A380-800

Flight Deck and Systems Briefing for Pilots

Issue 02 - March 2006

Customer Services

AIRBUS

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A380-800
Flight Deck and Systems
Briefing for Pilots

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Any questions you may have on this brochure should be submitted to:

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A380 Flight Deck and Systems Briefing for Pilots

Contents

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1. General

Flight Deck and Systems Briefing for Pilots

Contents

AIRBUS

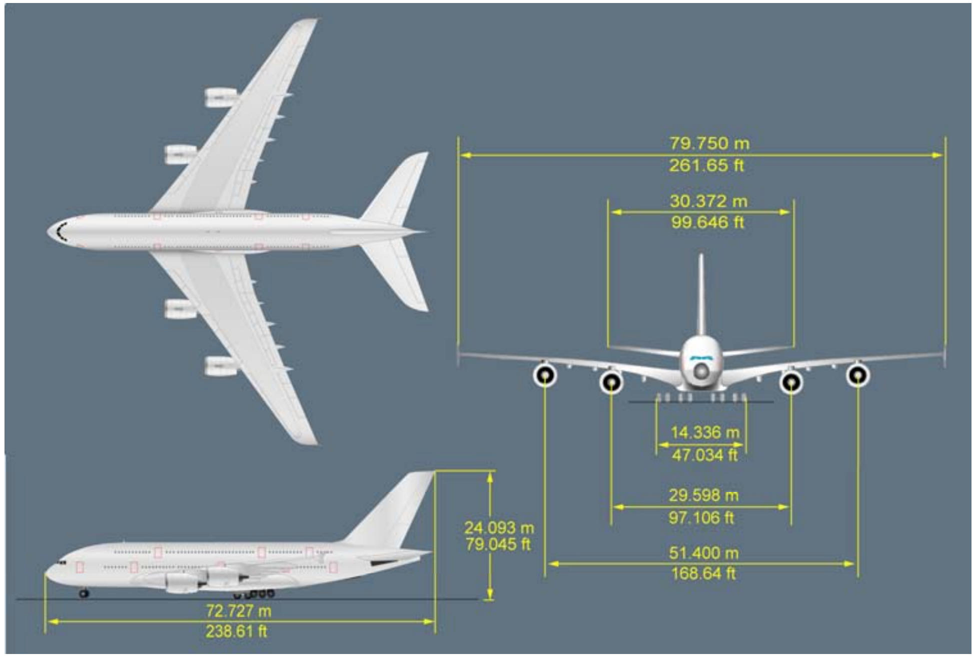
General

The A380 is a Very Long Range (VLR), subsonic, civil transport aircraft. The design combines the in-service experience gained from the A330 and A340 aircraft operated all around the world with new technology developed specifically for the A380 program.

The general arrangement is a four-engine configuration with rearward swept low wing and a conventional tail.

The basic model is the A380-800 Long Range passenger model.

Dimensions



Certification Basis

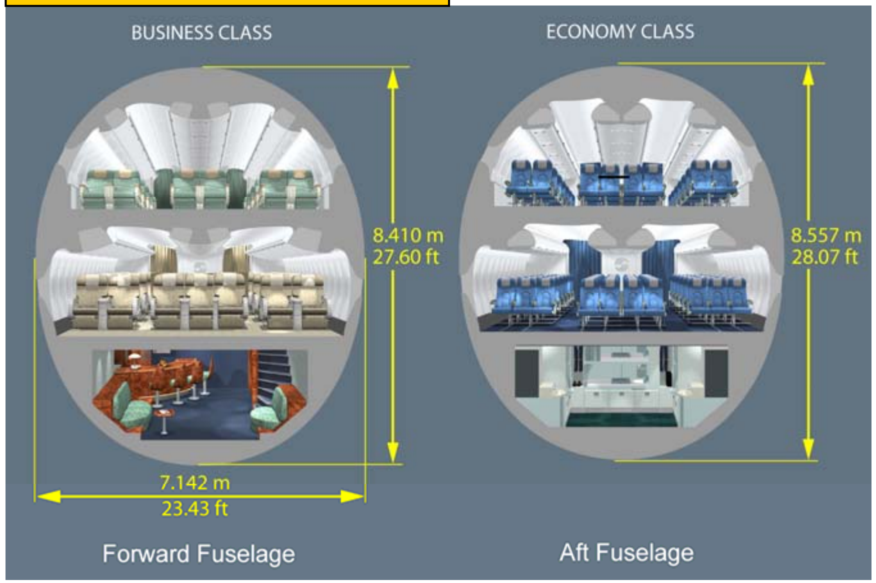
- Design, construction and type certificate: JAR 25 at change 15 (FAR 25 amendments 1 to 98 exc. 87 and 96)
- Noise requirements: JAR 36 (plus 2 NPAs) equivalent to ICAO Annex 16 (Chapter 4)
- Emission requirements: JAR 34

Typical Cabin Layout

The A380 has a full-length double-deck fuselage.
The two passenger decks are referred to as the main and upper deck.

Both decks are connected by cabin stairs and galley lifts. The cockpit is located between these two decks (Refer to Flight Deck Layout).
The typical cabin layout is 555 seats. The passenger seating layout may vary, depending on the Operator's requirements.
The two passenger decks offer a wide range of cabin arrangement possibilities.

Typical and Optional Arrangement

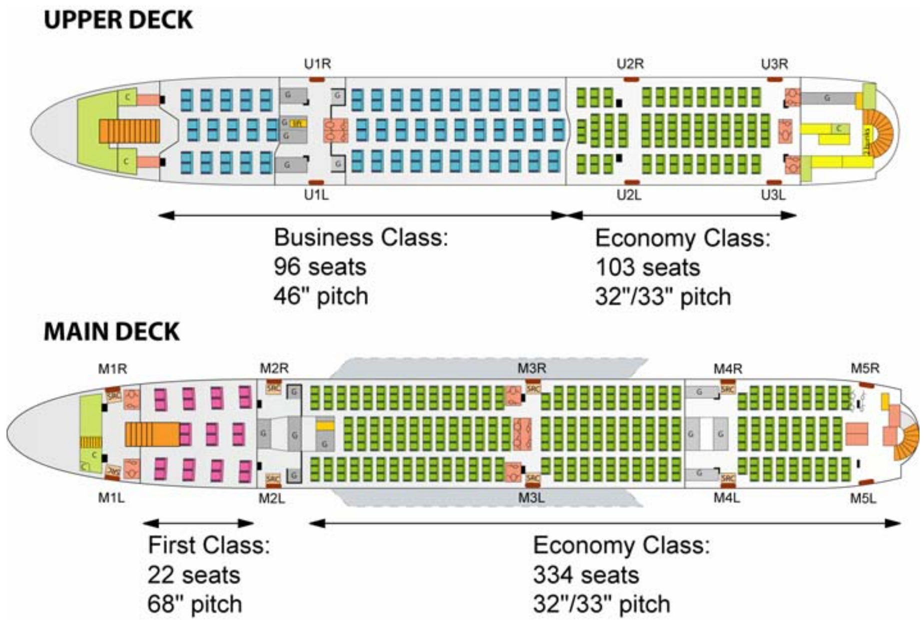


Each deck can have up to:

- 10 seats abreast in each row of the main deck
- 8 seats abreast in each row of the upper deck.

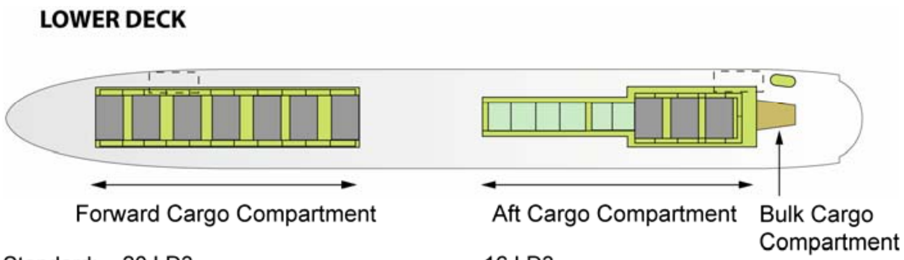
Each deck can either be serviced from the main deck only, or from both decks simultaneously.

The A380–800 aircraft has 8 pairs of large passenger doors (Type A). Five pairs are on the main deck and three pairs are on the upper deck.



Cargo Hold Capacity

The lower deck is divided into three different cargo compartments: The forward cargo compartment, the aft cargo compartment, and the bulk cargo compartment.



Standard:	20 LD3 or 7 pallets 88" or 96" x 125"	16 LD3 or 6 LD3 + 3 pallets 88" or 96" x 125"
Option:	22 LD3 or 7 pallets 88" or 96" x 125"	6 pallets 88" or 96" x 125"

Design Specifications

- **Design Weights**

	Standard	Option 1	Option 2
MRW	562 000 kg	512 000 kg	571 000 kg
MTOW	560 000 kg	510 000 kg	569 000 kg
MLW	386 000 kg	394 000 kg	391 000 kg
MZFW	361 000 kg	372 000 kg	366 000 kg

- **Design Speeds**

V_{MO}	= 340 kt CAS
M_{MO}	= 0.89
V_D	= 375 kt CAS
M_D	= 0.96
V_{LO}	= 250 kt CAS (extension) = 250 kt CAS (retraction) = 220 kt CAS (gravity extension)
V_{LE}	= 250 kt CAS
M_{LE}	= 0.55

- **Pavement Strength**

Main Landing Gear & Body Landing Gear tires (radial)	ACN							
	Flexible Pavement				Rigid Pavement			
	Cat A	Cat B	Cat C	Cat D	Cat A	Cat B	Cat C	Cat D
1400 x 530 x R23	63	69	83	111	55	67	88	110

Note: The Nose Landing Gear is equipped with 2 radial 1 270 x 455 x R22 tires.

- **Slats and Flaps Design Speeds**

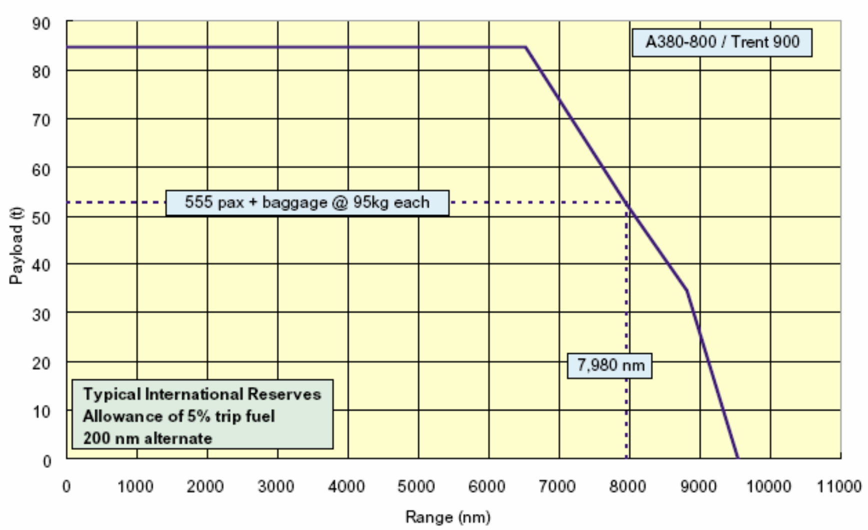
Configuration	Function	Slats (°)	Flaps (°)	Ailerons (°)	Design Speeds VFE kt (CAS)
0	Climb / Cruise / Holding	0	0	0	VMO / MMO
1	Holding	20	0	0	263
1+F	Takeoff	20	8	5	222
2	Takeoff / Approach	20	17	5	220
3	Takeoff / Approach / Landing	23	26	5	196
Full	Landing	23	33	10	182

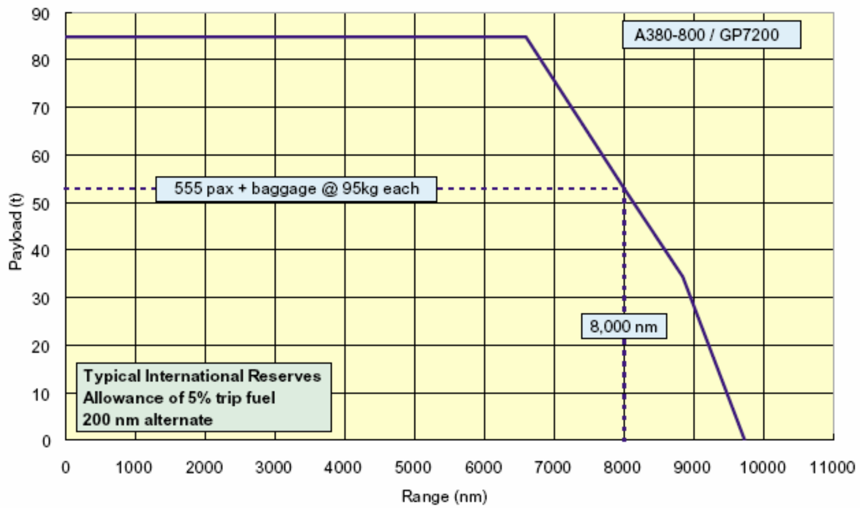
General

The A380 can be powered by two engine types:

- The Rolls-Royce TRENT 900
- The Engine Alliance GP7200.

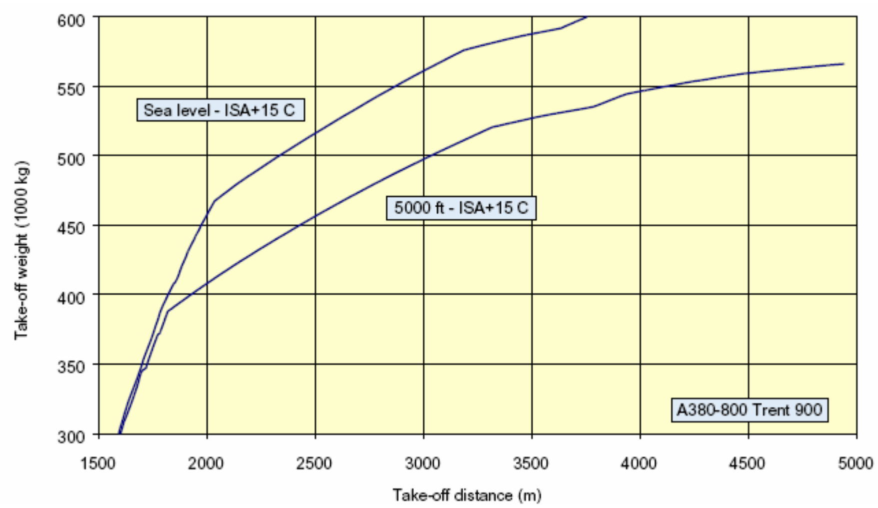
Payload/Range

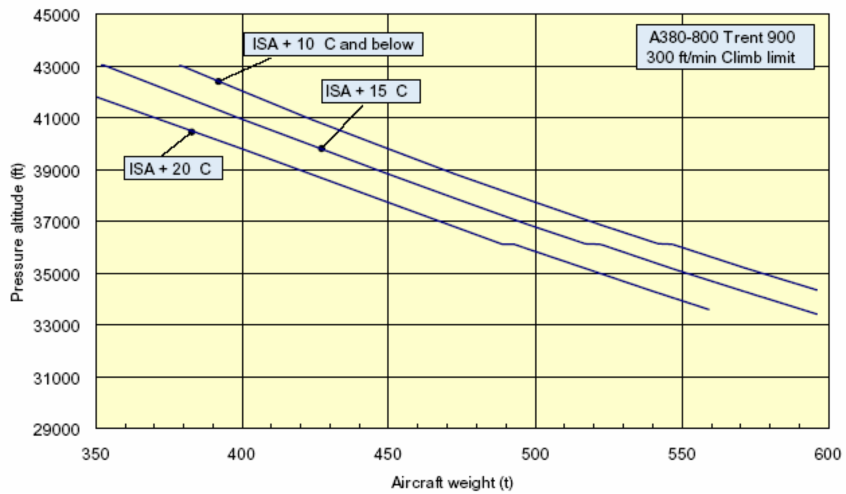


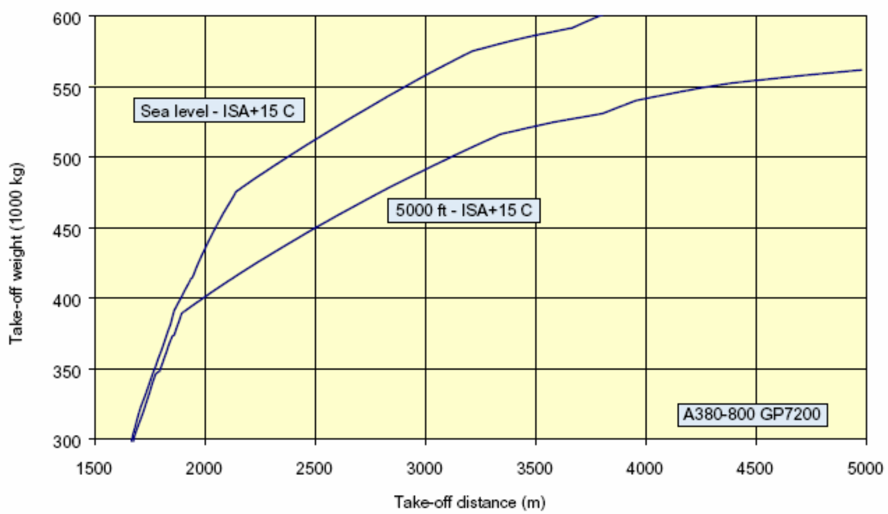


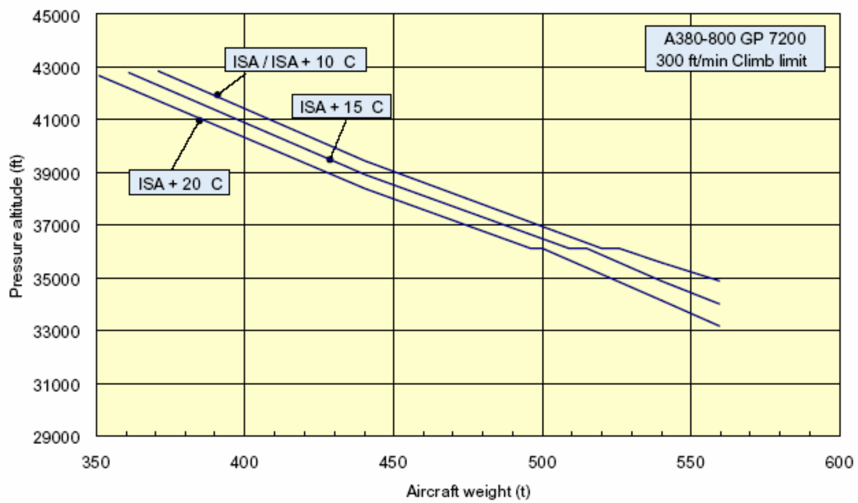
Takeoff Performance

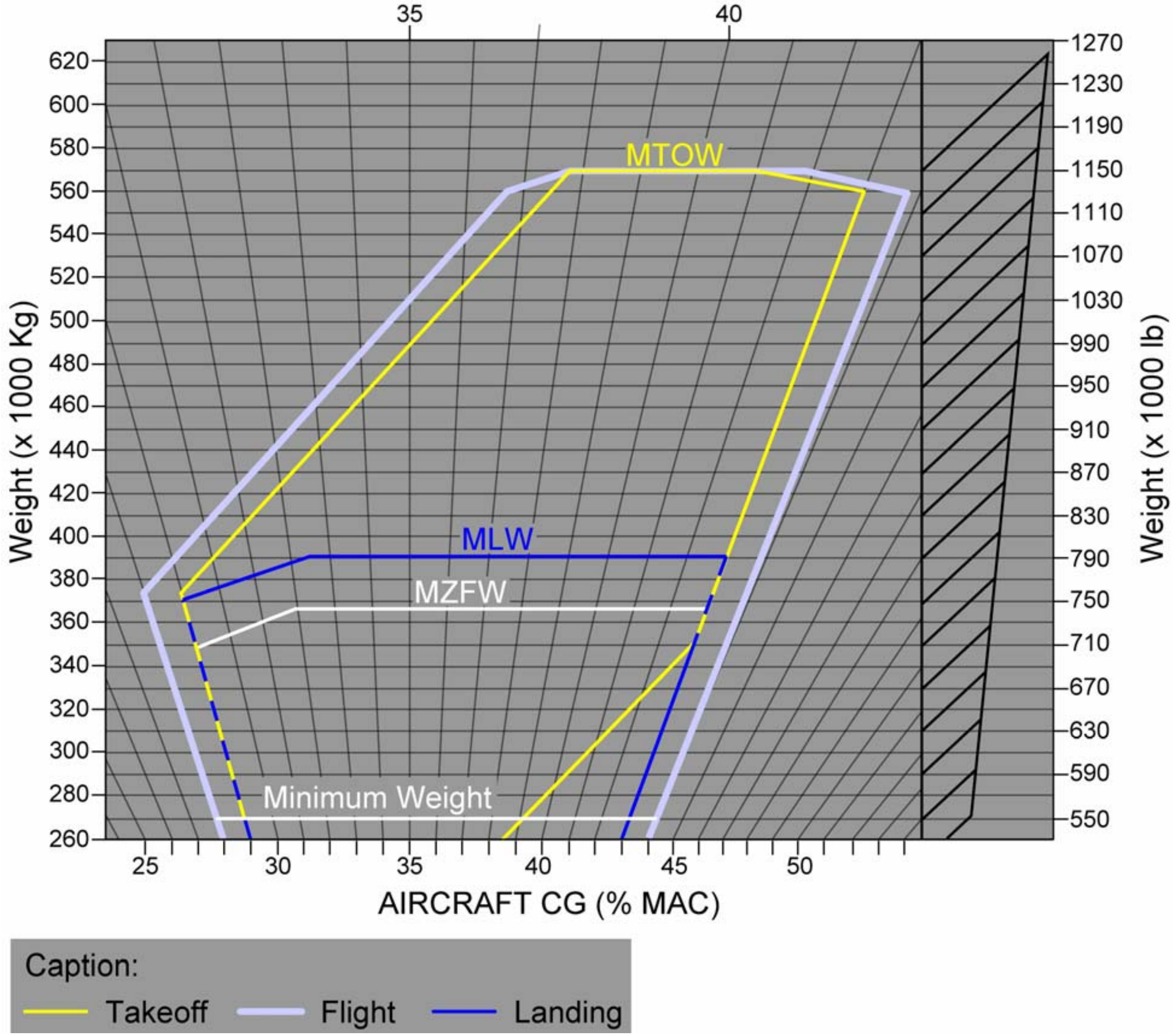
Initial Cruise Altitude Capability









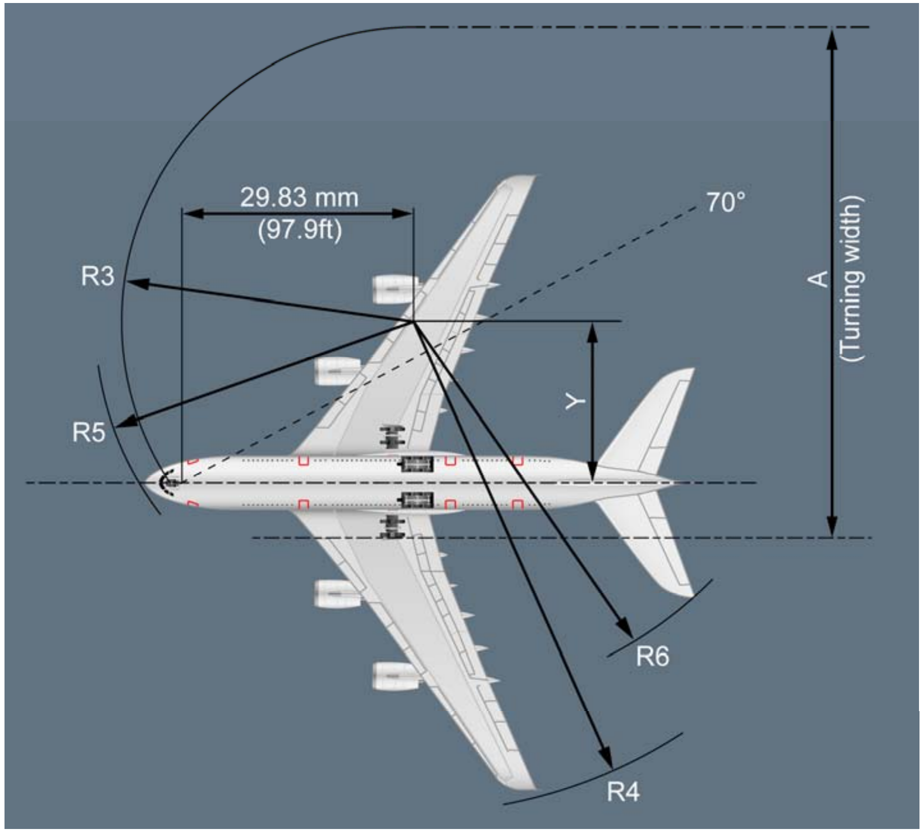


35
40
MTOW
MLW
MZFW
Minimum Weight
620
600
580
560
540
520
500
480
460
440
420
400
380
360
340
320
300
280
260
Weight (x 1000 Kg)
1270
1230
1190
1150
1110
1070
1030
990
950
910
870
830
790
750
710
670
630
590
550
Weight (x 1000 lb)
25
30
35
40
45
50
AIRCRAFT CG (% MAC)
Caption:
Takeoff
Flight
Landing

A380 General
6.Ground Maneuvering Capability

The A380 can be towed or pushed up to a nosewheel angle of 70 degrees from the aircraft centreline, at all weights up to the maximum ramp weight without mechanically disconnecting the steering.

The A380 is capable of towbarless towing.



	Type of turn 1: - Asymmetric thrust - Differential braking	
Steering Angle	70°	
Effective Steering Angle	69.5°	
	m	ft
Y	11.08	36.35
A	50.91	167.0
R3	32.66	107.2
R4	53.76	176.4
R5	36.52	119.8
R6	46.01	150.9

2. ATA 25 Flight Deck Layout

Flight Deck and Systems Briefing for Pilots

A380 Flight Deck Layout
1.General

Introduction

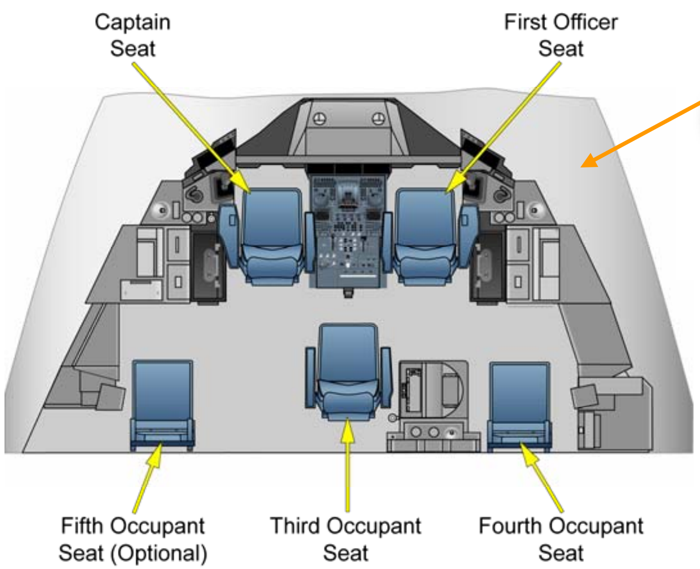
The cockpit is located in between the main and upper deck, and is accessible via the main deck by the cockpit stairs.

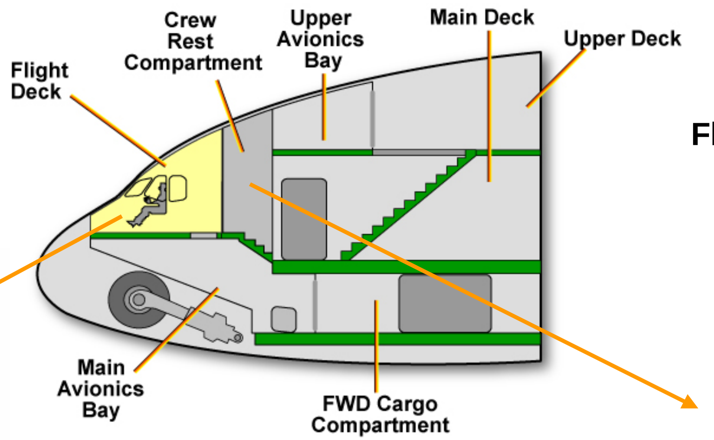
The A380 cockpit has the following seats :

- A Captain and a First Officer seat
- A third observer seat
- A fourth and fifth (optional) occupant folding seat.

An optional flight crew rest compartment can be installed on the main deck just behind the flight deck.
The flight crew rest compartment is divided into two separate flight crew compartments, one on top of the other.
The entrance to the lower compartment is on the main deck at the rear wall of the compartment. The entrance to the upper compartment is at the top of the cockpit stairs.

Flight Deck





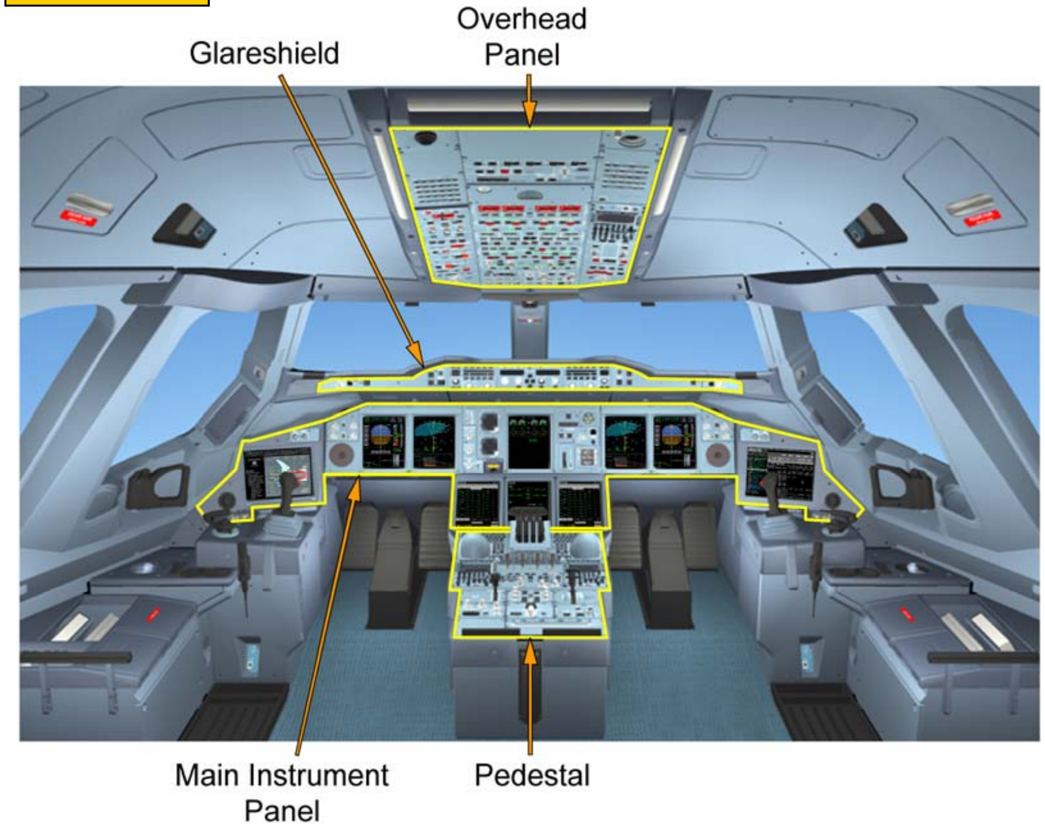
Flight Crew Rest Compartment (optional)

A380 Flight Deck Layout
1.General

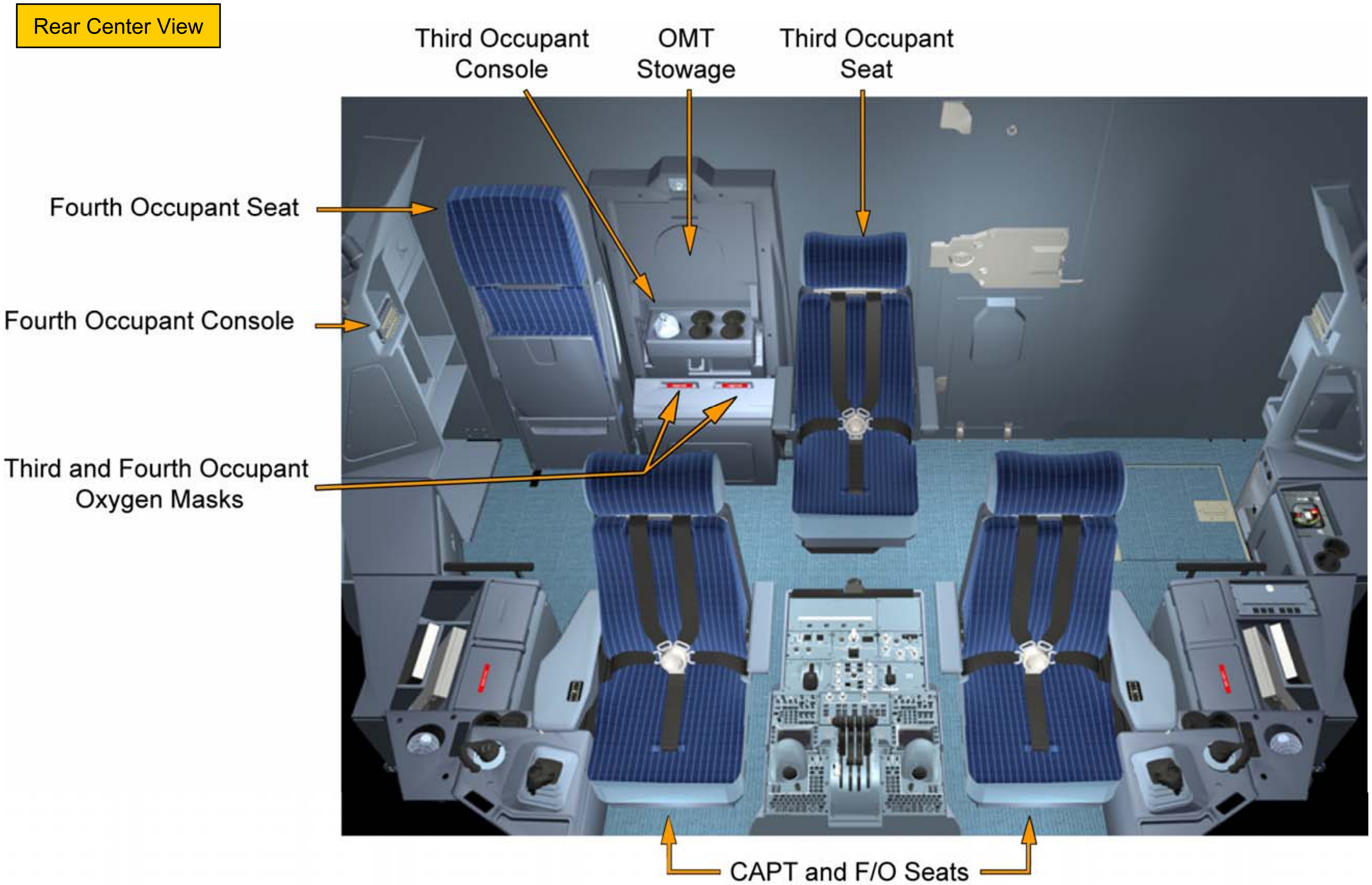
The cockpit includes:

- The following instrument panels:
  - Overhead panel
  - Main instruments panel
  - Glareshield
  - Pedestal.
- The Captain and First Officer lateral consoles that each have:
  - One sidestick
  - One steering handwheel
  - Oxygen masks.
- An Onboard Maintenance Terminal (OMT) for maintenance staff
- A third occupant console
- A fourth and fifth (optional) occupant console.

Forward View

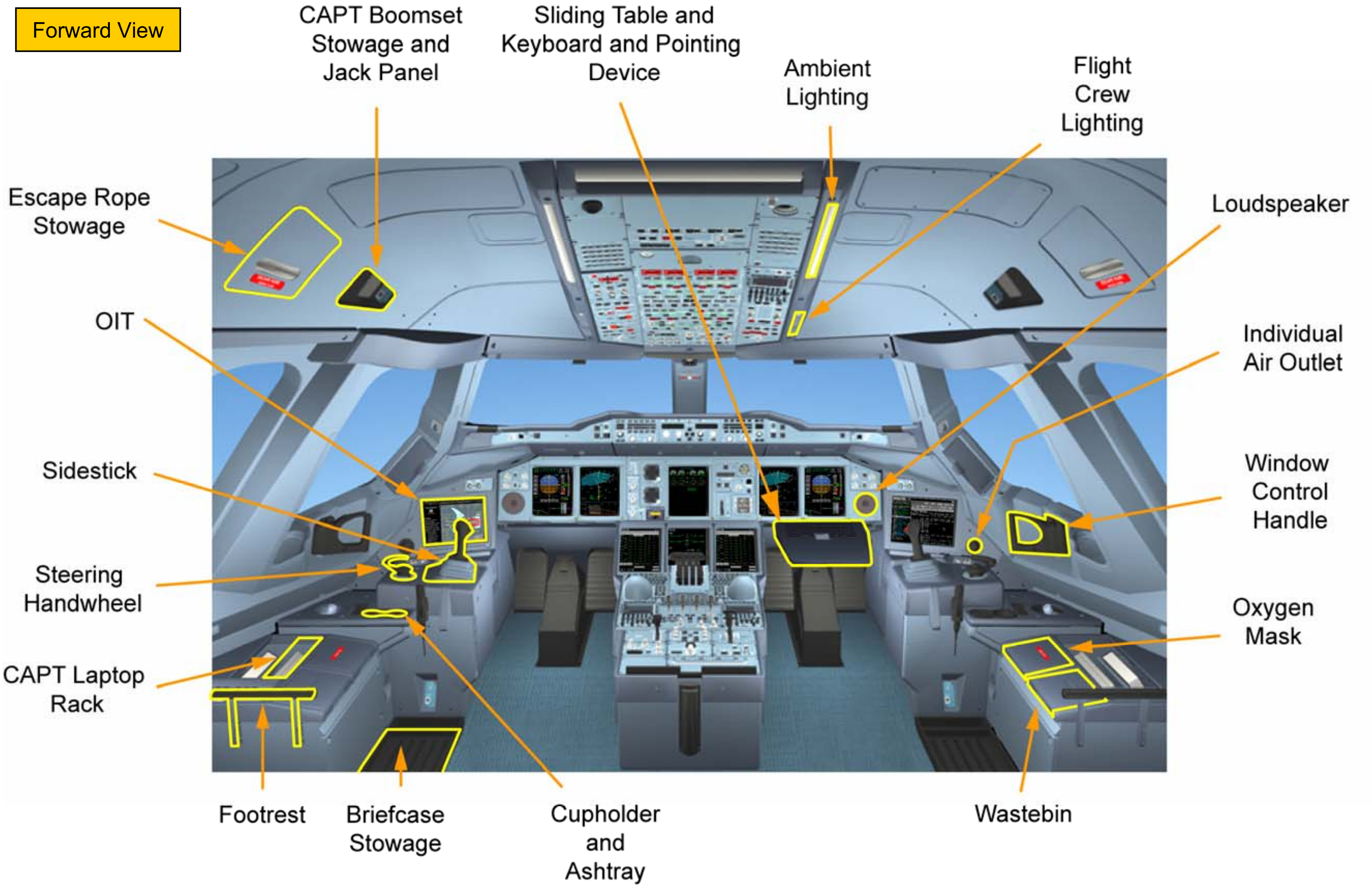


A380 Flight Deck Layout
1.General



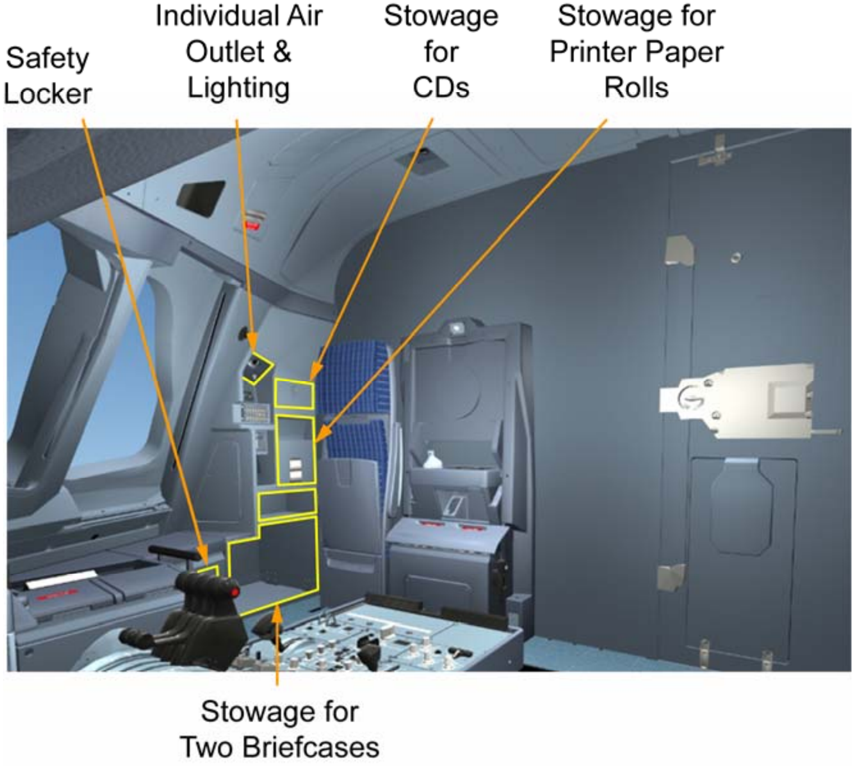
Equipment

Forward View

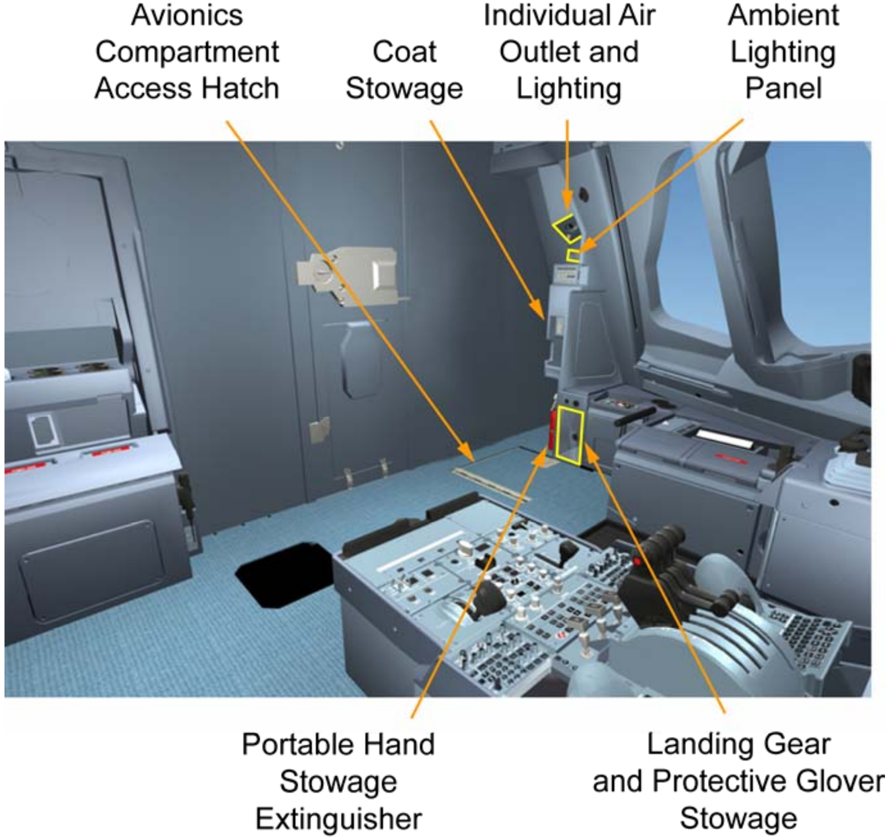


A380 Flight Deck Layout
1.General

Rear Right Side View



Rear Left Side View

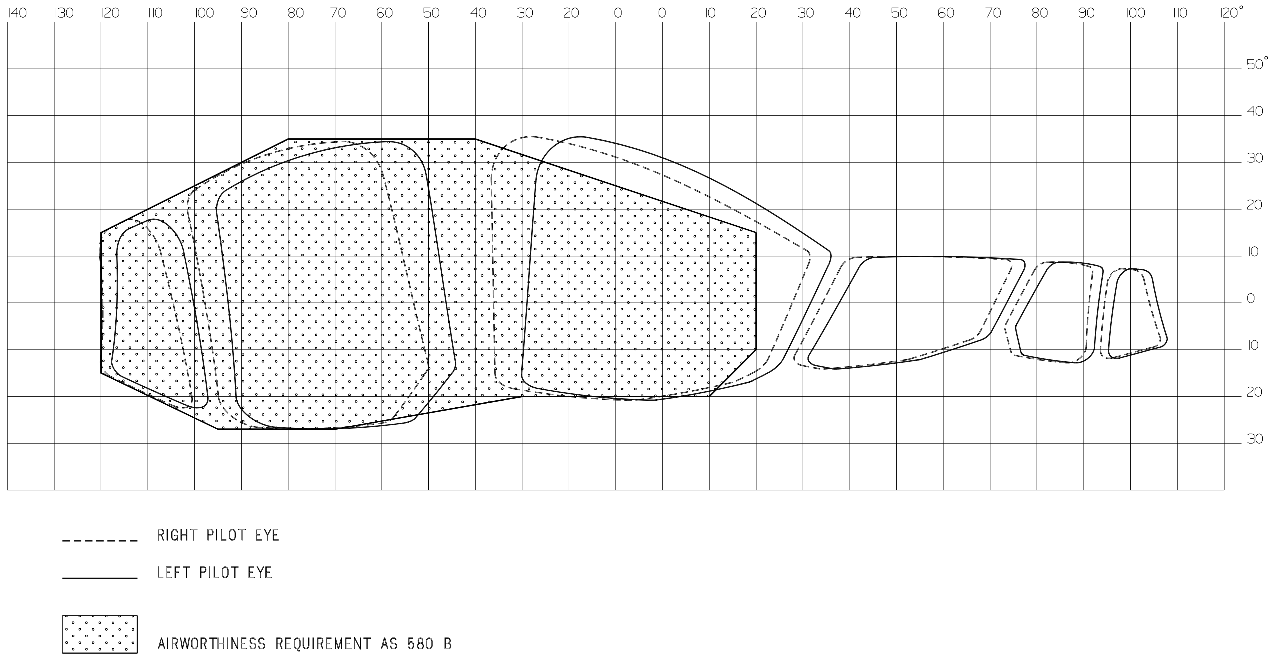


Flight Crew's Vision Envelope

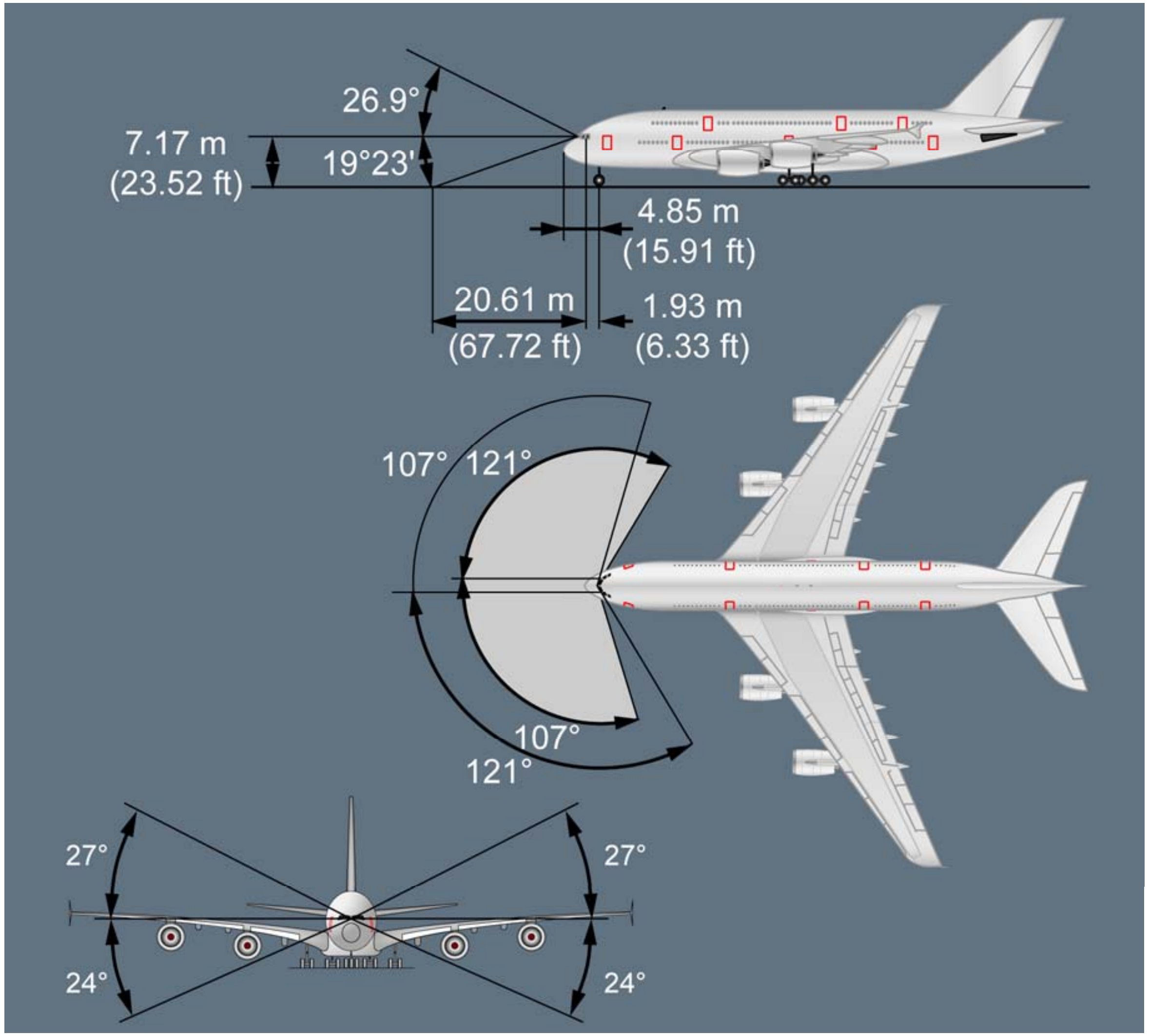
- The A380 cockpit layout is similar to that of previous Airbus family aircrafts.

- The outline of the nose cone, the windshield and the side window panels have been defined to obtain an outside visibility comparable to that of all modern aircraft. The visibility is greater than that defined by the Aerospace Standard: AS 580 B.

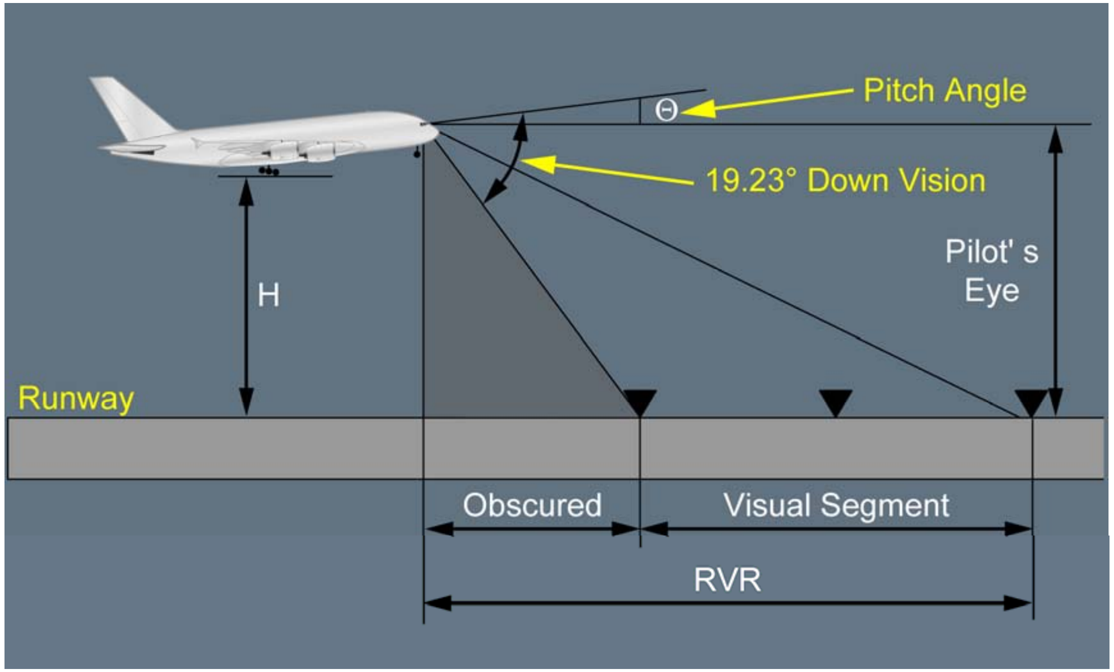
Flight Crew's Binocular Vision



Flight Crew’s Outside Visibility



Landing Minimum Visual Ground Segments



	CAT III		CAT II
H	15 ft	50 ft	100 ft
PITCH	3°	2°	2°
Pilot's Eye	15 m (49 ft)	25 m (82 ft)	40 m (131 ft)
OBSCURED	42 m (138 ft)	70 m (230 ft)	114 m (374 ft)
MINIMUM RVR	102 m (345 ft)	130 m (426 ft)	234 m (768 ft)

Main Instrument Panel

The main instrument panel includes mainly:

- 8 identical interchangeable liquid cristal display units of the Control and Display System (CDS):
  - Two **Primary Flight Displays (PFD)**
  - Two **Navigation Displays (ND)**
  - One **Engine/Warning Display (E/WD)**
  - One **System Display (SD)**
  - Two **Multi-Function Displays (MFD)**.

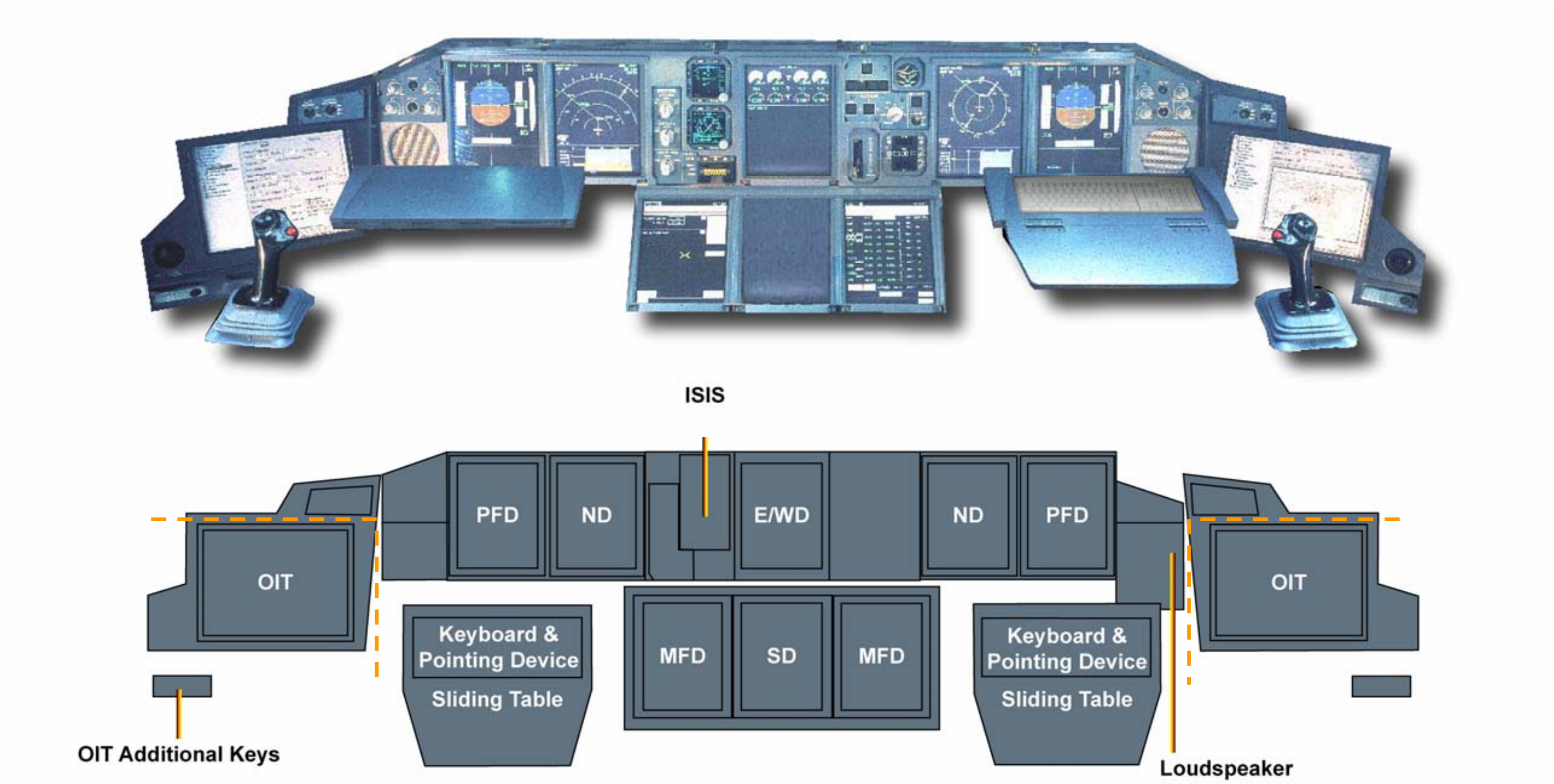
    Note; the MFD are controlled using the Keyboard and Cursor Control Units (KCCUs)

  (Refer to Indicating/Recording Systems)

- Two **Onboard Information Terminals (OIT)**, each with associated additional keys and a keyboard and pointing device integrated in the sliding table.
  The OIT is the flight crew's interface with the Onboard Information System (OIS) applications.
  (Refer to Information Systems)

- Two **Integrated Standby Instrument Systems (ISIS)** for backup navigation.
  (Refer to Navigation)

MAIN INSTRUMENT PANEL



PFD: Primary Flight Display
ND: Navigation Display
MFD: MultiFunction Display
E/WD: Engine Warning Display
SD: System Display

Glareshield

The glareshield includes:

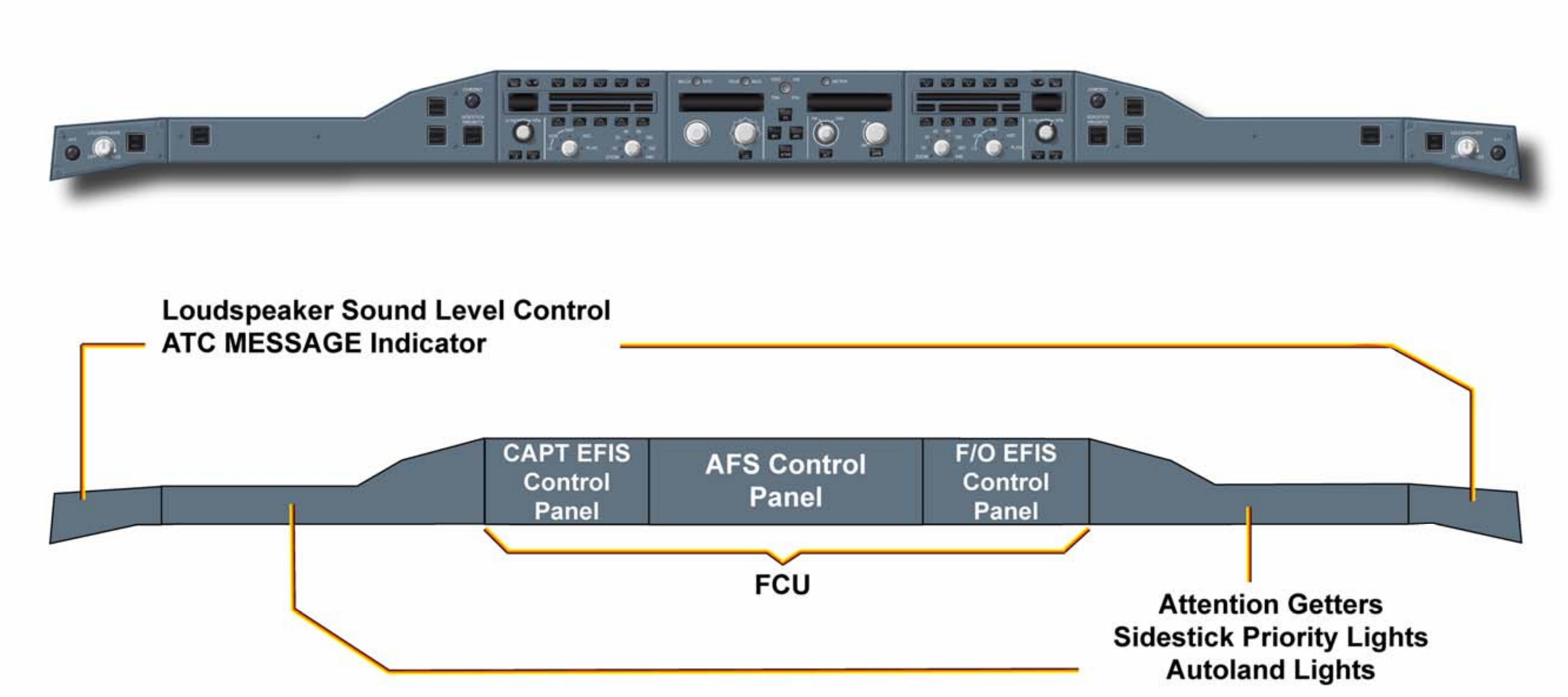
- One **Flight Control Unit (FCU)** with:
  - Two **EFIS Control Panels (EFIS CP)**
    Each EFIS CP is used to select the display on the onside PFD and ND, and to change the barometer settings.
  - One **Auto Flight System Control Panel (AFS CP)**
    The AFS CP is the main interface with the Flight Guidance (FG) system.
    (Refer to Auto Flight System)

- Two panels with:
  - Attention getters: Master warning and master caution lights
  - Sidestick priority lights
  - Autoland lights.

- Two panels with:
  - Loudspeaker sound level controls
  - ATC MESSAGE indicators.

A380 Flight Deck Layout
3.Instrument Panels

GLARESHIELD



FCU: Flight Control Unit
EFIS: Electronic Flight Instrument System
ATC: Air Traffic Control
AFS: Auto Flight System

Pedestal

The central pedestal includes:

- Two **Keyboard and Cursor Control Units (KCCUs)**. Each KCCU is used to interface with the SD and its onside MFD and ND.
  (Refer to Indicating/Recording Systems)

- Two **Radio Management Panel (RMPs)**
  The RMPs can be used:
  - To tune all radio communications
  - To enter the squawk code
  - As a backup for radio navigation
  - To adjust the volume for communication and NAVAID identification.

  Note: There is a third RMP on the overhead panel.
  (Refer to Communication)

- One **SURV Control Panel**
  The SURV Control Panel is used to interface with the SURVeillance (SURV) functions of the aircraft:
  - Terrain Awareness and Warning System (TAWS)
  - Weather radar
  - Traffic Collision Avoidance System (TCAS).

  (Refer to Navigation)

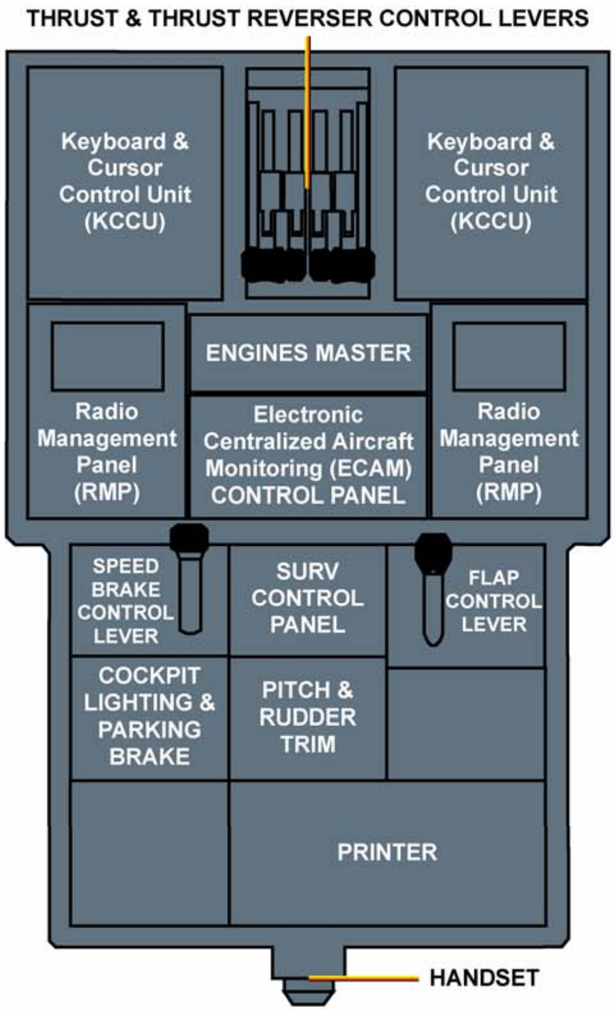
- One **ECAM Control Panel (ECP)**
  The ECP is the interface with the ECAM.
  (Refer to Indicating/Recording Systems)

- **Thrust levers and engine master levers**
  (Refer to Engines)

- The following panels for the flight controls:
  - **Pitch trim and rudder trim panels**
  - **Speed brake lever and flaps/slats lever**
  - **Parking brake panel**.

PEDESTAL

SURV = Surveillance System



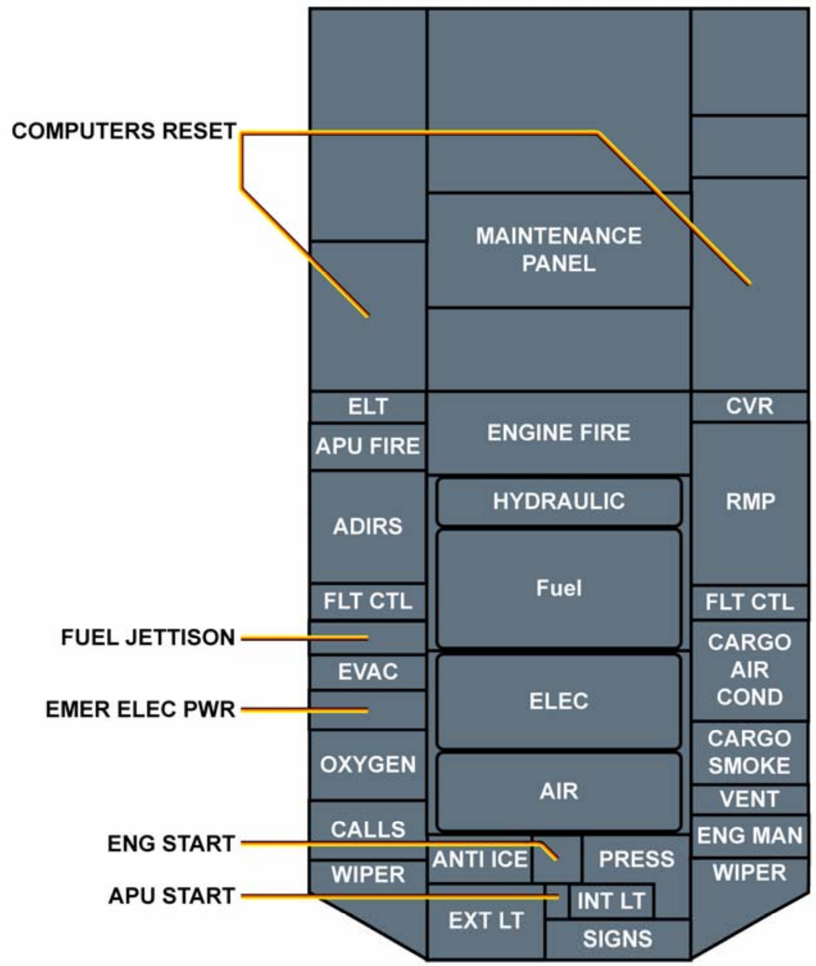
Overhead Panel

- The overhead panel includes the system controls and is arranged in three main rows:
  - One center row for engine-related systems, arranged in a logical way
  - Two lateral rows for other systems.

- All the controls on the overhead panel can be reached by either pilot.

- The pushbutton philosophy is identical to that already applied on previous Airbus aircraft.

OVERHEAD PANEL



A380 Flight Deck Layout

4.Avionics Bays

The A380 has three avionics bays:

- The main avionics bay
- The upper avionics bay
- The aft avionics bay.

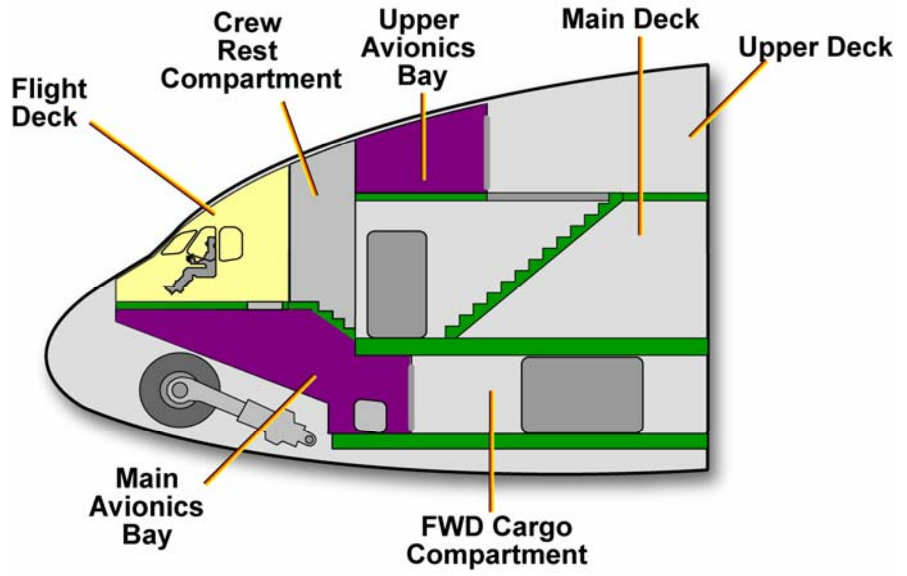
The main avionics bay contains the normal electrical power center, and most of the systems' computers.

This bay is accessible:

- From the cargo hold forward area, via a door
- From outside, via a hatch
- From the cockpit, via a hatch.

The upper bay contains the emergency electrical power center, some ultimate emergency equipment, the Network Server System (NSS) and most of the In-Flight Entertainment (IFE) equipment (Refer to Information Systems).

This bay is accessible from the upper deck area, via a door.



3. ATA 21 & 36 Air Systems

Flight Deck and Systems Briefing for Pilots

Contents

General

The bleed air system supplies high-pressure air to the following systems:

- Air conditioning and cabin pressurization
- Wing and engine anti-ice
- Engine start
- Hydraulic reservoir pressurization
- Pack bay ventilation system.

In normal conditions, the bleed air system operates automatically.

If necessary, the pilot can manually operate the bleed air system.

System Description

There are three bleed air sources:

- **Engine Bleed Air System**
  Engine bleed air usually comes from the Intermediate Pressure (IP) stage of the engine compressor.
  At low engine thrust settings, the pressure of the IP stage is not sufficiently high and bleed air is provided by the High Pressure (HP) stage of the compressor, via the HP valve.

  For each engine:
  - The engine bleed valve automatically regulates the delivered bleed pressure. This valve can also close and isolate its applicable engine bleed system.
  - Bleed air temperature is regulated by the precooler.

- **APU Bleed Air Supply**
  The APU can supply bleed air to the bleed air system via the APU bleed valve:
  - On ground, without any restriction
  - In flight, up to 22 500 ft.

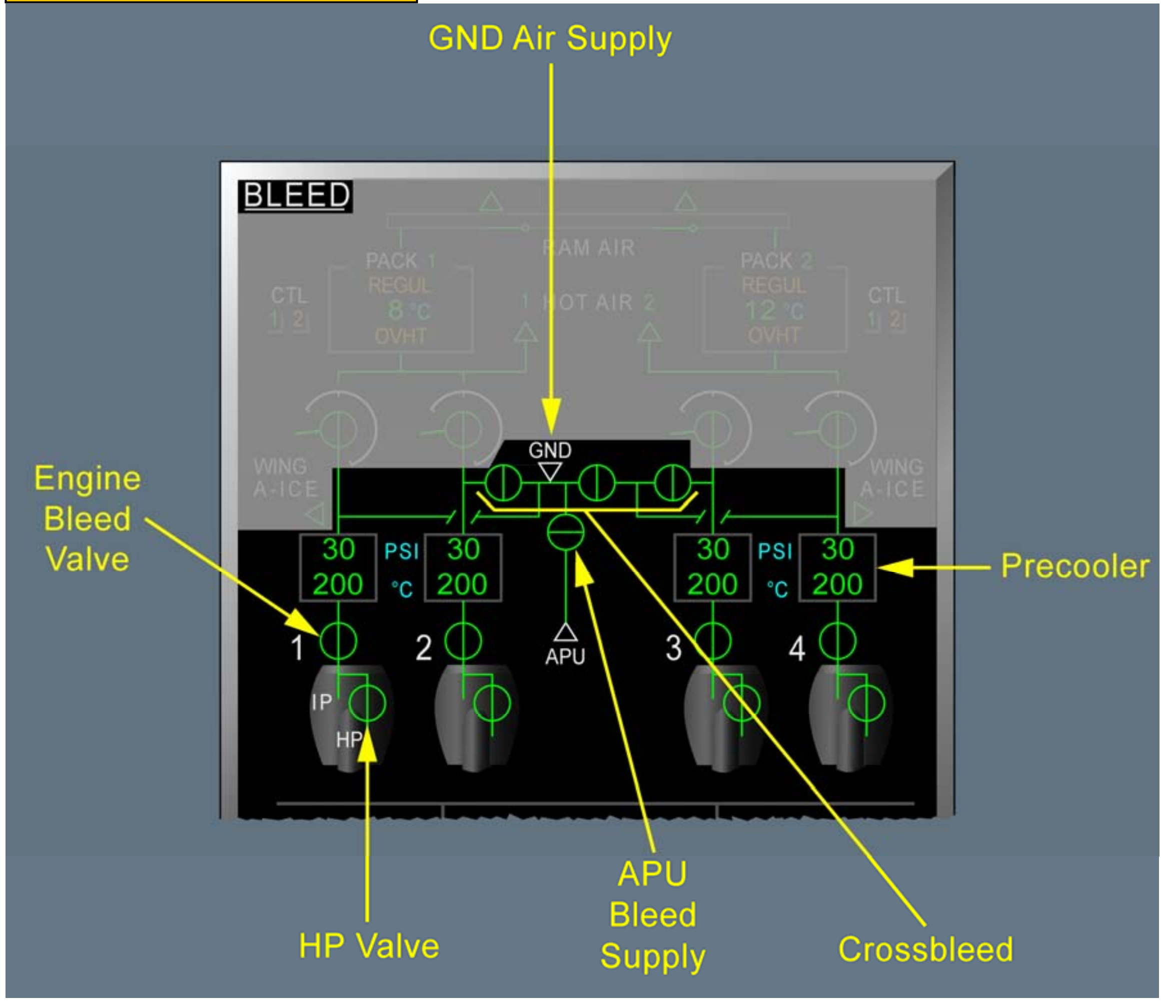
- **Ground Air Supply**
  There are three HP ground connectors. Three HP ground sources can be connected to the HP ground connectors to supply bleed air to the bleed air system.

A **crossbleed** duct with three crossbleed valves interconnects the various LH and RH bleed supply systems.

One leak detection system can detect air leaks in the bleed ducts of the:

- Engines
- Outer and inner wings
- APU
- Pack bays
- Air conditioning hot air system.

Pneumatic System Architecture



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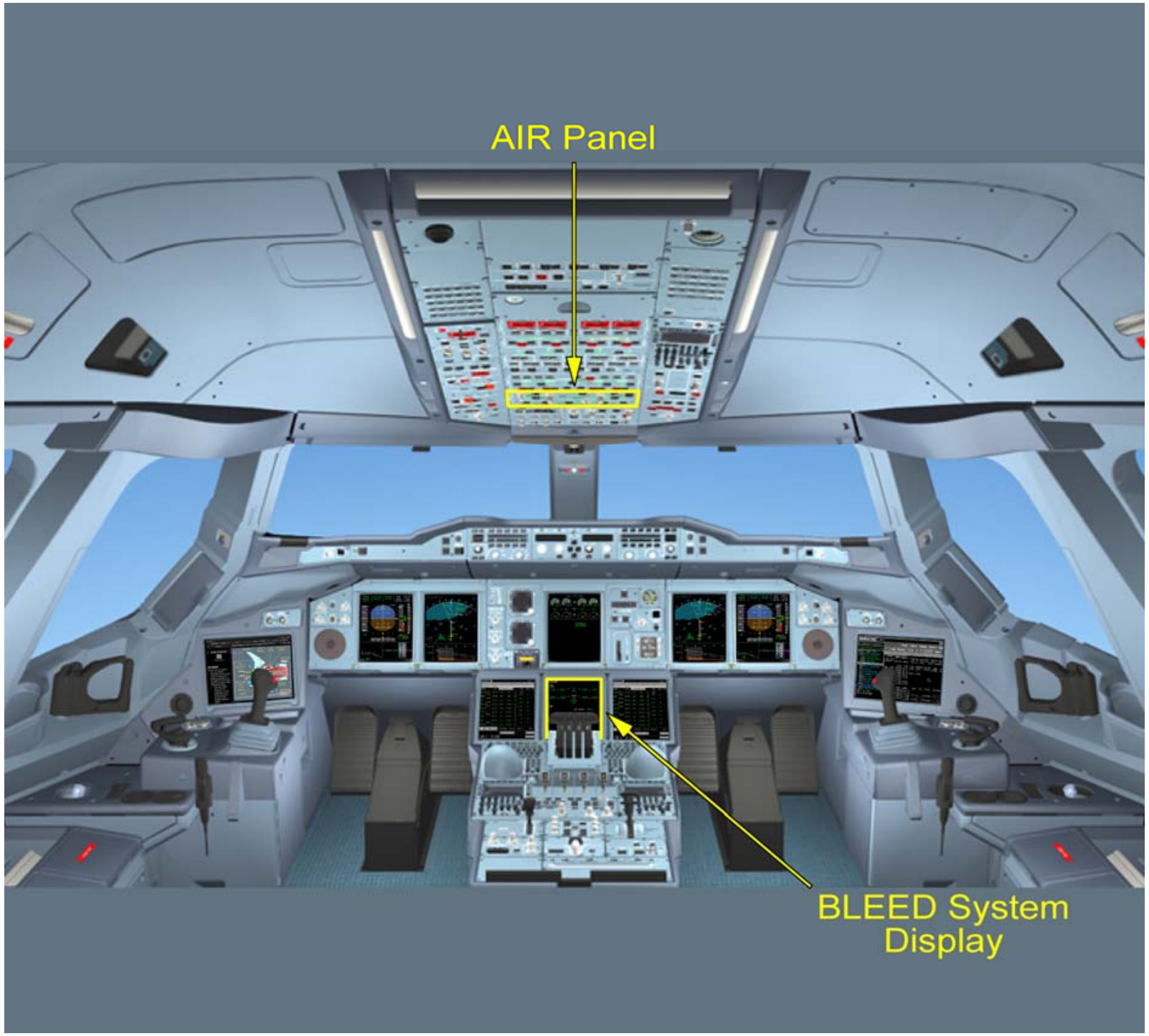
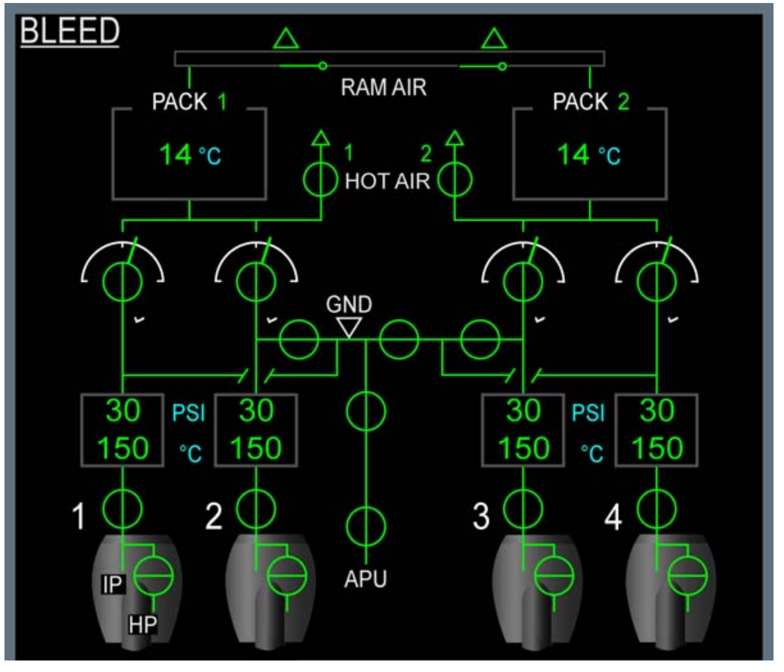
Controls and Indicators



AIR Panel

ECAM SD BLEED Page



General

The air conditioning system is fully automatic.
It provides continuous air renewal and maintains a constant selected temperature and airflow in the cabin and cockpit zones.
Air from the air conditioning system is also used for cargo ventilation.

Architecture

- The bleed air system supplies two aircraft packs with air from the engines, the APU, or the ground air connectors.
  To provide high redundancy, each pack includes:
  - Two cooling units
  - One controller with two independent channels that can each control both cooling units of the pack.

  Each pack cools the bleed air using:
  - One heat exchanger and
  - Two cooling units.

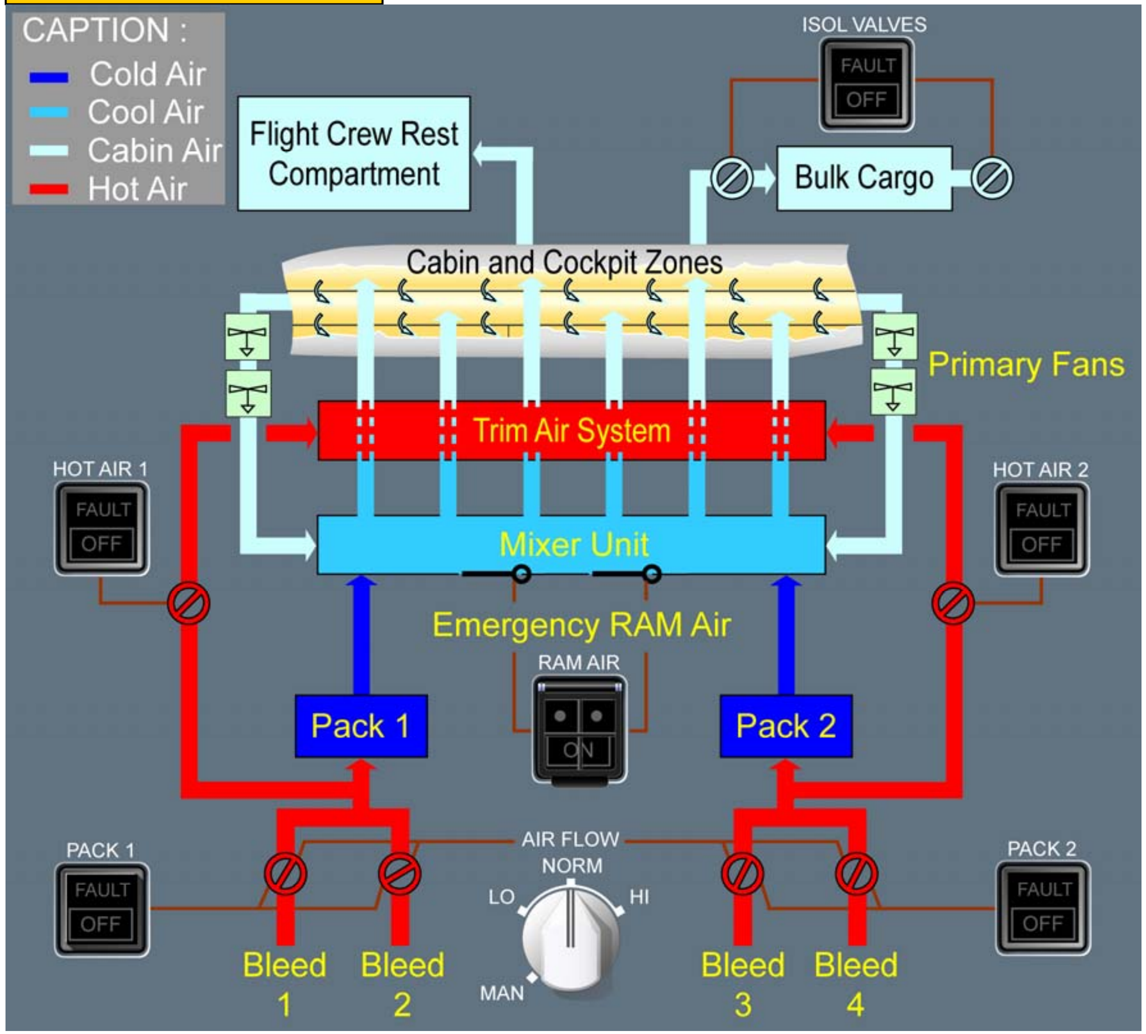
  The cooled air then flows out of the packs.

- This cooled air from the packs is combined with recycled cabin and cockpit air in the mixer unit.
  Fresh air can also be supplied to the mixer unit via:
  - The low pressure ground inlets
  - The RAM air inlets that operate during flight if there is a complete failure of the air generation system.

  There are four primary fans that recycle cabin and cockpit air to the mixer unit.

- The trim air system adjusts the temperature of the air in the various cockpit and cabin zones.
  Temperature is adjusted, according to the demand, by adding hot air from the bleed system to air from the mixer unit. The hot air is added via two hot-air valves.

Air Conditioning Architecture



Temperature and Flow Regulation

- **Cabin and Cockpit Zones:**
  The temperature in the cabin and cockpit can be controlled by the flight crew.
  The temperature in each cabin zone can be adjusted or directly controlled by the cabin crew.

- **Cargo Compartments:**
  Some air from the cabin is recycled into the bulk cargo compartment for ventilation and temperature regulation (temperature regulation is optional for the forward and aft cargo compartments).

  If necessary, to obtain the desired temperature:
  - An electrical heater can heat the air that flows into the bulk cargo compartment
  - Air from a trim air pipe can heat the air that flows into the forward and aft cargo compartments (optional).

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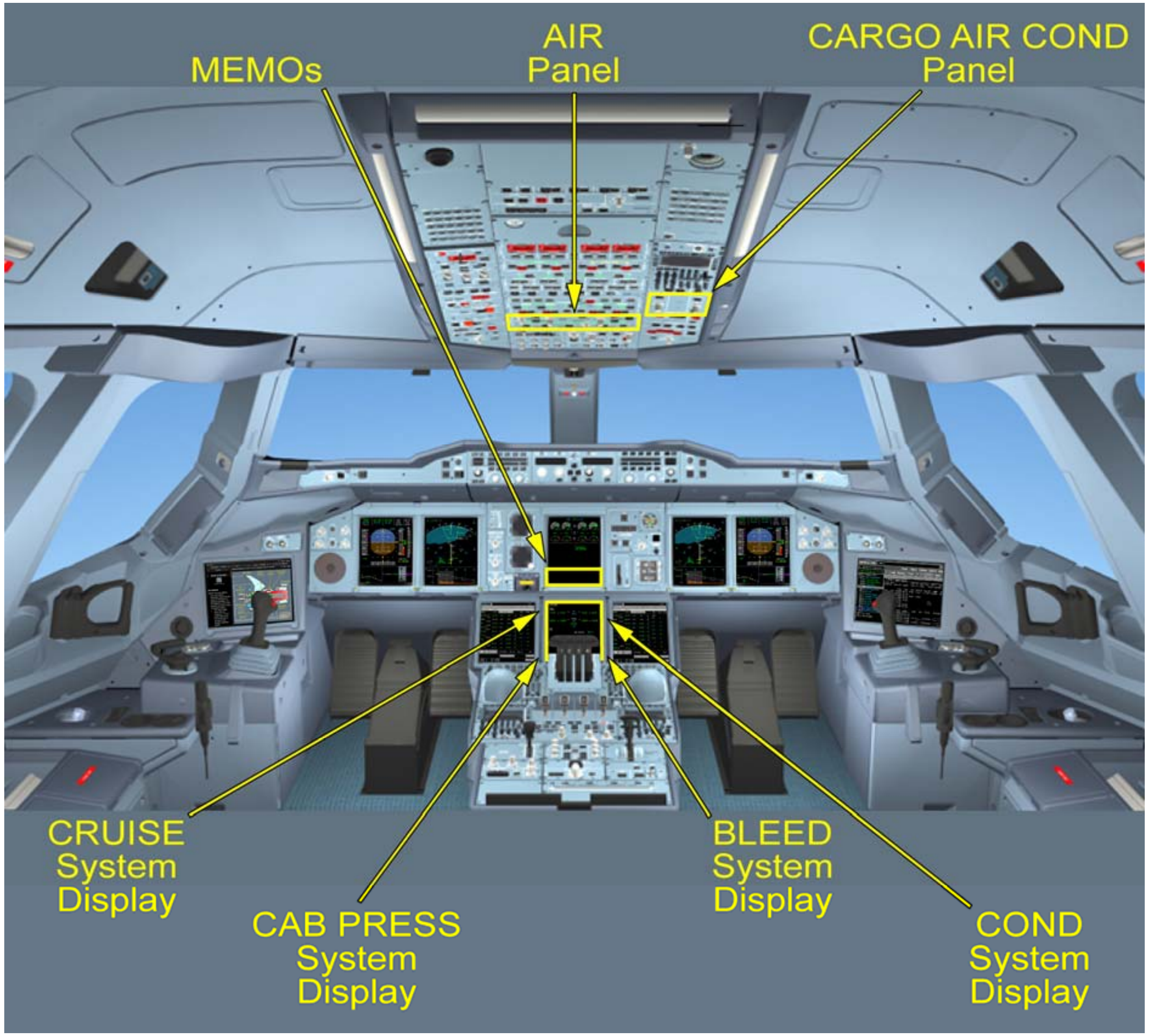
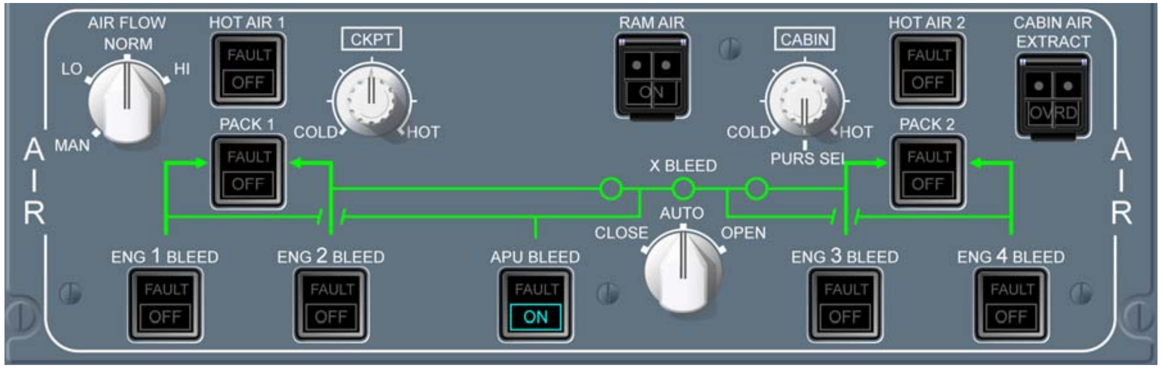
Controls and Indicators

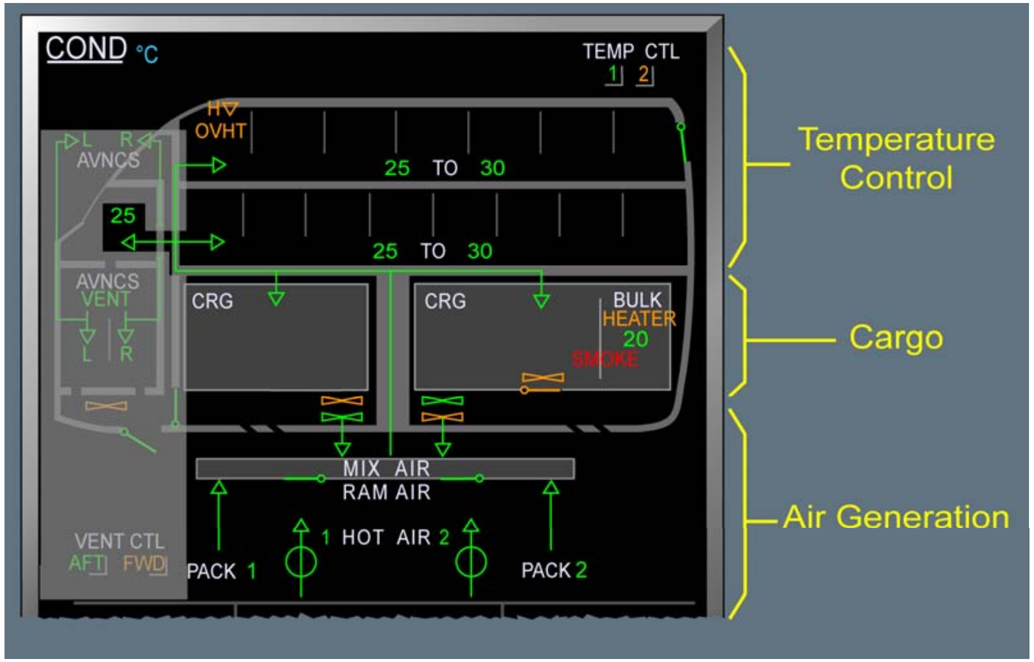


AIR Panel

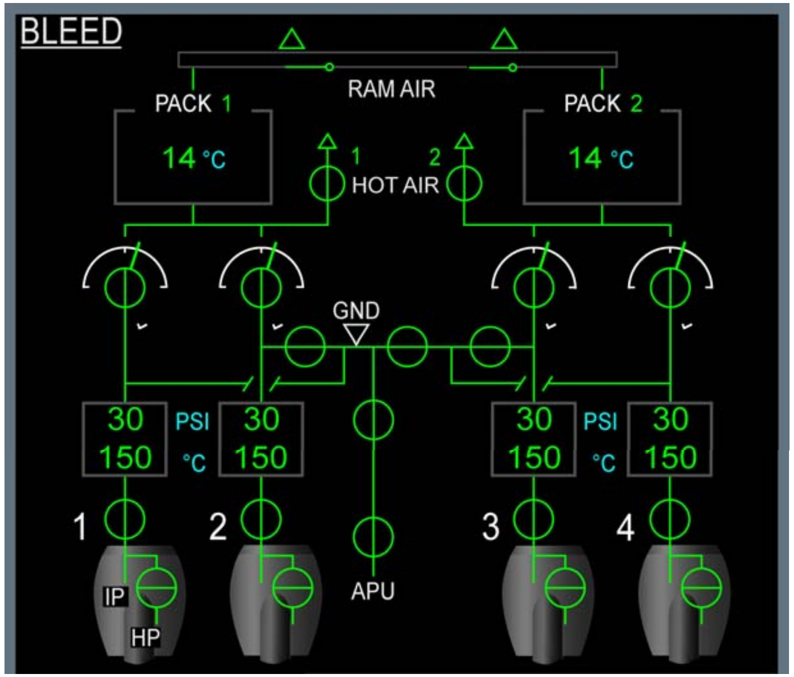


CARGO AIR COND Panel

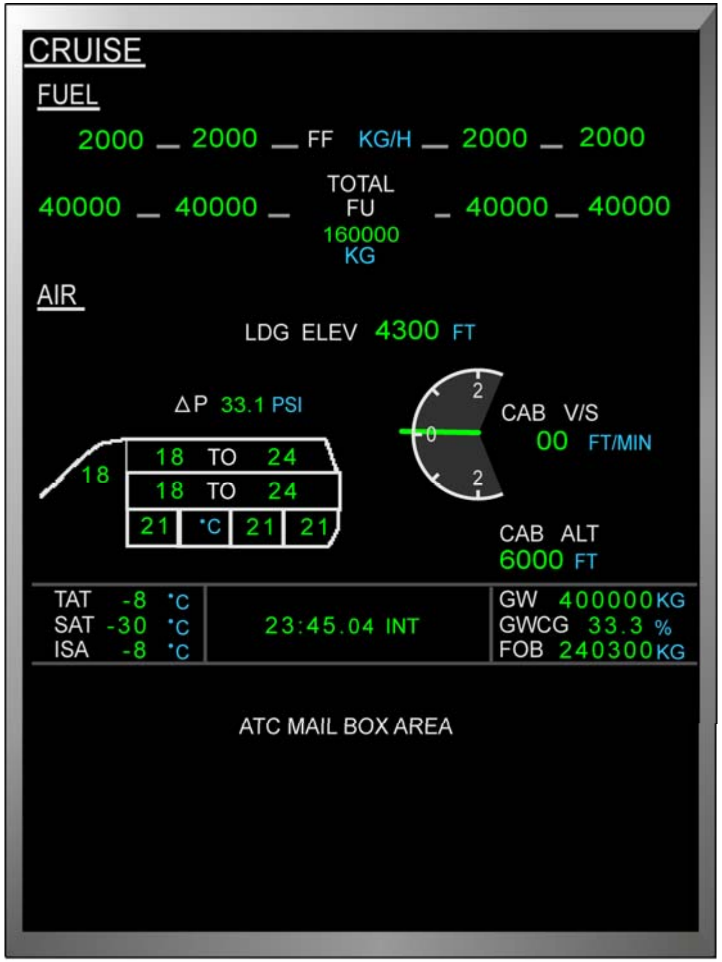
ECAM SD COND Page



ECAM SD BLEED Page



ECAM SD CRUISE Page



General

The aircraft has a fully automatic ventilation system that ventilates:

- The three avionics bays (main, upper and aft)
- The cockpit and cabin zones
- The IFE bay
- The pack bays
- The bulk and cargo aft compartment.

The ventilation system of the avionics bays has an assigned controller. The other ventilation systems are controlled and monitored by the forward and aft ventilation controllers.

System Description

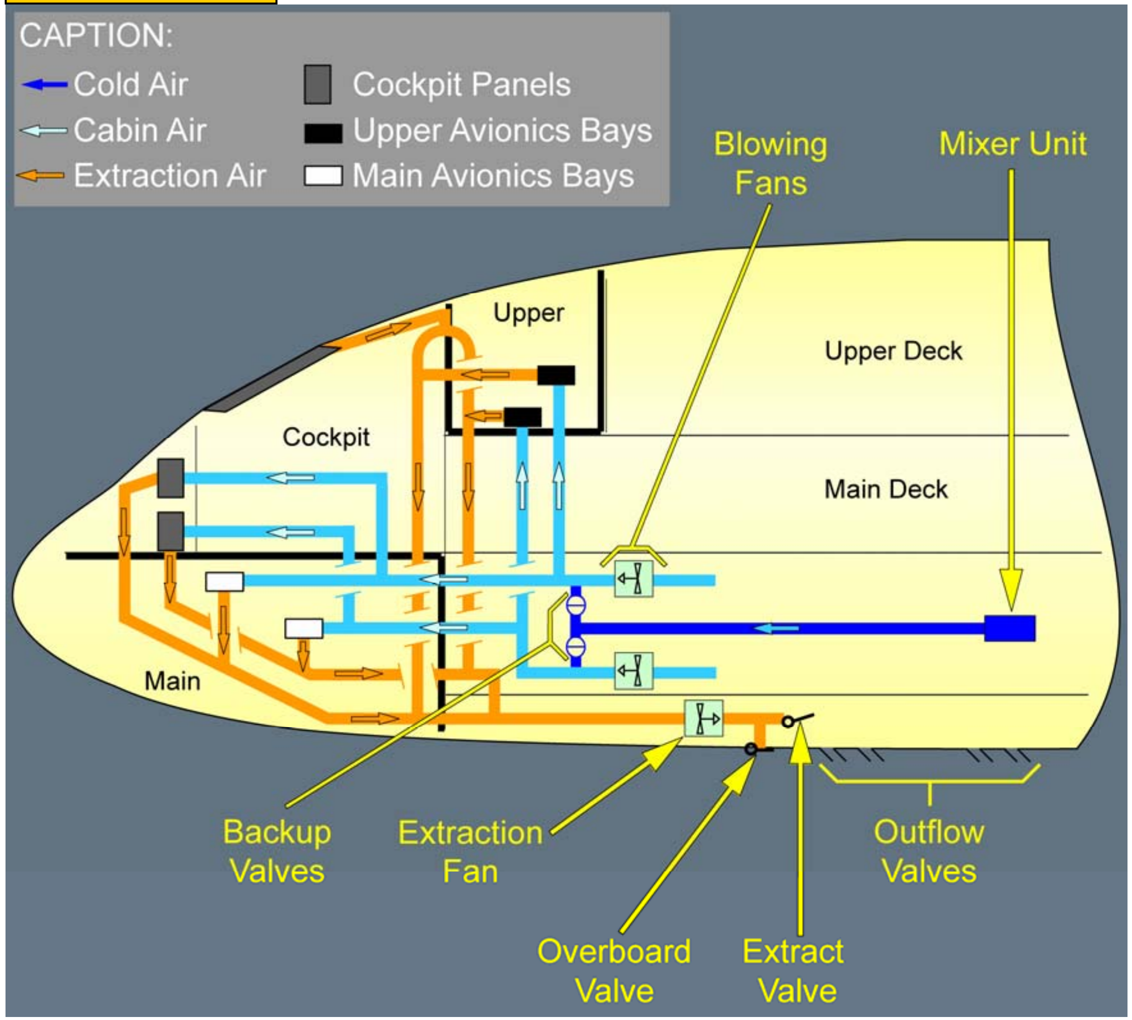
- **Main and Upper Avionics Bays Ventilation**
  The main and upper avionics bays are ventilated via two redundant ventilation circuits, the left (L) and the right (R) circuit, that each have a blowing fan.
  The fans blow cabin air into the various cockpit panels and equipment racks of the main and upper avionics bays.

  An extraction fan then extracts and discharges the air from the avionic bays and cockpit panels, either through the extract valve or through the overboard valve:
    - On ground, when the engines are not running, air is discharged through the overboard valve
    - In flight, in normal operations, air is discharged through the extraction valve and outflow valves.

  The main and upper avionics bays also have a backup ventilation circuit: If necessary, air from the mixer unit of the air conditioning system can directly ventilate the avionics bays, via two backup valves.

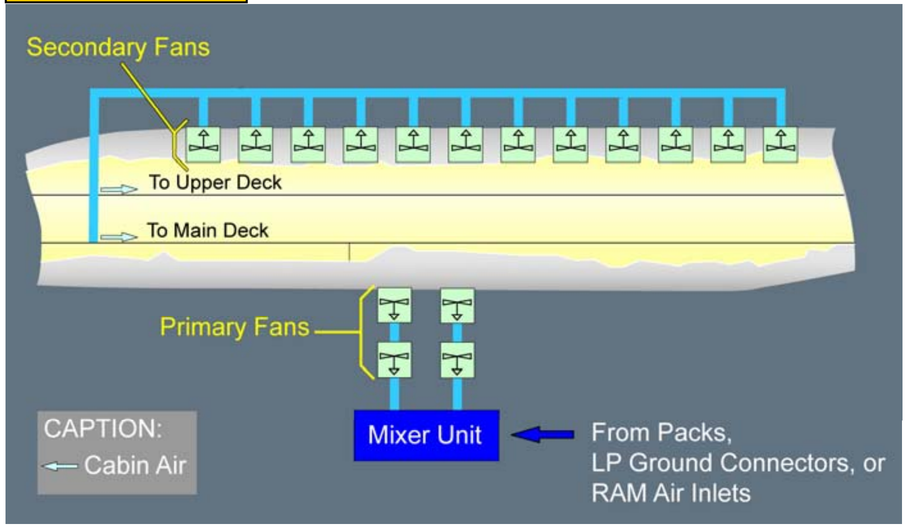
- **Aft Avionics Bay Ventilation**
  The aft avionics bay is ventilated by cabin air that is extracted and immediately discharged overboard.

Avionics Ventilation



- **Cabin Ventilation**
  Fresh air from the air generation system is mixed with recirculated air from the cabin.
  The recirculated air is supplied through recirculation filters and recirculation fans to the mixer unit:
  - The primary fans recycle the cabin air to the mixer unit
  - The secondary fans recirculate air between the upper and the main deck.

Cabin Ventilation

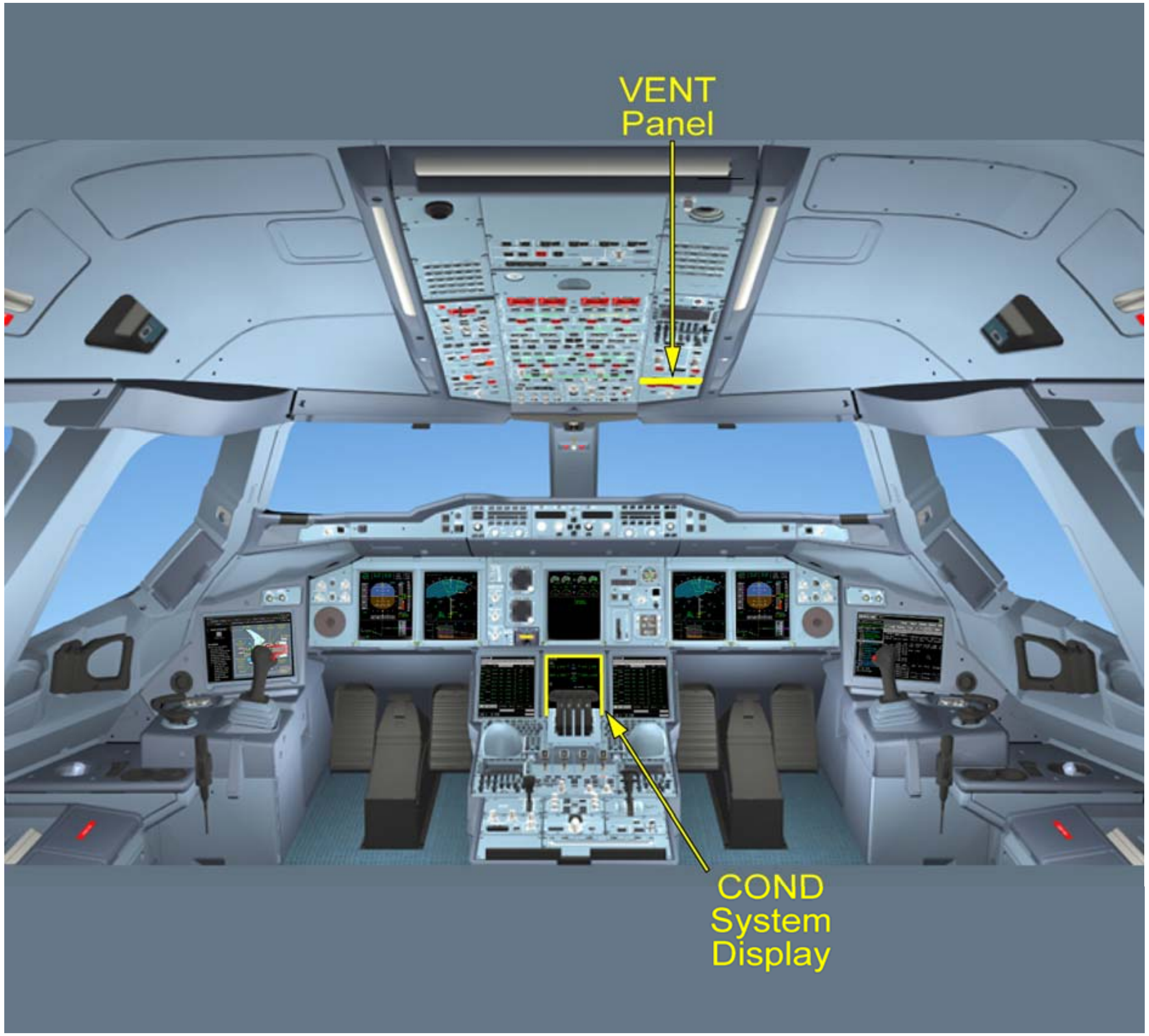


- **In-flight Entertainment (IFE) Bay Ventilation**
  The IFE has a fully automatic ventilation system that cools its electronic equipment.

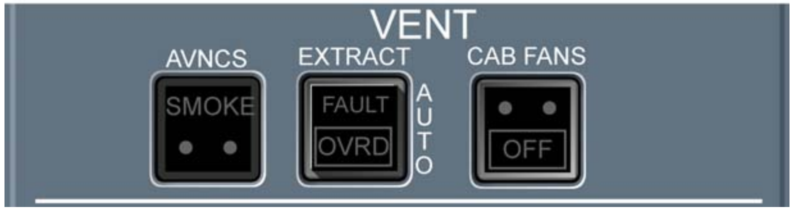
- **Pack Bays Ventilation**
  Each pack bay is cooled by a fully automatic ventilation system.

- **Bulk and Aft Cargo Ventilation**
  The bulk and aft cargo compartments are automatically ventilated. Temperature regulation is possible for the bulk cargo compartment only. If necessary (e.g. if smoke is detected in the cargo area), it is possible to isolate the bulk and aft cargo compartments (**Refer to Fire and Smoke Protection**).

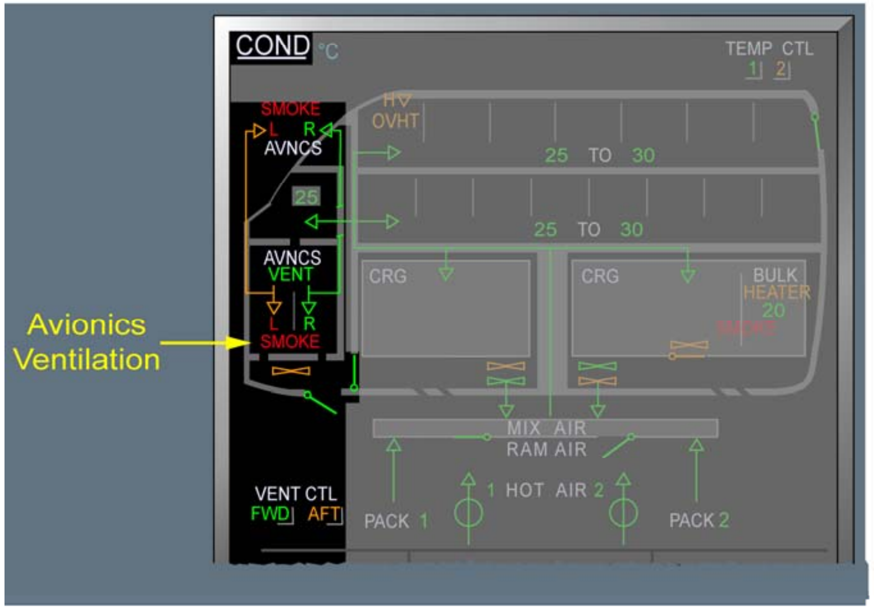
Controls and Indicators



VENT Panel



ECAM SD COND Page



General

In normal operation, the pressurization system does not require any action by the flight crew. Cabin air pressure is automatically regulated to provide maximum passenger comfort.

The cabin pressure regulation is performed via the automatic control of the outflow valves during all flight phases, from takeoff to landing.

If necessary, the flight crew can manually operate the cabin air pressurization system, by selecting the cabin altitude target and/or the cabin pressure vertical speed.

System Description

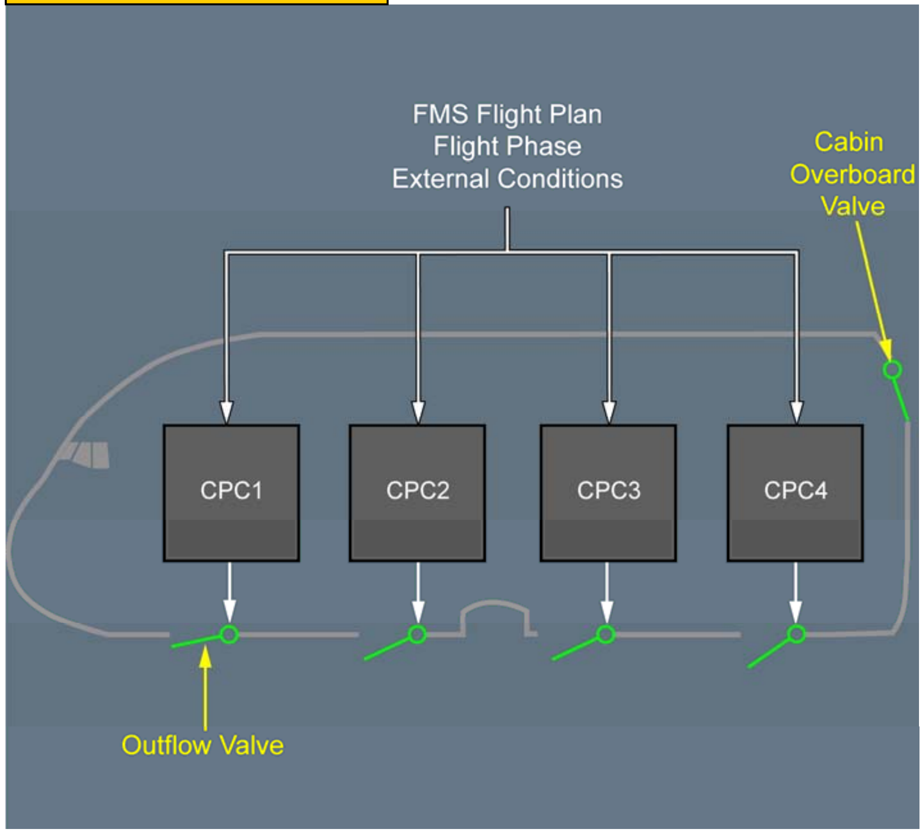
- There are four **Cabin Pressure Controllers (CPCs)**. Each CPC automatically controls one outflow valve.

- In **automatic control mode**, the four CPCs automatically control the cabin altitude target and the cabin vertical speed by using the FMS flight plan, the flight phase and the external conditions.

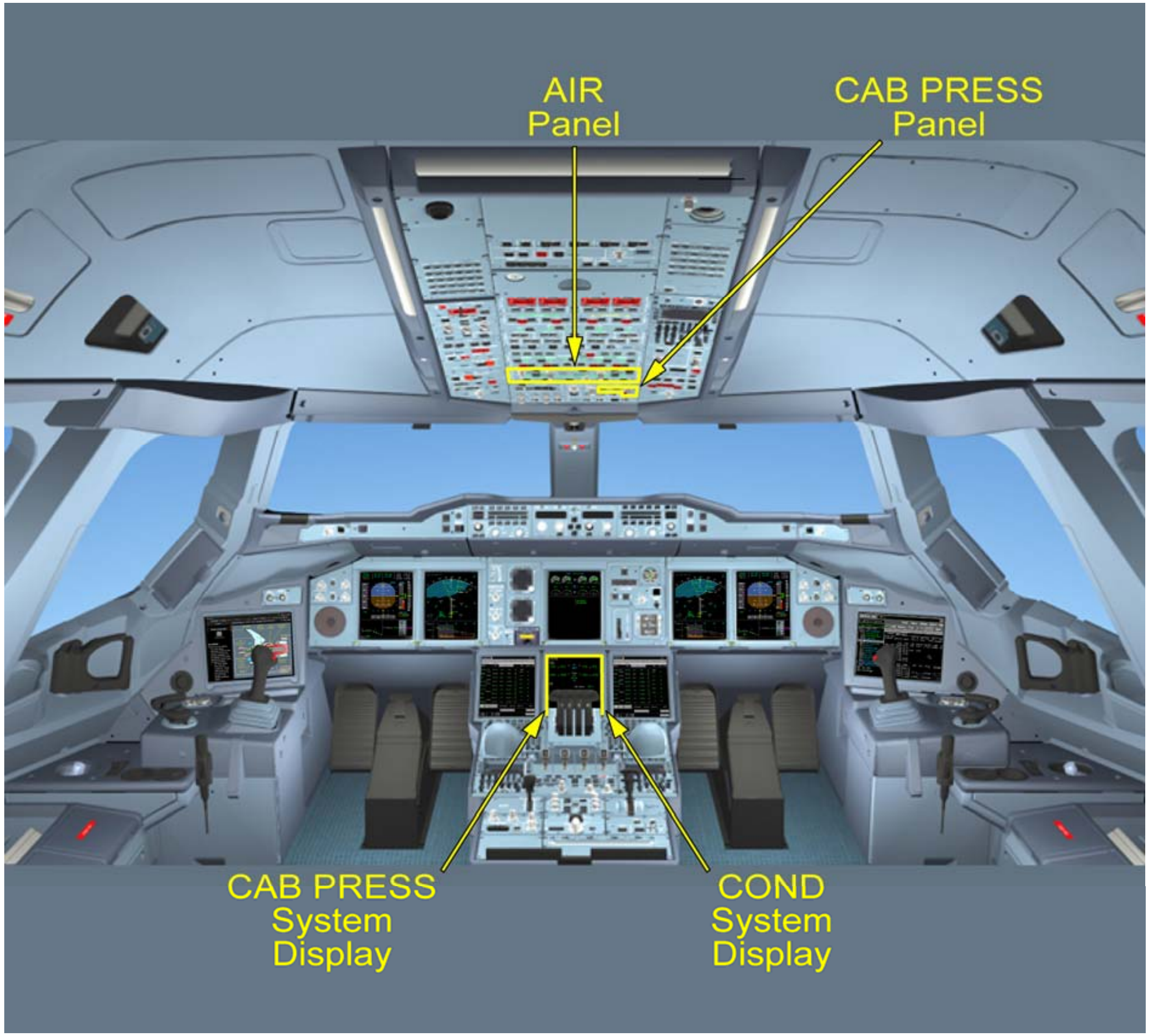
- If necessary, the flight crew can also control the cabin air pressure in **manual control mode**.
  The manual pressurization system operates independently of the automatic pressurization system.
  There are two manual pressurization modes:
  - Cabin altitude manual pressurization mode: The flight crew selects the cabin altitude target.
  - Vertical speed manual pressurization mode: If the cabin vertical speed is selected, the cabin altitude will change in accordance with the selected vertical speed until the cabin altitude target is reached.

- Two independent **cabin overboard valves** automatically prevent cabin air pressure from going too high or too low, in the event of a pressurization system failure.
  The cabin overboard valves can also be manually controlled.

Cabin Pressurization System

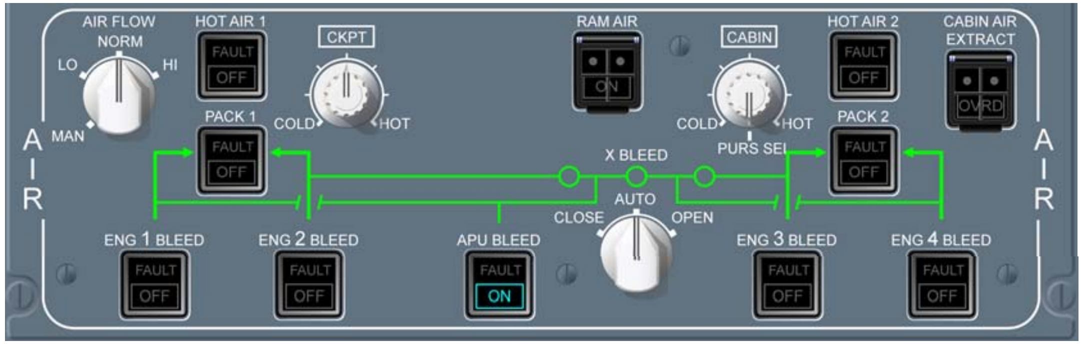


Controls and Indicators



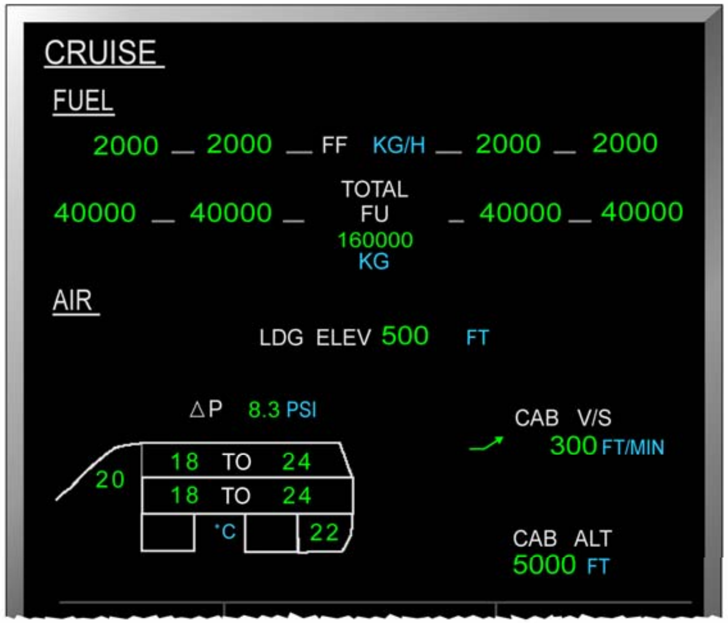
CABIN PRESS Panel

CABIN AIR EXTRACT pb on CABIN PRESS Panel



ECAM SD CAB PRESS Page

ECAM SD CRUISE Page



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4. ATA 22 Auto Flight System (AFS)

Flight Deck and Systems Briefing for Pilots

Contents

AIRBUS

General

The Auto Flight System (AFS) includes:

- The **Flight Guidance (FG**) system: Provides short-term lateral and vertical guidance based on flight parameters selected by the flight crew or managed by the FMS.
- The **Flight Management System (FMS)**: Provides long-term guidance by sending targets to the FG.

Architecture

The AFS has:

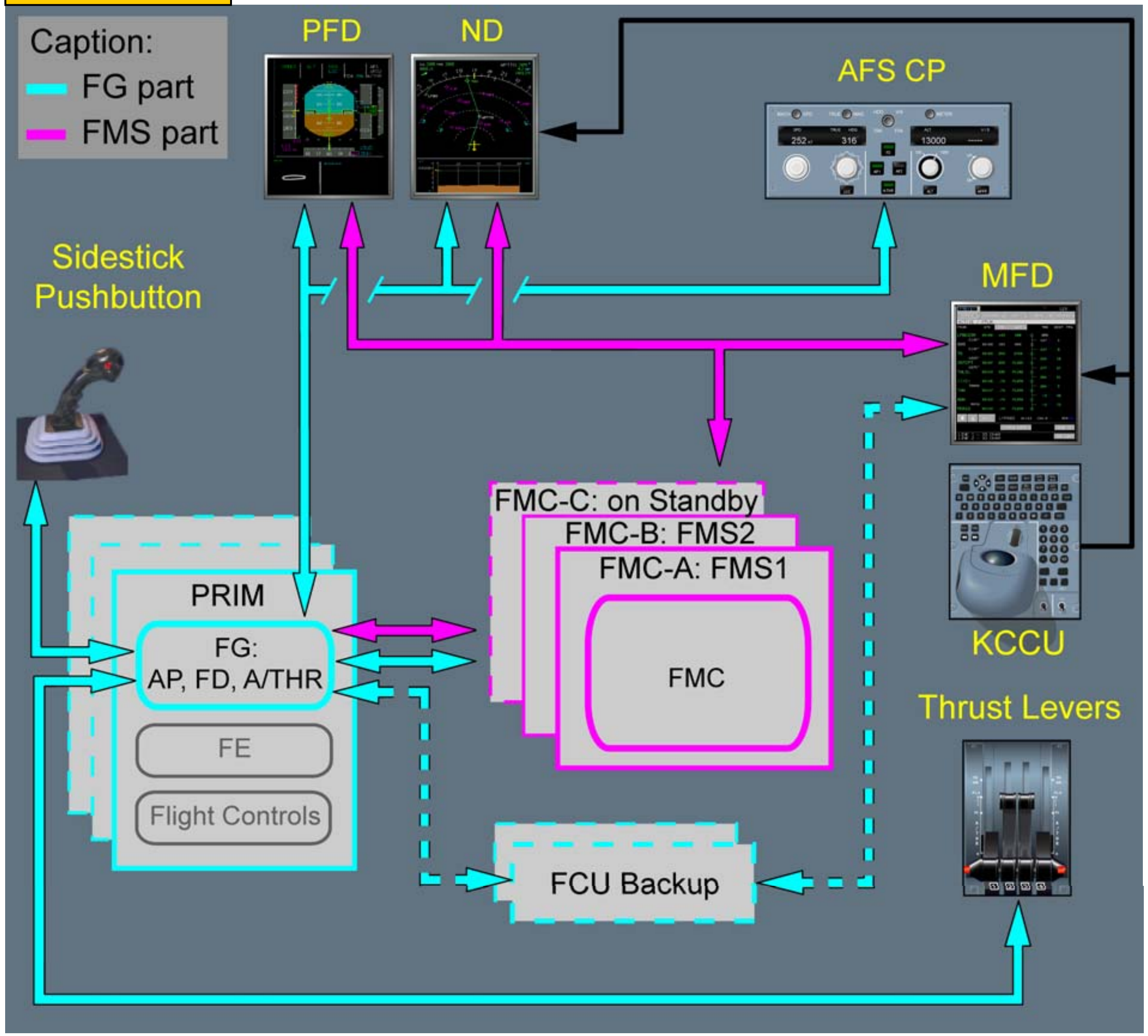
- Three Primary Flight Control and Guidance Computers (PRIMs) that operate the AP, FD and A/THR
- Three Flight Management Computers (FMCs) that operate 2 FMSs.

The flight crew interfaces with the AFS via:

- One AFS Control Panel (AFS CP). The AFS CP is the main interface with the FG. The MFD can provide a backup for the AFS CP.
- Two Multi Function Displays (MFDs). The MFD is the main interface with the FMS.
- Two Primary Flight Displays (PFDs) that display:
  - Primary flight parameters
  - Guidance targets (e.g. speed and altitude targets)
  - Armed and engaged modes on the Flight Mode Annunciator (FMA)
  - Flight Director guidance orders
  - Instrument approach information.
- Two Navigation Displays (NDs) that display lateral and vertical parts of flight plans, and associated navigation information.
- Two AP instinctive disconnect pushbuttons one on each sidestick
- Four thrust levers and two A/THR instinctive disconnect pushbuttons.

A380 Auto Flight System
1.System Description

AFS Architecture

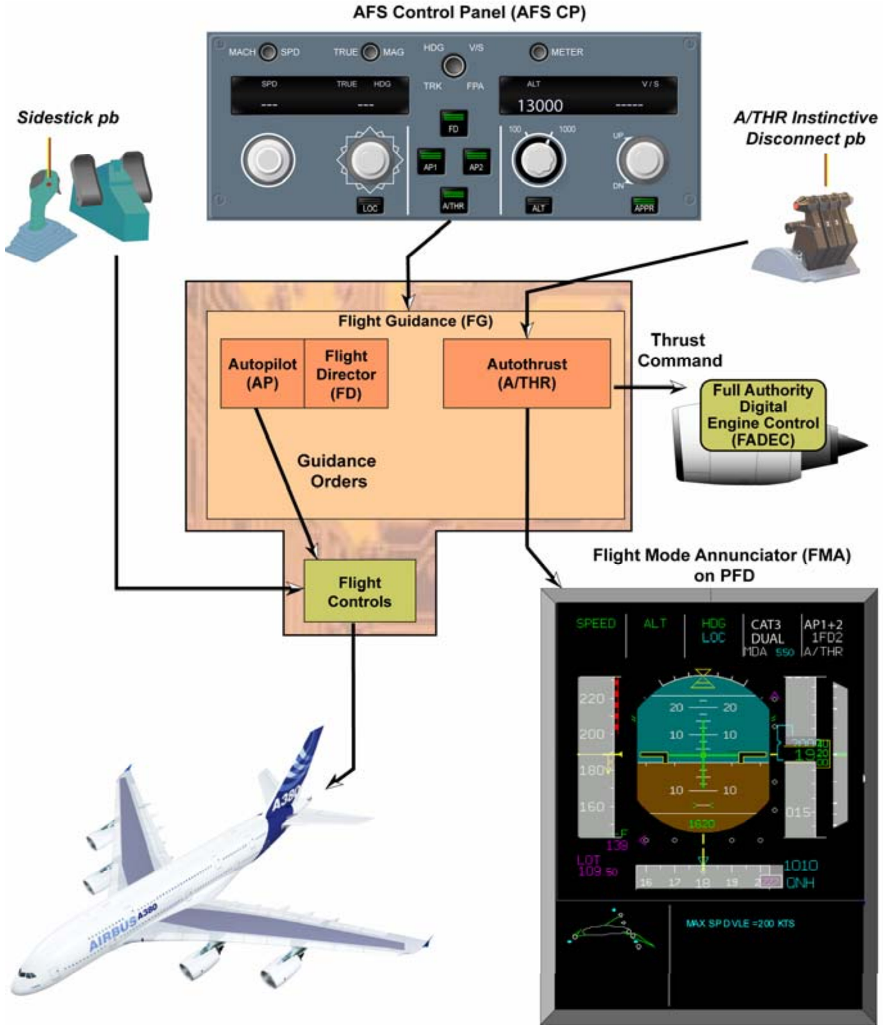


General

The objective of the **Flight Guidance (FG)** system is to provide short-term lateral and vertical guidance, including speed or Mach control, based on defined targets.

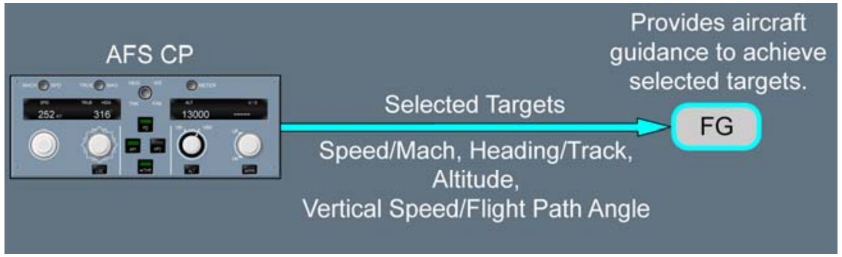
In order to achieve its objectives, the FG controls:

- The **Autopilots** (AP1 and AP2), that provide flight guidance by calculating pitch, roll and yaw orders.
- The **Flight Directors** (FD1 and FD2), that display guidance commands on the PFDs. This enables the flight crew to manually fly the aircraft or to monitor the flight guidance orders when the autopilot is engaged.
- The **Autothrust** (A/THR), that controls the thrust of the engines.

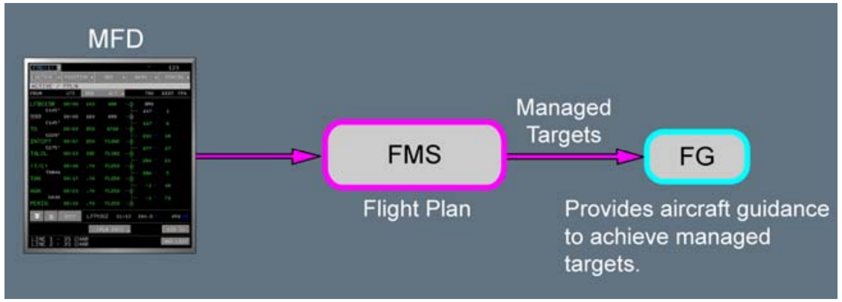


Flight guidance can be operated in two different ways:

- **Selected Guidance**
  The flight crew selects targets by using the AFS Control Panel (AFS CP). These selected targets are sent directly to the FG.



- **Managed Guidance**
  The FG uses the targets calculated by the FMS to operate managed guidance.



Selected guidance always has priority over managed guidance.

Lateral guidance and vertical guidance can be selected or managed independently of each other.

However, managed vertical guidance is not possible when selected lateral guidance is used.

Speed or Mach can be either selected or managed regardless of lateral and vertical guidance.

The flight crew can engage the FG modes via :

- The AFS CP pushbuttons: LOC, APPR, ALT, AP1, AP2, A/THR pushbuttons
- The thrust levers
- The AFS CP selection knobs (SPD, HDG/TRK, ALT and V/S-FPA selection knob):
  - When a selection knob is pushed, its managed guidance mode is engaged
  - When a selection knob is pulled, its selected guidance mode is engaged.

The FG modes appear on the Flight Mode Annunciator (FMA) of the Primary Flight Displays (PFDs).

Architecture

There are three PRIMs. Each PRIM can operate one or both APs, and/or FDs, and/or the A/THR.

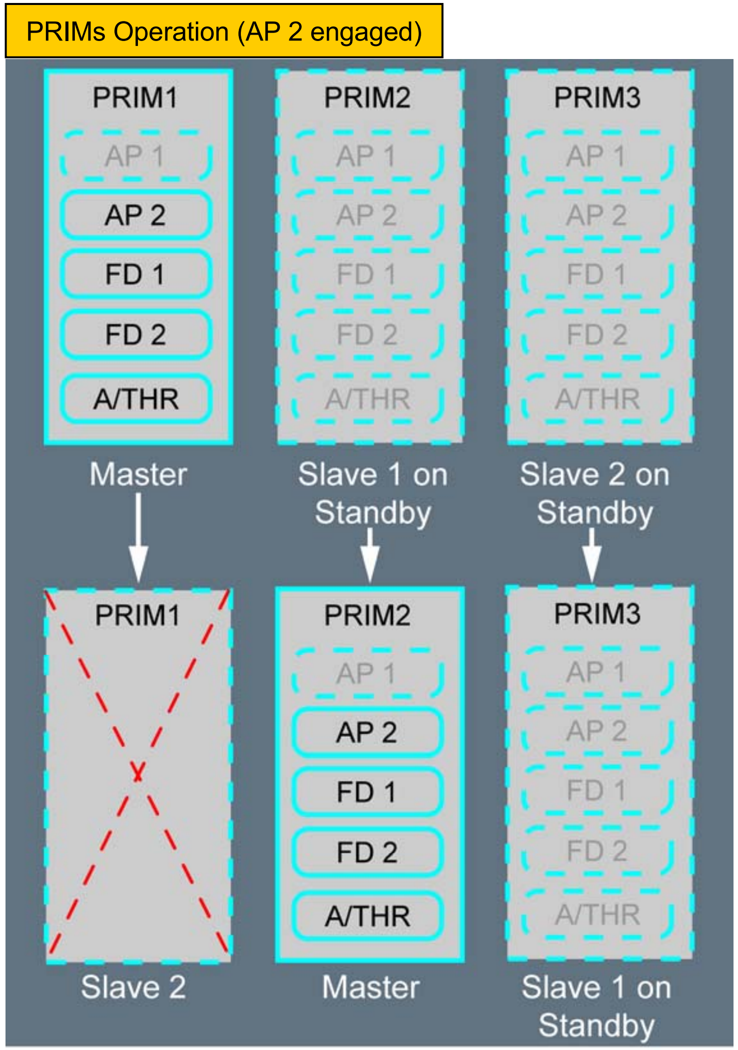
The Master PRIM is the PRIM that has the best operational capability. The Slave 1 PRIM has the second best operational capability, and the Slave 2 PRIM has the third best.

When all the PRIMs have the same capability:

- PRIM1 is the Master PRIM
- PRIM2 is the Slave 1 PRIM
- PRIM3 is the Slave 2 PRIM.

The Master PRIM has priority to operate AP(s), FDs and A/THR.

If the Master PRIM loses the best capability, the engaged AP, FDs and A/THR do not disconnect. They are transferred to the Slave 1 PRIM.



Flight Guidance (FG) Modes

Flight Guidance (FG) operates using the following modes:

- AP/FD lateral modes: Control the lateral trajectory
- AP/FD vertical modes: Control either:
  - The vertical trajectory, or
  - The speed or Mach.
- A/THR modes: Control either:
  - The thrust or
  - The speed or Mach.

The modes are either selected or managed.

FG Selected and Managed Modes

Guidance	Managed Modes	Selected Modes
Lateral	NAV LOC*, LOC LOC B/C*, LOC B/C F-LOC*, F-LOC RWY, RWY TRK GA TRK	HDG, TRACK
Vertical	SRS CLB ALT*, ALT ALT CRZ*, ALT CRZ ALT CSTR*, ALT DES G/S*, G/S F-G/S*, F-G/S	OP CLB ALT*, ALT ALT CRZ*, ALT CRZ OP DES V/S, FPA
Lateral and Vertical	LAND FLARE ROLL OUT	
Speed or Mach	SPEED, MACH with FMS reference.	SPEED, MACH with AFS CP reference.

Note:

The “star”-modes are the acquiring modes of their corresponding mode:
e.g. The G/S*-mode captures the glide slope whereas the G/S-mode maintains the aircraft on the glide slope.

AP/FD Modes

- **AP/FD Lateral Modes**

Mode	Description
• NAV	• NAV steers the aircraft along the lateral flight plan defined in the FMS • Interaction with vertical modes: the vertical managed modes take into account the speed/Mach constraints of the FMS flight path.
• LOC • LOC B/C	• LOC steers the aircraft along a localizer beam • LOC B/C steers the aircraft in back course along a localizer beam.
• HDG / TRACK	• HDG / TRACK steers the aircraft along a selected AFS CP heading or track.

- **AP/FD Vertical Modes**

Mode	Description
Level Changes • CLB / DES • OP CLB / OP DES	 • CLB / DES steers the aircraft along the vertical path of the FMS flight plan and takes into account altitude and speed constraints of the flight plan • OP CLB / OP DES enables climb or descent towards the AFS CP selected altitude, maintaining a TARGET SPEED (managed or selected) with a fixed given thrust. Altitude constraints of the FMS flight plan are disregarded.
Altitude hold • ALT • ALT CRZ • ALT CSTR	 • ALT maintains a AFS CP selected target altitude • ALT CRZ acquires and maintains the cruise altitude • ALT CSTR maintains an altitude constraint delivered of the FMS flight plan.
• V/S / FPA	• V/S / FPA acquires and maintains the AFS CP vertical speed or flight path angle selected on the AFS CP.
• G/S	• G/S steers the aircraft along a glide slope beam
• SRS	• SRS steers the aircraft along a vertical path at a speed defined by the SRS guidance law

- **AP/FD Associated Modes and Common Modes**

Common mode	Vertical mode	Lateral mode	Description
• TAKEOFF	SRS	RWY RWY TRK	• SRS steers the aircraft along a vertical path to maintain the speed defined by the SRS guidance law • RWY guides the aircraft along a LOC beam and below 50 ft RA • RWY TRK maintains the aircraft on the track it was flying at mode engagement (at 50 ft RA).
• ILS APPROACH	G/S	LOC	• G/S steers the aircraft along the glide slope beam • LOC steers the aircraft along the localizer beam • LAND steers the aircraft along the localizer and glide slope beam when descending below 400 ft RA, and aligns the aircraft before touchdown • FLARE flares the aircraft and sets the A/THR, if engaged, to IDLE
	LAND FLARE ROLLOUT		
• FLS APPROACH	F-G/S	F-LOC	• F-G/S steers the aircraft along a virtual FLS glide slope beam down to MDA • F-LOC steers the aircraft along a virtual FLS localizer beam.
• GO AROUND (GA)	SRS	GA TRK	• SRS steers the aircraft along a vertical flight path to maintain the speed that the aircraft had at GA engagement or VAPP, whichever is higher • GA TRK maintains the aircraft on the track it was flying at GA mode engagement.

A/THR Modes

The Autothrust (A/THR) controls the thrust of the 4 engines, and can operate independently or with the AP/FD:

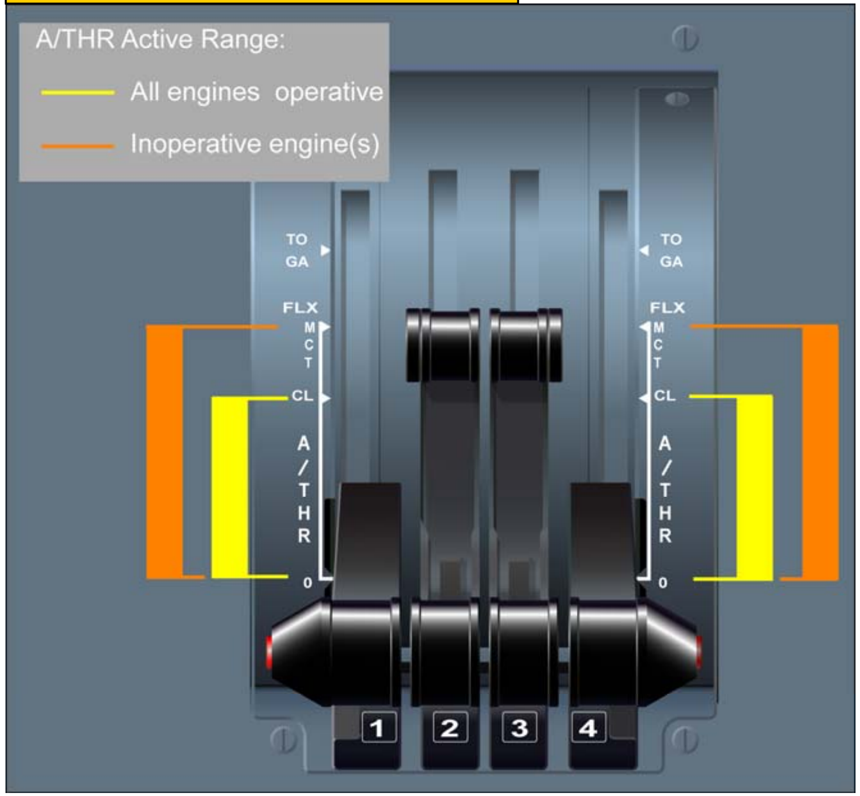
- If AP/FDs are off, the A/THR always controls the speed or Mach
- If AP and/or FDs are engaged, the A/THR mode and the AP/FD vertical mode are linked.

The A/THR sends its thrust commands to the Full Authority Digital Engine Control (FADEC) for automatic engine control (Refer to Engines).

- **Thrust levers**:
  The flight crew uses the thrust levers to:
  - Manually select the engine thrust
  - Arm and activate the autothrust
  - Engage the takeoff and go-around modes.

  4 detents divide each of the thrust lever sectors into three segments:
  - TO GA: Maximum takeoff thrust
  - FLX MCT: Maximum continuous thrust (or FLX at takeoff, in accordance with the FLX/TO temperature setting on the TO page of the MFD)
  - CL: Maximum climb thrust
  - IDLE: Idle thrust.

Thrust Levers and A/THR Active Range



- **A/THR Modes**
  Except during takeoff, normal operation of the A/THR system requires the thrust levers to be in the CL detent or MCT detent (in engine out configuration).

  The A/THR modes are automatically selected in conjunction with the AP/FD modes.

A/THR Modes	Description
SPEED/MACH	• The autothrust acquires and maintains a speed or Mach target • The AP/FD, if engaged, controls the vertical path.
THRUST THR MCT THR CLB THR LVR THR IDLE THR DCLB THR DES ALPHA FLOOR	• The auto thrust commands a specific thrust level • The AP/FD vertical mode controls the speed or Mach.

Interaction between AP/FD and A/THR

The AP/FD vertical mode determines the associated A/THR mode: :

- When an AP/FD vertical mode controls a speed or Mach target, the A/THR mode controls thrust
- When an AP/FD vertical mode controls the vertical trajectory, the A/THR mode controls a speed or Mach target.

AP/FD Vertical Modes and Associated A/THR Modes

AP/FD		A/THR	
Vertical Modes	**Objectives**	**Modes**	**Objectives**
SRS OP CLB CLB OP DES DES in idle path	Control of Speed or Mach Target	THRUST modes	Control of Thrust
V/S / FPA ALT*, ALT ALT CSTR*, ALT CSTR ALT CRZ*, ALT CRZ DES in geometric path G/S*, G/S F-G/S, F-G/S* LAND common mode FLARE common mode with FDs engaged only	Control of Vertical Trajectory	SPEED/MACH	Control of Speed or Mach Target
FLARE common mode with AP engaged ROLL OUT common mode	Control of Vertical Trajectory	THRUST modes	Control of Thrust at Idle
None		SPEED/MACH	Control of Speed or Mach

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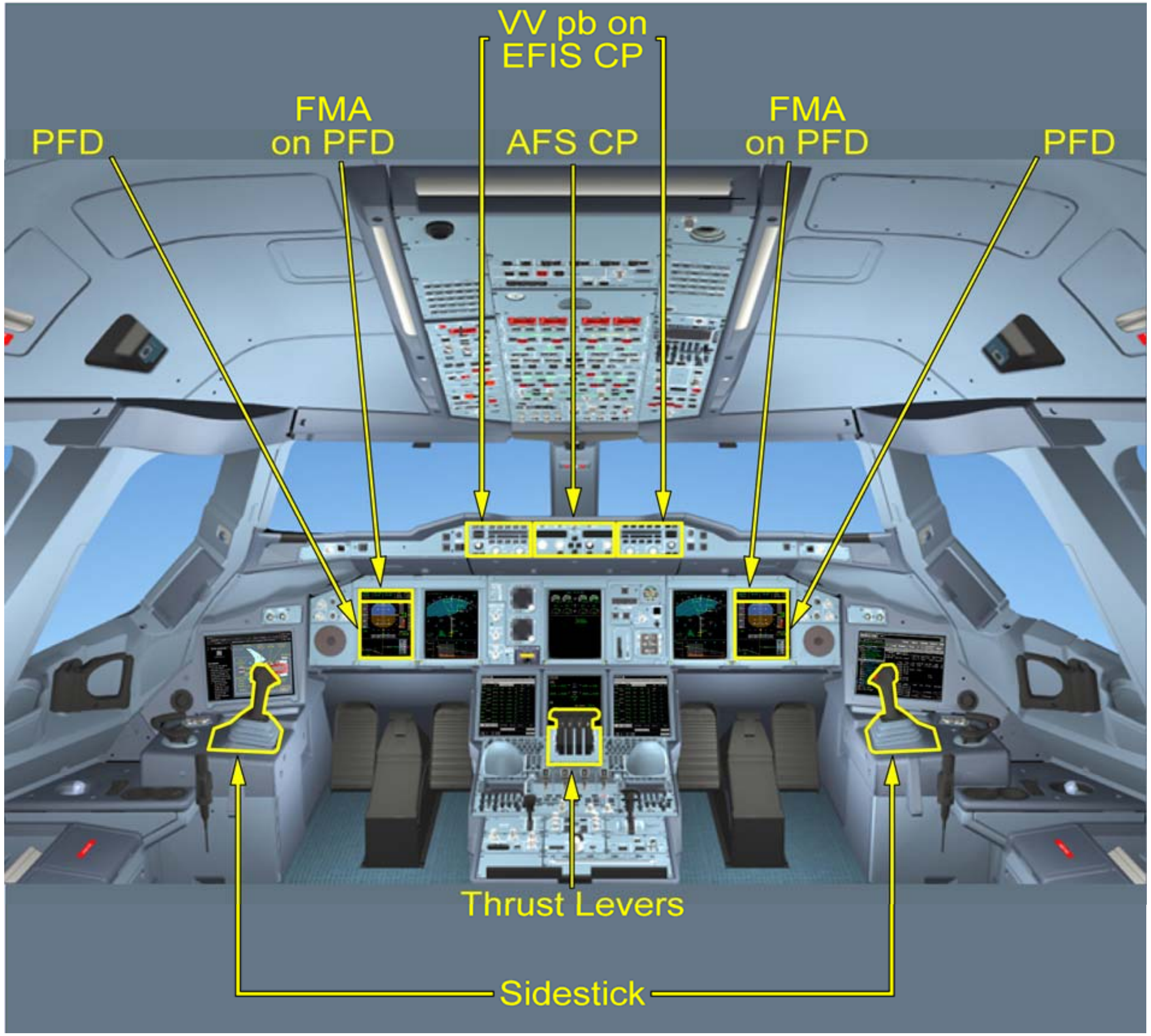
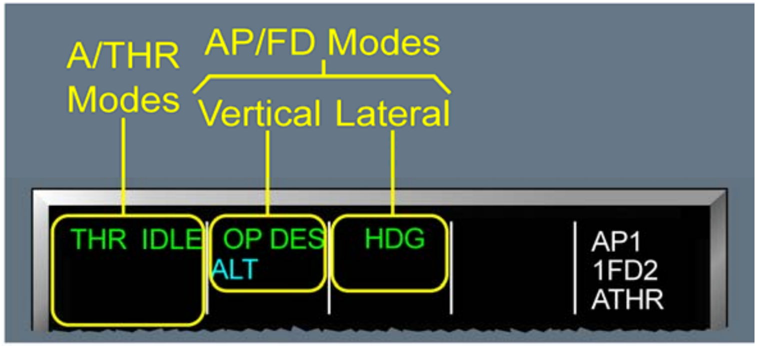
Controls and Indicators



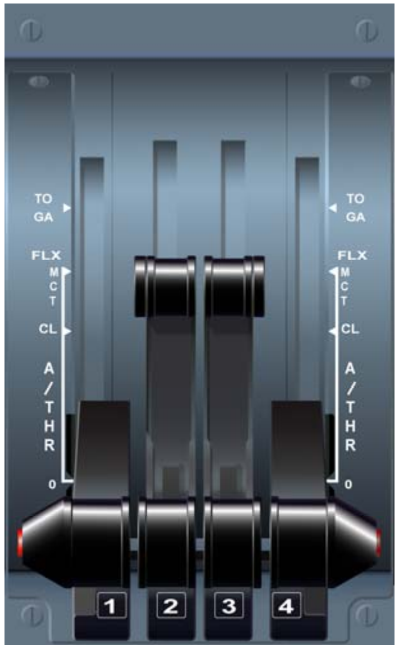
A380 Auto Flight System
2.Flight Guidance

FMA on PFD

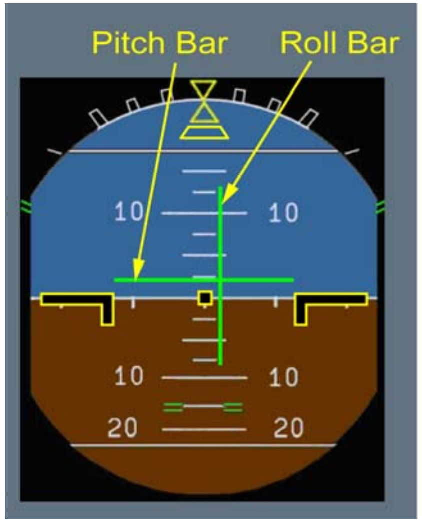


AFS CP

Thust Levers



FD on PFD



Sidesticks

EFIS CP

General

The **Flight Management System (FMS)** helps flight crews complete flight operation tasks by providing the following functions:

- Navigation
  - Aircraft position computation
  - Radio navigation tuning
  - Polar navigation.
- Flight planning
  - Flight plan creation
  - Flight plan revisions
  - Flight plan predictions.
- Performance calculation and optimization
- Long-term guidance
- Information display on the MFD, ND and PFD.

Architecture

There are two flight management systems:

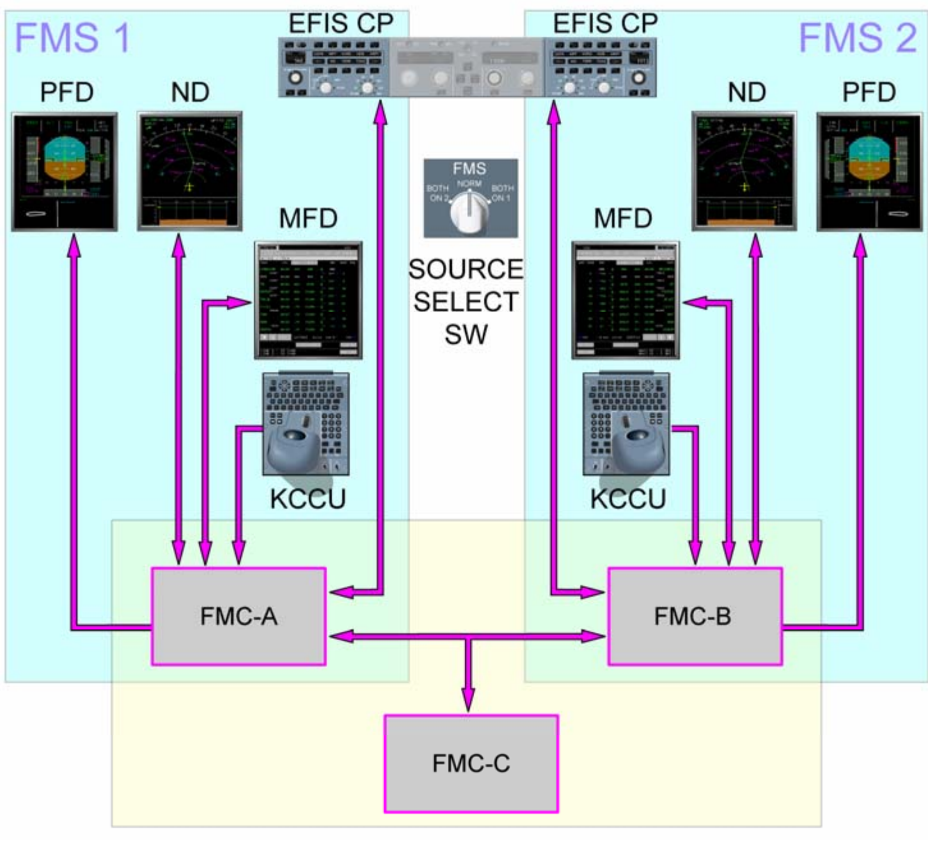
- FMS 1 on the captain's side
- FMS 2 on the first officer's side.

Each FMS uses:

- A computer, called the **Flight Management Computer (FMC)**
- The following cockpit interfaces:
  - One **Multi Function Display (MFD)**
  - One **Keyboard and Cursor Control Unit (KCCU)**
  - One **Navigation Display (ND)**
  - One **Primary Flight Display (PFD)**
  - One **EFIS Control Panel (EFIS CP).**

There are three FMCs : FMC-A, FMC-B and FMC-C.

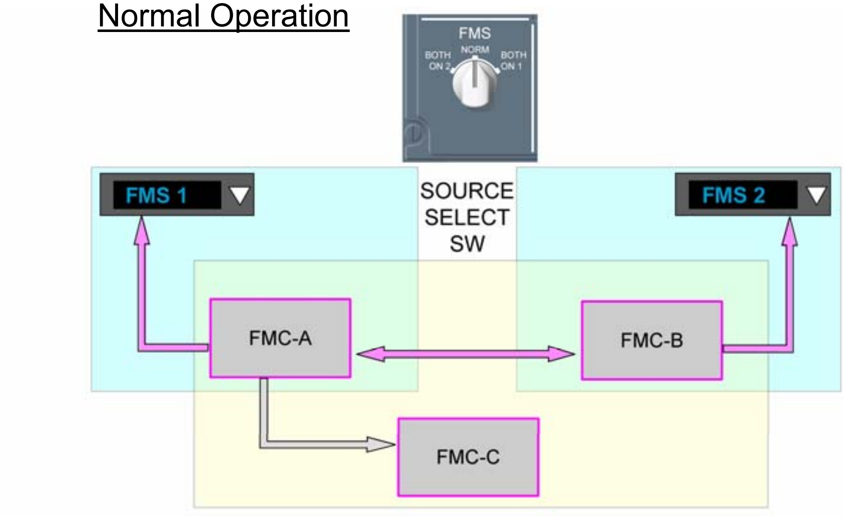
FMS Architecture



There are three different operating modes: DUAL, INDEPENDENT and SINGLE mode.

- **DUAL Mode:** FMS 1 and FMS 2 are healthy

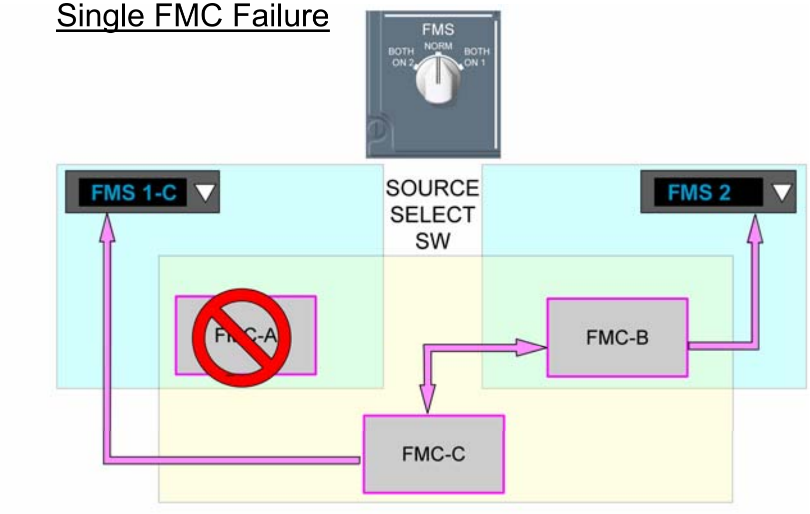
Normal Operation



FMC-A provides data to FMS 1, FMC-B provides data to FMS 2 and FMC-C is the standby computer.

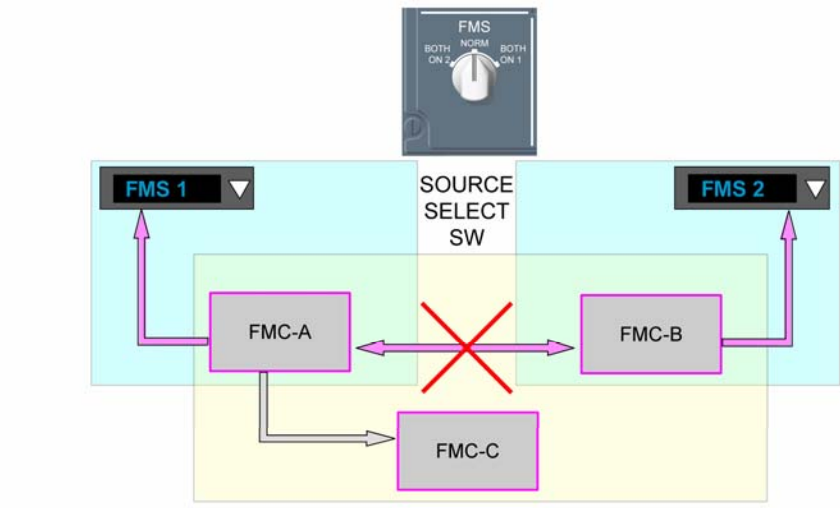
Of the two active computers, one FMC is the “master”, the other is the “slave”, depending on which Autopilot (AP) is active and on the selected position of the FMS SOURCE SELECTE switch.
The two active FMCs independently calculate data and exchange, compare and synchronize this data.
The standby computer does not perform any calculation, but is regularly updated by the master FMC.

Single FMC Failure

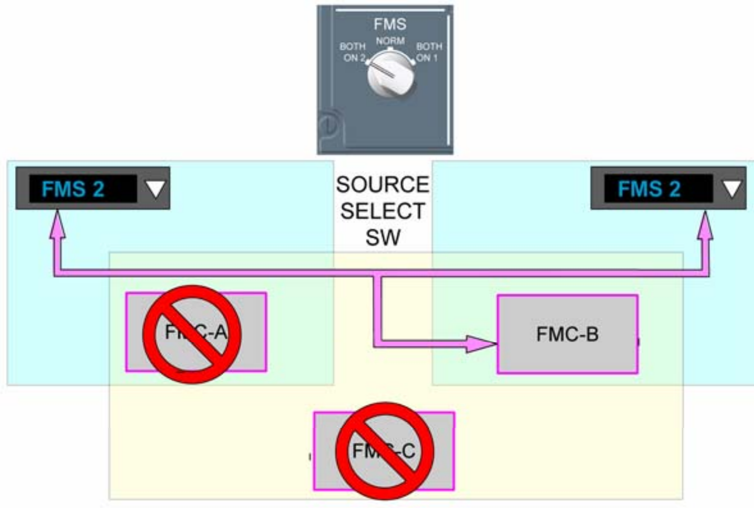


Example: FMC-A failure.
In this case, FMC-C provides data to FMS 1.

- **INDEPENDENT Mode:**
  FMS 1 and FMS 2 are both operative but there is no data exchange between them because they disagree on one or more critical items such as aircraft position, gross weight,etc.



- **SINGLE Mode**
  The loss of two FMCs causes the loss of FMS 1 or FMS 2.
  The flight crew displays the data from the operative FMS on both sides with the FMS SOURCE SELECT switch.



Navigation

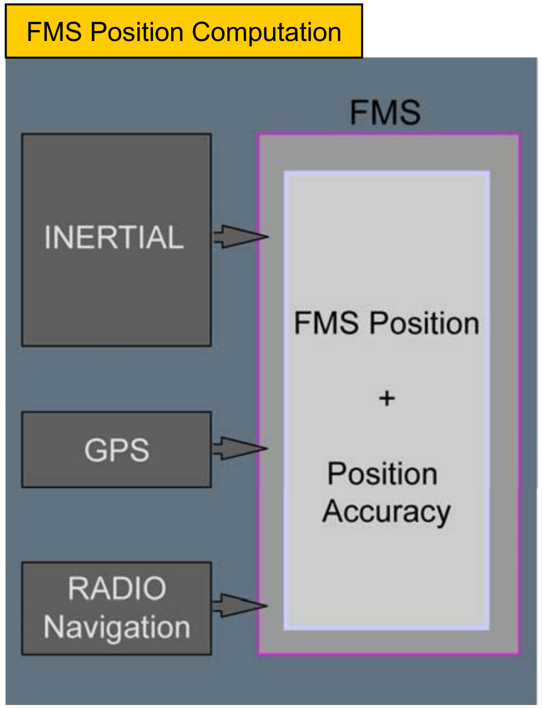
Position Computation

The position computation function consists of determining the best estimate of the aircraft position and evaluating the accuracy of this estimation.

- **Position Computation**
  Each FMS computes its aircraft position and the position accuracy, using three sources (Refer to Navigation):
  - Inertial via the ADIRS
  - Global Positioning System (GPS) via the MMR
  - Radio navigation via NAVAIDS receivers.

  The FMS position is a combination of the inertial position and the GPS or radio position, depending on which equipment provides the most accurate data. This results in four navigation modes, in decreasing order of priority:
  - Inertial - GPS (IRS/GPS)
  - Inertial - DME/DME (IRS/DME/DME)
  - Inertial - VOR/DME (IRS/VOR/DME)
  - Inertial only (IRS).

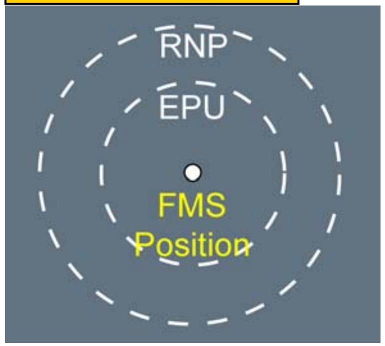
Note :The FMS aircraft position computation always uses the inertial position. This computation is not possible if the inertial position is not valid. In this case, all FMS navigation and flight planning functions are no longer available.



- **FMS Position Accuracy**
  The FMS continuously computes the Estimated Position Uncertainty (EPU). The EPU is used, together with the Required Navigation Performance (RNP), to define the aircraft navigation accuracy.
  The FMS continuously compares the actual EPU with the current RNP and defines the navigation class as:
  - HIGH, if the EPU is less than, or equal to, the RNP
  - LOW, if the EPU is greater than the RNP.

  The navigation class has to satisfy the Airworthiness Authorities Accuracy Requirements (AAAR).

FMS navigation class



Radio Navigation Tuning

The FMS automatically tunes:

- The NAVAIDS used for the radio position computation
- The NAVAIDS for display on the ND
- The landing system NAVAIDS.

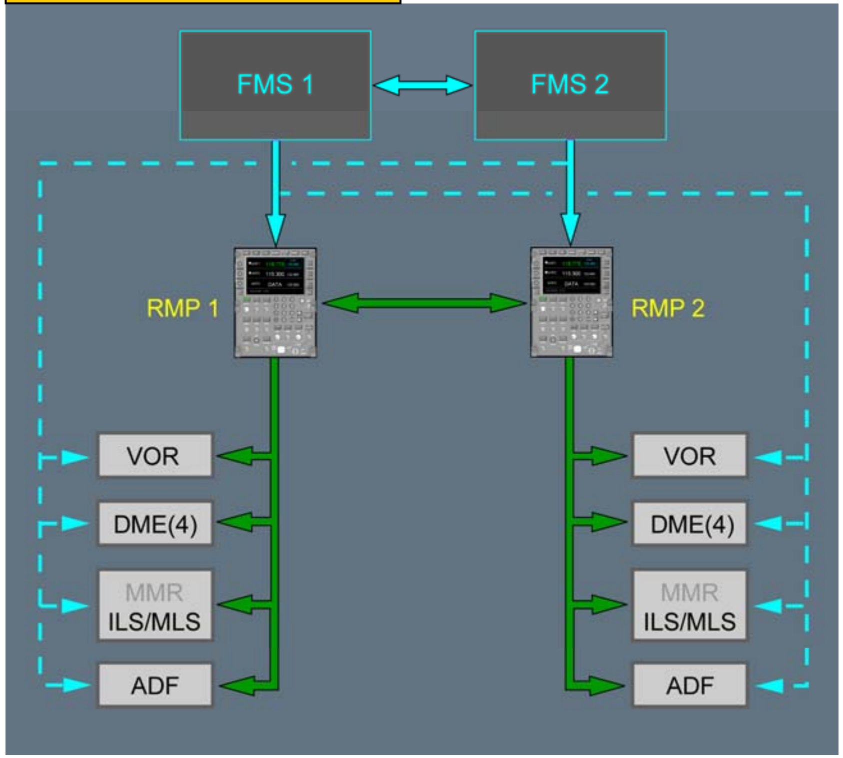
In dual and independent FMS mode, each FMS tunes its onside NAVAIDS:

- 1 VOR
- 4 DMEs
- 1 ILS (MLS / GLS optional)
- 1 ADF (optional).

In single FMS mode or in the case of a communication failure between an FMS and its onside RMP, the available FMS will tune the NAVAIDS on both sides.

The tuning of the onside NAVAIDS passes through the onside RMP, to synchronize the NAVAIDS tuning between the FMS and the RMP.

FMS Radio Navigation Tuning



Note: The NAVAIDS that are displayed on the ND, and the landing system NAVAIDS, can also be tuned manually on the POSITION / NAVAIDS page or on the RMP.Manual tuning always has priority over automatic tuning.

MFD POSITION / NAVAIDS Page

Backup Navigation

The Integrated Standby Instrument System (ISIS) is the independent backup system in the case of a failure of the ADIRS, CDS or avionics networks (Refer to Navigation).

Flight planning

General

A major purpose of the Flight Management System (FMS) is to help the flight crew with flight planning.

The flight crew can enter the **flight plan** in the FMS. This flight plan includes the intended **lateral** and **vertical** trajectory.

When all of the necessary data is entered, the FMS computes and displays the speed, altitude, time, and fuel **predictions** that are associated with the flight plan.

The flight crew can change the flight plan at any time:

- If the change is made to the lateral flight plan, the change is called a **lateral revision**
- If the change is made to the vertical flight plan, the change is called a **vertical revision**.

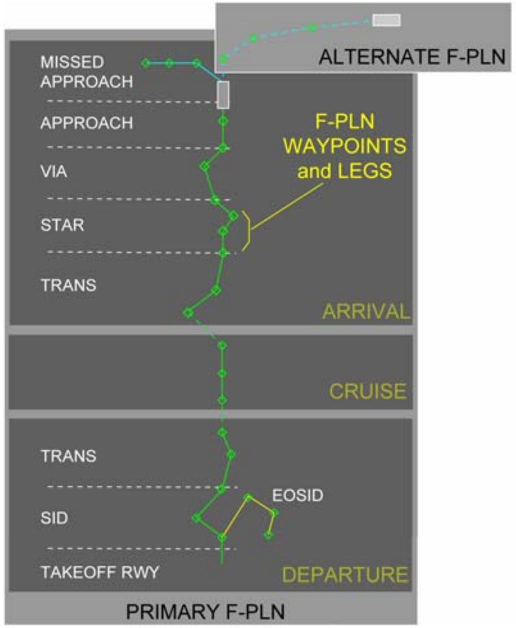
The FMS can simultaneously memorize four flight plans:

- One **active** flight plan: For lateral and vertical long-term guidance and for radio navigation auto-tuning
- Three **secondary** flight plans: Drafts to compare predictions, to anticipate a diversion or to store company, ATC and OIS flight plans.

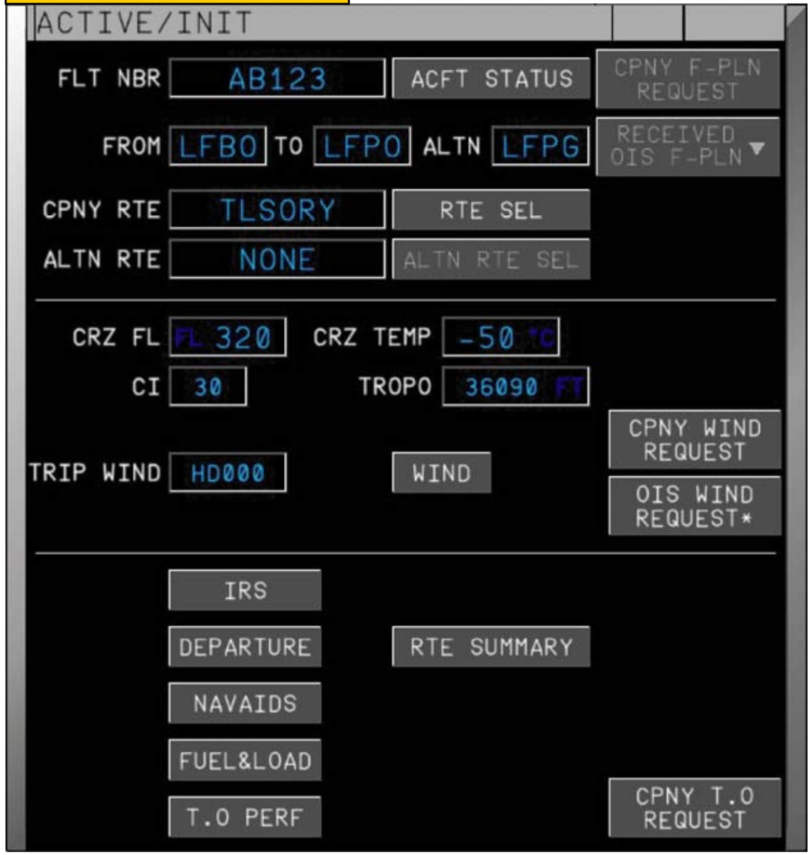
Flight Plan Creation

The lateral flight plan includes the departure, cruise and arrival and is composed of waypoints that are linked with flight plan legs and transitions between legs.
A flight plan can be created in either three ways:

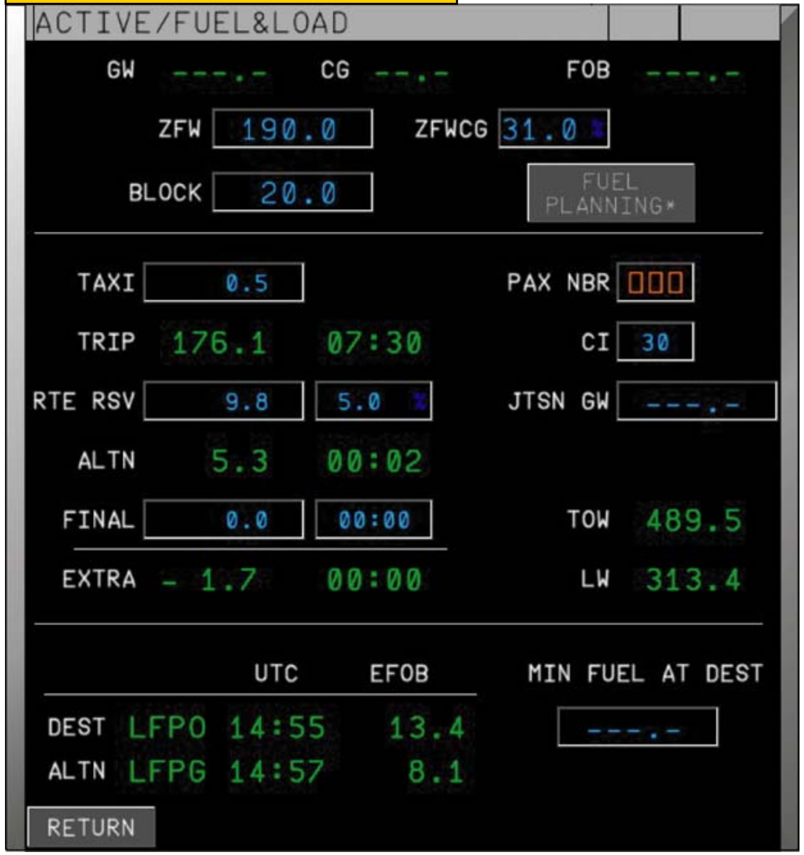
- By inserting an origin/destination pair and then manually selecting the departure, waypoints, airways and arrival
- By inserting a company route stored in the database
- By sending a company request to the ground for an active F-PLN uplink.



MFD ACTIVE / INIT Page



MFD ACTIVE / FUEL&LOAD Page



Flight Crew Data Entries

In order to make performance computations and flight plan predictions, the flight crew has to enter the following data:

- Zero Fuel Weight (ZFW) and Zero Fuel Center of Gravity (ZFCG)
- Block fuel
- Airline cost index (CI)
- Flight conditions (CRZ FL, temperature, wind).

Predictions

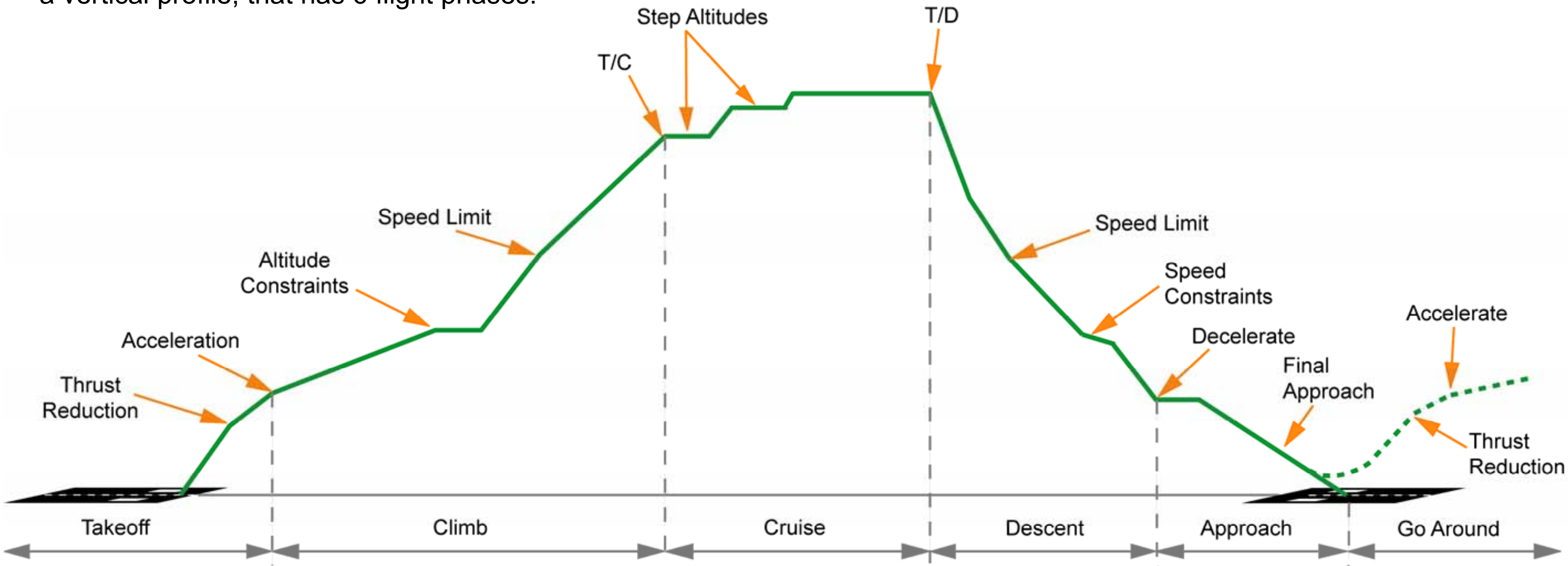
With the lateral flight plan and the flight crew data entries, the FMS computes the following predictions:

- Wind and temperature
- Speed changes
- Pseudo waypoint computation: T/C, T/D, LVL OFF,…
- For each waypoint or pseudo waypoint:
    - Distance
    - Estimated Time of Arrival (ETA)
    - Speed
    - Altitude
    - Estimated Fuel On Board (EFOB)
    - Wind for each waypoint or pseudo waypoint.
- For primary and alternate destination:
    - ETA
    - Distance to destination
    - EFOB at destination.

These predictions are continually updated depending on:

- Revisions to the lateral and vertical flight plans
- Current winds and temperature
- Actual position versus lateral and vertical flight plans
- Current guidance modes.

The predictions and the lateral flight plan combine to form a vertical profile, that has 6 flight phases:



Takeoff
- V2+10kt (SRS)
- TO GA thrust up to thrust reduction altitude, then CLB thrust

Climb
- 30% of thrust for altitude gain
- 70% of thrust for acceleration up to first climb speed
- Altitude/speed constraints taken into account

Cruise
- Altitude steps may exist
- ECON cruise speed varies as weight decreases

Descent
- ECON descent speed
- IDLE thrust
- Altitude/speed constraints taken into account

Approach
- Deceleration for configuration changes
- Approach speed reached at 1000 ft AGL

Go Around
- Same as takeoff

Note: A Noise Abatment Departure Procedure (NADP) has different thrust parameters for takeoff and acceleration

Flight Plan Revisions

The flight crew can perform the following lateral revisions:

- Delete and insert waypoints
- Departure procedures: Takeoff runway, SID and transition
- Arrival procedures: Runway, type of approach, STAR, via, transition,…
- Airways segments
- Holding patterns
- Alternate airport.

The flight crew can also perform the following vertical revisions:

- Time constraints
- Speed constraints
- Constant Mach segments
- Altitude constraints
- Step altitudes
- Wind.

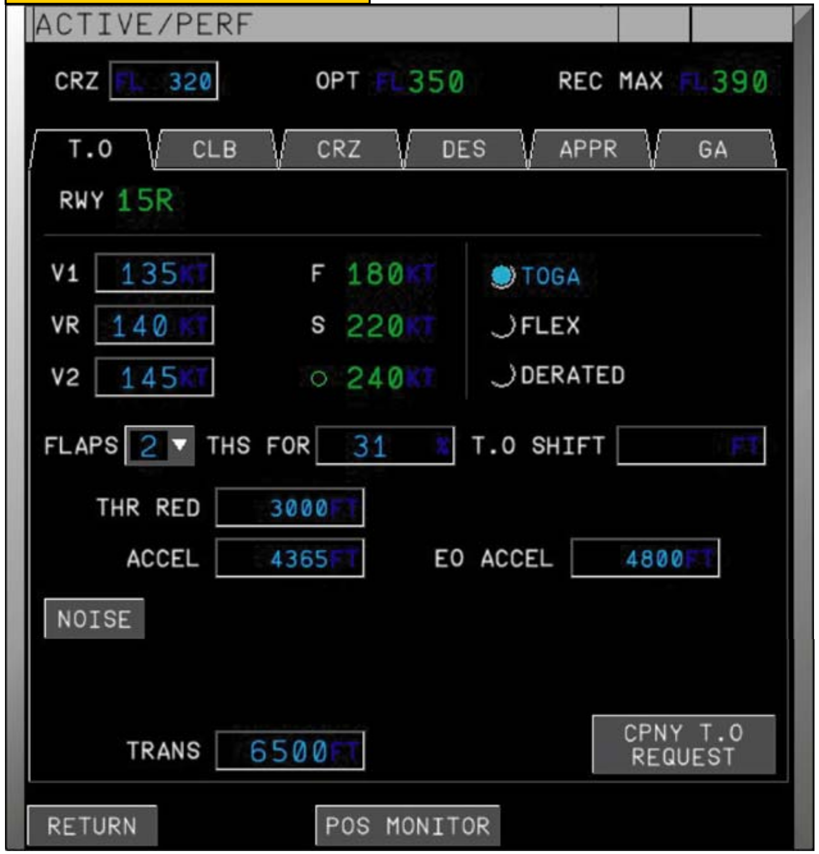
MFD ACTIVE / F-PLN Page

Performance Calculation and Optimization

For each vertical flight phase, the FMS computes the optimized speed/Mach profile and additionally also computes for:

- Takeoff: Characteristic speeds (F, S, O)
- Climb: Optimum target speed
- Cruise: Optimum flight level and ECON cruise Mach
- Descent: Optimized target speed and profile
- Approach: Characteristic speeds (F, S, O, VAPP, VLS).

MFD ACTIVE / PERF Page



Long-Term Guidance

The FMS sends targets to the FG:

- To guide the aircraft along the inserted flight plan (when AP is engaged)
- To display the FD on the PFD.

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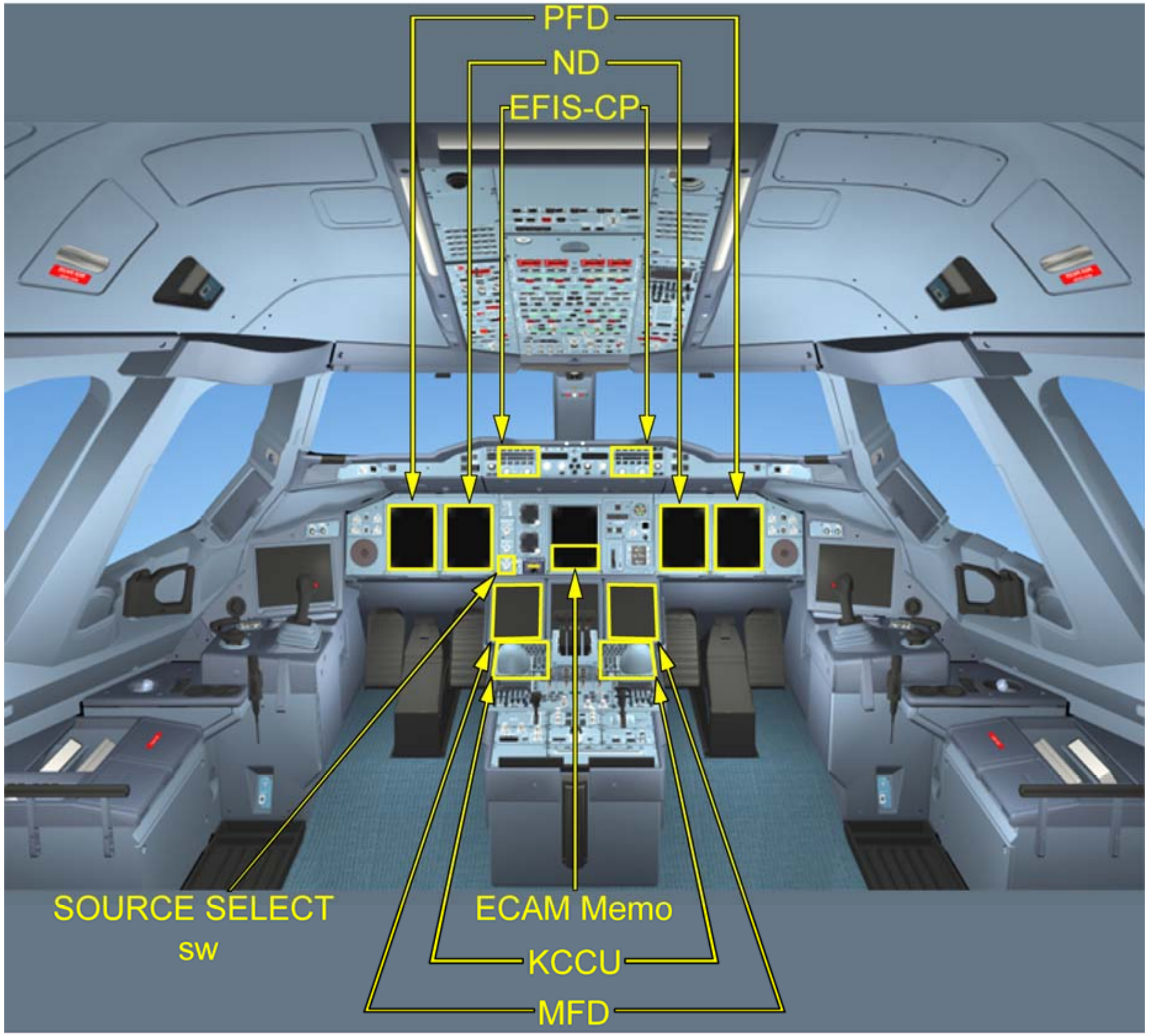
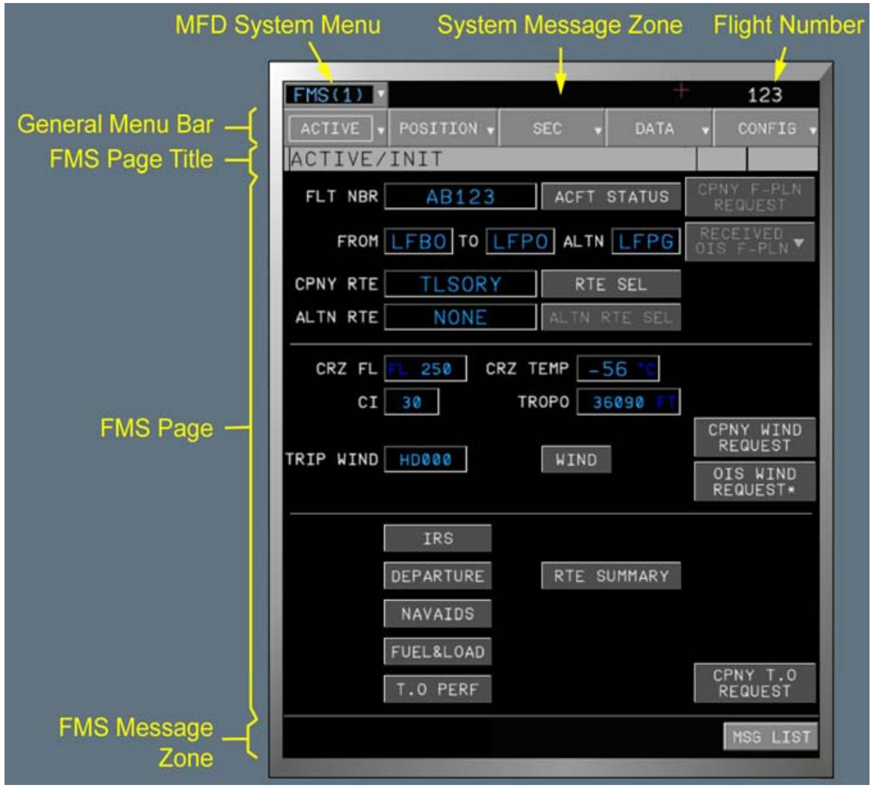
Controls and Indicators



Multi Function Display (MFD)

The MFD displays FMS textual data.
There are more than 50 FMS pages that provide information on the flight plan, aircraft position and flight performance.
The MFD is interactive: The flight crew can navigate through the pages and can consult, enter or modify the data via the KCCU.

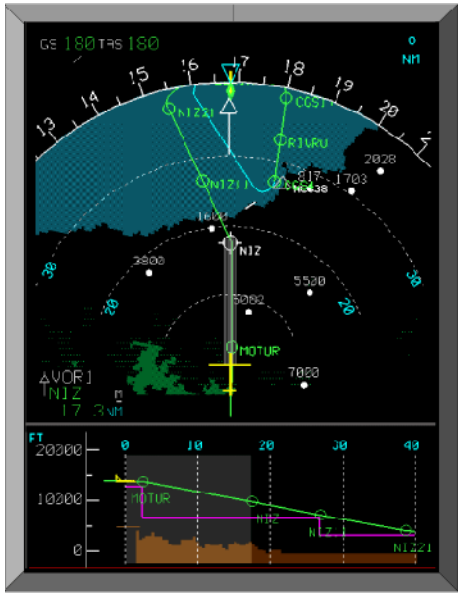


Keyboard and Cursor Control Unit (KCCU)

The flight crew uses the KCCU to:
- Navigate through the FMS pages on the MFD
- Enter and modify data on the MFD
- Perform some flight plan revisions on the lateral ND.

Navigation Display (ND) and Primary Flight Display (PFD)

The ND and the PFD display graphical and textual information related to flight management. The ND displays the lateral and vertical parts of the flight plan. On the lateral part of the ND, the flight crew can make some FMS lateral flight plan modifications via the KCCU. Only the lateral ND is interactive.



EFIS CP

With the EFIS CP, the flight crew controls the graphical and textual FMS data that appear on the ND.

SOURCE SELECT sw

The FMS SOURCE SELECT sw allows the flight crew to link all flight management interfaces on both sides with the FMC on Captain's side (when selecting BOTH ON 1), or the FMC on First Officer's side (when selecting BOTH ON 2).

5. ATA 23 Communication

Flight Deck and Systems Briefing for Pilots

General

The communication system enables:

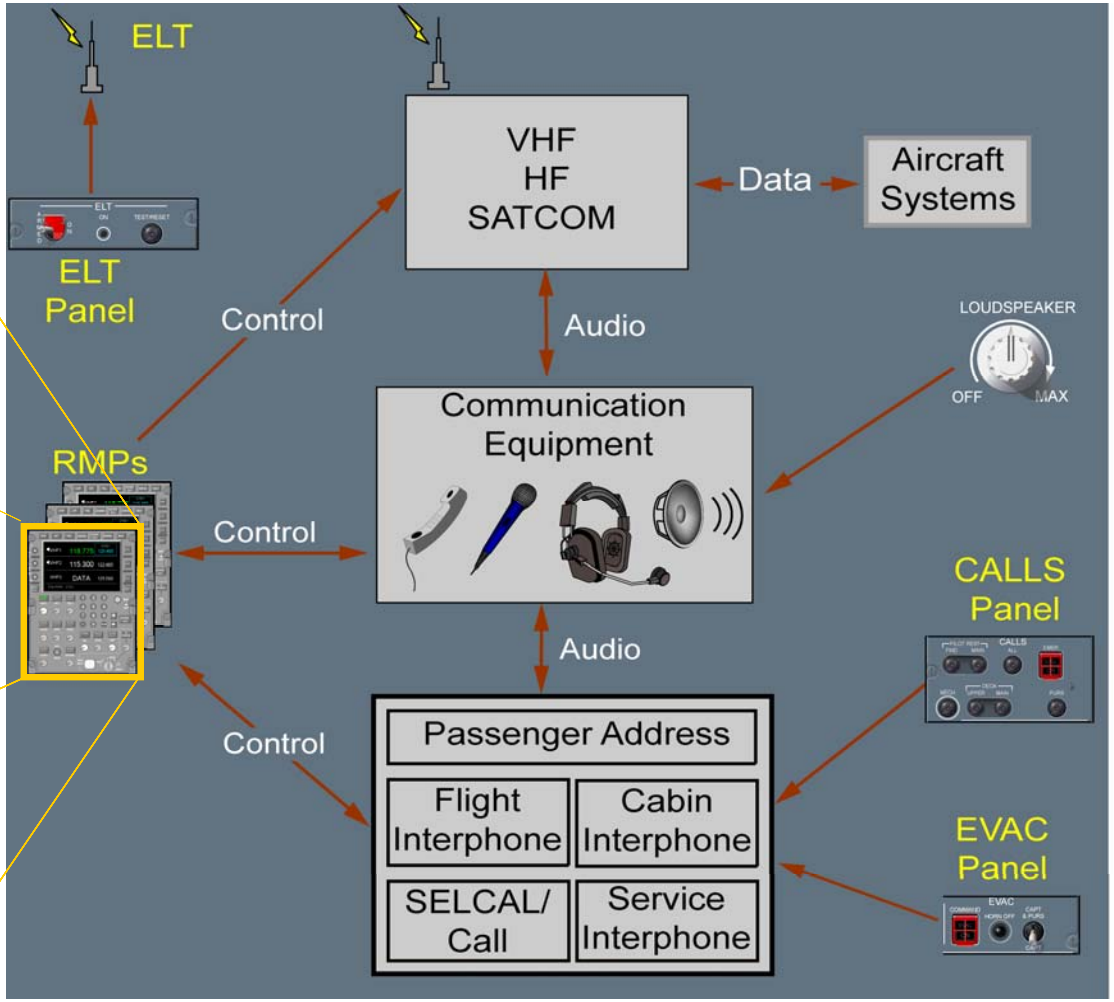
- **External Communication:**
  - Radio communication: VHF and HF
  - Satellite communication: SATCOM
  - Selective calling (SELCAL).
- **Internal Communication:**
  - Flight Interphone
  - Cabin Interphone
  - Passengers Address (PA)
  - Service Interphone.

Interfaces

The cockpit is equipped with:

- **Communication Equipment**: Loudspeakers and microphones
- **Three Radio Management Panels (RMPs)**: Two on the pedestal and one on the overhead panel. The flight crew uses the RMPs to:
  - Select the way of communication (radio communication, SATCOM, interphones)
  - Tune the radio frequencies
  - Dial SATCOM Telephone (TEL) numbers
  - Select voice or data mode communication
  - Monitor and select data communication parameters
  - Enter the squawk (SQWK) code
  - Select standby (STBY) radio navigation
  - Adjust the volume for communication and NAVAID identification.
- **One CALLS panel** to generate visual and aural call indications
- **One Evacuation (EVAC) panel** to initiate evacuation of the aircraft
- **One Emergency Locator Transmitter (ELT) panel**.

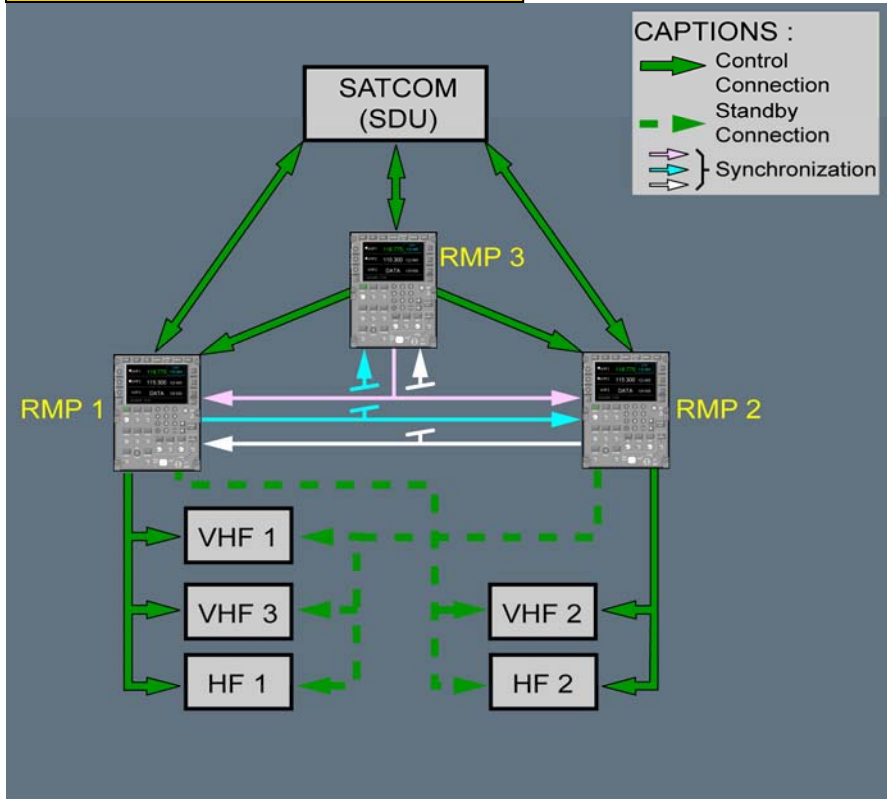
Communication System Architecture



Control and Synchronization

- The Captain controls RMP 1.
- The First Officer controls RMP 2.
- RMP 3 commands are received by RMP 1 or RMP 2 via the appropriate control connection and sent to the transceivers.
  RMP 3 can also be controlled by the third occupant.
- The RMPs share selections and inputs, in order to synchronize the main displays and enable control of all radio communication via any RMP. However, it is possible to display a different page on each RMP.
- The synchronization of the RMPs enables reconfiguration of the RMPs in the case of a failure of one or more RMPs.

RMP Architecture and Normal Operation



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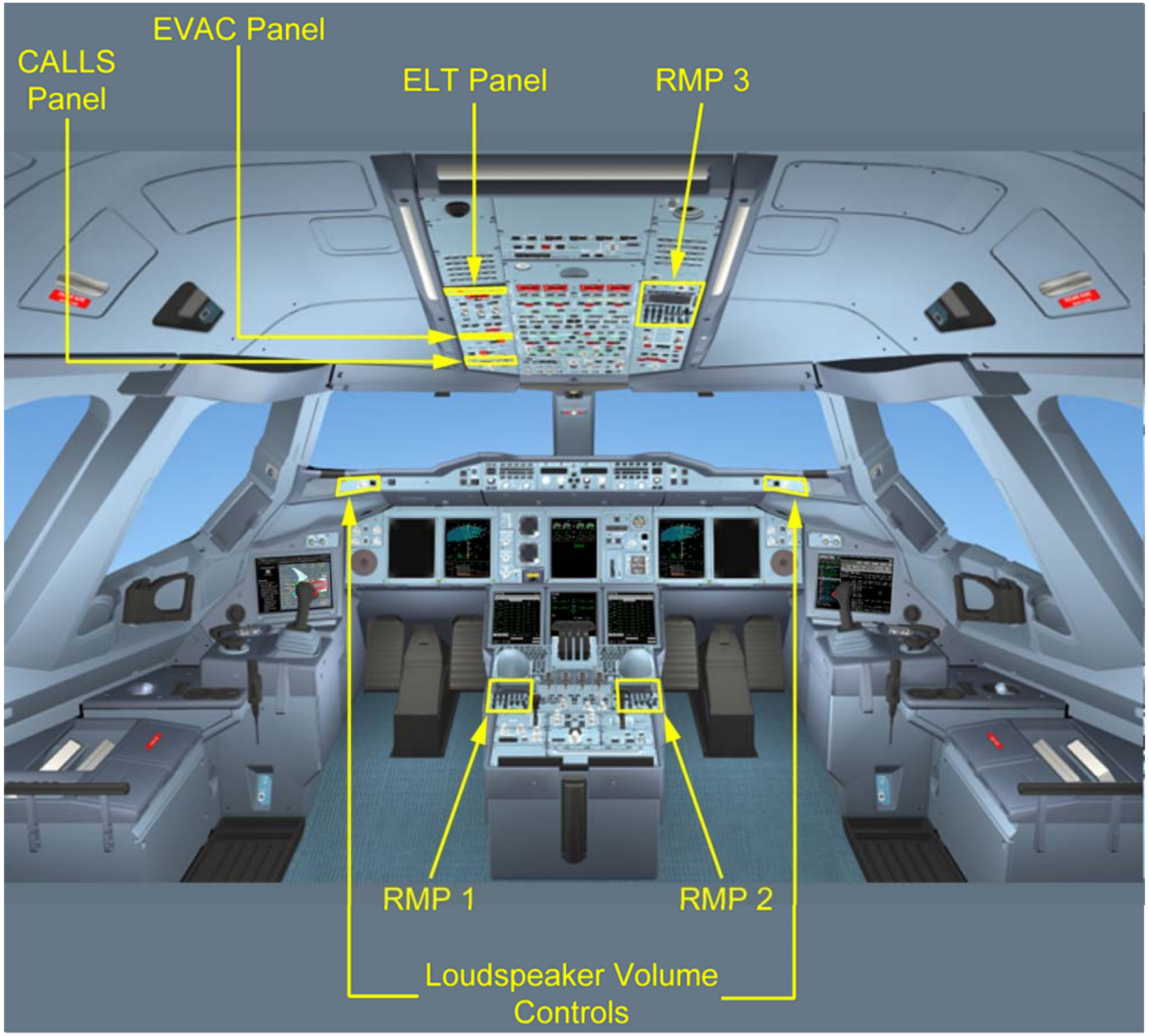
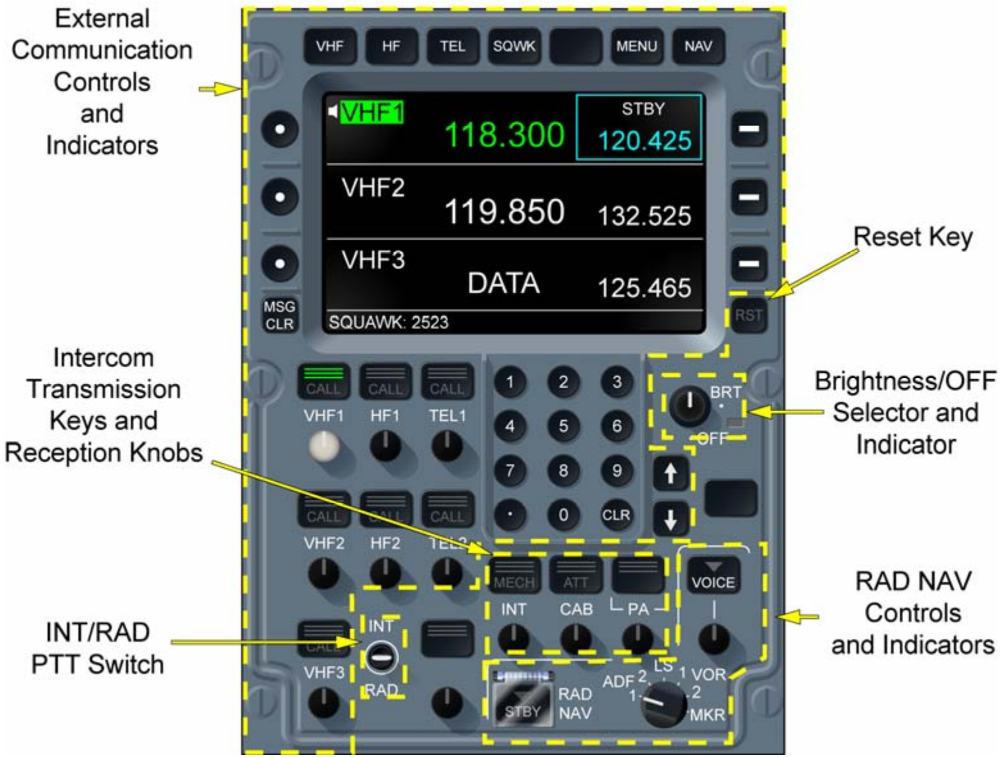


EVAC Panel
CALLS Panel
ELT Panel
RMP 3
RMP 1
RMP 2
Loudspeaker Volume Controls

EVAC Panel

ELT Panel

RMP



CALLS Panel

Loudspeaker Volume Control

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6. ATA 24 Electrical System

Flight Deck and Systems Briefing for Pilots

AIRBUS

AC Power Generation

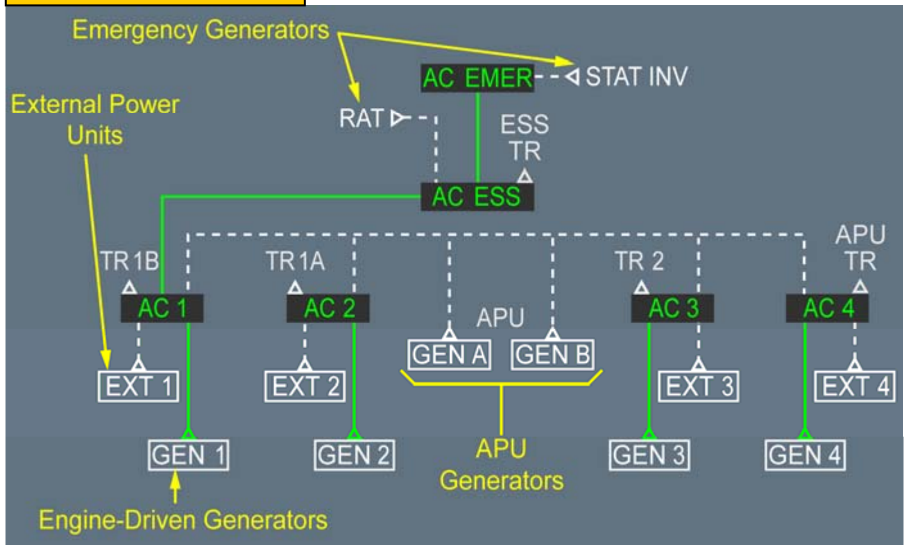
115 V Alternating Current (AC) power can be provided by three types of power sources:

- **Engine-Driven Generators**
  Each engine has one generator. These engine-driven generators are the main source of electrical power. When an engine is running, its generator provides 115 V AC power at variable frequency to its assigned AC busbar (e.g. GEN 1 supplies AC 1).
  Each engine generator can supply up to 150 KVA.

- **APU Generators**
  The APU can drive two generators. When the APU is running, it drives both generators at the same time. These generators provide 115 V AC power at a constant frequency of 400 Hz.
  Each APU generator can supply up to 120 KVA.

- **External Power Units**
  On ground, it is possible to connect as many as four external power units. The external power units provide 115 V AC power at a constant frequency of 400 Hz.
  Each external power unit can supply up to 90 KVA.

AC Power Generation



DC Power Generation

- **Transformer Rectifiers (TRs)**
  28 V Direct Current (DC) power is provided from AC power by four Transformer Rectifiers (TR 1A, ESS TR, TR 2A, and APU TR). TR 2A can be backed up by TR 2B, and TR 1A can be backed up by TR 1B.

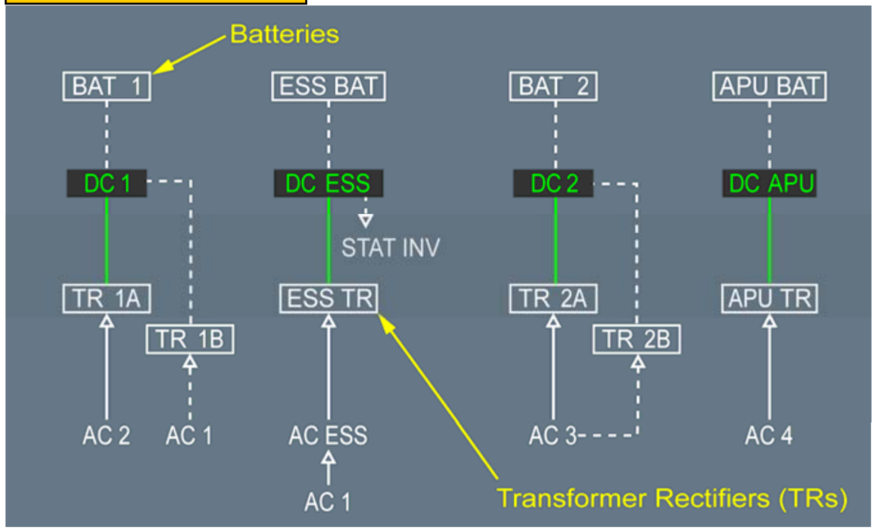
- **Batteries**
  The aircraft has four batteries, each with a nominal capacity of 50 Ah. These batteries can provide DC power, if AC power is not available.

Emergency Generation

If AC 1, AC 2, AC 3, and AC 4 busbars are lost in flight, the **Ram Air Turbine (RAT)** will automatically extend and mechanically drive the emergency generator. This emergency generator supplies the AC ESS busbar with AC power at a variable frequency..
The emergency generator can supply all the electrical loads that are necessary for the remainder of the flight, and for landing.

During RAT extension and after landing (speed less than 140 kt), the static inverter powers the AC EMER busbar.

DC Power Generation



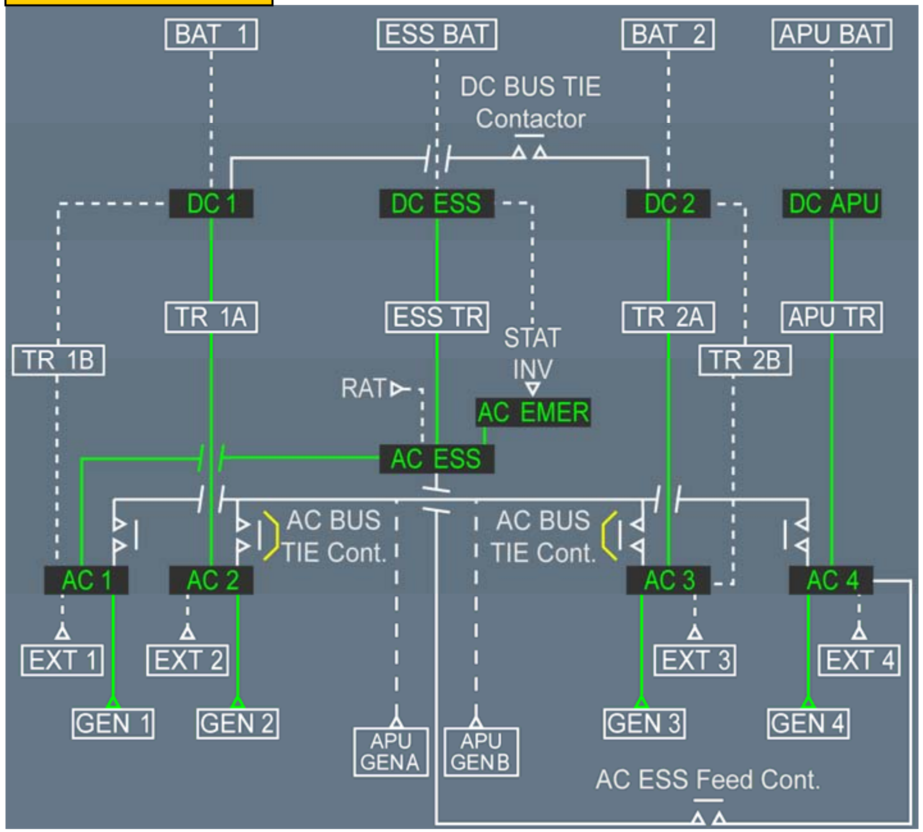
Electrical Networks

The **normal network** is supplied by
- Four AC busbars (AC 1, AC 2, AC 3, and AC 4)
- Two DC busbars (DC 1 and DC 2)
- One DC APU busbar (DC APU busbar).

BUS TIE contactors operate automatically to enable any necessary reconfiguration by segregating/connecting:
  - The AC busbars to/from each other and
  - The DC 1 and DC 2 busbars to/from each other.

The **emergency network** is supplied by:
- One AC essential busbar (AC ESS)
- One AC emergency busbar (AC EMER)
- One DC essential busbar (DC ESS).

Electrical Networks



Load Shedding

A generator overload can occur, when only two (or less) generators supply the entire electrical network.

In the event of a generator overload, some commercial AC loads (galleys, IFE, etc.) are temporarily automatically shed by the Electrical Load Monitoring Unit (ELMU). When sufficient power is recovered, connections resume automatically.

If the ELMU is not available, load shedding will only be available on high AC loads (galleys only).

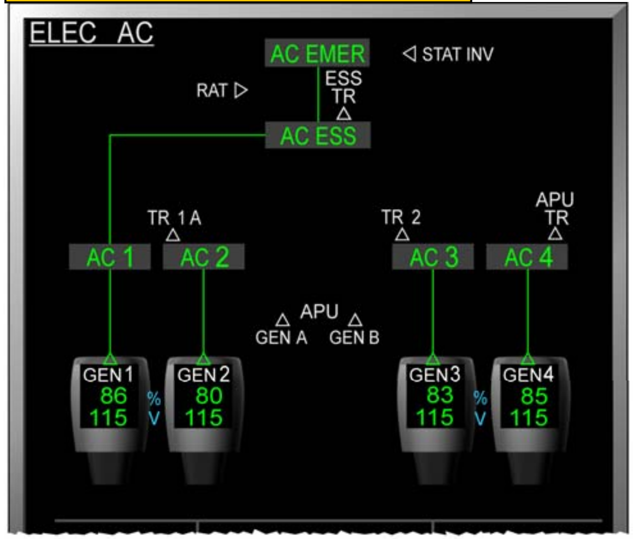
All Engines Running

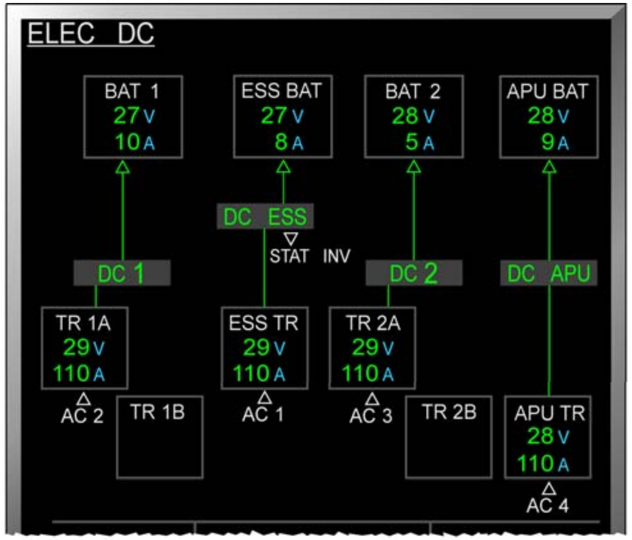
- **AC Distribution Network**

  Each engine generator supplies its assigned AC busbar. The AC busbars then supply power, as follows:
  - The AC 1 busbar supplies the AC ESS busbar. The AC ESS busbar supplies the AC EMER busbar and the ESS TR.
  - The AC 2 busbar supplies TR 1A
  - The AC 3 busbar supplies TR 2A
  - The AC 4 busbar supplies APU TR.

- **DC Distribution Network**
  - ESS TR supplies the DC ESS busbar
  - TR 1A supplies the DC 1 busbar
  - TR 2A supplies the DC 2 busbar
  - APU TR supplies the DC APU busbar.

All Engines Running: ECAM Display





General

In any abnormal electrical configuration (e.g. failure of one or more engine generators, TR failure), the electrical network automatically reconfigures to ensure that the remaining power sources continue to supply as many busbars as possible.

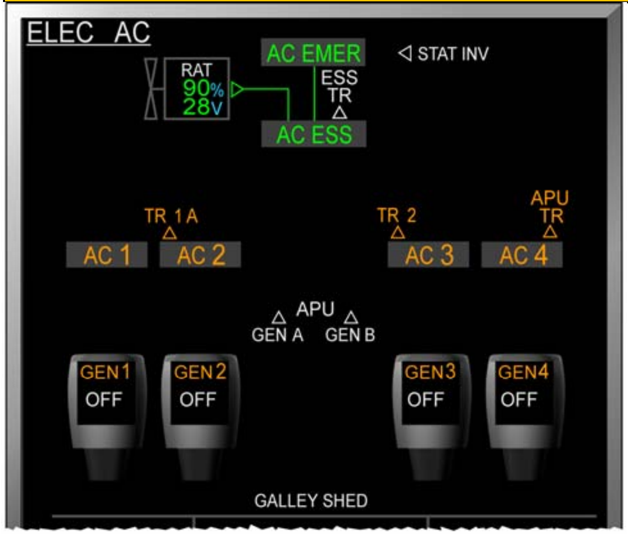
Any two electrical generators can supply the entire electrical network since each generator can supply up to two AC busbars.

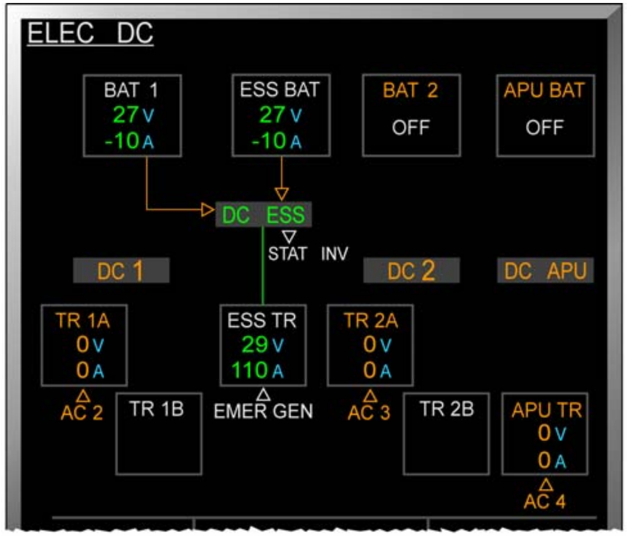
Generator Failure

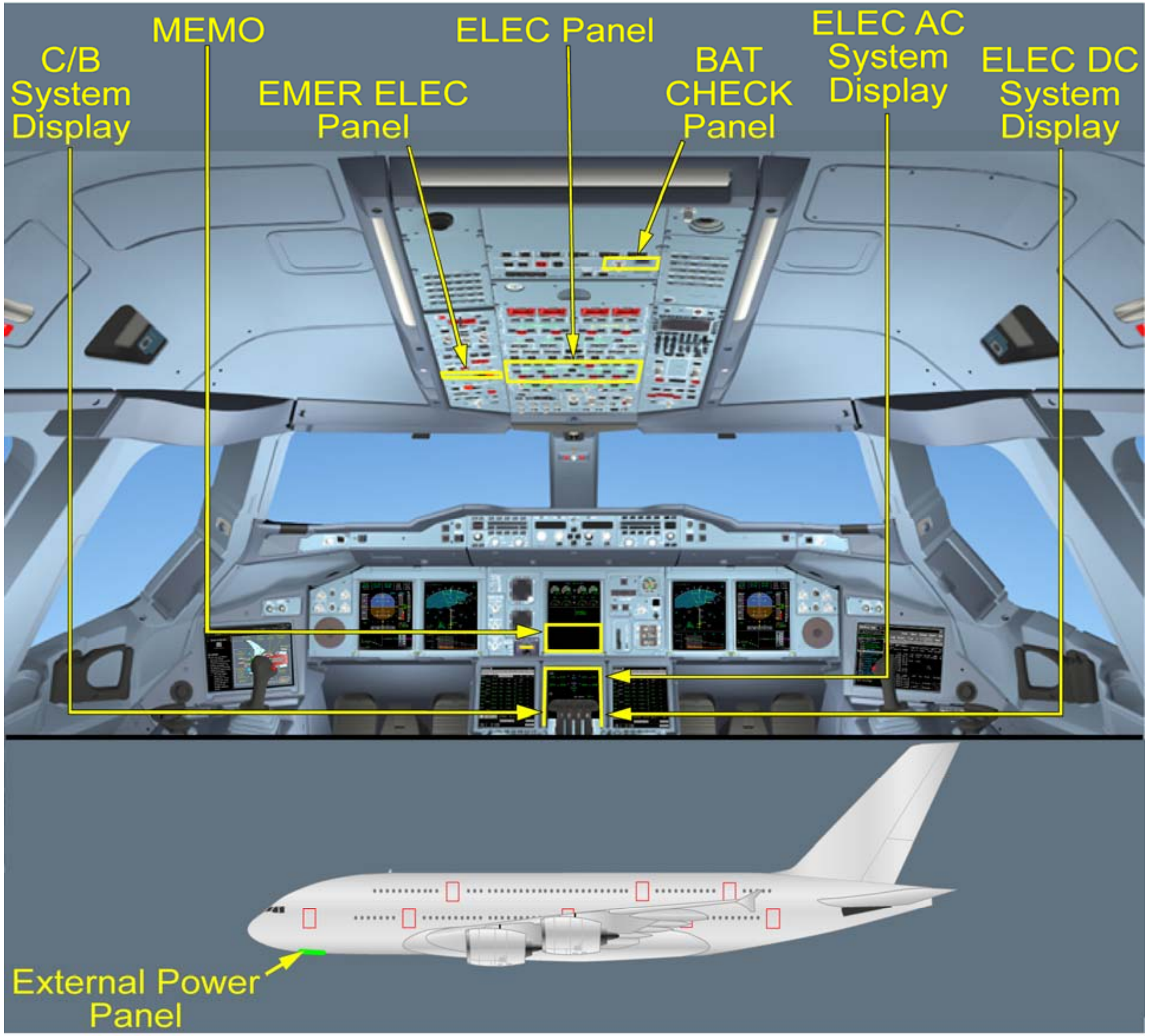
- **Failure of Some Engine/APU Generators**
  Each AC busbar will be supplied, in the following order of priority, by:
  - The APU generators
  - The other engine generators.

- **Failure Of AC 1, AC 2, AC 3 and AC 4 Busbars**
  The RAT automatically extends to power the AC ESS and AC EMER busbars and the ESS TR. The ESS TR then supplies the DC ESS busbar.

Failure of AC1, AC 2, AC 3 and AC 4 Busbar: ECAM Display



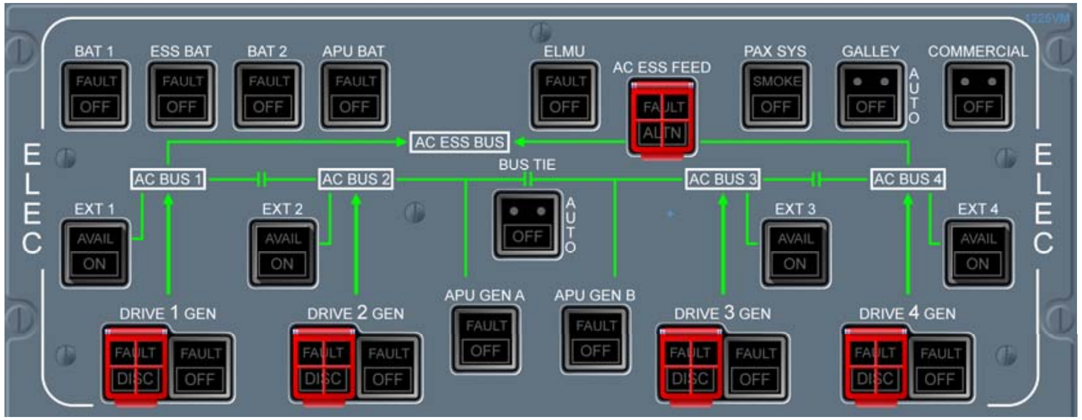




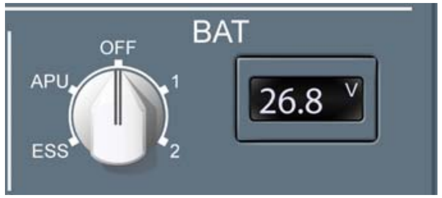
MEMO
C/B System Display
EMER ELEC Panel
ELEC Panel
BAT CHECK Panel
ELEC AC System Display
ELEC DC System Display
External Power Panel

A380 Electrical System
4.Controls and Indicators

ELEC Panel

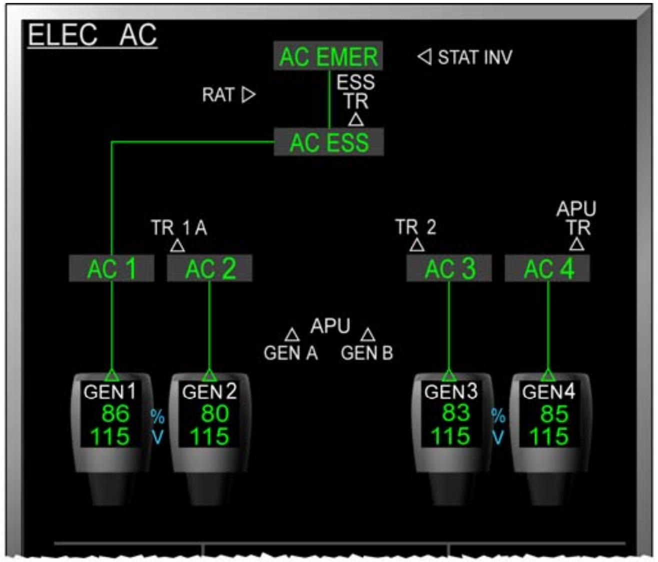


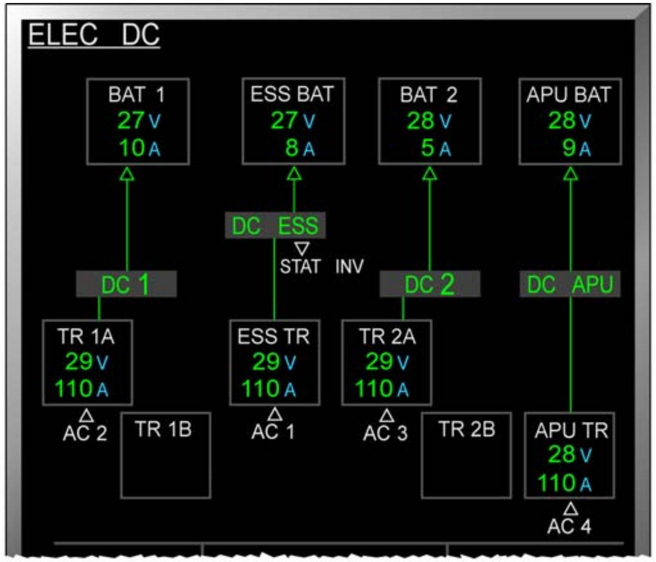
BATT CHECK Panel



EMER ELEC PWR Panel

ECAM SD ELEC AC/DC Page





7. ATA 26 Fire and Smoke Protection

Flight Deck and Systems Briefing for Pilots

Contents

AIRBUS

A380 Fire and Smoke Protection
1.General

The following aircraft zones have a fire detection and extinguishing system:

- Engines
- APU
- Cargo compartments
- Lavatories.

The following aircraft zones have a fire detection system:

- Main Landing Gear (MLG) bays
- Avionics bays (main, upper and aft bay)
- Crew rest compartments.

The engines, the APU and the Main Landing Gear are monitored by the Fire Detection Unit (FDU).
The avionics bays, the cargo compartments, the crew rest compartments and the lavatories are monitored by the Smoke Detection Function (SDF).

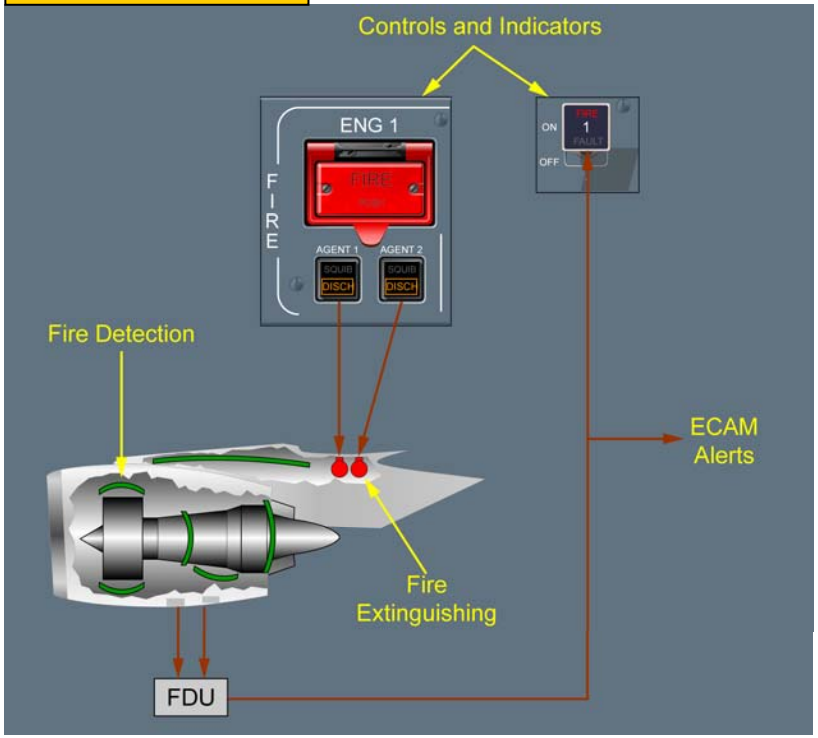
When fire or smoke is detected, the FDU or SDF provide necessary information to the ECAM, in order to trigger an applicable alert.

A380 Fire and Smoke Protection
2.System Description

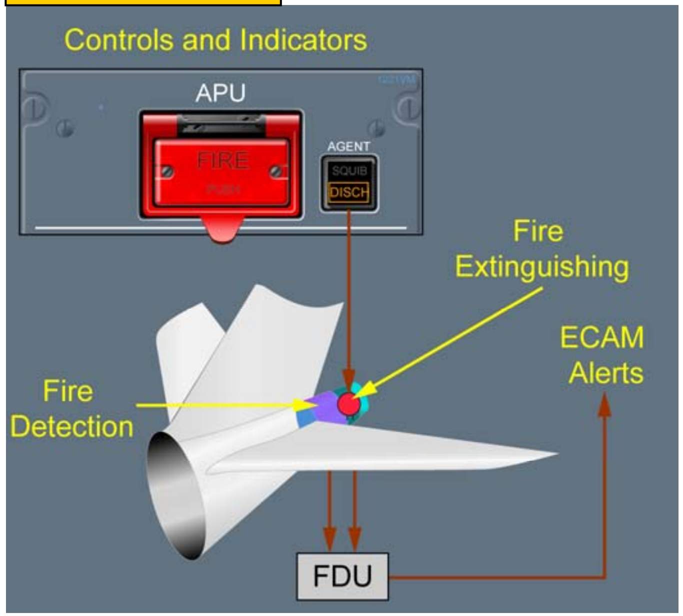
- **Engines:**
  - The Fire Detection Unit monitors all sensitive zones of each engine
  - The flight crew can isolate and extinguish the fire from the ENG FIRE panel in the cockpit. There are two extinguisher bottles per engine.

- **APU:**
  - The Fire Detection Unit monitors the APU
  - The flight crew can isolate and extinguish the fire using the APU FIRE panel in the cockpit. The APU has one extinguisher bottle.

Engine Fire Protection



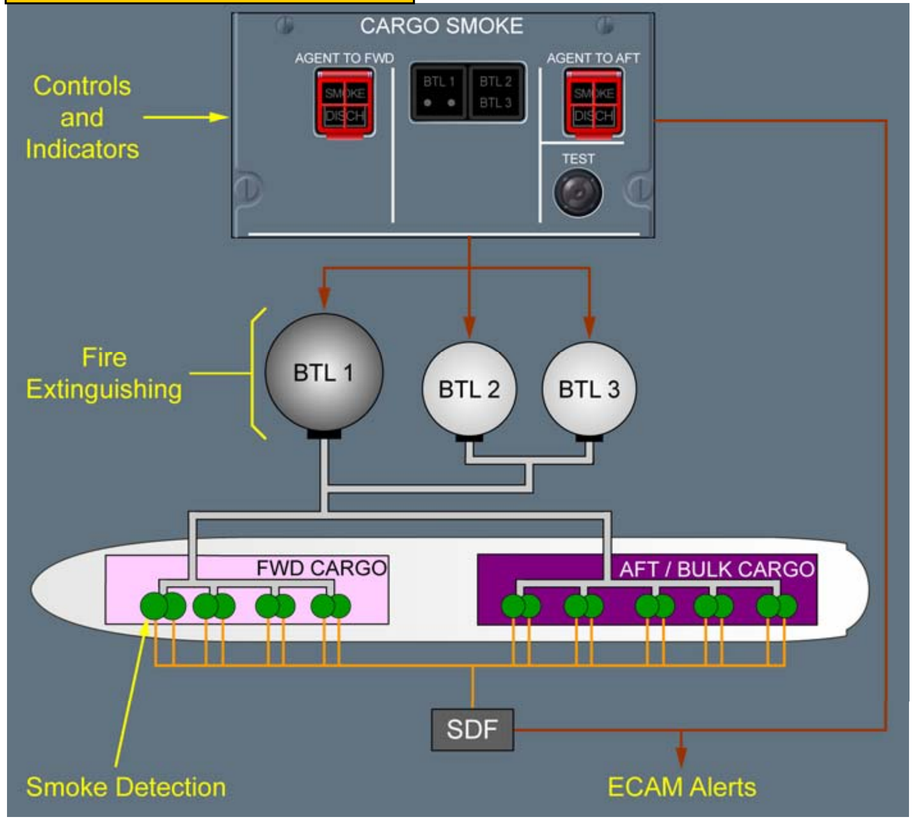
APU Fire Protection



- **Cargo Compartments:**
  - The Smoke Detection Function monitors the forward and aft/bulk cargo compartments
  - The flight crew can extinguish the fire using the CARGO SMOKE panel in the cockpit. The system has three extinguisher bottles that discharge an extinguishing agent in any cargo compartment
  - If the affected cargo compartment is a ventilated compartment, it is automatically isolated.

- **Lavatories:**
  - The Smoke Detection Function monitors each lavatory.
    If smoke is detected, the FAP also triggers an alert to the cabin crew
  - The waste bin in each lavatory has a built-in automatic fire extinguishing system.

Cargo Compartment Protection



- **Main Landing Gear:**
  - The Fire Detection Unit monitors the Main Landing Gear (MLG) bays and detects an overheat.

- **Avionics Bays:**
  - The Smoke Detection Function monitors each avionics bay and the In-Flight Entertaining System (IFE).
    If an IFE fire is detected, the Flight Attendant Panel (FAP) also triggers an alert to the cabin crew.

- **Crew Rest Compartments:**
  - The Smoke Detection Function monitors the flight crew, the upper cabin and the lower cabin rest compartments.

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8. ATA 27 Flight Controls

Flight Deck and Systems Briefing for Pilots

Contents

AIRBUS

Introduction

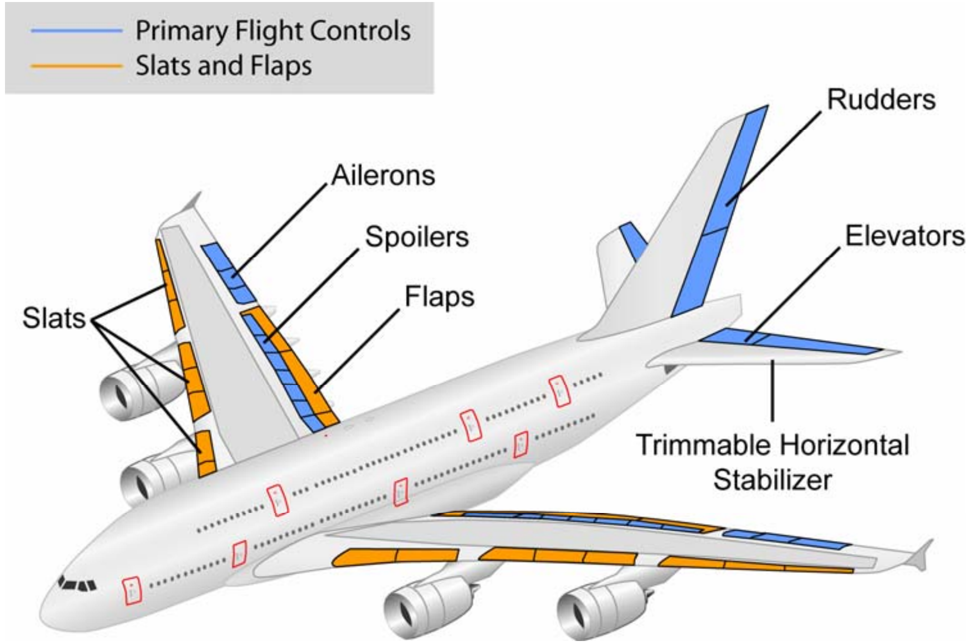
The A380 has fly by wire flight controls.
The flight controls can be divided into two categories:

- The **primary flight controls** which control the aircraft according to the three axes (roll, pitch and yaw) and fulfill the auxiliary functions
- The **slats and flaps** which fulfill the high-lift function. (Refer to Slats and Flaps)

The A380 introduces the following major evolutions:

- Suppression of all mechanical backup controls. These are replaced by electrical backup controls.
- Addition of a new pitch trim switch, that replaces the trim wheels due to the deletion of the mechanical pitch trim control.
- Integration of the Flight Guidance (FG) and Flight Envelope (FE) function in the primary flight computers. (Refer to Auto Flight System)
- Introduction of active stability for longitudinal and lateral axes in order to reduce the size of the horizontal and vertical tail plane.
- Introduction of Electro-Hydrostatic Actuators (EHAs) and Electrical Backup Hydraulic Actuators (EBHAs) in order to delete one hydraulic circuit. (Refer to Servocontrols)

Control Surfaces



Architecture

The primary flight controls system is composed of:

- Three **Primary computers (PRIMs)**. Each PRIM can provide complete aircraft control under normal, direct or alternate law. The PRIMs perform the:
  - Flight control function
  - Flight Guidance (FG) function
  - Flight envelope (FE) function.

- Three **Secondary computers (SECs)**. The SECs can provide complete aircraft control in direct law only.

- Two **Flight Control Data Concentrators (FCDCs)** that:
  - Concentrate data and send it to the Control and Display System (CDS) for display on the PFD, E/WD and SD
  - Send data to the Flight Warning System (FWS)
  - Send data to the Central Maintenance System (CMS).

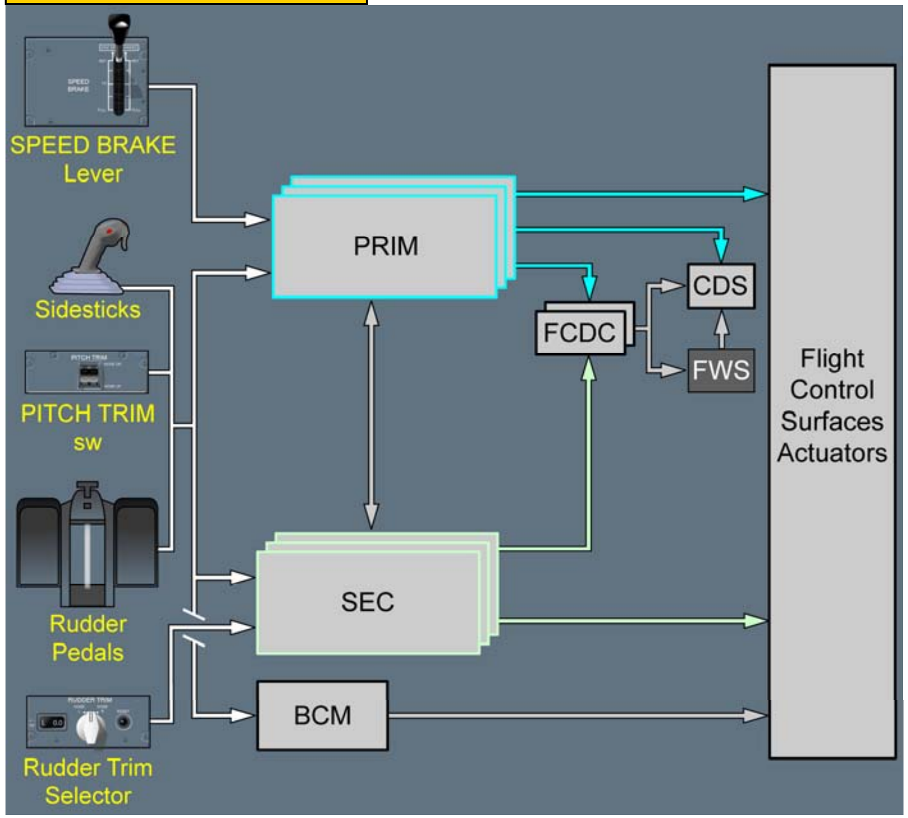
- Flight deck controls

- Flight control surfaces and servocontrols

- An **electrical backup system** that controls the aircraft in case all of the PRIMs and all of the SECs fail.

The PRIMs and the SECs have a different architecture and use different technology and software to increase the system's robustness.

Flight Controls Architecture



Operation

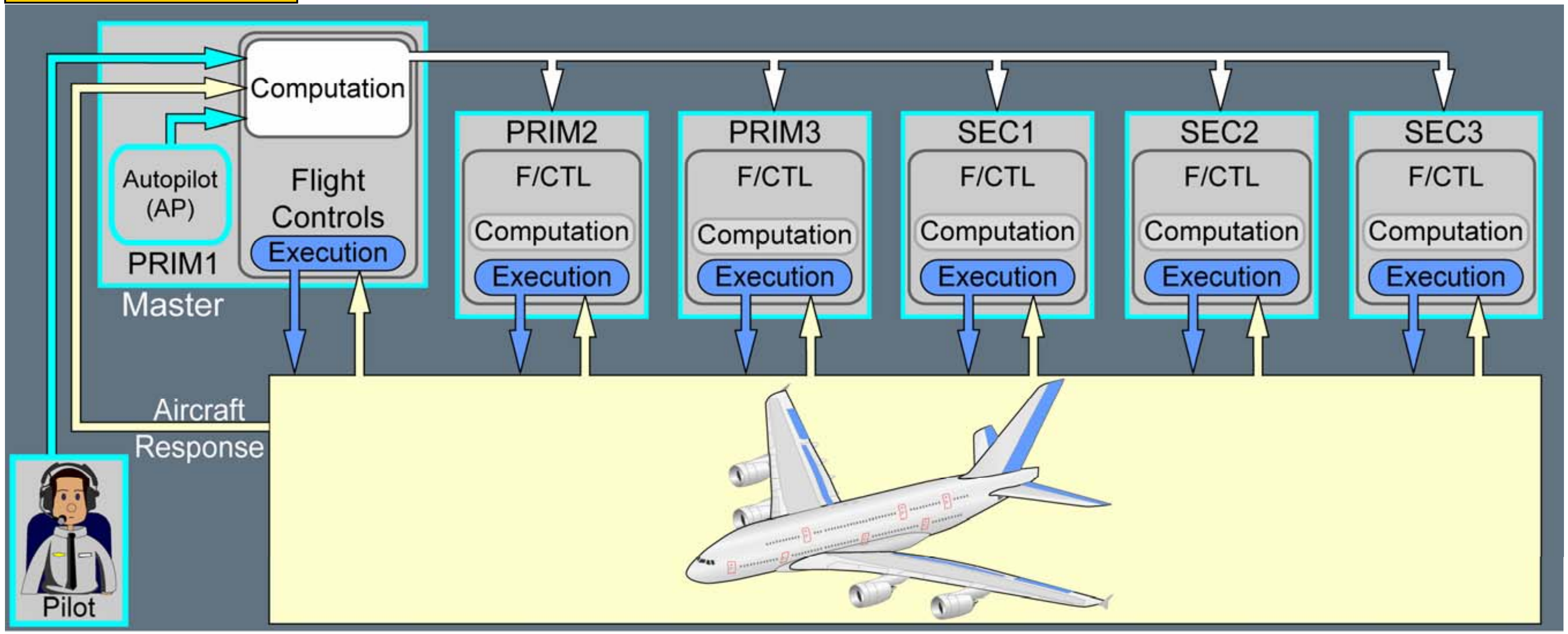
The flight control is computed by the PRIMs and SECs. Each of these computers can perform two functions:

- The computation function:
  - Converts flight crew or FG orders to aircraft objectives, and computes corresponding surface deflections that are sent to the other computers
  - Compares the aircraft response with the objective to check if its orders are fulfilled.
- The execution function, that performs the surfaces servoing and monitors the position of the surfaces to check if they reach the correct deflection.

One of the three PRIMs is the master. The master PRIM performs the computation function, and sends its orders to the other computers.
The three PRIMs and the three SECs perform each the execution function on their assigned control surfaces.
As a part of the computation function, the master PRIM performs self monitoring, by checking if the aircraft response corresponds to the computed aircraft targets.

If a malfunction is detected, the master PRIM passes the computation function to another PRIM. The master PRIM continues to perform the execution function, depending on the malfunction.
If all the PRIMs are lost, each SEC performs the computation and execution functions. There is no master SEC.

Normal Operating Mode



Servocontrols

The A380 has three types of servocontrols:

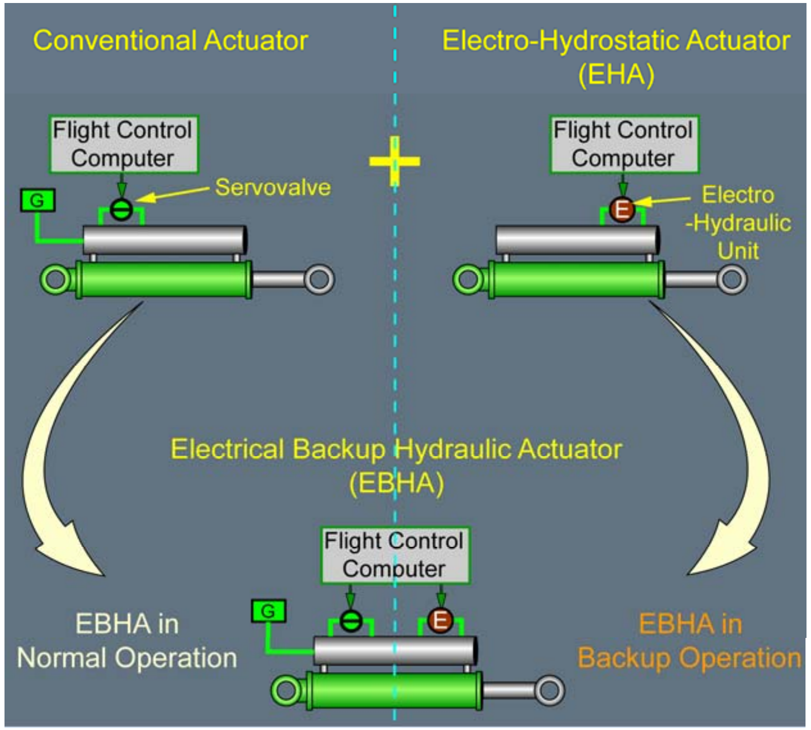
- **Conventional servocontrols** that include:
  - An actuator
  - A hydraulic block connected to one hydraulic power supply of the aircraft
  - A servovalve that receives orders from the flight control computers and controls the translation direction of the actuator rod.

  A conventional servocontrol cannot operate if there is no hydraulic supply.

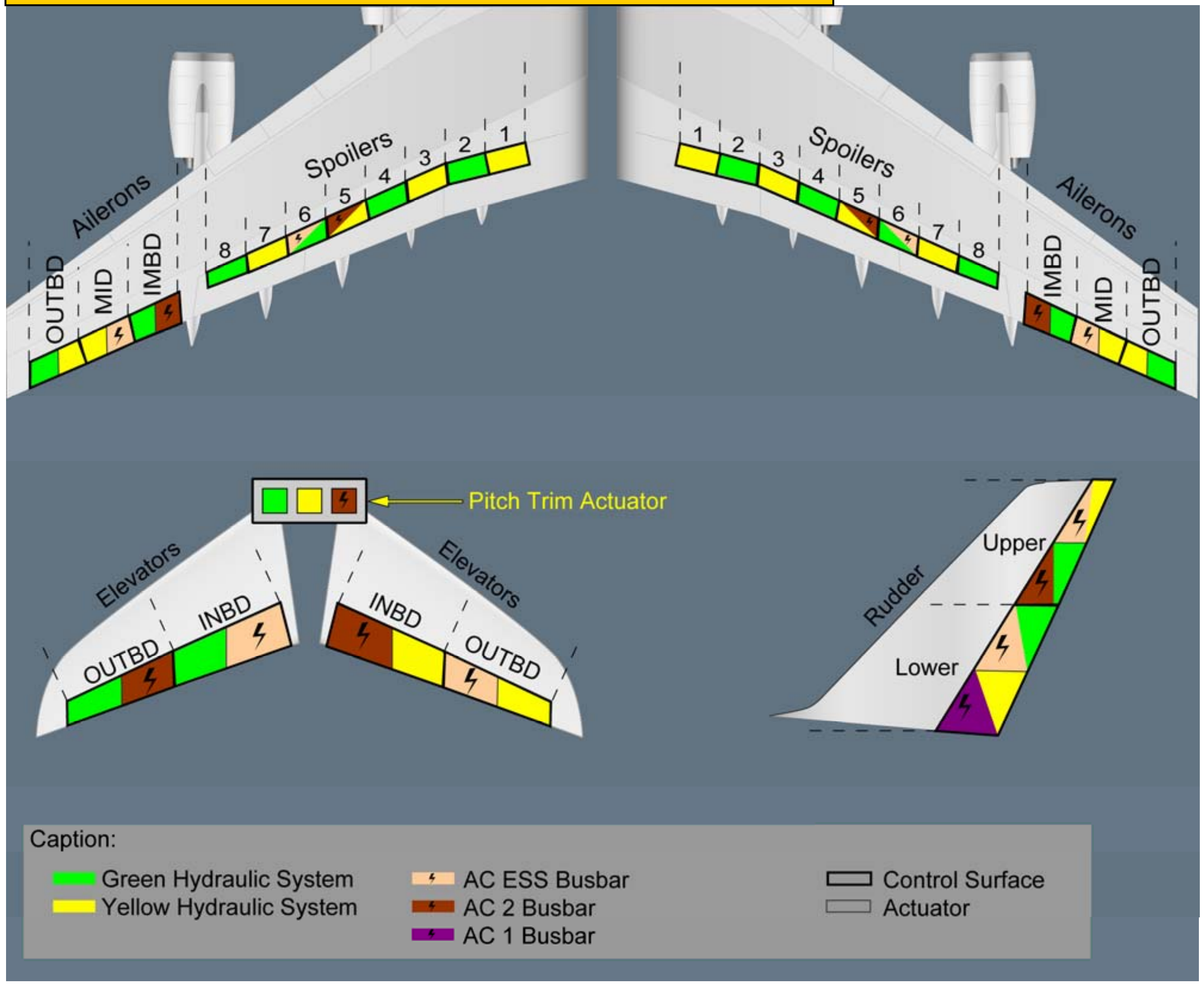
- **Electro-Hydrostatic Actuators (EHAs)** that include:
  - An actuator
  - A hydraulic block
  - An electro-hydraulic generation system that receives orders from the fight control computers. The rotation direction and the speed of the electro-hydraulic generation system determine the translation direction and speed of the actuator rod.

  EHAs are fully isolated from the hydraulic power supplies of the aircraft.
  An EHA can operate when there is no hydraulic supply, but needs an electrical supply.

- **Electrical Backup Hydraulic Actuators (EBHAs)** that are a combination of a conventional servo-control and an EHA.
  In normal mode, they operate as conventional servo-controls.
  If there is a hydraulic failure, they operate as EHAs.



Type, Location and Operation of the Servocontrols and Control Surfaces



Primary Functions

- **Lateral Control (Roll+Yaw)**
  Lateral control is provided by
  - All the ailerons
  - Spoilers 3 to 8
  - Both rudders.

  Lateral orders are sent by:
  - The sidesticks, to the PRIMs and SECs
  - The rudder pedals and pedal feel and trim unit, to the PRIMs and SECs
  - The rudder trim control panel, to the SECs only
  - The autopilot, to the PRIMs only.

- **Pitch Control**
  Pitch control is provided by:
  - The elevators for short-term actions
  - The Trimmable Horizontal Stabilizer (THS) for long-term actions.

  Pitch orders are sent by:
  - The sidesticks, to the PRIMs and the SECs
  - The pitch trim control switches, to the PRIMs and the SECs (only active on ground or in direct law)
  - The autopilot, to the PRIMs only.

Auxiliary Functions

- **Speedbrake Function**
  The objective of the speedbrake function is to increase the aircraft's drag with an acceptable buffet for passenger comfort.
  A speedbrake demand deflects all the spoilers.
  The roll order has priority over the speedbrake order.
  An automatic retraction is provided, when one of the following conditions is fulfilled:
  - Angle-of-Attack (AOA) protection is active
  - Load factor is lower than 0.3 g in normal or alternate law
  - A go-around is initiated.

  Spoilers are lost in symmetrical pairs in the case of a failure.

- **Ground Spoilers Function**
  The objective of the ground spoiler function is to:
  - Stick the aircraft to the ground and reduce the risk of bounce at touchdown
  - Increase the efficiency of the brakes
  - Decelerate the aircraft.

  The ground spoilers function commands the deflection of all the spoilers.

- **Aileron Droop Function**
  The objective of the aileron droop function is to increase the high lift function performed by the slats and flaps.
  All the ailerons droop downwards, when the flaps are extended. They continue to execute the roll function.

- **Load Alleviation Function (LAF)**
  The objective of the LAF is to reduce structure fatigue and static loads on the wing during maneuvers and turbulence.
  Spoilers 6 to 8 and all the ailerons are involved in the LAF.
  The LAF is available in normal law only.

- **Flight Envelope (FE) Function**
  The FE function performs the following functions:
  - Characteristic speeds computation
  - Computation of Flight Envelope (FE)
  - Detection of abnormal flight conditions:
    - Windshear
    - Low energy.

General

- A **flight control law** determines the relationship between a flight crew order and the aircraft response.

  The main objectives of the normal control law are:
  - To provide instinctive and comfortable handling characteristics
  - To provide comfort to the passengers and crew.

- **Protections** prevent the aircraft from leaving the normal flight envelope.
  Full pilot authority prevails within the normal flight envelope.
  The pilot authority is progressively reduced when exiting the normal flight envelope and entering the peripheral flight envelope.

Progressive control law reconfigurations occur depending on the number and type of failures (computers, sensors and actuator availability). These reconfigurations ensure the best possible performance of the flight control system.

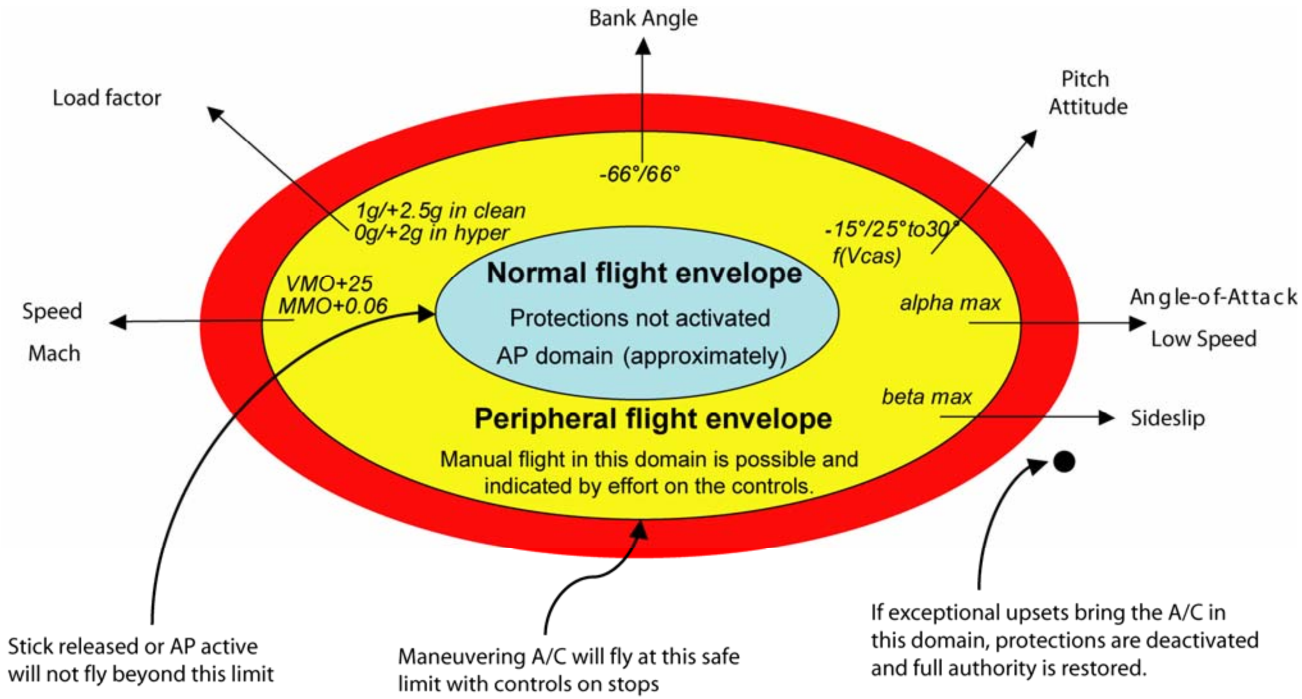
There are different levels of control laws that are a combination of control laws and protections:

- The **normal Law**: For normal operations (even after a single failure of sensors, electrical system, hydraulic system or PRIM)
- The **alternate law**
- The **direct law**

Note: A single failure cannot cause to the loss of the normal flight control law.

The control laws and protections that apply to these laws are summarized in the following graph and table.

Normal/Peripheral Flight Envelope and Protections in Normal Law



	Normal Law	Alternate Law	Direct Law
Longitudinal Control Law	Pitch normal law	Pitch normal law (less efficient)	Pitch direct law
Lateral Control Law	Lateral normal law	Depending on failures: Lateral normal law (less efficient) or Roll direct / Yaw alternate law	• Roll direct law • Yaw alternate law
Protections	All active	Most protections lost	No
Autopilot	All modes available	Available depending on failures	No

Normal Law

Pitch Control

In order to provide optimum handling characteristics in all flight phases, the normal pitch control law changes, according to the flight phases, and provides the following control laws:

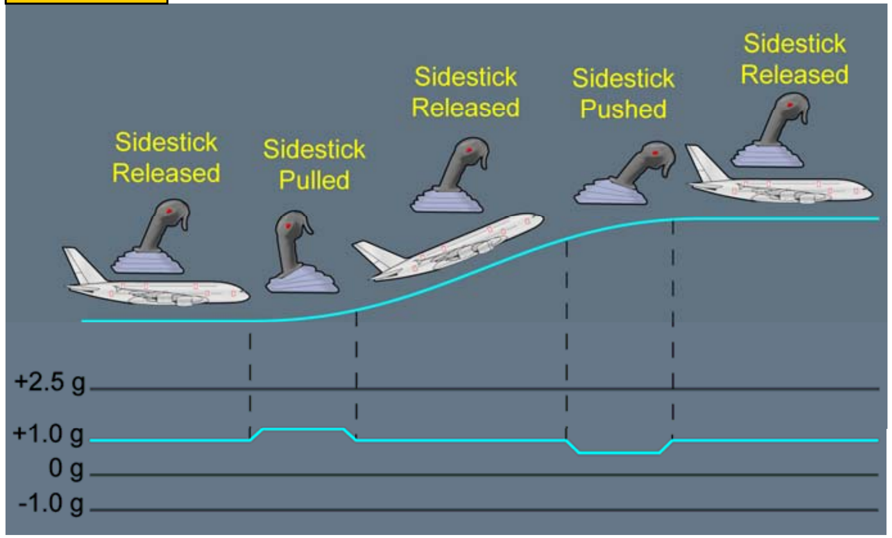
- **Rotation Law**
  Objective:
  To provide a homogeneous rotation for all possible weights, CGs and configurations, while minimizing the risk of a tail strike.

  Features:
  - Rotation in direct law
  - Damping in case of important pitch rate to prevent tail strike.

- **Pitch Normal Law**
  Objective:
  To control the flight path of the aircraft through a load factor demand and to secure the flight envelope.

  Features:
  - A sidestick deflection results in a change in vertical load factor and leads to a flight path variation.
    When the pilot releases the sidestick, the flight path is maintained.
  - Load factor limitation to
    - -1 g / +2.5 g in clean configuration
    - 0 g / +2 g when slats or flaps extended
  - Autotrim
  - Pitch compensation for spoiler deflection, slats and flaps extension or retraction, and thrust variations.

Flight Law



- **Flare Law**

  Objective:

  To provide an aircraft behavior similar to that of a conventional aircraft during flare and enable a precise control of vertical speed and touchdown point.

  Features:

  - Flare in direct law (no autotrim)

- **Derotation Law**

  Objective:

  To provide a comfortable nosewheel touchdown without interfering with the prompt activation of all the decelerating devices.

  Features:

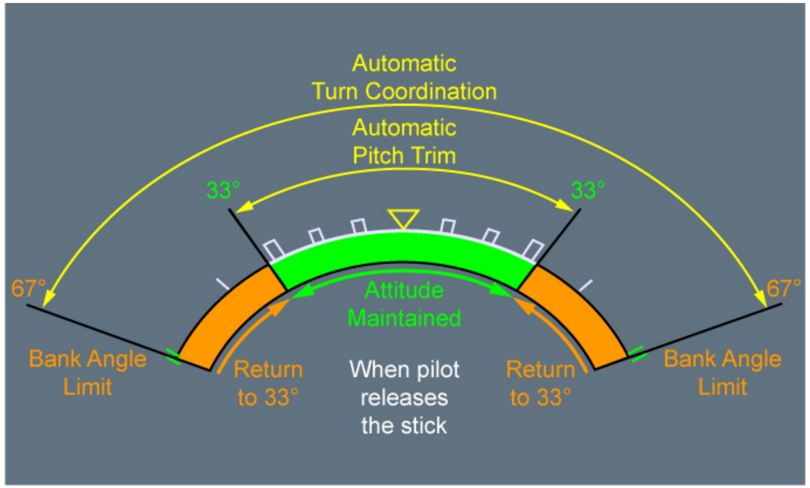
  - Stick free derotation.

Lateral Control

- **Lateral Normal Law**
  Objective:
  To control the roll and yaw axes of the aircraft through roll rate and sideslip demands.

  Features:
  - A sidestick deflection results in a roll rate demand with turn coordination.
    Neutral spiral stability up to 33° bank:
    - Automatic pitch trim
    - The bank angle is maintained when the sidestick is at neutral

    Positive spiral stability restored above 33° bank:
    - No automatic pitch trim
    - The bank angle returns to 33° if the sidestick is at neutral
  - Bank angle limitation to:
    - 67° in clean configuration
    - 60° in high lift configuration
    - 45° when the high speed or Angle-of-Attack (AOA) protection is active
  - A pedal deflection results in a proportional sideslip and bank angle
    In the case of an engine failure, the law provides a sideslip and bank angle to indicate the engine failure, as on a conventional aircraft
  - Yaw rate feedback for stabilization.



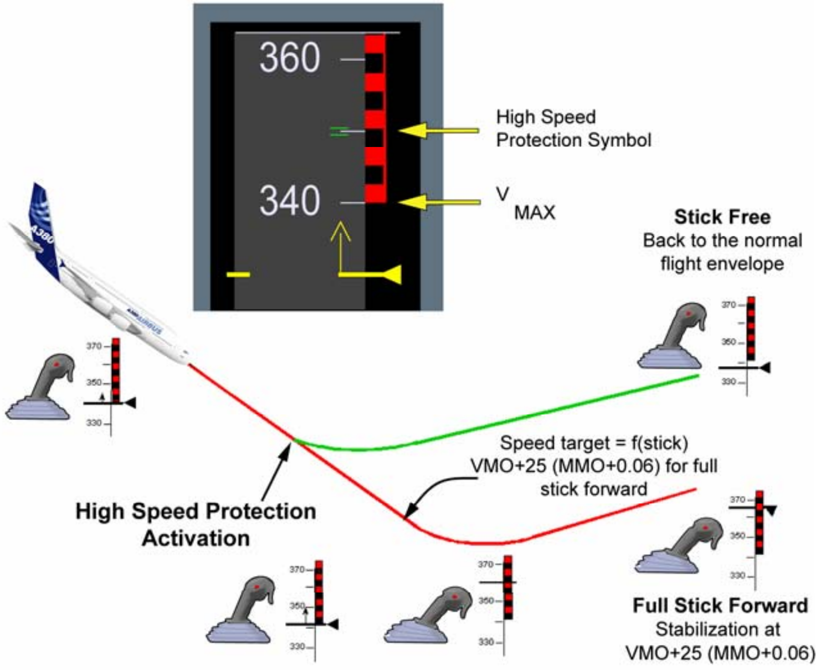
- **Lateral Ground Control Law**
  Objective:
  To facilitate aircraft handling on ground.

  Features:
  - Bank angle that is proportional to the sidestick deflection. If the sidestick is set to neutral, the wings remain level.
  - A pedal deflection results in a proportional yaw rate, instead of a proportional rudder and steering control order. A nosewheel offset or crosswind has no effect on the lateral control of the aircraft.

Protections

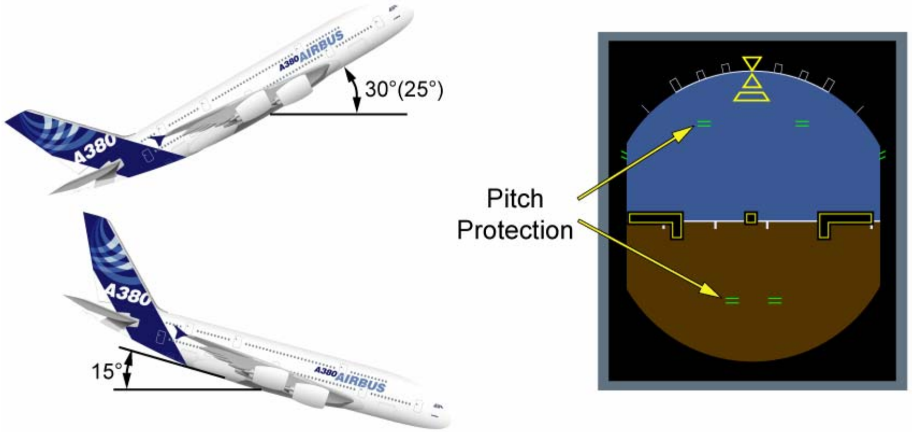
- **High Speed Protection**
  Objective:
  - To limit the possible speed/Mach excursions beyond VMO/MMO whatever stick input
  - To cause no interference with flight at VMO/MMO.

  Features:
  - Pilot nose down authority is reduced and progressive elevator up is applied to stabilize the aircraft at VMO+25kt (MMO+0.06) if full forward stick is maintained.



- **Pitch Attitude Protection**
  Objective:
  To enhance the effectiveness of the Angle-of-Attack (AOA) and high speed protections in extreme conditions.

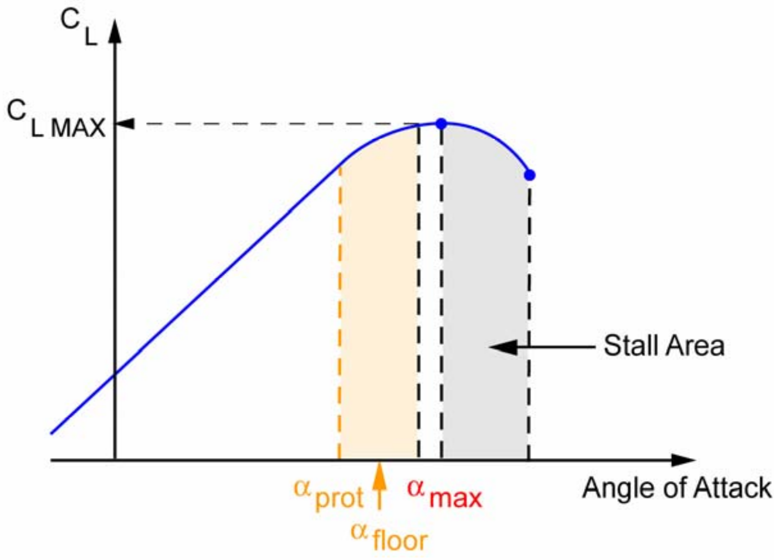
  Features:
  - Pitch limitation to:
    - -15° / +30° at high aircraft speed
    - -15° / +25° at low aircraft speed.

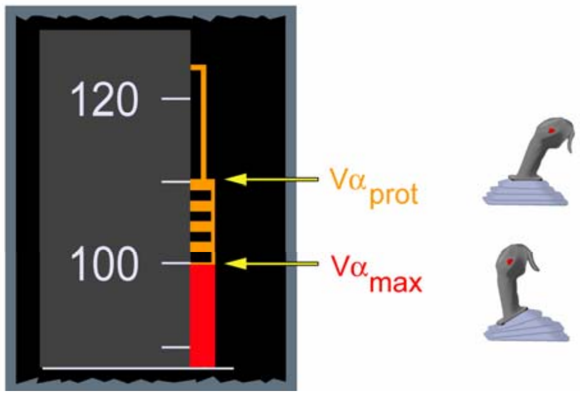


- **Angle-of-Attack (AOA) Protection**
  Objective:
  - To protect the aircraft against stall in dynamic maneuvers or gusts
  - To ensure safe flight and good handling characteristics at high angle of attack
  - To cause no interference with normal operating speeds and maneuvers.

  Features:
  - The angle of attack is limited to
    - α_{prot} with neutral stick
    - α_{max} with full back stick.

    When reaching α_{floor} ($\alpha_{prot} < \alpha_{floor} < \alpha_{max}$), TO GA thrust is automatically applied.
  - Speedbrakes retraction
  - Deactivation, as soon as the sidestick deflection commands a smaller angle of attack than α_{prot}.





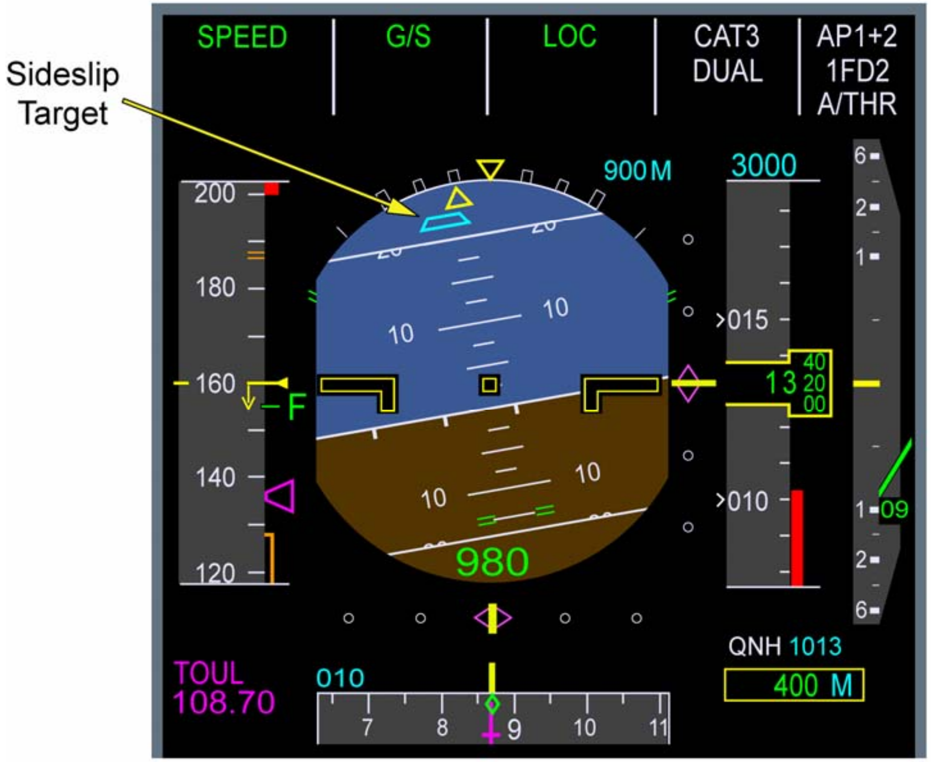
Engine Failure or Aircraft Asymmetry

The fight control laws provide unique handling characteristics in the case of an engine failure.
With no corrective action:

- Stabilized sideslip and bank angle
- Slowly diverging heading
- Safe flight.

The control law computes, at takeoff, the sideslip target that provides optimum trim (optimized roll surfaces deflection so as to minimize spoilers deflection).

The difference between the current sideslip, and the sideslip target, is indicated by a blue symbol on the PFD (only at takeoff).



The short-term recommended actions are to achieve:

- Zero sideslip or sideslip target with pedals
- Then stabilize heading with stick input
- Steady flight with stick free and no pedal force (rudder trim).

Alternate Law

Longitudinal Control Laws

The pitch normal law is still available but less efficient depending on the number and type of failures, the speed and the configuration.

Lateral Control Laws

Depending on the number and type of failures, the following control laws are available:

- **Lateral normal law** but less efficient depending on the type of failures, speed and configuration (Refer to normal law)
- **Roll direct law** & **yaw alternate law**.

- **Roll Direct Law**
  Objective:
  To control the roll axis of the aircraft through a direct link between stick and roll surfaces.

  Features:
  - Linear roll response with respect to roll order
  - Sufficient but not excessive roll order deflections (or authority) to provide adequate efficiency.

- **Yaw Alternate Law**
  Objective:
  To control the yaw axis through a rudder command function of pedals deflection.

  Features:
  - Turn coordination
  - Yaw rate feedback for stabilization.

Protections

Protections are indicated as lost. However, depending on the failure, some protections may still be available.

Direct Law

Longitudinal Control Laws

- **Pitch Direct Law**
  Objective:
  To control the pitch axis through an elevator command proportional to the stick deflection.

  Features:
  - No autotrim
  - Pitch rate feedback for stabilization
  - Aircraft behavior adequate to perform landing and sufficient authority to compensate airbrake extension/retraction, thrust variation or slats/flaps movements.

Lateral Control Laws

Roll direct law & Yaw Alternate law (**Refer to alternate law**).

Protections

All protections are lost.

A conventional aural stall warning ($\alpha > \alpha_{sw}$) and an overspeed warning replace the protections in normal law.

An electrical backup system controls the aircraft in case of failure of all the PRIMs and all the SECs or their electrical power supplies.

The electrical backup system is totally segregated from the normal flight control system and relies on the availability of the green or yellow hydraulic power source and the use of dedicated sensors and transducers in the pilot controls.

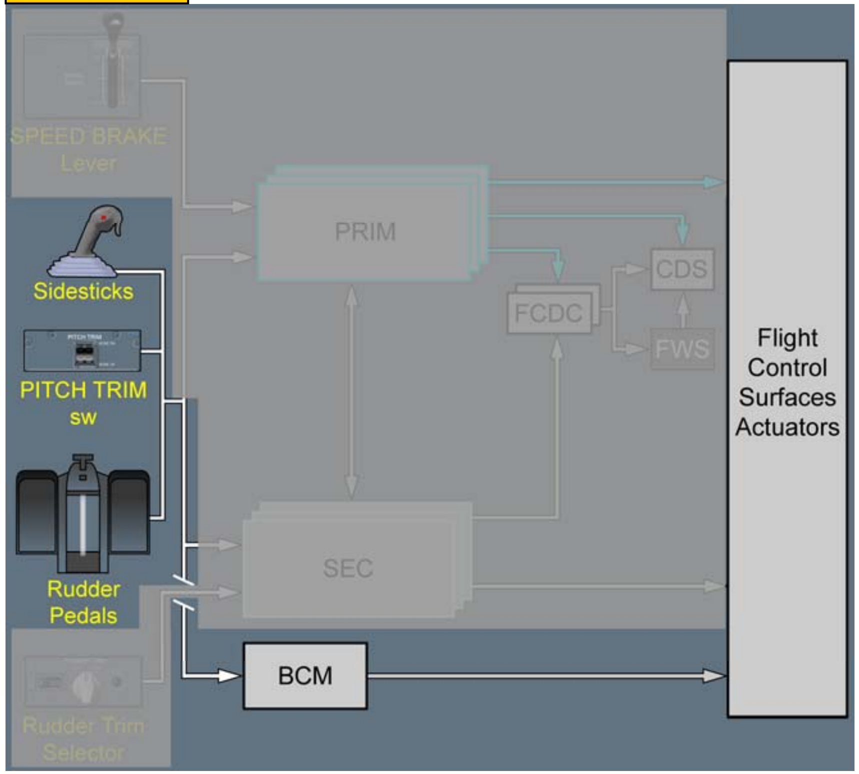
The backup control module controls and monitors only:

- The THS
- The inboard ailerons
- The inboard elevators
- The upper and lower rudder.

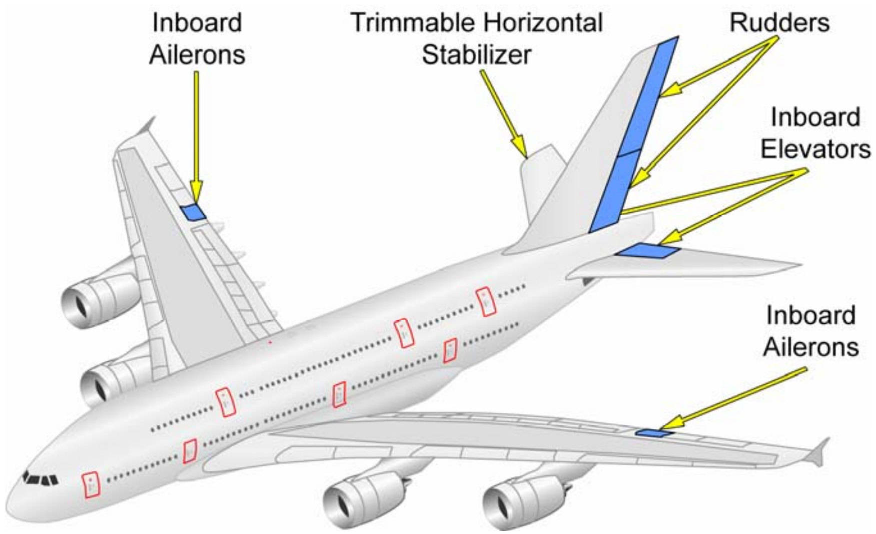
Specific control control laws apply whenever the electrical backup system is active, with the following features:

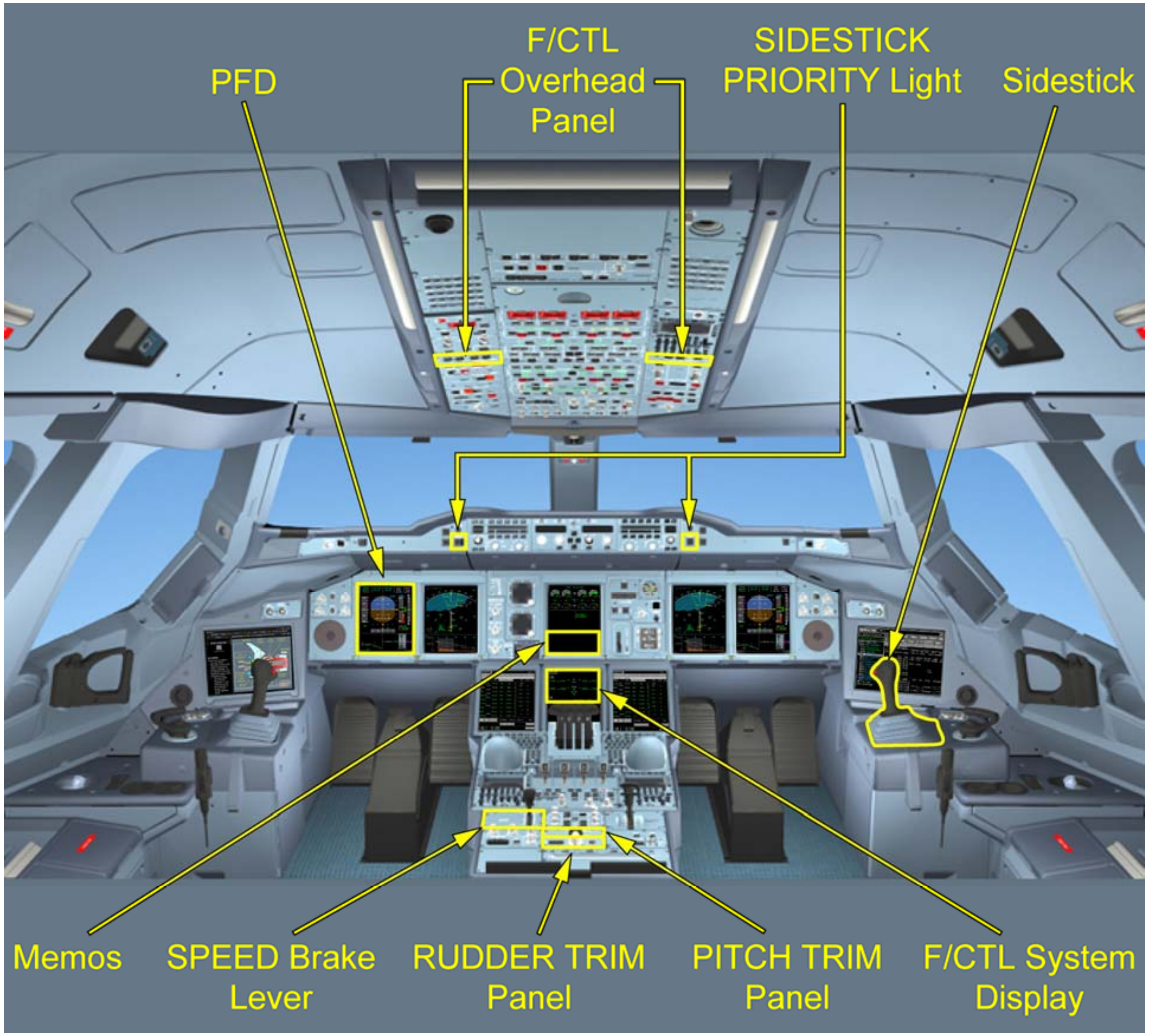
- Pitch motion damping
- Yaw damping
- Direct roll

Architecture



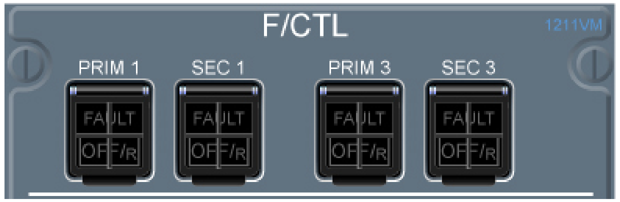
Control Surfaces

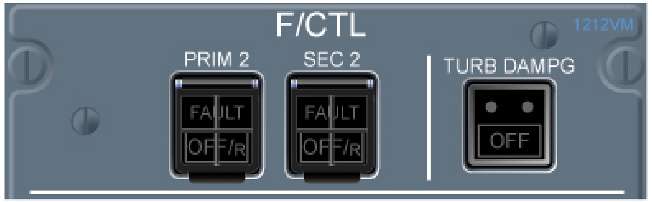



PFD
F/CTL Overhead Panel
SIDESTICK PRIORITY Light
Sidestick
Memos
SPEED Brake Lever
RUDDER TRIM Panel
PITCH TRIM Panel
F/CTL System Display

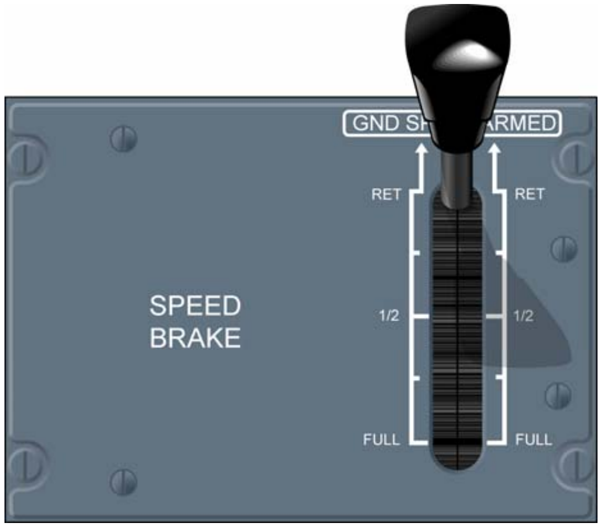
Controls

F/CTL Overhead Panel





SPEED Brake Lever

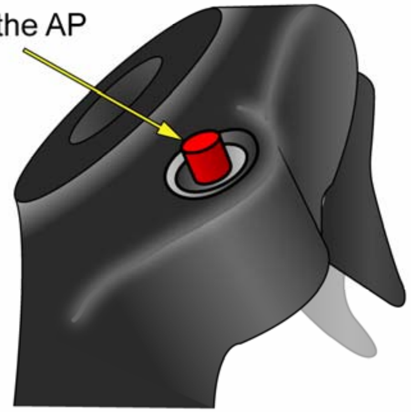


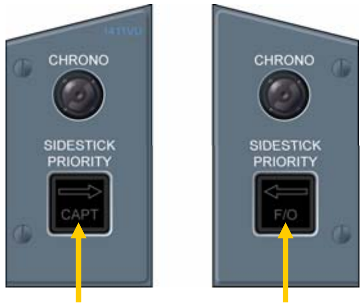
PITCH TRIM & RUDDER TRIM Panel

Sidestick and Priority Logic

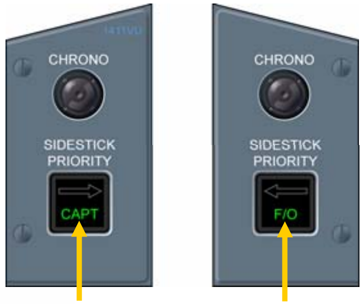
- The sidestick pushbutton is used as priority takeover pushbutton:
    - The pilot can deactivate the other sidestick and take full control by pressing and keeping pressed his sidestick pushbutton.
    - If the sidestick pushbutton is pressed for more than 30 seconds, the priority is latched and the other sidestick is maintained deactivated.
    - At any time, a deactivated sidestick can be reactivated by momentarily pressing the sidestick pushbutton.

Sidestick pb:
To takeover from
opposite sidestick
or disengage the AP



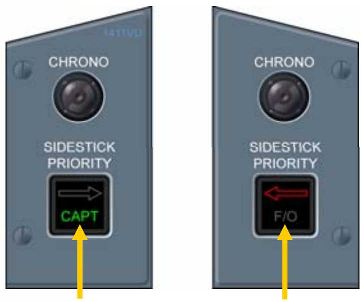


Normal Operation: Only one sidestick is deflected



+ « DUAL INPUT » Aural Message

The Captain and First Officer inputs are algebraically summed. The maximum resulting input is limited to a full deflection input of a single sidestick.

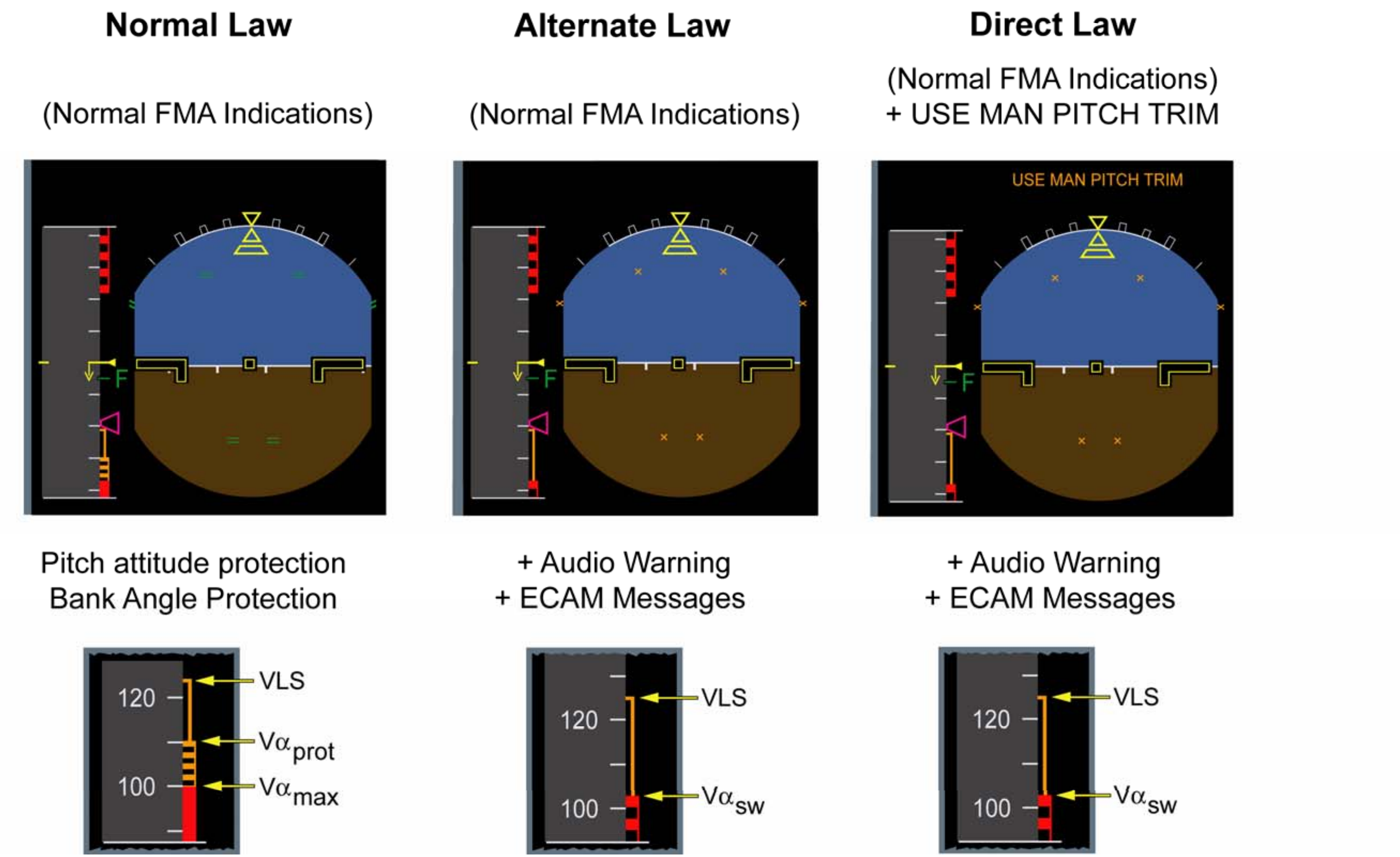


+ « PRIORITY LEFT » Aural Message

The Captain presses his sidestick pushbutton, while the First Officer moves his sidestick. The Captain gains the priority.

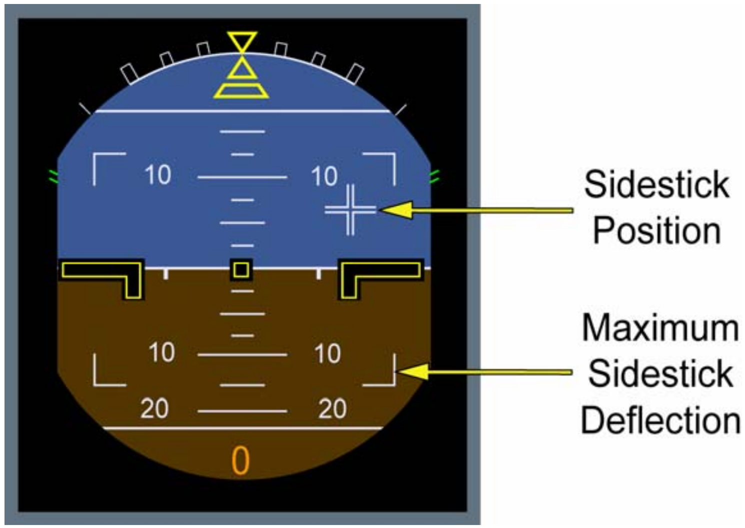
Indicators

PFD: Control Law Status Information

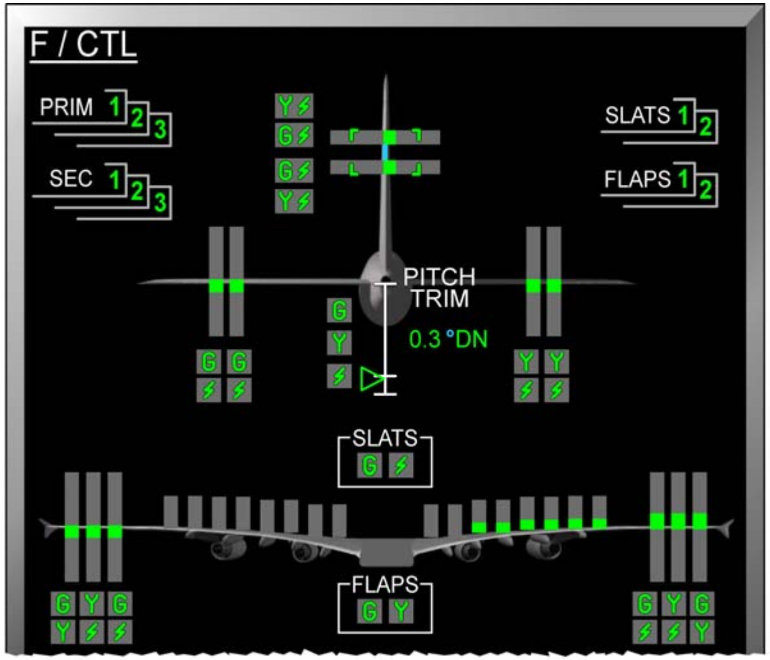


AIRBUS

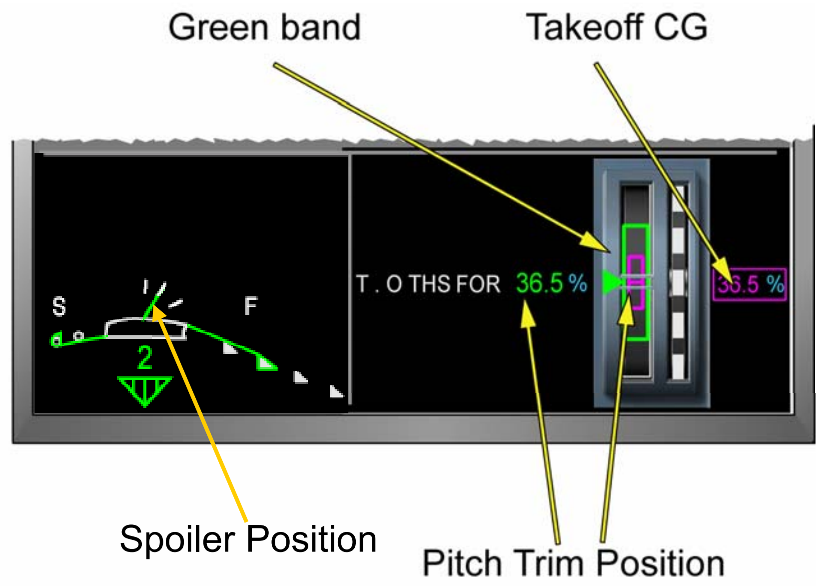
PFD


10
10
10
10
20
20
0
Sidestick Position
Maximum Sidestick Deflection

ECAM SD F/CTL Page



PFD Slats/Flaps and Pitch Trim Display



The pitch trim display is available on ground only.

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9. ATA 27 Slats and Flaps

Flight Deck and Systems Briefing for Pilots

1. **System Description**
2. **Automatic Functions**
3. **Controls and Indicators**

Contents

A380 Slats and Flaps
1.System Description

High lift control is achieved on each wing by:

- 8 slats
- 3 flaps
- 3 ailerons, via the aileron droop function.

The flight crew uses the FLAPS lever to manually select the position of the slats and flaps.

Each slats (flaps) control unit monitors the slats (flaps) and controls the motor of its associated slats (flaps) system.

For redundancy purposes, each slats (flaps) control unit can also control the other slats (flaps) motor, in case the other slats (flaps) control unit fails. This enables the slats (flaps) to operate normally.

The slats are actuated by:

- The electrical motor of SLAT SYS 1, supplied by the AC ESS busbar
- The hydraulic motor of SLAT SYS 2, supplied by the GREEN hydraulic circuit
- A torque shaft transmission and a gearbox that adds the speed of the motors.

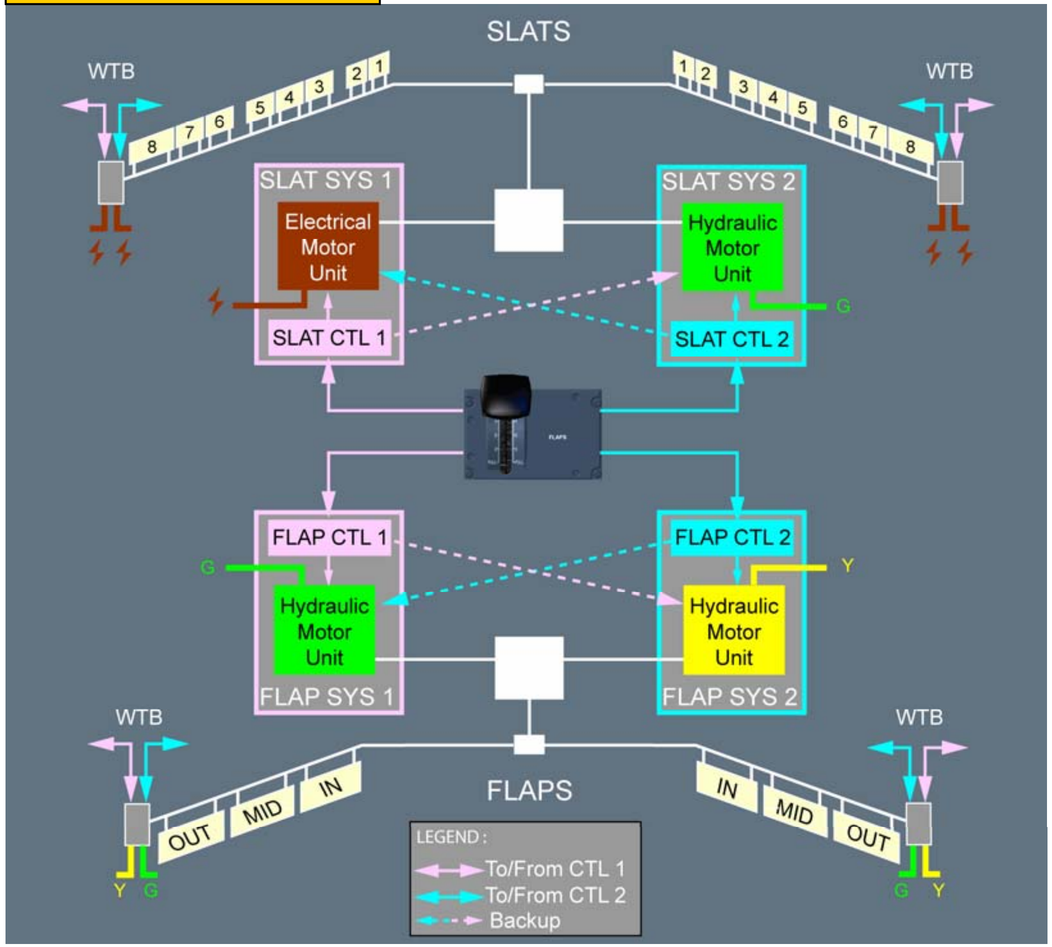
The flaps are actuated by:

- The hydraulic motor of FLAP SYS 1, supplied by the GREEN hydraulic circuit
- The hydraulic motor of FLAP SYS 2, supplied by the YELLOW hydraulic circuit
- A torque shaft transmission and a gearbox that adds the speed of the motors.

Wing Tip Brakes (WTBs) will mechanically lock the slats (flaps) in case of runaway, overspeed or asymmetry.

A380 Slats and Flaps
1.System Description

High Lift System Achitecture



Slats/Flaps Configurations

FLAPS Lever Position	Configuration on ECAM	Maximum Speed	Flight Phase
0		VMO/MMO	Cruise
1	S F 1	263 kt	Holding
	S F 1+F	222 kt	Takeoff/ Approach
2	S F 2	220 kt	Takeoff/ Approach
3	S F 3	196 kt	Takeoff/ Approach/ Landing
FULL	S F FULL	182 kt	Landing

A380 Slats and Flaps
2.Automatic Functions

- **Auto Retraction System (ARS)**
  In CONF 1+F, the Auto Retraction System (ARS) automatically retracts the flaps at 212kt. The resulting configuration is CONF 1.
  This prevents excessive loads on the flaps, and improves climb performance.

- **Auto Extension System (AES)**
  In CONF 1, the AES automatically extends the flaps at 205kt. The resulting configuration is CONF 1+F.

- **Flap Load Relief System (FLRS)**
  The FLRS retracts the flaps to the next retracted flaps position in the case of a VFE exceedance.
  This limits the loads on the flaps.
  The FLRS is only available in CONF 2, 3, or FULL.

- **Slat Alpha/Speed Lock Function**
  The slat alpha/speed lock function inhibits slats retraction to zero if there is an excessive Angle-of- Attack (AOA) and low speed.
  This prevents the aircraft from stalling and/or losing altitude, when the slats are retracted to zero.

- **Slats/Flaps Cruise Balk Function**
  If the lever is inadvertently moved from 0 to 1 during cruise, the slats/flaps cruise balk function will maintain the slats and flaps in their fully retracted position.
  This prevents excessive loads on the flaps.

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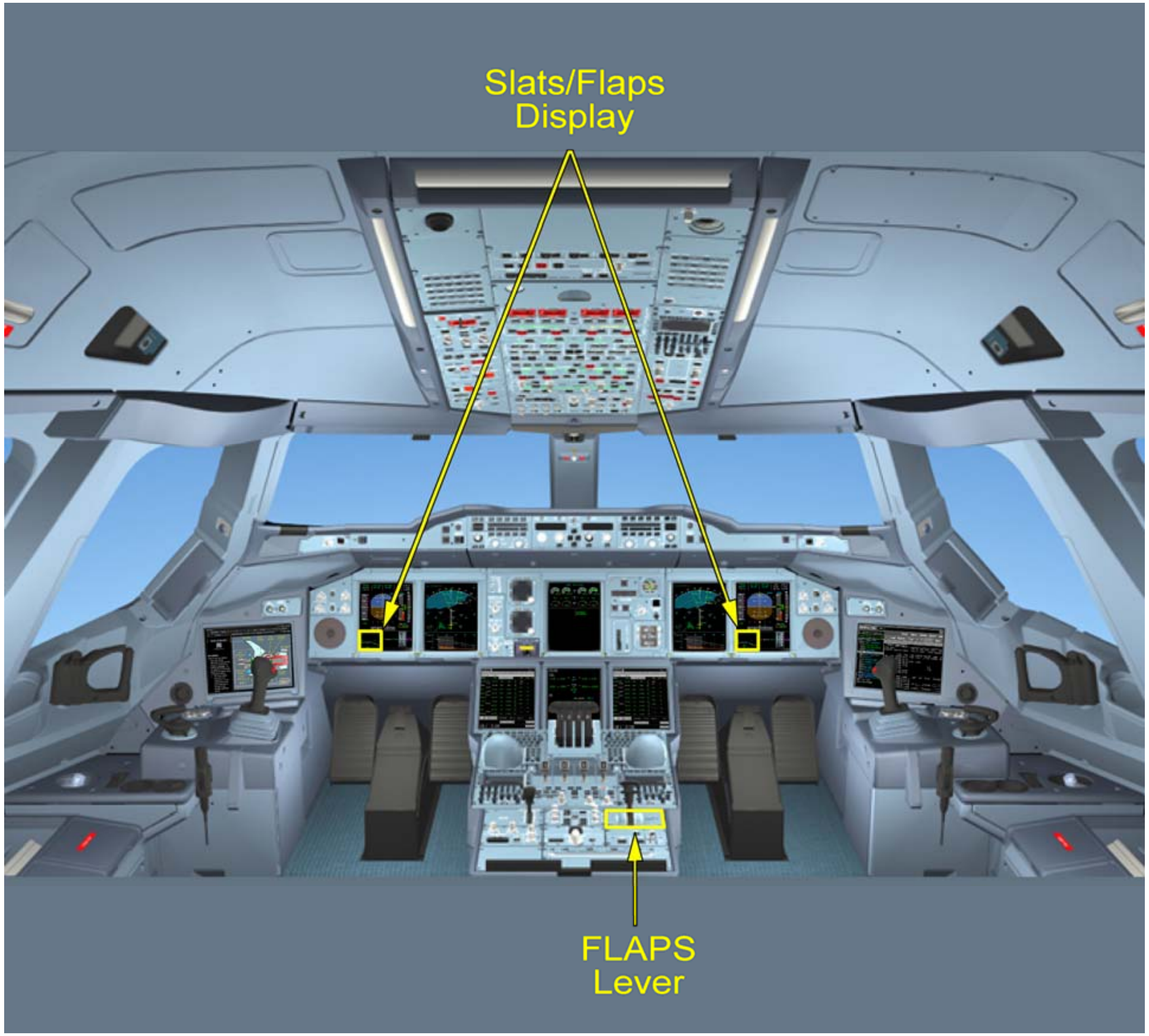
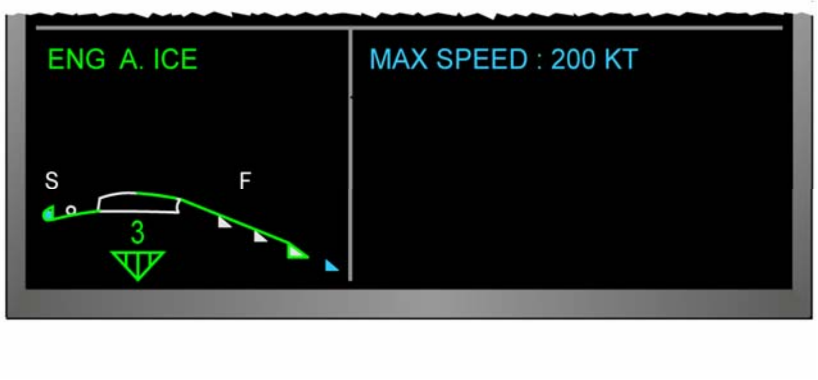
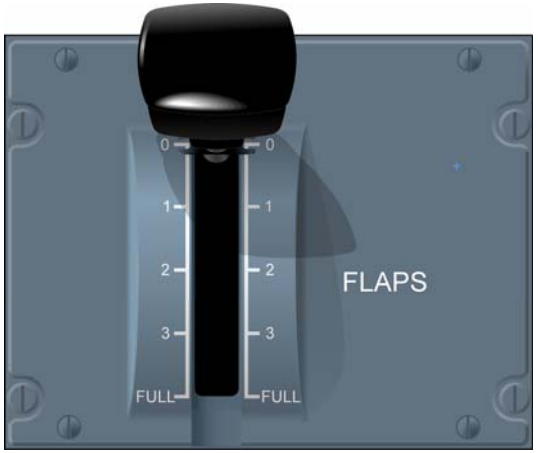
A380 Slats and Flaps
3.Controls and Indicators



PFD Slats/Flaps Display



Flaps/Slats Lever



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10. ATA 28 Fuel System

Flight Deck and Systems Briefing for Pilots

1. **System Description**
   - General
   - Architecture
   - Engine Feed
   - APU Feed
   - Transfer System
2. **Normal Operations**
   - Main Transfers
   - Load Alleviation (LA) Transfers
   - Center of Gravity (CG) Control Transfers
3. **Abnormal Operations**
   - Fuel Jettison
4. **Ground Operations**
   - Automatic Refueling and CG Targeting
   - Automatic Ground Transfer
   - Manual Refuel
   - Defuel
5. **Controls and Indicators**

Contents

AIRBUS

General

The fuel system stores fuel, monitors the quantity of fuel in each tank and controls fuel transfers, in order to:

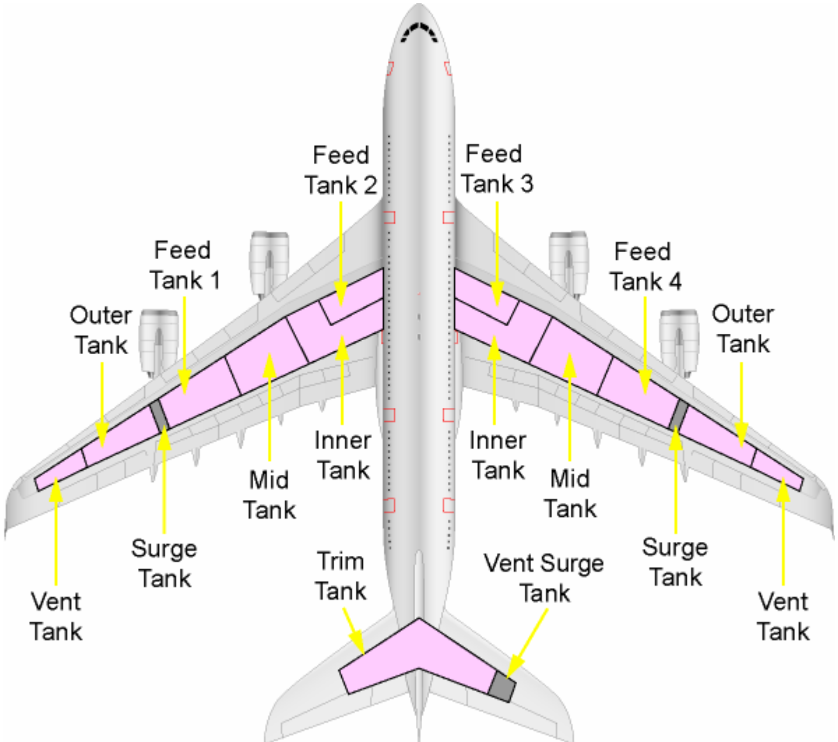
- Supply fuel to the engines and to the Auxiliary Power Unit (APU)
- Maintain the Center of Gravity (CG) within limits
- Alleviate structural loads
- Control refueling and defueling
- Enable fuel jettison, if necessary.

Architecture

- **Fuel Tank Quantity**

USABLE FUEL (Fuel Specific Density: 0.785 kg / l)								
		Outer Tanks (each)	Feed Tanks 1 / 4 (each)	Mid Tanks (each)	Inner Tanks (each)	Feed Tanks 2 / 3 (each)	Trim Tank	Total
VOLUME	(liters) (US gallons)	10 520 2 780	27 960 7 390	36 460 9 630	46 140 12 190	29 340 7 750	23 700 6 260	324 540 85 740
WEIGHT	(kg) (lbs)	8 260 18 200	21 950 48 390	28 620 63 100	36 220 79 850	23 030 50 780	18 600 41 020	254 760 561 660

- **Tank Arrangement**
  Each feed tank:
  - Provides fuel directly to the engines and the APU
  - Receives fuel from all of the transfer tanks (inner, mid, outer, and trim tanks)
  - Contains a collector cell that has a fuel capacity of approximately 1 000 kg to keep the fuel pumps immersed.



Engine Feed

- **Engine Feed Pumps**

  Each collector cell contains two engine feed pumps, one main pump and one standby pump. In normal operation, each main fuel pump runs continuously and feeds its assigned engine.

  If a main pump fails or is off, the corresponding standby pump automatically takes over.

  One main or standby pump can supply fuel to the four engines.

  If all fuel pumps fail, fuel can be fed to the engines by gravity.

- **Crossfeed Valves**

  Each engine has an assigned crossfeed valve. This valve enables the engine to be fed via any engine-feed pump, if necessary.

- **Engine Low-Pressure Valves**

  Each engine has a Low Pressure (LP) valve that can stop the flow of fuel to the engine.

APU Feed

The APU can be fed via its assigned feed pipe by:

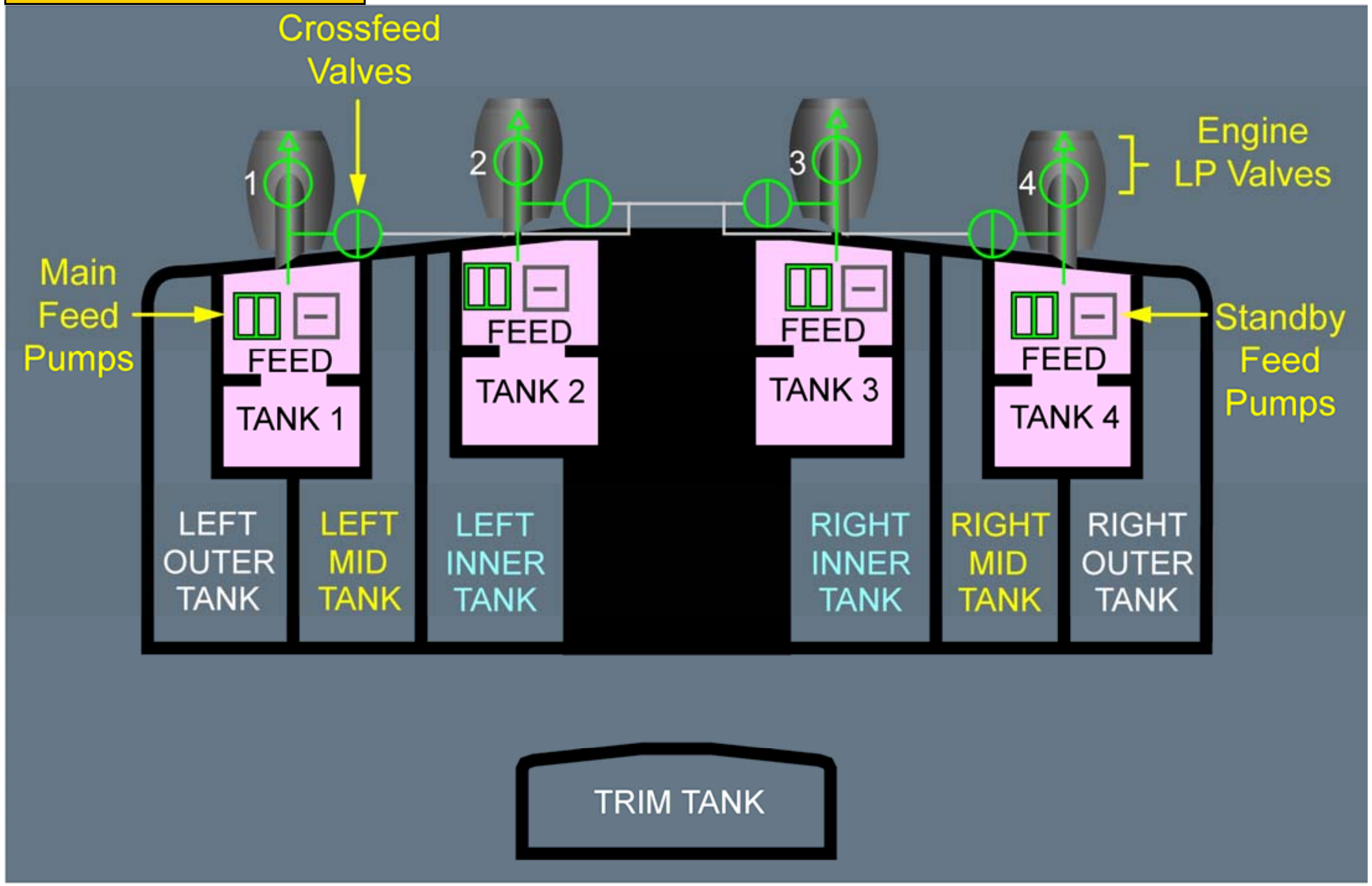
- The main or standby pump of ENG 4, or
- The APU feed pump, that operates automatically, if fuel pressure is too low for the APU to operate correctly.

Note :

The APU can also be fed by the main or standby pump of any other engine, provided that the applicable crossfeed valves are open.

A380 Fuel System
1.System Description

Engine Feed and APU Feed



Transfer System

Fuel tank transfers enable the transfer of necessary fuel quantities from tank to tank.

The purpose of fuel transfers is:

- To provide fuel to the engines (Main Transfers)
- To reduce the loads on the aircraft structure (Load Alleviation Transfers)
- To control the center of gravity (CG) of the aircraft (CG control transfers).

Two galleries (FWD and AFT) pass through all wing tanks (inner, mid, outer, and feed tanks) to enable fuel transfers.

Each wing transfer tank has one or two transfer pumps, each connected to one of the two galleries.

One trim pipe connects the trim tank to the AFT and FWD galleries. The trim tank is equipped with two trim transfer pumps, each connected to the trim pipe.

In normal operation:

- The FWD gallery is for fuel transfers between the wing tanks
- The AFT gallery is for fuel transfers between the trim tank and the wing tanks via the trim pipe.

The FWD and AFT galleries can be connected to each other via two auxiliary refuel valves (one on each side) during refueling, defueling and jettison.

In the case of a failure of any gallery, the other gallery takes over for alternate fuel transfers using a network of transfer pumps, inlet valves and crossfeed valves.

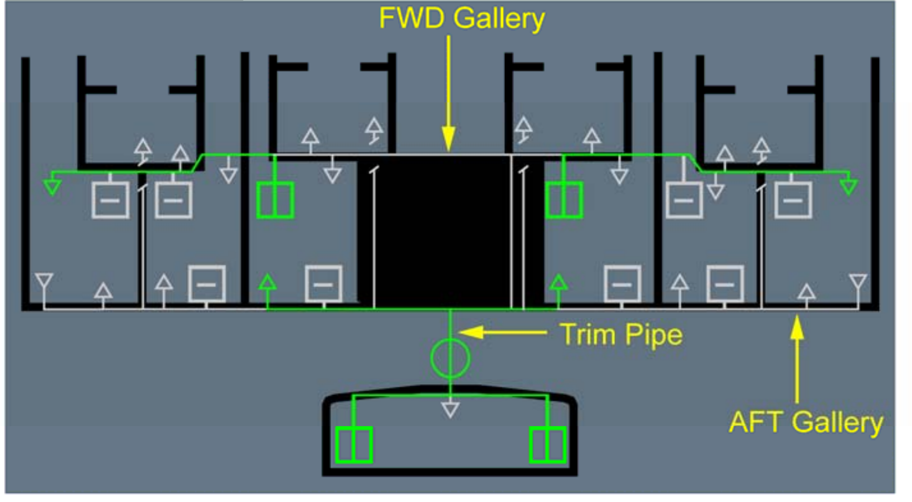
FQMS

Two Fuel Quantity and Management Systems (FQMS) permanently monitors the fuel quantity and the Center of Gravity (CG) of the aircraft in order to:

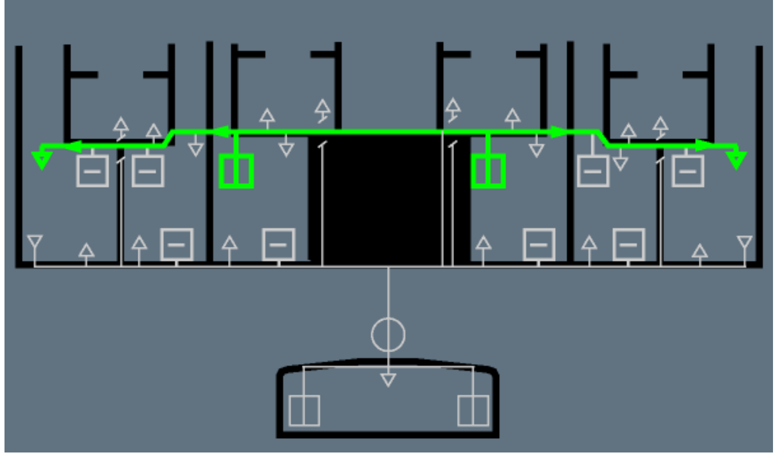
- Perform CG control
- Control fuel transfers
- Perform ground operations: Refueling and defueling
- Control fuel jettison.

A380 Fuel System
1.System Description

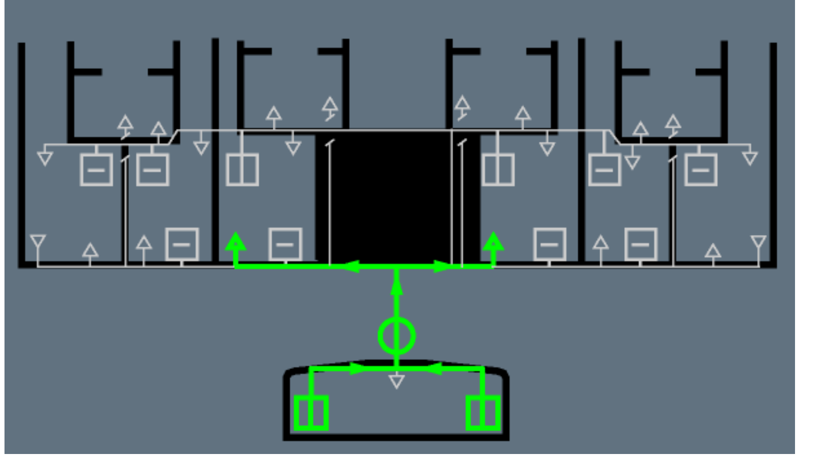
Transfer System



Inner to Outer Transfer



Trim to Inner Transfer



Main Transfers

The quantity of fuel in the feed tanks continuously decreases, due to engine fuel burn. Main transfers are automatic transfers from the other tanks to the feed tanks, and occur in the following sequence:

1. Inner tanks to feed tanks, until empty
2. Mid tanks to feed tanks, until empty
3. Trim tanks to feed tanks, until empty
4. Outer tanks to feed tanks.

Load Alleviation (LA) Transfers

The following load alleviation transfers occur in flight:

- **After Takeoff:**
  - Transfer to the outer tanks, until the outer tanks are full.
- **Before Landing:**
  - Transfer from the trim tank, until the trim tank is empty
  - Transfer from the outer tanks, until the outer tanks are half empty.

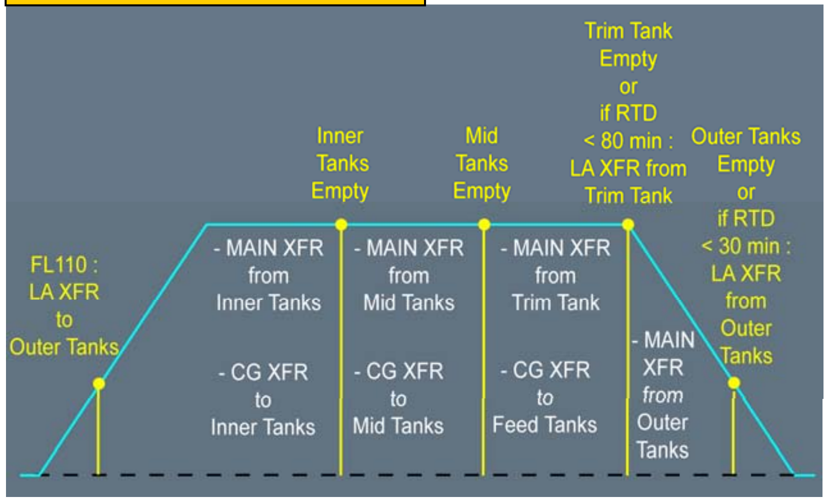
Center of Gravity (CG) Control Tranfers

CG control transfers maintain the aircraft's CG forward of the aft certified limit by transferring fuel from the trim tank to the appropriate wing tanks.

Note:

There are no aft CG transfers, because the CG only has a minor impact on the cruise performance.

In-flight Fuel Transfer Sequence



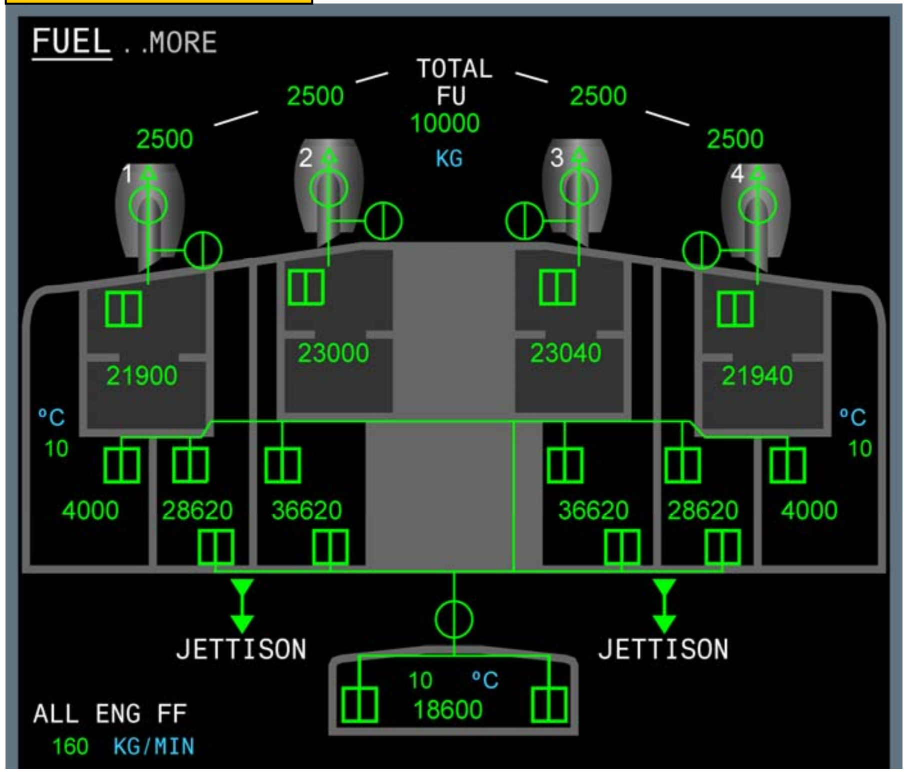
Fuel Jettison

To rapidly reduce the aircraft's gross weight, fuel can be jettisoned from all the transfer tanks simultaneously at an output rate of approximately 150 000 kg (330 000 lbs) per hour.

Note :

It is not possible to jettison fuel from the feed tanks.

ECAM SD FUEL Page



Automatic Refuel and CG Targeting

In normal operations, refueling is performed under full control of the FQMS. This automatic refuel can be initiated from the external refuel panel or from the cockpit.

The FQMS can control the fuel loading and distribution, depending on the ZFW and ZFCG, to obtain a post-refuel CG of 39.5% . This is referred to as CG targeting.

If no ZFW/ZFCG values have been entered, the FQMS uses the default ZFW/ZFCG values to start the refueling.

The aircraft has two refuel couplings. When both couplings are used, it takes approximately 45 minutes to completely refuel (with a pressure of 40 psi).

Automatic Ground Transfer

When refueling is completed, the actual CG may be different from the ground CG target of 39.5%.

This occurs when:

- The final ZFW/ZFCG values are available after refueling, or
- CG targeting is no longer effective.

If the actual CG is out of the takeoff limits, the flight crew can start an automatic ground transfer using the AUTO GND XFR pb. This will redistribute the fuel, to obtain the ground CG target (+/- 1%), based on the final ZFW/ZFCG values entered in the FMS .

The automatic ground transfer is complete in less than 25 minutes, and can be stopped at any time by the flight crew.

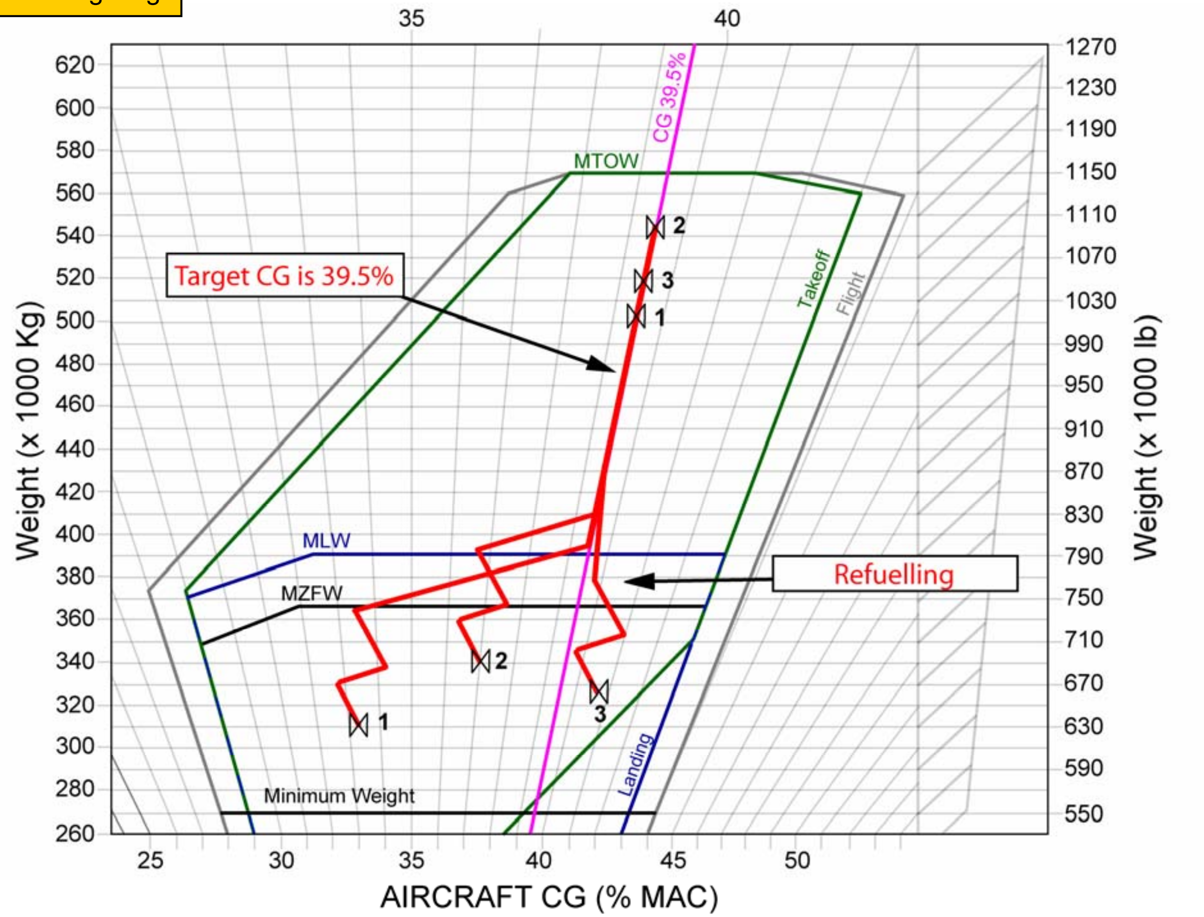
Manual Refuel

Manual refuel is also possible from the external refuel panel, if necessary (e.g. failure cases). In this case, refueling is controlled by an operator, via the FQMS.

Defuel

Defueling may be necessary for maintenance reasons. Defueling is manually controlled via the FQMS, using the external refuel panel. The discharged fuel is collected via the refuel couplings.

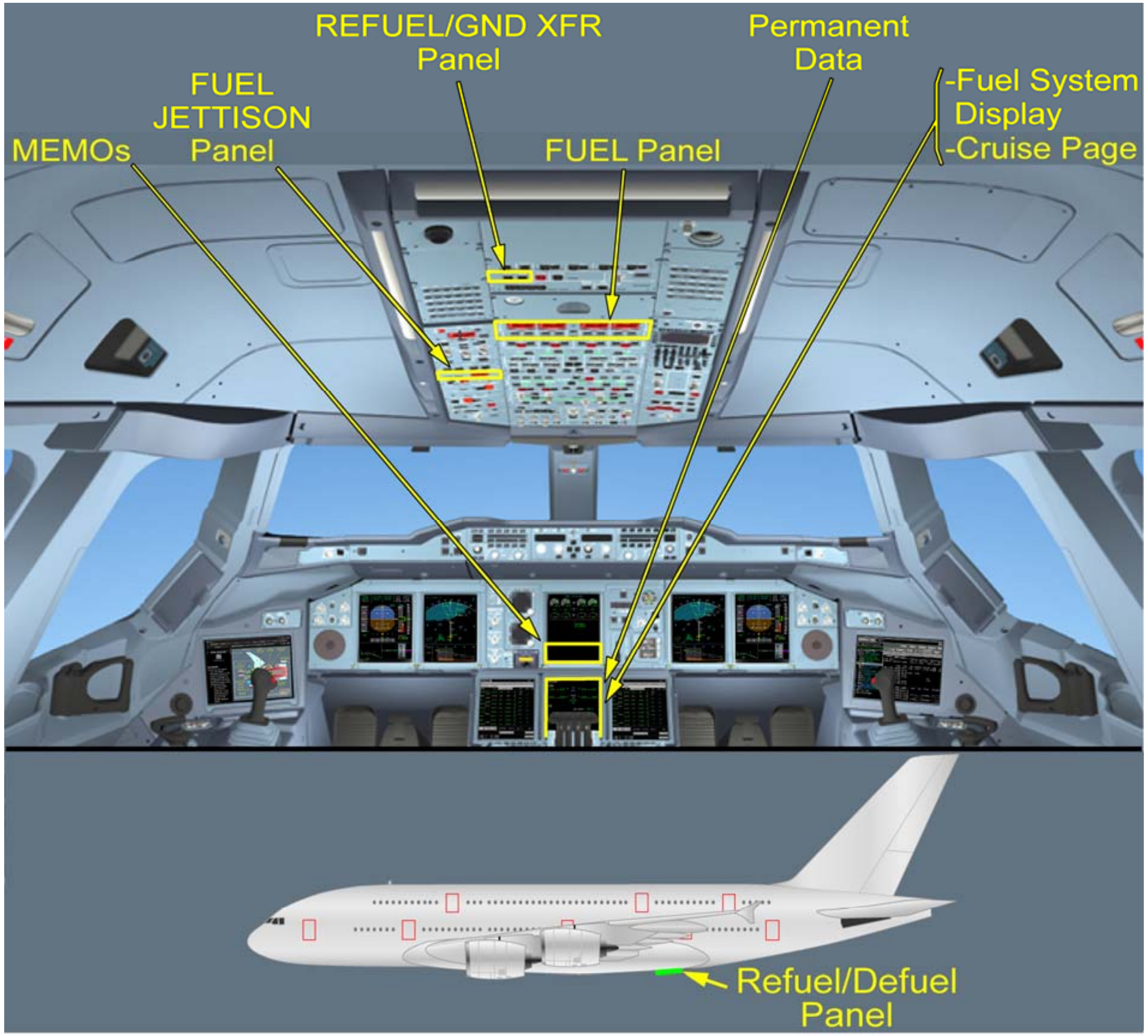
Automatic Refuel and CG Targeting



Examples of Refuelling:

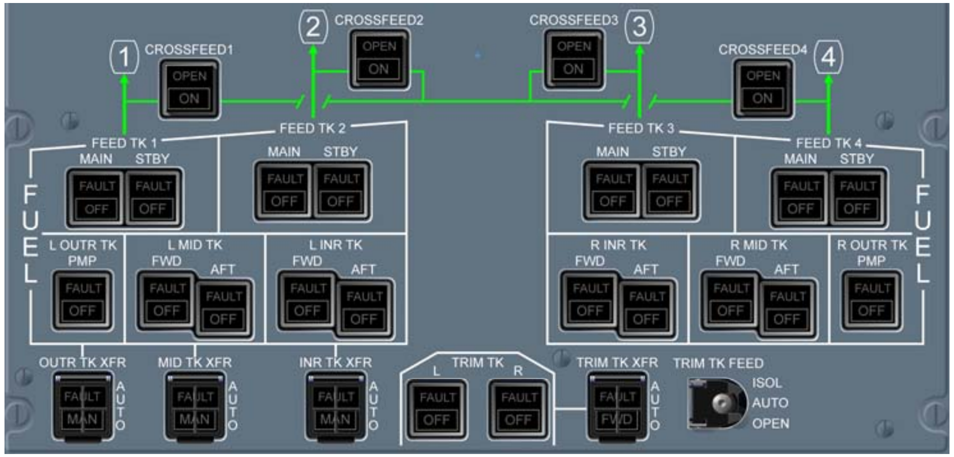
Weight and CG before Refuelling	Refuelling (195 000 kg)	Weight and CG after Refuelling
1: ZFW = 310 000 kg / ZFCG = 33.2% MAC	→	TOW = 505 000 kg / TO CG = 39.5% MAC
2: ZFW = 340 000 kg / ZFCG = 37.0% MAC	→	TOW = 545 000 kg / TO CG = 39.5% MAC
3: ZFW = 324 000 kg / ZFCG = 40.7% MAC	→	TOW = 519 000 kg / TO CG = 39.5% MAC

A380 Fuel System
5.Controls and Indicators

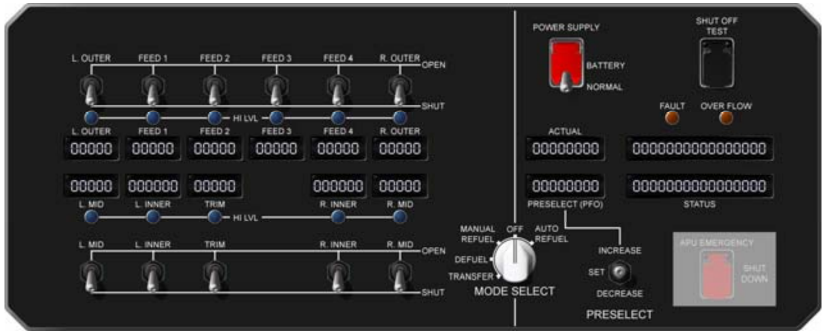


A380 Fuel System
5.Controls and Indicators

FUEL Overhead Panel



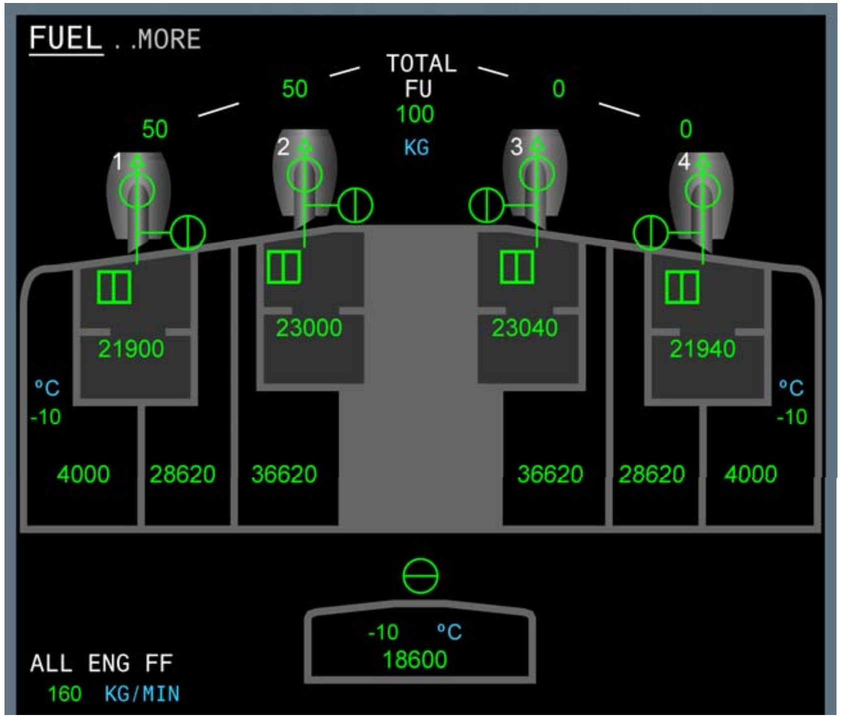
Refuel Panel



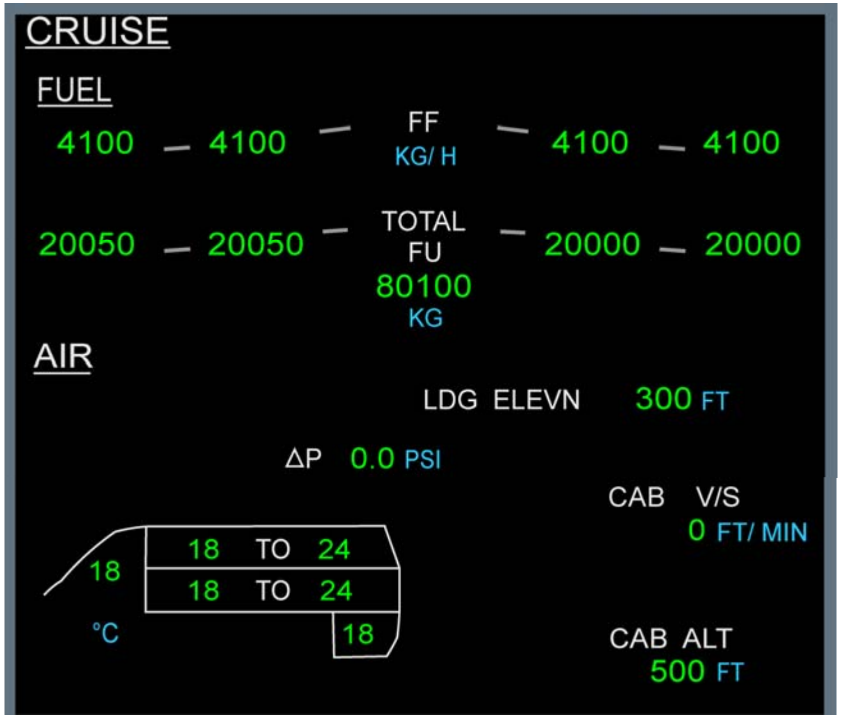
FUEL JETTISON Panel

Refuel/Ground Transfer Panel

ECAM SD FUEL Page



ECAM SD CRUISE Page



ECAM SD Permanent Data Zone

11. ATA 29 Hydraulic System

Flight Deck and Systems Briefing for Pilots

A380 Hydraulic System
1.System Description

General

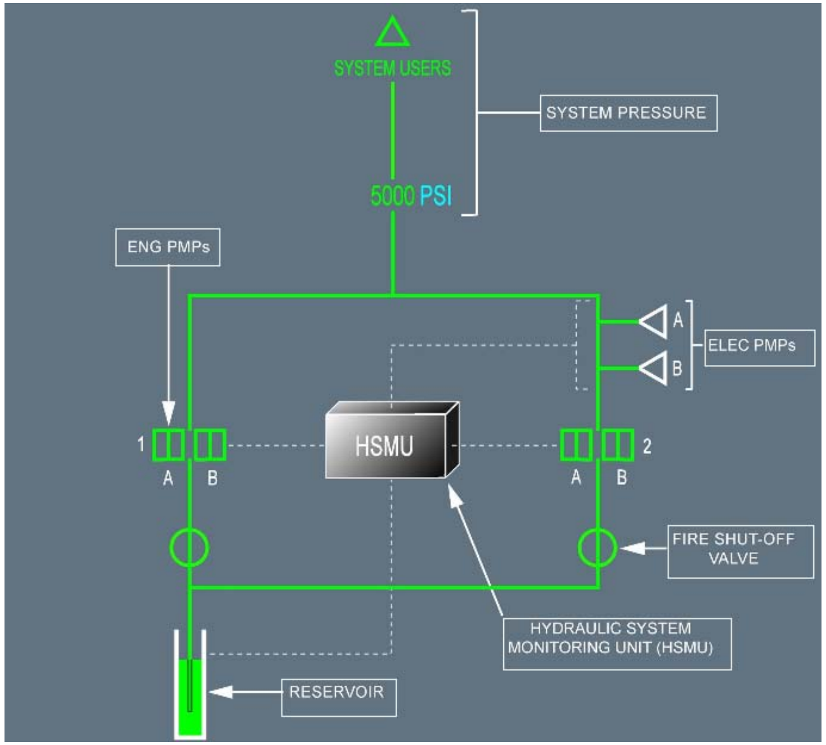
- There are two identical and independent hydraulic circuits: YELLOW and GREEN. They operate continuously and power the flight controls, the landing gear system, and the cargo doors at a nominal pressure of 5000 psi instead of 3000 psi on previous Airbus aircrafts
- Each hydraulic system is controlled and monitored by its assigned Hydraulic System Monitoring Unit (HSMU)
- If one or both hydraulic systems fail, the following hydro-electrical backups remain available:
  - For flight controls: The Electrical-Hydrostatic Actuators (EHAs) and the Electrical Backup Hydraulic Actuators (EBHAs) (**Refer to Flight Controls**)
  - For braking and steering: The Local Electro-Hydraulic Generation System (LEHGS) (**Refer to Landing Gear**).

Hydraulic Generation

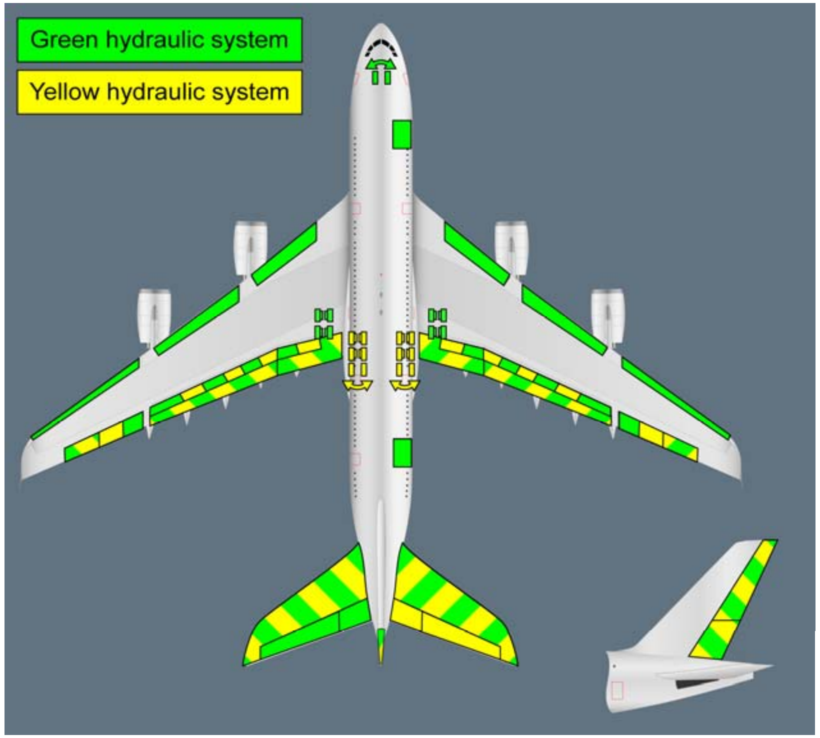
- Four engine-driven pumps (two per engine) pressurize each hydraulic system
  - The pumps of engine 1 and 2 pressurize the GREEN hydraulic system
  - The pumps of engine 3 and 4 pressurize the YELLOW hydraulic system.
- Two pumps are sufficient to pressurize one single hydraulic system
- Two electric pumps per hydraulic system can provide hydraulic pressure on ground only, when all engines are off. They operate automatically for cargo door actuation and Body Wheel Steering (BWS) (**Refer to Landing Gear**)
- There is one fire shut-off valve per engine. Closing the fire shut-off valves prevents hydraulic fluid from flowing into the pump and hence sustaining a fire.

A380 Hydraulic System
1.System Description

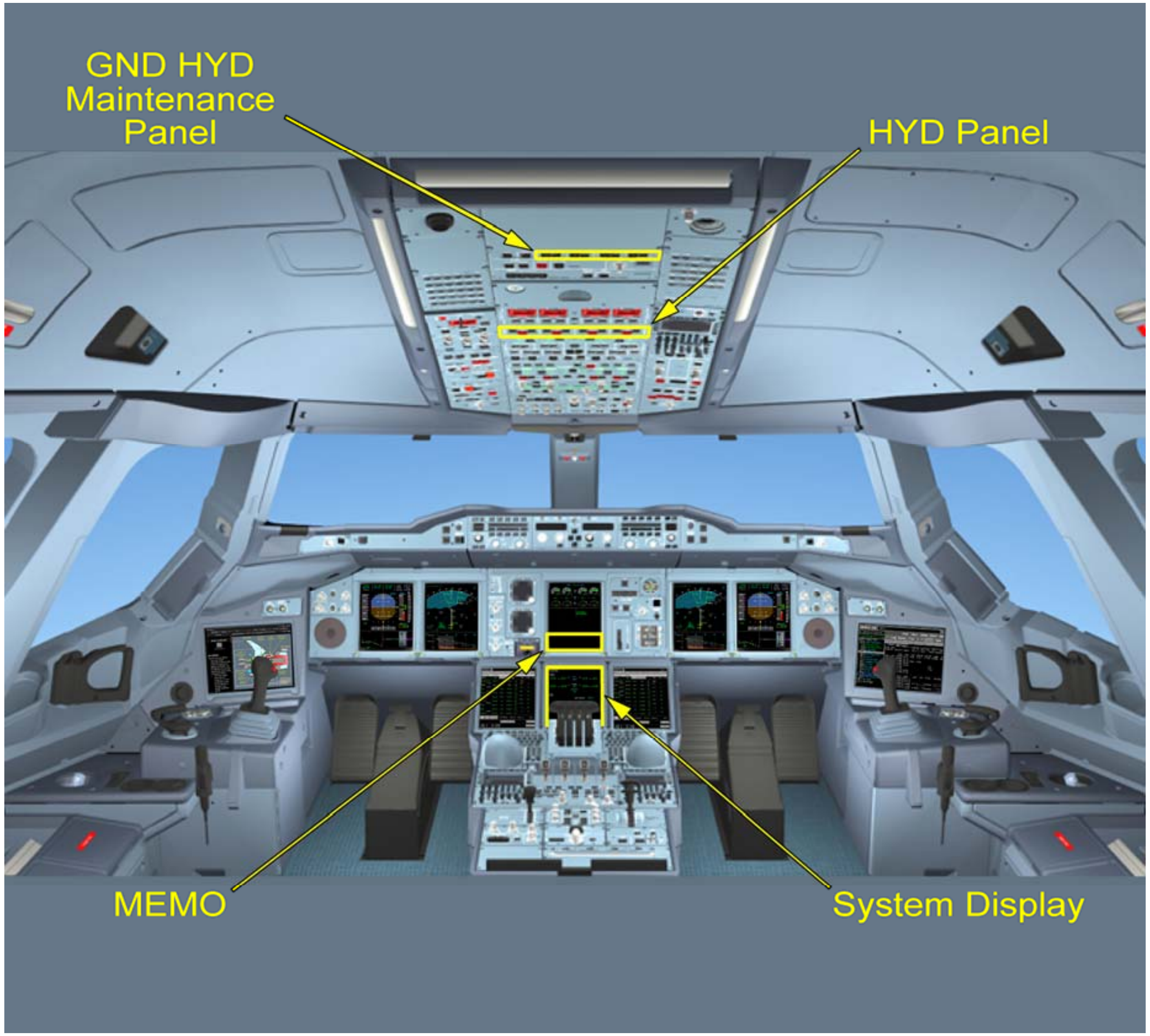
Architecture



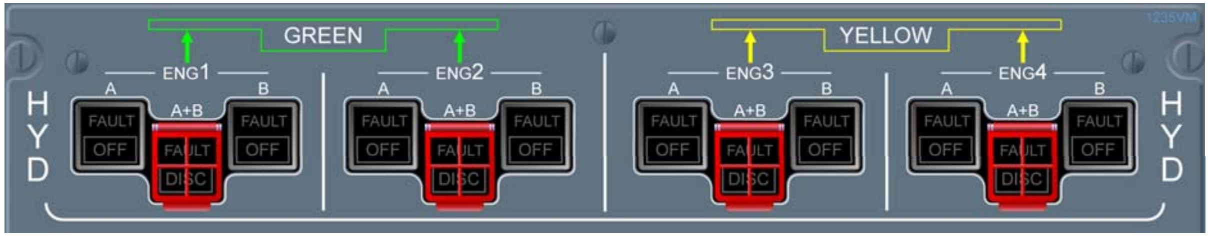
Hydraulic Distribution



A380 Hydraulic System
2.Controls and Indicators



HYD Overhead Panel



ECAM SD HYD Page

GND HYD Panel

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12. ATA 30 Ice and Rain Protection

Flight Deck and Systems Briefing for Pilots

Contents

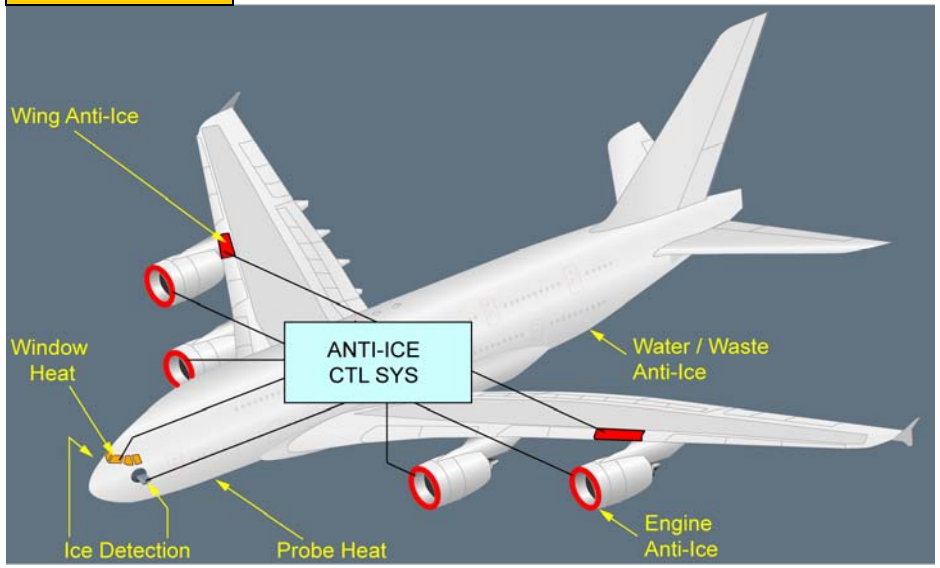
General

The ice protection system enables unrestricted operation of the aircraft in icing conditions. This system protects the aircraft against ice by using:

- Hot bleed air for:
  - Engine anti-ice
  - Wing anti-ice.
- Electrical power for:
  - Window heating
  - Water/waste drain masts heating
  - Probe heating.

An ice detection system enables the automatic activation and deactivation of the wing and engine anti-ice.
The flight crew can, however, manually activate the anti-ice system at any time.

Anti-Ice System



System Description

- **Engine Anti-Ice**
  Each engine has its own anti-ice system: An anti-ice valve on each engine enables the flow of hot air from its compressor to de-ice its air inlet.

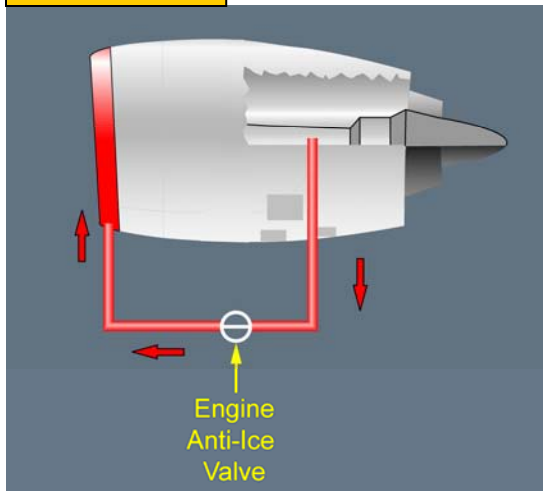
- **Wing Anti-Ice**
  Only slat 4 of each wing is de-iced: anti-ice valves enable the hot air to flow from the pneumatic system (Refer to Air Systems).
  Wing anti-ice is inhibited on ground and during takeoff, until takeoff thrust reduction.

- **Cockpit Window Heating**
  The cockpit windows (windshield and side windows) are electrically heated to prevent icing and to defog.

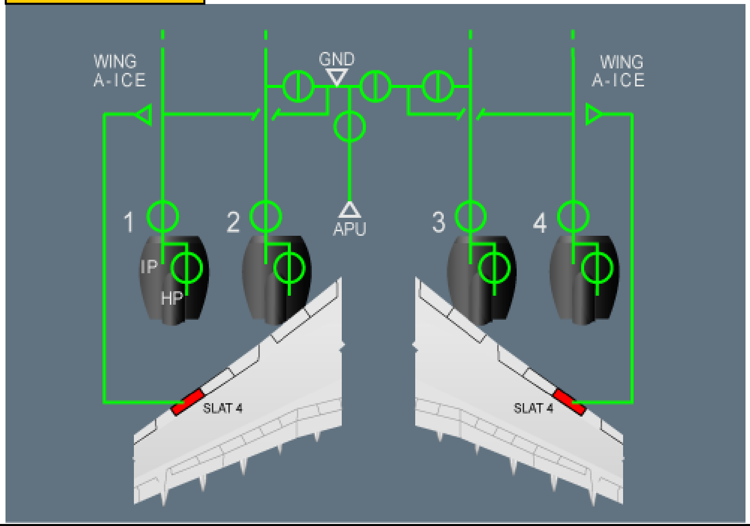
- **Water/Waste Anti-Ice**
  The water lines are automatically heated to prevent ice formation that could cause damage and/or obstruction of the water lines.

- **Probe Heating**
  The aircraft probes are electrically heated to prevent icing.

Engine Anti-Ice



Wing Anti-Ice



- **Ice Detection**
  The ice detection system has two ice detectors that measure ice accretion. If icing or severe icing conditions exist, the ice detectors automatically activate the anti-ice system and provide this information to the flight crew.
  Two visual ice indicators provide the flight crew with a visual backup to the ice detection system.

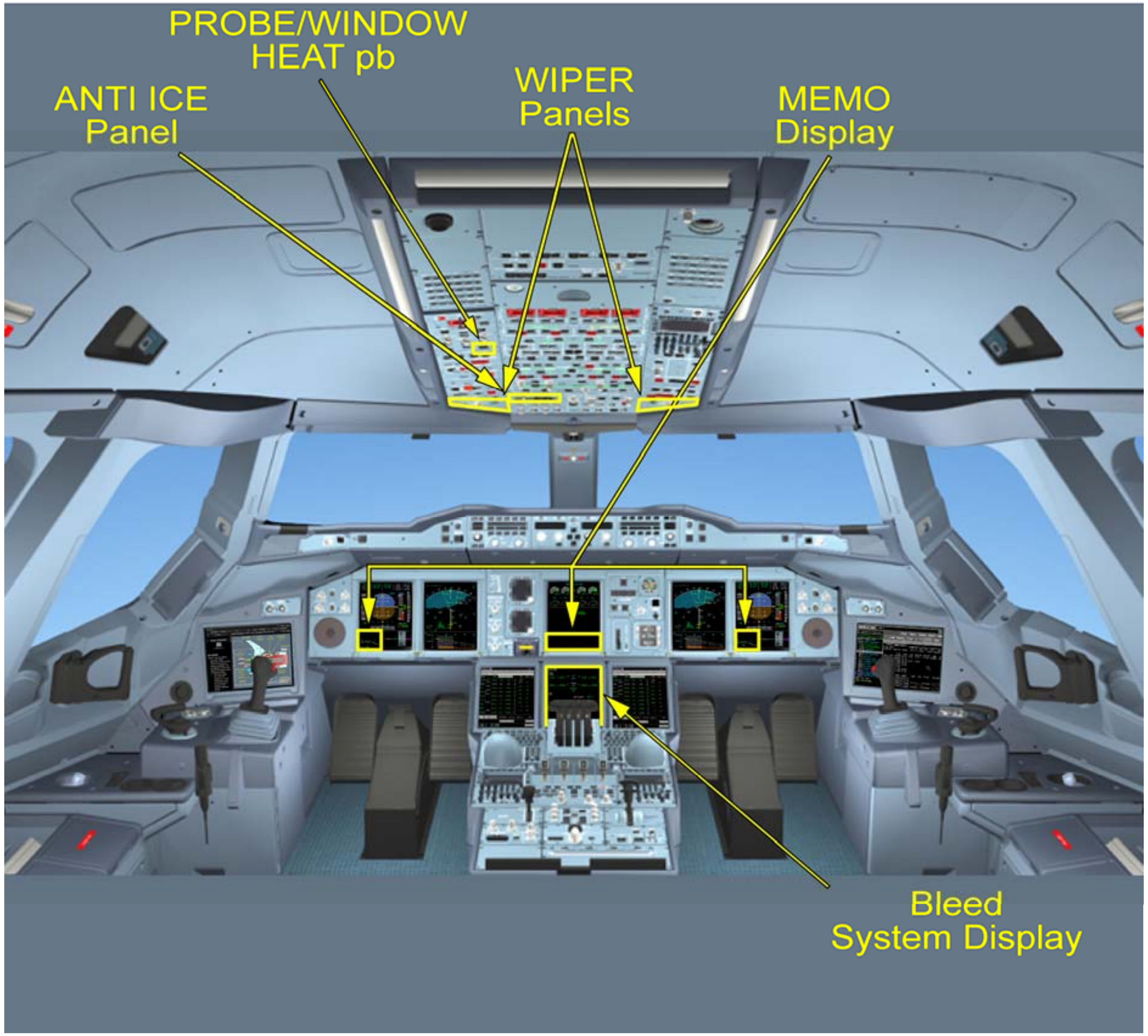
- **Anti-ice Activation Modes**
  The anti-ice automatic mode activates in flight after takeoff thrust reduction.
  It operates as follows:
  - The engine anti-ice activates if at least one ice detector detects icing conditions
  - The wing anti-ice also activates if at least one ice detector subsequently detects severe icing conditions
  - Both engine and wing anti-ice turn off if none of the ice detectors detect ice for approximately two minutes.

System Description

- **Wipers**
  The Captain and First Officer windshields each have a two-speed electric wiper.
  The wipers can be used during taxi, takeoff, holding, approach and landing.

- **Rain Repellent** (optional)
  A rain repellent fluid can be sprayed on the surface of the windshields to improve visibility in moderate to heavy rain conditions.

A380 Ice and Rain Protection
3.Controls and Indicators

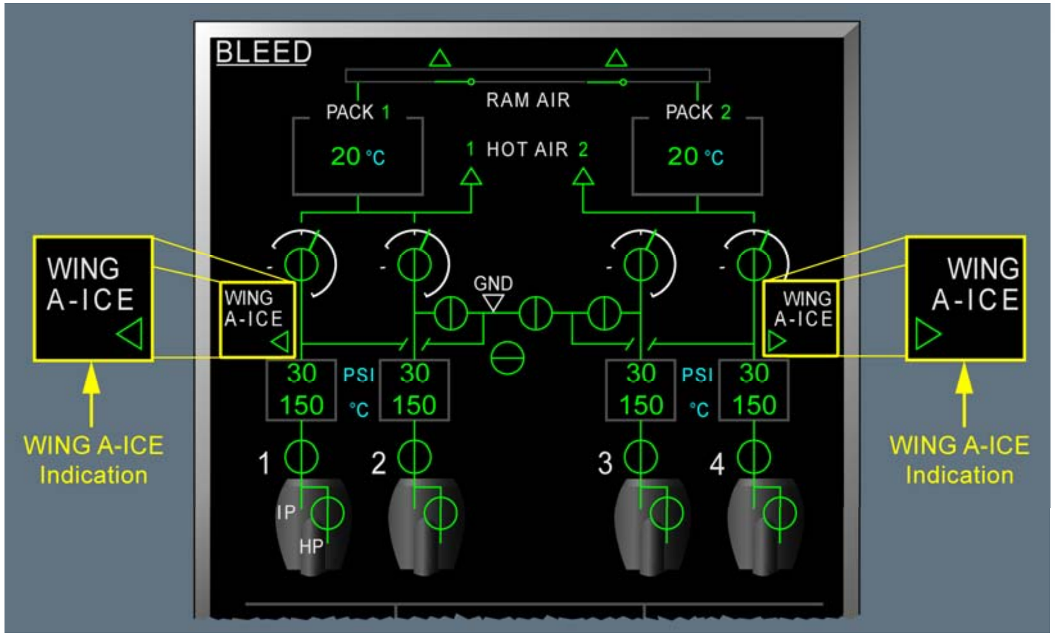


ANTI ICE Panel

PROBE / WINDOW HEAT pb

WIPER sel & RAIN RPLT pb

ECAM SD BLEED Page



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13. ATA 31 Indicating/Recording Systems

Flight Deck and Systems Briefing for Pilots

Contents

AIRBUS

General

The following systems and displays provide the flight crew with the information necessary to operate the aircraft:

- **Control and Display System (CDS)**
  The CDS performs a display function for flight operation and system operation. The information is displayed on 8 identical Liquid Crystal Display Units (LCDUs).
  (Refer to CDS)

- **Head-Up Display (HUD)**
  The optional HUD provides guidance to the flight crew by gathering primary flight display information.
  (Refer to Head-Up Display)

- **Onboard Information System (OIS)**
  The OIS provides access to flight operation manuals and applications (Refer to Information Systems).
  The Onboard Information Terminal (OIT) is the main interface with the OIS.

- **Clock**
  The clock system operates independently of other systems and provides time data to all aircraft systems that require a time and date reference.

- **Integrated Standby Instrument System (ISIS)**
  The ISIS provides information in case of loss of the PFD or ND (Refer to Navigation).

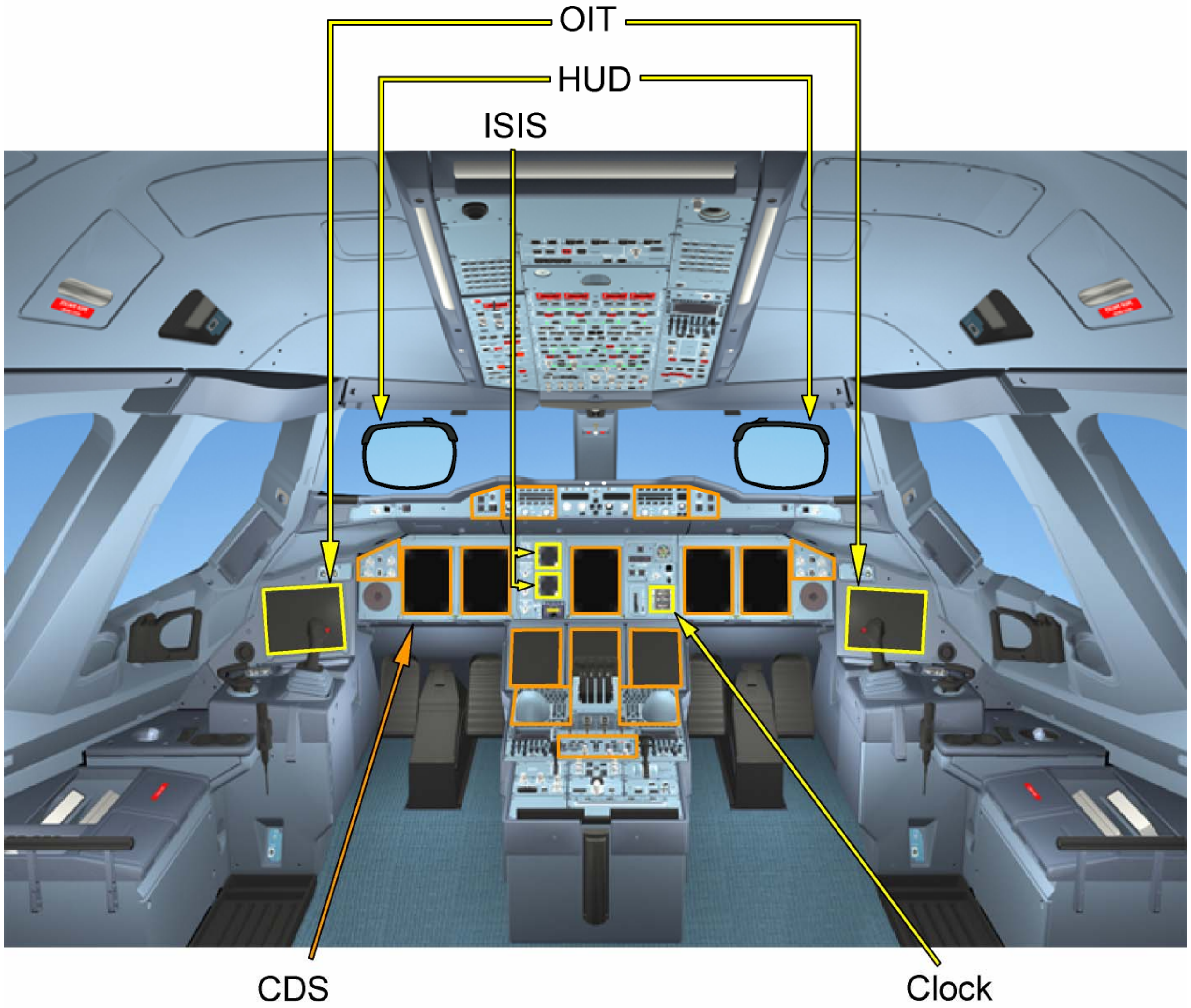
- **Concentrator and Multiplexer for Video (CMV)**
  (Refer to CMV)

In compliance with Airworthiness Regulations, all mandatory flight instrument and aircraft system parameters, as well as cockpit conversations, are recorded by the:

- **Flight Data Recording System (FDRS)** that records all flight parameters
- **Cockpit Voice Recorder (CVR)** that records all conversations in the cockpit.

A380 Indicating/Recording Systems
1.System Description

Indicating and Recording System Controls and Displays



General

The CDS consists of 8 identical interchangeable 15.6 cm x 20.8 cm (6.17 in x 8.22 in) Liquid Crystal Display Units (LCDUs) and associated control panels.
The CDS manages the display of flight and system information to allow system monitoring and aircraft environment video monitoring through the 8 DUs.

Each DU can support different display formats to enable reconfigurations in case of loss of one or more displays.

In normal operation, the CDS displays:

- Two Primary Flight Displays (PFDs)
- Two Navigation Displays (NDs)

EFIS

- One Engine/Warning Display (E/WD)
- One System Display (SD)

ECAM

- Two Multi-Function Displays (MFDs)

The different displays can be controlled through the following CDS control panels:

- Two EFIS Control Panels (EFIS-CPs)
- One ECAM Control Panels (ECPs)
- Two Keyboard and Cursor Control Units (KCCUs)
- Two CDS displays brightness panels.

Architecture

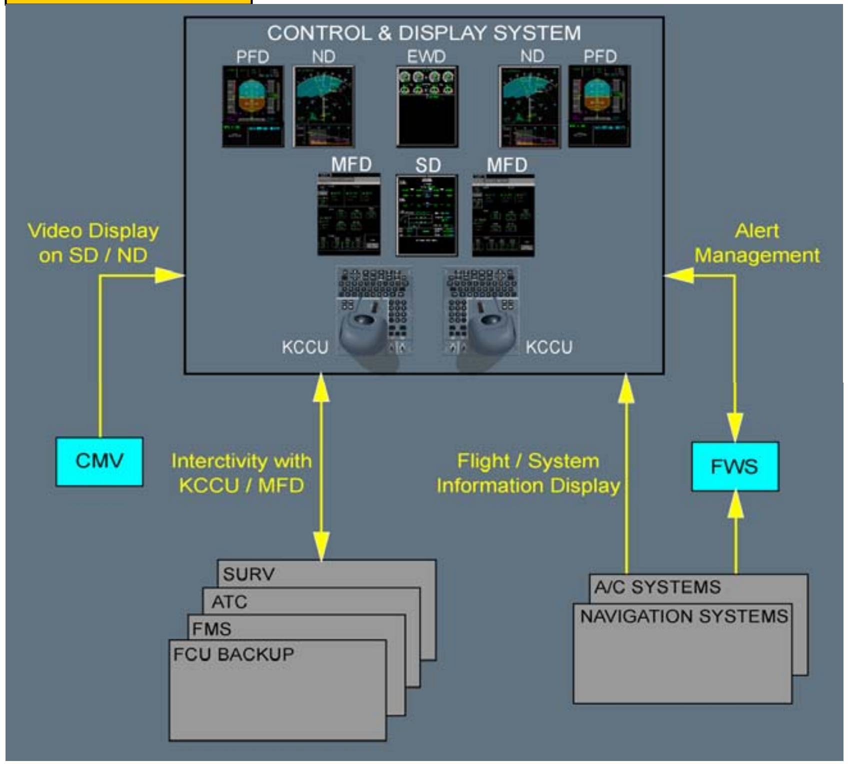
The CDS receives flight and system information from various aircraft systems and from the:

- **Flight Warning System (FWS)**
- **Navigation systems**
- **Concentrator and Multiplexer for Video (CMV)**
- **SURVeillance (SURV)**
- **Flight Management System (FMS)**
- **Air Traffic Control (ATC) system**
- **Full Authority Digital Engine Controls (FADECs)**
- **PRIMary flight computers (PRIMs)**.

The CDS also provides an interface, through the MFDs and KCCUs, with the following systems:

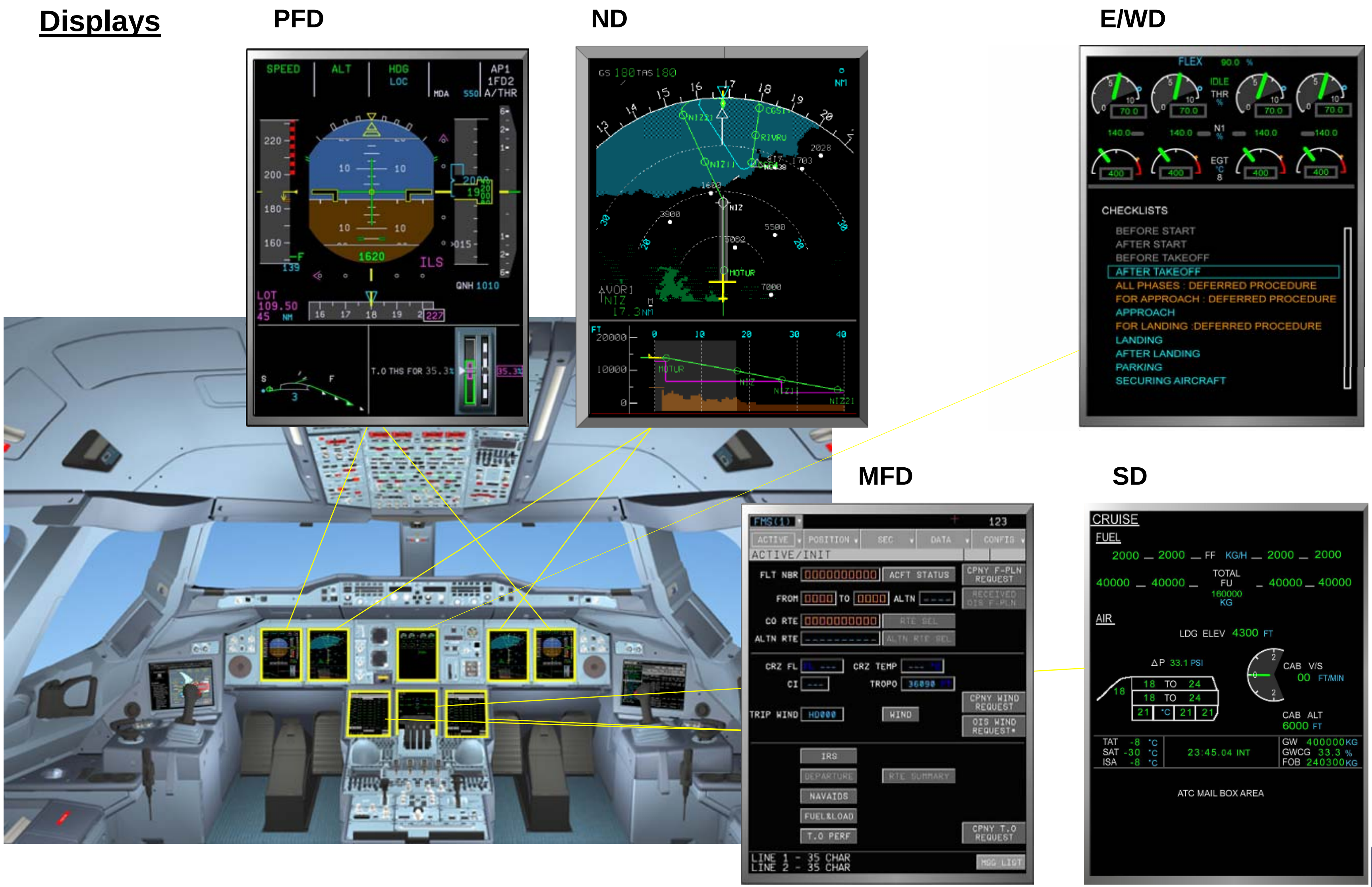
- Flight Management System (FMS)
- Air Traffic Control (ATC)
- SURVeillance (SURV)
- Flight Control Unit (FCU) backup.

CDS Architecture

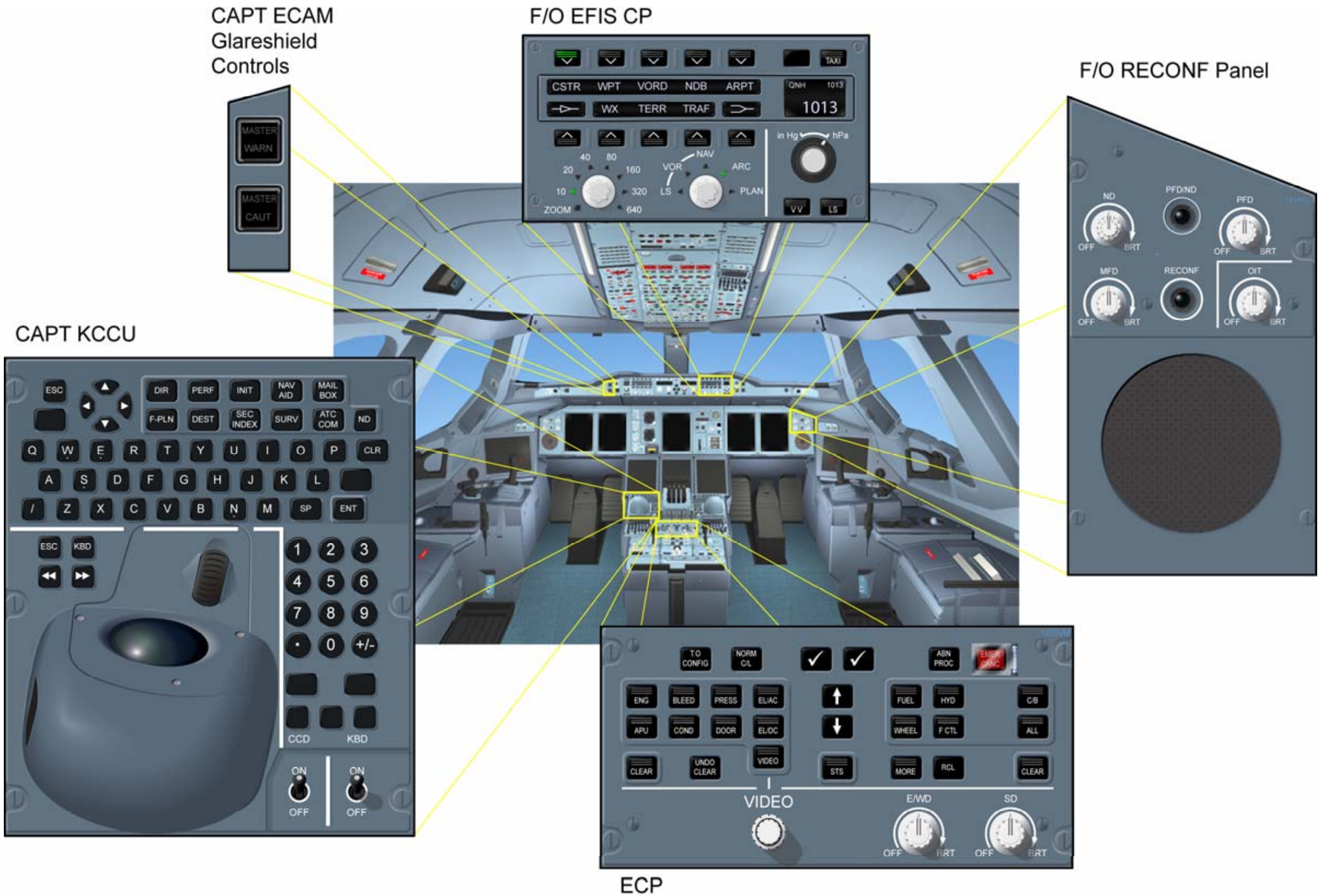


Controls and Displays

Displays

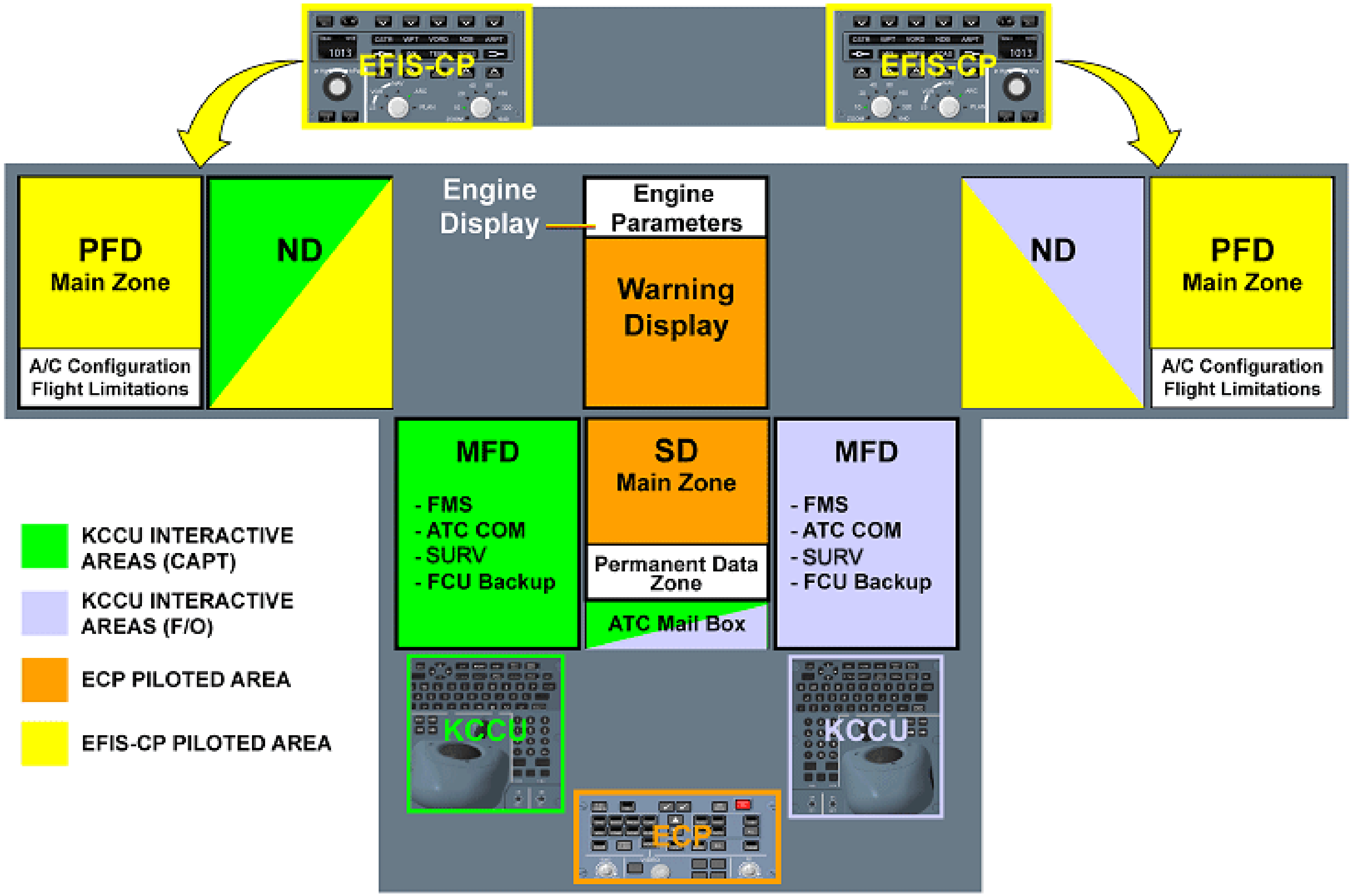


Controls



CAPT ECAM
Glareshield
Controls
MASTER WARN
MASTER CAUT
F/O EFIS CP
CSTR WPT VORD NDB ARPT
WX TERR TRAF
1013
F/O RECONF Panel
ND
PFD/ND
PFD
MFD
RECONF
OIT
OFF BRT
CAPT KCCU
ESC
DIR PERF INIT NAV AID MAIL BOX
F-PLN DEST SEC INDEX SURV ATC COM ND
CLR
SP ENT
KBD
CCD
ON OFF
ECP
TO CONFIG
NORM C/L
ABN PROC
ENG BLEED PRESS EL/AC
APU COND DOOR EL/DC
FUEL HYD C/B
WHEEL F CTL ALL
CLEAR UNDO CLEAR VIDEO STS MORE RCL CLEAR
VIDEO
E/WD
SD

Controls and Displays Interactivity



A380 Indicating/Recording Systems
3.Keyboard and Cursor Control Unit (KCCU)

The cockpit is equipped with two **Keyboard and Cursor Control Units (KCCUs)**. Both are on the center pedestal.

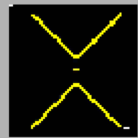
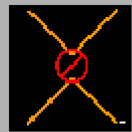
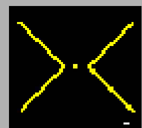
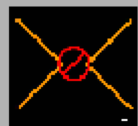
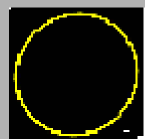
The KCCUs enable the flight crew to directly interact with the onside ND, MFD and the mailbox section of the SD.
Each KCCU displays a different cursor.
If both cursors are displayed on the SD, only one can be active.

The KCCUs have two parts:

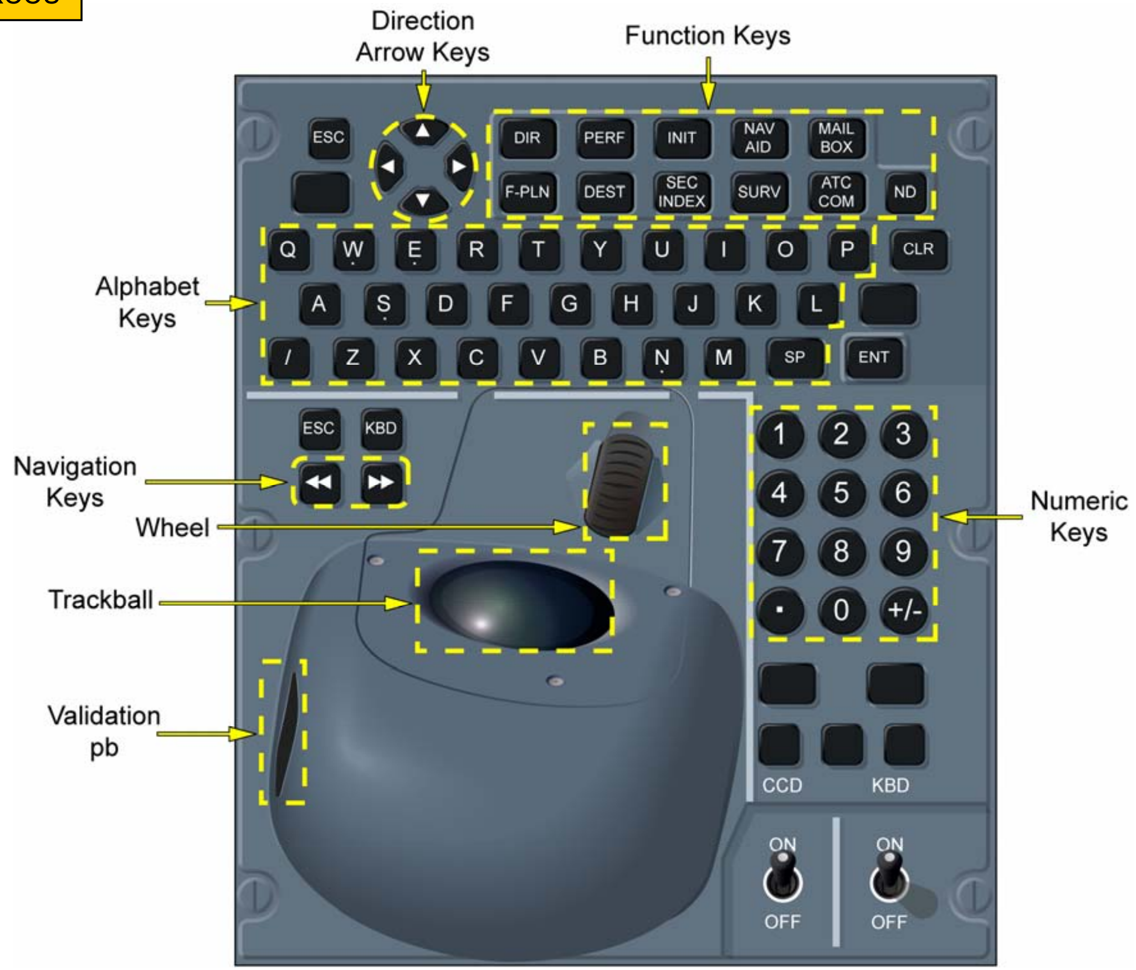
- A keyboard to enter alphanumeric information
- A cursor control device.

There is a functional redundancy between the keyboard and the cursor control unit.

KCCU Cursors

	The Captain's cursor is active.
	The Captain's cursor is not active.
	The First Officer's cursor is active.
	The First Officer's cursor is not active.
	Appears when a cursor is to be displayed but is not yet active.

KCCU



Direction Arrow Keys
Function Keys
Alphabet Keys
Navigation Keys
Wheel
Trackball
Validation pb
Numeric Keys
ESC
DIR
PERF
INIT
NAV AID
MAIL BOX
F-PLN
DEST
SEC INDEX
SURV
ATC COM
ND
Q W E R T Y U I O P
CLR
A S D F G H J K L
/ Z X C V B N M
SP
ENT
ESC
KBD
1 2 3
4 5 6
7 8 9
0
+/-
CCD
KBD
ON
OFF
ON
OFF

The CDS has two **Multi-Function Displays (MFDs)**.
The MFDs serve as an interface to control and display computed data from the:

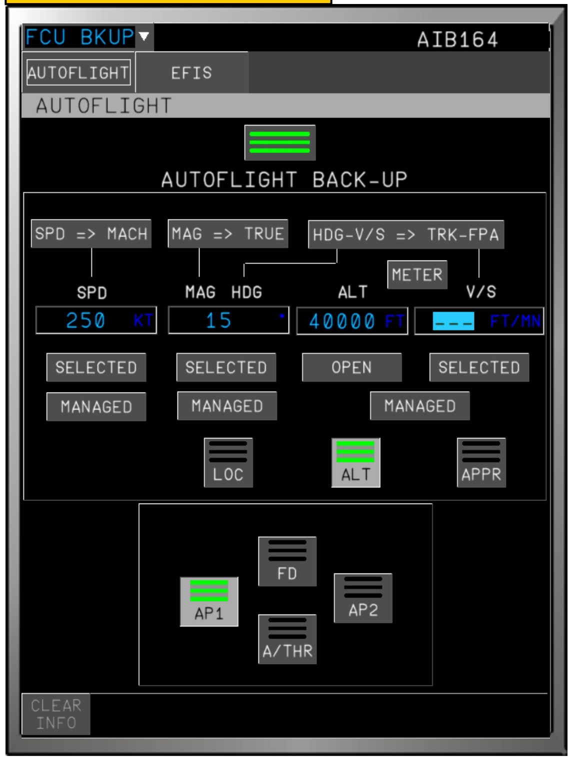
- Flight Management System (FMS)
  ([Refer to Auto Flight System]())
- Air Traffic Control (ATC)
  ([Refer to Information Systems]())
- SURVeillance (SURV)
  ([Refer to Navigation]())
- Flight Control Unit (FCU) backup function for the Auto Flight System (AFS).
  ([Refer to Auto Flight System]())

Each flight crew member can interact with his MFD using the assigned KCCU.

MFD FMS Page

AIRBUS

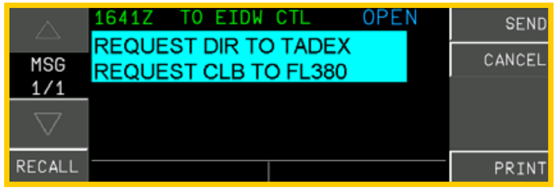
MFD FCU Backup Page



MFD ATC Page

MFD SURV Page

SD ATC Mailbox Area



General

The **Electronic Flight Instrument System (EFIS)** displays flight parameters and navigation data.
The EFIS is displayed on four display units:

- Two Primary Flight Display (PFD) units for short-term flight information and
- Two Navigation Display (ND) units for navigation.

The flight crew interacts with the EFIS displays through the:

- KCCUs
- EFIS control panels
- CDS RECONF control panels for reconfigurations.

Controls and Indicators

Indicators

- The two **Primary Flight Displays (PFDs)** provide short-term information.

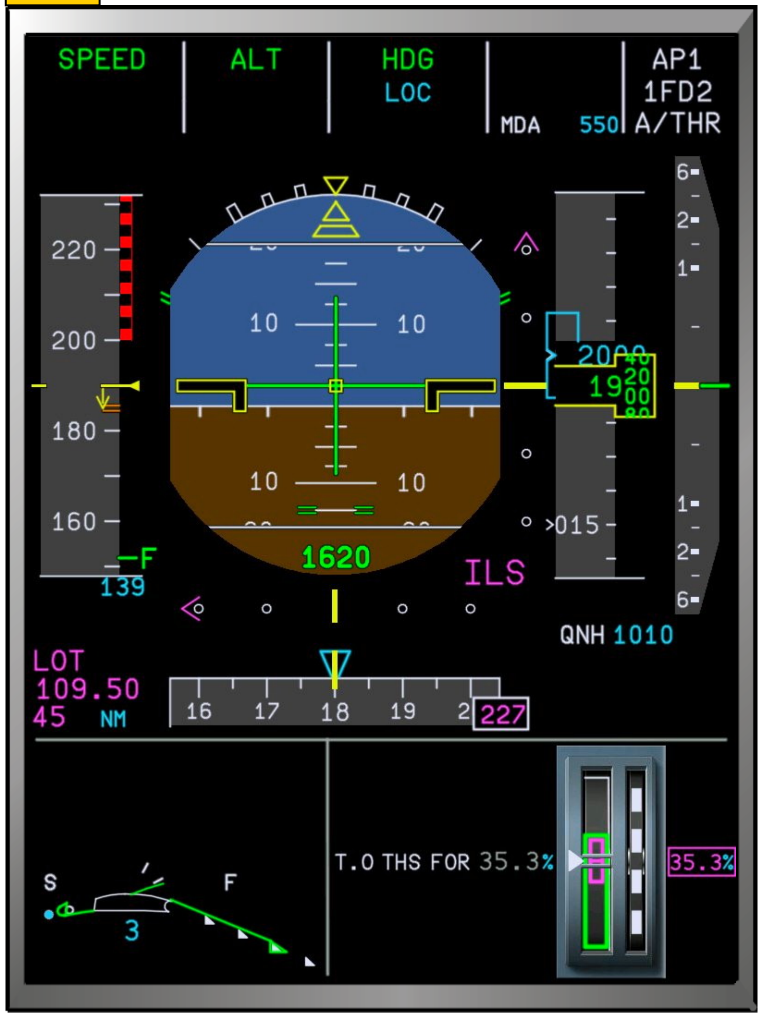
The upper section of the PFD is generated by the EFIS and displays the:

- Complete Basic T including the:
  - Attitude
  - Airspeed / Mach
  - Altitude / Vertical speed
  - Heading
- AFS status
- ILS deviation / marker
- Radio altitude.

The lower section of the PFD displays:

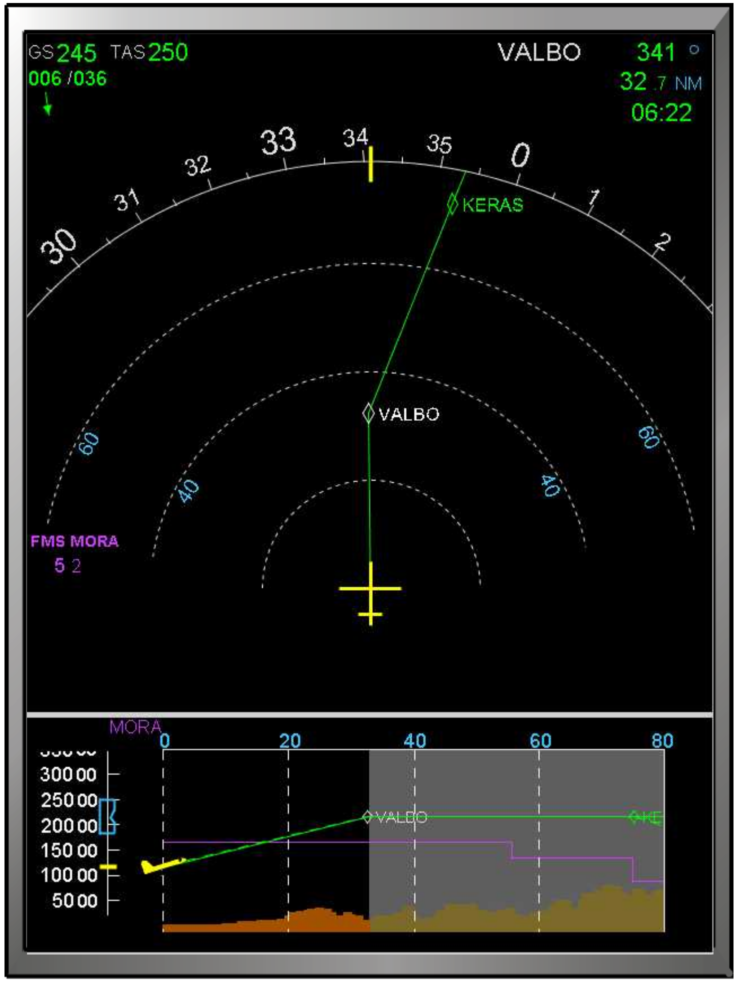
- Memos and limitations (refer to ECAM)
- Slat/Flap/Trim positions.

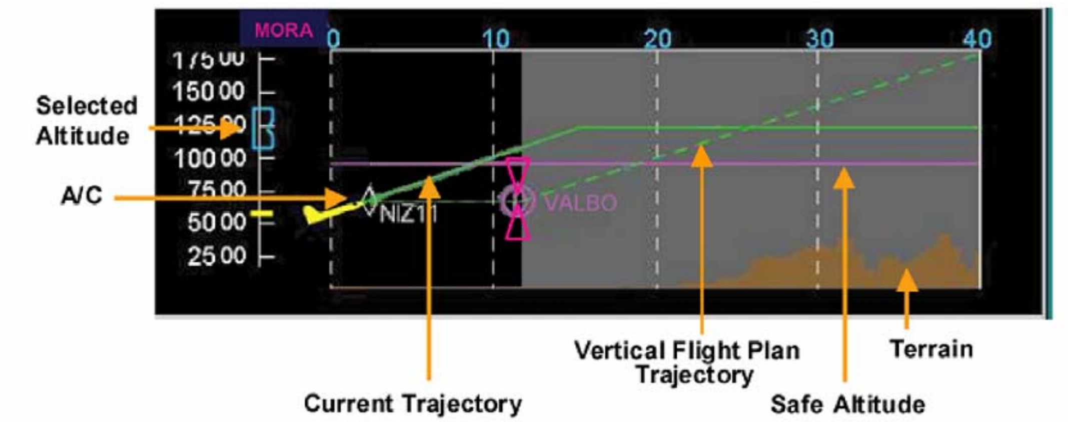
PFD



- The two **Navigation Displays (NDs)** provide long-term flight information.
  The upper section of the ND, called **ND Main Zone**, displays:
  - Aircraft position with respect to navigation aids, FMS flight plan and map data
  - Weather radar information
  - SURV information.

  The lower section of the ND, called **Vertical Display (VD) Zone**, displays:
  - Weather radar information
  - SURV vertical information combined with the vertical flight profile to provide a synthetic view of the aircraft's vertical situation (Refer to Navigation).

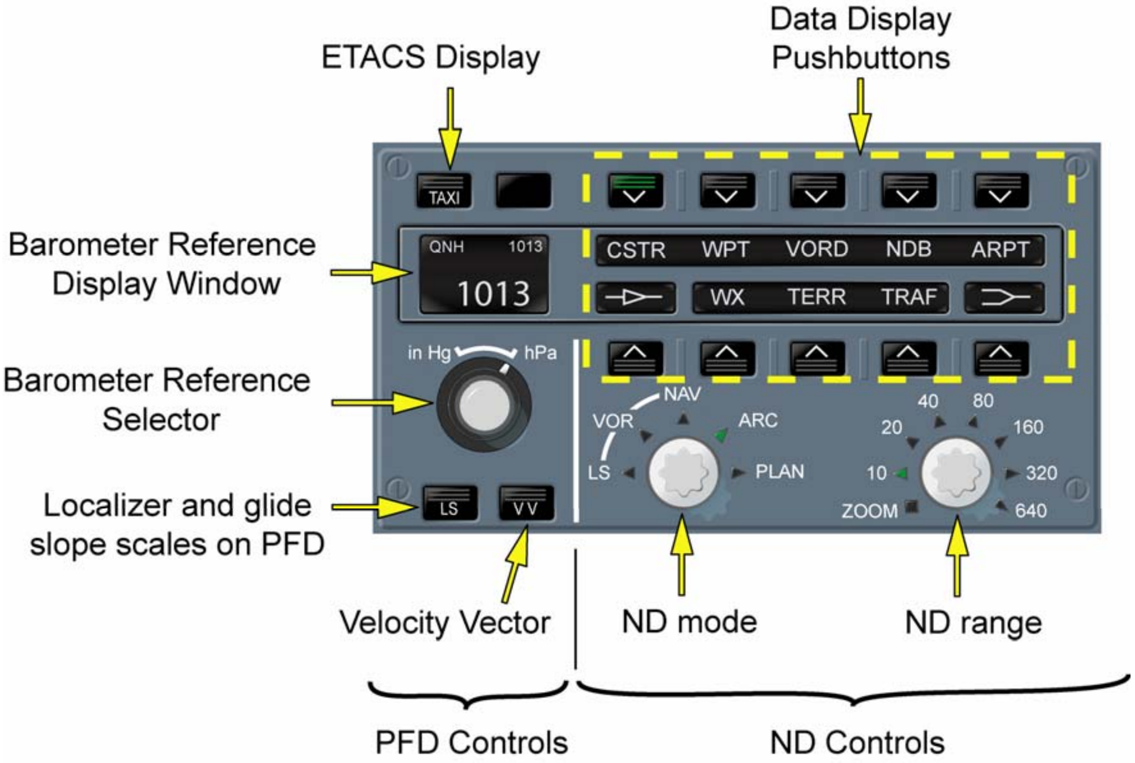




Controls

EFIS RECONF Control Panel

EFIS Control Panel



General

The **Electronic Centralized Aircraft Monitoring (ECAM)** provides information to the flight crew about normal and abnormal procedures.

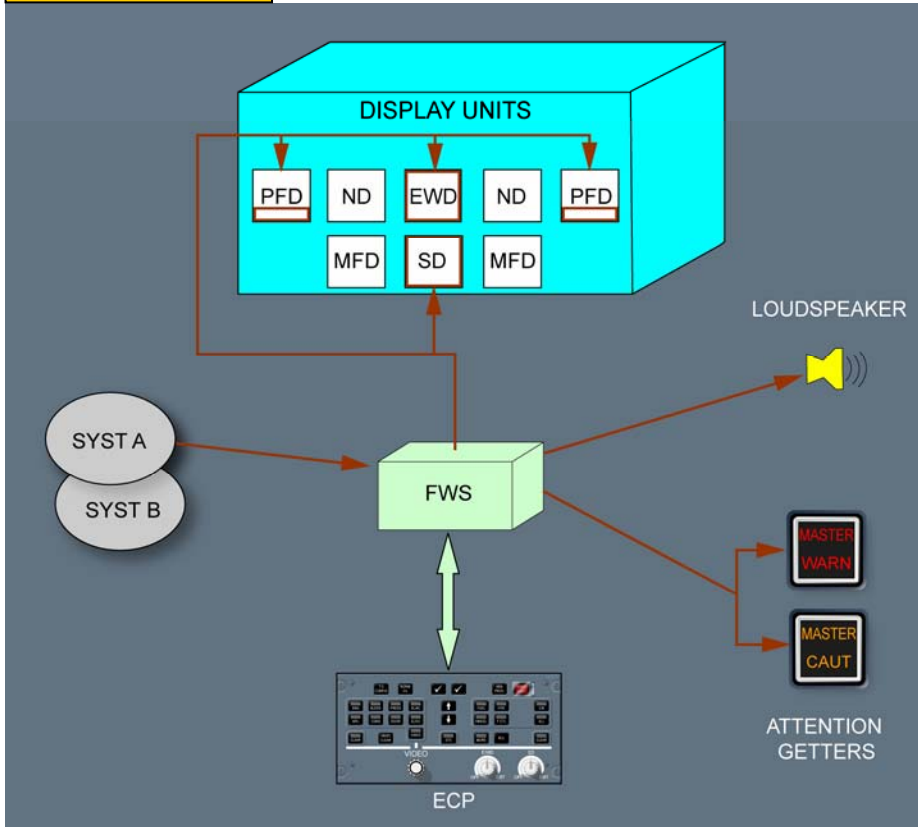
The ECAM is composed of:

- Two Flight Warning Systems (FWSs) that compute alerts and manage the display of the ECAM information
- One ECAM Control Panel (ECP)
- Two sets of visual attention-getters
- Four loudspeakers for aural warnings.

The ECAM is displayed on four display units:

- The Engine/Warning Display (E/WD) display unit
- The System Display (SD) display unit
- The lower part of the two Primary Flight Display (PFD) display units.

ECAM Architecture



Operation

In **normal operation**, the ECAM provides the necessary information to assist the flight crew to operate and monitor the aircraft systems:

- System synoptic pages on the SD. The synoptic pages are displayed automatically in accordance with the flight phase but can also be requested manually.
- Memos (e.g. SEAT BELTS, ENG A-ICE, TO and LDG memos) on the E/WD and PFD
- Normal checklists on the E/WD, on flight crew request.

The ECAM also manages aural altitude callouts and decision-height announcements during approach.

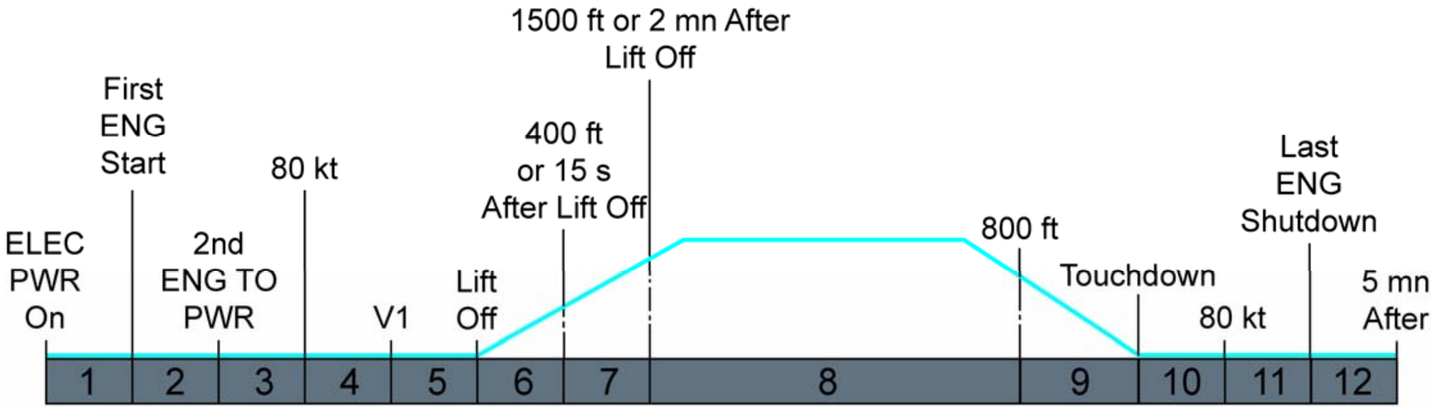
In **abnormal operation**, the ECAM helps the flight crew to manage system failures and aircraft abnormal configurations by:

- Producing visual and aural warnings and cautions, if failures are detected
- Providing associated procedures and associated limitations and memos, if any
- Displaying the applicable system synoptic pages
- Providing ABNORMAL not sensed procedures, on flight crew request.

The ECAM also computes flight phases to inhibit warnings and cautions that can be postponed, for example during takeoff and landing.

ECAM Flight Phases and SD Pages According to the ECAM Flight Phase

Condition	Flight Phase	SD System Synoptic Page
Aircraft at gate and no engine running.	1	DOOR
During APU start-up and until the APU is fully running.	All	APU
During the engine-start sequence.	2	ENGINE
From engine start to the setting of takeoff power.	2	WHEEL
When on ground and the flight crew moves either the sidestick or the rudder pedals.	2	F/CTL
From the setting of takeoff power to thrust reduction at 1500 ft or above.	3,4,5,6,7	ENGINE
During cruise to landing gear extension.	8	CRUISE
From landing gear extension to engine shutdown.	9,10,11	WHEEL
From LAST ENG SHUTDOWN to 5 MIN AFTER.	12	DOOR



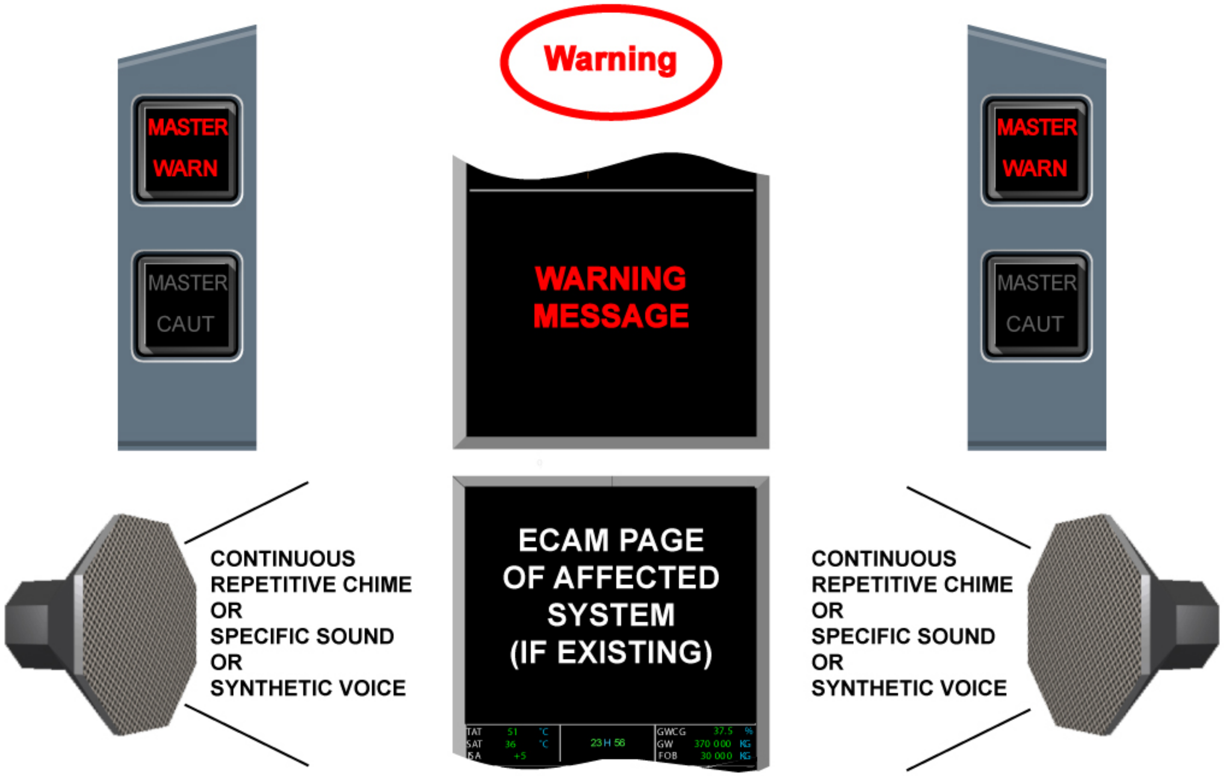
Color Codes

The ECAM information for normal and abnormal procedures is displayed in different colors, according to the following table.

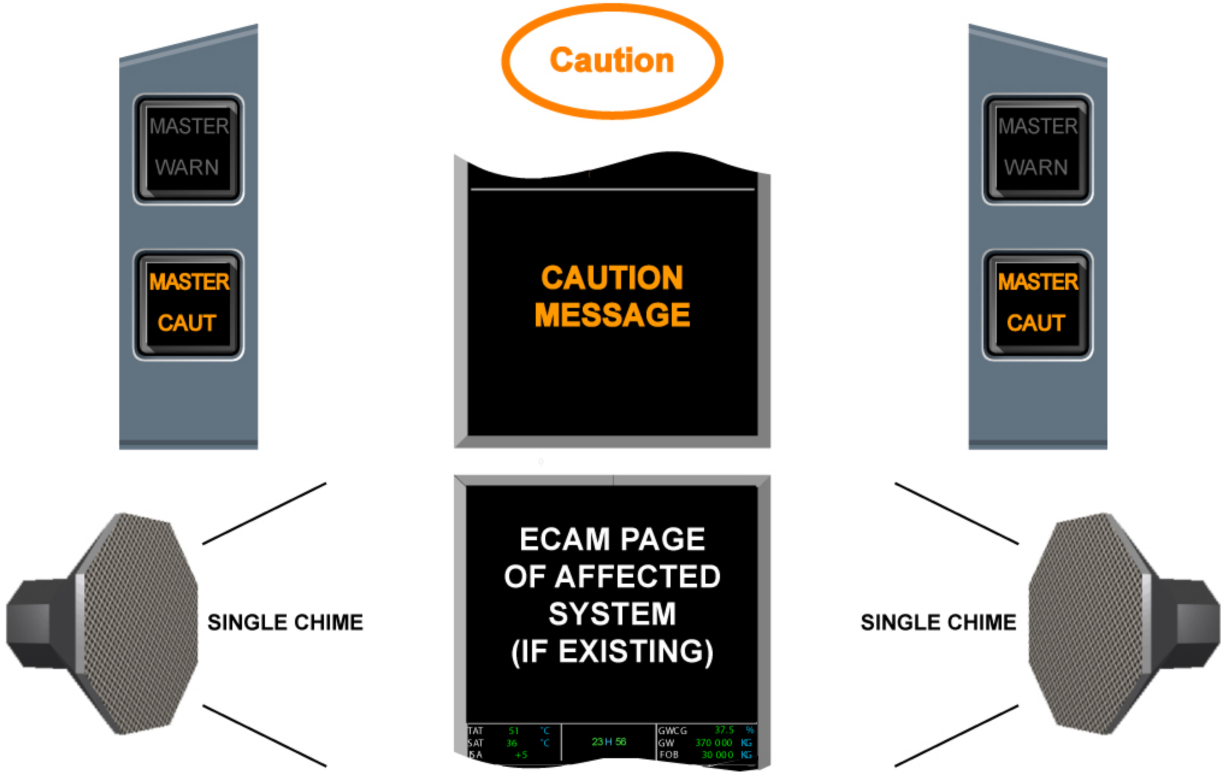
RED	For configurations or failures requiring immediate action.
AMBER	For configurations or failures requiring awareness but not immediate action.
GREEN	• Normal operations: memo • Information in procedure or on STATUS page • Items checked in a normal checklist.
WHITE	• Actions completed in a procedure • Conditional items • Title of a menu.
CYAN	• Actions to be done in procedure / Checklist item to be checked in checklist • Limitations • Title of an not completed normal checklist.
MAGENTA	For a specific memo (e.g. TO or LDG inhibition).
GRAY	• Items that are not valid/not active (e.g. actions subsequent to a condition that is not detected, and not validated) • Completed checklist items / Title of a completed normal checklist.

ECAM Alerts

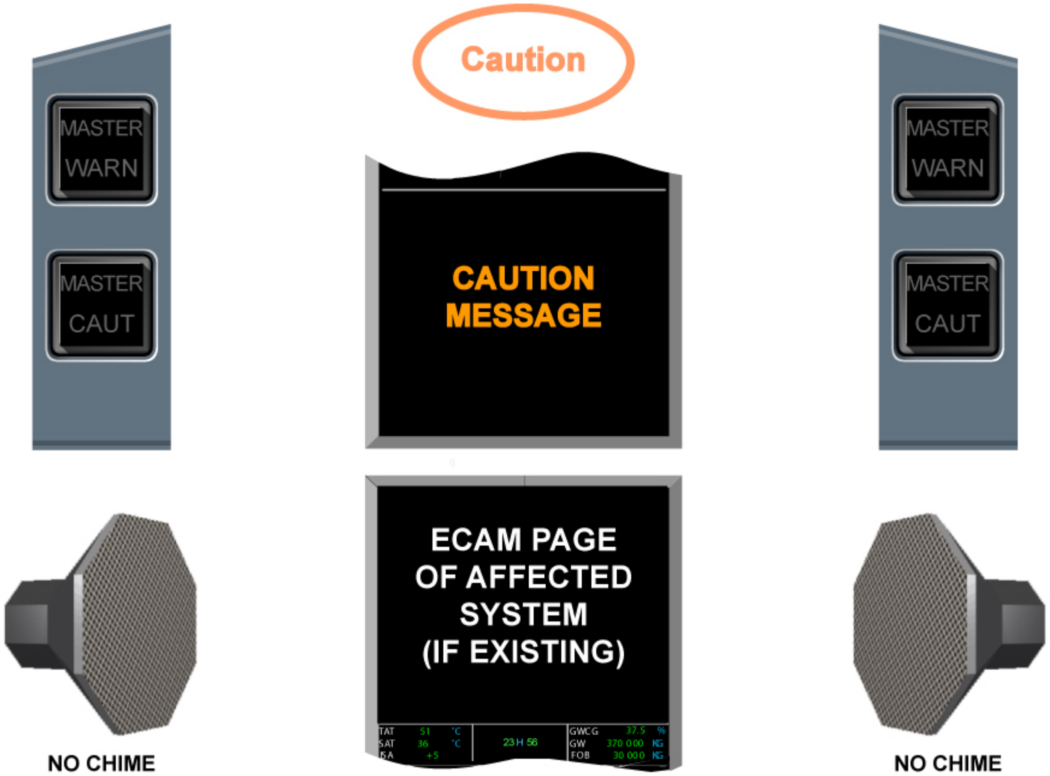
Alert Type	Description
Warning	For an emergency situation requiring immediate crew action: • The aircraft is in a dangerous configuration or in a limiting flight condition (e.g. engine on fire) • Failure of a system that impacts the safety of the flight (e.g. engine fire).



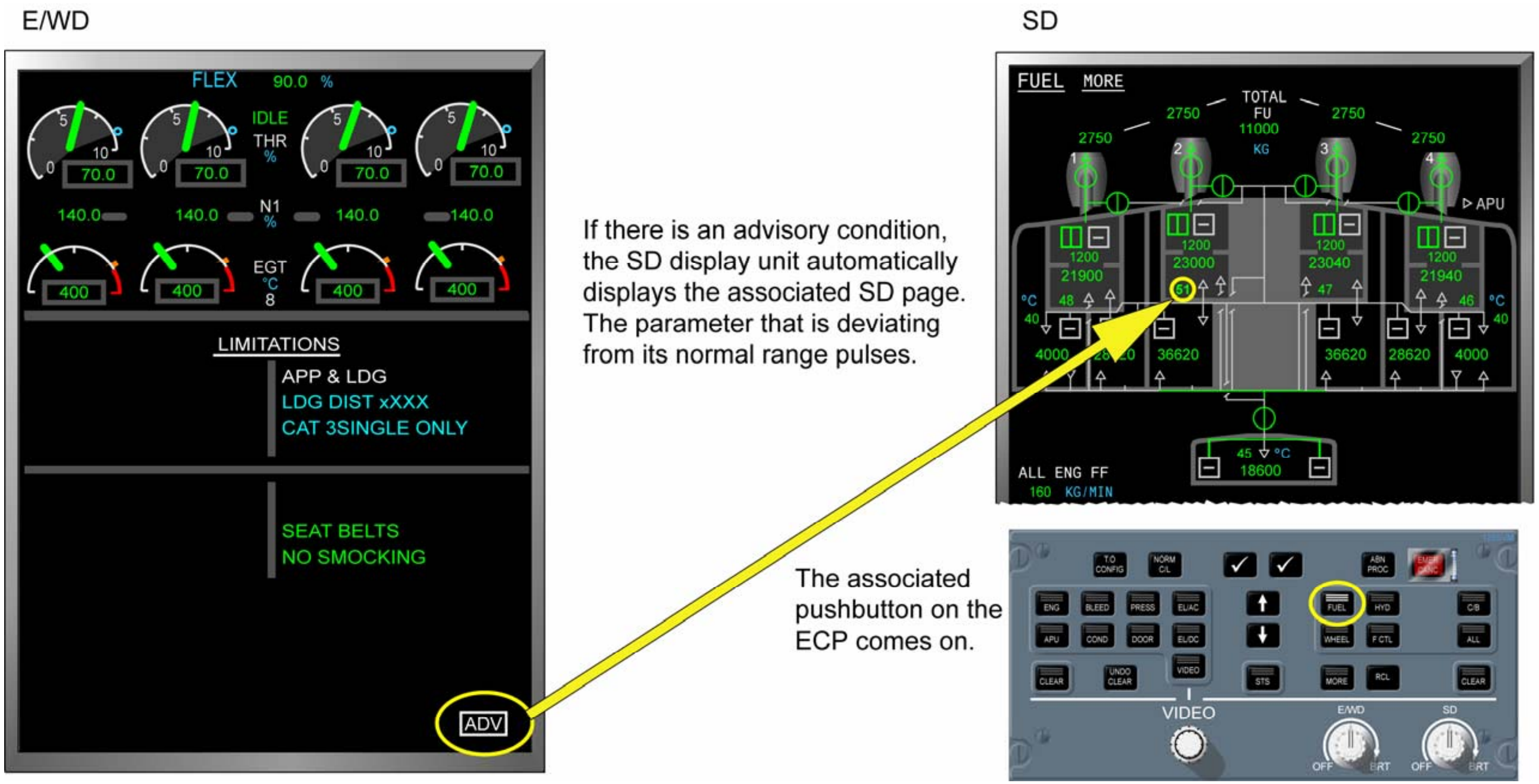
Alert Type	Description
Caution	For an abnormal situation requiring awareness but not immediate action: • Failure of a system that does not impact the safety of the flight. However, to prevent any further degradation of the affected system, a crew action is required whenever possible.



Alert Type	Description
Caution	For a situation that requires the crew to be informed (crew awareness) but does not require a crew action (e.g. redundancy loss or system degradation).



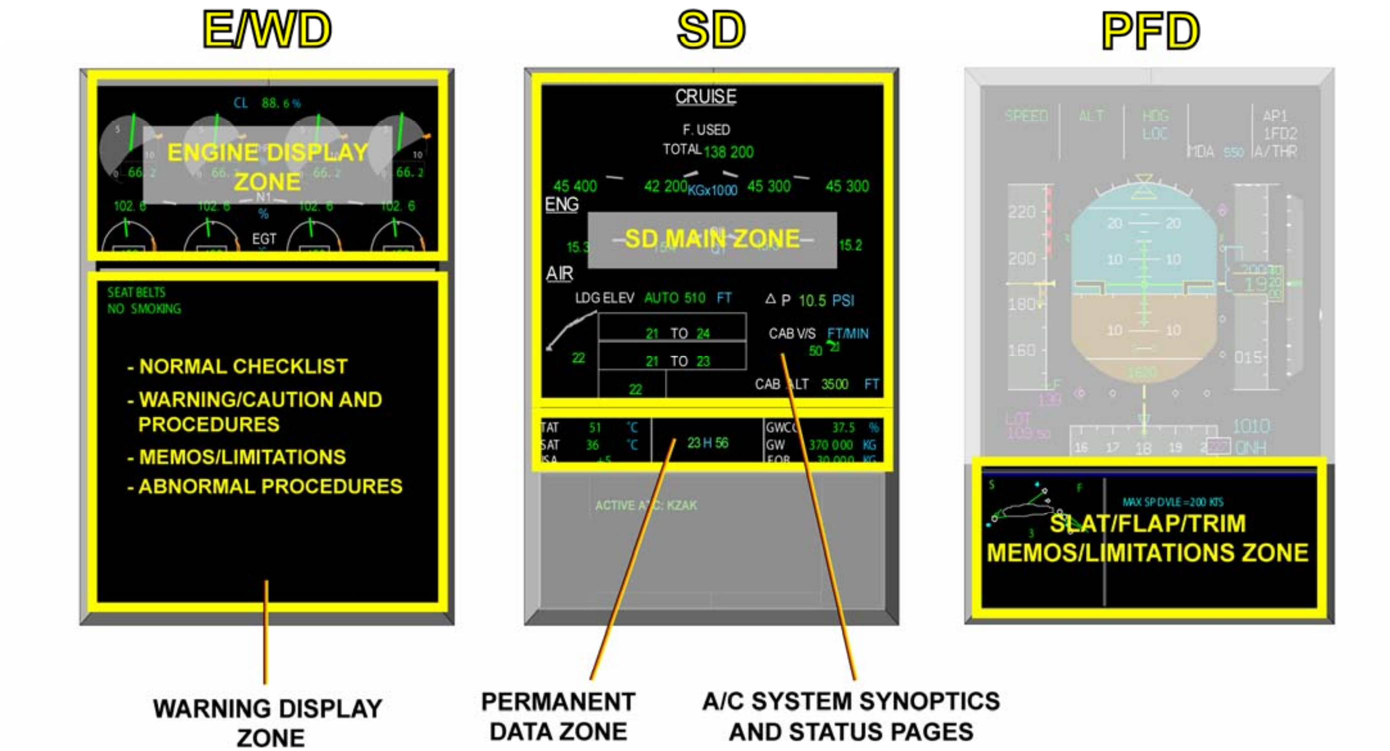
Alert Type	Description
Advisory	For a monitored parameter that is still in the normal operating range but is drifting away.



Controls and Indicators

Indicators

The ECAM information is displayed on three different displays (E/WD, SD and PFD).
Each display is divided into different sections or zones.



ND : Navigation Display PFD : Primary Flight Display	E/WD : Engine/Warning Display

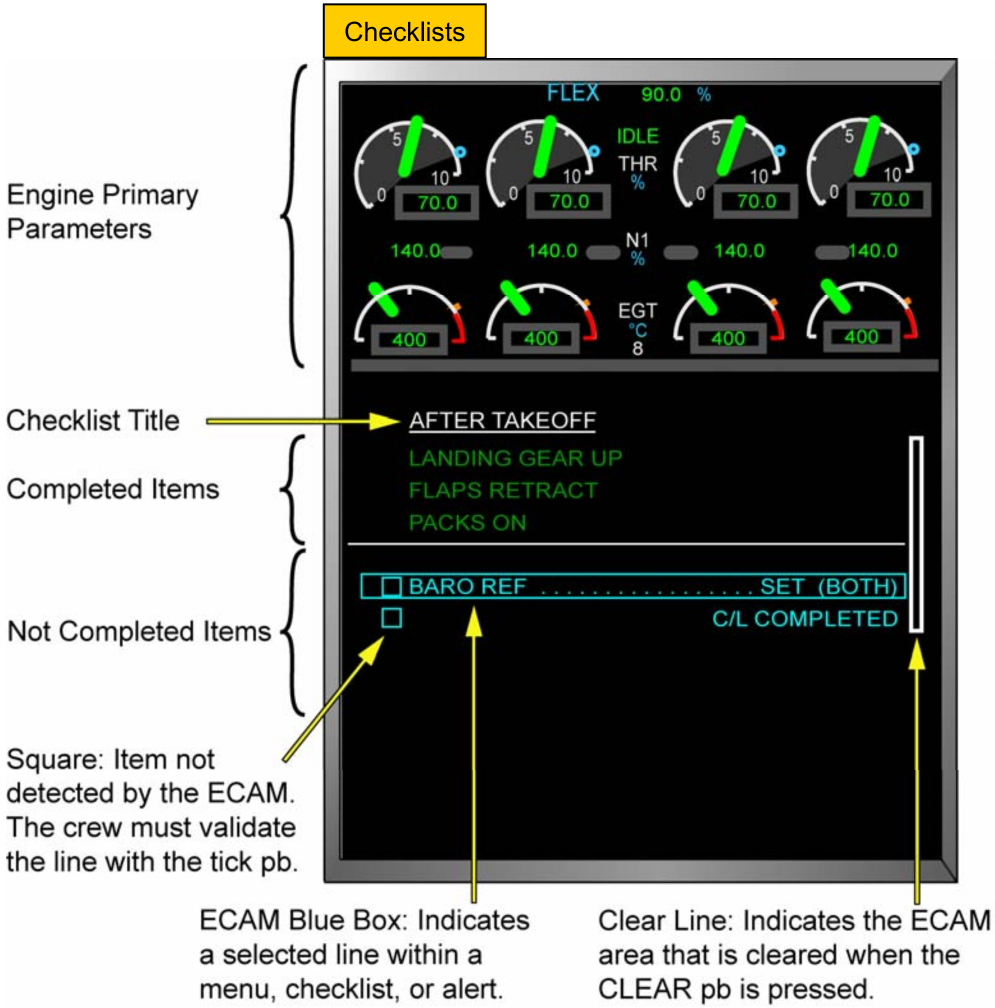
E/WD

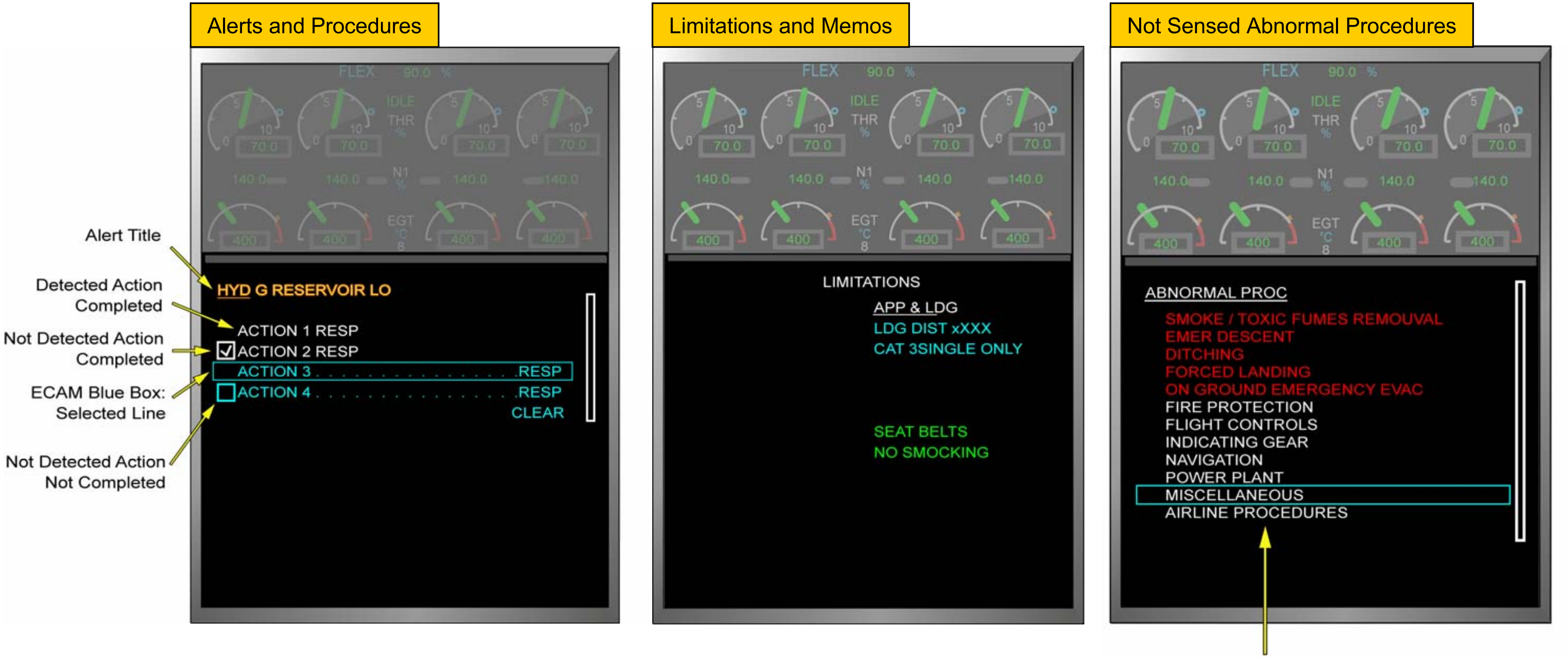
The E/WD display is divided into two sections:

- The top section (**Engine Display Zone**) displays the engine primary parameters (Refer to Engines).
- The bottom section (**Warning Display Zone**) displays either:

  In normal operations:
  - Checklist menus and items requested by the flight crew
  - All the memos.

  In abnormal operations:
  - Failure related procedures
  - Deferred procedures, also accessible through the normal checklist menu
  - Not sensed abnormal procedures and associated menus requested by the flight crew
  - All the limitations due to the failure
  - Advisory Indications, if a monitored parameter deviates from its defined operational range
  - Status indication, following an ECAM alert.





Not Sensed (Abnormal and Emergency) procedures: Specific procedures corresponding to system failures and some aircraft configurations, that the ECAM is not able to detect

SD

The SD display is divided into three sections:

- The top section (**SD Main Zone**) displays:
  In normal operations:
  - A system synoptic page (SD page) or the MORE INFORMATION page

  In abnormal operations:
  - The failure related system synoptic page
  - The STATUS page after the flight crew has cleared the procedure(s) on the E/WD. The STATUS page draws the flight crew's attention to limitations and deferred procedures and displays inoperative systems and general information.
- The center section (**Permanent Data Zone**) mainly displays temperature, time and aircraft weight data.
- The bottom section displays the **ATC Mailbox** (Refer to Information Systems).

SD CRUISE Page

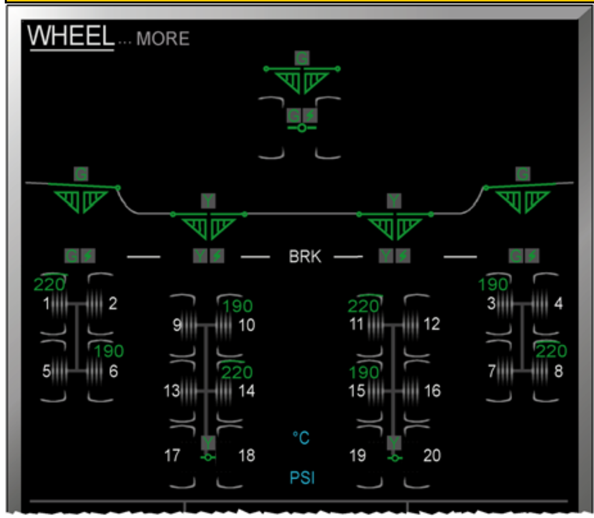
A380 Indicating/Recording Systems
6.Electronic Centralized Aircraft Monitoring (ECAM)

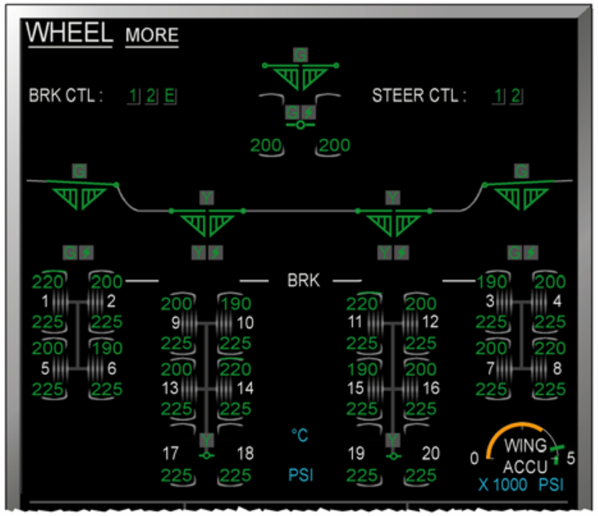
When MORE appears next to the STATUS title, or next to the system page title, it indicates that the MORE INFORMATION page is available. The MORE INFORMATION page provides information in addition to the STATUS page, or to a system synoptic page.

The different SD system synoptic pages are:

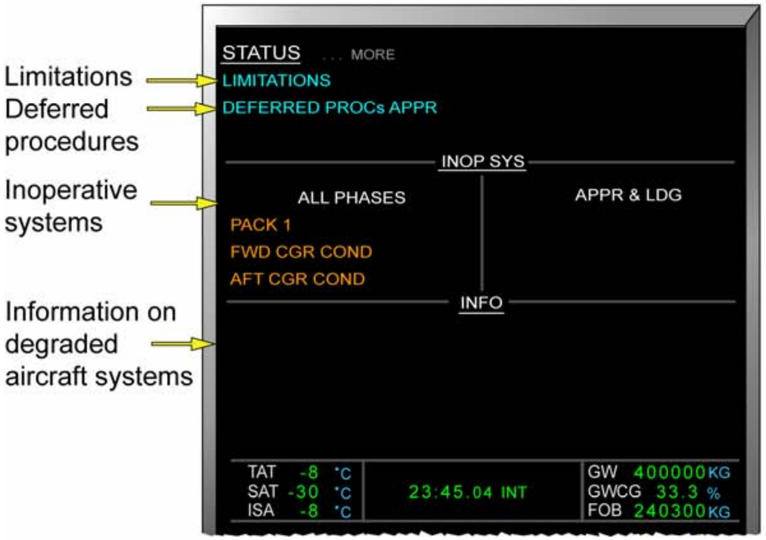
- APU (Auxiliary Power Unit)
- BLEED (Pneumatics)
- C/B (Circuit breakers)
- COND (Air conditioning)
- CRUISE (Cruise)
- DOOR/OXY (Doors/oxygen)
- ENGINE (Engine secondary parameters)
- ELEC DC (DC electrical power)
- ELEC AC (AC electrical power)
- F/CTL (Flight controls)
- FUEL (Fuel)
- HYD (Hydraulics)
- PRESS (Cabin pressurization)
- WHEEL (Landing gear, braking, ground spoilers, etc.)

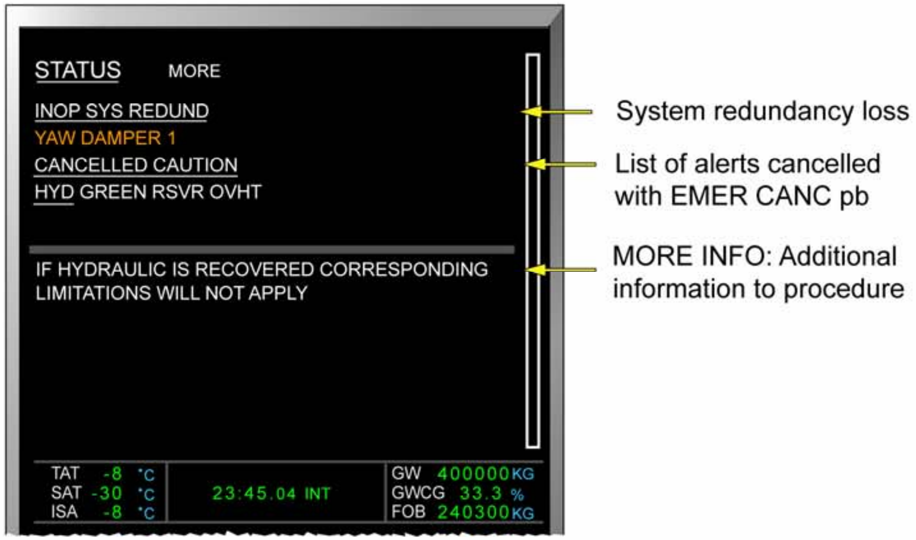
SD WHEEL Page and SD WHEEL MORE Page





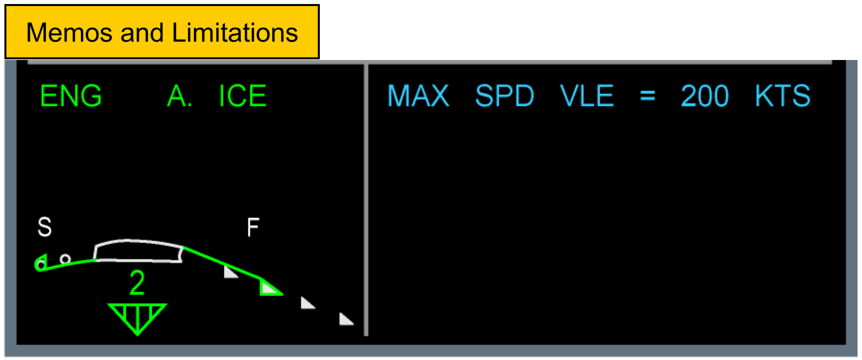
SD STATUS & STATUS MORE Pages





PFD

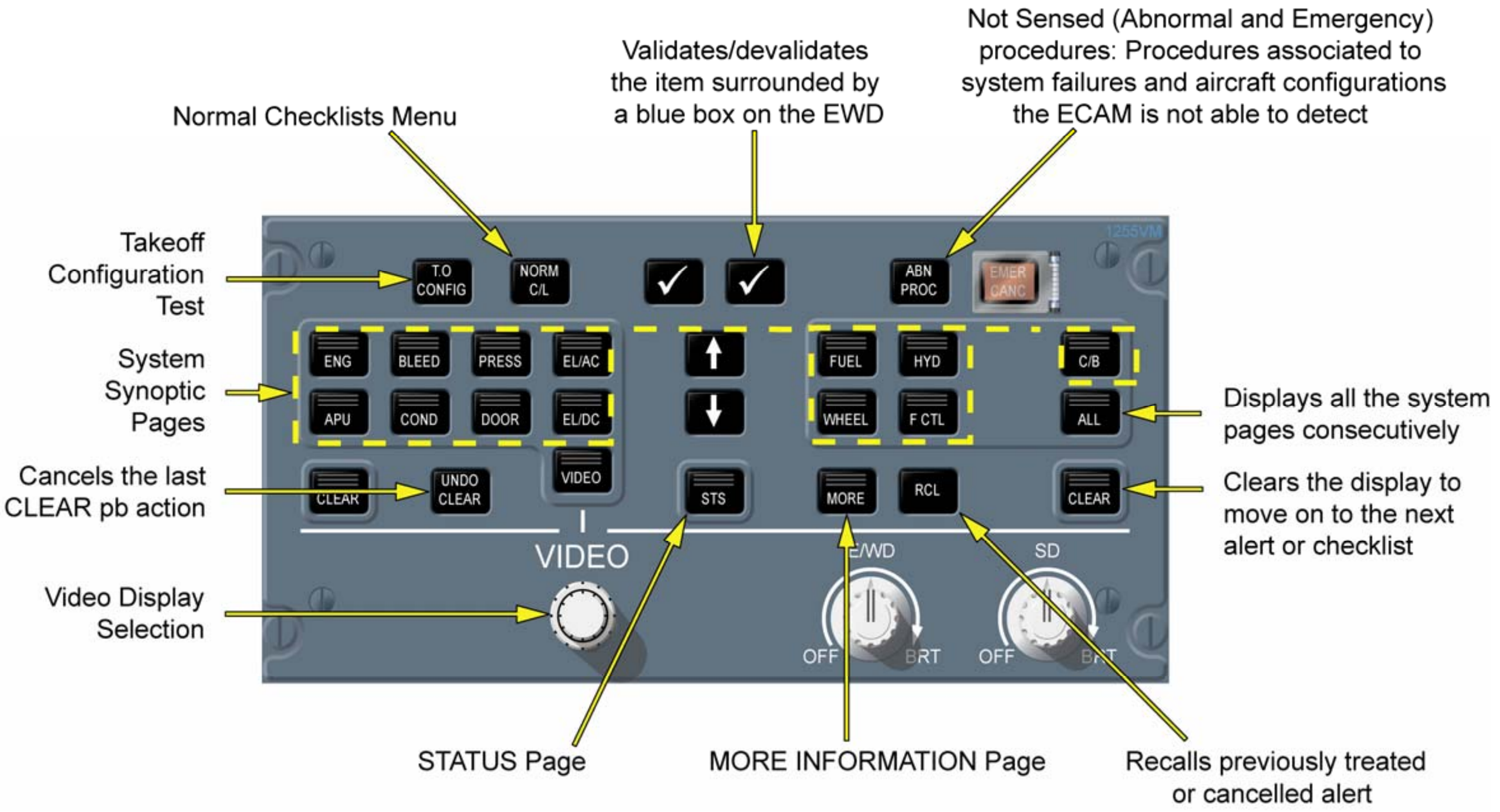
The lower section of the PFD (Slat/Flap/Trim/Memos/ Limitations Zone) displays, in addition to the E/WD, the memos and limitations that have a direct impact on the aircraft flight performance.



Controls

ECP

ECAM Glareshield Controls

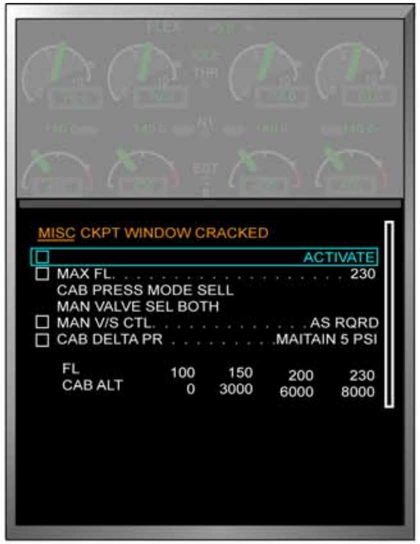


Example: Managing a Not Sensed Abnormal Procedure

The flight crew requests the not sensed (abnormal and emergency) procedures menu, with the ABN PROC pb on the ECP.

If the flight crew selects, the MISCELLANEOUS menu, a list with the miscellaneous procedures appears. The flight crew can change the procedure selection in the menu, with the following pushbuttons:

When the flight crew selects a procedure, by pressing the tick pb, it appears on the E/WD.



To validate the procedure, the flight crew presses the tick pb on the ECP, when the blue box is on the ACTIVATE line of the procedure.

When the procedure activates, the action lines of the procedure change from gray to the applicable color.

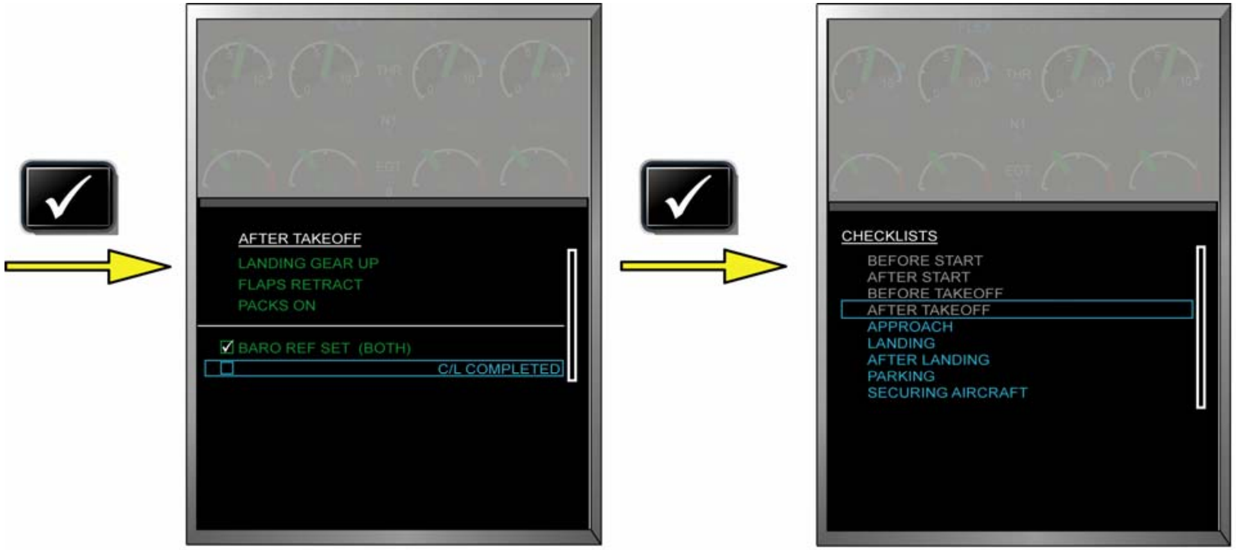
Example: Managing a Checklist

After a checklist is selected from the menu, it appears on the E/WD

The flight crew can display the checklist menu, by pressing the NORM C/L pb on the ECP

Completed checklist items, detected by the ECAM, appear in green. The flight crew must validate any undetected items with the tick pb .

A380 Indicating/Recording Systems
6.Electronic Centralized Aircraft Monitoring (ECAM)



C/L COMPLETED is the last line of the checklist. When the blue box reaches this line, and the flight crew validates it with the tick pb, the checklist is completed.

The checklist menu indicates that the checklist has been completed.

7.Concentrator and Multiplexer for Video (CMV)

The **Concentrator and Multiplexer for Video (CMV)** concentrates and multiplexes video signals coming from several aircraft video sources and transmits these for display to the CDS.

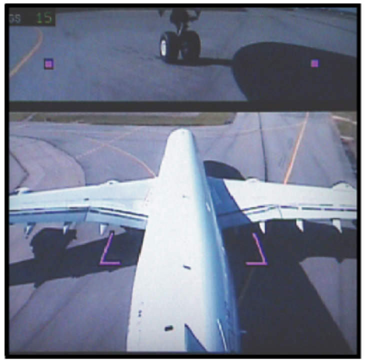
The different video sources are:

- The External and Taxiing Camera System (ETACS)
- Onboard Aircraft Navigation System (OANS). (Refer to Navigation)

and the optional:

- Cockpit Door Surveillance System (CDSS)
- Cabin Video Monitoring System (CVMS).

ETACS

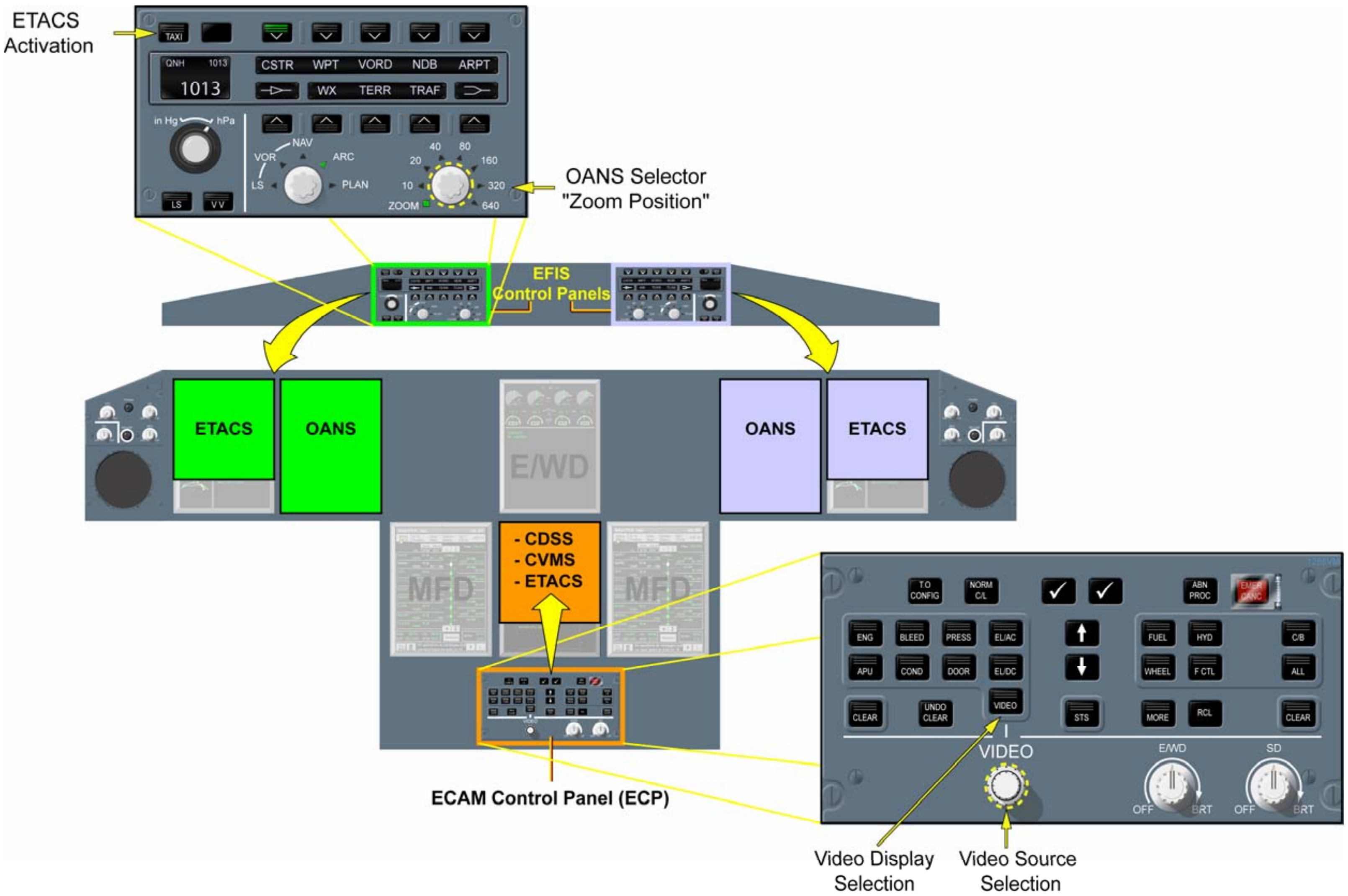


OANS

CVMS

CDSS

Displays and Control Panels Interactivity



A380 Indicating/Recording Systems
9.Head-up Display (HUD)

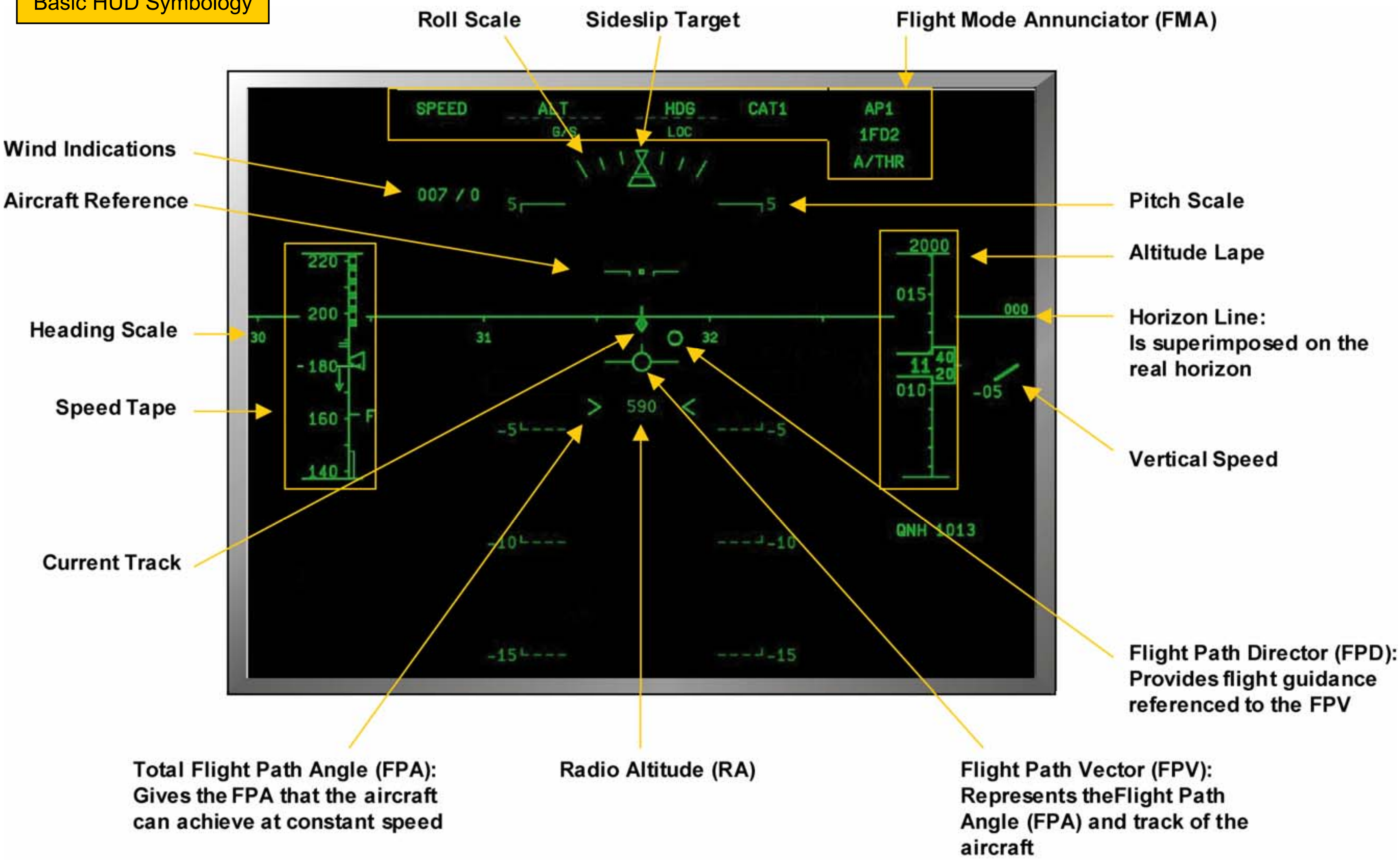
- The HUD (optional equipment) provides flight information that is superimposed on the pilot's external view. The flight information is displayed in conformity with the external scenery to provide an easy transition from instrumental to visual flight.

- The purpose of the HUD is to improve the situational awareness of the flight crew and to bring operational benefits such as:
  - For takeoff: RVR minima reductions down to 75m or 300ft
  - For Approach: Minima reductions to fly CAT II on TYPE I facilities with Class II ILS beam.

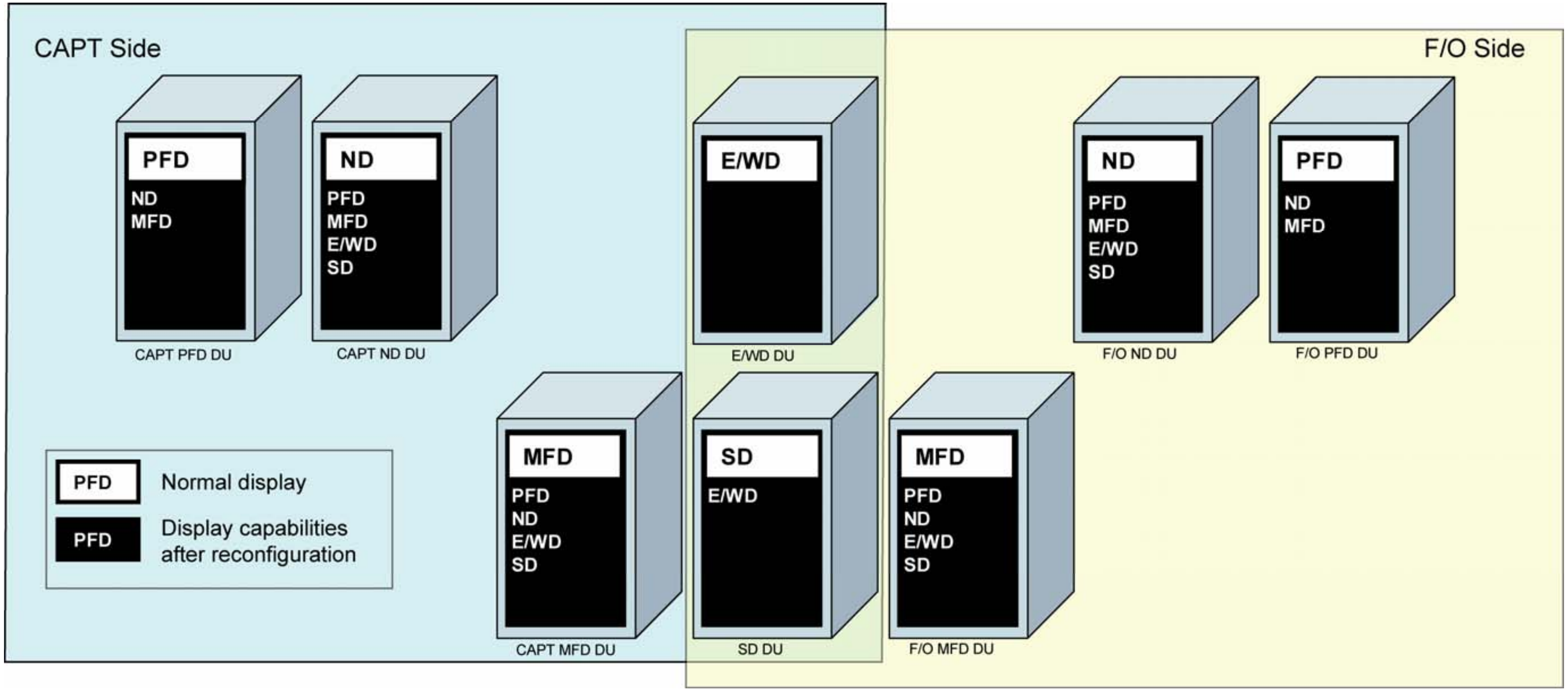
- The HUD has a specific display for each of the following flight phases, in order to help the pilot focus on pertinent data:
  - Taxi
  - Takeoff
  - Flight
  - Roll Out/Rejected Takeoff.

- The HUD has only two controls:
  - A brightness control to override the automatic brightness control
  - A de-clutter pushbutton to switch to a simplified display (less symbols).

Basic HUD Symbology

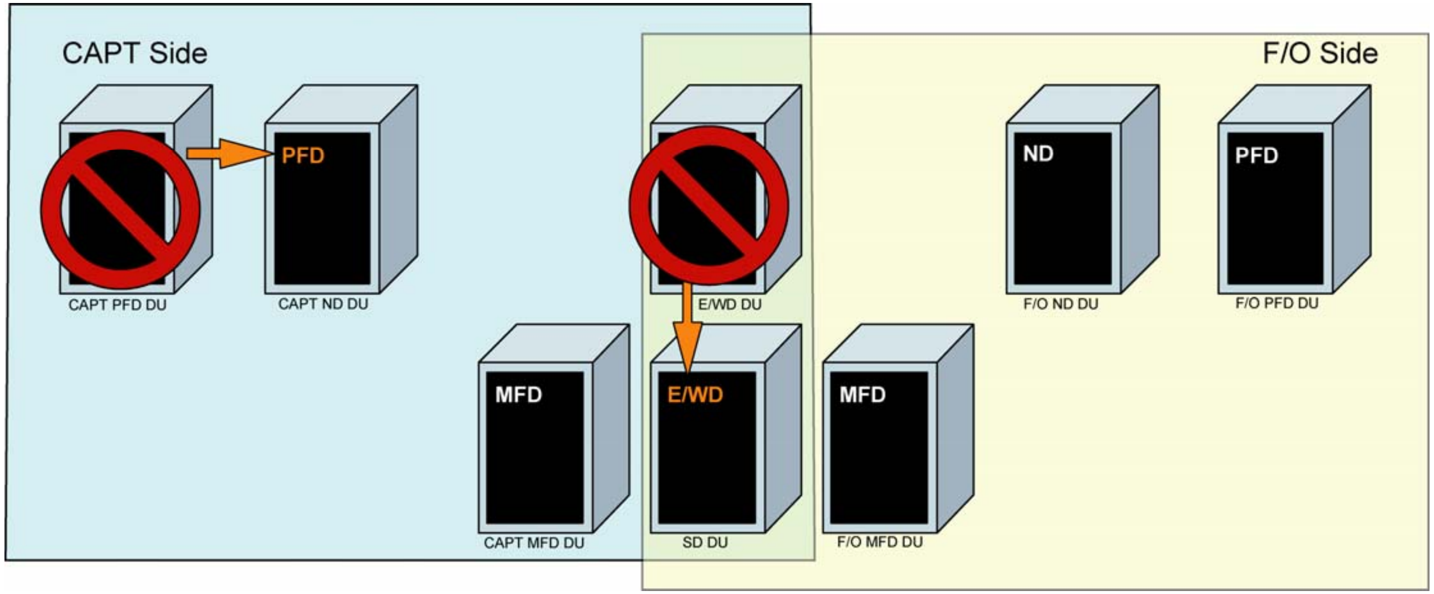


Display Capabilities



Reconfiguration Rules

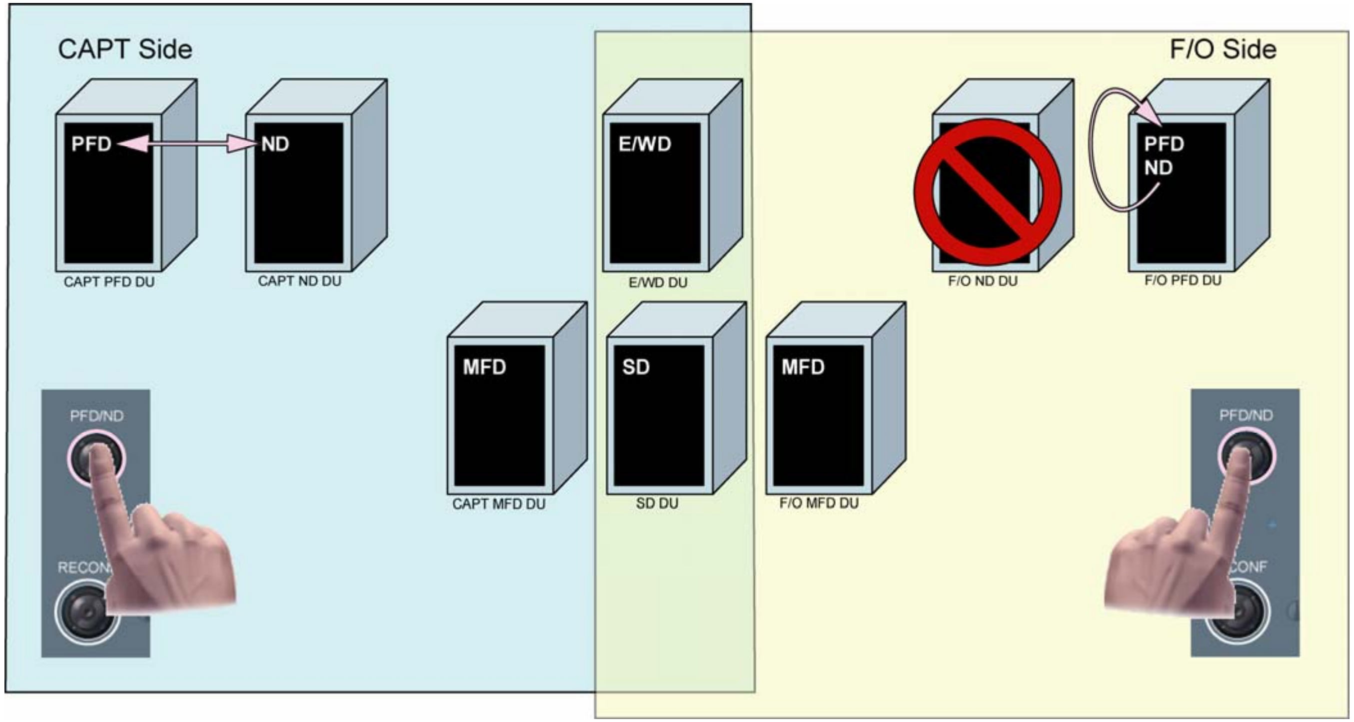
Auto-reconfigurations:



Manual Reconfigurations:

The RECONF panel controls the displays on the DUs, that are on the same side (e.g. the left RECONF panel controls the CAPT PFD DU, CAPT ND DU and the CAPT MFD DU).

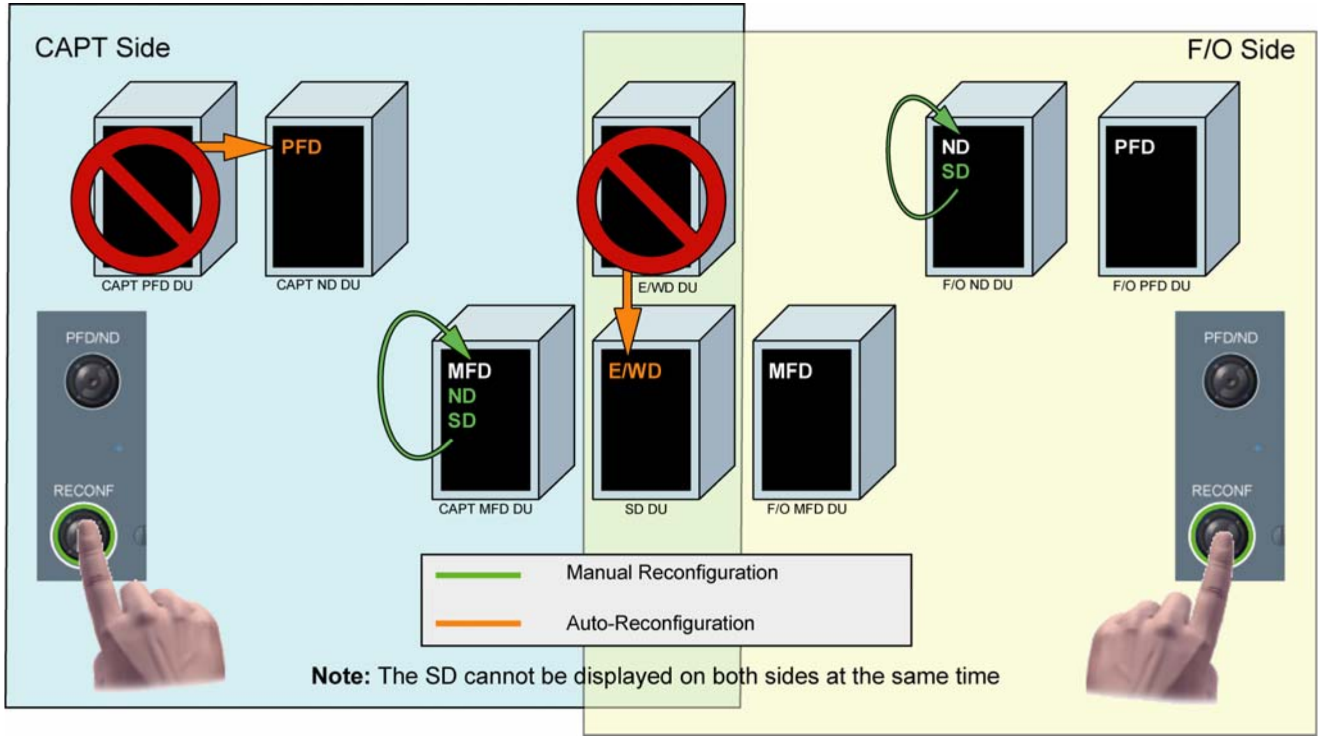
To swap between the ND and the PFD (at all times)



When a DU is lost, one of the remaining DUs on the same side is reconfigured to display the lost display.
This reconfiguration occurs on a specific DU, following priority rules:

- CAPT side: MFD DU > ND DU > PFD DU
- F/O side: ND DU > MFD DU > PFD DU

Each pilot cycles through the different displays on his side using his assigned RECONF pb.
The SD and E/WD format cannot be displayed on the Captain and the First Officer side at the same time.



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14. ATA 32 Landing Gear

Flight Deck and Systems Briefing for Pilots

1. **System Description**
   - General
   - Landing Gear Extension and Retraction System (LGERS)
   - Braking System
   - Steering System
2. **Controls and Indicators**

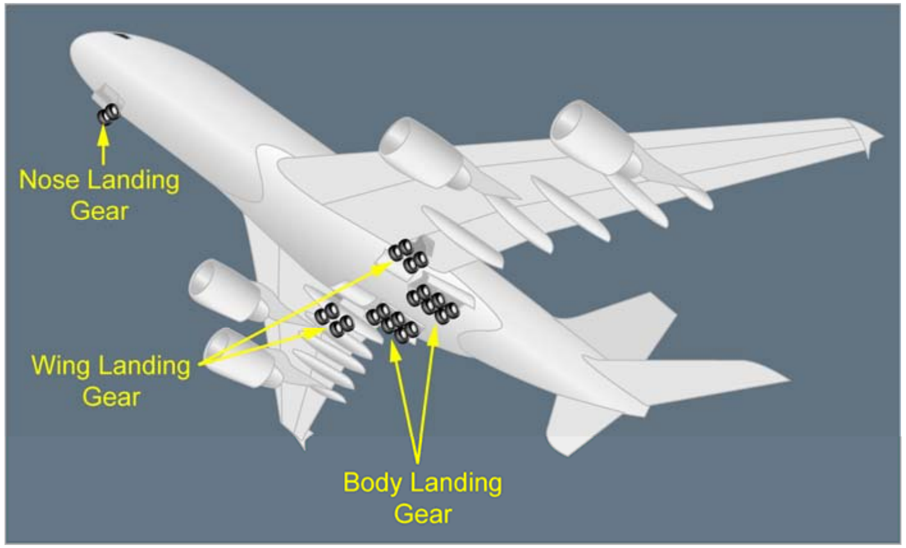
Contents

A380 Landing Gear
1.System Description

General

The A380 has:

- One Nose Landing Gear (NLG)
- Two Wing Landing Gears (WLG)
- Two Body Landing Gears (BLG).



The following systems are associated with the landing gear:

- The Landing Gear Extension and Retraction System (LGERS)
- The braking system
- The steering system.

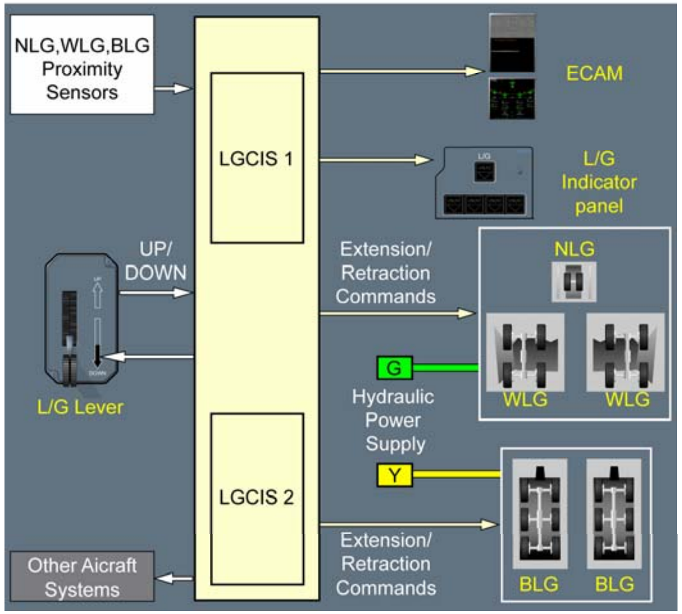
The following parameters are permanently monitored:

- Tire pressure
- Brake temperature
- Landing gear shock absorber pressure.

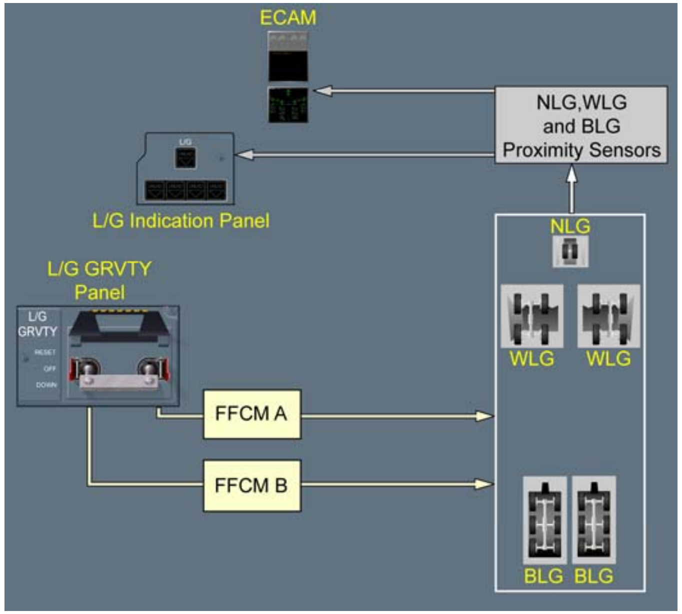
Landing Gear Extension and Retraction System (LGERS)

- **Normal Operation**
  The landing gear hydraulically extends and retracts. However, it is released from its up-lock position via electrical power:
  - The GREEN hydraulic system powers the NLG, WLG and associated doors
  - The YELLOW hydraulic system powers the BLG and associated doors.
    (Refer to Hydraulic System)

  Two redundant Landing Gear Control and Indicating Systems (LGCIS) monitor and electrically control the extension and retraction sequences.



- **Landing Gear Gravity Extension**
  If the normal extension and retraction system is not available, gravity-assisted landing gear extension can be performed using the independent freefall system. Two Free Fall Control Modules (FFCM) monitor and electrically control the extension sequence.



Braking System

The aircraft has 16 carbon brakes. There is:

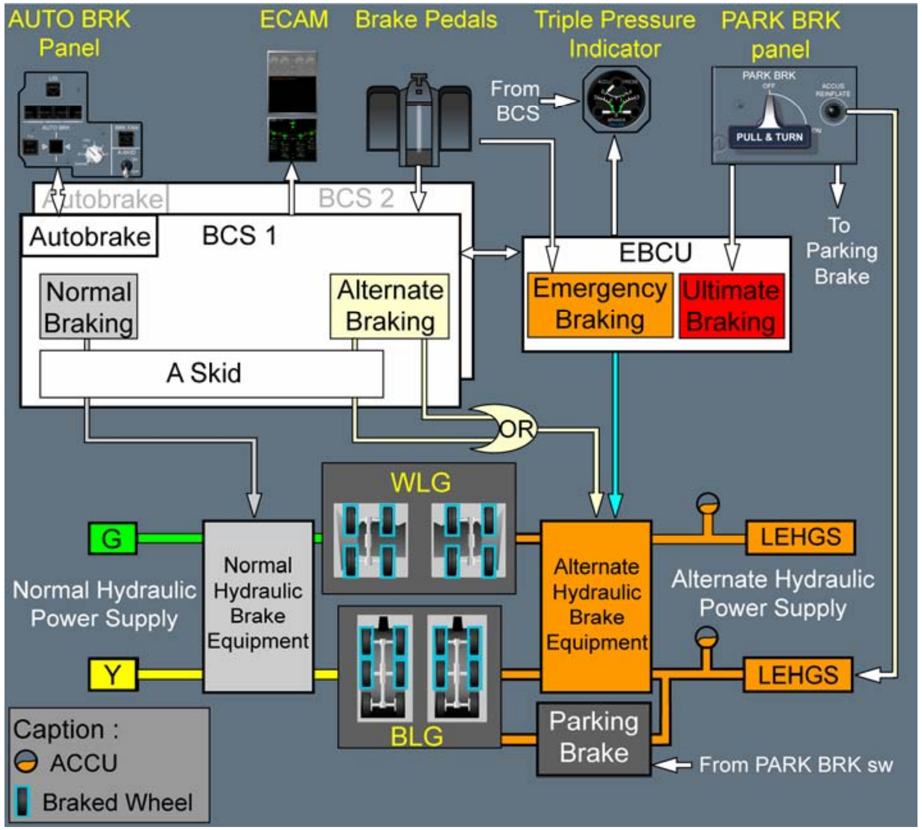
- One brake on each WLG wheel
- One brake on each of the four most forward wheels of each BLG.

The brakes can be applied either manually or automatically via the autobrake. The brakes on the BLG can also be applied, as a parking brake.

The braking system has 4 braking modes: Normal, Alternate, Emergency, and Ultimate.
If there is a braking system failure, the system will automatically reconfigure to the appropriate mode, in order to optimize braking performance.

The Normal and Alternate modes are controlled by the **Brake Control System** (**BCS**) with two redundant control systems.

The Emergency and Ultimate modes are controlled by the **Emergency Brake Control Unit (EBCU)**.



Braking System Reconfiguration

Braking Modes	Normal Braking	Alternate Braking (with antiskid)	Alternate Braking (without antiskid)	Emergency Braking	Ultimate Braking
Controller	BCS 1 (2)	BCS 1 (2)	BCS 1 (2)	EBCU	EBCU
Hydraulic Power Supply	• WLG: GREEN hydraulic system • BLG: YELLOW hydraulic system	LEHGS* and brake accumulators	LEHGS* and/or brake accumulators Note: If the LEHGS* is not available, the number of brake applications is limited.		
Pedal Braking	Yes	Yes	Yes	Yes	
Autobrake	Yes	Yes			
Antiskid	Yes	Yes			
Braking Performance	Normal	Normal	Degraded (limited brake pressure)	Degraded (limited brake pressure)	Degraded (limited brake pressure)
Comments			Brake pressure is automatically limited to avoid skidding.	Brake pressure is automatically limited to avoid skidding.	• Pedal braking is not available. PARK BRK handle is used to apply the parking brake on the BLG and a limited brake pressure on the WLG. • Brake pressure is automatically limited to avoid skidding.

* : **Local Electro-Hydraulic Generation System (LEHGS**): Independent hydraulic power source, that has an electrically-powered pump, a hydraulic reservoir, and an assigned control unit.

AIRBUS

Steering System

The steering system provides directional control of the aircraft on ground, and combines:

- Nose Wheel Steering (NWS)
- Body Wheel Steering (BWS).

The steering system has two redundant Steering Control Systems (SCS).

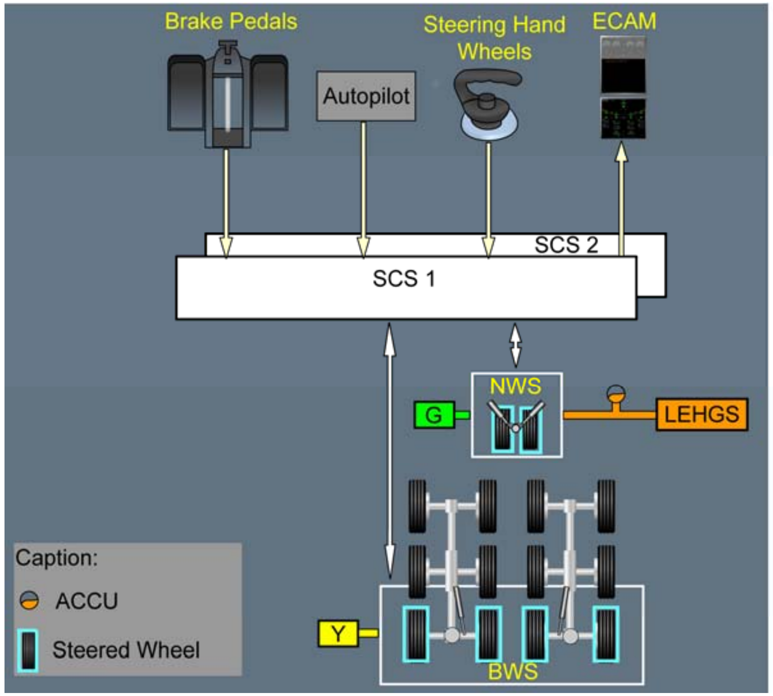
- **Nose Wheel Steering (NWS)**
  The NWS has two modes.
  - In Normal mode, the NWS is powered by the GREEN hydraulic system.
  - In Alternate mode, the NWS has degraded performance and is powered by its own LEHGS and NWS accumulator.

  The NWS angle depends on the aircraft speed and:
  - The position of the steering handwheel that is used by the flight crew, or
  - The deflection of the rudder pedals, or
  - The autopilot orders.

  NWS is not available when the engines are shut down.

- **Body Wheel Steering (BWS)**
  The BWS is powered by the YELLOW hydraulic circuit. The BWS angle depends on the current NWS angle and is inhibited at ground speeds above 30kt.

  BWS is available only during taxi, pushback and towing (if power is applied to the aircraft), and controls the rear axle of the BLG.



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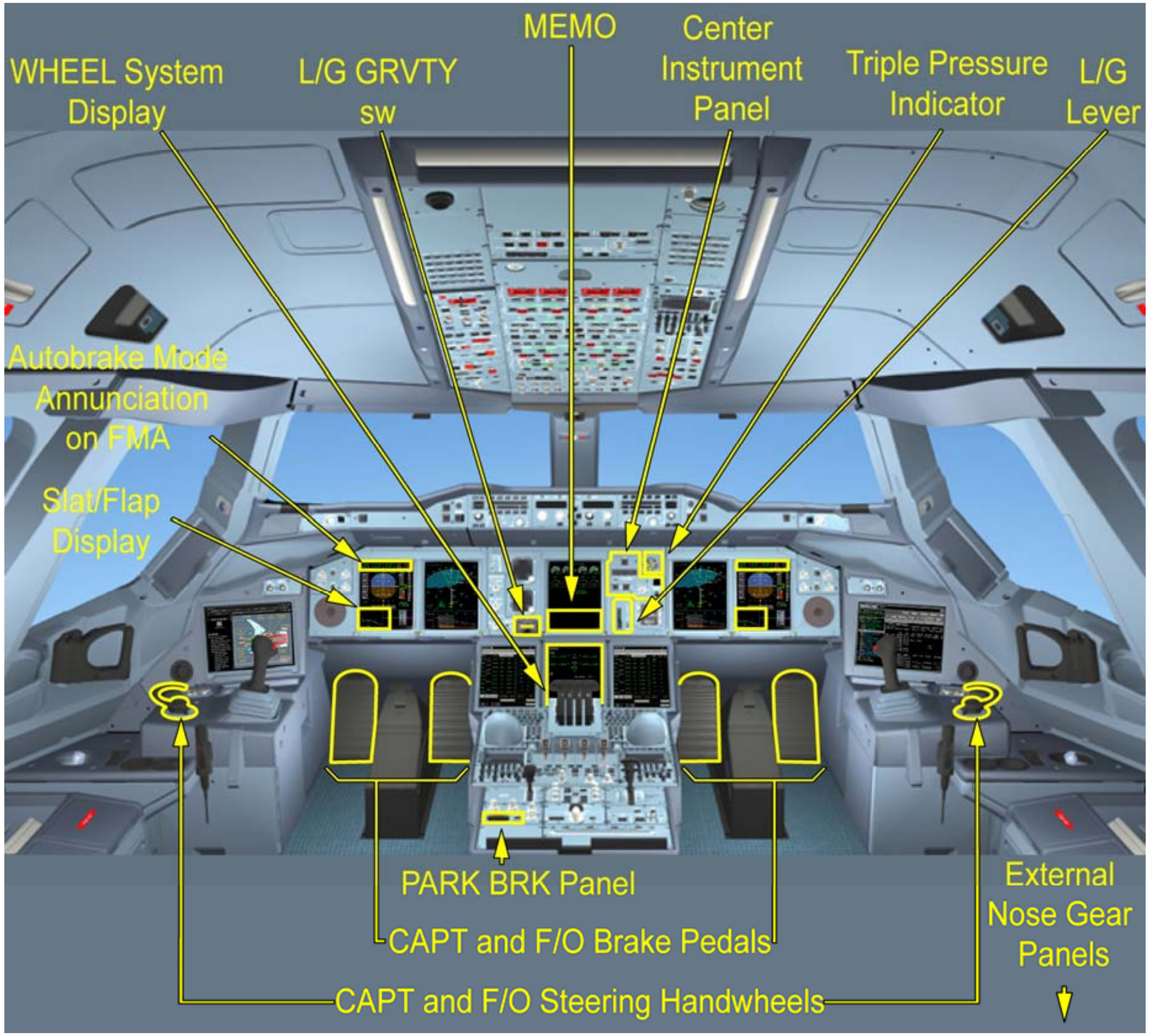
A380 Landing Gear
2.Controls and Indicators



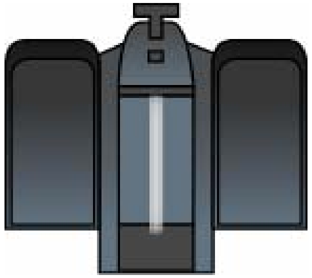
A380 Landing Gear
2.Controls and Indicators

Steering Handwheel

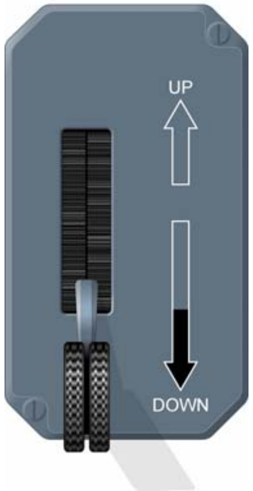
Center Instrument Panel **Triple Pressure Indicator**

L/G GRVTY sw

Brake Pedals



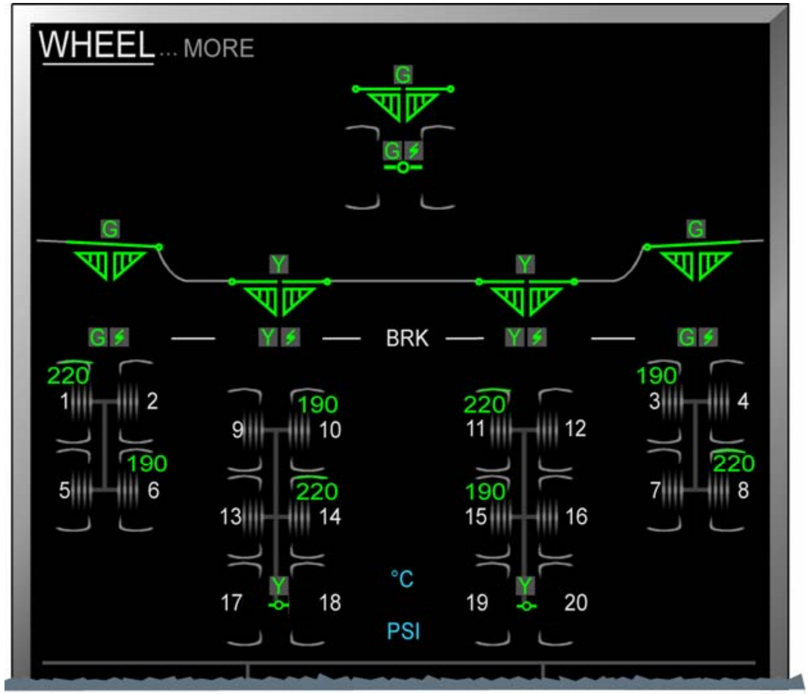
L/G Lever



PARK BRK Panel

Autobrake Mode Annunciation on FMA

ECAM SD WHEEL Page



Slat/Flap Display on the PFD

15. ATA 34 Navigation

Flight Deck and Systems Briefing for Pilots

Contents

AIRBUS

The navigation system is composed of:

- Navigation sources for aircraft position computation:
  - The **Air Data and Inertial Reference System (ADIRS)**
  - Navigation sensors:
    - **Multi-Mode Receiver (MMR)**
    - Radio NAVAIDS
    - Radio Altimeters (RAs).
- A backup navigation system: The **Integrated Standby Instrument System (ISIS)**
- Systems that provide assistance to the flight crew in various domains:
  - The **SURVeillance (SURV)** that alerts the flight crew for all types of existing hazards within the aircraft environment
  - The **Onboard Airport Navigation System (OANS)** that helps the flight crew for navigation on airports.

System Description

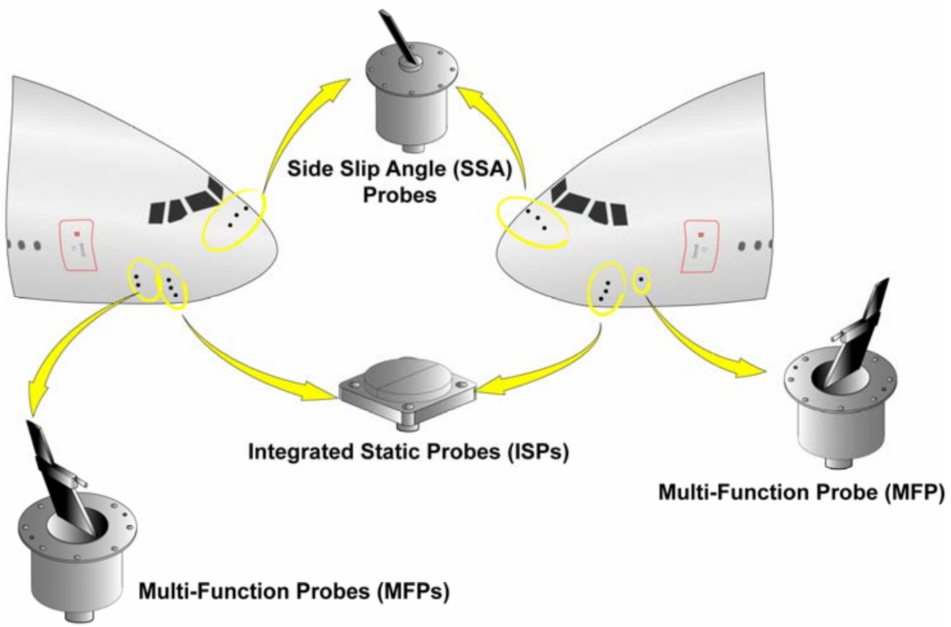
The **Air Data and Inertial Reference System (ADIRS)** is the aircraft navigation center. It provides air data and inertial reference parameters to different aircraft systems (including the Flight Controls and the FMS) and to the Control and Display System (CDS) (**Refer to Auto Flight System and Indicating/Recording Systems**).

The ADIRS is composed of three Air Data and Inertial Reference Units (ADIRUs).

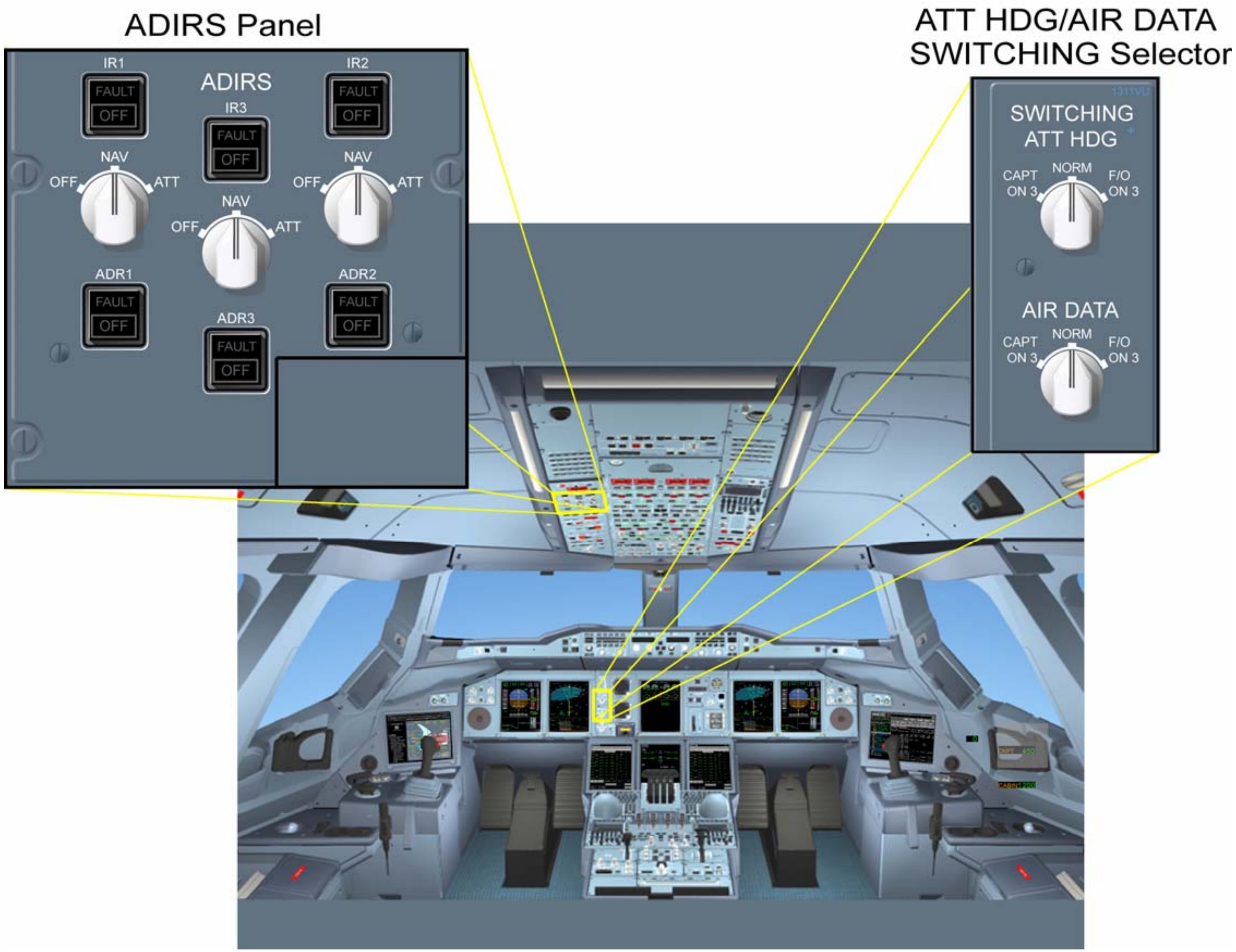
- The Air Data (AD) section computes primary air data parameters using data from different probes installed on the aircraft fuselage:
  - One Multi-Function Probe (MFP) per ADIRU provides total pressure (Pt), Total Air Temperature (TAT) and Angle-of-Attack (AOA) measurements
  - One Side Slip Angle (SSA) probe per ADIRU provides the sideslip angle
  - Two Integrated Static Probes (ISPs) per ADIRU provide the static pressure (Ps).

- The Inertial Reference (IR) section computes primary inertial reference information using data from its internal accelerometers and gyros.
  In normal operation, the IR part is automatically aligned using the GPS position.

Air Data Probes



Controls



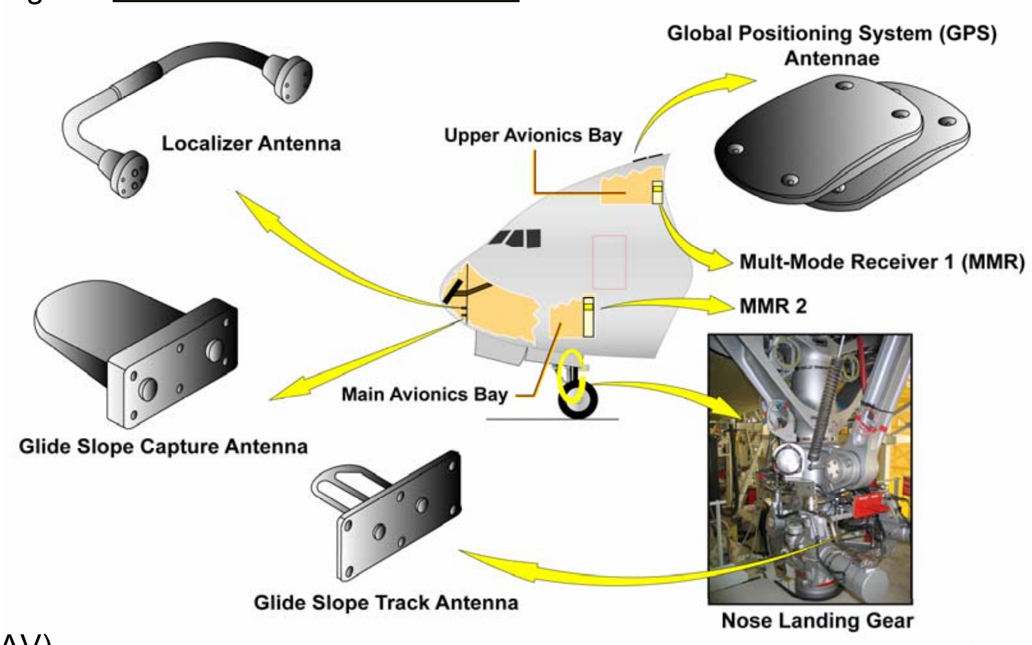
ADIRS Panel
IR1
FAULT
OFF
ADIRS
IR3
FAULT
OFF
IR2
FAULT
OFF
NAV
OFF
ATT
ADR1
FAULT
OFF
ADR3
FAULT
OFF
ADR2
FAULT
OFF
ATT HDG/AIR DATA
SWITCHING Selector
SWITCHING
ATT HDG
CAPT ON 3
NORM
F/O ON 3
AIR DATA
CAPT ON 3
NORM
F/O ON 3

System Description

The main function of the **Multi-Mode Receiver (MMR)** system is to give flight path guidance to the aircraft during the final approach and landing phases of navigation.

The MMR system is composed of:
- Two MMR receivers
- Two active GPS antennae
- One localizer antenna
- One glide slope track antenna
- One glide slope capture antenna.

Multi-Mode Receiver Antennae



The MMR includes the following functions:
- The Instrument Landing System (ILS) function
- The FMS Landing System (FLS) function
- The Global Positioning System (GPS) function
- The Mix Localizer/Vertical Navigation (MIX LOC/VNAV) function
- The GPS Landing System (GLS) function (optional).

General

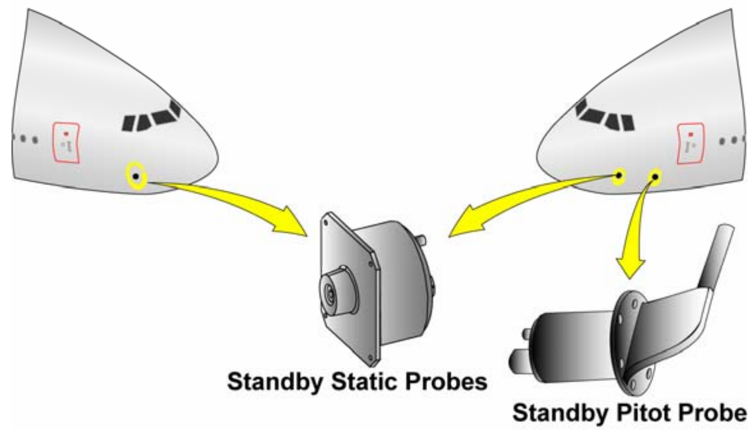
The **Integrated Standby Instrument System (ISIS)** provides backup flight and navigation displays in the case of an ADIRS, FMS or CDS failure.

The ISIS is composed of:

- Two independent ISIS units, the **Standby Flight Display (SFD)** unit and **Standby Navigation Display (SND)** unit
- One standby pitot probe (Pt)
- Two standby static probes (Ps)
- Internal gyros (attitude).

In addition to the ISIS, there is one standby compass that provides the magnetic heading.

ISIS Probes



System Description

The ISIS has two independent ISIS units, the **Standby Flight Display (SFD)** unit and the **Standby Navigation Display (SND) unit.**
In normal configuration:

- The SFD unit computes and displays air data and inertial reference parameters (SFD)
- The SND unit computes and displays navigation and flight plan information (SND).

Each unit can perform all the ISIS functions.

Controls and Indicators

The SFD provides:

- Pitch and roll attitude
- Side slip
- ILS display
- Computed airspeed
- Lateral acceleration indication
- Altitude
- Speed and altitude bugs
- Mach number.

The SND provides:

- Backup navigation aids (NAVAIDS)
- Capability to manually insert geographical waypoints
- GPS position.

General

The purpose of the **SURVeillance (SURV)** is to regroup all the aircraft surveillance functions into one system with one integrated control panel.

The SURV provides:

- The **Terrain Awareness and Warning System (TAWS)** function for terrain proximity hazards
- The **Weather Radar (WXR)** with Predictive Windshear (PWS) and Turbulence (TURB) detection functions for atmospheric disturbance hazards
- The **Traffic Collision Avoidance System (TCAS)** surveillance function for airborne collision hazards and a transponder (XPDR) function.

Architecture

The SURV has two surveillance systems (SYS 1 and SYS 2).

Each SYS can perform all the aircraft environmental surveillance functions, that are grouped in pairs:

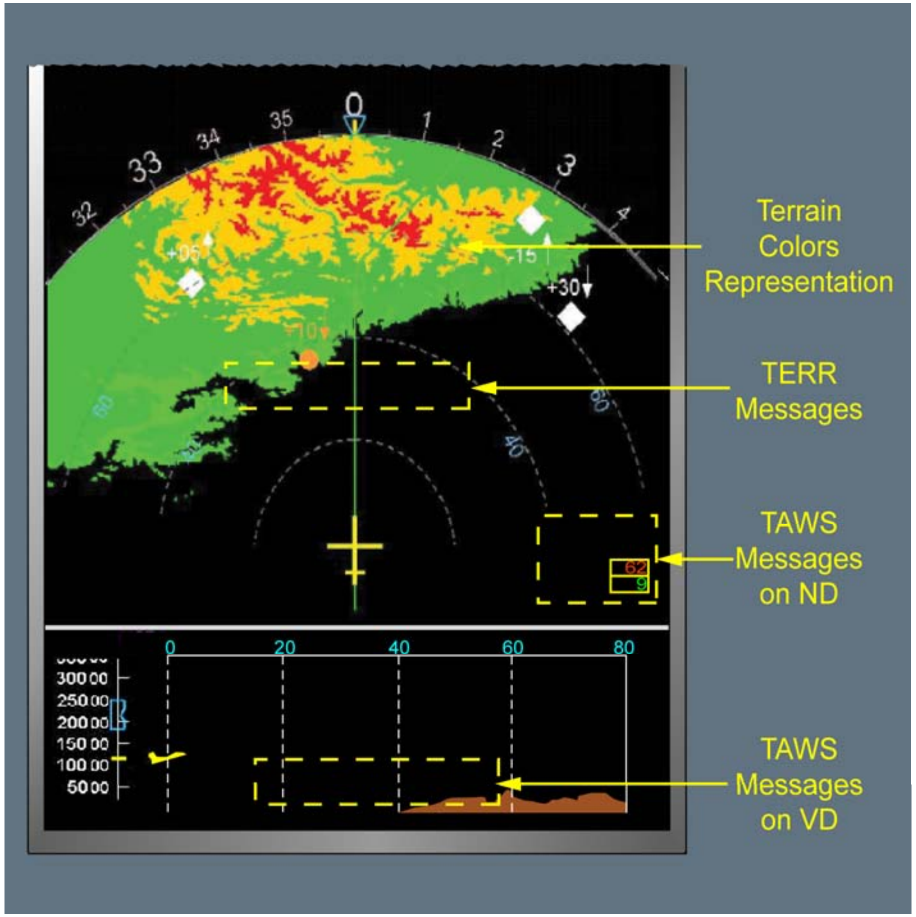
- The WXR/TAWS
- The TCAS/XPDR.

Traffic Awareness and Warning System (TAWS)

The TAWS includes a Ground Proximity Warning System (GPWS) with five modes.

In addition, the TAWS has the following functions, based on a worldwide terrain database:

- The Terrain/obstacle Awareness and Display (TAD), that computes a caution envelope and a warning envelope ahead of the aircraft
- The Terrain Clearance Floor (TCF), that complements the GPWS Mode 4 by providing alerts based on insufficient terrain clearance even when in landing configuration.

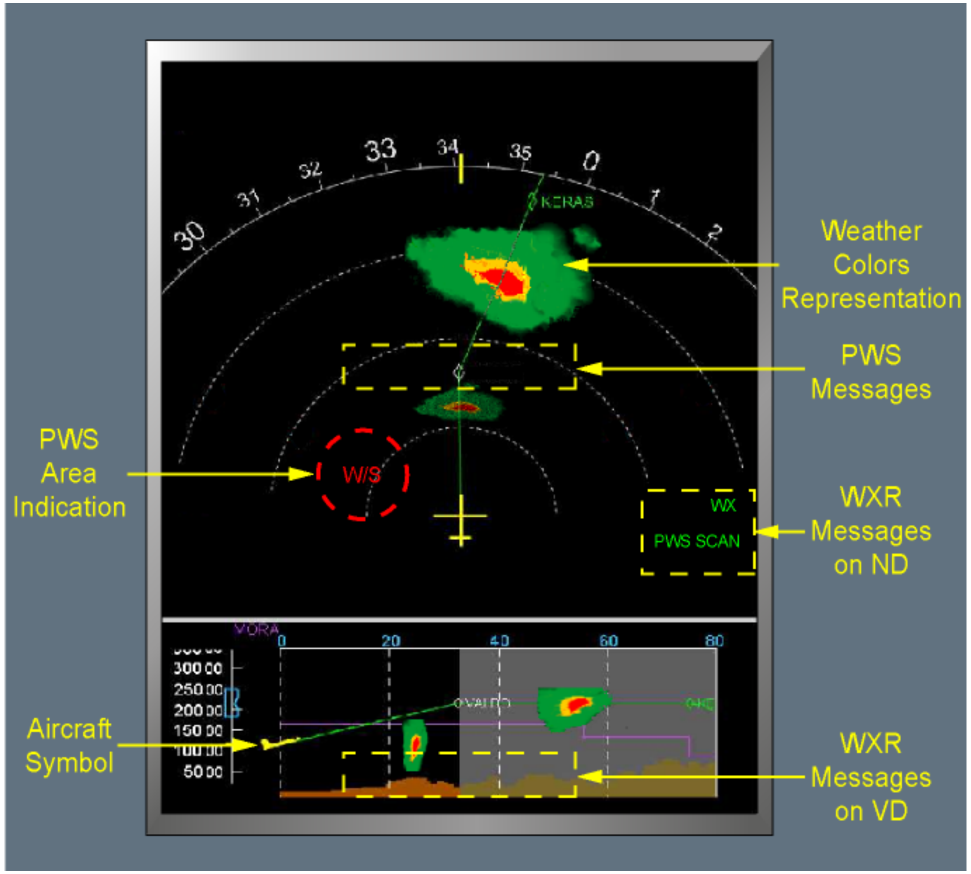


Weather Radar (WXR)

The weather radar includes Predictive Windshear (PWS) and Turbulence (TURB) detection.

The weather radar continuously scans a volume of space within proximity of the aircraft and stores this 3D weather information in a database.
The system uses this database to display weather images from different points of view.

- In automatic selection, the weather is displayed on the ND and VD, along the FMS flight plan and the ADIRS vertical flight path angle.
- In manual selection:
  - The ND displays weather information according to the selected
    - Tilt angle, or
    - Elevation (height above or below the aircraft).
  - The VD displays weather information depending on the selected azimuth value.

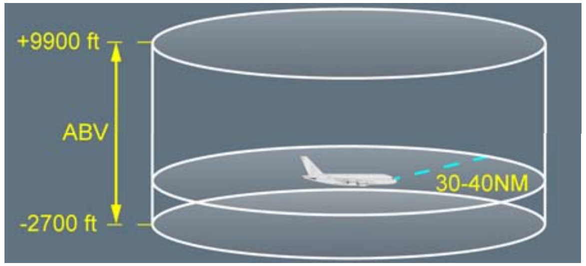


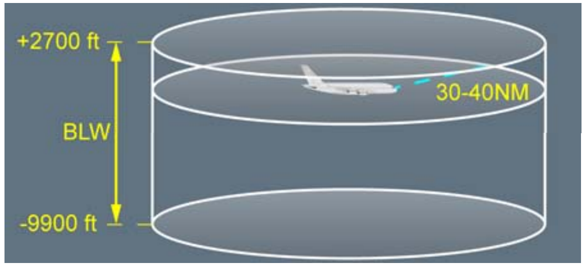
Traffic Collision Avoidance System (TCAS)

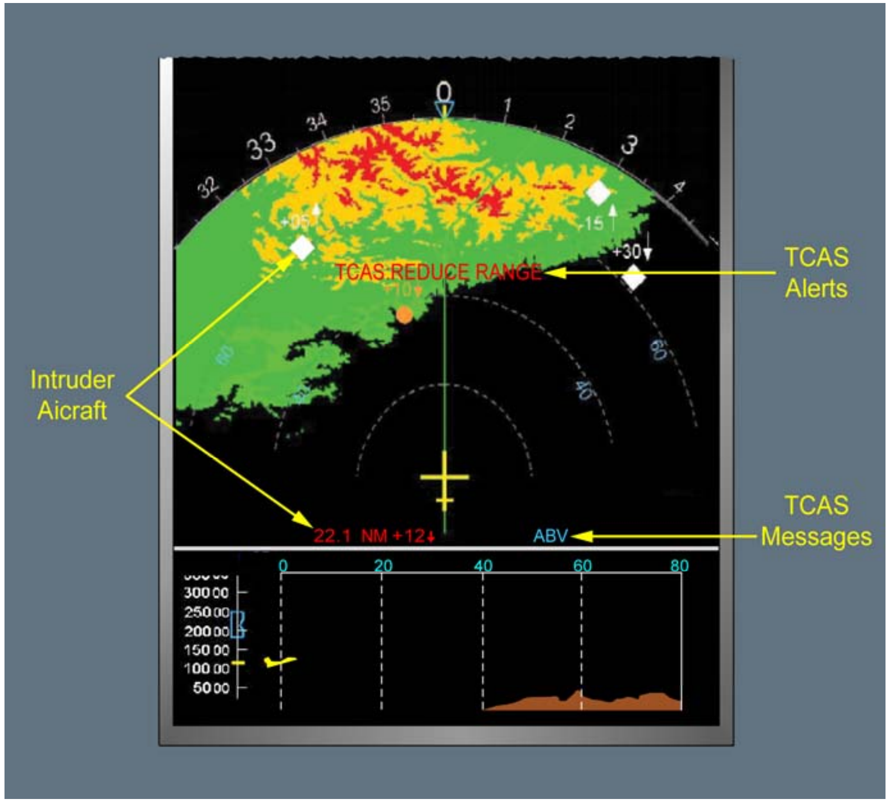
The TCAS detects and displays surrounding aircraft that have a transponder.
It calculates potential collision threats and generates associated advisories.

The TCAS displays on the ND, traffic that is within a volume of space around the aircraft:

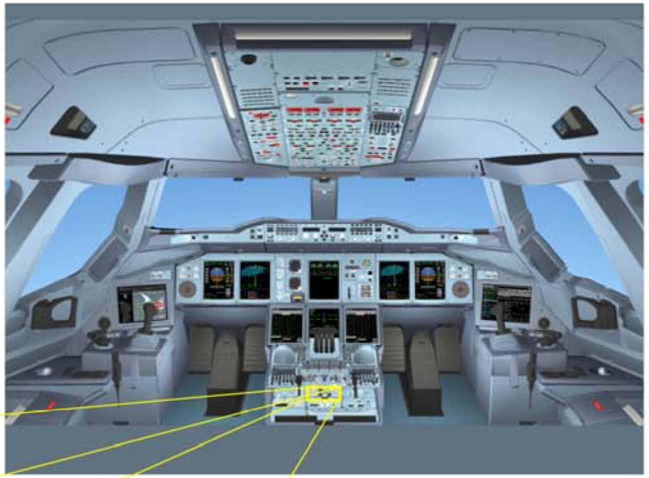
- In automatic selection, the upper and lower boundaries of this volume are automatically adjusted to display all the intruders along the flight path
- In manual selection, the flight crew can choose between two displays: ABV or BLW.



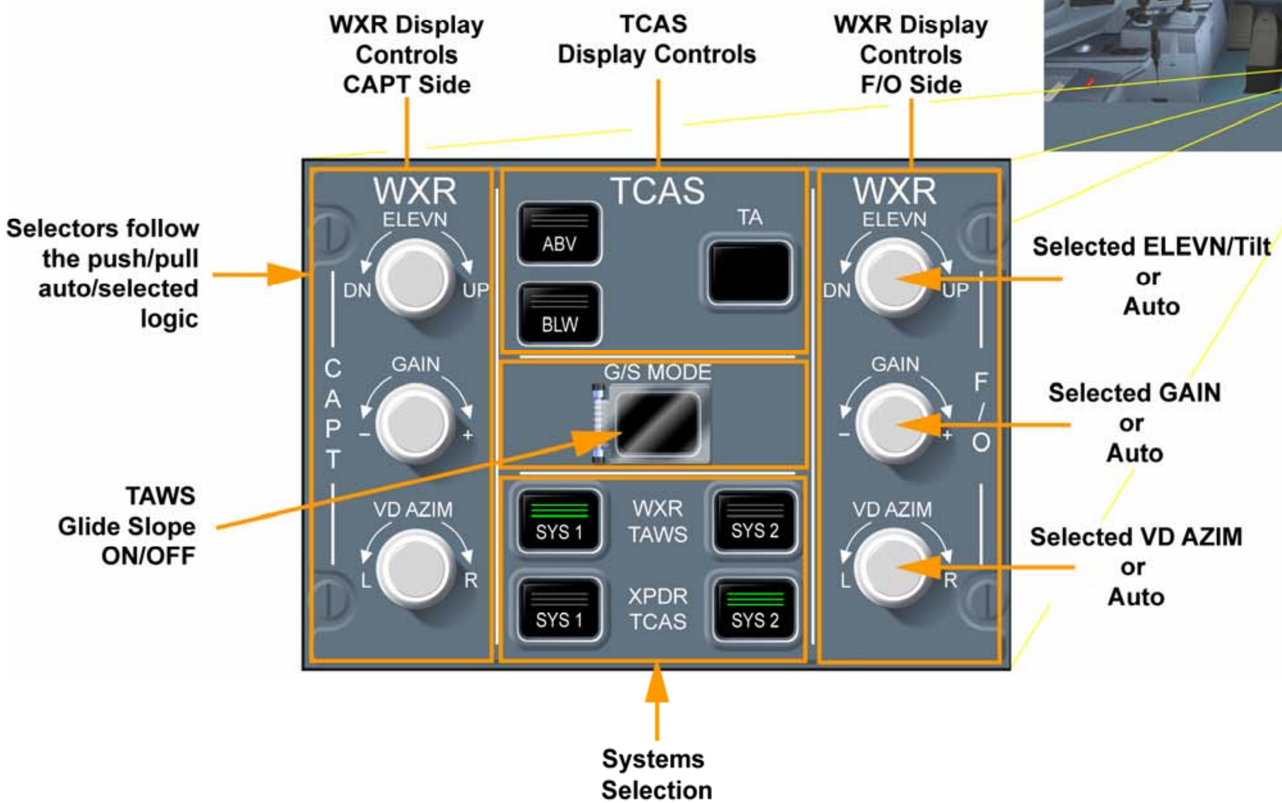




Controls and Indicators



SURV Panel



MFD SURV Page

- **Backup for SURV Control Panel**
- **Additional System Switching Selections**

Systems
Selection and Status

EFIS CP

SURV Data Display Selection

RMP

SQWK Key

General

The Onboard Airport Navigation System (OANS) provides the flight crew an improved situational awareness of the aircraft location on the airport surface, by displaying a moving airport navigation map.

The OANS generates the airport navigation image using:

- Airport data stored in the airport database
- Aircraft data mainly from the FMS and the ADIRS
- Flight crew data entries.

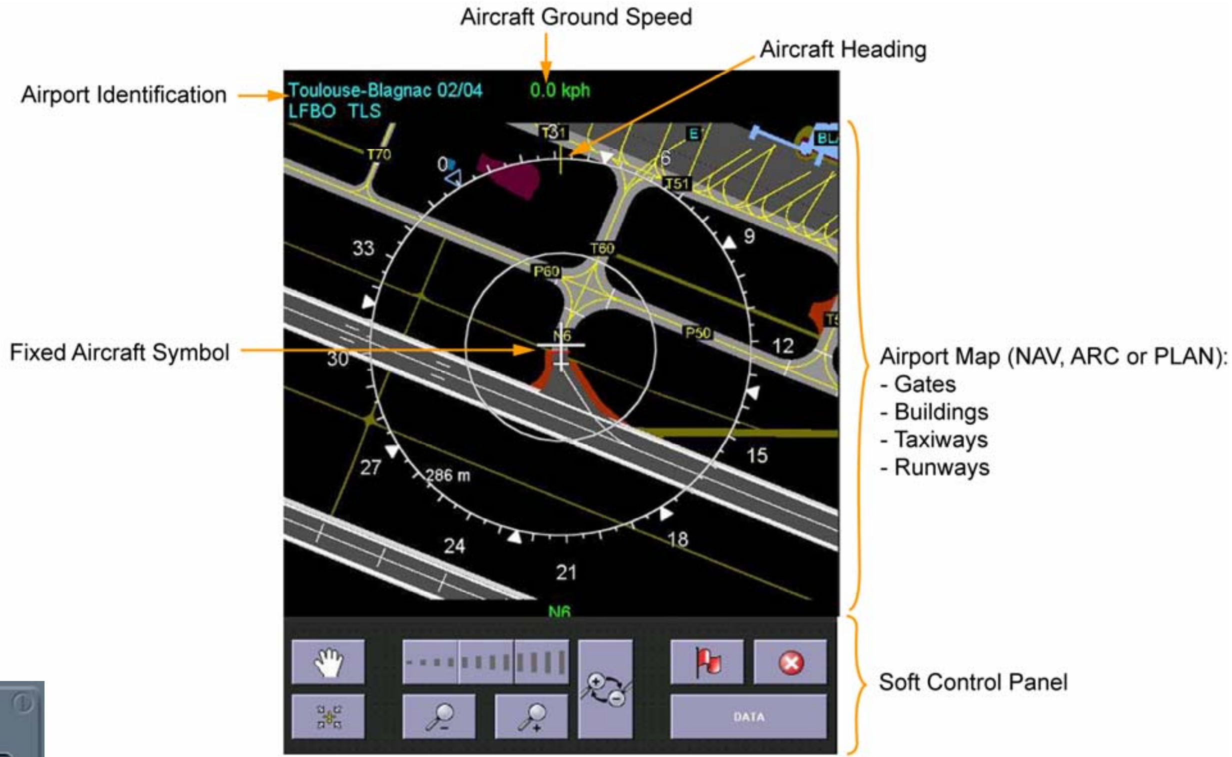
The onside EFIS CP controls the display of the airport navigation image on the ND.

The flight crew uses the Keyboard and Cursor Control Unit (KCCU) for direct interactivity with the airport navigation image.

Controls and Indicators

KCCU

OANS Airport Navigation Map on ND (NAV mode)



EFIS CP

16. ATA 35 Oxygen

Flight Deck and Systems Briefing for Pilots

Contents

General

The oxygen system is designed to supply oxygen to the flight crew, cabin crew and passengers, if necessary (e.g. in case of depressurization).

The oxygen system has:

- A fixed oxygen system in the cockpit
- A fixed oxygen system in the cabin
- A Protective Breathing Equipment (PBE) for the cockpit and cabin.

Each Operator can determine a customized oxygen system profile and the number of oxygen bottles installed, depending on the maximum number of cabin occupants, the type of operations and the intended routes to be flown.

Cockpit Oxygen System

The fixed cockpit oxygen system has:

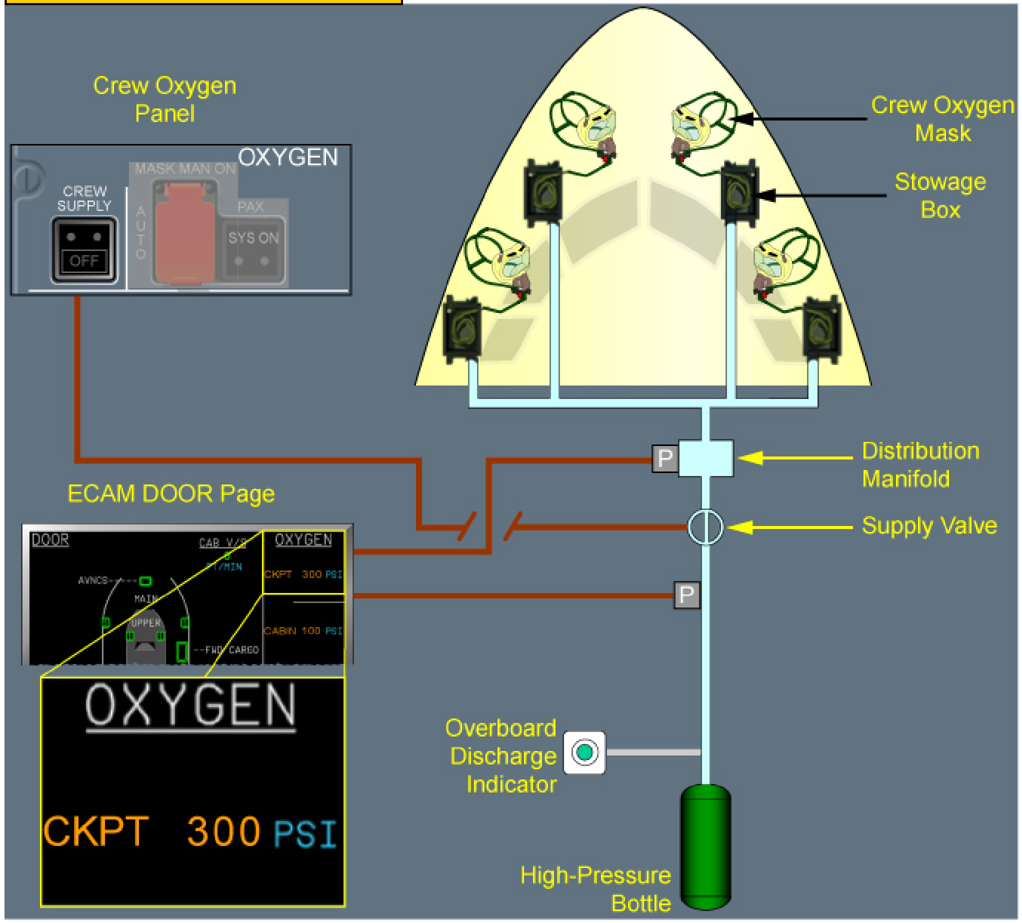
- At least one (up to four) oxygen bottle(s)
- A supply valve, that can be manually closed by the flight crew
- Four (optional 5) full-face quick-donning masks that cover the entire face, and are next to each crew member. Each mask has its own stowage box.

The fixed cockpit oxygen system protects the flight crew in the case of depressurization, toxic gases and smoke emissions.
An oxygen pressure value indication on the ECAM DOOR page informs the flight crew whether there is enough oxygen to dispatch the aircraft.

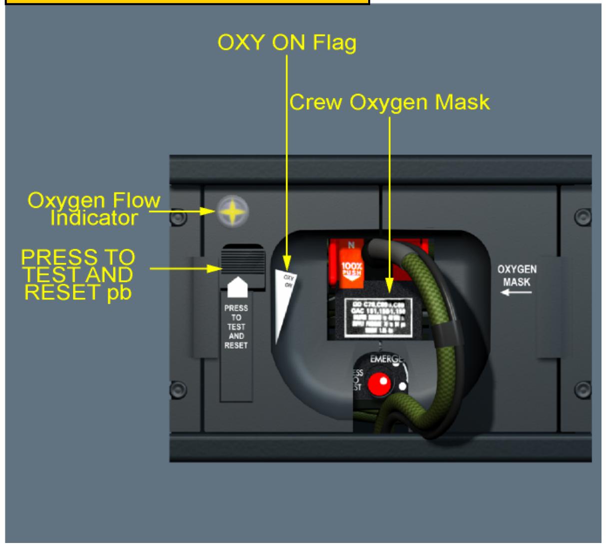
There is one Protective Breathing Equipment (PBE) in the cockpit. The PBE is a hood contained in a stowage box.
The PBE can be used below 25 000 ft cabin altitude in the case of smoke, fire, noxious gas emissions or cabin depressurization.
The PBE protects the user's eyes and respiratory system for 15 minutes.

A380 Oxygen
1.System Description

Fixed Cockpit Oxygen System



Cockpit Mask Stowage Box



Protective Breathing Equipment (PBE)

Fixed Cabin Oxygen System

The fixed cabin oxygen system provides oxygen in the cabin (passengers and cabin crew), and in the crew rest compartments.

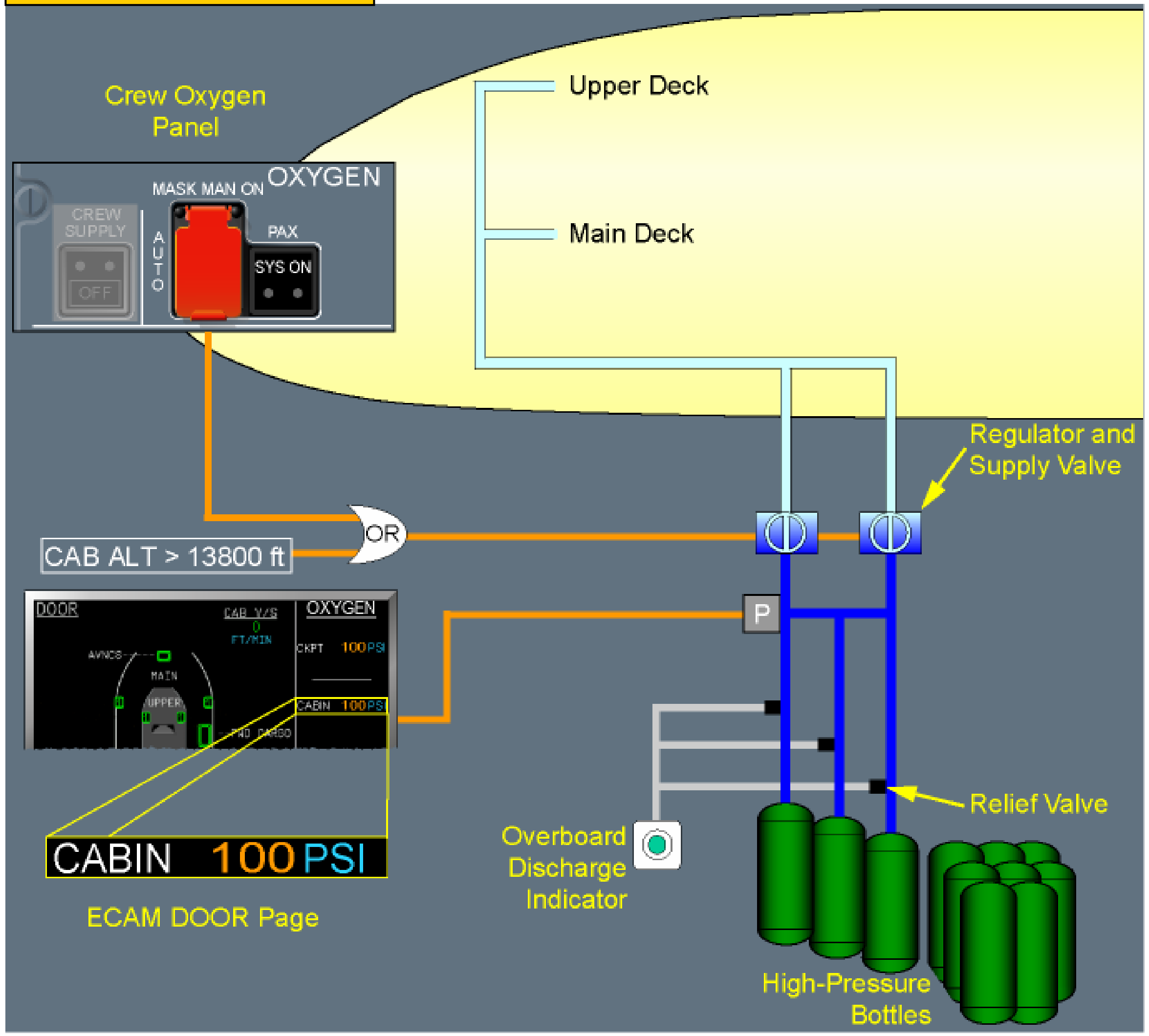
It operates manually or automatically, when the cabin altitude is higher than 13 800ft.

The fixed cabin oxygen system has:

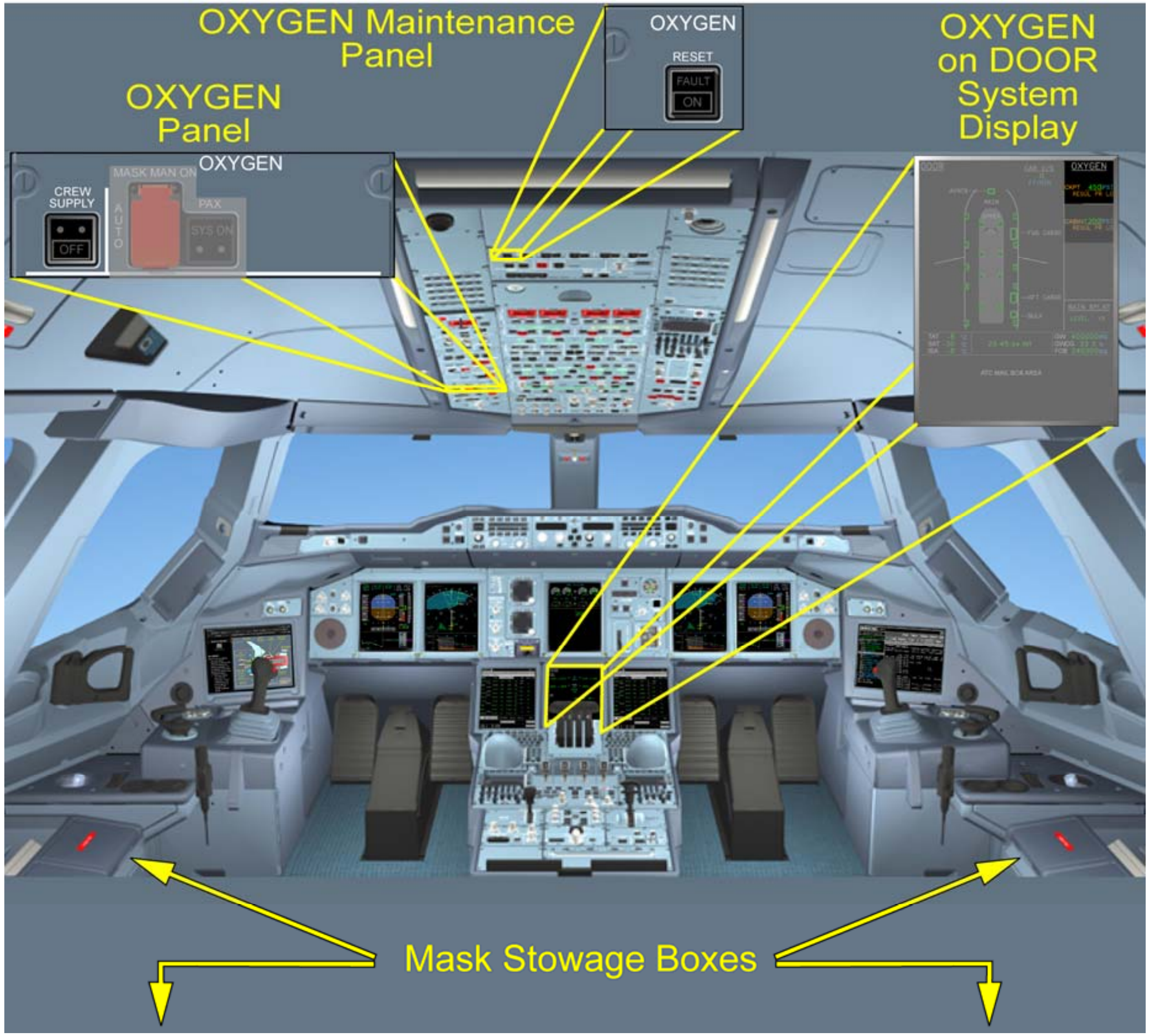
- High-pressure bottles (between 3 and 15)
- Two regulators with supply valves that provide oxygen to all cabin occupants
- Two supply lines: One for the main deck and one for the upper deck
- Masks that can be automatically released.

A pressure value indication on the ECAM DOOR page informs the flight crew whether there is enough oxygen for the maximum number of cabin occupants, in accordance with the customized oxygen system profile.

Fixed Cabin Oxygen System



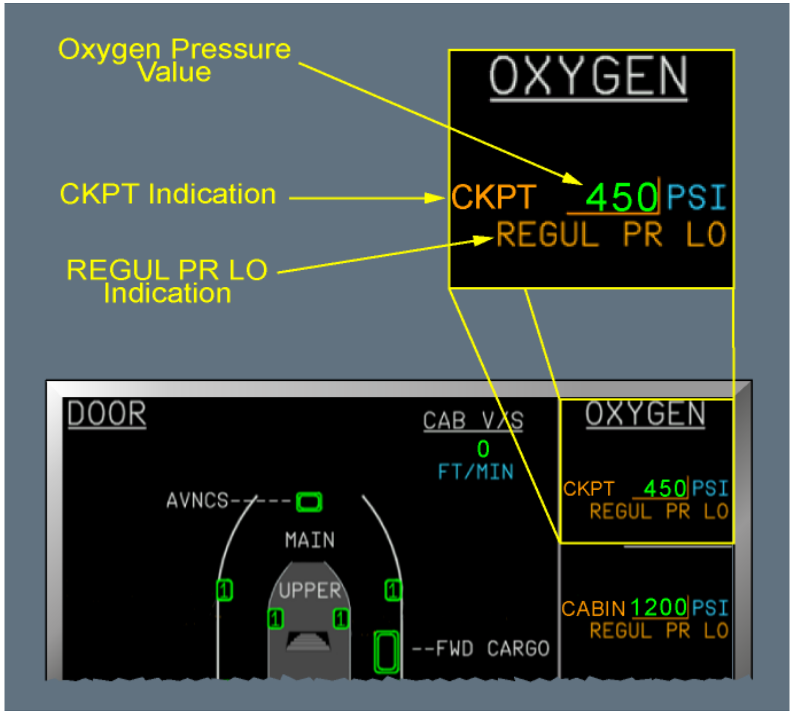
A380 Oxygen
2.Controls and Indicators



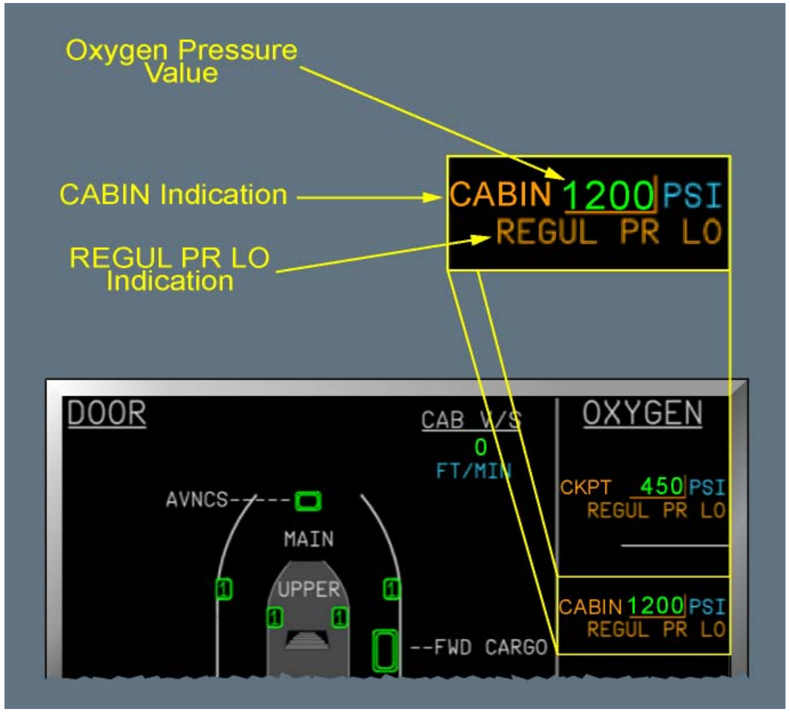
OXYGEN Panel

OXYGEN MAINTENANCE Panel

ECAM SD DOOR Page: Cockpit Oxygen System Display



ECAM SD DOOR Page: Cabin Oxygen System Display



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17. ATA 42 Avionics Networks and IMA

Flight Deck and Systems Briefing for Pilots

1. **System Description**
   - General
   - Integrated Modular Avionics (IMA)
   - Avionics Networks

Contents

General

All aircraft systems communicate with each other using two redundant avionics networks, instead of conventional wiring.

These aircraft systems are monitored and controlled by:

- Conventional avionics, with computers that are assigned to specific systems, or
- Integrated Modular Avionics (IMA), with computers that can monitor and control several systems via several applications.

Integrated Modular Avionics (IMA)

The IMA is composed of:

- **Core Processing Input/Output Modules (CPIOMs)** that are directly connected to the avionics networks.
  Each CPIOM can monitor and control several aircraft systems.

- **Input/Output Modules (IOMs)** that act as an interface for conventional avionics that cannot directly connect to the avionics networks.
  For redundancy purposes, each conventional avionics is connected to two IOMs to enter the avionics networks.

Avionics Networks

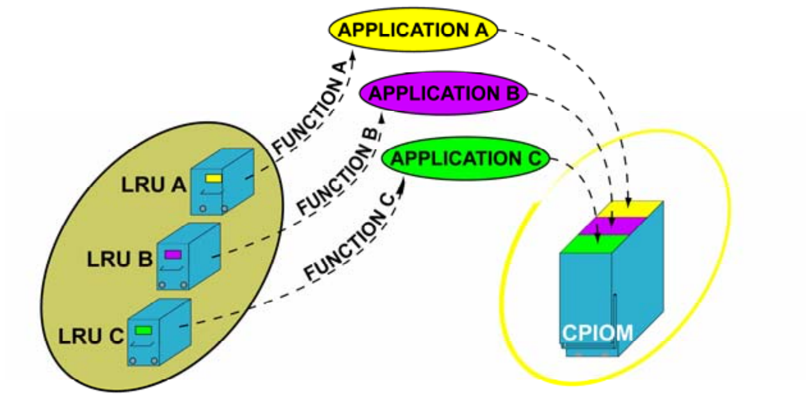
All aircraft systems are connected to both avionics networks.

The information that comes from the aircraft systems is transmitted to the avionics networks via various entry points, referred to as switches.
These switches automatically manage the communication between the aircraft systems:

- They connect the aircraft systems to the network
- They route the information that is exchanged between the applicable systems.

Note: The critical systems can always communicate with each other via conventional wiring to ensure that communication remains possible, if both avionics networks fail.

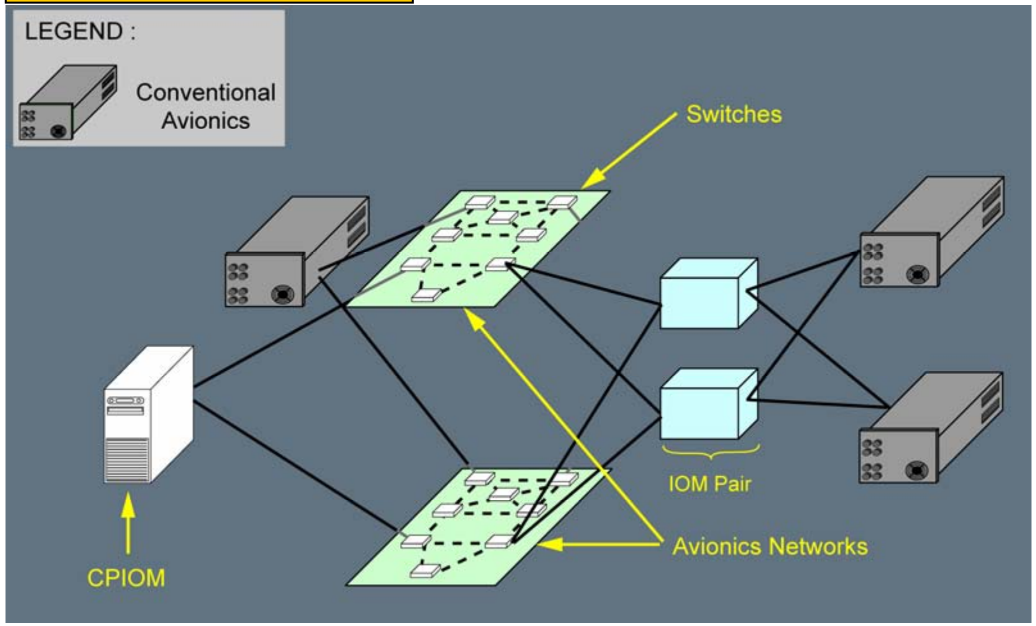
Conventional Avionics vs. IMA



Conventional Avionics
"Line Replaceable Unit"
(LRU)

Integrated Modular Avionics (IMA)
"Core Processing Input/Output Module"
(CPIOM)

Avionics Networks Architecture



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18. ATA 45 Onboard Maintenance System

Flight Deck and Systems Briefing for Pilots

Contents

AIRBUS

General

The **Onboard Maintenance System (OMS)** is an integrated system providing support for:

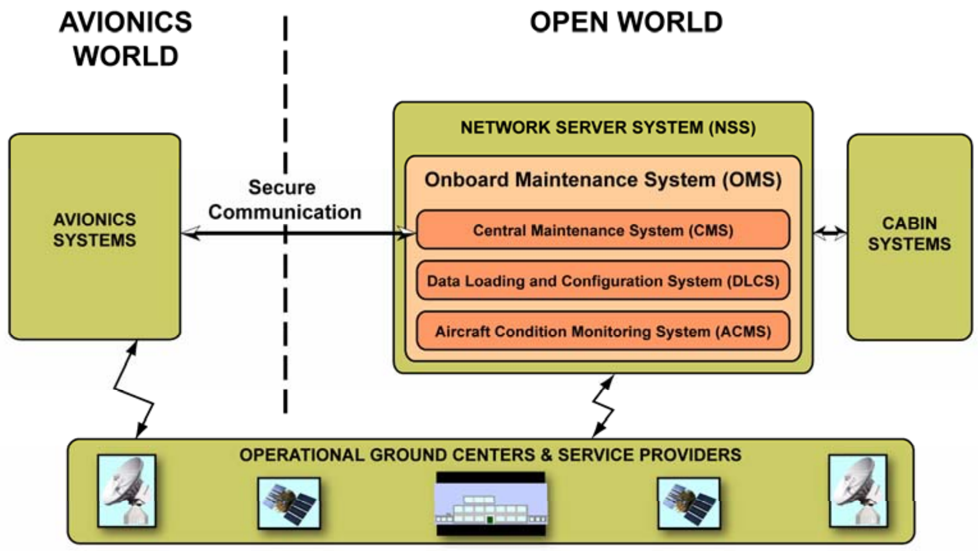
- Aircraft servicing
- Line, scheduled and unscheduled maintenance
- Aircraft configuration and reconfiguration monitoring.

The OMS has three subsystems:

- The **Central Maintenance System (CMS)** that identifies, centralizes and memorizes system failures
- The **Aircraft Condition Monitoring System (ACMS)** that provides support to preventive maintenance and in-depth investigations
- The **Data Loading and Configuration System (DLCS)** that manages data loading and equipment configuration.

The OMS is hosted on the Network Server System (NSS). It receives data from the avionics systems (through a secure communication interface) as well as data from the cabin systems.
The maintenance data is accessible through the various NSS & OIS HMIs, and is transmitted to the operational ground centers and service providers during flight.

OMS architecture



Central Maintenance System (CMS)

- In flight (and on ground), the CMS centralizes data from the Built-In Test Equipment (BITE) of the various aircraft systems.This fault data is recorded in the CMS databases.

  The CMS classifies the faults and creates standard or customized fault reports.
  These reports can be consulted by the flight crew, and are transmitted to the operational ground centers.

- On ground, the maintenance personnel can consult and download the CMS **servicing reports**. These reports list the items that require servicing, according to customized thresholds and the current aircraft systems status. The CMS also provides links to the applicable electronic maintenance documentation.
  The CMS provides direct access to all the BITE data for **scheduled and unscheduled** maintenance.
  Manual system tests can be initiated, and standard or customized test reports can be elaborated and downloaded.

  The CMS also contains applications dedicated to support maintenance activities (Airn@v, E-Logbook), and provides access to the databases with recorded maintenance parameters.

Aircraft Condition Monitoring System (ACMS)

The ACMS provides Operators with performance and trend information about aircraft systems and engines.
The objective is to support **scheduled and preventive maintenance**, by monitoring the system parameters to improve the dispatch reliability.

The ACMS data can be consulted and transmitted in flight to the ground for real-time monitoring, or downloaded after flight.

Data Loading and Configuration System (DLCS)

The DLCS manages:

- The uploading of databases and software for various avionics systems
- The downloading of CMS and ACMS reports.

The DLCS also provides the **configuration** and configuration history of the hardware and software of the avionics systems equipment.

A380 Onboard Maintenance System
2.Controls and Indicators

- **Onboard Maintenance Terminal (OMT) and Portable Multipurpose Access Terminal (PMAT)**:
  The OMT is a PMAT located in the cockpit between the third and fourth occupant seat. It is the main terminal to interface with the OMS.
  During aircraft turn-around or maintenance, the OMS can also be accessed by connecting a PMAT into one of the network ports installed on various aircraft locations.

OMT and PMAT

- **Onboard Information Terminals (OITs)**:
  The OITs are dedicated to flight crew operations (E-Logbook), but can be used by maintenance personnel to access the other OMS applications.
  (Refer to Information Systems)

FAP

- **Flight Attendant Panels (FAPs)**:
  The FAPs enable access to the cabin E-Logbook.

- **Printer-1**: Is used for maintenance reports (avionics related)

- **Printer-2** (optional): Is used for maintenance reports (cabin systems related).

19. ATA 46 Information Systems

Flight Deck and Systems Briefing for Pilots

Contents

General

The **Onboard Information System (OIS)** is a set of electronic documentation and applications for flight, maintenance and cabin operations. For the flight crew, these applications replace the previously used paper documentation and charts.

The main objective of the electronic documentation is to provide the flight crew with attractive documentation, that enables an easy access to the necessary information related to an operational need.

The OIS applications can be divided into:

- Tools for flight operations support
- Tools for cabin operations support
- Tools for maintenance operations support
- Services to the passengers, flight crew and cabin crew.

The applications are hosted on three sub-networks or domains of the **Network Server System (NSS)**:

- The avionics domain
- The flight operations domain
- The communication and cabin domain.

Avionics Domain

The avionics domain includes the applications that exchange data with the aircraft avionics:

- Tools to support maintenance operations like the:
  - Electronic Logbook
  - Central Maintenance System (CMS)
- Electronic documentation that needs to be accessed by both flight and maintenance crew:
  - Minimum Equipment List (MEL)
  - Configuration Deviation List (CDL)
  - Cabin Crew Operating Manual (CCOM)
    Note: The CCOM is on the avionics domain to enable its display on the FAP.
- A servicing tool dedicated to the refueling operation
- An Airline Operational Control (AOC) application that manages the communication between the aircraft and the operators' operations centers.

Flight Operations Domain

The flight operations domain includes the applications that support the flight crew on ground and in flight. These applications are part of the Airbus Electronic Flight Bag (EFB) and include mainly:

- Performance computation tools for takeoff, in-flight and landing
- A Weight & Balance (W&B) computation tool
- Electronic documentation:
  - Flight Crew Operating Manual (FCOM)
  - Aircraft Flight Manual (AFM)
  - Configuration Deviation List (CDL)
  - Minimum Equipment List (MEL)
  - Flight Crew Training Manual (FCTM)
- Contact Manager
- Navigation and weather charts
- The Electronic Flight Folder (EFF) and the Flight Follow Up (FFU) tool.

The flight operations domain can accept customized operators' applications.
The flight operations domain will also be able to receive information from the avionics domain to create contextual access to the applicable tools and documentation.
The aim is to provide faster and easier access to the necessary information during high workload phases, and to improve the flight crew's situational awareness.

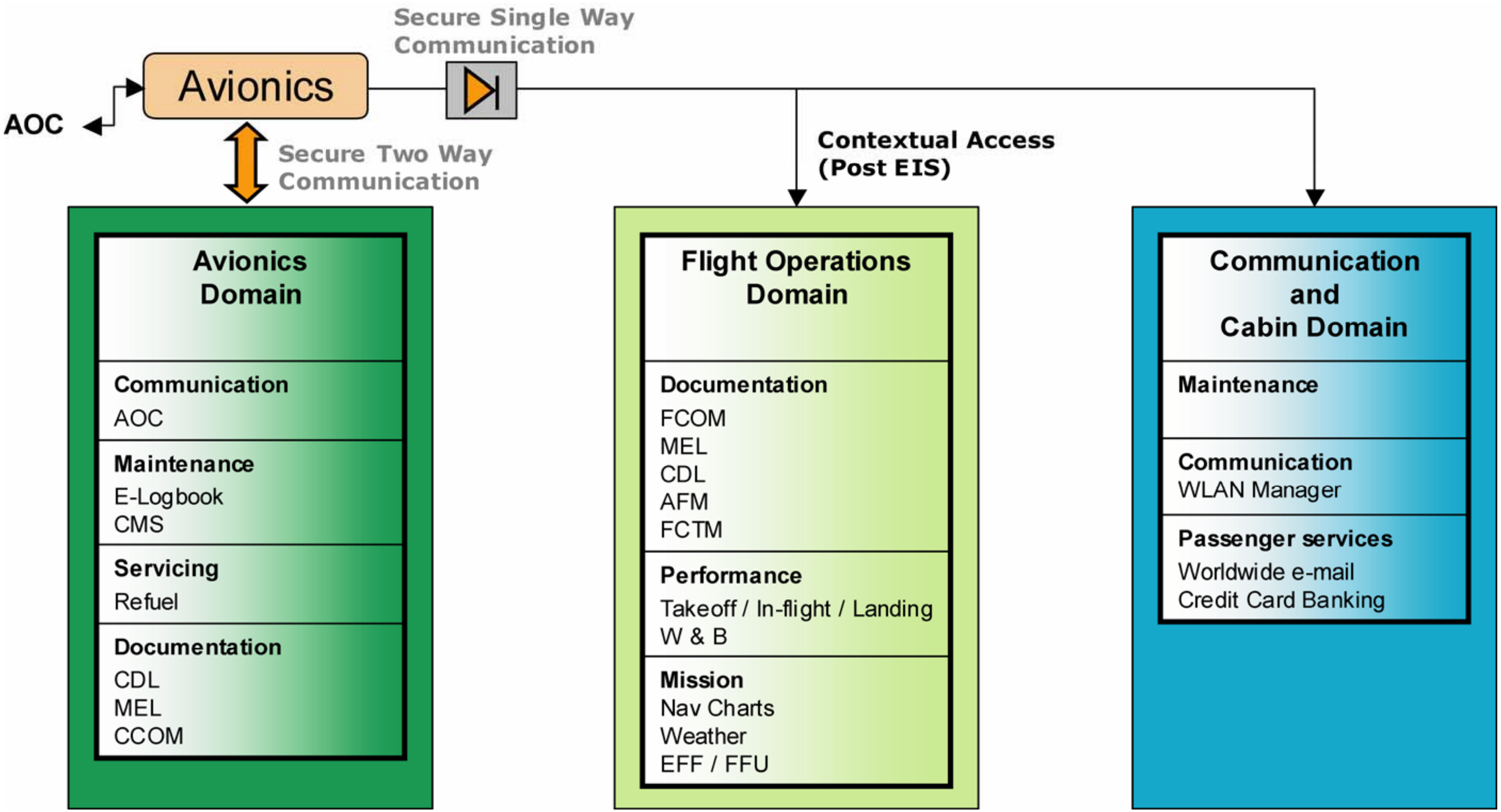
Communication and Cabin Domain

The communication and cabin domain hosts the tools for cabin operations and maintenance, and services for passengers:

- Services for passengers:
  - Worldwide electronic mail (wired or wireless)
  - Credit card banking
- Tools to support maintenance operations dedicated to the cabin and communication domain's systems
- A wireless area network manager application.

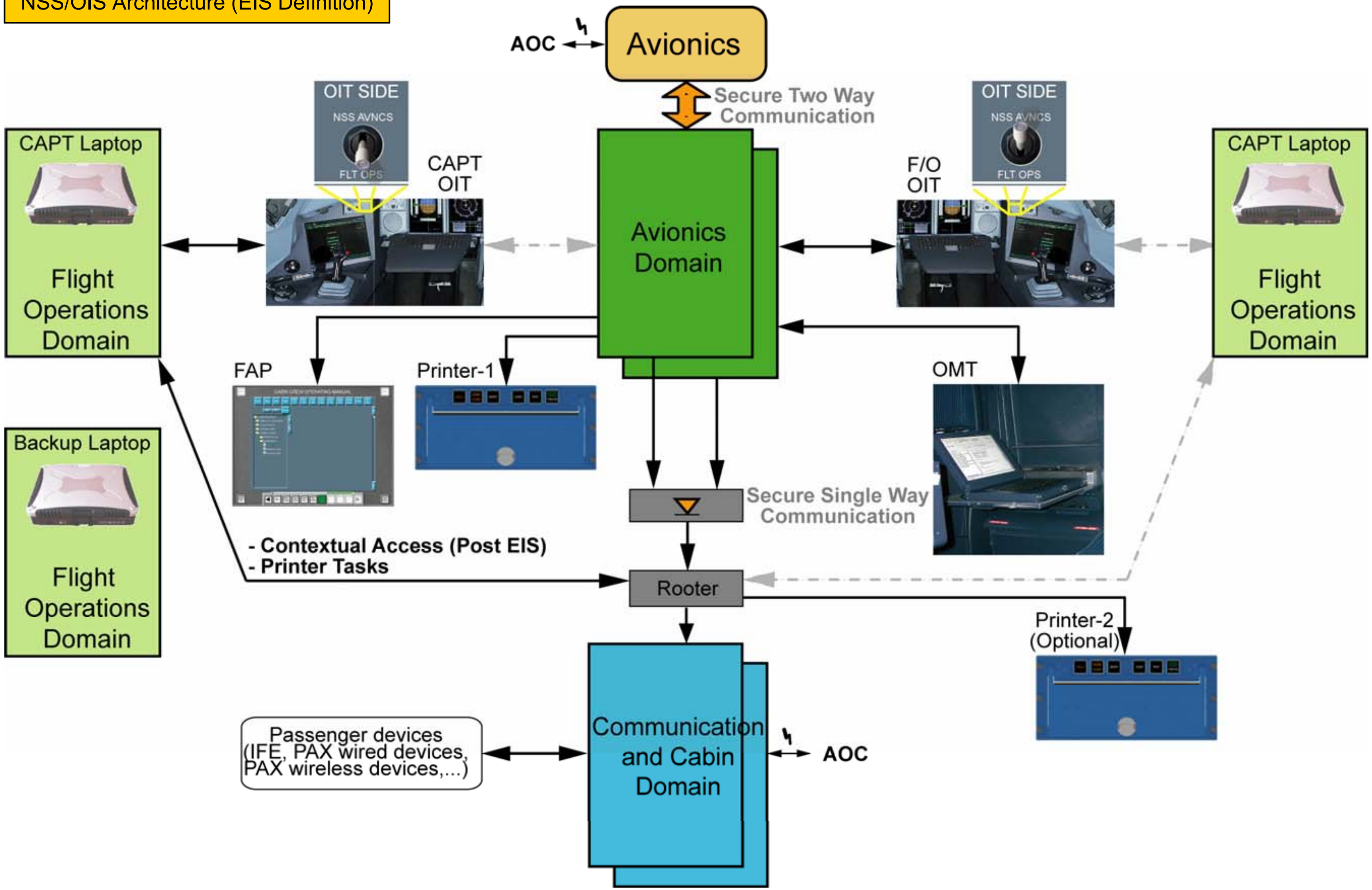
A380 Information Systems
1.Onboard Information System (OIS)

NSS/OIS Domains & Applications (EIS Definition)



A380 Information Systems
1.Onboard Information System (OIS)

NSS/OIS Architecture (EIS Definition)



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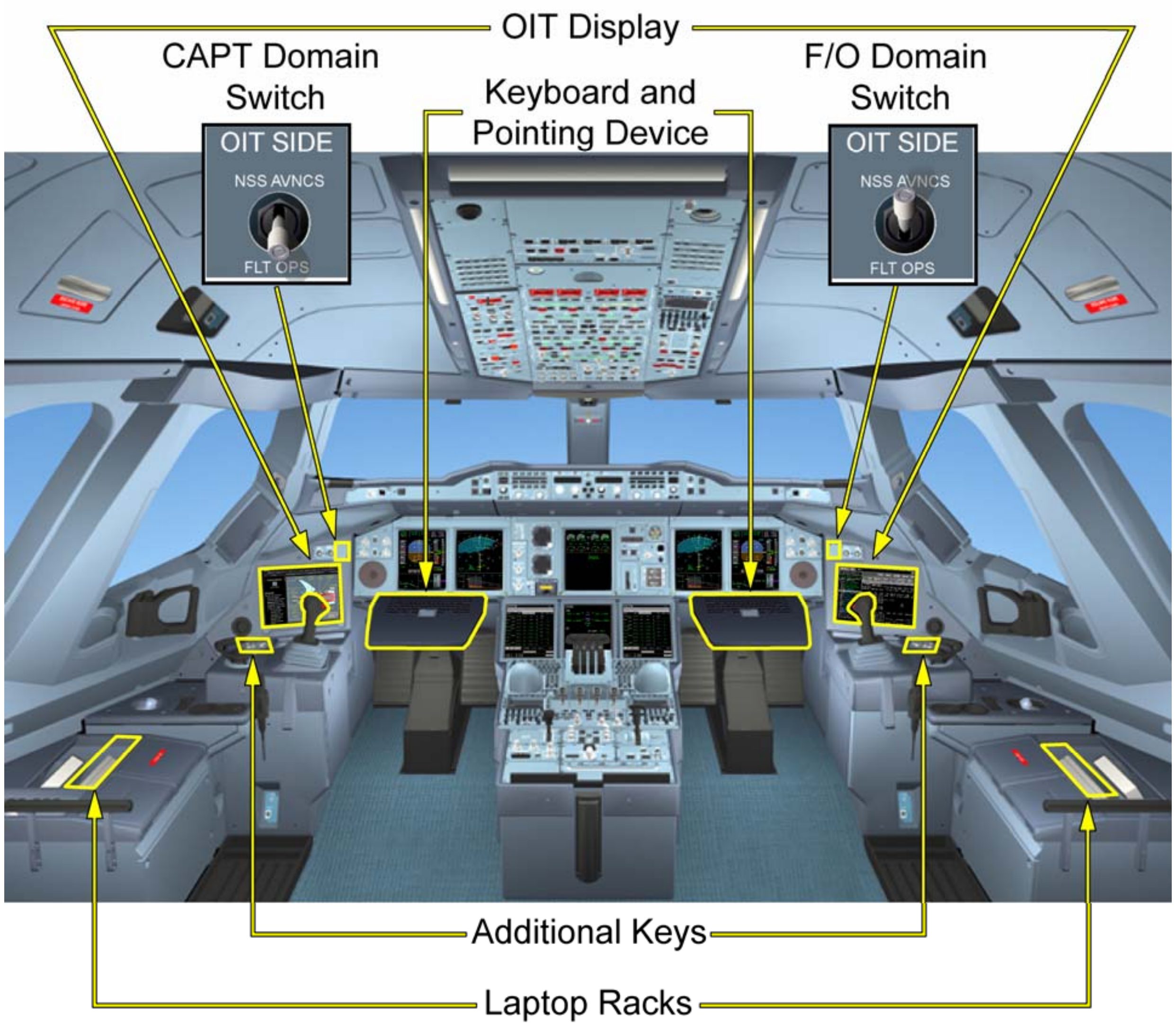
Controls and Indicators



For the Flight Crew

- The cockpit has two **Onboard Information Terminals (OITs)**. The OITs are the main displays for the OIS applications.

- A **keyboard and pointing device**, integrated in the sliding table, serves as an interface with the applications within a domain

- **Additional keys** enable navigation through applications when the sliding table is folded away

- **Domain switches** enable switching between the avionics domain and the flight operations domain

- The CAPT and the F/O each have a laptop.
  Each laptop supplies computing and memory resources for the flight operation applications on its onside OIT.
  The laptops are stored in their respective stowage boxes.

- A backup laptop is available in the cockpit and can replace any of the CAPT and F/O laptops.

A380 Information Systems
1.Onboard Information System (OIS)

For Maintenance Personnel

- The **Onboard Maintenance Terminal (OMT**) is installed in the rear part of the cockpit.
  The OMT is used by maintenance personnel to access the avionics domain for maintenance applications, including the logbook.
  (**Refer to Onboard Maintenance System**).

- The **Portable Multipurpose Access Terminals (PMATs)** are laptops that serve for maintenance purposes. They are connected to the NSS through dedicated network ports throughout the aircraft.

For the Cabin Crew

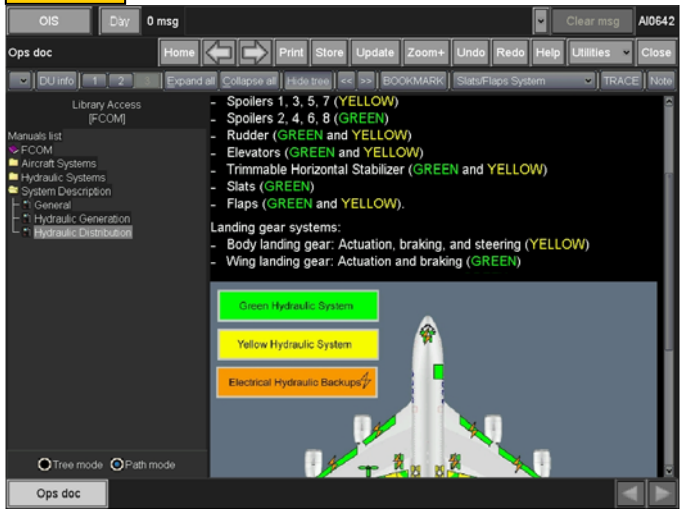
- **Flight Attendant Panel (FAP)**
  The cabin has two FAPs: One on the upper deck and one on the lower deck.
  The FAPs are used by the cabin crew for cabin operations. The FAPs also display the CCOM.

FAP

Examples of Applications

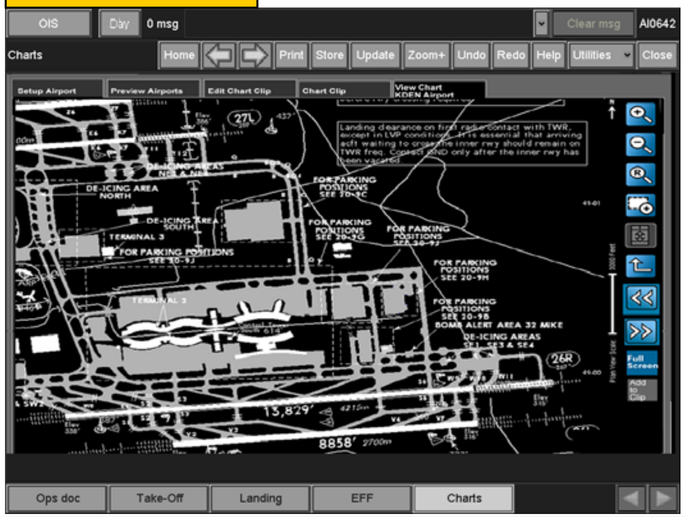
Landing Performance Application

FCOM



Weather Charts

Navigation Charts



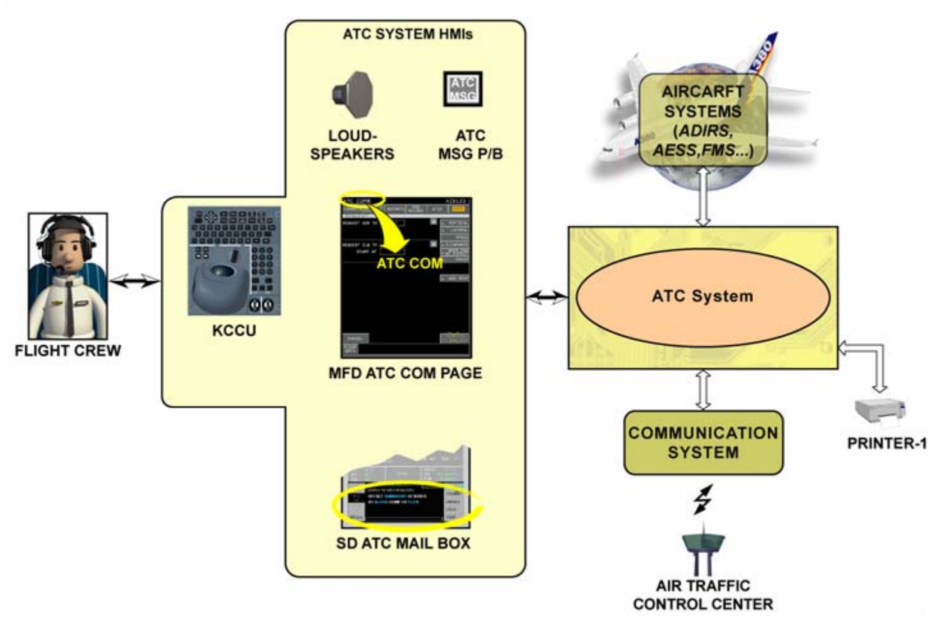
General

The Air Traffic Control (ATC) system enables data link communication between the aircraft and the ATC centers.

The ATC system provides the flight crew and the avionics systems with communication, navigation and surveillance means.

The data link communication between the aircraft and the ground network is made via the HF, VHF or SATCOM communication systems.

ATC System Architecture



Architecture

The ATC application includes:

- A **notification** function to establish a data link connection between the aircraft and the ATC center by sending aircraft identity information such as the aircraft registration number and flight number.

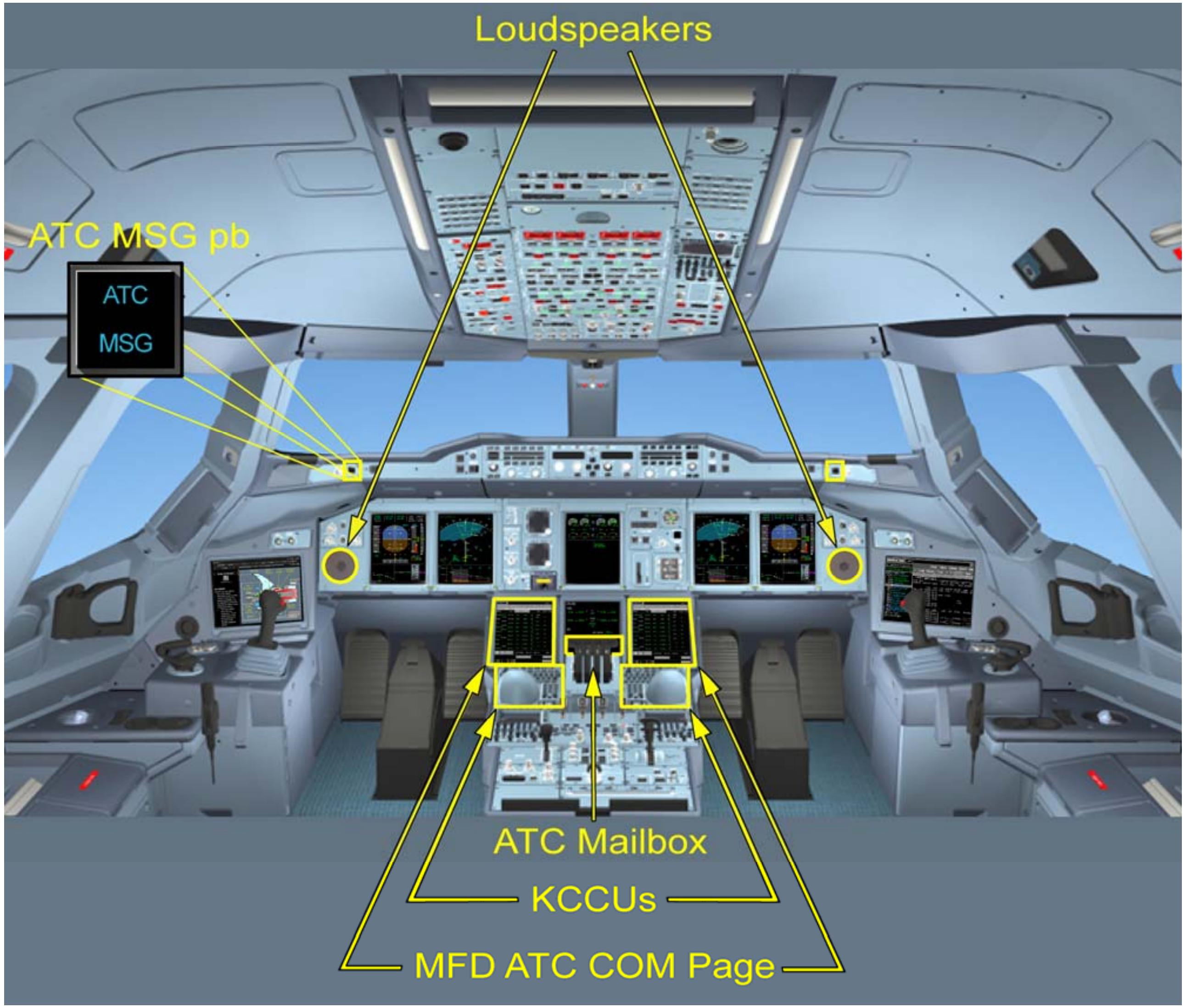
- A **datalink communication** function enabling the flight crew to:
  - Send requests
  - Send reports: Position reports and others
  - Read uplink messages
  - Answer uplink messages
  - Ask for and receive digital ATIS messages.

  The datalink communication function also includes departure clearance and oceanic clearance requests.

  The flight crew creates messages by combining a pre-defined set of messages and/or free text.

- The **Automatic Dependant Surveillance (ADS)** function which automatically generates surveillance-data reports for transmission to the ATC centers.

Controls and Indicators



The flight crew uses the following interfaces:

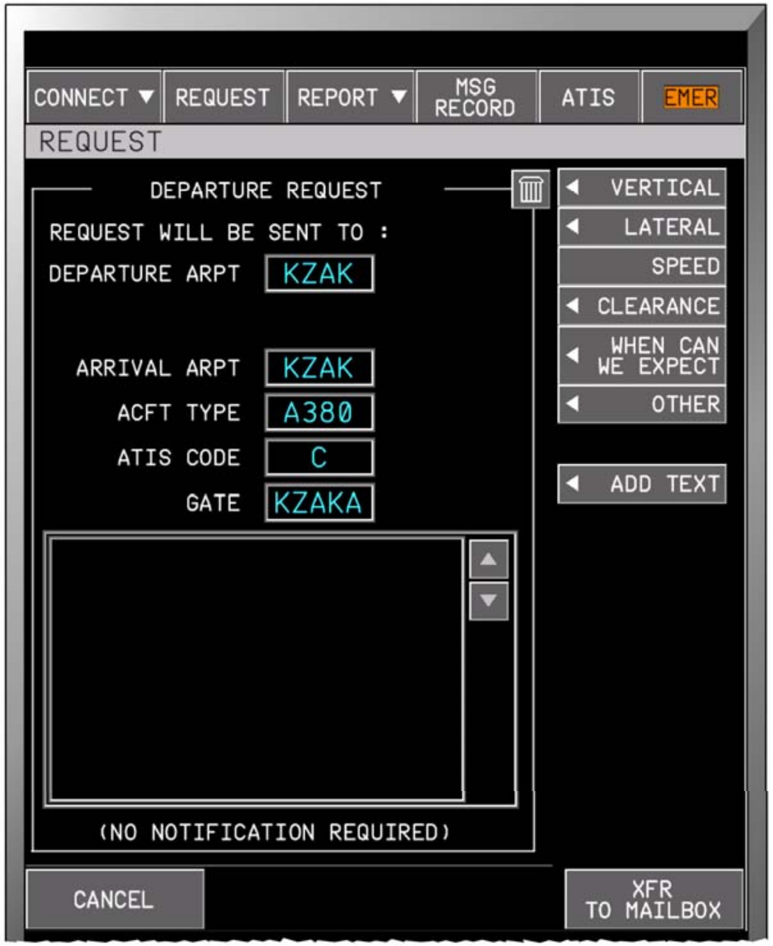
- An MFD ATC COM page on the MFD, mainly to create a request/report.
- An ATC MAILBOX on the SD to display ATC system messages exchanged between the flight crew and the ATC centers.

The CAPT and F/O ATC MSG pbs and loudspeakers indicate the arrival of an ATC message.

SD ATC Mailbox

ATC MSG pb

MFD ATC COM Pages



20. ATA 49 Auxiliary Power Unit (APU)

Flight Deck and Systems Briefing for Pilots

1. **System Description**
   - General
   - Architecture
2. **Controls and Indicators**

Contents

AIRBUS

General

The Auxiliary Power Unit (APU) can provide:

- On ground:
  - Bleed air for engine start and for air conditioning
  - Electrical power via two generators.
- During takeoff:
  - Bleed air for air conditioning.
- In flight:
  - A backup for air conditioning up to an altitude of 22 500 ft
  - A backup for electrical power for the entire flight envelope
  - Bleed air for engine start.

The APU can be started either by using the aircraft battery, external power, or normal aircraft supply.

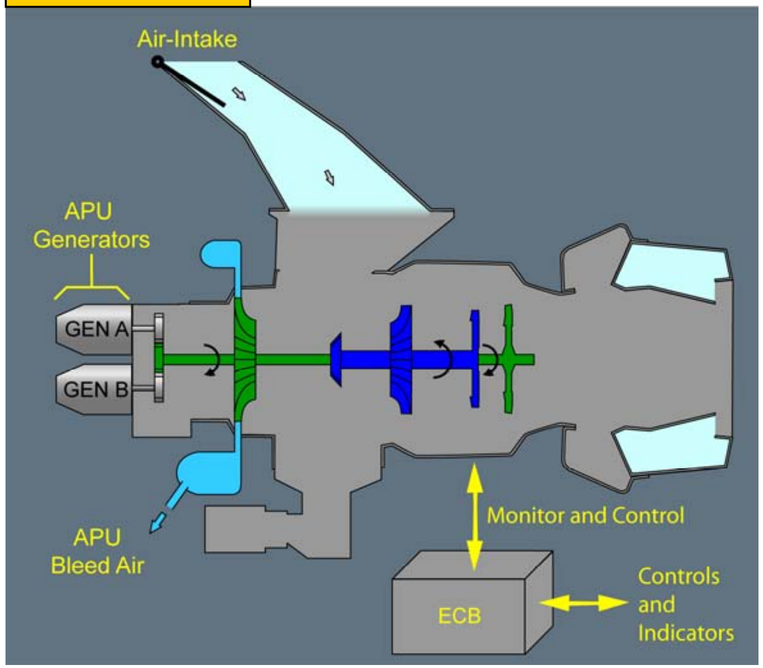
In flight, the APU can be started within the entire flight envelope.

Architecture

The Electronic Control Box (ECB) monitors and controls the operation of the APU and displays the applicable information on the ECAM. The ECB:

- Sequences and monitors the APU start
- Sequences and monitors the manual, automatic, and emergency APU shutdown
- Monitors the operating parameters of the APU
- Monitors the APU bleed air.

APU Architecture



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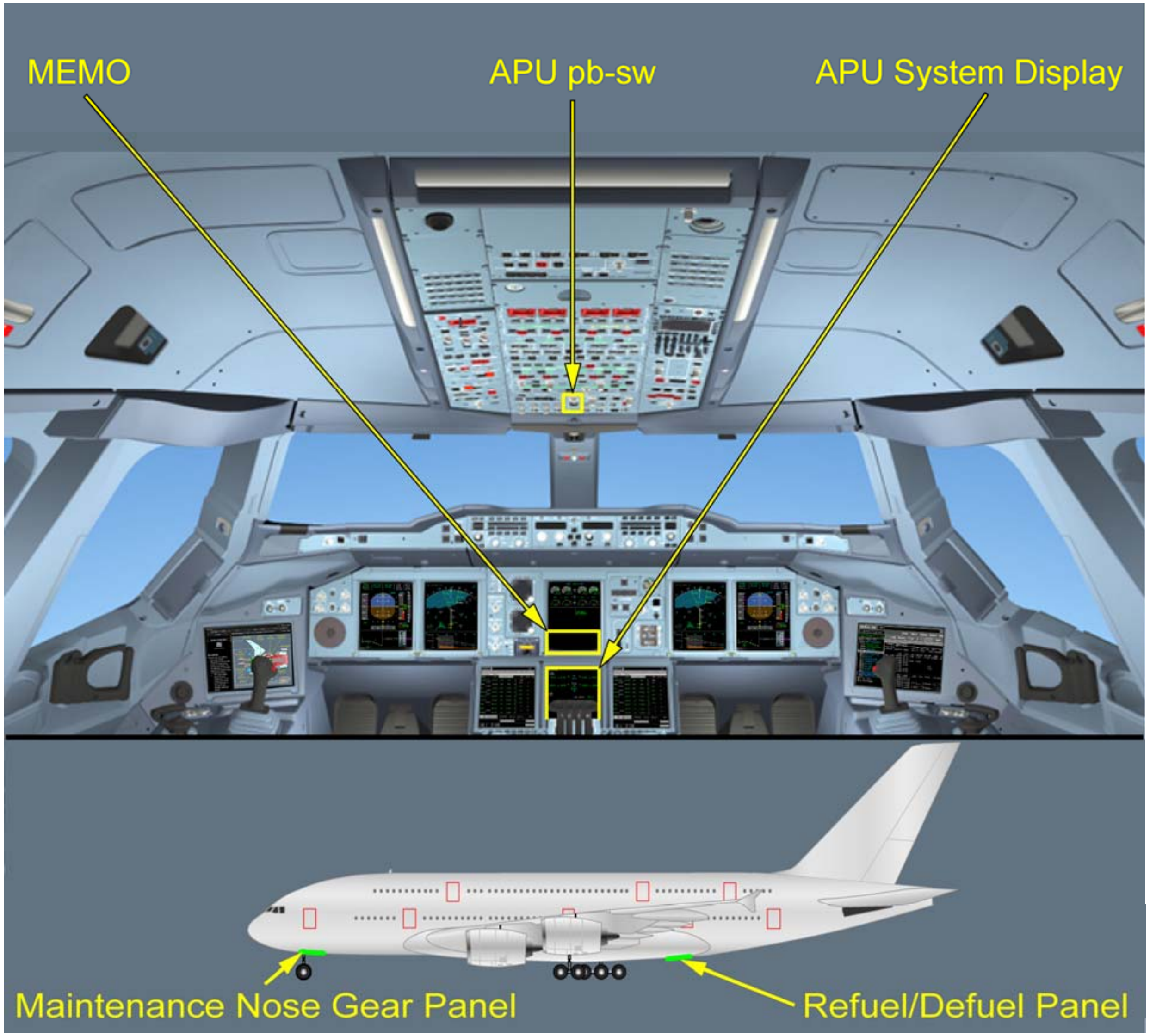
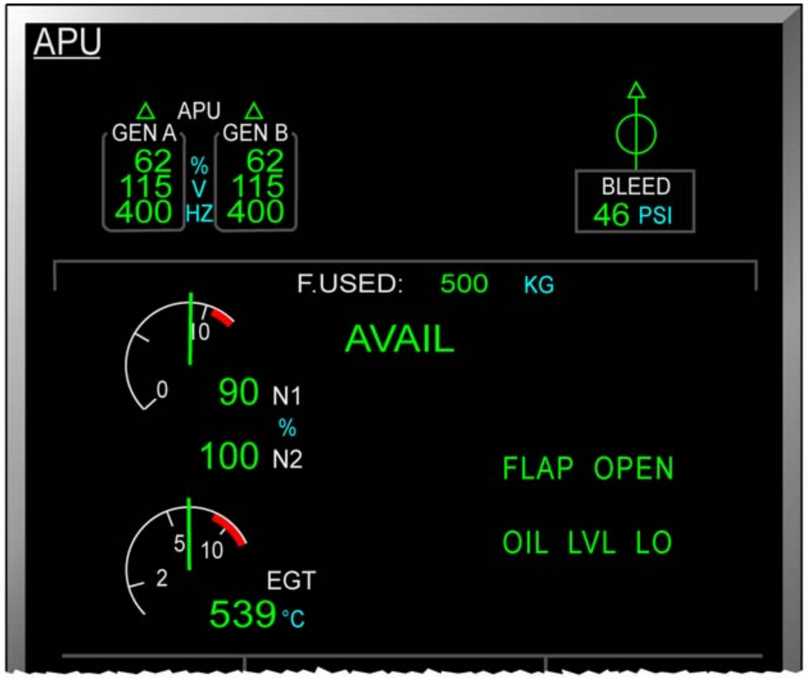
A380 Auxiliary Power Unit
2.Controls and Indicators



APU pb-sw

APU EMERGENCY SHUTDOWN pb on the Refuel/Defuel Panel

ECAM System Display APU Page



Maintenance Nose Gear Panel

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21. ATA 70 Engines

Flight Deck and Systems Briefing for Pilots

Contents

General

The A380 can be powered by two engine types:

- The Rolls-Royce TRENT 900
- The Engine Alliance GP7200.

Both engines are high bypass ratio turbofans and are offered at different thrust levels to support all variants of the A380 family.

For all types, takeoff thrust is flat rated up to ISA +15° C (i.e. 30° C/ 86° F at static sea level conditions).

Nominal Static Thrust of A380 Engines

Engine Type	Nominal Static Thrust (sea level, ISA)
RR TRENT 972	320 kN (72.0 klbs)
RR TRENT 977	343 kN (77.0 klbs)
EA GP7272	320 kN (72.0 klbs)
EA GP7277	343 kN (77.0 klbs)

FADEC

The **Full Authority Digital Engine Control (FADEC)** system controls thrust. The objectives of the FADEC system are:

- To ensure that the engines provide the required thrust for each flight phase
- To automatically provide associated engine protection.

Each engine has one FADEC with two fully redundant channels.

Each FADEC:

- Provides automatic engine start and shutdown
- Provides engine control for thrust setting both in forward and reverse thrust (only on inboard engines)
- Processes the engine parameters, including the Airbus Cockpit Universal Thrust Emulator (ACUTE) (**Refer to Controls and Indicators**)
- Includes engine protections such as the overspeed, overheat or thrust control malfunction protection.

Thrust Control

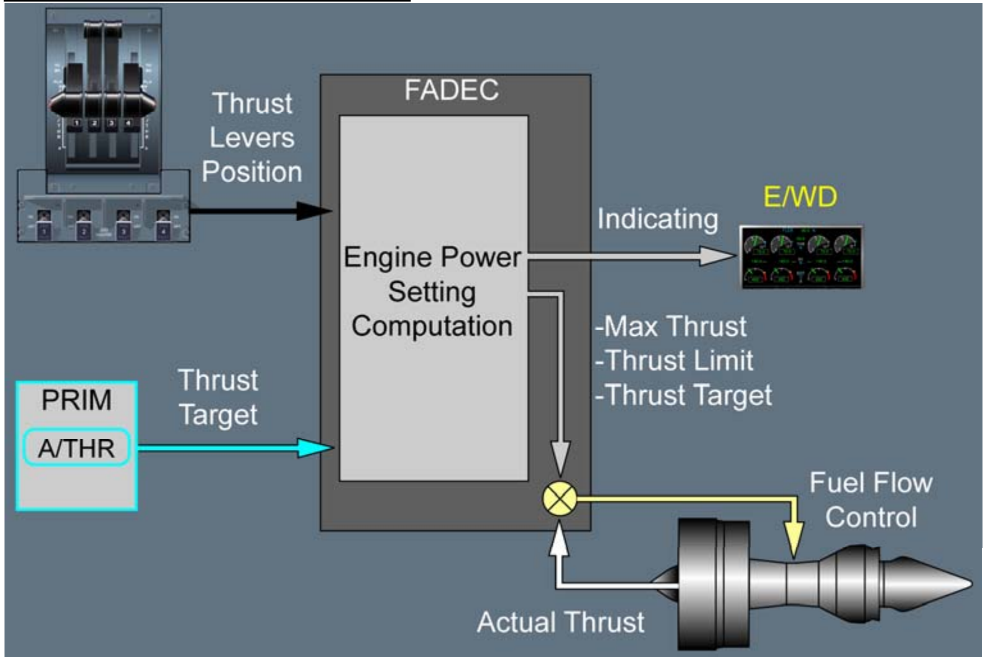
Engine thrust control is provided by the FADEC.
The FADEC controls the thrust either:

- In manual mode, according to the thrust control lever position
- In automatic mode, according to thrust targets coming from the Flight Guidance (FG) function.

The FADEC also computes thrust rating limits.

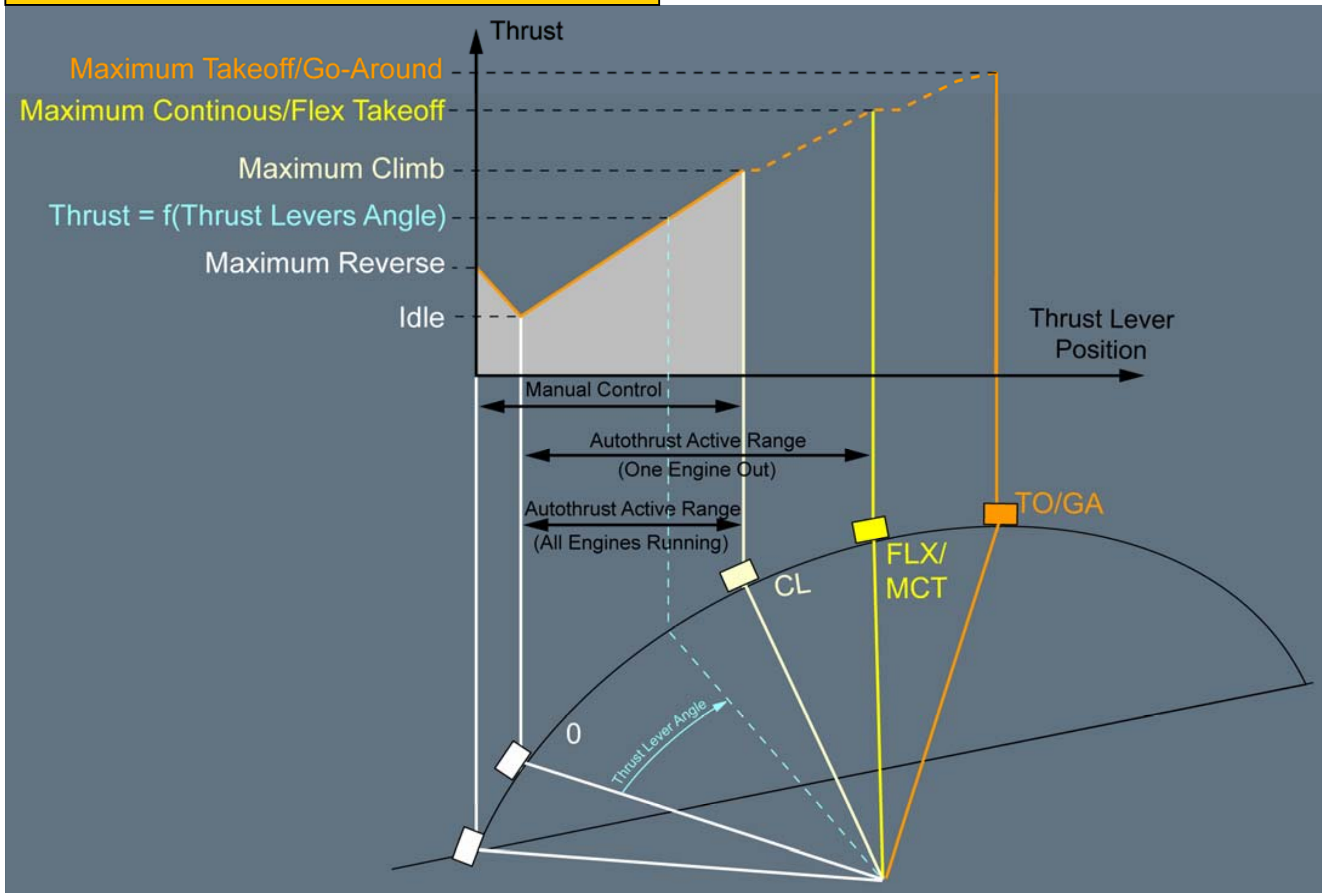
There is no mechanization of the thrust levers (no servomotor). Therefore, any thrust lever displacement must be performed manually.

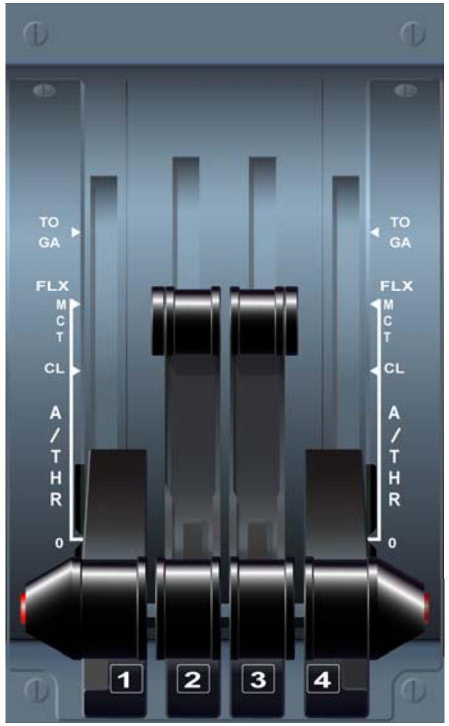
Principles of the Thrust Control



A380 Engines
1.System Description

Thrust Levers Detents/Angle and Corresponding Thrust



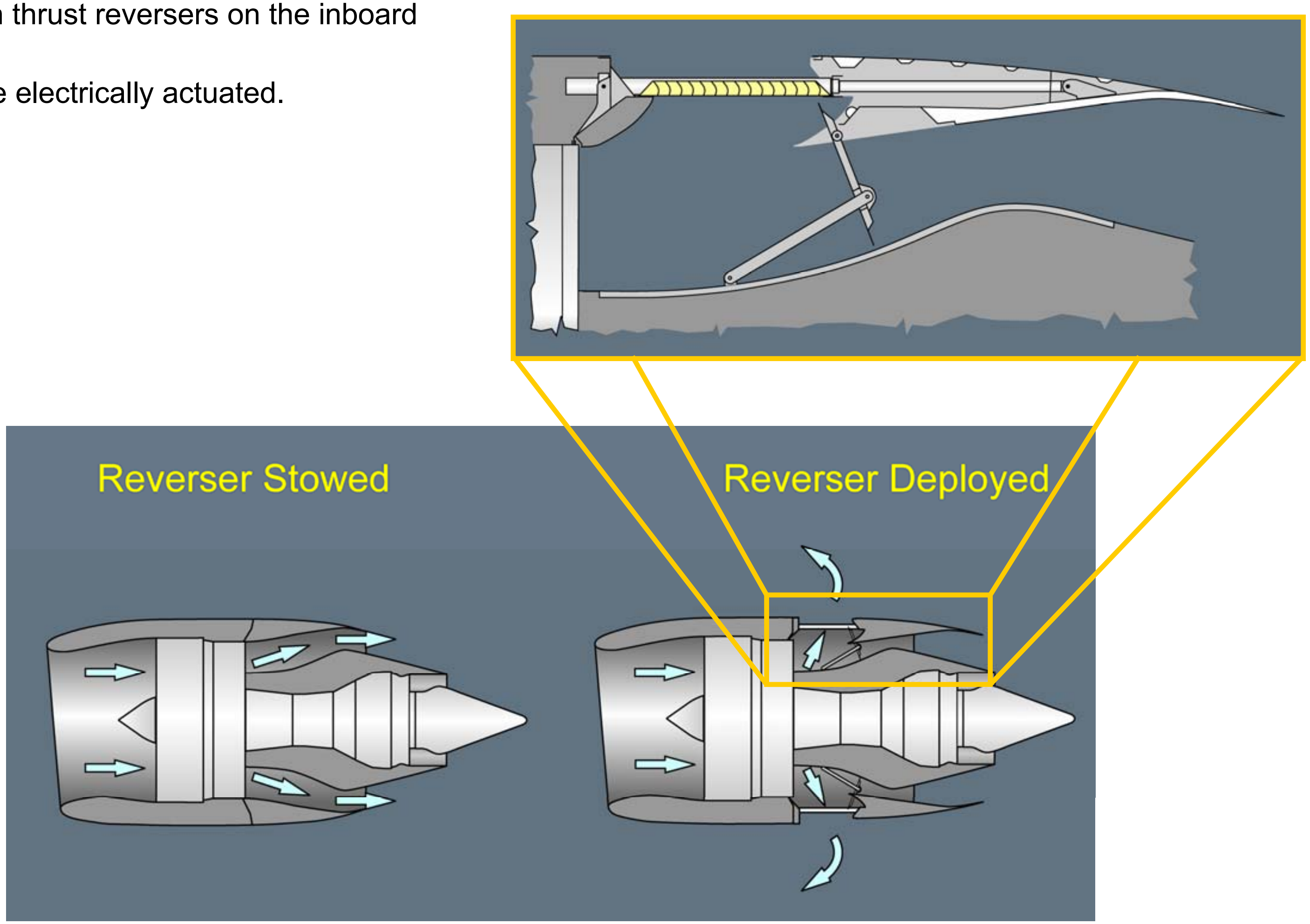


AIRBUS

Thrust Reverser

The aircraft is fitted with thrust reversers on the inboard engines only.

The thrust reversers are electrically actuated.



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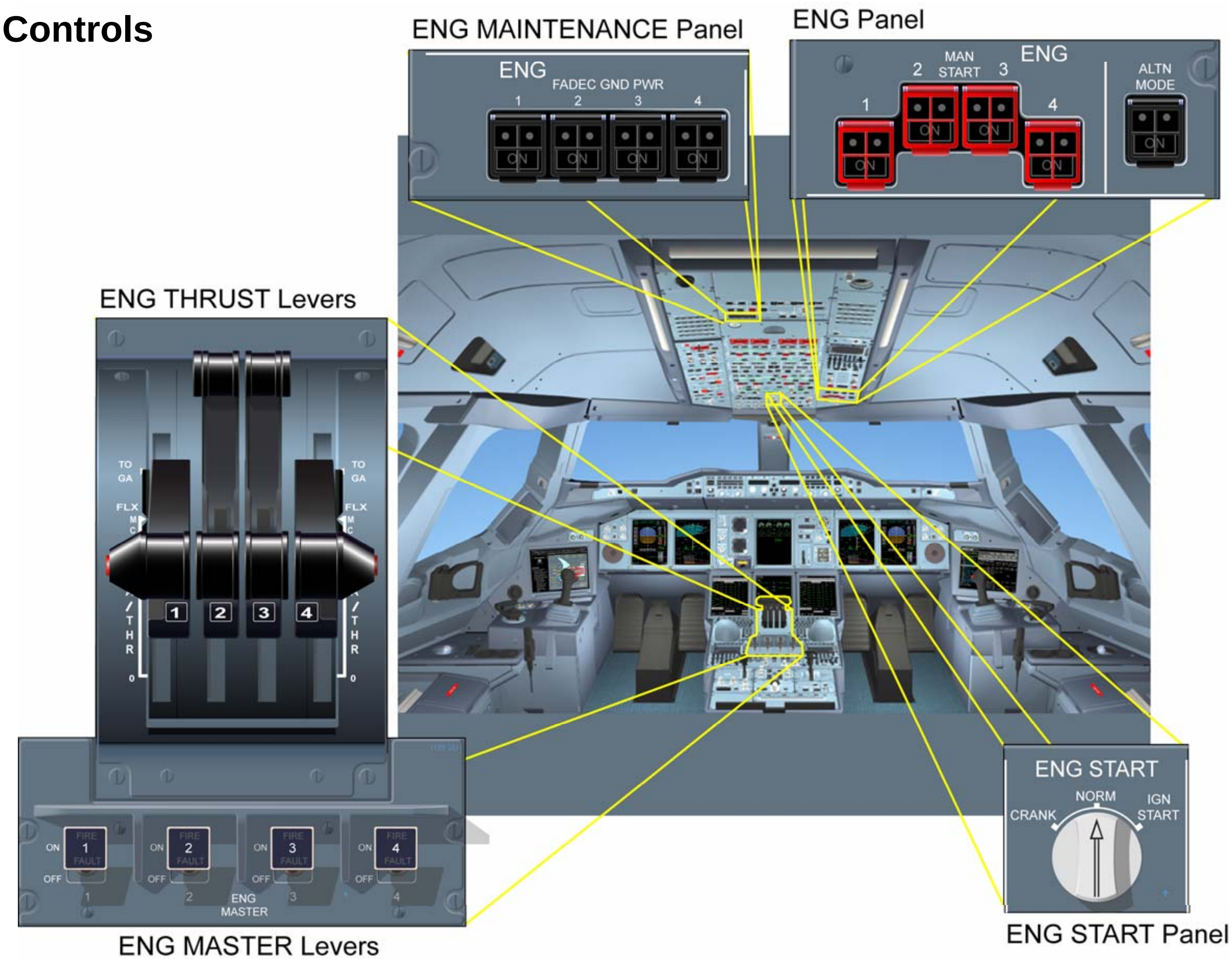
Controls



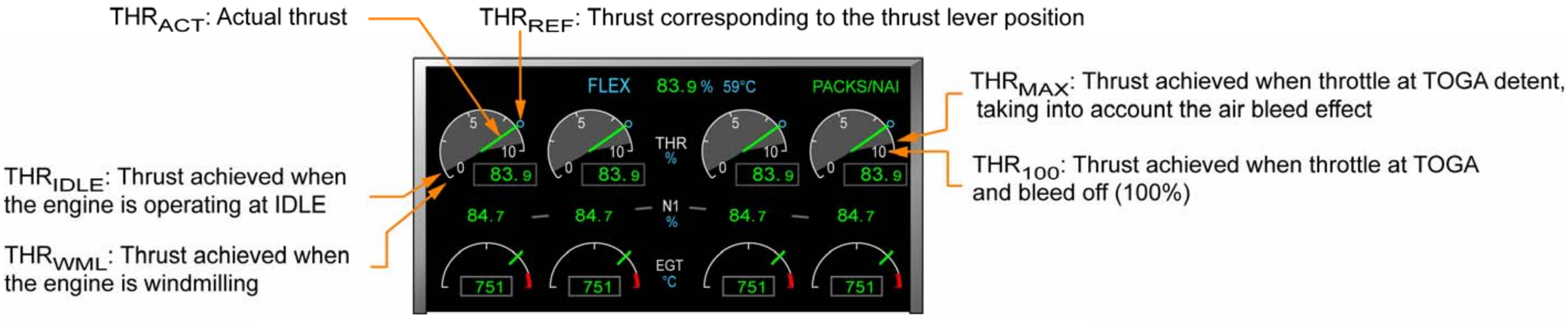
ENG MAINTENANCE Panel
ENG
FADEC GND PWR
1 2 3 4
ON ON ON ON
ENG Panel
ENG
MAN START
1 2 3 4
ON ON ON ON
ALTN MODE
ON
ENG THRUST Levers
TO GA
FLX MCT
1 2 3 4
A/THR
ENG MASTER Levers
ON
OFF
FIRE
FAULT
ENG MASTER
ENG START
CRANK
NORM
IGN START
ENG START Panel

Indicators

The **Airbus Cockpit Universal Thrust Emulator (ACUTE)** converts the engine control parameter into a common thrust parameter (THR) for all engine types.

The thrust parameter varies between 0% and 100% in all flight conditions and is defined as follows:

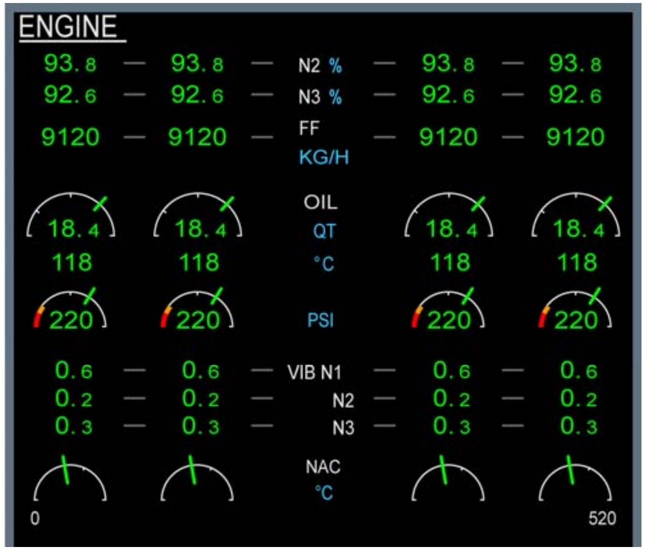
E/WD: Forward Thrust



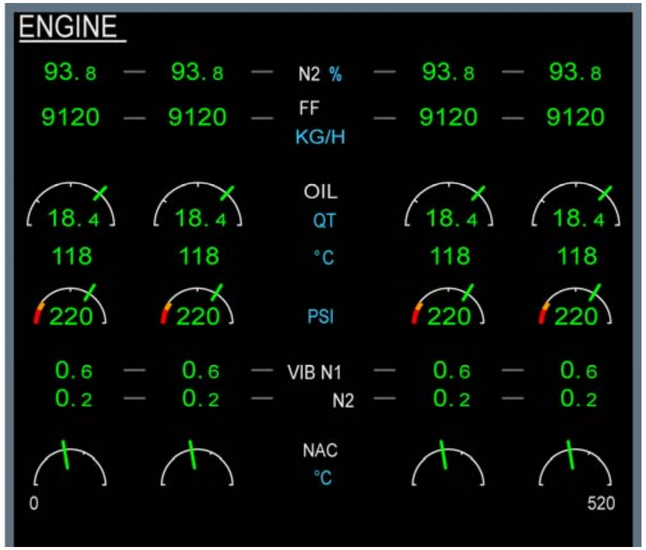
E/WD: Reverse Thrust

ECAM SD ENGINE Page

Trent 900



GP 7200



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List of Abbreviations

A

- **A/THR** Autothrust
- **ABN PROC** Not Sensed Procedures
- **AC** Alternating Current
- **ACMS** Aircraft Condition Monitoring System
- **ACUTE** Airbus Cockpit Universal Thrust Emulator
- **ADIRS** Air Data and Inertial Reference System
- **ADIRU** Air Data and Inertial Reference Unit
- **ADS** Automatic Dependent Surveillance
- **AES** Auto Extension System
- **AFM** Aircraft Flight Manual
- **AFS** Auto Flight System
- **AFS CP** AFS Control Panel
- **AFT** Aft
- **A-ICE** Anti-Ice
- **ALT** Altitude
- **AOA** Angle-of-Attack
- **AOC** Airline Operations Communications
- **AP** Autopilot
- **APPR** Approach
- **APU** Auxiliary Power Unit
- **ARS** Auto Retraction System
- **ATC** Air Traffic Control

B

- **B/C** Back Course
- **BAT** Battery
- **BCS** Brake Control System
- **BITE** Built-In Test Equipment
- **BLG** Body Landing Gears
- **BWS** Body Wheel Steering

C

- **C/B** Circuit Breaker
- **C/L** Checklist
- **CAPT** Captain
- **CCOM** Cabin Crew Operating Manual
- **CDL** Configuration Deviation List
- **CDS** Control and Display System
- **CDSS** Cockpit Door Surveillance System
- **CG** Center of Gravity
- **CI** Cost Index
- **CL** Climb
- **CMS** Central Maintenance System
- **CMV** Concentrator and Multiplexer for Video
- **CP** Control Panel
- **CPC** Cabin Pressure Controller
- **CPIOM** Core Processing Input/Output Module
- **CRZ** Cruise
- **CSTR** Constraint
- **CVMS** Cabin Video Monitoring System
- **CVR** Cockpit Voice Recorder

List of Abbreviations

D

- **DC** Direct Current
- **DCLB** Derated Climb
- **DES** Descent
- **DLCS** Data Load and Configuration System
- **DU** Display Unit
- **E/WD** Engine/Warning Display

E

- **EBCU** Emergency Brake Control Unit
- **EBHA** Electrical Backup Hydraulic Actuator
- **ECAM** Electronic Centralized Aircraft Monitoring
- **ECB** Electronic Control Box
- **ECP** ECAM Control Panel
- **EFB** Electronic Flight Bag
- **EFF** Electronic Flight Folder
- **EFIS** Electronic Flight Instrument System
- **EFOB** Estimated Fuel On Board
- **EHA** Electro-Hydrostatic Actuator
- **EIS** Entry Into Service
- **E-Logbook** Electronic Logbook
- **ELT** Emergency Locater Transmitter
- **EPU** Estimated Position Uncertainty
- **ETA** Estimated Time of Arrival
- **ETACS** External And Taxiing Camera System
- **EVAC** Evacuation
- **EXT** External

F

- **F** Minimum Flap Retract Speed
- **F/CTL** Flight Controls
- **F/O** First Officer
- **FADEC** Full Authority Digital Engine Control
- **FAP** Flight Attendant Panel
- **FCDC** Flight Control Data Concentrator
- **FCOM** Flight Crew Operating Manual
- **FCTM** Flight Crew Training Manual
- **FCU** Flight Control Unit
- **FD** Flight Director
- **FDRS** Flight Data Recording System
- **FDU** Fire Detection Unit
- **FE** Flight Envelope
- **FFCM** Free Fall Contol Module
- **FFU** Flight Follow Up
- **FG** Flight Guidance
- **FL** Flight Level
- **FLRS** Flap Load Relieve System
- **FLS** FMS Landing System
- **FMA** Flight Mode Annunciator
- **FMC** Flight Management Computer
- **FMS** Flight Management System
- **FOM** Flight Operations Manual
- **FPA** Flight Path Angle
- **FPV** Flight Path Vector
- **FQMS** Fuel Quantity and Management System
- **FWD** Forward
- **FWS** Flight Warning System

List of Abbreviations

G

- **G/S** Glide slope
- **GA** Go Around
- **GEN** Generator
- **GLS** GPS Landing System
- **GPS** Global Positioning System
- **GPWS** Ground Proximity Warning System
- **HDG** Heading
- **HF** High Frequency

H

- **HMI** Human Machine Interface
- **HP** High Pressure
- **HSMU** Hydraulic System Monitoring Unit
- **HUD** Head-up Display

I

- **IFE** In-Flight Entertainment
- **ILS** Instrument Landing System
- **IMA** Integrated Modular Avionics
- **INR** Inner
- **IOM** Input/Output Module
- **IP** Intermediate Pressure
- **ISA** International Standard Atmosphere
- **ISIS** Integrated Standby Instrument System
- **ISP** Integrated Static Probe

K

- **KCCU** Keyboard and Cursor Unit

L

- **LA XFR** Load Alleviation Transfer
- **LAF** Load Alleviation Function
- **LCD** Liquid Crystal Display
- **LEHGS** Local Electro-Hydraulic Generation System
- **LGCIS** Landing Gear Control and Indicating System
- **LGERS** Landing Gear Extension and Retraction System
- **LOC** Localizer
- **LP** Low Pressure
- **LRU** Line Replaceable Unit
- **LVL** Level
- **LVR** Lever

M

- **MCT** Maximum Continuous Thrust
- **MEL** Minimum Equipment List
- **MFD** Multi-Function Display
- **MFP** Multi-Function Probe
- **MIX LOC/VNAV** Mix Localizer/Vertical Navigation
- **MLG** Main Landing Gears
- **MLS** Microwave Landing System
- **MMO** Maximum Operating Mach
- **MMR** Multi-Mode Receiver
- **MSG** Message

List of Abbreviations

N

NAV	Navigation
NAVAID	(Radio) Navigation Aid
ND	Navigation Display
NLG	Nose Landing Gear
NSS	Network Server System
NWS	Nose Wheel Steering

O

O	Green Dot Speed (best lift to drag ratio)
OANS	Onboard Airport Navigation System
OIS	Onboard Information System
OIT	Onboard Information Terminal
OMS	Onboard Maintenance System
OMT	Onboard Maintenance Terminal
OUTR	Outer

P

pb	Pushbutton
PBE	Protective Breathing Equipment
PFD	Primary Flight Display
PMAT	Portable Multipurpose Access Terminal
PRIM	Primary Flight Control Computer
Ps	Static Pressure
Pt	Total Pressure
PWS	Predictive Windshear

R

RA	Radio Altimeter/Altitude
RAT	Ram Air Turbine
RMP	Radio Management Panel
RNP	Required Navigation Performance
RVR	Runway Visual Range
RWY	Runway

S

S	Minimum Slat Retract Speed
SATCOM	Satellite Communication
SCS	Steering Control System
SD	System Display
SDF	Smoke Detection Function
SEC	Secondary Flight Control Computer
sel	Selector
SFD	Standby Flight Display
SID	Standard Instrument Departure
SND	Standby Navigation Display
SQWK	Squawk
SRS	Speed Reference System
SSA	Side Slip Angle
STAR	Standard Terminal Arrival Route
STBY	Standby
SURV	Surveillance system
sw	Switch

List of Abbreviations

T

- **T/C** Top of Climb
- **T/D** Top of Descent
- **TAD** Terrain/obstacle Awareness and Display
- **TAT** Total Air Temperature
- **TAWS** Terrain Awareness and Warning System
- **TCAS** Traffic Collision Avoidance System
- **TCF** Terrain Clearance Floor
- **THR** Thrust
- **THS** Trimmable Horizontal Stabilizer
- **TK** Tank
- **TO** Takeoff
- **TR** Transformer Rectifier
- **TRANS** Transition
- **TRK** Track

V

- **V/S** Vertical Speed
- **VAPP** Final Approach Speed
- **VD** Vertical Display
- **VHF** Very High Frequency
- **VLS** Lower Selectable Speed
- **VMO** Maximum Operating Speed
- **VV** Velocity Vector

W

- **W & B** Weight and Balance
- **WLAN** Wireless Local Area Network
- **WLG** Wing Landing Gears
- **WTB** Wing Tip Brakes
- **WXR** Weather Radar

X

- **XFR** Transfer

Z

- **ZFCG** Zero Fuel Center of Gravity
- **ZFW** Zero Fuel Weight

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AIRBUS

AN EADS JOINT COMPANY WITH BAE SYSTEMS