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ATA 46
Information Systems

ATIMS (Air Traffic and Information Management System)
Airplane Information Network
EFB (Electronic Flight Bag)

EASA Part-66
B1/B2

Training Manual

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ATA 46 INFORMATION SYSTEMS

46–00 INFORMATION SYSTEMS

INTRODUCTION

COCKPIT INFORMATION SYSTEMS

The Cockpit Information Systems are:

- Air Traffic and Information Management System (ATIMS), ATA 46–21.
- Air Traffic Services (ATS), ATA 46–22.
- Airline Information Services (AIS) ATA 46–23.
- ATSU Router, ATA 46–24.

Air Traffic and Information Management System (ATIMS)

The Air Traffic and Information Management System (ATIMS) enables data link communications and the exchange of complex data or specific reports between the aircraft and the ground centers:

- controller–pilot datalink communications (VHF/HF voice in backup) for air traffic management,
- automatic reporting (position, intention) for air traffic surveillance,
- specific airline–aircraft communications (operational control) to improve airline operational costs and flexibility.

Air Traffic Services (ATS)

The Air Traffic Services are in charge of:

- the ATC FANS A applications:
  - ATS Facilities Notification (AFN) for connection with an ATC ground center,
  - Controller–Pilot Data Link Communications (CPDLC),
  - Automatic Dependent Surveillance (ADS) for aircraft path surveillance,
- and of the ATC ARINC 623 applications:
  - Departure Clearance (DC) application,
  - Oceanic Clearance (OC) application,
  - Automatic Terminal Information Service (ATIS) application.

Airline Information Services (AIS)

The Standard Airline Operational Control (AOC) applications are datalink applications used by the airline for maintenance, flight operations and administrative purposes.

ATSU Router

The ATSU router provides:

- data link services to remote AOC applications hosted in on–board peripherals,
- data link services to the ATC/AOC applications hosted in the ATSU,
- management of the datalink media: VHF, SATCOM (optional), HF (optional).

ATIMS GENERAL

The Air Traffic Information Management System (ATIMS) complies with the future developments of the Communication, Navigation, Surveillance and Air Traffic Management (ATM) also known as Future Air Navigation System (FANS). It covers the evolution of the way the airspace will be used in the years to come. It will be used in different operational environments and is designed to be easily configured to the airlines needs.

ATIMS enables data–link communication: VHF Data Radio (VDR), HF Data Radio (HFDR) and SATCOM (if installed) and the exchange of complex data or specific reports between the aircraft and the ground centers.

Standard AOC functionalities are basically provided but airlines can customize these functions and the way they are accessed by the crew. On the ground, the different existing networks dispatch the messages. These networks are operated by private companies such as ARINC, SITA and others, which are known as service providers.

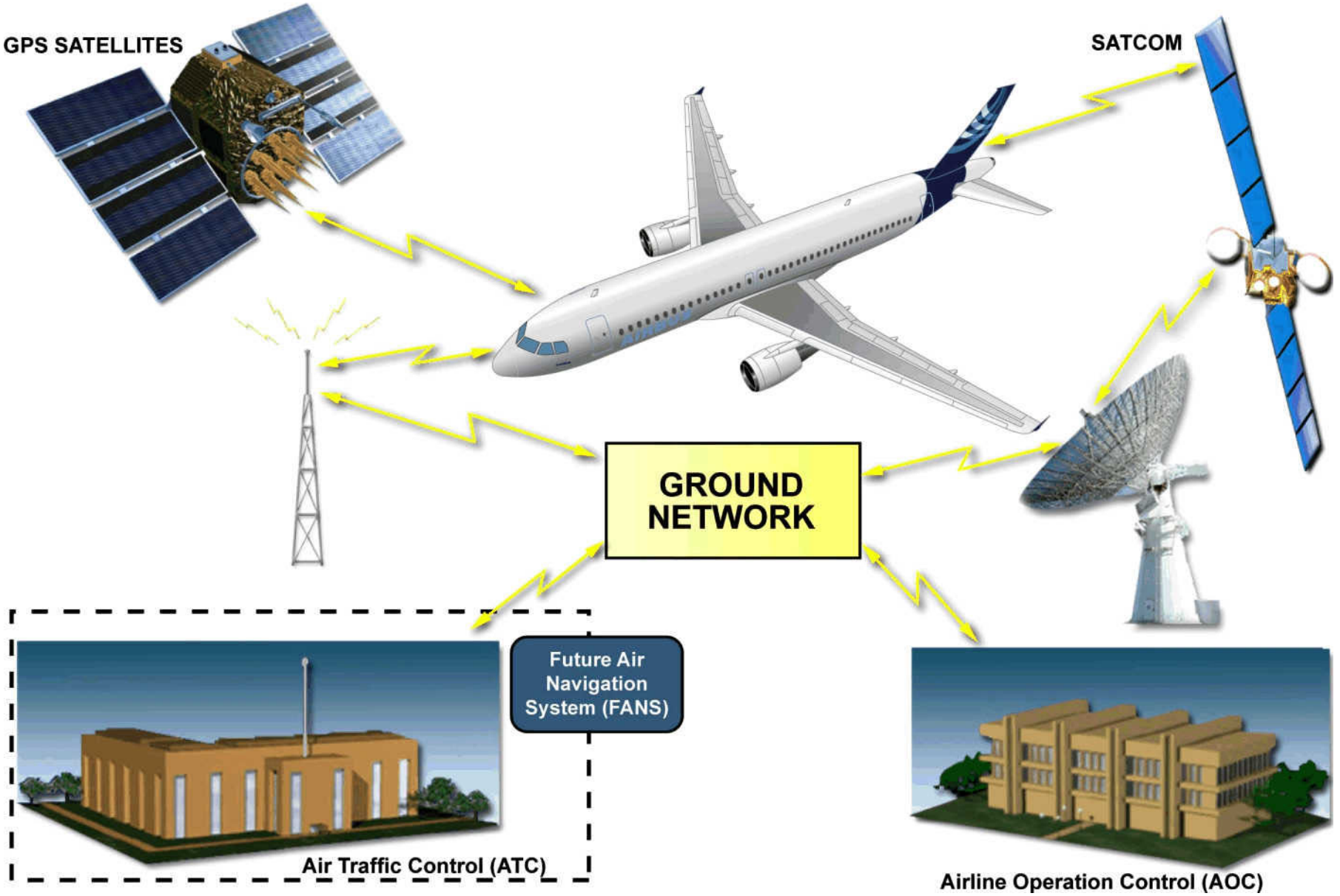


Figure 1 ATIMS Principle

General/What is FANS?

FANS is an abbreviation and is for **F**uture **A**ir **N**avigation **S**ystem. Thus a procedure represents FANS, which is to be used in the future for navigation in aviation. The air traffic control created for it a concept, which itself is called CNS/ATM (**C**ommunication **N**avigation and **S**urveillance/**A**ir **T**raffic **M**anagement). This information defined by the I.C.A.O. 1983 were already published.

CNS/ATM represents a concept for the safe and efficient handling of future air traffic, whereby additionally larger capacities result from this new procedure.

Further the structure of a GNSS (**G**lobal **N**avigation **S**atellite **S**ystem) is being introcuded which is led by the European countrys. This wil be a system used only for cvil aviation.

The IATA (Asia Pacific Group) undertook large efforts, to introduce this concept and their members will benefit from introduction of the ”test tracks” in 1998 between Asia, Europe and the USA.

For future Navigation procedures in aviation the abbreviation FANS has been generally established.

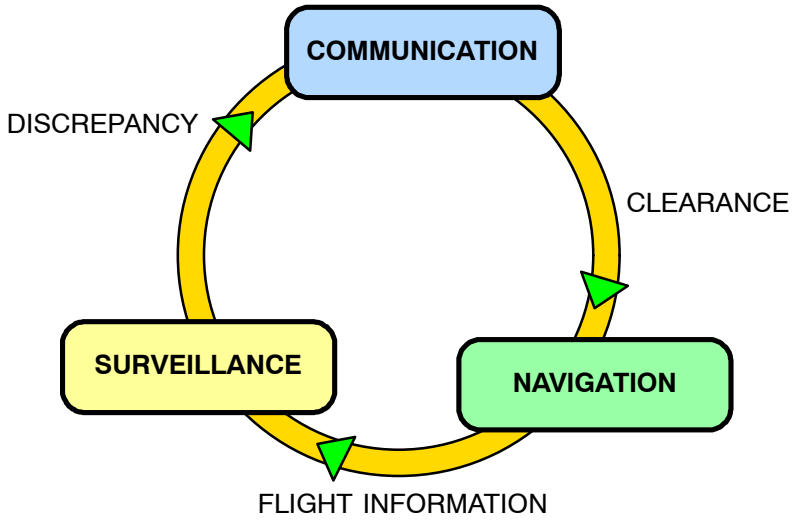


Figure 2 ATIMS Concept

Air Traffic Control Today	Air Traffic Control Tomorrow
Communication / Navigation / Surveillance	
Communication takes place by VHF, HF or SATCOM radio communication. This language transmittal, typically through a “Third ” person , which translates the messages of the crews at the teleprinter and further sends them to the air traffic controllers.	Communication takes place via Satellite Communication (Data and Voice)
Over the continents (the USA, Europe) navigation is based on GPS or ground–based radio beacons (VOR, NDB). Over water and small settled or poor countries, navigation takes place by GPS or INS (Inertial Navigation Systems).	Navigation takes place by GPS (Global Positioning System). For this a “civil ” GPS = GNSS ✳will be introduced.
In the air space over highly developed countries the position monitoring takes place by ground–based radar. Over water and small developed countries the position monitoring is made by verbally delivered position signals via HF.	Position monitoring takes place automatically and via Satellites. The GPS position and A/C heading is automatically transmitted via the datalink to ATC.

✳

GNSS 1 represents a transition level to GNSS 2 it be based on the militarily controlled systems GPS and GLONASS, but however certain civilian components (e.g. EGNOS) have been added to improve the use of the Satellitennavigtion in the European air space.

GNSS 2 is a global ” civilian ” satellite system, which is controlled and led by the EU+CIS. It fulfills all European aviation requirements and will be introduced in addition, in order to become certified as the only navigation system for all flight phases (+Differential GNSS Ground station).

SYSTEM INTRODUCTION

Up to now, flight crew have communicated with air traffic controllers using HF and VHF radio communications which are subject to atmospheric disturbances and so, often difficult to understand.

Furthermore, the transmission networks become saturated due to the air traffic increase, and to the limited capability to exchange complex data (routes, weather information...).

Consequently, the Air Traffic and Information Management System (ATIMS) has been developed to enable datalink communications and the exchange of complex data or specific reports between the aircraft and the ground centers:

- controller–pilot datalink communications (HF voice in backup) for air traffic management,
- specific airline–aircraft communications (operational control) to improve airline operational costs and flexibility.

PRE–FANS, FANS

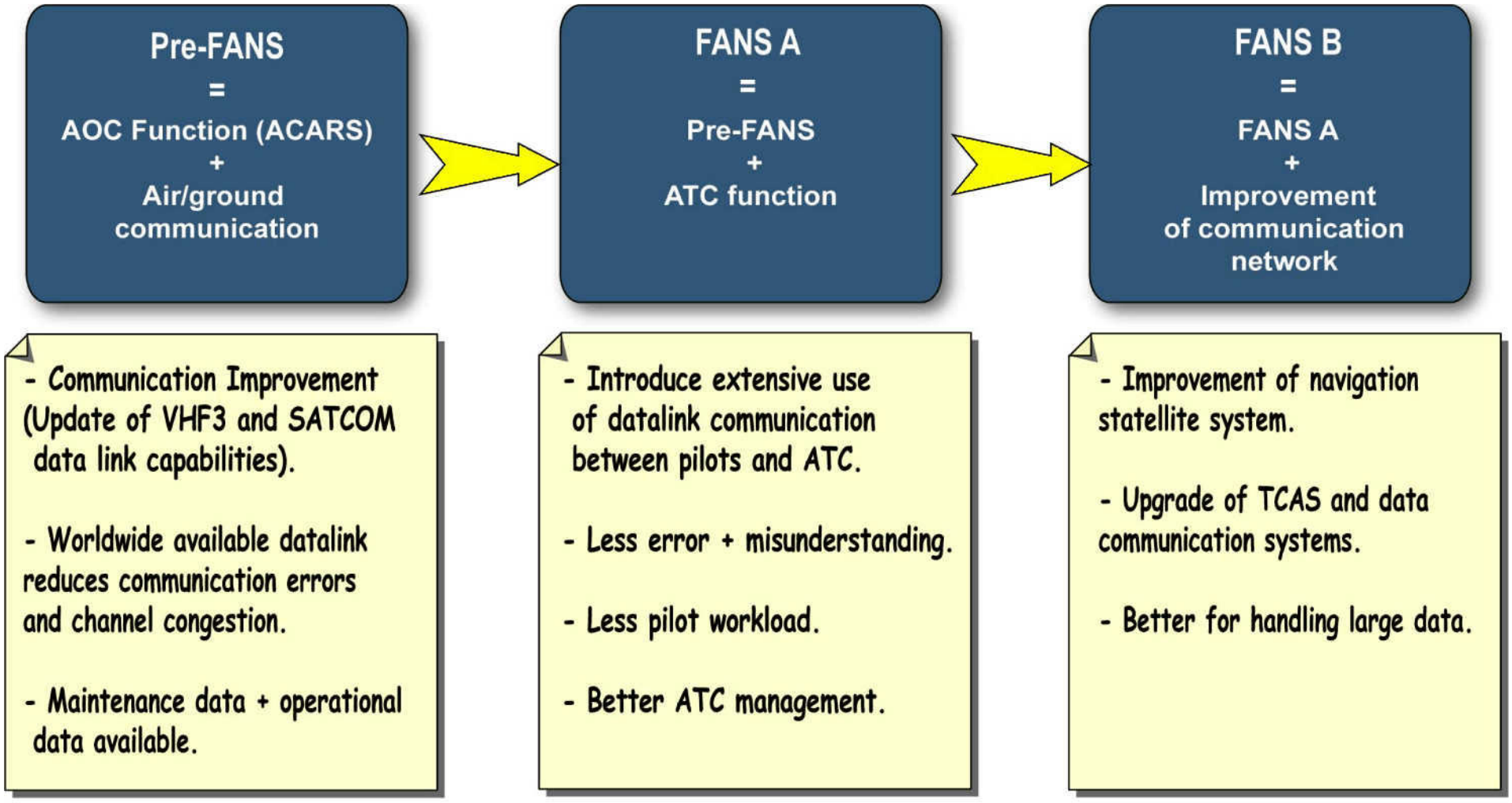
There are three stages of FANS development.

- Pre–FANS (Communications (COM) and AOC functions),
- FANS A (pre–FANS + ATC functions) and
- FANS B (FANS A + improved ground network + Traffic Alert and Collision Avoidance System (TCAS)).

Today, the pre–FANS allow the AOC function.

It provides the crew with Aircraft Communication Addressing and Reporting System (ACARS) equivalent functions and more, as for instance:

- NOtice To AirMen (NOTAM), weather, winds aloft requests,
- free text message exchanges,
- diversion, delay, refueling, flight reports,
- aircraft data from Centralized Fault Display System (CFDS), Aircraft Integrated Data System (AIDS), cabin terminal...etc.



ACARS: Aircraft Communication Adressing and Reporting System
AOC: Airline Operation Center
ATC: Air Traffic Control
FANS: Future Air Navigation System

Figure 3 FANS Overview

WHAT ARE THE ADVANTAGES OF FANS?

1. The seperation between the airplanes (in flight) can be reduced. More airplanes per time unit on a route.
2. Air routes can be optimized.
3. More direct routes.
4. Satellite communication.
5. When crossing other air routes it can be omitted more frequently to change to a lower and thus uneconomic flight level.

At the same time an increase of the safety standard will take place.

Why FANS is necessary?

- increased fuel consumption by ”detours”.
- cargo capacities cannot be used completely, since too much fuel must be carried forward.
- takeoff delays caused by overcrowded air space.

1. Distance/Separation

In order to be able to determine the ” safety margin ” from airplanes, the following factors must be considered:

- errors in navigation actually and
- potential errors in the voice communication between crews and air traffic controllers.

The problems of the traditional, spoken position signals and the delays in connection with high frequency transfers over ”Relay” stations (20 – 45 minutes to transmit a position report), require an enormous distance between individual airplanes. This distance is typically 100 Nm to geographical latitude and 120 Nm at geographical length. This results in a surface of 48.000 square NM, which are blocked by a single airplane.

The consequence of the fact is that many airplanes can‘t fly at the optimum altitude and with the optimum speed.

FANS equipped airplanes however can deliver automatically their position as well as its further intentions (heading/track, speed, altitude) with the help of a satellite connection at least every five minutes.The determination of the position takes place with the help of the very exact GPS (**G**lobal **P**ositioning **S**ystem) or GNSS (**G**lobal **N**avigation **S**atellite **S**ystem).

Digital data communication between the crew and the air traffic controller reduces drastically the possibilities of errors and permits less seperation between individual airplanes.

The total of improvements in communication, navigation and surveillance of air traffic enables Air Traffic Control to reduce the seperation between the airplanes. For this reason the flight can be performed in optimum altitude which also reduces the fuel burn.

2. Optimized air routes

Transatlantic flights e.g. are planned at present with meteorological data, which are approx. 12 to 18 hours old. If satellite communication is used, which represents a section of FANS, the current meteorological data can be transmitted to the airplane during flight. The flightcrews are now able to create an optimized flight plan, or on the ground an appropriate plan is created and transmitted to the crew. This dynamic planning enables airlines to carry forward, less fuel for “Eventualities ”, which means again that still less fuel is used, or more pay load can be carried forward.

3. More direct routes

In many cases the current air routes are a compromise due to the navigation aids available on the ground and radar coverage. This leads to extended air routes. However if the advantages of the satellite navigation and communication are used, the possibility is higher of flying more direct and thus shorter routes.

After introduction of FANS the operators of airplanes benefit of the lower fuel consumption, of shorter flying times and increased pay loads.

Costs related to crews and maintenance are thereby reduced,too.

To fly FANS routes, the airplanes must fulfill the following requirements:

1. **AOC (Airline operational control) data link**

   AOC connection permits the airlines, to transmit optimized routes, to deliver position signals and to transmit current wind information about the data link.

2. **ADS (Automatic Dependent Surveillance)**

   The ADS function transmits the current position via satellite or VHF data link to air traffic control. Automatic surveillance of ”enroute” airplanes takes place.

3. **ATC (Air Traffic Control) data link**

   The ATC datalink connection replaces voice communication of the crew with the air traffic controllers. Desired modifications of the original flight plan can be transmitted. The air traffic controllers have the possibility of requesting via this way modifications of the original flight plan.

4. **GPS (Global Positioning System) or GNSS integration**

   By using GPS or GNSS a more exact positioning on routes and during approach is possible. The navigation system must prove that it achieves the necessary RNP**.** It provides also a time reference for the RTA, see below..

5. **RNP (Required Navigation Performance)**

   RNP criteria describe accuracy, integrity and availability for ”FANS” operations. The navigation systems are permanently monitored.If the accuracy required for a route is reduced, the crew is informed and can initiate counteractions if necessary.

6. **RTA (Required time of Arrival)**

   With RTA air traffic control can transmit temporal limitations concerning a waypoint. This enables the crew to achieve a certain geographical point at a previously defined point in time. The cruising speed is adapted to the requirements automatically, so that the desired waypoint at the desired point in time (+ / – 30 seconds) is achieved. If the desired RTA is not possible, the crew is alarmed visually.

4. Satellite communication

With the aid of the satellite navigation the period of reply for an airplane, which requests a LEVEL CHANGE on an optimal flight altitude, can be reduced to a few minutes. A saving of fuel is the result. At present the time for a reply is approx. 20 min. to 45 min..

5. Flight level change

In order to avoid potential conflicts, an airplane, which achieves a crossing airway, must be vertically separated from all other airplanes. This means that one of two airplanes must leave its actual altitude to an altitude up to 4000 feet below its optimal flight altitude. If the air traffic controller has more accurate position data and if the airplane can control its speed in such a way that the flight level change is achieved at a certain point in time, the vertical seperation for this manouver is used less often.

46–20 FLIGHT DECK INFORMATION SYSTEMS

GENERAL DESCRIPTION

PANEL LOCATION/CONTROL AND INDICATING

Pre-FANS

The ATSU line key from the MCDU MENU gives access to:

AOC MENU line key and,

COMM line key.

MCDU ”ATC COM” key is inoperative.

The COMM line key gives access to the COMM MENU, which is used for the management and control of the air/ground router.

The AOC line key gives access to the AOC MENU page, which is used for the management of AOC functions (equivalent to ACARS functions).

The content of this menu depends on the AOC applications selected by the airline.

Messages related to the pre–FANS status are displayed on the EWD.

The ”ATC MSG” pushbutton is inoperative.

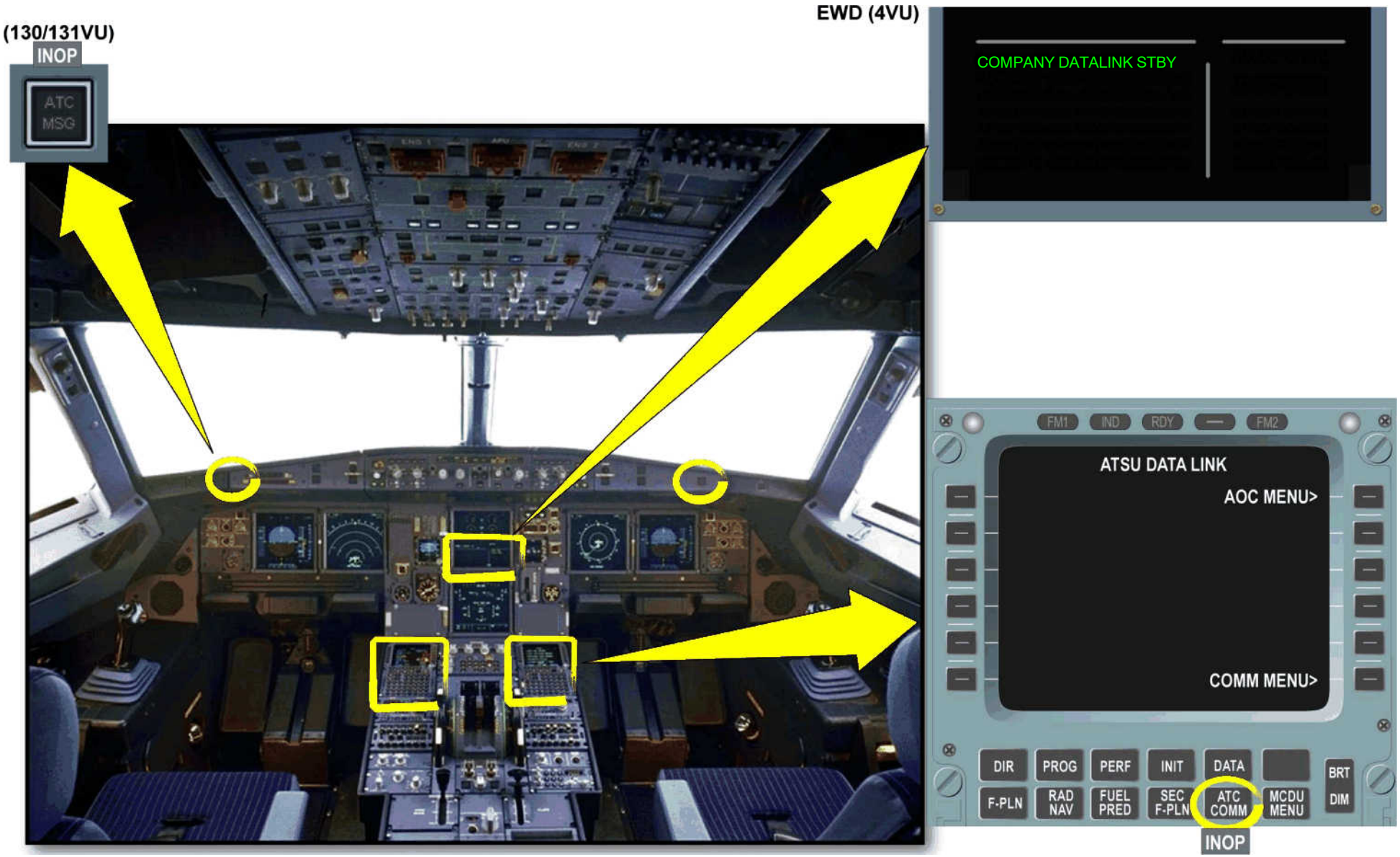


Figure 4 Pre-FANS Configuration

FANS A & B

In FANS configuration the ”ATC MENU” prompt is available to get access to ATC pages. The ”ATC COMM” key gives the same access but as a shortcut.

Two attention getter pushbuttons are operative and indicate ATC incoming messages.

Two DCDUs give full time accessibility and readability for messages exchanged with the ATC and both crew, which require only limited head–down time.

Text messages instead of voice communication reduce the risk of misunderstanding.

NOTE: The DCDUs are the interfaces for ATC messages only.

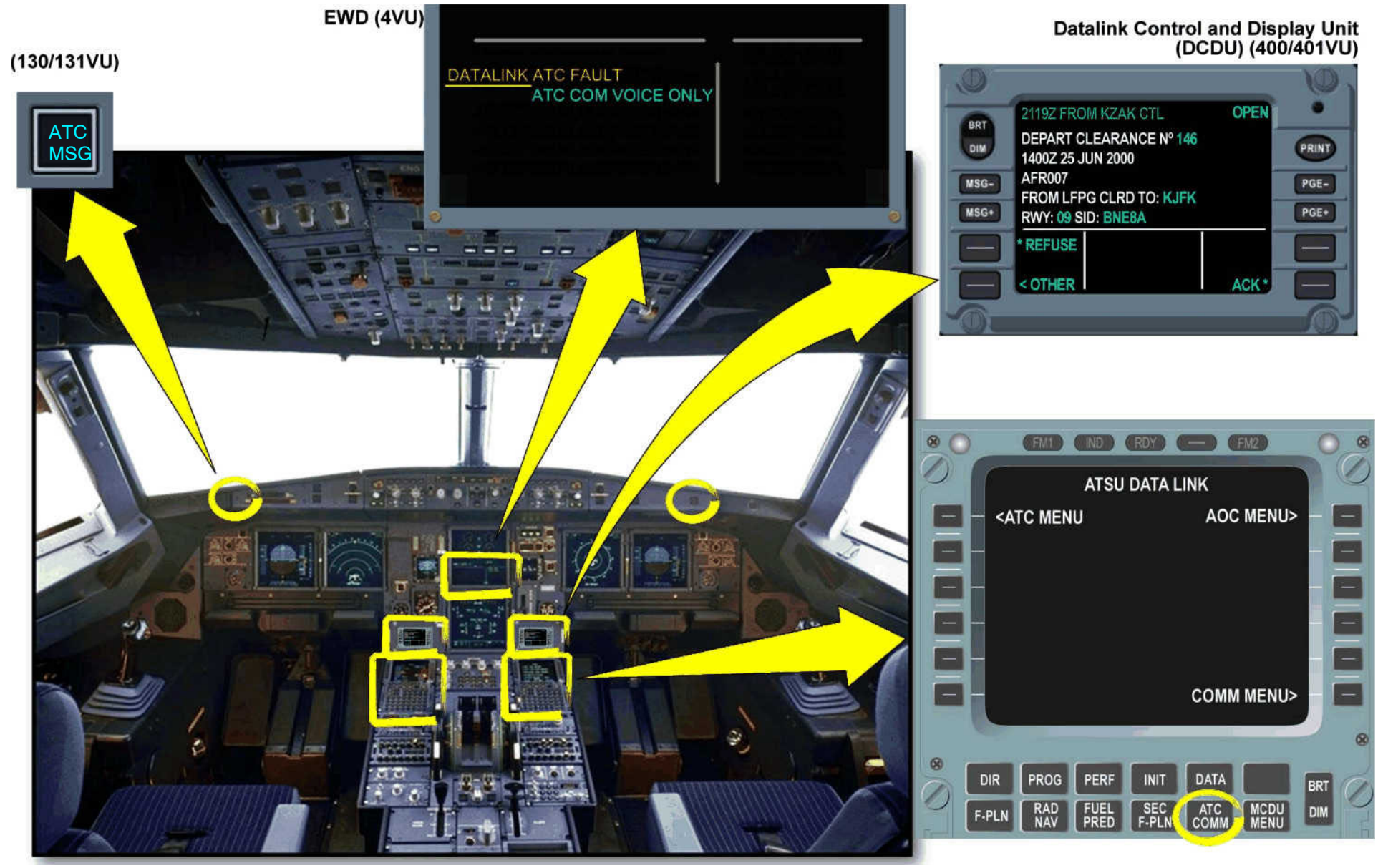


Figure 5 FANS Configuration

ATIMS SYSTEM ARCHITECTURE

General

The ATIMS pre–FANS configuration mainly has an Air Traffic Service Unit (ATSU).

The ATSU is used:

- to manage communications (air/ground data–links),
- to manage applications (on board data routing).

The ATSU is configured in pre–FANS to do:

- the management of air/ground communication,
- Airline Operational Control applications.

The communication devices include:

- the SATCOM if installed,
- the VDR
- the HF.

The Pre FANS crew interfaces include:

- the ECAM, and,
- the MCDU.

For FANS–A and FANS–B equipped aircraft there are:

- two Data Communication Display Units (DCDUs),
- two attention getter pushbuttons, marked ”ATC MSG”,
- the MCDU ”ATC COM” key operative.

The ATSU manages the communication message exchanges to and from the peripheral computers (on–board routing function).

The software is uploaded in the ATSU by means of the Multipurpose Disk Drive Unit (MDDU) or the Portable Data Loader (PDL).

System Description

The ATIMS consists mainly of an Air Traffic Service Unit (ATSU) which provides:

- datalink services for ATC
- datalink services to remote Airline Operational Control (AOC) application embedded in the ATSU and in on–board peripherals:
  - Flight Management and Guidance (Envelope) Computer (FMG(E)C),
  - Flight Data Interface Management Unit (FDIMU),
  - Centralized Fault Display Interface Unit (CFDIU), or
  - on A330/A340 Central Maintenance Computer 1 & 2
- management of the datalink media:
  - VHF 3 datalink (mode ACARS also known as ACARS Aviation VHF Link Control (AOA): new frequency, new modulation, new air/ground protocol)
  - Satellite datalink (optional)
  - HF datalink (optional).
- Aircraft Interface software (for host platform services)
- Configuration software (for manufacturer configuration parameters)
- Router parameters software
- AOC application software
- AOC database software.

FWC Interface

The ATSU uses the services provided by the FWCs to activate visual/aural alerts and warnings for the different applications.

MCDU Interface

Two sets of functions are accessed via the MCDU:

- hosted AOC applications,
- air/ground communication management function.

NOTE: If a third MCDU is installed, only two MCDUs upon three can be used simultaneously by the ATSU.

Printer Interface

The AOC applications use the services of the printer for the following purposes:

- print out of received messages (automatic or manually initiated on MCDU)
- MCDU screen hard copies

RMP Interface

Each of the three RMPs is an interface device for the VDR3 operation. The frequency range is from 118000 to 136975 KHz by 25 KHz or 8.33KHz steps. Each RMP enables the crew to request a switching of the system (between the RMP and the ATSU) which controls the VDR3 (VHF 3 Digital Radio) frequency by pressing the transfer pushbutton switch, located between the two windows.

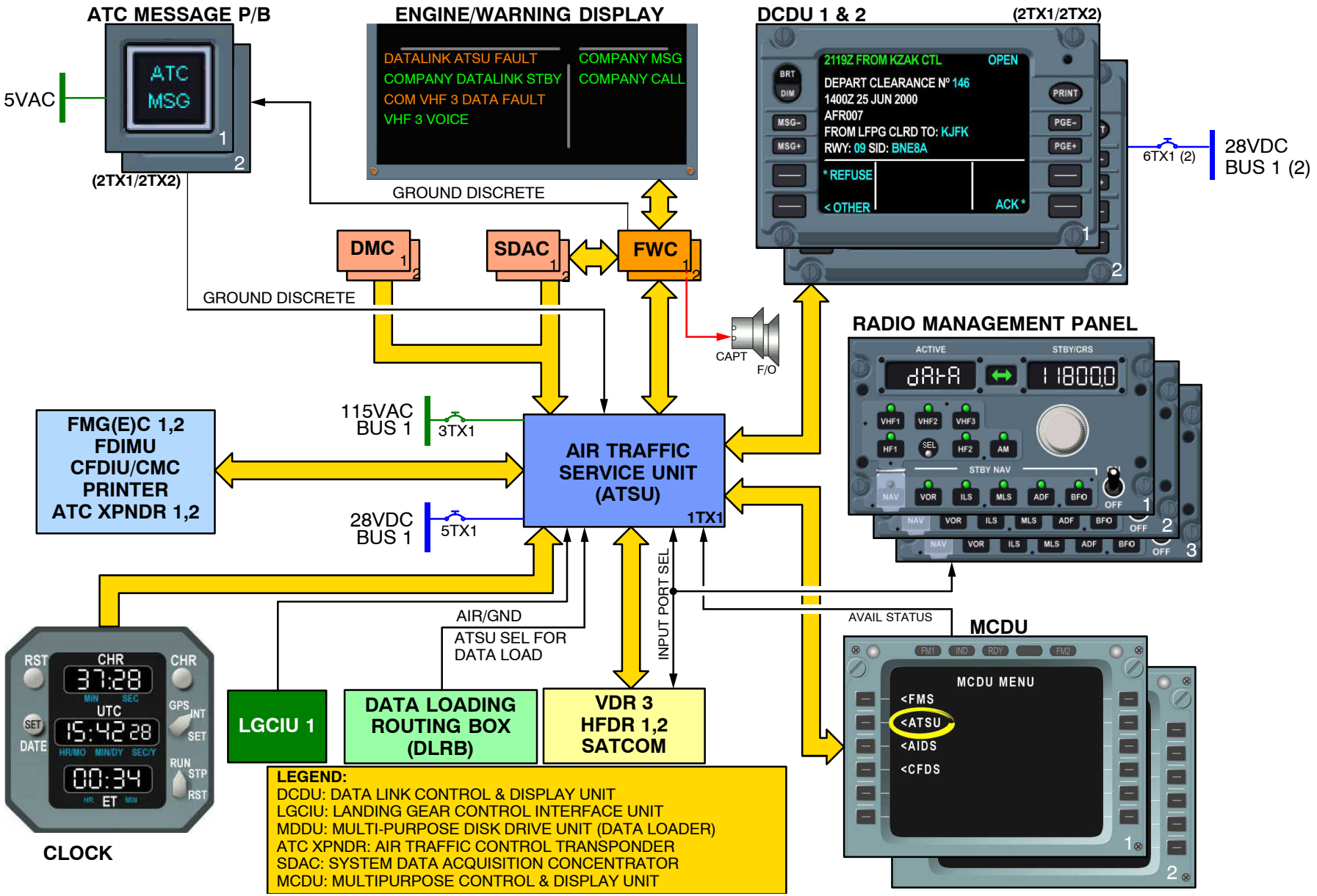


Figure 6 ATIMS System Architecture

ATIMS SYSTEM OPERATION

ATSU

The Air Traffic Service Unit (ATSU) has been designed to take provision of all foreseen evolutions. The modularity concept for the software (S/W) makes easy data link capability during all Communication Navigation Surveillance and Air Traffic Management (CNS/ATM) transitions.

The ATSU S/W is partitioned into two main parts:

- aircraft interface/host platform and,
- data link applications.

Aircraft Interface/Host Platform Software

The aircraft interface/host platform S/W is composed of four services:

- air/ground communication, used for the management of the air/ground communication media,
- Human–Machine Interface (HMI), used for the management of the CNS/ATM cockpit interfaces: MCDU, printer and alert function,
- on–board peripherals, used for the management of the communication with the on–board peripheral units: Data Management Unit (DMU) part of the Flight Data Interface and Management Unit (FDIMU), Centralized Fault Display Interface Unit (CFDIU) or Central Maintenenace Computer (CMC), Flight Management System (FMS) and cabin terminal (optional),
- system management, used for the acquisition of the aircraft parameters for application S/W use and monitoring of power supply and BITE functions.

Data Link Applikation

The data link applications include only Airline Operational Control (AOC) for the pre–Future Air Navigation System (FANS) configuration. The AOC applications are dedicated to data communication services between the aircraft and the airline facility.

The AOC is composed of:

- remote AOC applications,
- hosted AOC applications.

For the remote AOC applications, the ATSU only routes data to and from AOC peripherals.

This routing is in charge of receiving ground messages and routing them to the right AOC peripheral and acquiring messages or reports from these peripherals and sending them to the ground. The hosted applications depend on airline definition and uploaded into the ATSU. These applications include standard and customized functions.

The main functions are:

- AOC menu display,
- processing, printing and display of received messages,
- generation, triggering and sending of messages.

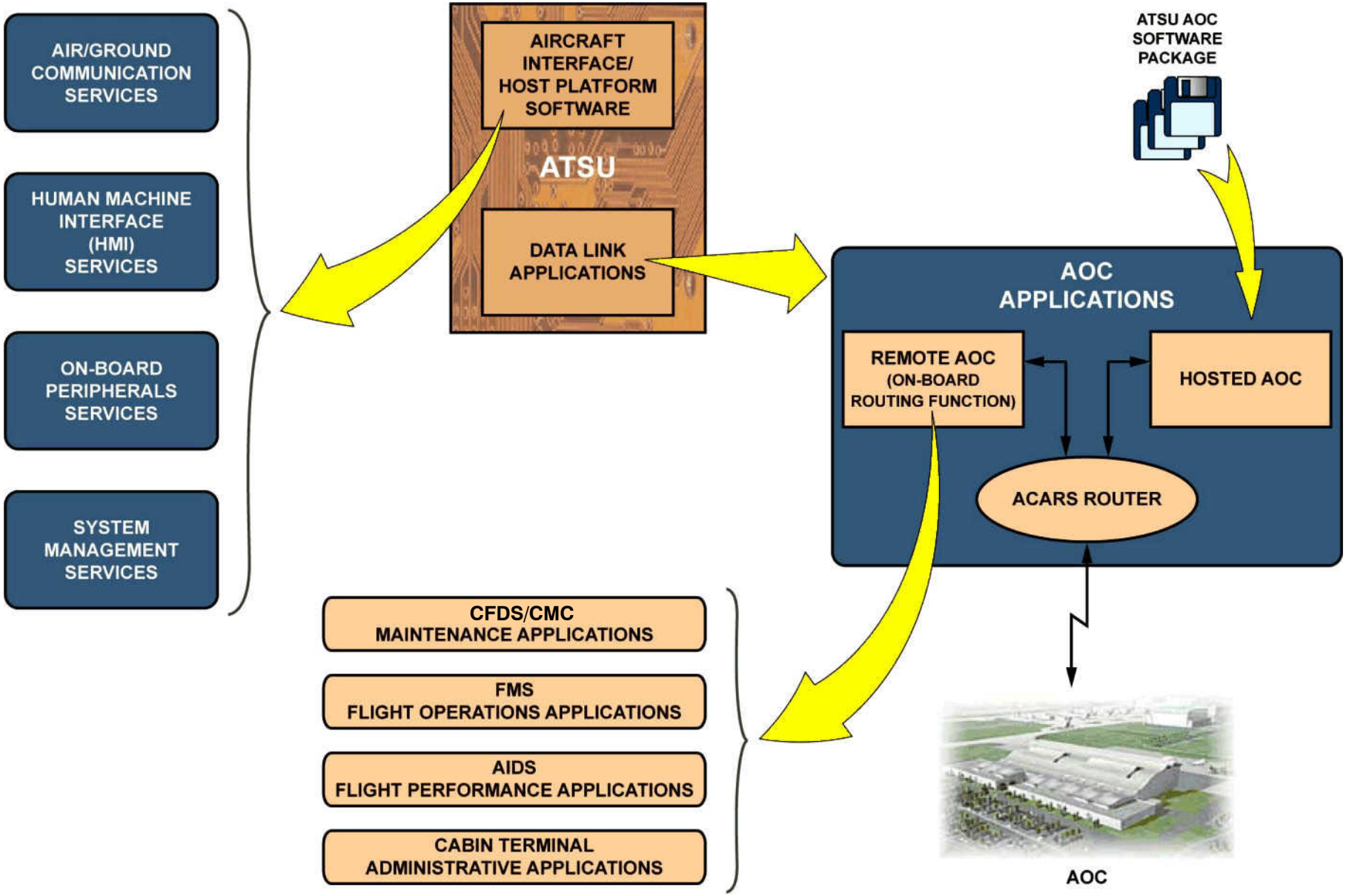


Figure 7 ATSU Description

DCDU PRESENTATION

The DCDUs (**D**ata **L**ink **C**ontrol **D**isplay **U**nits) are the interface means dedicated to the ATC applications. They provide the flight crew with display capabilities and control means, allowing the display of messages received from ATC ground center and the sending of answer and messages to the ground center. The DCDUs are managed by the ATSU which processes and organizes the data in screen pages to be displayed and translates received key codes into crew orders (soft keys).

Functional Operation

The DCDU has two main functions:

- **Display function:** Display of the air traffic system information to the flight crew

  The DCDU is equipped with an LCD flat panel. The DCDU displays the messages formatted by the ATSU on a black background, in eight different colors: amber, black, cyan, green, magenta, red, white and yellow.

  These messages are in semi–graphical format and include alphanumerical text and simple graphical attributes such as boxes, arrows, separation lines, ”inverse video”...

- **Control function:** A response device for the flight crew.

  The DCDU has:

  – four pushbuttons switches associated to menu keys named ”soft keys”

  – four engraved pushbuttons switches dedicated to:

    - page up and down functions,
    - message up and down functions,
    - print function,
    - manual brightness control.

      In addition, the pushbuttons switches are lighted for night vision in accordance with the general cockpit selection.

Each DCDU has a ”black screen” function in order not to disturb the flight crew in case of abnormal display. Any action on a pushbutton switch is transmitted to the ATSU.

Any action on a menu key is acknowledged by the DCDU itself on the display, prior to and independently of a possible message change from the ATSU, by a reverse video display.

Physical Description

The DCDU is equipped with a LCD screen and twice four push–buttons located on each side of the screen.

Electrical Characteristics:

- power supply: 28VDC,
- dissipated power: 16.5 Watts (average value),
- one back connector.

ATC MSG Illuminated Pushbutton Switches Description

These pushbutton switches provide the flight crew with a visual alert in case of ATC message reception and with an alert cancel means by pressing them. They are activated by the FWCs.

In addition, an aural alert is triggered by the FWCs, single or repetitive audio sounds according to the priority of the message.

ATSU/DCDU Interface

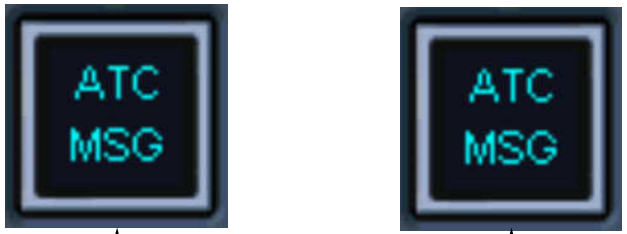
The display function enables the DCDUs to provide the flight crew with information relative to ATC applications, screen by screen on the DCDUs with the required frame. The recall function enables the DCDU to receive again all the information relative to the last display. The response function enables the DCDUs to transmit to the ATSU the flight crew order generated by pushing the keys located on the DCDU front face, except for the BRT/DIM keys.

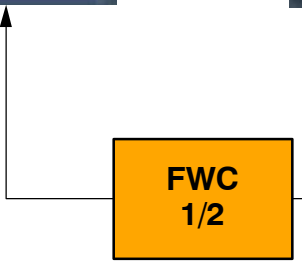
The test function enables to display DCDU test or self test when the aircraft is on ground.

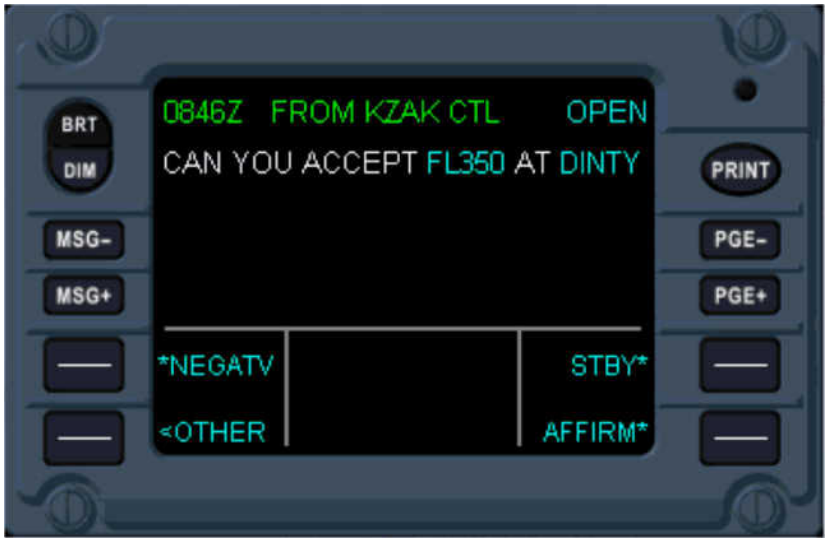
The report function enables to provide the ATSU with BITE memory data concerning specific events which do not occur in normal operation:

- Error Reports when a problem occurs during the transmission of information between ATSU and DCDU for maintenance purpose.
- Status Reports when internal faults are detected in the DCDU.

The LRU identification function enables the ATSU to get the part number and the serial number of the DCDUs. The Initialization function enables to inform the ATSU that the data transmission protocol has been initialized or reinitialized (after ATSU power up or reset, after DCDU reset or after consecutive transmission errors). The ATSU transmits display information to the DCDU via the ARINC 429 high speed bus, using the bit–oriented communication protocol as defined in ARINC 429 specifications







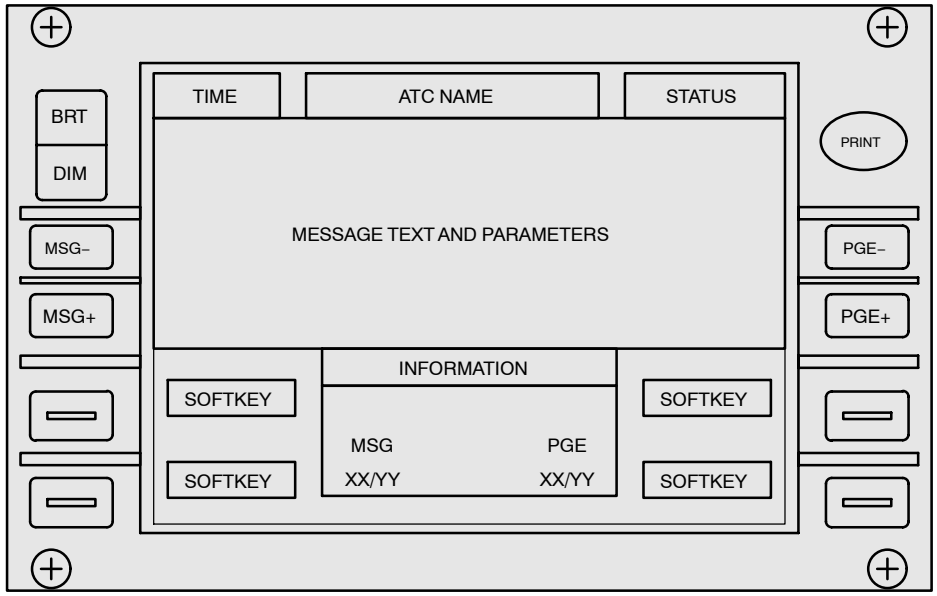


Figure 8 DCDU and ATC MSG Lights

RMP DESCRIPTION

Each of the three RMPs is an interface device for the VDR3 operation.

The frequency range is from 118000 to 136975 KHz by 8.33KHz steps.

Each RMP enables the crew to ask for a switching between the RMP and the ATSU to control the VDR3 frequency:

- When the RMP controls the VDR3 frequency, only the Voice mode is available and the selection of the VDR3 frequency is done through the RMP by displaying the frequency in the ACTIVE window.
- When the ATSU controls the VDR3 frequency, the Voice mode can be accessed through the ATSU menu on the MCDU and the selection of the VDR3 frequency is done on the MCDU either in Data mode or in Voice mode.

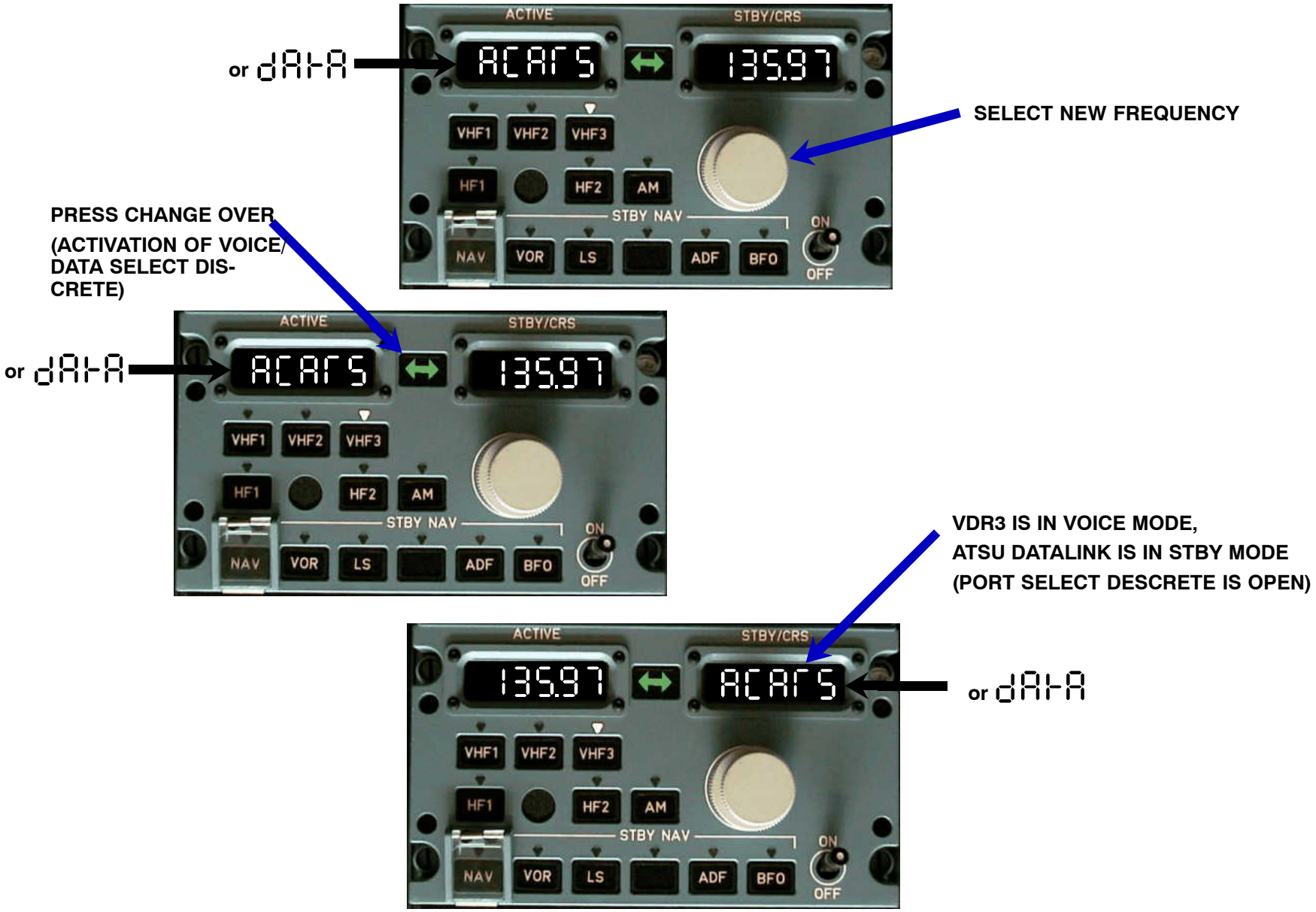


Figure 9 Initialization on RMP

ATSU INTERFACES

GENERAL

The ATSU uses the data transparent protocol, defined in ARINC 429 Specification, when it communicates with the on–board avionics systems.

The ATSU is interfaced with the following peripherals units:

- the Datalink Control and Display Unit 1 and 2 (DCDU 1 & 2),
- the Flight Management Guidance and Envelope Computers 1 and 2, (FMGEC / A330/340 ATA 22–83),
- the Flight Management and Guidance Computer 1 and 2 (FMGC / A318–321 ATA 22–83),
- the Multipurpose Control and Display Units (MCDU / ATA 22–84),
- the VHF Data Radio 3 (VDR3) transceiver (ATA 23–12),
- the SATCOM Satellite Data Unit (SDU / ATA 23–28),
- the Radio Management Panels 1, 2 and 3 (RMP / ATA 23–81),
- the Clock (ATA 31–21),
- the Flight Warning Computers 1 and 2 (FWC / ATA 31–52),
- the System Data Acquisition Concentrators 1 and 2 (SDAC / ATA 31–54),
- the Display Management Computers (DMC / ATA 31–62),
- the ATC transponders (ATA 34–52),
- the Central Maintenance Computer(s) (A330/340 ATA 45–13),
- the Centralized Fault Display Interface Unit (CFDIU / A318–321 ATA 31–32),
- the Multipurpose Disk Drive Unit (MDDU) (ATA 45–22),
- the printer (A330/340 ATA 45–41 / A318–321 ATA 31–32).

OPTIONAL

- *the Fligt Data Interface Management Unit (FDIMU / ATA 31–36),*
- *the High Frequency Data Radio 1 (HFDR1) transceiver (ATA 23–11),*
- *the Cabin Terminals (ATA 23–74),*
- *the ATSU RESET pushbutton switch (optional).*

NOTE: The connection to, or the units itself, written in *cursive* are optional.

ATSU/DCDU INTERFACE

This interface fulfills the following functions:

- display function,
- recall function,
- flight crew response,
- BITE test,
- Report function,
- LRU Identification,
- communication protocol in the Initialization function.

INTERFACE WITH THE FLIGHT MANAGEMENT SYSTEM (FMGC OR FMGEC)

The interface with the Flight Management System fulfills the following functions:

- acquisition by the ATSU of aircraft data and parameters for hosted AOC application (origin/destination airport, flight number, fuel on board...),
- acquisition by the ATSU of aircraft data and parameters for air/ground communication functions and system management (flight number, FMS master/slave...),
- acquisition by the ATSU of navigation and flight management data file for ADS application,
- exchange of ARINC 619 messages for AOC remote application. For this application, the ATSU acts like a router,
- exchange of ARINC 619 messages for CPDLC application,
- acquisition by the FMS of datalink status information for both AOC remote application and ATC application. These data are sent by the ATSU on ATSU SYS 3 & 4 output buses.

The data and parameters for hosted AOC application, air/ground communication function and system management are sent by the FMG(E)C1 and the FMG(E)C2. ADS data files are sent by both FMG(E)C 1 & 2 on FMG(E)C M ADS output buses.

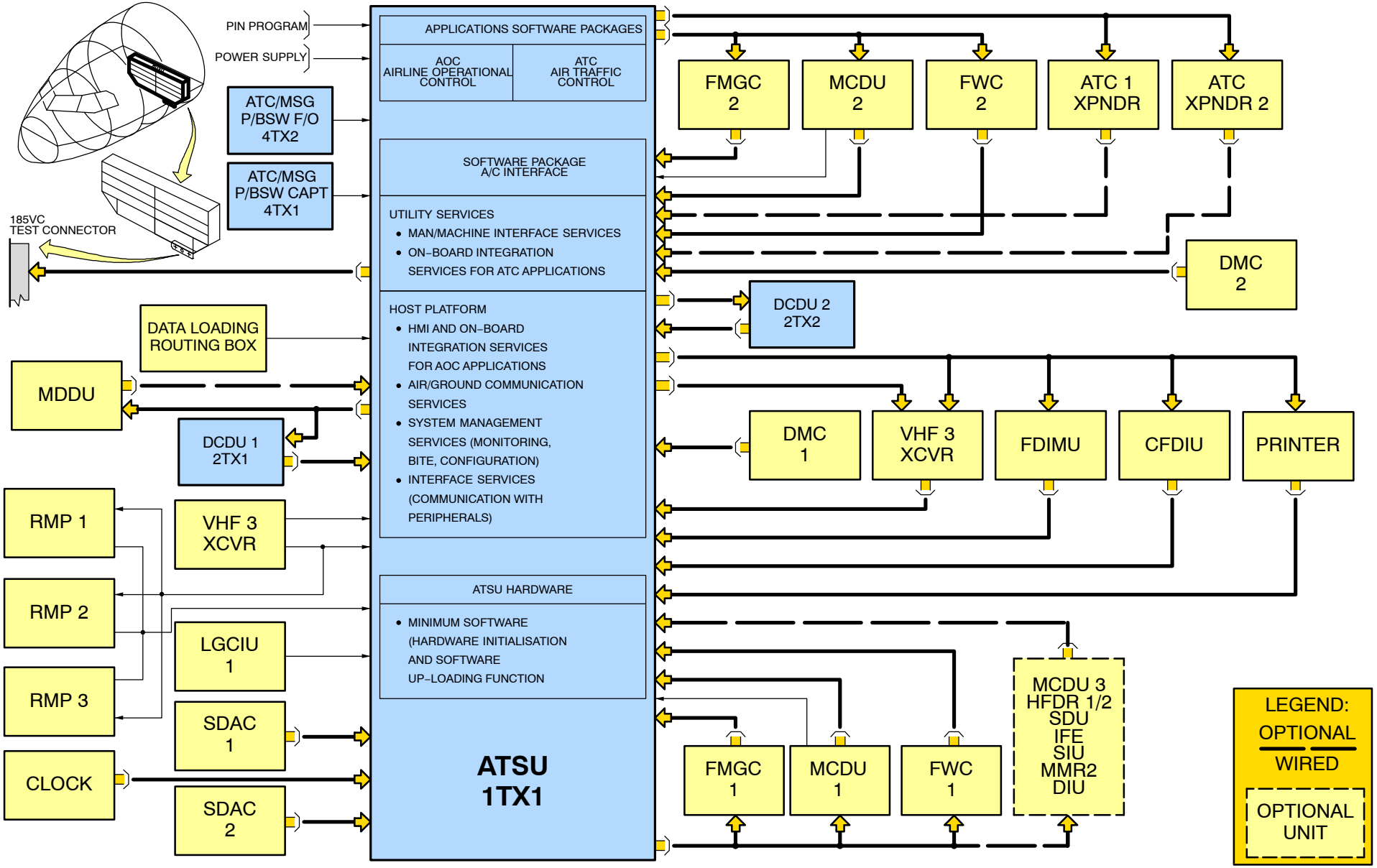


Figure 10 A320 Family: ATSU Interfaces

INTERFACE WITH THE MCDU

This interface is used for:

- AFN application to enable Logon request,
- ADS application to enable ADS activation/deactivation and mode selection,
- CPDLC application to enable ATC activation/deactivation, ATC menu selection, message generation, parameters entry and message display (Logbook function)
- hosted AOC applications to enable AOC menu selection, display of specific AOC information (AOC received messages, scratchpad messages...) and parameters entry by the crew (captain name, fuel units...),
- air/ground communication functions to enable display of specific router information, crew request and parameters entry,
- system management and configuration to enable status and configuration exchanges between ATSU and MCDUs.

INTERFACE WITH COMMUNICATION SYSTEM

The system is interfaced with:

- VDR3 for VHF data communications and VHF voice/data mode control,
- RMP 1/2/3 for VDR3 voice/data mode switching,
- SDU1 for Satellite data communications,
- HFDR1 for HF data communications (optional).

ATSU/VDR3 Interface

This interface is in accordance with ARINC 750 specifications.

The ATSU uses the services provided by the VDR3 to communicate with the ground in Data or Voice mode. Broadcasted data are sent on an output bus of the ATSU to the VDR3 Port A for VDR3 frequency.

The VDR/3 input bus and the ATSU COM2 output bus support:

- VDR3 status transmission to the ATSU (Voice/Data mode, failure...),
- ATSU status transmission to the VDR3 (primary source/destination, failure...),
- VDR3 configuration and control,
- ARINC 618 downlink and uplink block exchanges.

RMP/ATIMS Interface

One output discrete signal from the RMP is used to request the mode switching to the ATSU: remote port select discrete.

One output discrete signal from the ATSU indicates to the RMP which system, ATSU or RMP is controlling the VDR3: Port select discrete.

Remote port select information:

- The ATSU acquires the remote port select discrete from each of the three RMPs. Each RMP sends this signal to the ATSU to transmit the pilot request of switching the system controlling the VDR3 frequency.

Port select information:

- The ATSU indicates to the RMPs which system, ATSU or RMP, has to control the frequency by means of the port select discrete.

Satcom/ATIMS Interface (Optional)

The ATSU uses the service provided by the SDU1 to communicate with the ground in Data mode. The ATSU COM1 output bus and SDU1 input bus support:

- SDU status transmission to the ATSU,
- ATSU status transmission to the SDU1 (primary source/destination, failure...),
- ARINC 618 downlink and uplink block exchanges.

In Data mode, the SDU manages by itself its frequency tuning and connection with the ground network. The ATSU does not control the mode of operation of the SDU. The ATSU only uses the SDU status information.

ATSU/HFDR1 Interface (Optional)

The ATSU uses the service provided by the HFDR1 to communicate with the ground in Data mode. The ATSU COM2 output bus and HFDR1 input bus support:

- HFDR1 status transmission to the ATSU,
- ATSU status transmission to the HFDR1 (primary source/destination, failure...),
- ARINC 618 downlink and uplink block exchanges.

In Data mode, the HFDR1 manages by itself its frequency tuning and connection with the ground network.

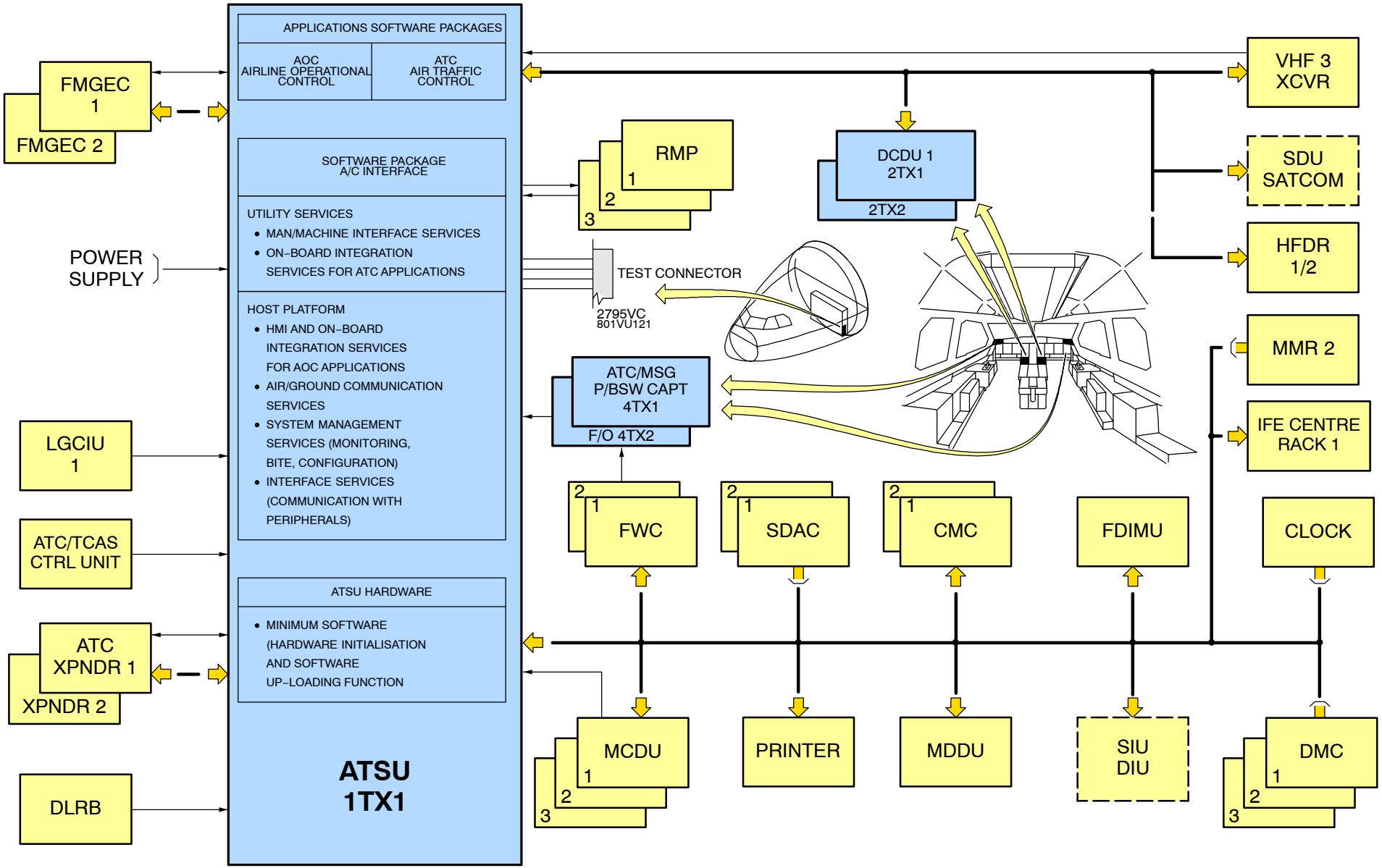


Figure 11 A330: ATSU Interfaces

INTERFACE WITH THE FLIGHT WARNING SYSTEM

Interface Description

The FWCs are used to generate warning indications to the crew.

The ATSU acquires broadcasted data needed for AOC hosted application from both FWCs and both SDACs.

Alerts And Warning Management

The ATSU broadcasts the following data on ATSU SYS1 & SYS2 output buses:

- ATC alerts:

  The ATSU handles this alert operationally (flight phase inhibition, sound and light repetition, synchronization and delay, alert cancel...) while the FWCs handle electrical signal generation, aural alert and alarm priority. The FWCs generate aural and visual ATC alerts when a CPDLC message is received.

- Airline warnings:

  The ATSU generates the alert while the FWCs manage the alert display, the flight phase inhibition, the alert cancel and priority.

- Datalink system alarms:

  The system management function of the ATSU sends signals to the FWCs concerning its own status and the VDR3 mode. The air/ground communication router of the ATSU sends signals to the FWCs concerning the status of the interface with communication system peripherals and the datalink communication availability. The FWCs generate the system alarms such as internal ATSU alarm, datalink alarm and communication system alarm, according to the flight phase inhibition and the priority level. The FWC displays the warnings/malfunctions in amber on the EWD, the INOP SYSTEM in amber and the limitations in cyan on the System Displays (SD).

Data delivery for ATSU applications

The FWCs and the SDACs broadcast data on FWC L1 & L2, SDAC L1 & L2 for the following functions:

- ATC application data delivery (in FANS A configuration only).

  The FWCs and the SDACs provide the ATSU with the parameters required for ADS reports.

- AOC application data delivery.

  The FWCs and the SDACs generate parameters requested by AOC application for AOC reports.

- ACARS Routing function data delivery.

  The FWCs provide the ATSU with A/C configuration parameters such as software pin programming: SDU1 and DMU installed or not installed. This information is used by the system management function of the ATSU for peripheral management (alarm signals, BITE message generation or inhibition, on–board routing function...).

INTERFACE WITH THE CLOCK

The clock provides the ATSU with UTC date and time.

INTERFACE WITH THE ELECTRONIC INSTRUMENT SYSTEM (EIS)

The DMCs provide the ATSU with position data in case of FMG(E)C failure and with various data for hosted AOC application.

INTERFACE WITH AIRCRAFT CONDITION MONITORING SYSTEM (ACMS) OR AIRCRAFT INTEGRATED DATA SYSTEM (AIDS)

The FDIMU is an optional peripheral hosting a remote AOC application. The FDIMU uses the ATSU as an ACARS Router (e.g. Engine Reports).

The ATSU broadcasts status information to the FDIMU to indicate the availability of the datalink communication:

- status of the air/ground datalink communication with the ground because the FDIMU checks it before sending downlink reports.
- status of the communication between ATSU and FDIMU.

INTERFACE WITH THE CENTRAL MAINTENANCE SYSTEM

A remote AOC application is hosted in the CMC(s) or CFDIU and the ATSU is used as an ACARS router.

The following services are implemented in this interface:

- Data acquisition for AOC application hosted in the ATSU.
- Data acquisition for Air/Ground communication function.
- Configuration label acquisition to adapt the ATSU to A/C configuration.

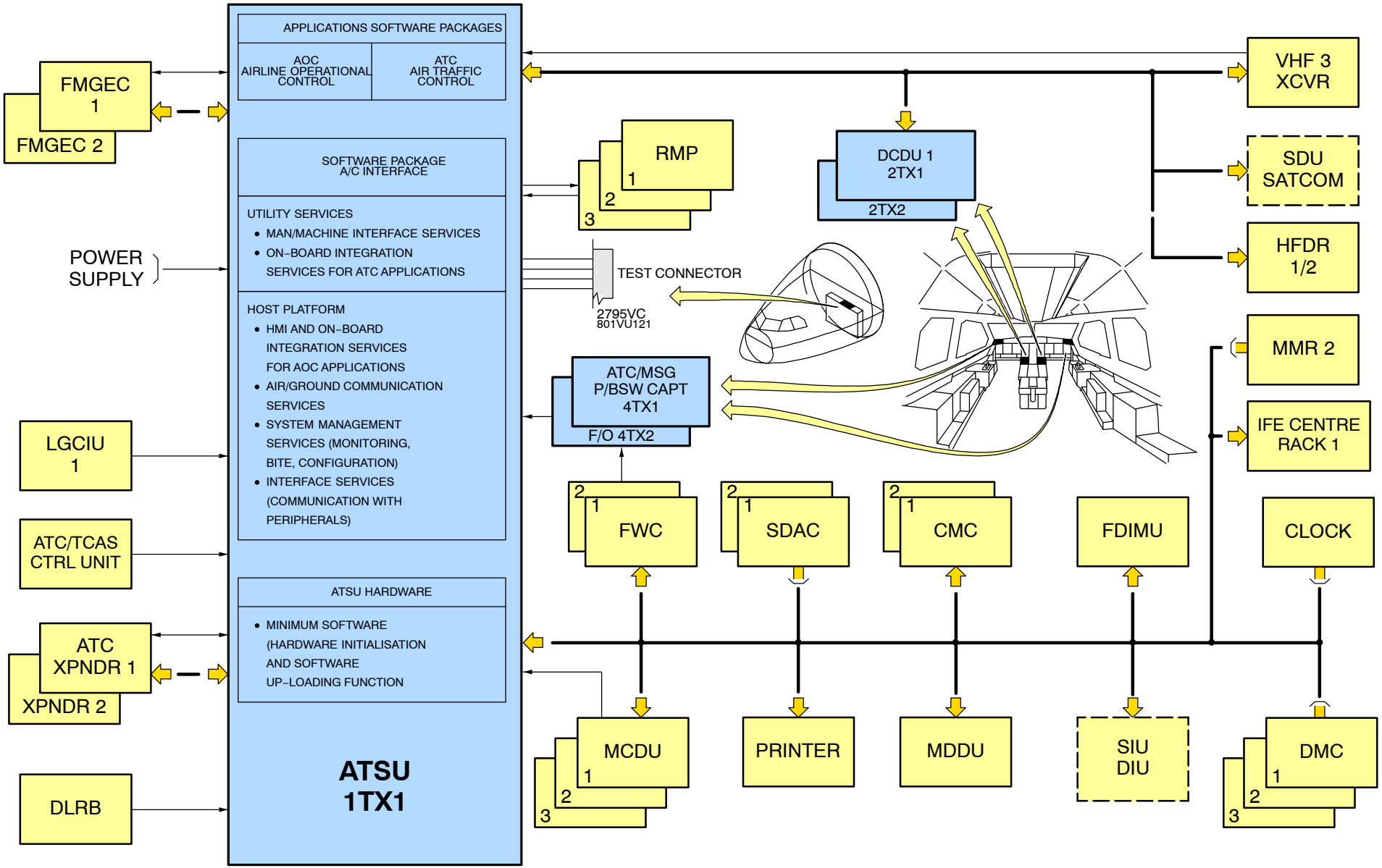


Figure 12 A340: ATSU Interfaces

INTERFACE WITH THE DATA LOADING SYSTEM

The ATSU uses the Data Loading System services for core application software and database uploading.

ATSU Software Uploading

The ATSU software is loaded through the MDDU by selecting the ATSU on the Data Loading Selector (DLS) 101TD (overhead panel). The loading procedure is ensured in the ATSU by the ”Boot software” included in the ATSU hardware case. The ATSU is automatically reset after a software loading operation when the DLS is set to OFF. The ATSU complies with ARINC 615 requirements for the interface with the Data Loading System.

ARINC–615A Data–Loading Function (A330/A340)

When this function is activated, the ATSU software can be directly uploaded by a high data rate Portable Data Loader (PDL) through a connector 3105VC located on the electronics rack 883VU.

PRINTER/ATIMS INTERFACE

The ATSU transmits data to the printer in accordance with ARINC 740 and ARINC 744 specifications. The ATSU acquires the printer status to determine whether it is operational or not. If the printer is available, a star is displayed near the print command on the concerned MCDU menus. If not, PRINTER NOT AVAILABLE indication is displayed on the scratchpad of the MCDU.

The printer is a multipurpose printer. So, the ATSU buffers data printing when the printer is busy.

INTERFACE WITH THE CABIN TERMINALS (OPTION)

The Cabin Terminal system to be considered is the Passenger Flight Information System (PFIS). The ATSU is connected to the Data Interface Unit (DIU). This interface is optional and no pin programming enables to determine if the DIU is installed or not. This ATSU/DIU interface supports exchanges using ARINC 429 protocol. These exchanges concern ARINC 619 messages related to the remote AOC application hosted in the DIU: DIU downlink reports and DIU uplink requests. The DIU uses the ATSU as an ACARS router. The ATSU sends downlink reports and informs the Cabin Terminals of the result of the transmission. The transmissions are only automatic or on ground request. The ATSU broadcasts to the DIU the status of the datalink communication: availability of the communication with the ground and between the ATSU and the DIU.

LANDING GEAR/ATIMS INTERFACE

The ATSU and both DCDUs receive information from the Landing Gear Control Interface Unit (LGCIU) to determine whether the aircraft is on ground or in flight. This information corresponds to ”Nose Landing Gear compressed or not”. It is provided by the LGCIU through three distinct discrete signals, one sent to the ATSU, the second one to the DCDU1 and the last one to the DCDU2:

- A ground signal indicates that the aircraft is on ground.
- An open signal indicates that the aircraft is in flight.

INTERFACE WITH THE ATC MSG PUSHBUTTON SWITCH LIGHTS

The ATC MSG pushbutton switches power supply is provided by transformers from LP circuit (Annunciator Light Test and Dimming) which supply with 7.5VDC voltage:

- Transformer 2LP2 supplies the legends of the pushbutton switches corresponding to FWC2 signals, for both Captain and First Officer alert.
- Transformer 2LP3 supplies the legends of the pushbutton switches corresponding to FWC1 signals, for both Captain and First Officer alert.

The DCDU face is illuminated through a 5VAC/400Hz voltage supplied by the LF circuit (Circuit LF Instrument and panel integral lighting). This voltage is provided through the graduator 6LF which enables light dimming in the cockpit.

INTERFACE WITH THE GPS

The ATSU receives the UTC date and time through the output bus 3 of the MMR2.

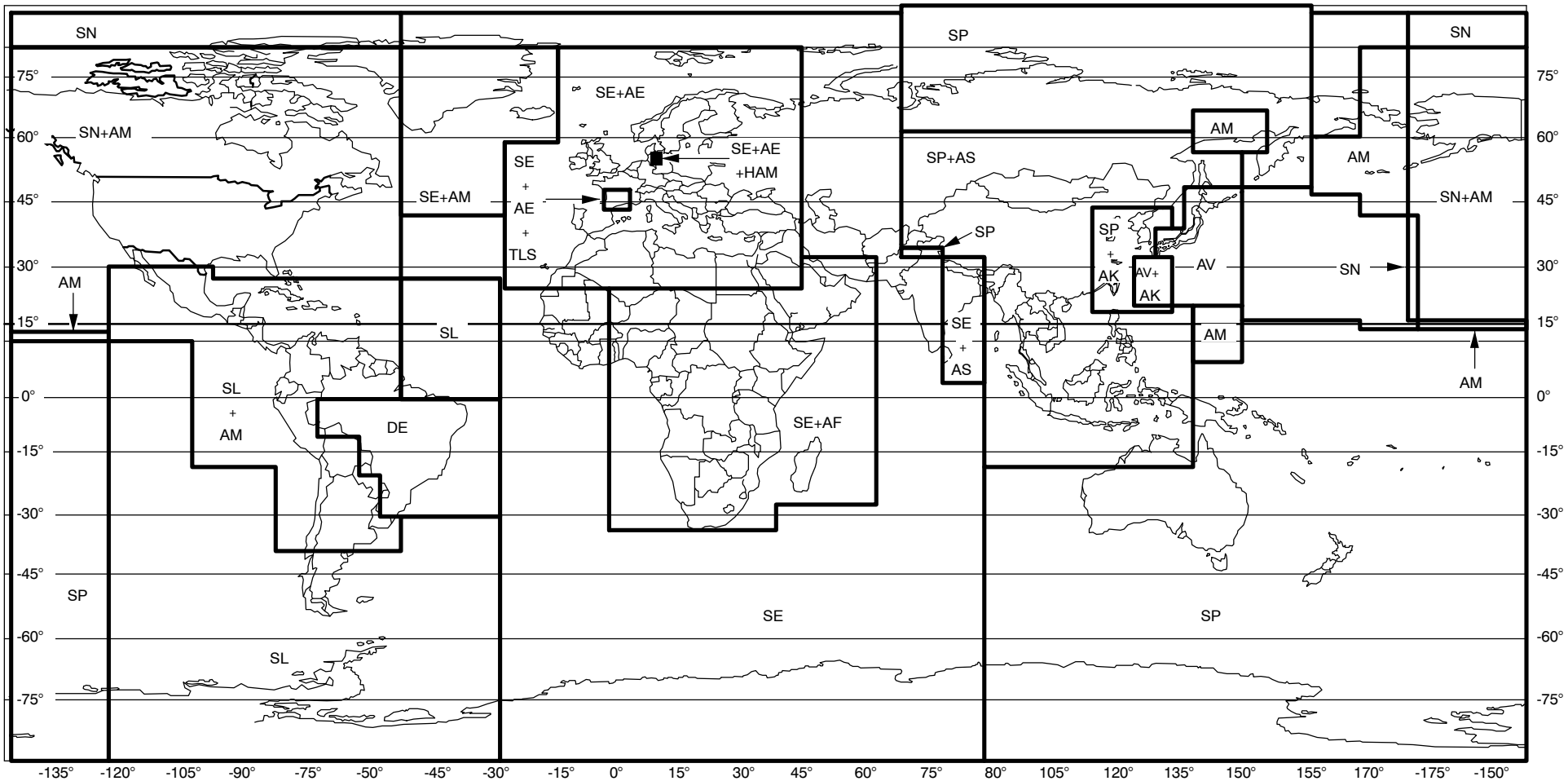
ATIMS/AIR CONDITIONING INTERFACE

The ATSU is ventilated in the electronics rack 80VU.

DATA EXCHANGE BETWEEN AIRCRAFT AND GROUND NETWORK

The signal transmitted by the ATSU to the VHF 3 is modulated with the VHF radio signal and then, sent to the ground. Conversely, the signal transmitted by the VHF 3 to the ATSU is obtained after demodulation of the radio signal from the ground.

The transmitted data are characters from the ISO alphabet No.5 except the block check sequence field at the end of transmission.



ABBR	PROVIDER	MCDU	FREQ		ABBR	PROVIDER	MCDU	FREQ
AF	ARINC AFRIKA	ARI-AFR	126.900MHZ		DE	DEPV BRAZIL	DEPV	131.550MHZ
AM	ARINC AMERICA	ARI-AM	131.550MHZ		SE	SITA EURPE	SITA-E/A	131.725MHZ
AS	ARINC ASIA	ARI-ASI	131.450MHZ		SL	SITA LATIN AMERICA	SITA-LAM	131.725MHZ
AE	ARINC EUROPE	ARI-EUR	136.925MHZ		SN	SITA NORTH AMERICA	SITA-NAM	136.850MHZ
AK	ARINC KOREA	ARI-KOR	131.725MHZ		SP	SITA PACIFIC	SITA-PAC	131.550MHZ
AV	AVICOM	AVICOM	131.450MHZ					

Figure 13 Ground Network Architecture

RECONFIGURATION RULES IN CASE OF INTERFACED SYSTEM FAILURE

The main rule is when a system includes two units connected to the ATSU, the Captain unit is first used as long as it provides valid data.

The following table defines the rules of reconfiguration to ensure the information availability for the ATSU.

Parameter	1st Source	2nd Source	3rd Source	4th Source	5th Source
A/C Altitude	FMS Master Guidance	EIS			
A/C Position	FMS Master Guidance	FMS	EIS		
A/C Registration	CMS / CFDS				
A//C Type	FMS Master COM				
ADS Event Lateral Deviation Waypoint Change	FMS Master Guidance				
ADS Fixed Intermediate Intent	FMS Master Guidance				
ADS FOM: NAV Redundancy	FMS Master Guidance	YES if FMG(E)C's OK	Fixed NO	Fixed NO	Fixed NO
ADS FOM: POS Redundancy	FMS Master Guidance	Fixed 20 NM	Fixed 20 NM	Fixed 30 NM	Fixed 30 NM
ADS FOM: TCAS Healthy	FWS				
ADS Predicted route	FMS ADS BUS				
ADS Tlime stamp	FMS Master Guidance	GPS synchro Clock	GPSSU / MMR 2	Clock	CMS / CFDS
Alternate Airport	FMS Master COM				
ATIMS Time & Date	GPS synchro Clock	GPSSU / MMR 2	Clock	CMS / CFDS	
Departure Airport	CMS / CFDS				
Destination Airport	FMS Master COM	CMS / CFDS			
Engine Shut Down	FWS & LGCIU				
Flight Number	FMS Master COM	CMS / CFDS			
Flight Phases	FWS				
FMS Communication Status	FMS Master COM				
Ground Speed	FMS Master Guidance	EIS			
Mach	FMS Master Guidance	FWS			
Temperature	FMS Master Guidance	EIS			
True Heading	FMS Master Guidance	FWS			
True Track	FMS Master Guidance	EIS			
Vertical Rate	FMS Master Guidance	EIS			
Wind Direction	FMS Master Guidance	EIS			
Wind Speed	FMS Master Guidance	EIS			

ENHANCED SURVEILLANCE (EHS) (OPTIONAL)

Transponder Basic Principles Review

The Elementary Surveillance (ELS) is used for a basic communication between the Secondary Surveillance Radar (SSR) of the Air Traffic Control (ATC) ground station and the on–board ATC Transponder.

There are 2 frequencies: 1030 Mhz for SSR radar interrogation and 1090 Mhz for Transponder modulated by pulses for 3 modes:

- Mode A: Identification,
- Mode C: Coded Barometric Altitude referenced to Standard Altitude (1013 Hpa) giving Flight Level,
- Mode S: Data Link – Used for TCAS, selective interrogation, enhanced surveillance.

Elementary Surveillance (ELS) to Automatic Dependent Surveillance (ADS)

The Elementary Surveillance (ELS) sends to the ATC Center:

- Aircraft Identification
- Flight Level

The specific parameters related to the enhanced surveillance are:

- Selected Altitude
- Barometric Pressure Setting
- Roll Angle
- Track Angle Rate
- True Track Angle
- Ground Speed
- True Air Airspeed
- Magnetic Heading
- Indicated Airspeed
- Mach
- Barometric Altitude Rate
- Inertial Vertical Velocity

The communication is made through modes S transponder.

The ADS gives more data to the ATC Center, for example:

- Aircraft Position
- GPS Altitude
- Aircraft Speed
- Aircraft Ground Speed

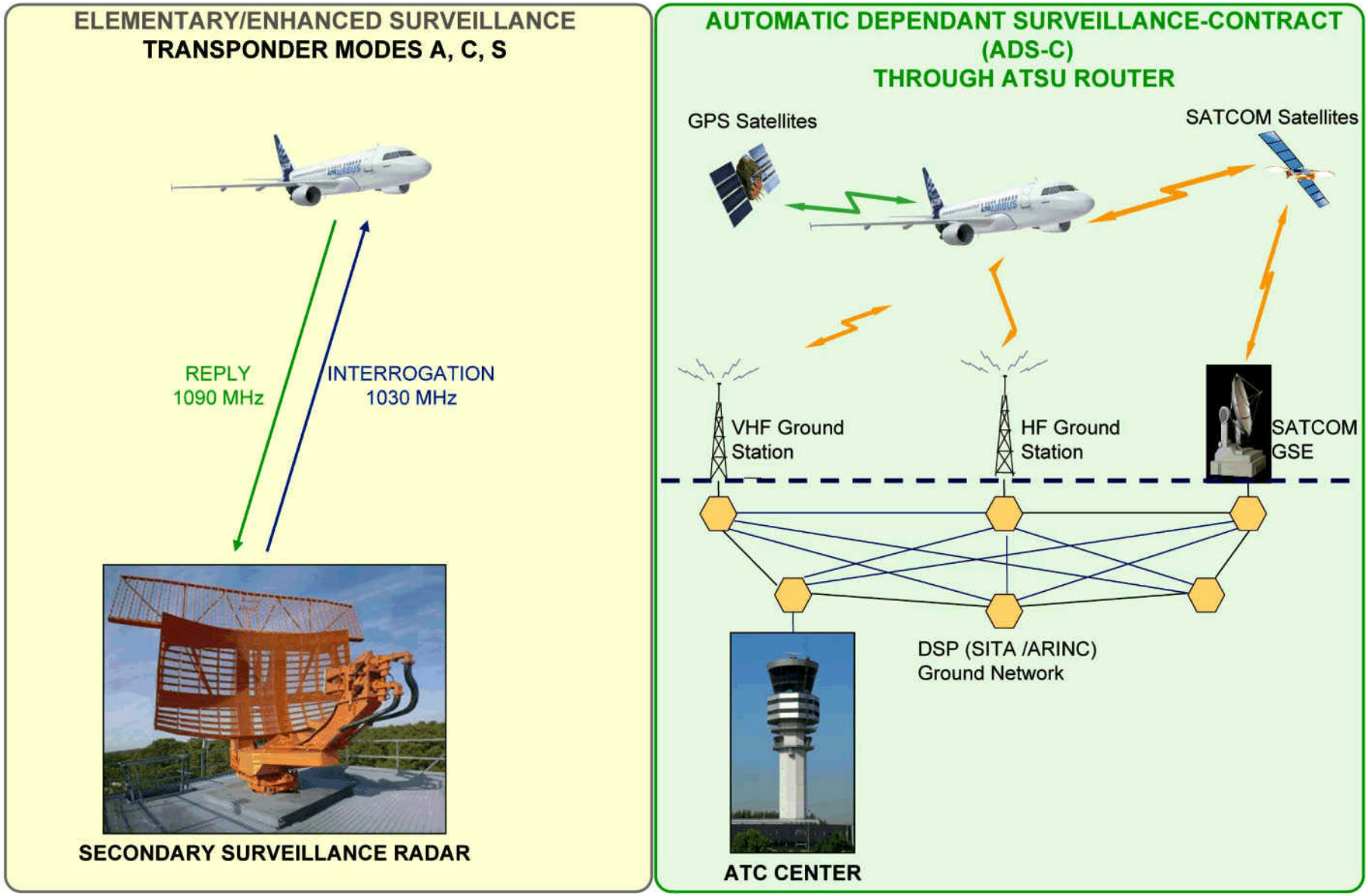


Figure 14 ELS to ADS

Enhanced Surveillance (EHS) to Automatic Dependent Surveillance (ADS)

The ADS also sends to the ATC center more parameters than those of Enhanced Surveillance (EHS), but the communication is done differently.

ADS–B and ADS–C

There are two types of ADS: ADS–Broadcast (ADS–B) and ADS–Contract (ADS–C). These two types of ADS are very different, because they do not use the same system.

The ADS–B is an application of the Mode S transponder. Thus, this application is hosted by the transponder. ADS–B broadcasts extended squitters to report data. A Mode S receiver is necessary to collect broadcasted data. No data link is necessary. Because ADS–B uses the transponder aerial, the range limit is 120NM. All units (ground or airborne) that have an ADS–B receiver can pick up broadcasted data.

The specific parameters related to the extended squitters are:

- Altitude
- Longitude
- Latitude
- Movement
- Ground Track
- Flight Number
- E/W Velocity
- N/S Velocity
- Vertical Rate

The ADS–C application is hosted by the ATSU and reports data requested in a contract made between the airborne system and the ATC ground system. ADS–C is an end–to–end application. ADS–C uses the almost worldwide data link range and can track aircraft out of SSR coverage.

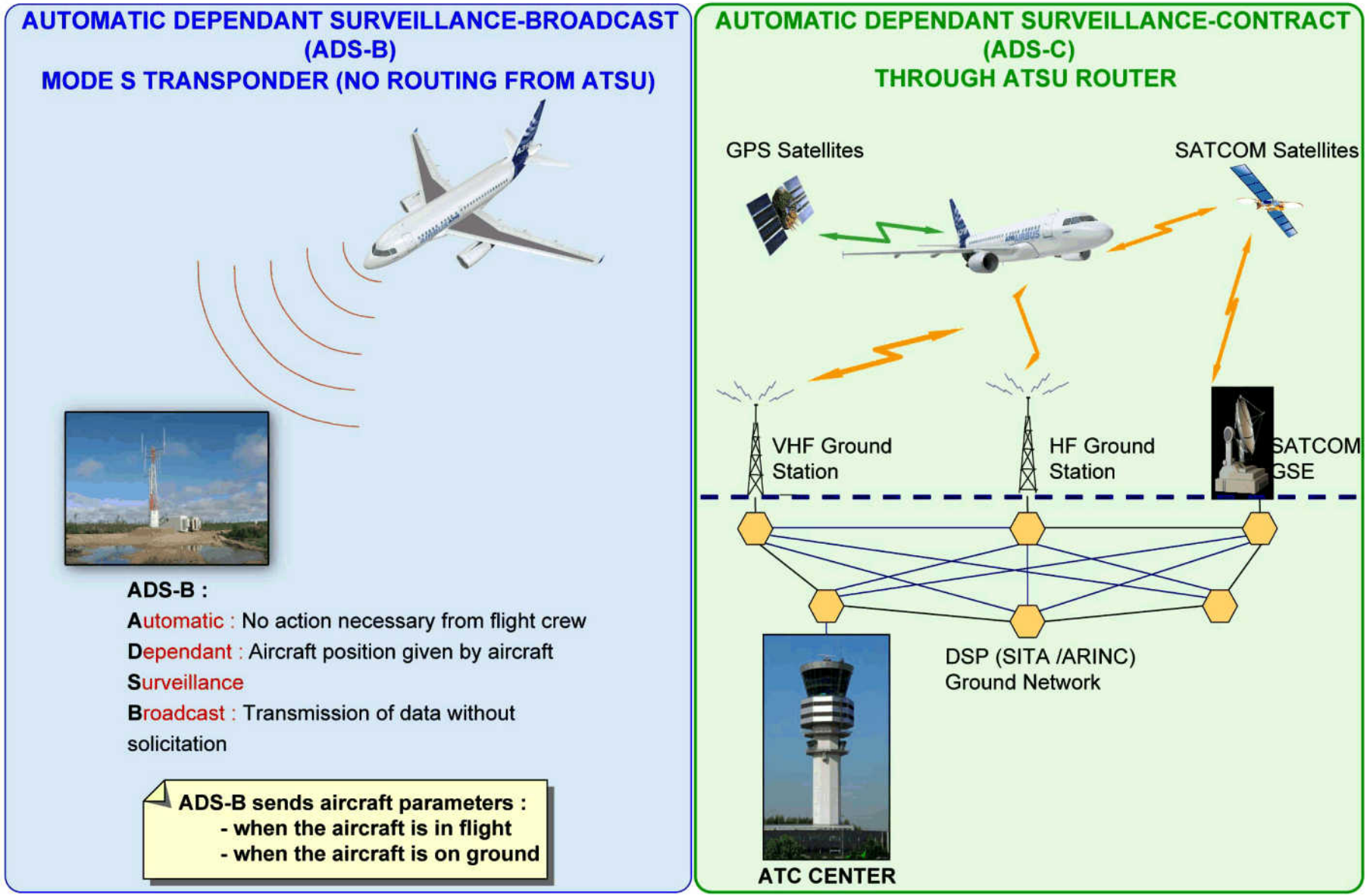


Figure 15 EHS to ADS

ADS-B and ADS-C Comparison

ADS-B	COMPARISON	ADS-C
SURVEILLANCE	OPERATIONS	PROCEDURAL CONTROL
CONTINENTAL	AIRSPACE	OCEANIC AND REMOTE
MODE “S“ TRANSPONDER	AVIONICS	ATSU - FANS A/A+
250NM FROM ADS-B GROUND RECEIVER	RANGE	WORLDWIDE WITH SATCOM AND HF DATA LINK
DATA BROADCAST EVERY 0.5 SEC	DATA LINK	END TO END CONNECTION: PERIODIC, ON DEMAND, ON EVENT CONTRACTS

Sum–Up of ADS Optional Packages

There are 3 steps:

- Step 1: Worldwide communication through VHF, HF, SATCOM data link that uses ATSU Router.
- Step 2: Continental communication coverage with Mode S Transponder
  No routing from ATSU - Range: 250 NM from ADS–B ground receiver.
- Step 3: Worldwide with SATCOM and HF data link (no VHF)
  Oceanic and Remote – ATSU routing.

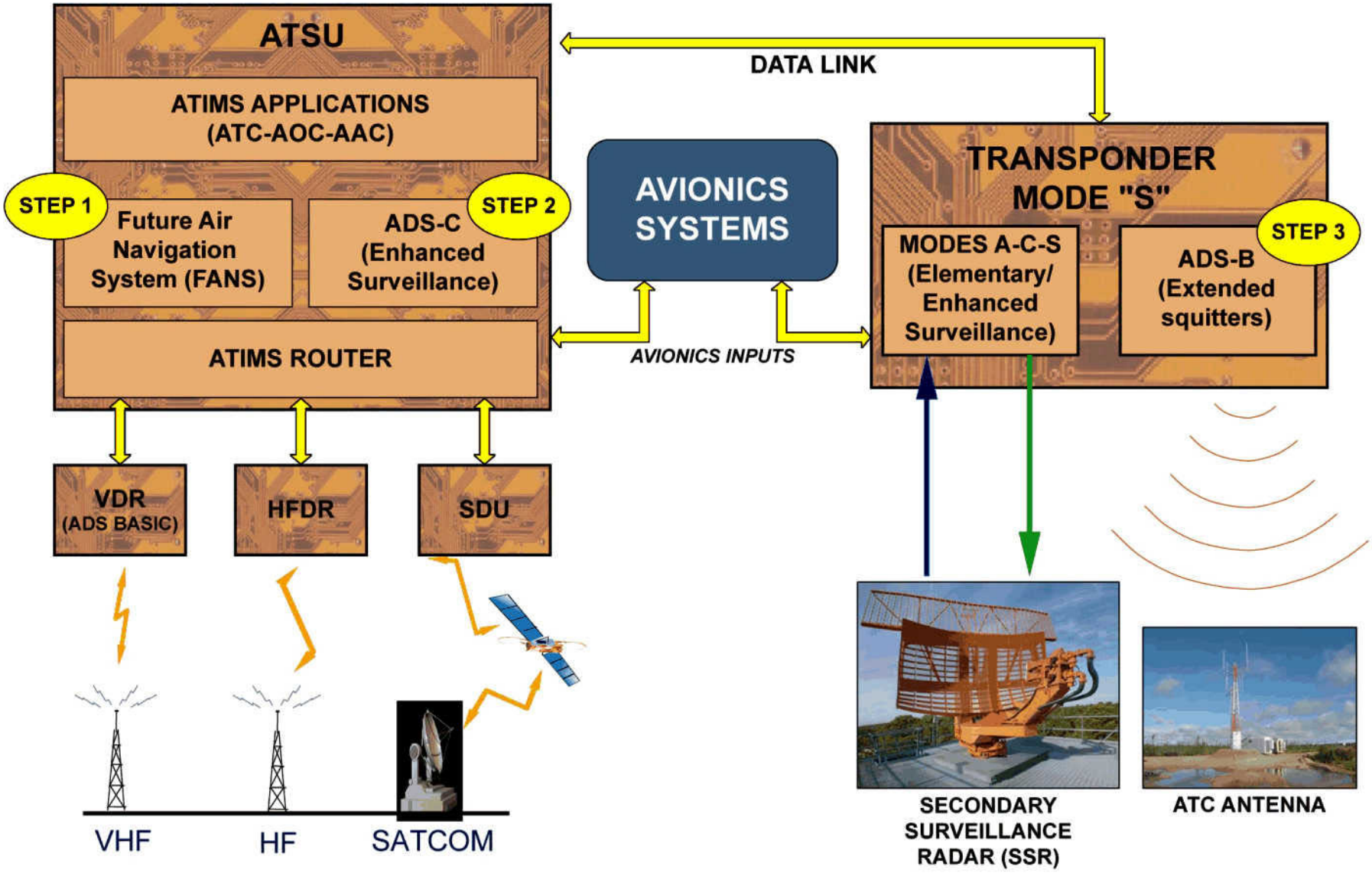


Figure 16 ADS Optional Packages

ATSU SOFTWARE LOADING DESCRIPTION

DATA LOADING

The ATSU S/W is uploaded via the Multipurpose Disk Drive Unit (MDDU). If a complete S/W uploading is required, a de–selection of the ATSU data loading must be carried out, for each type of S/W, so that a re–initialization of the ATSU can be made until the DATALINK ATSU FAULT warning goes off on the EWD.

ATSU Configuration Software

The configuration software is a complement to the A/C interface software.

This software consists of a database containing:

- routing policies definitions,
- configuration elements,
- downlink messages priorities,
- VDL2 parameters.

The configuration database also contains three elements that are ”software pin programmed”:

- HFDL for ATC applications,
- VHF3 voice/data switching by MCDU: this is enabled in the VDL2 configuration and it is inhibited when ATC applications are loaded,
- VDL activation.

ATSU Router Parameters Software

The ATSU router parameters software is a complement to the A/C interface software. This software contains the standard DSP world map database and a customisation file for the Airline Identification (A/L Id) and for the Scan Mask parameters. The DSP world map contains two types of tables. A Media configuration tables and VHF world map.

AOC Software

The AOC software consists of hosted AOC applications which depend on airline definition. An AOC data base enables customization of AOC applications. In this package, is defined the list of the labels used by the AOC application, which have to be extracted from the ATSU input data.

These datalink applications concern operations related to the flight such as flight plans, weather, behaviour of aircraft elements transmitted for maintenance reasons, fuel quantity, personnel management, gate management...

VHF World Map

The DSP World Map database contains the VHF geographic areas for each service provider. The world map is described over rectangular zones defined by the latitude/longitude of their South–East limits.

The first zone of the World Map defined is delimited by 90 deg. at its North border and 180 deg. at its West border. The World Map can contain up to 512 zones.

Media Configuration Tables

The Media configuration tables give the ARINC 618 parameters for each air/ground communication medium, such as timers, counters, identifiers, VDL2 parameters.

There is a SATCOM, a VHF and a HF configuration tables for each service provider.

ATSU FANS B Applications Software

The different Air Traffic Control (ATC) applications contained in this package are:

- Context Management Application (CMA)

  The CMA provides the necessary information to enable data–link communication between Air Traffic Service (ATS) units and aircraft systems. This function will typically be initiated when an aircraft is either at the gate in the pre–departure phase of flight, or before entering a new FIR supporting data–link communications.

  The CMA supports the Data–Link Initiation Capability (DLIC) ATS.

- Controller–Pilot DataLink Communications (CPDLC) application

  The aim of this application is to provide dialog between ground controllers and flight crews, using datalink instead of voice communications.

  Each CPDLC message comprises a set of message elements which correspond to the existing phraseology used by current ATC procedures.

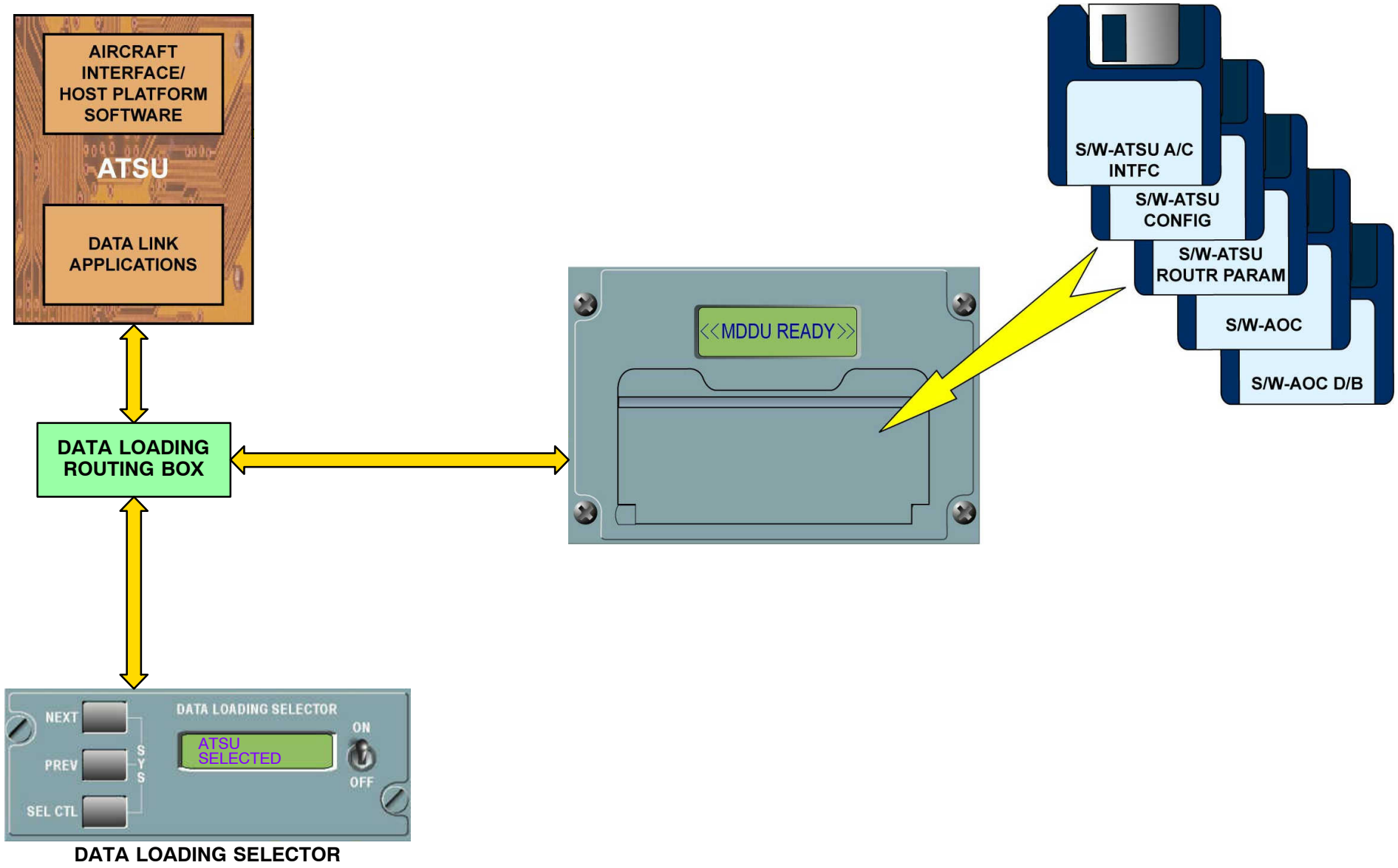


Figure 17 ATSU Data Loading

ATSU SOFTWARE UPLOADING DESCRIPTION

CAUTION: YOU MUST DO THE UPLOADING OF THE AOC APPLICATION SOFTWARE AND ASSOCIATED DATABASE AFTER UPLOADING OF THE ATSU A/C INTERFACE SOFTWARE. UPLOADING OF THE ATSU A/C INTERFACE SOFTWARE ERASES THE AOC APPLICATION SOFTWARE AND ASSOCIATED DATABASE.

CAUTION: DO THE UPLOADING OF THE STANDARD AOC SOFTWARE (22TX) BEFORE YOU DO THE UPLOADING THE AOC DATABASE SOFTWARE (24TX).

ATSU Software

- ATSU A/C INTERFACE software (disk 20TX),
- ATSU CONFIGURATION software (disk 21TX),
- ATSU AOC APPLICATION software (disk 22TX),
- ATSU AOC DATABASE software (disk 24TX),
- ATSU ROUTER PARAMETERS software (disk 30TX),
- ATSU ATC UTILITIES for the ATC HMI UTILITIES software (disk 25TX),
- ATSU ISM for the ATSU ISM APPLICATION software (disk 31TX),
- ATSU FANS B for the ATSU FANS B APPLICATIONS software (36TX),
- ATSU CMA for the ATSU CMA CONFIGURATION software (37TX).

NOTE: They have to be loaded in the order shown above and the two DATA LOADER selector switches must be set to OFF between each set of disk uploading. The ATSU must perform a Power On Self Test to validate each application uploading.

AOC software

The AOC software consists in hosted AOC applications which are depending on airline definition.

These datalink applications concern operations related to the flight such as flight plans, weather, behaviour of aircraft elements transmitted for maintenance reasons, fuel quantity, personnel management, gate management...

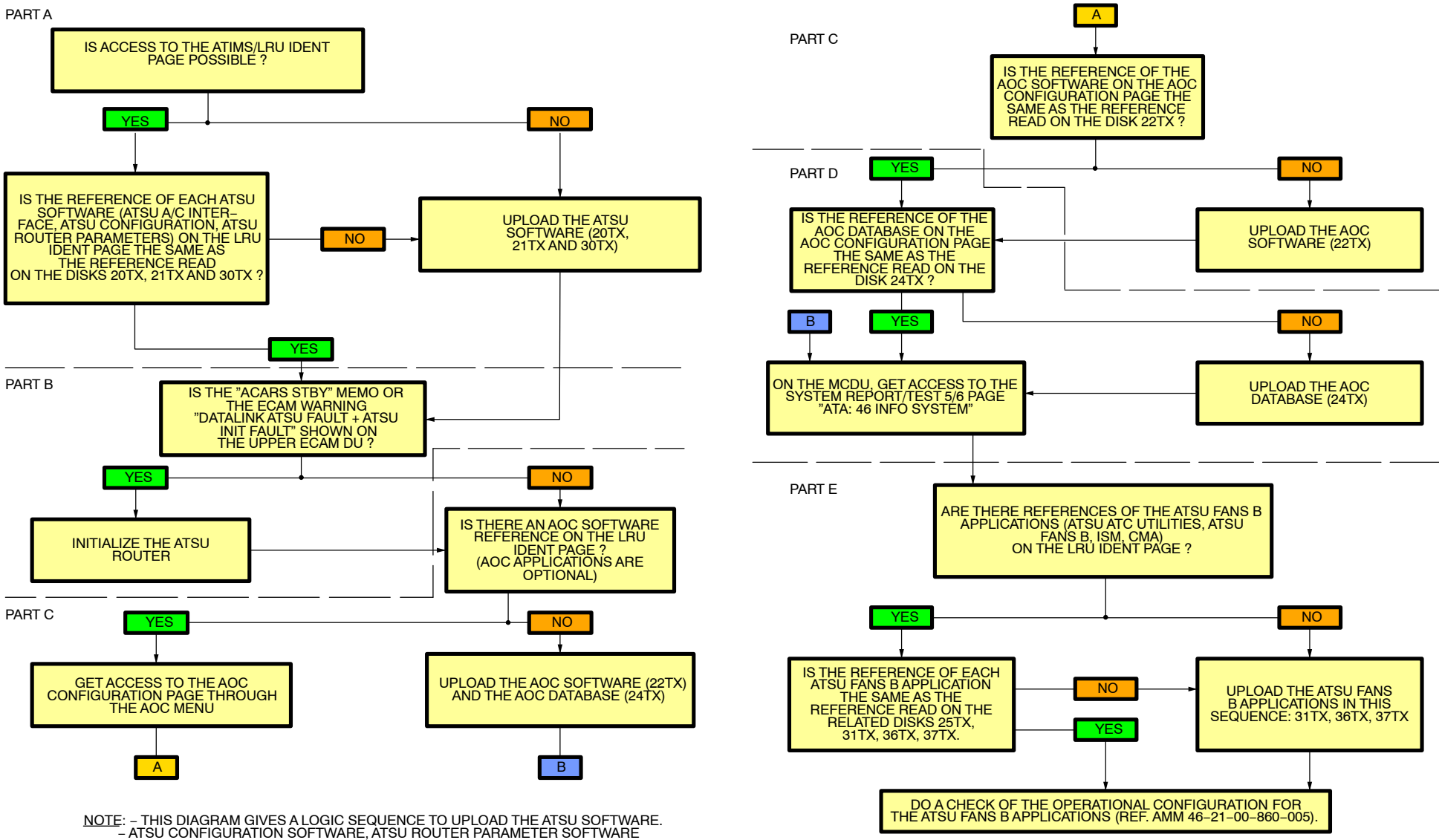
The Software loaded is the AOC (**A**irline **O**perational **C**ontrol) Application Software (22TX) and the AOC Database (24TX)

IMPORTANT NOTE FOR ALL DATA LOADING PROCEDURES !!!

As mentioned in the Airbus AMM and TSM procedures the Data Loader selector switches (overhead panel) must be set to OFF when the data loading of ONE software P/N, which may include 1 or more disks, is completed (TRANS COMPLETE on MDDU) then, you must wait for the disappearance of the ECAM alert, DATALINK ATSU FAULT, and the return of the ATSU prompt on MCDU, before go on with the NEXT software P/N uploading.

The loading time for one full disk is ten minutes approximately but the AFN application is quickly loaded (two minutes approximately).

After the uploading operations, the operator must mandatory do a check of the reference of the data loaded in the computer, on the MCDU.



NOTE: – THIS DIAGRAM GIVES A LOGIC SEQUENCE TO UPLOAD THE ATSU SOFTWARE.
– ATSU CONFIGURATION SOFTWARE, ATSU ROUTER PARAMETER SOFTWARE AND AOC APPLICATIONS ARE OPTIONAL.

Figure 18 ATSU Software Upload Logic Diagram

ATIMS MENU DESCRIPTION

MCDU MENU

The COMM MENU is used for communication settings, as selection of the Service provider and frequency.

The AOC MENU line key gives access to the AOC MENU which is equivalent to ACARS functions.

The content of this menu depends on the AOC applications selected by the airline.

The ATC MENU gives access to the least frequent ATC operations,which are:

- data entry for message preparation,
- access to previously exchanged messages (MSG LOG).

Note that the ATC COMM key has the same functions as ATC MENU but provides quick access to the page whatever the MCDU menus displayed.

NOTE: The ATC Menu is only available when the ATIMS is in FANS A or B configuration.

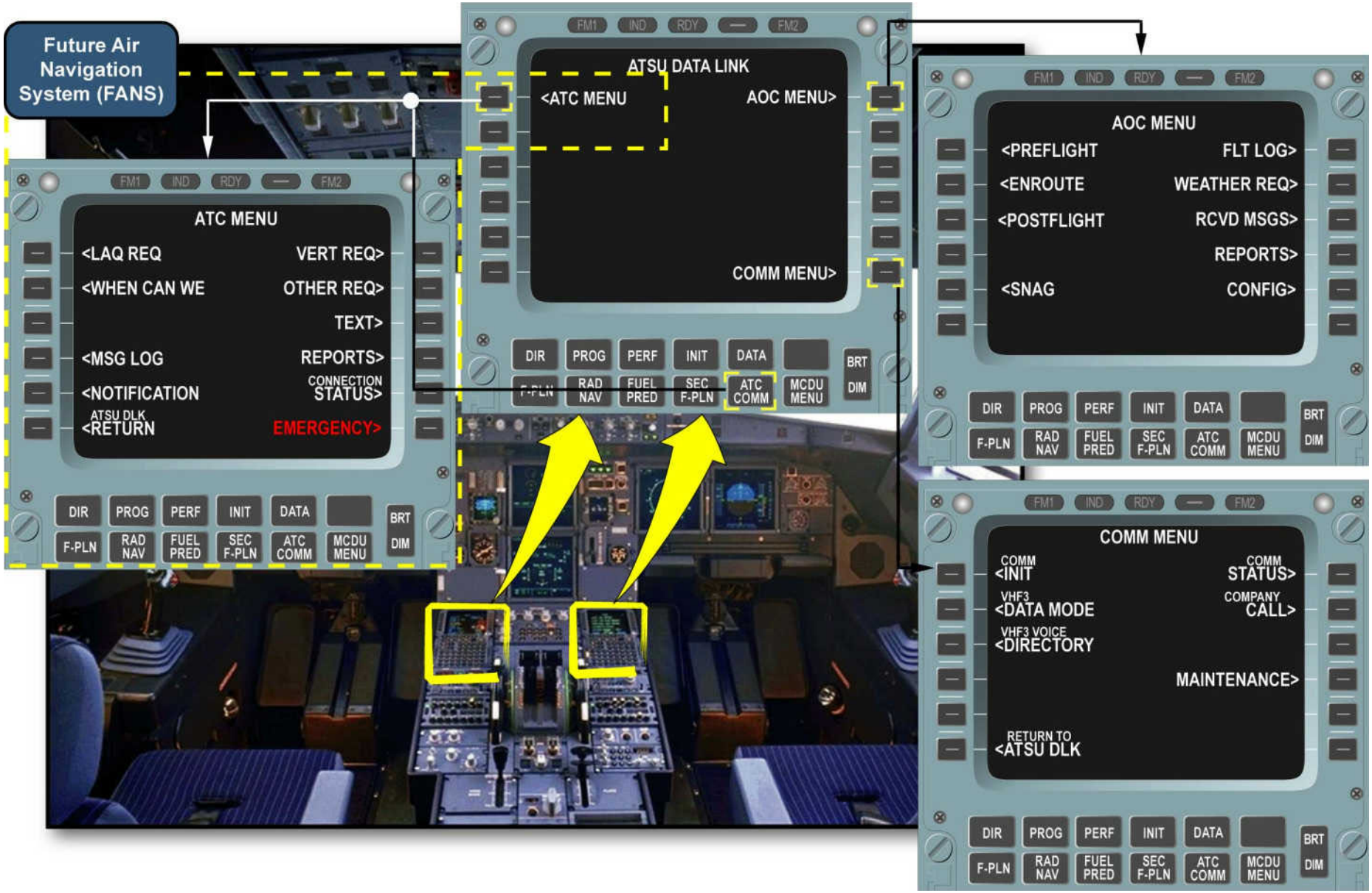


Figure 19 ATIMS Menu on MCDU

ATSU MCDU MENU INTRODUCTION

MCDU USE

Three sets of functions are accessed via the MCDU:

- hosted AOC applications,
- air/ground communication management function,
- ATC applications in FANS B configuration.

These three functions are considered as independent. When inside the menu structure of one of these functions, it is not possible to access directly the other one. The user has to return to the main ATSU menu in order to activate the other function.

The MCDU provides the crew with the following functions:

- for air/ground communication management:
  - configuration/initialization,
  - VHF3, SATCOM (optional) and HF (optional) control,
  - communication statistics display,
  - test/audit mode control.
- for AOC hosted applications:
  - configuration/initialization,
  - downlink message entry/selection/transmission,
  - uplink message display.
- for ATC applications in FANS B configuration:
  - preparation and modificaton of all the messages initiated by the crew,
  - justifications to negative replies or to a particular request,
  - configuration of applications (CMA initialization), and
  - configuration of systems (ATSU management, automatic or on–request printing).

The pages managed by the ATSU are independently accessible from two MCDUs and are accessible in parallel on two MCDUs: access to and exit from MCDU pages are independent on these MCDUs.

NOTE: If a third MCDU is installed, only two MCDUs upon three can be used simultaneously by the ATSU.

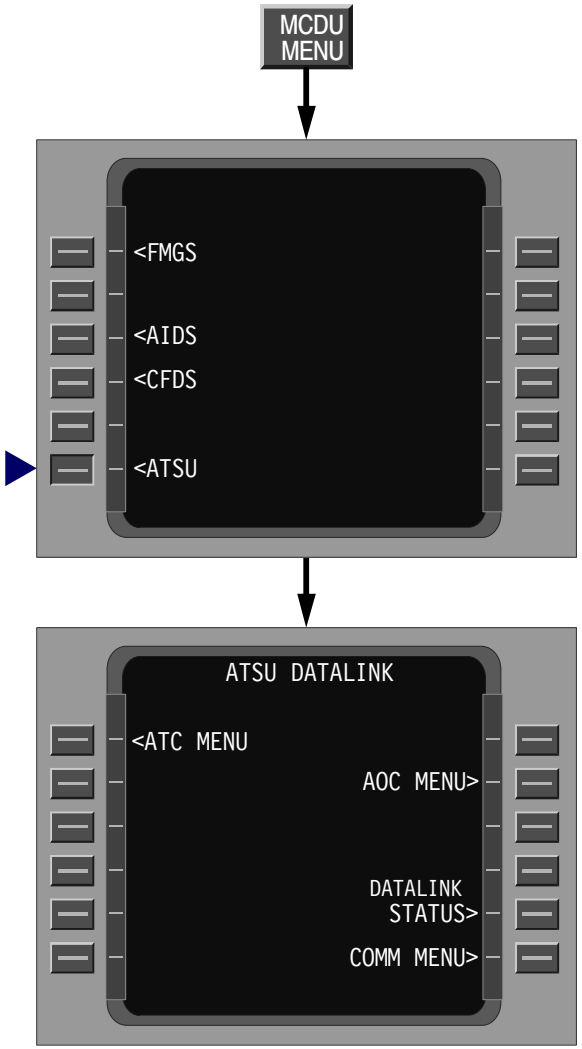
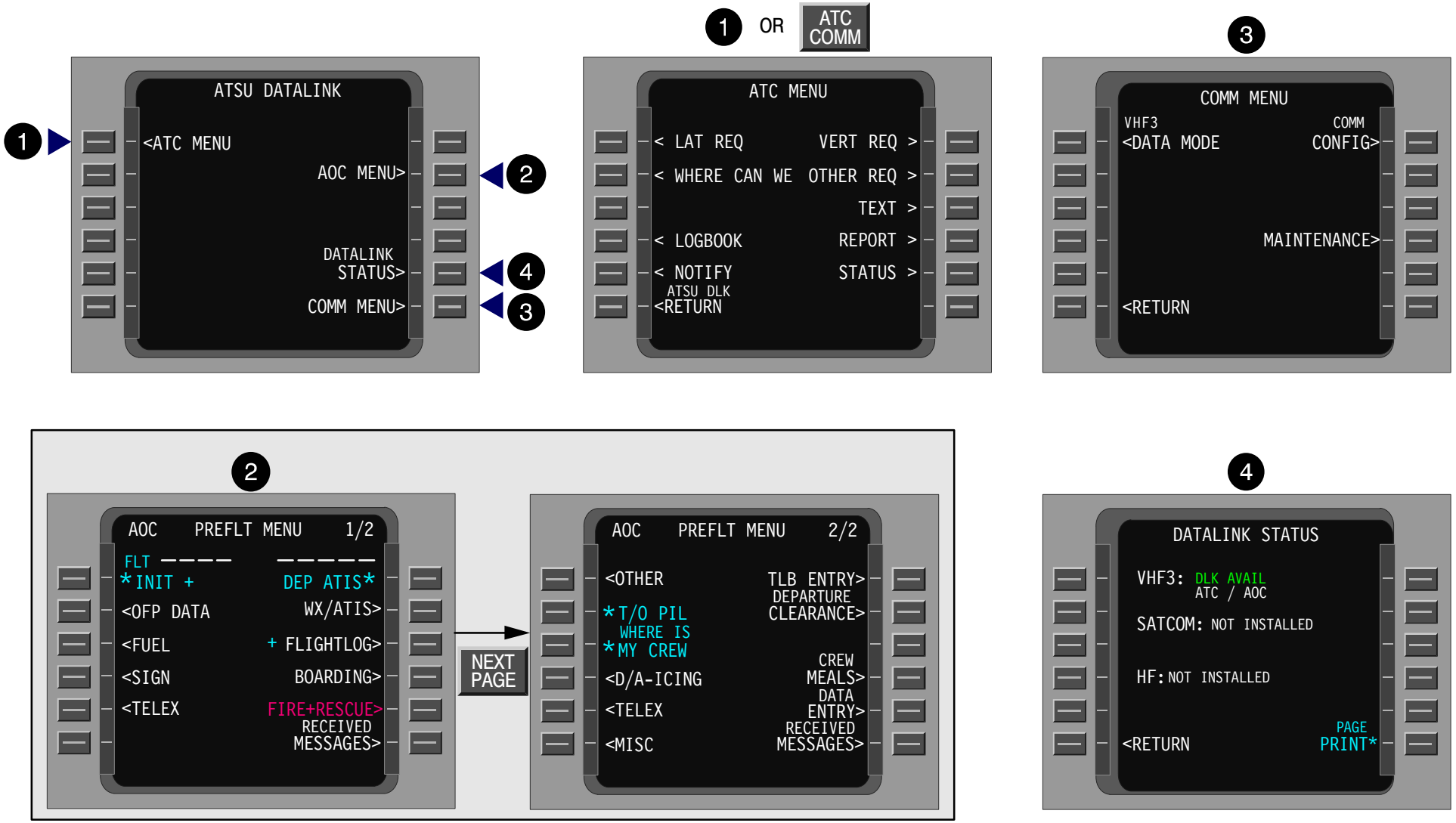


Figure 20 Access To ATSU Datalink Menu



NOTE: **The ATSU menus are different depending on A/C type and airline.**

Figure 21 ATSU Main MCDU Menu

AOC MENU

The AOC applications use the services of the printer for the following purposes:

- print out of received messages (automatic or manually initiated on MCDU),
- MCDU screen hard copies,
- company needs through the hosted AOC application and manually initiated on MCDU.

If the printer is busy with a previous task, the BUSY indication is displayed on the MCDU scratchpad.

No print task can exceed 5 minutes. After this time, the operation is stopped. When the star is removed from the ”PRINT*” command, the print function is unavailable.

The printer failure (out of paper, printer interruption or failure) is indicated to the crew by the ”PRINT FAILED” scratchpad message on the corresponding MCDU pages.

1 AOC FUEL REPORT

Purpose:

- Provides a mask for fuel check and auditing.

Access:

- ”FUEL” LSK (3L) on AOC PREFLT MENU page 1/2.

VOLUME (ENTER)

- Supplied fuel volume as received by paper receipt or by uplink.

UNITS (SELECT)

- Use LSK 2L to enter appropriate unit (liters: LT, US gallons: UG, imperial gallons: IG) of supplied fuel as stated on paper receipt or as uplinked LT is default.

DENSITY (ENTER)

- Fuel density may be entered. Default value is 0.800. If measured or calculated by the fuel truck it will be uplinked and displayed for information only, just right of the entered or aircraft sensed density value.

SUPPLIER (ENTER)

- The international 3–letter Supplier Code has to be entered for each flight, if not uplinked automatically. If no refueling takes place, enter “NIL“. If code is unknown, enter “AAA“.

FUEL DEST (ENTER)

- Setting is downlinked as part of the Fuel Report to give the Fueling Company an early notice. See procedure “Refueling at Destination“ for details.

2 AOC WX/ATIS REQUEST

Purpose:

- This page can be used to request weather, ATIS and SIGMETS. Weather and ATIS are requested through their IATA or ICAO airport code. SIGMETS are requested through their FIR/UIR.

Airport/FIR Code:

- Up to 4 airports or FIRs/UIRs may be entered via LSK 1R to 4R. On Non–ATSU aircraft, LSK 1L and 2L may be used to insert 4–letter–code of departure/destination airport via scratchpad.

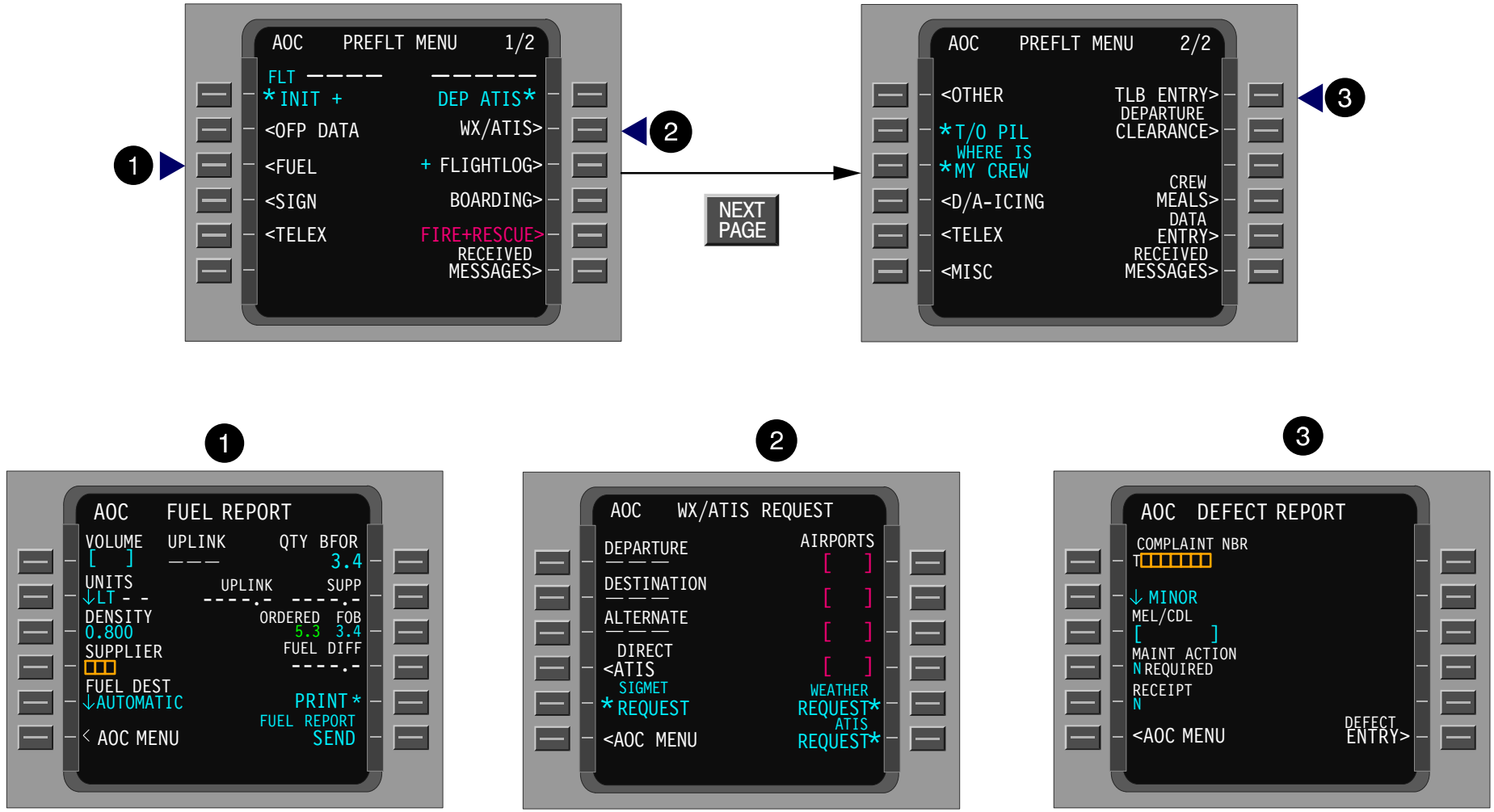
If weather reports are needed press “WEATHER REQUEST“ LSK 5R and weather (METAR and FORECAST) of entered airports will be uplinked.

If ATIS reports are needed press “ATIS REQUEST“ LSK 6R and ATIS of entered airports will be uplinked. If ATIS is not available, the message ”NO ATIS” followed by METAR only will be uplinked.

If SIGMET reports are needed press “SIGMET REQUEST“ LSK 5L and SIGMETs of entered FIR–/UIR–codes will be uplinked. Do not enter airport codes! If no code has been entered, all SIGMETs applicable for the whole route will be uplinked.

3 AOC DEFECT REPORT

This report may be used by the crew to send complaints from the technical logbook to a maintenance support station so that the maintenance at the destination may be informed about the technical problem.



NOTE: **The ATSU menus are different depending on A/C type and airline.**

Figure 22 ATSU Preflight Menu (1)

AOC MENU (CONTINUED)

4 AOC DEPART REQUEST

Purpose:

- This request should be used at airports whenever ”DCL” is mentioned in the OM–C Departure Info under ”STARTUP PROCEDURES”. Check this text for local restrictions.

Immediately after pressing SEND, go back to MENU and open the Received Message Display. Only the last received ATC Uplink will appear in this log. ATC uplinks may trigger a chime and may be autoprinted. In order to accept the Clearance Uplink, it must be selected from the received messages display first.

5 AOC CREW MEALS

Purpose:

- The flight crew can choose between different meals at the destination station in case of a short turn around time.

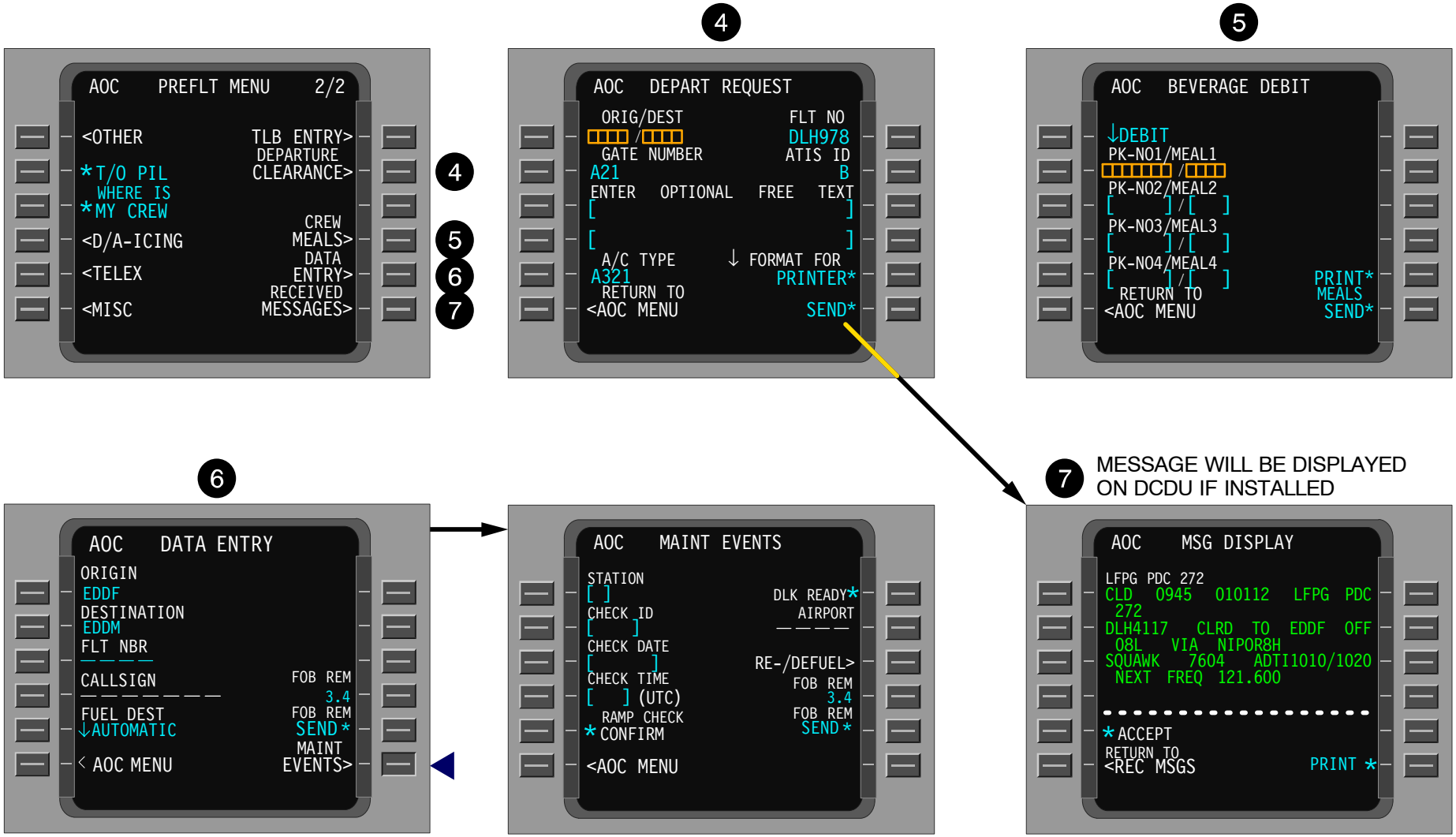
PK-NO/MEAL:

- Insert PK number and meal code.
- To order more than 1 meal of a distinct type, the respective number shall be inserted prior the meal code, e.g. 2SCH.
- To order more than 1, but different meals, for one person use the second PK–NO/MEAL line.

6 AOC DATA ENTRY & MAINT EVENTS

Purpose:

- This menu is used to confirm the certifcate release to service to the airline, so that the operation control knows about the status of the aircraft at a certain station.



NOTE: **The ATSU menus are different depending on A/C type and airline.**

Figure 23 ATSU Preflight Menu (2)

AOC MISCELLANEOUS MENU PRESENTATION

GENERAL

The AOC miscellaneous menu provides access to the following additional menus:

1 PARTNUMBERS

Pressing the “PARTNUMBERS“ LSK 1L the “AOC CONFIGURATION“ menu is shown. This page shows the ATSU software and hardware partnumbers. This page should be checked after each software update.

2 OOOI STATUS

The AOC OOOI STATUS 1/3 page is accessed by pushing the LSK 4L of the AOC MISCELLANEOUS menu screen. These are three AOC OOOI status pages. On page 1/3, OOOI states not yet encountered will have time values of white dashes. When the aircraft transitions to one of these states, the time will be inserted as hhmm. The current state will be indicated with an arrow in column 12 pointing to the appropriate state name. Absence of the arrow indicates the current state is INIT.

Pages 2/3 and 3/3 display the values of the inputs used to determine the OOOI state and the time of the last change in value. Page 3/3 display the individual door discretes. The door status on page 2/3 represents the output of the door logic.

Door status is displayed in a data field. When minimum one of the doors is open, then the OPEN indication is displayed, and when all the doors are closed then the CLOSED indication is displayed.

Slide status is displayed in a data field. When the slide is armed, then ARMED is displayed, and when the slide is not armed, then UNARMD is displayed.

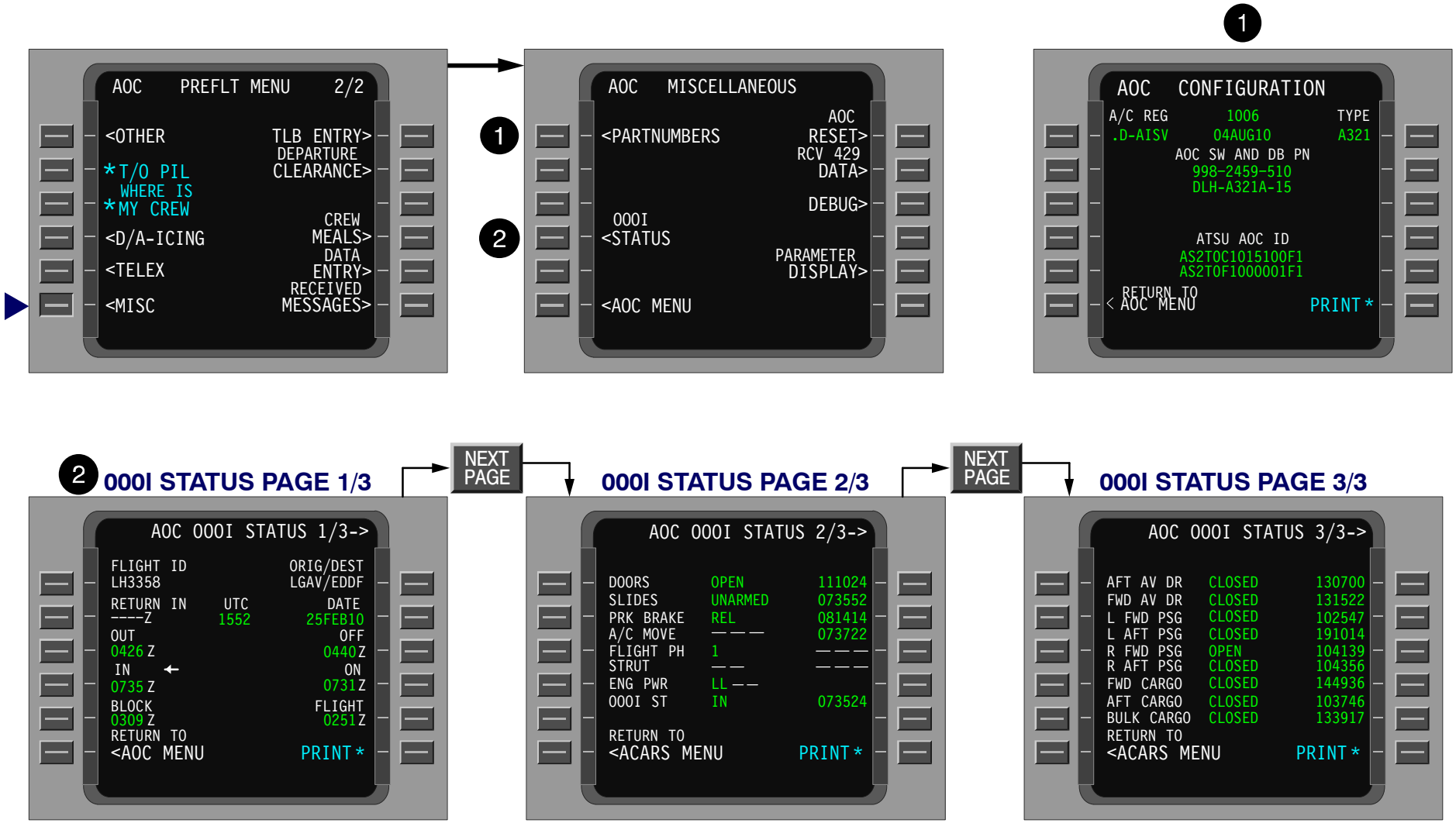
Parking brake status is displayed in a data field. When the parking brake is set, then the SET indication is displayed, and when the parking brake is released, then the REL indication is displayed.

Aircraft movement status is displayed in a data field. When the aircraft movement is detected, then the MOVE indication is displayed, and when no aircraft movement is detected, then the STABLE indication is displayed.

The flight phase is displayed in a data field. The current OOOI state is displayed in a data field with OUT, OFF, ON, IN, RET IN, INIT, and HOLD. Each entry has a corresponding time tag.

Actuation of line key 6R (PRINT prompt) on any page will attempt to print only that page of the ACARS OOOI STATUS screen on the cockpit printer. Actuation of line key 6L (RETURN TO ACARS MENU prompt) will return the user to the ACARS MENU page.

When the A/C is an A321 there are four OOOI pages displayed because of the additional door status lines.



NOTE: **The ATSU menus are different depending on A/C type and airline.**

Figure 24 ATSU Miscellaneous Menu

ATSU RESET FUNCTION

GENERAL

DataLink is a complex, distributed system. Reasons for malfunctions may be outside the aircraft and therefore not correctable by the following procedure or a ground mechanic. Reset if the ATSU is suspected to be the reason for the DataLink malfunctioning.

ACARS Cold Start

When the ATSU is reenergized after a power up it will use the values stored in its memory. A cold start procedure erases this memory. The MCDU screen turns blank, after a few seconds the “AOC NOT RESPONDING“ is shown. To continue procedure press MCDU MENU key. Afterward a manual entry of AOC data in this case the quantity before value on the “AOC FUEL REPORT“ page has to be performed.

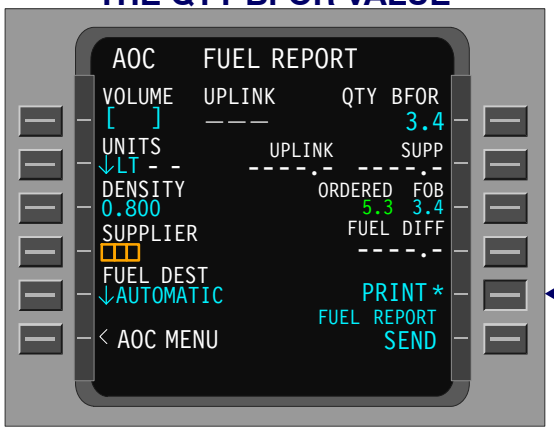
Following actions will activate a MU or CMU cold start:

- Re-racking of the unit.
- Software upload.
- APM programming via MCDU.
- ACARS reset via the ACARS DEBUG menu.

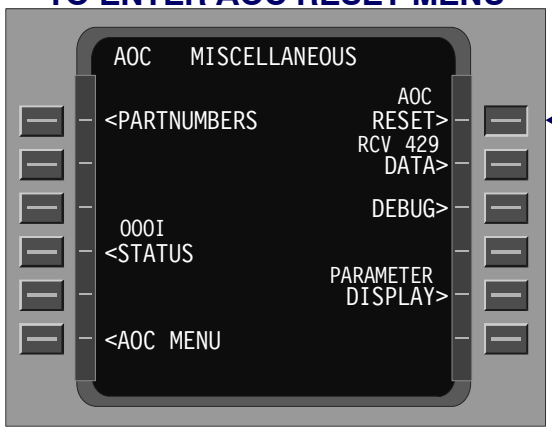
ATTENTION: During reset the QTY BEFORE value on the AOC FUEL REPORT page is cleared. Type in old value without the dot after RESET AOC on the FUEL REPORT page.

STEP 1:
SELECT FUEL ON AOC PREFLT MENU PAGE

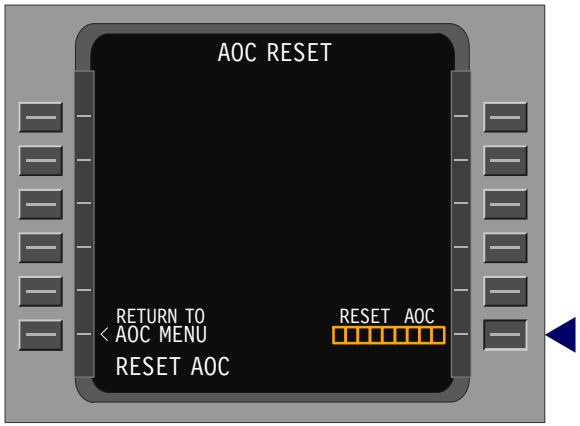
STEP 2:
PRINT OUT OR WRITE DOWN THE QTY BFOR VALUE



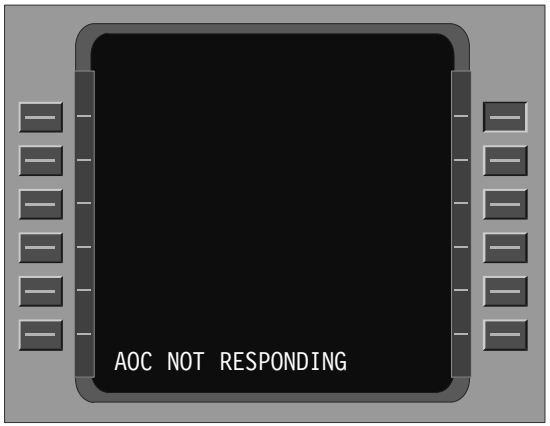
STEP 3:
SELECT AOC RESTE (LSK 1R) TO ENTER AOC RESET MENU



STEP 4:
ENTER “RESET AOC“ ON THE MCDU KEYBOARD AND PRESS LSK 6R



STEP 5:
PRESS “MCDU MENU“ AND GET BACK TO THE “AOC FUEL REPORT“ PAGE



STEP 6:
RE-SELECT THE “AOC FUEL REPORT“ MENU AND RE-ENTER THE “QTY BFOR“ VALUE ON THE MCDU KEYBOARD AND PRESS LSK 1R

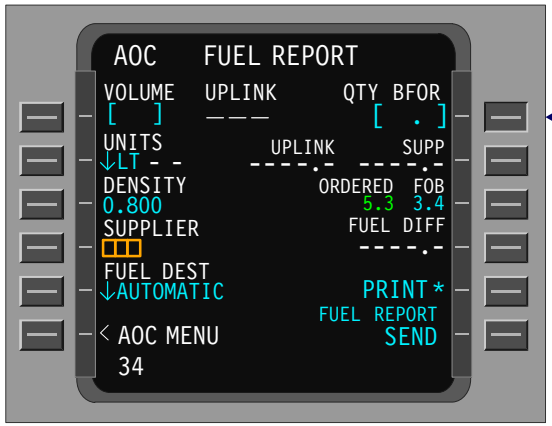


Figure 25 AOC Reset Procedure

AOC COMM MENU PRESENTATION

GENERAL

The air–ground communications functions and services are active as soon as their initialization is complete.

1 VHF3 DATA MODE

The VHF3 DATA MODE page shows the various regions, which can be selected. Each region is associated with a data link service provider and a frequency.

2 COMM CONFIG

The initialization through COMM CONFIG menu is considered as completed when the Air Traffic Service Unit (ATSU) has received a valid aircraft registration number, airline identification and scan mask.

The aircraft registration number and airline identification are used in the air/ground communication as aircraft addressing means. The VHF3 SCAN SEL gives an ordered list of authorized service providers usable for data communications.

3 MAINTENANCE

The MAINTENANCE page in the ATSU COMM MENU gives access to TEST, STATISTICS and AUDIT pages.

4 TEST Page

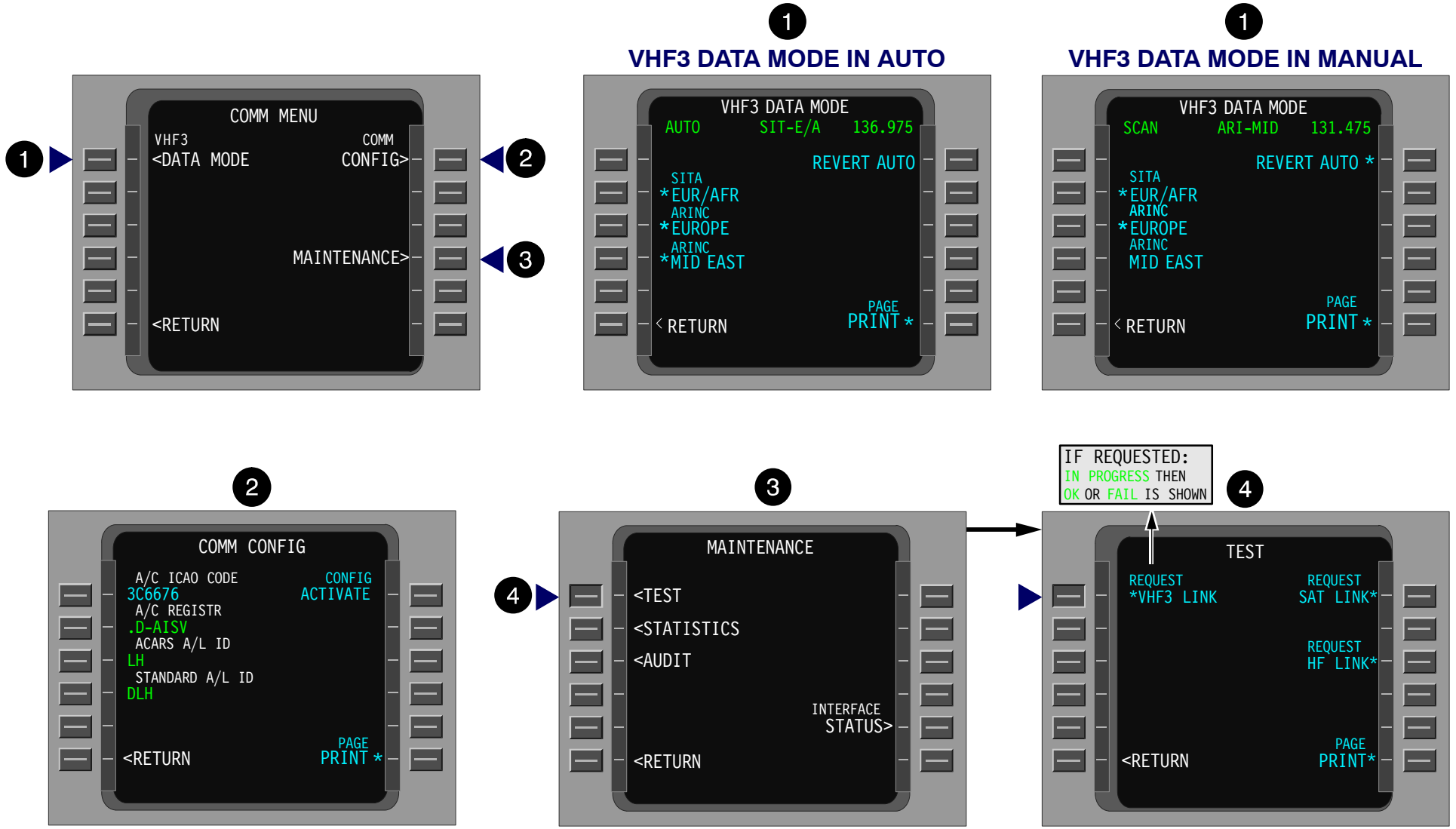
This page is used to test the link between the aircraft and the ground through a specific communication media. Pressing the related line key causes the ATSU to send a downlink message to the ground and wait for the answer:

- the IN PROGRESS indication is displayed instead of the REQUEST indication during the link test.
- Then, the result of the test is shown: OK or FAILED indication.
  - REQUEST VHF3 LINK (LSK 1L)

    This line key enables to activate the link test and to display the status of the connection between VDR3 and the ground center.
  - REQUEST SAT LINK (LSK 1R) if installed

    This line key enables to activate the link test and to display the status ofthe connection between the SDU (Satellite Data Unit) and the ground center.
  - REQUEST HF LINK (LSK 3R) is installed

    This line key enables to activate the link test and to display the status of the connection between the HFDR1 (High Frequenzy Digital Radio) and the ground center.



NOTE: **The ATSU menus are different depending on A/C type and airline.**

Figure 26 ATSU COMM & Maintenance Menu

AOC MAINTENANCE MENU (CONTINUED)

1 AUDIT Page

The AUDIT page enables automatic printing of all downlink and/or uplink datalink messages that pass through the ATSU. Specific communication media can be audited separately by pressing the line key adjacent to the YES/NO indication to display YES (for activation) or NO (for de–activation) next to:

- VHF3 (LSK 1L),
- SATCOM (LSK 1R) (optional),
- HFDR (LSK 2R) (optional),
- UPLINKS (LSK 2L),
- DOWNLINKS (LSK 3L),
- VHF GND STA (LSK 4L).

NOTE: The AUDIT mode is de–activated by default (all toggles set to NO).

2 STATISTICS Page

The STATISTICS page is used to display and print the statistics reports on each communication media:

- ACARS VHF STATS page (LSK 1L),
- VDL MODE2 STATS page (LSK 1R),
- SATCOM STATS page (LSK 2L) (optional),
- HFDR STATS page (LSK 3L) (optional),
- ROUTER STATS page (LSK 4L).

Statistics are representative of the state of each media at the time when the line key corresponding to this media is pressed.

On the ACARS VHF3 STATS, SATCOM STATS and HF STATS pages, the indication is comprised between 0 and 999 and indicates the number of blocks transmitted, received and failed through the concerned media and also the number of retries.

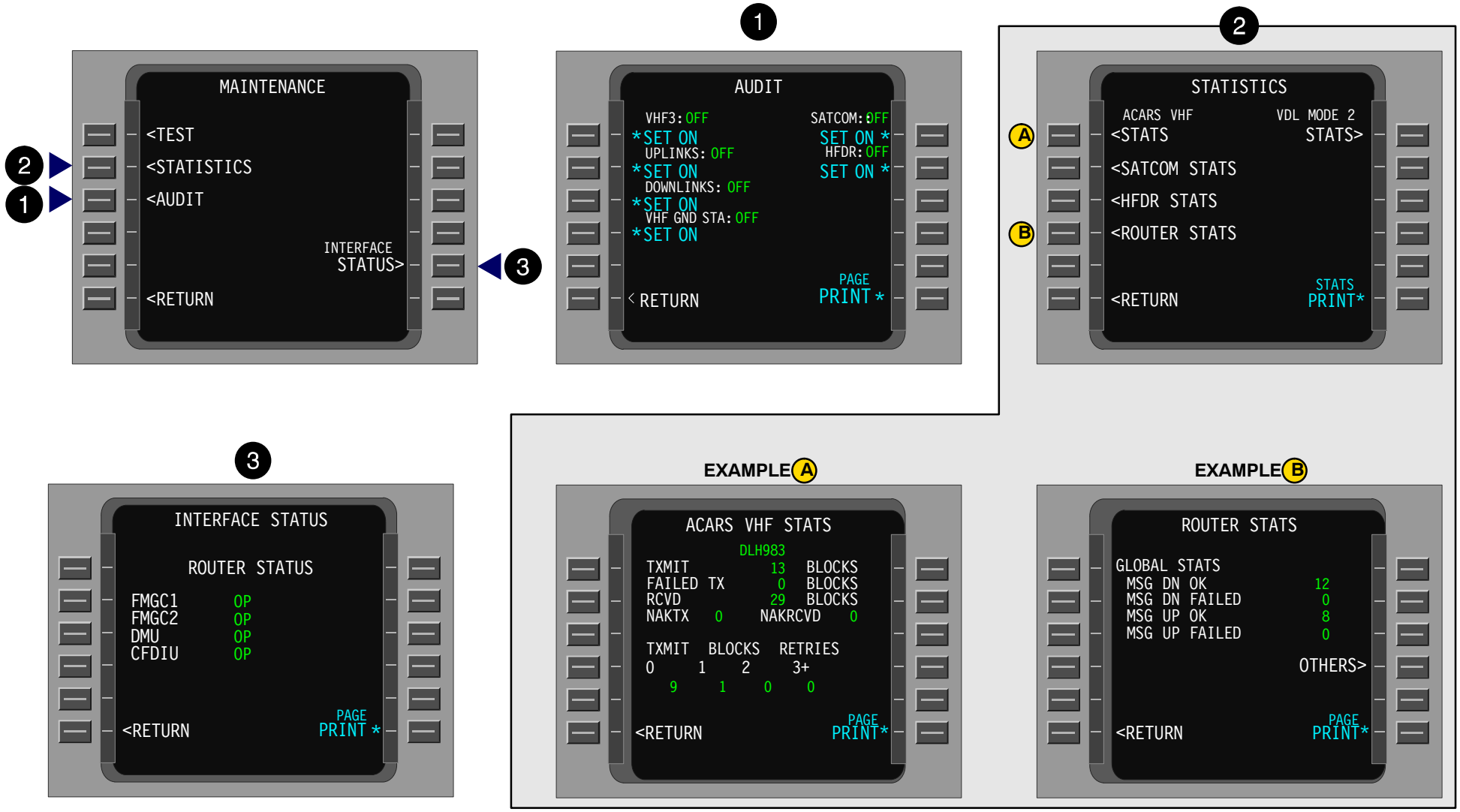
The ROUTER STATS page shows the statistics for different communication means, and for different types of messages (ATC, peripherals...). This page displays the global statistics for uplink and downlink messages and gives access to three specific pages for more details:

- the ATC STATS page gives the number of uplink and downlink ATC messages, OK and failed
- the PERIPHERALS STATS page gives the number of uplink and downlink messages, OK and failed coming from the ATSU peripherals (FMGEC1 and 2, CMC, DMU, Cabin Terminal1 and 2)
- the OTHERS STATS page gives the number of uplink and downlink messages, OK and failed exchanged between the hosted AOC applications and the router.

3 INTERFACE STATUS page

The interface status page displays the status of the connections with ARINC peripherals FMGEC1, FMGEC2, DMU and CFDIU or CMC:

- OP/INOP/NOT INST to indicate the peripheral status.



NOTE: **The ATSU menus are different depending on A/C type and airline.**

Figure 27 ATSU Maintenance Submenus

DATALINK ALERTS AND WARNINGS-OPERATION

The ATIMS system uses the services provided by the FWCs to activate visual/aural alerts and warnings for:

- air/ground communication services,
- hosted AOC applications,
- ATC applications.

They are generated depending on the following ATSU information:

- its own status:
  - ATSU Fault/No Fault,
  - CPDLC application Fault/No Fault,
  - ADS application Fault/No Fault,
  - Standard AOC application Fault/No Fault.
- its interface status with communication system units:
  - VDR3 data mode status (Fault/No Fault),
  - Selected VDR3 mode (Data/Voice),
- the Data–link availability:
  - Communication peripheral status (Fault/No Fault),
  - ATC presence in ATSU (to avoid an automatic display in Pre–FANS configuration).

Air/ground communication warnings

In FANS A configuration:

The FWCs are used to generate air/ground communication warnings such as internal ATSU failure, datalink status (failure or unavailability) and Communication system failure.

They are managed by the FWCs according to ATSU information (and from other on–board systems), to the flight phase and to the priority level.

Limitations are displayed to the crew to indicate the availability of the communication sub–networks and of the pilot/controller communication (CPDLC application). In case of datalink unavailability, the procedure is to return to the VOICE mode.

The following table presents the main alarm generation conditions.

NOTE: All these alarms are inhibited during takeoff and landing phases.

In Pre–FANS configuration

The FWCs generate the system warnings such as internal ATSU failure, loss of datalink applications or communications...

They are inhibited during some flight phases according to the priority level.

1. System warnings

   The FWCs display the following warnings/malfunctions in amber on the EWD:
   - DATALINK ATSU / ACARS FAULT in case of ATSU failure
   - DATALINK ATSU / ACARS FAULT+ ATSU INIT FAULT when the ATSU Router is not initialized
   - DATALINK COM NOT AVAIL when the VHF3 and the SATCOM networks are not available
   - DATALINK COM FAULT + VHF3 + SATCOM FAULT when the VHF3 and the SATCOM systems are faulty.

   This green memo is displayed on the bottom left section of the EWD:
   - DATALINK STBY when the VHF3 and the SATCOM systems are in NO COMM status.
2. INOP System

   The following INOP System indications are displayed in amber on the SDs (**S**ystem **D**isplays):
   - ATSU / ACARS
   - DATALINK COM
3. Limitations

   This limitation indication is displayed in cyan in the SD:
   - COMPANY COM VOICE ONLY

NOTE: On A320 family aircraft a failure concerning the ATSU is still indicated as an „ACARS FAULT“ on the ECAM displays.

EWD MESSAGE	ATTENTION GETTERS	STATUS	FAILURE CASE
DATALINK ATSU FAULT (Amber)	Master Caution / Single Chime	INOP SYSTEM (Amber): ATSU / ACARS DATALINK ATC DATA COMPANY LIMITATION (Cyan): ATC COM VOICE ONLY	ATSU failure or wrong pin programming parity No datalink communications are available between ground and the aircraft
DATALINK ATSU INIT FAULT (Amber)	Master Caution / Single Chime	INOP SYSTEM (Amber): ATSU / ACARS DATALINK ATC DATA COMPANY LIMITATION (Cyan): ATC COM VOICE ONLY	Initialization failure: Mandatory parameter(s) (VHF SCAN MASK; A/L IDENT or A/C REGISTRATION) are is (are) missing No datalink communication
COMPANY DATALINK STBY (Green Left Memo)			Temporary loss of AOC datalink communication, but no failure detected
DATALINK COMPANY FAULT		INOP SYSTEM (Amber): DATA COMPANY	AOC datalink communication failure due to loss of all air-ground communication means
ATC DATALINK STBY			Temporary loss of ATC datalink communication, but no failure detected.
DATALINK ATC FAULT (Amber) ATC COM VOICE ONLY (Cyan)	Master Caution / Single Chime	INOP SYSTEM (Amber): DATALINK ATC LIMITATION (Cyan): ATC COM VOICE ONLY	ATC datalink communication failure due to loss of all air-ground communication means, airborne ATC applications lost or both DCDU‘s failed
COM HF1 DATA FAULT (Amber)		INOP SYSTEM (Amber): HF1 DATA	HF1 datalink communication failure
COM VHF3 DATA FAULT (Amber)		INOP SYSTEM (Amber): VHF3 DATA	VHF3 datalink communication failure
COM SATCOM DATA FAULT (Amber)		INOP SYSTEM (Amber): SATCOM DATA	SATCOM datalink communication failure, message is not displayed if COM SATCOM FAULT is already shown
HF VOICE (Green Right Memo pulsing)			HFDR is in VOIVE mode

EWD MESSAGE	ATTENTION GETTERS	STATUS	FAILURE CASE
GND HF DATA (Green Right Memo)			HF DATA on ground
VHF3 VOICE (Green Right Memo pulsing)			VDR3 in VOICE mode

UPPER ECAM DU

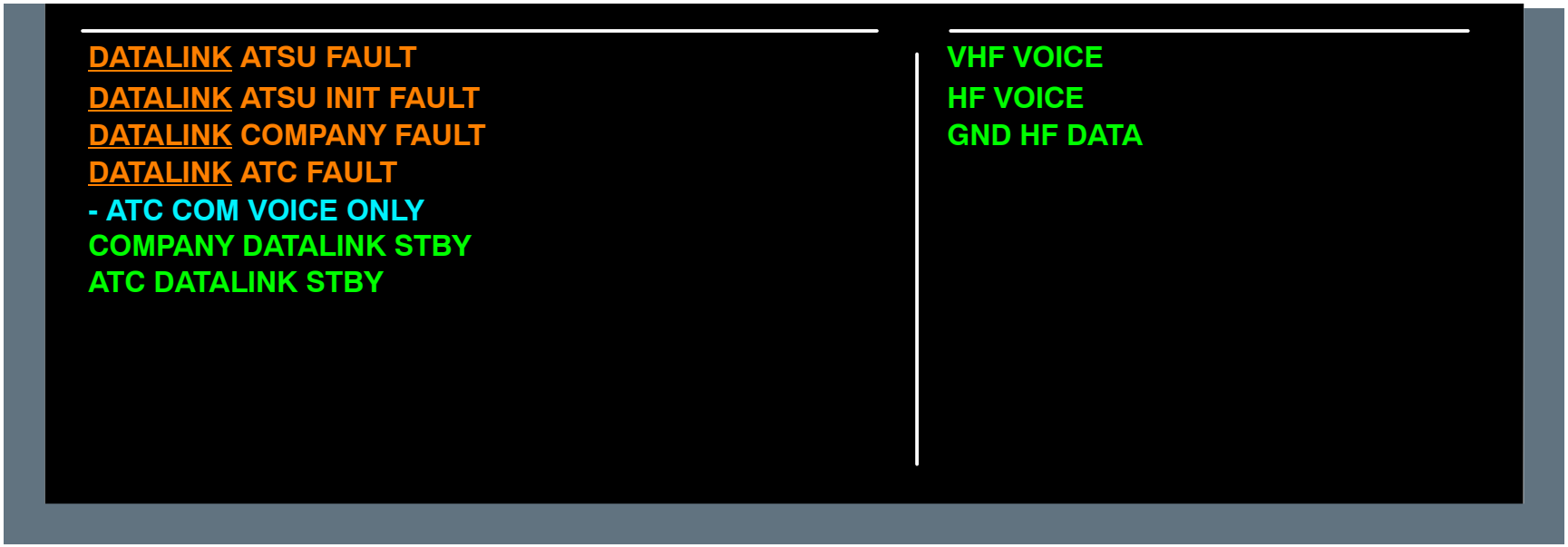


Figure 28 Possible ATIMS Messages on E/WD

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BITE ARCHITECTURE

ATIMS BITE

The ATIMS BITE is used to facilitate the aircraft maintenance in compliance with ABD048 specifications. It detects, identifies and memorizes the internal and external failures related to the ATIMS system:

- ATSU internal failures,
- external interface failures with ATSU peripherals.

The ATIMS BITE is ensured by the ATSU which concentrates the failure information provided by the ATSU internal monitoring.

This BITE is of type 1 and operates in two modes, the normal mode and the MENU mode.

NORMAL MODE

During the normal mode, the BITE monitors the ATSU status, monitors data inputs from the various ATIMS peripherals (FMG(E)C, MCDU, CFDIU,...), permanently transmits ATIMS system status and its identification message to the CFDIU or CMC. In case of fault detection, the BITE stores the information in the fault memories and transmits it to the CFDIU. The BITE memorizes the failures which occurred during the last 63 flight legs.

MENU MODE

In the menu mode (system/Report/Test) the following pages are available:

- LAST LEG REPORT

  This report contains the failure messages (internal and external, Class 1 and 2) recorded during the last flight. It is available at the end of the flight. Each failure message is reported with the failure classes defined by the CFDS standard.
- PREVIOUS LEGS REPORT

  This report contains the fault messages related to the external or internal failures (Class 1 or 2) recorded during the previous 63 flight legs.
- LRU IDENTIFICATION

  This menu enables to display the identification of the various ATIMS components (ATSU and Software packages). It is used to check the uploading of the correct software Part Number.
- GROUND SCANNING

  This function is based on the monitoring and the fault analysis during the flight and enables consultation of the ATIMS failure recordings.
  The ATSU peripheral monitoring and internal cyclic tests are used in order to detect transient failures.
- TROUBLE SHOOTING DATA

  This function provides correlation parameters and snapshot data concerning the failure displayed in the LAST LEG REPORT and the PREVIOUS LEGS REPORT pages.
- CLASS 3 FAULTS

  This menu enables to display the Class 3 faults recorded during the last flight leg.
- SYSTEM TEST

  The ATIMS BITE test is initiated when pressing the line key adjacent to the SYSTEM TEST indication.

  The test ends with the display of the following message on the MCDU:
  - TEST OK indication when all the tests are completed and no failure has been detected
  - or the failure message(s) when one or more failures have been detected.
- GROUND REPORT

  This function is used to present Class 1, 2 or 3 internal failures when they are detected on ground. The relevant trouble shooting data are displayed by pressing the line key adjacent to the failure indication. These failures differ from those displayed on the LAST LEG REPORT page.
- SPECIFIC DATA.

  This menu enables acces to different functions:
  - LOAD STATUS (available in Pre–FANS+ configuration only),
  - PIN PROGRAMMING to check the ATSU configuration with its parity validity,

    The order of the pin programming display is in accordance with the one of the ATSU input connector:
    - a pin programming not defined (spare) is displayed with a zero value,
    - an active pin programming is displayed with a 1 value.
  - DUMP TSD,
  - SW P/N PRINT OUT.

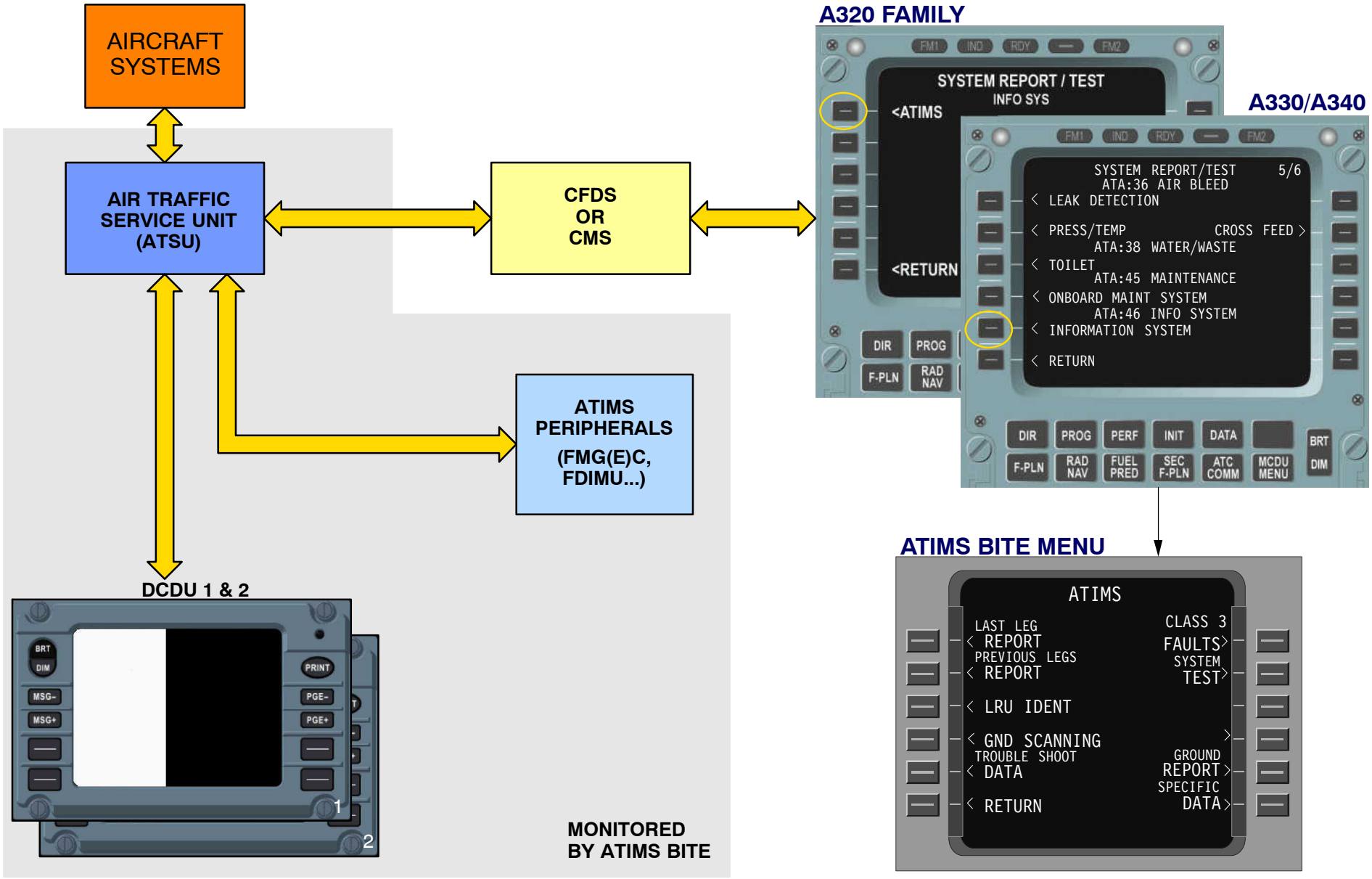


Figure 29 ATIMS BITE Architecture

SYSTEM TEST PAGE

The ATIMS BITE test is initiated when pressing the line key adjacent to the SYSTEM TEST indication.

This activates the following subtests:

- DCDU self tests
- ATSU Internal tests
  - ARINC Reception and Transmission
  - Discrete Inputs Reception
  - Discrete Outputs Activation
  - EPROM Check
  - RAM Check
  - EEPROM Check
  - CPU CORE
  - Timers and Interrupt Control
  - ARINC Outputs Switching

The test ends with the display of the following message on the MCDU:

- TEST OK indication when all the tests are completed and no failure has been detected
- or the failure message(s) when one or more failures have been detected.

NOTE: Communication Tests with the ground (VHF3, HF and SATCOM link tests) are initiated from ATSU DATALINK sreen on MCDU (Test Page from MAINTENANCE sreen of COMM MENU).

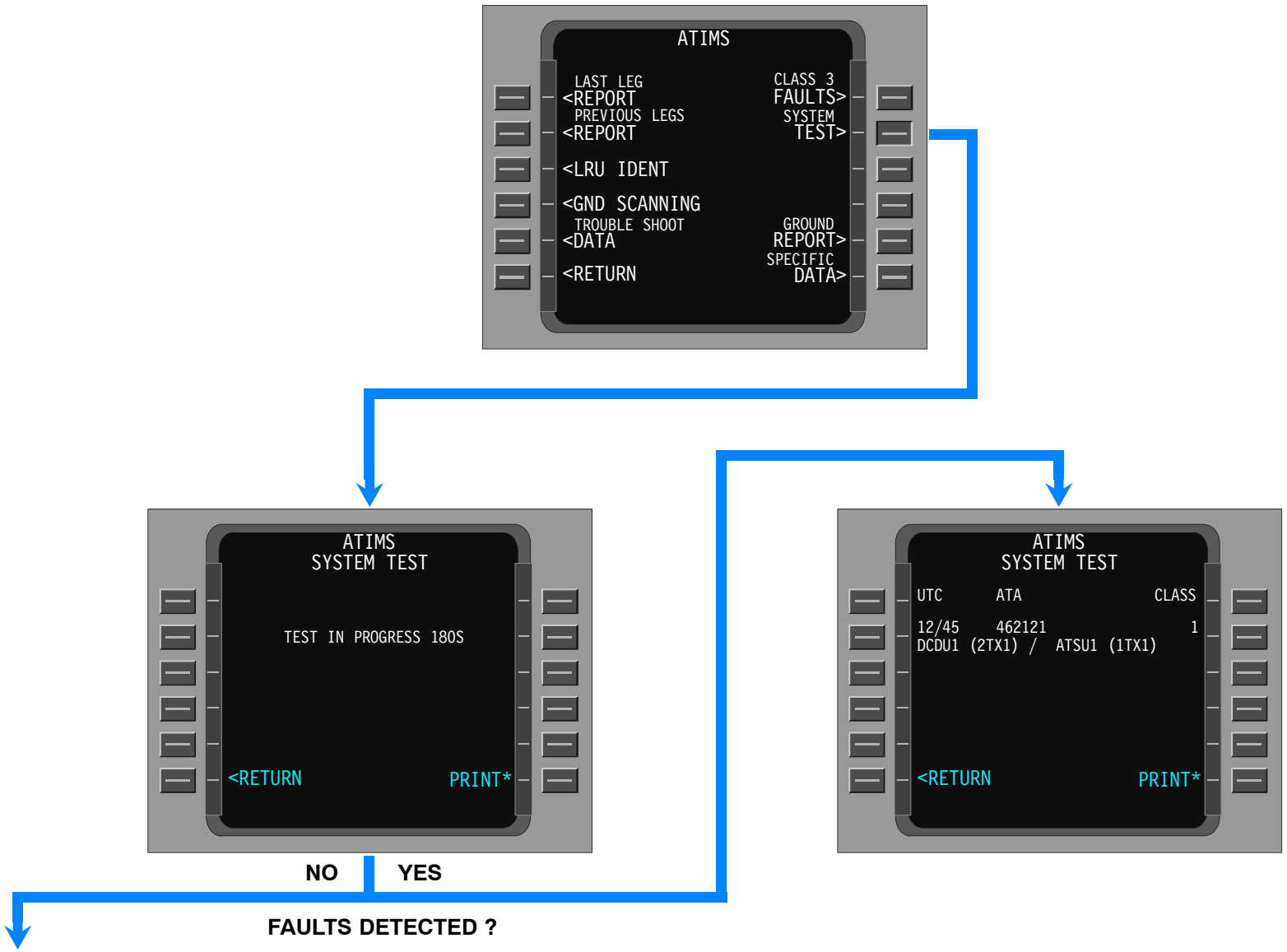


Figure 30 SYSTEM TEST Page 1

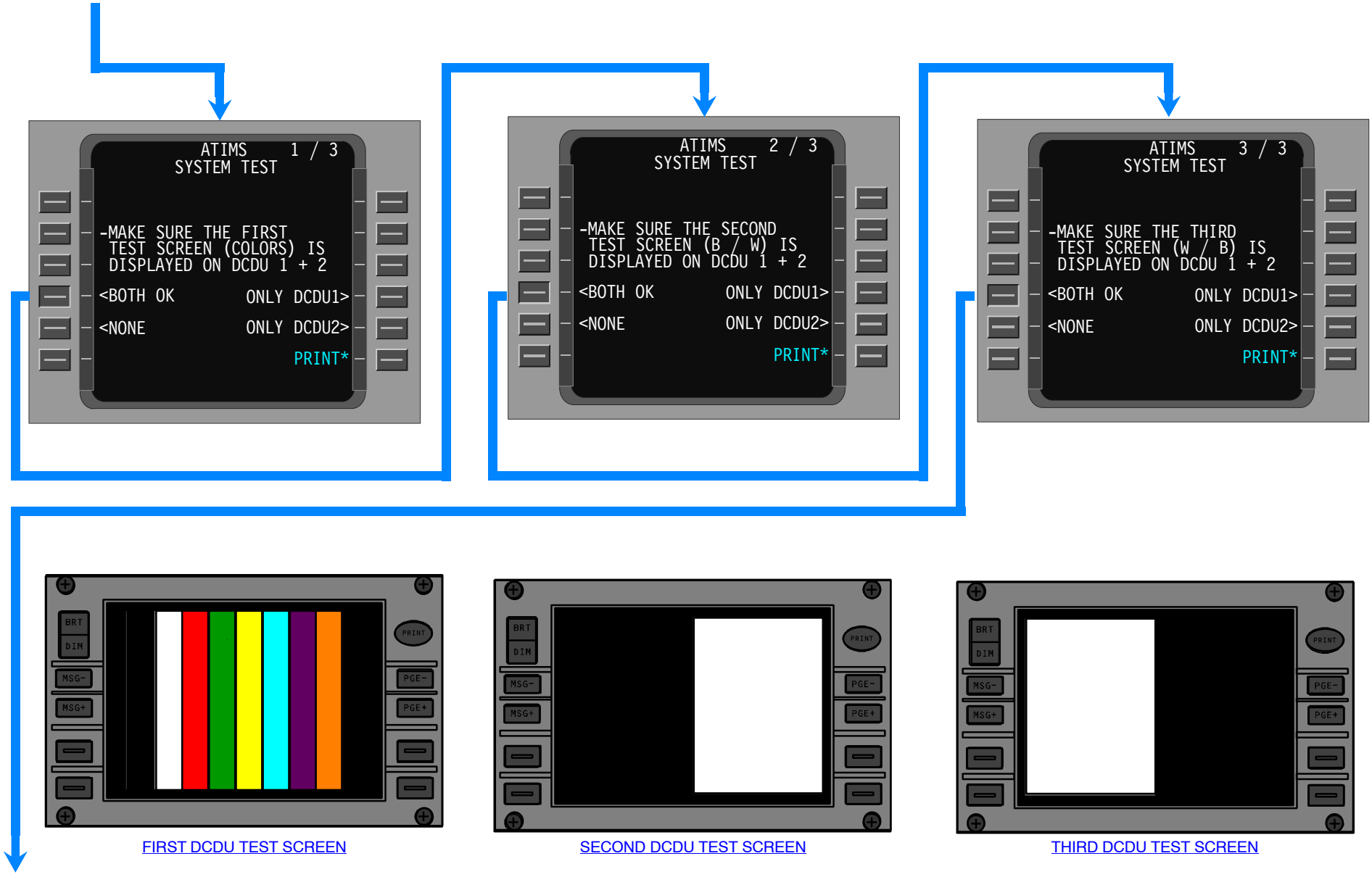


Figure 31 SYSTEM TEST Page 2 (DCDU TEST Indication)

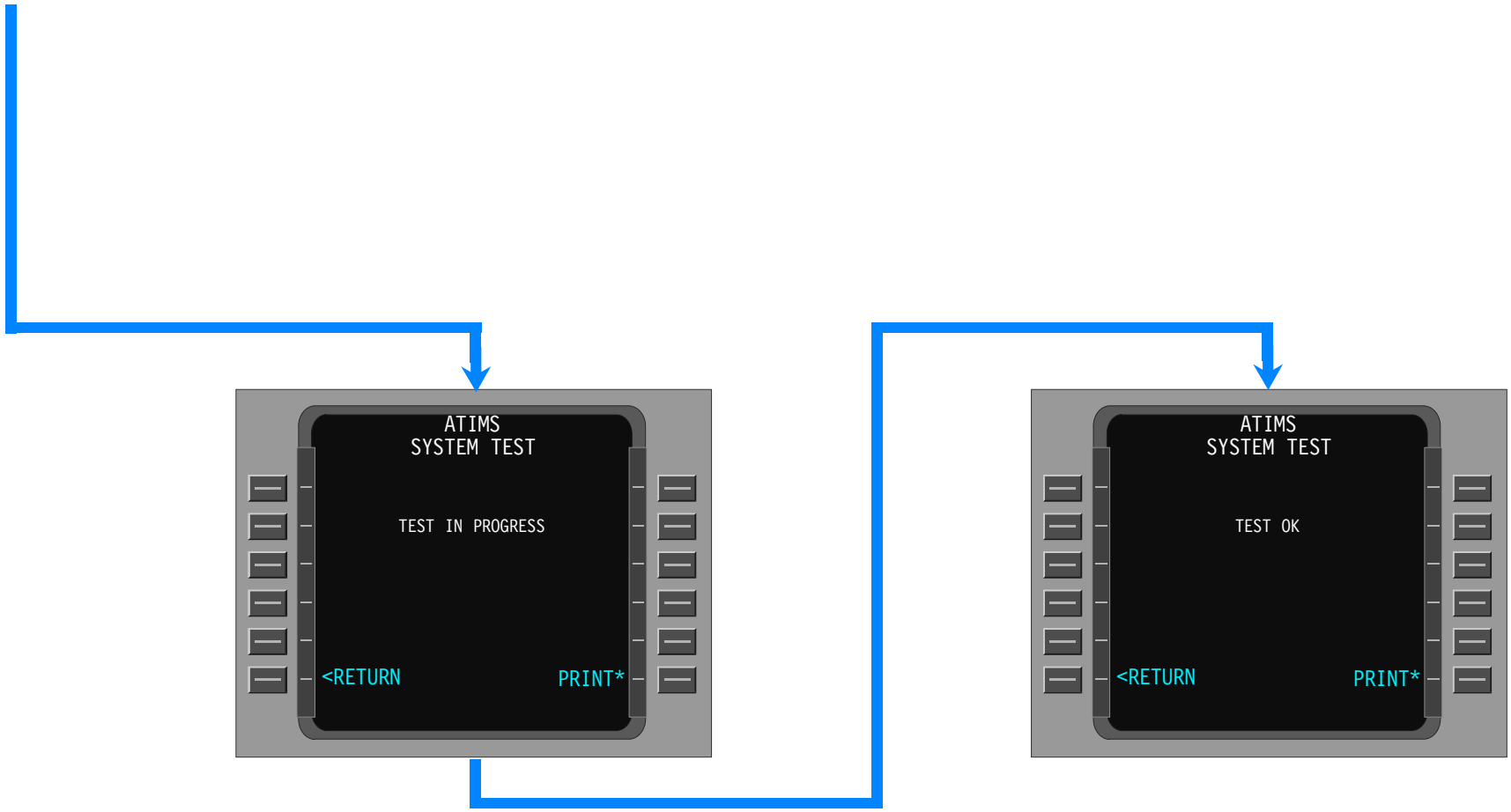


Figure 32 SYSTEM TEST Page 3

COMPONENT LOCTATION

ATSU LOCATION A320 FAMILY

The ATSU 1TX1 is installed in the electronics rack 81VU in the aft avionic compartment.

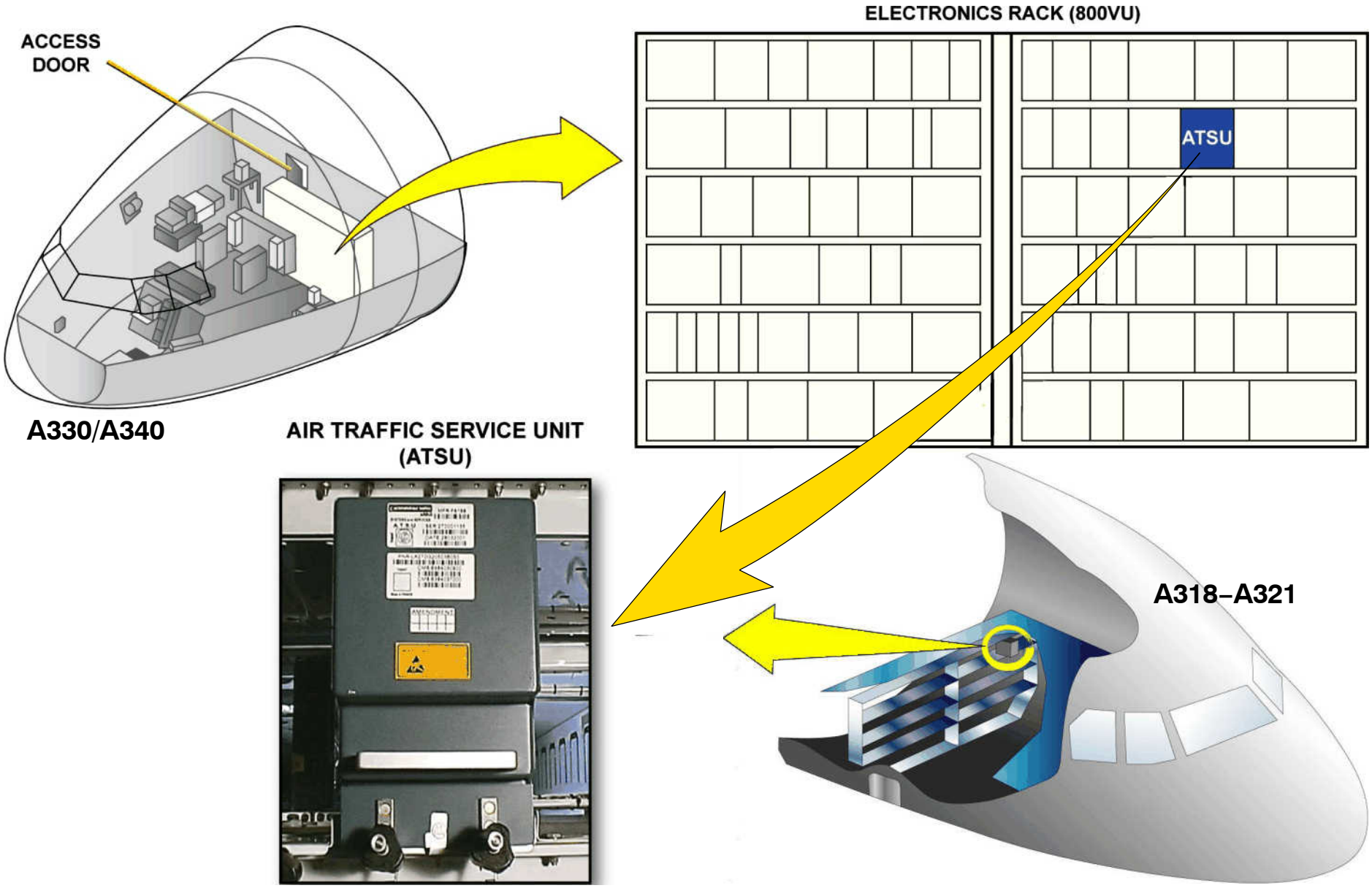


Figure 33 ATSU Location (A320 Family)

ATSU LOCATION A330/A340

The ATSU 1TX1 is installed in the electronics rack 821VU in the avionic compartment.

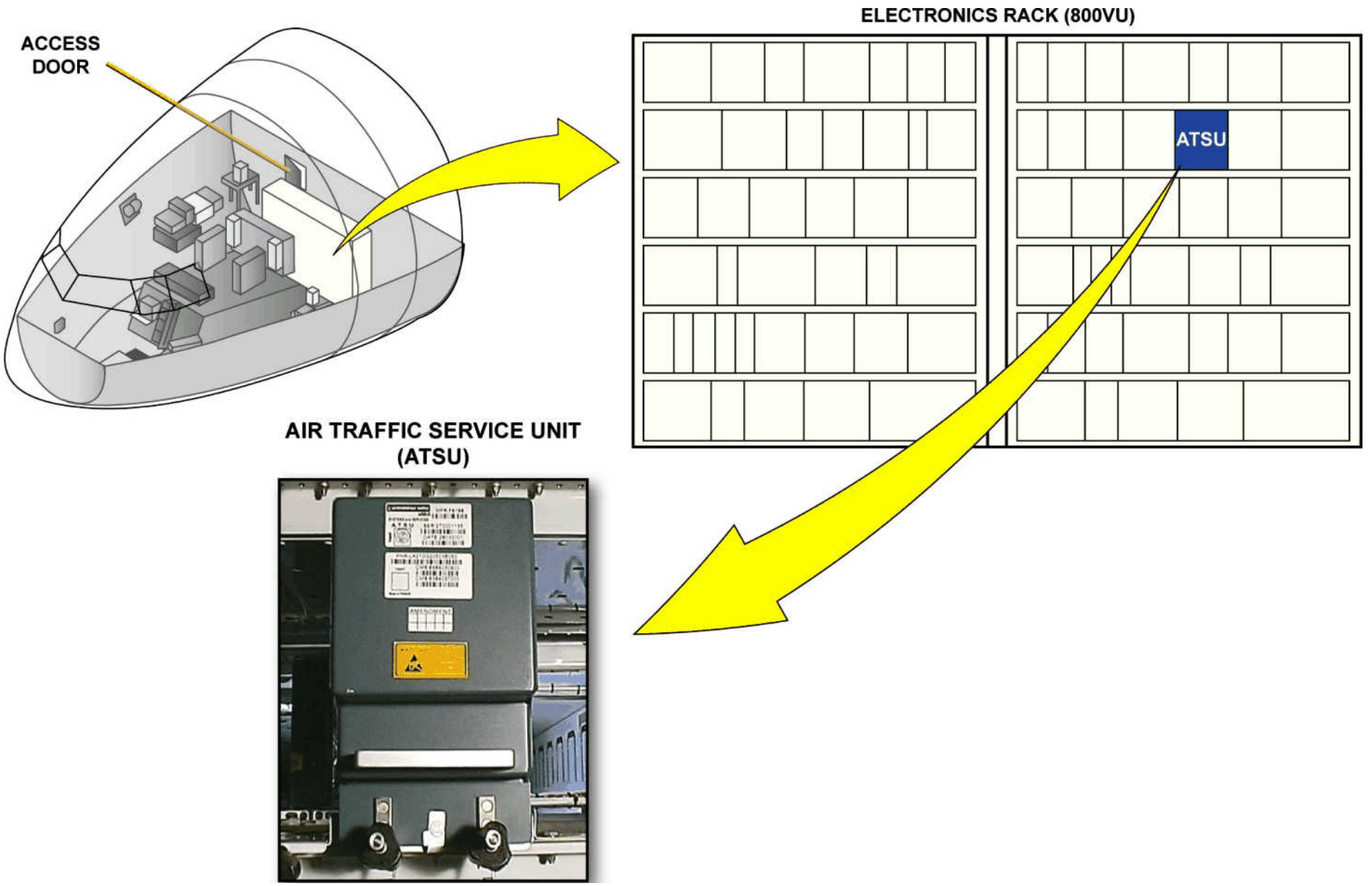


Figure 34 ATSU Location (A330/340)

46–10 AIRPLANE INFORMATION NETWORK

AIRBUS INFORMATION NETWORK SYSTEM DESCRIPTION (OPTIONAL SYSTEM)

GENERAL

The FlySmart with Airbus (FSA) system is composed of two systems:

The Aircraft Information Network System (AINS), which is the maintenance and operations part of the FSA while the Cabin Information Network System (CINS) is the passenger part of the FSA.

The main objective of the FSA system is to install, in the aircraft, a cost–effective system to implement new electronic services for flight operations, maintenance and passengers.

NOTE: The Aircraft Information Network System (AINS) is dedicated to ATA 46–11 while the Cabin Information Network System (CINS) is dedicated to ATA 46–41.

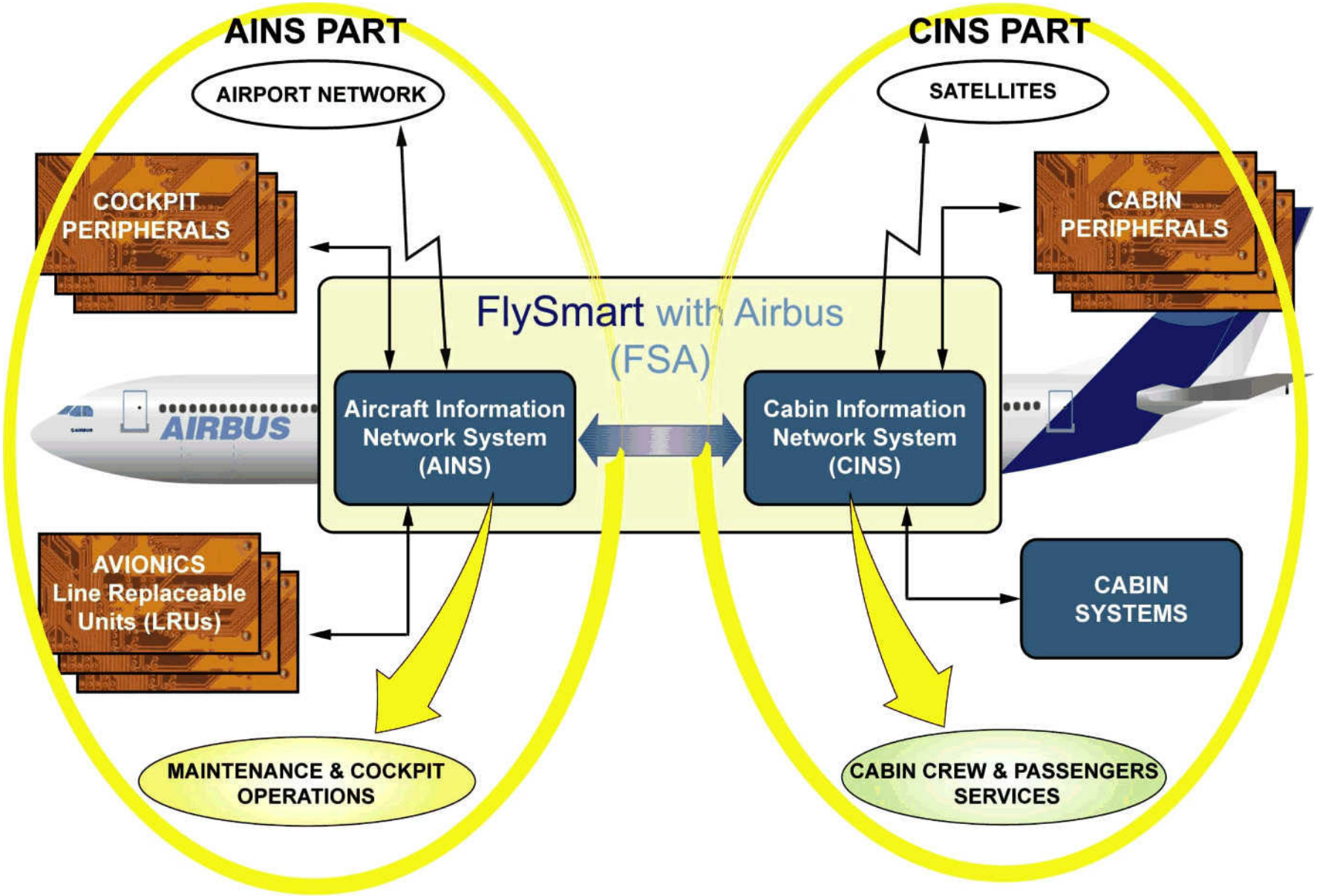


Figure 35 Fly Smart with Airbus

AINS APPLICATION

The AINS gives access to **flight crew** applications and to the **maintenance** applications.

The functions are:

- the Less Paper Cockpit including the weight and balance module, the take off module, the landing module, the performance calculations and the electronics manuals (Flight Crew Operating Manual and Minimum Equipment List (MEL)),
- the electronic logbook,
- the e–mail function which enables reception of graphical weather, charts and maps.

The functions of the maintenance applications are:

- the electronic maintenance manuals through Airn@v,
- an electronic logbook and MEL,
- system performance monitoring,
- flight operations monitoring,
- data loading.

CINS APPLICATION

The CINS gives access to the cabin crew applications and to the passenger's applications.

The functions of the **cabin crew applications** are:

- crew e–mails,
- electronic logbook,
- electronics manuals (Cabin Crew Operating Manual (CCOM)),
- cabin inventory,
- cabin management,
- credit card validation.

The functions of the **passenger applications** are:

- internet access,
- possibility to consult the e–mail and the Short Message Service (SMS),
- e–commerce,
- access to the news and the sports,
- live television,
- entertainment.

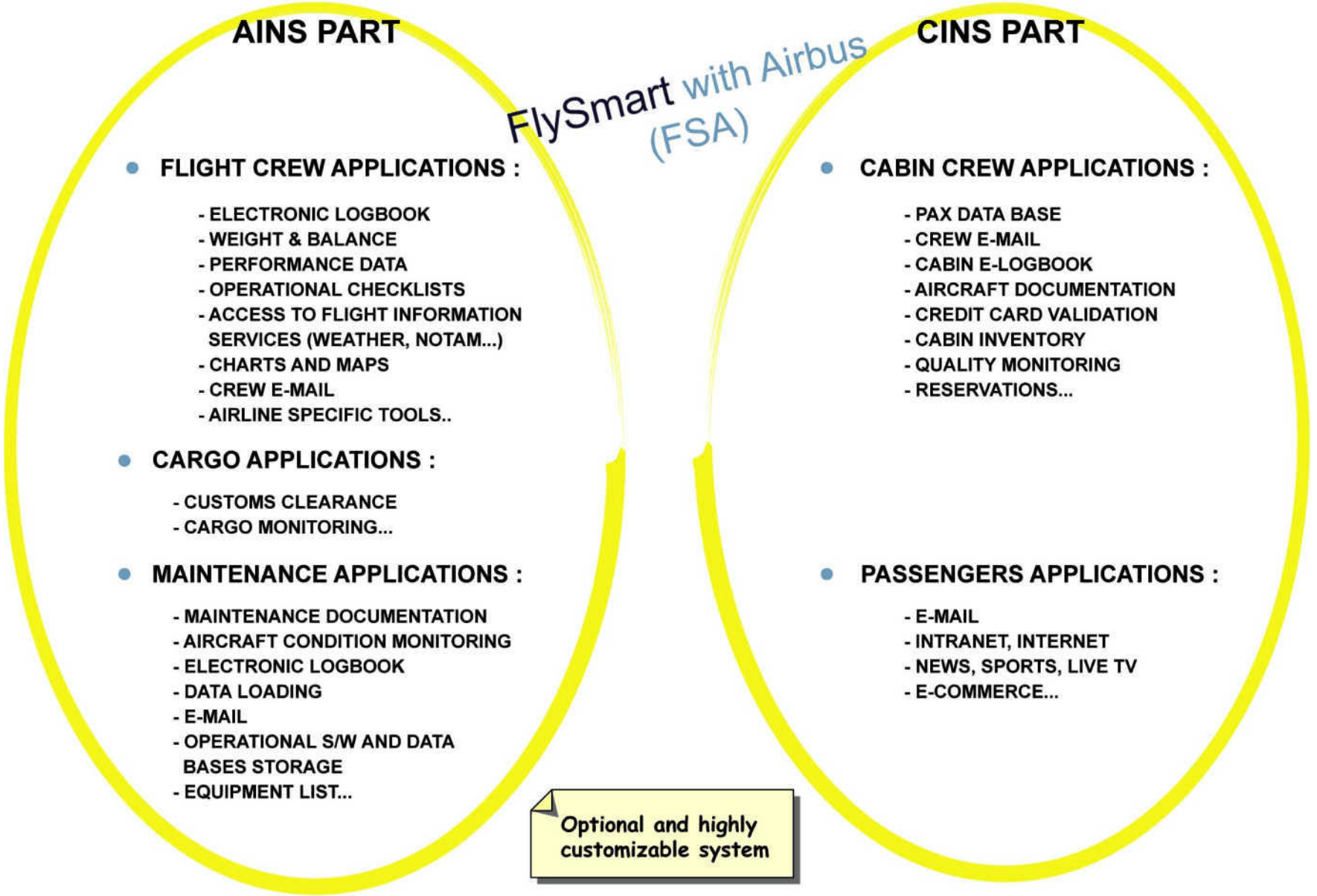


Figure 36 AINS & CINS Applications

GENERAL

The host platform of the Airbus Information Network System (AINS) has three components:

- the Aircraft Network Server Unit (ANSU), which provides a powerful server and data management functions on–board the aircraft,
- the Server Interface Unit (SIU), which protects the ”avionics world” systems from pollution or hacking intrusion from the ”open world”, and gives a security barrier between the avionics and open networks.

Additionally, the Terminal Wireless LAN Unit (TWLU) and its related antenna makes sure that wireless communications of AINS with the airport LAN (A/C on ground) operates.

ANSU (AIRCRAFT NETWORK SERVER UNIT)

The ANSU gives a common data/file storage system, a host–platform for airline application processing and network communication services. The ANSU is an open world data server, which manages the Ethernet LAN (ELAN) network by means of an Ethernet switch and enables communication between the ”open world” and the ”avionics world”. Its main function is to host airline applications on–board the aircraft while providing also significant mass storage capability for loadable software and other applications. The ANSU is interfaced with the TWLU for ground network connection, with the Cabin Information Network System (CINS), with three cockpit plugs, two for connection of a laptop and one for connection of a maintenance laptop and a printer.

The ANSU uses high speed data transfer and is connected to the outside world via 8 ports. These ports are used to connect the ANSU to wired peripherals:

- cockpit CAPT plug,
- cockpit F/O plug,
- cockpit PC and printer plug.

The SIU is the only LRU connected to the CMS or CFDS computer. Then the SIU is directly connected to the MCDU and the printer.

SIU (SERVER INTERFACE UNIT)

The function of the SIU is to supply an interface between the open world and the avionics world, to host ”sensitive” applications and to accommodate an Ethernet switch.

The SIU supports the following functions:

- Avionics LAN (ALAN); an Ethernet switch which gives the connection to Ethernet LRUs,
- Input/Output (I/O) with the avionics; an I/O module locks on, transmits labels, etc. This I/O is done through a direct interface,
- Avionics Software Protection Module:

  as the system supplies interface with the avionics, it makes sure that avionics will be isolated from the open world, protecting it from degradation and corruption. The protection module therefore controls every input to the avionics and allows throughput only if the data meet conditions defined in loadable database.

It is the core of the AINS safety policy to make sure that the AINS embedded applications cannot interfere with the aircraft functions:

- the core software,
- the loadable database (filtering table database).

TWLU (TERMINAL WIRELESS LAN UNIT)

The TWLU is used to bridge a connection between the on–board ELAN and the airport LAN. The TWLU bridges these two networks using a wireless RF spread spectrum link.

The TWLU supports the following functions:

- operation independent of LAN protocols,
- typical network functions, such as file server access from aircraft terminals, terminal emulation sessions to ground–based host, providing file transfer capability and internet access.

The function of the TWLU is to operate only while the aircraft is on the ground. The antenna is an omni–directional antenna coaxially connected to the TWLU.

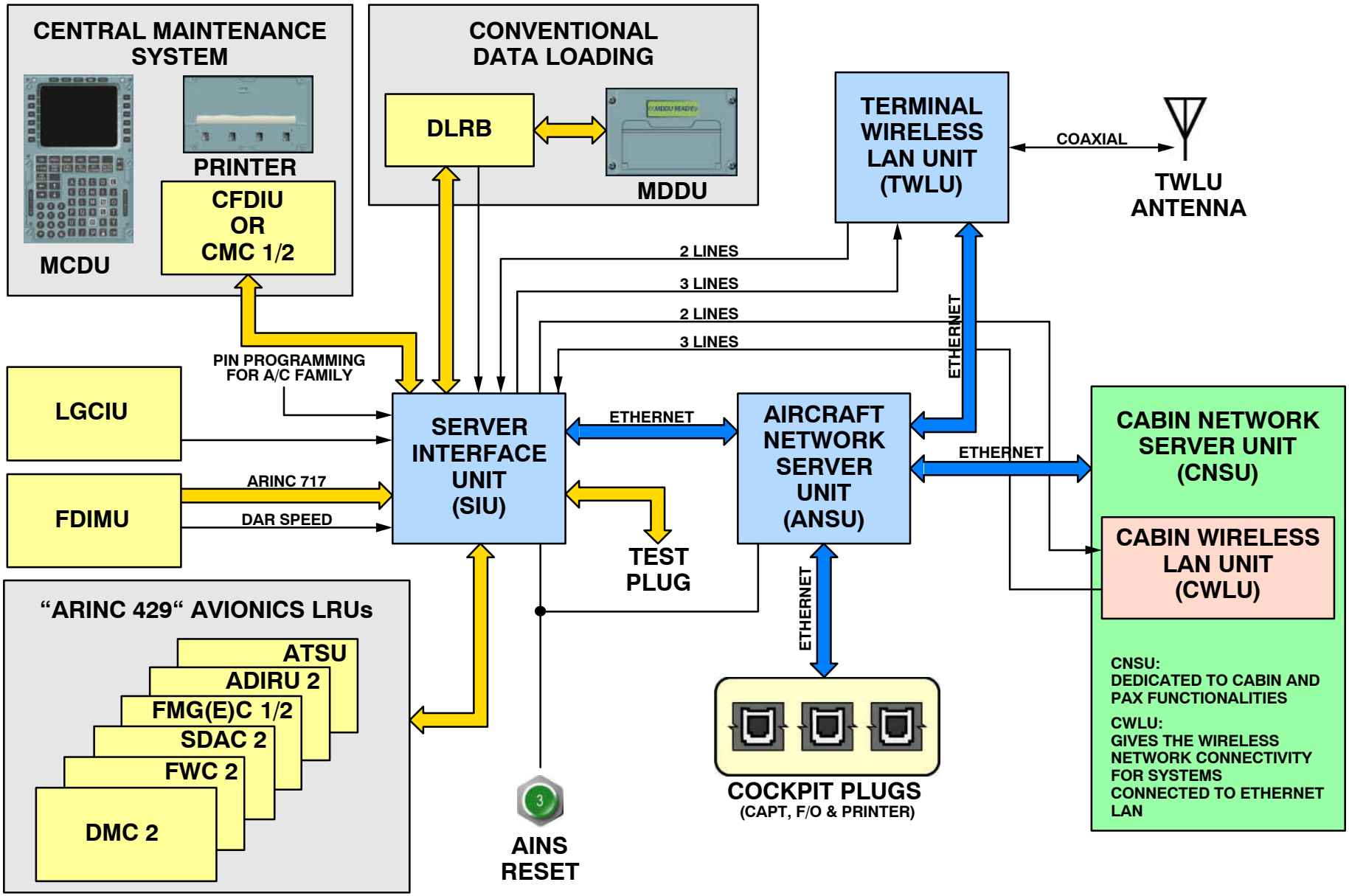


Figure 37 Aircraft Information Network Server System Schematic

46–61 ELECTRONIC FLIGHT BAG (EFB)

EFB INTRODUCTION

EFB PRINCIPLE

One Solution For All

The EFB (Electronic Flight Bag) is an electronic platform that fully replaces the pilot‘s flight bag based on paper. With the EFB pilots have a readily available electronic information management system that helps them to prepare and to conduct flights more easily, more securely and more efficiently.

This solution is independent of the aircraft type and hardware used and can be installed as a class 1, 2 or 3 solution.

Benefits Of EFB Class 2

Real–time access to all relevant operational data is one of the major assets of an electronic flight bag. Aircraft and aircrew operating manuals, navigational charts, briefing packages and different types of flight reports become completely redundant, the EFB provides all data in electronic format. As the EFB is integrated with IT ground systems, it offers a seamless and bidirectional flow of information between operational IT systems and the flight deck.

The EFB is the integrated solution to support the entire flight process. Comfortable working conditions for the pilot on ground and on board are just one of the advantages that pilots will appreciate. It also enables them to access the electronic briefing package from anywhere in the world, prepare the clipboard and set annotations.

CLASS 1:

- Off the shelf laptops, not mounted, aircraft or pilot specific
- Advantages: pricing, additional business cases, personalization
- Limitations: communication to A/C, usage during T/O & Landing

CLASS 2:

- Dedicated 3rd party hardware, mounted, connected to A/C avionics
- Advantages: usable during all flight phases, flexible upgrade of hard– and software, one standard for the whole fleet
- Limitations: Individual certification required

CLASS 3:

- Provided by aircraft manufacturers, fixed installation integrated in cockpit avionics
- Advantages: usable during all flight phases, highest level of integration
- Limitations: higher life–cycle costs, reduced flexibility, limited range of applications

Figure 38 EFB Classes

DISPLAY MODULE:

The Display Module is mounted to the cockpit window frame via the Docking Station Adapter (DSA).

LAPTOP DOCKING STATION:

Illustrated is a dual LDS. In this case two single LDS are installed on one mounting plate.

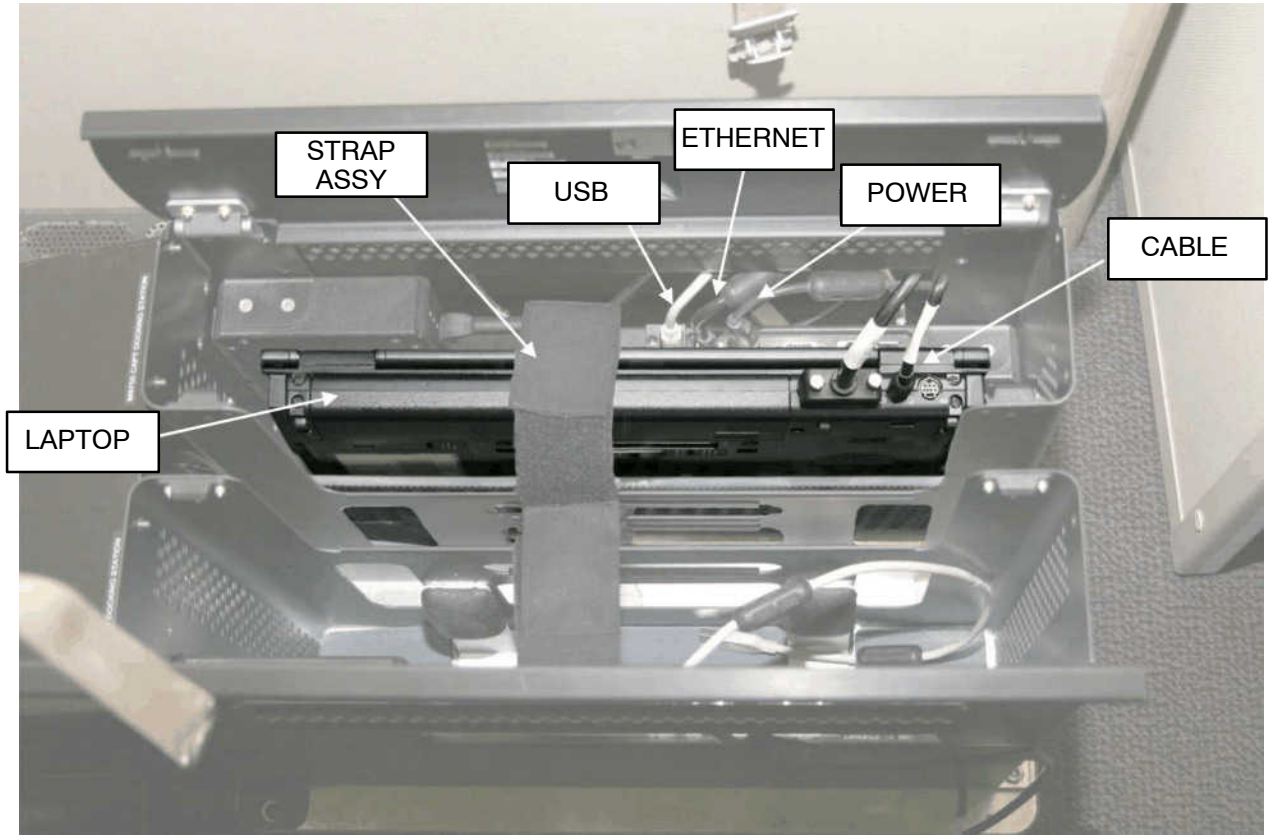
The cover of the rear LDS is open. In every aircraft type the location of the LDS is different.

POWER SWITCH CONTROL PANEL:

A power switch is available for each EFB for ON/OFF.

Next to it you see the plug which connects the DSA to the aircraft wiring.

Figure 39 EFB Components



LAPTOP DOCKING STATION:

The LDS is not a docking station in the traditional way. It is rather a fixed box for safe storage of various laptop models. The laptop is kept rear side up in the LDS by a flexible strap assy. USB–, Ethernet– and power cables must be plugged in manually. To enable the DC–output of the LDS the laptop power cable must be connected to the laptop. The LDS EFB units receive data from the ARINC data busses of different A/C systems depending on A/C type. These interfaces are limited to read only.

Figure 40 EFB Docking Station

GENERAL

The EFB Class 2 provides the cockpit crew with the support hardware necessary to allow an airline supplied laptop computer (the so called PU = Processor Unit) to function as an EFB on the aircraft. The EFB provisions system encloses:

- two forward mounted Display Modules (DM), also called Display Unit (DU),
- two Docking Station Adapters (DSA),
- two (Laptop) Docking Stations (LDS or DS) and
- associated interconnection wiring and power switch panels.

For the EFB Provisions System to become operational, a COTS (consumer–offthe–shelf) laptop computer must be installed and electrically connected in the Laptop Docking Station. Laptop Power, USB, and Ethernet ports to the corresponding LDS connection ports are connected to the LDS via a set of patch cables. The laptop computers with EFB software drive the DMs (Display Modules) via the DSA (Docking Station Adapter). The EFB Provisions System power is controlled via two forward switch panels, one for the Captain‘s and one for the First Officer‘s EFB.

Display Module

The DM (Display Module) displays on its LCD Screen the images generated by its associated LDS and laptop.

The DM has the following features:

- a power switch to turn on the DM backlight lamp and initiate communication with the Laptop Docking Station,
- a LCD backlight brightness control,
- a video transfer button that transfers and displays the image of the opposite EFB DM,
- a touch screen for finger control of the associated laptop,
- an external USB– and Ethernet port,
- a map clip for securing paper on the DM surface.

Laptop Docking Station

Both LDS (Laptop Docking Stations) are floor mounted. Depending of the different cockpit designs the location can vary.

Each LDS has the following functions:

- providing a protected secure enclosure for the laptop,
- distributing power to its associated DM, DC/DC converter, graphic converter and laptop,
- supporting various communication bus connections (ARINC, Ethernet) to the aircraft,
- providing connection ports for the laptop I/O interconnections (Power, USB, Ethernet).

Power Switch Control Panel

The Control Panel provides an ON/OFF power control switch for the respective EFB System and provides a disconnect for the DSA to the aircraft wiring (to the LDS).

Docking Station Adapter

The Docking Station Adapter (DSA) is a separate docking station and not mounted to the LDS. Each DSA connects the Display Module mechanically to the aircraft via the mount assembly and it connects electrically the DM to the aircraft wiring (and the LDS) via the Control Panel disconnect.

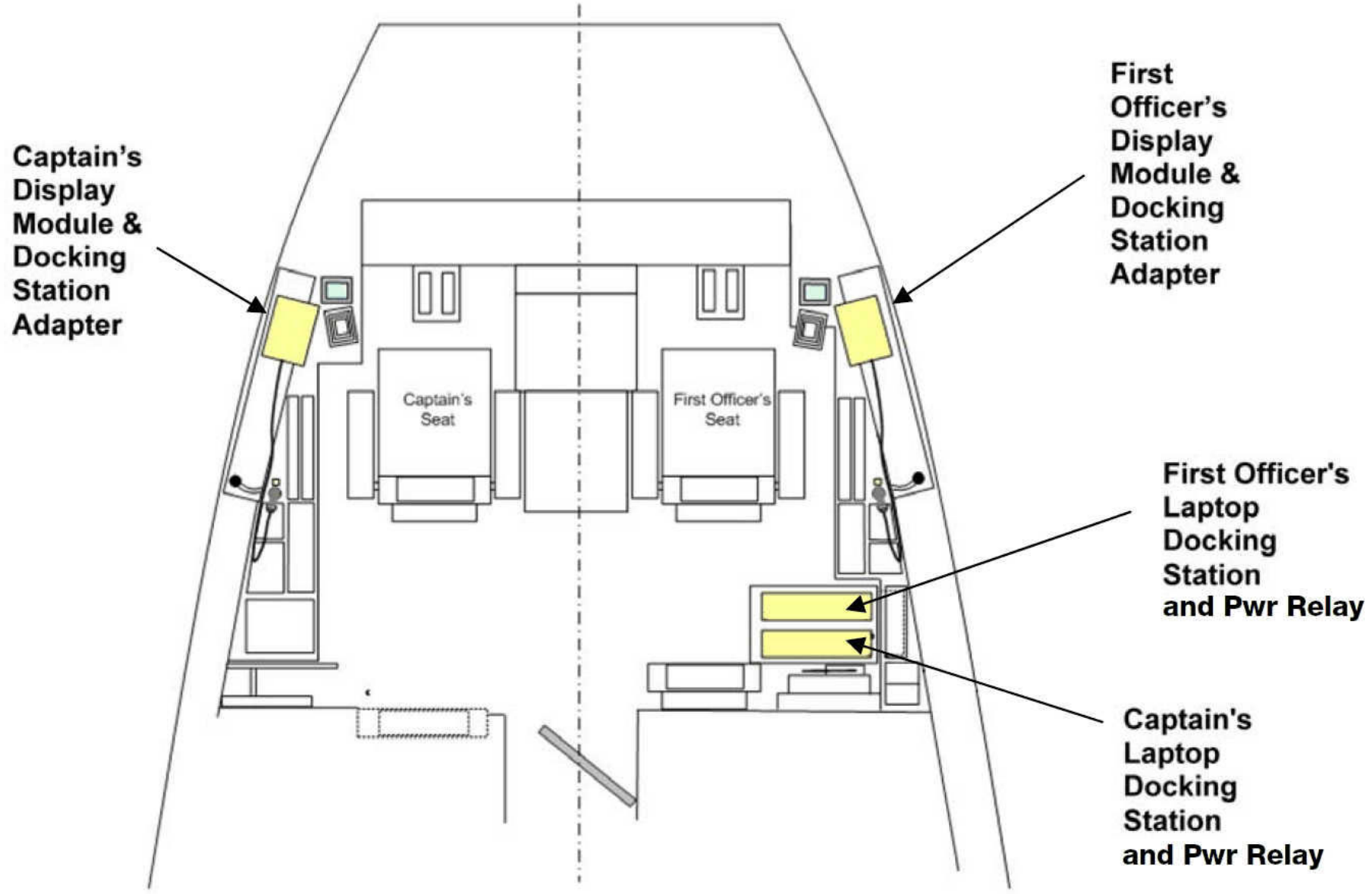


Figure 41 A320 EFB Cockpit Components

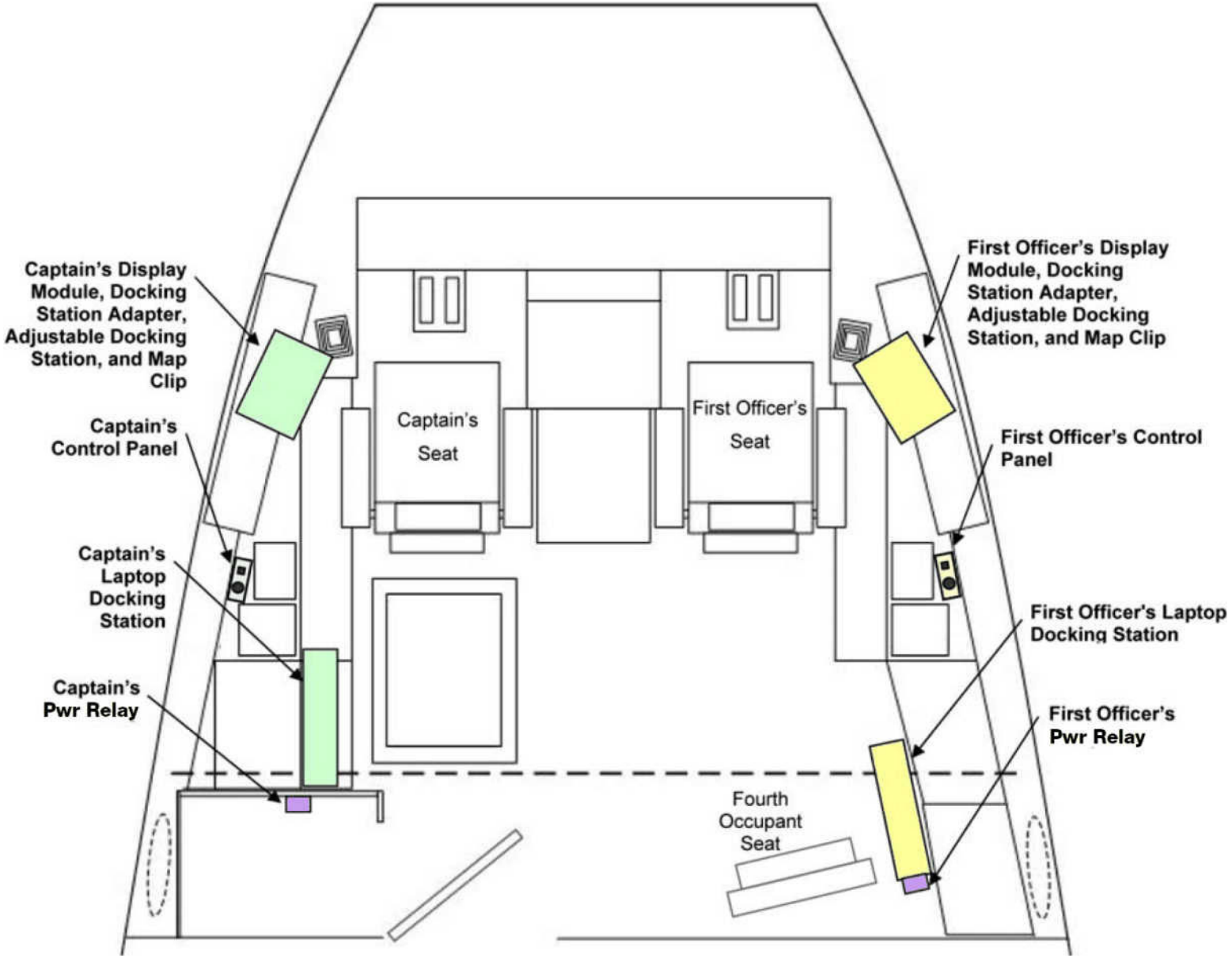
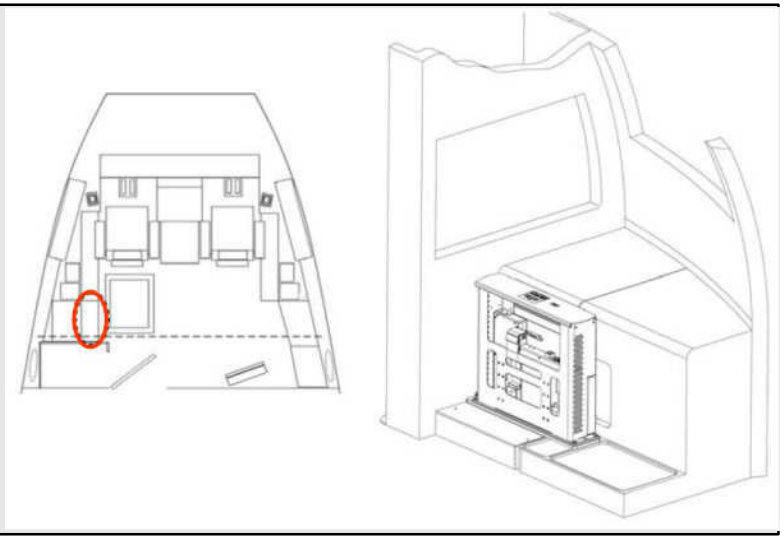


Figure 42 A330/A340 EFB Cockpit Components

LAPTOP DOCKING STATION CAPTAIN:

A single Laptop Docking Station for the Captain is located in front of the wardrobe next to the document box.



LAPTOP DOCKING STATION F/O:

The Laptop Docking Station for the First Officer is located right of the Fourth Occupant Seat.

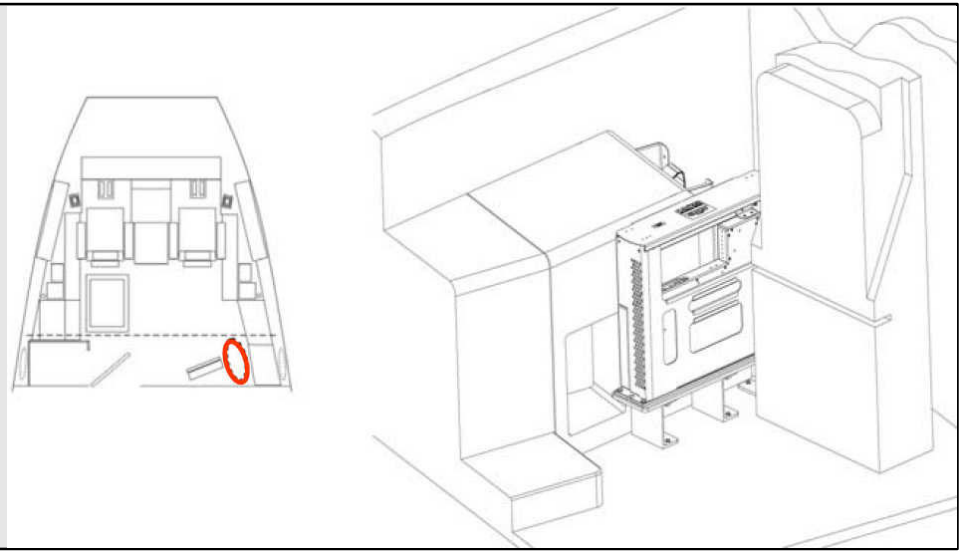


Figure 43 A330/A340 EFB Docking Station Location

EFB SYSTEM DESCRITPION

GENERAL

The 8700C2–400 Series Laptop Docking Station – Electronic Flight Bag (LDS–EFB) System Provisions provides the cockpit crew with the support hardware necessary to allow an airline supplied laptop computer to function as an EFB on Airbus aircraft. The EFB system provisions include: two, forward mounted Display Modules (DM), two Docking Station Adapters (DSA), two Laptop Docking Stations (LDS), and associated interconnection wiring and power switch panels.

SYSTEM FEATURES AND FUNCTION

The 8700C2–400 Series EFB system consists of the following equipment:

- Two 8720F2–2 Series Display Modules (DM) / Docking Station Adapter (DSA) assemblies located in the cockpit as follows:
  - The Captain‘s DM / DSA are mounted on the window frame outboard of the Captain‘s seat.
  - The First Officer‘s DM / DSA are mounted on the window frame outboard of the First Officer‘s seat.
- Two 8740B2 Series Laptop Docking Stations (LDS) assemblies located in the cockpit as follows:
  - On the A320 family the Captain‘s and First Officer‘s LDS is floor mounted behind the First Officers seat.
  - On the A330/340 the Captain‘s ADS is mounted to the sliding window frame outboard of the Captain‘s seat.
  - On the A330/340 the First Officer‘s LDS is floor mounted outboard of the fourth occupant‘s seat.
- Two power Switch Panel (SP) assemblies located in the cockpit as follows:
  - The Captain‘s SP is mounted in the outboard side panel.
  - The First Officer‘s SP is mounted in the outboard side panel.

Display Module (DM)

The DM displays images generated by the airline supplied laptop and has the following features and functions:

- a video enable switch to turn on the DM backlight lamp and initiate communication with the LDS,
- an LCD backlight brightness control,
- a video transfer button that transfers and displays the image displayed on crossside EFB DM,
- a touch screen for finger touch control of the associated laptop‘s cursor,
- an external USB port and an external Ethernet port.

Map Clip

Each Map Clip has the following features and functions:

- provides a method for securing paper on the surface of the DM.

Docking Station Adapter (DSA)

Each DSA has the following features and functions:

- provides electrical connection between the DM and the aircraft (and the LDS) via the Control Panel disconnect,
- provides mechanic connection between the DM and the aircraft mounted support brackets.

Laptop Docking Station (LDS)

Each LDS has the following features and functions:

- provides a protected secure enclosure for the airline supplied laptop,
- distributes power to its associated DM and airline supplied laptop,
- supports various communication bus connections (ARINC, Ethernet) to the aircraft,
- provides connection ports for the various airline supplied laptop I/O interconnections (Power, USB, Ethernet).

Power Supply

The LDS–EFB systems operate off of 28 VDC electrical power. The DC Bus 2 supplies 28 VDC through circuit breaker 9003TE1 to the Captain‘s LDS–EFB system.

The Essential Shed Bus supplies 28 VDC through circuit breaker 9003TE2 to the First Officer‘s LDS–EFB system.

Interface

The LDS–EFB units receive data from the following ARINC data busses:

- ADIRU 1 (F/O) or 2 (CAPT) IR OUTPUT BUS 4,
- FMG(E)C–1 (F/O) or 2 (CAPT) M GEN BUS 1.

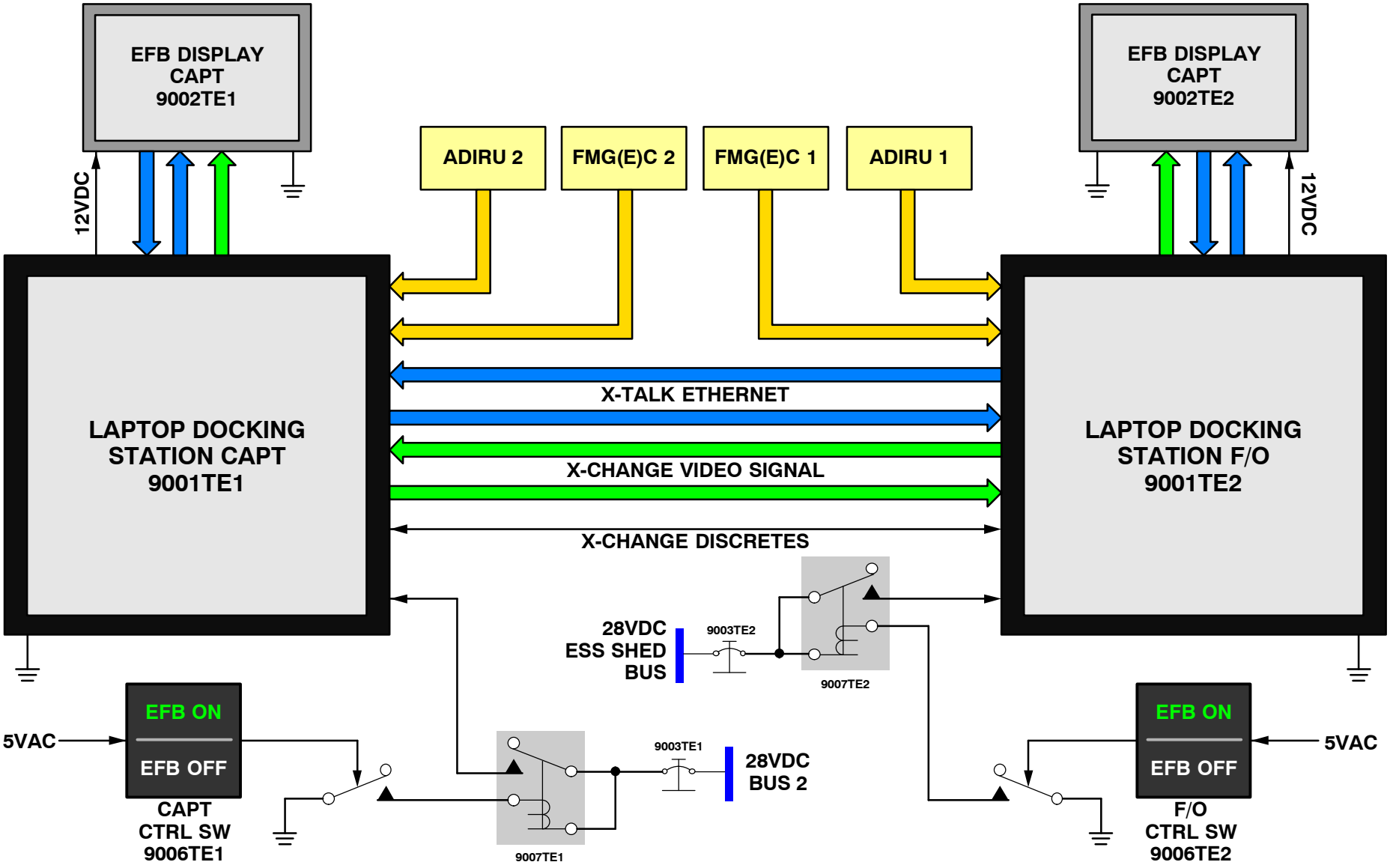


Figure 44 EFB System Schematic

EFB TEST DESCRIPTION

PERFORMANCE TESTS USING THE ALOFT AUTOMATED TEST SOFTWARE

ALOFT is a Windows–based software application that aids in verifying that the data input and output wiring for a Goodrich LDS has been connected correctly.

The following performance tests will be performed using the ALOFT automated test software:

- ARINC Receive,
- Aircraft Discrete In,
- Ethernet Cross Connection (with cross side laptop),
- Ethernet Communication (DM Ethernet port to cross side laptop),
- Serial Communication (between LDS and DM).

Test Preparation and ALOFT Initialization

Activate the following equipment:

- ADIRU–1,
- ADIRU–2,
- FMG(E)C–1,
- FMG(E)C–2.

From the Captain‘s DM, launch the airline (user) specified short–cut to run the LDS–EFB Ground Test Software (ALOFT).

NOTE: The file that will be executed is “ALOFT.exe“.

When the ALOFT program interface appears,

- Use the pull down menu on the bottom of the screen, next to “Select Configuration“, to choose the aircraft type and applicable pilot position (Captain).
- Click the “Start“ button.
- While waiting for the software to start a “Please Wait“ message will be displayed in the status areas for each of the monitored functions.

ALOFT Display Screen ARINC Field Definition

The only fields that require review are as follows:

- “Expected“ (Set by configuration file),
- “Recent“ (Data received on specified data label, to be compared with “Expected“),
- “Status“ (Indicates status of data bus read).

The SSM and SDI fields are for information only:

- The “Expected“ and “Recent“ data fields should match unless otherwise specified in the procedure.

The Status field messages are as follows:

- “ACTIVE“ = Specified label present on specified channel.
- “MATCH“ = Specified label present on specified channel and data in Label matches expected data.
- “MISMATCH“ = Specified label present on specified channel but data in Label does not match expected data.
- “TIME OUT“ = Specified label not received on specified channel.

Rx X: “Sending Equipment ID“				
Label:	XXX	Data	SSM	SDI
Expected:		0xXXXXX	-	-
Recent:		0xXXXXX	X	X
Status:	**ACTIVE**, **MATCH**, **MISMATCH**, or **TIME OUT**			

Figure 45 EFB Test with ALOFT Testsoftware

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TABLE OF FIGURES