC centre is usually terminated once this centre has sent an "END SERVICE" message to the aircraft. This message is sent once all the preparatory messages for the automatic transfer (as described in the two previous §) have been exchanged. It is sent just prior to the FIR boundary.

Upon receipt of this message the ATSU:
- Sends down a “DISCONNECT” message and physically disconnects from the first ATC centre
- Activates the pending connection to the next ATC centre.

If the next ATC centre has not been connected to the aircraft at the time the “END SERVICE” message is received, the aircraft is left without any connection.

One trap should be known and avoided:

- If a message has been left open (not answered) with the first ATC centre at the time the “END SERVICE” is sent, then a disconnection with **both** ATCs will occur.

4.4.7 Abnormal cases at the time of transfer of connection

Non delivery of the END SERVICE

Whenever the controller is aware that the “END SERVICE” message has not been successful, he will tell (by voice) the crew to manually disconnect.
Voice will be used until the connection with the next ATC has been done.
The recommended voice phraseology is:
- Controller: “Select ATC Com Off then logon to ATCXXXX”
- Pilot: “Select ATC Com Off then logon to ATCXXXX”

Automatic connection transfer not successful

Before crossing the boundary of the second data link ATC centre, the crew should have checked that the connection is well established with this ATC.
Whenever the crew is aware that the connection with the first ATC centre is not terminated (e.g. at the time when a first position report to the next ATC) he should follow the recommended procedure:

- Advise the first ATC of the situation by voice
- Manual disconnect from the current ATC
- Logon to the next ATC
- Send a CPDLC position report at the FIR boundary to the second ATC

4.4.8 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 for recommendations directly based on the lessons learned in the South Pacific operations.

A list of all the up and down link messages supported by the CPDLC system is given in appendix A.

a) To be known

Pending for the ATN, as long as the FANS 1/A ACARS based protocols exist, both pilot and controllers cannot know whether a message has been delivered to their right counterpart.

However, the following is worth noting:

- Whenever the controller sends a message to an aircraft, a message assurance is triggered to indicate the controller that his message has reached the right aircraft (but this does not mean the message has been displayed and read by the pilot
- Whenever the crew sends a message to a controller, the "SENDING" then "SENT" indications displayed on the DCDU, indicates that the message has been delivered to the network. This does not mean the message has been displayed and read by the relevant controller.

Should any doubt or problem occur when dialoguing through CPDLC, voice should be resumed.

b) Use and context of messages

• *Usual answers*

Most of the clearances can be directly answered through appropriate answer keys on the DCDU. 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 the crew is fully aware of the right meaning and implications of these answers. The following lists the recognised statements for these response elements:

- **WILCO**: This down link message tells the controller that the pilot will comply fully with the clearance/instruction contained in the associated up link message

- **UNABLE**: Through this either up or down link message the pilot or the controller is informed that the request(s) contained in the associated message cannot be complied with

- **STANDBY**: Through this either up or down link message the pilot or the controller is informed that the request is being assessed and there will be a short term delay (within 10 minutes). The exchange is not closed and the request will be answered when conditions allow.

- **ROGER**: Through this either up or down link message the pilot or the controller is informed that the content of the associated message has been received and understood. **ROGER is the only correct response to any up link free text message.** ROGER shall not be used instead of AFFIRM.

- **AFFIRM**: Whether up or down link, AFFIRM means YES and is an appropriate response to up linked message of negotiation request (e.g. “CAN YOU ACCEPT FL 350 AT ALCOA?”).

- **NEGATIVE**: Whether up or down link, NEGATIVE means NO and is an appropriate response to up linked message of negotiation request (e.g. “CAN YOU ACCEPT FL 350 AT ALCOA?”).

• *Meaning of other messages*

- **DISREGARD**: This up link message means that the previous up link shall be ignored. DISREGARD should not refer to an instruction or clearance. Another element shall be added to clarify which message is to be disregarded.

- **CONFIRM**: The **present** parameter (e.g. position, altitude, speed…) is awaited by the controller whenever CONFIRM XXXX is used. The DCDU will automatically propose to the crew the current FMS target linked to the considered parameter. Sending this answer is done directly on the DCDU. Should the crew be not satisfied with the proposed answer, he then could modify before sending.

- **CONFIRM ASSIGNED**: The **currently assigned** parameter (e.g. altitude, speed, route) is awaited by the controller whenever CONFIRM ASSIGNED XXXX is used.

c) 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 1/A performance requirements have been given for the South Pacific operations:

- Down link: 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 ground controller station and that of the sending action of the pilot.

- Up link: A 120 second round trip delay on 95%. Round trip being obtained by comparing the time the up link is sent from the controller system against the time the message assurance (indicating successful delivery) was received back to the ground controller station. To be noted that a 6 minute round trip delay is also aimed at on 99%.

As an order of magnitude both controller and pilot should consider that it takes up to one minute for a message to be received, around 30 seconds for the pilot or controller to take action and respond and up to one other minute for the reply to be received.

STANDBY answers assume that a further response should come within the next 10 minutes. The message thus remains open. If the controller does not respond within this time the pilot shall send an inquiry. **In no case should a duplicate message be sent** (this would cause failure of the system).

d) Recommended answers to request and clearances

• *Affirmative answer to a clearance*

WILCO is to be used. Pilot will then fully comply with the clearance or instruction

• *Affirmative answer to a negotiation request*

AFFIRM is to be used whenever an up linked negotiation request is approved (e.g. “CAN YOU ACCEPT FL 350 AT 1030Z”)

• *Negative answer to a negotiation request*

NEGATIVE is to be used whenever an up linked negotiation request is not approved (e.g. “CAN YOU ACCEPT FL 350 AT 1030Z”)

e) Position report

• *General recommendations*

- **Only compulsory reporting points** (unless requested otherwise by ATC) shall be reported by either voice, CPDLC or ADS for the “POSITION” and “NEXT POSITION”. In particular, when ADS is used, only ATC reporting points will be entered in the FMS F-PLN. This will avoid that reports are triggered immediately and at unknown fixes.

- Whenever ADS is not used, CPDLC position reporting will be done once the waypoint is passed over (or abeam when an offset is in progress). Use of the POSITION REPORT message (as given on the MCDU ATC pages) is expected.

- 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 centre to the next one, or
. when crossing the FIR boundary

- Updating the estimate for a given waypoint should be done through a free text message in the form of e.g. “REVISED ETA ALCOA 1034”

- Whenever a position report is not received by the ground, the controller may ask for it through the CPDLC up link: “REQUEST POSITION REPORT”

• *Sequencing Abeam waypoints*

The FMS does not sequence the active waypoint when the aircraft is abeam this point by more than 7 NM. 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 specially in RNP or FANS route, updating the flight plan is highly recommended.

• *ARINC 424 Waypoints*

In some parts of the world, oceanic latitudes and longitudes of some fixes happen to be encoded in the ARINC 424 format (e.g. 10N40, which stands for 10N/140W). Ground stations cannot cope with such points, and will reject any down link reports containing them.

f) Multi-element messages

- It is highly recommended to avoid potential ambiguity, that the crews **do not send multiple clearance requests in a single message.**

- Pilots should send one message per clearance element.

g) Duplicate messages

• *General*

- As a general rule, duplicate messages, which can cause potential ambiguity, should be carefully avoided.

- To avoid the risk of duplicate messages, incoming request messages shall be answered as soon as possible

• *Re-sending of a message*

- After a reasonable period without answer to his request, the 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”.

h) Use of free text

Free text messages cannot be treated by the automated station of the controller as standard ATC messages. As such, no correlation between the free text and its answer can be provided. Automatic pre-formatted answers cannot be provided in response to a free text. This thus increases the controller 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 pre-formatted messages do not allow for a specific message element.

- Standard ATC phraseology should be used in free text and abbreviations should be avoided.

Remark:
“Standardised free text” messages have been developed and agreed upon by the main FANS actors of the South Pacific area, to cope with the lack of pre-formatted functions.

i) Message closure

Among the basic assumptions and rules which 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 far as possible.
Pilots should be prompt to answer the received messages and to clean up their DCDU with the “CLOSE” prompt. They should be aware of the following definitions, which apply:

- A message is open as long as an associated response is not received

- A message which needs not an answer is closed once received

- A message is closed when its associated response, other than STANDBY or REQUEST DEFERRED, is received.

Free text message received on board will be closed once ROGER has been answered. ROGER is the sole response to any up linked free text.

j) Emergency procedures

Pilots should be aware of the CPDLC emergency procedures, which apply in the considered area. The emergency mode is activated through the EMERGENCY prompt of the ATC menu page.
In particular, they should know what can be expected from the controller once the emergency mode is triggered.
The general rules usually apply:

- The controller shall immediately acknowledge receipt of an emergency message, which has been sent by the pilot (e.g. MAYDAY or PAN). Either voice or CPDLC free text will be used. If free text is used, the crew is not required to close it through the “ROGER” reply.

- The 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 controller will keep the connection active to provide the assistance. In particular, no transfer (either automatic or manual) of connection will be done.

Remark:
When both CPDLC and ADS are active, sending an emergency message through

CPDLC automatically switches the ground ADS contract to the “High Periodic Reporting rate” (ADS Emergency mode). Conversely, sending the CPDLC “CANCEL EMERGENCY” message deactivates the ADS emergency mode.

4.5 ADS PROCEDURES

4.5.1 ADS connection

As soon as the ATSU is initialised, the ADS application is "armed", waiting for a possible connection (ADS "ON" is the default state on the MCDU ATC pages).

The initiation of an ADS connection is identical to that of CPDLC. In addition, up to 4 ADS connections may be done with 4 different ground stations (whereas only 1 is possible for CPDLC).

The AFN Logon procedure as described in § 4.3 is to be applied to initiate an ADS connection with the desired ATC centre.
The ATC centre can establish ADS contracts once the AFN logon has been done either manually from the aircraft or through a transfer from a previous ATC centre.

4.5.2 ADS connections management and closure

Management of the ADS connections

As up to four connections may occur, priority rules for management of the connections have been defined and should be agreed upon by the concerned ATC centres.
At the date of publication, there is no region in the world, where priority issues might be critical. In addition, ADS concepts of operations are not yet frozen and are expected to vary in short to medium terms. That is the reason why these rules are not given in a first edition.

ADS contracts should normally be terminated by the ATC centre when:
- The aircraft has crossed its FIR boundary
- The aircraft F-PLN has been completed

Closure of the ADS connection

ADS is totally transparent to the crew. In particular, contracts can not be modified from the aircraft. A connection may be stopped from the ground or be manually switched OFF through the ADS page of the MDCU ATC menu.

4.5.3 Position reporting with ADS

Whenever ATC centres can support ADS, position reporting through either CPDLC or voice will not be required.

Here also, and to a greater extent, whenever ADS is used, **only ATC reporting points will be entered in the FMS F-PLN**. This will avoid that reports are triggered immediately and at unknown fixes.

Route offset

The accuracy of the ADS intent and predicted route information is of prime importance when it is to be used by the ATC centre 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 purpose may be incorrect. A Waypoint will not be sequenced if the position is beyond 7NM from this point.

It is then recommended that the crew keeps updated his FMS flight plan, and that he 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.

4.5.4 ADS shutdown

When a shutdown occurs the controller will advise the crew of the requirements for the position reports.
If CPDLC is still available, the controller shall send a CPDLC free text: “ADS SHUTDOWN. REVERT TO ATC DATALINK POSITION REPORT”
As for any free text the pilot will answer “ROGER”.

4.5.5 Emergency procedures

The emergency mode can be activated through the EMERGENCY prompt accessed on the MCDU ATC page.
When selected, all the established connections switch to this emergency mode.
This means that the High Reporting Rate will be automatically selected.

The controller in charge of the flight shall acknowledge any ADS emergency message.
This is done through either a voice contact or a free text CPDLC message.
The following phraseology is then expected: “ROGER MAYDAY” or “ROGER PAN”.

5. HOW TO GET THE OPERATIONAL APPROVAL

5.1 General

Based on the systems global description and operational points, as described in the previous parts, the aim of this chapter is to provide the airline with recommendations and guidance material, that will help it to prepare pilots and dispatchers procedures and training programs, and aircraft engineering programs necessary for obtaining operational approval to use CPDLC and ADS.

Operational approval rules are not yet fully available and individual operational authority may choose the “means of compliance” stating what the applicant airline may have to demonstrate.
It is however expected that the following items will have to be complied with, by the applicant airline:

- Aircraft configuration
- Flight crew training/qualification
- Maintenance training
- Approved operational documentation

In complement to the FANS A certification system, the airworthiness authorities of the applicant airline may require additional demonstration activities for specific environment or operational conditions. To this end, the FANS A Airworthiness Approval Summary document will be written for certification and will be provided to both the airline and its authority. Based on this document, which lists the assumptions on the ground environment and gives a synthesis of the tests carried out for certification, the scope of additional tests may be defined:

- Interoperability test scenarios
- Verification of the safety and performance criteria with regards to the considered environment

5.2 Aircraft configuration

The aircraft should be configured in accordance with the approved certification configuration for FANS A operations.
In particular the following list of equipment shall be implemented:

- 1 ATSU
- 2 DCDU
- 2 Attention getter pushbuttons on the glareshield
- 3 VDR
- New FMS (2nd generation FMS)
- MCDU with the “ATC COMM” key
- FWC at appropriate standard
- UTC Time Clock
- MDDU at appropriate standard
- SATCOM system
- 2 HF

The list of the approved FANS aircraft configuration will be kept updated by Airbus Industrie. Compliance to this list will have to be ensured.
Remark:
To operate in the South Pacific and take benefit of the problem analysis as currently proposed by the FIT (FANS Interoperability Team, subgroup of the ISPACG), a strict adherence to the South Pacific Operations approved aircraft configuration list will have to be observed.

5.3 Flight crew training / qualification

5.3.1 General recommendations

Operating an aircraft in a FANS type environment requires from the crew understanding, knowledge and operational use of the three C, N and S dimensions of the CNS/ATM concept.
The Navigation aspects are addressed in the RNP/RVSM document - A flight operations view.
The following chapters develop recommendations to assure flight crew qualification for a safe and efficient use of data link communications and surveillance systems. They should be part of the programmes to be presented to the airworthiness authorities.

To this end, the following points will be emphasised in preparing the flight crew training programmes:

- Basic knowledge of the overall CNS/ATM environment for which, the various concepts and interacting elements, the involved aircraft systems and relevant operating procedures to be applied should be covered in a dedicated academic training.

- Operational use of data link communications (e.g. handling of up and down link ATC messages or ATC operating procedures) should be taught so as to develop skills and practices for the considered FANS environment.

- Initial evaluation and recurrent training have to be part of the approved syllabi.

- Specific Human Factors points pertaining to the data link communications should be carefully addressed (they are mentioned in the here below "academic training" chapter.

5.3.2 Proposed qualification means

Waiting for the implementation of the AIM-FANS package into simulators, a "stand alone" training programme has been discussed with the main airworthiness authorities FAA/JAA. The individual airline should submit its own training programme to its relevant authority to get the operational approval.

It is Airbus Industrie opinion that the initial qualification should be made of the following components:

- Half a day familiarisation course, to address the academic training, and emphasise the main operational critical points.

- "Home work" training for each pilot, through the interactive CD-ROM developed by Airbus Industrie.

- One operational flight conducted with an airline check pilot.

As soon as the FANS devices are available in the simulators, the FANS training can be proposed in various options: initial, transition, recurrent or upgrade training or qualification programmes.

5.3.3 Academic training

The aim of the academic training is to familiarise the flight crew with the main characteristics of the digital communications, as used in a CNS/ATM context. In a first step prior to FANS operations, pilots will be introduced to the basic principles of CNS/ATM concept.
Such an initial training may be based on the CD-ROM developed by Airbus Industrie or given as a first step.

Once completed, this programme should not be repeated. Only the new, modified or specific points will be addressed during further programmes.

The following points should be part of this academic training:

General presentation of the CNS/ATM concept.

C, N and S together with the current trends for ATM should be described. The general characteristics of the data link communications will be given and the chain links of the components that exist in between a pilot and a controller will be emphasised.
Flight crews should be made aware of the nominal systems operations and performance parameters, normal and abnormal use together with the limitations of the systems.

Basic use of the AIM-FANS.

The crews should be taught on the normal handling of the data link. In particular, coping with the DCDU ATC messages reception and acknowledgement, acceptance or rejection should be addressed. At this stage, the crews will be made aware of the DCDU / MCDU relations for handling of Clearances and Requests and of the role of the FMS in such operations.

Basic knowledge of the data link communications language, terms to be used and information to be exchanged.

Use of CPDLC and ADS for instance, are based on an extensive set of formatted messages, agreed upon abbreviations, conventions and assumptions the main of which will have to be known. The crews will be made aware of and familiar with the existing terminology as used by the considered ATS, as displayed on relevant charts or manuals, or given by the various service providers (ATC and communications). Familiarisation with all the available means of communications (e.g. VDR, HF, Satcom both in voice and data communications) is expected at that stage. In particular Satcom voice procedures, call addressing, ATC facility phone access, codes, call ID and priority will be covered. Later on, mode S or VDL 2, 3 or 4 will be included.

Awareness of the ATS communications, co-ordination and credits for use of data link

The ATC requirements in terms of F-PLN classification, separation criteria, operating procedures or MEL credits that are based on digital communications use should be known of the crews. A special emphasis on the voice/data link communications transition in both normal and abnormal configurations will be given. Although voice remains the ultimate back up mode, procedures for its use must be carefully followed.

Basic knowledge of the main AIM-FANS components, equipment and controls in both the nominal and abnormal operations.

The interaction of the various computers (e.g. ATSU, FMS, FWC) or the relations in between their interface (e.g. DCDU, MCDU, ECAM, printer, warning lights..) will have to be described here. Transmission times, failure annunciation, constraints and limitations of these components should be known of the crews for a safe and efficient operation.

Human Factors considerations.

The following recommendations have been developed to cope with the specific issues of the data communications:

- The pilot responsible for the communications ensures that the situation awareness, as entailed by the ATC data link messages, is fully shared by the other pilot. To this end, any message transiting through the DCDU (whether received or to be sent) will be read in a loud voice so as to ensure a common understanding and allow for a good cross checking between the two pilots.

- Crew co-ordination should be completed before any action ensuing a received message is done or before any message or answer is sent to the ground.

- Emphasis will be done on the crew work sharing, so as to avoid simultaneous head down attention by both pilots, while handling of the messages is done.

5.3.4 Operational training

In addition to the academic training, the airline will have to demonstrate to its authorities that an operational training is done to provide all the flight crew members with the adequate training to perform their duties in an operational FANS environment.

a) Operational points

This paragraph addresses the practical application of the operational procedures described in chapter 4.
The Airbus Industrie CD-ROM training device, through its interactive operational scenarios, mostly covers this training syllabus. It may be presented by the airline to the airworthiness authorities as a “stand alone” computer-based instruction (CBI). It covers the data link communications items of the global FANS, and comes in complement to the RNP/RVSM operational training (as described in the AI/ST-F RNP/RVSM - A flight operations view - document).

The following lists the items to be tackled in a training course. All but the “Special Recommendations” § are addressed in the Airbus Industrie CD-ROM:

Message handling

The pilots should be trained on how to receive and interpret ATC messages. Understanding the CPDLC / ADS phraseology is to be acquired.

Appropriate use of the pre-formatted answers of the DCDU (e.g. WILCO, ROGER, UNABLE, CANCEL...) together with the knowledge for storing and retrieving messages from the ATC messages logbook will be addressed.

Will also be practised the operations that require simultaneous work on both the DCDU and the MCDU. In particular, loading route clearance messages in the FMS, or preparing requests on the ATC pages of the MCDU should be covered.

The automatism, as provided by the FMS, for monitoring and answering to some specific messages (e.g. differed clearances) should be known from the flight crews. Handling of automatically FMS proposed answers should be mastered.

Managing the communications systems

The global use of the communications systems, whether they are traditional voice or new data link communications will have to be acquired.
Establishing and terminating CPDLC, activating and deactivating ADS, switching from traditional voice based to digital communications control and coping with failures of these systems should be practised.

All the available controls and indicators of the AIM-FANS system should be known and used (e.g. the meaning of the various displays, advisories, available functions).

Whenever CPDLC is the primary means of communications, pilots should be trained to monitor the appropriate HF primary and secondary frequencies through the SELCAL.

Whenever CPDLC is the primary means of communications, the use of voice communications should be done as a complement, and through the following available means:

- VHF
- HF
- SATVOICE

SATVOICE may be considered, at pilot's discretion whenever required (emergency, medical advice, hazards,..)

ATS procedures and services

Knowledge of the ATS procedures for the considered FANS area (e.g. timely, relevant and appropriate responses to communications and surveillance failures) is of prime importance.
In addition, crews should be able to recognise "usual" failures and be fully aware of the tricks pertaining to the sensitivity of the end-to-end data link communications (Refer to the following paragraph).

Special recommendations

Derived from the lessons learned during FANS operations in the South Pacific area, the following list gives the main points to be underlined in the operational training:

- Flight identification

  The correlation of the flight identification, between that expected by an ATC ground system according to the filed F-PLN, and that of the coded message exercised during the initial log on attempt (AFN), is very prone to errors.
  Pilots should be fully aware that the flight identification of both the filed F-PLN and the one used for data link communications must be identical. It is the pilot's responsibility

to ensure that correct flight identification and registration number are used.
In particular, the operator ICAO 3-letter code is to be used (e.g. ICAO ATC filed F-PLN, FMS, data link). Attempting a connection with a TP 232 ident for instance, whereas TAP232 has been filed, will cause the ground system to reject the connection.
Space and leading zeros in these identifications have to be carefully handled.

• Use of free text

Limit the use of free text message to exceptional cases. Pilots should be made aware that free text messages cannot be treated by the automated station of the controller as a standard ATC message. As such, no correlation between the free text and its answer can be provided.

Avoid abbreviations and acronyms since they may have different meanings to different operators.

Use standard English aeronautical terminology only.

“ROGER” is the sole answer for an up linked free text message. Any other answer will keep the received message open.

• FIR transfer of control

- Until the AIDC function in between subsequent ATC centres is fully implemented, the transfer of control between two FIR will have to be carefully monitored by the crew.
The applicable procedures will have to be strictly followed.
Whenever an automatic transfer is done, it is recommended to monitor it through the display of the active ATC centre on the DCDU. In case a manual transfer is done, carefully apply the correct sequence of actions (as described in the “operational procedures” chapter or by the relevant ATC).
In particular, pilots should verify that the expected ICAO 4 letter code for the region is displayed on the DCDU, and should not send any message before this check has been done.

- Disconnection may also occur during FIR transfers due to pending uplink messages and this, although the recommended procedures specify that the “END SERVICE” message be not transmitted while there are open messages. Pilots should be aware of such occurrences.

• Open message

Open messages should be chased and it should be recommended to avoid sending messages whenever one is open. This is to avoid crossing answers, misunderstanding of replies, wrong correlation of up/down links or even disconnection (in the case of transfer of centre).

• Delays in responding

Both pilots and ATC answers to messages should be done as soon as possible. In case a STANDBY response has been received from the ATC, the flight crew should expect a further answer within 10 minutes. Waiting for it, the message remains open. If no answer comes on time, and to avoid a duplicate message, it is then recommended that the next message of the crew is based on an inquiry (e.g. "When can we expect...")

• Multi-element messages

Multi-elements messages (up/down links) should be avoided.
Answering multi-elements messages is prone to misunderstanding since it is done for the whole message itself and cannot apply to each element individually.

• Waypoint sequencing

When an aircraft is laterally displaced by more than a set distance (7NM for Airbus models) from the track defined by an active flight plan, waypoints cease to be sequenced. This affects the data transmitted in CPDLC position reports and prevents ADS waypoint events from triggering reports.
Monitoring the correct sequencing of the waypoints together with the updating of the F-PLN is thus to be recommended, especially in those areas of flight where ADS (or CPDLC) position reporting is done.

• Position reporting

Pilots should be aware that there is no ATC response to their CPDLC position report. As such, they must not re-send their message.

The ATC ground systems are designed so as to address compulsory reporting points as defined on approved En route charts. Pilots are thus invited to check that their FMS F-PLN is consistent with these charts, and that only compulsory position reports are sent through data link (CPDLC or ADS).

• Weather deviation

Weather deviation procedures should be emphasised in training.
Increasing use of ADS and radar cover in some unexpected areas have shown that crews routinely deviate from track without a clearance for ATC.
Clearances and use of offset should be highlighted.

Weather deviation procedures have been developed and published:
- Priority is given to aircraft which include “Due to weather” in requests or those using the urgency pro-word “PAN”)
- If ATC is unable to achieve the required deviation and maintain minimum horizontal separation, a 1000-foot vertical buffer will be provided.
- If ATC is unable to issue a clearance or if communication cannot be established, the aircraft should climb or descend 500 feet, establish communications, and make the aircraft visible. This is a simple modification of global contingency procedures.

• Abnormal configurations

Pilots should be well aware of applicable procedures to revert to voice communications whenever a data link failure or misbehaviour is encountered.

b) Operational responsibilities

During their operational training, flight crews should be taught of their responsibilities with regards to the use of digital communications.

The following lists the expected pilot’s behaviour for an efficient use of the data communications systems, whether this is used as either a primary or a secondary means:

- Prompt and appropriate answer to up linked messages
- Appropriate emission of down linked messages
- Nominal crew work share for an efficient handling of the messages
- Compensation of system failures through prompt back up voice
- Compliance with the voice clearance whenever this contradicts the data link one
- Use of data link only within approved area and configuration

c) Operational feed back

Pilots should be encouraged to report on the overall performance of the FANS system. Specific data link events should be reported to the flight operations department or to the ATC whenever appropriate.
Data link anomalies (failures, loss of messages, unanswered messages, very long response time, disconnection...), procedural difficulties, human factors issues should be reported through any appropriate devices according to the airline policies.

5.4 Maintenance training

To get its operational approval, the airline must demonstrate that an appropriate maintenance training programme relative to the digital communications, is given to its maintenance people. This is part of the ICAO Annex 6, paragraph 8.3.
In this programme, the procedures for digital communications maintenance will be consistent with that recommended in the relevant chapters of the approved maintenance manuals.

The aim is to train the maintenance personnel to properly implement, maintain, or replace the AIM-FANS equipment (e.g. ATSU, DCDU, FMS, printer, VDR...)
Installation, modification and use of testing tools are some of the points to be trained. The maintenance people should also be aware of the MEL items associated to the relief of FANS equipment.

Adhering to configuration control lists that may be recommended in some FANS areas, so as to maintain recognised operating equipment and performance levels, might be part of the requirements. Data link service providers can provide the airline with information on poor performance by individual aircraft. It is also recommended that the airline provide Airbus Industrie with information on their current avionics configuration and operating performance so as to ensure a good feed back on the FANS systems and documentation update.
Implementing the adequate Service Bulletins for approved configuration and ensuring software updates of the FANS systems are correctly incorporated should also be assured.

5.5 Approved Documentation

The applicant airline should present to its relevant authority a set of documents to be approved. It is expected that the following documentation will be required:
- FANS A Airworthiness Approval Summary
- MEL
- AFM

5.5.1 FANS A Airworthiness Approval Summary

This document is part of the manufacturer operational approval. It can be made available to the national authority of the applicant airline.
It contains the assumptions on the ground environment and a synthesis of the results of certification tests.

Based on this document, the operational and technical context may be evaluated and additional demonstration activities be asked by the authority.

5.5.2 MEL (Minimum Equipment List)

The airline should submit its intended MEL for operation of FANS routes to its airworthiness authority. In addition to the MEL provisions taken for the navigation equipment, in the frame of RNP/RVSM context (see AI/ST-F RNP/RVSM - A flight operations view - document), provisions will have to be taken for the digital communications equipment.

Reference to the MMEL and to the AFM is recommended to establish the MEL.

The MEL items for data link communications may depend on the considered FANS route (oceanic, continental, remote areas). The airline should thus take provisions for some specific operating systems at dispatch, and consider the consequences of their loss on the data link communications.

For FANS A flights in the South Pacific area, for instance, CPDLC/ADS operations require to have:

- ATSU
- DCDU
- SATCOM
- FMS
- Printer (according to some airline policy)

Dispatching in this area will also require to have two operational HF radios.
The availability and the reliability of the SATCOM have proven to be good enough in this region. That is why, dispatch with one HF only is currently claimed for, but is still not granted.
As soon as HFDL is available and authorised for ATC data link purpose, dispatch equipment list may be reconsidered.

5.5.3 Airplane Flight Manual

The airplane flight manual shall reference the FANS A Airworthiness Approval Summary document.


A330

APPENDIX A

LIST OF CPDLC MESSAGES WITH THEIR MEANING

Listed in this appendix are all the FANS 1/A messages supported by the CPDLC, as defined by the RTCA DO 219 and endorsed by the ICAO ADS panel. Additional comments provided by the ISPACG user forum are displayed in italics.

The abbreviations used for classification purpose are defined here below.

All up and down messages have been classified into operational groups. The reference number is that of the initial DO 219.

TYPE	CLOSURE RESPONSES
W/U	WILCO, UNABLE, will close the uplink message.
A/N	AFFIRM, NEGATIVE, will close the uplink message.
R	ROGER, will close the uplink message.
NE	Only the actual referenced response will close the uplink message. WILCO, UNABLE, AFFIRM, NEGATIVE, ROGER, STANDBY, will not close the uplink message.
Y	Response required.
N	Response not required

Uplink - Responses and Acknowledgements

UL	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
0	UNABLE	Indicates that ATS cannot comply with the request.	NE
1	STANDBY	Indicates that ATS has received the message and will respond. *The pilot is informed that the request is being assessed and there will be a <u>short-term delay</u> (within 10 minutes). The exchange is not closed and the request will be responded to when conditions allow.*	NE
2	REQUEST DEFERRED	Indicates that ATS has received the request but it has been deferred until later. *The pilot is informed that the request is being assessed and a <u>long-term delay</u> can be expected. The exchange is not closed and the request will be responded to when conditions allow.*	NE
3	ROGER	Indicates that ATS has received and understood the message..	NE
4	AFFIRM	Yes	NE
5	NEGATIVE	No	NE

Uplink - Vertical Clearances

UL	Message Element	Message Intent	Response
6	EXPECT [altitude]	Notification that a level change instruction should be expected.	R
7	EXPECT CLIMB AT [time]	Notification that an instruction should be expected for the aircraft to commence climb at the specified time.	R
8	EXPECT CLIMB AT [position]	Notification that an instruction should be expected for the aircraft to commence climb at the specified position.	R
9	EXPECT DESCENT AT [time]	Notification that an instruction should be xpected for the aircraft to commence descent at the specified time.	R
10	EXPECT DESCENT AT [position]	Notification that an instruction should be expected for the aircraft to commence descent at the specified position.	R
11	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	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	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	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	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	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	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	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	MAINTAIN [altitude]	Instruction to maintain the specified level.	W/U

Uplink - Vertical Clearances (Continued)

20	CLIMB TO AND MAINTAIN [altitude]	Instruction that a climb to the specified level is to commence and the level is to be maintained when reached.	W/U
21	AT [time] CLIMB TO AND MAINTAIN [altitude]	Instruction that at the specified time, a climb to the specified level is to commence and once reached the specified level is to be maintained.	W/U
22	AT [position] CLIMB TO AND MAINTAIN [altitude]	Instruction that at the specified position, a climb to the specified level is to commence and once reached the specified level is to be maintained.	W/U
23	DESCEND TO AND MAINTAIN [altitude]	Instruction that a descent to the specified level is to commence and the level is to be maintained when reached.	W/U
24	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	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	CLIMB TO REACH [altitude] BY [time]	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified time.	W/U
27	CLIMB TO REACH [altitude] BY [position]	Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified position.	W/U
28	DESCEND TO REACH [altitude] BY [time]	Instruction that a descent is to commence at rate such that the specified level is reached at or before the specified time.	W/U
29	DESCEND TO REACH [altitude] BY [position]	Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified position.	W/U
30	MAINTAIN BLOCK [altitude] TO [altitude]	A level within the specified vertical range is to be maintained.	W/U
31	CLIMB TO AND MAINTAIN BLOCK [altitude] TO [altitude]	Instruction that a climb to a level within the specified vertical range is to commence.	W/U
32	DESCEND TO AND MAINTAIN BLOCK [altitude] TO [altitude]	Instruction that a descent to a level within the specified vertical range is to commence.	W/U
33	*Reserved*		
34	CRUISE CLIMB TO [altitude]	A cruise climb is to commence and continue until the specified level is reached.	W/U
35	CRUISE CLIMB ABOVE [altitude]	A cruise climb can commence once above the specified level.	W/U
36	EXPEDITE CLIMB TO [altitude]	The climb to the specified level should be made at the aircraft's best rate.	W/U
37	EXPEDITE DESCENT TO [altitude]	The descent to the specified level should be made at the aircraft's best rate.	W/U

Uplink - Vertical Clearances (Continued)

38	IMMEDIATELY CLIMB TO [altitude]	Urgent instruction to immediately climb to the specified level.	W/U
39	IMMEDIATELY DESCEND TO [altitude]	Urgent instruction to immediately descend to the specified level.	W/U
40	IMMEDIATELY STOP CLIMB AT [altitude]	Urgent instruction to immediately stop a climb once the specified level is reached.	W/U
41	IMMEDIATELY STOP DESCENT AT [altitude]	Urgent instruction to immediately stop a descent once the specified level is reached.	W/U
171	CLIMB AT [vertical rate] MINIMUM	Instruction to climb at not less than the specified rate.	W/U
172	CLIMB AT [vertical rate] MAXIMUM	Instruction to climb at not above the specified rate.	W/U
173	DESCEND AT [vertical rate] MINIMUM	Instruction to descend at not less than the specified rate.	W/U
174	DESCEND AT [vertical rate] MAXIMUM	Instruction to descend at not above the specified rate.	W/U

Uplink - Crossing Constraints

UL	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
42	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	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	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	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	CROSS [position] AT [altitude]	The specified position is to be crossed at the specified level. This may require the aircraft to modify its climb or descent profile.	W/U
47	CROSS [position] AT OR ABOVE [altitude]	The specified position is to be crossed at or above the specified level.	W/U
48	CROSS [position] AT OR BELOW [altitude]	The specified position is to be crossed at or below the specified level.	W/U
49	CROSS [position] AT AND MAINTAIN [altitude]	Instruction that the specified position is to be crossed at the specified level and that level is to be maintained when reached.	W/U

Uplink - Crossing Constraints (Continued)

50	CROSS [position] BETWEEN [altitude] AND [altitude]	The specified position is to be crossed at a level between the specified levels.	W/U
51	CROSS [position] AT [time]	The specified position is to be crossed at the specified time.	W/U
52	CROSS [position] AT OR BEFORE [time]	The specified position is to be crossed at or before the specified time.	W/U
53	CROSS [position] AT OR AFTER [time]	The specified position is to be crossed at or after the specified time.	W/U
54	CROSS [position] BETWEEN [time] AND [time]	The specified position is to be crossed at a time between the specified times.	W/U
55	CROSS [position] AT [speed]	The specified position is to be crossed at the specified speed and the specified speed is to be maintained until further advised.	W/U
56	CROSS [position] AT OR LESS THAN [speed]	The specified position is to be crossed at a speed equal to or less than the specified speed and the specified speed or less is to be maintained until further advised.	W/U
57	CROSS [position] AT OR GREATER THAN [speed]	The specified position is to be crossed at a speed equal to or greater than the specified speed and the specified speed or greater is to be maintained until further advised.	W/U
58	CROSS [position] AT [time] AT [altitude]	The specified position is to be crossed at the specified time and the specified level.	W/U
59	CROSS [position] AT OR BEFORE [time] AT [altitude]	The specified position is to be crossed at or before the specified time and at the specified level.	W/U
60	CROSS [position] AT OR AFTER [time] AT [altitude]	The specified position is to be crossed at or after the specified time and at the specified level.	W/U
61	CROSS [position] AT AND MAINTAIN [altitude] AT [speed]	Instruction that the specified position is to be crossed at the specified level and speed and the level and speed are to be maintained.	W/U
62	At [time] CROSS [position] AT AND MAINTAIN [altitude]	Instruction that at the specified time the specified position is to be crossed at the specified level and the level is to be maintained.	W/U
63	At [time] Cross [position] at and maintain [altitude] at [speed]	Instruction that at the specified time the specified position is to be crossed at the specified level and speed and the level and speed are to be maintained.	W/U

Uplink - Lateral Offsets

UL	Message Element	Message Intent Response	
64	OFFSET [direction] [distance offset] OF ROUTE	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction.	W/U
65	AT [position] OFFSET [direction] [distance offset] OF ROUTE	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified position.	W/U
66	AT [time] OFFSET [direction] [distance offset] OF ROUTE	Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified time.	W/U
67	PROCEED BACK ON ROUTE	The cleared flight route is to be rejoined.	W/U
68	REJOIN ROUTE BY [position]	The cleared flight route is to be rejoined at or before the specified position.	W/U
69	REJOIN ROUTE BY [time]	The cleared flight route is to be rejoined at or before the specified time.	W/U
70	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	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	RESUME OWN NAVIGATION	Instruction to resume own navigation following a period of tracking or headind clearances. May be used in conjunction with an instruction on how or where to rejoin the cleared route.	W/U

Uplink - Route Modifications

UL	Message Element	Message Intent	Response
73	[predepartureclearance]	Notification to the aircraft of the instructions to be followed from departure until the specified clearance limit.	W/U
74	PROCEED DIRECT TO [position]	Instruction to proceed directly from the present position to the specified position.	W/U
75	WHEN ABLE PROCEED DIRECT TO [position]	Instruction to proceed, when able, directly to the specified position.	W/U
76	AT [time] PROCEED DIRECT TO [position]	Instruction to proceed, at the specified time, directly to the specified position	W/U
77	AT [position] PROCEED DIRECT TO [position]	Instruction to proceed, at the specified position, directly to the next specified position.	W/U
78	AT [altitude] PROCEED DIRECT TO [position]	Instruction to proceed, upon reaching the specified level, directly to the specified position.	W/U

Uplink - Route Modifications (Continued)

79	CLEARED TO [position] VIA [route clearance]	Instruction to proceed to the specified position via the specified route.	W/U
80	CLEARED [route clearance]	Instruction to proceed via the specified route.	W/U
81	CLEARED [procedure name]	Instruction to proceed in accordance with the specified procedure.	W/U
82	CLEARED TO DEVIATE UP TO [direction] [distance offset OF ROUTE	Approval to deviate up to the specified distance from the cleared route in the specified direction.	W/U
83	AT [position] CLEARED [route clearance]	Instruction to proceed from the specified position via the specified route.	W/U
84	AT [position] CLEARED [procedure name]	Instruction to proceed from the specified position via the specified procedure.	W/U
85	EXPECT [route clearance]	Notification that a clearance to fly on the specified route may be issued.	R
86	AT [position] EXPECT [route clearance]	Notification that a clearance to fly on the specified route from the specified position may be issued.	R
87	EXPECT DIRECT TO [position]	Notification that a clearance to fly directly to the specified position may be issued.	R
88	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	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	AT [altitude] EXPECT DIRECT TO [position]	Notification that a clearance to fly directly to the specified position commencing when the specified level is reached may be issued.	R
91	HOLD AT [position] MAINTAIN [altitude] INBOUND TRACK [degrees][direction] TURN LEG TIME [leg type]	Instruction to enter a holding pattern with the specified characteristics at the specified position and level.	W/U
92	HOLD AT [position] AS PUBLISHED MAINTAIN [altitude]	Instruction to enter a holding pattern with the published characteristics at the specified position and level.	W/U
93	EXPECT FURTHER CLEARANCE AT [time]	Notification that an onwards clearance may be issued at the specified time.	R
94	TURN [direction] HEADING [degrees]	Instruction to turn left or right as specified onto the specified heading.	W/U
95	TURN [direction] GROUND TRACK [degrees]	Instruction to turn left or right as specified onto the specified track	W/U
96	FLY PRESENT HEADING	Instruction to continue to fly on the current heading.	W/U
97	AT [position] FLY HEADING [degrees]	Instruction to fly on the specified heading from the specified position.	W/U
98	IMMEDIATELY TURN [direction] HEADING [degrees]	Instruction to turn immediately left or right as specified onto the specified heading.	W/U

Uplink - Route Modifications (Continued)

99	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

UL	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
100	AT [time] EXPECT [speed]	Notification that a speed instruction may be issued to be effective at the specified time.	R
101	AT [position] EXPECT [speed]	Notification that a speed instruction may be issued to be effective at the specified position.	R
102	AT [altitude] EXPECT [speed]	Notification that a speed instruction may be issued to be effective at the specified level.	R
103	AT [time] EXPECT [speed] TO [speed]	Notification that a speed range instruction may be issued to be effective at the specified time.	R
104	AT [position] EXPECT [speed] TO [speed]	Notification that a speed range instruction may be issued to be effective at the specified position.	R
105	AT [altitude] EXPECT [speed] TO [speed]	Notification that a speed range instruction may be issued to be effective at the specified level.	R
106	MAINTAIN [speed]	The specified speed is to be maintained.	W/U
107	MAINTAIN PRESENT SPEED	The present speed is to be maintained.	W/U
108	MAINTAIN [speed] OR GREATER	The specified speed or a greater spee is to be maintained.	W/U
109	MAINTAIN [speed] OR LESS	The specified speed or a lesser speed is to be maintained.	W/U
110	MAINTAIN [speed] TO [speed]	A speed within the specified range is to be maintained.	W/U
111	INCREASE SPEED TO [speed]	The present speed is to be increased to the specified speed and maintained until further advised.	W/U
112	INCREASE SPEED TO [speed] OR GREATER	The present speed is to be increased to the specified speed or greater, and maintained at or above the specified speed until further advised.	W/U
113	REDUCE SPEED TO [speed]	The present speed is to be reduced to the specified speed and maintained until further advised.	W/U
114	REDUCE SPEED TO [speed] OR LESS	The present speed is to be reduced to the specified speed or less and maintained at or below the specified speed until further advised.	W/U

Uplink - Speed Changes (Continued)

115	DO NOT EXCEED [speed]	The specified speed is not to be exceeded.	W/U
116	RESUME NORMAL SPEED	Notification that the aircraft need no longer comply with the previously issued speed restriction.	W/U

Uplink - Contact/Monitor/Surveillance Requests

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

Uplink - Report/Confirmation Requests

UL	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
127	REPORT BACK ON ROUTE	Instruction to report when the aircraft is back on the cleared route.	R
128	REPORT LEAVING [altitude]	Instruction to report when the aircraft has left the specified level. *Either a level that has been maintained, or a level passed hrough on climb or descent.*	R
129	REPORT LEVEL [altitude]	Instruction to report when the aircraft is in level flight at the specified level. *Note: To avoid confusion, Some States have decided that they will not use this element, as it does not comply with existing phraseology*	R

175	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	Report reaching block [altitude] to [altitude]	Instruction to report when the aircraft is within the specified vertical range.	R
130	Report passing [position]	Instruction to report when the aircraft has passed the specified position.	R
181	Report distance [to/from] [position]	Instruction to report the present distance to or from the specified position.	NE
131	Report remaining fuel and souls on board	Instruction to report the amount of fuel remaining and the number of persons on board.	NE
132	Confirm position	Instruction to report the present position.	NE
133	Confirm altitude	Instruction to report the present level.	NE
134	Confirm speed	Instruction to report the present speed.	NE
135	Confirm assigned altitude	Instruction to confirm and acknowledge the currently assigned level.	NE
136	Confirm assigned speed	Instruction to confirm and acknowledge the currently assigned speed.	NE
137	Confirm assigned route	Instruction to confirm and acknowledge the currently assigned route.	NE
138	Confirm time over reported waypoint	Instruction to confirm the previously reported time over the last reported waypoint.	NE
139	Confirm reported waypoint	Instruction to confirm the identity of the previously reported waypoint.	NE
140	Confirm next waypoint	Lnstruction to confirm the identity of the next waypoint.	NE
141	Confirm next waypoint ETA	Instruction to confirm the previously reported estimated time at the next waypoint.	NE
142	Confirm ensuing waypoint	Instruction to confirm the identity of the next plus one waypoint.	NE
143	Confirm request	The request was not understood. It should be clarified and resubmitted.	NE
144	Confirm squawk	Instruction to report the currently selected transponder code.	NE
145	Confirm heading	Instruction to report the present heading.	NE
146	Confirm ground track	Instruction to report the present ground track.	NE
182	Confirm ATIS code	Instruction to report the identification code of the last ATIS received.	NE
147	Request position report	Instruction to make a position report. *To be used if the controller does not receive a scheduled position report.*	NE

Uplink - Negotiation Requests

UL	Message Element	Message Intent Response	
148	When can you accept [altitude]	Request for the earliest time at which the specified level can be accepted.	NE
149	Can you accept [altitude] at [position]	Instruction to report whether or not the specified level can be accepted at th specified position.	A/N
150	Can you accept [altitude] at [time]	Instruction to report whether or not the specified level can be accepted at the specified time.	A/N
151	When can you accept [speed]	Instruction to report the earliest time when the specified speed can be accepted.	NE
152	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

UL	Message Element	Message Intent	Response
153	Altimeter [altimeter]	ATS advisory that the altimeter setting should be the specified setting.	R
154	Radar services terminated	ATS advisory that the radar service is terminated.	R
155	Radar contact [position]	ATS advisory that radar contact has been established at the specified position.	R
156	Radar contact lost	ATS advisory that radar contact has been lost.	R
157	Check stuck microphone [frequency]	A continuous transmission is detected on the specified frequency. Check the microphone button.	R
158	Atis [atis code]	ATS advisory that the ATIS information identified by the specified code is the	R

Uplink - System Management Messages

UL	Message Element	Message Intent	Response
159	Error [error information]	A system generated message that the ground system has detected an error.	NE
160	Next data authority [facility designation]	Notification to the avionics that the next data authority is the specified ATSU.	NE
161	End service	Notification to the avionics that the data link connection with the current data authority is being terminated.	NE
162	Service unavailable	Notification that the ground system does not support this message.	NE
163	[icao facility designation] [tp4Table]	Notification to the pilot of an ATSU identifier.	NE

Uplink - Additional Messages

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

Downlink - Responses

DL	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 controller is informed that the request is being assessed and there will be a <u>short term</u> delay (within 10 minutes). The exchange is not closed and the request will be responded to when conditions allow.*	N
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.*	
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 - Responses

DL	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
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 Off-Set Requests

DL	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

DL	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

DL	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
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

DL	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
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

Downlink – Reports (Continued)

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
80	DEVIATING [direction] [distance offset] OF ROUTE	Notification that the aircraft is deviating from the cleared route by the specified distance in the specified direction.	N

Downlink - Negotiation Requests

DL	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

DL	MESSAGE ELEMENT	MESSAGE INTENT	RESPONSE
55	PAN PAN PAN	Urgency prefix.	N
56	MAYDAY MAYDAY MAYDAY	Distress prefix.	N
57	[remaining fuel] OF FUEL REMAINING AND [souls on board]SOULS ON BOARD	Notification of fuel remaining and number of persons on board.	N
58	CANCEL EMERGENCY	Notification that the pilot wishes to cancel the emergency condition.	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.	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.	N
61	DESCENDING TO [altitude]	Notification that the aircraft is descending to the specified level.	N

Downlink - System Management Messages

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

Downlink - Additional Messages

DL	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
67b	We can accept [altitude] at [time]	We can accept the specified level at the specified time.	N
67c	We can accept [speed] at [time]	We can accept the specified speed at the specified time.	N
67d	We can accept [direction] [distance offset] at [time]	We can accept a parallel track offset the specified distance in the specified direction at the specified time.	N
67e	We cannot accept [altitude]	We cannot accept the specified level.	N
67f	We cannot accept [speed]	We cannot accept the specified speed.	N
67g	We cannot accept [direction] [distance offset]	We cannot accept a parallel track offset the specified distance in the specified direction.	N
67h	When can we expect climb to [altitude]	Request for the earliest time at which a clearance to climb to the specified level can be expected.	N
67i	When can we expect descent to [altitude]	Request for the earliest time at which a clearance to descend to the specified level can be expected.	N
68	[free text]	*Distress urgency attribute*	Y

APPENDIX B

ADS REPORT DATA

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

(*): On request

Output values of the parameters of the ADS messages

PARAMETE	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∞	.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 are 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

DYNAMIC AIRBORNE ROUTE PLANNING

The dynamic re-routing procedure has been developed by the ISPACG forum to provide FANS equipped aircraft with the possibility of a complete F-PLN change once airborne.
On the typical Los Angeles/Sydney or Los Angeles/Auckland routes, the wind updates after the first hours of flight may happen to show that a better F-PLN could be considered.
Procedures, based on an extensive use of the data link capabilities of the three AOC, ATC and A/C, have thus been developed to allow for the crew to get an in-flight route re-clearance.
The DARP scenario is described in the Airbus Industrie AIM-FANS A training CD-ROM.

The following describes the SPOM procedures, for a single re-route per flight, as currently in use.

1- 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.

2- PACOTS / DARP Track designations

KLAX/YSSY PACOTS track is called W. Once DARPed, this track is called Y.
KLAX/NZAA PACOTS track is called X. Once DARPed, this track is called Z.
YSSY/KLAX PACOTS track is called 20. Once DARPed, this track is called30.
NZAA/KLAX PACOTS track is called 21. Once DARPed, this track is called31.

3- Descriptive drawing

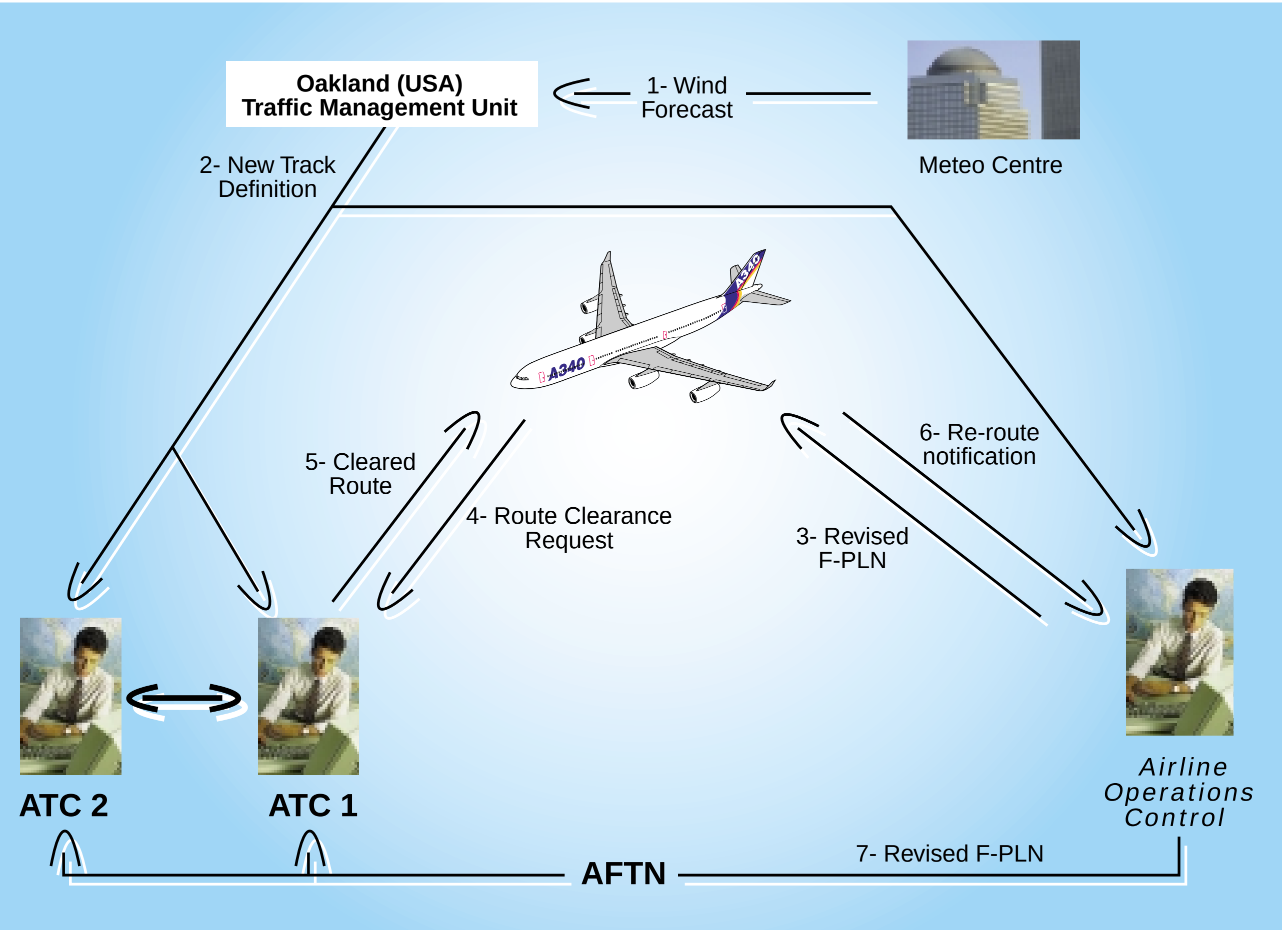
The following sequence is applied:
<u>OAKLAND</u>

- 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 a/c.
- 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
- After evaluation of the received P-PLN, the pilot asks for a re-route clearance
- Once cleared, the crew activates the re-route and notifies it to his 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.



APPENDIX D

Data Communications service providers

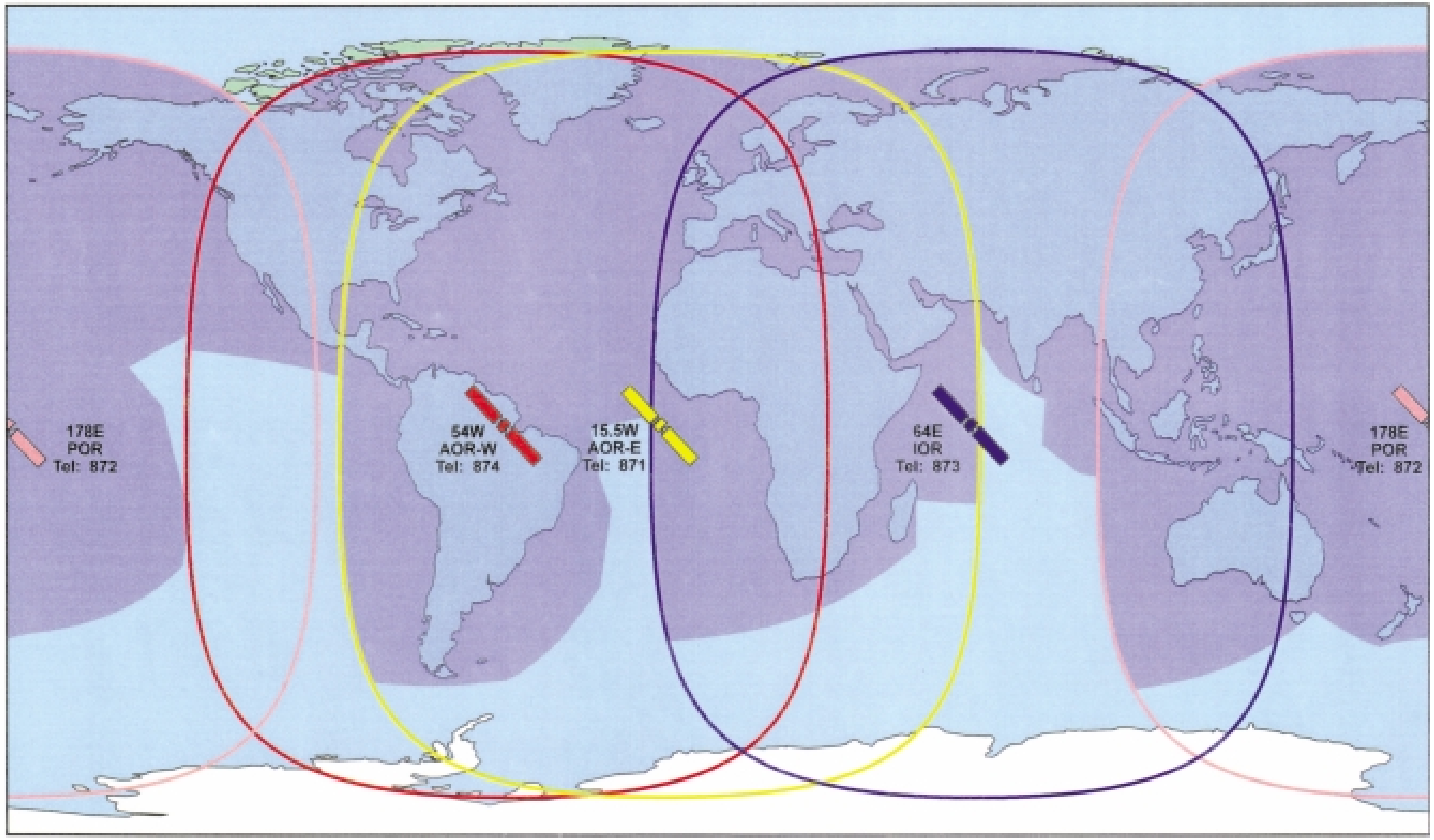
A) INMARSAT

B) ARINC

C) SITA

INMARSAT

Inmarsat Aeronautical Global and Spot Beam Coverage



Limit of global beam coverage for Inmarsat Aeronautical Services

- Pacific Ocean Region
- Atlantic Ocean Region-West
- Atlantic Ocean Region-East
- Indian Ocean Region

Inmarsat Aeronautical Spot Beam coverage

No Spot Beam coverage

This composite spot beam coverage diagram is based on computer predictions and should therefore be considered indicative only. 5° elevation angle contours shown.

INMARSAT

FACTS

Inmarsat communications for Air Traffic Services

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TITLE/POSITION

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DATE

March 1999

As Air Traffic Control moves into the new role of Air Traffic Management using the latest CNS tools, the need to maintain point to point communications even after events such as extreme weather or earthquakes which disrupt the local or national communication infrastructure becomes critical. Increasingly the world ATC service providers are turning to the use of satellite communications to support these mission critical communications.

ABOUT INMARSAT

Inmarsat has been operating global satellite systems dedicated to mobile and remote communications since 1982.

Today the Inmarsat constellation comprises nine geostationary satellites providing communications to four overlapping areas covering the whole of the globe except the extreme polar regions. Inmarsat's systems interconnect with the international terrestrial and fixed satellite communications networks through 39 land earth stations located around the world.

Inmarsat's systems provide a broad range of modern, high quality communications services to more than 140,000 users world-wide.

The Inmarsat services

Inmarsat's range of communications systems can provide all of the communications facilities of a modern ATC centre. They are particularly suited for outlying facilities beyond the economic reach of conventional telecommunication networks, or in a back-up role when the existing communications infrastructure has failed.

The top of the line Inmarsat-B terminal can provide all the communications needs of a modern ATC facility. These include direct-dial high quality telephony, group 3 facsimile, email, LAN connectivity and 56 or 64kbit/s high speed data capability suitable for radar data exchange and ATN access. In addition the usual office requirements for large file transfer, video conferencing and compressed or delayed transmission video are supported. Connection to the AFTN and airline (SITA and ARINC) networks is supported with a range of options ranging from TELEX to X.25.

The recently developed suitcase-size version of the Inmarsat-B terminal is today in widespread use in a number of industries providing a cost effective intranet link from mobile or remote users to corporate or international networks.

For those ATC facilities with smaller data volume requirements, Inmarsat-phone provides the answer. In a package smaller than a laptop computer and weighing less than 2 kilos, Inmarsat-phone provides user-friendly voice, fax and 2.4kbit/s data connections. Costs match size with Inmarsat-phone: terminals are around $3000 and user charges from around $3 a minute, from anywhere to anywhere.

Inmarsat Aeronautical services

In addition the ICAO SARPs compliant Inmarsat-Aero service provides oceanic and remote airspace air-ground communications support for the ATN and FANS-1/A aircraft globally, and provides direct controller pilot voice communications. Inmarsat Aeronautical services are the subject of a separate fact sheet.

Remote Radar site applications

The provision of real-time radar data from remote sites to ATC centres is pivotal to the operation of today's ATC systems. Because of the remote nature of some radar heads, and the high availability requirements for the data, it is often necessary to install very expensive duplicated telecommunications links using diverse paths. A cost -effective alternative is to use a low cost Inmarsat-phone terminal to provide a dial-up backup service to support the primary communications link.

Remote site maintenance team support

Maintenance teams servicing systems at remote locations are often isolated

Corporate Fact Sheets
Inmarsat communications for Air Traffic Services

from their base depot for hours and even days at a time. Contact with the teams is not always possible during the journey to and from the site through inhospitable and often hazardous terrain. The cost effective way to maintain contact is via vehicle mounted Inmarsat-phone or Inmarsat-C terminals which may be used in conjunction with GPS for automatic position reporting. Once at the site Inmarsat-phone or Inmarsat-B can be used for voice and data. As an example, where diagnostic files need to be exchanged, a 10MB file takes around 20 minutes to transfer from a remote site using an Inmarsat-B high speed data terminal (available in suitcase configuration) to a central maintenance depot linked to an ISDN line.

SCADA (supervisory control and data acquisition)

The problem of supporting the flow of accurate, up-to-date information from, and exercising control over remote installations has always been a complex and expensive exercise This is particularly so for unmanned remote automatic weather observing stations or isolated navaids many miles from the nearest reliable telecommunications network.

Now there is a low-cost, high-reliability solution for supervisory control and data acquisition (SCADA) systems supporting air navigation services. No matter how inhospitable the location or how extended the network, the Inmarsat-C data communication system can link SCADA units anywhere in the world to the ATS or MET computers and operators that control them.

Inmarsat-C is a low-speed store-and-forward messaging or data transfer system, featuring small, low-cost terminal equipment whose rugged simplicity and low power requirements make it ideal for unattended, remote operation.

Data packets can be transmitted from remote sites at pre-programmed times. Alternatively, SCADA units can be interrogated for data at will, or sent control instructions to activate special functions such as changing a navaid to a standby transmitter, adjusting power levels, or requesting a special MET observation.

The Inmarsat-based SCADA systems are tried, tested and in operation today in rugged environments for many diverse applications including:

* maritime navigational aids

* remote MET automatic weather observation station

* pipeline monitoring and control in the oil and gas industry

* offshore platform monitoring.

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INMARSAT

FACTS

Inmarsat aeronautical services

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Inmarsat's aeronautical satellite communications system (Inmarsat-Aero) offers phone, fax and data services for passenger, operational, administrative and air traffic control communications on board commercial, corporate and general-aviation aircraft worldwide.

Calls are transmitted from aircraft via Inmarsat's satellites to ground earth stations and then switched through international telecommunications networks to anywhere in the world.

Until satcoms, aviation was limited to radio communications, which suffered from the line-of-sight limitations of very-high-frequency (VHF) radio and the unreliability and variable quality of high-frequency (HF). Satellite links overcome these weaknesses, being unaffected by distance or ionospheric conditions.

APPLICATIONS

There are three main applications for aeronautical satcoms:

Passenger services

Inmarsat supports multichannel phone, packet-mode data messaging at up to 10.5kbit/sec, fax, and circuit-mode data at up to 4.8kbit/sec. In addition to being able to make phone calls and send faxes to anywhere in the world while in flight, passengers are being offered a growing range of data services. They include duty-free shopping; airline, hotel and car-hire reservations; and real-time world and financial news.

Air traffic control

Inmarsat aero satcoms is playing a major role in the implementation of ICAO's CNS/ATM (Communications Navigation Surveillance/Air Traffic Management) concept for air traffic control in the 21st century. The Inmarsat satellites will support automatic dependent surveillance (ADS) over the oceans and wilderness areas.

ADS is the reporting via satcoms of position and intention information derived from the aircraft's own navigation systems. Presented on radar-like displays at oceanic control centres, it will give controllers real-time knowledge of the traffic situation, permitting more fuel-efficient routing and reduced separation standards.

Improved routing is expected to yield millions of dollars in fuel and other operational cost savings, while reduced separations will increase the capacity of oceanic and wilderness airspace.

The Inmarsat-Aero datalink can also be used for routine pilot-controller communications such as the requests, clearances and advisories.

The first operational application of controller-pilot datalink communication was introduced in the South Pacific in October 1995. An ADS service is planned for the North Atlantic from the second quarter of 1999.

Voice communications are used for non routine and emergency ATC communications.

Airline operational and administrative communications

Use of satellite datalink to integrate aircraft in flight more closely into airline information systems can yield significant increases in operational and administrative efficiency.

Applications include support of extended-range twin operations; in-flight troubleshooting of technical problems; and improved handling of irregular operations resulting from weather and other delays.

Corporate Fact Sheets
Inmarsat aeronautical services

SYSTEMS

Inmarsat services for aircraft are supported by four systems:

• **Aero-L**, low-speed (600 bits/sec) real-time data communications, mainly for airline ATC, operational and administrative purposes

• **Aero-I** uses an intermediate-gain terminal exploiting the higher power of the Inmarsat-3 satellites. Aero-I allows aircraft flying within spot-beam coverage to receive multi-channel voice, fax and circuit mode data services through smaller, cheaper terminals. Packet data services are available worldwide in the global beams.

• **Aero-H**, a high-speed (up to 10.5kbit/sec) service supporting multichannel voice, fax and data communications anywhere in the global beam for passengers, operational, administrative and safety services applications.

• **Aero-H+** is an evolution of the Aero-H service that uses the higher power of the Inmarsat-3 satelllites when operating within the spot-beam coverage area. When operating outside these areas, the terminal operates using the global beam as a standard Aero-H system. Aero-H+ supports the same services as Aero-H.

In addition, **Aero-C**, the aeronautical version of Inmarsat-C low-rate data system allows store-and-forward text or data messages — flight safety communications excluded — to be sent and received by aircraft operating anywhere in the world.

CUSTOMERS

Over 1,900 aircraft have been fitted with Inmarsat-Aero terminals. These include more than 650 corporate and government aircraft and over 1,100 installations in airliners. Corporate users favour phone and fax service, while the airlines also make use of the data service. In addition, more than 950 business aircraft, helicopters and military transports are fitted with the Aero-C version of the Inmarsat-C data system.

Airlines using Inmarsat

Aeroflot, Air Afrique, Air Canada, Air China, Air France, Air Gabon, Air India, Air Mauritius, Air New Zealand, Alitalia, All Nippon Airways, American Airlines, Asiana Airlines, Atlas Air, Austrian Airlines, British Airways, Canada 3000, Cathay Pacific, China Airlines, China Southern Airlines, China United Airlines, Continental Airlines, Delta Air Lines, Egypt Air, Emirates, EVA Air, Finnair, Garuda, Gulf Air, Hainan Airlines, Iberia, Japan Airlines, KLM, Korean Air, Kuwait Airways, Lauda Air, Lufthansa, Maersk Airlines, Malaysia Airlines, Martinair, Meridiana, Northwest Airlines, Olympic Airways, Philippine Airlines, Qantas, Royal Air Maroc, Sabena, Saudia, SAS, Singapore Airlines, South African Airways, Swissair, TAM, Thai Airways, Turkish Airlines, United Airlines, Virgin Atlantic

SERVICE PROVIDERS

Several of Inmarsat's signatory (shareholder) organisations have formed consortia to offer worldwide aeronautical communications.

Australia's Telstra, France Telecom and Teleglobe Canada have teamed with the Société Internationale de Télécommunications Aéronautiques (SITA) to form the **Satellite Aircom** consortium.

BT of the UK, Telenor of Norway and Singapore Telecom comprise the **Skyphone** consortium.

Comsat of the USA, Kokusai Denshin Denwa (KDD) of Japan, the Communications Authority of Thailand (CAT), Indosat of Indonesia, Korea Telecom, the Philippine Long Distance Telephone Company, Telecom Italia and Telekom Malaysia form the **Skyways Alliance**.

In addition, Skyphone and Skyways Alliance have joined airline communications provider Aeronautical Radio Inc (ARINC) of the USA to form the **Globalink** consortium. ARINC receives satcoms services from Skyphone and Skyways Alliance, and the ground earth stations of the two consortia back each other up to assure the delivery of ARINC messages.

For further information about Inmarsat aeronautical services, please contact:
Customer Care Centre, Inmarsat, phone +44 171 728 1100, fax +44 171 728 1110, e-mail information@inmarsat.org

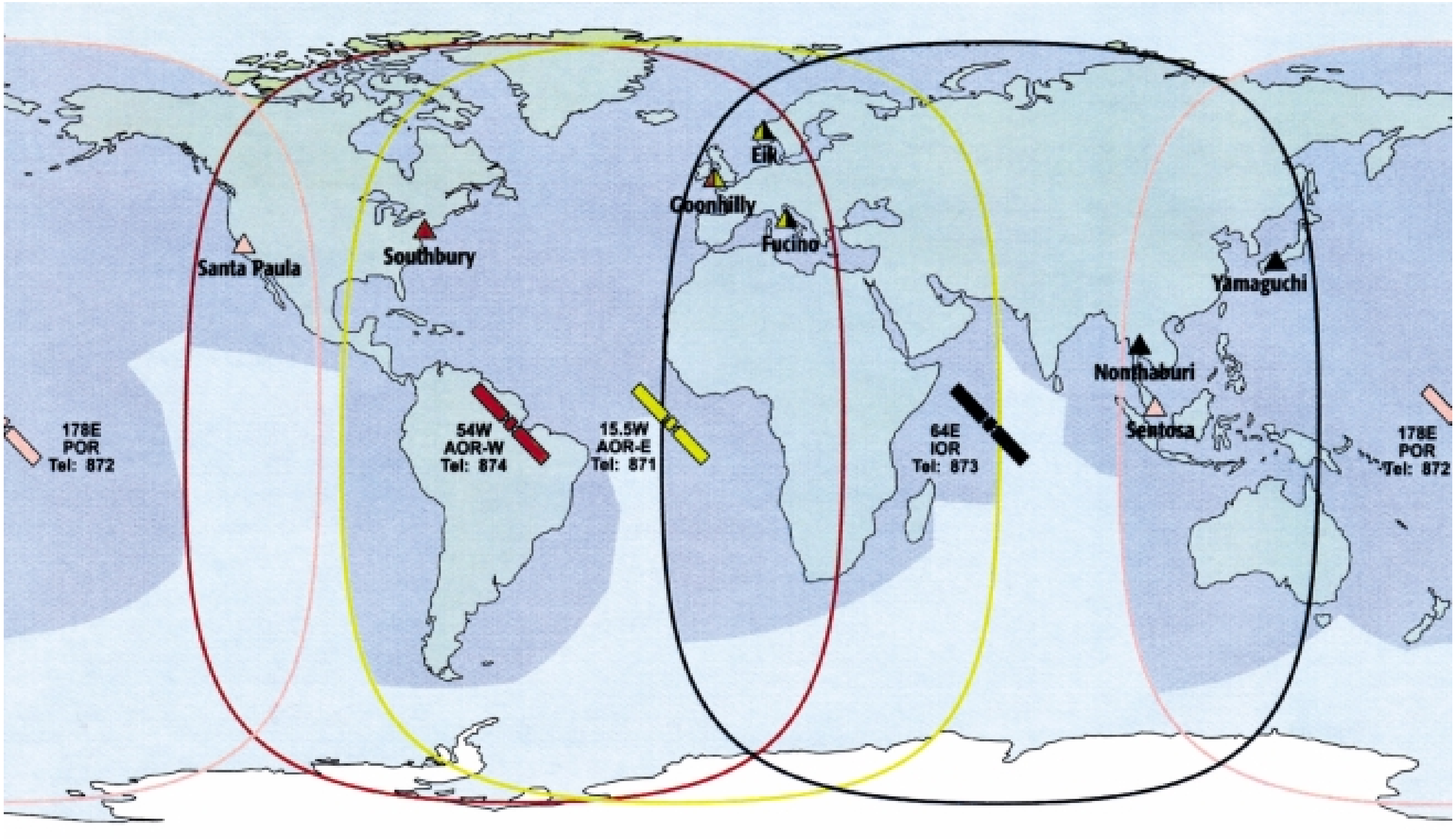
INMARSAT

Aeronautical Services Portfolio

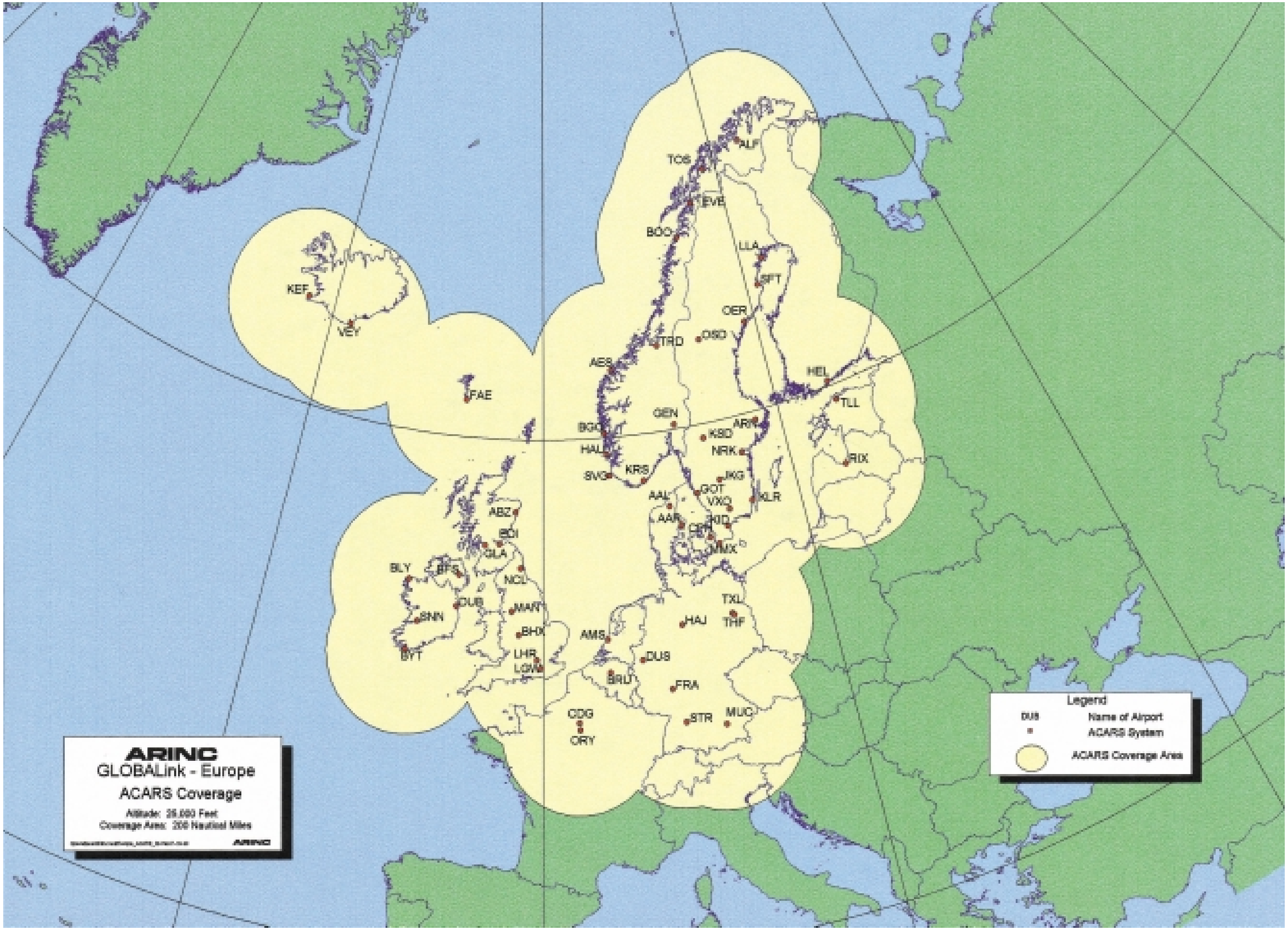
	mini-M aero	Aero-C	Aero-L	Aero-I	Aero-H	Aero-H+
Description	Voice, fax and circuit data. Single channel.	Store and forward text messaging. Single channel.	Packet mode data. Safety services. Single channel.	Spot beam voice, fax and circuit mode data. Global beam packet data. Safety services. Multi-channel.	Global beam voice, fax and data. Safety services. Multi-channel.	Global and spot beam voice fax and data. Safety services. Multi-channel.
Antenna Gain:						
High (12dBi)	-	-	-	-	✓	✓
Intermediate (6dBi)	✓	-	-	✓	-	-
Low (0dBi)	-	✓	✓	-	-	-
Operation:						
Global beam	no	yes	yes	yes[2]	yes	yes
Spot beam	yes[1]	no	no	yes[3]	no	yes
Voice service?	yes	no	no	yes[2]	yes	yes
Voice Codec (bps)	4800			4800	9600	4800/9600[4]
Packet Mode Data?	no	yes[5]	yes	yes	yes	yes
Data Rates		600 bps[5]	600/1200 bps	600 bps to 4.8 kbps	600 to 10.5 kbps 32 kbps proposed[6]	600 to 10.5 kbps 32 kbps proposed[6]
Circuit Mode Data?	yes	no	no	yes	yes	yes
Data Rates	2.4/4.8 kbps			2.4/4.8 kbps	4.8/9.6 kbps 64 kbps proposed[6]	4.8/9.6 kbps 64 kbps proposed[6]
Safety Services? (ICAO SARPS)	no	no	yes	yes	yes	yes
Number of Channels	1	1	1	1-7	1-11	1-11

Notes: 1 - Inmarsat mini-M Phone coverage; 2 - Packet data and emergency voice via global beam; 3 - Inmarsat Aero spot beam coverage; 4 - 9600 bps codec in global beam only; 5 - Store and forward data messaging only; 6 - User data rate

GLOBALink/Satellite Coverage



GLOBALink℠/HF Service Coverage - 1Q2000


ARINC
GLOBALink - Europe
ACARS Coverage
Altitude: 25,000 Feet
Coverage Area: 200 Nautical Miles
Legend
DUS Name of Airport
ACARS System
ACARS Coverage Area
KEF
VEY
FAE
TOS
ALF
EVE
BOO
LLA
SFT
OER
TRD
OSD
AES
HEL
TLL
GEN
ARN
BGO
KSD
HAU
NRK
RIX
SVG
KRS
JKG
AAL
GOT
VXO
XLR
AAR
KID
CPH
MMX
ABZ
EDI
GLA
BLY
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NCL
DUB
MAN
SNN
BHX
AMS
TXL
HAJ
THF
SYT
LHR
LGW
DUS
BRU
FRA
CDG
ORY
STR
MUC

B) ARINC

GLOBALink/VHF - Europe Operational Locations Base Frequency 136.925 * North Atlantic Stations 131.55 CPS Address: DDLXCXA				
Station Code	**Country**	**Station**	**Latitude**	**Longitude**
BRU	Belgium	Brussels (National)	50.9017	4.4983
CPH (A)	Denmark	Copenhagen (Kastrup)	55.6117	12.6417
CPH (B)	Denmark	Copenhagen (Kastrup)	55.6117	12.6417
AAR	Denmark	Aarhus	56.3017	10.6183
AAL	Denmark	Aalborg	57.0933	9.8483
TLL	Estonia	Tallinn (Ulemiste)	59.4133	24.8317
*FAE	Faroe Islands	Vestmann	62.0433	7.1933
HEL	Finland	Helsinki (Vantaa)	60.3267	24.9717
CDG	France	Paris-Charles de Gaulle	49.0083	2.5567
ORY	France	Paris (Orly)	48.7233	2.3800
FRA	Germany	Frankfurt (Main)	50.0317	8.5700
MUC	Germany	Munich (Munchen)	48.3533	11.7867
TXL	Germany	Berlin (Tegel)	52.5617	13.2900
DUS	Germany	Duesseldorf	51.2867	6.7700
STR	Germany	Stuttgart (Echterding)	48.6883	9.2100
THF	Germany	Berlin (Tempelhof)	52.4717	13.4050
HAJ	Germany	Hannover	52.4617	9.6850
*KEF	Iceland	Keflavik (Þorbjörn)	63.9850	22.6050
*VEY	Iceland	Háfell	63.4433	18.8667
DUB	Ireland	Dublin	53.4267	6.2533
Enroute	Ireland	Dooncarton	54.2733	9.8183
BYT	Ireland	Mt. Gabriel	51.5574	9.5417
SNN	Ireland	Shannon	52.7125	8.9022
RIX	Latvia	Riga	56.9233	23.9717
AMS	Netherlands	Amsterdam (Schiphol)	52.3083	4.7633
BFS	Northern Ireland (UK)	Belfast (Aldergrove)	54.6583	6.2150
GEN (A)	Norway	Oslo (Gardermoen)	59.8967	10.6183
GEN (B)	Norway	Oslo (Gardermoen)	59.8967	10.6183
BOO	Norway	Bodo	67.2700	14.3717
EVE	Norway	Evenes	68.4917	16.6783
SVG	Norway	Stavanger (Sola)	58.8767	5.6367
TRD	Norway	Trondheim (Vaernes)	63.4583	10.9367
BGO	Norway	Bergen (Flesland)	60.2933	5.2167
TOS	Norway	Tromso	69.6833	18.9200
HAU	Norway	Haugesund (Karmoy)	59.3383	5.2083
ALF	Norway	Alta	69.9767	23.3700
KRS	Norway	Kristiansand	63.1183	7.8100
AES	Norway	Alesund	62.5500	6.0366
ARN (A)	Sweden	Stockholm (Arlanda)	59.6567	17.9333
ARN (B)	Sweden	Stockholm (Arlanda)	59.6567	17.9333
GOT	Sweden	Goteborg (Landvetter)	57.6650	12.2800
MMX	Sweden	Malmo (Sturup)	55.5300	13.3717
KLR	Sweden	Kalmar	56.6833	16.2883
VXO	Sweden	Vaxjo (Kronoberg)	56.9283	14.7250
KSD	Sweden	Karlstad	59.3600	13.4667
SFT	Sweden	Skelleftea	64.6233	21.0800
JKG	Sweden	Jonkoping	57.7567	14.0700

GLOBALink/VHF - Europe Operational Locations Base Frequency 136.925 * North Atlantic Stations 131.55 CPS Address: DDLXCXA				
Station Code	**Country**	**Station**	**Latitude**	**Longitude**
KID	Sweden	Kristianstad	55.9200	14.0867
LLA	Sweden	Lulea (Kallax)	65.5417	22.1250
NRK	Sweden	Norrkoping (Kungsangen)	58.5833	16.2517
OSD	Sweden	Ostersund (Froson)	63.1950	14.5000
OER	Sweden	Ornskoldsvik	63.4100	18.9900
LHR	United Kingdom	London (Heathrow)	51.4717	0.4533
LHR	United Kingdom	London (Heathrow)	51.4717	0.4533
GLA	United Kingdom	Glasgow Scotland (Abbotsichn)	55.8717	4.4317
LGW	United Kingdom	London (Gatwick)	51.1600	0.1783
BHX	United Kingdom	Birmingham	52.4533	1.7467
MAN	United Kingdom	Manchester	53.3533	2.2733
ABZ	United Kingdom	Aberdeen (Dyce)	57.2033	2.2000
NCL	United Kingdom	Newcastle	55.0367	1.6917
EDI	United Kingdom	Edinburgh	55.9533	3.3617


ARINC
GLOBALink - North America
ACARS Coverage
Altitude: 25,000 Feet
Coverage Area: 200 Nautical Miles
Legend
Name of Airport
ACARS System
ACARS Coverage Area

GLOBALink/VHF - North America
Base Frequency: 131.550 MHz
CPS Address: DDLXCXA

STATION CODE	CITY	STATE/COUNTRY	LAT	LONG
ABE	Allentown/Bethlehem	Pennsylvania	40.6530	-75.4400
ABI	Abilene	Texas	32.4113	-99.6818
ABQ	Albuquerque	New Mexico	35.0409	-106.6081
ABY	Albany	Georgia	31.5353	-84.1946
ACA	Acapulco	Guerrero	16.7567	-99.7533
ACT	Waco	Texas	31.6110	-97.2280
ACV	Eureka/Arcata (Eureka)	California	40.9783	-124.1070
ACY	Atlantic City (Int'l)	New Jersey	39.4575	-74.5776
ADK	Adak Island	Alaska	51.8800	-176.6433
AFW	Dallas/Ft. Worth (Alliance)	Texas	32.9885	-97.3177
AGS	Augusta	Georgia	33.3698	-81.9647
AKN	King Salmon	Alaska	58.6783	-156.6467
ALB	Albany	New York	42.7480	-73.8034
ALS	Alamosa	Colorado	37.4349	-105.8663
AMA	Amarillo	Texas	35.2193	-101.7055
ANC	Anchorage (Int'l)	Alaska	61.1750	-149.9933
APF	Naples	Florida	26.1510	-81.7760
ATL	Atlanta	Georgia	33.6403	-84.4270
ATW	Appleton	Wisconsin	44.2574	-88.5194
AUS	Austin	Texas	30.2984	-97.7014
AVL	Asheville	North Carolina	35.4361	-82.5200
AVP	Wilkes Barre/Scranton	Pennsylvania	41.3381	-75.7246
AZO	Kalamazoo	Michigan	42.2348	-85.5521
BDA	Hamilton	Bermuda	32.3650	-64.6783
BDL	Hartford (Bradley Int'l)	Connecticut	41.9387	-72.6836
BET	Bethel	Alaska	60.4648	161.5012
BFI	Seattle (Boeing Field Int'l)	Washington	47.5302	-122.3007
BFL	Bakersfield	California	35.3286	-118.9970
BFM	Brookley Field	Alabama	30.6555	-88.0777
BGM	Binghampton	New York	42.2084	-75.9800
BGR	Bangor	Maine	44.8074	-68.8286
BHM	Birmingham	Alabama	33.5637	-86.7545
BIL	Billings	Montana	45.8084	-108.5432
BIS	Bismark	North Dakota	46.7740	-100.7474
BJX	Leon-Guanajuato	Mexico	20.9933	-101.4816
BLI	Bellingham	Washington	48.7939	-122.5371
BNA	Nashville	Tennessee	36.1254	-86.6764
BOI	Boise	Idaho	43.5651	-116.2243
BOS	Boston (Logan Int'l)	Massachusetts	42.3642	-71.0057
BTM	Butte	Montana	45.9534	-112.4934
BTR	Baton Rouge	Louisiana	30.533	-91.1495
BTV	Burlington	Vermont	44.4714	-73.1532
BUF	Buffalo	New York	42.9405	-78.7324
BUR	Burbank	California	34.2006	-118.3580
BWI	Baltimore (Int'l)	Maryland	39.1753	-76.6685
BZE	Belize City	Belize	17.5380	-88.3060

GLOBALink/VHF - North America Base Frequency: 131.550 MHz CPS Address: DDLXCXA				
STATION CODE	**CITY**	**STATE/COUNTRY**	**LAT**	**LONG**
BZN	Bozeman	Montana	45.8036	-111.1367
CAE	Columbia	South Carolina	33.9403	-81.1195
CAK	Akron/Canton	Ohio	40.8533	-81.3214
CDB	Cold Bay	Alaska	55.2067	-162.7217
CHA	Chattanooga	Tennessee	35.1875	-85.1778
CHO	Charlottesville	Virginia	38.1384	-79.4531
CHS	Charleston	South Carolina	32.8985	-80.0407
CID	Cedar Rapids/Iowa City	Iowa	41.8846	-91.7107
CLE	Cleveland (Hopkins Int'l)	Ohio	41.4108	-81.8495
CLT	Charlotte	North Carolina	35.2144	-80.9436
CMH	Columbus (Port Columbus Int'l)	Ohio	39.9833	-83.0236
CMI	Champaign	Illinois	40.0396	-88.2776
COS	Colorado Springs	Colorado	38.8744	-104.4094
CPR	Casper	Wyoming	42.9082	106.4630
CRP	Corpus Christi	Texas	27.7701	-97.5009
CRW	Charleston	West Virginia	38.3731	-81.5933
CSG	Columbus	Georgia	32.5160	-84.9390
CUN	Cancun	Quintana Roo	21.0350	-86.8783
CUU	Chihuahua	Mexico	28.7033	-105.9650
CVG	Cincinnati (Cin/N.Kentucky Int'l)	Ohio	39.0461	-84.6605
DAB	Daytona Beach	Florida	29.1807	-81.0560
DAL	Dallas/Ft. Worth (Love Field)	Texas	32.8471	-96.8518
DAY	Dayton (James Cox Dayton Int'l)	Ohio	39.9023	-84.2194
DCA	Washington (Washington National)	District Of Columbia	38.8522	-77.0379
DEC	Decatur	Illinois	39.8346	-88.8664
DEN	Denver (Int'l)	Colorado	39.8550	-104.6731
DFW	Dallas/Ft. Worth (Int'l)	Texas	32.8963	-97.0412
DLH	Duluth	Minnesota	46.8417	-92.1933
DSM	Des Moines	Iowa	41.5349	-93.6605
DTW	Detroit (Wayne County)	Michigan	42.2152	-83.3487
DUT	Dutch Harbor	Alaska	53.9000	-166.5433
EFD	Houston (Ellington Field)	Texas	29.6071	-95.1586
EGE	Vail (Eagle Airport)	Colorado	39.6425	-106.9171
EKO	Elko	Nevada	40.8251	-115.7903
ELM	Elmira	New York	42.1595	-76.8918
ELP	El Paso	Texas	31.8066	-106.3773
ELY	Ely	Nevada	39.2997	-114.8410
ERI	Erie	Pennsylvania	42.0819	-80.1764
EUG	Eugene	Oregon	44.1219	-123.2175
EVV	Evansville	Indiana	38.0379	-87.5306
EWN	New Bern	North Carolina	35.0721	-77.0438
EWR	Newark (Int'l)	New Jersey	40.6929	-74.1689
EYW	Key West	Florida	24.5557	-81.7597
FAI	Fairbanks (Int'l)	Alaska	64.8327	-147.8556
FAR	Fargo	North Dakota	46.9157	-96.8145
FAT	Fresno	California	36.7762	-119.7170
FAY	Fayetteville	North Carolina	34.9913	-78.8803

GLOBALink/VHF - North America Base Frequency: 131.550 MHz CPS Address: DDLXCXA				
STATION CODE	CITY	STATE/COUNTRY	LAT	LONG
FCA	Kalispell/Glacier Nat'l Park	Montana	48.1786	-114.3028
FLL	Ft. Lauderdale (Int'l)	Florida	26.0722	-80.1530
FNT	Flint	Michigan	42.9655	-83.7435
FSD	Sioux Falls	South Dakota	43.4575	-96.8017
FVE	Frenchville	Maine	47.1202	-68.2730
FWA	Fort Wayne	Indiana	40.9784	-85.1948
FYV	Fayetteville	Arkansas	36.0050	-94.1690
GDL	Guadalajara	Jalisco	20.5350	-103.3217
GDT	Grand Turk	West Indies	21.4450	-71.1416
GEG	Spokane (Int'l)	Washington	47.6100	-117.5328
GFK	Grand Forks	North Dakota	47.9493	-97.1757
GJT	Grand Junction	Colorado	39.1224	-108.5261
GNR	Green River (Non-Airport)	Utah	39.9614	-110.2267
GNV	Gainesville	Florida	29.6898	-82.2719
GPT	Gulfport	Mississippi	30.4380	-89.0600
GRB	Green Bay	Wisconsin	44.4851	-88.1287
GRR	Grand Rapids	Michigan	42.8826	-85.5239
GSO	Greensboro (Piedmont Triad Int'l)	North Carolina	36.1708	-79.7958
GSP	Greenville/Spartanburg	South Carolina	34.8990	-82.2139
GTF	Great Falls	Montana	47.4821	-111.3699
GUA	Guatemala City	Guatemala	14.5830	-90.5280
GUC	Gunnison	Colorado	38.5340	-106.9326
GUM	Guam (Agana Field)	Guam	13.4817	144.7933
HDN	Steamboat Springs (Hayden)	Colorado	40.4812	-107.2170
HHH	Hilton Head Island	South Carolina	32.2241	-80.6976
HLK	Haleakala (Non-Airport)	Hawaii	20.7117	-156.2592
HLN	Helena	Montana	46.6068	-111.9819
HMO	Hermosillo	Sonora	29.0970	-111.0480
HNL	Honolulu, Oahu	Hawaii	21.3218	-157.9252
HOU	Houston (Hobby)	Texas	29.6451	-95.2786
HPN	Westchester County/White Plains	New York	41.0669	-73.7080
HRL	Harlingen	Texas	26.2282	-97.6541
HSV	Huntsville/Decatur	Alabama	34.6412	-86.7740
HTS	Huntington	West Virginia	38.3666	-82.5581
HVN	New Haven	Connecticut	41.2637	-72.8872
IAD	Washington (Dulles)	District Of Columbia	38.9446	-77.4561
IAH	Houston (Intercontinental)	Texas	29.9802	-95.3395
ICT	Wichita	Kansas	37.6499	-97.4327
IDA	Idaho Falls	Idaho	43.5164	-112.0671
ILM	Wilmington	North Carolina	34.2704	-77.9029
IND	Indianapolis	Indiana	39.7199	-86.2868
INT	Winston/Salem (Smith-Reynolds)	North Carolina	36.1335	-80.2222
ISP	Long Island Macarthur (Islip-Bohemia	New York	40.7945	-73.1001
ITH	Ithaca	New York	42.4902	-76.4577
IXD	Olathe	Kansas	38.8317	-94.8896
JAC	Jackson Hole	Wyoming	43.6066	-110.7374
JAN	Jackson	Mississippi	32.3110	-90.0758

GLOBALink/VHF - North America Base Frequency: 131.550 MHz CPS Address: DDLXCXA				
STATION CODE	**CITY**	**STATE/COUNTRY**	**LAT**	**LONG**
JAX	Jacksonville (Int'l)	Florida	30.4925	-81.6899
JFK	New York (John F. Kennedy Int'l)	New York	40.6401	-73.7783
KOA	Kona, Hawaii	Hawaii	19.7388	-156.0456
KTN	Ketchikan (Int'l)	Alaska	54.9180	-130.8410
LAN	Lansing	Michigan	42.7787	-84.5874
LAS	Las Vegas (Mccarran Int'l)	Nevada	36.0805	-115.1503
LAX	Los Angeles (Int'l)	California	33.9425	-118.4072
LBB	Lubbock	Texas	33.6636	-101.8223
LCK	Columbus	Ohio	39.8143	-82.9265
LEX	Lexington	Kentucky	38.0369	-84.6054
LFT	Lafayette	Louisiana	30.2051	-91.9875
LGA	New York (La Guardia)	New York	40.7771	-73.8730
LGB	Long Beach	California	33.8177	-118.1510
LIT	Little Rock	Arkansas	34.7289	-92.2244
LMT	Klamath Falls	Oregon	42.1562	-121.7320
LNK	Lincoln	Nebraska	40.8508	-96.7589
LRD	Laredo	Texas	27.5446	-99.6818
LSE	La Crosse	Wisconsin	43.8792	-91.2562
LVS	Las Vegas (Non-Airport)	New Mexico	35.6187	-105.2240
LYH	Lynchburg	Virginia	37.3267	-79.2006
MAF	Midland/Odessa	Texas	31.9424	-102.201
MBS	Saginaw	Michigan	43.4333	-84.8639
MCG	Mc Grath	Alaska	62.9533	-155.6033
MCI	Kansas City (Int'l)	Missouri	39.2992	-94.7178
MCK	Mc Cook	Nebraska	40.2064	-100.5914
MCO	Orlando (Int'l)	Florida	28.4286	-81.3162
MDO	Middleton Island (Non-Airport)	Alaska	59.4300	-146.3380
MDT	Harrisburg/Middletown (Int'l)	Pennsylvania	40.1934	-76.7637
MDW	Chicago (Midway)	Illinois	41.7861	-87.7522
MEM	Memphis	Tennessee	35.0476	-89.9786
MEX	Mexico City (Juarez)	Mexico	19.4350	-99.0750
MFE	Mc Allen	Texas	26.1754	-98.2382
MFR	Medford	Oregon	42.3724	-122.8714
MGM	Montgomery	Alabama	32.3004	-86.3940
MHT	Manchester	New Hampshire	42.9334	-71.4382
MIA	Miami	Florida	25.7927	-80.2906
MKE	Milwaukee (General Mitchell)	Wisconsin	42.9468	-87.8969
MLB	Melbourne	Florida	28.1025	-80.6460
MLI	Moline	Illinois	41.4600	-90.4928
MLU	Monroe	Louisiana	32.5107	-92.0375
MMU	Morristown	New Jersey	40.7992	-74.4153
MOB	Mobile	Alabama	30.6912	-88.2428
MOT	Minot	North Dakota	48.2594	-101.2808
MQT	Marquette	Michigan	49.3535	-87.3957
MRY	Monterey	California	36.5870	-121.8420
MSN	Madison	Wisconsin	43.1395	-89.3370
MSO	Missoula	Montana	46.9164	-114.0896

GLOBALink/VHF - North America Base Frequency: 131.550 MHz CPS Address: DDLXCXA				
STATION CODE	**CITY**	**STATE/COUNTRY**	**LAT**	**LONG**
MSP	Minneapolis/St. Paul (St. Paul Int'l)	Minnesota	44.8842	-93.2149
MSY	New Orleans	Louisiana	29.9932	-90.2579
MTY	Monterrey	Nuevo Leon	25.7783	-100.1067
MWH	Moses Lake	Washington	47.2078	-119.319
MYR	Myrtle Beach	South Carolina	33.6689	-78.9186
MZT	Mazatlan	Sinaloa	23.1600	-106.2630
NAS	Nassau	New Providence	25.0416	-77.4771
OAJ	Jacksonville	North Carolina	34.8291	-77.6121
OAK	Oakland	California	37.8167	-122.3000
OGG	Kahului, Maui	Hawaii	20.8986	-156.4305
OIA	Gc19-Boxer Platform	Gulf Of Mexico	27.9460	-90.9970
OKC	Oklahoma City	Oklahoma	35.3930	-97.6004
OMA	Omaha	Nebraska	41.3021	-95.9834
ONT	Ontario	California	33.0560	-117.6000
ORD	Chicago (O'hare Int'l)	Illinois	41.9786	-87.9044
ORF	Norfolk	Virginia	36.8944	-76.2016
OTZ	Kotzebue	Alaska	66.8847	-162.5985
PAE	Everett (Paine Field)	Washington	47.9078	-122.2803
PBC	Puebla	Mexico	19.1567	-98.3717
PBI	West Palm Beach	Florida	26.6829	-80.0959
PDX	Portland	Oregon	45.5889	-122.5963
PFN	Panama City	Florida		
PHF	Newport News	Virginia	37.1317	-76.4933
PHL	Philadelphia (Int'l)	Pennsylvania	39.8703	-75.2454
PHX	Phoenix (Sky Harbor Int'l)	Arizona	33.4361	-112.0088
PIA	Peoria	Illinois	40.6647	-89.6916
PIT	Pittsburgh (Int'l)	Pennsylvania	40.4915	-80.2327
PNS	Pensacola	Florida	30.4731	-87.1875
PSC	Pasco	Washington	46.2648	-119.1179
PSP	Palm Springs	California	33.8281	-116.5050
PTY	Panama City	Panama	9.0720	-79.3830
PVD	Providence	Rhode Island	41.7249	-71.4284
PVR	Puerto Vallarta	Jalisco	20.6717	-105.2483
PWK	Chicago (Pal-Waukee)	Illinois	42.1133	-87.9008
PWM	Portland	Maine	43.6461	-70.3092
RAP	Rapid City	South Dakota	44.0453	-103.0560
RDD	Redding	California	40.5091	-122.2923
RDU	Raleigh-Durham	North Carolina	35.8775	-78.7877
RFD	Rockford	Illinois	42.1962	-89.0926
RIC	Richmond	Virginia	37.5050	-77.3100
RKS	Rock Springs	Wyoming	41.5942	-108.0644
RNO	Reno	Nevada	39.4991	-119.7672
ROA	Roanoke	Virginia	37.3253	-79.9757
ROC	Rochester	New York	43.1188	-77.6727
RSW	Fort Myers (S.W. Florida Regional)	Florida	26.5864	-81.8636
SAN	San Diego (Lindberg Field)	California	32.7335	-117.1867
SAP	San Pedro Sula	Honduras	15.4510	-87.9250

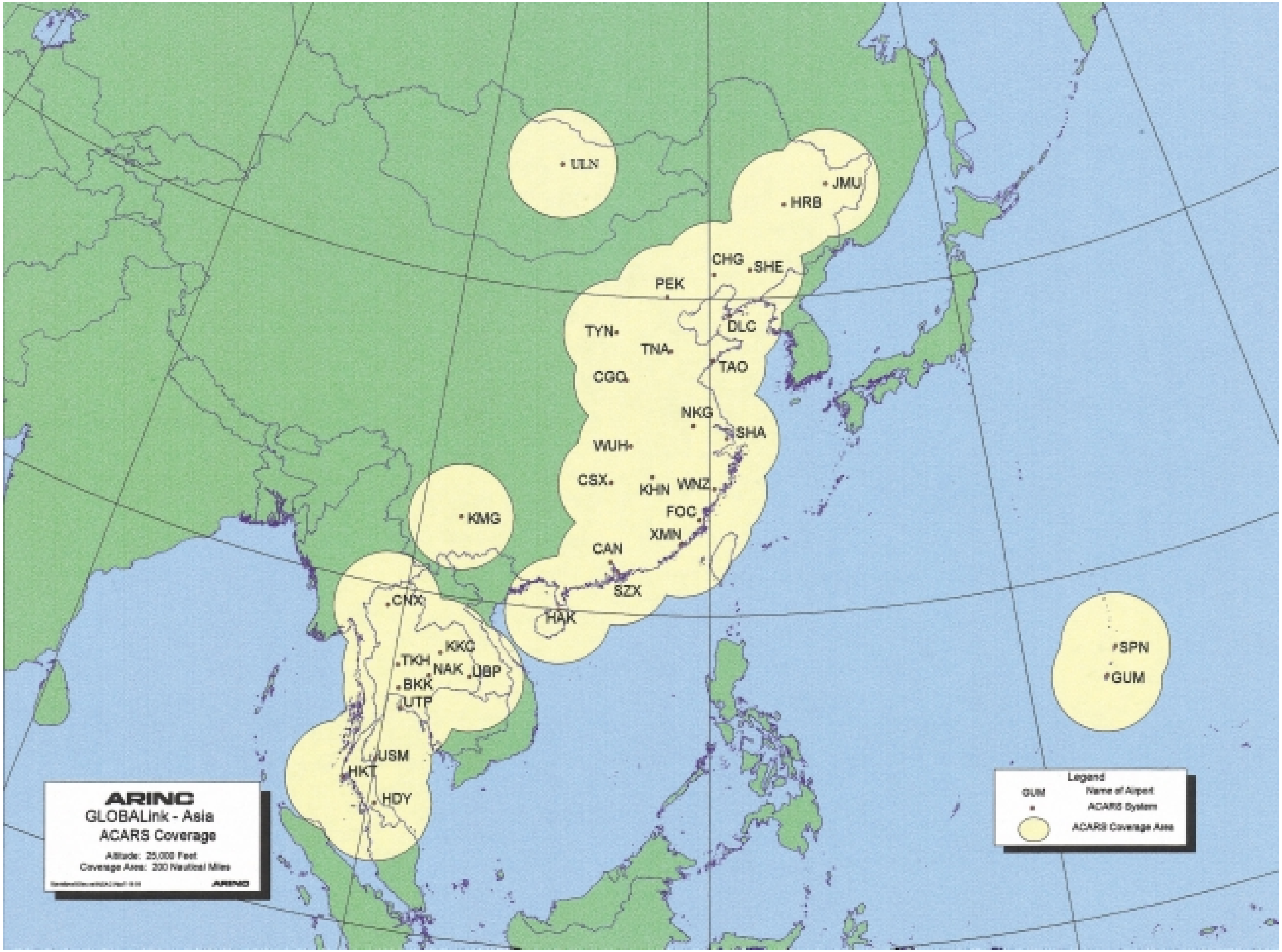
GLOBALink/VHF - North America Base Frequency: 131.550 MHz CPS Address: DDLXCXA				
STATION CODE	CITY	STATE/COUNTRY	LAT	LONG
SAT	San Antonio	Texas	29.4695	-98.5334
SAV	Savannah	Georgia	32.1274	-81.2026
SBA	Santa Barbara	California	34.4262	-119.8390
SBN	South Bend	Indiana	41.7072	-86.3177
SBP	San Luis Obispo	California	35.2371	-120.6414
SBY	Salisbury	Maryland	38.3404	-75.5106
SDF	Louisville	Kentucky	38.1747	-85.7364
SEA	Seattle (Seattle/Tacoma Int'l)	Washington	47.4492	-122.3081
SFO	San Francisco (Int'l)	California	37.6191	-122.3738
SGF	Springfield	Missouri	37.2443	-93.3867
SHV	Shreveport	Louisiana	32.4465	-93.8254
SJC	San Jose	California	37.3616	-121.9276
SJD	San Jose Del Cabo	Mexico	23.1570	-109.7230
SJO	San Jose	Costa Rica	9.9930	-84.2110
SJU	San Juan (Luis Munoz Marin Int'l)	Puerto Rico	18.4517	-66.0001
SLC	Salt Lake City	Utah	40.7868	-111.9680
SMF	Sacramento (Metropolitan)	California	38.6955	-121.5900
SNA	Orange County/Santa Ana	California	33.6756	-117.8673
SNP	St. Paul Island	Alaska	57.1633	-170.2183
SPI	Springfield	Illinois	39.8437	-89.6771
SPN	Saipan	Mariana Islands	15.1203	145.7303
SPS	Wichita Falls	Texas	33.9863	-98.4980
SRQ	Sarasota/Bradenton	Florida	27.395	-82.5543
STL	St. Louis	Missouri	38.7476	-90.3599
STT	St. Thomas	Virgin Islands	18.3583	-65.025
STX	St. Croix	Virgin Islands	17.7016	-64.4798
SUX	Sioux City	Iowa	42.4039	-96.3834
SVC	Silver City	New Mexico	32.6363	-108.1541
SWF	Newburgh	New York	41.5040	-74.1053
SYA	Shemya Island	Alaska	52.7183	174.0621
SYR	Syracuse	New York	43.1111	-76.1067
TAM	Tampico	Mexico	22.2980	-97.6880
TEB	Teterboro	New Jersey	40.8500	-74.0613
TLH	Tallahassee	Florida	30.3963	-84.3504
TOL	Toledo	Ohio	41.5867	-83.8079
TPA	Tampa/St. Petersburg (Tampa Int'l)	Florida	27.9752	-82.5334
TPH	Tonopah	Nevada	38.0581	-117.0886
TRI	Bristol/Johnson/Kingsport (Tri-City)	Tennessee	36.4751	-82.4076
TUL	Tulsa	Oklahoma	36.1983	-95.8880
TUS	Tucson	Arizona	32.1162	-110.9406
TVC	Traverse City	Michigan	44.7408	-85.5824
TYR	Tyler	Texas	32.3540	-95.4021
TYS	Knoxville	Tennessee	35.9638	-83.8738
UNV	State College	Pennsylvania	40.8488	-77.8496
VER	Vera Cruz	Mexico		
VPS	Ft. Walton Beach	Florida	30.4061	-86.8291
VSA	Villahermosa	Mexico	17.9970	-92.8130

GLOBALink/VHF - North America
Base Frequency: 131.550 MHz
CPS Address: DDLXCXA

STATION CODE	CITY	STATE/COUNTRY	LAT	LONG
WMS	Williams Mountain (Non-Airport)	Arizona	35.1950	-112.2083
YAK	Yakutat	Alaska	59.5400	-139.7350
YBK	Baker Lake	Northwest Territory	64.3144	-96.0647
YDQ	Dawson Creek	British Columbia	55.7416	-120.1827
YEG	Edmonton (Int'l)	Alberta	53.3097	-113.5786
YFB	Iqaluit (Frobisher Bay)	Northwest Territory	63.7389	-68.5569
YGH	Ft. Good Hope	Northwest Terratory	66.2625	-128.6214
YGL	La Grande Riviere	Quebec	53.6320	-77.7080
YHM	Hamilton	Canada	43.1719	-79.9314
YHY	Hay River	Northwest Territory	60.7560	-115.7080
YHZ	Halifax (Int'l)	Nova Scotia	44.8808	-63.5092
YIF	St. Augustin	Quebec	51.1412	-58.3830
YKL	Schefferville	Quebec	54.8210	-66.0760
YMA	Mayo, YT	Yukon Territory	63.9172	-135.3903
YMM	Ft. McMurray	Alberta	56.6539	-111.3361
YMT	Chibougamau	Quebec	49.9486	-74.3439
YMX	Montreal (Mirabel)	Quebec	45.6744	-73.9919
YOW	Ottawa	Ontario	45.3225	-75.6694
YPL	Pickle Lake	Ontario	51.4464	-90.2167
YQH	Watson Lake	Yukon Territory	60.1770	-128.8460
YQR	Regina	Saskatchewan	50.4328	-104.6544
YQY	Sydney	Nova Scotia	46.6167	-60.0492
YSF	Stony Rapids	Saskatchewan	59.2503	-105.8414
YTH	Thompson	Manitoba	55.8011	-97.8639
YUL	Montreal (Dorval)	Quebec	45.4681	-73.7417
YVC	La Ronge	Saskatchewan	55.1394	-105.2697
YVP	Kuujjuaq	Quebec	58.0575	-68.4956
YVR	Vancouver (Int'l)	British Columbia	49.1942	-123.1831
YWG	Winnipeg	Manitoba	49.9108	-97.2431
YXE	Saskatoon	Canada	52.1708	106.6997
YXJ	Fort St. John	British Columbia		
YYC	Calgary	Alberta	51.1139	-114.0109
YYU	Kapuskasing	Ontario	49.4158	-82.4008
YYZ	Toronto (Pearson Int'l)	Ontario	43.6772	-79.6308
YZT	Port Hardy	British Columbia	50.6380	-128.1170
YZV	Sept-Iles	Quebec	50.2181	-66.2486

B) ARINC

GLOBALink/VHF-South America (planned coverage) Base Frequency: 131.550 MHz		
STATION CODE	CITY	STATE/COUNTRY
EZE	Buenos Aires	Argentina
ASU	Asuncion	Paraguay
BAQ	Barranquilla	Colombia
BOG	Bogata	Colombia
CCS	Caracas	Venezuela
CLO	Cali	Colombia
GYE	Guayaquil	Ecuador
LIM	Lima	Peru
LPB	La Paz	Bolivia
MVD	Montevideo	Uruguay
SCL	Santiago	Chile
UIO	Quito	Ecuador


ULN
JMU
HRB
CHG
SHE
PEK
DLC
TYN
TNA
TAO
CGO
NKG
SHA
WUH
CSX
KHN
WNZ
FOC
KMG
XMN
CAN
SZX
CNX
HAK
KKC
TKH
NAK
UBP
BKK
UTP
USM
HKT
HDY
SPN
GUM
ARINC
GLOBALink - Asia
ACARS Coverage
Altitude: 25,000 Feet
Coverage Area: 200 Nautical Miles
Legend
GUM
Name of Airport
ACARS System
ACARS Coverage Area

GLOBALink/VHF - CHINA Provided in Partnership with Aviation Data Communication Corporation Base Frequency: 131.450 MHz CPS Address: BJSDLCA				
Station Code	City	State/Country	Latitude	Longitude
CAN	Guangzhou #1	China	23.1167	113.2547
CGO	Zhengzhou	China	34.7500	113.6714
CHG	Chaoyang	China	41.5417	120.4300
CSX	Changsha	China	28.2000	112.9714
DLC	Dalian	China	38.9167	121.6547
FOC	Fuzhou	China	26.0333	119.3047
HAK	Haikou	China	19.9833	110.0381
HRB	Harbin	China	45.7500	126.6547
JMU	Jiamusi	China	46.7850	130.4050
KHN	Nanchang	China	28.6833	115.8881
KMG	Kunming	China	25.0000	102.7500
NKG	Nanjing	China	31.9906	118.8117
PEK	Beijing	China	40.0664	116.6047
SHA	Shangai	China	31.2000	121.3381
SHE	Shenyang	China	41.8000	123.4547
SZX	Shenzhen	China	22.6450	113.8033
TAO	Qingdao	China	36.1000	120.3214
TYN	Taiyuan	China	37.8236	112.5578
WNZ	Wenzhou	China	27.9917	120.3603
WUH	Wuhan	China	30.5919	114.2436
XMN	Xiamen	China	24.5364	118.1233
TNA	Jinan	China	36.6667	117.0214

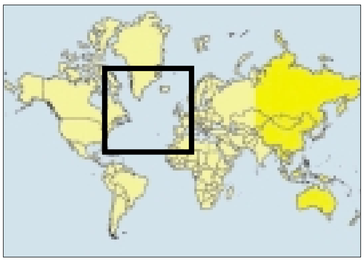
B) ARINC

GLOBALink/VHF - Thailand Provided Partnership with Aeronautical Radio of Thailand, Inc. Base Frequency 131.450 MHz CPS address: BKKXCXA				
STATION CODE	**CITY**	**STATE/COUNTRY**	**LATITUDE**	**LONGITUDE**
ULN	Ulaan-Baatar	Mongolia	47.8200	106.7400
SIN (A)	Singapore	Singapore	1.3547	103.9890
SIN (B)	Singapore	Singapore	1.3547	103.9890
BKK	Bangkok	Thailand	13.9117	100.6067
CNX	Chiang Mai	Thailand	18.5833	98.4950
HDY	Hat Yai	Thailand	6.9333	100.3950
HKT	Phuket	Thailand	8.1133	98.3167
NAK	Korat	Thailand	14.9367	102.0783
TKH	Nakhon Sawan	Thailand	15.6733	100.1367
UBP	Muang Ubon	Thailand	15.2500	104.8683
USM	Ko Samui Island	Thailand	9.4917	99.9950
UTP	Utapao	Thailand	12.8650	100.9750

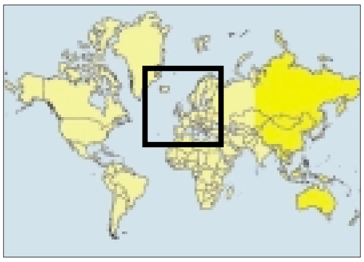

SITA *AIRCOM*
World Coverage

Atlantic Ocean

Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue



Europe, Eastern Europe, CIS, Middle-Est, North Africa



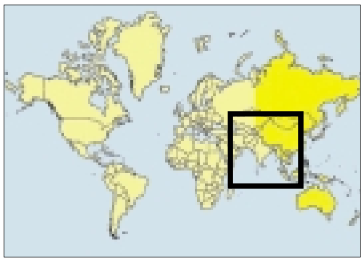
Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue

▼

Africa, Middle East

Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue

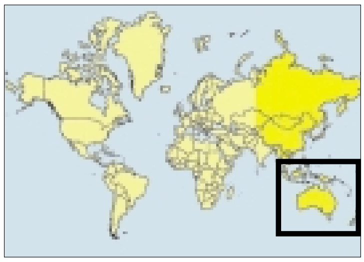
Middle East, India,Far-East, South East Asia



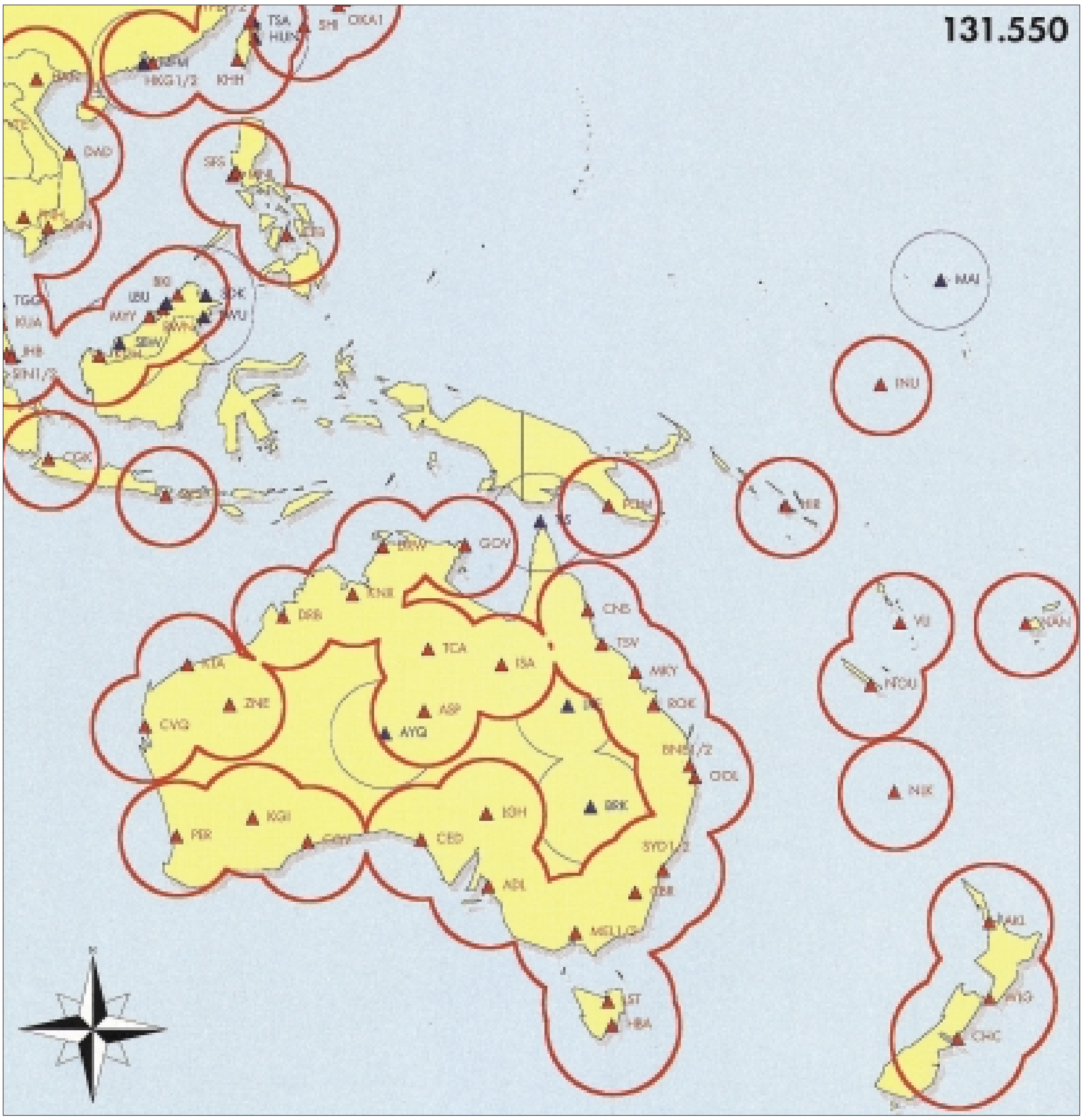
Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue

C) SITA

South Pacific

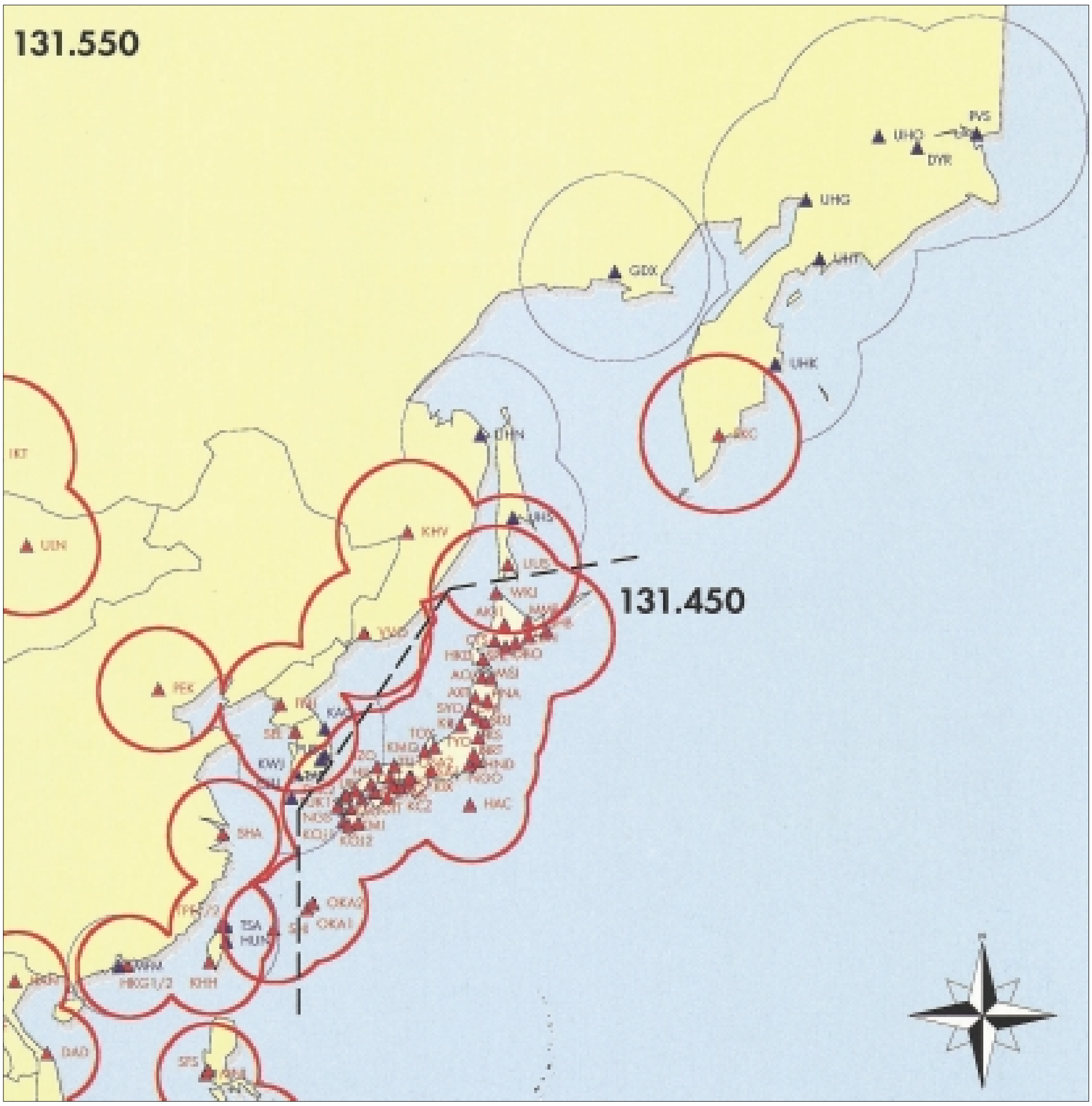


Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue

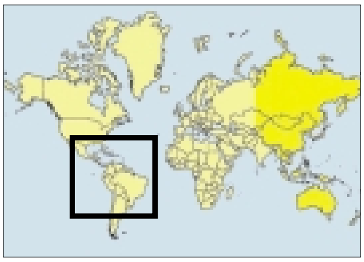


North Pacific, Asia, CIS

Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue



Latin Americas, Caribbean

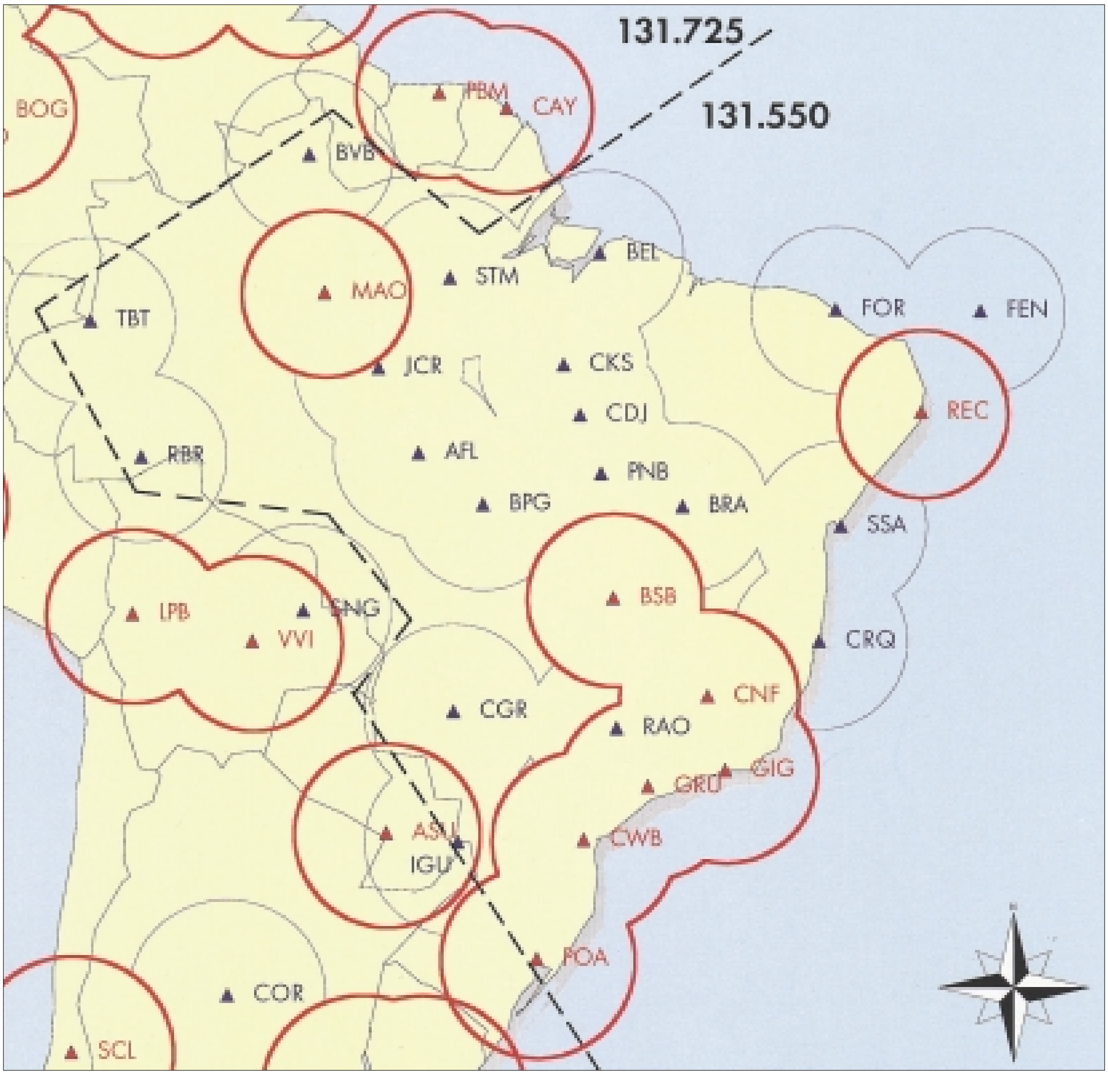


Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue

Brazil - DEPV

Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue

▼

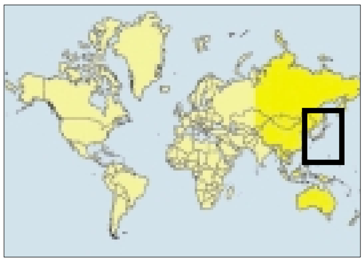


Europe
En-Route / Alternate and Terminal Frequencies

Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue

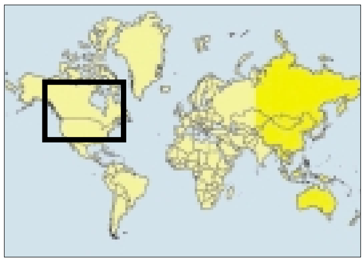
▼

Japan - Avicom through Inter-Networking Agreement



Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue

Canada - Air Canada through Inter-Networking Agreement



Altitude: 30 000 feet
On-Line RGS are in Red
Planned RGS are in Blue

RGS List

ABJ - BOD3

Code	City	Country	Provider	Frequency	Latitude	Longitude	On-Line
ABJ	Abidjan	Ivory Coast	SITA	131.725	0515N	0356W	✓
ABZ	Aberdeen	United Kingdom	SITA	131.725	5712N	0212W	✓
ACC	Accra	Ghana	SITA	131.725	0536N	0010W	✓
ADD	Addis Ababa	Ethiopia	SITA	131.725	0859N	3848E	
ADL	Adelaide	Australia	SITA	131.550	3457S	13832E	✓
AFL	Alta Floresta	Brazil	DEPV	131.550	0951S	5606W	
AGM1/2	Angmagssalik	Greenland	SITA	131.725	6540N	3720W	✓
AGP	Malaga	Spain	SITA	131.725	3640N	0430W	✓
AJA	Ajaccio	France	SITA	131.725	4155N	0848E	✓
AKJ1	Asahikawa	Japan	Avicom	131.450	4340N	14227E	✓
AKL	Auckland	New Zealand	SITA	131.550	3701S	17448E	✓
ALA	Almaty	Kazakhstan	SITA	131.725	4321N	7701E	
ALF	Alta	Norway	SITA	131.725	6959N	2322E	
ALG	Algiers	Algeria	SITA	131.725	3642N	0313E	✓
ALY	Alexandria	Egypt	SITA	131.725	3111N	2957E	
AMM	Amman	Jordan	SITA	131.725	3143N	3600E	✓
AMS1/2	Amsterdam/SPL	The Netherlands	SITA	131.725	5219N	0446E	✓
AMS3	Amsterdam/SPL	The Netherlands	SITA	131.525	5219N	0446E	✓
ANK	Ankara	Turkey	SITA	131.725	3957N	3241E	✓
ANU	Antigua	Antigua	SITA	131.725	1708N	6147W	✓
AOJ	Aomori	Japan	Avicom	131.450	4044N	14042E	✓
APW	Apia	Western Samoa	SITA	131.550	1349S	17200W	✓
ARH	Arkhangelsk	Russian Federation	SITA	131.725	6434N	4032E	
ARN	Stockholm Arlanda	Sweden	SITA	131.725	5939N	1755E	✓
ARN3	Stockholm Arlanda	Sweden	SITA	131.525	5939N	1755E	✓
ASB	Ashkhabad	Turkmenistan	SITA	131.725	3758N	5824E	
ASP	Alice springs	Australia	SITA	131.550	2349S	13354E	✓
ASU	Asuncion	Paraguay	SITA	131.725	2514S	5731W	✓
ATH	Athens	Greece	SITA	131.725	3754N	2344E	✓
AUA	Aruba	Aruba	SITA	131.725	1230N	7001W	✓
AUH	Abu Dhabi	United Arab Emirates	SITA	131.725	2426N	5428E	✓
AXT	Akita	Japan	Avicom	131.450	3936N	14013E	✓
AYQ	Ayers Rock	Australia	SITA	131.550	2520S	13103E	
BAH	Bahrain	Bahrain	SITA	131.725	2616N	5036E	✓
BAK	Baku	Azerbaijan	SITA	131.725	4028N	5003E	
BAQ	Barranquilla	Colombia	SITA	131.725	1054N	7447W	✓
BCN	Barcelone	Spain	SITA	131.725	4118N	0204E	✓
BCN3	Barcelone	Spain	SITA	131.525	4118N	0204E	✓
BEG	Belgrade	Yugoslavia	SITA	131.725	4449N	2019E	✓
BEL	Belem	Brazil	DEPV	131.550	0123S	4828W	
BES	Brest	France	SITA	131.725	4827N	0425W	✓
BES3	Brest	France	SITA	131.525	4827N	0425W	✓
BEY	Beirut	Lebanon	SITA	131.725	3349N	3529E	✓
BFN	Bloemfontein	South Africa	SITA	131.725	2906S	2618E	✓
BFS	Belfast	United Kingdom	SITA	131.725	5439N	0614W	✓
BGF	Bangui	Central African Republic	SITA	131.725	0424N	1831E	✓
BGI	Bridgetown	Barbados	SITA	131.725	1304N	5930W	✓
BGO	Bergen	Norway	SITA	131.725	6017N	0513E	✓
BHX	Birmingham	United Kingdom	SITA	131.725	5227N	0145W	✓
BIA	Bastia	France	SITA	131.725	4233N	0929E	✓
BIO	Bilbao	Spain	SITA	131.725	4318N	0256W	✓
BIQ	Biarritz	France	SITA	131.725	4328N	0132W	✓
BJL	Banjul	Gambia	SITA	131.725	1321N	1640W	
BKI	Kota Kinabalu	Malaysia	SITA	131.550	0556N	11603E	✓
BKK	Bangkok	Thailand	SITA	131.550	1355N	10037E	✓
BKO	Bamako	Mali	SITA	131.725	1232N	0757W	✓
BLL	Billund	Denmark	SITA	131.725	5544N	0909E	✓
BLQ	Bologna	Italy	SITA	131.725	4432N	1118E	✓
BNE1/2	Brisbane	Australia	SITA	131.550	2723S	15307E	✓
BOD	Bordeaux	France	SITA	131.725	4450N	0043W	✓
BOD3	Bordeaux	France	SITA	131.525	4450N	0043W	✓

RGS List

BOG - DAR

Code	City	Country	Provider	Frequency	Lattitude	Longitude	On-Line
BOG	Bogota	Colombia	SITA	131.725	0442N	7409W	✓
BOM	Bombay	India	SITA	131.725	1906N	7252E	✓
BOO	Bodo	Norway	SITA	131.725	6716N	1422E	
BPG	Barra dos Garcas	Brazil	DEPV	131.550	1200S	5324W	
BRA	Barreiras	Brazil	DEPV	131.550	1205S	4500W	
BRE	Bremen	Germany	SITA	131.725	5303N	0848E	✓
BRI	Bari	Italy	SITA	131.725	4108N	1647E	✓
BRK	Bourke	Australia	SITA	131.550	3002S	14557E	
BRR	Barra	United Kingdom	SITA	131.725	5710N	0726W	
BRU	Brussels	Belgium	SITA	131.725	5054N	0429E	✓
BSB	Brasilia	Brazil	DEPV	131.550	1552S	4755W	✓
BUD	Budapest	Hungary	SITA	131.725	4727N	1915E	✓
BUE	Buenos Aires	Argentina	SITA	131.725	3449S	5832W	✓
BUQ	Bulawayo	Zimbabwe	SITA	131.725	2001S	2838E	✓
BVB	Boa Vista	Brazil	DEPV	131.550	0251N	6041W	
BWN	Brunei	Brunei Darussalam	SITA	131.550	0457N	11456E	✓
BZE	Belize City	Belize	SITA	131.725	1732N	8818W	✓
BZV1/2	Brazzaville	Congo	SITA	131.725	0415S	1515E	✓
CAI	Cairo	Egypt	SITA	131.725	3006N	3124E	✓
CAY	Cayenne	French Guyana	SITA	131.725	0449N	5222W	✓
CBR	Canberra	Australia	SITA	131.550	3519S	14912E	✓
CCS	Caracas	Venezuela	SITA	131.725	1036N	6659W	✓
CCU	Calcutta	India	SITA	131.725	2239N	8827E	✓
CDG1/2	Paris CDG	France	SITA	131.725	4901N	0233E	✓
CDG3	Paris CDG	France	SITA	131.525	4901N	0233E	✓
CDG5/6	Paris CDG	France	SITA	136.900	4901N	0233E	✓
CDJ	Conceicao do Araguaia	Brazil	DEPV	131.550	0815S	4918W	
CEB	Cebu	Philippines	SITA	131.550	1020N	12354E	✓
CED	Ceduna	Australia	SITA	131.550	3208S	13342E	✓
CFE	Clermont F.	France	SITA	131.725	4547N	0310E	✓
CFU	Kerkyra	Greece	SITA	131.725	3936N	1955E	✓
CGK	Jakarta	Indonesia	SITA	131.550	0608S	10640E	✓
CGN	Cologne	Germany	SITA	131.725	5052N	0709E	✓
CGR	Campo Grande	Brazil	DEPV	131.550	2028S	5440W	
CGV	Caiguna	Australia	SITA	131.550	3215S	12529E	✓
CHC	Christchurch	New Zealand	SITA	131.550	4329S	17232E	✓
CJU	Cheju	Republic of Korea	SITA	131.550	3330N	12630E	
CKS	Carajas	Brazil	DEPV	131.550	0607S	5000W	
CLO	Cali	Colombia	SITA	131.725	0333N	7623W	✓
CLY	Calvi	France	SITA	131.725	4231N	0848E	✓
CMB	Colombo	Sri Lanka	SITA	131.725	0711N	7953E	✓
CMN	Casablanca	Morocco	SITA	131.725	3322N	0735W	✓
CNF	Belo Horizonte	Brazil	DEPV	131.550	1951S	4357W	✓
CNS	Cairns	Australia	SITA	131.550	1653S	14545E	✓
CNX	Chiang Mai	Thailand	SITA	131.550	1846N	9858E	✓
COO	Cotonou	Benin	SITA	131.725	0621N	0223E	✓
COR	Cordoba	Argentina	SITA	131.725	3119S	6413W	
CPH	Copenhagen	Denmark	SITA	131.725	5537N	1239E	✓
CPH3	Copenhagen	Denmark	SITA	131.525	5537N	1239E	✓
CPT	Cape Town	South Africa	SITA	131.725	3358S	1836E	✓
CRQ	Caravelas	Brazil	DEPV	131.550	1738S	3915W	
CTA	Catania	Italy	SITA	131.725	3728N	1504E	✓
CTS	Chitose	Japan	Avicom	131.450	4248N	14140E	✓
CUN	Cancun	Mexico	SITA	131.725	2102N	8653W	✓
CUR	Curacao	Netherlands Antilles	SITA	131.725	1212N	6857W	✓
CVQ	Carnarvon	Australia	SITA	131.550	2453S	11340E	✓
CWB	Curitiba	Brazil	DEPV	131.550	2531S	4911W	✓
DAC	Dacca	Bangladesh	SITA	131.725	2346N	9023E	✓
DAD	Da Nang	Vietnam	SITA	131.550	1603N	10812E	✓
DAM	Damascus	Syrian Arab Republic	SITA	131.725	3325N	3631E	✓
DAR	Daressalaam	Tanzania	SITA	131.725	0653S	3912E	✓

RGS List

DEL - HAM3

Code	City	Country	Provider	Frequency	Lattitude	Longitude	On-Line
DEL	Delhi	India	SITA	131.725	2835N	7712E	✓
DHA	Dhahran	Saudi Arabia	SITA	131.725	2616N	5010E	
DJE	Djerba	Tunisia	SITA	131.725	3352N	1047E	✓
DKR	Dakar	Senegal	SITA	131.725	1445N	1730W	✓
DLA	Douala	Cameroon	SITA	131.725	0401N	0943E	✓
DME	Moscow	Russian Federation	SITA	131.725	5524N	3753E	✓
DOH	Doha	Qatar	SITA	131.725	2516N	5134E	✓
DPS	Denpasar Bali	Indonesia	SITA	131.550	0845S	11510E	✓
DRB	Derby	Australia	SITA	131.550	1722S	12340E	✓
DRS	Dresden	Germany	SITA	131.725	5108N	1346E	✓
DRW	Darwin	Australia	SITA	131.550	1225S	13053E	✓
DUB	Dublin	Ireland	SITA	131.725	5326N	0615W	✓
DUR	Durban	South Africa	SITA	131.725	2958S	3057E	✓
DUS	Dusseldorf	Germany	SITA	131.725	5117N	0646E	✓
DUS5	Dusseldorf	Germany	SITA	136.900	5117N	0646E	
DXB	Dubai	United Arab Emirates	SITA	131.725	2515N	5522E	✓
DYR	Anadyr	Russian Federation	SITA	131.550	6444N	17745E	
EDI	Edinburgh	United Kingdom	SITA	131.725	5557N	0322W	✓
ELS	East London	South Africa	SITA	131.725	3302S	2749E	✓
EMA	East Midlands	United Kingdom	SITA	131.725	5250N	0119W	✓
ERF	Erfurt	Germany	SITA	131.725	5059N	1058E	✓
EVE	Evenes	Norway	SITA	131.725	6830N	1641E	
FAE	Faroe Island	Faroe Islands	SITA	131.725	6204N	0718W	✓
FAO	Faro	Portugal	SITA	131.725	3701N	0758W	✓
FCO	Rome Fiumicino	Italy	SITA	131.725	4149N	1215E	✓
FDF	Fort de France	Martinique	SITA	131.725	1435N	6100W	✓
FEN	Fernando de Noronha	Brazil	DEPV	131.550	0351S	3225W	
FKS	Fukushima	Japan	Avicom	131.450	3713N	14026E	✓
FMO	Muenster	Germany	SITA	131.725	5208N	0741E	✓
FNA	Freetown	Sierra Leone	SITA	131.725	0824N	1308W	✓
FNI	Nimes	France	SITA	131.725	4345N	0425E	✓
FNJ	Pyongyang	North Korea	SITA	131.550	3912N	12540E	✓
FOR	Fortaleza	Brazil	DEPV	131.550	0347S	3832W	
FRA1/2	Frankfurt	Germany	SITA	131.725	5002N	0834E	✓
FRA3	Frankfurt	Germany	SITA	131.525	5002N	0834E	✓
FRA5	Frankfurt	Germany	SITA	136.900	5002N	0834E	✓
FUK1	Fukuoka	Japan	Avicom	131.450	3335N	13025E	✓
FUK2	Sugitake	Japan	Avicom	131.450	3339N	13034E	✓
GAJ	Yamagata	Japan	Avicom	131.450	3824N	14022E	✓
GBE	Gaborone	Botswana	SITA	131.725	2433S	2555E	✓
GCM	Grand Cayman	Cayman Islands	SITA	131.725	1918N	8122W	✓
GDX	Magadan	Russian Federation	SITA	131.550	5955N	15043E	
GIG	Rio de Janeiro	Brazil	DEPV	131.550	2248S	4314W	✓
GLA	Glasgow	United Kingdom	SITA	131.725	5552N	0426W	✓
GLA3	Glasgow	United Kingdom	SITA	131.525	5552N	0426W	✓
GNB	Grenoble	France	SITA	131.725	4522N	0520E	✓
GOA	Genoa	Italy	SITA	131.725	4425N	0850E	✓
GOT	Gothenburg	Germany	SITA	131.725	5740N	1217E	✓
GOV	Gove	Australia	SITA	131.550	1217S	13651E	✓
GRJ	George	South Africa	SITA	131.725	3358S	2225E	✓
GRU	Sao Paulo	Brazil	DEPV	131.550	2326S	4629W	✓
GRX	Granada	Spain	SITA	131.725	3711N	0347W	✓
GRZ	Graz	Austria	SITA	131.725	4700N	1526E	✓
GUA	Guatemala City	Guatemala	SITA	131.725	1434N	9032W	✓
GVA	Geneva	Switzerland	SITA	131.725	4615N	0607E	✓
GYE	Guayaquil	Ecuador	SITA	131.725	0209S	7953W	✓
HAC	Hachijo	Japan	Avicom	131.450	3305N	13948E	✓
HAH	Moroni	Comoros	SITA	131.725	1132S	4316E	
HAJ	Hannover	Germany	SITA	131.725	5228N	0942E	✓
HAM	Hamburg	Germany	SITA	131.725	5338N	1000E	✓
HAM3	Hamburg	Germany	SITA	131.525	5338N	1000E	✓

RGS List

HAM5 - LBU

Code	City	Country	Provider	Frequency	Lattitude	Longitude	On-Line
HAM5	Hamburg	Germany	SITA	136.900	5338N	1000E	
HAN	Hanoi	Vietnam	SITA	131.550	2113N	10548E	✓
HAV	Havana	Cuba	SITA	131.725	2300N	8225W	✓
HBA	Hobart	Australia	SITA	131.550	4250S	14730E	✓
HDY	Hatyai	Thailand	SITA	131.550	0656N	10025E	
HEL	Helsinki	Finland	SITA	131.725	6015N	2458E	✓
HER	Heraklion	Greece	SITA	131.725	3520N	2511E	✓
HIJ	Hiroshima	Japan	Avicom	131.450	3422N	13225E	✓
HIR	Honiara	Solomon Islands	SITA	131.550	0925S	16003E	✓
HKD	Hakodate	Japan	Avicom	131.450	4146N	14049E	✓
HKG1/2	Hong Kong	Hong Kong	SITA	131.550	2219N	11412E	✓
HKT	Phuket	Thailand	SITA	131.550	0806N	9819E	✓
HNA	Morioka-Hanamaki	Japan	Avicom	131.450	3925N	14108E	✓
HND	Haneda	Japan	Avicom	131.450	3533N	13947E	✓
HRE	Harare	Zimbabwe	SITA	131.725	1756S	3106E	✓
HUN	Hualien	Taiwan	SITA	131.550	2401N	12137E	
IGU	Foz do Iguacu	Brazil	DEPV	131.550	2536S	5429W	
IKT	Irkutsk	Russian Federation	SITA	131.550	5216N	10425E	✓
INU	Nauru	Nauru	SITA	131.550	0033S	16655E	✓
ISA	Mont Isa	Australia	SITA	131.550	2040S	13929E	✓
IST	Istanbul	Turkey	SITA	131.725	4059N	2849E	✓
IXZ	Port Blair	Andaman Islands	SITA	131.550	1139N	9245E	
IZO	Izumo	Japan	Avicom	131.450	3524N	13253E	✓
JCR	Jacareacanga	Brazil	DEPV	131.550	0614S	5747W	
JED	Jeddah	Saudi Arabia	SITA	131.725	2141N	3909E	✓
JER	Jersey	United Kingdom	SITA	131.725	4913N	0212W	✓
JHB	Johor Bahru	Malaysia	SITA	131.550	0138N	10340E	✓
JNB1/2	Johannesburg	South Africa	SITA	131.725	2608S	2815E	✓
KAG	Kangnung	Republic of Korea	SITA	131.550	3745N	12857E	
KAN	Kano	Nigeria	SITA	131.725	1203N	0832E	✓
KBL	Kabul	Afghanistan	SITA	131.725	3434N	6912E	
KBP	Kiev	Ukraine	SITA	131.725	5021N	3055E	
KBR	Kota Bharu	Malaysia	SITA	131.550	0610N	10218E	✓
KCH	Kuching	Malaysia	SITA	131.550	0129N	11020E	✓
KCZ	Kochi	Japan	Avicom.	131.450	3332N	13340E	✓
KEF	Keflavik	Iceland	SITA	131.725	6359N	2237W	✓
KGD	Kaliningrad	Russian Federation	SITA	131.725	5443N	2030E	
KGI	Kalgoorlie	Australia	SITA	131.550	3047S	12128E	✓
KHH	Kaohsiung	Taiwan	SITA	131.550	2235N	12021E	✓
KHI	Karachi	Pakistan	SITA	131.725	2454N	6709E	
KHV	Khabarovsk	Russian Federation	SITA	131.550	4831N	13511E	✓
KIJ	Niigata	Japan	Avicom	131.450	3757N	13907E	✓
KIM	Kimberley	South Africa	SITA	131.725	2848S	2446E	✓
KIN	Kingston	Jamaica	SITA	131.725	1756N	7648W	
KIX	Kansai	Japan	Avicom	131.450	3425N	13514E	✓
KMI	Miyazaki	Japan	Avicom	131.450	3152N	13126E	✓
KMJ	Kumamoto	Japan	Avicom	131.450	3250N	13052E	✓
KMQ	Komatsu	Japan	Avicom	131.450	3624N	13625E	✓
KNX	Kununurra	Australia	SITA	131.550	1547S	12843E	✓
KOJ1	Kagoshima	Japan	Avicom	131.450	3147N	13043E	✓
KOJ2	Shibi	Japan	Avicom	131.450	3159N	13022E	✓
KRT	Khartoum	Sudan	SITA	131.725	1536N	3234E	✓
KTA	Karratha	Australia	SITA	131.550	2043S	11646E	✓
KTM	Kathmandu	Nepal	SITA	131.725	2742N	8522E	✓
KUA	Kuantan	Malaysia	SITA	131.550	0346N	10313E	✓
KUH	Kushiro	Japan	Avicom	131.450	4302N	14412E	✓
KUL	Kuala Lumpur/ Subang	Malaysia	SITA	131.550	0308N	10133E	✓
KWI	Kuwait City	Kuwait	SITA	131.725	2913N	4758E	✓
KWJ	Kwangju	North Korea	SITA	131.550	3507N	12649E	
LAD	Luanda	Angola	SITA	131.725	0851S	1314E	✓
LBU	Labuan	Malaysia	SITA	131.550	0518N	11515E	

RGS List

LCA - MUC5

Code	City	Country	Provider	Frequency	Latitude	Longitude	On-Line
LCA	Larnaca	Cyprus	SITA	131.725	3452N	3338E	✓
LDE	Lourdes	France	SITA	131.725	4311N	0001W	✓
LED	St. Petersburg	Russian Federation	SITA	131.725	5948N	3016E	✓
LEJ	Leipzig	Germany	SITA	131.725	5123N	1214E	✓
LFW	Lome	Togo	SITA	131.725	0610N	0115E	✓
LGH	Leigh Creek	Australia	SITA	131.550	3028S	13825E	✓
LGK	Langkawi	Malaysia	SITA	131.550	0620N	9944E	
LGW1/2	London Gatwick	United Kingdom	SITA	131.725	5109N	0011W	✓
LHR1/2	London Heathrow	United Kingdom	SITA	131.725	5128N	0027W	✓
LHR3	London Heathrow	United Kingdom	SITA	131.525	5128N	0027W	✓
LHR5/6	London Heathrow	United Kingdom	SITA	136.900	5128N	0027W	
LIL	Lille	France	SITA	131.725	5034N	0305E	✓
LIM	Lima	Peru	SITA	131.725	1201S	7707W	✓
LIN	Milan Linate	Italy	SITA	131.725	4527N	0917E	✓
LIS	Lisbon	Portugal	SITA	131.725	3846N	0908W	✓
LJU	Ljubljana	Slovenia	SITA	131.725	4613N	1428E	✓
LLA	Lulea	Sweden	SITA	131.725	6533N	2208E	
LLW	Lilongwe	Malawi	SITA	131.725	1347S	3347E	✓
LNZ	Linz	Austria	SITA	131.725	4814N	1411E	✓
LOS	Lagos	Nigeria	SITA	131.725	0635N	0319E	✓
LPA	Las Palmas	Spain	SITA	131.725	2756N	1523W	✓
LPB	La Paz	Bolivia	SITA	131.725	1631S	6811W	✓
LRE	LongReach	Australia	SITA	131.550	2326S	14417E	
LRT	Lorient	France	SITA	131.725	4748N	0326W	✓
LST	Launceston	Australia	SITA	131.550	4133S	14713E	✓
LUN	Lusaka	Zambia	SITA	131.725	1520S	2827E	✓
LUX	Luxembourg	Luxembourg	SITA	131.725	4937N	0612E	✓
LXR	Luxor	Egypt	SITA	131.725	2541N	3243E	✓
LYS	Lyon	France	SITA	131.725	4544N	0505E	✓
LYS3	Lyon	France	SITA	131.525	4544N	0505E	✓
MAA	Madras	India	SITA	131.725	1300N	8011E	✓
MAD1/2	Madrid	Spain	SITA	131.725	4028N	0334W	✓
MAD3	Madrid	Spain	SITA	131.525	4028N	0334W	✓
MAD5	Madrid	Spain	SITA	136.900	4028N	0334W	✓
MAJ	Marshall Island	Marshall Island	SITA	131.550	0704N	17116E	
MAN	Manchester	United Kingdom	SITA	131.725	5321N	0216W	✓
MAO	Manaus	Brazil	DEPV	131.550	0302S	6003W	✓
MAR	Maracaibo	Venezuela	SITA	131.725	1034N	7144W	
MBJ	Montego Bay	Jamaica	SITA	131.725	1830N	7756W	
MCT	Muscat	Oman	SITA	131.725	2336N	5817E	✓
MEL1/2	Melbourne	Australia	SITA	131.550	3741S	14451E	✓
MEX	Mexico City	Mexico	SITA	131.725	1926N	9904W	✓
MFM	Macau	Macau	SITA	131.550	2216N	11335E	
MGA	Managua	Nicaragua	SITA	131.725	1207N	8611W	✓
MKY	Mackay	Australia	SITA	131.550	2110S	14911E	✓
MLA	Malta	Malta	SITA	131.725	3552N	1429E	✓
MLE	Maldives	Maldives	SITA	131.725	0411N	7332E	✓
MLH	Mulhouse/Basle	France	SITA	131.725	4735N	0732E	✓
MMB	Memanbetsu	Japan	Avicom	131.450	4352N	14409E	✓
MMX	Malmo	Sweden	SITA	131.725	5533N	1322E	
MNL	Manila	Philippines	SITA	131.550	1431N	12001E	✓
MOW	Moscow	Russian Federation	SITA	131.725	5558N	3725E	✓
MPL	Montpellier	France	SITA	131.725	4335N	0358E	✓
MPM	Maputo	Mozambique	SITA	131.725	2555S	3234E	
MRS	Marseille	France	SITA	131.725	4326N	0513E	✓
MRU	Mauritius	Mauritius	SITA	131.725	2026S	5741E	✓
MSJ	Misawa	Japan	Avicom	131.450	4041N	14123E	✓
MSQ	Minsk	Belarus	SITA	131.725	5352N	2733E	
MUC	Munich	Germany	SITA	131.725	4821N	1147E	✓
MUC3	Munich	Germany	SITA	131.525	4821N	1147E	✓
MUC5	Munich	Germany	SITA	136.900	4821N	1147E	✓

RGS List

MVD - PTP

Code	City	Country	Provider	Frequency	Latitude	Longitude	On-Line
MVD	Montevideo	Uruguay	SITA	131.725	3450S	5602W	✓
MXP	Milan Malpensa	Italy	SITA	131.725	4538N	0843E	✓
MYJ	Matsuyama	Japan	Avicom	131.450	3350N	13242E	✓
MYY	Miri	Malaysia	SITA	131.550	0420N	11359E	✓
NAN	Nandi	Fiji Islands	SITA	131.550	1745S	17726E	✓
NAP	Naples	Italy	SITA	131.725	4053N	1418E	✓
NAS	Nassau	Bahamas	SITA	131.725	2502N	7728W	✓
NBO	Nairobi	Kenya	SITA	131.725	0119S	3656E	✓
NCE	Nice	France	SITA	131.725	4340N	0713E	✓
NCE3	Nice	France	SITA	131.525	4340N	0713E	✓
NCL	Newcastle	United Kingdom	SITA	131.725	5502N	0141W	✓
NDJ	Ndjamena	Chad	SITA	131.725	1208N	1502E	✓
NGO	Nagoya	Japan	Avicom	131.450	3514N	13655E	✓
NGS	Nagasaki	Japan	Avicom	131.450	3254N	12955E	✓
NIM	Niamey	Niger	SITA	131.725	1329N	0210E	✓
NKC	Nouakchott	Mauritania	SITA	131.725	1806N	1557W	✓
NLK	Norfolk Island	Norfolk Island	SITA	131.550	2903S	16756E	✓
NOU	Noumea	New Caledonia	SITA	131.550	2201S	16613E	✓
NRT	Narita	Japan	Avicom	131.450	3546N	14023E	✓
NTE	Nantes	France	SITA	131.725	4709N	0136W	✓
NUE	Nuremberg	Germany	SITA	131.725	4930N	1105E	✓
OBO	Obihiro	Japan	Avicom	131.450	4243N	14315E	✓
ODS	Odessa	Ukraine	SITA	131.725	4626N	3041E	
OIT	Oita	Japan	Avicom	131.450	3328N	13144E	✓
OKA1	Naha	Japan	Avicom	131.450	2612N	12739E	✓
OKA2	Tano	Japan	Avicom	131.450	2636N	12803E	✓
OKJ	Okayama	Japan	Avicom	131.450	3445N	13351E	✓
OOL	Coolangatta	Australia	SITA	131.550	2810S	15330E	✓
OPO	Porto	Portugal	SITA	131.725	4114N	0841W	✓
ORY1/2	Orly	France	SITA	131.725	4843N	0223E	✓
ORY3	Orly	France	SITA	131.525	4843N	0223E	✓
ORY5	Orly	France	SITA	136.900	4843N	0223E	✓
OSA1	Osaka	Japan	Avicom	131.450	3447N	13526E	✓
OSA2	Rokko	Japan	Avicom	131.450	3445N	13515E	✓
OSL	Oslo Fornebu	Norway	SITA	131.725	5954N	1037E	✓
OSL3	Oslo Fornebu	Norway	SITA	131.525	5954N	1037E	✓
OTP	Bucharest	Romania	SITA	131.725	4434N	2606E	✓
OUA	Ouagadougou	Burkina Faso	SITA	131.725	1221N	0131W	✓
OVB	Novosibirsk	Russian Federation	SITA	131.550	5506N	8300E	✓
PAP1/2	Port au Prince	Haiti	SITA	131.725	1835N	7218W	✓
PBM	Paramaribo	Suriname	SITA	131.725	0528N	5512W	✓
PDL	Ponta Delgada	Portugal	SITA	131.725	3744N	2542W	✓
PEK	Beijing	China	SITA	131.550	4004N	11635E	✓
PEN	Penang	Malaysia	SITA	131.550	0517N	10016E	✓
PER	Perth	Australia	SITA	131.550	3157S	11558E	✓
PGF	Perpignan	France	SITA	131.725	4244N	0252E	✓
PHC	Port Harcourt	Nigeria	SITA	131.725	0501N	0657E	✓
PIK	Prestwick	United Kingdom	SITA	131.725	5531N	0435W	✓
PKC	Petropavlovsk-Kamchatsk	Russian Federation	SITA	131.550	5310N	15827E	✓
PLS	Providenciales	Turks and Caicos Islands	SITA	131.725	2148N	7218W	✓
PLZ	Port Elizabeth	South Africa	SITA	131.725	3359S	2537E	✓
PMI	Palma Mallorca	Spain	SITA	131.725	3933N	0244E	✓
PNB	Porto Nacional	Brazil	DEPV	131.550	1042S	4825W	
PNH	Phnompenh	Cambodia	SITA	131.550	1133N	10451E	✓
POA	Porto Alegre	Brazil	DEPV	131.550	3000S	5111W	✓
POM	Port Moresby	Papua New Guinea	SITA	131.550	0927S	14713E	✓
POS	Port of Spain	Trinidad and Tobago	SITA	131.725	1036N	6121W	✓
PPT	Papeete	French Polynesia	SITA	131.550	1734S	14937W	✓
PRG	Prague	Czech Republic	SITA	131.725	5006N	1416E	✓
PSA	Pisa	Italy	SITA	131.725	4341N	1024E	✓
PTP	Pointe a Pitre	Guadeloupe	SITA	131.725	1616N	6132W	✓

RGS List

PTY - SYY

Code	City	Country	Provider	Frequency	Lattitude	Longitude	On-Line
PTY	Panama city	Panama	SITA	131.725	0905N	7923W	✓
PUF	Pau	France	SITA	131.725	4323N	0025W	✓
PUS	Pusan	Korea	SITA	131.550	3511N	12858E	
PVS	Provideniya	Russian Federation	SITA	131.550	6417N	17319E	
RAK	Marrakech	Morocco	SITA	131.725	3137N	0803W	✓
RAO	Ribeirao Preto	Brazil	DEPV	131.550	2108S	4747W	
RAR	Rarotonga	Cook Islands	SITA	131.550	2112S	15946W	✓
RBR	Rio Branco	Brazil	DEPV	131.550	1000S	6748W	
REC	Recife	Brazil	DEPV	131.550	0808S	3455W	✓
REK	Reykjavik	Iceland	SITA	131.725	6410N	2150W	✓
RGN	Yangon	Myanmar	SITA	131.550	1654N	9608E	
RIX	Riga	Latvia	SITA	131.725	5700N	2404E	✓
RKT	Ras al Khaimah	United Arab Emirates	SITA	131.725	2537N	5556E	✓
ROB	Monrovia	Liberia	SITA	131.725	0614N	1022W	
ROK	Rockhampon	Australia	SITA	131.550	2323S	15029E	✓
ROV	Rostov	Russian Federation	SITA	131.725	4715N	3948E	
RUH	Riyadh	Saudi Arabia	SITA	131.725	2458N	4642E	
RUN	St-Denis	Reunion	SITA	131.725	2053S	5531E	✓
SAH	Sana'a	Yemen Arab Republic	SITA	131.725	1519N	4412E	
SAL	San Salvador	El Salvador	SITA	131.725	1326N	8903W	✓
SBW	Sibu	Malaysia	SITA	131.550	0220N	11150E	
SCL	Santiago-Chile	Chile	SITA	131.725	3323S	7047W	✓
SCU	Santiago de Cuba	Cuba	SITA	131.725	1958N	7550W	
SDJ	Sendai	Japan	Avicom	131.450	3808N	14056E	✓
SDK	Sandakan	Malaysia	SITA	131.550	0554N	11804E	
SDL	Sundsvall	Sweden	SITA	131.725	6232N	1727E	
SDQ	Santo Domingo	Dominican Republic	SITA	131.725	1828N	6958W	✓
SEL	Seoul	Republic of Korea	SITA	131.550	3733N	12648E	✓
SEZ	Maheisland	Seychelles	SITA	131.725	0440S	5531E	✓
SFS	Subic Bay	Philippines	SITA	131.550	1448N	12016E	✓
SGN	Ho Chi Minh City	Vietnam	SITA	131.550	1049N	10639E	✓
SHA	Shanghai	China	SITA	131.550	3112N	12120E	✓
SHB	Nemuro	Japan	Avicom	131.450	4320N	14535E	✓
SHI	Shimojishima	Japan	Avicom	131.450	2449N	12509E	✓
SHJ	Sharjah	United Arab Emirates	SITA	131.725	2520N	5531E	✓
SID	Sal	Cape Verde	SITA	131.725	1645N	2257W	✓
SIN1/2	Singapore	Singapore	SITA	131.550	0122N	10359E	✓
SIP	Simferopol	Ukraine	SITA	131.725	4501N	3359E	
SJO1/2	San Jose	Costa Rica	SITA	131.725	1000N	8412W	✓
SKG	Thessalonika	Greece	SITA	131.725	4031N	2258E	✓
SLL	Salalah	Oman	SITA	131.725	1703N	5406E	
SNG	San Ignacio de Velasco	Bolivia	SITA	131.725	1622S	6059W	
SNN	Shannon	Ireland	SITA	131.725	5242N	0855W	✓
SNN3	Shannon	Ireland	SITA	131.525	5242N	0855W	✓
SOF	Sofia	Bulgaria	SITA	131.725	4242N	2325E	✓
SPK	Sasayama	Japan	Avicom	131.450	4228N	14230E	✓
SPU	Split	Croatia	SITA	131.725	4332N	1618E	✓
SSA	Salvador	Brazil	DEPV	131.550	1255S	3820W	
STM	Santarem	Brazil	DEPV	131.550	0225S	5447W	
STN	Stansted	United Kingdom	SITA	131.725	5153N	0014E	✓
STR	Stuggart	Germany	SITA	131.725	4841N	0913E	✓
SVG	Stavanger	Norway	SITA	131.725	5853N	0538E	✓
SVQ	Sevilla	Spain	SITA	131.725	3726N	0554W	✓
SVX	Ekaterinburg	Russian Federation	SITA	131.725	5645N	6048E	
SXB	Strasbourg	France	SITA	131.725	4833N	0738E	✓
SXB3	Strasbourg	France	SITA	131.525	4833N	0738E	✓
SXF	Schoenefeld	Germany	SITA	131.725	5222N	1330E	✓
SXM	St. Maarten	Netherlands Antilles	SITA	131.725	1803N	6307W	✓
SYD1/2	Sydney	Australia	SITA	131.550	3357S	15111E	✓
SYO	Shounai	Japan	Avicom	131.450	3849N	13947E	✓
SYY	Stornoway	United Kingdom	SITA	131.725	5813N	0620W	✓

RGS List

SYZ - WKJ

Code	City	Country	Provider	Frequency	Latitude	Longitude	On-Line
SYZ	Shiraz	Iran	SITA	131.725	2933N	5236E	
TAE	Taegu	Republic of Korea	SITA	131.550	3553N	12840E	
TAK	Takamatsu	Japan	Avicom	131.450	3413N	13401E	✓
TAS	Tashkent	Uzbekistan	SITA	131.725	4115N	6917E	✓
TBT	Tabatinga	Brazil	DEPV	131.550	0414S	6955W	
TBU	Tonga	Tonga	SITA	131.550	2115S	17509W	
TCA	Tennant Creek	Australia	SITA	131.550	1938S	13411E	✓
TFS	Tenerife	Canary Islands	SITA	131.725	2803N	1634W	✓
TGG	Kuala Terengganu	Malaysia	SITA	131.550	0523N	10306E	
TGU	Tegucigalpa	Honduras	SITA	131.725	1402N	8714W	✓
THR	Teheran	Iran	SITA	131.725	3541N	5119E	
TIA	Tirana	Albania	SITA	131.725	4125N	1942E	✓
TIS	Thursday Island	Australia	SITA	131.550	1035S	14217E	
TKS	Tokushima	Japan	Avicom	131.450	3408N	13435E	✓
TLL	Tallin	Estonia	SITA	131.725	5925N	2450E	
TLN	Toulon	France	SITA	131.725	4305N	0556E	✓
TLS	Toulouse	France	SITA	131.725	4337N	0123E	✓
TLS3	Toulouse	France	SITA	131.525	4337N	0123E	✓
TLV	Tel Aviv	Israel	SITA	131.725	3201N	3453E	✓
TNG	Tangier	Morocco	SITA	131.725	3543N	0555W	✓
TNR	Antananarivo	Madagascar	SITA	131.725	1848S	4729E	
TOS	Tromso	Norway	SITA	131.725	6942N	1902E	✓
TOY	Toyoma	Japan	Avicom	131.450	3638N	13711E	✓
TPE1/2	Taipei	Taiwan	SITA	131.550	2505N	12113E	✓
TRD	Thondheim	Norway	SITA	131.725	6327N	1056E	✓
TRN	Turin	Italy	SITA	131.725	4512N	0739E	✓
TSA	Taipei Sung Shan	Taiwan	SITA	131.550	2504N	12133E	
TSV	Townsville	Australia	SITA	131.550	1915S	14646E	✓
TTJ	Tottori	Japan	Avicom	131.450	3531N	13410E	✓
TUN	Tunis	Tunisia	SITA	131.725	3651N	1014E	✓
TWU	Tawau	Malaysia	SITA	131.550	0420N	11755E	
TXL1/2	Berlin	Germany	SITA	131.725	5234N	1317E	✓
TXL3	Berlin	Germany	SITA	131.525	5234N	1317E	
TYO	Tsukuba	Japan	Avicom	131.450	3613N	14006E	✓
UAK1/2	Narsarsuaq	Greenland	SITA	131.725	6110N	4526W	✓
UBJ	Ube	Japan	Avicom	131.450	3356N	13116E	✓
UHG	Manily	Russian Federation	SITA	131.550	6231N	16500E	
UHK	Ust-Kamchatsk	Russian Federation	SITA	131.550	5615N	16241E	
UHN	Nikolaevsk-na-Amure	Russian Federation	SITA	131.550	5309N	14039E	
UHO	Markovo	Russian Federation	SITA	131.550	6440N	17025E	
UHS	Poronajsk-Sakhalinsk	Russian Federation	SITA	131.550	4914N	14304E	
UHT	Tilichiki	Russian Federation	SITA	131.550	6024N	16600E	
UIO	Quito	Ecuador	SITA	131.725	0008S	7829W	✓
ULN	Ulan Bator	Mongolia	SITA	131.550	4751N	10645E	✓
UTN	Upington	South Africa	SITA	131.725	2825S	2116E	✓
UUS	Yuzhno-Sakhalinsk	Russian Federation	SITA	131.550	4653N	14243E	✓
UVF	St Lucia	Saint Lucia	SITA	131.725	1344N	6057W	✓
VCE	Venice	Italy	SITA	131.725	4530N	1221E	✓
VFA	Victoria Falls	Zimbabwe	SITA	131.725	1806S	2550E	✓
VIE	Vienna	Austria	SITA	131.725	4807N	1634E	✓
VLC	Valencia	Spain	SITA	131.725	3929N	0029W	✓
VLI	Port Vila	Vanuatu	SITA	131.550	1742S	16819E	✓
VNO	Vilnius	Lithuania	SITA	131.725	5438N	2517E	✓
VSA	Villahermosa	Mexico	SITA	131.725	1759N	9247W	✓
VTE	Vientiane	Laos	SITA	131.550	1759N	10234E	✓
VVI	Santa Cruz	Bolivia	SITA	131.725	1738S	6308W	✓
VVO	Vladivostok	Russian Federation	SITA	131.550	4313N	13156E	✓
VXO	Vaxjo	Sweden	SITA	131.725	5656N	1444E	
WAW	Warsaw	Poland	SITA	131.725	5210N	2058E	✓
WDH	Windhoek	Nambia	SITA	131.725	2237S	1705E	✓
WKJ	Wakkanai	Japan	Avicom	131.450	4523N	14148E	✓

RGS List

WLG - ZRH5

Code	City	Country	Provider	Frequency	Lattitude	Longitude	On-Line
WLG	Wellington	New Zealand	SITA	131.550	4120S	17448E	✓
YAM	Sault Ste.Marie	Canada	Air Canada	131.475	4629N	8431W	✓
YAY	St. Anthony	Canada	Air Canada	131.475	5133N	5556W	✓
YEG	Edmonton	Canada	Air Canada	131.475	5319N	11335W	✓
YFB	Iqaluit	Canada	Air Canada	131.475	6345N	6833W	✓
YFC	Fredericton	Canada	Air Canada	131.475	4552N	6632W	✓
YGL	La Grande Riviere	Canada	Air Canada	131.475	5338N	7742W	✓
YHD	Dryden	Canada	Air Canada	131.475	4950N	9245W	✓
YHZ	Halifax	Canada	Air Canada	131.475	4453N	6331W	✓
YJT	Stephenville	Canada	Air Canada	131.475	4833N	5833W	✓
YMO	Moonsonee	Canada	Air Canada	131.475	5117N	8036W	✓
YMX	Mirabel	Canada	Air Canada	131.475	4541N	7402W	✓
YOW1/2	Ottawa	Canada	Air Canada	131.475	4519N	7540W	✓
YQB	Quebec	Canada	Air Canada	131.475	4648N	7124W	✓
YQG	Windsor	Canada	Air Canada	131.475	4216N	8258W	✓
YQI	Yarmouth	Canada	Air Canada	131.475	4350N	6605W	✓
YQM	Moncton	Canada	Air Canada	131.475	4607N	6441W	✓
YQR	Regina	Canada	Air Canada	131.475	5026N	10440W	✓
YQT	Thunder Bay	Canada	Air Canada	131.475	4822N	8919W	✓
YQX	Gander	Canada	Air Canada	131.475	4856N	5434W	✓
YQY	Sydney	Canada	Air Canada	131.475	4610N	6003W	✓
YSB	Sudbury	Canada	Air Canada	131.475	4638N	8048W	✓
YSJ	St. John	Canada	Air Canada	131.475	4519N	6553W	✓
YTS	Timmins	Canada	Air Canada	131.475	4834N	8123W	✓
YUL1/2	Dorval	Canada	Air Canada	131.475	4528N	7345W	✓
YUY	Rouyn	Canada	Air Canada	131.475	4812N	7850W	✓
YVO	Val d'Or	Canada	Air Canada	131.475	4803N	7747W	✓
YVP	Kuujjuaq	Canada	Air Canada	131.475	5806N	6825W	✓
YVR	Vancouver	Canada	Air Canada	131.475	4911N	12311W	✓
YWG	Winnipeg	Canada	Air Canada	131.475	4955N	9714W	✓
YWK	Wabush	Canada	Air Canada	131.475	5255N	6652W	✓
YXE	Saskatoon	Canada	Air Canada	131.475	5210N	10642W	✓
YXS	Prince George	Canada	Air Canada	131.475	5353N	12241W	✓
YYB	North Bay	Canada	Air Canada	131.475	4622N	7925W	✓
YYC	Calgary	Canada	Air Canada	131.475	5107N	11401W	✓
YYF	Penticton	Canada	Air Canada	131.475	4928N	11936W	✓
YYG	Charlottetown	Canada	Air Canada	131.475	4617N	6308W	✓
YYJ	Victoria	Canada	Air Canada	131.475	4839N	12325W	✓
YYR	Goose Bay	Canada	Air Canada	131.475	5319N	6026W	✓
YYT 1/2	St. Johns	Canada	Air Canada	131.475	4737N	5245W	✓
YYZ1/2	Toronto	Canada	Air Canada	131.475	4341N	7938W	✓
YZV	Seven Islands	Canada	Air Canada	131.475	5013N	6616W	✓
ZAG	Zagreb	Croatia	SITA	131.725	4545N	1605E	✓
ZAZ	Zaragoza	Spain	SITA	131.725	4138N	0053W	✓
ZNE	Newman	Australia	SITA	131.550	2325S	11948E	✓
ZRH1/2	Zurich	Switzerland	SITA	131.725	4728N	0833E	✓
ZRH3	Zurich	Switzerland	SITA	131.525	4728N	0833E	✓
ZRH5	Zurich	Switzerland	SITA	136.900	4728N	0833E	✓

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AIRBUS INDUSTRIE

The statements made herein do not constitute an offer. They are based on the assumptions shown and are expressed in good faith. Where the supporting grounds for these statements are not shown the Company will be pleased to explain the basis thereof.

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