A350
TECHNICAL TRAINING MANUAL
MAINTENANCE COURSE - T1+T2 - RR Trent XWB
ELECTRO-MECHANICAL SYSTEMS (Power Plant) Level 1

This document must be used for training purposes only

Under no circumstances should this document be used as a reference

It will not be updated.

AIRBUS Environmental Recommendation
Please consider your environmental responsability before printing this document.

ELECTRO-MECHANICAL SYSTEMS (POWER PLANT) LEVEL 1

V1813401 - V01T0M0

FUEL TANK SAFETY PRESENTATION (1)

General

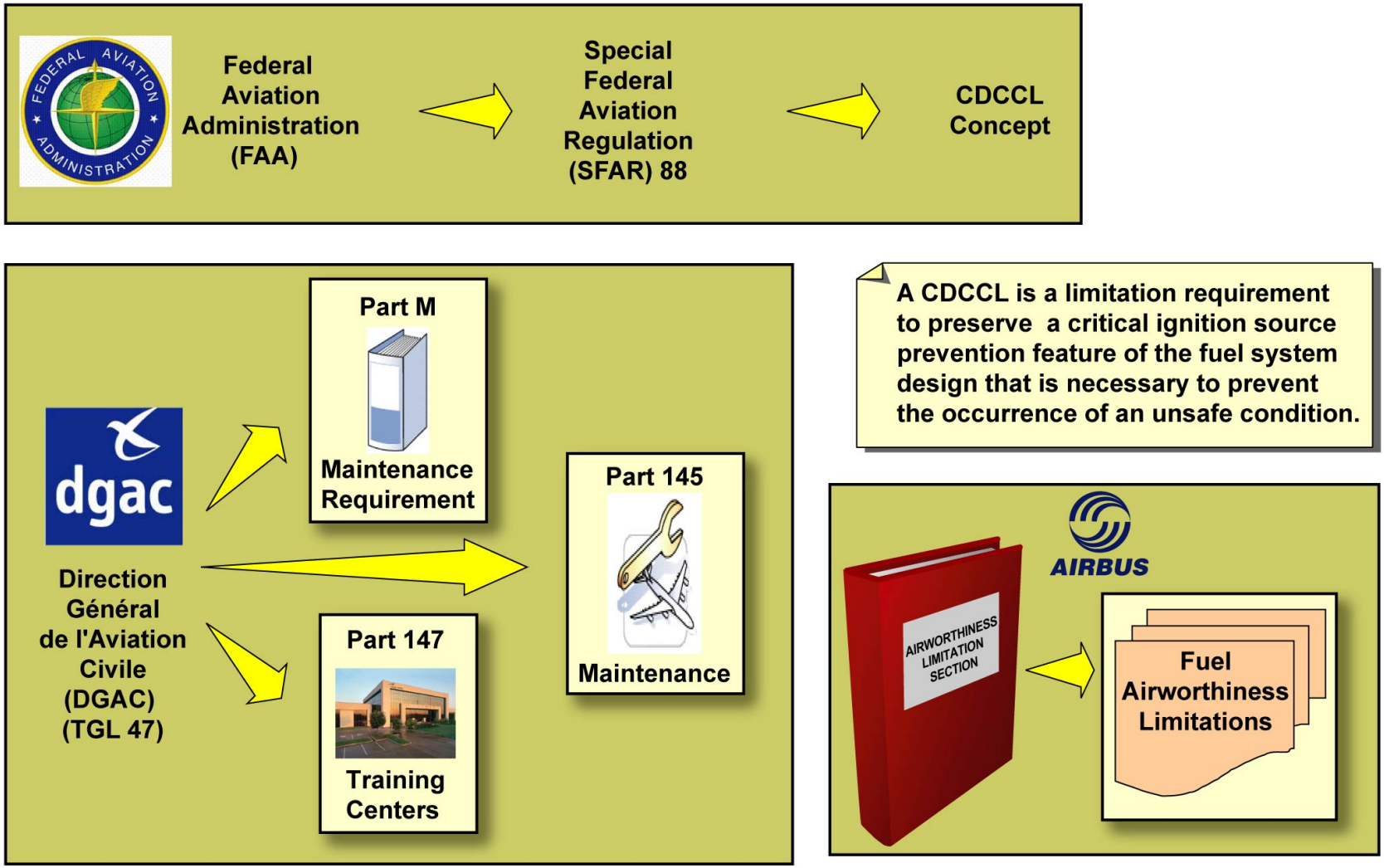
Following three fuel tank explosions over the past 14 years which resulted in 346 fatalities, the U.S Department of Transportation's Federal Aviation Administration (FAA), have introduced new regulations to improve fuel tank safety.
These regulations relate to the prevention of ignition sources within fuel tanks of current type certificated aircraft. They require carrying out a one-time fuel system safety and design review.

Critical Design Configuration Control Limitations (CDCCL)

The FAA issued Special Federal Aviation Regulation (SFAR) 88 which gives a detailed description of the CDCCL concept.
The DGAC requested the SFAR 88 (TGL 47) to be added to PART 145, PART M and PART 147 to reinforce the application of these regulations.
This includes:
- A conception part intended to aircraft design features,
- A maintenance part.

A CDCCL is a limitation requirement to preserve a critical ignition source prevention feature of the fuel system design that is necessary to prevent the occurrence of an unsafe condition.
The function of the CDCCL is to give instructions to retain the critical ignition source prevention feature during configuration change that may be caused by alterations, repairs or maintenance actions.
The aircraft manufacturers have to emit a document to their customers giving the list of all the maintenance tasks impacted by the CDCCL.
For AIRBUS this document is called the Fuel Airworthiness Limitations and it is added to the Airworthiness Limitation Section part 5.
CDCCL items are listed in Airworthiness Limitations Form.

CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL)



GENERAL - CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL)

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FUEL TANK SAFETY PRESENTATION (1)

Fuel System Design Configuration

The Airbus aircraft fuel systems have, by design, a number of features that are intended to protect the system from inadvertent ignition.

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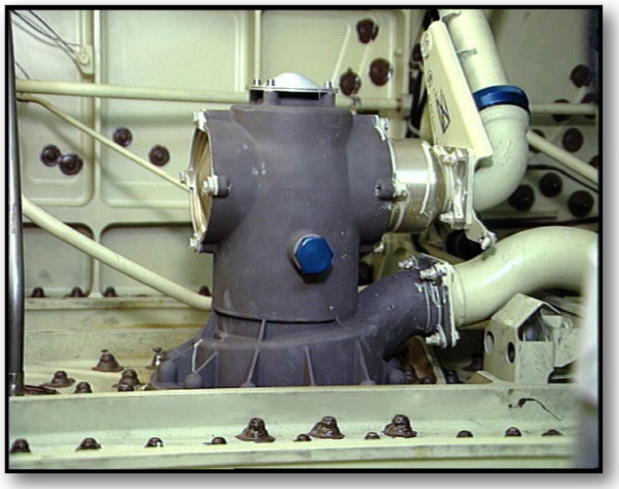
EXAMPLES OF AIRBUS FUEL SYSTEM DESIGN

Electrical harnesses in the tanks use very low voltage current (less than 5 VDC) and are far enough for the surrounding equipment and structure (segregated routing).

Fuel pumps are the only electrical equipment using high power current (115 VAC). Consequently, pumps harnesses are located under the lower wing skin panels outside the fuel tanks.



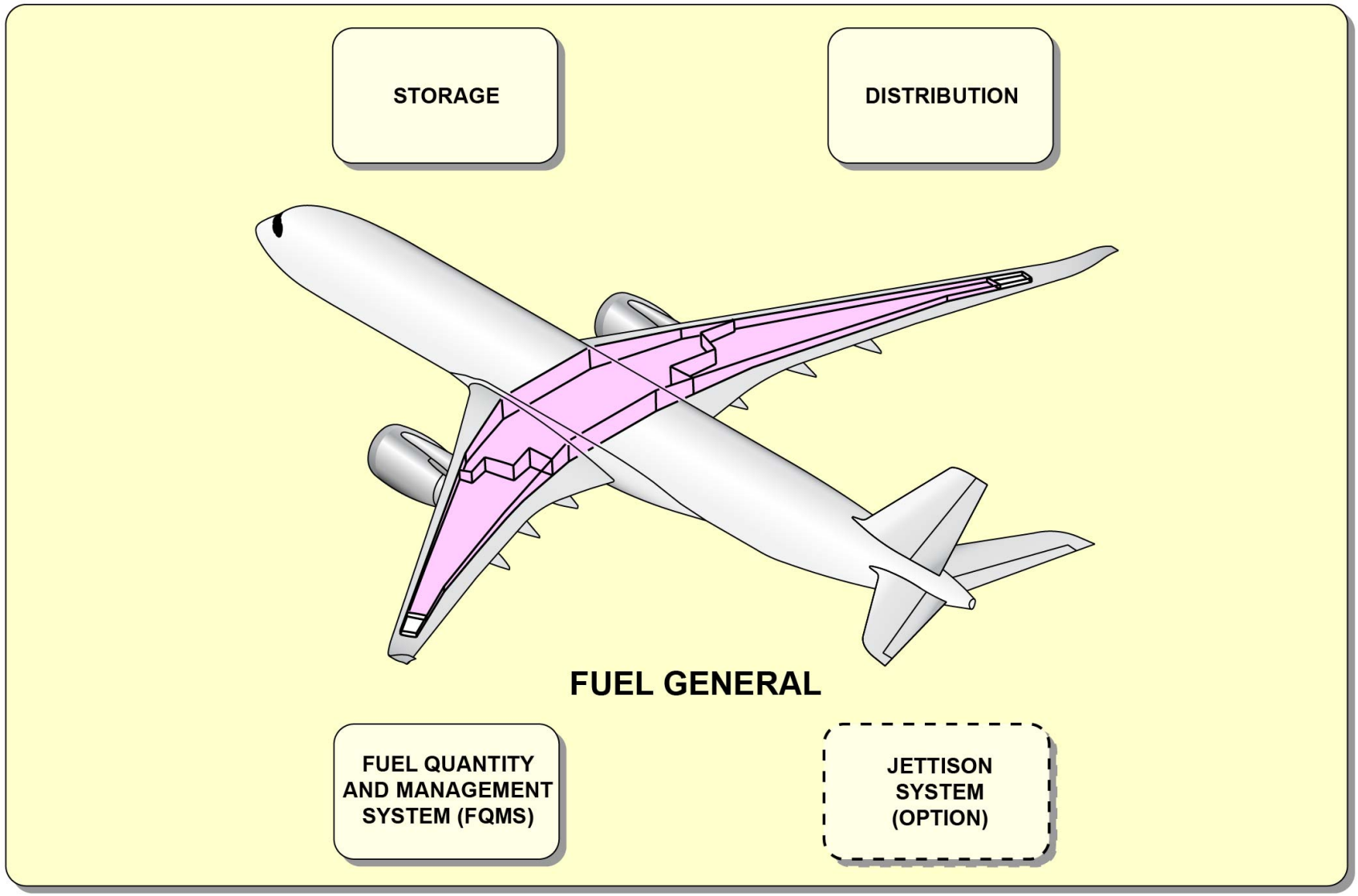
Fuel pumps are installed in a self-contained explosive canister.

FUEL SYSTEM DESIGN CONFIGURATION

FUEL SYSTEM PRESENTATION (1)

Overview

The primary function of the fuel system is to store and supply fuel to the engines and the APU.
General familiarization training for this system focuses on:
- Storage
- Distribution
- Jettison System (option)
- Fuel Quantity and Management System (FQMS).


STORAGE
DISTRIBUTION
FUEL GENERAL
FUEL QUANTITY AND MANAGEMENT SYSTEM (FQMS)
JETTISON SYSTEM (OPTION)

OVERVIEW

FUEL SYSTEM PRESENTATION (1)

Storage - Presentation

Function/Description

The storage system includes:
- Tanks
- Tanks Venting System.

The primary function of the storage system is to store fuel and keep the tanks internal pressure near the ambient air pressure.
The tanks store the fuel to supply the engines and Auxiliary Power Unit (APU) and collect possible fuel spillage during refuel and aircraft movements.
There are three tanks for fuel storage, a left wing tank, a right wing tank and a center tank.
There are two vent/surge tanks, one in each wing, which can collect possible fuel spillage.
The tank venting system keeps the tanks ventilated and prevents overpressure/underpressure during refuel/defuel and in flight.
The fuel tanks are connected to the vent/surge tanks by vent pipes and each vent/surge tank is connected to the atmosphere through a NACA intake.

Location

The center tank is located in the inner parts of the left and right wings and in the center wing box. The left and right wing tanks are located in the wings between the vent/surge tank and the center tank. The vent/surge tanks are located outboard of the wing tanks.
One NACA intake is located below each vent/surge tank.

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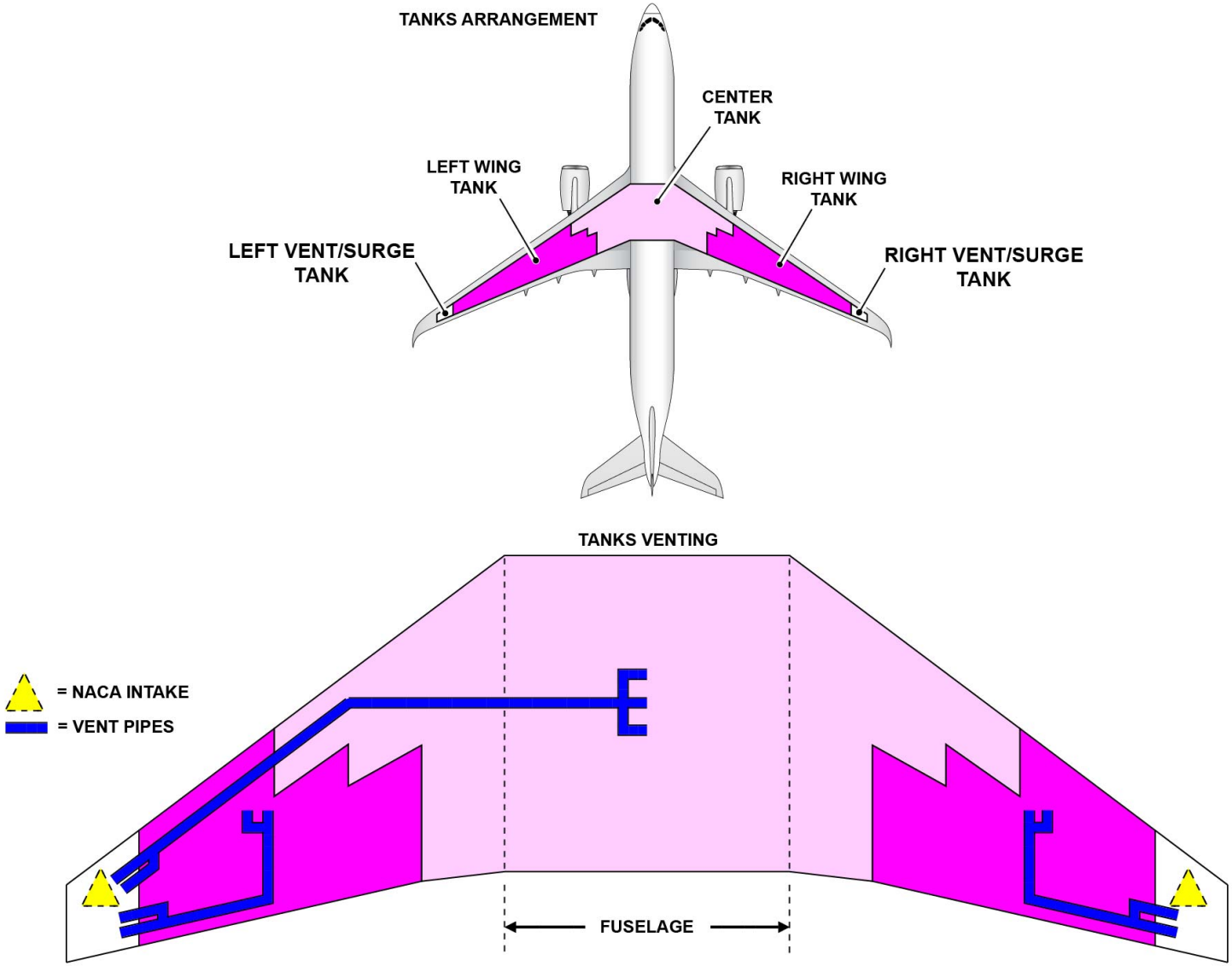


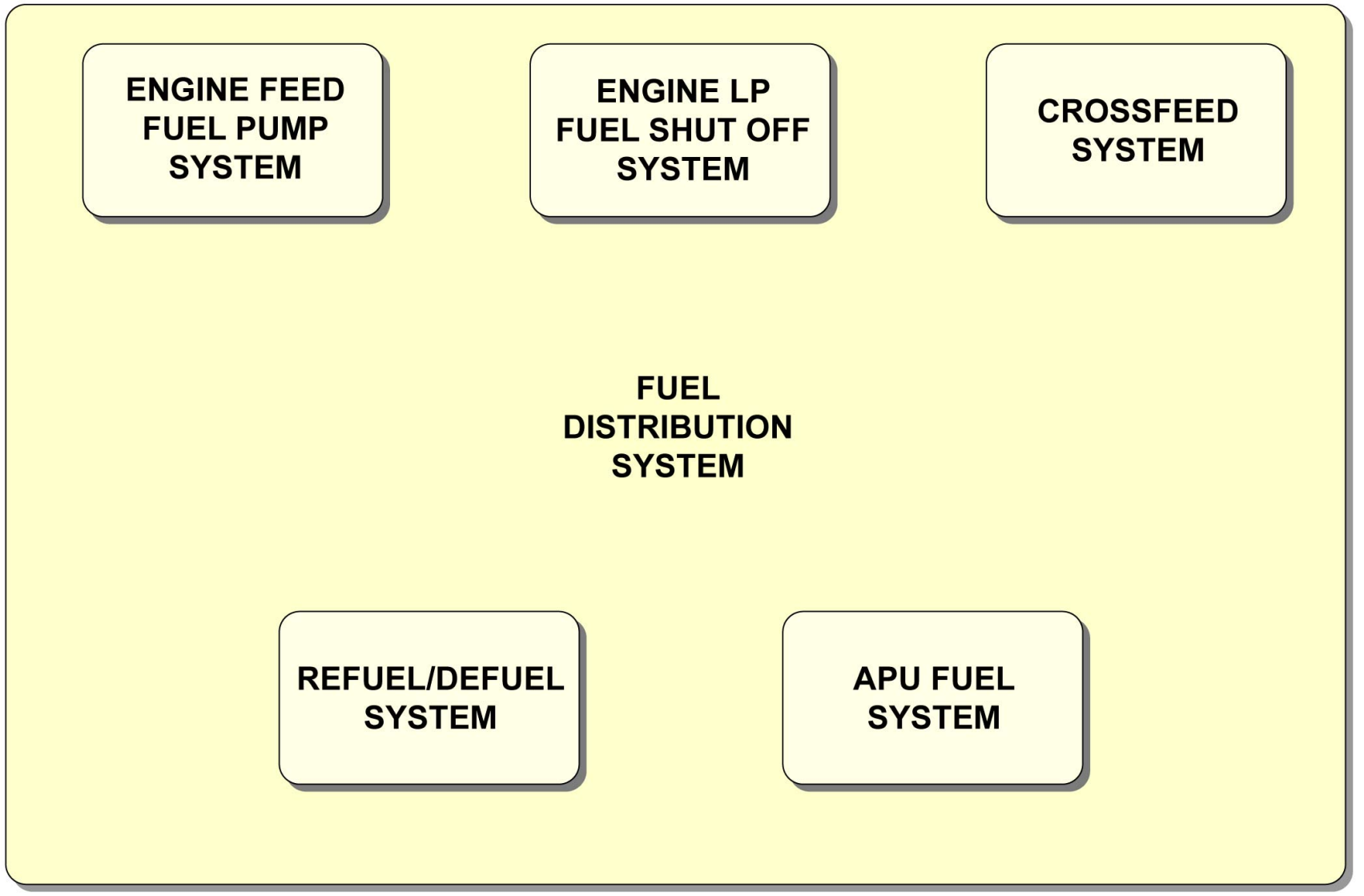
STORAGE - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

FUEL SYSTEM PRESENTATION (1)

Distribution - Presentation

Function/Description

The distribution system includes:
- Engine Feed Fuel Pump System
- Engine LP Fuel Shut Off System
- Crossfeed System
- APU Fuel System
- Refuel/Defuel System.



DISTRIBUTION - PRESENTATION - FUNCTION/DESCRIPTION

FUEL SYSTEM PRESENTATION (1)

Distribution - Engine Feed Fuel Pump System - Presentation

Function/Description

The engine feed fuel pump system supplies fuel to the engines from the centre tank or wing tanks. There are six fuel pumps:
- Two pumps, one main pump and one standby pump, to take fuel from the left wing tank.
- Two pumps, one main pump and one standby pump, to take fuel from the right wing tank.
- Two pumps, a left and a right override pump, to take fuel from the center tank.

During normal operation (when all the engine fuel pumps are ON), the center tank override pumps and pressure holding valves make sure that the engines are supplied with fuel from the center tank first (except during take off flight phase, when center tank pumps are automatically turned OFF.)
When the center tank is empty (or the center tank pumps are selected OFF):
- Engine 1 receives fuel from the left wing tank main pump or standby pump (if main pump is low pressure).
- Engine 2 receives fuel from the right wing tank main pump or standby pump (if main pump is low pressure).

Location

The six engine feed pumps are located in the center tank.

Distribution - Engine LP Fuel Shut Off System - Presentation

Function/Description

The engine Low Pressure (LP) fuel shut off system isolates the engines from the engine feed gallery. There is one LP valve for each engine. These valves are controlled open if the engine master switch is ON and the engine fire pushbutton is not selected.

Location

There is one LP valve in each wing.

Distribution - Crossfeed System - Presentation

Function/Description

The function of the crossfeed system is to:
- Let engine 1 or engine 2 have fuel supplied from left wing tank, right wing tank or center tank
- Correct fuel imbalance between wing tanks
- Isolate the left and the right side of the engine feed gallery.

The two crossfeed valves are connected in parallel on the engine feed gallery. They are both closed during normal operation and are controlled by their applicable P/BSWs.

Location

The crossfeed valves are located in the center tank.

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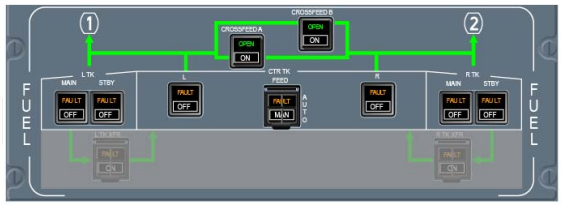
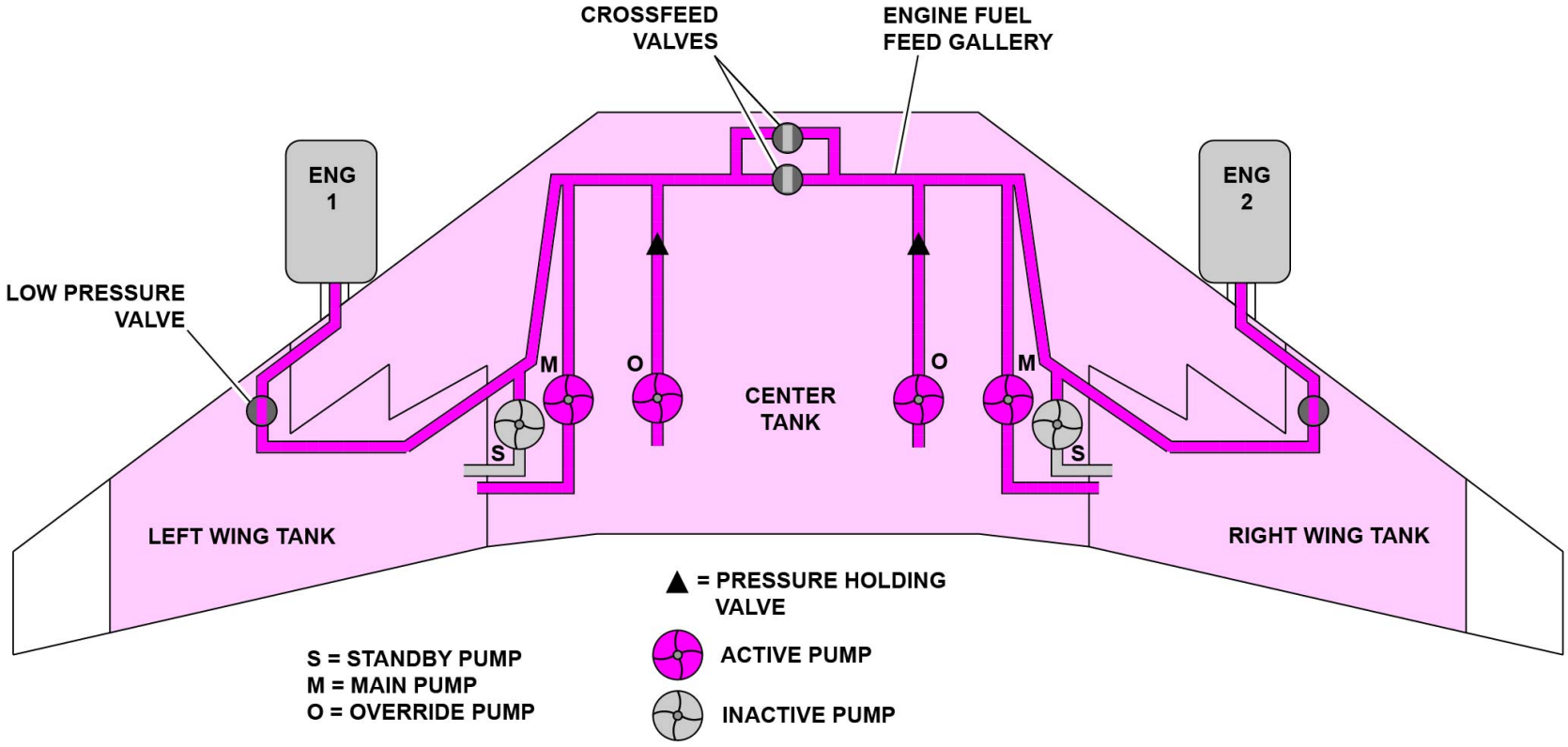
ENGINE MASTER SWITCH

ENGINE FIRE PUSH BUTTONS



PUMPS AND CROSSFEED PUSH BUTTONS



DISTRIBUTION - ENGINE FEED FUEL PUMP SYSTEM - PRESENTATION ... DISTRIBUTION - CROSSFEED SYSTEM - PRESENTATION

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FUEL SYSTEM PRESENTATION (1)

Distribution - APU Fuel System - Presentation

Function/Description

The function of the APU fuel system is to supply fuel to the APU.
If there is not sufficient fuel pressure upstream of the APU fuel pump, the APU fuel pump operates. The APU receives fuel from the left wing tank during normal operation, if the engine feed pumps are OFF.
If there is sufficient fuel pressure upstream of the APU fuel pump, the APU pump does not operate. Fuel is supplied to the APU by the engine 1 feed pumps.
Fuel is supplied to the APU through an APU line, which has two valves, an APU isolation valve and an APU low pressure valve.
The APU pump operates with APU isolation valve and APU low pressure valve open if the APU MASTER SWITCH is set to ON and there is no selection of the APU emergency shutdown.

Location

The APU fuel pump and APU isolation valve are located in the center tank. The APU low pressure valve is located in front of the APU compartment.

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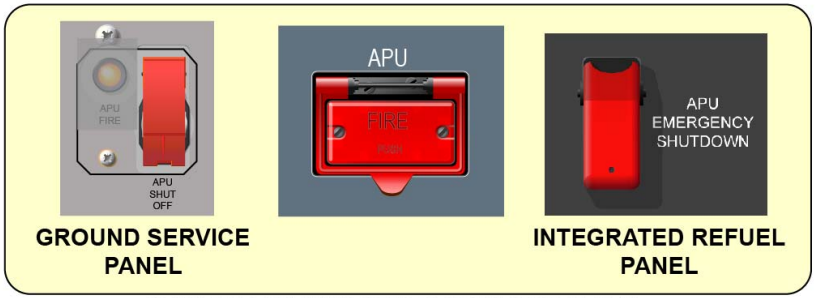
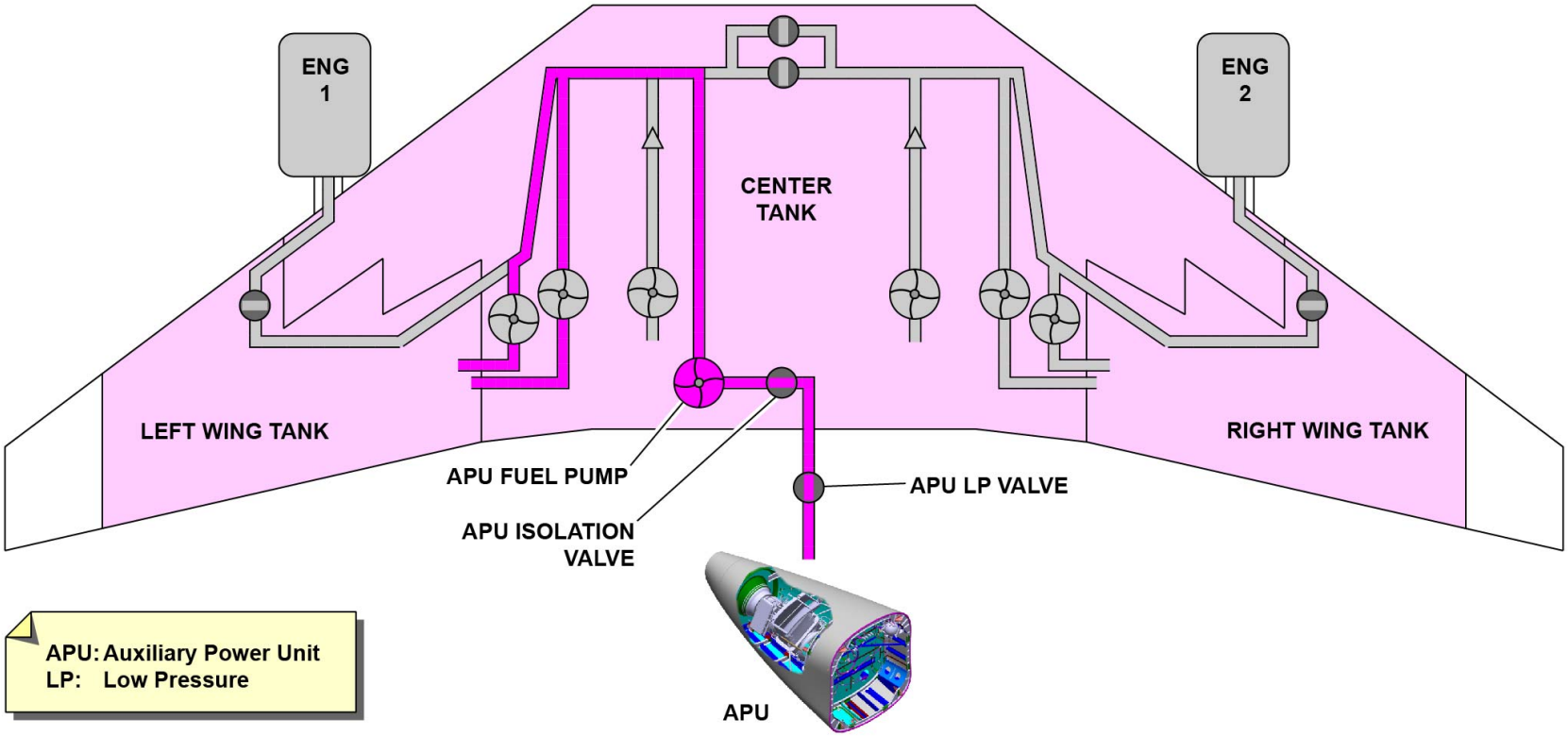


APU EMERGENCY SHUTDOWN CONTROLS



DISTRIBUTION - APU FUEL SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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FUEL SYSTEM PRESENTATION (1)

Distribution - Refuel/Defuel System - Presentation

Function/Description

The function of the refuel/defuel system is to control an automatic or manual refuel, a manual defuel or a manual ground transfer.
A refuel/defuel/ground fuel transfer is controlled by the Fuel Quantity Management System (FQMS).
An external Integrated Refuel Panel (IRP) is used to manage an automatic refuel and a manual refuel/defuel/ground transfer.
A REFUEL P/BSW in the cockpit can be used to start an automatic refuel (option).
There is a refuel coupling on the right wing and left wing (option).
The refuel couplings are connected to a refuel gallery through an isolation valve and the refuel gallery is connected to each tank through inlet valves.
There is one defuel valve or two defuel/jettison valves (depending on jettison option), which are used to do a pressure defuel or ground transfer from the wing and center tank. The defuel/jettison valves connect the tank pumps outlet fuel pressure to the refuel gallery.

Location

The right refuel coupling and the left refuel coupling (option) are located on the leading edge of the right and left wings.

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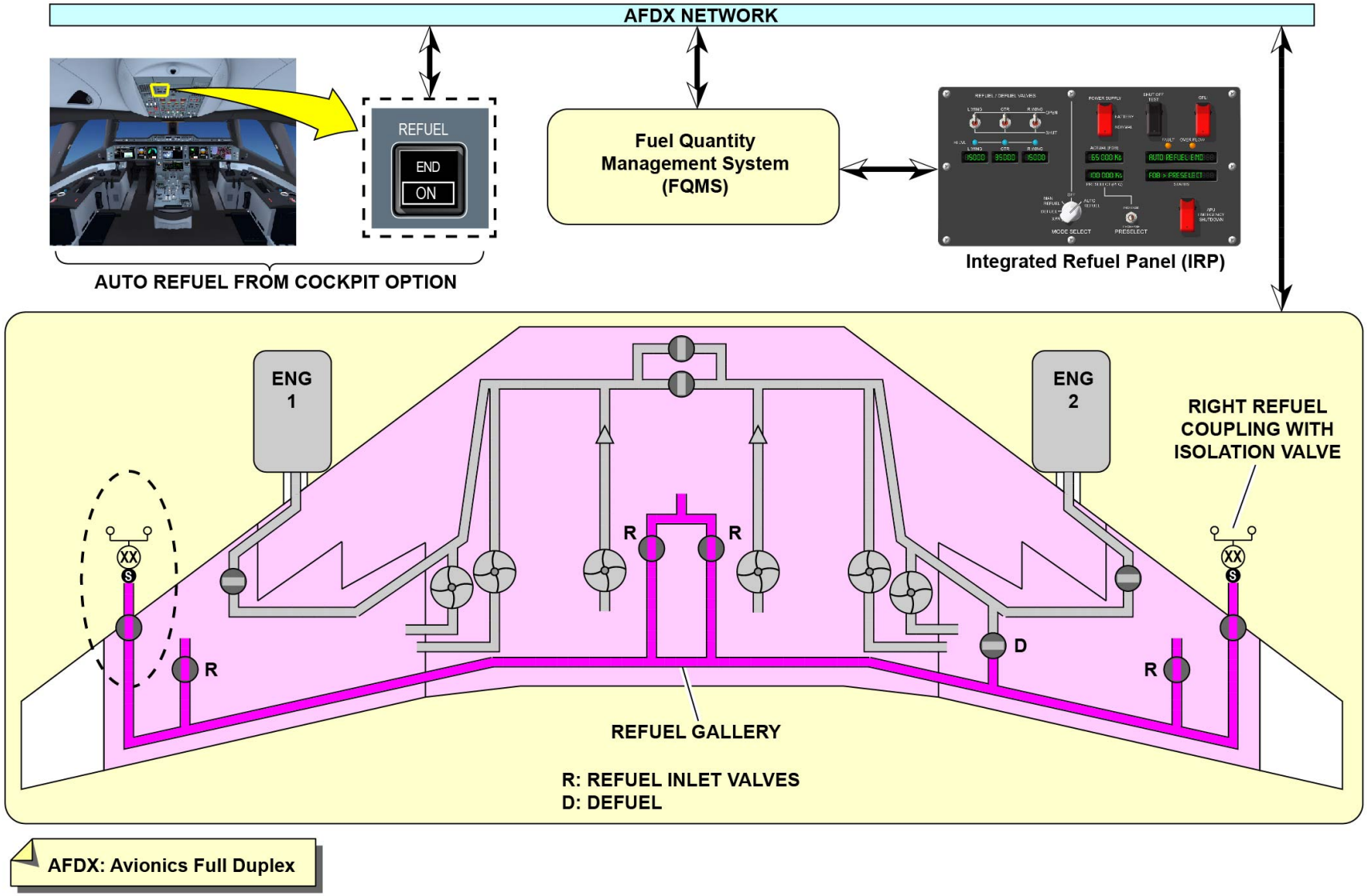

DISTRIBUTION - REFUEL/DEFUEL SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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FUEL SYSTEM PRESENTATION (1)

Jettison System - Presentation

Function/Description

The jettison system (option) is used to dump fuel overboard to decrease the fuel load and avoid an overweight landing.
A jettison is started manually and controlled by the FQMS. Fuel can be dumped from all tanks.
Each wing tank jettison is done by the related wing tank pumps and a defuel/jettison valve. Fuel is sent to the refuel gallery from the pump outlets.
Center tank jettison is done by center tank pumps and center tank jettison valves. Fuel is sent to the refuel gallery from the pump outlets.
There is a left and right jettison valve in the refuel gallery. They are used to let the fuel go overboard through a related discharge pipe.

Location

The two jettison valves are installed in the center tank, and a defuel/jettison valve and a jettison valve are installed in each wing tank.

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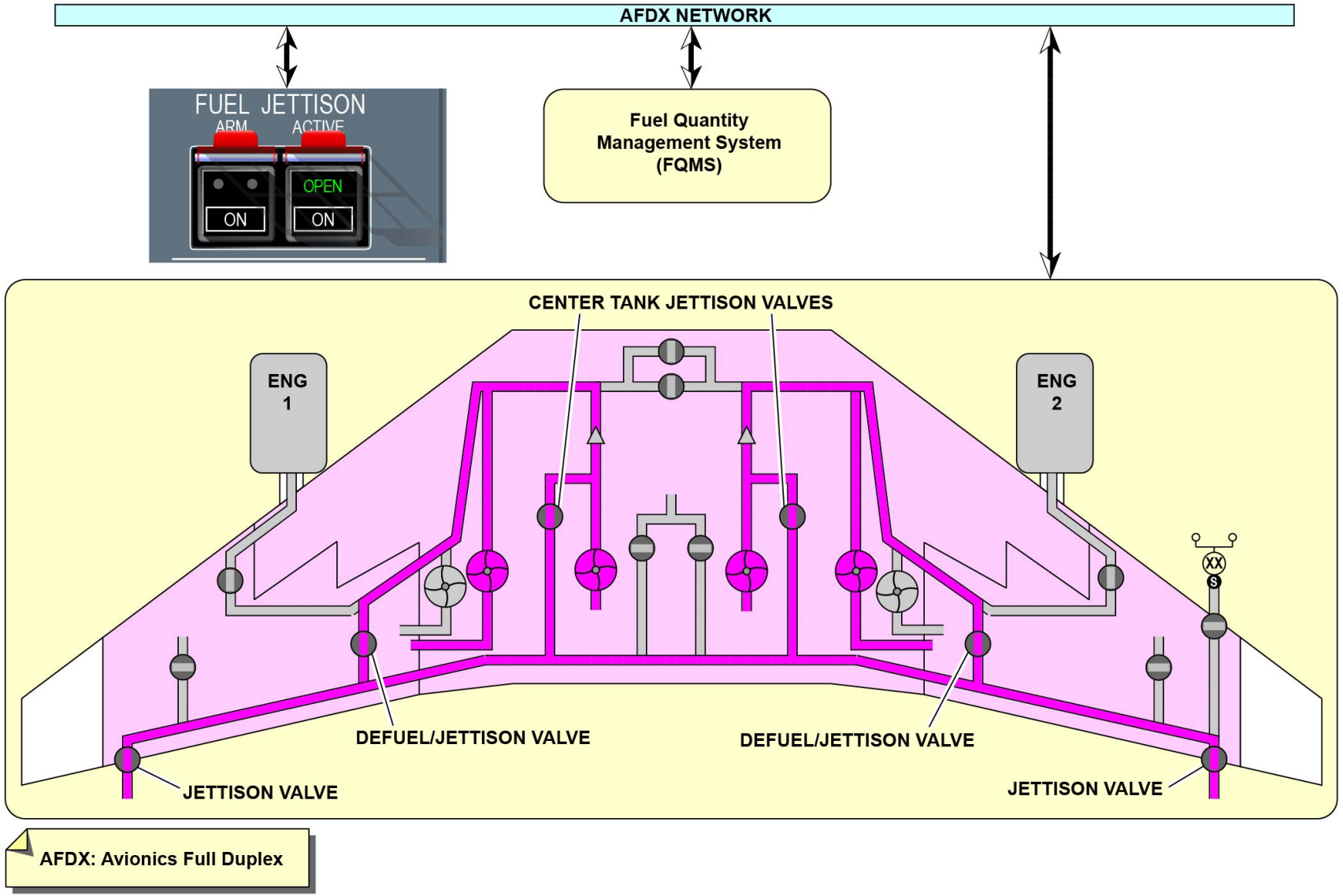

JETTISON SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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FUEL SYSTEM PRESENTATION (1)

Fuel Quantity and Management System (FQMS) - Presentation

Function/Description

The primary function of the FQMS includes:
- Measurement (fuel quantity, temperature, specific levels)
- Fuel systems management.

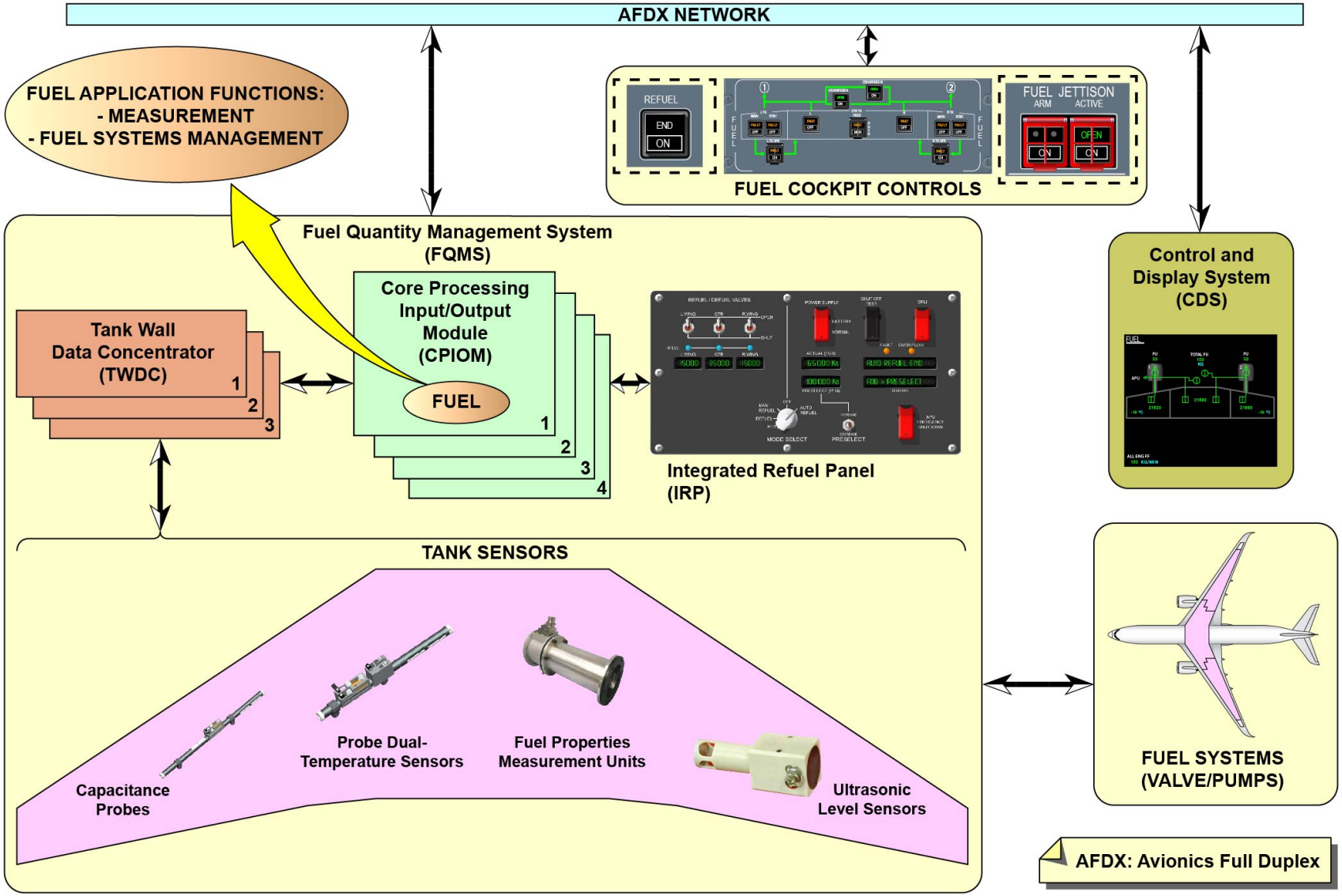
The FQMS includes:
- Tank sensors (capacitance probes, probe dual-temperature sensors, Fuel Properties Measurement Unit (FPMU), ultrasonic level sensors, temperature sensors)
- Three Tank Wall Data Concentrators (TWDC)
- The primary fuel application software hosted in Core Processing Input/Output Module CPIOMs
- The Integrated Refuel Panel (IRP).

The tank sensors are connected to the TWDCs. The TWDCs change the sensors analogue signals to digital signals. The TWDCs interface with the fuel application in the CPIOMs.

The fuel application in the CPIOMs:
- Interfaces with the IRP and the cockpit fuel controls
- Controls and monitors the pumps and valves of the fuel system.

Interface

The FQMS interfaces with the Control and Display System (CDS) (Electronic Centralized Aircraft Monitoring (ECAM) Fuel page).



FUEL QUANTITY AND MANAGEMENT SYSTEM (FQMS) - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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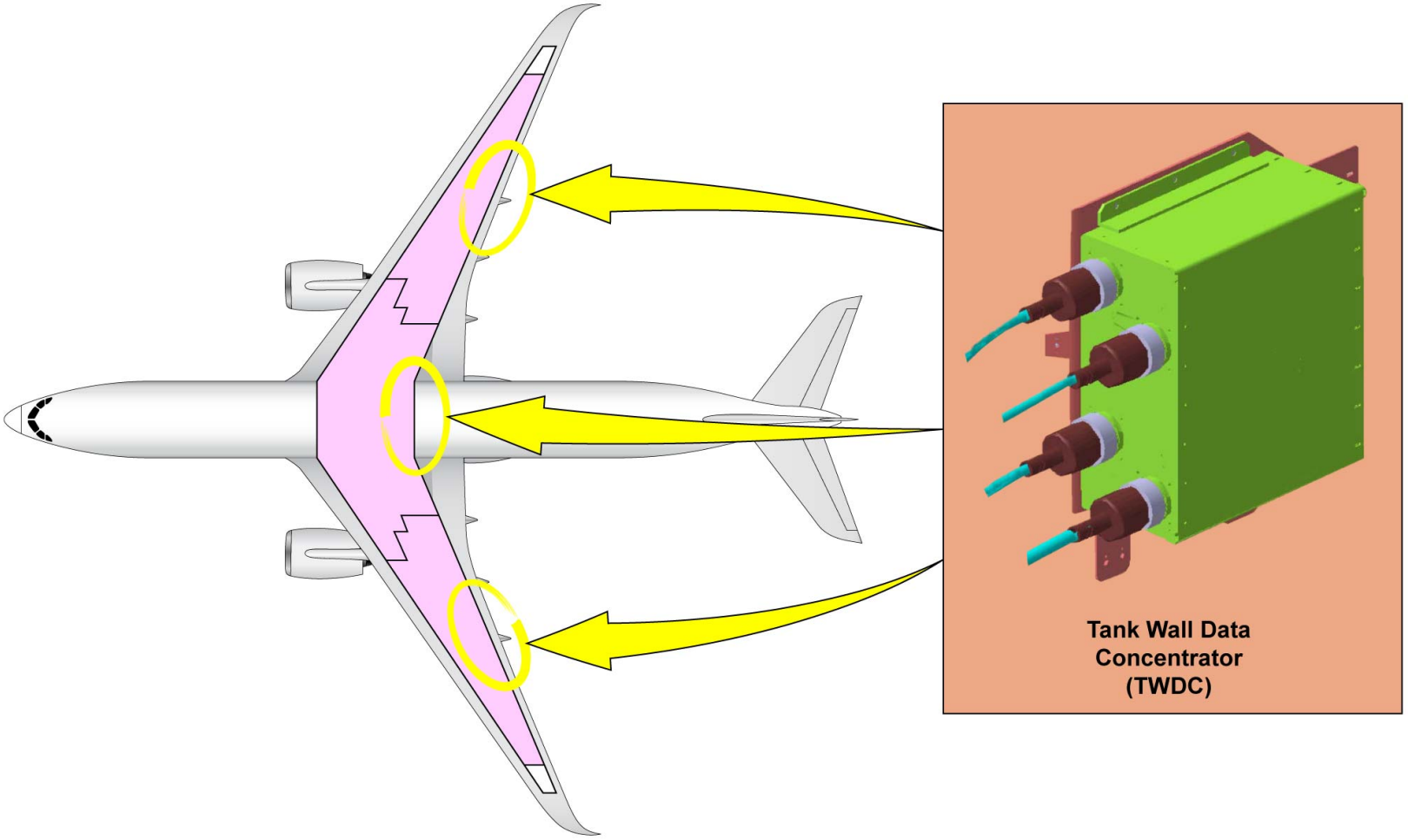
FUEL SYSTEM PRESENTATION (1)

Fuel Quantity and Management System (FQMS) - Presentation (continued)

Location

The TWDCs are located on the rear spar of the wing tanks and the center tank.



FUEL QUANTITY AND MANAGEMENT SYSTEM (FQMS) - PRESENTATION - LOCATION

FUEL SYSTEM PRESENTATION (1)

Control and Indicating - Presentation

Cockpit

The cockpit controls for the fuel system include:
- Engine and APU fire P/BSWs on the cockpit overhead panel
- Automatic REFUEL P/BSW on the cockpit overhead panel (option)
- Pumps and crossfeed valves control P/BSWs on the fuel overhead panel
- APU master Switch on the cockpit overhead panel
- Engine Master Switches on the cockpit pedestal
- JETTISON ARM and ACTIVE P/BSWs on the cockpit overhead panel (option).

The cockpit indications for the fuel system are shown on the ECAM System Display (SD) Fuel page.

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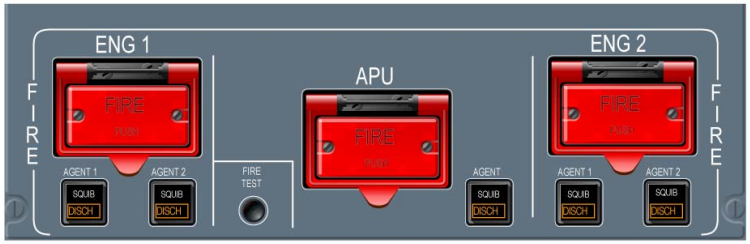
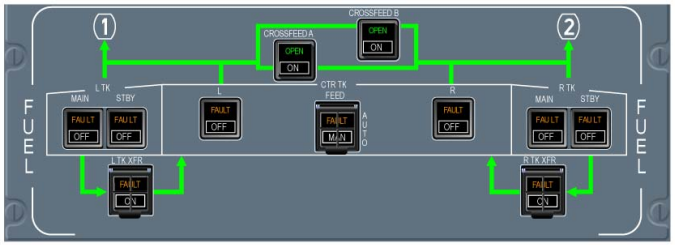
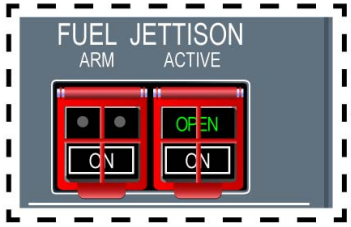
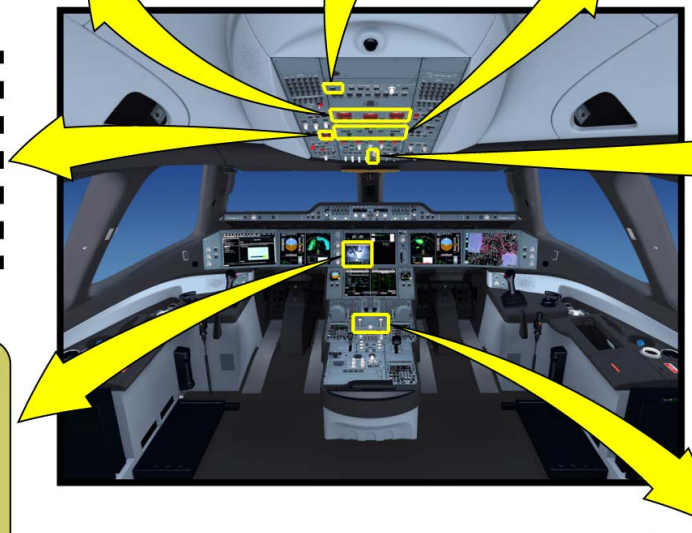


ENGINES AND APU FIRE PUSHBUTTONS

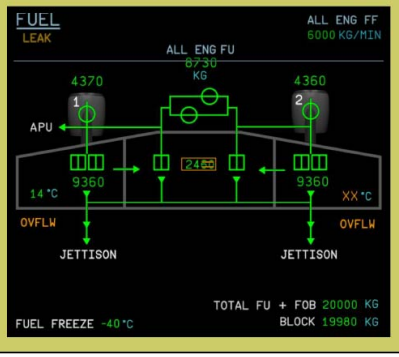


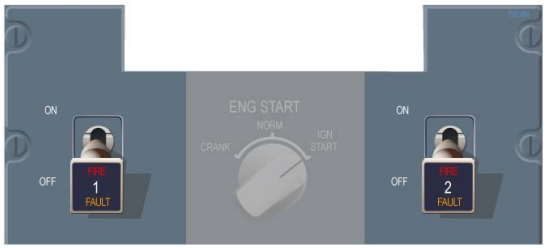
PUMPS AND CROSSFEED PUSH BUTTONS





Electronic Centralized Aircraft Monitoring (ECAM)
System Display (SD) Fuel Page





ENGINE MASTER SWITCHES

CONTROL AND INDICATING - PRESENTATION - COCKPIT

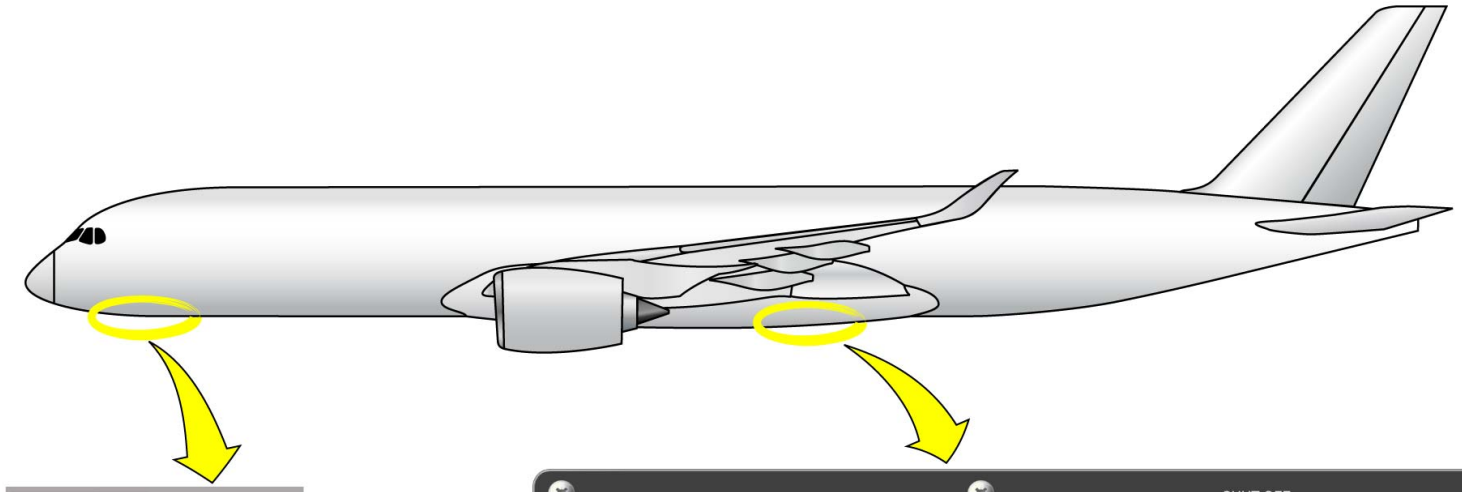
FUEL SYSTEM PRESENTATION (1)

Control and Indicating - Presentation (continued)

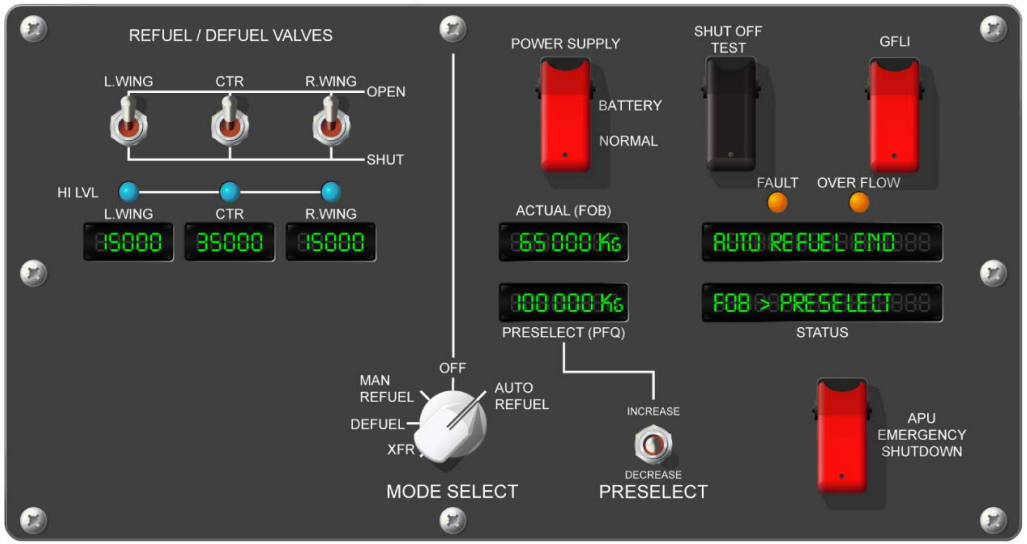
External

The aircraft external controls for the fuel system include:
- APU emergency shutdown switch on the nose landing gear ground service panel
- Refuel/Defuel and transfer controls on the IRP
- APU emergency shutdown switch on the IRP.

The external indications for the fuel system are shown on the IRP.



NOSE LANDING GEAR
GROUND SERVICE PANEL



Integrated Refuel Panel (IRP)

CONTROL AND INDICATING - PRESENTATION - EXTERNAL

FIRE PROTECTION SYSTEM PRESENTATION (1)

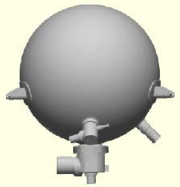
Overview

The function of the Fire Protection System (FPS) is to detect smoke and/or fire and to extinguish fire on the aircraft.
General familiarization training for this system focuses on:
- Detection
- Extinguishing .

DETECTION

FIRE PROTECTION

EXTINGUISHING



OVERVIEW

FIRE PROTECTION SYSTEM PRESENTATION (1)

Detection - Presentation

Function/Description

The function of the detection system is to monitor the different pressurized and unpressurized compartments and areas of the aircraft for smoke and/or fire. If smoke and/or fire is detected, the detection system sends warnings to the cockpit and/or cabin.

Smoke detectors

The smoke detectors are installed in the pressurized areas that follow:

- Avionics compartment
- Lavatories
- Cabin sub-compartments (Flight Crew Rest Compartment (FCRC) and Cabin Crew Rest Compartment (CCRC))
- Additional electronics compartments (including In-Flight Entertainment Center (IFEC), if installed)
- Lower Deck Cargo Compartments (LDCCs) (aft + bulk cargo and forward cargo).

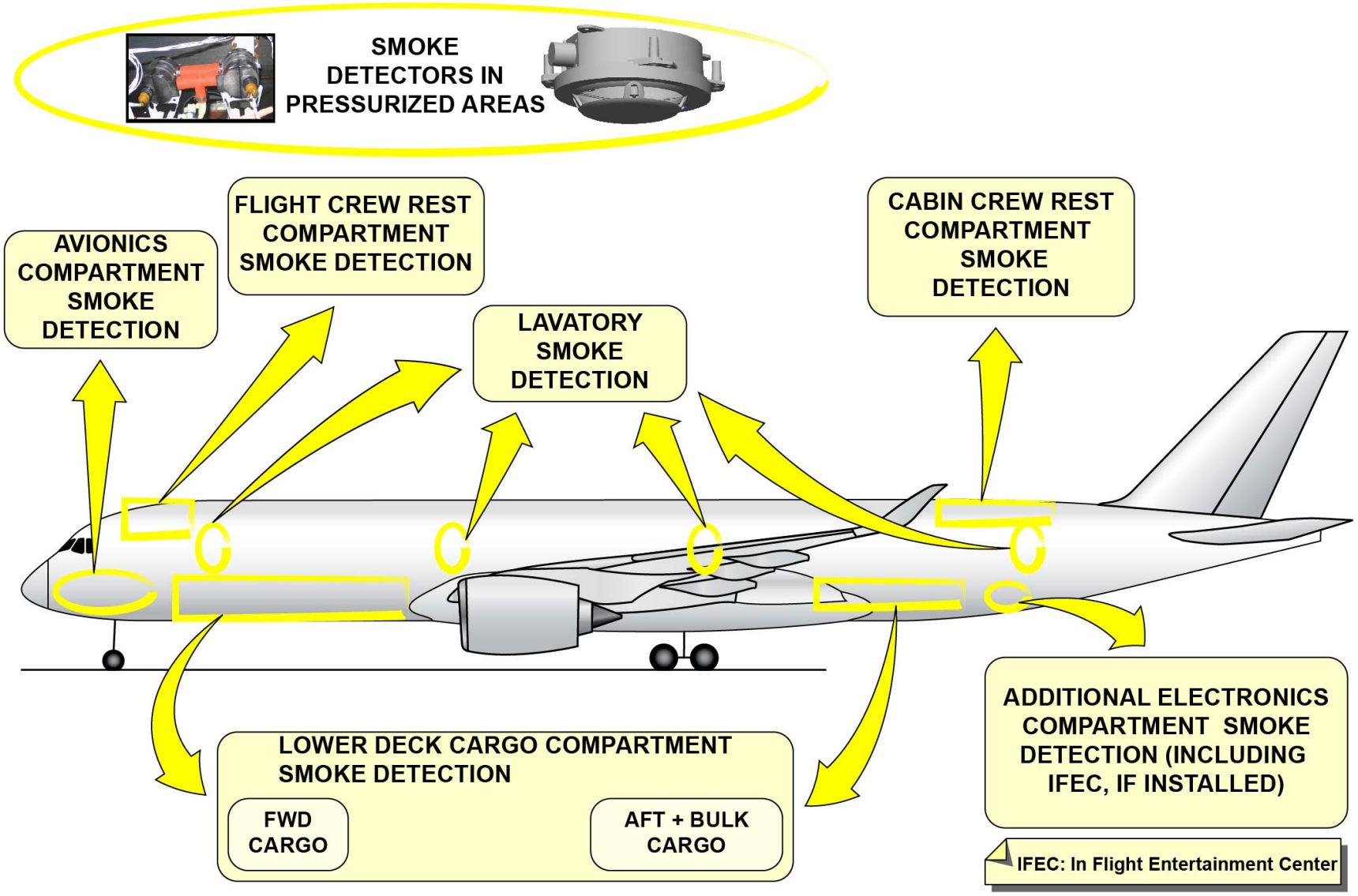
If there is smoke, the smoke detectors send signals to the Smoke Detection Function (SDF) which is a partition of the Cabin Intercommunication Data System (CIDS). Then, the SDF monitors and sends warnings to the cockpit and/or cabin.

Fire detectors

The fire detectors are installed in the unpressurized areas that follow:

- Auxiliary Power Unit (APU)
- Main Landing Gear Bay (MLGB)
- Engines.

If there is a fire, the fire detectors send signals through conversion modules to the Fire Protection Function (FPF) which is an application hosted in the Core Processing Input/Output Module (CPIOM). Then, the FPF sends warnings to the cockpit and/or cabin.



DETECTION - PRESENTATION - FUNCTION/DESCRIPTION

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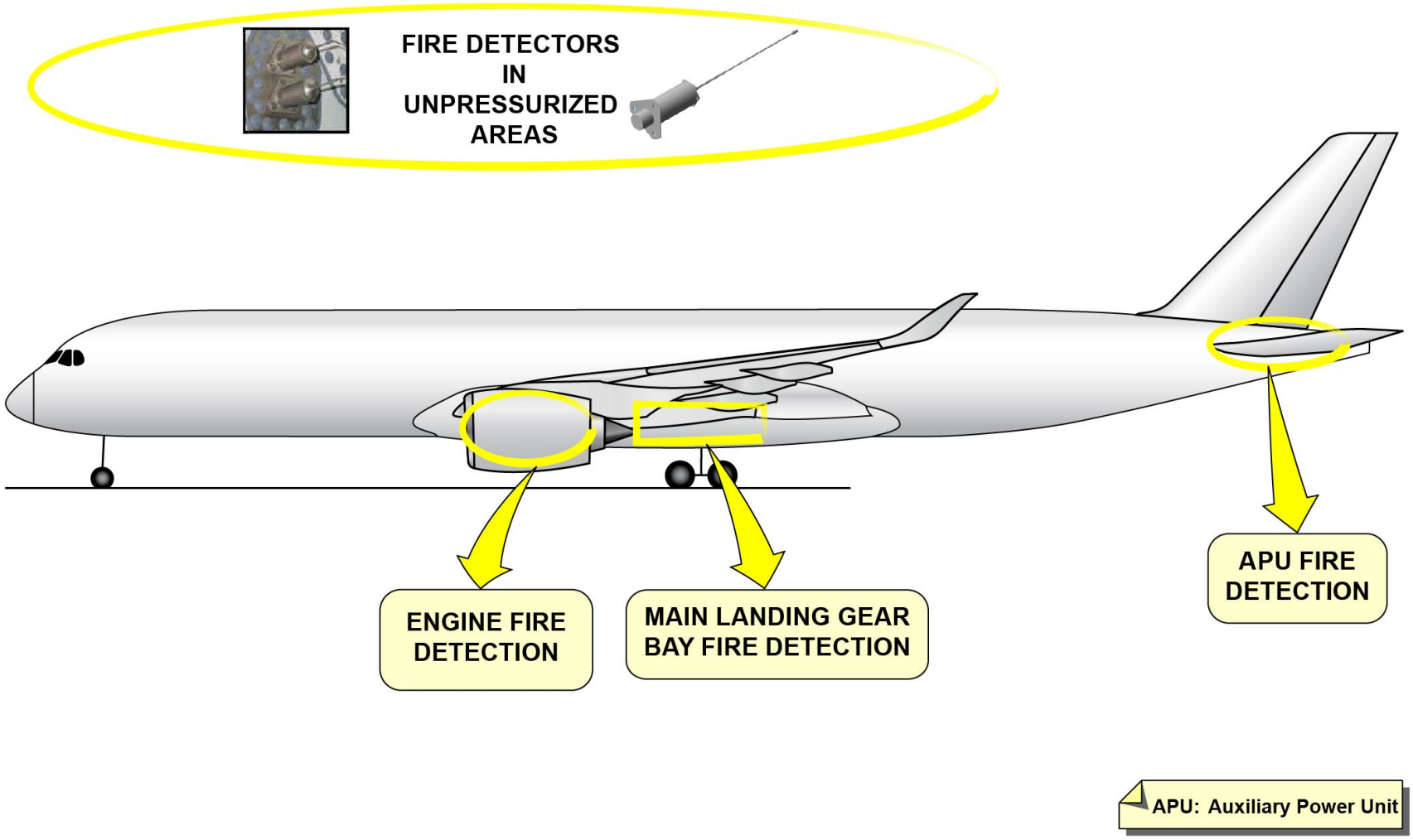

DETECTION - PRESENTATION - FUNCTION/DESCRIPTION

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FIRE PROTECTION SYSTEM PRESENTATION (1)

Detection - Presentation (continued)

Interface

Through the Avionics Full Duplex Switched Ethernet (AFDX) network:
The SDF has interfaces with:
- Control and Display System (CDS)
- Flight Warning System (FWS)
- Flight Attendant Panel (FAP).

The FPF has interfaces with:
- CDS
- FWS
- Landing Gear Extension and Retraction System (LGERS) application hosted in the CPIOM (to get a ground signal to generate APU FIRE warnings that are applicable on the ground).

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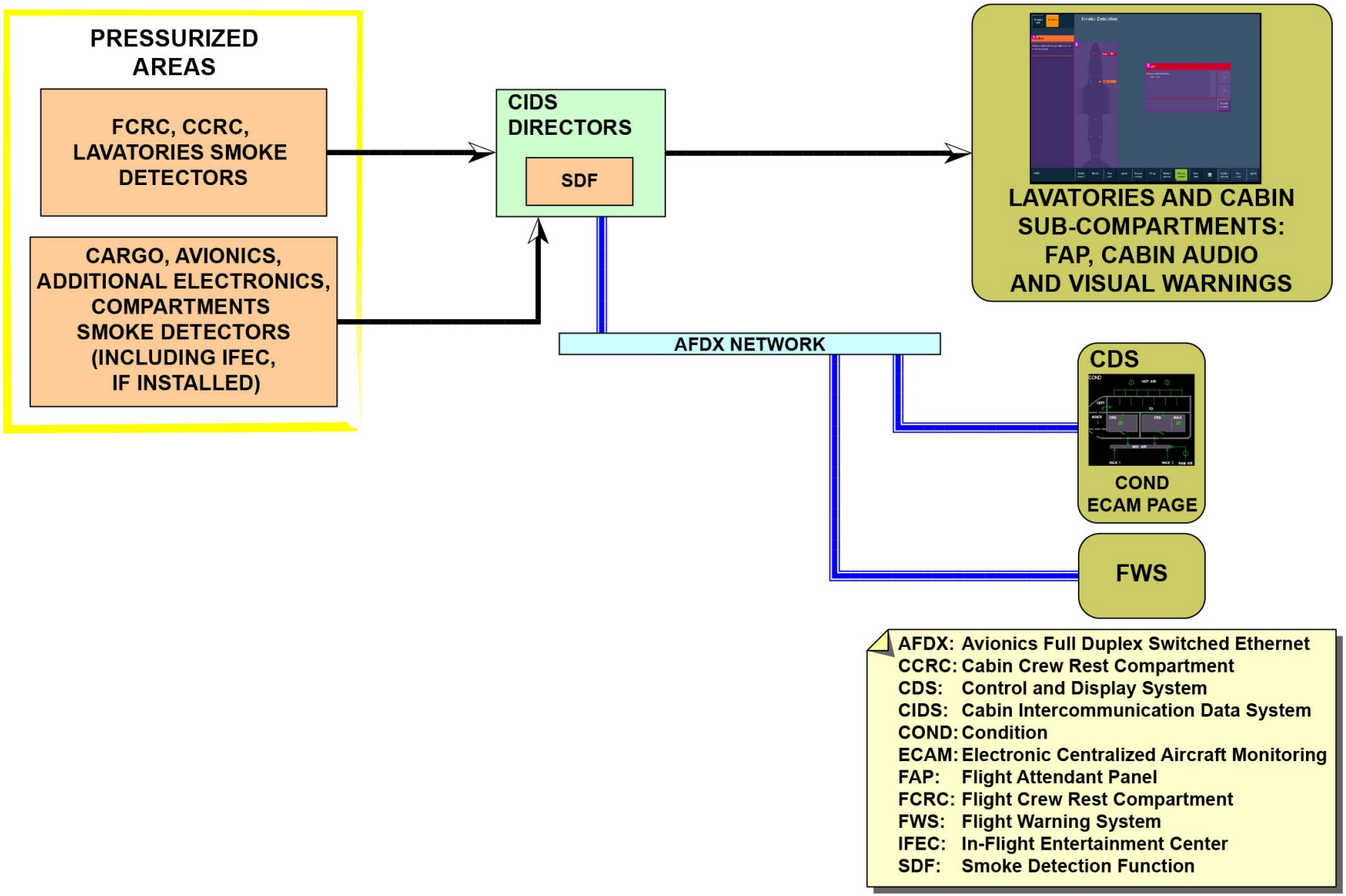
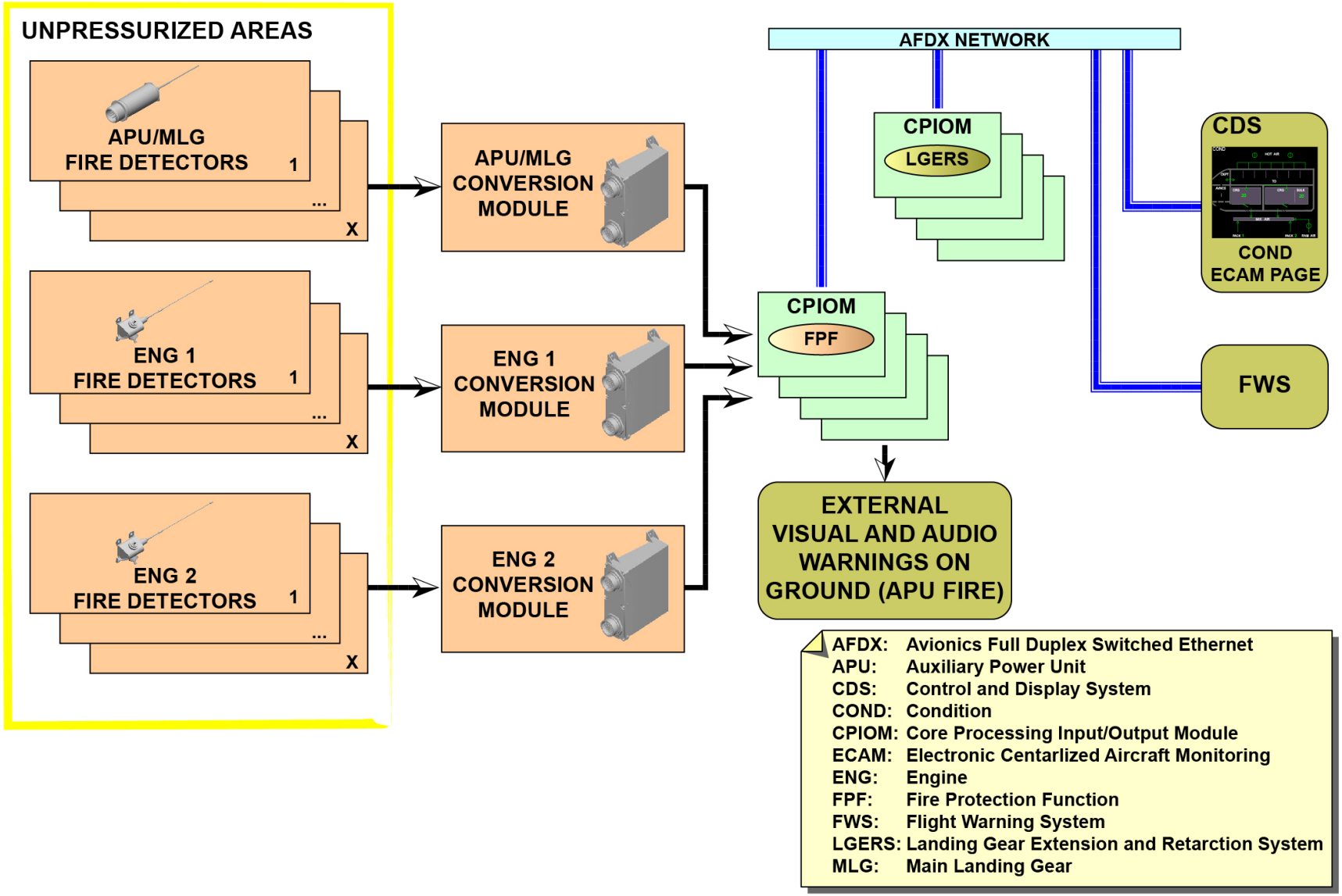


DETECTION - PRESENTATION - INTERFACE



DETECTION - PRESENTATION - INTERFACE

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FIRE PROTECTION SYSTEM PRESENTATION (1)

Extinguishing - Presentation

Function/Description

The extinguishing system includes these subsystems:
For the pressurized areas:
- Portable fire extinguishers (for cockpit, cabin and crew rest compartments)
- Lavatory fire extinguishing
- LDCC fire extinguishing.

For the unpressurized areas:
- Engine fire extinguishing
- APU fire extinguishing.

The function of the fire extinguishing system is to extinguish fire in the pressurized and unpressurized areas.

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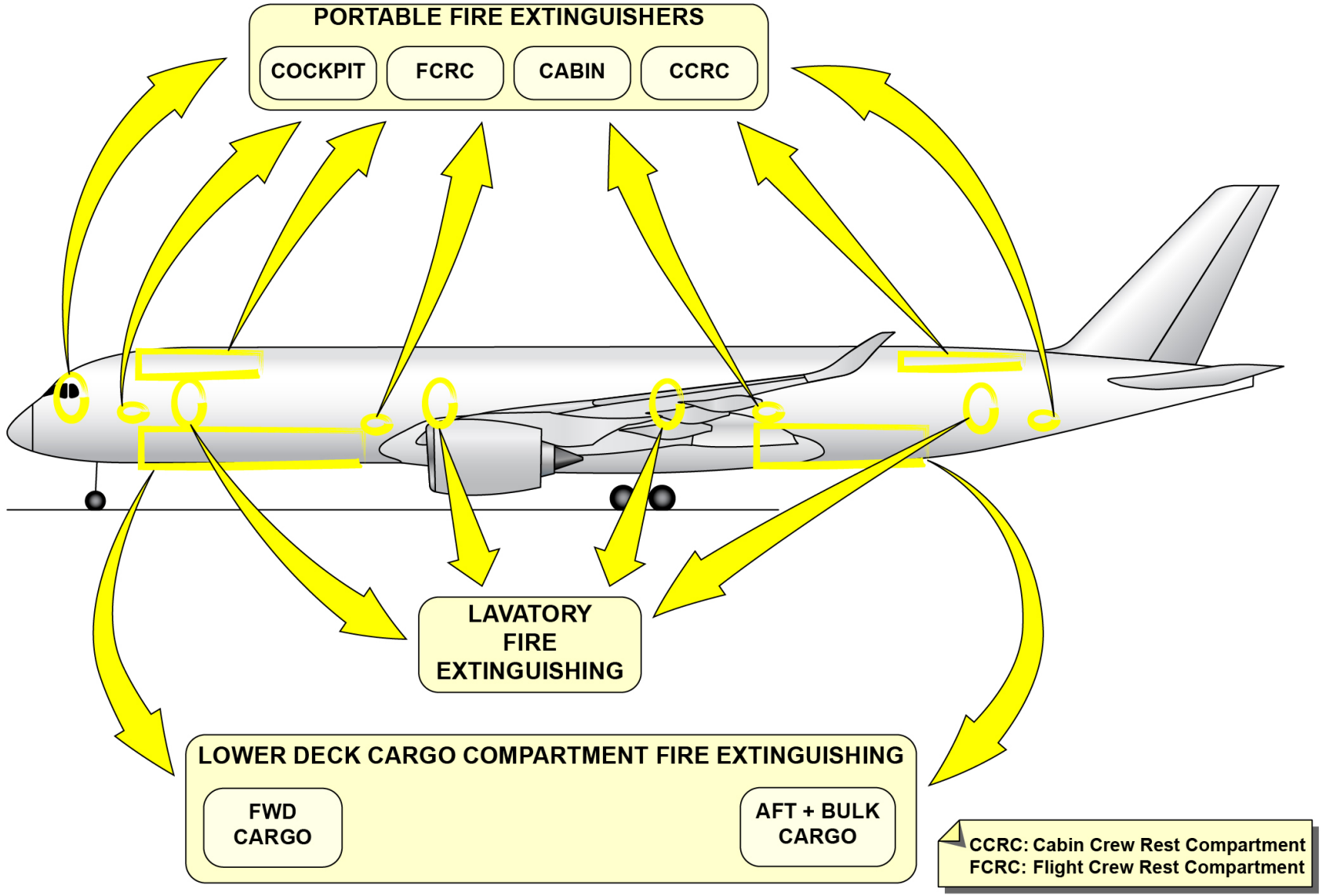

EXTINGUISHING - PRESENTATION - FUNCTION/DESCRIPTION

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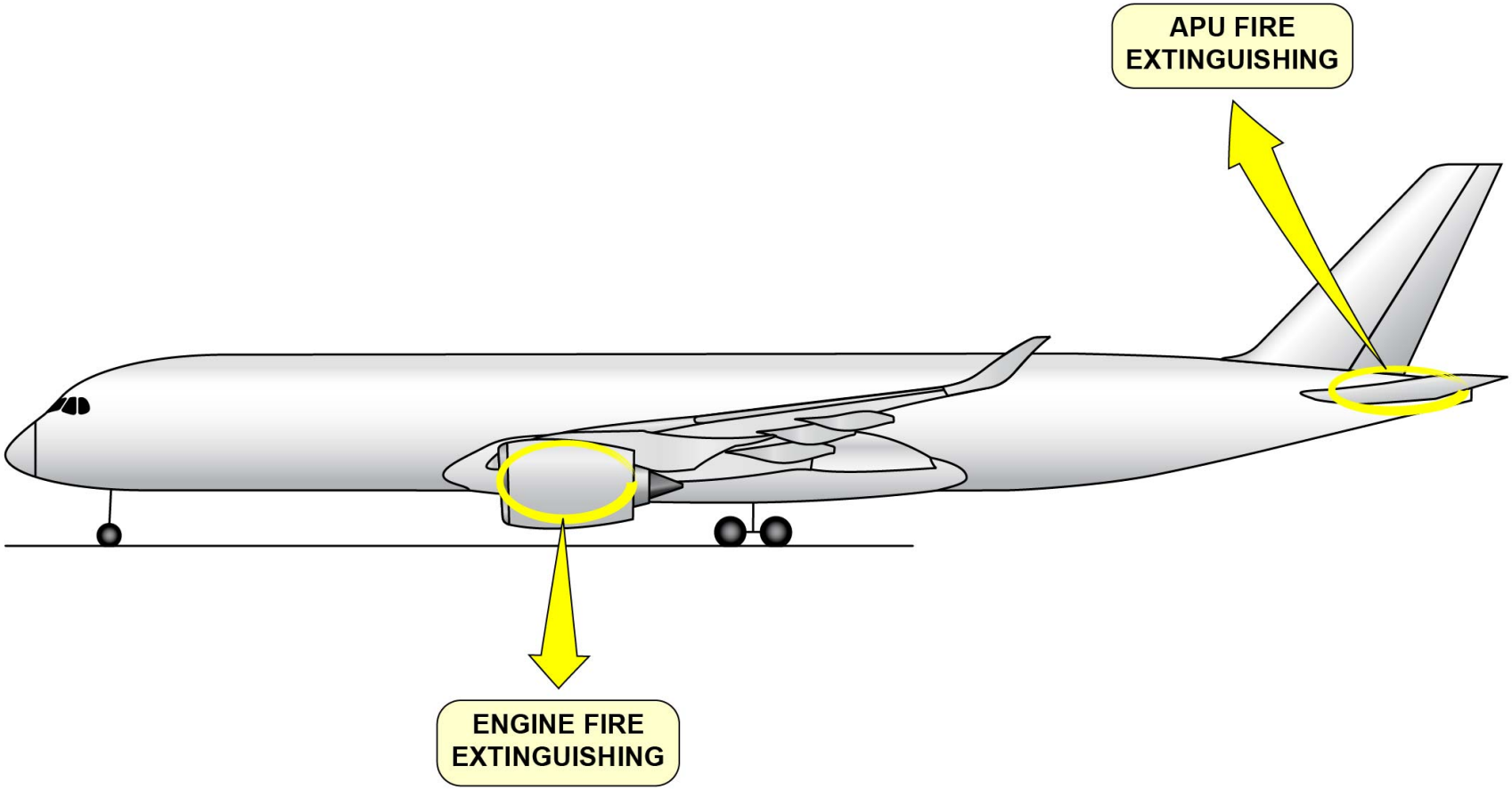

EXTINGUISHING - PRESENTATION - FUNCTION/DESCRIPTION

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FIRE PROTECTION SYSTEM PRESENTATION (1)

Engine Fire Extinguishing - Presentation

Function/Description

After detection of a fire by the engine fire-detection system:
- The operation of the ENG 1 FIRE or ENG 2 FIRE pushbutton switch isolates the engine to decrease the fire.
- Then, the operation of the FIRE/ENG 1(2)/AGENT 1 pushbutton switch (and FIRE/ENG 1(2)/AGENT 2 pushbutton switch, if necessary) causes the fire extinguishing bottle to release an extinguishing agent through the discharge head to the nacelle fire zones.

Location

There are two fire extinguishing bottles in each engine pylon. They are installed in the aft part of the pylon.

APU Fire Extinguishing - Presentation

Function/Description

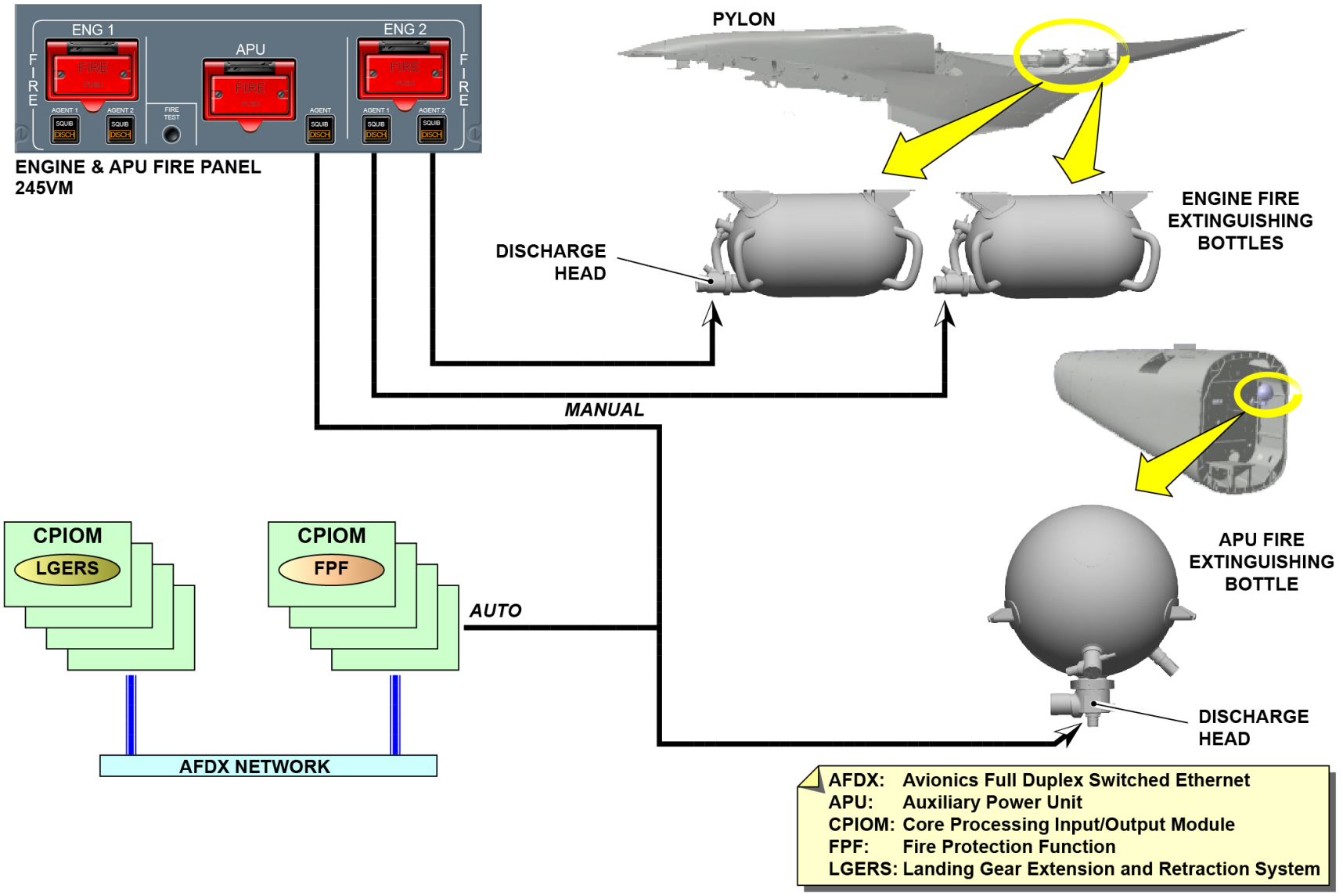
The APU fire extinguishing system operates when a fire is detected in the APU compartment. The fire extinguishing bottle supplies an extinguishing agent in the APU compartment. The APU fire-extinguishing system is controlled:
- Manually, through the operation of the APU FIRE, then of the FIRE/APU/AGENT pushbutton switches
- Automatically on ground, through the FPF hosted in the CPIOM.

Location

There is one fire extinguishing bottle installed behind the APU compartment.

Interface

The FPF application hosted in the CPIOM controls the APU fire-extinguishing system through the AFDX network:
It has interfaces with:
- CDS
- FWS
- LGERS application hosted in the CPIOM (to get a ground signal to generate APU fire warnings that are applicable on the ground).



ENGINE FIRE EXTINGUISHING - PRESENTATION & APU FIRE EXTINGUISHING - PRESENTATION

V1813401 - V01T0M0 - VM26P1LEVEL0101

FIRE PROTECTION SYSTEM PRESENTATION (1)

Lower Deck Cargo Compartment Fire Extinguishing - Presentation

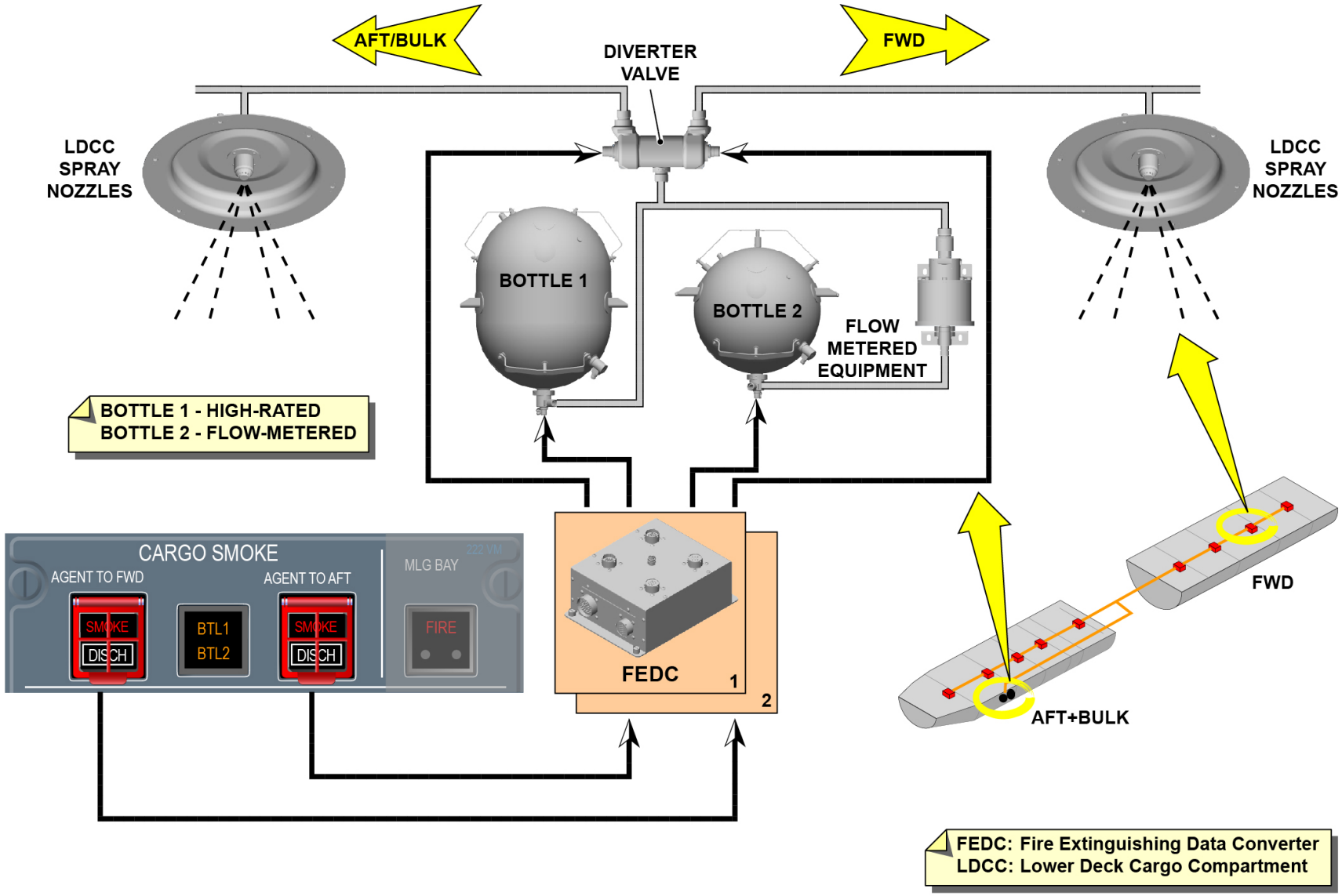
Function/Description

The fire extinguishing system of the LDCC operates if smoke is detected in the cargo compartments. It has two fire extinguishing bottles.
The main parts of the LDCC fire-extinguishing system are:
- High-rated fire-extinguisher bottle
- Flow-metered fire-extinguisher bottle
- Diverter valve
- Flow metering equipment
- Piping, hoses and spray nozzles.

If a smoke warning is shown in the cockpit, the flight crew pushes the CARGO SMOKE/AGENT TO FWD or AGENT TO AFT pushbutton switch. A signal is sent through the Fire Extinguishing Data Converters (FEDCs). The extinguishing agent in two fire extinguishing bottles is then sprayed into the forward or the aft and bulk cargo compartments through a diverter valve and spray nozzles.

Location

There are two fire extinguishing bottles in the aft cargo compartment. The spray nozzles are installed in the ceiling cavities of the forward and aft and bulk cargo compartments.



LOWER DECK CARGO COMPARTMENT FIRE EXTINGUISHING - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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FIRE PROTECTION SYSTEM PRESENTATION (1)

Portable Fire Extinguisher - Presentation

Function/Description

The fire extinguishing system has portable fire extinguishers which are manually operated. They are used to fight the fire directly at its source. A label bonded on the extinguisher container tells the user how to operate and do a check of the extinguisher.

Location

The portable fire extinguishers are installed in the cabin, in the cockpit and in the crew rest compartments.

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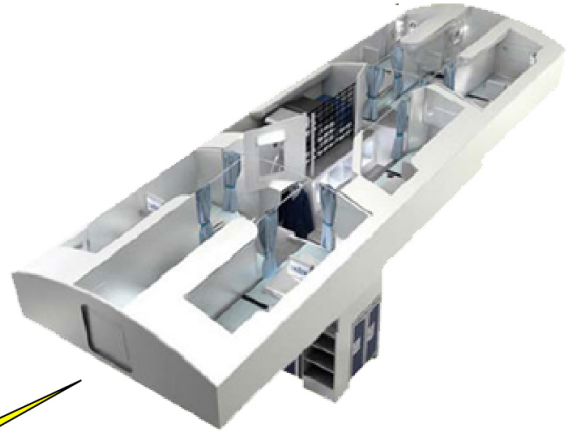
CABIN



CREW REST COMPARTMENTS

PORTABLE
EXTINGUISHER

COCKPIT

PORTABLE FIRE EXTINGUISHER - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

FIRE PROTECTION SYSTEM PRESENTATION (1)

Lavatory Fire Extinguishing - Presentation

Function/Description

The lavatory fire-extinguishing system has a fixed fire extinguisher which is fully automatic and self-contained, above the waste container in each lavatory. This extinguisher releases its agent directly into the waste container.

Location

There is a fire extinguisher in each lavatory.

LAVATORY FIRE EXTINGUISHER

LAVATORY FIRE EXTINGUISHING - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

FIRE PROTECTION SYSTEM PRESENTATION (1)

Control and Indicating - Presentation

The fire protection system has these controls and indicators:
In the cockpit:
- The ENGINE AND APU FIRE panel
- The ENG MASTER LEVERS panel
- The CARGO SMOKE panel
- The MLGB fire indicator
- The CAPT AND F/O ATTENTION GETTERS panels
- The System Display (SD) page
- The loudspeakers for audio warnings
- The IFEC SMOKE pushbutton switch
- The AVNCS SMOKE pushbutton switch.

On the Nose Landing Gear (NLG) maintenance panel:
- An APU FIRE warning light which comes on if an APU fire is detected (aircraft on ground)
- An APU SHUT OFF pushbutton switch.

In the NLG bay:
- A mechanical horn.

In the cabin:
- The FAP
- The Area Call Panel (ACP)
- The Attendant Indication Panel (AIP)
- The cabin loudspeakers
- A pressure gage on each lavatory fire extinguisher.

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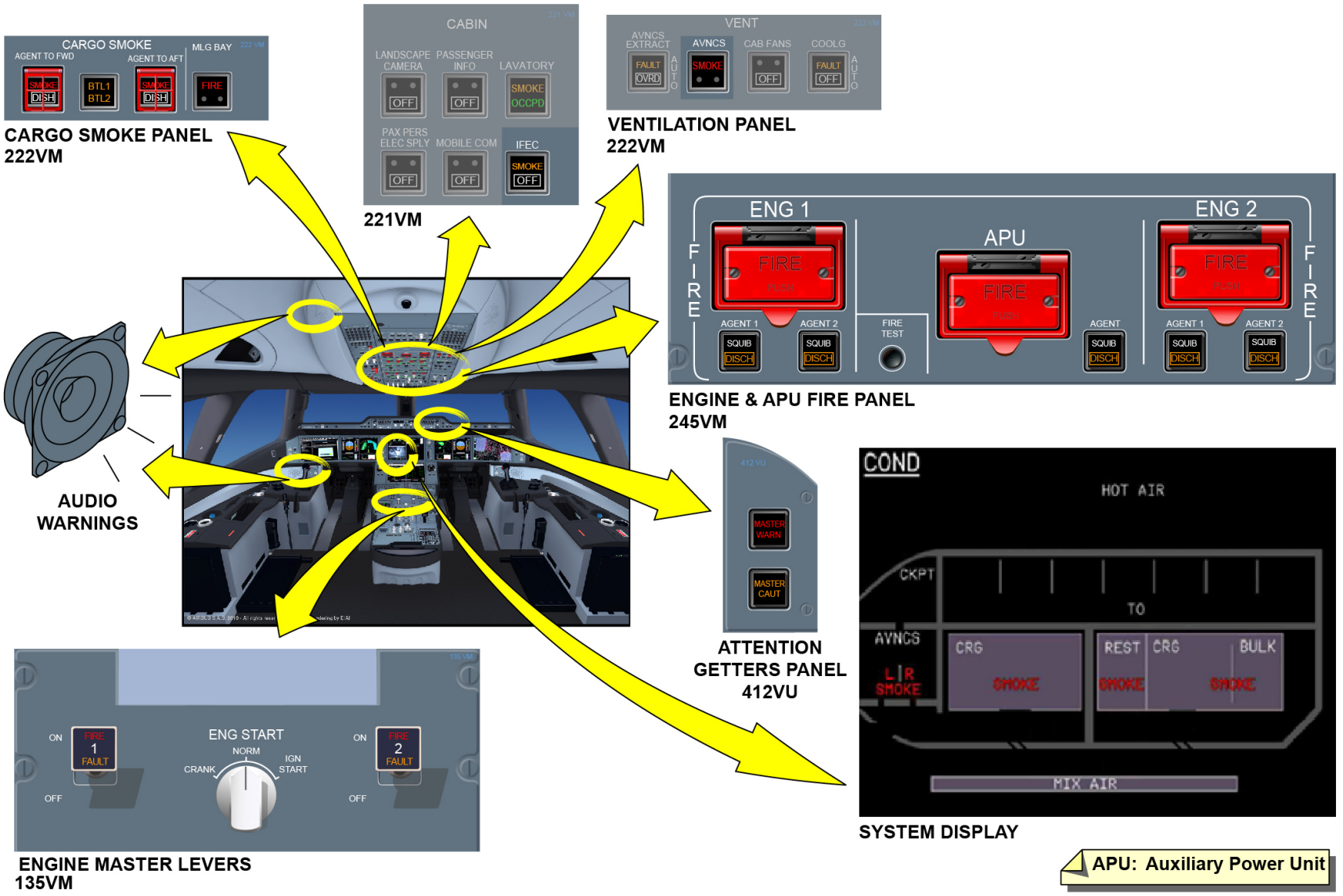
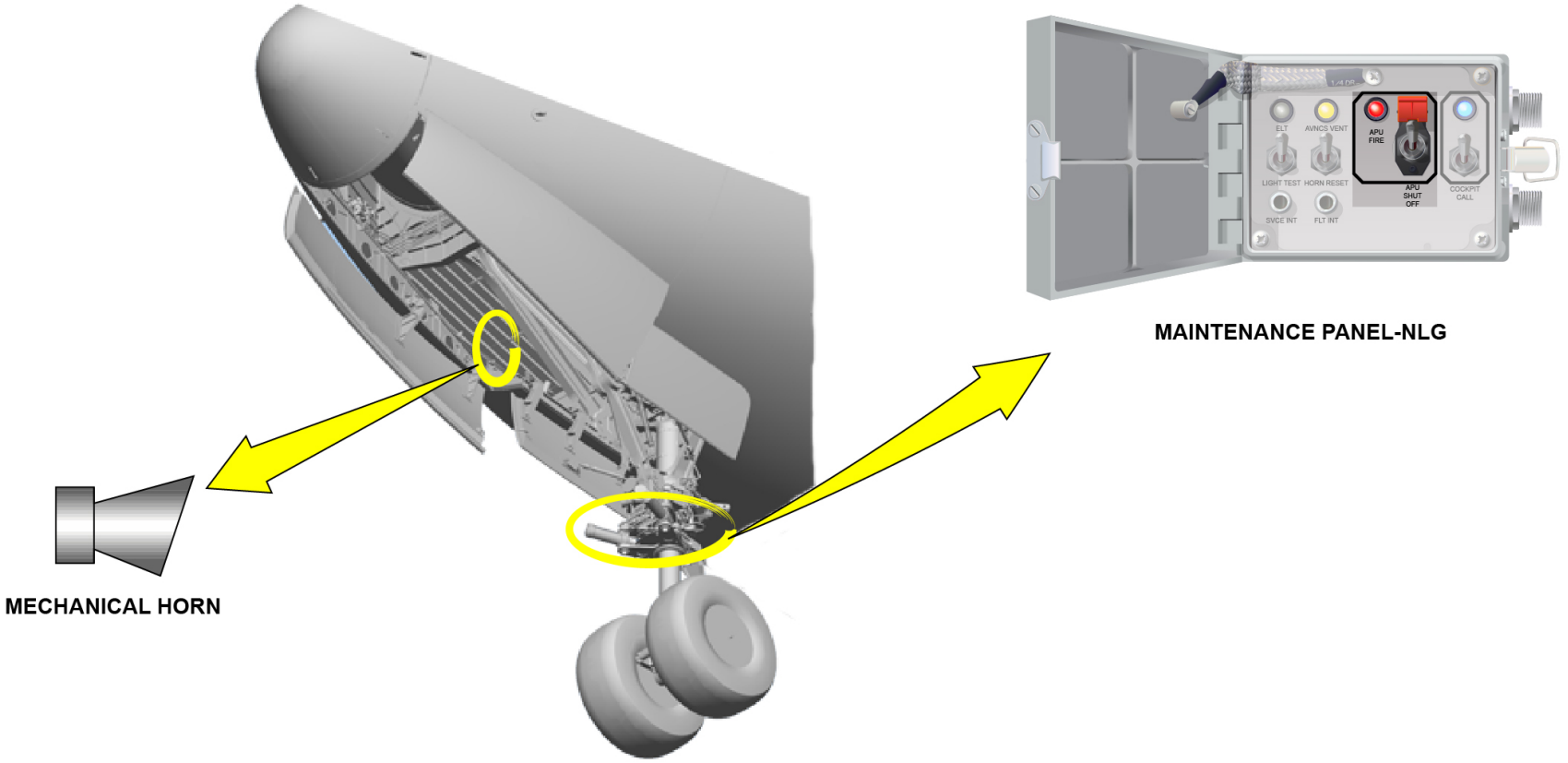
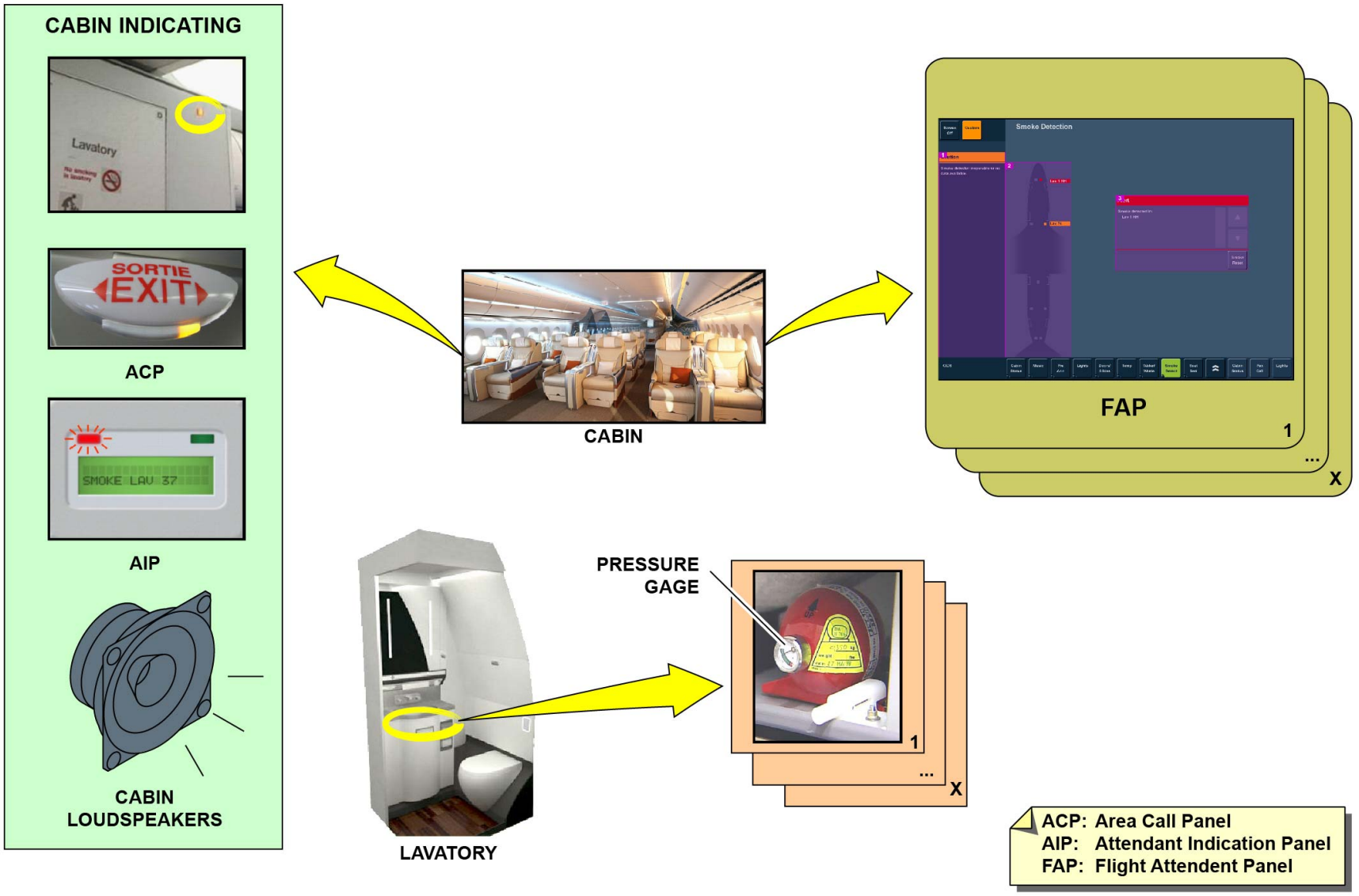


CONTROL AND INDICATING - PRESENTATION



NLG: Nose Landing Gear

CONTROL AND INDICATING - PRESENTATION



CONTROL AND INDICATING - PRESENTATION

AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Overview

The primary component of the airborne auxiliary power system is the Auxiliary Power Unit (APU). The APU supplies pneumatic and electrical power on ground and in flight.
General familiarization training of this system focuses on:
- The air intake system
- The exhaust system
- The engine system
- The oil system
- The air system
- The engine fuel and control system
- The ignition and starting/generation system
- The engine controls system
- The indicating system.

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AIRBORNE AUXILIARY POWER

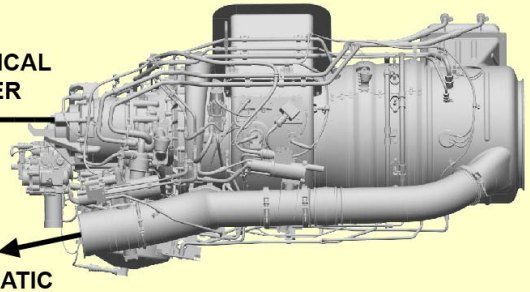
AIR INTAKE SYSTEM

EXHAUST SYSTEM

INDICATING

ENGINE

ELECTRICAL POWER



PNEUMATIC POWER

ENGINE CONTROLS

OIL

IGNITION AND STARTING/GENERATION

ENGINE FUEL AND CONTROL

AIR

OVERVIEW

AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Air Intake System - Presentation

Function/Description

The air intake system supplies ambient air to the APU engine. It also supplies the air for the APU compartment cooling and ventilation.
It has two supply ducts, one for the APU engine and one for the APU compartment cooling. The supply ducts have the same air intake flap.
The flap points forward when it opens and has two different open positions for operation on ground or during flight.

Location

There is one air intake flap. It is installed in the top right area of the tail cone.
There are two air intake ducts. They are installed above the APU engine.

Exhaust System - Presentation

Function/Description

The exhaust system releases the APU engine exhaust gas and decreases the noise.
The primary component of the exhaust system is the exhaust muffler assembly. The APU exhaust gas goes out of the compartment directly aft of the tail cone.

Location

There is one exhaust muffler assembly. It is installed at the rear of the APU.

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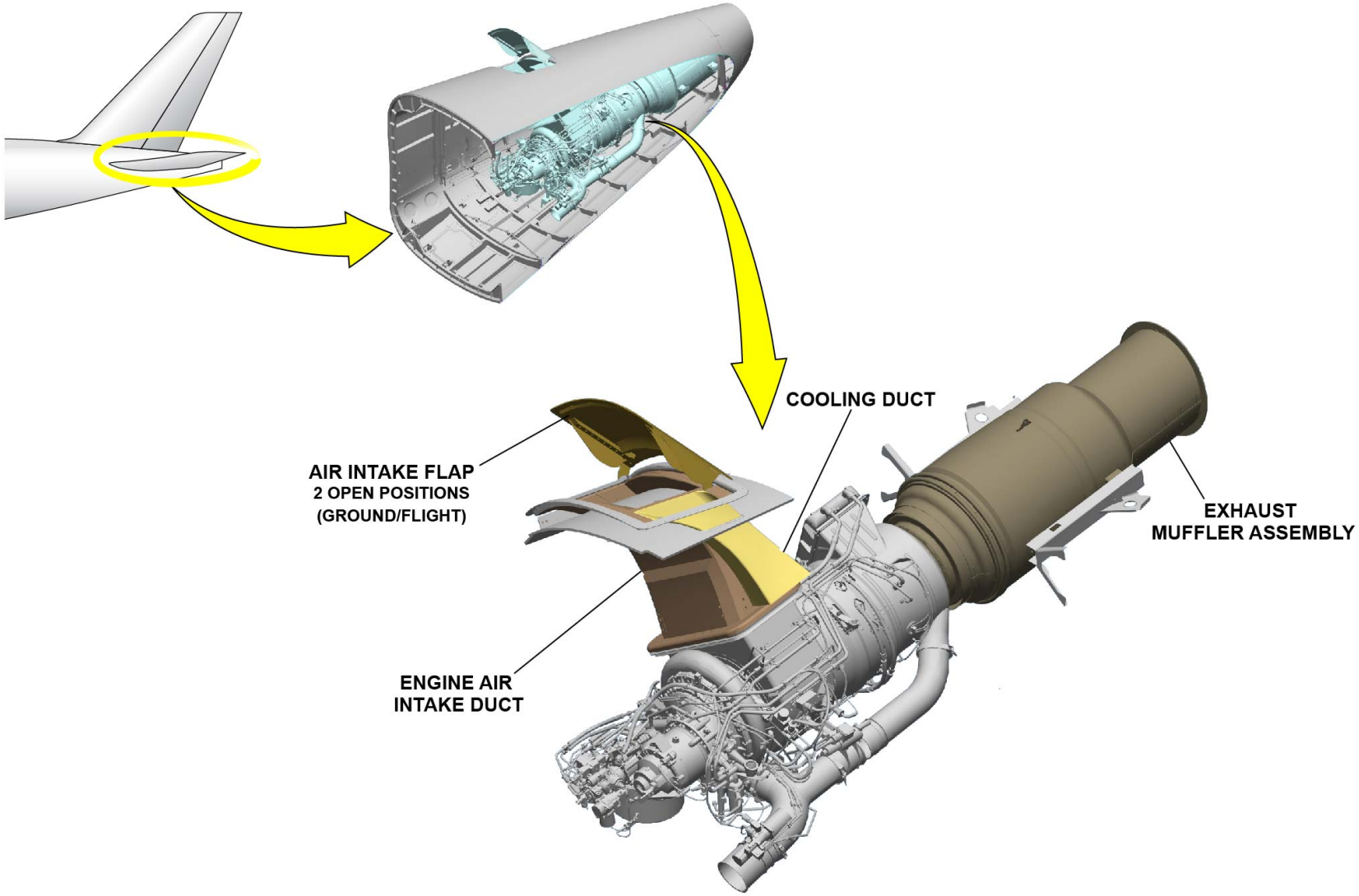

AIR INTAKE SYSTEM - PRESENTATION & EXHAUST SYSTEM - PRESENTATION

AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Engine System - Presentation

Function/Description

The engine system includes:
- The power section
- The load compressor
- The accessory drive gearbox.

The function of the engine system is to supply auxiliary power. The power section has a compressor assembly, a combustion chamber and a turbine. The power section is connected to the load compressor and the accessory drive gearbox.

The power section supplies mechanical power to the load compressor and the accessory drive gearbox. It is a single shaft gas turbine.

The load compressor supplies compressed air. It is a centrifugal compressor type with adjustable Inlet Guide Vanes (IGVs).

The accessory drive gearbox operates different accessories, for example the Fuel Control Unit (FCU), the oil pump assembly or the starter generator.

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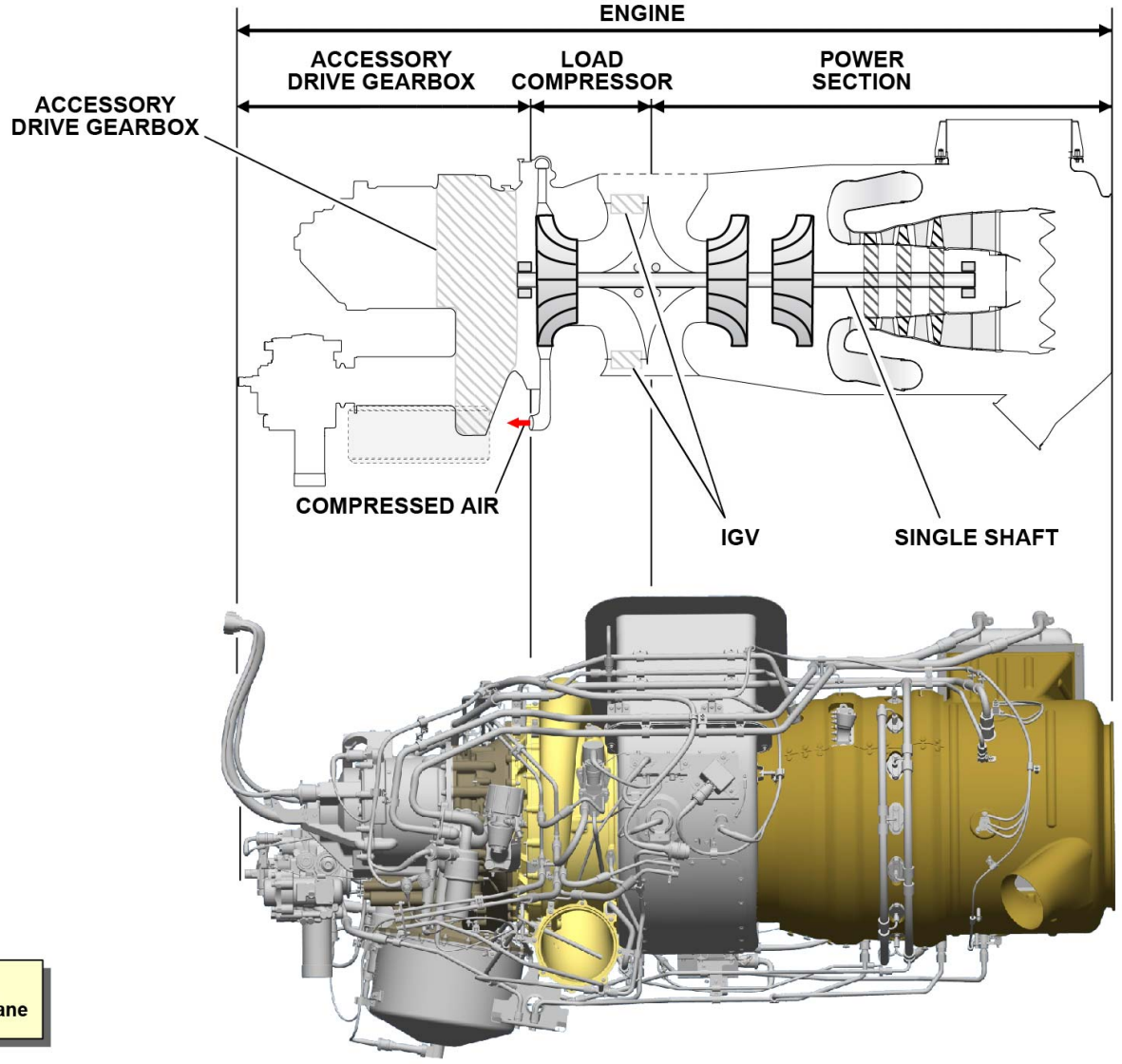

ENGINE SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION

AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Oil System - Presentation

Function/Description

The oil system lubricates and decreases the temperature of the APU bearings, the gears and the starter generator.
The primary components are an oil tank, an oil pump assembly and an air/oil cooler. The oil tank is connected to the oil pump assembly. The oil pump assembly has a connection to the air/oil cooler.
The air from the APU compartment flows through the air/oil cooler because of the venturi effect of the exhaust gas.
The air/oil cooler decreases the temperature of the oil before it goes to the APU bearings, the gears, and the starter generator. Then, the oil goes back to the oil tank.

Location

There is one oil tank. It is installed on the accessory gearbox.
There is one oil pump assembly. It is connected to the accessory gearbox.
There is one air/oil cooler. It is installed on the APU.

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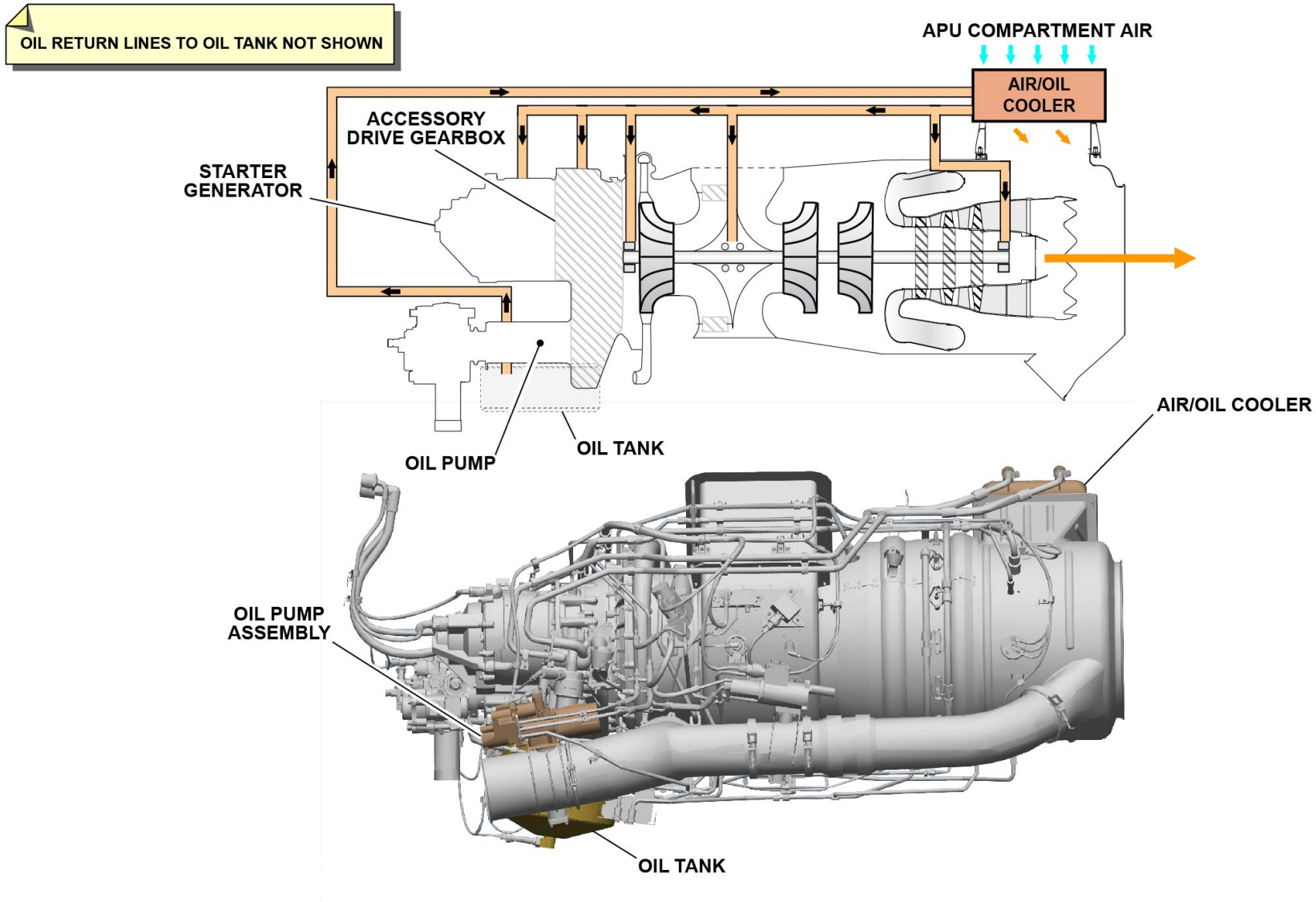


OIL SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Air System - Presentation

Function/Description

The air system includes:
- The bleed and surge air system
- The accessory cooling system.

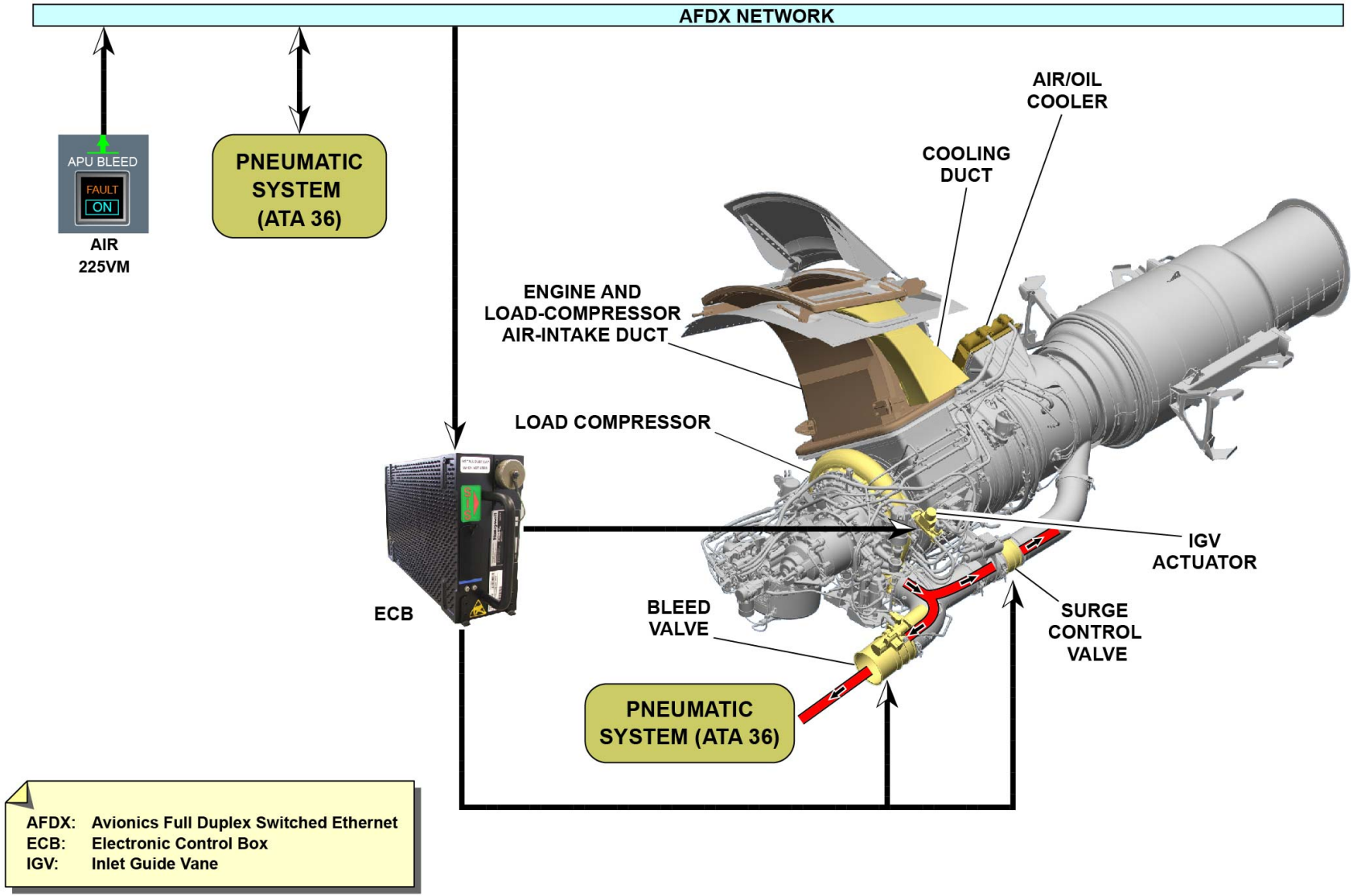
The air system supplies compressed air and cooling air. The accessory cooling air system operates independently of the bleed and surge air system.
The bleed and surge air system supplies compressed air to the aircraft pneumatic system with surge protection.
The load compressor compresses the external air from the engine and load-compressor air-intake duct and supplies this air through the APU bleed valve. IGVs control the quantity of air that flows into the load compressor.
If necessary, the surge control valve releases a part of the air to the APU exhaust to prevent load compressor surge.
The Electronic Control Box (ECB) controls the APU bleed valve, the IGVs and the surge control valve.
The accessory cooling system supplies external air from the air inlet through a specified duct into the APU compartment for ventilation. This air also goes through an air/oil cooler to decreases the temperature of the oil.

Interface

A bleed valve supplies the bleed air that is downstream of the load compressor to the pneumatic system.
The APU BLEED pushbutton switch has an interface with the ECB through the pneumatic system.

Location

There is one APU bleed valve, one surge control valve and one IGV actuator. They are installed on the APU.
There is one engine and load-compressor air-intake duct and one cooling duct. They are installed above the APU.
There is one air/oil cooler. It is installed on the APU.



AIR SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION ... LOCATION

AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Engine Fuel and Control System - Presentation

Function/Description

The engine fuel and control system includes:
- The fuel distribution system
- The fuel control and monitoring system.

The engine fuel and control system supplies pressurized fuel and controls the fuel flow to the combustion chamber.
The FCU is the primary component of the engine fuel and control system. It supplies the pressurized fuel to the combustion chamber (through manifolds and atomizers), the IGV, the surge control valve and the bleed valve actuators. The ECB automatically controls the fuel flow through the FCU.

Interface

The engine fuel and control system has an interface to the APU fuel system, which provides the fuel to the FCU.

Location

There is one FCU. It is connected to the accessory gearbox.
There are fuel actuators for the IGV, the bleed valve and the surge control valve. The actuators are installed on each related valve.

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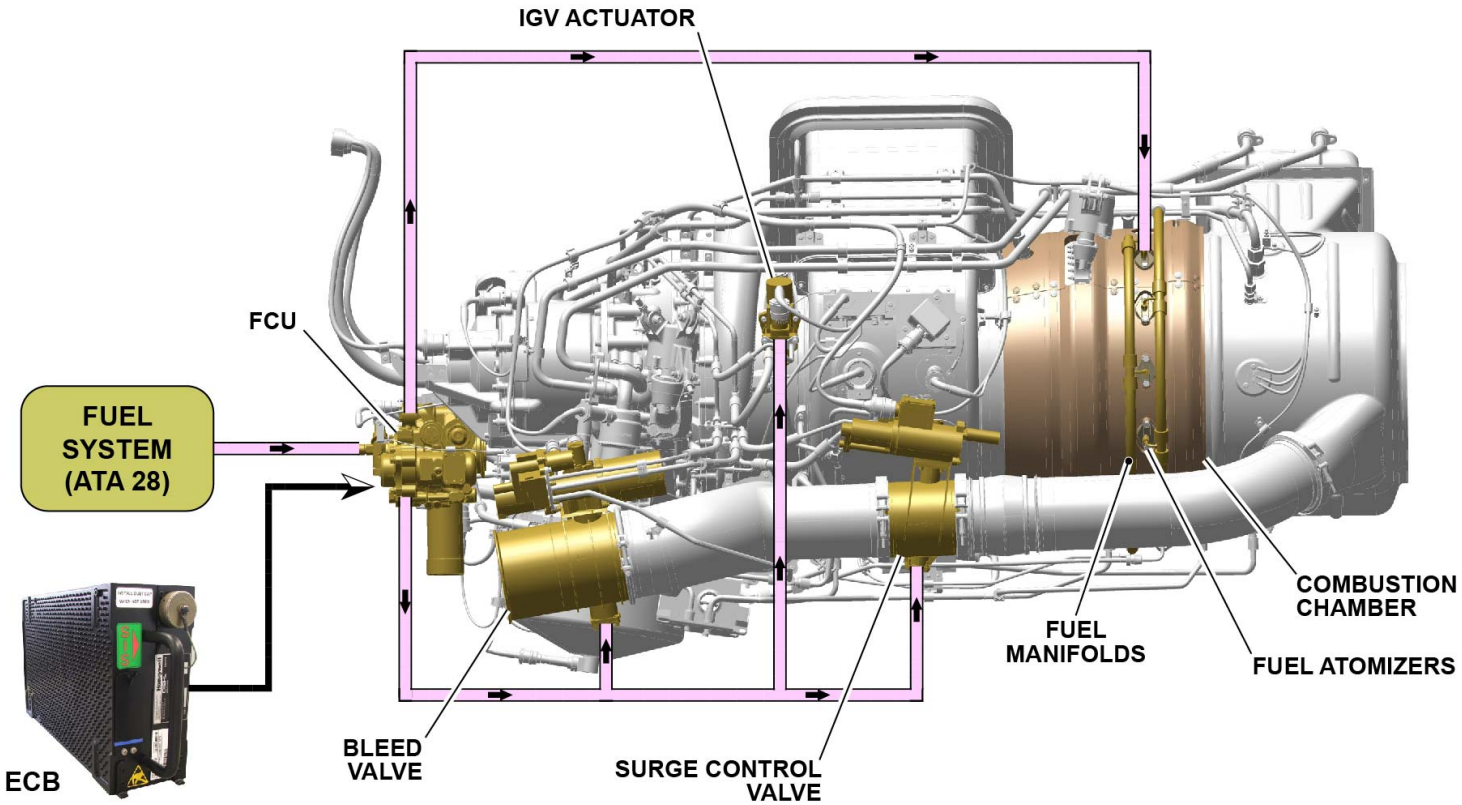

ECB: Electronic Control box
FCU: Fuel Control Unit
IGV: Inlet Guide Vane

ENGINE FUEL AND CONTROL SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION ... LOCATION

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AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Ignition and Starting System - Presentation

Function/Description

The ignition and starting system includes:
- The ignition system
- The starting-generation system.

The ignition system supplies the ignition for the APU start sequence. One ignition unit supplies high voltage to one igniter plug. The ECB controls this.

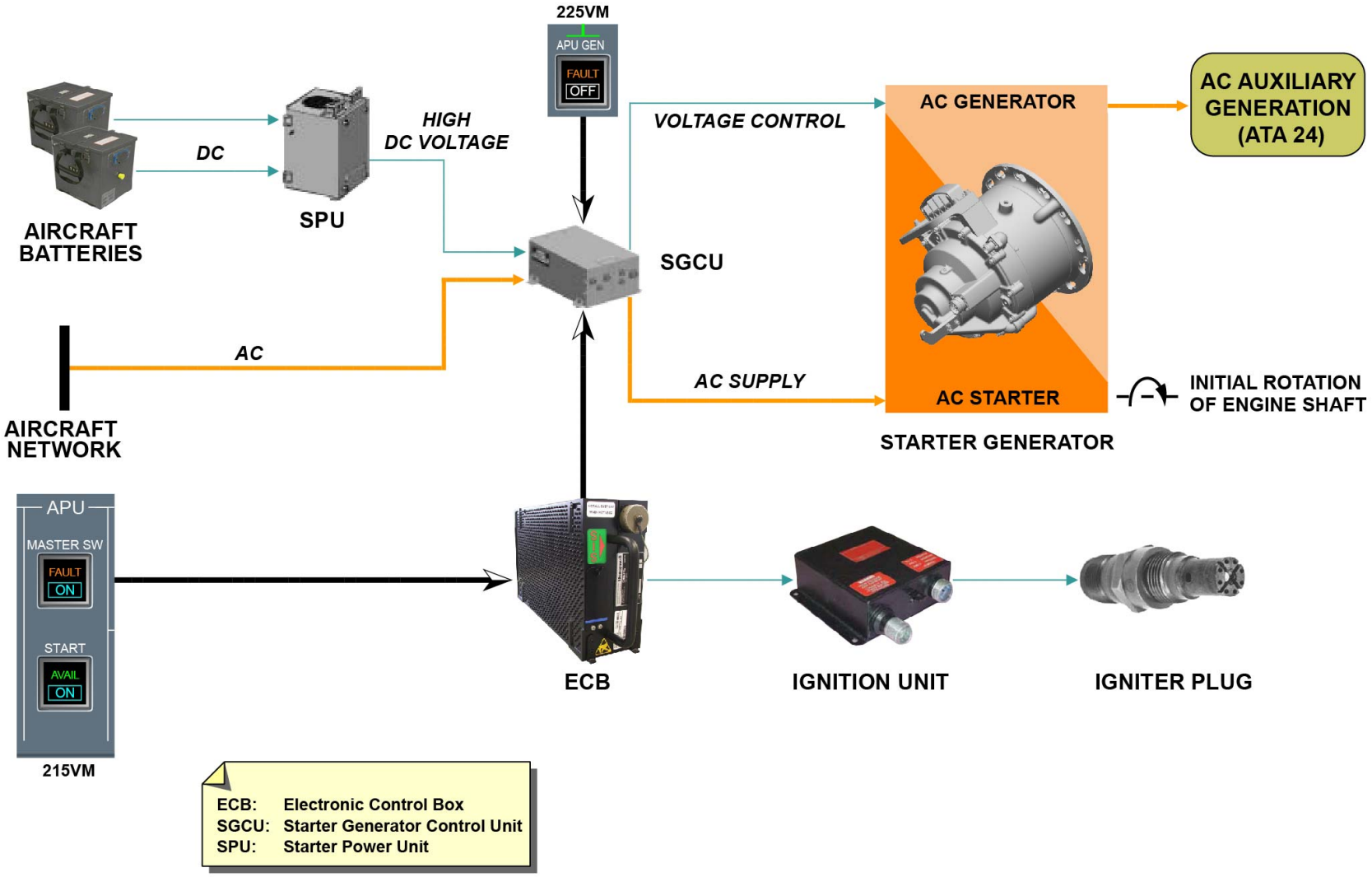
The starting-generation system can operate in starting mode or in generation mode. In starting mode, the starting-generation system starts the APU rotation for APU start. In generation mode, the starting-generation system generates electrical power for the aircraft systems.

For APU rotation, the ECB sends the starting signal to the Starter Generator Control Unit (SGCU). Then, the SGCU sends an adjusted Alternating Current (AC) to the starter part of the starter-generator.

Interface

The SGCU gets electrical power from the aircraft batteries after electrical conversion to a higher voltage by the Starter Power Unit (SPU). It can also get electrical power from the aircraft electrical network.

The starting-generation system is connected to the aircraft electrical network, if the APU GEN pushbutton switch is pushed.



IGNITION AND STARTING SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

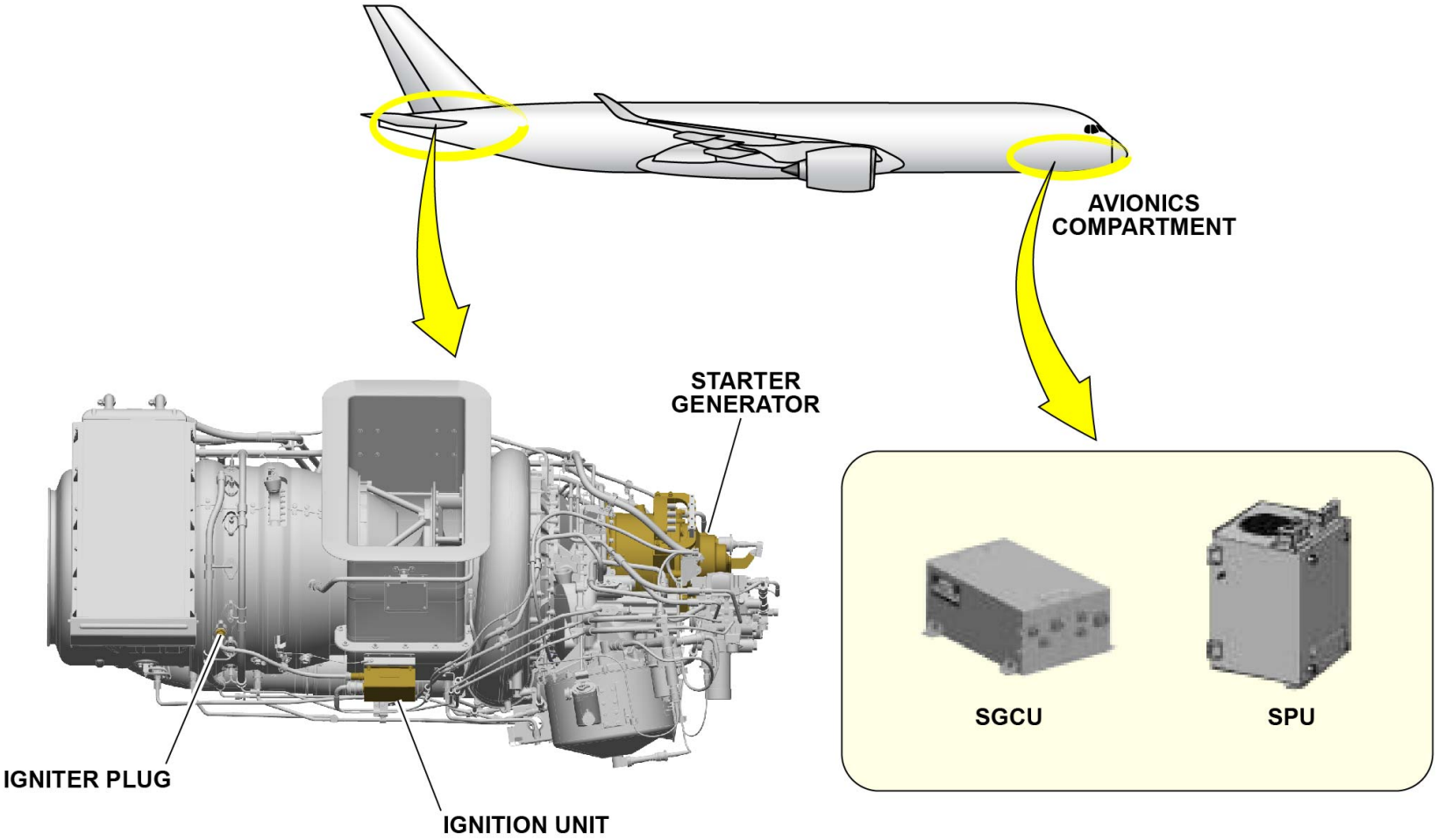
V1813401 - V01T0M0 - VM49P1LEVEL0101

AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Ignition and Starting System - Presentation (continued)

Location

There is one ignition unit and one igniter plug. They are installed on the APU.
There is one starter generator. It is connected to the accessory drive gearbox.
There is one SGCU and one SPU. They are installed in the avionics compartment.



IGNITION AND STARTING SYSTEM - PRESENTATION - LOCATION

AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Engine Controls System - Presentation

Function/Description

The engine controls system includes:
- The control and monitoring system
- The emergency shutdown system.

The control and monitoring system automatically controls and monitors all the APU operation. This includes the start and stop sequences and the protective shutdown of the APU. The control and monitoring system also sends APU data to other aircraft systems.
The ECB is the primary component of the control and monitoring system. It controls all the APU components and also the actuator of the air intake flap. The APU monitoring sensors are also connected to the ECB.
The ECB controls the APU start and shutdown with the signals from the MASTER SW and START pushbutton switches.
The emergency shutdown system stops the APU immediately when this is necessary.
The ECB automatically operates the emergency shutdown system on ground if there is an APU fire. The emergency shutdown system is manually activated from the APU FIRE panel in the cockpit or from the external panels.

Interface

The ECB has an interface with other aircraft systems, for example with the APU fire protection system for APU auto shut down on ground.

Location

There is one ECB. It is installed in the pressurized area rear of the bulk cargo compartment.

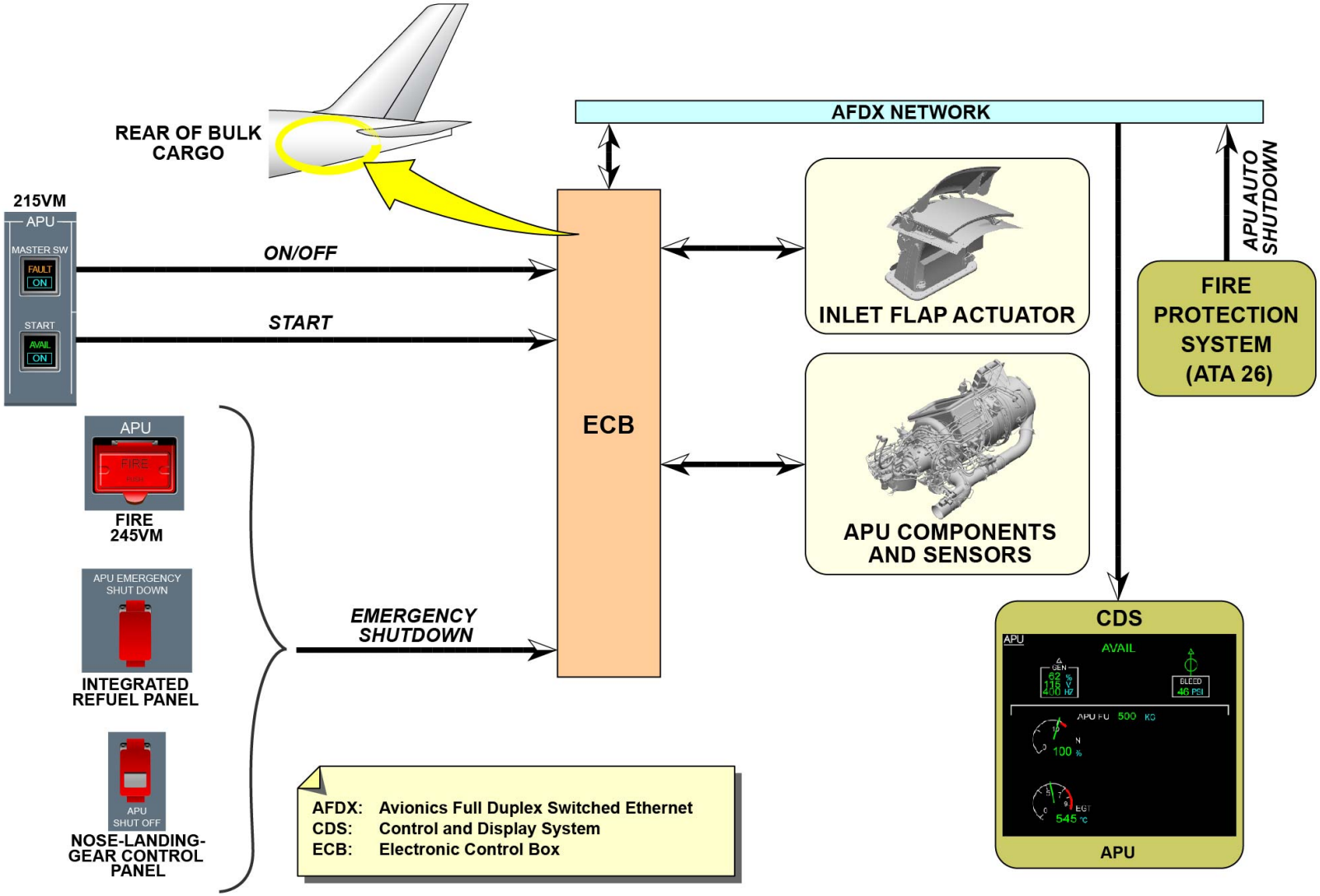
Indicating System - Presentation

Function/Description

The indicating system sends signals about the APU operation parameters to the Centralized Display System (CDS). The ECB monitors the APU sensors and the crew sees the results on the CDS.

Interface

The ECB has an interface to the CDS through the AFDX network. The APU parameters are displayed on the Electronic Centralized Aircraft Monitoring (ECAM) System Display (SD) page.



ENGINE CONTROLS SYSTEM - PRESENTATION & INDICATING SYSTEM - PRESENTATION

AIRBORNE AUXILIARY POWER SYSTEM PRESENTATION (1)

Control and Indicating - Presentation

These controls are installed on the cockpit overhead panel:
- The MASTER SW and START pushbutton switches
- The APU FIRE PUSH pushbutton switch
- APU BLEED pushbutton switch
- APU GEN pushbutton switch.

These external controls are installed on the aircraft:
- The APU EMERGENCY SHUTDOWN pushbutton switch on the Integrated Refuel Panel (IRP) and the APU SHUT OFF pushbutton switch on the maintainability panel of the nose-landing-gear.

The engine operation parameters are on the ECAM APU page.

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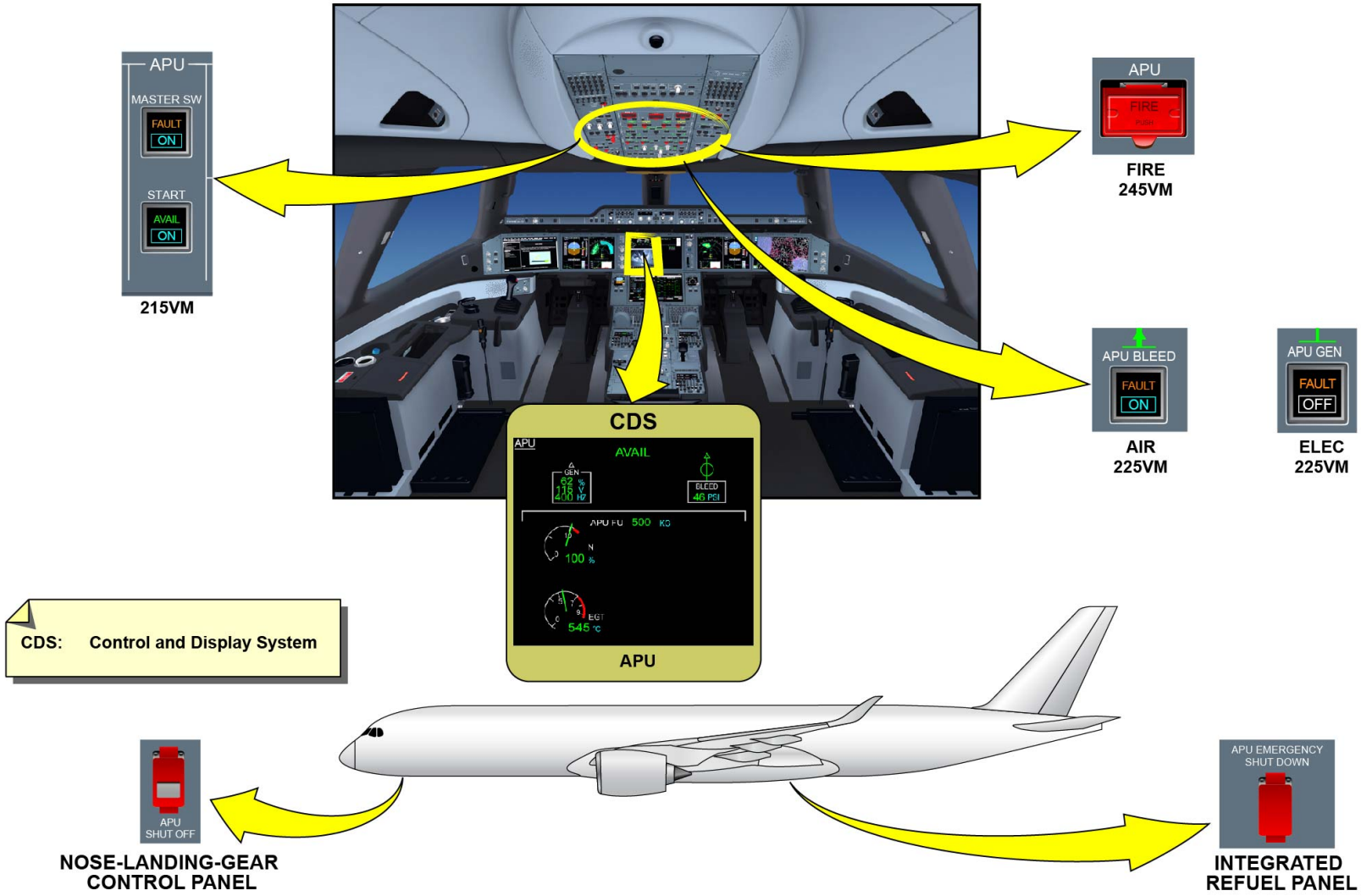

CONTROL AND INDICATING - PRESENTATION

V1813401 - V01T0M0 - VM49P1LEVEL0101

ENGINE (RR) SYSTEM PRESENTATION (1)

Overview

The primary function of the power plant is to supply propulsion power to the aircraft. It also supplies electrical power, pneumatic power and hydraulic power to the aircraft systems.
General familiarization training for this system focuses on:
- Cowling
- Mounts
- Engine
- Propulsion Control System (PCS)
- Engine fuel distribution
- Engine power control
- Air system
- Ignition
- Starting
- Oil system
- Thrust Reverser (T/R).

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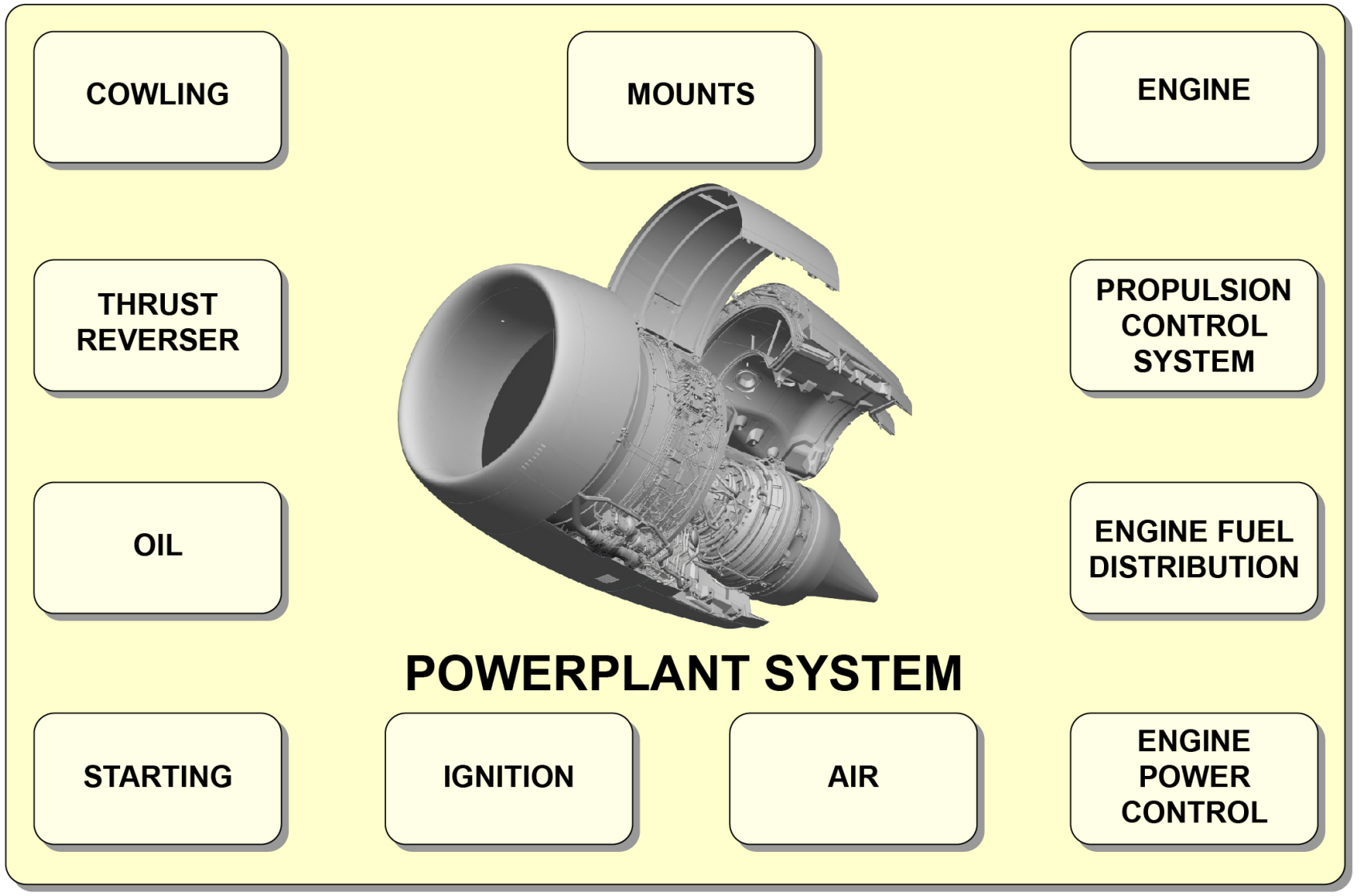

COWLING
MOUNTS
ENGINE
THRUST REVERSER
PROPULSION CONTROL SYSTEM
OIL
ENGINE FUEL DISTRIBUTION
POWERPLANT SYSTEM
STARTING
IGNITION
AIR
ENGINE POWER CONTROL

OVERVIEW

ENGINE (RR) SYSTEM PRESENTATION (1)

Cowling - Presentation

Function/Description

The cowling gives protection to the engine and an aerodynamic, unrestricted airflow around the engine during the flight. They give access to the engine components and to various systems. Cowlings adapt the engine airflow to the external airflow.
The cowling is composed of:
- Inlet cowl
- Fan cowls
- T/R cowls.

The Power Door Opening System (PDOS) operates the fan and the T/R cowls through an electric pump to supply the hydraulic power to the actuators.

Location

The inlet cowl is attached to the front of the engine.
The fan cowls are installed around the engine fan case between the inlet cowl and the T/R cowls.
The T/R cowls are in the aft part of the nacelle. They are attached to the engine pylon by hinges.

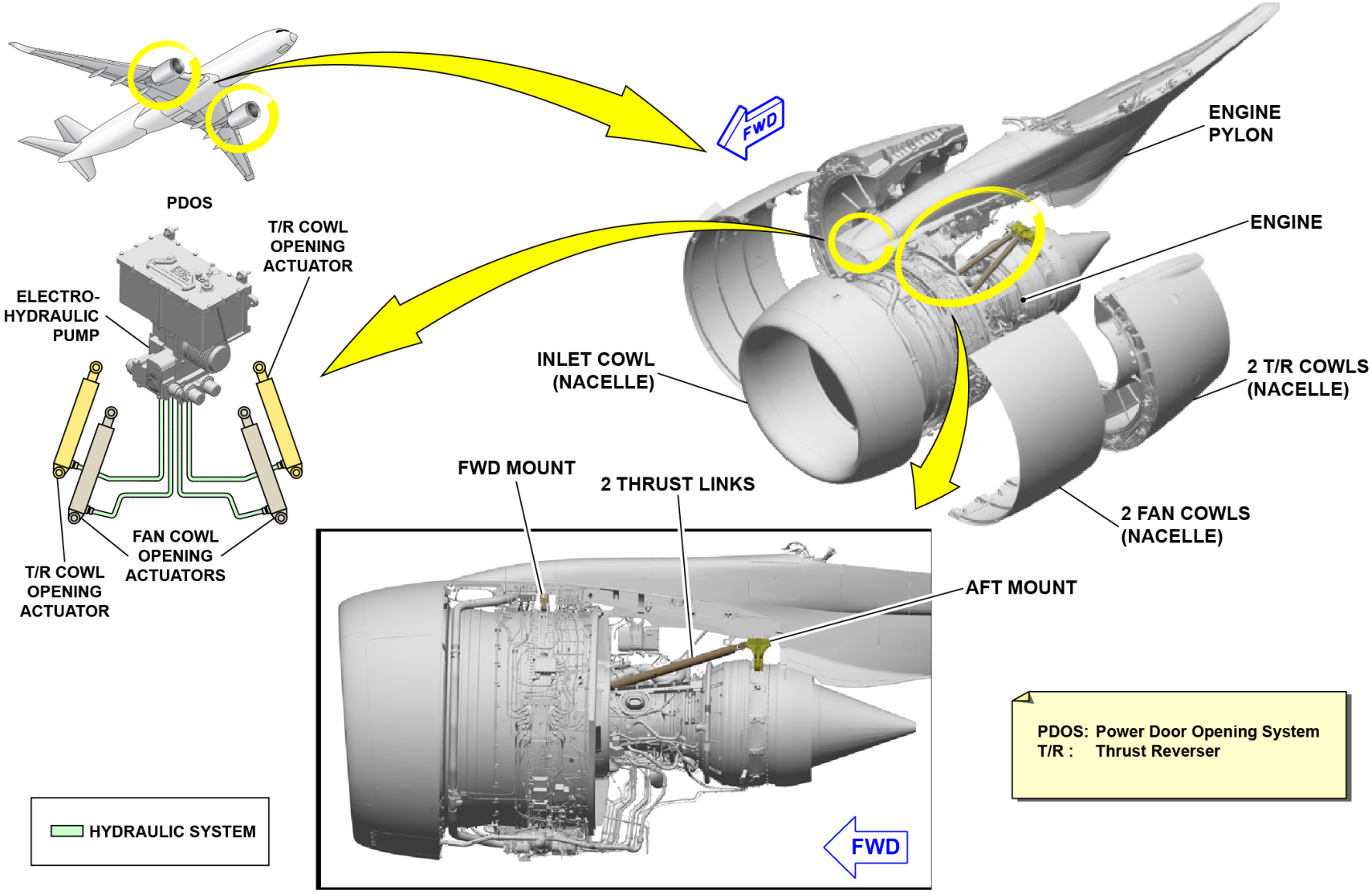
Mounts - Presentation

Function/Description

Three mount assemblies attach the engine to the engine pylon. They hold the weight of the engine and transmit the thrust of the engine to the aircraft.
The engine mount assembly has three components:
- Fwd mount
- Aft mount
- Two thrust links which transmit the engine thrust to the pylon through the aft mount.

Location

The fwd mount attaches the engine at the top of the engine fan case and on the pylon side.
The aft mount is at the top of the Low Pressure Turbine (LPT) case and to the pylon.
The thrust links are installed one on each side of the engine.



COWLING - PRESENTATION & MOUNTS - PRESENTATION

ENGINE (RR) SYSTEM PRESENTATION (1)

Engine - Presentation

Function/Description

The Rolls Royce TRENT XWB engine is a high by-pass ratio and triple spool turbofan. It gives thrust for the aircraft, drives the accessories and supplies the pneumatic power.
The air is compressed by the Low Pressure Compressor (LPC) and then divides into two flows. Much of the air goes through the by-pass duct (cold flow) and causes most of the thrust. The remaining air is compressed more by the Intermediate Pressure (IP) compressor and the High Pressure Compressor (HPC) before it goes into the combustion system.
The fuel which is supplied to the burners, mixes with the air and this mixture is burned in the combustion chamber. The increase in temperature causes the gases to expand and the gas flow accelerates rearward. Most of this energy turns the turbines, each of which supplies power to its related compressors.
The engine has these primary components:
- Low Pressure (LP) spool (N1) composed of a LPC assembly and a LPT
- IP spool (N2) composed of an IP compressor assembly and a IP turbine
- High Pressure (HP) spool (N3) composed of a HPC assembly and a High Pressure Turbine (HPT)
- Combustion chamber to burn a mixture of air and fuel
- External gearbox connected to the HP spool to drive accessories.

Location

The external gearbox is at the bottom of the engine.

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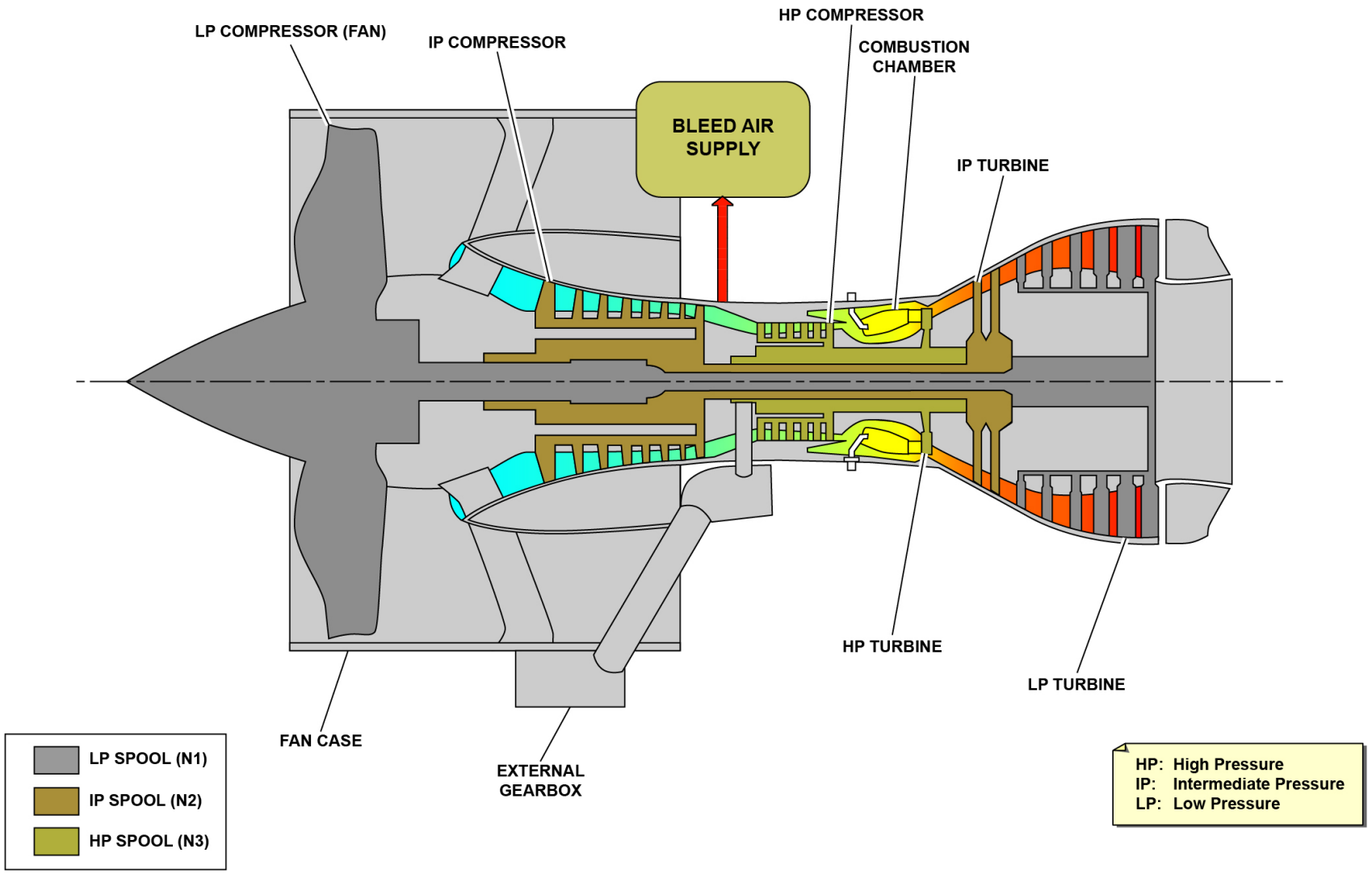


ENGINE - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

V1813401 - V01T0M0 - VM7RP1LEVEL0101

ENGINE (RR) SYSTEM PRESENTATION (1)

Propulsion Control System - Presentation

Function/Description

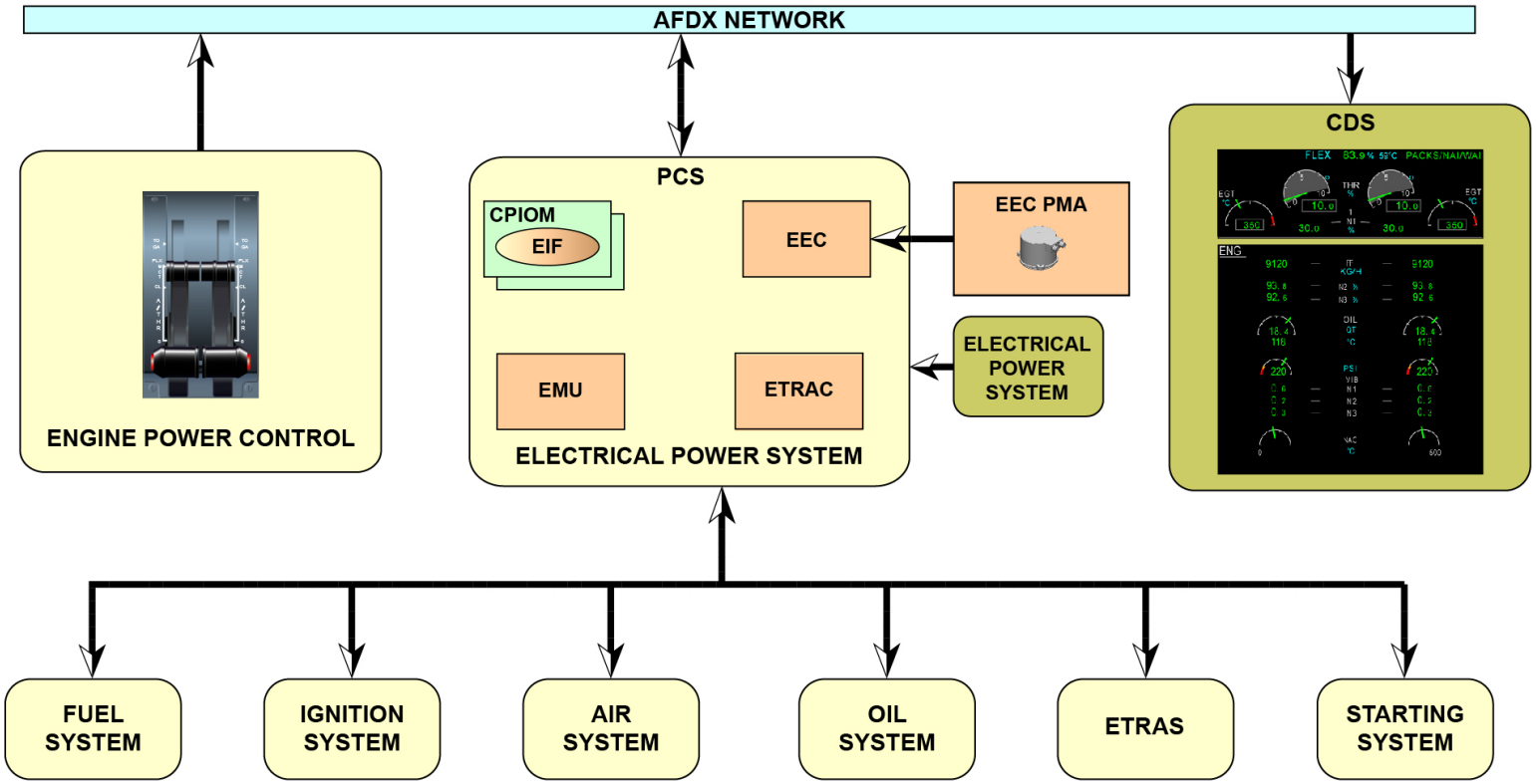
The PCS gives control for engine starting, shutdown, power management and engine indicating/monitoring functions.
The PCS controls and monitors these engine subsystems:
- Engine starter and ignition for starting operation
- Fuel system
- Compressor airflow of the engine
- Engine thrust
- Oil system
- Indicating/monitoring of the engine
- T/R actuation
- Throttle control assembly.

The PCS includes:
- Engine Interface Function (EIF)
- Engine Electronic Controller (EEC)
- Engine Monitoring Unit (EMU)
- Electronic Thrust Reverser Actuation Controller (ETRAC).

The EEC Permanent Magnet Alternator (PMA) supplies the electrical power to the EEC when the engine is running. It is supplied by the aircraft electrical network when engine is not running.

Interface

The PCS has an interface with the Control and Display System (CDS) through the Avionics Full Duplex Switched Ethernet (AFDX) network.
The EEC has an interface with the aircraft electrical network.



AFDX: Avionics Full Duplex Switched Ethernet
CDS: Control and Display System
CPIOM: Core Processing Input/Output Module
EEC: Engine Electronic Controller
EIF: Engine Interface Function
EMU: Engine Monitoring Unit
ETRAC: Electronic Thrust Reverser Actuation Controller
ETRAS: Electronic Thrust Reverser Actuation System
PCS: Propulsion Control System
PMA: Permanent Magnet Alternator

PROPULSION CONTROL SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

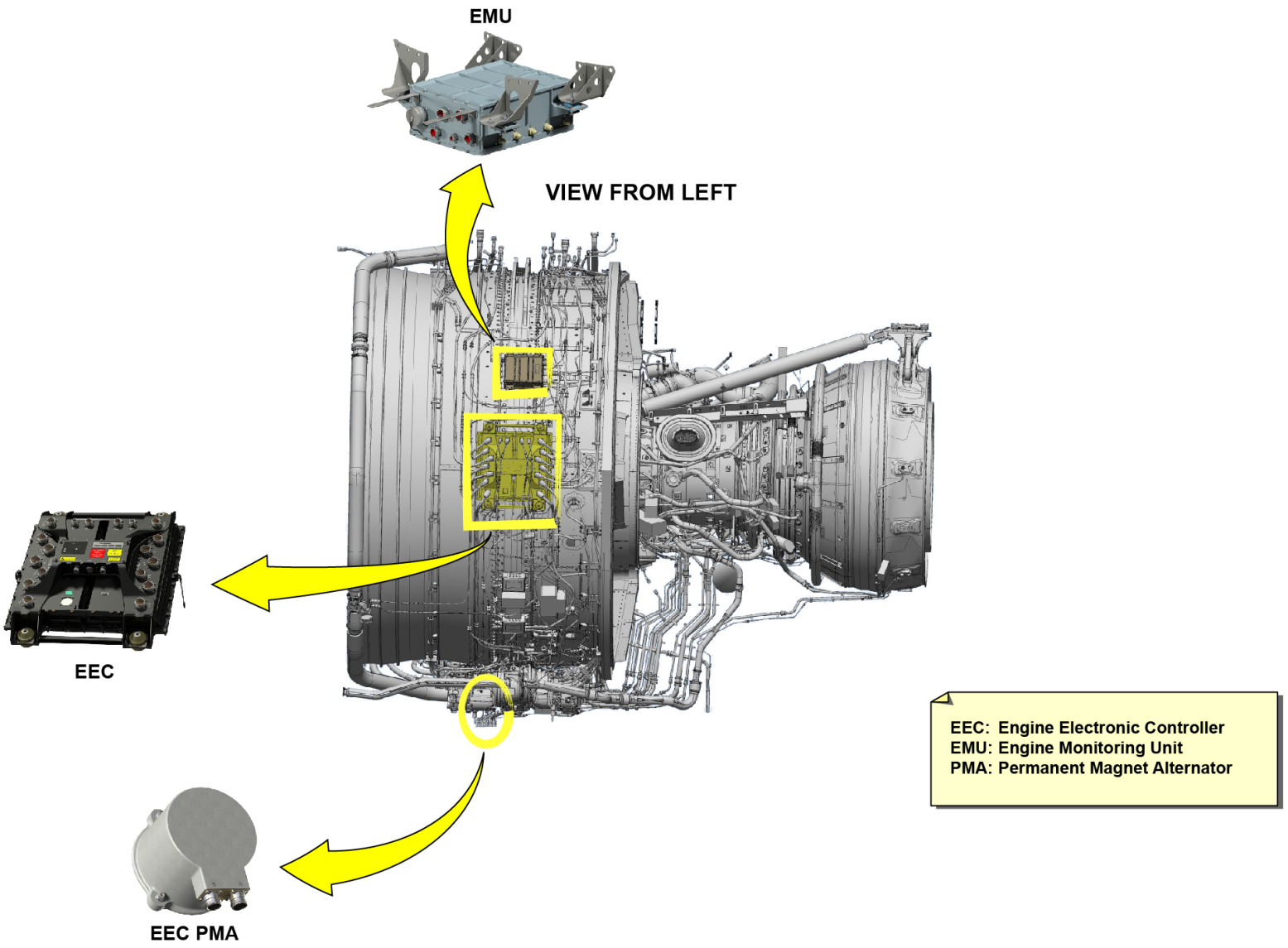
V1813401 - V01T0M0 - VM7RP1LEVEL0101

ENGINE (RR) SYSTEM PRESENTATION (1)

Propulsion Control System - Presentation (continued)

Location

The EMU is on the left side of the fan case.
The EEC PMA is on the gearbox.
The EEC is on the left side of the fan case.



PROPULSION CONTROL SYSTEM - PRESENTATION - LOCATION

ENGINE (RR) SYSTEM PRESENTATION (1)

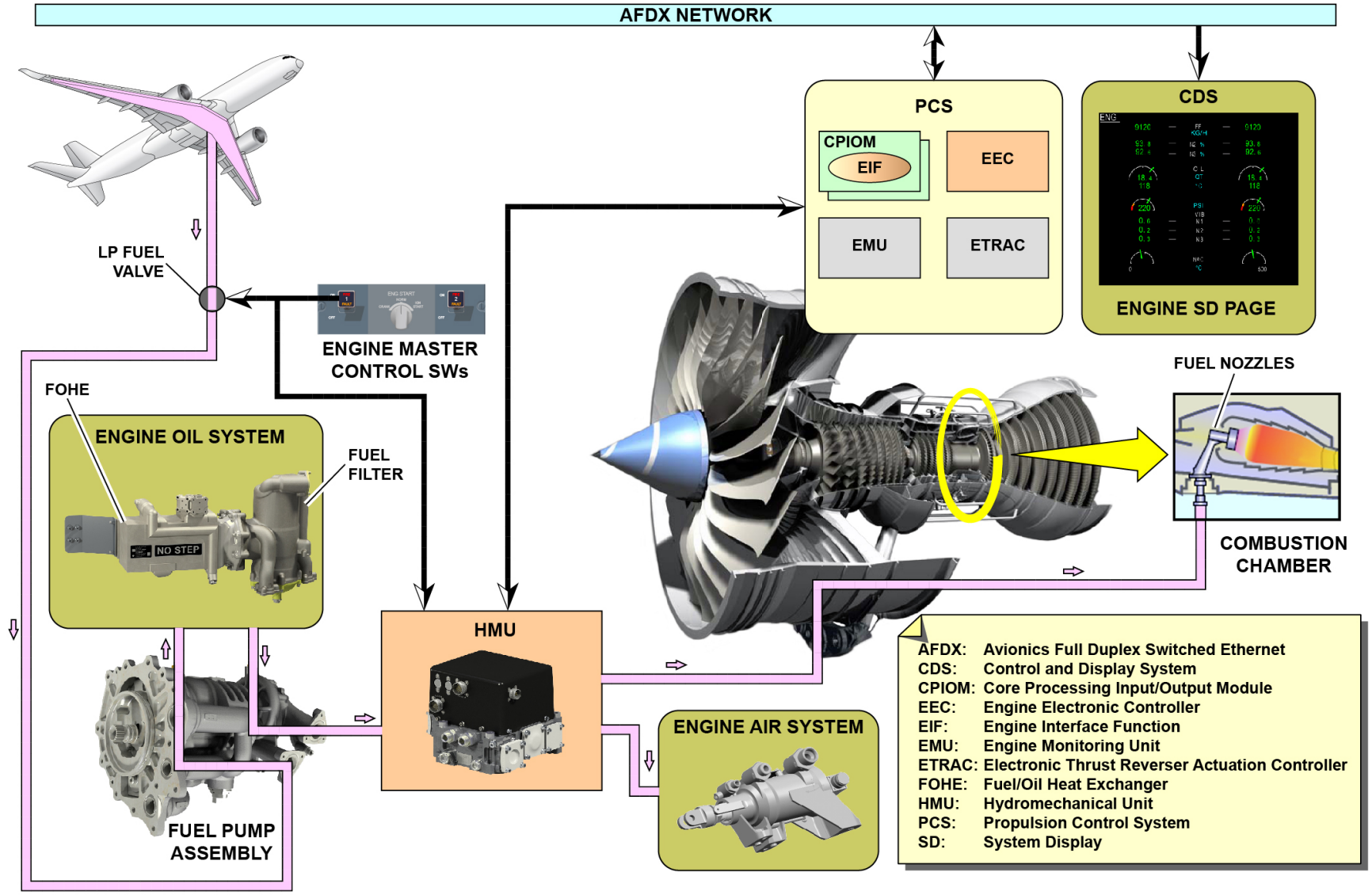
Engine Fuel Distribution - Presentation

Function/Description

The primary function of the fuel distribution system is to supply sufficient pressurized fuel to the combustion system for all modes of engine operation.
The fuel distribution system is divided into an LP system and an HP system.
Fuel is supplied from the aircraft fuel tanks to the fuel pump assembly. The pump supplies the fuel to the Fuel/Oil Heat Exchanger (FOHE). This decreases the temperature of the oil and increases the temperature of the fuel to prevent ice in the fuel. The fuel filter element cleans the fuel at the outlet of the FOHE. Then the clean fuel goes back to the fuel pump assembly and then to the Hydro-mechanical Unit (HMU). The HMU supplies calibrated fuel to the fuel nozzles in the combustion chamber and to the engine air system actuators as servo muscle pressure.

Interface

The fuel is supplied from the aircraft fuel tanks through the LP valve controlled by the engine master control switches.
For the engine fuel distribution system, the PCS has an interface with the CDS (engine System Display (SD) page) through the AFDX network.



ENGINE FUEL DISTRIBUTION - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

V1813401 - V01T0M0 - VM7RP1LEVEL0101

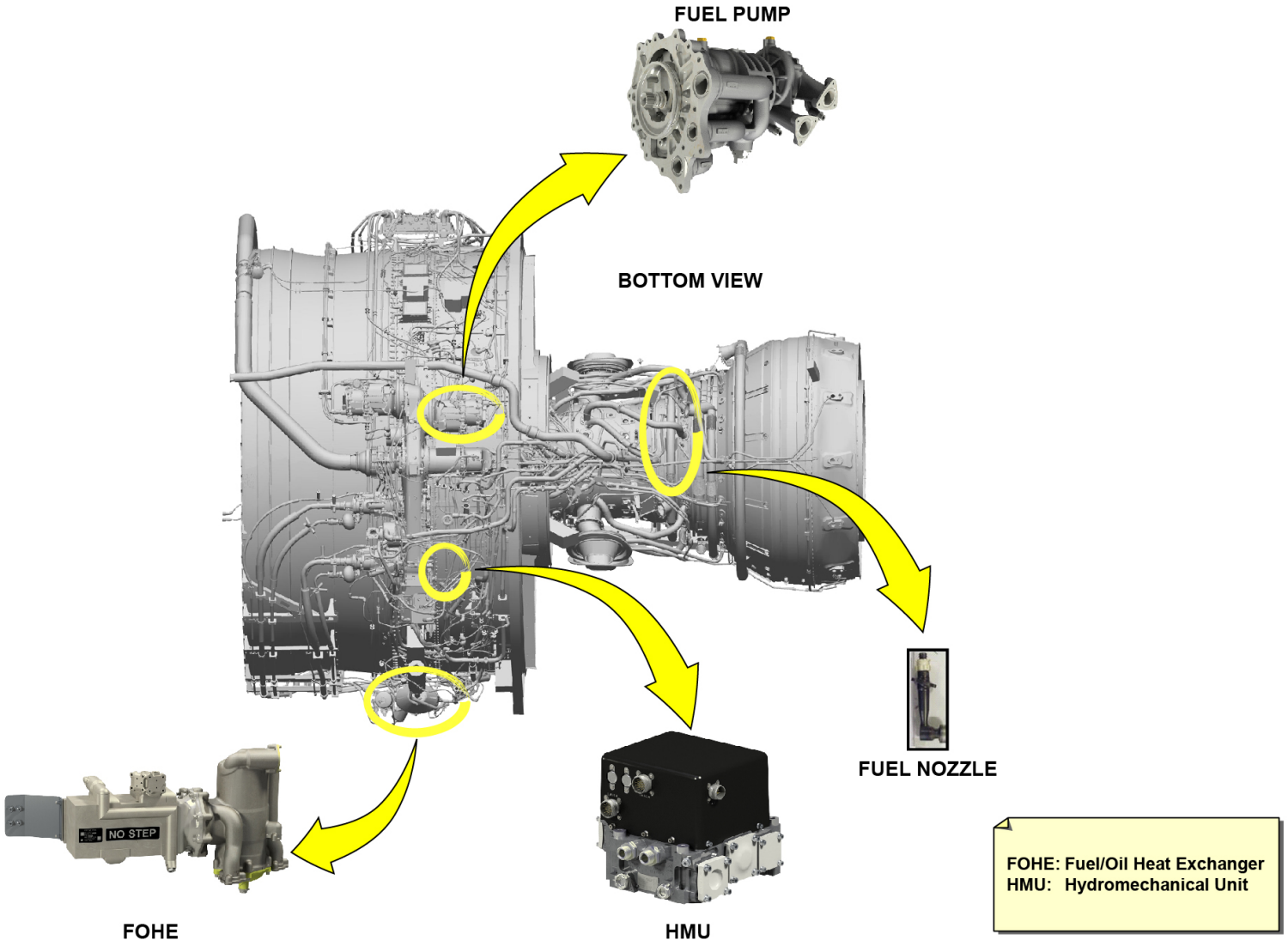
ENGINE (RR) SYSTEM PRESENTATION (1)

Engine Fuel Distribution - Presentation (continued)

Location

The fuel pump is on the external gearbox.
The FOHE is on the fan case.
Fuel nozzles are on the combustion chamber.
The HMU is on the external gearbox.

V1813401 - V01T0M0 - VM7RP1LEVEL0101



ENGINE FUEL DISTRIBUTION - PRESENTATION - LOCATION

ENGINE (RR) SYSTEM PRESENTATION (1)

Engine Power Control - Presentation

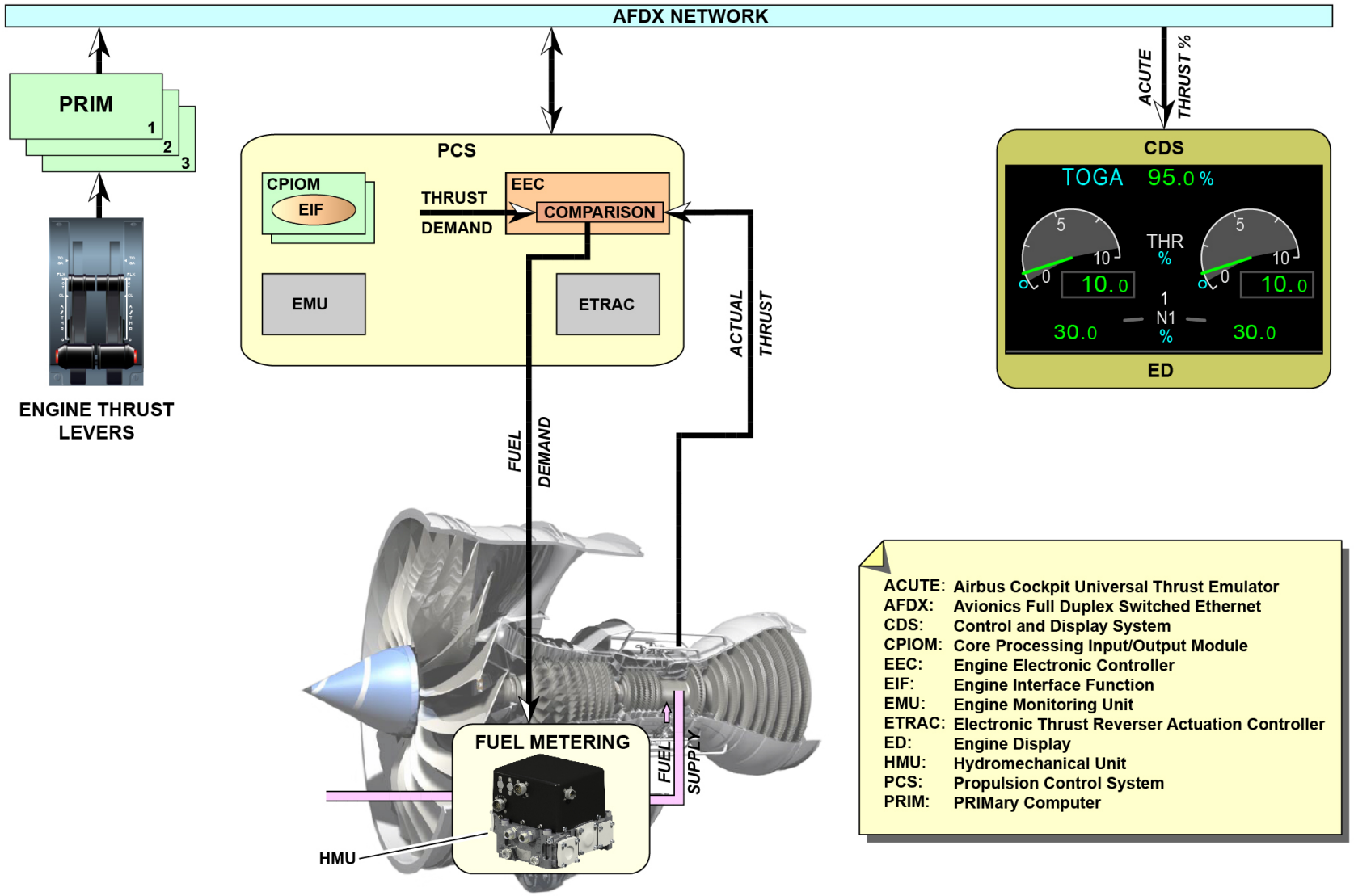
Function/Description

The flight crew operates the engine through the engine power controls. The manual thrust or Autothrust (A/THR) controls the engine power. The manual thrust demand is transmitted from the throttle control levers to the EEC through the Primary (PRIMs) computers and the EIF application. The A/THR is transmitted from the PRIMs computers to the EEC through the EIF application. The EEC that is a part of the PCS, compares the actual thrust with the thrust demand and adjusts the fuel supply accordingly. The CDS Engine Display (ED) permanently displays the actual thrust.

Interface

The engine PCS has interfaces with the CDS to display an engine thrust percentage calculated by the ACUTE (Airbus Cockpit Universal Thrust Emulator) function.

V1813401 - V01T0M0 - VM7RP1LEVEL0101



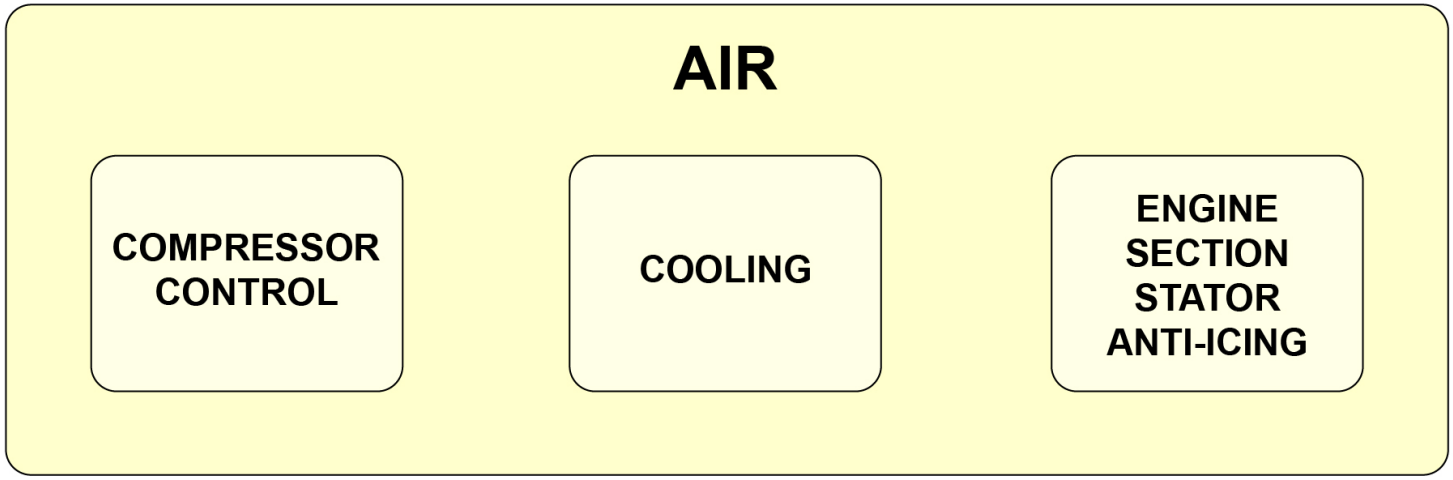
ENGINE POWER CONTROL - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

ENGINE (RR) SYSTEM PRESENTATION (1)

Air System - Presentation

Function/Description

The engine air system controls the compressor airflow to increase the engine performance.
The engine air system includes:
- Compressor control
- Cooling
- Engine Section Stator (ESS) anti-icing.



AIR SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION

ENGINE (RR) SYSTEM PRESENTATION (1)

Compressor Control - Presentation

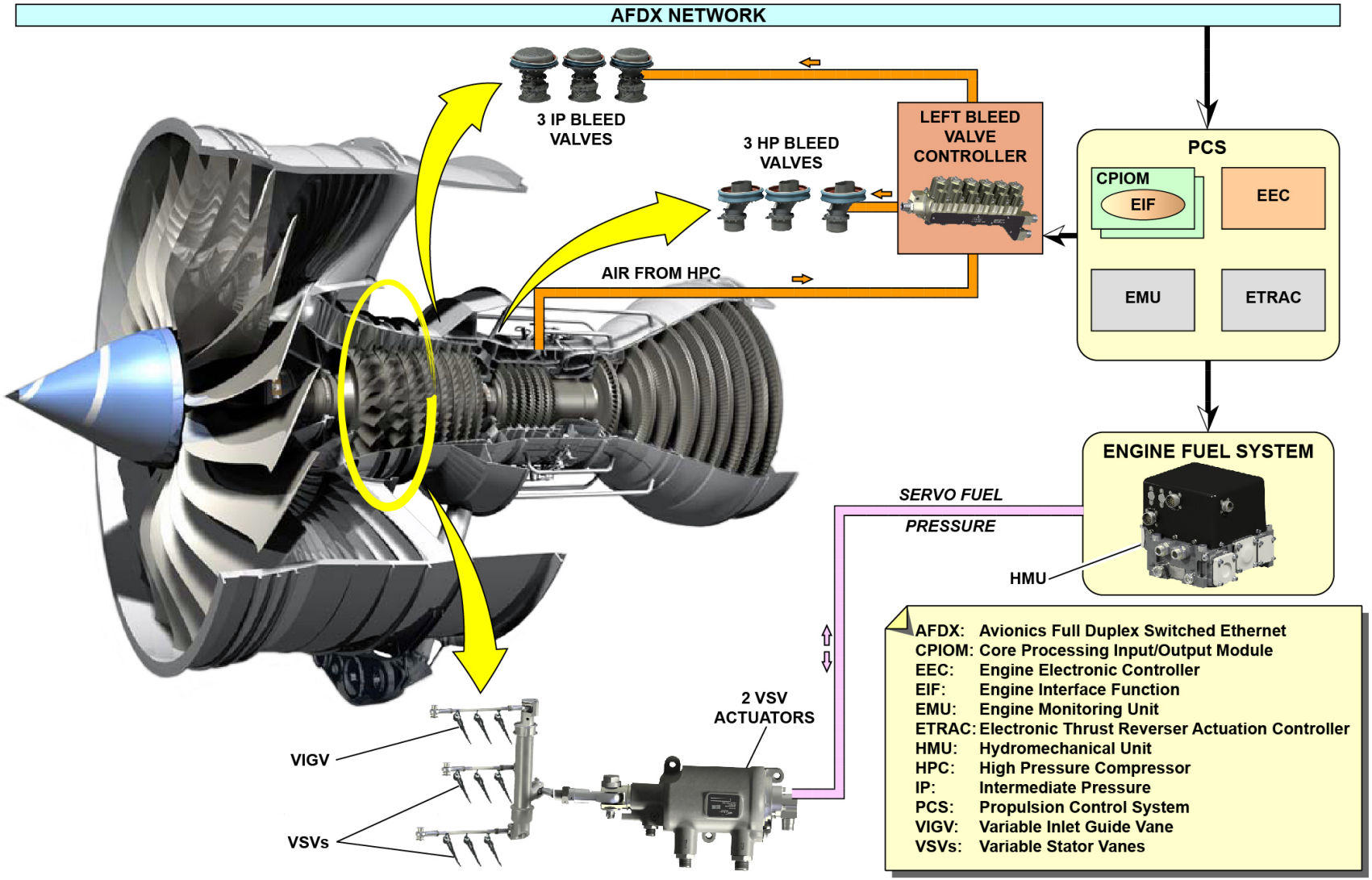
Function/Description

The compressor control system controls the airflow through the compressors to optimize and protect operation of the engine at all thrust conditions.
The compressor control system controls the airflow through the IP compressors and HPC. The compressor control system includes:
- Variable Inlet Guide Vanes (VIGVs) and two stages of IP compressor Variable Stator Vanes (VSVs)
- Two VSV actuators connected through an actuating mechanism to the VIGVs/VSVs
- HMU for VSV actuation (servo fuel pressure)
- Two bleed valves controllers receiving muscle pressure from the HPC
- Three IP bleed valves
- Three HP bleed valves.

The compressor airflow control system is controlled by the EEC.

Location

The VSV system is installed around the IP compressor case.
The three IP bleed valves are installed on and around the IP compressor case.
The three HP bleed valves are installed on and around the HP compressor case.
The two bleed valve controllers are fitted in Zone 2 (IP compressor case).



COMPRESSOR CONTROL - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

ENGINE (RR) SYSTEM PRESENTATION (1)

Cooling - Presentation

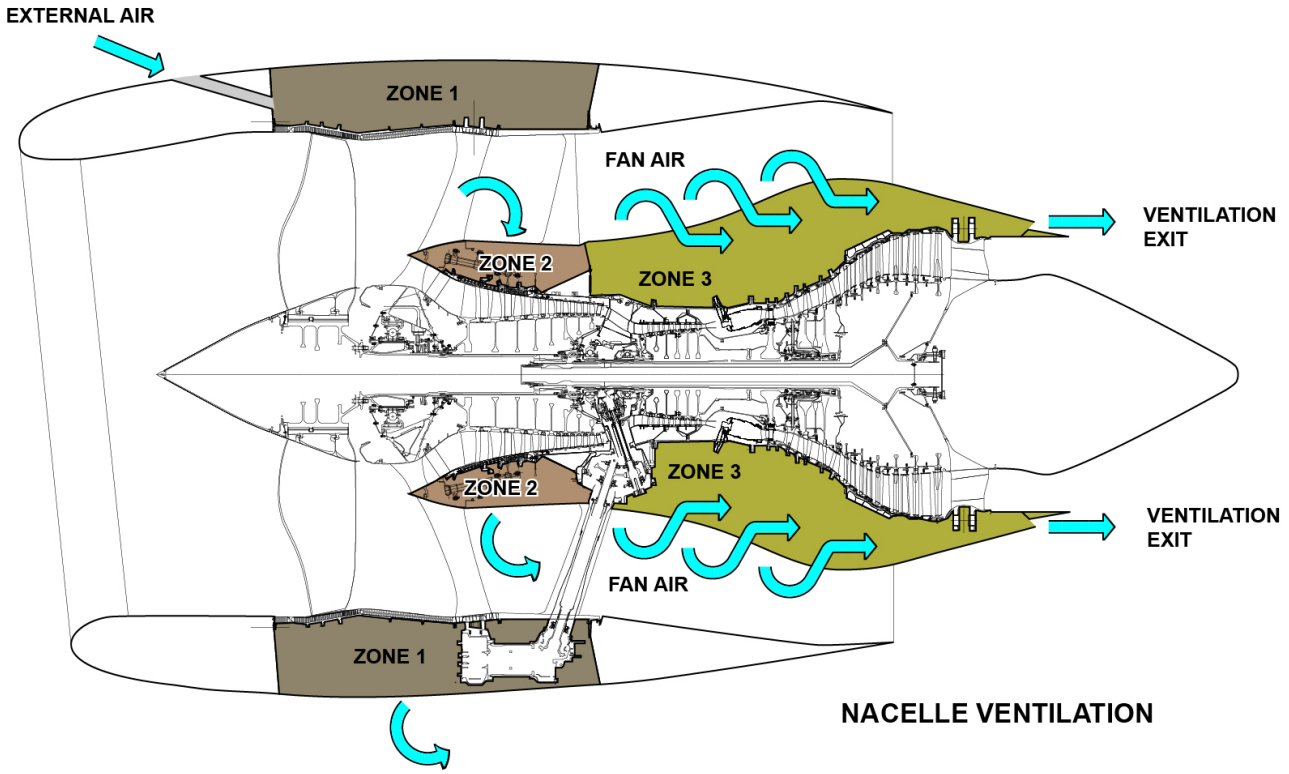
Function/Description

Nacelle ventilation:
The air supply comes from different sources to decrease the engine temperature.
The space between the engine cowls and the engine case has these zones:
- Zone 1: Annular space between the fan case and the fan cowls.
- Zone 2: Annular space between the IP compressor case and the gas generator fairings.
- Zone 3: Annular space between the core engine and the T/R cowls.

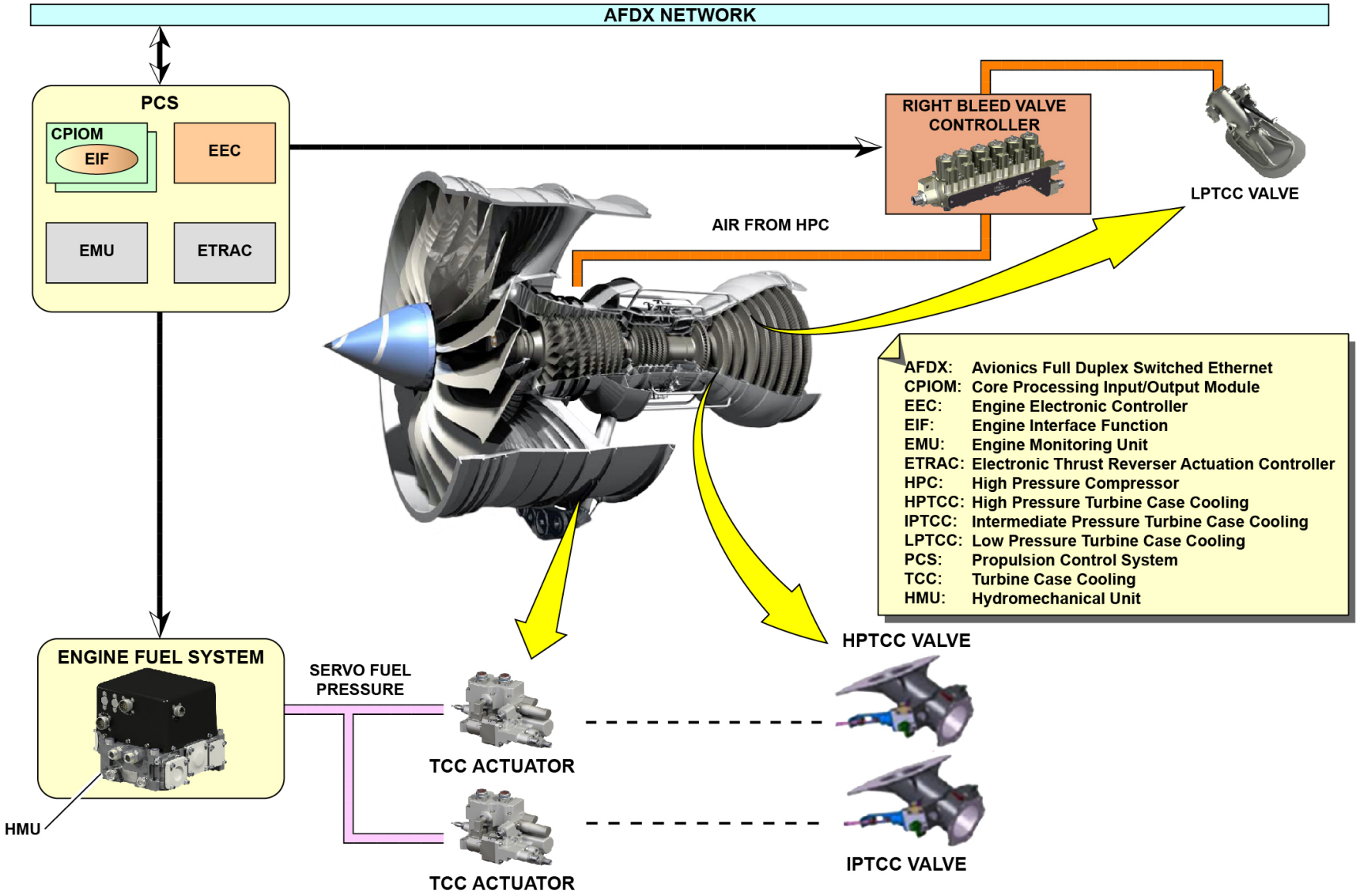
Turbine Case Cooling (TCC):
The TCC system decreases the temperature of the turbine cases. This system controls tip clearance of the LP, HP and IP turbines blades to increase the engine performance. The LPC flow (fan air) supplies the air for the TCC system through three TCC valves. The Low Pressure Turbine Case Cooling (LPTCC) valve is operated through the right bleed valve controller using HPC air pressure. The Intermediate Pressure Turbine Case Cooling (IPTCC) and High Pressure Turbine Case Cooling (HPTCC) valves are operated through the TCC actuators controlled by the HMU.

Location

The TCC valves are on the turbines cooling air manifolds.



COOLING - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION



COOLING - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

V1813401 - V01T0M0 - VM7RP1LEVEL0101

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ENGINE (RR) SYSTEM PRESENTATION (1)

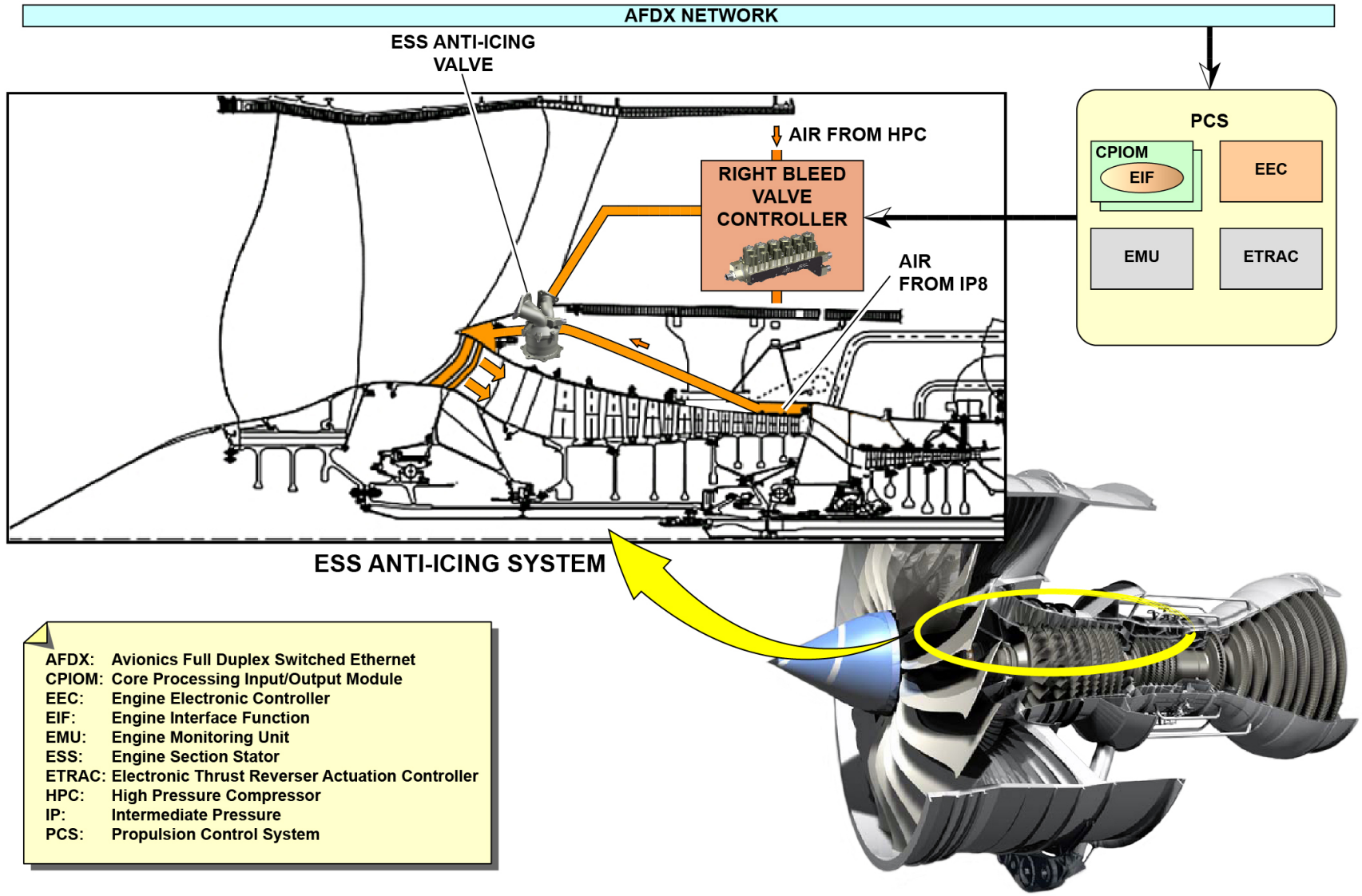
Engine Section Stator Anti-Icing - Presentation

Function/Description

The primary function of the ESS anti-icing system is to prevent ice accretion on the IP compressor stator.
The EEC controls the ESS anti-icing valve to supply hot air from the last (eighth) stage of the IP compressor to the inlet of the IP compressor. The ESS anti-icing valve is operated through the right bleed valve controller using air pressure from the HP compressor.

Location

The ESS anti-icing valve is installed in Zone 2 (IP compressor case).



ENGINE SECTION STATOR ANTI-ICING - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

V1813401 - V01T0M0 - VM7RP1LEVEL0101

ENGINE (RR) SYSTEM PRESENTATION (1)

Ignition - Presentation

Function/Description

The ignition system gives electrical sparks. These sparks are to start the ignition of the fuel/air mixture in the engine combustion chamber. Each engine has two ignition systems. These systems can operate together or independently.
The EIF, hosted on Core Processing Input/Output Modules (CPIOMs), controls the electrical power supply to the ignition units.
The EEC makes the selection of the ignition system to be used.
Each ignition system has:
- One ignition unit
- One igniter plug.

Location

The ignition units are on the left side of the fan case.
The igniter plugs are installed on the combustion chamber.

Interface

The ignition system has interface with the electrical power system. This system has interface with the CDS (engine SD page) through the AFDX network.

Starting - Presentation

Function/Description

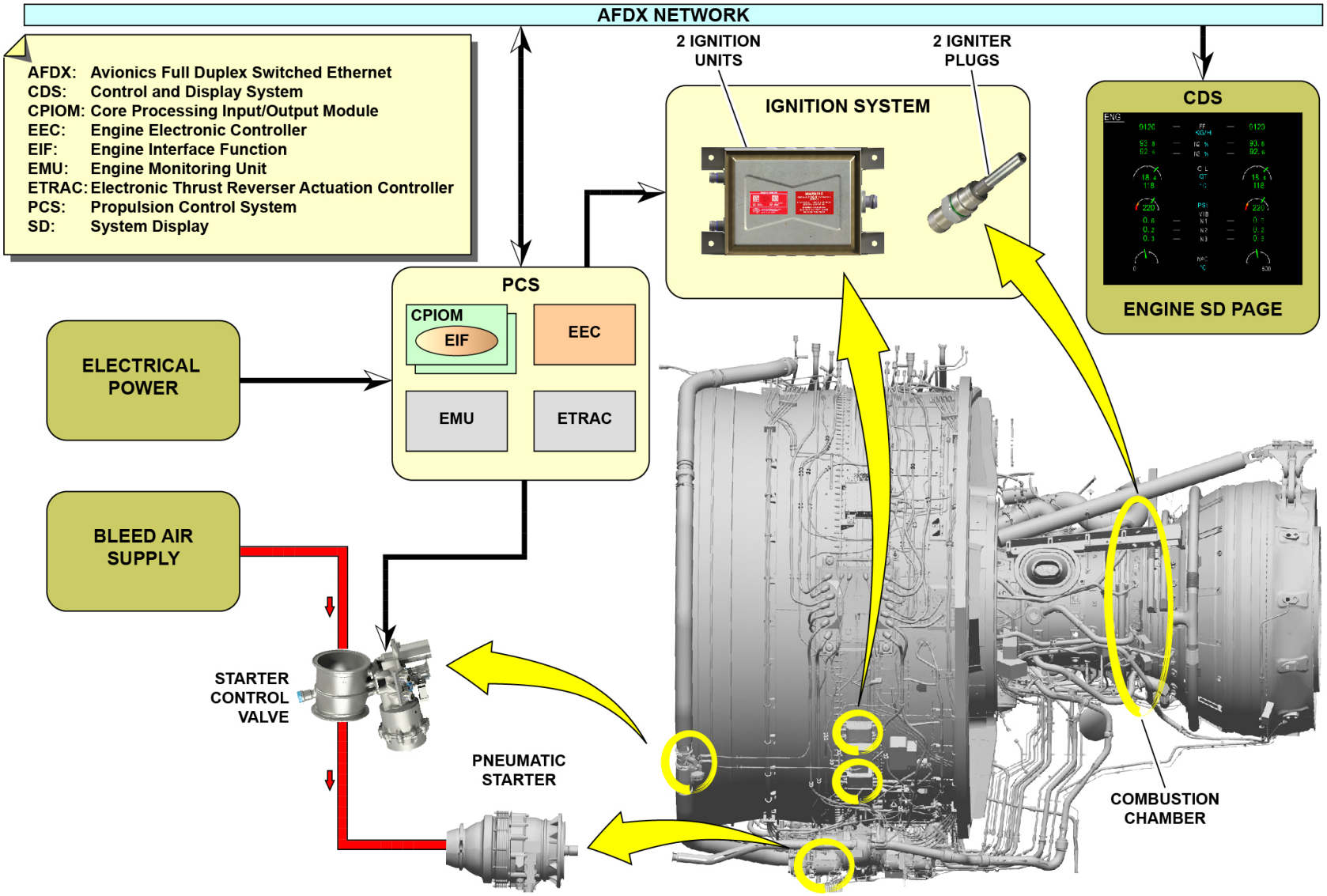
The engine starting system is necessary to start or to crank the engine. The engine uses a pneumatic start system. The system uses pneumatic power to drive an air turbine starter at high speed.
The starter control valve receives the pneumatic power. The EIF, hosted in CPIOMs, sends input to the EEC to control the starter control valve in order to supply air pressure to the pneumatic starter.

Location

The starter control valve is on the bottom of the LH fan case.
The pneumatic starter is on the front side of the gearbox.

Interface

The starting system has an interface with the CDS (engine SD page) through the AFDX network for display in the cockpit. This system has an interface with the pneumatic power system.



IGNITION - PRESENTATION & STARTING - PRESENTATION

ENGINE (RR) SYSTEM PRESENTATION (1)

Oil System - Presentation

Function/Description

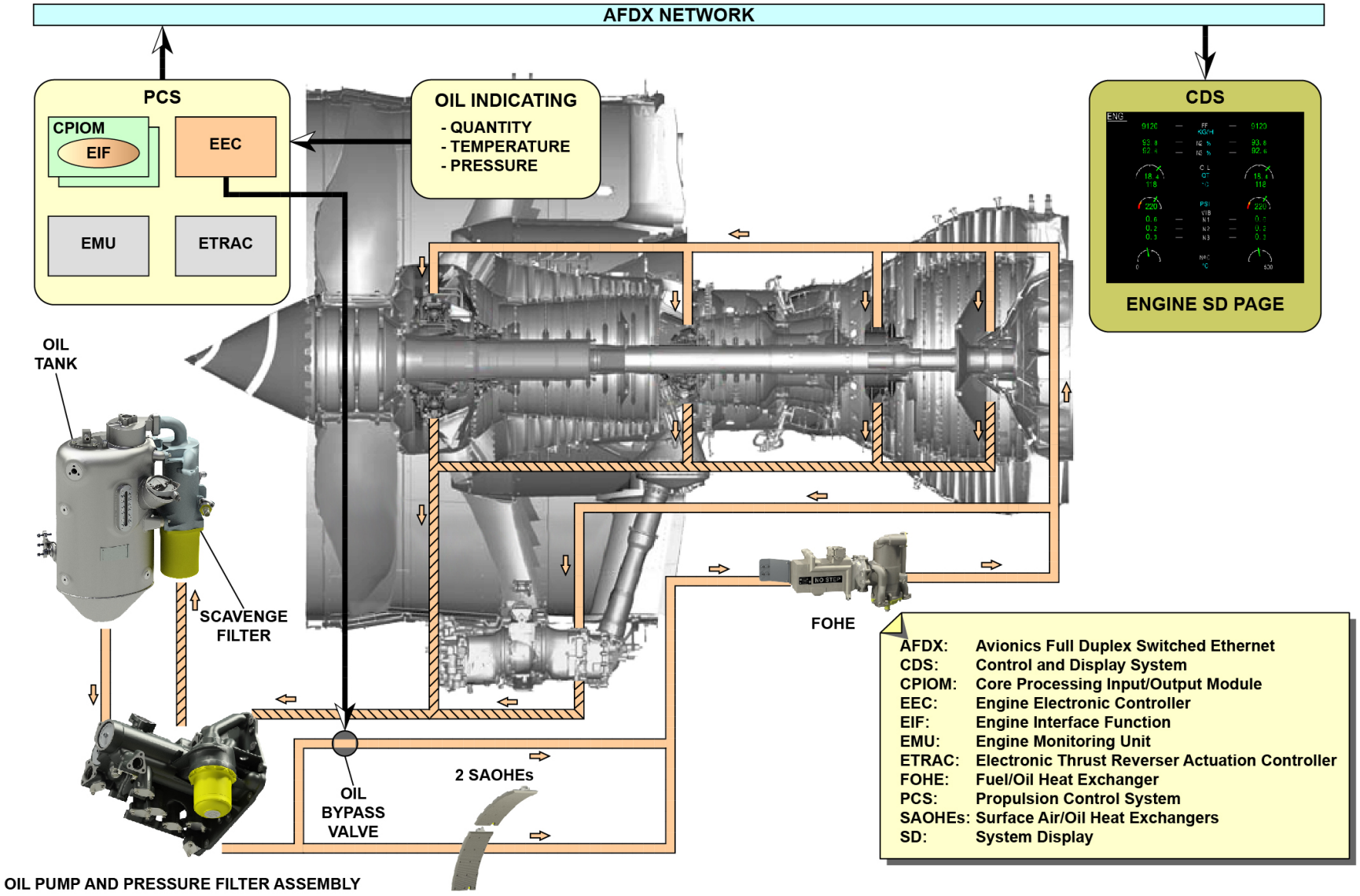
The function of the oil system is to lubricate and supply sufficient oil at a correct temperature and pressure to these engine internal components:
- Drives
- Gears
- Bearings.

The oil distribution system has:
- An oil tank
- A FOHE
- An oil pump and filter housing assembly
- A scavenge filter housing assembly
- Two Surface Air/Oil Heat Exchangers (SAOHEs)
- One oil bypass valve to cool the oil if necessary.

The oil system includes:
- Oil storage
- Oil distribution
- Oil indicating (quantity, pressure and temperature).

Interface

The oil system has an interface with the CDS (engine SD page) through the AFDX network.



OIL SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

V1813401 - V01T0M0 - VM7RP1LEVEL0101

ENGINE (RR) SYSTEM PRESENTATION (1)

Thrust Reverser - Presentation

Function/Description

The T/R with two translating cowls gives more aircraft deceleration during landing or rejected take-off.
The EIF receives the position of the engine throttle control levers and sends deploy/stow order signals to the ETRAC. Then the ETRAC controls the T/R system. Two electric motors operate the translating cowls of the T/R system. Each electric motor drives the three actuators of its translating cowl through the flex synchro shafts.

Location

Two ETRACs are installed in the forward cargo compartment.
The electric motors and actuators are on the T/R structure.

Control and Indicating

The operation of the T/R is shown on the CDS (Engine Display (ED) page). The ED indication in the cockpit shows the T/R status.

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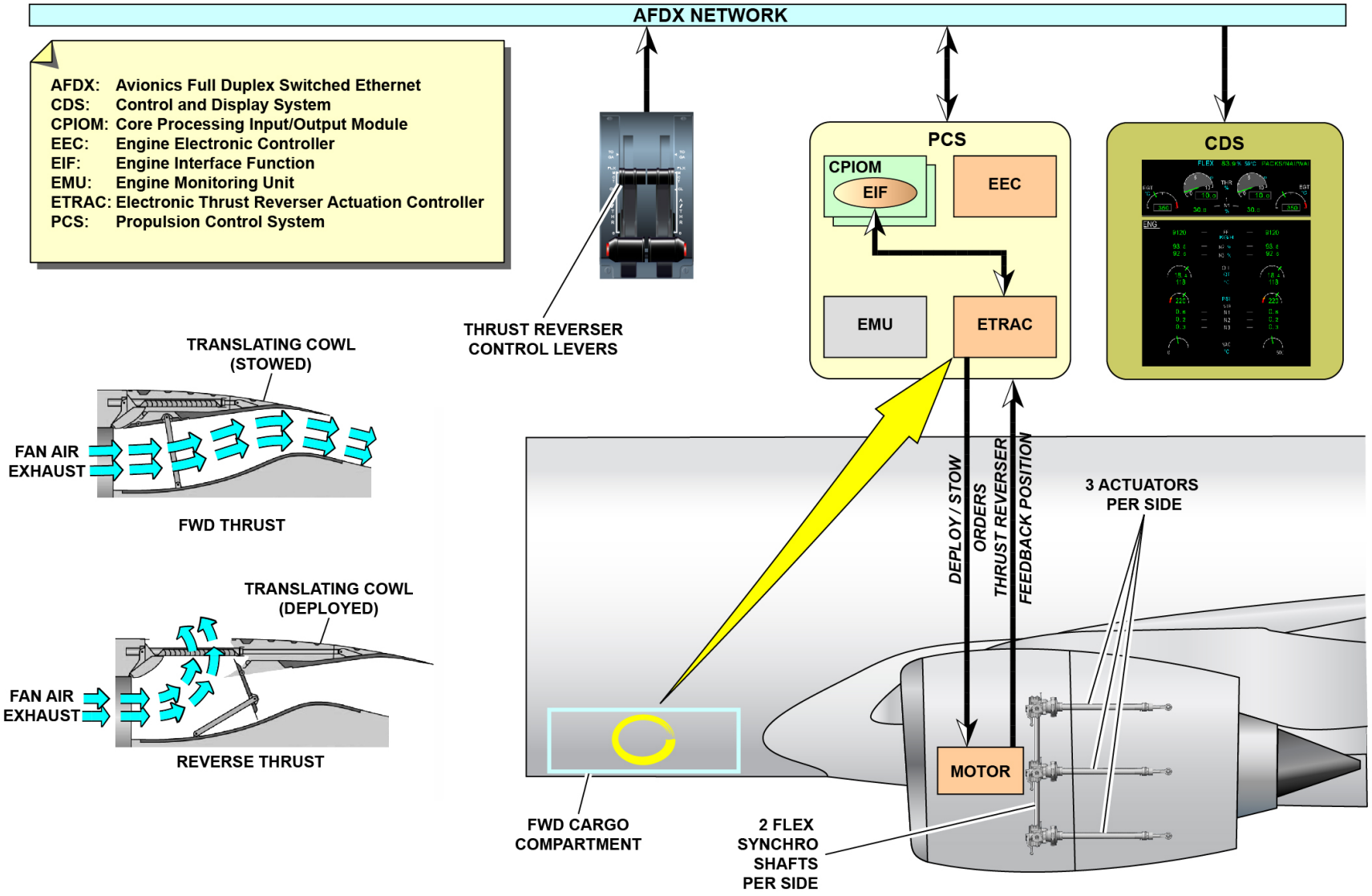

THRUST REVERSER - PRESENTATION - FUNCTION/DESCRIPTION ... CONTROL AND INDICATING

V1813401 - V01T0M0 - VM7RP1LEVEL0101

ENGINE (RR) SYSTEM PRESENTATION (1)

Control and Indicating - Presentation

Engine controls

The engine controls in the cockpit are:
- ENG FADEC GND PWR Pushbutton Switches (P/BSWs) on the Overhead Panel (OHP)
- ENG MAN START P/BSWs on the OHP
- ENG MASTER SWs AND ENGINE START SELECTOR SW on center pedestal
- THROTTLE CONTROL LEVERS and T/R CONTROL LEVERS on center pedestal.

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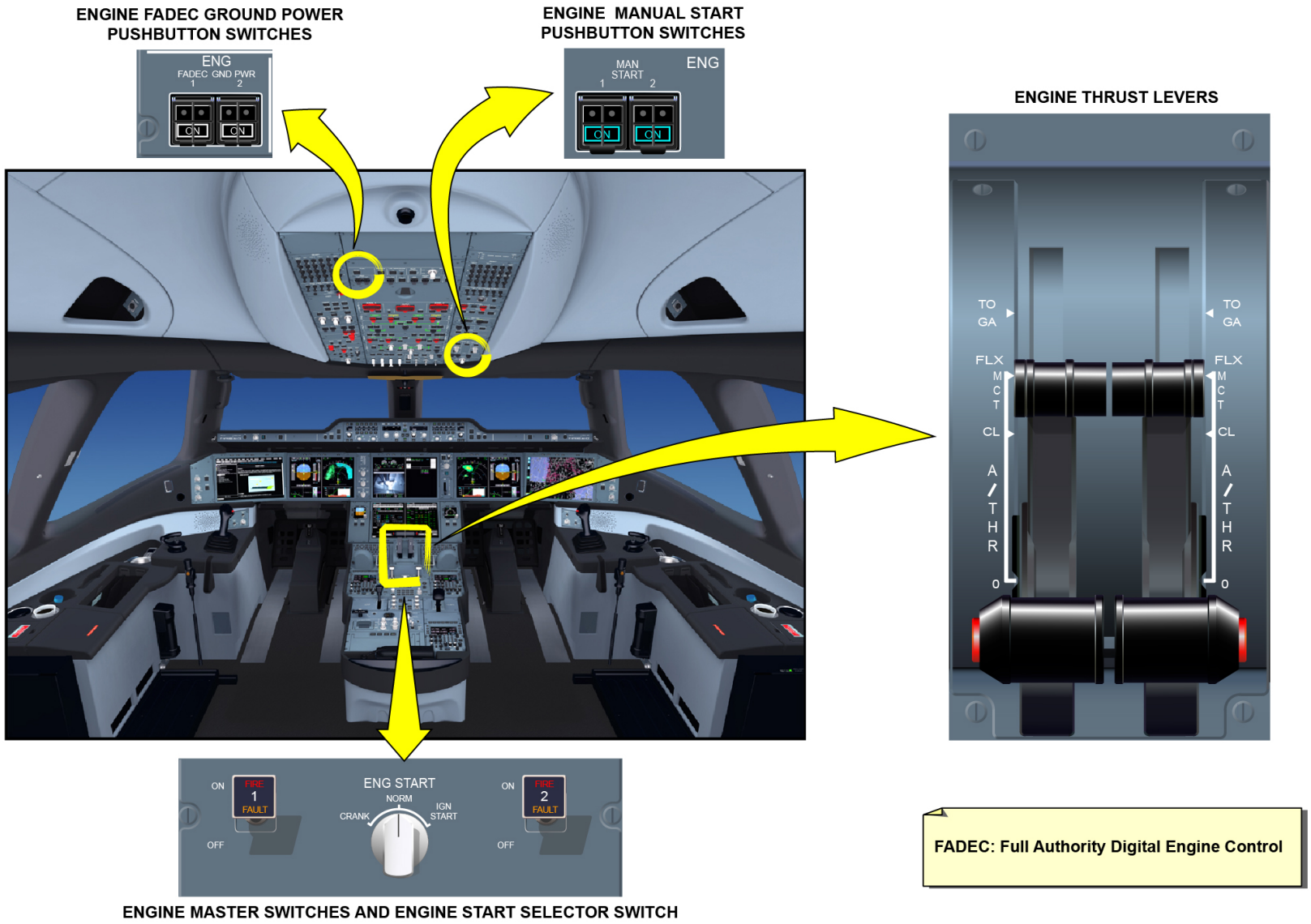

CONTROL AND INDICATING - PRESENTATION - ENGINE CONTROLS

V1813401 - V01T0M0 - VM7RP1LEVEL0101

ENGINE (RR) SYSTEM PRESENTATION (1)

Control and Indicating - Presentation (continued)

Engine indicating

Engine indicating has primary and secondary parameters.
The primary engine parameters that follow are shown on the ED:
- THR (%): Percentage of thrust versus the maximum available thrust
- N1 (%): LP shaft speed
- EGT (°C): Exhaust Gas Temperature.

The secondary engine parameters that follow are shown on the SD:
- N2 (%): IP shaft speed
- N3 (%): HP shaft speed
- FF (KG/H or LBS/H): Fuel flow
- Oil system
- Engine vibration for LP/IP/HP shafts (N1, N2 and N3)
- Nacelle temperature (°C) or ignition/start parameters.

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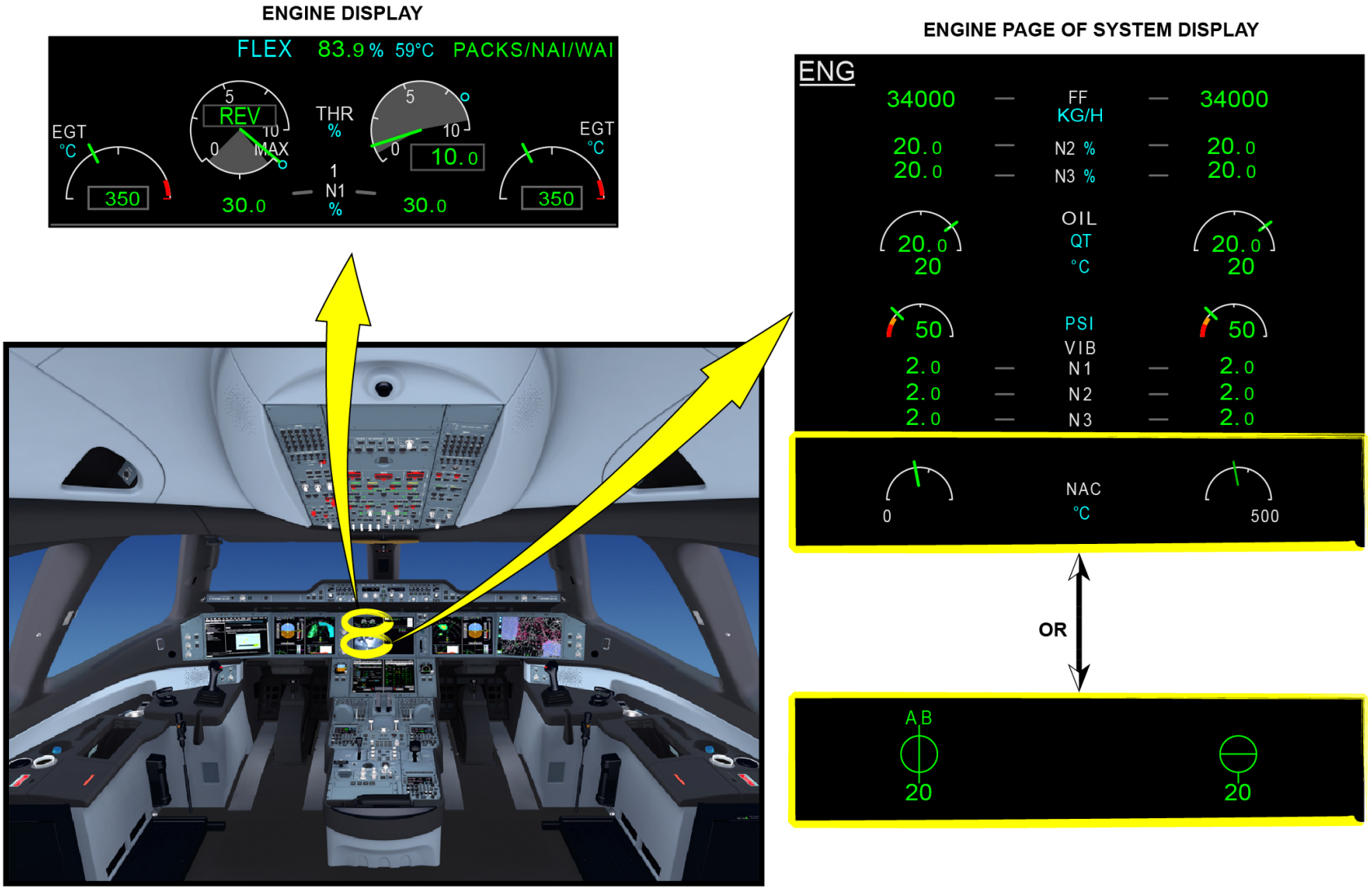


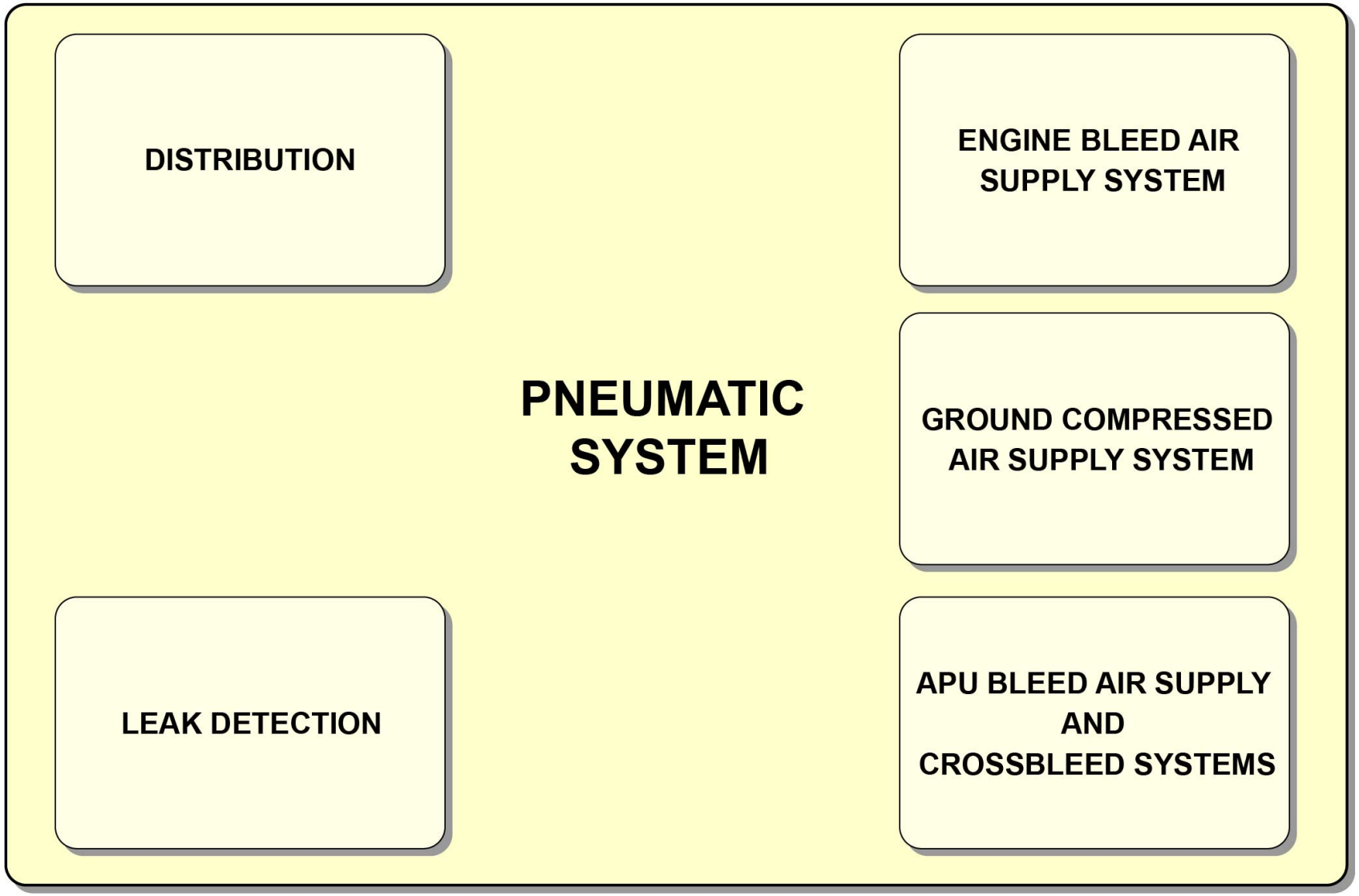
CONTROL AND INDICATING - PRESENTATION - ENGINE INDICATING

PNEUMATIC SYSTEM PRESENTATION (1)

Overview

The function of the pneumatic system is to supply compressed air from the pneumatic air sources through ducts to the users.
The pneumatic system is monitored for leaks, pressure and temperature.
General familiarization training for this system focuses on:
- The distribution system
- The engine bleed-air supply system
- The ground compressed air supply system
- The Auxiliary Power Unit (APU) bleed-air supply and cross bleed systems
- The leak detection.

V1813401 - V01T0M0 - VM36P1LEVEL0101


DISTRIBUTION
ENGINE BLEED AIR SUPPLY SYSTEM
PNEUMATIC SYSTEM
GROUND COMPRESSED AIR SUPPLY SYSTEM
LEAK DETECTION
APU BLEED AIR SUPPLY AND CROSSBLEED SYSTEMS

OVERVIEW

PNEUMATIC SYSTEM PRESENTATION (1)

Distribution - Presentation

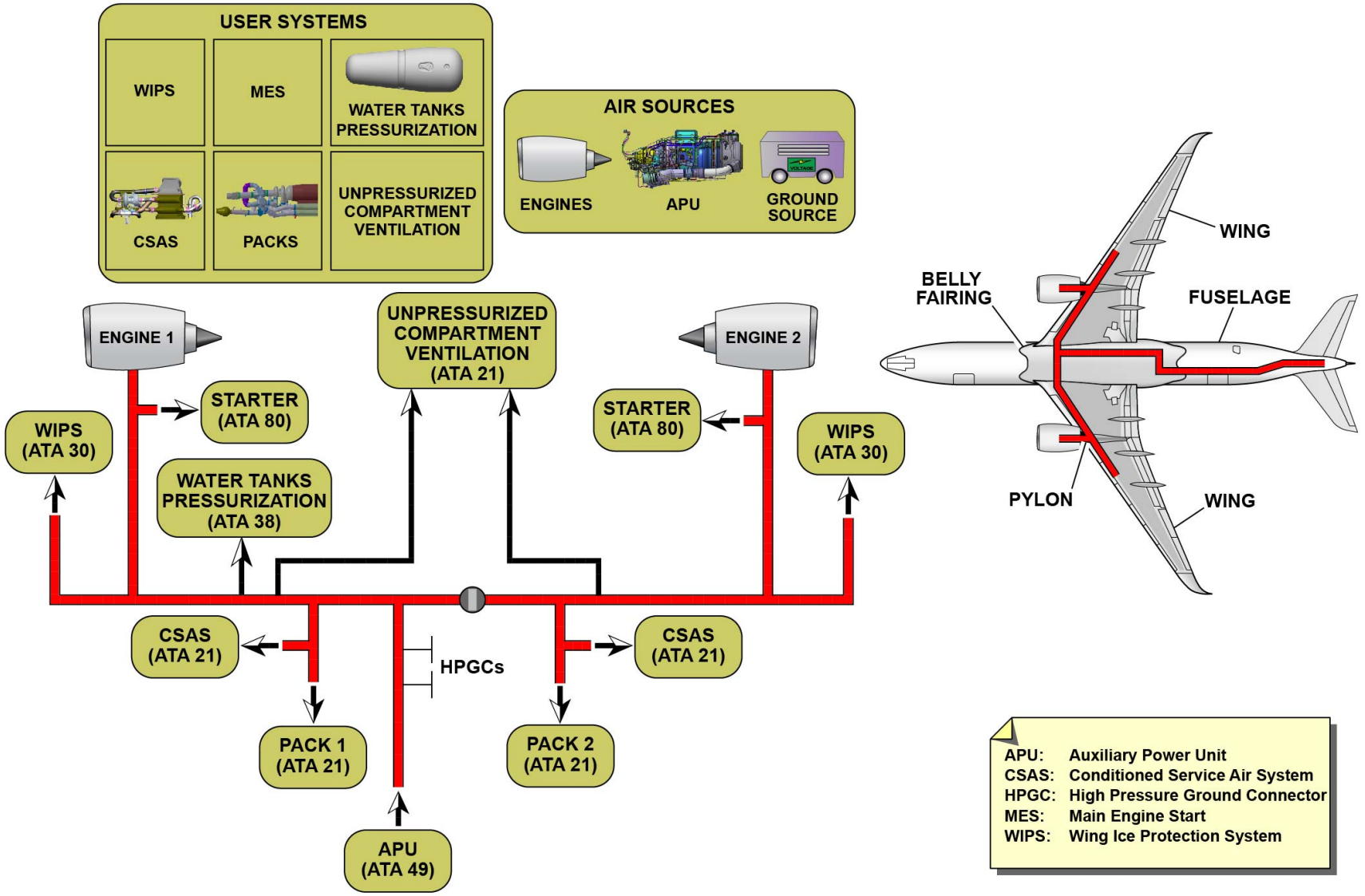
Function/Description

The distribution system has ducts that collect compressed air from the different pneumatic air sources and supply the compressed air to the aircraft users.
The pneumatic air sources are:
- The two engines
- The APU
- The ground air source (through two high-pressure ground connectors).

The pneumatic users are:
- The packs, which are the heaviest consumers
- The unpressurized compartment ventilation system
- The Conditioned Service Air System (CSAS)
- The Wing Ice Protection System (WIPS)
- The water tanks pressurization system
- The Main Engine Start (MES).

Location

The pneumatic bleed-air ducts and valves are installed in the wings, the belly fairing, the fuselage, the nacelles and the pylons.



DISTRIBUTION - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

V1813401 - V01T0M0 - VM36P1LEVEL0101

PNEUMATIC SYSTEM PRESENTATION (1)

Engine Bleed-Air Supply System - Presentation

Function/Description

The function of the Engine Bleed-Air Supply System, referred to as the Engine Bleed Air System (EBAS), is to supply the users with pressurized and temperature controlled air from the engines.
Two Core Processing Input/Output Modules (CPIOMs) host a Bleed Air System (BAS) application. The BAS application controls the EBAS through the Avionics Full Duplex Switched Ethernet (AFDX):
- High Pressure (HP) / Intermediate Pressure (IP) bleed port selection (the feedbacks of the pressure sensors and the bleed demand control the HP bleed Valve (HPV) through the remote servo). HPV is open at engine low rating, when it is open, the Intermediate Pressure Check Valve (IPCV) is closed to prevent airflow back into the engine.
- Engine bleed-air pressure regulation (the pressure sensor feedback controls the Manifold Pressure Valve (MPV) through the remote servo to get the bleed demand)
- Engine bleed-air temperature regulation (the temperature sensor feedback controls the Fan Air Valve (FAV) through the remote servo to modulate the fan airflow through the Precooler (PCE))
- The Overpressure Shut-off Valve (OPSOV) control (in closed position, to prevent overpressure in the system).

Location

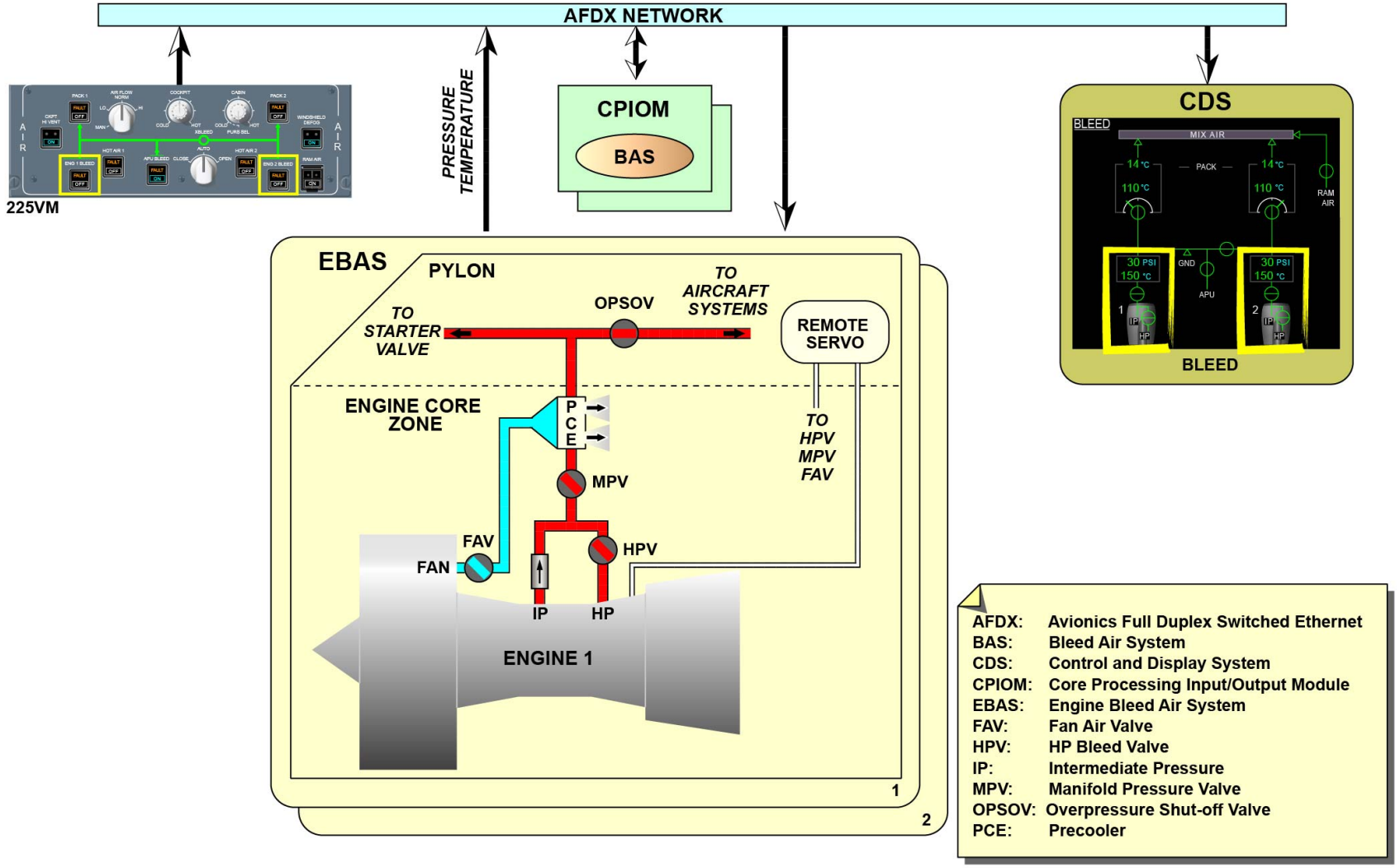
The HPV, the MPV, the FAV and the PCE are in the engine core zone.
The OPSOV is in the pylon zone, downstream of the PCE.

Interface

The EBAS has an interface with the Control and Display System (CDS) through the AFDX.

Control and Indicating

The main controls of the EBAS are the ENG 1 BLEED and ENG 2 BLEED pushbutton switches. They are on the AIR section of the overhead panel.
The main indications of the pneumatic system are on the BLEED page of the CDS.



ENGINE BLEED-AIR SUPPLY SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION ... CONTROL AND INDICATING

PNEUMATIC SYSTEM PRESENTATION (1)

Ground Compressed Air Supply System - Presentation

Function/Description

The ground compressed air supply system supplies compressed air to the pneumatic users on ground. For this, it is necessary to connect air ground carts to the High Pressure Ground Connectors (HPGCs). The HPGCs are installed on the left side of the cross bleed ducts.

Location

The ground compressed air supply system has two HPGCs in the belly fairing.

APU Bleed-Air Supply and Cross Bleed Systems - Presentation

Function/Description

The APU bleed-air supply and cross bleed system, referred to as the Pneumatic Air Distribution System (PADS), supplies the users with air from the APU load compressor. The APU bleed duct is connected to the left side of the cross bleed valve. The APU check valve is part of the APU bleed duct and prevents the airflow back into the APU.
The bleed air from the APU supplies the users through the pneumatic manifold.
The PADS supplies the bleed air from the engine, the APU or the ground cart to the users and isolates or connects the Left Hand (LH) and Right Hand (RH) sections of the pneumatic manifold.
The cross bleed valve and the APU bleed valve are controlled from the AIR panel.
In AUTO mode, the BAS application on the CPIOMs controls the cross bleed valve through the Bleed and Overheat Monitoring Units (BOMUs).
In manual mode, the BOMUs controls the cross bleed valve from the Integrated Control Panel (ICP).

Location

The BOMUs are installed in the avionics compartment.
The cross bleed valve is installed in the belly fairing.

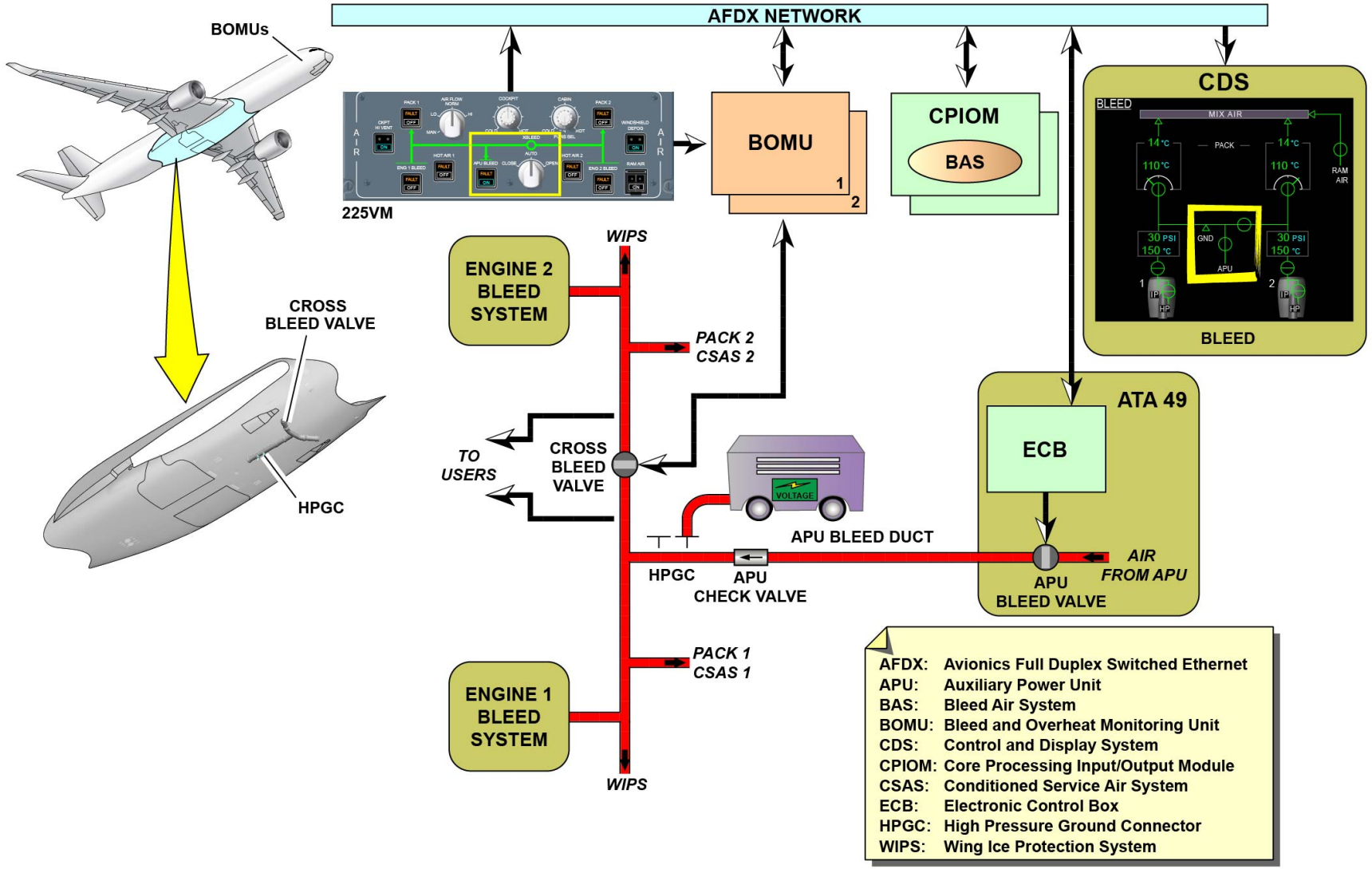
Interface

The BAS application on the CPIOMs has an interface with the Electronic Control Box (ECB) through the AFDX. The ECB sends open signals to the APU bleed valve.

Control and Indicating

The PADS controls are on the AIR panel. The main indications of the PADS are on the BLEED page of the CDS.

V1813401 - V01T0M0 - VM36P1LEVEL0101



GROUND COMPRESSED AIR SUPPLY SYSTEM - PRESENTATION & APU BLEED-AIR SUPPLY AND CROSS BLEED SYSTEMS - PRESENTATION

PNEUMATIC SYSTEM PRESENTATION (1)

Leak Detection - Presentation

Function/Description

The leak detection system senses overheat and sends closure commands to the related systems to prevent structural damage.
The OverHeat Detection System (OHDS) monitors the sensing elements in a dual loop configuration (loop A and loop B). The sensing elements are installed along the ducts that supply the hot pressurized air.
The loops are connected to the BOMUs. The BOMUs send data to the CPIOMs OHDS application through the AFDX.
The OHDS is a software application on the CPIOMs.
The OHDS sends a warning to the crew when it senses overheat and sends a signal to the AFDX to isolate the leak.

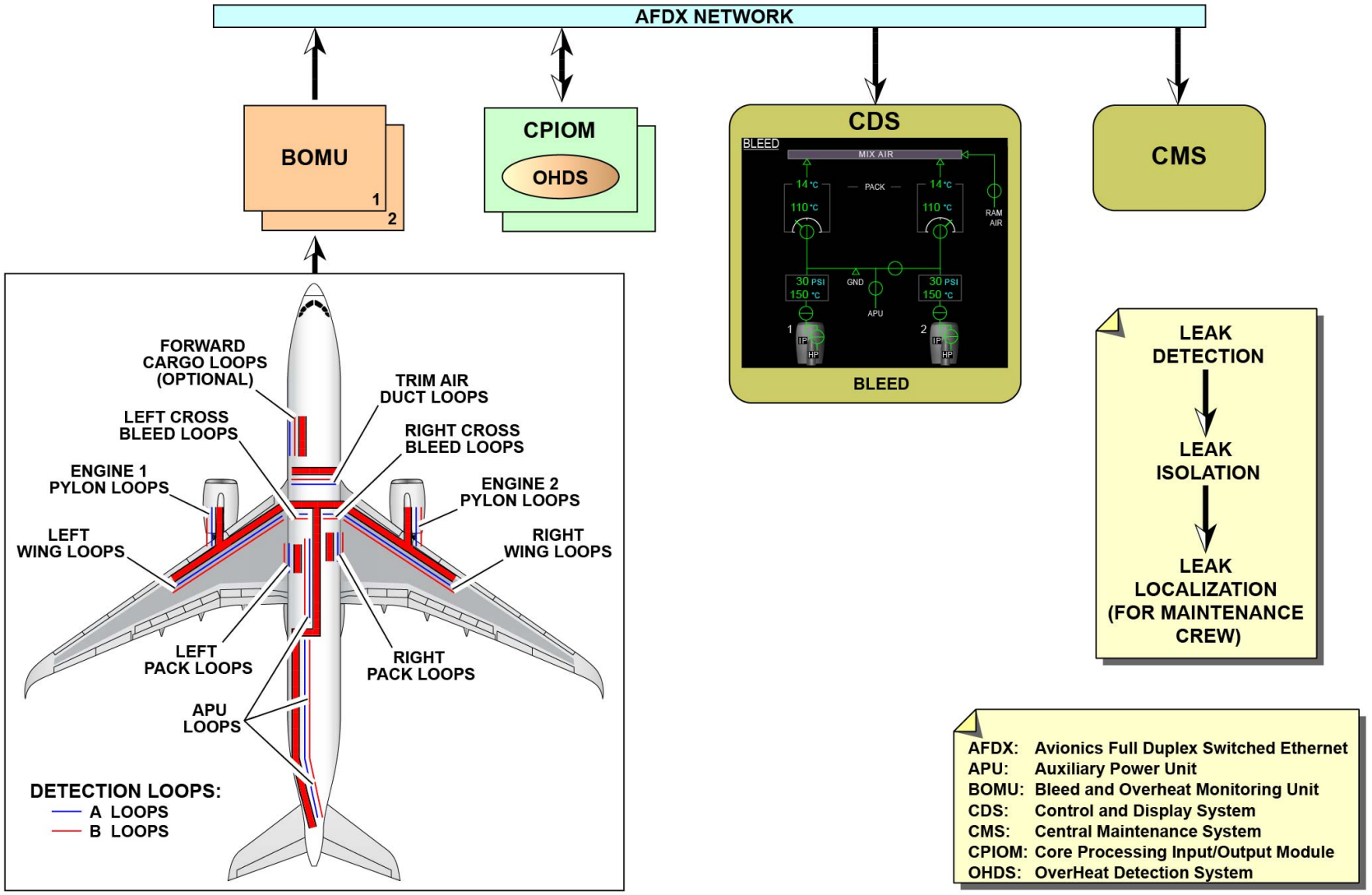
Location

The sensing elements are on and along:
- The engine pylons
- The wing bleed ducts
- The packs and trim air ducts
- The cross bleed ducts
- The APU bleed ducts
- The forward cargo heating ducts (optional).

Interface

The OHDS has an interface with the CDS to show the leak isolation and with the Onboard Maintenance System (OMS) for leak localization.

V1813401 - V01T0M0 - VM36P1LEVEL0101



LEAK DETECTION - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

V1813401 - V01T0M0 - VM36P1LEVEL0101

PNEUMATIC SYSTEM PRESENTATION (1)

Maintenance

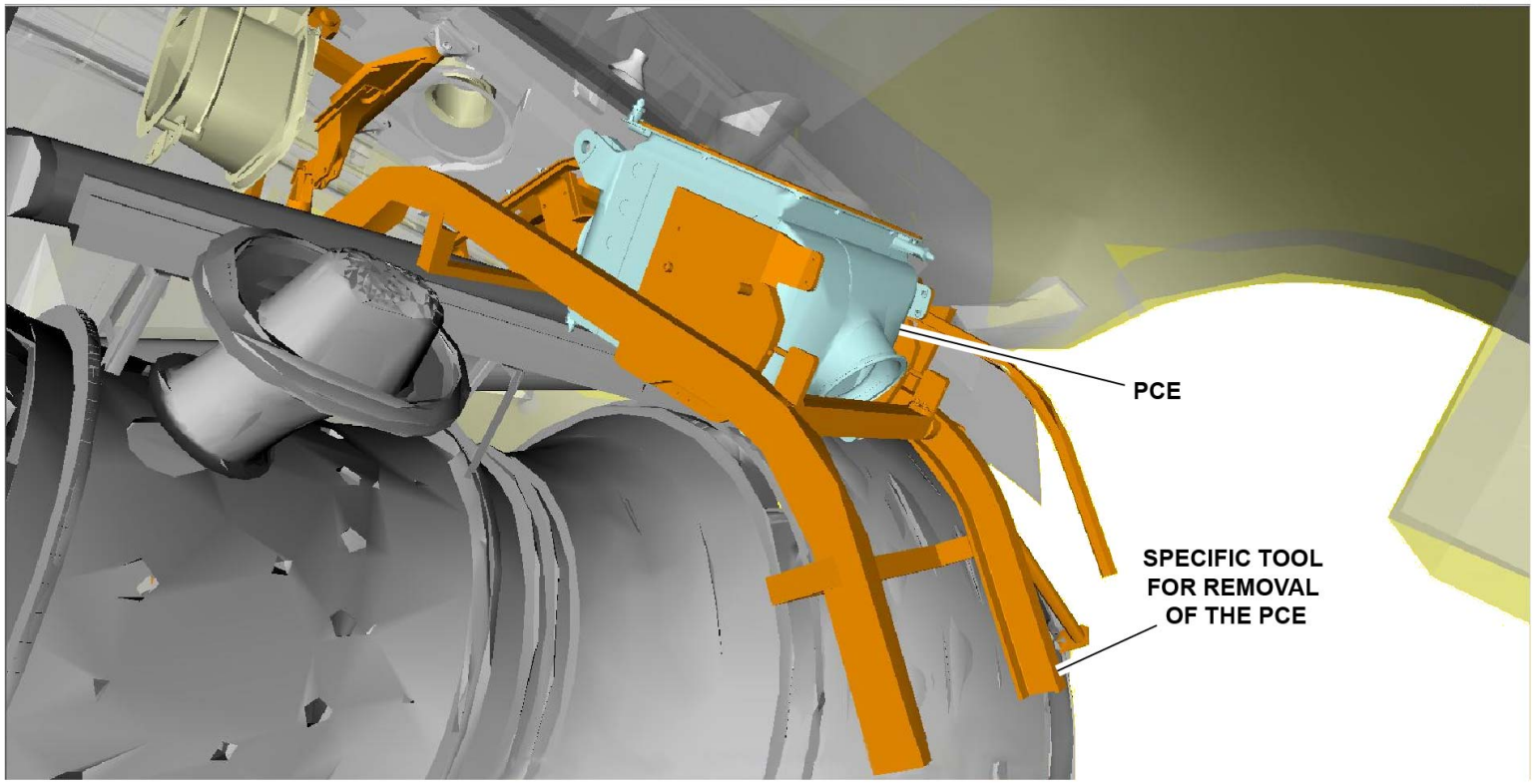
Safety Precautions

WARNING: BE CAREFUL WHEN YOU REMOVE OR INSTALL THIS EQUIPMENT. THIS EQUIPMENT IS HEAVY (MORE THAN 12 KG (26.5 lb)) AND CAN CAUSE INJURY AND/OR DAMAGE.

Tools

There is a specific tool to remove the PCE from the engine core zone.

V1813401 - V01T0M0 - VM36P1LEVEL0101

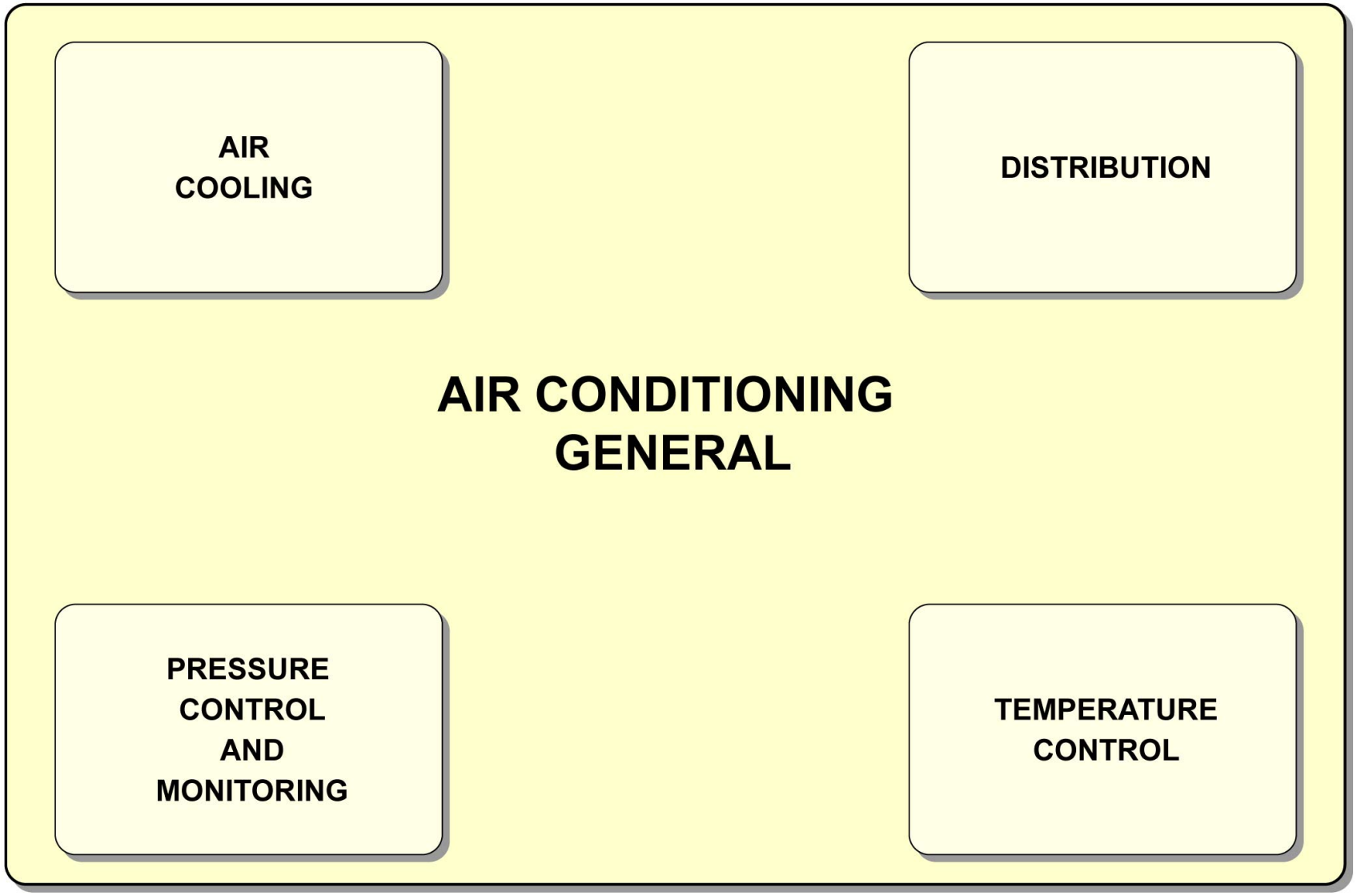


MAINTENANCE - SAFETY PRECAUTIONS & TOOLS

AIR CONDITIONING SYSTEM PRESENTATION (1)

Overview

The air conditioning system supplies clean air, adjusts the temperature and controls the air pressure to give a safe and comfortable environment for the passengers, crew and cargo.
General familiarization training for this system focuses on:
- The air cooling system
- The distribution system
- The temperature control system
- The pressure control and monitoring system.


AIR
COOLING
DISTRIBUTION
AIR CONDITIONING
GENERAL
PRESSURE
CONTROL
AND
MONITORING
TEMPERATURE
CONTROL

OVERVIEW

AIR CONDITIONING SYSTEM PRESENTATION (1)

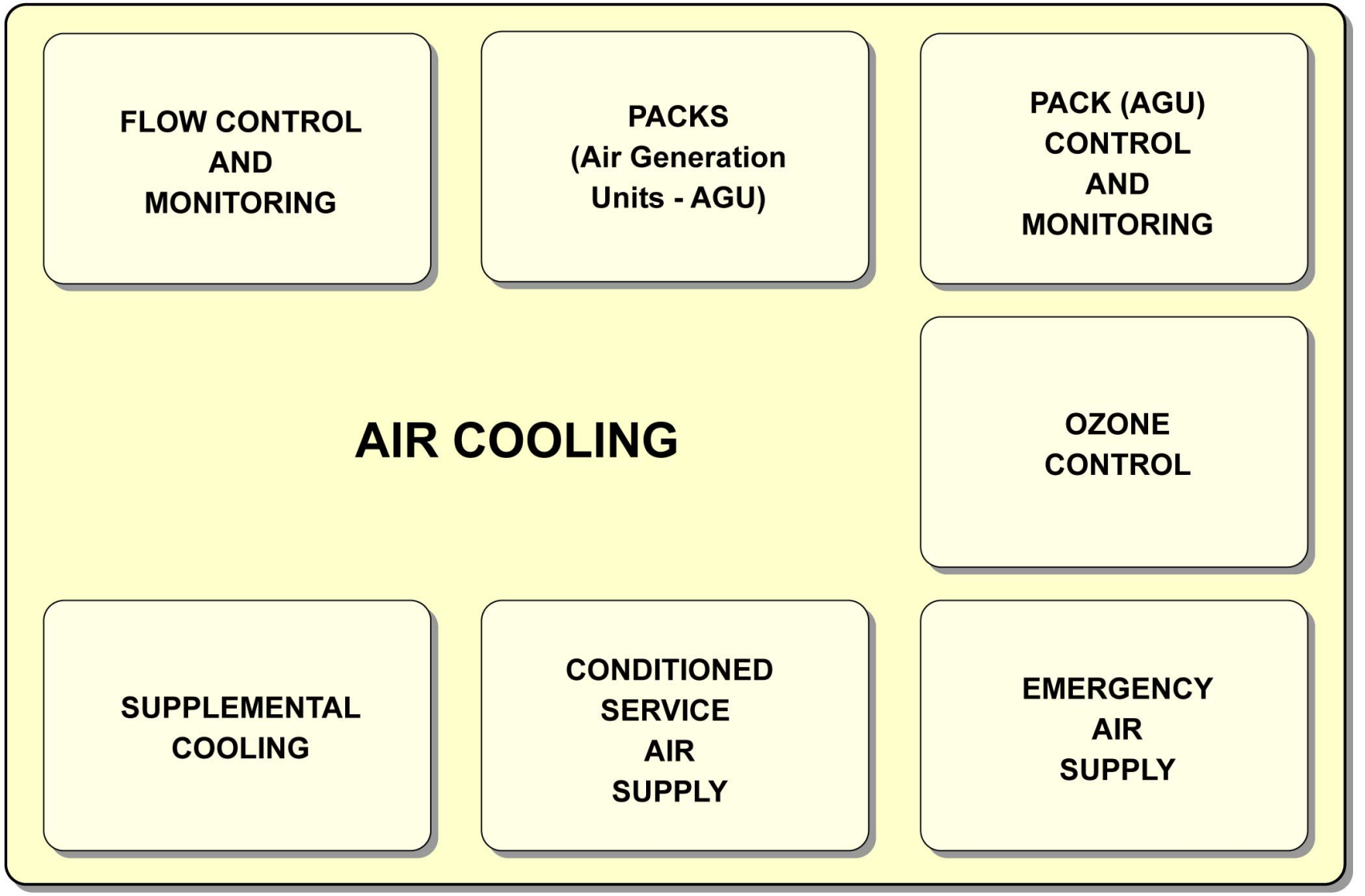
Air Cooling System - Presentation

Function/Description

The air cooling system includes:
- The flow control and monitoring system
- The packs (Air Generation Units - AGUs)
- The pack control and monitoring system
- The ozone control system
- The emergency air-supply system
- The conditioned service air supply-system
- The supplemental cooling system.

The air cooling system supplies cool and fresh air to the passengers, crew, food storage areas, equipment cooling and Fuel Tank Inerting System (FTIS).

V1813401 - V01T0M0 - VM21P1LEVEL0101



AIR COOLING SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION

AIR CONDITIONING SYSTEM PRESENTATION (1)

Air Cooling - Ozone Control - Presentation

Function/Description

The ozone control system decreases the concentration of ozone in the hot bleed air.
An ozone converter uses a catalytic process to decrease the level of ozone in the bleed air before it flows to the FCVs.

Interface

The ozone control system has interfaces with the bleed air ducts (ATA 36).

Air Cooling - Flow Control and Monitoring - Presentation

Function/Description

The flow control and monitoring system adjusts the quantity of bleed air that flows to the packs and the trim air system.
Each pack has two Flow Control Valves (FCVs) that are installed in parallel. When the pack pushbutton switches are pushed, the Air Systems Control Units (ASCUs) and the Air Conditioning System (ACS) applications on the Core Processing Input/Output Modules (CPIOMs) control and monitor the FCVs.

Interface

The flow control and monitoring system has an interface with the BLEED page on the Control and Display System (CDS) through the Avionics Full Duplex Switched Ethernet (AFDX) network.

Air Cooling - Packs (Air Generation Units - AGUs) - Presentation

Function/Description

The Air Generation Units (AGUs), referred to as the packs, supply cool air to the cockpit, cabin and cargo compartments.
Each of the two packs has an Air Cycle Machine (ACM), a water extractor system and a heat exchanger assembly. Each pack gets bleed air through the FCVs. The packs decrease the temperature of the bleed air and send this air through the premixers to the mixer.

Interface

The packs have interfaces with the bleed air system (ATA 36) and the Conditioned Service Air Supply (CSAS) system.

Air Cooling - Pack Control and Monitoring - Presentation

Function/Description

The pack control and monitoring system controls and monitors the pack temperature to supply air at the set temperature.
There is one ASCU for each pack. The ASCUs and their related CPIOM ACS applications control and monitor the packs.

Interface

The pack control and monitoring system has an interface with the CDS through the AFDX network for the visual indication of the packs on the BLEED page.

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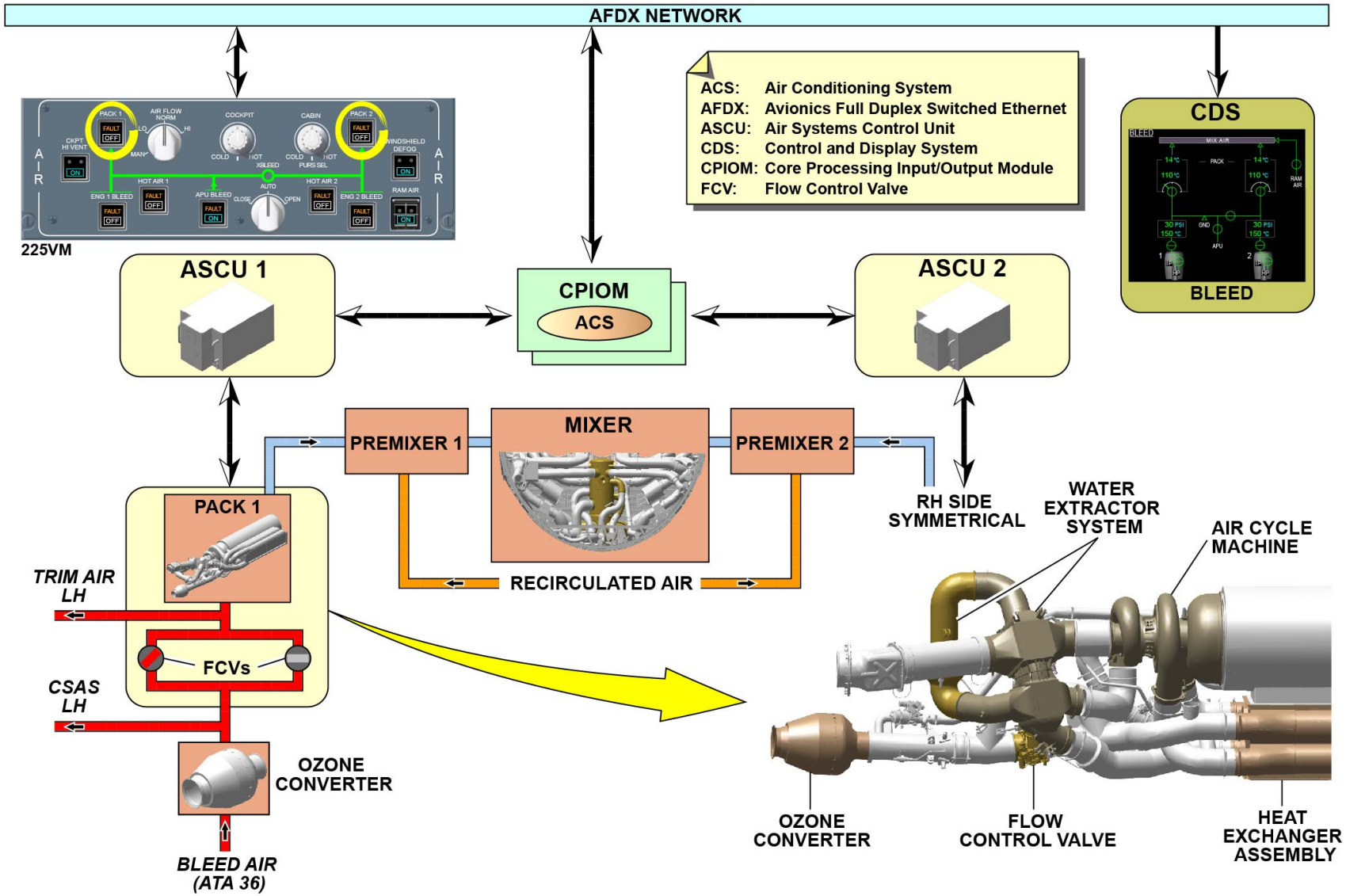

AIR COOLING - OZONE CONTROL - PRESENTATION ... AIR COOLING - PACK CONTROL AND MONITORING - PRESENTATION

V1813401 - V01T0M0 - VM21P1LEVEL0101

AIR CONDITIONING SYSTEM PRESENTATION (1)

Air Cooling - Ozone Control - Presentation

Location

There is one ozone converter in each pack bay.

Air Cooling - Flow Control and Monitoring - Presentation

Location

There are two FCVs for each pack. They are installed on each side of the forward belly fairing.
There are two ASCUs. They are installed in the forward cargo compartment.

Air Cooling - Packs (Air Generation Units - AGUs) - Presentation

Location

There are two packs. They are installed on each side of the forward belly fairing.

Air Cooling - Pack Control and Monitoring - Presentation

Location

There are two ASCUs. They are installed in the forward cargo compartment.

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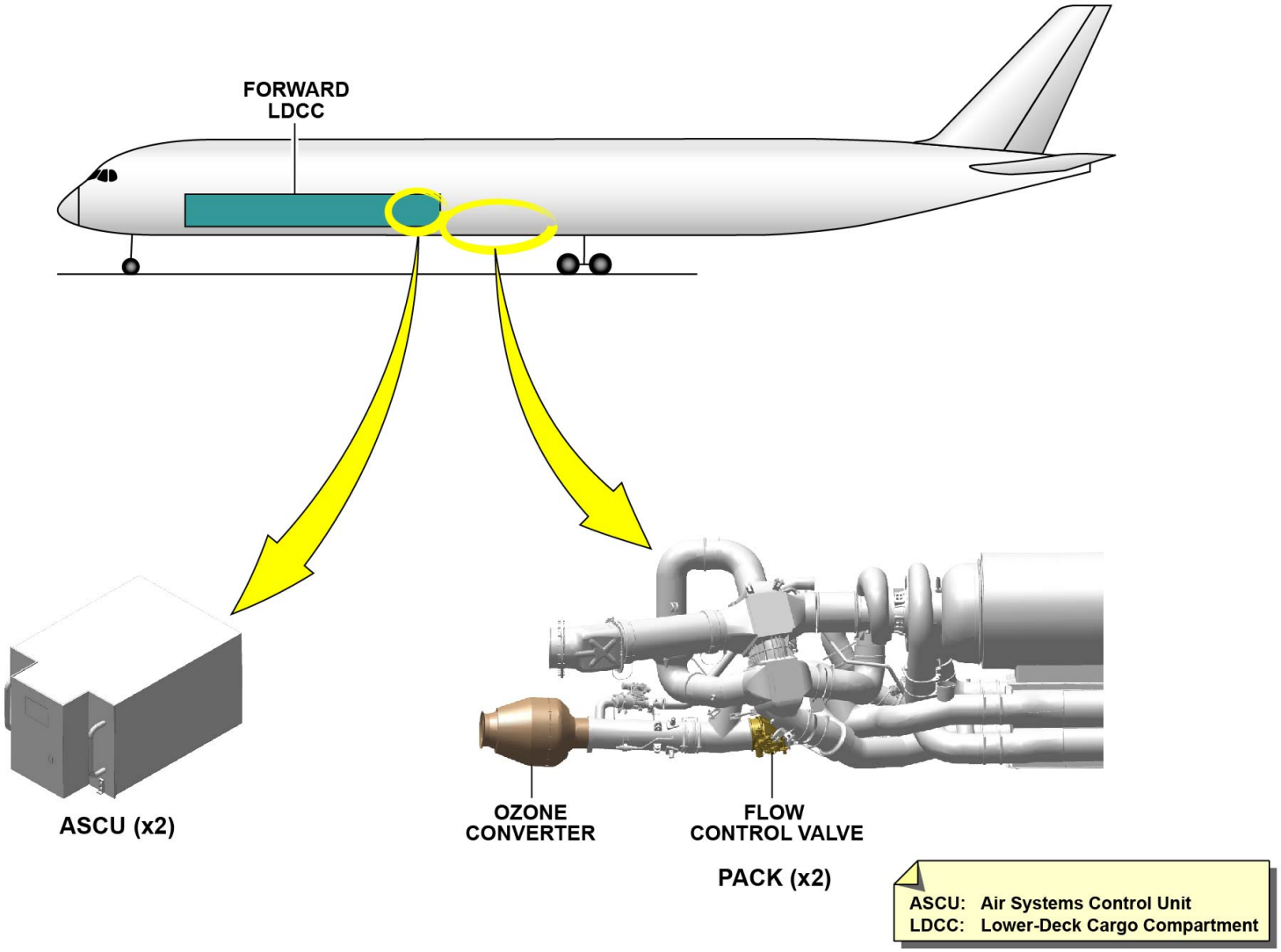

AIR COOLING - OZONE CONTROL - PRESENTATION ... AIR COOLING - PACK CONTROL AND MONITORING - PRESENTATION

AIR CONDITIONING SYSTEM PRESENTATION (1)

Air Cooling - Emergency Air Supply - Presentation

Function/Description

The emergency air-supply system supplies air to the mixer if the two packs are unserviceable.
In flight, it supplies external ram air to the mixer.
It is possible to control the emergency ram-air inlet manually from the AIR panel in the cockpit. The Cabin Pressure Control System (CPCS) applications monitor the system and can also automatically control it.
When the aircraft is on the ground, the air supply comes from ground carts.
A maximum of two LP ground carts can be connected to the related LP ground connectors.

Location

There are two LP ground connectors and there is one Emergency Ram Air Inlet (ERAI) system. They are installed in the forward belly fairing.

Interface

The emergency air-supply system has interfaces with the CDS through the AFDX network.

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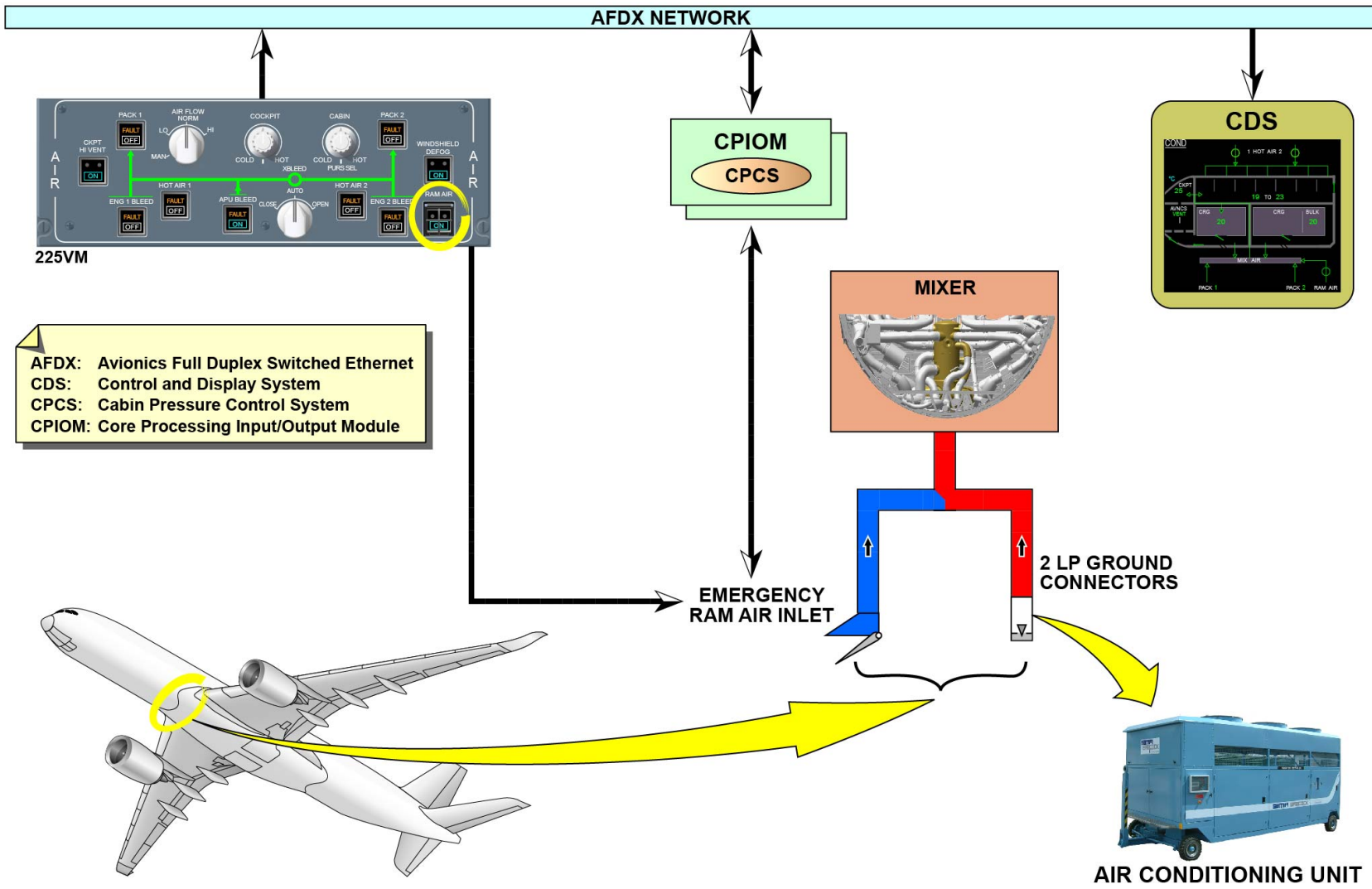

AIR COOLING - EMERGENCY AIR SUPPLY - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

AIR CONDITIONING SYSTEM PRESENTATION (1)

Air Cooling - Conditioned Service Air Supply - Presentation

Function/Description

The Conditioned Service Air System (CSAS) supplies bleed air to the Inert Gas Generating System (IGGS).
A turbo compressor and a heat exchanger control the pressure and temperature of the bleed air that is supplied to the IGGS.
Two CSAS are installed symmetrically. Each system operates automatically in flight. The related ASCU and the CPIOM ACS applications control and monitor the two systems.

Location

There are two CSASs. They are installed on each side of the forward belly fairing.

Interface

The CSAS have interfaces with the Integrated Modular Avionics (IMA) IGGS applications of the CPIOM, the IGGS and the bleed air system.

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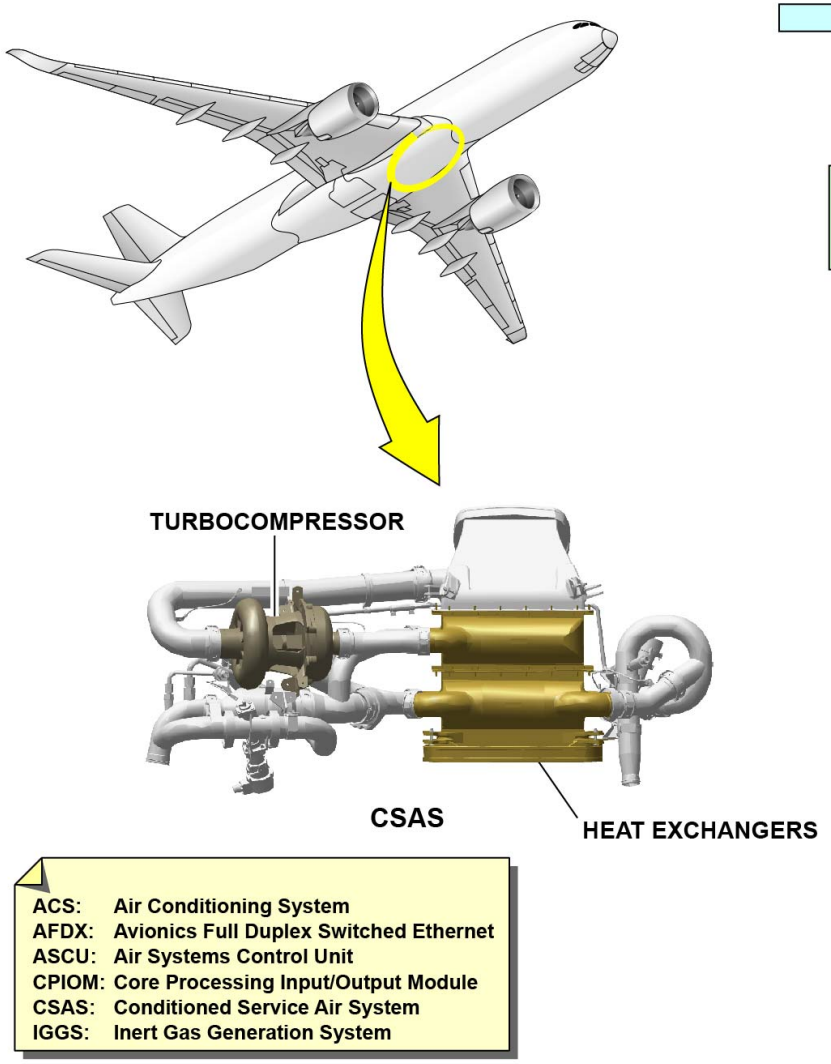
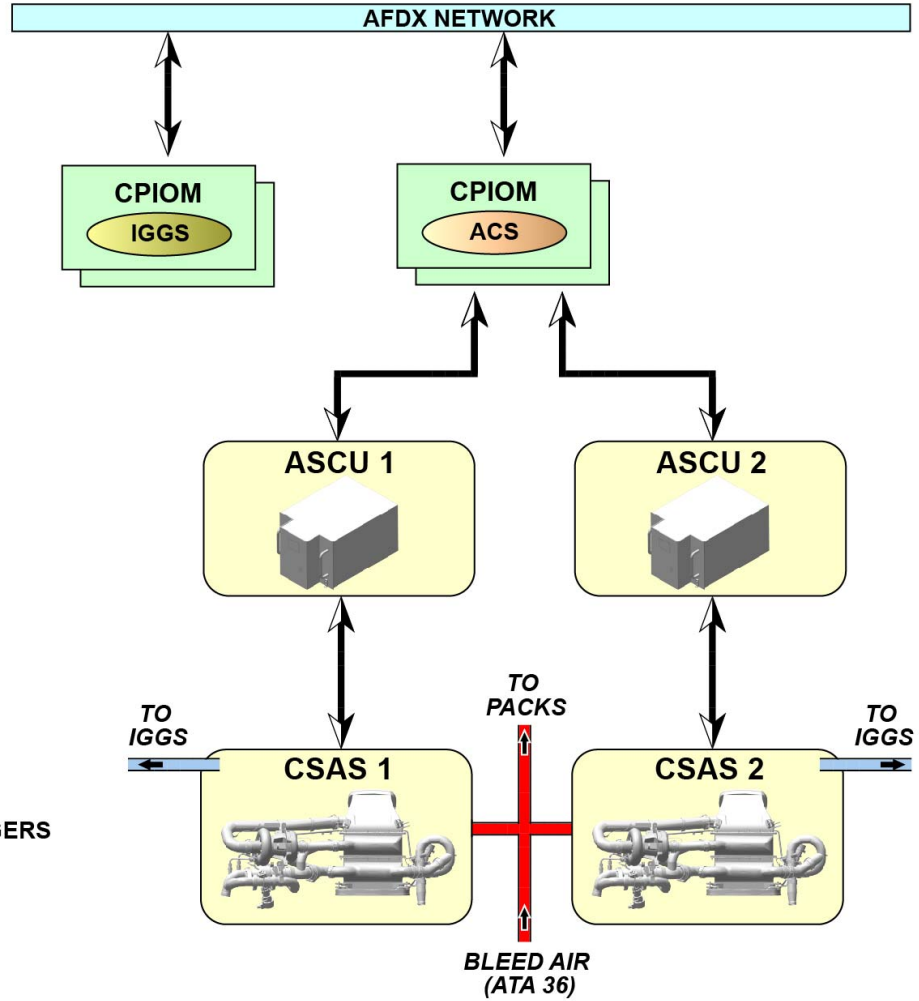




AIR COOLING - CONDITIONED SERVICE AIR SUPPLY - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

AIR CONDITIONING SYSTEM PRESENTATION (1)

Air Cooling - Supplemental Cooling - Presentation

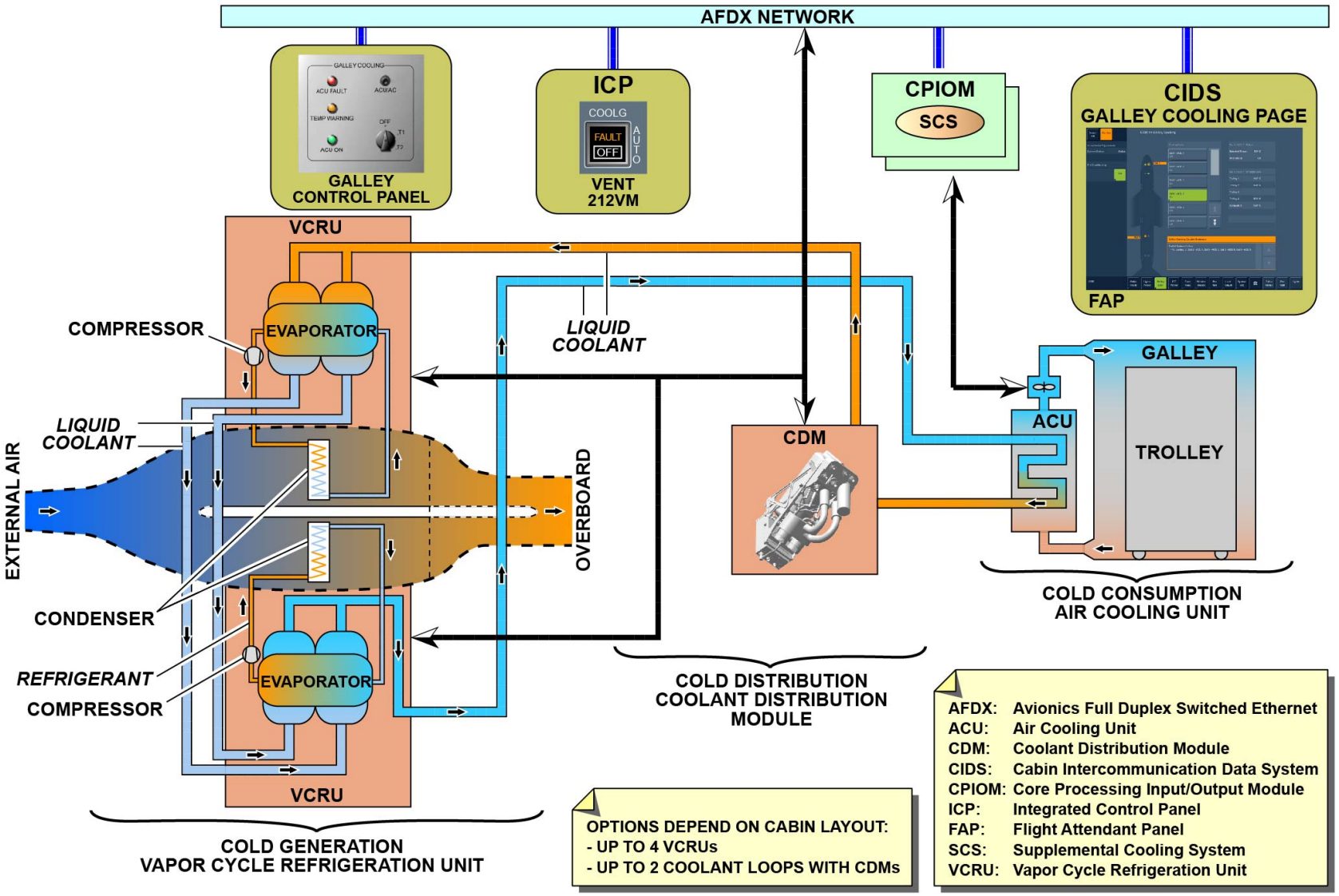
Function/Description

The Supplemental Cooling System (SCS) supplies cool air to the galley storage areas to keep meals and beverages at a satisfactory temperature.
In the basic configuration, the SCS has:
- Two Vapor Cycle Refrigeration Units (VCRUs)
- A Coolant Distribution Module (CDM)
- Air Cooling Units (ACUs).

There is a different number of ACUs for different cabin layouts.
Each VCRU has a compressor, a condenser and an evaporator. The VCRU uses external air to decrease the temperature of its refrigerant. The refrigerant then decreases the temperature of the liquid coolant that flows through the system pipes.
The CDM has pumps which supply the liquid coolant to the consumers in the galleys.
Each ACU uses a fan to supply the cooling capacity from the liquid coolant to the air in the trolleys.
The SCS usually has one coolant loop with two VCRUs and a CDM. As an option for special cabin layouts, there can be two coolant loops with four VCRUs and two CDMs.
It is possible to operate the SCS from the cockpit and galley control panels. The CPIOM SCS applications control and monitor the system.

Interface

The SCS has an interface with the Flight Attendant Panel (FAP) SCS page of the Cabin Intercommunication Data System (CIDS) through the AFDX network.



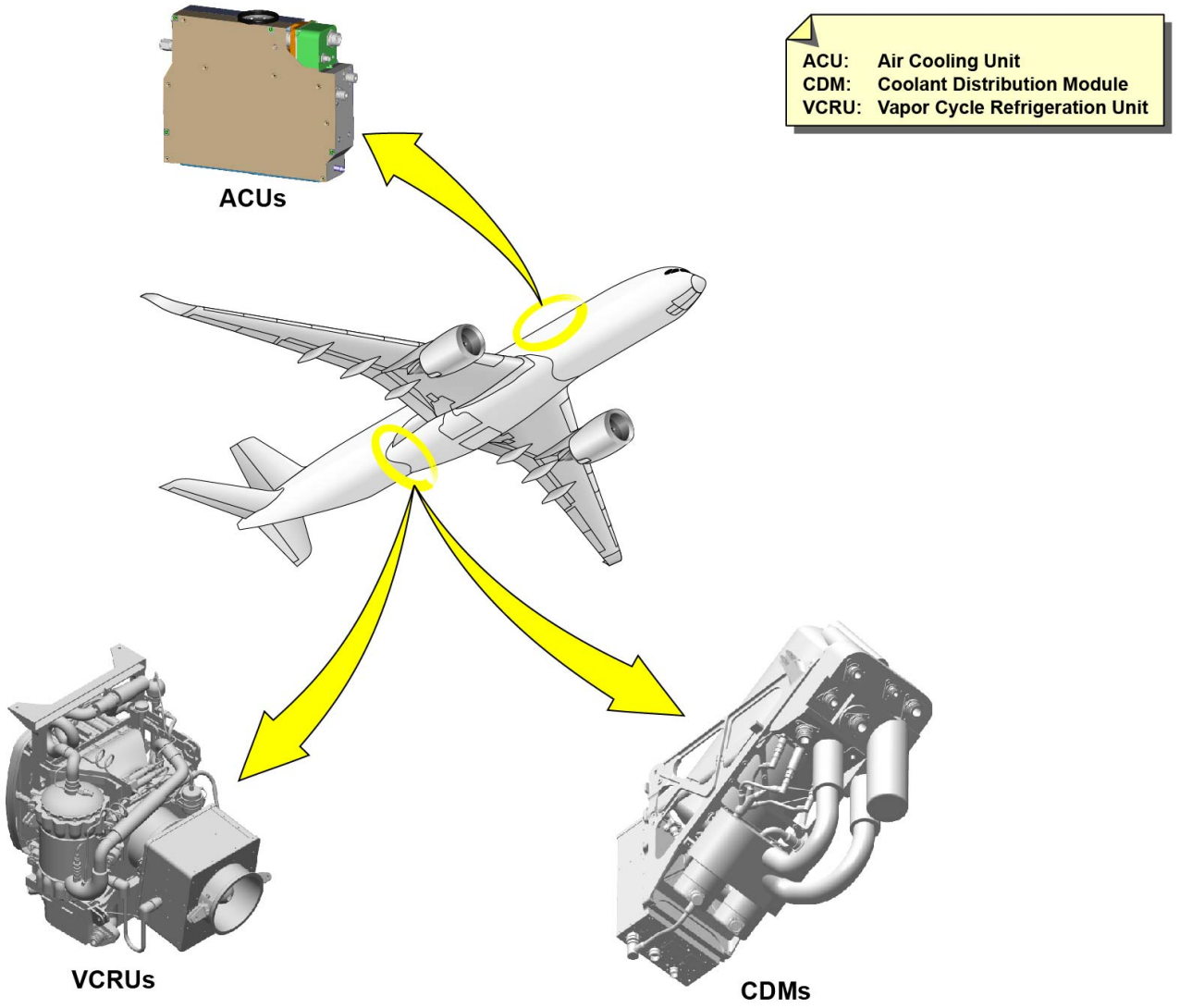
AIR COOLING - SUPPLEMENTAL COOLING - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

AIR CONDITIONING SYSTEM PRESENTATION (1)

Air Cooling - Supplemental Cooling - Presentation (continued)

Location

The VCRUs and CDMs are installed in the aft belly fairing.
The ACUs are installed in the cabin.



AIR COOLING - SUPPLEMENTAL COOLING - PRESENTATION - LOCATION

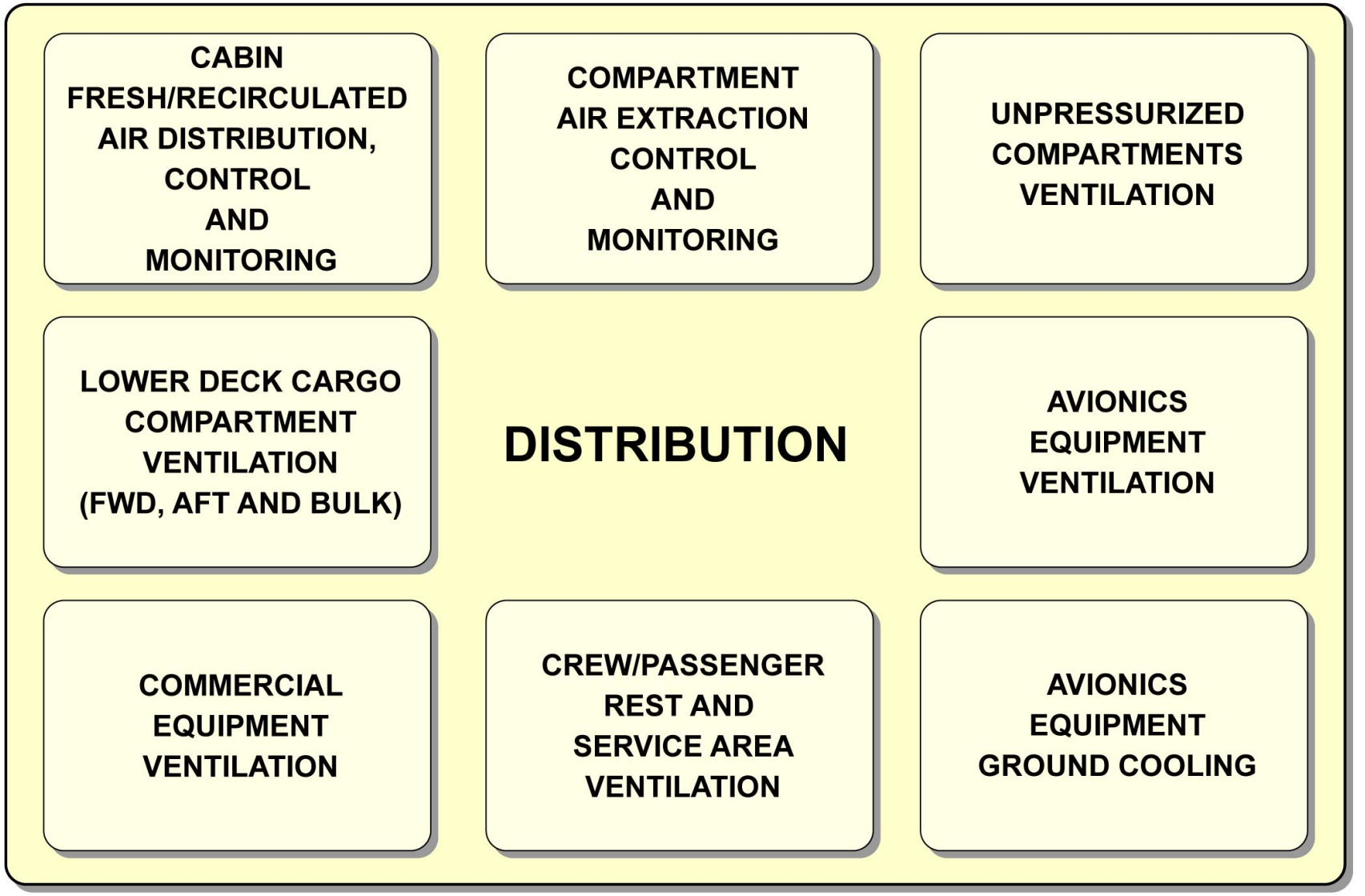
AIR CONDITIONING SYSTEM PRESENTATION (1)

Distribution - Presentation

Function/Description

The distribution system includes :
- The cabin fresh/recirculated air distribution system
- The compartment air-extraction system
- The unpressurized compartments ventilation system
- The avionics equipment ventilation-system
- The avionics equipment ground-cooling system
- The crew/passenger rest and service-area ventilation-system
- The lower-deck cargo-compartment ventilation-system
- The commercial equipment ventilation-system.

The distribution system supplies air from the air generation system to the specified areas and removes the air from these areas.



DISTRIBUTION - PRESENTATION - FUNCTION/DESCRIPTION

AIR CONDITIONING SYSTEM PRESENTATION (1)

Distribution - Cabin Fresh/Recirculated Air Distribution, Control and Monitoring - Presentation

Function/Description

The cabin fresh/recirculated air distribution system mixes conditioned air with recirculated air and supplies it to:
- The cabin temperature zones
- The forward cargo compartment
- The cockpit
- The Flight Crew Rest Compartment (FCRC)
- The Cabin Crew Rest Compartment (CCRC)
- The bulk cargo compartment.

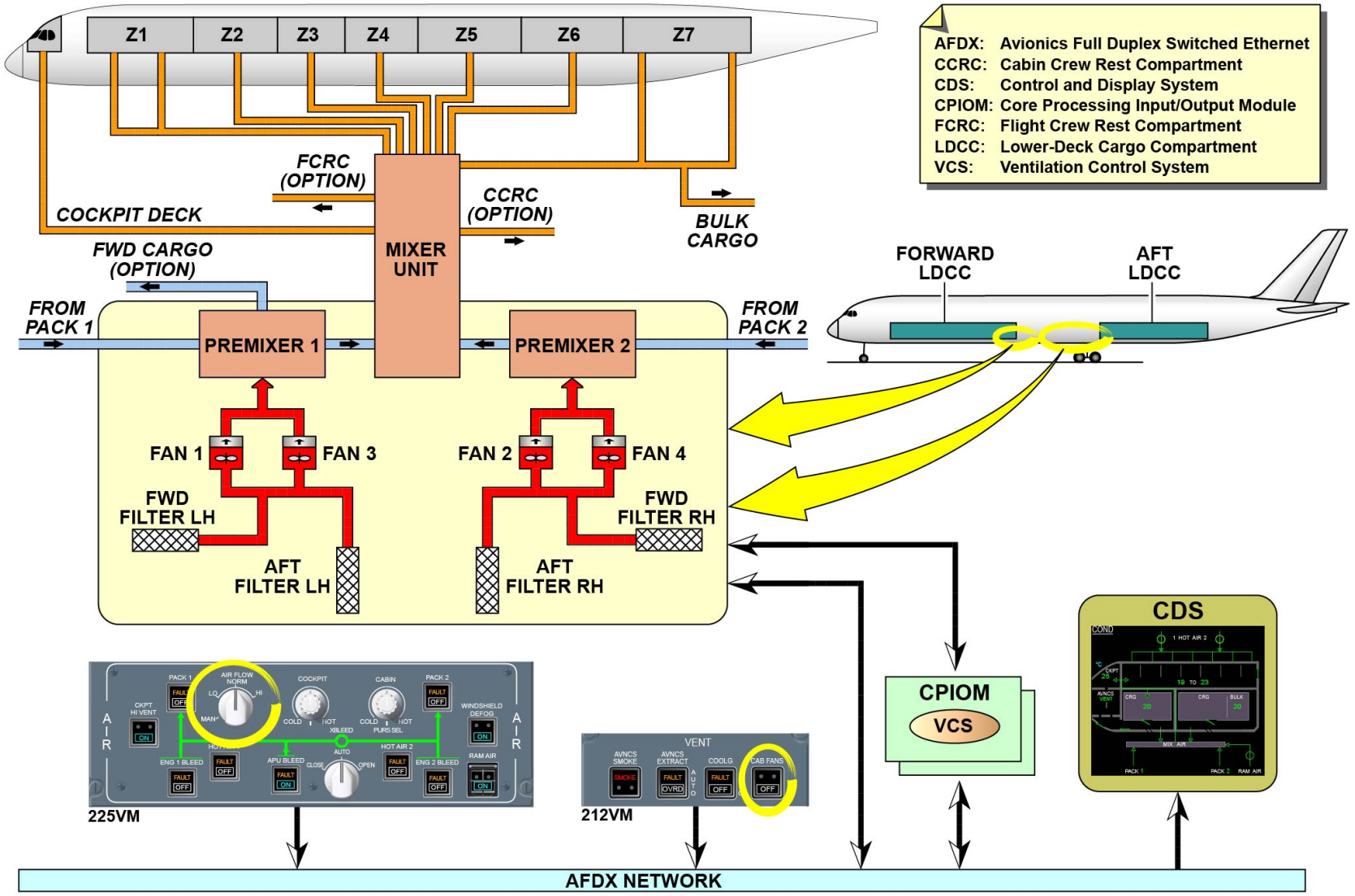
Four recirculation fans remove the air from the cabin zones through the forward and aft branches, which have air filters. The air goes to the mixing system, which has two premixers and one mixer. Here this air mixes with conditioned air from the packs and then goes back to the cabin zones and to the other compartments.
The CPIOM Ventilation Control System (VCS) applications control and monitor the system and the speed of the fans.
The speed of the fans changes with the position of the AIR FLOW rotary selector.
It is possible to stop the system with the CAB FANS pushbutton switch on the VENT panel.

Location

The components of the cabin fresh/recirculated air distribution system are installed in the aft of the forward cargo compartment and above the main landing gear bay.

Interface

The cabin fresh/recirculated air distribution system has an interface with the CDS through the AFDX network for the visual indication on the COND page.



DISTRIBUTION - CABIN FRESH/RECIRCULATED AIR DISTRIBUTION, CONTROL AND MONITORING - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

V1813401 - V01T0M0 - VM21P1LEVEL0101

AIR CONDITIONING SYSTEM PRESENTATION (1)

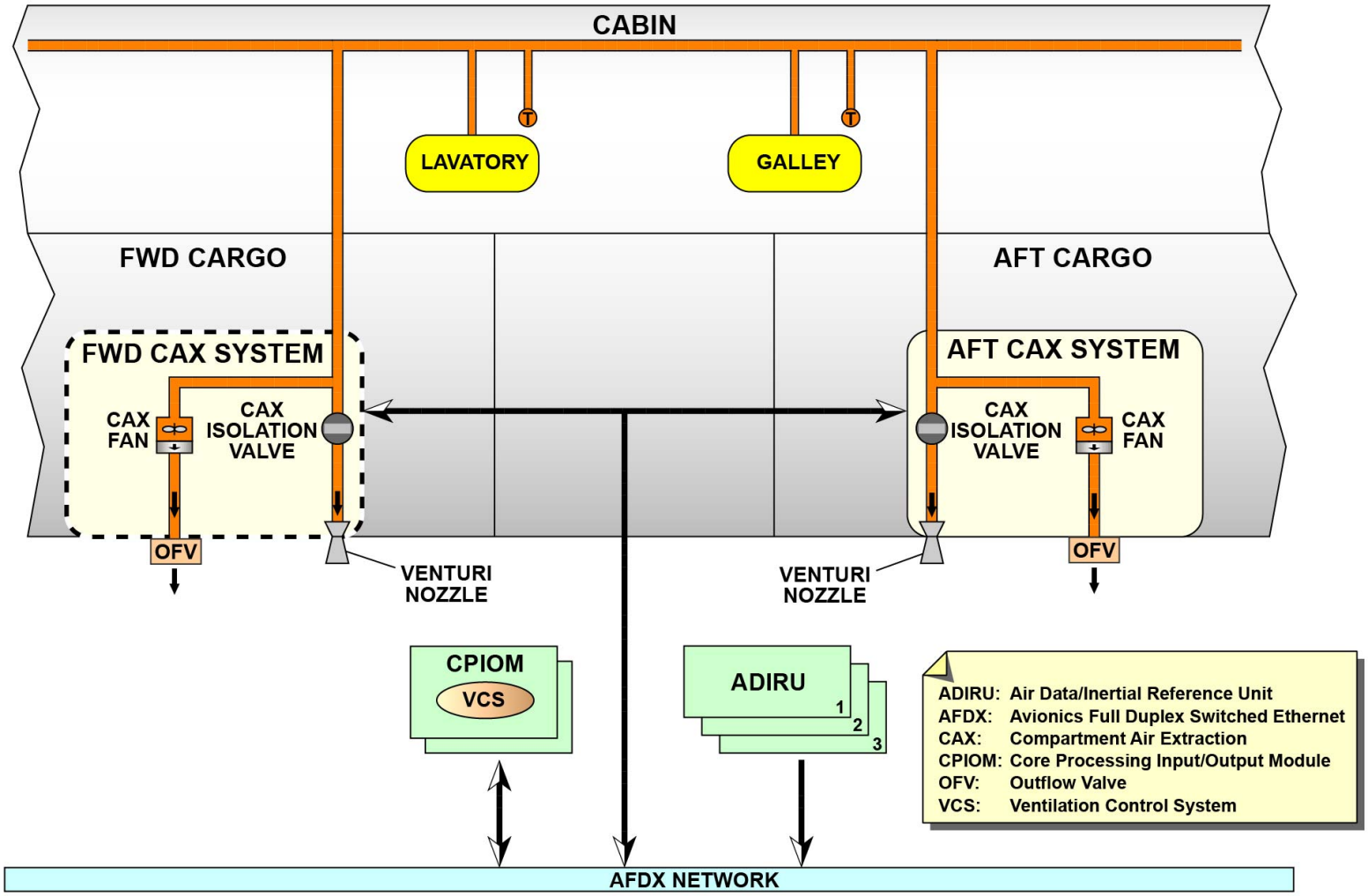
Distribution - Compartment Air Extraction, Control and Monitoring - Presentation

Function/Description

The Compartment Air Extraction (CAX) system removes odors from the galleys and lavatories and supplies a constant airflow around the cabin temperature sensors.
The forward extraction subsystem, which is optional, and the aft extraction subsystem remove the air and release it overboard. They have a CAX fan, a CAX isolation valve and a venturi nozzle. The CAX system starts automatically when the aircraft is energized.
On the ground, the two CAX fans remove the air through the two Outflow Valves (OFV). In flight, the two CAX isolation valves open and the CAX fans stop. Because of the differential pressure (delta P), the air goes overboard through the venturi nozzles.
The CPIOM VCS applications control and monitor the system.
The Air Data/Inertial Reference Units (ADIRUs) supply data about the ground/flight condition.

Location

A forward CAX subsystem can be installed as an optional system in the forward cargo compartment.
There is one aft CAX subsystem. It is installed in the aft cargo compartment.



DISTRIBUTION - COMPARTMENT AIR EXTRACTION, CONTROL AND MONITORING - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

AIR CONDITIONING SYSTEM PRESENTATION (1)

Distribution - Unpressurized Compartments Ventilation - Presentation

Function/Description

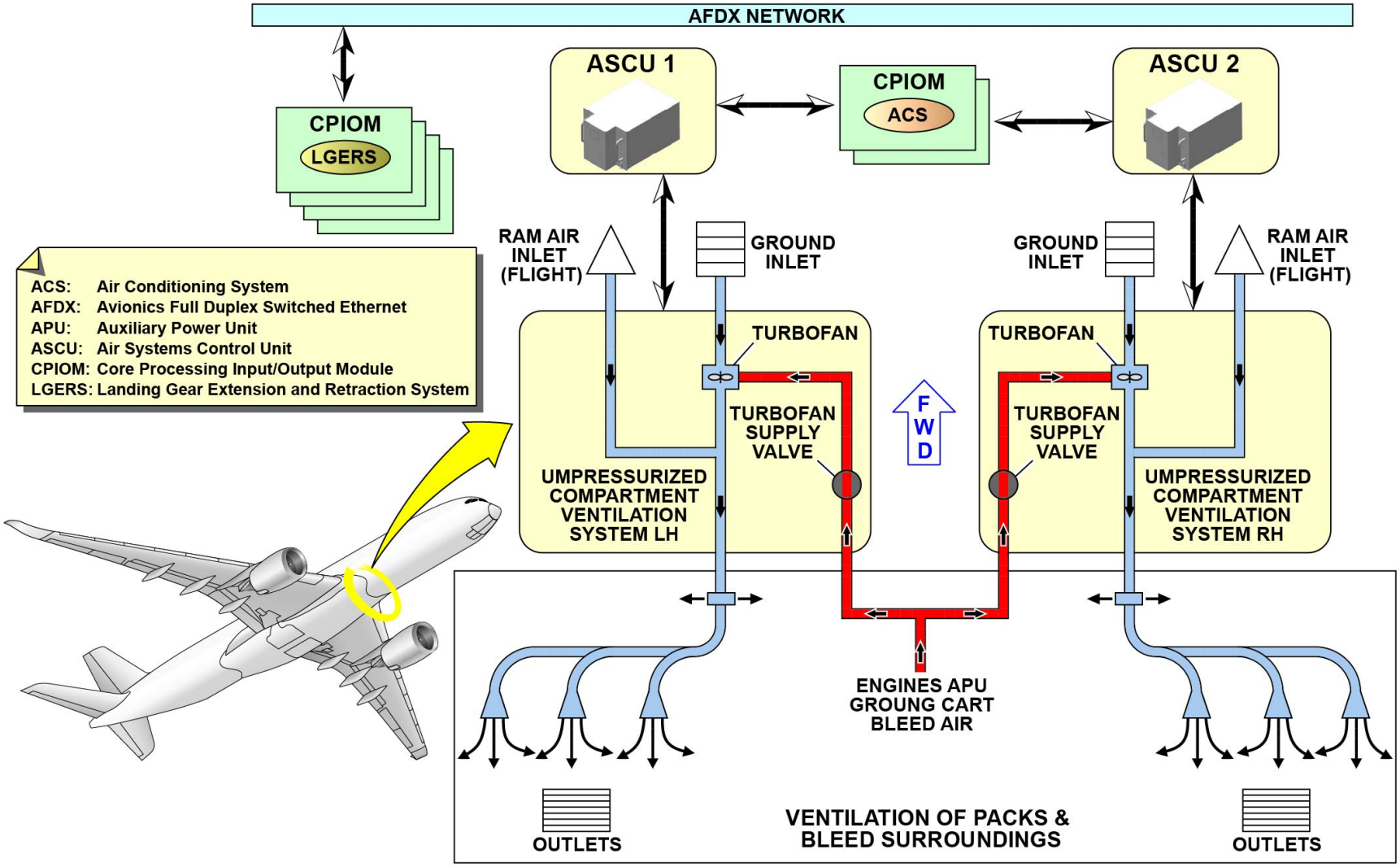
The unpressurized compartments ventilation system prevents temperatures that are too high and supplies airflow to the pack bays (packs and bleed air ducts).
There is one ventilation subsystem for each pack bay. It uses external air to supply an airflow to the pack bay.
In flight, the ram air inlets supply external air to the system.
On the ground, the bleed air system operates the two turbofans through the turbofan supply valves. The turbofans supply air from the ground inlets to the system. The air goes out of the system through dedicated outlets.
The dedicated ASCU and the CPIOM ACS applications control and monitor the system.

Location

There is one ventilation system on the left side and one on the right side of the aircraft. They are installed in the forward belly fairing.

Interface

The system has interfaces with the bleed air system and the Landing Gear Extension and Retraction System (LGERS) applications of the CPIOM through the AFDX network for the ground/flight condition.



DISTRIBUTION - UNPRESSURIZED COMPARTMENTS VENTILATION - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

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AIR CONDITIONING SYSTEM PRESENTATION (1)

Distribution - Avionics Equipment Ventilation - Presentation

Function/Description

The Avionics Ventilation System (AVS) blows air through the avionics equipment and removes used, warm air from the equipment.
The avionics equipment ventilation-system has a left blowing subsystem, a right blowing subsystem and an extraction subsystem. Each blowing subsystem operates a fan to supply air to the different racks and to the cockpit. In backup mode operation, the related backup valve opens and the mixer supplies air to the system.
Two fans remove used air and release it through the Overboard Valve (OBV) when the engine is off, or through the Inboard Valve (INBV) when the engine is on. The CPIOM Engine Interface Function (EIF) applications control the engine status. The CPIOM VCS applications control and monitor the system which starts when the aircraft is energized.

Location

The avionics equipment ventilation-system is installed in the avionic bay which is below the cockpit.

Interface

The system has interfaces with:
- The CDS through the AFDX network for the visual indication on the COND page
- The CPIOM EIF applications for the engine running signal
- The CPIOM LGERS applications for the ground/flight signals.

Distribution - Avionics Equipment Ground Cooling - Presentation

Function/Description

The avionics equipment ground-cooling system can be installed as an optional system. It helps to increase the performance of the cooling system in the main avionics bay when the related pushbutton switch is in the AUTO position.
On the ground, the Ground Cooling Units (GCU) use the coolant fluid line of the SCS to decrease the temperature of the air that flows into the avionics bays.
The CPIOM SCS applications control and monitor the system.

Interface

The avionics equipment ground-cooling system has interfaces with the CPIOM LGERS applications that show if the aircraft is in flight or on the ground (ground signal).

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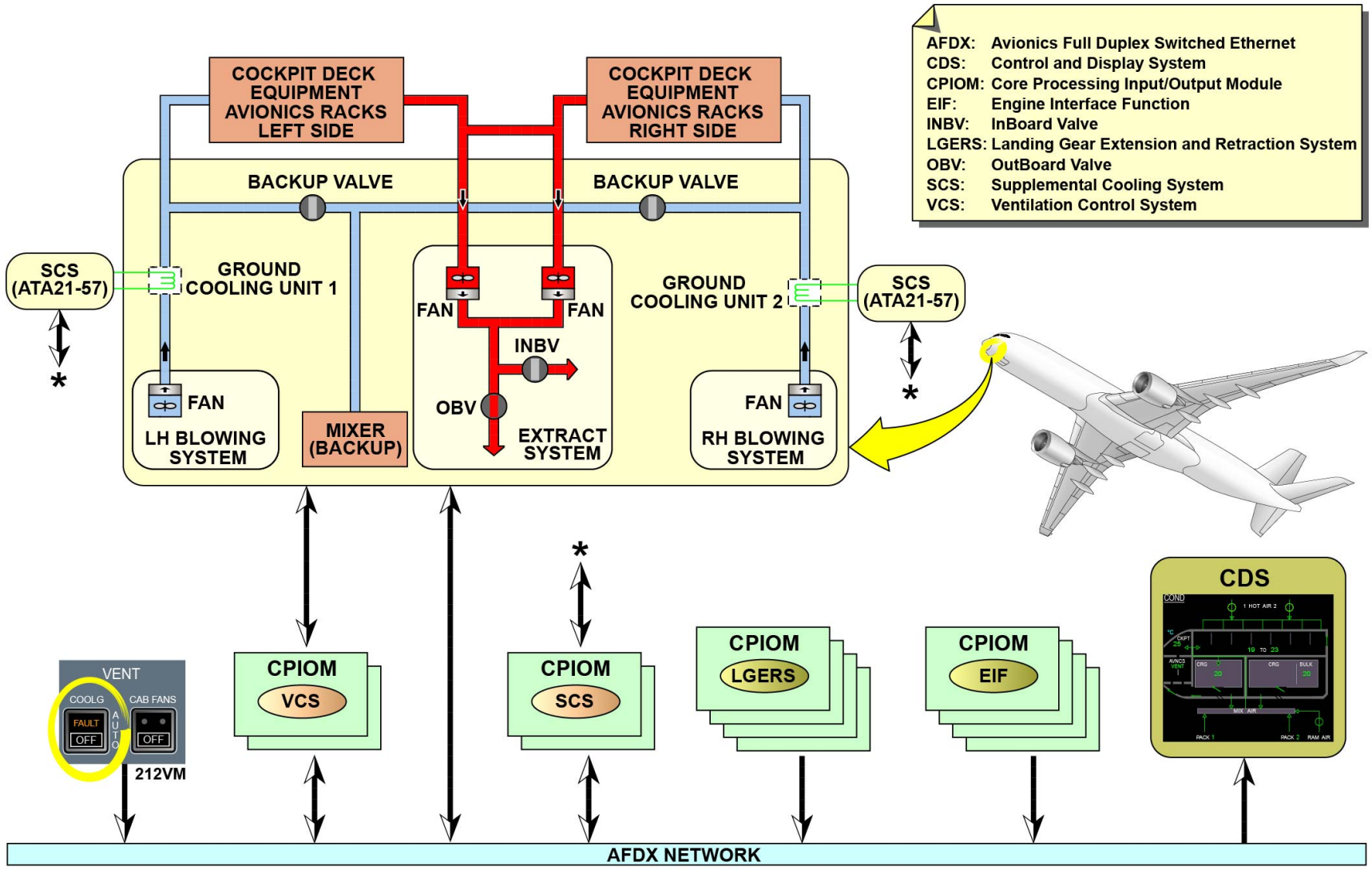

DISTRIBUTION - AVIONICS EQUIPMENT VENTILATION - PRESENTATION & DISTRIBUTION - AVIONICS EQUIPMENT GROUND COOLING - PRESENTATION

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AIR CONDITIONING SYSTEM PRESENTATION (1)

Distribution - Crew/Passenger Rest and Service Area Ventilation - Presentation

Function/Description

The crew/passenger rest and service-area ventilation-system is an optional system that supplies conditioned, fresh air to the crew rest compartment(s).
The mixer and the cabin air-distribution system supply air to the FCRC and the CCRC. The Compartment Air Extraction (CAX) system removes the air from the FCRC and the IFE (In-Flight Entertainment) ventilation system removes the air from the CCRC.
The CPIOM VCS applications control and monitor the system.

Location

There is one ventilation system for the FCRC and the CCRC.
The FCRC is installed in the overhead area of the forward part of the cabin.
The CCRC is installed in the overhead area of the aft part of the cabin.
The IFE racks and the IFE ventilation system are installed in the bulk cargo compartment.

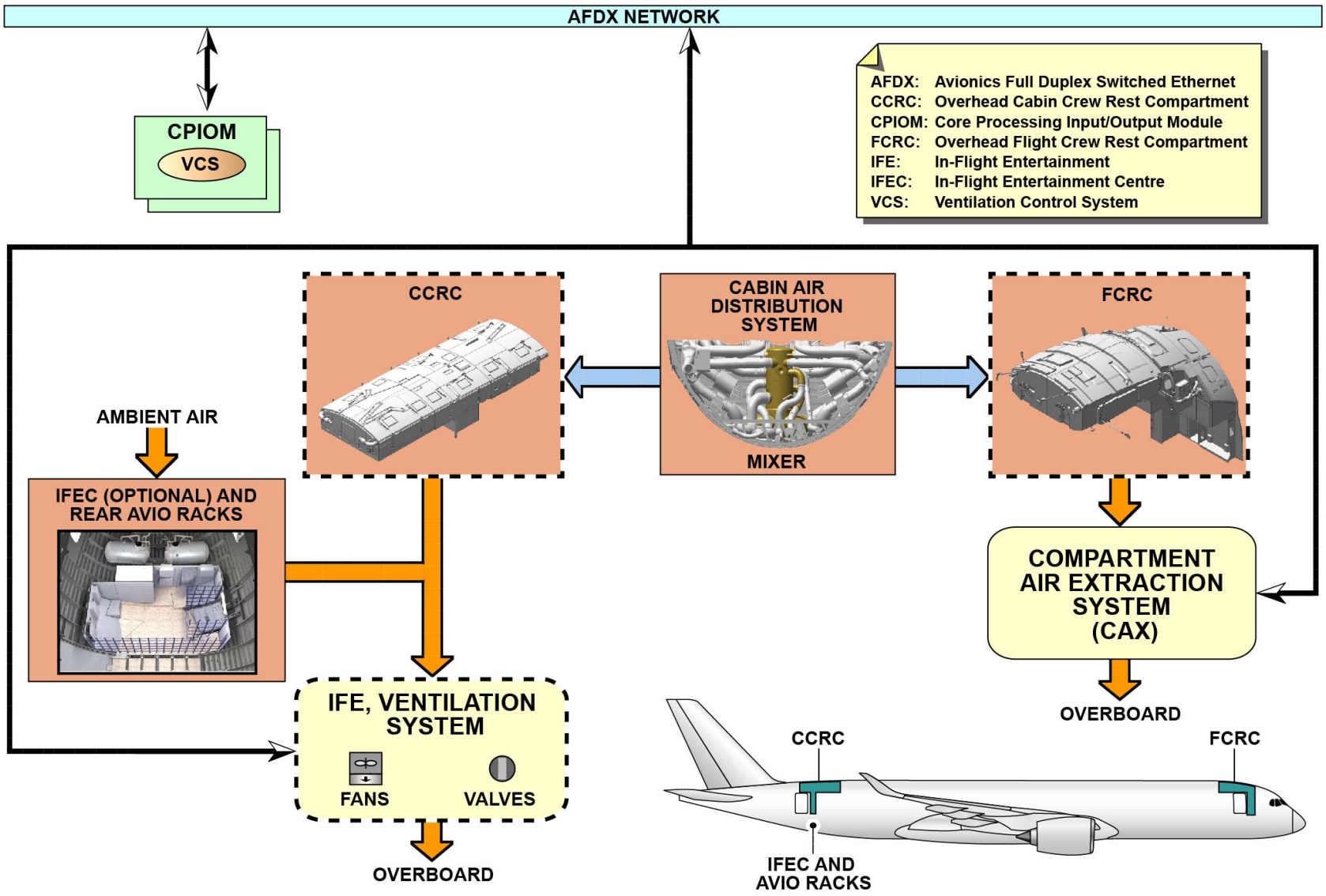
Distribution - Commercial Equipment Ventilation - Presentation

Function/Description

The commercial equipment ventilation-system (referred to as the IFE ventilation system) is optional.
It supplies a cool airflow to the IFE racks and the rear avionics racks.
The system, which has extraction fans and isolation valves, blows ambient air through the different racks. It then releases the air into bilge area of the aft cargo compartment.
The CPIOM VCS applications control and monitor the system.

Location

The system is installed behind the bulk cargo compartment.



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DISTRIBUTION - CREW/PASSENGER REST AND SERVICE AREA VENTILATION - PRESENTATION & DISTRIBUTION - COMMERCIAL EQUIPMENT VENTILATION - PRESENTATION

AIR CONDITIONING SYSTEM PRESENTATION (1)

Distribution - Lower Deck Cargo Compartment Ventilation (FWD, AFT and Bulk) - Presentation

Function/Description

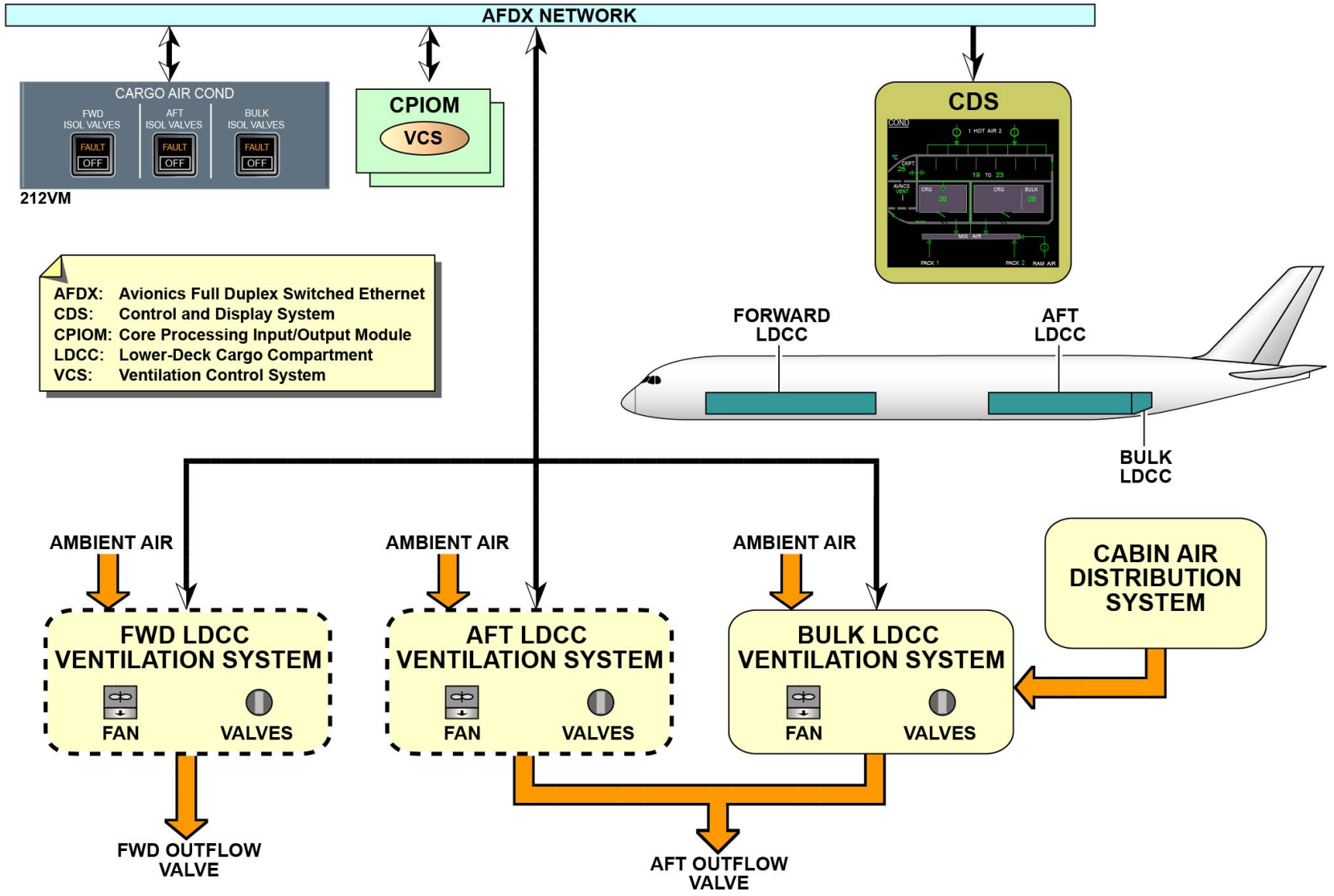
The forward and aft cargo-compartment ventilation-systems can be installed as optional systems. They use ambient air and release it near the outflow valves.
The bulk cargo-compartment ventilation-system is a basic configuration. It uses ambient air and air from the cabin air-distribution system and then releases this air near the aft outflow valve.
Each system has isolation valves and an extraction fan and starts operation when the aircraft is energized.
It is possible to stop each system from the CARGO AIR COND panel.
The CPIOM VCS applications control and monitor the cargo-compartment ventilation systems.

Location

The ventilation system for each cargo compartment is installed in the related compartment.

Interface

The system has interfaces with the CDS through the AFDX network for the visual indication on the COND page.



DISTRIBUTION - LOWER DECK CARGO COMPARTMENT VENTILATION (FWD, AFT AND BULK) - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

V1813401 - V01T0M0 - VM21P1LEVEL0101

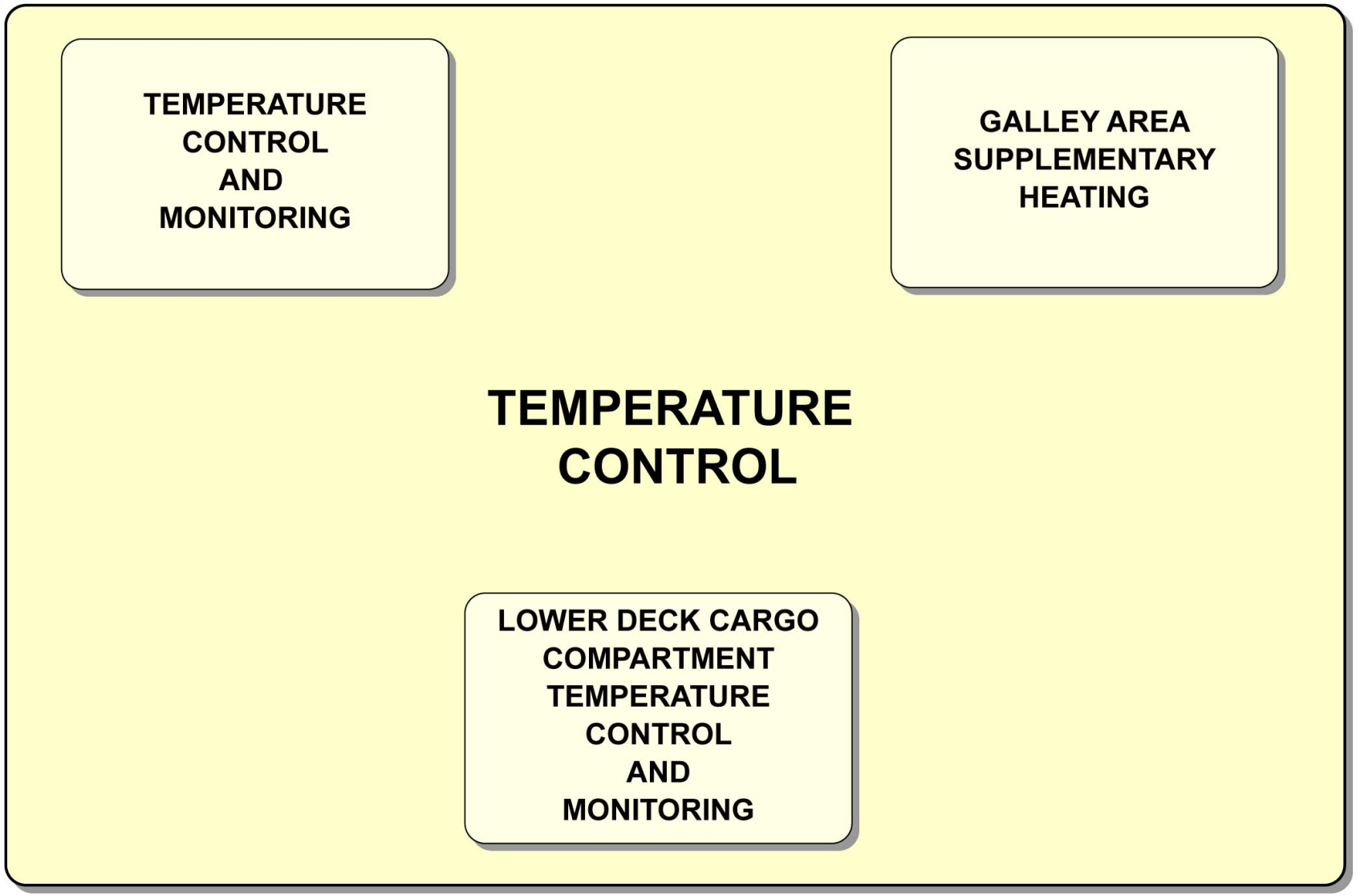
AIR CONDITIONING SYSTEM PRESENTATION (1)

Temperature Control - Presentation

Function/Description

The Temperature Control System (TCS) includes:
- The temperature control and monitoring system
- The galley-area supplementary-heating system
- The lower-deck cargo-compartment temperature-control and monitoring system.

The TCS controls and monitors the temperature in the cabin, in the galleys and in the cargo compartments.



TEMPERATURE CONTROL - PRESENTATION - FUNCTION/DESCRIPTION

AIR CONDITIONING SYSTEM PRESENTATION (1)

Temperature Control - Temperature Control and Monitoring - Presentation

Function/Description

The temperature control and monitoring system controls the temperature of the air for the best comfort of the passengers and crew in:
- The cabin zones
- The cockpit
- The FCRC
- The CCRC.

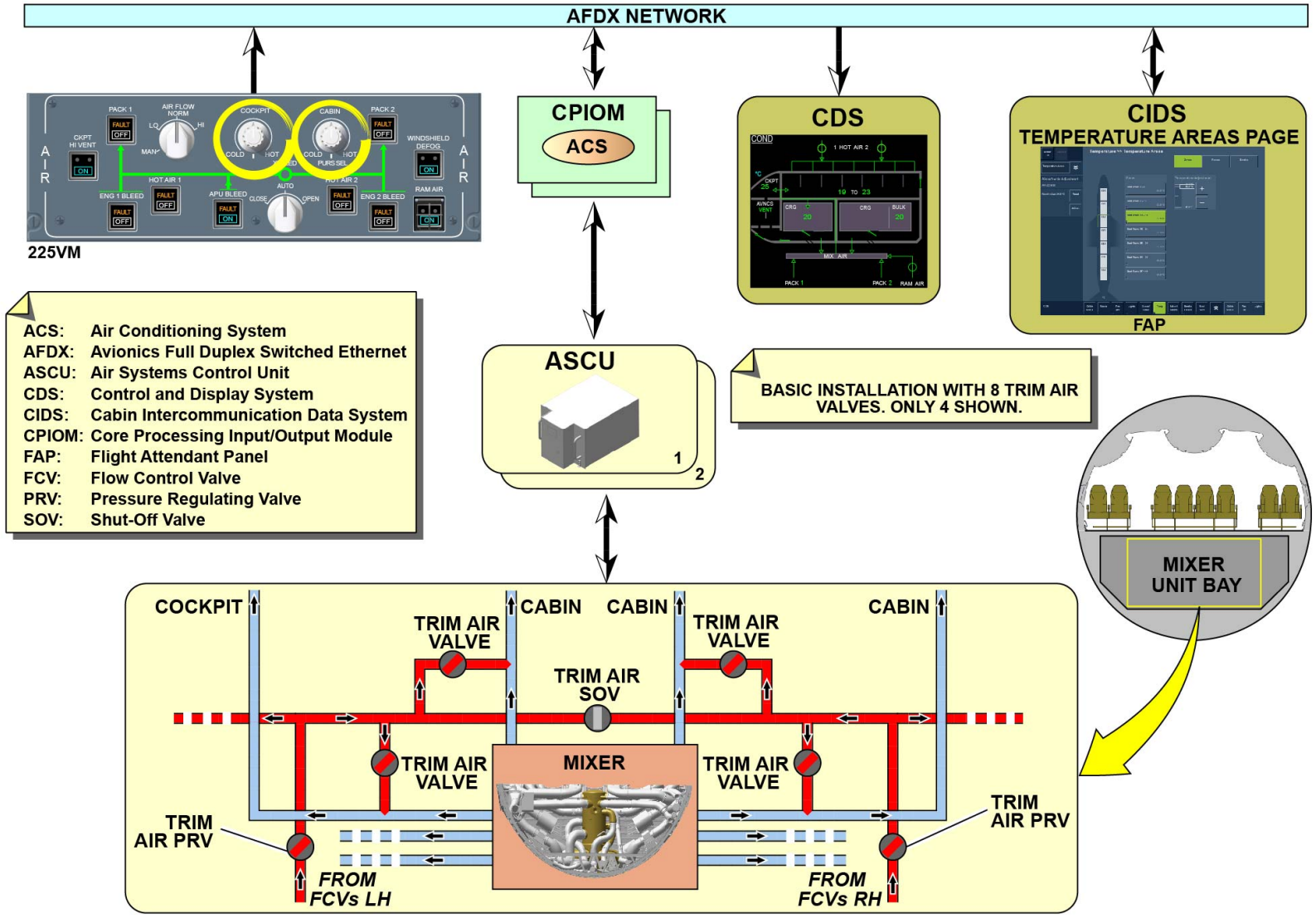
The bleed air system supplies hot air through the FCVs and the trim air Pressure Regulating Valves (PRV). This hot air comes through the trim air valves and mixes with the conditioned air from the mixer to get the set temperature for each zone.
A trim air Shut-Off Valve (SOV) is installed for system reconfiguration. In normal operation mode, the trim air SOV is closed. If a specified failure occurs, the trim air SOV opens to keep the system fully serviceable.
It is possible to set the temperature in the cockpit or on the FAP.
The CPIOM ACS applications and the two ASCUs control and monitor the system.

Location

The trim air PRV is installed in the pack bay.
The trim air SOV and the trim air valves are installed in the mixer unit bay.

Interface

The system has interfaces with the FAP page of the CIDS and the CDS through the AFDX network for the visual indication on the COND page.



TEMPERATURE CONTROL - TEMPERATURE CONTROL AND MONITORING - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

AIR CONDITIONING SYSTEM PRESENTATION (1)

Temperature Control - Galley Area Supplementary Heating - Presentation

Function/Description

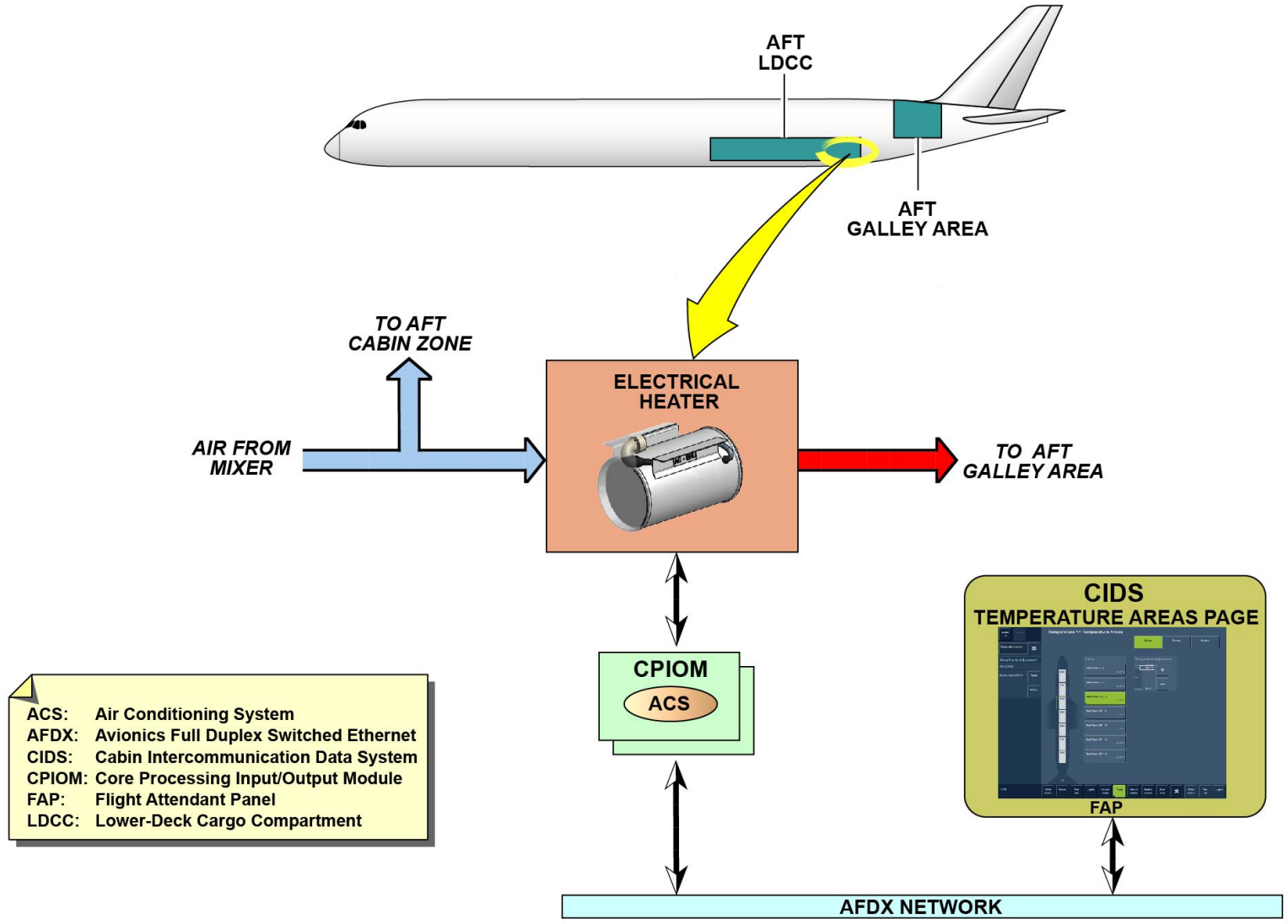
The galley-area supplementary-heating system increases the temperature in the aft galley area.
In the last cabin zone, an electrical heater is installed on the supply duct to increase the temperature for the aft galley area.
It is possible to start the system and set the temperature through the FAP.
The CPIOM ACS applications control and monitor the system.

Location

An electrical heater is installed on the supply duct in the aft cargo compartment.

Interface

The system has interfaces with the FAP TEMP page of the CIDS through the AFDX network.


AFT
LDCC
AFT
GALLEY AREA
TO AFT
CABIN ZONE
ELECTRICAL
HEATER
AIR FROM
MIXER
TO AFT
GALLEY AREA
CIDS
TEMPERATURE AREAS PAGE
CPIOM
ACS
FAP
AFDX NETWORK
ACS: Air Conditioning System
AFDX: Avionics Full Duplex Switched Ethernet
CIDS: Cabin Intercommunication Data System
CPIOM: Core Processing Input/Output Module
FAP: Flight Attendant Panel
LDCC: Lower-Deck Cargo Compartment

AIR CONDITIONING SYSTEM PRESENTATION (1)

Temperature Control - Lower Deck Cargo Compartment
Temperature Control and Monitoring - Presentation

Function/Description

The lower-deck cargo-compartment temperature control and monitoring system adjusts the temperature in the forward and bulk cargo compartments.
This system can be installed as an optional system for the forward cargo compartment. For the bulk cargo compartment the system is a basic configuration.
It is possible to control the temperature in the forward and bulk cargo compartments from the CARGO AIR COND panel.
The bulk-cargo electrical heater increases the temperature of the air that comes from the cabin distribution system.
For the forward cargo compartment, a trim air valve adds hot air from the trim air manifold to increase the temperature. A cold air valve adds conditioned air from the mixer to decrease the temperature in the forward cargo compartment.
The CPIOM ACS and VCS applications and the left ASCU control and monitor the system.

Location

There is one bulk-cargo electrical heater. It is installed in the bulk cargo compartment.
The trim air valve, the cold air valve and the left ASCU are installed in the forward cargo compartment.

Interface

The system has an interface with the CDS through the AFDX network for the visual indication on the COND page.

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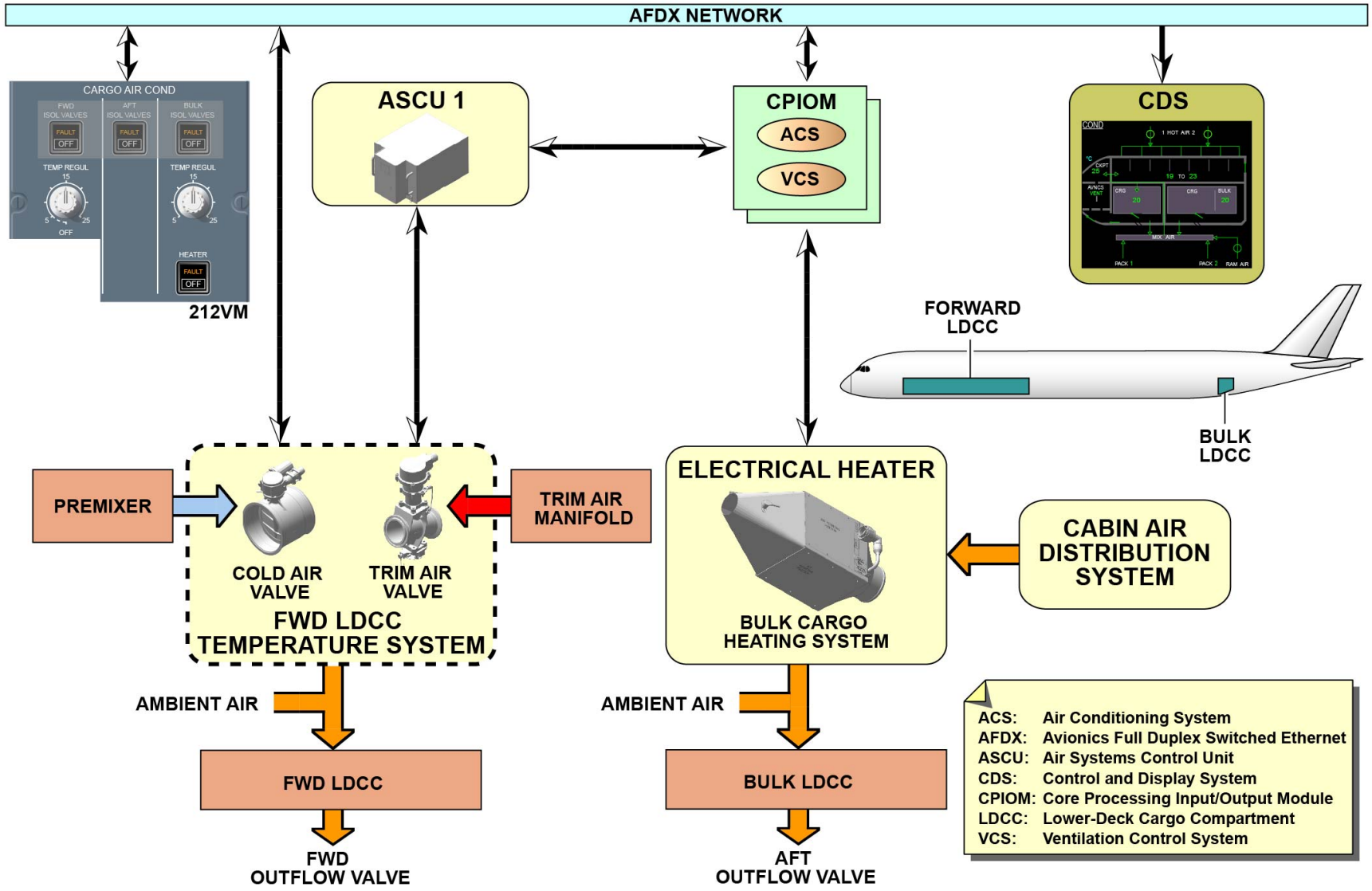


TEMPERATURE CONTROL - LOWER DECK CARGO COMPARTMENT TEMPERATURE CONTROL AND MONITORING - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

AIR CONDITIONING SYSTEM PRESENTATION (1)

Pressure Control and Monitoring - Presentation

Function/Description

The pressure control and monitoring system increases or decreases the internal air pressure to give a safe and comfortable environment for the passengers and the crew. To control the cabin pressure the system adjusts the airflow that goes overboard.
The system has:
- Two Outflow Valves (OFVs)
- Two Outflow Valve Control Units (OCUs)
- A Semi-Automatic Control Unit (SACU)
- An overpressure relief valve
- Two negative relief valves.

The system has two modes of operation. They are:
- The automatic mode
- The manual mode.

In the automatic mode, the CPIOM Cabin Pressure Control System (CPCS) applications control the position of the OFVs through the OCUs. When the system receives inputs from the pilot through the CABIN PRESS panel, the manual mode overrides the automatic mode.
In the manual mode, the SACU receives inputs from the CABIN PRESS panel and calculates new commands for the OCUs. The OCUs then control the OFVs.
If the system is fully unserviceable, two negative relief valves and one overpressure relief valve prevent a high negative or positive pressure difference in the fuselage to prevent damage to the structure.
When the DITCHING pushbutton switch on the CABIN PRESS panel is pushed, both OFVs close.

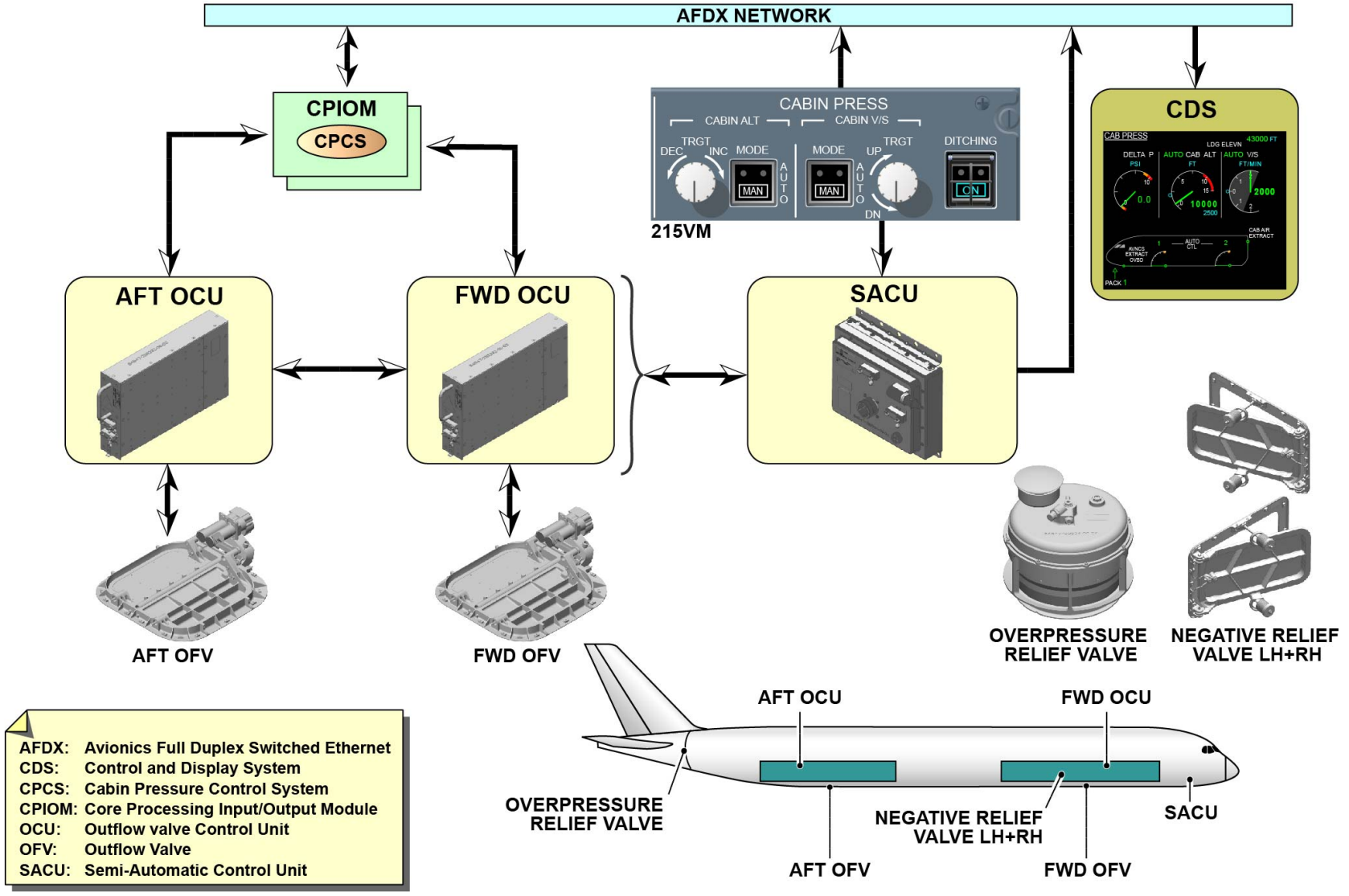
Location

There is one overpressure relief valve. It is installed on the rear pressure bulkhead of the pressurized fuselage.
There are two OFVs. One is installed on the forward fuselage and one on the aft fuselage.
There are two OCUs. They are installed in the triangle area near the forward and aft cargo doors.
There is one semi-automatic control unit. It is installed in the avionics compartment.
There are two negative relief valves. They are installed on the left and right sides of the aircraft below the cabin floor.

Interface

The system has an interface with the CDS through the AFDX network for the visual indication on the CABIN PRESS page.

V1813401 - V01T0M0 - VM21P1LEVEL0101



PRESSURE CONTROL AND MONITORING - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

V1813401 - V01T0M0 - VM21P1LEVEL0101

AIR CONDITIONING SYSTEM PRESENTATION (1)

Control and Indicating - Presentation

These primary cockpit controls are installed on the overhead panel:
- The AIR panel
- The VENT panel
- The CARGO AIR COND panel
- The CABIN PRESS panel
- The MAINTENANCE panel

The main cockpit indications on the CDS are:
- The BLEED page
- The COND page.

The main cabin controls and indications are on:
- The FAP, which has the SCS and TEMP pages
- The galley control panel, which is installed in the galley area and which has the galley cooling and cooling unit pages.

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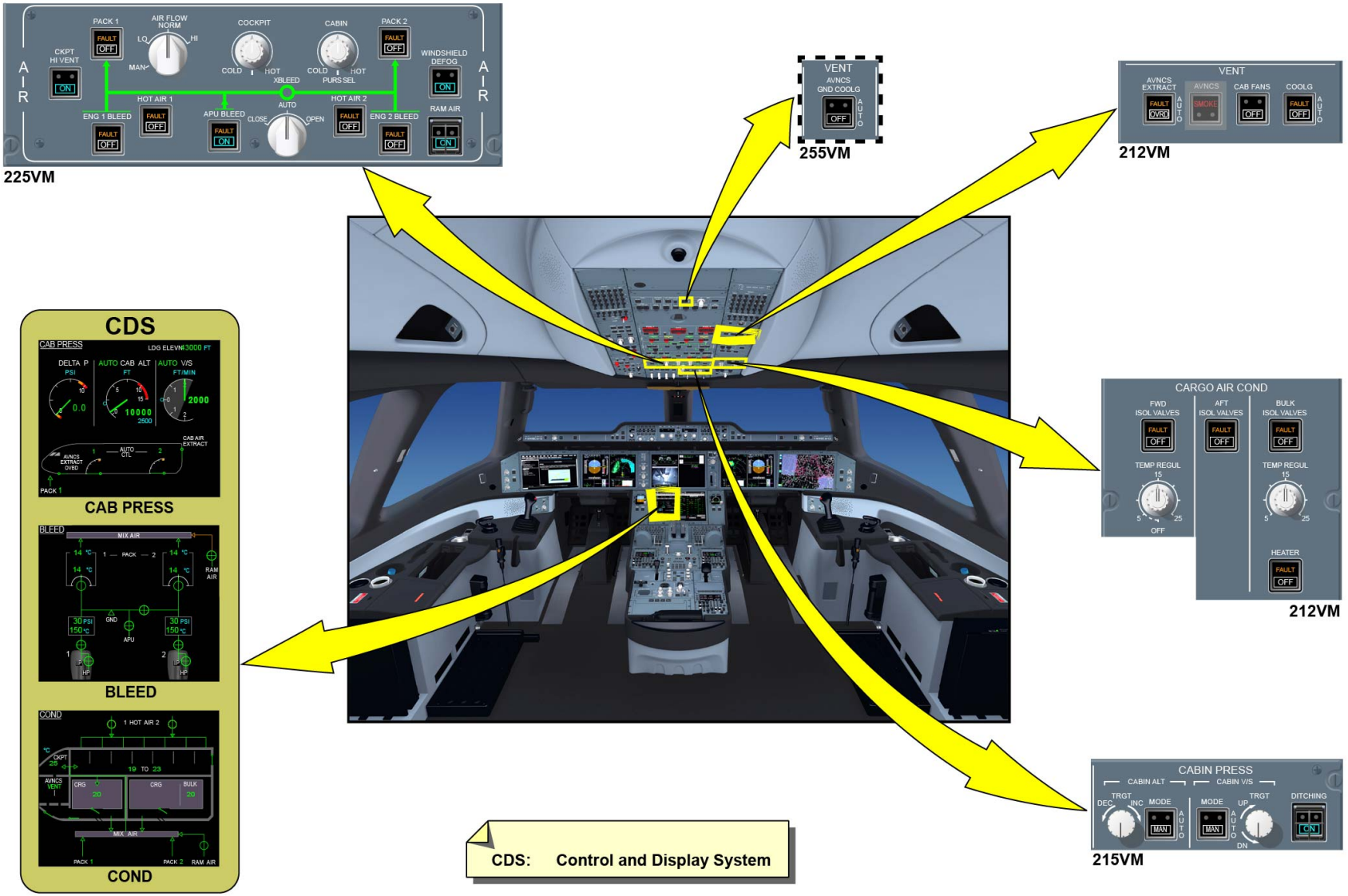
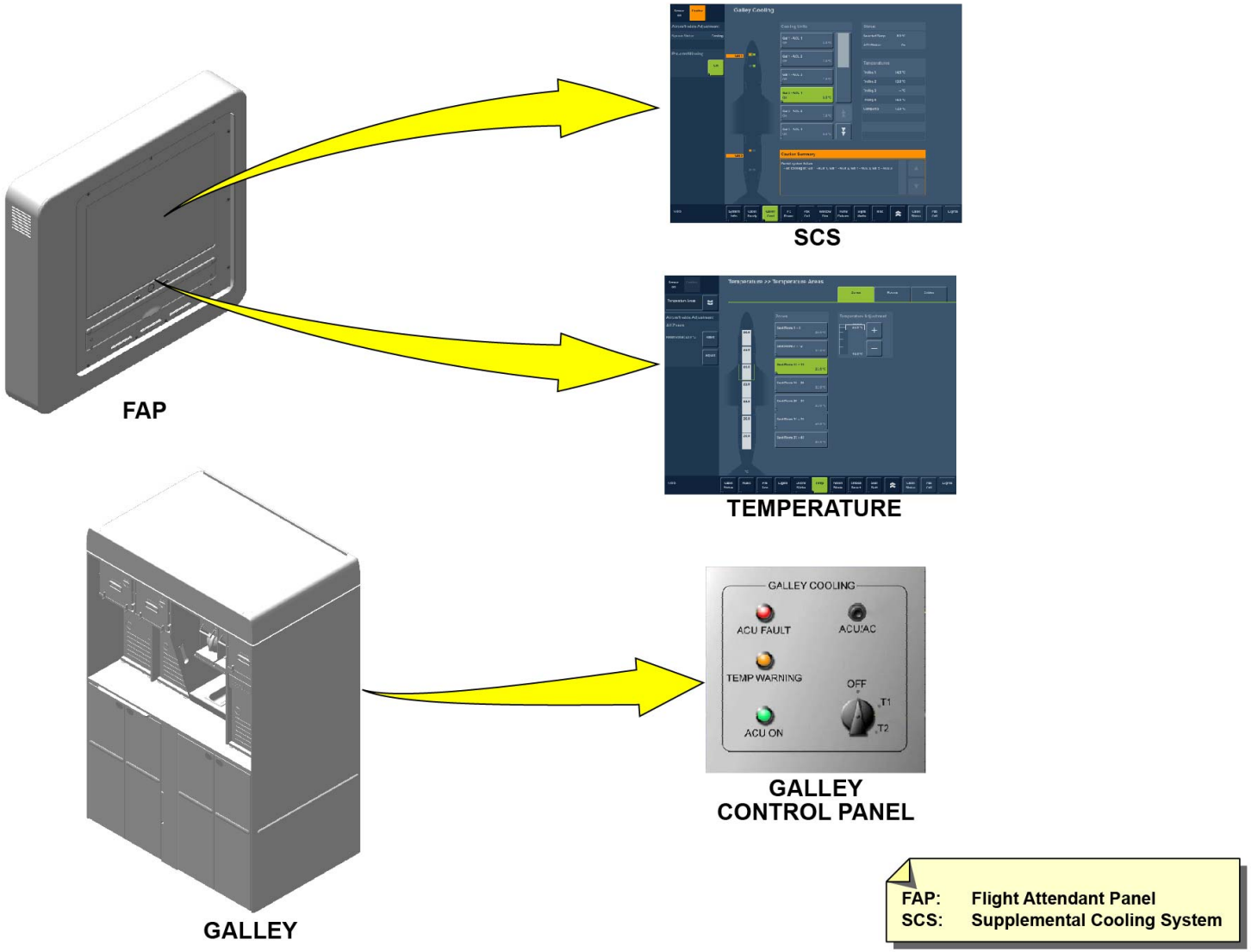


CONTROL AND INDICATING - PRESENTATION



CONTROL AND INDICATING - PRESENTATION

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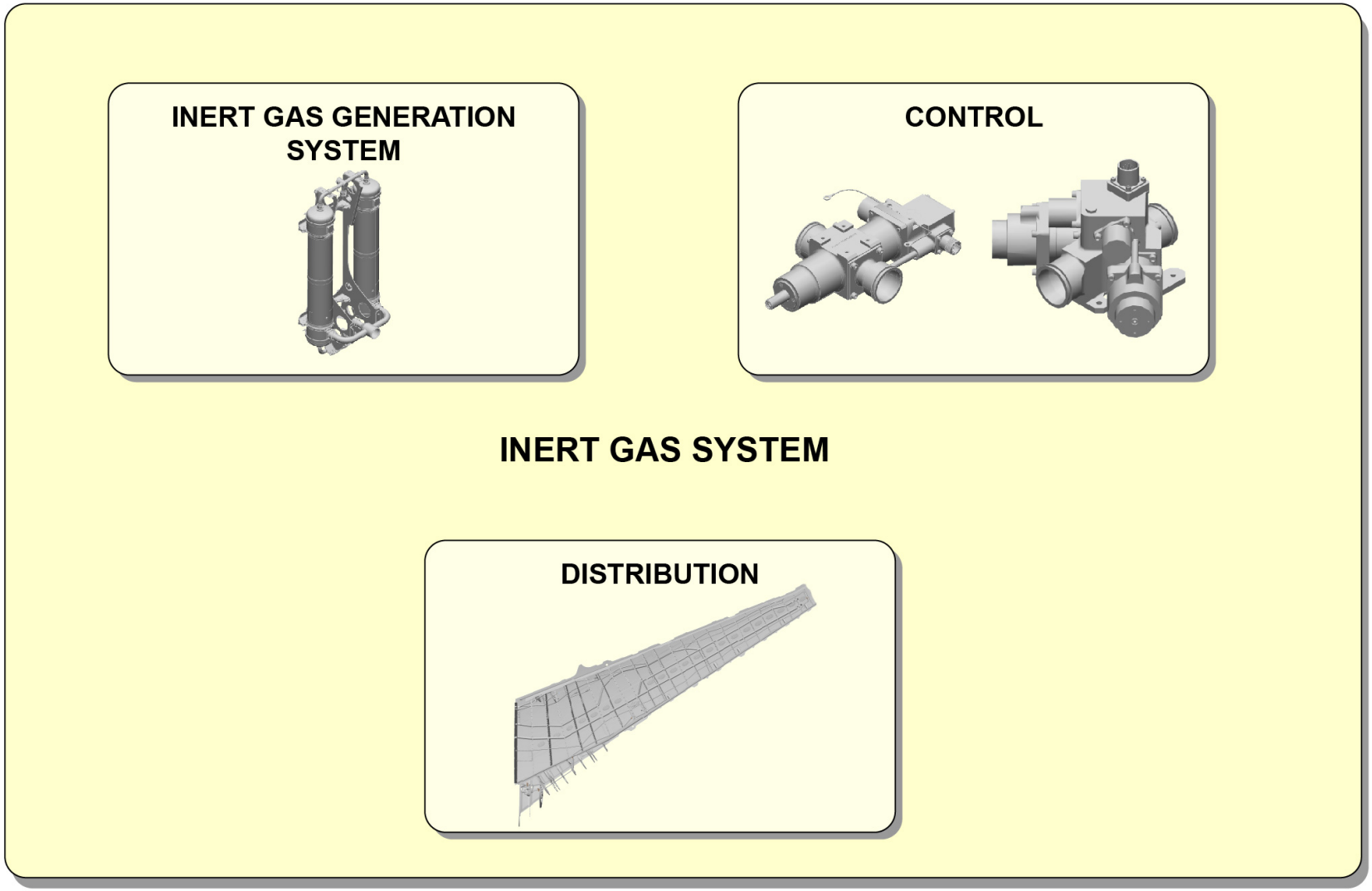
INERT GAS SYSTEM PRESENTATION (1)

Overview

The function of the Inert Gas System is to decrease oxygen concentration in fuel tanks for safety.
General familiarization training of this system focuses on:
- Inert Gas Generation System (IGGS)
- Inert Gas System Control (IGSC)
- Inert Gas Distribution System (IGDS).

V1813401 - V01T0M0 - VM47P1LEVEL0101


INERT GAS GENERATION SYSTEM
CONTROL
INERT GAS SYSTEM
DISTRIBUTION

OVERVIEW

INERT GAS SYSTEM PRESENTATION (1)

Inert Gas Generation System (IGGS) - Presentation

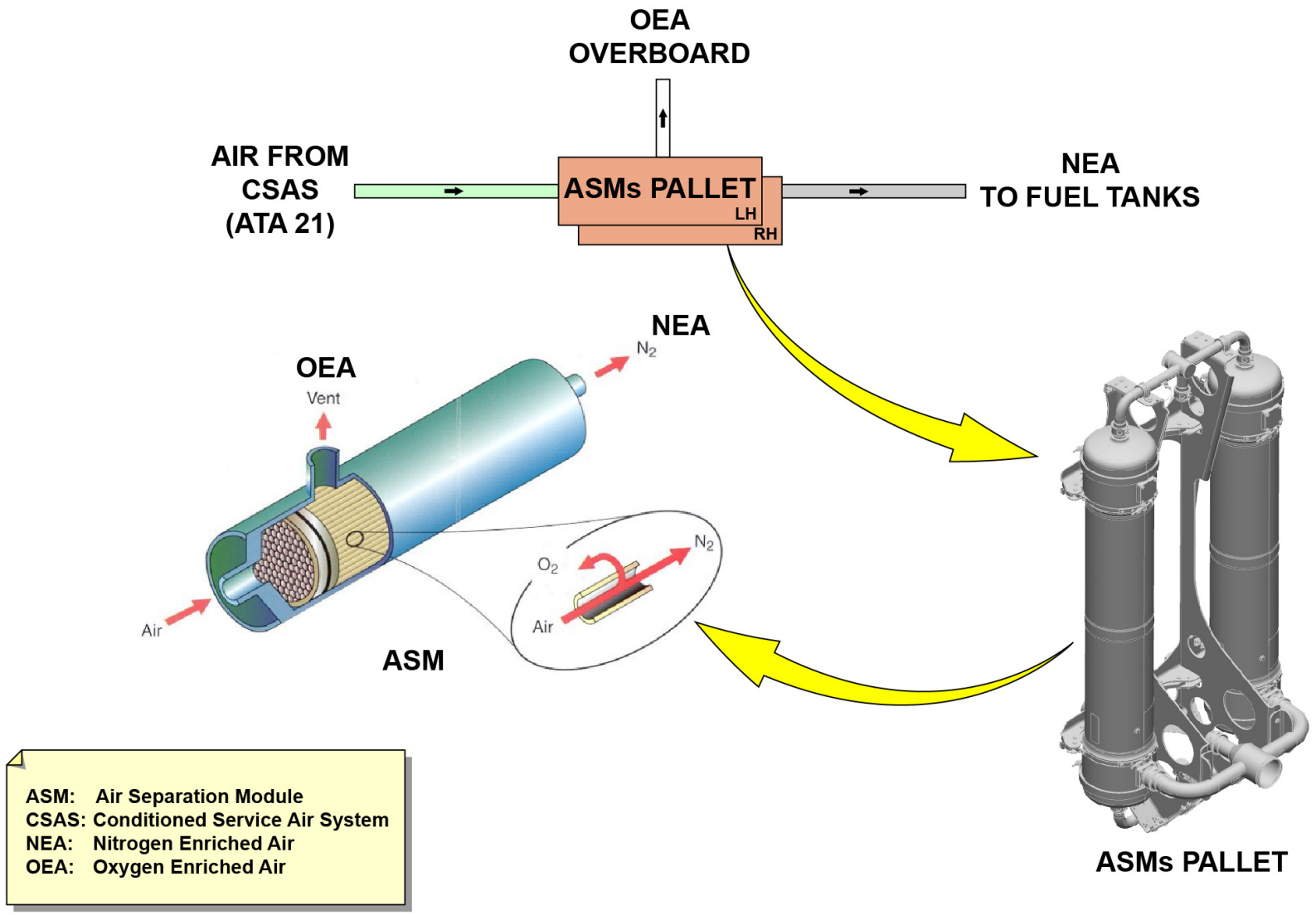
Function/Description

The function of the IGGS is to decrease tanks flammability exposure with generation of Nitrogen Enriched Air (NEA) by separation and release overboard of Oxygen Enriched Air (OEA) from dedicated supplied air to supply NEA to fuel tanks.
Two pallets of two Air Separation Modules (ASMs), with a molecular filtering, remove and vent a very large quantity of oxygen from dedicated supply air to get inert gas (NEA).

Interface

The Conditioned Service Air System (CSAS) supplies conditioned air to the IGGS.

V1813401 - V01T0M0 - VM47P1LEVEL0101



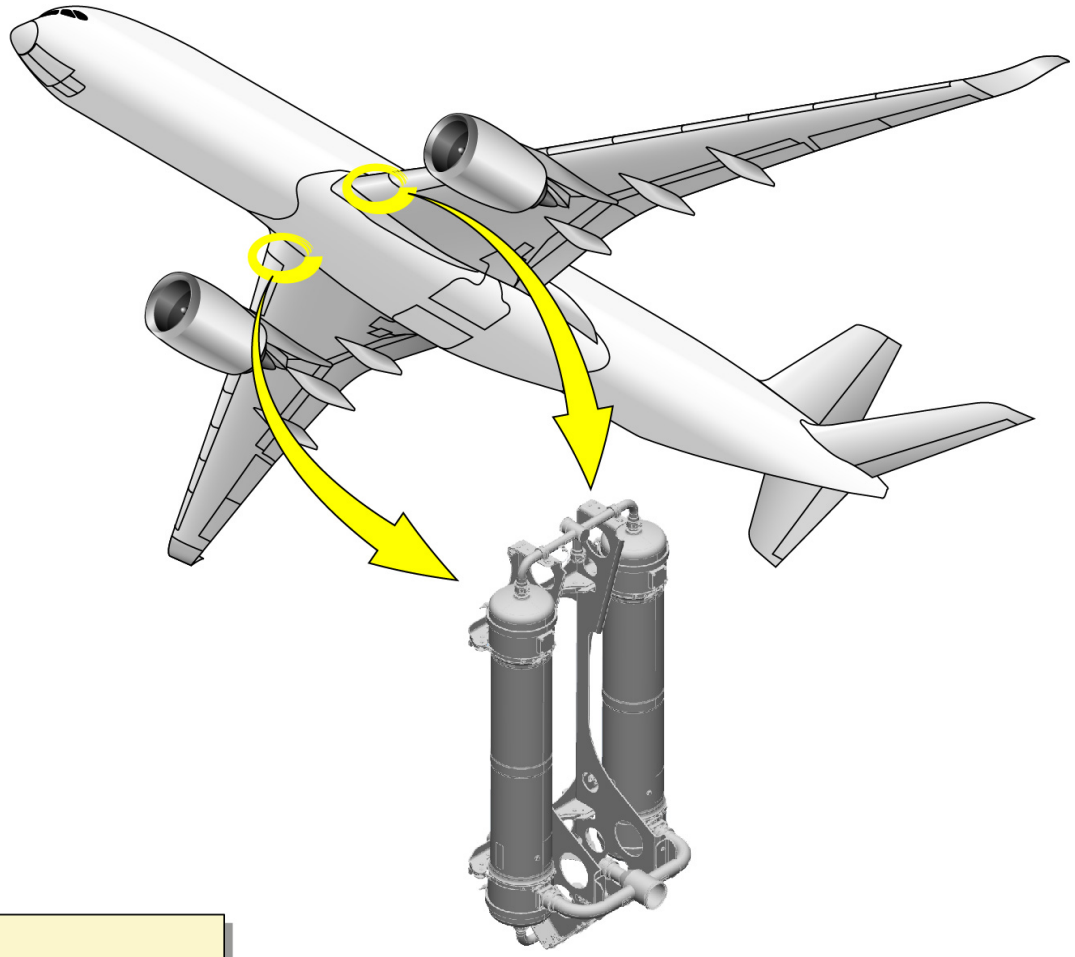
INERT GAS GENERATION SYSTEM (IGGS) - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

INERT GAS SYSTEM PRESENTATION (1)

Inert Gas Generation System (IGGS) - Presentation (continued)

Location

There are two ASM pallets installed, one in each wing leading edge.



ASMs PALLET

ASM: Air Separation Module

INERT GAS GENERATION SYSTEM (IGGS) - PRESENTATION - LOCATION

INERT GAS SYSTEM PRESENTATION (1)

Inert Gas System Control (IGSC) - Presentation

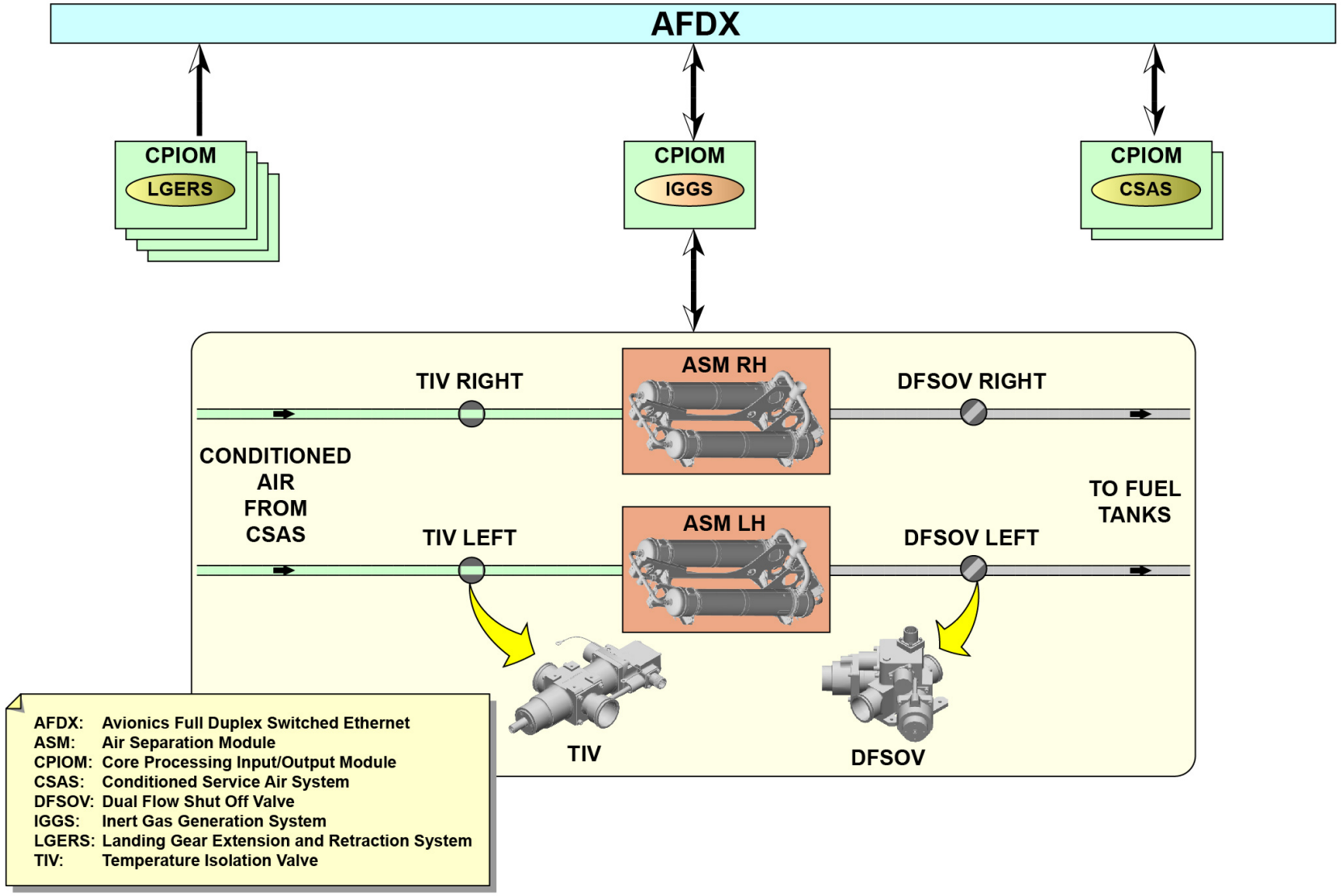
Function/Description

The IGSC controls the supply of conditioned air from CSAS to ASMs. It controls the NEA flow to the fuel tanks.
An IGGS application hosted in Core Processing Input/Output Module (CPIOM) controls automatically the Inert Gas System.
Temperature Isolation Valves (TIVs) control the conditioned air supply to ASMs and Dual Flow Shut-Off Valves (DFSOVs) control the NEA flow to fuel tanks.

Interface

Through the Avionics Full Duplex-Switched Ethernet (AFDX):
- The IGGS application interfaces with the Landing Gears Extension/Retraction System (LGERS) application for flight/ground condition, as the Inert Gas System operates only in flight.
- The IGGS application interfaces with the CSAS application to operate Inert Gas System in accordance with the CSAS status.

V1813401 - V01T0M0 - VM47P1LEVEL0101



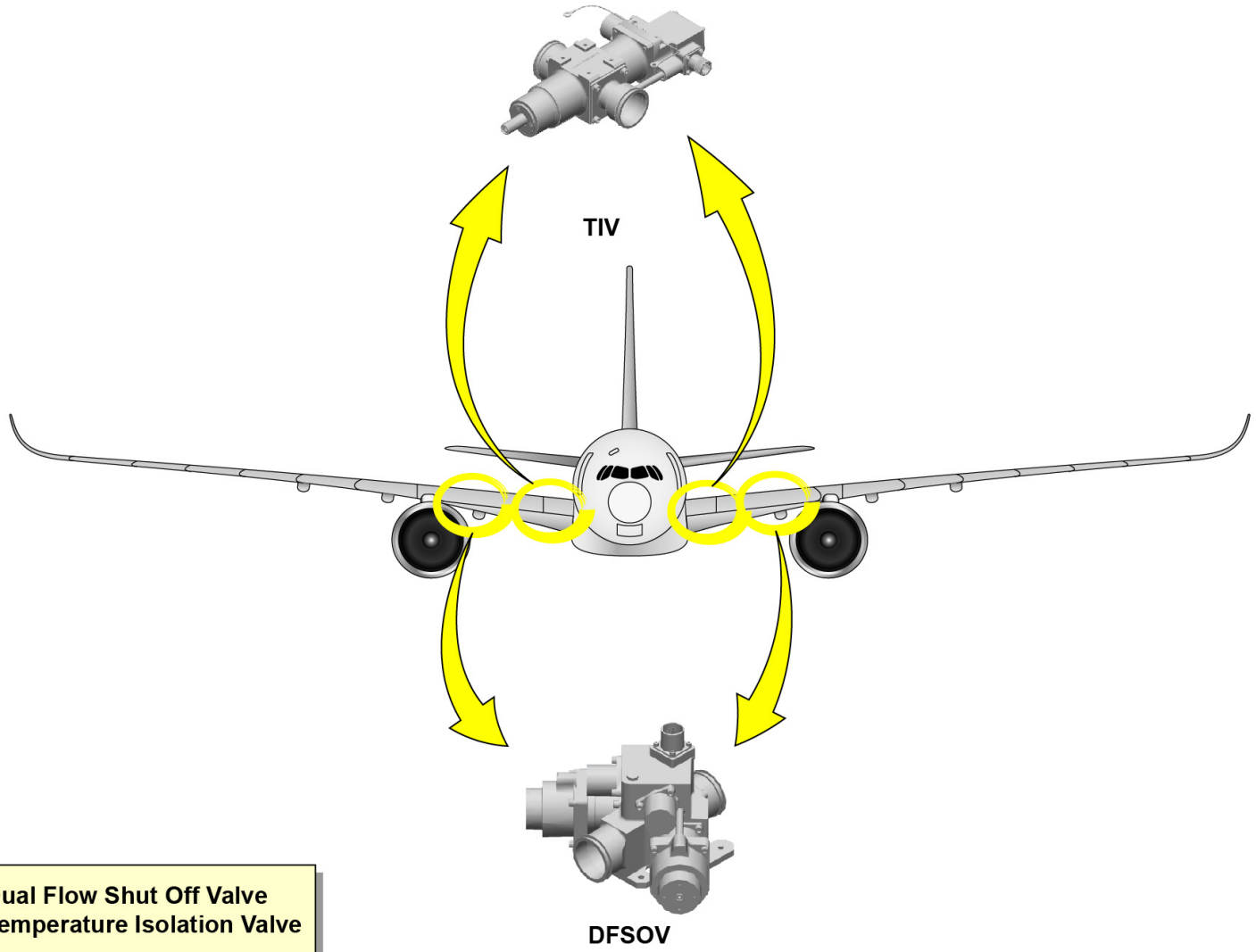
INERT GAS SYSTEM CONTROL (IGSC) - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

INERT GAS SYSTEM PRESENTATION (1)

Inert Gas System Control (IGSC) - Presentation (continued)

Location

There are two TIVs installed, one in each wing leading edge.
There are two DFSOVs installed, one in each wing leading edge.



INERT GAS SYSTEM CONTROL (IGSC) - PRESENTATION - LOCATION

INERT GAS SYSTEM PRESENTATION (1)

Inert Gas Distribution System (IGDS) - Presentation

Function/Description

The IGDS supplies Nitrogen Enriched Air (NEA) to the three fuel tanks.
Distribution pipes allow NEA supply to fuel tanks and check valves prevent fuel reverse flow from fuel tanks to IGGS.

Interface

The IGDS has an interface with the three fuel tanks.

Location

There are distribution pipes in the wings leading edge and inside the fuel tanks.
There are six check valves:
- One check valve in each wing leading edge
- Four check valves inside the fuel tanks.

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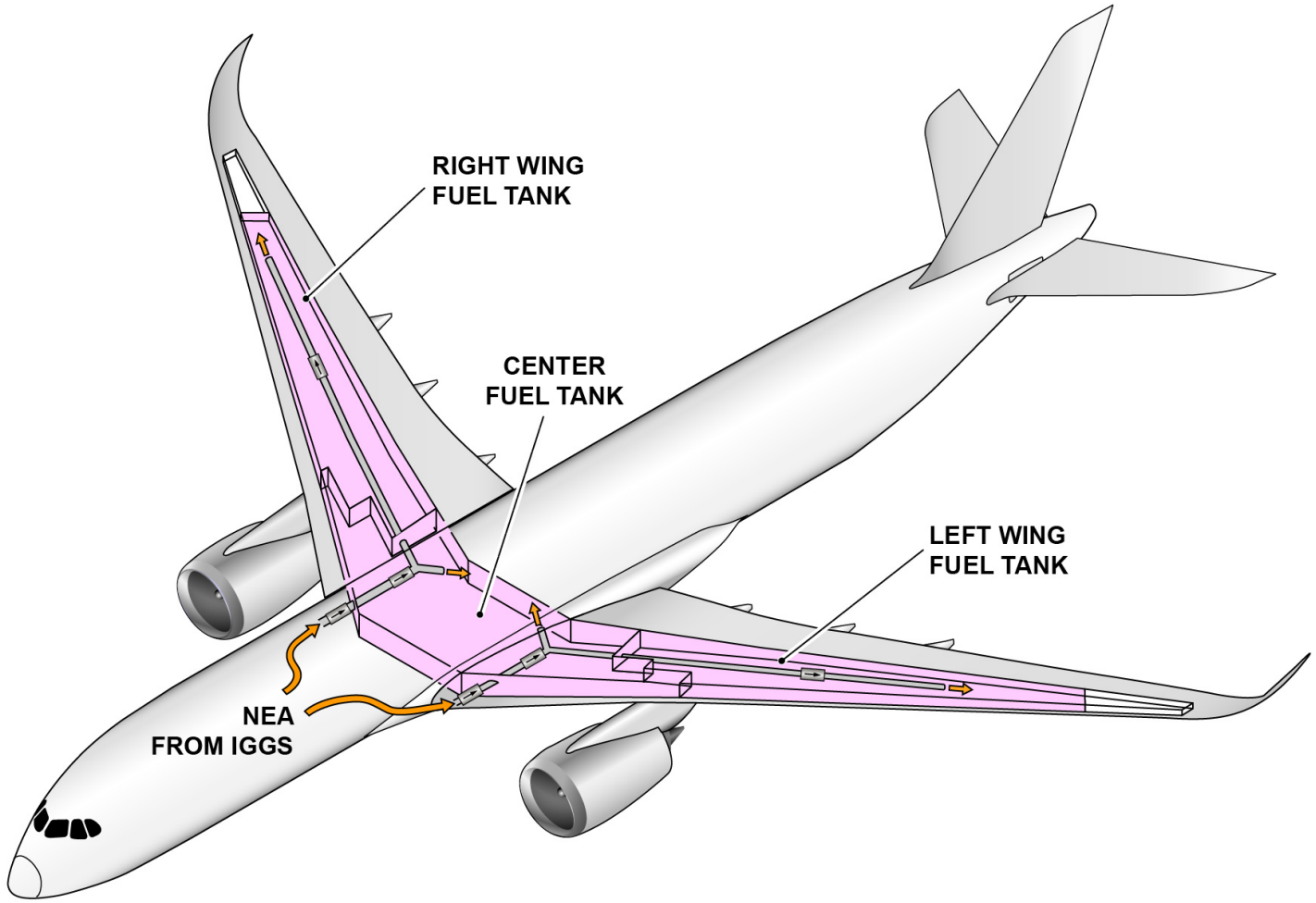
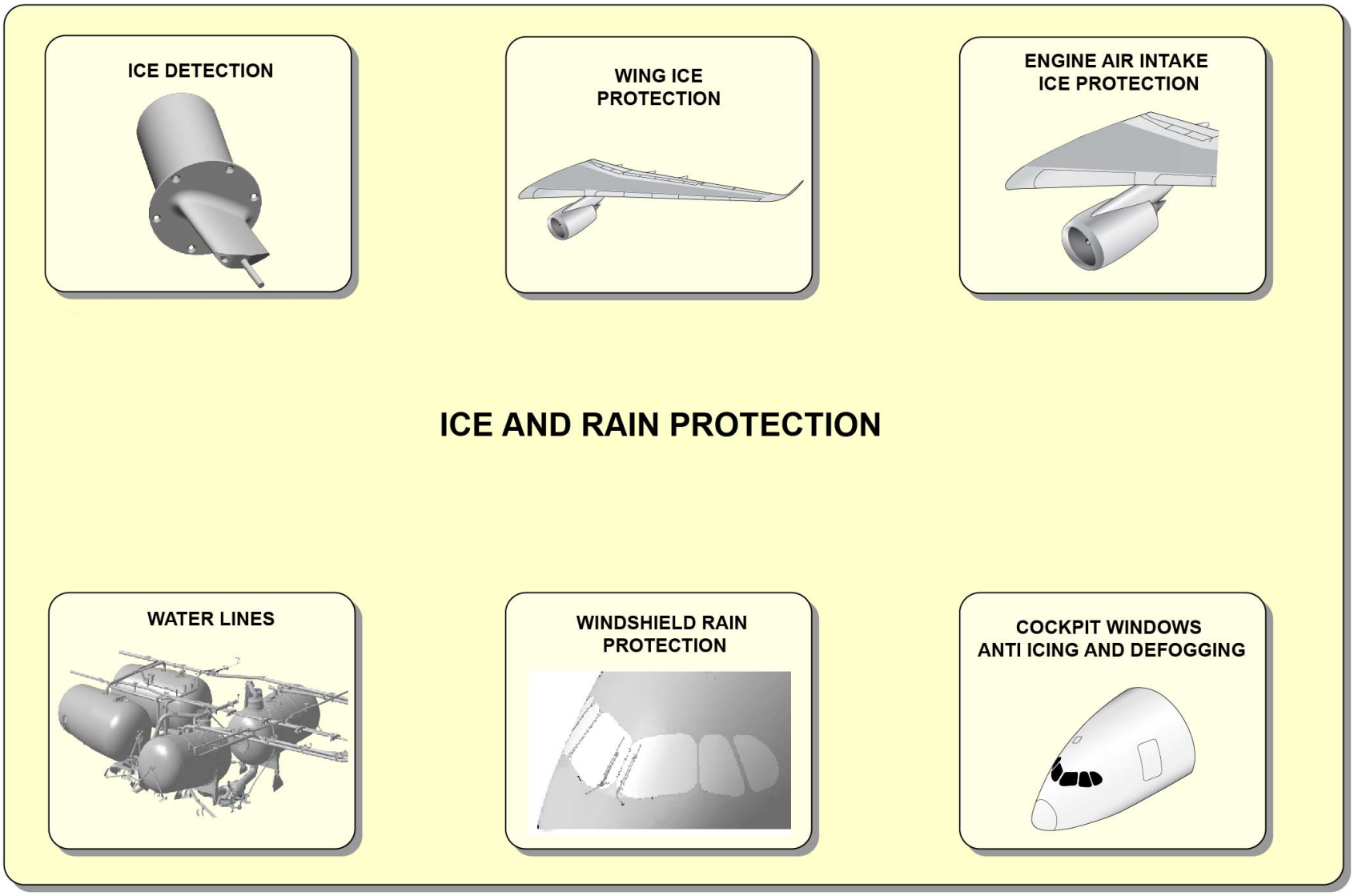


INERT GAS DISTRIBUTION SYSTEM (IGDS) - PRESENTATION - FUNCTION/DESCRIPTION ... LOCATION

ICE & RAIN PROTECTION SYSTEM PRESENTATION (1)

Overview

The functions of the ice and rain protection system are to detect icing conditions and to protect the aircraft systems from the effects of ice and rain.
General familiarization training for this system focuses on:
- Ice Detection
- Wing Ice Protection
- Engine Air Intake Ice Protection
- Cockpit Windows Anti Icing and Defogging
- Windshield Rain Protection
- Water Lines.


ICE DETECTION
WING ICE PROTECTION
ENGINE AIR INTAKE ICE PROTECTION
ICE AND RAIN PROTECTION
WATER LINES
WINDSHIELD RAIN PROTECTION
COCKPIT WINDOWS ANTI ICING AND DEFOGGING

OVERVIEW

ICE & RAIN PROTECTION SYSTEM PRESENTATION (1)

Ice Detection - Presentation

Function/Description

The function of the ice detection system is to detect and give visual indication of ice accretion.
Detection is by ice detectors (vibrating probe type).
Visual indication is by lighted icing indicators.
When the ice detectors detect ice accretion, they send signals to the Anti Ice Control Function (AICF) Nacelle Anti-Icing (NAI) application through the Avionics Full Duplex Switched Ethernet (AFDX) network, to tell the flight crew that ice is detected.
The lighted icing indicators give visual confirmation of ice accretion.
The flight crew operates the lighted icing indicators with the ICE IND control switch on the INT LT panel.

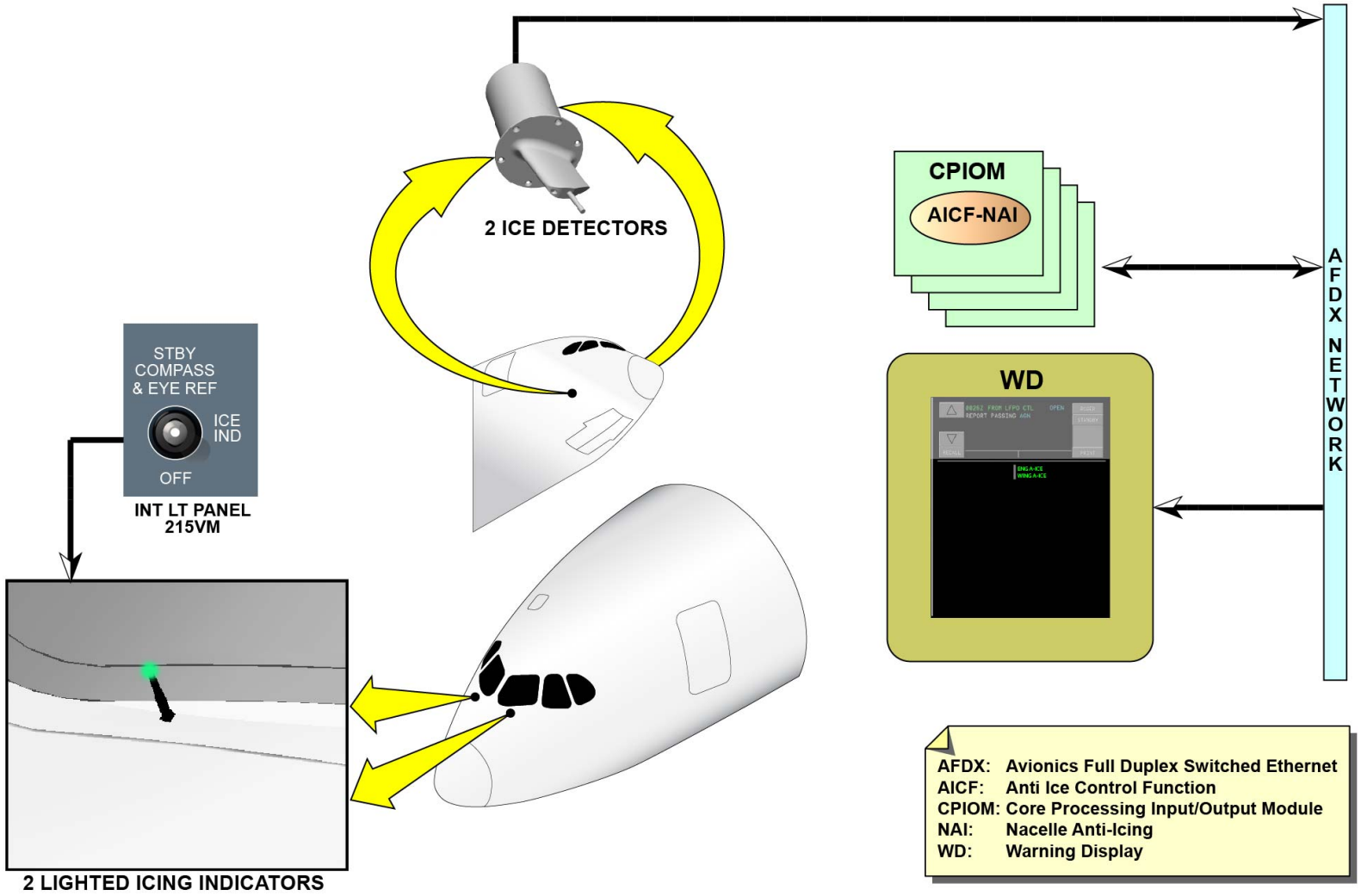
Location

There are two ice detectors, one on each side of the nose section.
There are two lighted icing indicators, one below each windshield frame.

Interface

The AICF-NAI application sends an ice detection signal to the Warning Display (WD) to tell the crew that ice is detected.

V1813401 - V01T0M0 - VM30P1LEVEL0101



ICE DETECTION - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

ICE & RAIN PROTECTION SYSTEM PRESENTATION (1)

Wing Ice Protection - Presentation

Function/Description

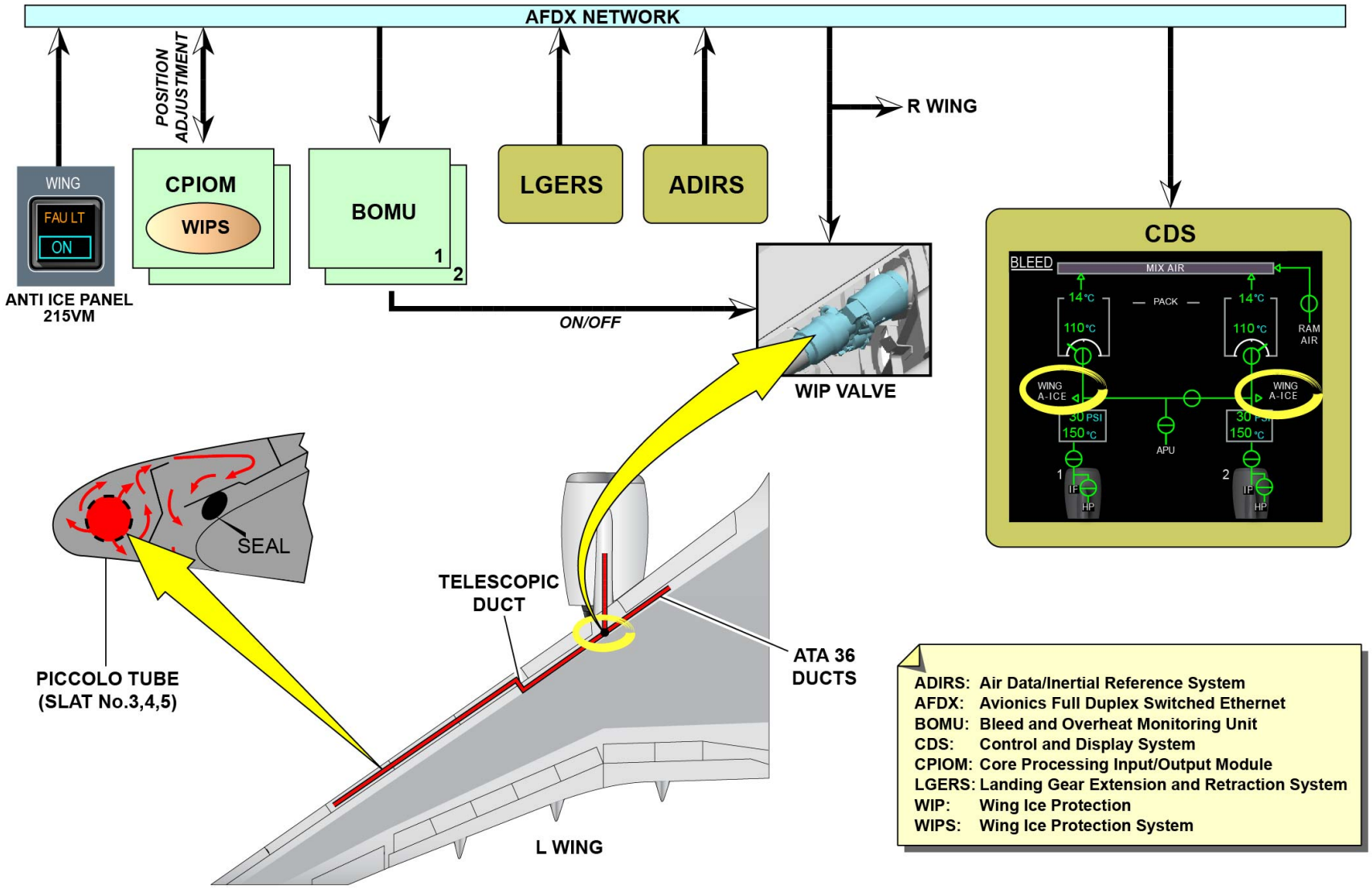
The function of the Wing Ice Protection System (WIPS) is to prevent ice accretion on the wing leading edge.
In flight, this system supplies hot air from the engine bleed-air system to three slats on each wing. Hot air is supplied to each wing by a Wing Ice Protection (WIP) valve, through a telescopic duct and piccolo tubes.
The system is controlled and monitored by the WIPS application hosted in two Core Processing Input/Output Modules (CPIOMs) and two Bleed and Overheat Monitoring Units (BOMUs).
The WIPS has a manual operation mode:
When the WING pushbutton switch is pushed, a signal is sent to the WIPS CPIOMs application through the AFDX network and a different signal is sent to the BOMUs. The BOMUs open the valve and the WIPS CPIOMs application modulate the valve position in relation to the air supply temperature given by other systems through AFDX network.

Location

There is a WIP valve and a telescopic duct in the leading edge of each wing.
There are three piccolo tubes on each wing, one for each slat that has ice protection.

Interface

The WIPS applications send data to the Control and Display System (CDS) BLEED page through the AFDX network.
The Landing Gear Extension and Retraction System (LGERS) and the Air Data/Inertial Reference System (ADIRS) send flight or ground status to the WIPS application.



WING ICE PROTECTION - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

V1813401 - V01T0M0 - VM30P1LEVEL0101

ICE & RAIN PROTECTION SYSTEM PRESENTATION (1)

Engine Air Intake Ice Protection - Presentation

Function/Description

The function of this system is to prevent ice accretion on the engine air intakes.
The system supplies hot air from the HP compressor to the inlet lip of the air intake. The hot air is supplied through a pressure-regulating and shutoff valve and a pressure regulating valve.
An AICF-NAI application controls and monitors the ice protection of each engine through an Engine Electronic Controller (EEC).
The engine-air-intake ice protection system has a manual operation mode:
When the ENG pushbutton switch is pushed, a signal is sent to the AICF-NAI application through the AFDX network. Then, the AICF-NAI application sends a signal to the Engine Interface Function (EIF) through the AFDX network. Through the AFDX network, the signal is sent to the EEC to operate the pressure-regulating and shutoff valve and the pressure regulating valve.
Through the AFDX network, signals are sent from the EEC to the AICF application to monitor the pressure-regulating and shutoff valve and the pressure regulating valve.

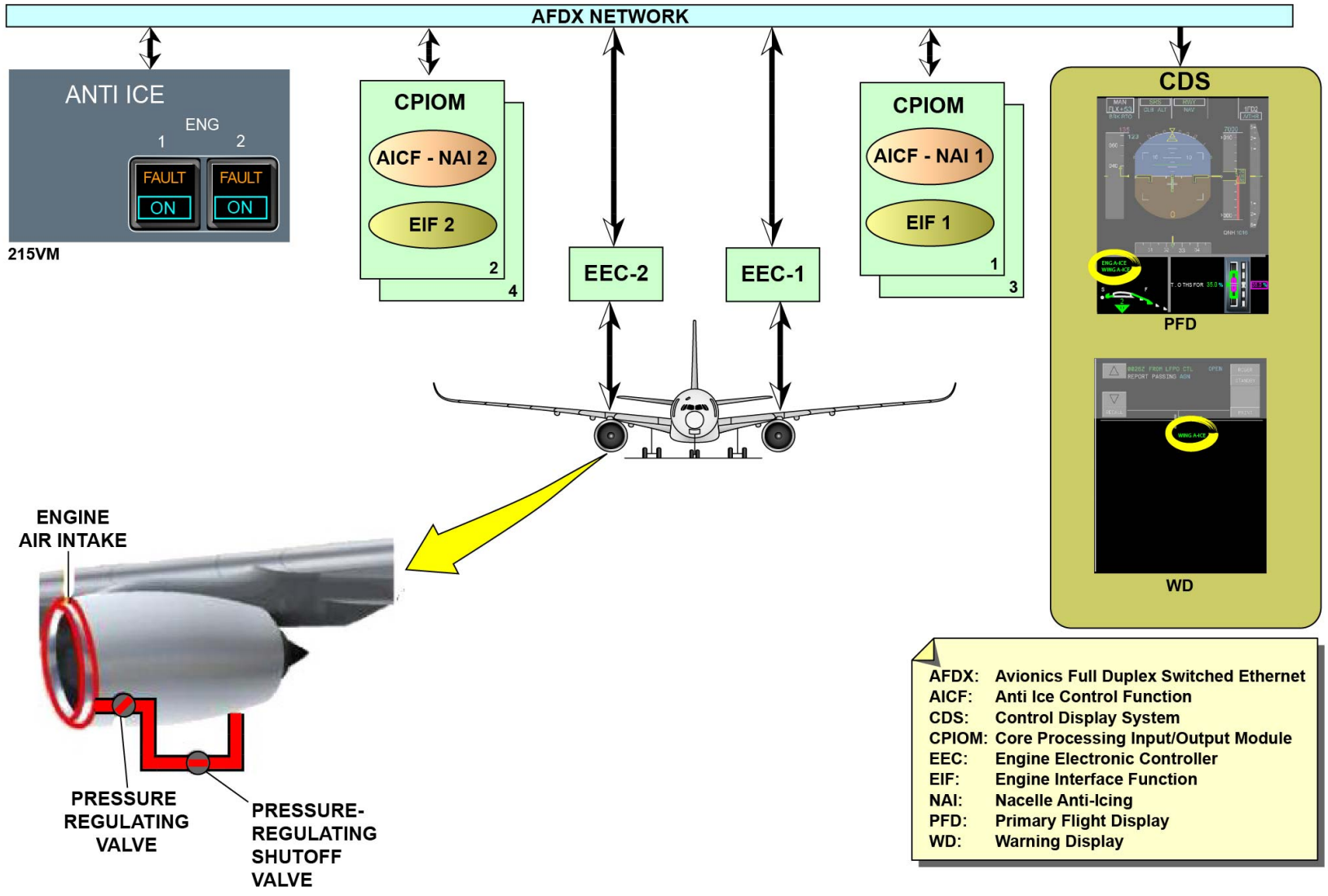
Location

There is one pressure-regulating and shutoff valve and one pressure regulating valve on each engine.

Interface

The NAI command selection is sent by the EIF application to the CDS through the AFDX network.

V1813401 - V01T0M0 - VM30P1LEVEL0101



ENGINE AIR INTAKE ICE PROTECTION - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

ICE & RAIN PROTECTION SYSTEM PRESENTATION (1)

Cockpit Windows Anti Icing and Defogging - Presentation

Function/Description

The function of this subsystem is to protect the windshields and the lateral windows from icing and fogging.
Two Window Heat Computers (WHCs) control and monitor the heating of each window through heating films and temperature sensors.
There is one WHC for the Captain side (WHC1) and one for the First Officer side (WHC2).
The cockpit-windows anti-icing and defogging system has two operation modes:
Automatic Mode:
The system receives an engine running signal from the EIF application through AFDX network.
Manual Mode:
The PROBE & WINDOW HEAT pushbutton switch on the overhead panel starts the operation of the system.

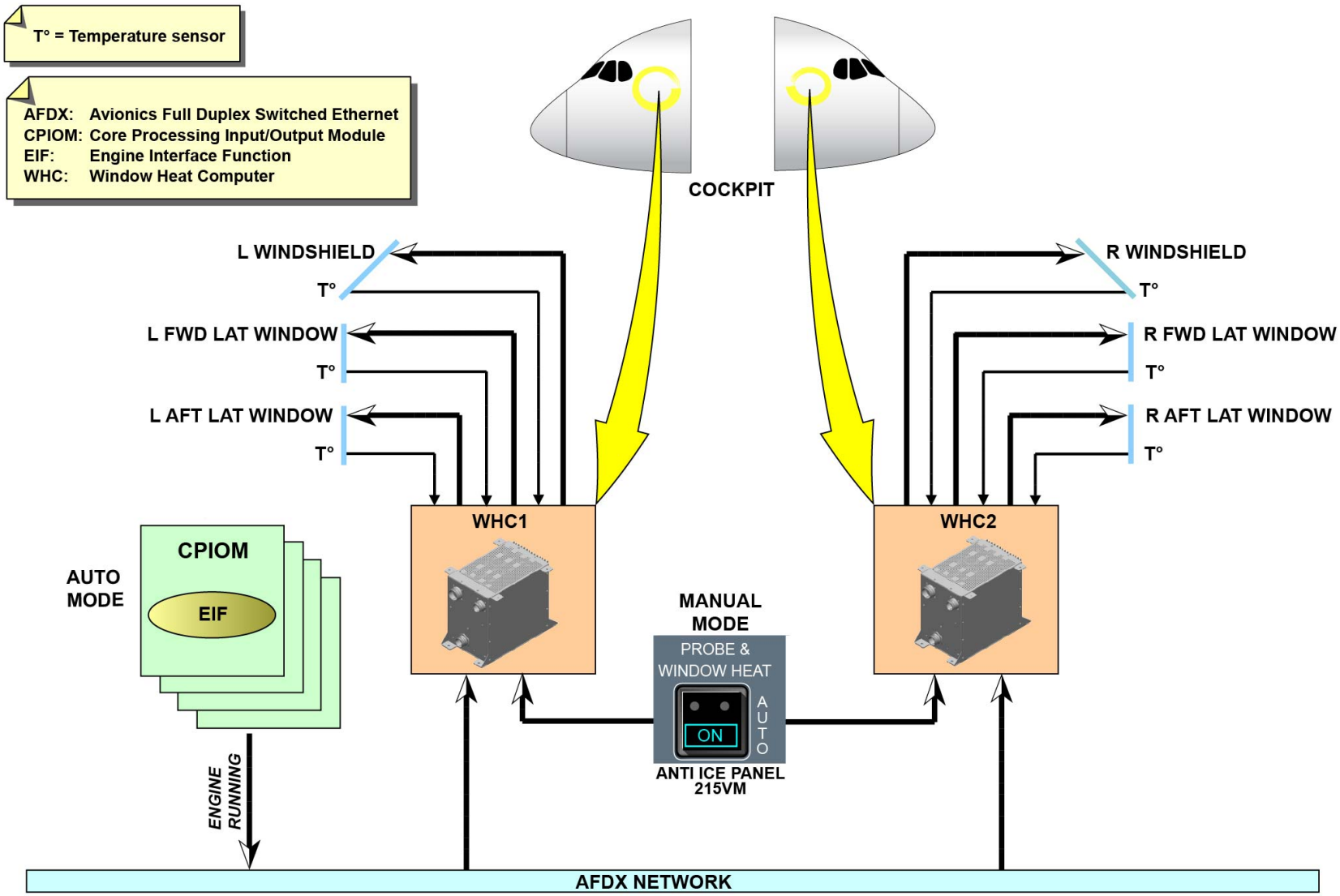
Location

The WHCs are installed in the cockpit.
The heating films and the temperature sensors are part of the cockpit windows.

Interface

The WHCs receive inputs from the EIF application through the AFDX network when the engines are running.

V1813401 - V01T0M0 - VM30P1LEVEL0101



COCKPIT WINDOWS ANTI ICING AND DEFOGGING - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

V1813401 - V01T0M0 - VM30P1LEVEL0101

ICE & RAIN PROTECTION SYSTEM PRESENTATION (1)

Windshield Rain Protection - Presentation

Function/Description

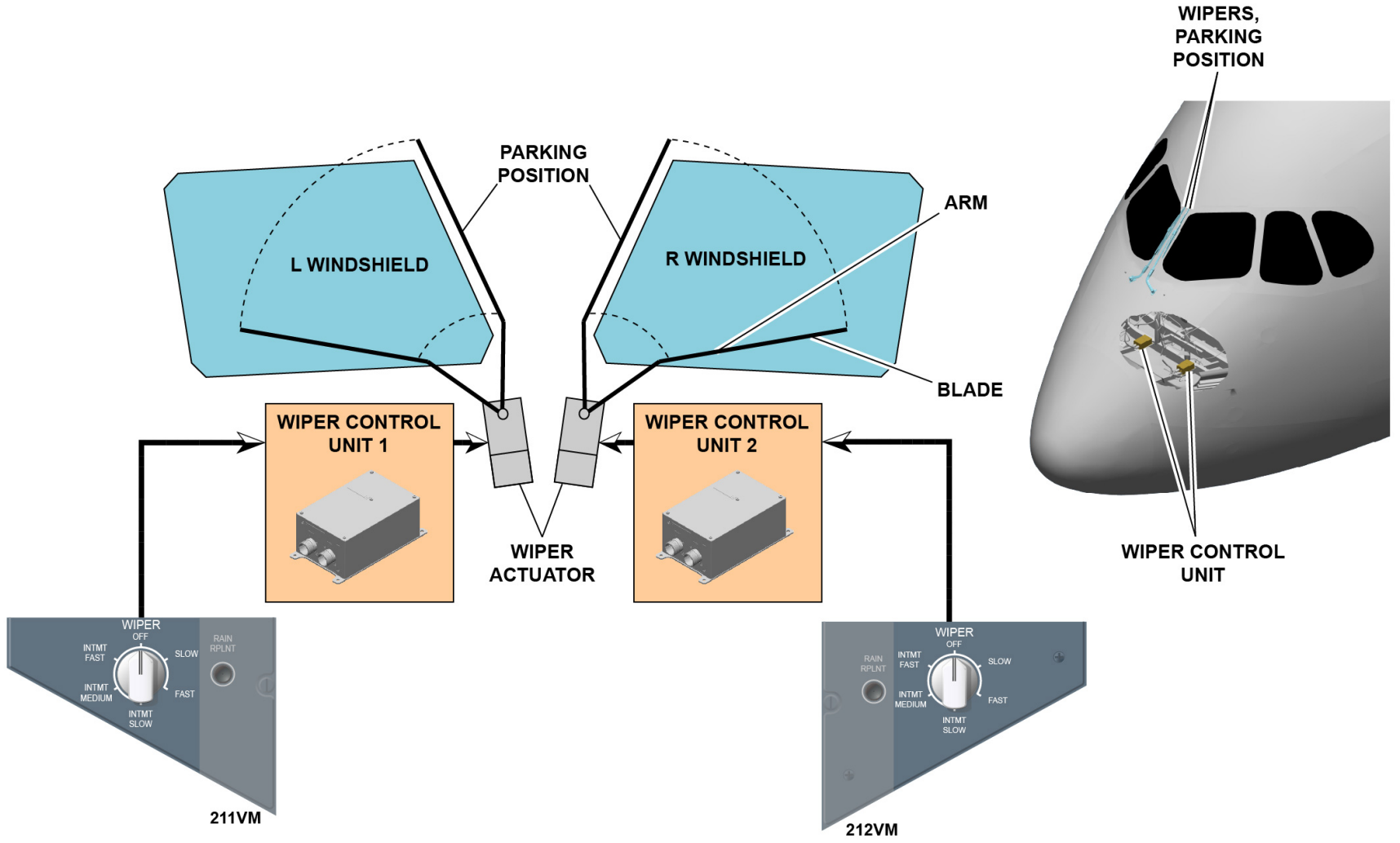
The function of the windshield rain-protection system is to remove rain from the windshield. The rain protection system has a wiper system and a rain repellent system.
Wiper System:
There are two independent wiper systems, one for each side (Captain and First Officer). Each system has a control switch, a wiper control unit, a wiper actuator and a wiper arm and blade assembly. The control switch sends signals to the wiper control unit to start and control the speed of the related wiper actuator.
Rain Repellent System (for Heavy Rain Conditions):
There are two rain repellent systems, one for each side (Captain and First Officer). Each system has a pushbutton switch that controls an ejector valve to spray rain repellent fluid on the windshield.
The two ejector valves are supplied with rain repellent fluid from a common can which is part of the gage assembly.
The system does not operate when the engines are stopped. The system can operate when WHC1 and WHC2 receive an engine running signal from the EIF application.
WHC2 also monitors the fluid level.

Location

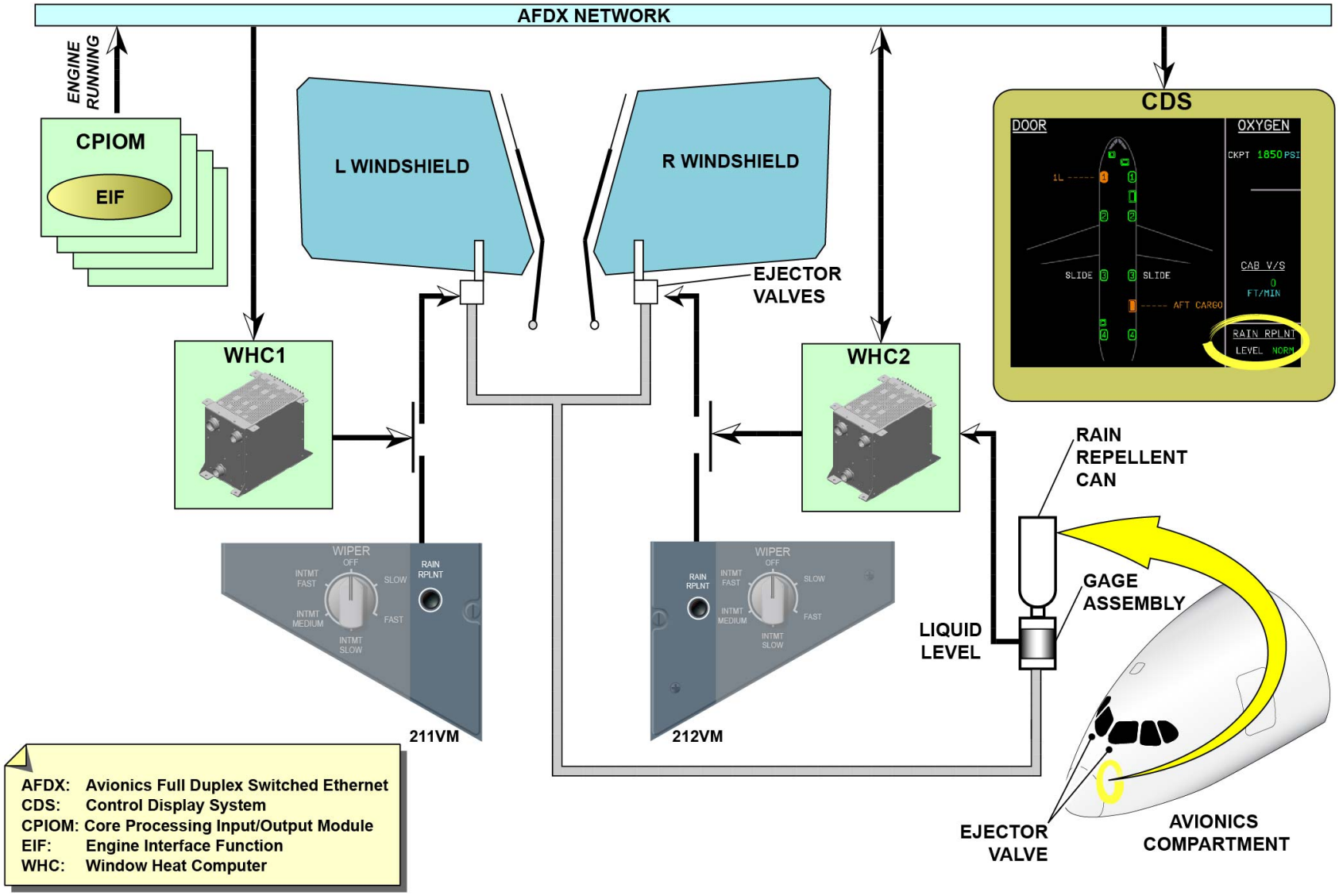
There is one wiper on each windshield. The parking position of the wiper is vertical, along the center frame between the two windshields.
The wiper control units are installed in the avionics compartment.
The gage and can assemblies are installed in the avionics compartment.

Interface

WHC2 receives a fluid level signal from the gage assembly and sends this data to the CDS through the AFDX network.



WINDSHIELD RAIN PROTECTION - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE



WINDSHIELD RAIN PROTECTION - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

V1813401 - V01T0M0 - VM30P1LEVEL0101

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ICE & RAIN PROTECTION SYSTEM PRESENTATION (1)

Water Lines - Presentation

Function/Description

The function of the water-line ice-protection system is to prevent ice formation in:
- The waste water lines
- The water servicing panels
- The potable water lines and tanks
- The drain masts
- The drain panel.

The water-line ice-protection system has Ice Protection Control Units (IPCUs), temperature sensors and electrical heating elements. The IPCUs receive temperature data from the temperature sensors and use this data to control the heating elements.

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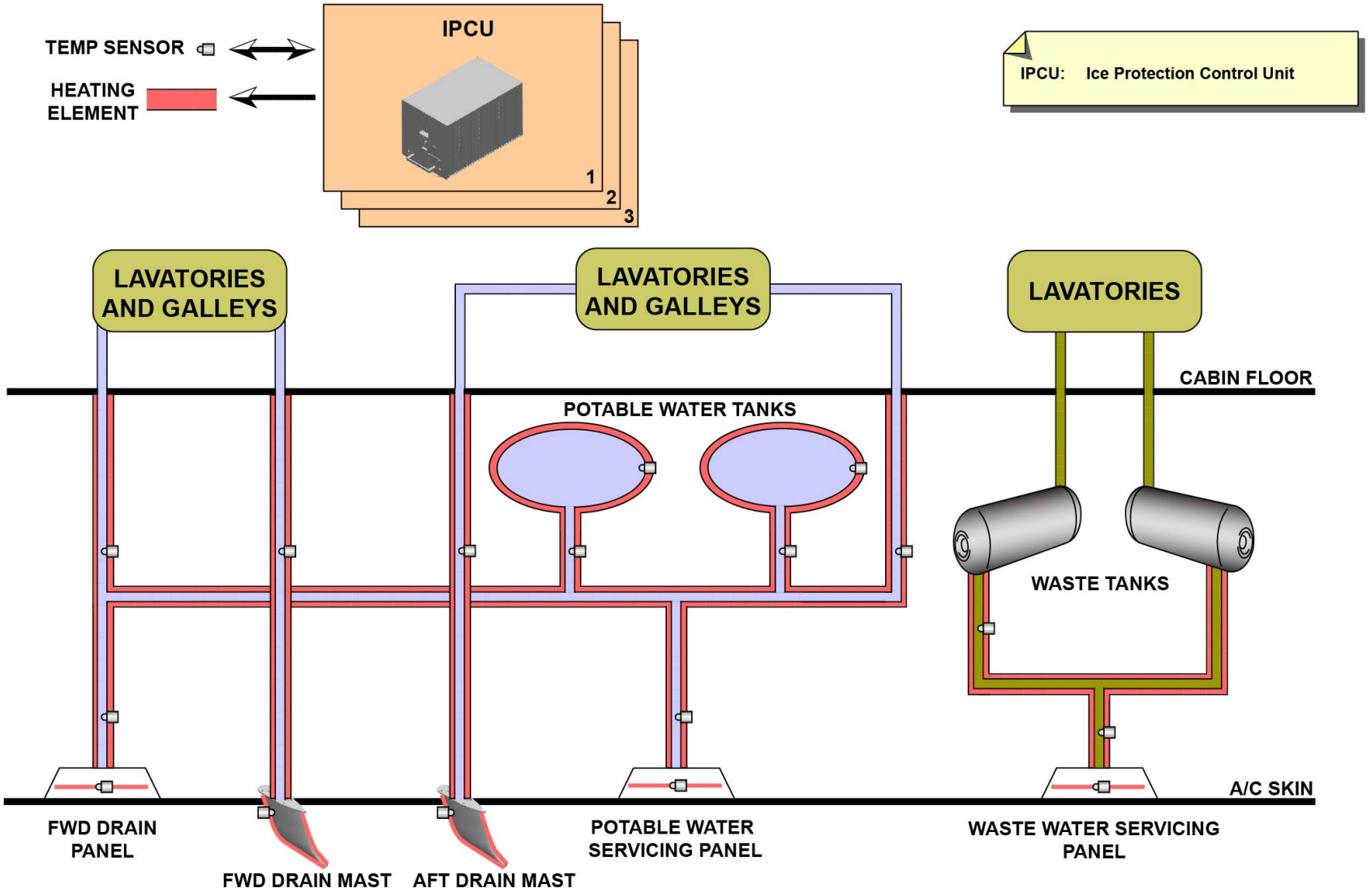


WATER LINES - PRESENTATION - FUNCTION/DESCRIPTION

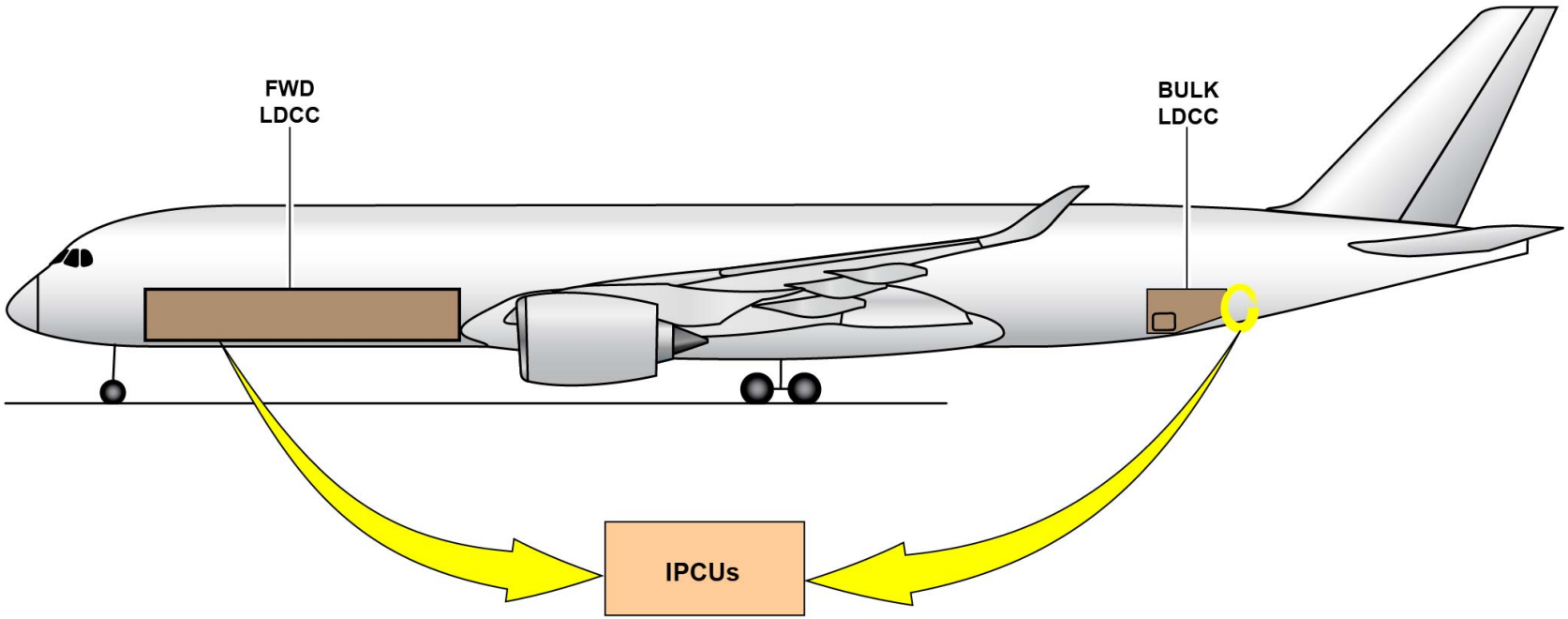
V1813401 - V01T0M0 - VM30P1LEVEL0101

ICE & RAIN PROTECTION SYSTEM PRESENTATION (1)

Water Lines - Presentation (continued)

Location

The IPCUs are installed in the forward cargo compartment and in the aft cabin underfloor-compartment, behind the bulk compartment.



WATER LINES - PRESENTATION - LOCATION

ICE & RAIN PROTECTION SYSTEM PRESENTATION (1)

Control and Indicating - Presentation

The manual controls of the ice and rain protection system are on the overhead panel:
- INT LT/ICE IND control switch, to illuminate the lighted icing indicators
- ANTI ICE/PROBE & WINDOW HEAT pushbutton switch
- ANTI ICE/WING pushbutton switch
- Two ANTI ICE/ENG pushbutton switches
- Two WIPER selector switches, one for each side
- Two RAIN RPLNT pushbutton switches, one for each side.

Data related to the system status is shown on the CDS.

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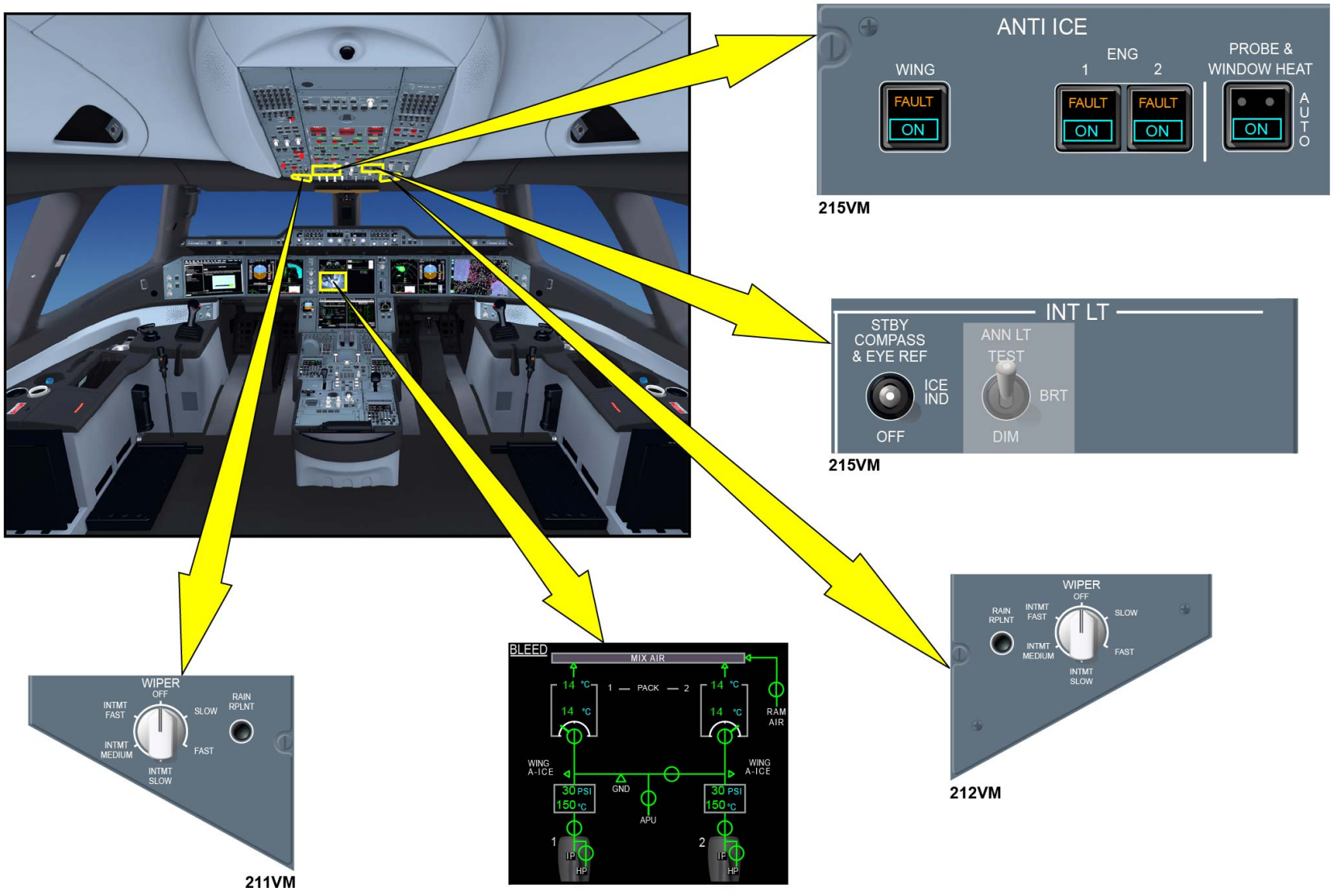

CONTROL AND INDICATING - PRESENTATION

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