SB 503 - Avionics Technologies (Module 4.5)
Integrated Modular Avionics
4-5 LRUs/LRMs (1) Technological Solutions across A/c Programs

(1) LRUs: Line Repleceable Unit – LRM: Line Repleceable Module
Professor: H. GOUTELARD (Contractor ENAC/Sup'Aéro)
Thales Avionics

THALES

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Avionic EE-Bay

Bear in Mind…For an Aircraft
• Km of wiring
• Tons of cabling
• Hundreds of computers

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GEA Tianjin / 中国民航大学中欧航空工程师学院
Avionics Innovation & Trends

LRUs & Cabinets

Avionic & Avionic

**Modularity / Standardization
Growth potential (IO and/or CPU)**

Simplicity (+)   Evolutivity (+)

*Trade-off
know how*

Evolutivity (-)   Complexity (-)

**Several Functions
1 LRU
(Cabinet)**
IMA is a vector
For this benefit

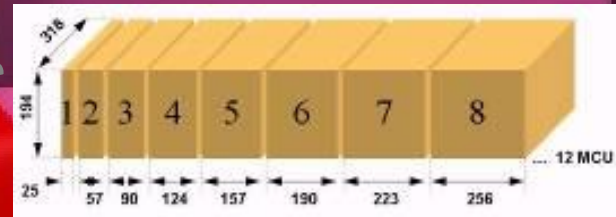*Industrial but...
...cannot fly as is !!*

VPX

ANSI
VITA 46/48
VME

3U / 6U

From a mechanical perspective, the VITA standard reuse the 3U and 6U eurocard dimensions (100 x 160 mm and 223 x 160 mm)

Avionics

ARINC 600

Modular Concept Unit / LRU

**1 Function
1 LRU**

ARINC 600 is based on the principle of using of Modular Concept Unit (MCU) or LRU (Line Replaceable Unit) connected in a RACK. Different standard sizes of MCU are specified: 1 MCU, 2 MCU,….. 12 MCU as shown below

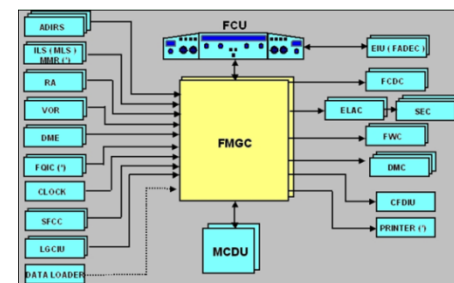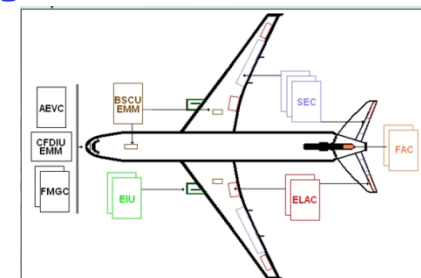THALES   AIRBUS GROUP   SAFRAN

Thales Computing Portofolio

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Example: Thales perimeter on A318-319-320

Example: Thales Solutions & LRUs on A318-319-320 (1/2)

ELAC B

ELevator and Ailerons Computer   P/N: 3945128

Programs: A318 / A319 / A 320 / A321   Quantity : 2 per shipset

Functional description & Main Features

Les ELAC (Elevator and Ailerons Computer) contrôlent les gouvernes de profondeur, de gauchissement et le plan horizontal des AIRBUS de la famille A320. L'ELAC B constitue la 2ème génération d'ELAC.

The ELAC B provides control surface deflection signals for the fly-by-wire Electrical Flight Control System (EFCS)

FAC

Flight Augmentation Computer   P/N:B397

Programs : A318 / A319 / A 320 / A321   Quantity : 2 per Shipset

Functional description & Main Features

The FAC performs the following functions: Yaw damper, Rudder Trim, Rudder travel limiting, Flight envelope protection (speeds, alpha floor, gamma, beta, balance and weight computations), Wind shear detection.

FMGC

Flight Management Guidance Computer   P/N:C13042 FMGC HWL Pegasus   P/N:C13043 FMGC THAV (ex B546)

Programs : A318 / A319 / A 320 / A321   Quantity : 2 per shipset

Functional description & Main Features

The Flight Management and Guidance Computer consists of two lanes : the Flight Guidance part and the Flight Management part. The FG part of the FMGC provides the following main functions: Flight Director, Autopilot Cruise Modes, Autothrust, Automatic Landing capability. It interfaces with the Fly by Wire system to control pitch and roll axis, with the FAC to control yaw axis and with the FADEC to control the trust of the engines.

It includes also the Built In Test Equipment (BITE) function, which is part of the Flight Detection System.

SEC

Spoiler and Elevator Computer   P/N:B372

Programs : A318 / A319 / A 320 / A321   Quantity : 3 per shipset

Functional description & Main Features

The Spoiler and Elevator Computer is a subassembly of the fly-by-wire system. It controls the aircraft's spoilers and, in backup mode, the elevators.
The role of the SEC is to convert the control surface deflection command signals according to the aircraft movement data output by the roll and pitch sensors, accelerometers or speedbrake lever. The SEC computers provide the interface between the manual or automatic deflection commands and the servomotors associated with each control surface.

EIU

Engine Interface Unit   P/N's:39579006 & 3957985114 (EIU CFM)   P/N's:395790500 & 3957985205 (EIU IAE)

Programs : A318 / A319 / A 320 / A321   Quantity : 2 per Shipset

Functional description & Main Features

The EIU acts as an interface with the engine computers (FADEC) at aircraft level. It enables ignition, start-up and the indication of engine parameters to take place. Two EIU's (one pér engine) are mounted on the A/C.

CFDIU EMM

Centralized Fault Display Interface Unit   *P/N:C12860 (ex B401)*

Programs : A319 / A 320 / A321   Quantity : 2 per shipset

Functional description & Main Features

A CFDIU acquires and processes (completes, correlates, memorizes and displays) the data transmitted by the built-in-test equipment and the warnings which have originated the crew complaint.

AEVC step 2

Avionics Equipment Ventilation Computer   *P/N:87292325*

Programs : A318 / A319 / A 320 / A321   Quantity : 1 per shipset

Functional description & Main Features

The Avionics Equipment Ventilation Computer (AEVC) controls the ventilation of the aircraft avionics compartment and monitors all equipment under its control. The AEVC must be able:
- to command 6 valves and 2 fans according to the aircraft skin temperature, the rotation of the reactors and the ground/flight conditions,
- to assure the surveillance and the warning of defective ventilation equipment,
- to assure the test of those ventilation equipment.

SEC

Spoiler and Elevator Computer   *P/N:B372*

Programs : A318 / A319 / A 320 / A321   Quantity : 3 per shipset

Functional description & Main Features

The Spoiler and Elevator Computer is a subassembly of the fly-by-wire system. It controls the aircraft's spoilers and, in backup mode, the elevators.
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EIU

Engine Interface Unit
P/N's:39579006 & 3957985114 (EIU CFM)
P/N's:395790500 & 3957985205 (EIU IAE)

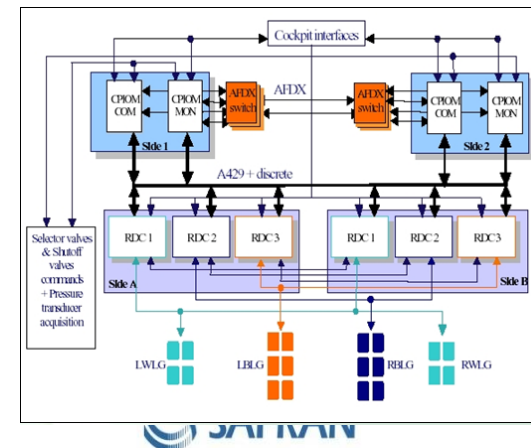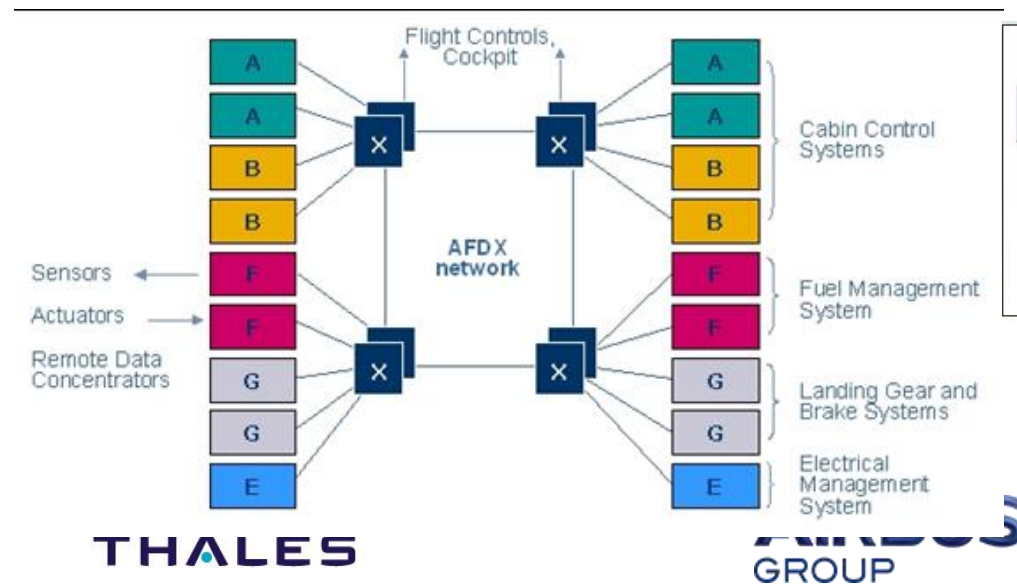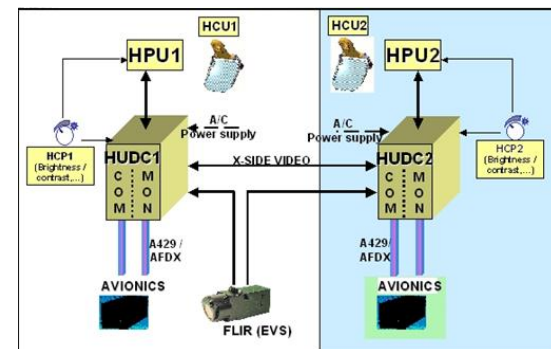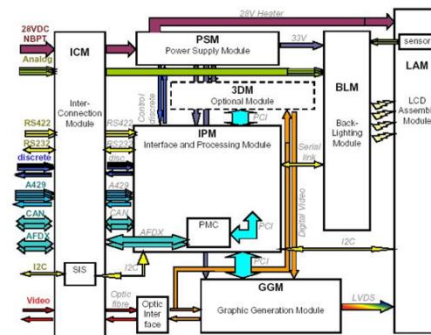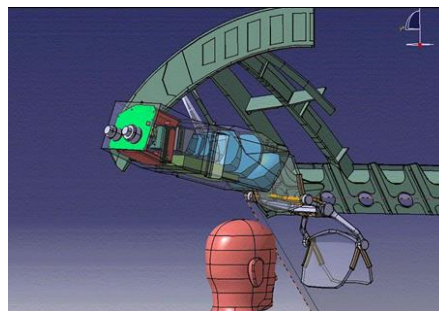Programs : A318 / A319 / A 320 / A321   Quantity : 2 per Shipset

Functional description & Main Features

The EIU acts as an interface with the engine computers (FADEC) at aircraft level. It enables ignition, start-up and the indication of engine parameters to take place. Two EIU's (one per engine) are mounted on the A/C.

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Example: Thales perimeter on A380 (1/2)

Example: Thales solutions on A380 (2/2)

RDC

Remote Data Concentrator   P/N:E21375

Program: A380	Quantity : 3 per shipset

Functional description & Main Features

The RDC units perform several functions for the braking control system (BCS) of the A380 aircraft. The Braking and Body Wheel Steering RDC is an equipment that controls part of braking anti skid function for wing and body landing gears, and wheel steering function for body landing gears. A complete braking and steering system includes three identical RDC boxes, each controlling up to eight wheels.
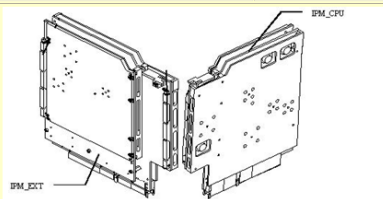
CDS: IPM

Interface Processing Module of the Control and Display System   P/N:E29032

Programs : A380 / A400M	Quantity : 8 per shipset

Functional description & Main Features

The main role of the Control and Display System (CDS), developed for the A380 aircraft, is to display flight, navigation, communication, system and warning data to the crew.
The system is composed of :
- 8 Display Units (PDU's), using Liquid Crystal Display (LCD) technology,
- 2 KCCU (composed each of a Keyboard –KBD- and a Cursor Control Device – CCD-).

The Interface Processing Module (IPM), which is a part of the PDU 68, is composed of 2 boards. IPM provides the electrical interface with the aircraft. It ensures the data computation and management of graphic orders to be sent to the GGM board via PCI bus. It's the only part of the PDU38 which is made by ACS

CPIOM F

Core Processing Input Output Modules Fuel   P/N:E29190

Programs : A380 / A400M	Quantity : 4 per Shipset

Functional description & Main Features

- *General CPIOM description*

The Operating System of the CPIOM treats the Avionics Applications requests made via API services. Those services are used to :
- create software tasks corresponding to avionics functions,
- check software execution according to system requirements (frequency of tasks, max duration of processing, etc.),
- provide communication devices and synchronization between tasks,

- *CPIOM-F description*

The CPIOM Fuel is able to cover the following baseline functions:
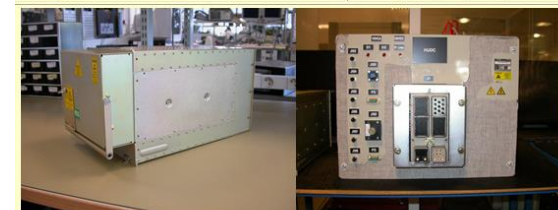- Fuel Gauging,
- Fuel Management

HUDC

Head Up Display Computer   P/N:E29238

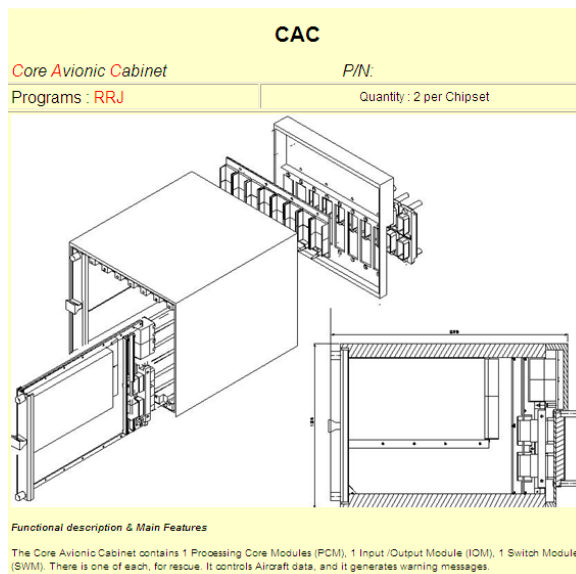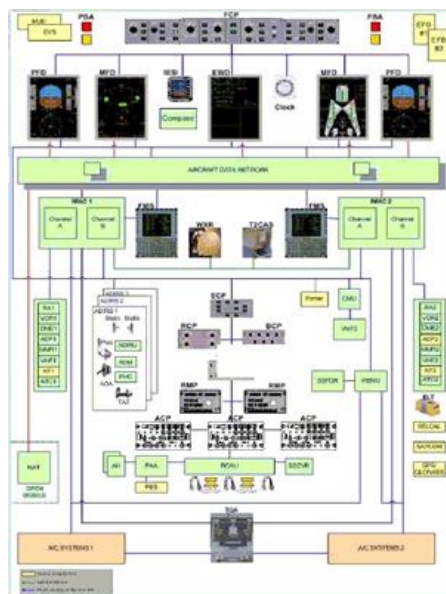| Program: A380	Quantity : 2 per shipset

Functional description & Main Features

The HUDC is able to generate pictures for the head up display of the pilot. It can display video and different kind of symbols.

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Example: Thales offer & solutions on SSJ