JeeHell A320 FMGS
User Guide

Version B54.x

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1. Foreword

A320 FMGS software is a freeware solution to replicate the real Airbus A320's Flight Management & Guidance System (FMGS) and main electronic instruments, for Microsoft's Flight Simulator ®.

If you have any questions, remarks or else, you can contact me through e-mail (jeehell “at“ jeehell.org), or through ☞ **mycockpit.org** forums (English) or ☞ **aircockpit.com** forums (French).

The present guide will depict every functions implemented in the software and describe all instruments.

The standard operations will be explained on a sample flight between, Toulouse (LFBO) and Nice (LFMN).

ATTENTION :

This software is by no means related to Airbus, EADS or any affiliated group. It is intended to use only as a recreational software together with Microsoft Flight Simulator. Do not use as a part of training toward any kind or aeronautical certification, be it private pilot or commercial pilot training.

This software should cause no harm to your computer. In the very unlikely event damage occurred to your system, I won't take any liability. Use at your own risk.

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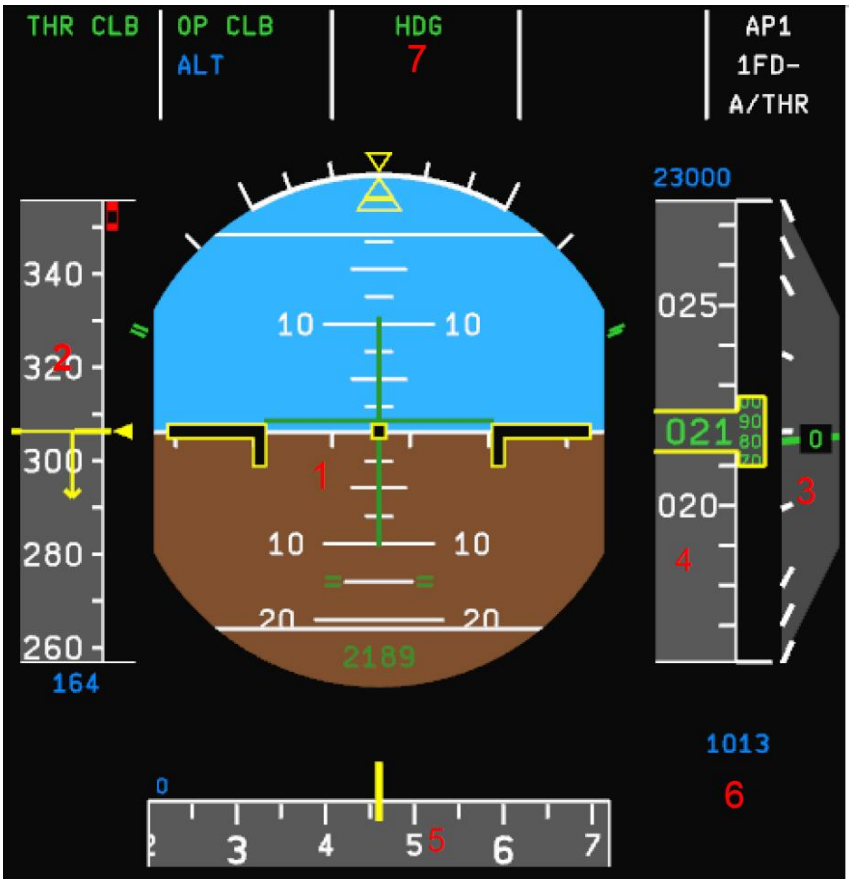
2. Instrument applications

2.1 - PFD (Primary Flight Display)

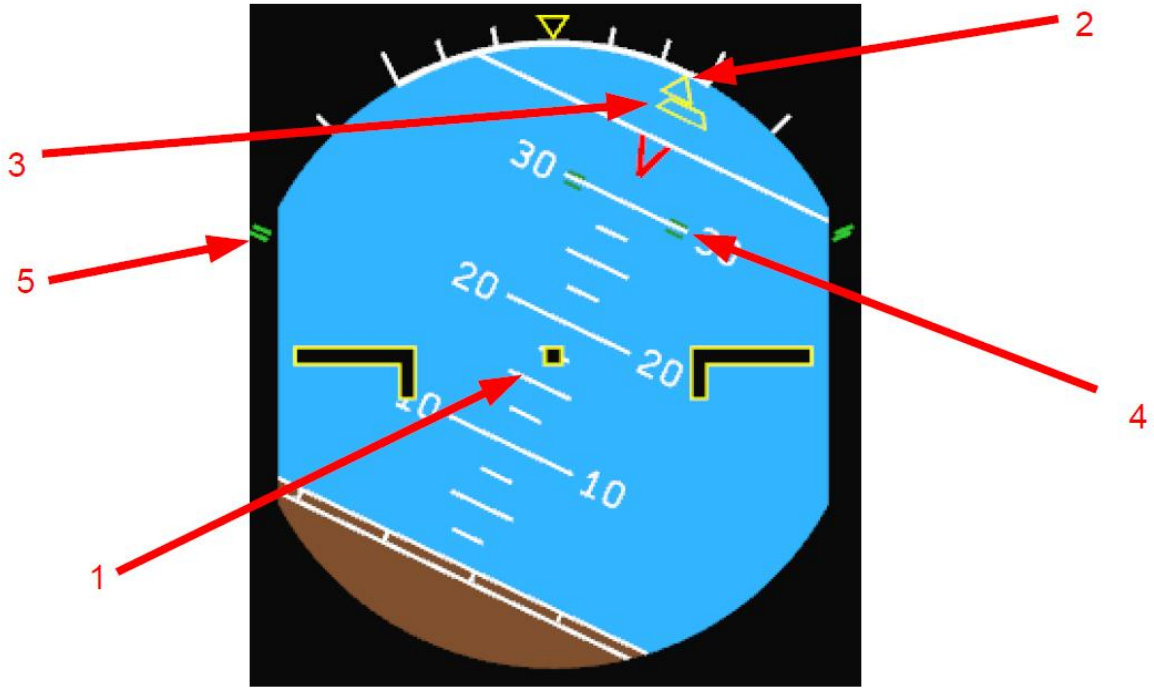
2.1.1 - General View



- (1) – Attitude Indicator (ADI)
- (2) – Speed Tape
- (3) – Vertical Speed
- (4) – Altitude Tape
- (5) – Compass Tape
- (6) – Barometric Setting
- (7) – Flight Mode Annunciator (FMA)

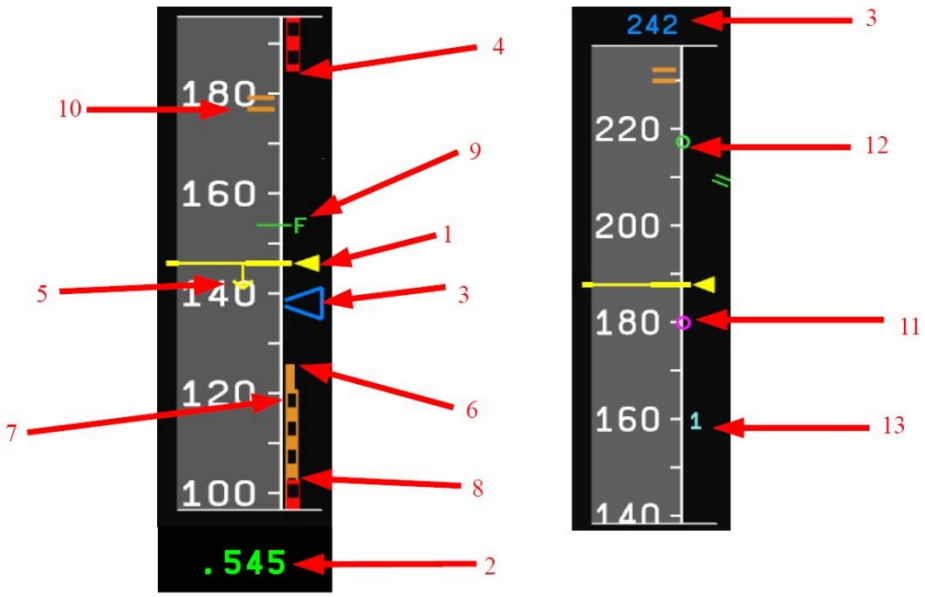
2.1.2 - Attitude Indicator

This is the heart of the PFD. It shows the ACFT attitude (pitch, bank, sideslip).



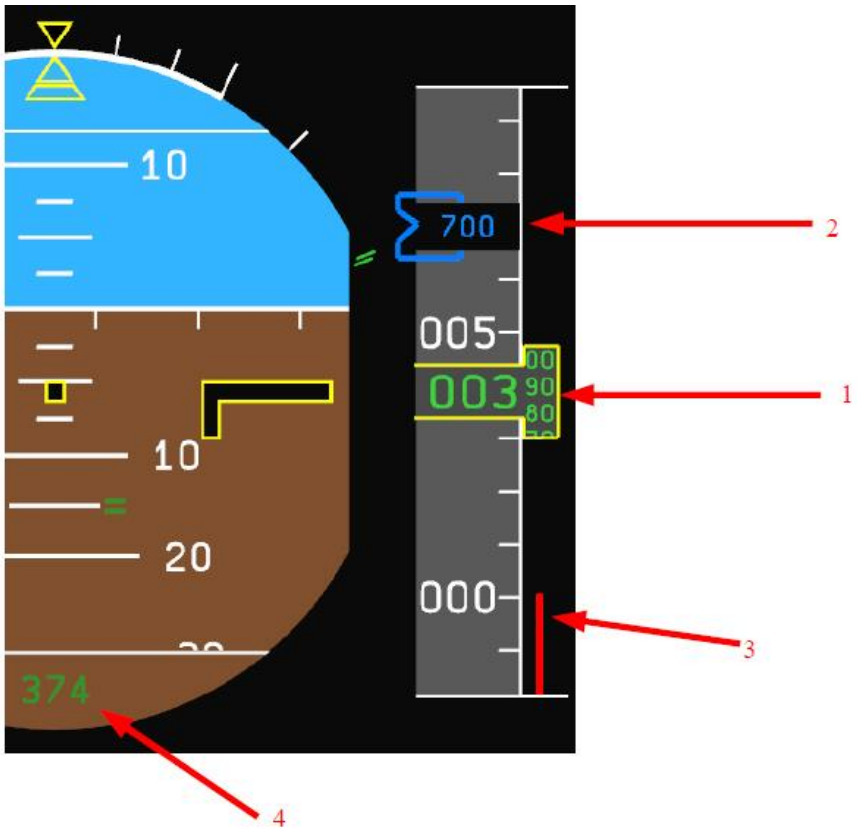
- (1) – Aircraft reference symbol
- (2) – Roll index
- (3) – Sideslip index
- (4) – Pitch limits of the Fly-By-Wire (FBW) (+30°/-15°)
- (5) – Bank limits of FBW

2.1.3 - *Speed Tape*



- (1) – IAS index
- (2) – Actual Mach number, shown if greater than M0.5
- (3) – IAS target. If speed target is out of scale range, then the numeric value is shown either above or below the scale in the same color as the index.
- (4) – Maximum IAS, red and black ribbon moving according to aircraft maximum speeds (VFE, VLE, MMO, VMO).
- (5) – IAS trend. Shows the IAS to be reached in 10s if acceleration is constant.
- (6) – VLS speed : this amber ribbon starts at α-protection speed and stops at the VLS speed (lowest selectable speed).
- (7) – α-protection ribbon. Ranges from Vstall to Vα-protection. If IAS drops inside this ribbon, α-protection automatically engages and TOGA is applied.
- (8) – Stall speed ribbon.
- (9) – Flaps retraction speed
- (10) – Next flap setting VFE
- (11) – Rotation speed (Vr) (*not a real value shown*)
- (12) – Green dot, best lift/drag ration in clean configuration
- (13) – Decision speed V1 (*not a real value shown*).

2.1.4 - *Altitude indications*

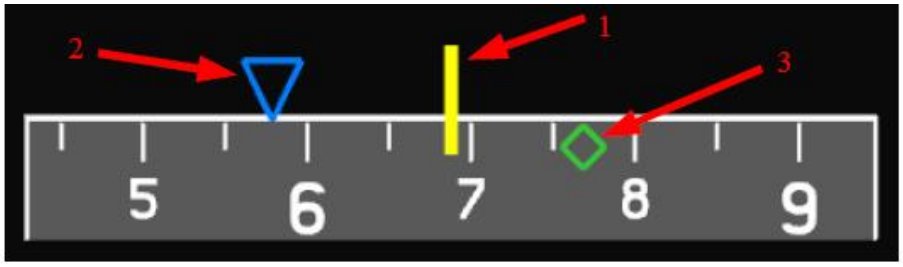


- (1) – Actual altitude (in respect to the barometric setting)
- (2) – Altitude target. If the target is out of scale range, then the numeric value is shown either above or below the scale in the same color as the index.
- (3) – Ground altitude ribbon
- (4) – Radio altimeter

2.1.5 - *Vertical Speed*

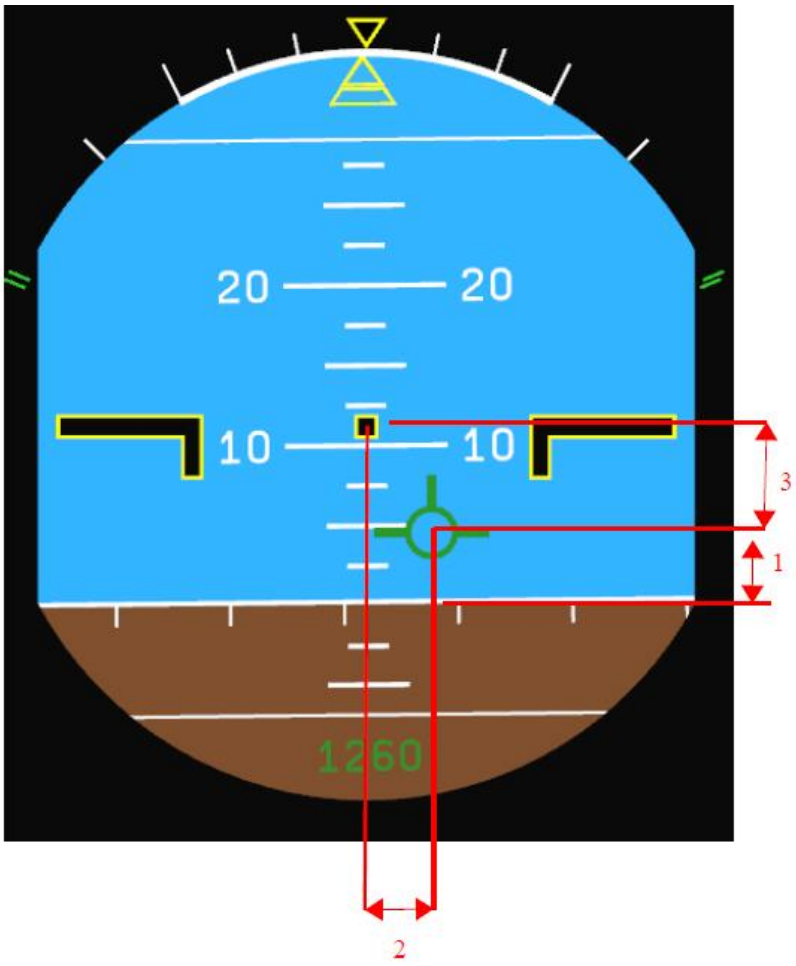
The green line is an analog indicator and moves along the V/S scale. Limits are ±2000ft/min. The green number is the V/S in hundreds of ft/min (here V/S is then +1100 ft/min).

2.1.6 - *Heading Tape*



- (1) – Magnetic heading index
- (2) – Magnetic heading target. If target is out of scale range, then the numeric value is shown either left or right of the scale, in the same color as the index.
- (3) – Actual magnetic track

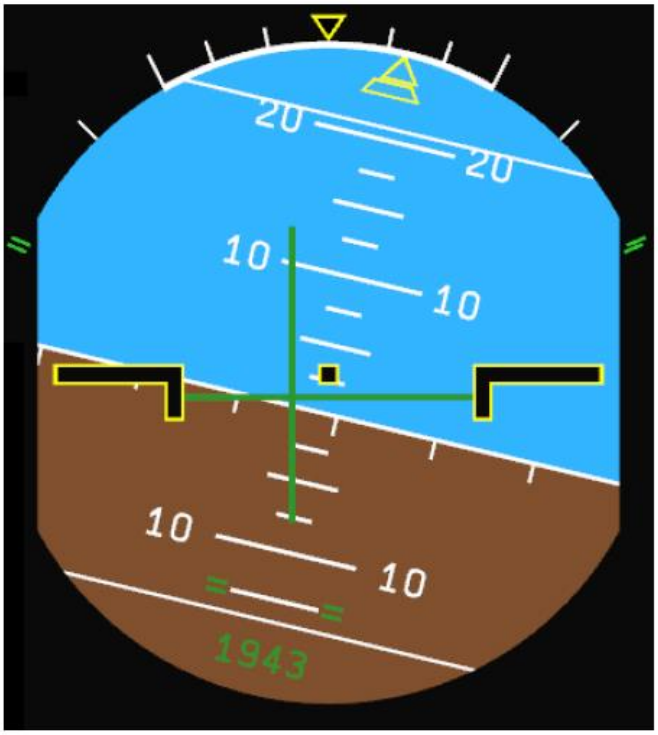
2.1.7 - Flight Path Vector



- The Flight Path Vector (FPV) is only shown when in Track/FPA mode (see FCU section)
- (1) – Flight Path Angle
- (2) – Drift Angle
- (3) – Angle Of Attack

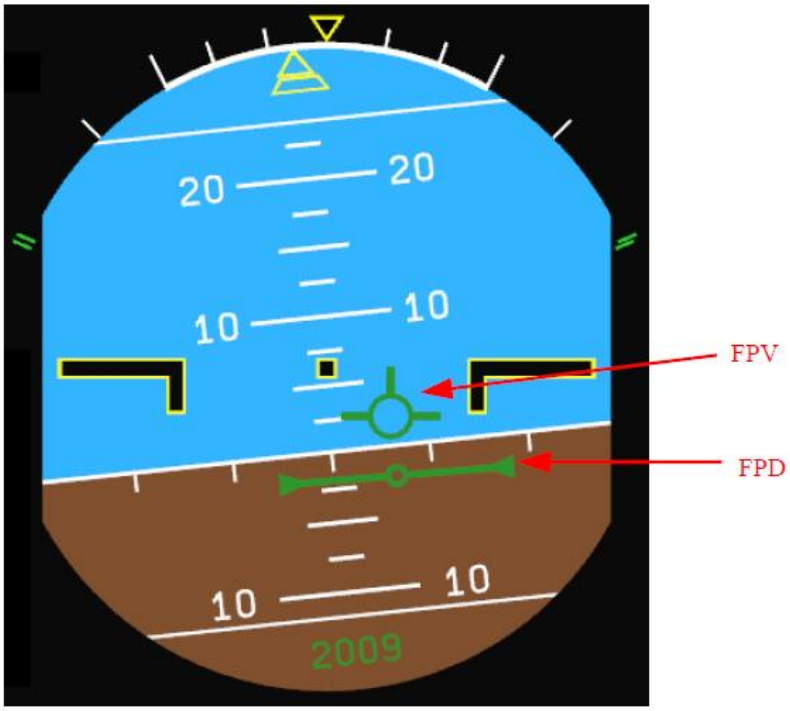
2.1.8 - Flight Director (FD)

HDG - V/S mode :



In HDG-V/S mode, the FD shows two green bars: pitch and roll. To follow the FD guidance, center the ACFT symbol on both bars.

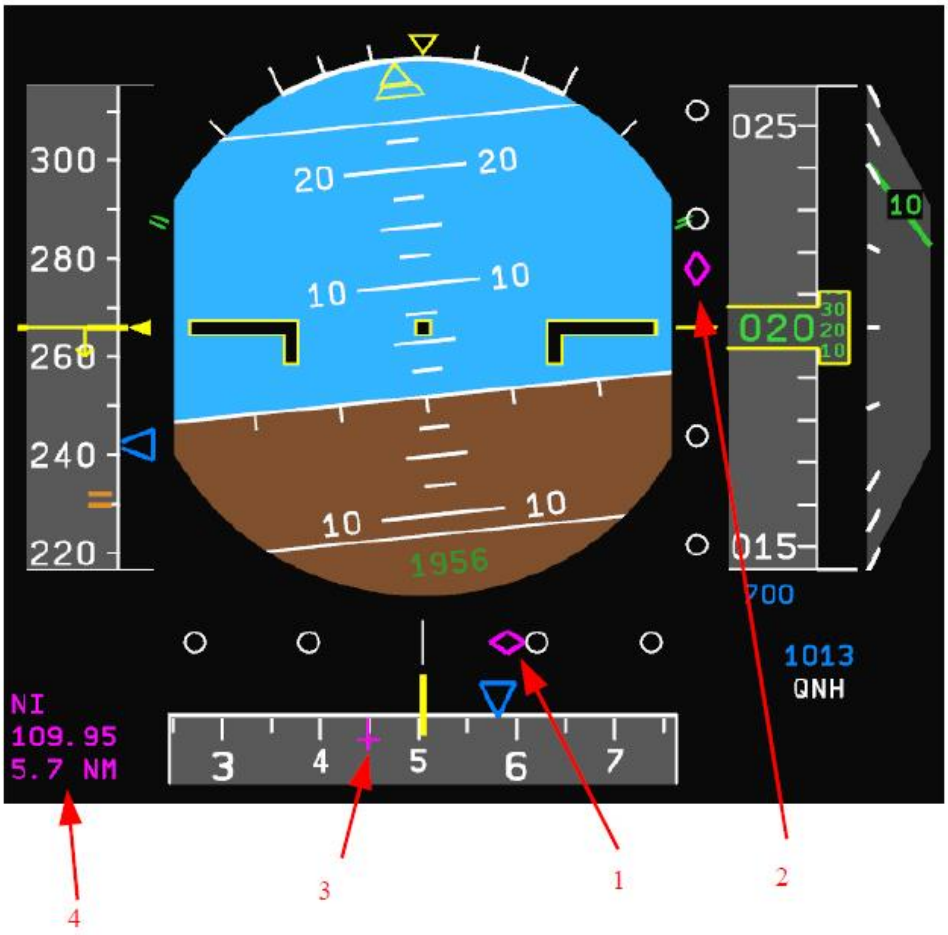
Track/FPA mode :



In TK/FPA mode, the FD shows the Flight Path Director (aka the “Bird”). You need to center the FPV on the FPD to achieve the correct pitch attitude, and roll in order to get the FPD horizontal.

2.1.9 - ILS and VDEV deviation Scales

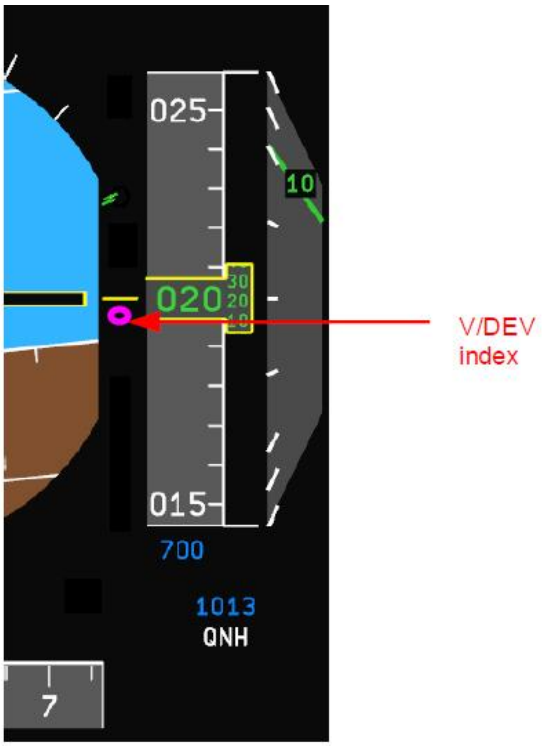
ILS trajectory deviation :



The ILS scales appear when an ILS frequency is entered, either via the MCDU or the Radio Management Panel (RMP), and the signal is received.

- (1) – Localizer Course Deviation indicator index and scale
- (2) – Glidepath Deviation Indicator index and scale
- (3) – Localizer magnetic track
- (4) – ILS data : ID, frequency and DME distance if there is a DME co-implanted with the glide path.

Vertical Deviation V / DEV :



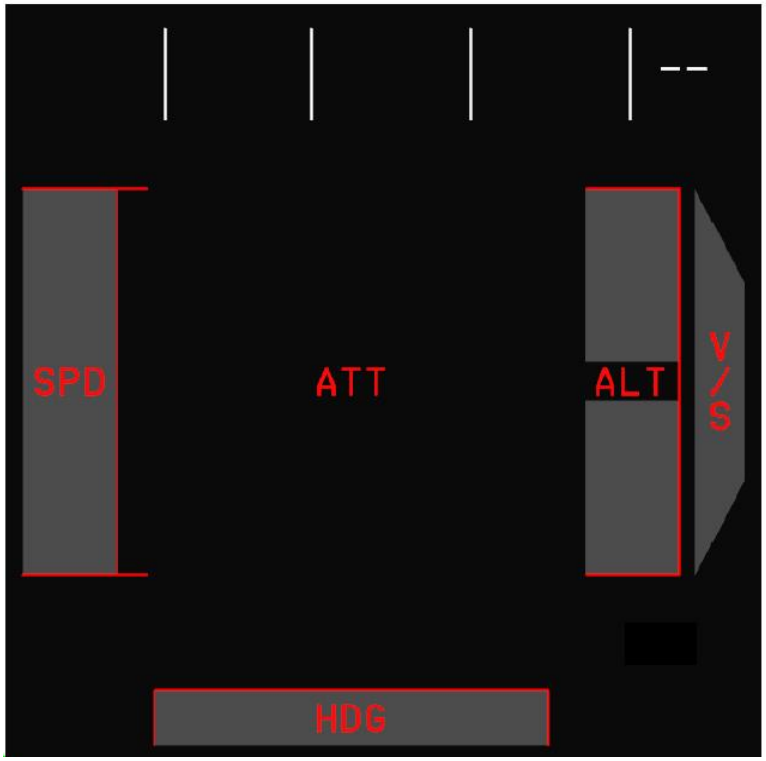
The V / DEV index appears at the engagement of descent (at TOD or on manual activation of DES mode).

During a non-precision approach, the index is shown as a rectangle.

2.1.10 - Flight Mode Annunciator (FMA)

The FMA is a summary of FMGS mode status and will be discussed later on in the AP/FD and A/THR section.

2.1.11 - Flags and messages



Here are all the flags currently implemented. They appear when the corresponding data is not available, which means that the ADIRS are not operational, check on the OVHD to switch them on and align them.

2.2 - Navigation Display (ND)

2.2.1 - General

The ND has five modes, each representing different data :

- ILS rose mode,
- VOR rose mode,
- NAV rose mode,
- NAV arc mode,
- PLAN mode.

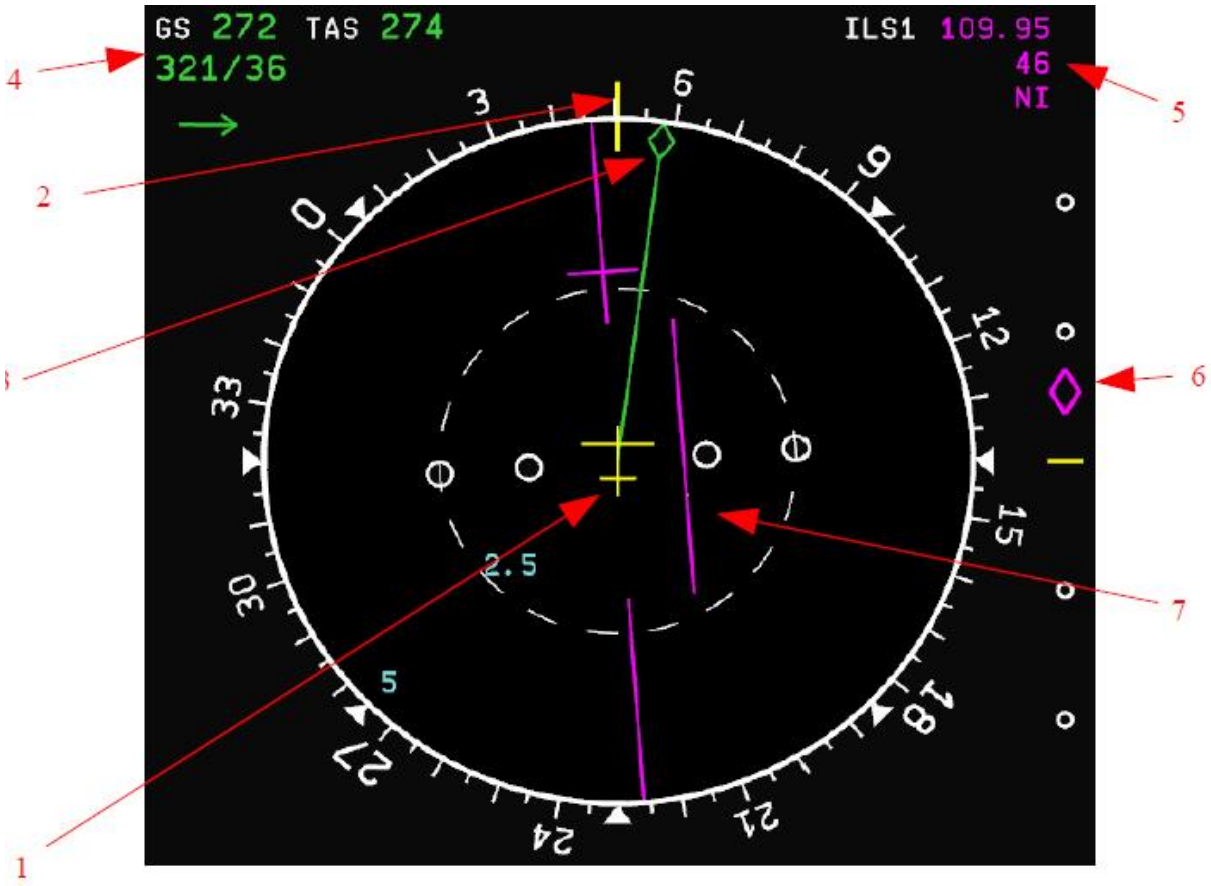
NAV arc and rose modes display the same data, but arc only shows the 90° forward sector whereas rose modes show a 360° sector.

There are six range selections which do not affect the data displayed :

- 10NM,
- 20NM,
- 40NM,
- 80NM,
- 160NM,
- 320NM.

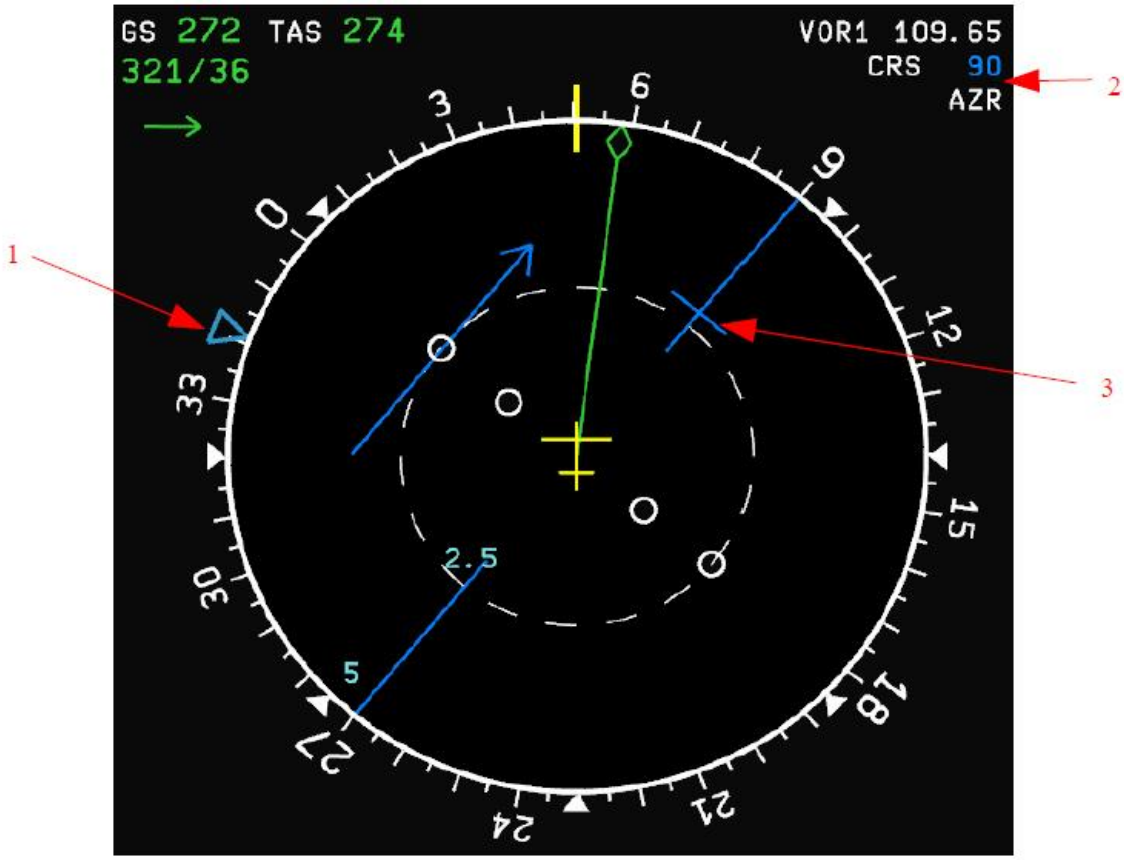
ND mode and range can be selected via the EFIS panels next to the FCU.

2.2.2 - *ILS Rose mode*



- (1) – Aircraft symbol
- (2) – Magnetic heading index (yellow line)
- (3) – Magnetic track (green line and diamond shape)
- (4) – Ground Speed, True AirSpeed and wind at the aircraft. The green arrow represents the wind direction relative to aircraft direction.
- (5) – ILS data block. Displayed only if a valid ILS signal is received on ILS receiver. It shows the frequency, magnetic track and ID.
- (6) – Glide Path deviation scale and index
- (7) – Localizer course deviation. Points toward the localizer track (automatically tuned from navigation database).

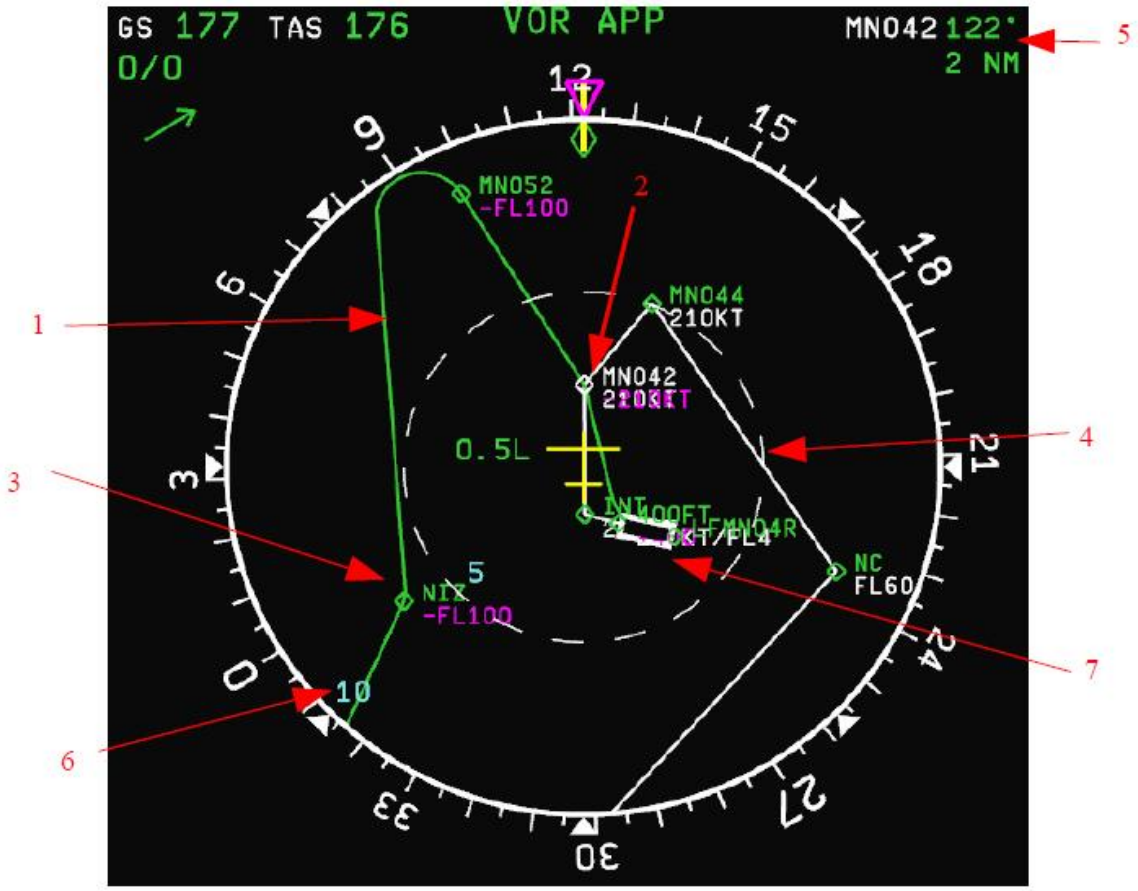
2.2.3 - VOR Rose mode



- (1) – Heading target
- (2) – VOR data block. Shown only if a valid signal is received on NAV receiver. It shows frequency, course selected (through MCDU RAD NAV page) and ID
- (3) – Course Deviation Indicator. Pointing towards the selected course.

Captain ND show NAV 1 indications, FO ND shows NAV 2 indications.

2.2.4 - NAV modes (Rose and Arc)

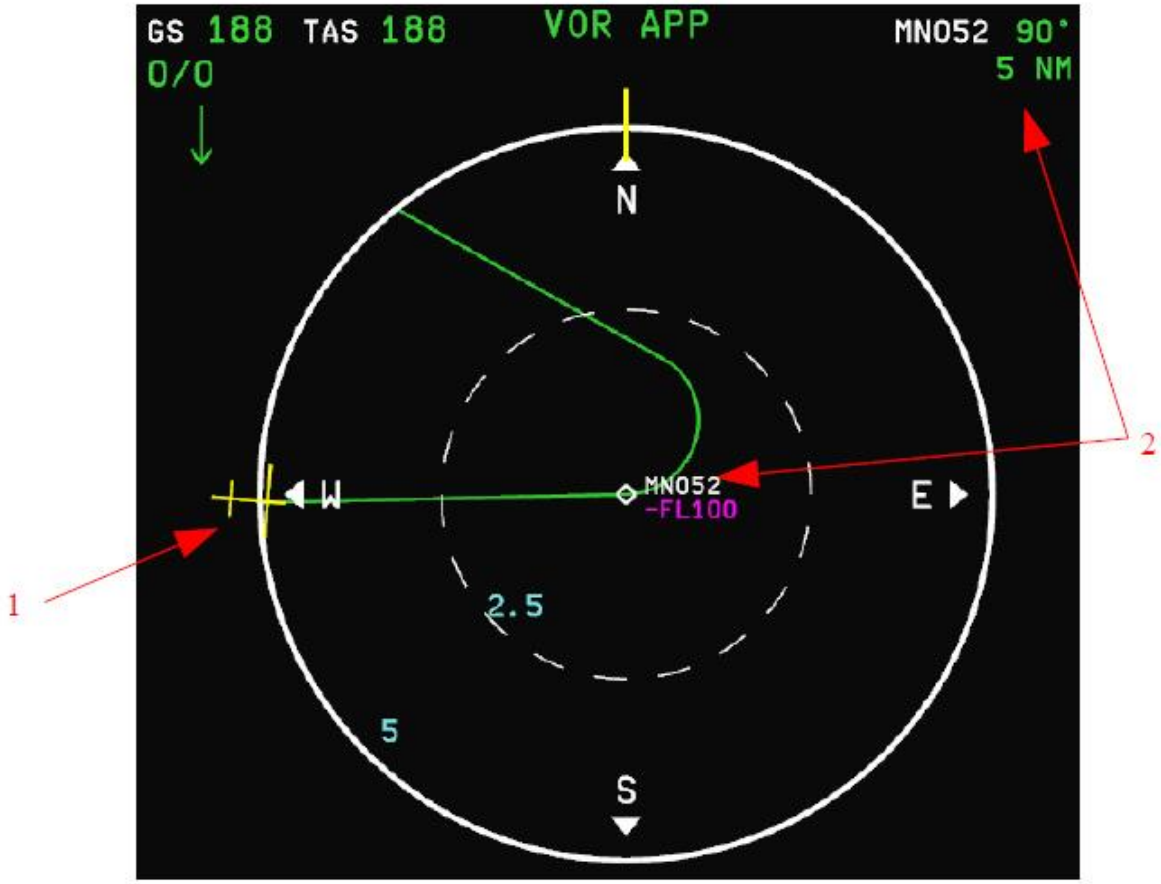


- (1) – Active Flight Plan track. This green line is continuous if NAV mode is engaged and broken otherwise.
- (2) – Active point. The magenta number is a constraint (here below FL100).
- (3) – Non active point.
- (4) – Secondary Flight Plan (if MCDU page is a SEC page).
- (5) – Active point data block. It shows the name, magnetic bearing and the distance to the active point.
- (6) – Range mark
- (7) – Runway (length is at correct scale).

- (1) – Bearing 1 pointer and NAV1 data block
- (2) – Bearing 2 pointer and NAV2 data block
- (3) – Cross Track Error. 1.9L means the ACFT is 1.9NM to the left of the FPLN track. (on this picture, the ACFT is flying in reverse direction of the FPLN...)

The bearing pointers appear in all modes except Plan mode. The color is green for ADFs and white for VORs. You can select to display them or not via the EFIS.

2.2.5 - Plan mode

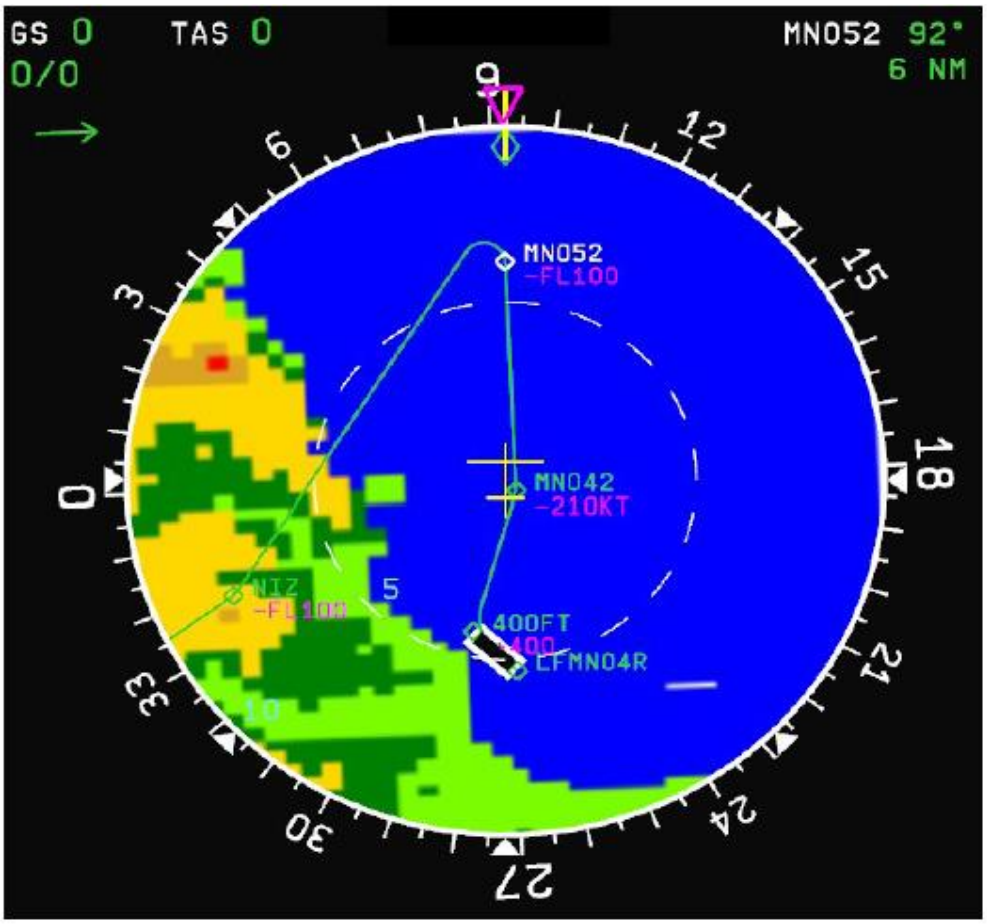


The PLAN mode shows a map centered on the 2nd line point in the MCDU FPLN page. It is oriented relatively to the true north.

- (1) – ACFT symbol
- (2) – Map reference point and Active point data block.

2.2.6 - EGPWS

When Terrain On ND is selected, the ND displays (in all modes) the terrain elevation according to the aircraft reference altitude in colors. The aircraft reference altitude is the ACFT altitude or the altitude expected in 30s if descending more than 1000 ft/minute.



Color code :

- Deep Blue: sea or ocean
- Black : 2000ft below reference altitude
- Light green : 2000 to 1000ft below reference altitude
- Dark green :
    - ➢ 500 to 1000 ft below reference altitude if gear is up
    - ➢ 250 to 1000 ft below reference altitude if gear is down

- Light yellow : 500 or 250ft (according to gear) below reference altitude to 1000ft above reference altitude.
- Dark : 1000 to 2000 ft above reference altitude
- Red :higher than 2000 ft above reference altitude

You can switch ON/OFF the EGPWS via the MCDU MENU simulating the TERR ON ND button on the main panel of the real ACFT.

2.2.7 - TCAS

The Traffic Collision Avoidance System (TCAS) use the transponders of all aircraft in the vicinity to detect risks of collision. It represents on the ND the position of other traffic to help acquire a situation awareness. It can detect traffic 40NM from ACFT position and ±9900ft from ACFT altitude.

There are four levels of risk, each represented by a different symbol on ND:

- (1) – proximate : no collision risk. Intruder within 6NM laterally and ±1200ft vertically
- (2) – Traffic Advisory (TA) : potential collision risk. Estimated time of closest position ≤ 40s
- (3) – Resolution Advisory (RA) : real collision risk. Estimated time of closest position ≤ 25s
- (4) – Other intruder : no risks of collision

For each type of symbol, the number below is the altitude difference in hundred of feet, and the arrow is the vertical trend (the difference between the two aircraft vertical speed).

For TA alerts there is an aural warning 'TRAFFIC TRAFFIC', and if the ND range or mode is not adequate, an amber flag appears on the ND.

For RA alerts there is an aural warning 'CLIMB CLIMB' or 'DESCEND DESCEND' and a visual aid on the PFD vertical speed indicator. If the ND range or mode is not adequate, a red flag appears on the ND.

When an RA is over, an aural message 'Clear of conflict' is played.

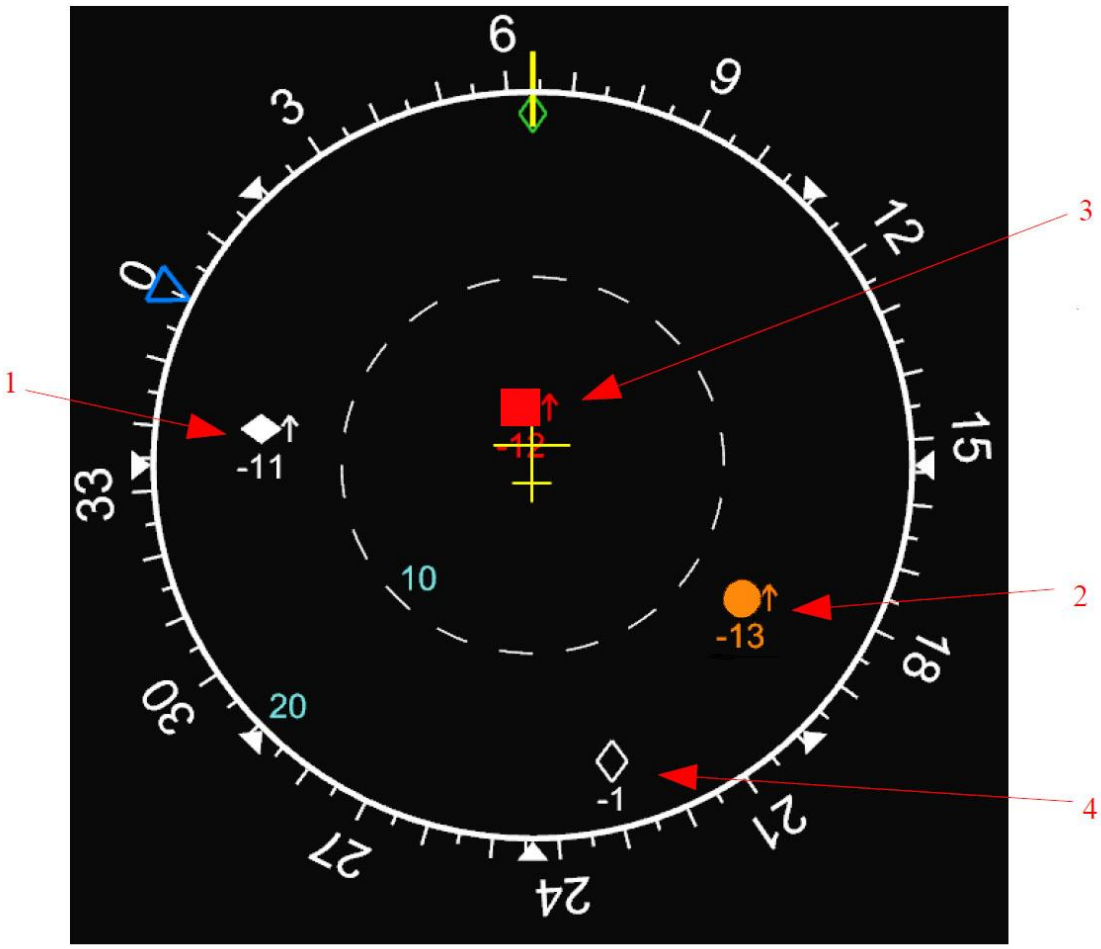
In order for the TCAS to function, you need to set your transponder on mode C, and the TCAS on any mode besides STBY. You can do so via the MCDU MENU page

TCAS modes are :

- **STBY** : TCAS does not provide any traffic information
- **TA** : only TA alerts are provided (RAs are treated as TAs).
- **TA/RA** : all intruders displayed

It is possible to inhibit proximates and other intruders via the MCDU MENU page (on the real aircraft via the transponder panel). TA's and RA's are always shown.

- **ALL** : Proximates and intruders are shown at all times if within ±2700ft.
- **THRT** : Proximates and intruders are shown only if within ±2700ft AND a TA or RA is present.
- **ABV** (above) : Proximates and intruders are shown at all times if within +9900ft and -2700ft
- **BLW** (below) : Proximates and intruders are shown at all times if within -9900ft and +2700ft.



2.2.8 - Chronometer

Both CPT and F/O NDs have a built-in chronometer. When active, it is displayed in the lower left part of the ND :

There is only one control for it, located on the glare-shield panel on the real aircraft. In the software, you have two ways to activate it: either push C on the keyboard while the ND window is focused, or through the FSUIPC offset 66D0 (see table).

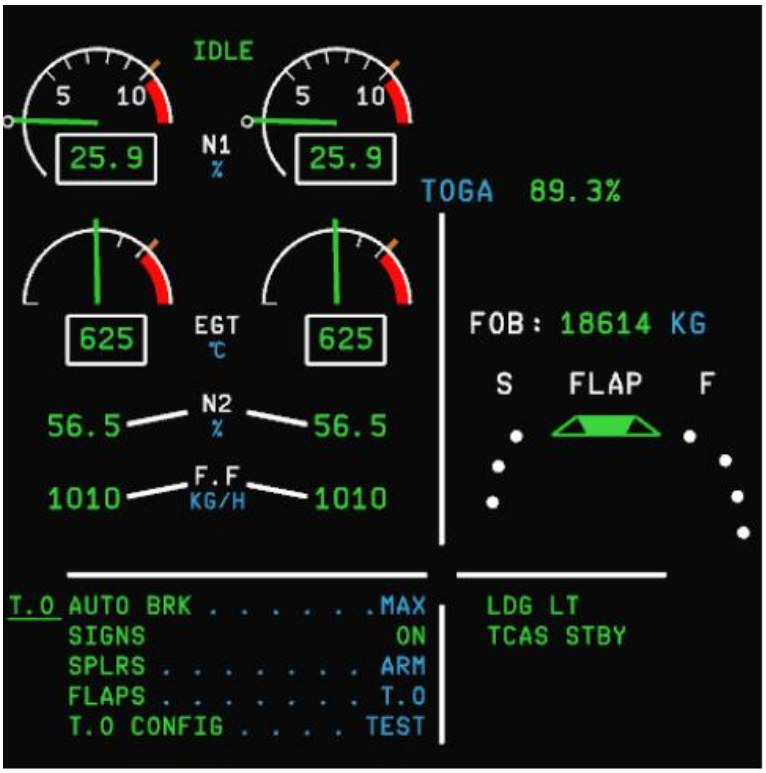
One push starts and shows the chronometer, the second push freezes it, and the third push resets and hides the chronometer.

2.3 - Engine / Warning Display E/WD

2.3.1 - General

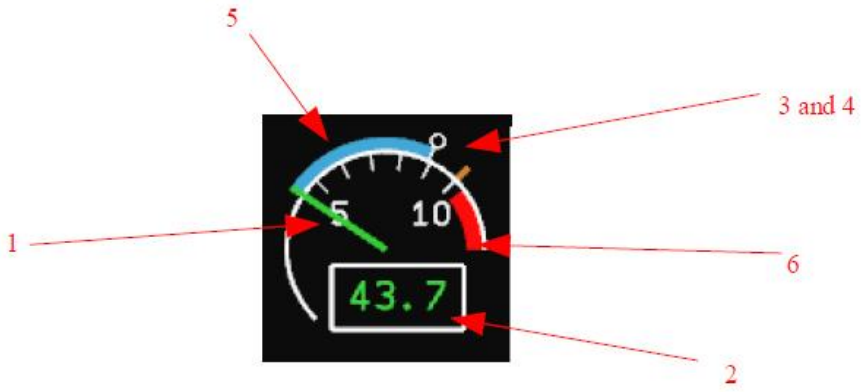
The E/WD, usually displayed on the upper ECAM, presents various important information on the ACFT systems. It is divided into four parts :

- The upper left part is reserved for engine parameters.
- The upper right part is for fuel and flaps.
- The lower two parts are for ECAM failure, warning and memo messages.
- Note that an EIS2 version is also available, check Experts User Guide.
- An IAE version, with EPR readings, is also available, check **Advanced User Guide** and **Installation Guide**.



2.3.2 - Engine Parameters

N1 : This indicator shows the N1 in percentage to the maximum N1.



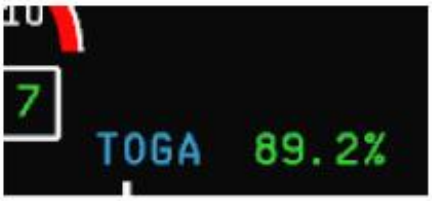
- (1) – Analog pointer
- (2) – Numerical value
- (3) – Small white circle : position of thrust lever
- (4) – Amber line : max N1
- (5) – Transient N1 : difference between commanded and actual N1. Only displayed with A/THR on.
- (6) – Max permissible N1 : starts at 104%, it's the prohibited area of N1.

EGT : This indicator shows the Exhaust Gas Temperature in Celsius degrees.

- (1) – Analog pointer
- (2) – Numerical value
- (3) – Maximum permissible EGT (starts at 950°C)
- (4) – Maximum EGT (915°C).

N2 and Fuel Flow : N2 is in percentage of maximum N2. Fuel flow is in kg/hour.

Lever setting : It shows the Thrust rating mode according to levers position, and the maximum %N1 value A/THR can deliver when in that position. If the levers are not in a defined notch, only the numerical value appears.



Fuel On Board (FOB) and flaps :

- The FOB (Fuel On Board) shows the total fuel on-board in kg.
- The Flap indicator shows the flaps (F) and slats (S) settings. The green triangles show the actual position. The blue ones the selected position (via pedestal lever), they disappear when selected and actual positions match.
- The text below the indicator is the selected flaps position. It's green when selected and actual positions match, and blue when flaps/slats are in transit.

2.4 - System/Status Display (SD)

2.4.1 - General

The SD is usually displayed on the lower ECAM, on the main panel. It displays information on most aircraft systems, through a set of system pages, in a total of 12 pages.

Here is a list of the pages, with the corresponding keypress to access it (with SD page focused):

- Engine (E)
- Bleed (B)
- Cabin pressure (P)
- Electric power (L)
- Hydraulic (H)
- Fuel (F)
- APU (A)
- Air conditioning (O)
- Doors (D)
- Wheels / landing gear (W)
- Flight controls (G)

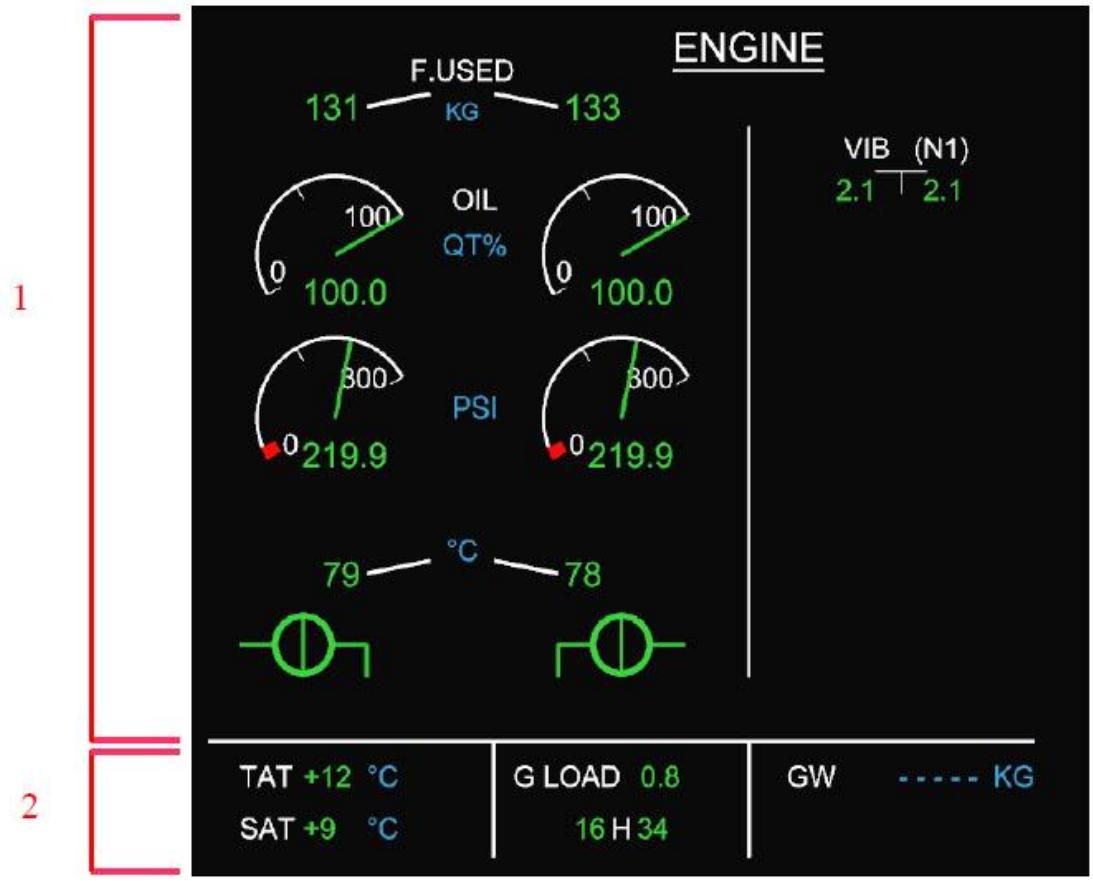
There are additional keyboard shortcuts for this window :

- Y and U arm/disarm the ground spoilers
- T is the TO CONFIG button on the ECAM control panel (ECP, located on the pedestal)
- R is the RCL button of the ECP
- BACKSPACE is the CLR button of the ECP
- DEL is the EMER CANC button of the ECP

The selection of a page can be either manual or automatic. By default, it's automatic, and the page displayed depends on the flight phase, and aircraft configuration. To manually select a page, push the key as in the list above. To get back to automatic selection, push the same key again. If a page is displayed as a result of a failure, you cannot manually override it to display another system page.

The description of the pages in this chapter is intended to remain brief. Almost every indicators and labels are modeled. For an in-depth description of SD pages and aircraft systems, I suggest you read material such as FCOMs (☞ **www.smartcockpit.com**).

The display is usually organized like in this picture :

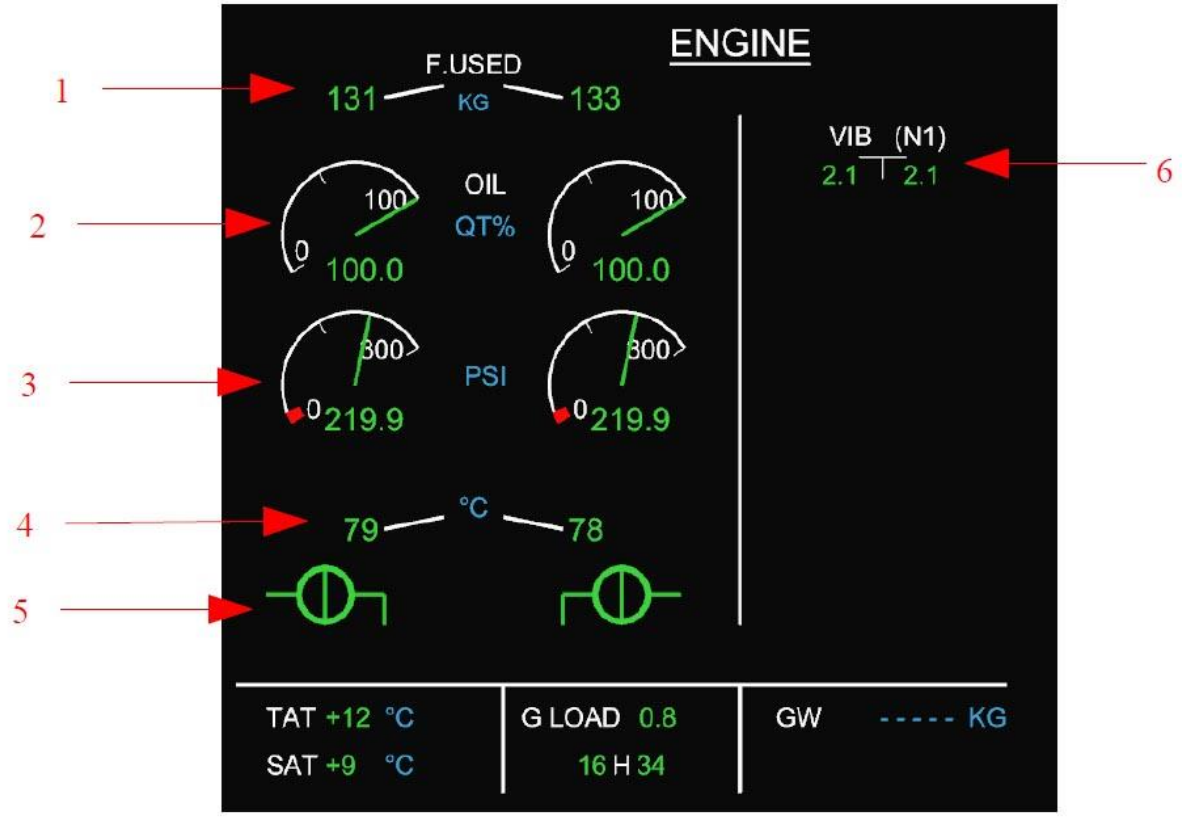


- (1) – System Page : varies according to the selected page (either automatically or manually)
- (2) – Permanent data : shows the Total and Static Air Temperature (TAT & SAT), the Gload, UTC time, and the Gross Weight (GW).

Note that an EIS2 version is also available, check **Advanced User Guide**.
Now let's see each page independently.

2.4.2 - ENGINE

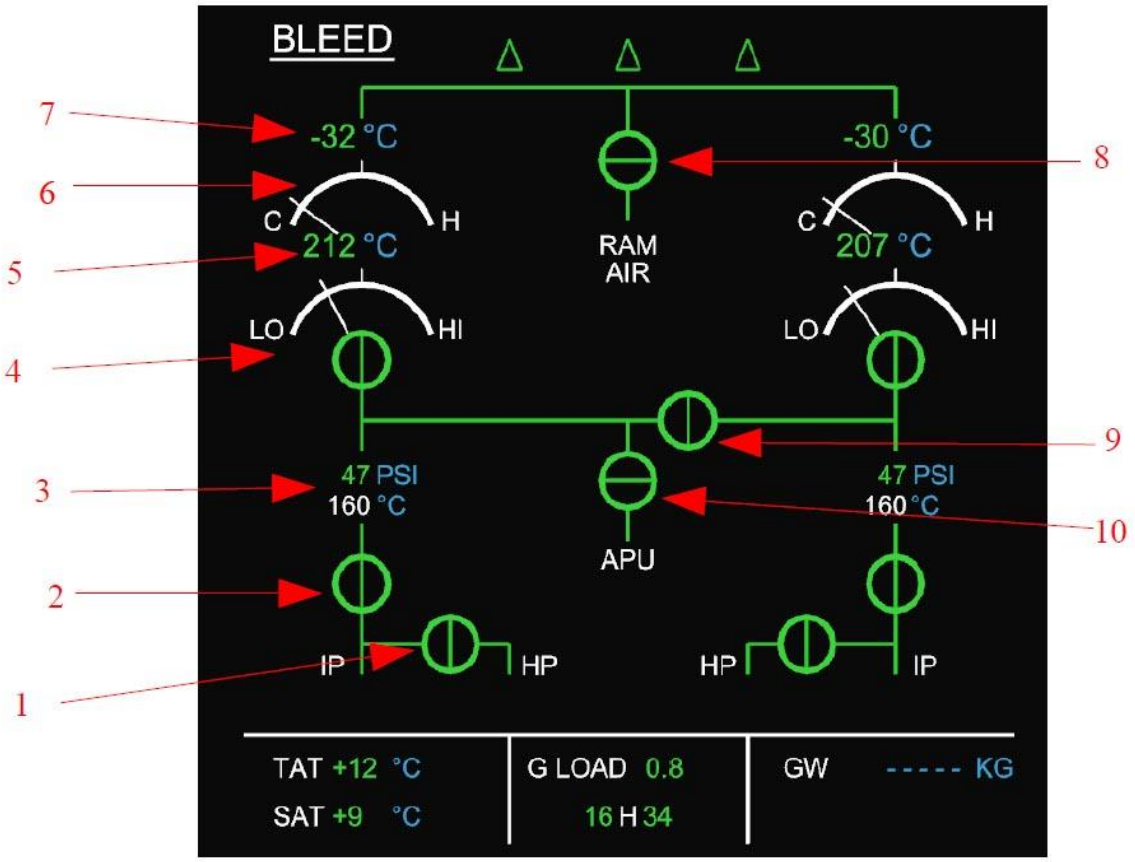
This page show various information for each engine, in addition to the EWD.



- (1) – Fuel used in kilograms
- (2) – Oil quantity in %
- (3) – Oil pressure in PSI
- (4) – Oil temperature in °C
- (5) – Start valve position (here closed)
- (6) – N1 fan vibrations

2.4.3 - BLEED

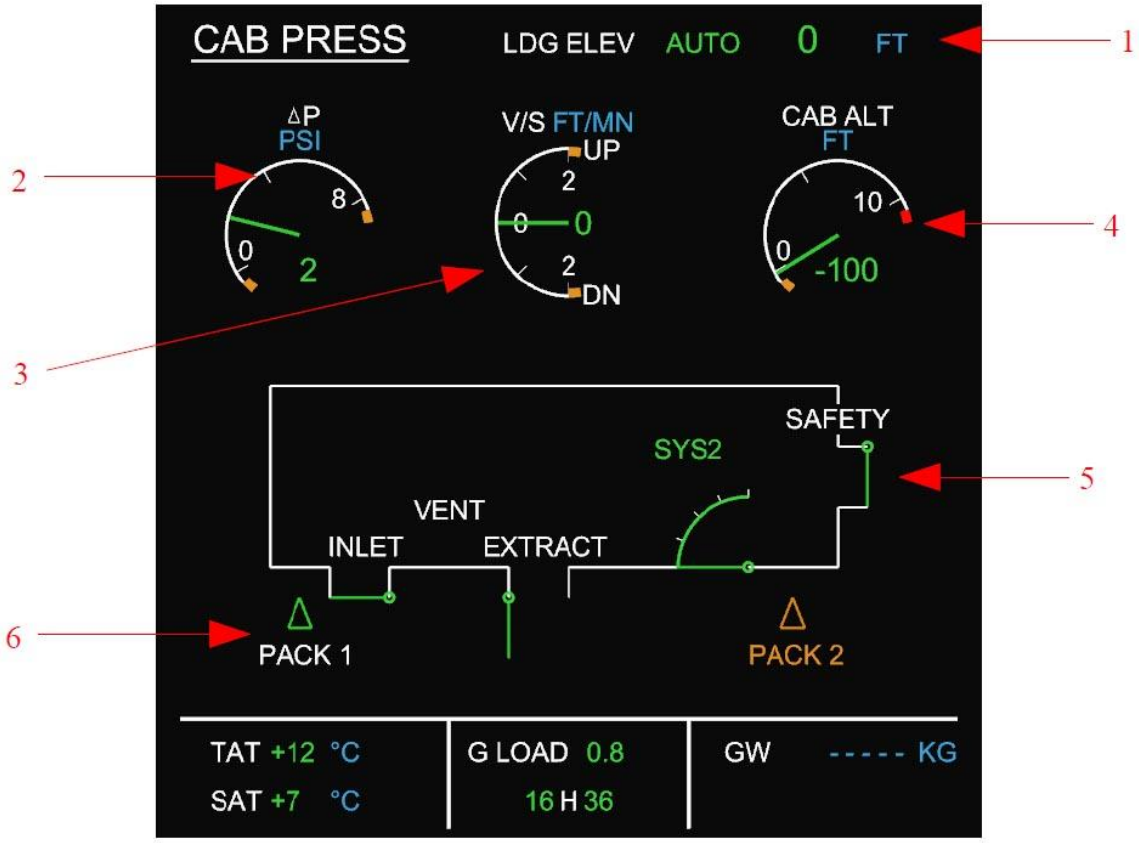
It displays the status of the air bleed system.



- (1) – High Pressure valve
- (2) – Engine Bleed valve
- (3) – Engine bleed pressure and temperature
- (4) – Pack flow control valve and flow indicator
- (5) – Pack compressor outflow temperature
- (6) – Pack by-pass valve
- (7) – Pack outlet temperature
- (8) – RAM air valve
- (9) – X-Bleed valve
- (10) – APU bleed valve

2.4.4 - CABIN PRESSURE

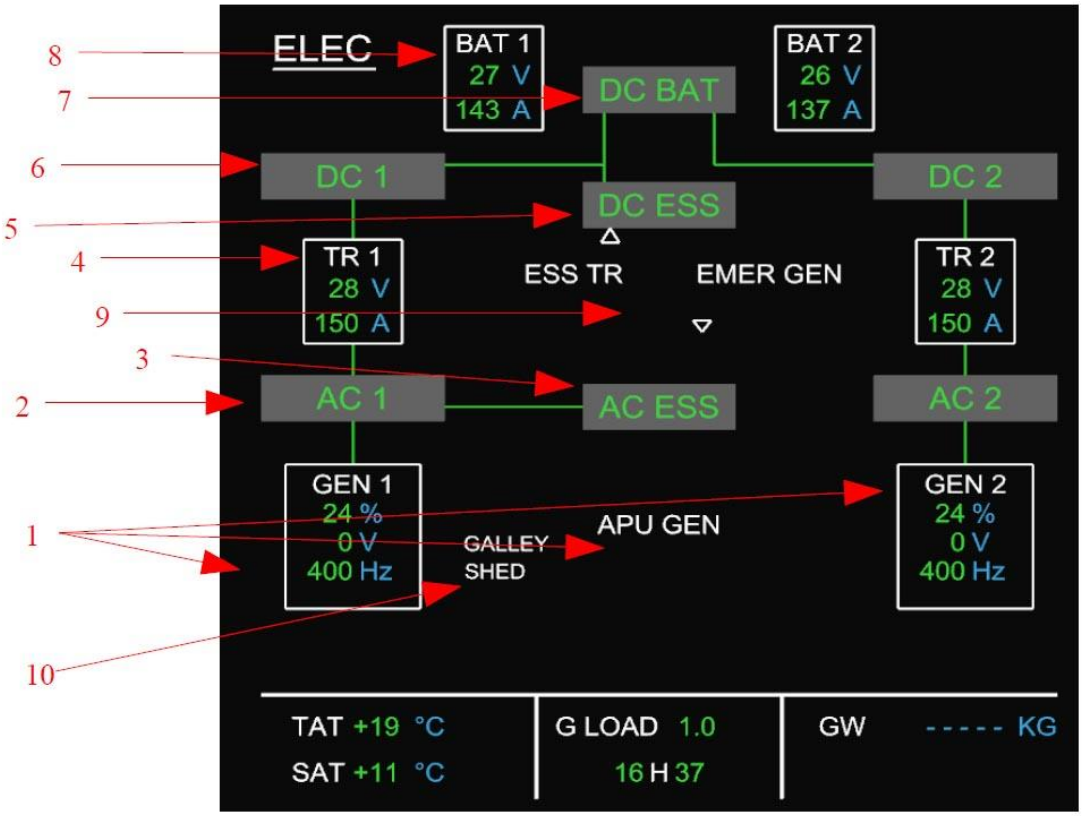
It displays the cabin pressurization system status.



- (1) – Landing runway elevation, either selected manually or automatically (cf overhead)
- (2) – Pressure difference ΔP (PSI).
- (3) – Cabin vertical speed (ft/min)
- (4) – Cabin altitude (feet)
- (5) – Safety valve
- (6) – Packs status

2.4.5 - ELECTRICAL

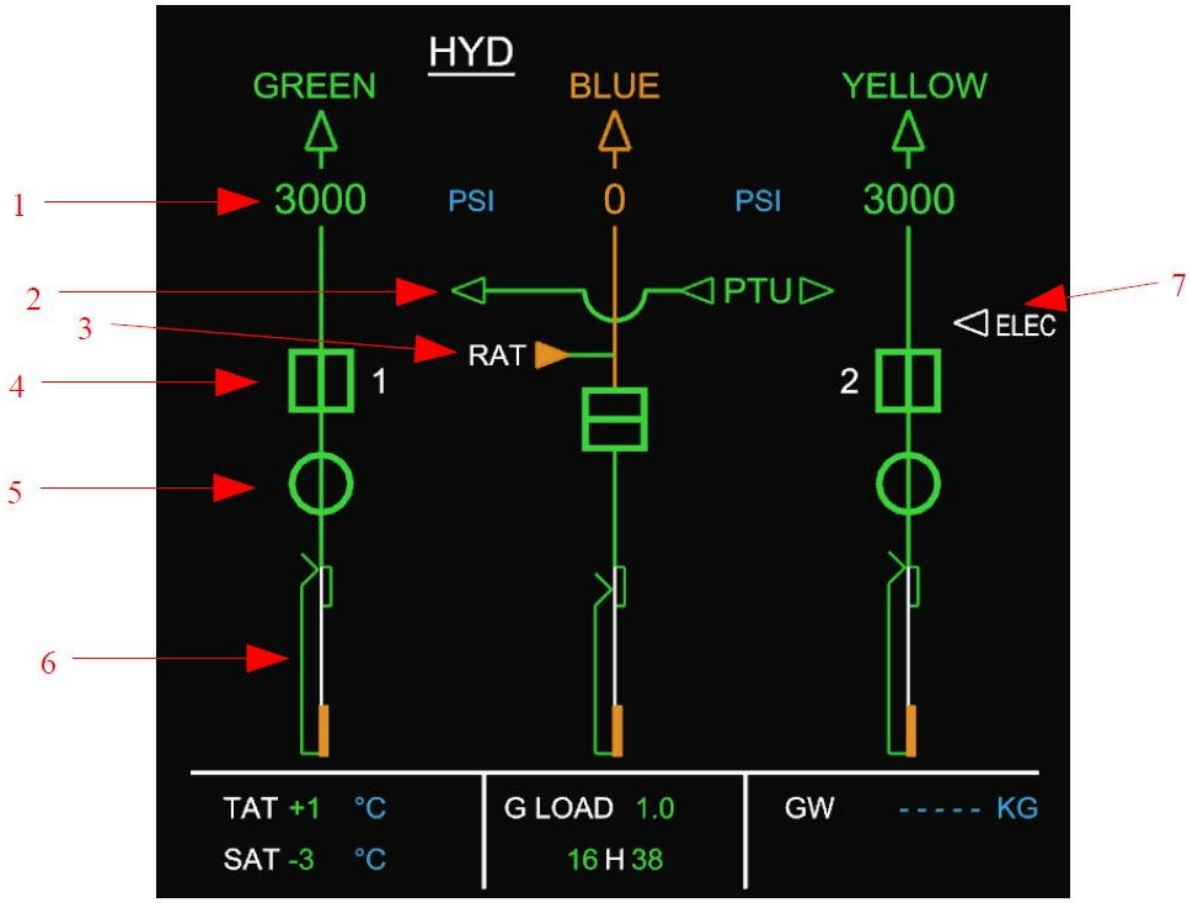
This page shows the electric power generation and distribution to the different buses.



- (1) – Normal electric generation status (voltage, load and frequency). Engine 1&2 generators, APU electric generator and ground power.
- (2) – AC buses 1 & 2
- (3) – AC essential bus
- (4) – Transformer-Rectifier 1 & 2
- (5) – DC essential Bus
- (6) – DS buses 1 & 2
- (7) – DC battery bus
- (8) – Batteries 1 & 2 voltage and current
- (9) – Essential Transformer-Rectifier and Emergency Generator
- (10) – Galley Shed, if a part of the commercial equipement is shed to save electric power.

2.4.6 - HYDRAULIC

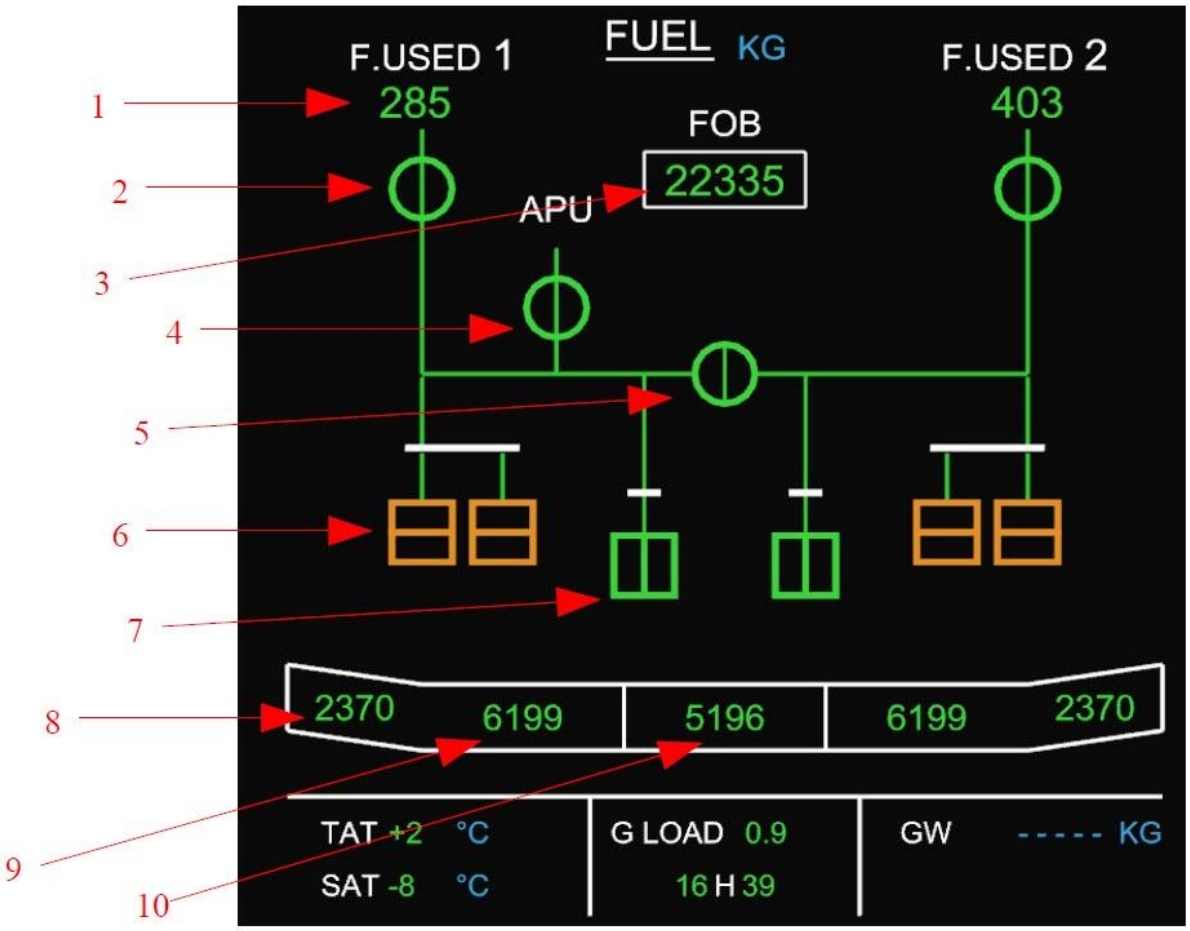
This page shows the hydraulic system status.



- (1) – Hydraulic flui pressure in G, B and Y circuits
- (2) – Power Transfer Unit (PTU).
- (3) – RAT driven electric pump
- (4) – Hydraulic pumps
- (5) – Fire valve
- (6) – Hydraulic fluid quantity
- (7) – Yellow electric pump

2.4.7 - FUEL

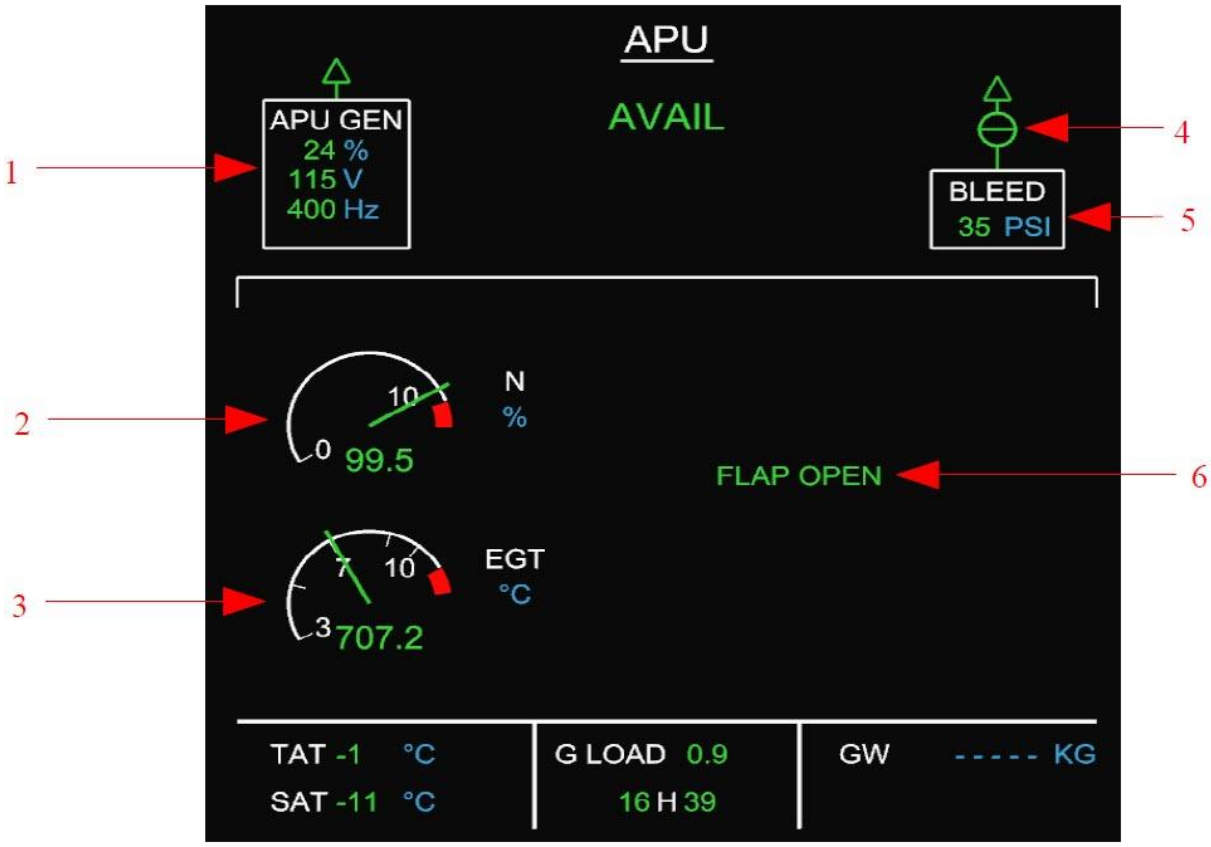
This page displays the fuel system status.



- (1) – Fuel used in kilograms
- (2) – Engine Low Pressure fuel valve
- (3) – Fuel On Board in kilograms
- (4) – APU low pressure fuel valve
- (5) – Fuel X-feed valve
- (6) – Wing tanks fuel pumps
- (7) – Center tank fuel pumps
- (8) – Outer wing tanks fuel quantity
- (9) – Inner wing tanks fuel quantity
- (10) – Center tank fuel quantity

2.4.8 - *APU*

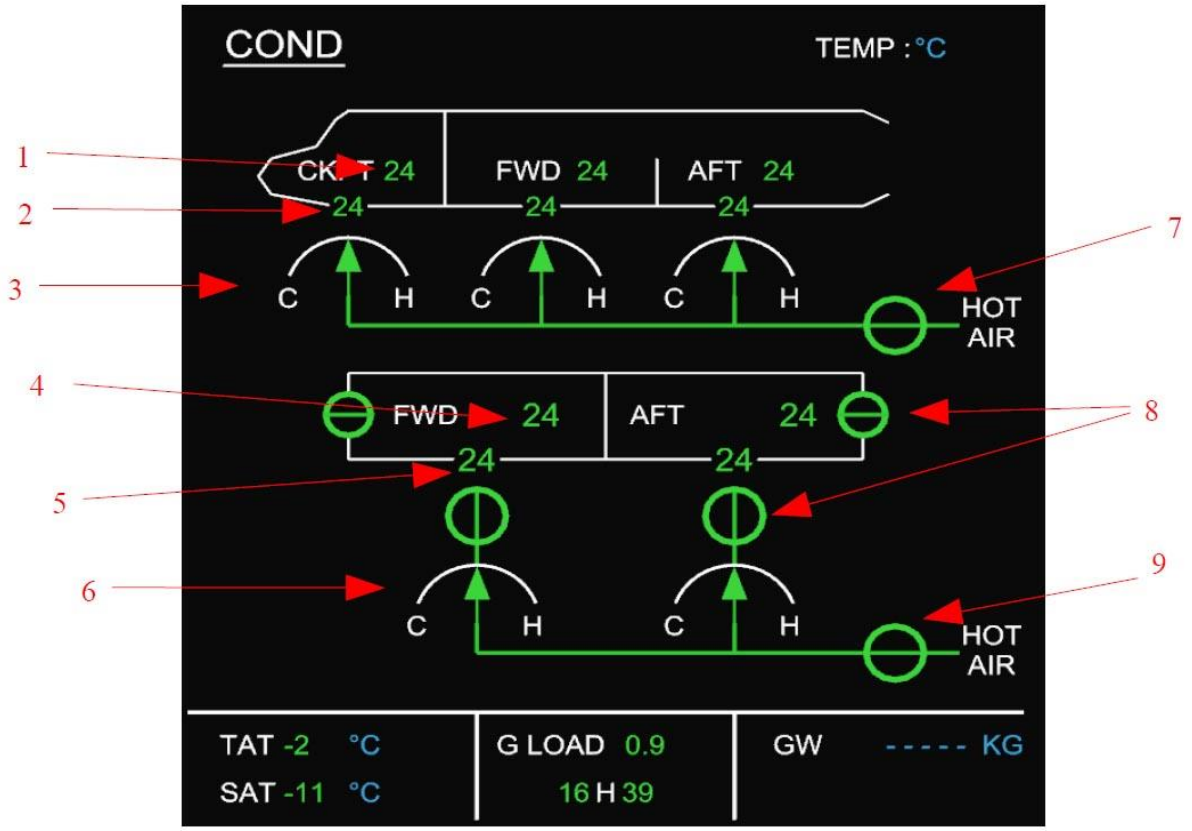
This page shows the Auxiliary Power Unit status.



- (1) – APU electric generator status
- (2) – APU fan N in percentage of maximum N
- (3) – APU Exhaust Gas Temperature
- (4) – APU bleed valve
- (5) – APU bleed air pressure in PSI
- (6) – APU flap indication (appears if flap open only)

2.4.9 - AIR CONDITIONING

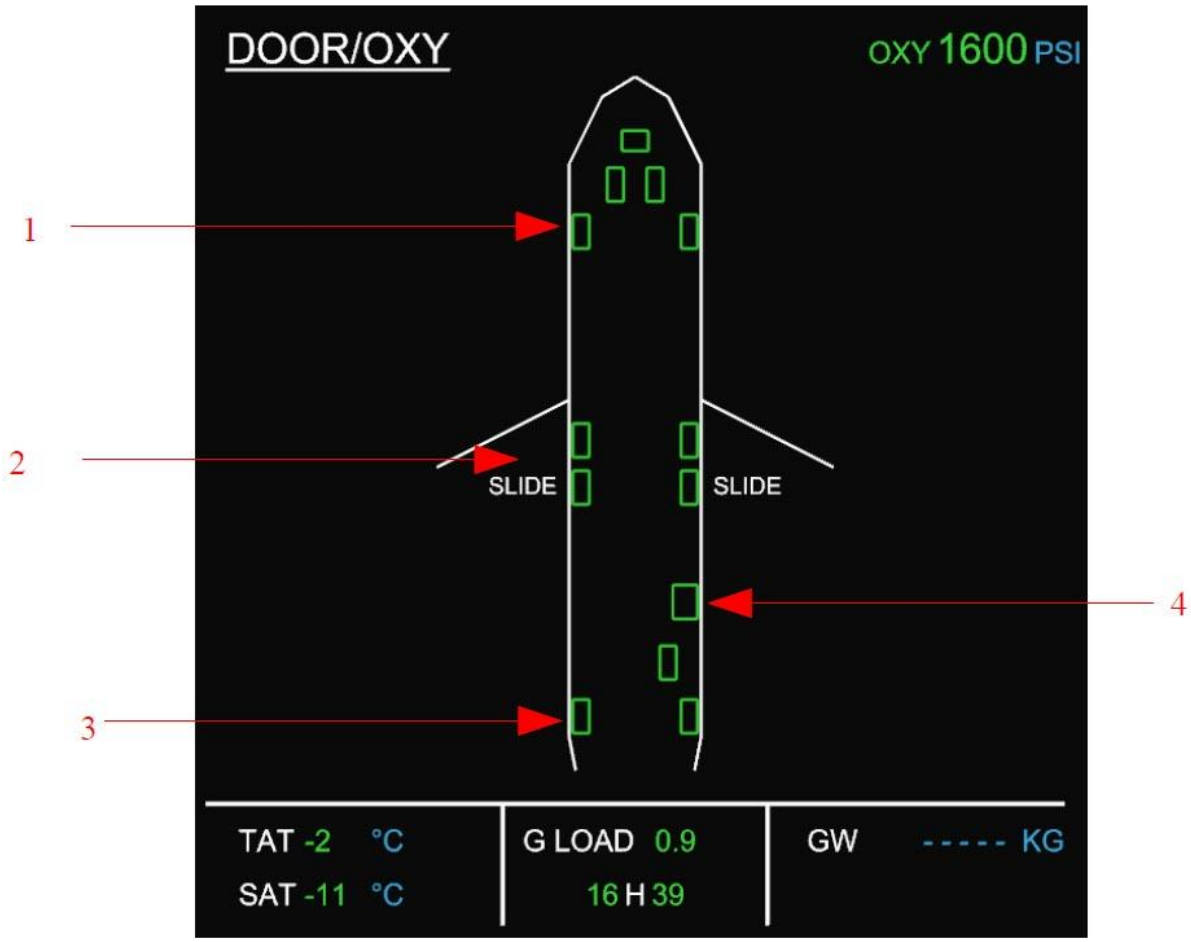
This page shows the air conditioning status.



- (1) – Cockpit, forward & aft compartments actual temperature (°C)
- (2) – Cockpit, forward & aft compartments desired temperature (°C)
- (3) – Trim air valves position
- (4) – Forward & aft cargo compartments actual temperature (°C)
- (5) – Forward & aft cargo compartments desired temperature (°C)
- (6) – Cargo trim air valve
- (7) – Cabin hot air valve
- (8) – Cargo isolations valves
- (9) – Cargo hot air valve

2.4.10 - DOOR/OXYGEN

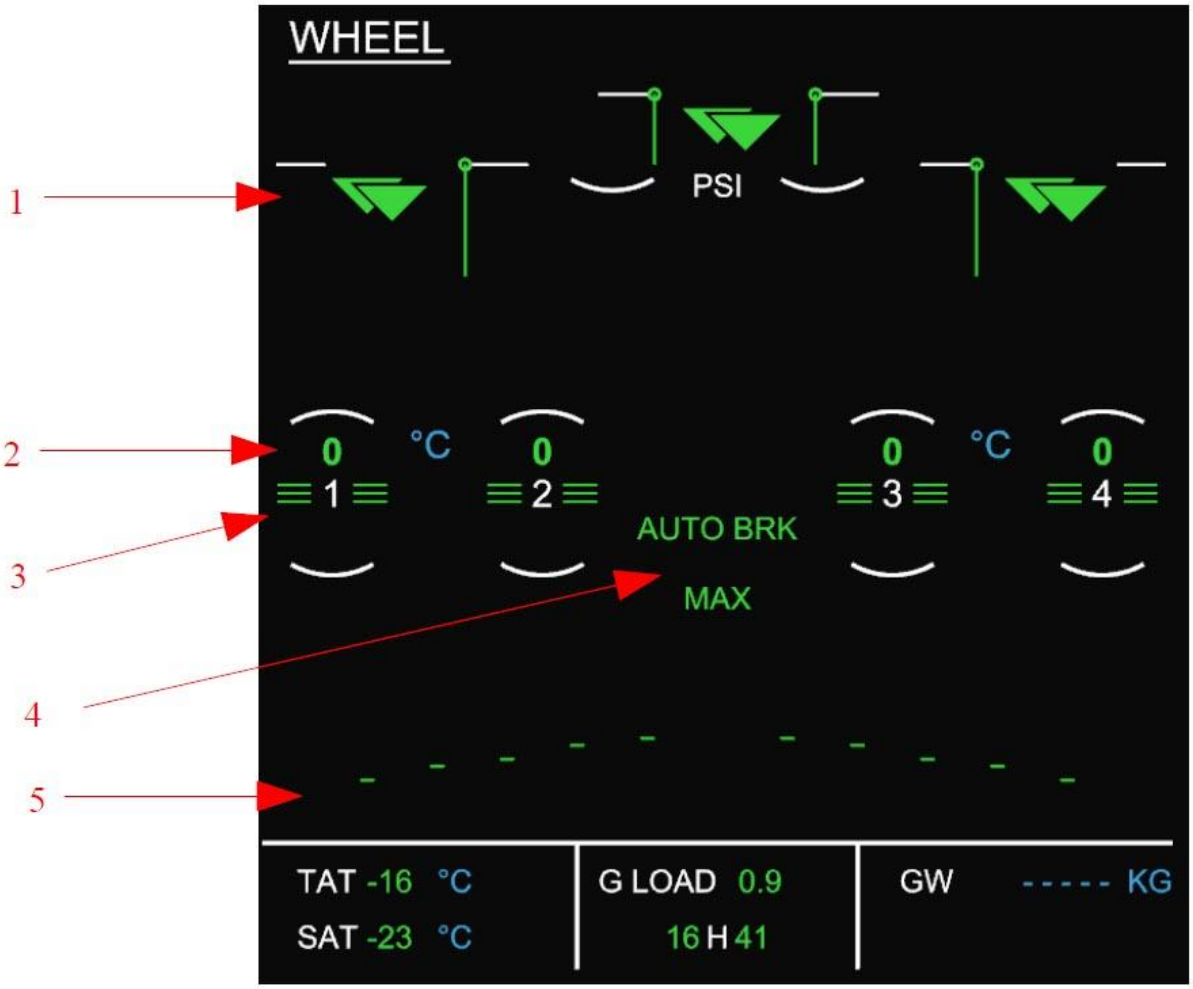
This page shows the status of cabin & cargo doors.



- (1) – Forward doors
- (2) – Emergency escape doors and slides arming indication
- (3) – Aft doors
- (4) – Cargo door

2.4.11 - WHEEL

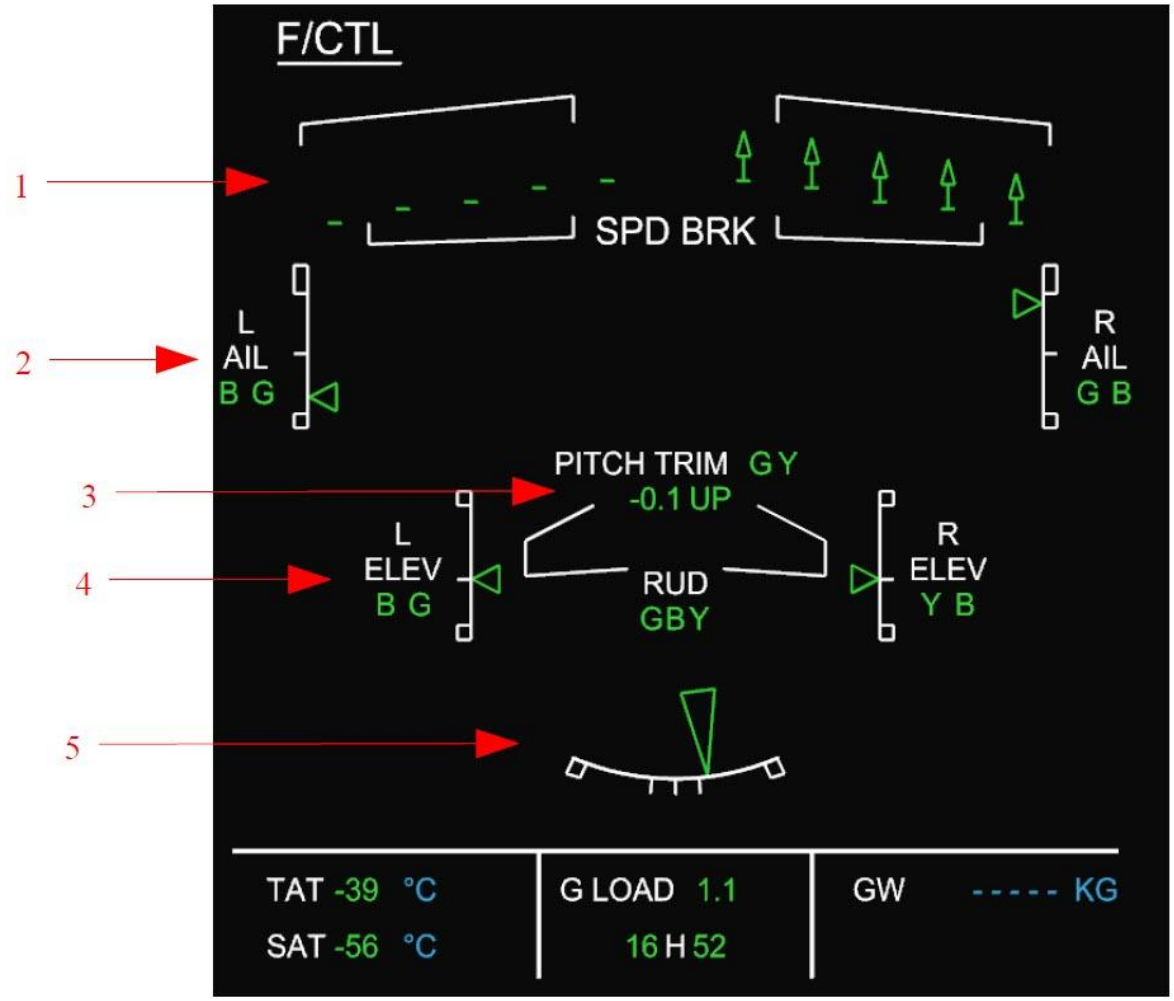
This page shows the status of the landing gear, the brakes and the spoilers.



- (1) – Landing gear and gear bay doors status
- (2) – Brake temperature
- (3) – Autobrake Ready indication
- (4) – Autobrake status
- (5) – Spoilers indication. Here fully retracted.

2.4.12 - FLIGHT CONTROLS

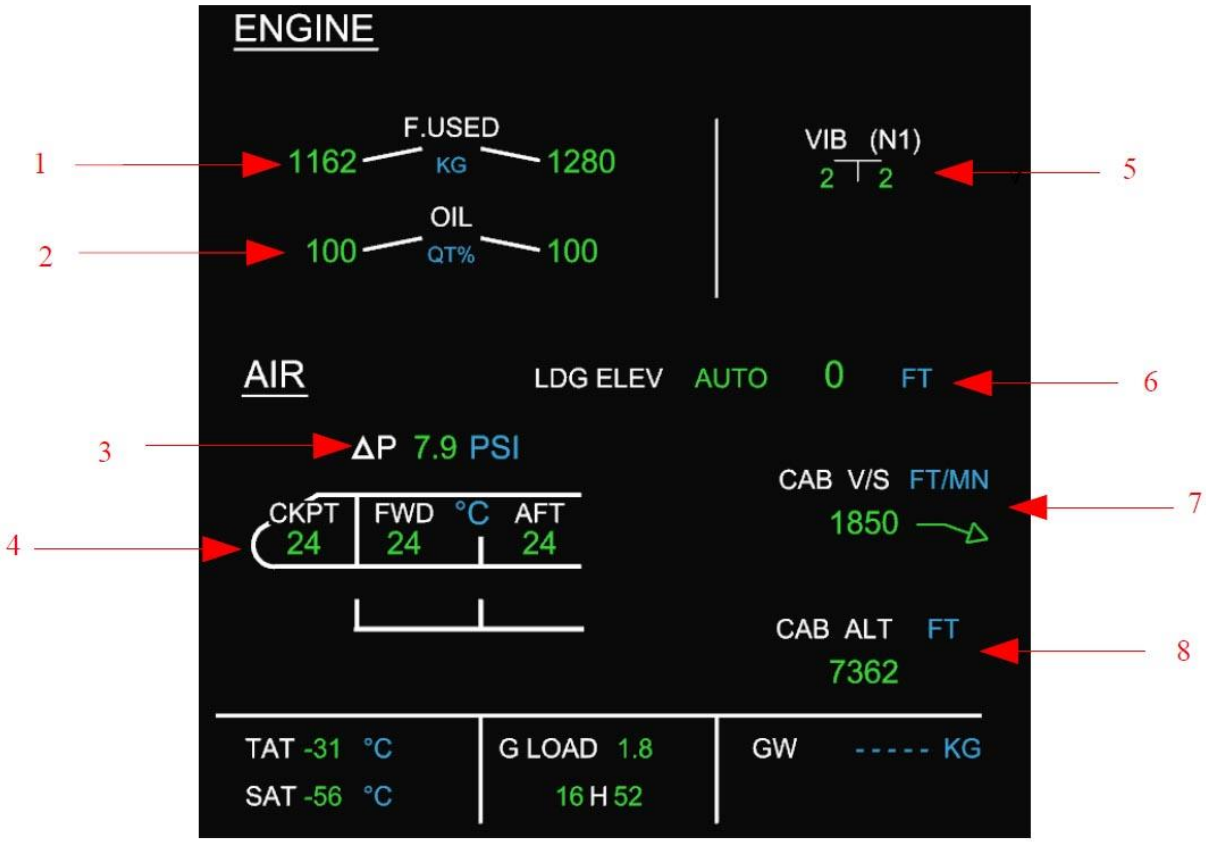
This page shows the position of the flight controls, as well as the functioning of relevant hydraulic circuits.



- (1) – Speed brakes. Here left Sbs are retracted and right Sbs are extended.
- (2) – L & R Ailerons and corresponding hydraulic circuit (B & G).
- (3) – Pitch Trim and corresponding hydraulic circuits (G & Y).
- (4) – Elevators and corresponding hydraulic circuits (G, B, Y)
- (5) – Rudder and corresponding hydraulic circuits (G, B, Y)

2.4.13 - CRUISE

This page shows a summary of engine, air conditioning and pressurization status.



- (1) – Fuel used in kilograms
- (2) – Oil quantity in %
- (3) – Pressure ΔP in PSI.
- (4) – Cabin compartments temperature
- (5) – Engine N1 vibrations
- (6) – Landing elevation in feet
- (7) – Cabin vertical speed (ft/min)
- (8) – Cabin altitude

2.5 - Flight Control Unit (FCU)

2.5.1 - General

The FCU is located on the glare-shield. It is one of the main interface between the pilots and the FMGS, along with the MCDU. The real unit has 3 panels: 2 EFIS on each side (CPT and F/O) and the auto-flight control.

You can launch the FO EFIS separately, it's logic is the same as the captain one. The two EFIS are independent, they act on the corresponding PFD and ND. QNH values are independent as well.

EFIS AutoFlight Control

The software logic implemented regarding switches ans selectors is quite intuitive :

Simple switches are pushed with a single click (left or right)

Rotary encoders (HDG, SPD, ALT, VS and QNH) :

- Turn with the mouse-wheel,
- Push with left click,
- Pull with right click.

Rotary switches, as ND range and modes switches, turn right with a right click and left with a left click.

You can click the text next to rotaries or NAV selectors to select what you want directly (i.e. click on 'ARC' to set ND in ARC mode, on 'inHG' to set QNH in inHG, or on 'ADF' to set nav pointers to ADF.)

Response time is not always immediate (due to networking delays), so do not triple or quadruple click...

Master Warning & Master Caution located on the glare-shield, are not displayed but

functional.

- If you disconnect the AP through the FCU, the « cavalry charge » will sound, *until you press the Master Warning button* !!
- In the same way, if you disconnect A/THR through the FCU button, a single chime will sound and an ECAM alert will show up on E/WD. If THR levers are in CL gate, the N1 value delivered by the FADEC will be locked, shown by an amber “THR LK” on the FMA. *To unlock the thrust, you have to move the THR levers out of the CL gate.*
- To remove the ECAM messages, you have to push the MC push-button.
- Master Warning & Master Caution switches can be controlled by an FSUIPC offset : see the « **Advanced User Guide** » for an offsets list.
- They can also be controlled through keyboard shortcuts on the FCU window (Master Warning : « W » et Master Caution : « C »).

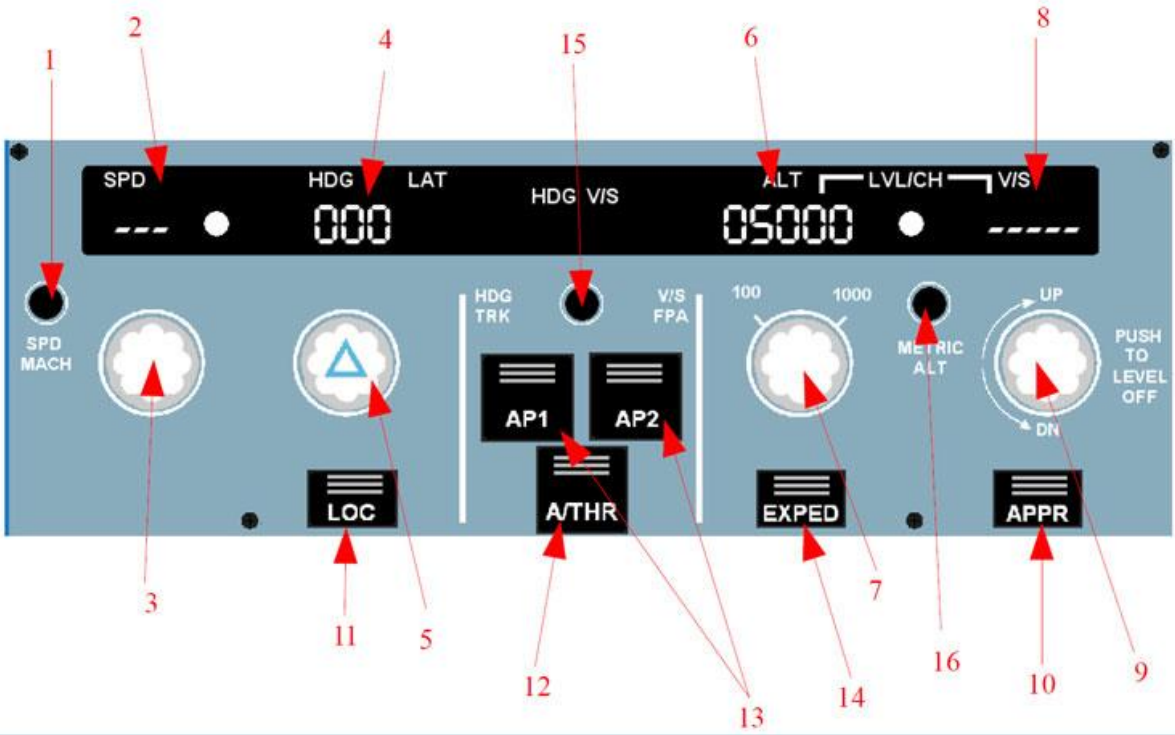
The standard procedure to disconnect Auto Pilot and Auto Thrust :

- AP : red Take Over button on both sticks, or keyboard shortcut « A ».
- A/THR : red « Instinctive Disconnect Button » on both THR LVR or keyboard shortcut « T ».

2.5.2 - EFIS panel

- (1) – Additional ND data display: (only one can be engaged)
  - CSTR : shows constraints in magenta next to flight plan points
  - WPT (Waypoints) : shows fixes that are not in the FPLN
  - NDB : shows NDBS that are not in the FPLN
  - VOR : shows VORs and DMEs that are not in the FPLN
  - ARPT : shows airports
- (2) – ND range selection
- (3) – ND mode selection
- (4) – ND bearing pointers selection
- (5) – ILS scales on PFD
- (6) – FD bars on PFD
- (7) – Toggles barometric pressure between standard (pull) and QNH (push)
- (8) – QNH displays, in mb or in.Hg. If set to standard, it reads “STD”

2.5.3 - *Auto-Flight Control*



- (1) – SPD/MACH switch: click to switch between SPD and Mach mode
- (2) – Speed display: shows selected speed or Mach number if in selected mode, otherwise shows dashes (– – –) and a white dot next to it shows up.
- (3) – Speed control :
  - Pull to enter selected speed mode
  - Push to enter managed speed mode
  - Mouse-wheel changes value by 1knot or 0.01 Mach
- (4) – Heading display: shows selected heading or track if in selected mode, otherwise shows dashes (– – –) and a white dot next to it shows up.
- (5) – HDG control :
  - Pull to enter selected lateral mode
  - Push to enter managed lateral mode
  - Mouse-wheel changes value by 1°.
- (6) – Altitude Display: displays altitude selected. Even in managed mode, you need to select an altitude, the managed mode will only manage the vertical profile up(or down) to the selected altitude (which should always be the ATC cleared altitude). When in managed mode, the white dot shows up.

- (7) – Altitude control :
  - Pull to enter selected vertical mode
  - Push to enter vertical managed mode
  - Mouse-wheel changes the value by 100ft or 1000ft
- (8) – Vertical speed display: Shows the selected vertical speed / Flight Path Angle or dashes(– – – – –) if vertical mode is either managed or OP CLB/DES
- (9) – V/S control :
  - Level-off : push
  - VS / FPA : pull
  - Mouse-wheel change value by 100 ft/min or by 0.1°
- (10) – APPR button: click to engage the approaches modes :
  - LOC or G/S if ILS approach entered in FPLN
  - APP-NAV / FINAL modes if non precision approach selected
- (11) – LOC pushbutton: arm/disarms LOC only mode
- (12) – A/THR pushbutton: arms/disarms A/THR. To disarm/disengage ATHR, use the instinctive buttons (located on the THR levers on the real ACFT)
- (13) – AP1 & AP2 push buttons: engage/disengage auto pilot. To disarm/disengage ATHR, use the instinctive button (located on the stick on the real ACFT)
- (14) – EXPED pushbutton: engages expedite mode (green dot in climb, VNE/MMO in descent)
- (15) – HDG / TRK selector: click to switch between HDG-V/S and TRK-FPA lateral modes. The corresponding modes show up above HDG and VS displays.
- (16) – Metric ALT switch (to toggle the display of altitude in meters on PFD and SD).

2.5.4 - Airbus FCU philosophy

The FMGS Guidance part is controlled via the Auto Flight Control panel.

Selected mode means the pilots decide of the trajectory of the ACFT whereas Managed means the FMGS computes the trajectory according to the FPLN entered via the MCDU.

On the real airbuses, the selectors for SPD, HDG and ALT are push/pull rotating knobs. To enter selected modes, you'd pull toward you to be in control. To enter managed modes, you'd push toward the FCU to give the ACFT control.

You can read more about selected/managed, guidance & management in the ☞ ***chapter 2.8.***

2.6 - Overhead panel

2.6.1 - General

The overhead panel is the main pilot/aircraft interface concerning the aircraft systems such as bleed air, electric power or hydraulic circuits. It is divided in smaller groups of switches, push-buttons, indicators, etc, according to the concerned system.

For the sake of readability over a computer screen, I decided to divide the overhead panel in two, which we'll call the lower & upper overhead panels (please note the upper OVHD here has nothing to do with the circuit breakers panel on the real A320).

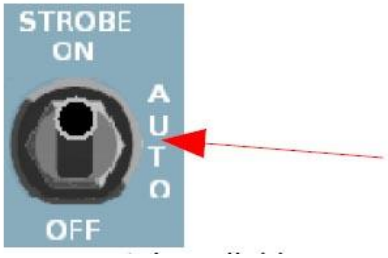
- The lower panel is launched whenever you launch the overhead software. If you close this panel, the software will close as well.
- You can fire up the upper panel with a right click on the panel then “Show upper OVHD”.
- Both panels are resizable, and position/size will be stores for next start-up.

The main type of switch is the “korry”. It's a pushbutton with one or two leds built-in.

- Usually, the lower part is the state of a function. Depending on the korry, the light will come up only if it's ON (in blue) or OFF (in white).
- The upper part indicates if the function is faulty (amber or red LED) or available (green LED). The upper part is not always present.

Korry

There are **2 or 3 positions switches** such as this one for the strobe light. You can choose the position you want by clicking on the label directly. So for example, if you want to set the strobe light to automatic mode, just click the “AUTO” label to its right (red arrow):



The same principle goes for the **rotary buttons**, only you can as well directly click left or right on it, to respectively turn clockwise and counter-clockwise the button.

Click the labels

Or left/right click the rotary

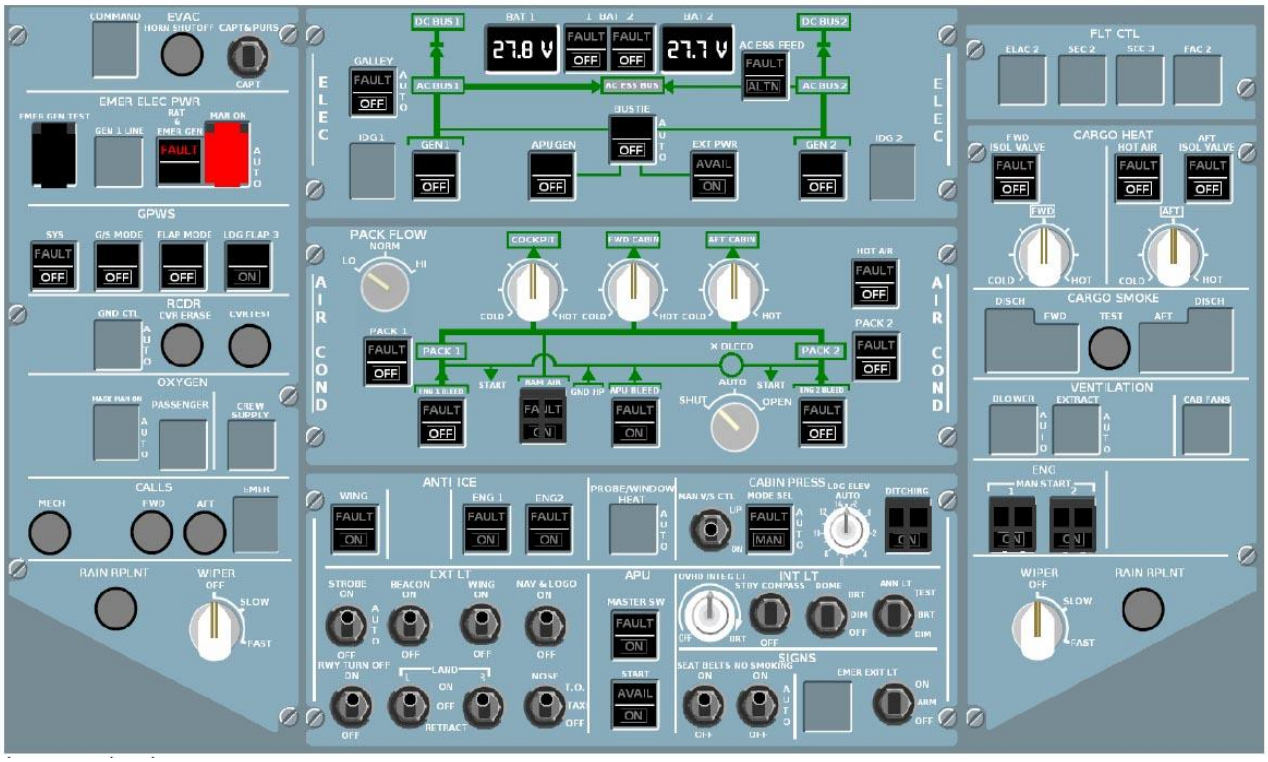
Some of the rotaries (such as cabin temperature or landing elevation), won't move even if clicked. To see the value selected, just move the mouse cursor over the rotary and a small label with the value will appear.

On the upper OVHD, you can show two additional panel, **which are not placed on the OVHD on the actual aircraft**. They are the Auto-Brake panel and the Engine start panel. Since my software simulates the real operations of engine start and auto-brake, it seemed necessary to have those controls in handy. However, if you prefer to only use the FSUIPC offsets, you can hide them via the options window of the overhead panel (accessible via a right click on the lower OVHD).

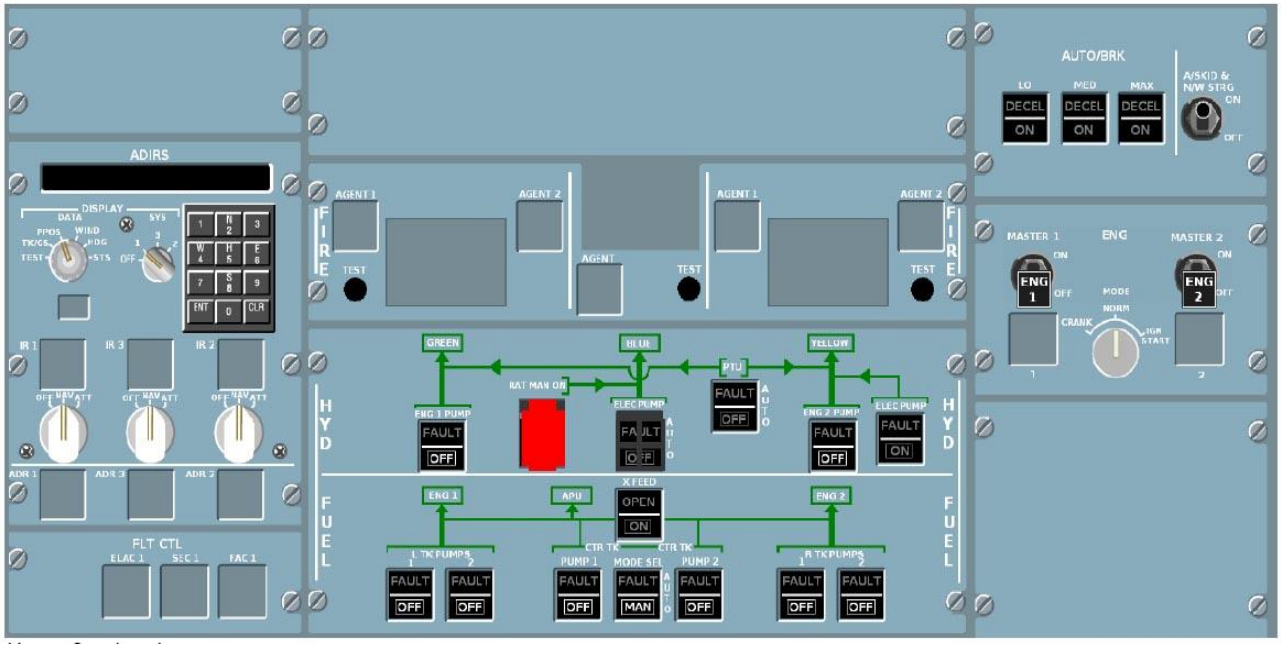
Some switches are **guarded**, you can only operate them when unguarded. To do so, simply click on the cover. To guard the switch back, simply click on the remaining visible part. If you use the FSUIPC offsets, guarded/unguarded state is ignored.

The gray spots mark where you can imagine there is a korry that will maybe be filled in later on...

One of the gray spots, on the lower left part of the lower panel, is called « RAIN RPLN », just next to the WIPER selector. By clicking on it, you will in fact switch the OVHD panel between “day mode” and “night mode”.



Lower Overhead



Upper Overhead

Please note that when you launch the OVHD, it will default to **cold and dark mode** (1), meaning :

- Engines will stop running,
- All power sources are shut off (electrical and pneumatics).
- In that state, all korryes and indicators are switched OFF. It looks closely to the OVHD status when in-flight and everything is working correctly, except that the battery voltage displays are OFF as well. **Everything remains off until you connect EXT PWR, or you switch one battery ON.**

(1) : However, an added function allows you to directly run the software in the “Engine Running” status, please check the **Installation Manual**, chapter 5.1.

2.6.2 - Anti-ice, Lights, APU, Cabin Pressure, ...

All those functions are located on the same sub-panel :

ANTI ICE : To operate the wing or engine anti-ice systems, simply click on the corresponding korry. The blue **ON** label will show up.

Probe/Window Heat activates the windshield heating and the various probes (Pitot, AoA, TAT, etc). When on AUTO mode (no light), the heating is automatic, and will be on as long as the aircraft is in the air. If **ON**, the heating will be on even on the ground.

EXT LT and SIGNS : The exterior lights and interior signs are quite simply operated, click the labels. For the right side landing light, you have to click on invisible spots, placed in the same way as for the left side one. Please, do not use FS standards FSUIPC offsets for lights, only those I provide.

APU : if starting condition are met, you first have to turn **ON** the master switch, then push the start korry. When APU power is available, the green **AVAIL** label comes up.

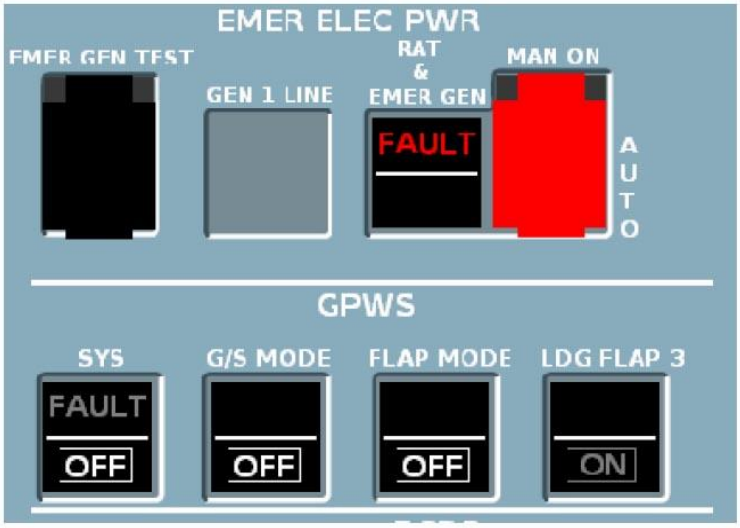
CABIN PRESS : Cabin pressure is managed either automatically, or manually.

- If you want to use automatic mode, make sure MODE SEL korry is not illuminated. You can select the landing elevation with the rotary (either automatic by clicking AUTO label, or manually with left/right clicks).
- If you want to control pressure manually, make sure MAN is illuminated, then select the cabin climb rate by clicking and maintaining mouse button down on the up or right label of MAN V/S CTL. This switch is spring-loaded to neutral position. There are two different calculators managing pressurization, you can switch by maintaining MODE SEL button pushed down 10 seconds.

Other functions are not yet modeled.

2.6.3 - Emergency Electric Power, GPWS.

EMER ELEC PWR : The emergency electric power is produced by a generator driven by the Ram Air Turbine (RAT). The RAT automatically deploys in flight when all other generators are lost. To manually extend it, unguard the red switch and push the korry. The RAT cannot be stowed in flight, it needs maintenance actions on the ground. The korry to the left is not pushable, it simply shows the status of the emergency generator. EMER GEN TEST is not operational.

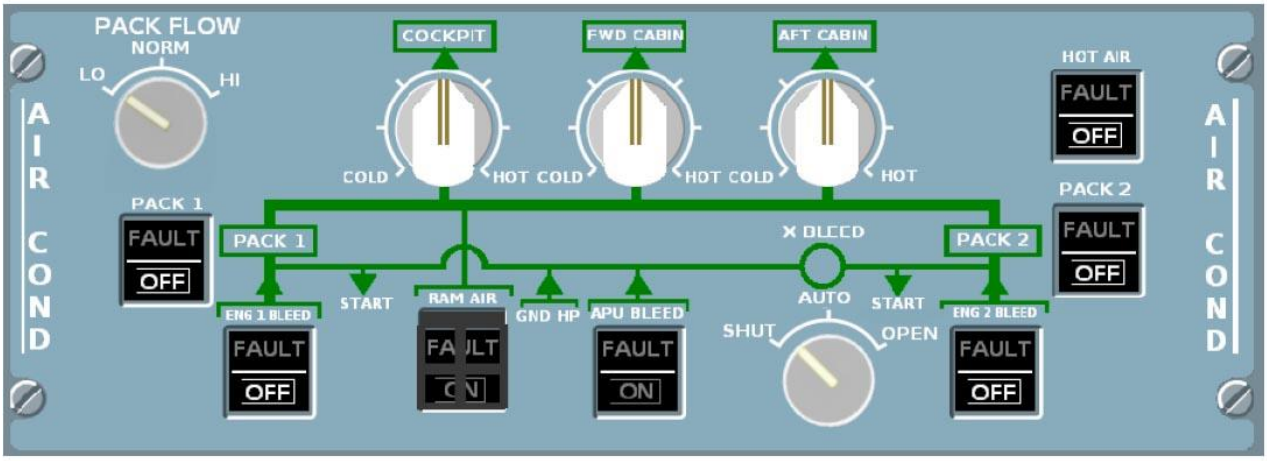


GPWS : The GPWS korrys arm/disarm the following system (from left to right) :

- SYS :overall GPWS system.
- G/S MODE : « glideslope » announcement.
- FLAP MODE : « too low flaps » announcement.

- LDG FLAP 3 : if landing configuration is flap 3 and not flaps full, then arm this korry to avoid unnecessary warnings on final approach.

2.6.4 - Air conditioning, Cargo Heat



AIR COND : This panel allows the management of bleed air, used for air conditioning and engine starting.

Bleed air can be obtained from different sources:

- GND HP : if on the ground, and engine bleeds are not available (click GND HP label to activate, or see the add-on menu)
- APU BLEED : if APU is running
- ENG 1 BLEED & ENG 2 BLEED : if corresponding engine is running

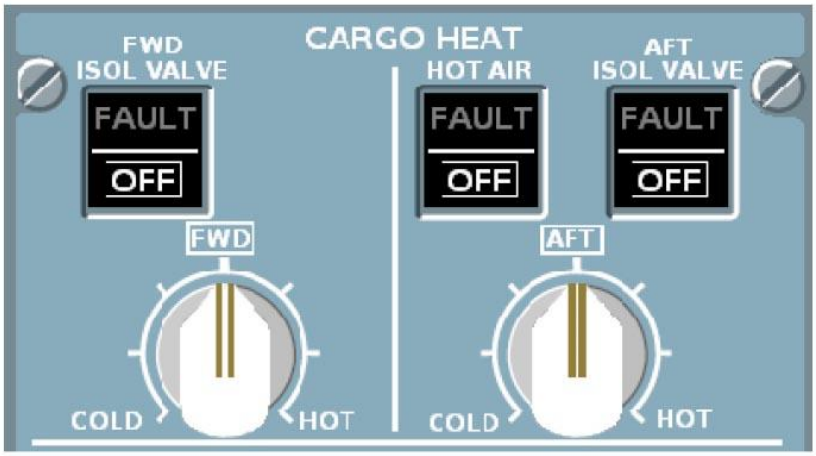
The bleed air is then used either to feed the start valves, or the PACKs, which are compressors to cool air, then regulating cabin temperature.

The X-Bleed valve is used to provide bleed air to one side if not available on the other (example: APU bleed to feed engine 2 start valve). Three positions: Shut, Auto or open.

You can select the flow of the PACKs with the PACK FLOW rotary.

You can select target temperature in the cabin with the three rotaries labeled COCKPIT, FWD CABIN and AFT CABIN. They are not animated. To select the temperature, you can click on the cold (18°C) or hot labels (30°C), or the green arrow (24°C). To select intermediate temperatures, left or right click to respectively increase/decrease temperature by 1°C.

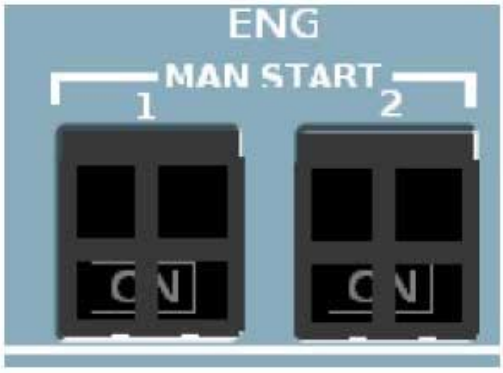
HOT AIR opens/closes the hot air valve, used to regulate the cold air coming from the PACKs.



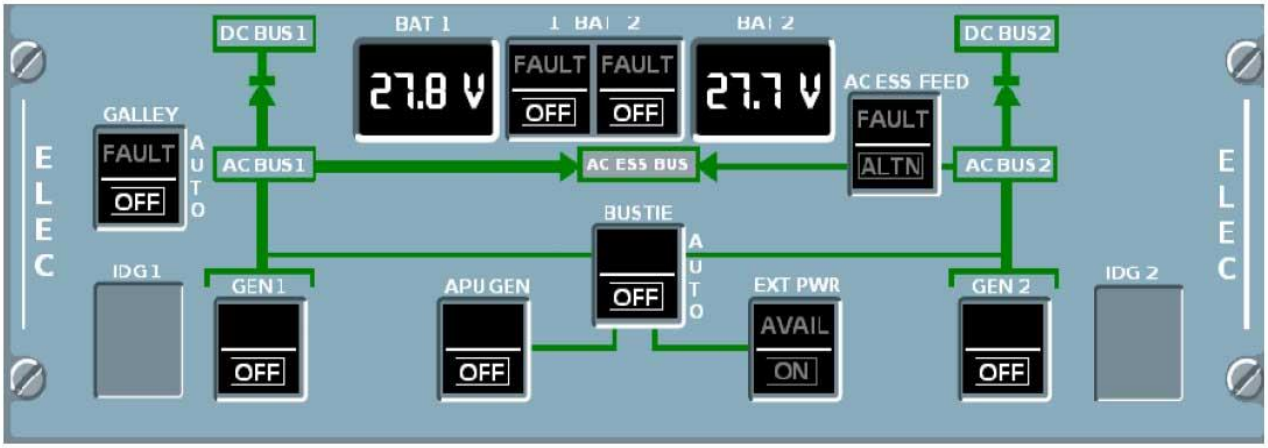
CARGO HEAT : This panel controls the temperature in the cargo hold compartments. Temperature is selected in the same way as the cabin compartments. The korrys control the cargo hot air valve and the isolation valves.

2.6.5 - Manual Engine Start

These guarded korrys are used to start the engines manually, see later on.



2.6.6 - ELEC panel



ELEC : This panel is used to manage electric generation and distribution.

BAT 1 & 2 are used to connect the batteries to the DC BAT BUS. Batteries remain connected to DC ESS BUS or the static invertor even if selected OFF. The LCD windows show batteries voltage.

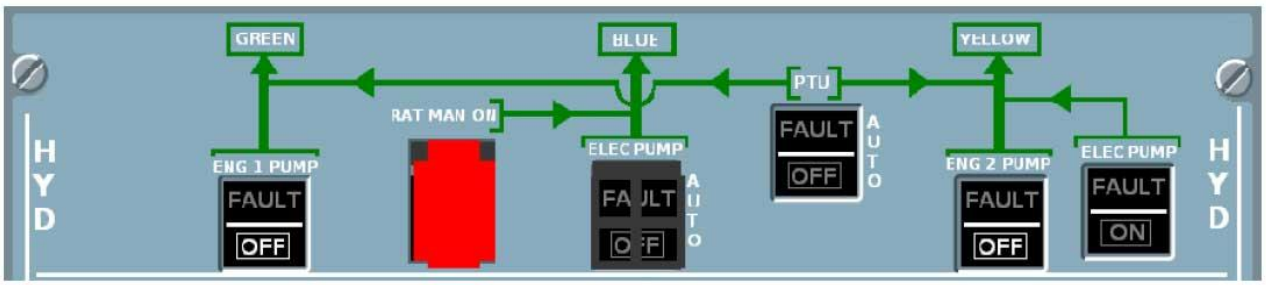
Use EXT PWR to use electricity coming from a ground generator plugged in, possible only on ground (…) if **AVAIL** light is on (ground connection via the Add-on menu, see later on).

Use the GEN 1 & 2, APU GEN to produce electricity with engines or APU running.

BUS TIE and AC ESS FEED are used to modify distribution of power between generators and AC buses.

GALLEY is used to shed commercial equipment when the generators cannot provide enough power to meet the load of essential aircraft equipment.

2.6.7 - Hydraulic



HYD : There are 3 hydraulic circuits on the A320 family :

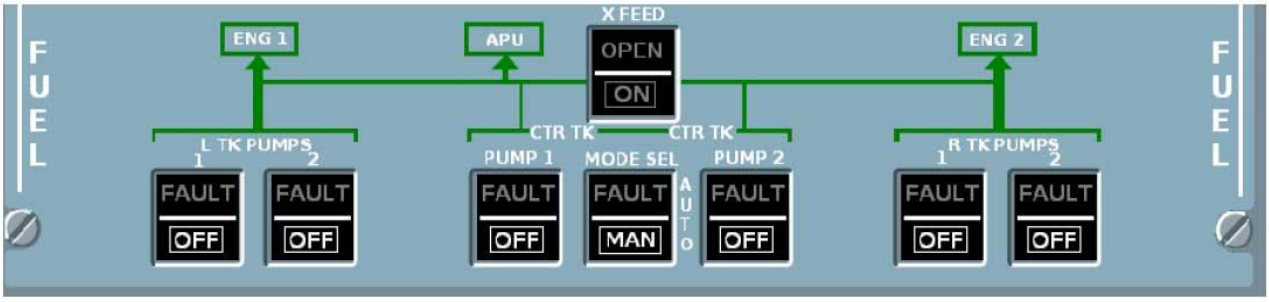
- Green: pressurized thanks to the ENG 1 Pump

- Blue: pressurized by an electric pump, or an emergency pump, powered by the RAT
- Yellow: pressurized thanks to the ENG 2 Pump, or an electric pump

In case of low pressure in green or yellow circuit, the Power Transfer Unit (PTU) can pressurize the two simultaneously (on ground with one running or pump failure in flight).

You can extend the RAT, here as well, via the red guarded switch.

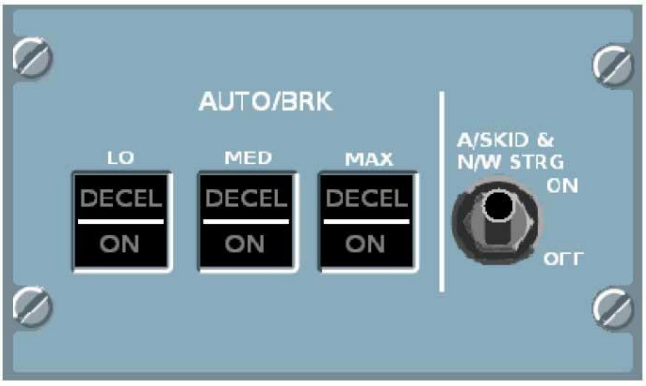
2.6.8 - Fuel



FUEL : This panel manages the fuel pumps and the fuel X-bleed. If all pumps are ON **and** MODE SEL is **not** MAN, then pumps are operated automatically by the aircraft. Otherwise, the center pumps are operated.

X-Bleed allows fuel from one side to feed the opposite engine.

2.6.9 - Auto Brake (optional on OVHD application)



AUTO/BRK : Located on the main instrument panel on the actual aircraft, it controls the auto-brake and anti-skid systems.

Click the korrys to select the level of auto-brake desired (push again to deactivate auto-brake).

The A/SKID switch is straight forward...

2.6.10 - Engine Start (optional on OVHD application)

Located on the Pedestal on the real ACFT, this panel is optionally displayed by going in the right click menu.

To start an engine automatically :

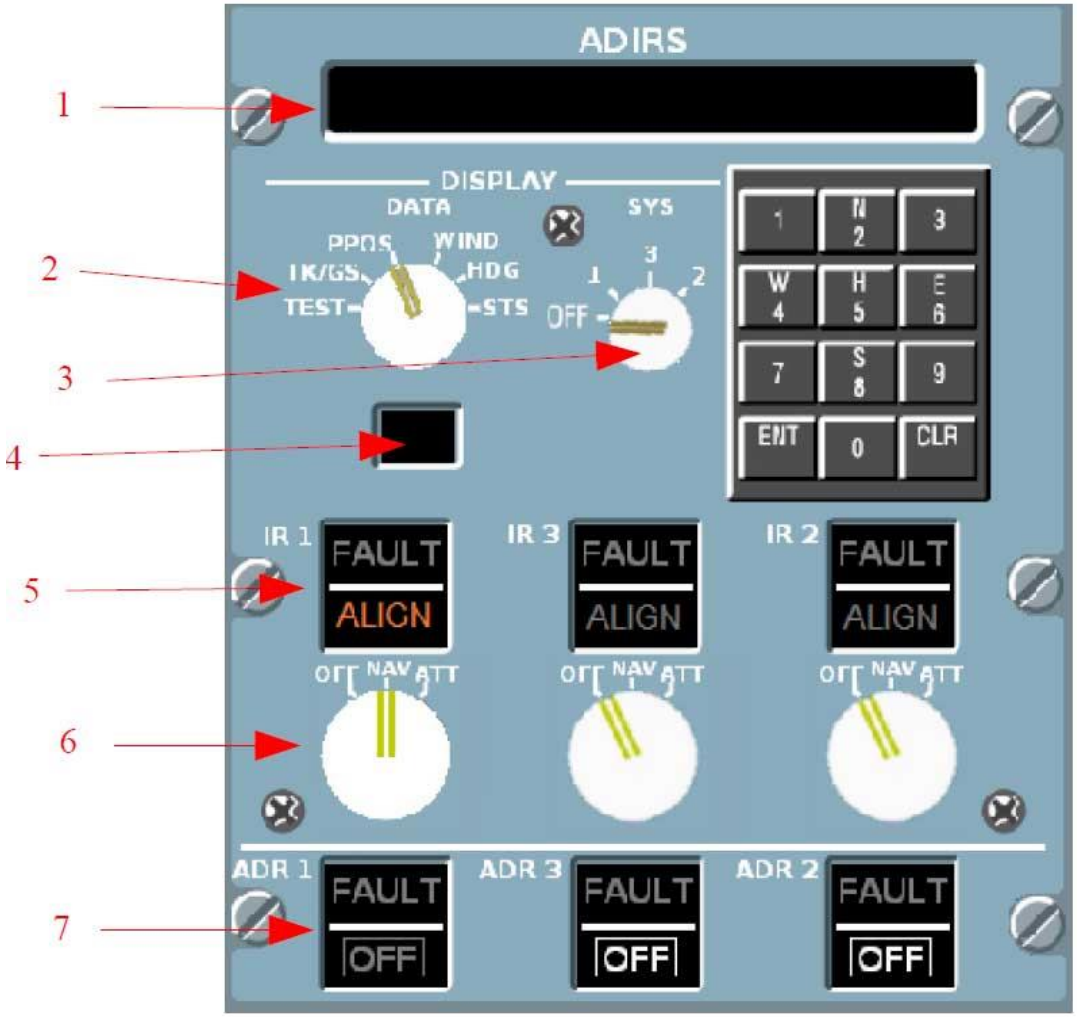
- Make sure start valve has pressure
- Select MODE IGN/START.
- Select MASTER switch ON.

To start an engine manually :

- Make sure start valve has pressure
- Select MODE IGN/START.
- Select ENG MAN START ON (lower OVHD)
- Select MASTER switch ON when N2>20%.

The fuel LP and HP valves are operated automatically. To abort start or stop an engine, select MASTER switch off.

2.6.11 - ADIRS



- (1) – LCD display
- (2) – Display data selector
- (3) – System selector
- (4) – Battery usage light
- (5) – IRs status light
- (6) – IRs mode selectors
- (7) – ADR korrys.

This panel is used to control the ADIRS: Air Data Inertial Reference System.

- The ADRs send Air Data (I.e. IAS, altitude and attitude) to the PFDs. You need to switch at least ADR1 or 3 for the captain side, and ADR2 or 3 for the FO side.
- The IRs provide inertial data (i.e. latitude/longitude and heading) to the PFDs and NDs. Again, IR 1 or 3 is necessary for CAPT side, and IR 2 or 3 for the FO side.

To work correctly, the IRs need to be “aligned”.

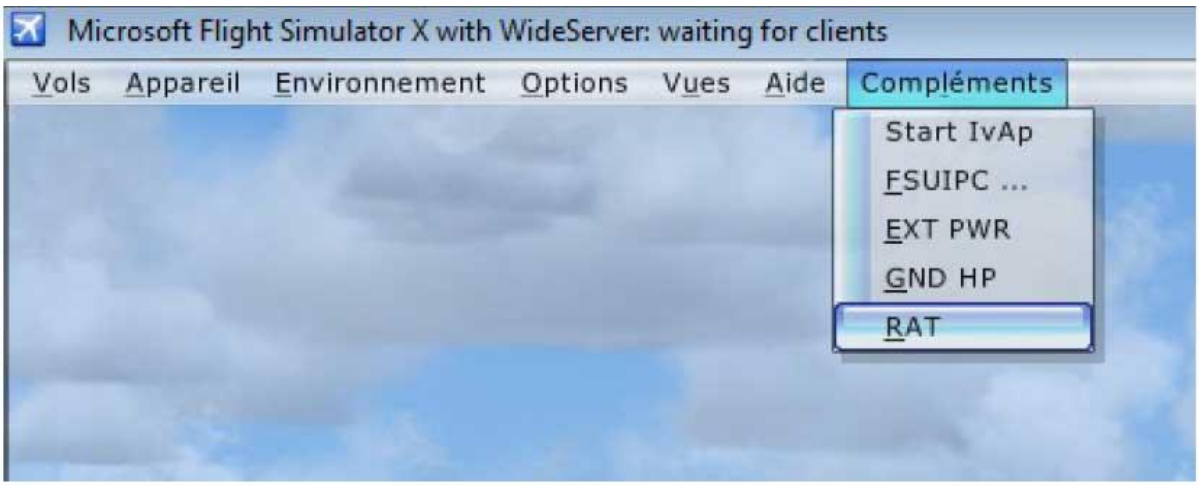
- Put the IRs mode selector on NAV, then the “ALIGN” light comes on. When it comes off, the corresponding IR is aligned. Full alignment takes around 10 minutes.
- There is a fast alignment feature, which takes only 30s. To do so, when on NAV, switch back to OFF then NAV again in less than 5 seconds.
- Fast alignment is always possible, unlike on the real ACFT.

The ATT mode is not yet fully functional, the ADIRS will only provide Air data. Later on, it will be possible to enter manually the HDG when in ATT

The keyboard is not working either, and the only way to initialize the IRS position is via the INIT page on the MCDU (“ALIGN IRS” prompt). It is not possible yet to change the value of LAT/LON through the MCDU, so the real LAT/LON is always used and there won't be any drift for the time being.

The LCD displays shows various information on the ADIRS, according to what you selected via the Data selector (2), and the System selector (3).

2.6.12 - Add-on Menu interface



Some options are only related to ground handling, such as connection of ground HP, ground PWR and stowing of the RAT. To simulate ground crew communications, the software adds 3 items in the Add-on menu in the FS tool bar:

- EXT PWR connects/disconnects the external electrical power.
- GND HP connects/disconnects the ground high pressure supply.
- RAT stows the ram air turbine (even in flight unrealistically).

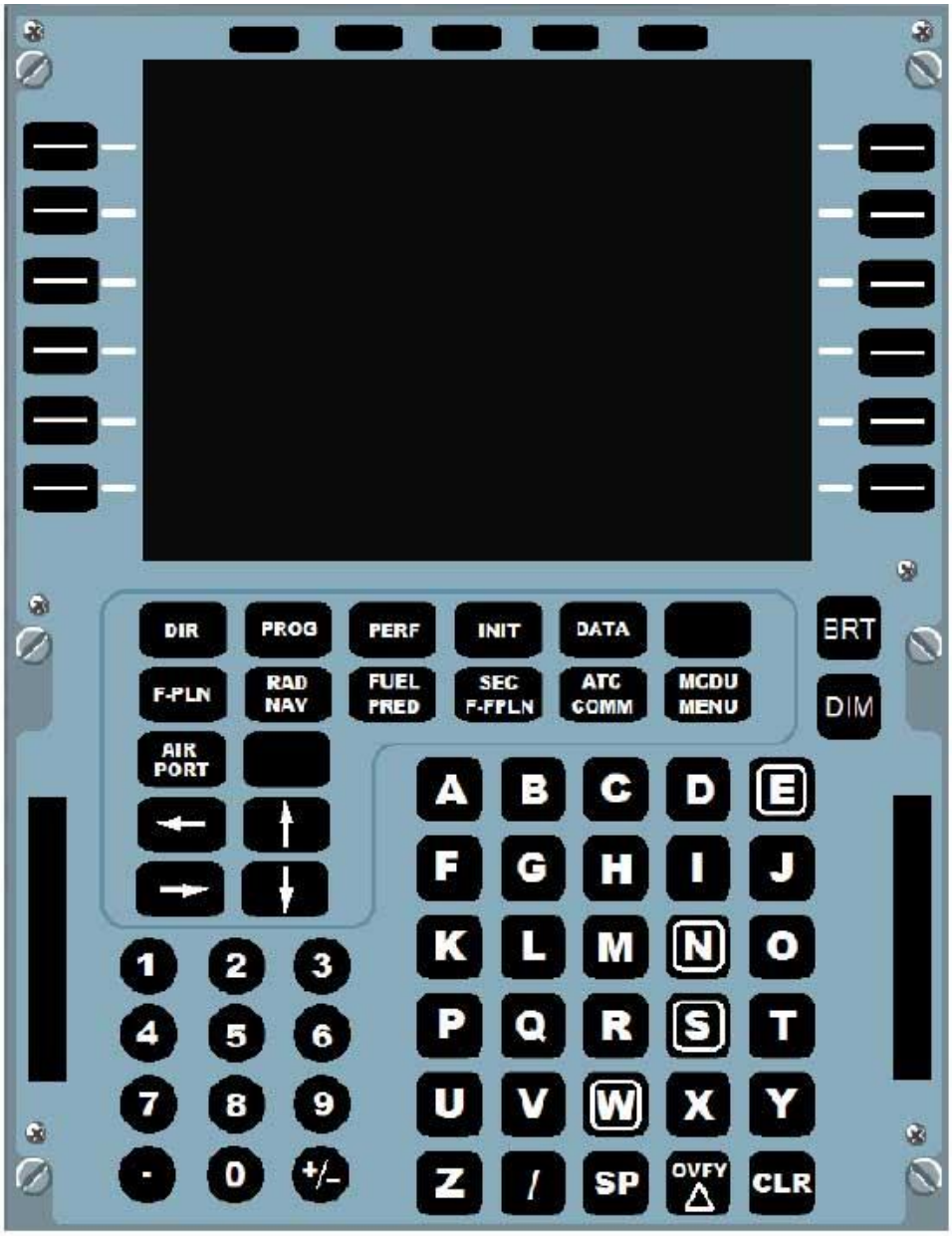
2.7 - MCDU

2.7.1 - General

The Multifunction Control & Display Unit (MCDU) is the heart of the Management part of the FMGS. The original unit looks like this (next page) :

- (1) – Left Selection Keys (LSK).
- (2) – Right Selection Keys (RSK).
- (3) – Alphanumeric keyboard
- (4) – MCDU pages selection

The MCDU face as currently modeled:



You can either simply use your own keyboard (see table next page)), while making sure the MCDU window is focused (i.e. click on it...), or you can as well use FSUIPC offsets, which are available for every buttons on the MCDU (see offsets table in "**Advanced User Guide**").

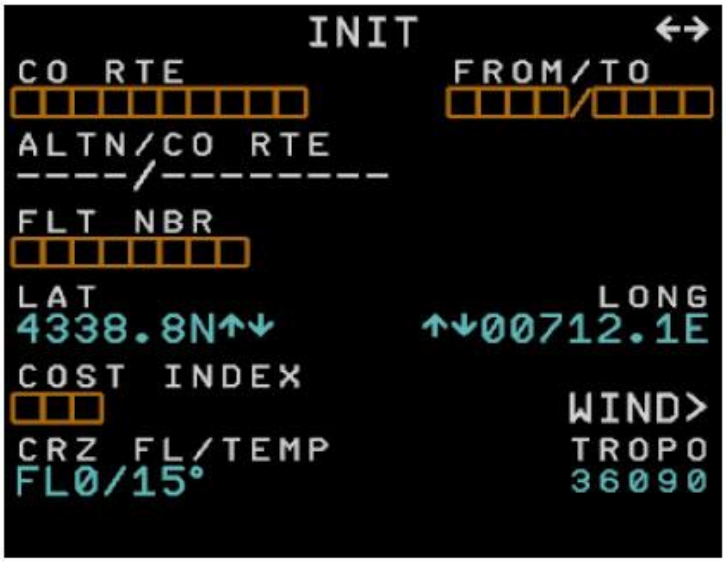
Both CPT and FO MCDU are available, and are independent.

All keys are effective except the ATC COMM one.

You can hide the keyboard to only display the screen via a right click then "Display only option".

The MCDU programming consist in filling a succession of different pages, each representing different aspects of the flight we want to conduct. Let's see every pages individually.

As long as we talk about the MCDU, the line showing “INIT” on next picture will be the Title Line.



Line number one has two captions : *left caption* (here « CO RTE ») and *right caption* (here « FROM/TO »).

We'll name **1L** the left caption line ; The right caption line will be **1R**.

On the same principle, we'll name the lines **2L**, **3L**, etc...

Each line has a switch :

- These are named Line Selection keys
- The **L**eft **S**election **K**eys will be called **LSK's**.
- The **R**ight **S**election **K**eys, will be of course the **RSK's.**
- First line LSK is thus **LSK1**, etc...

Below line number 6 is a line called « Scratchpad ». All data we want to enter using the LSK/RSK must first be typed in the Scratchpad. Then to transfer the data to the line, we push the corresponding LSK/RSK.

The orange squares signal data input necessary for a correct FPLN setup.

Blue data fields is usually modificable data.

Green fields are usually calculated and cannot be be changed by the pilots.

Keyboard table :

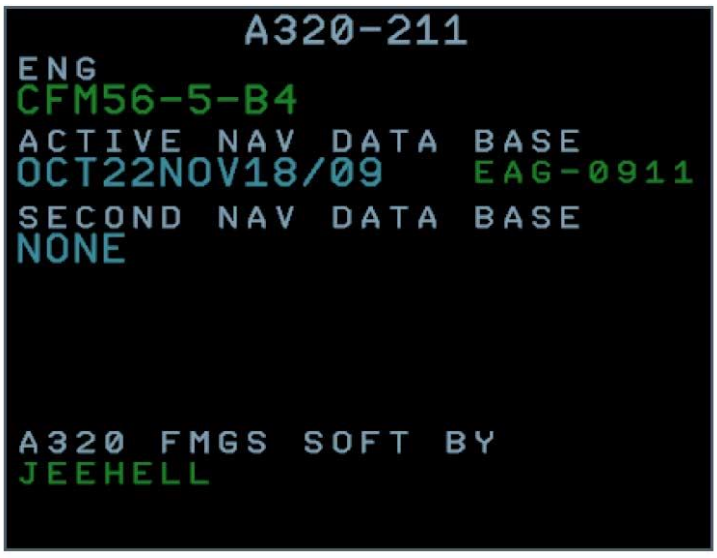
Input	Action
A - Z	A - Z
0 - 9	0 - 9
+	+ (if pushed twice, it'll output a -)

-	-
/	/
F1 - F6	LSK1 - LSK6
F7 - F12	RSK1 - RSK6
Arrows	Arrow keys
SHIFT+F1 à SHIFT+F6	First line of page key (left to right)
SHIFT+F7 à SHIFT+F12	Second line of page key (left to right)
SHIFT + O	Overfly
SHIFT + B or D	Bright or Dim

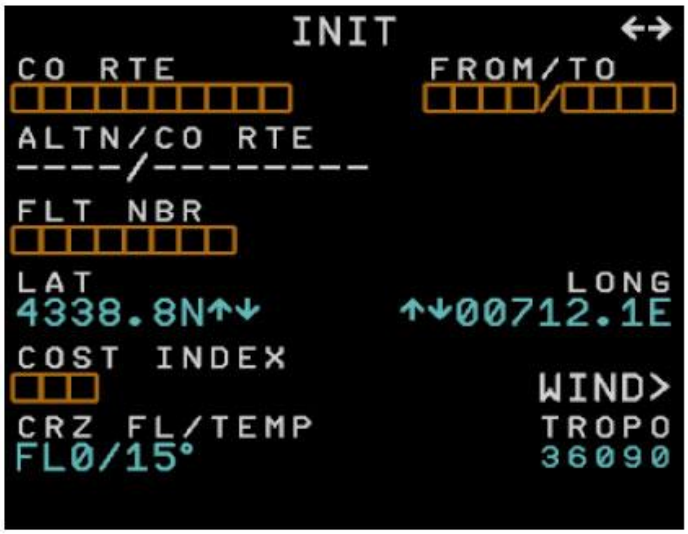
2.7.2 - STATUS page

This is the page that shows up when you launch the MCDU. You can bring it up anytime through the DATA page.

It shows some information on the aircraft type (as declared in the aircraft.cfg file in your FS folder) and the navdata used.



2.7.3 - INIT A page



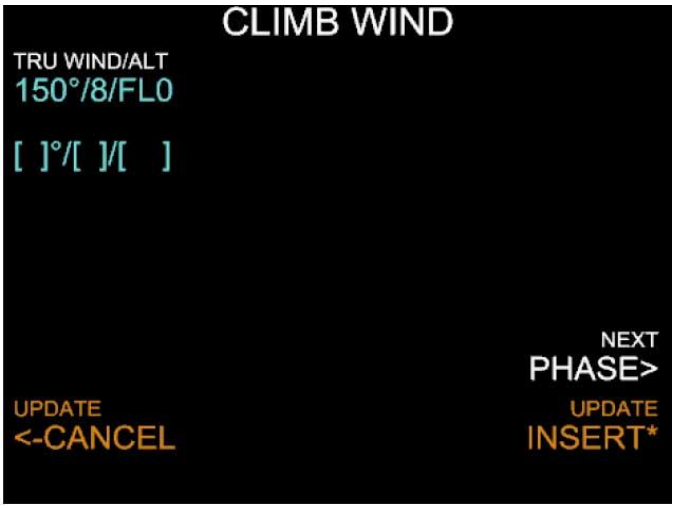
This page is brought up by pressing the INIT key on the MCDU. It asks for the basic information about the FPLN.

- **1R - FROM / TO :** input airports ICAO code for departure and arrival, separated by « / » (example EGLL/LFPG).
- **1L - CO RTE :** Company Route Enter here the name of the company route you want to used.
- **2R** empty.
- **2L - ALTN / CO RTE :** Either enter the ALTN ICAO code, or "/"+CORTE from arrival to ALTN. Not mandatory.
- **3L - FLT NBR :** input here your flight number (ex BAW31CE, or AF905HI).
- **4R et 4L :** longitude and latitude (cannot be changed)
- **5R - WIND :** push RSK5 to prompt the winds page.
- 5L - COST INDEX
- **6R - TROPO :** Tropopause altitude. By default 36090ft, you can change it but no effect on flight profile.
- **6L - CRZ FL / TEMP :** Cruise flight level has to input here. The number after the "/" automatically updates to predict temperature at cruising altitude, according to tropopause altitude.

If a FROM/TO couple is entered, « **ALIGN IRS** » in **3R**: push the RSK3 to initialize the IRS and display all attitude and position data on PFD and ND (if ADIRS are ON and alignment is finished).

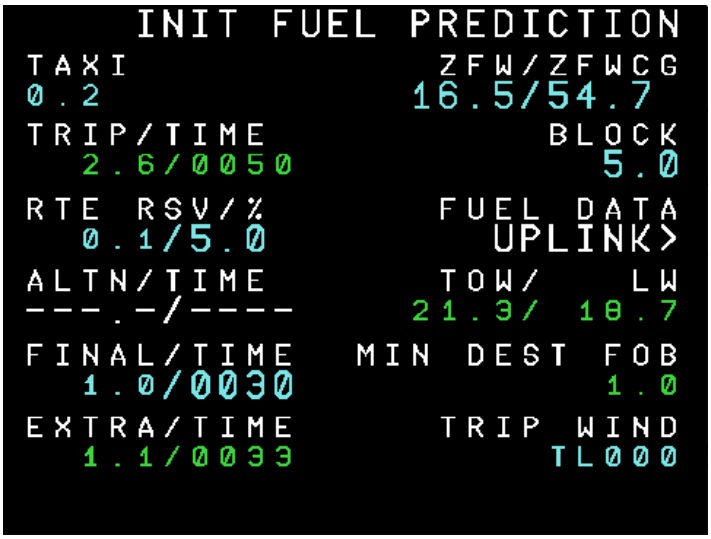
2.7.4 - WIND page

Only the climb wind page is modeled for the moment and it is pure eyecandy: it doesn't have any effect on flight profile. This page is accessed via INIT A page.



- **1L to 5L :** enter different winds for different altitudes. Syntax: XXX/YY/ZZZ where XXX is true wind direction, YY is wind speed in knots and ZZZ is a flight level (1000ft is thus FL10)
- **5R :** no effect
- **6L :** cancel any new value entered and back to INIT A page
- **6R :** Accepts new values entered and back to INIT A page.

2.7.5 - INIT B page

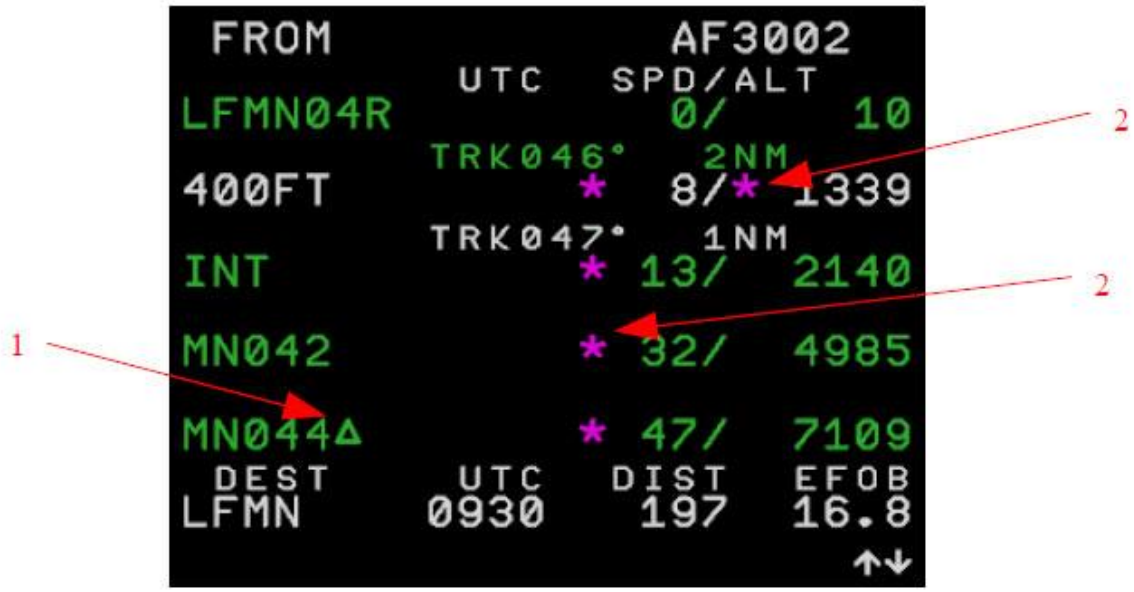


Also called INIT Fuel Prediction. Once a route has been entered, you need to enter here fuels values in order to initialize fuel calculations. **INIT B** is accessed on ground via Right or Left arrow when INIT A is shown. (the arrows in title line indicate you can switch pages).

- **1L :** Input taxi fuel in tons
- **1R :** input here the ZFWCG (Zero Fuel Weight Center of Gravity) and the ZFW (Zero Fuel Weight in tons). Syntax:
- ZFW/ZFWCG if you want to change both values,
- ZFW or /ZFWCG if you only want to change one value.
- **2L :** flight plan fuel in tons and in time. 2.6/0050 means the flight plan route will need 2.6 tons of fuel and will last 00h50min, without any reserve
- **2R :** Total fuel before start-up, in tons. You can uplink it via RSK3
- **3L :** Route fuel reserve: input a percentage of route fuel to consider as reserve fuel. You can only input a percentage, but the MCDU calculates the equivalent in tons. Here, reserve is 0.1 ton, which is equivalent to 5% of route fuel.
- **3R :** Use RSK3 to get ZFWCG, ZFW and block fuel via datalink.
- **4L :** Alternate route trip fuel and duration.
- **4R :** Take Off Weight as calculated the following way (TOW = ZFW + block – taxi) / Landing Weight (LW = TOW – RTE)
- **5L :** Final reserve (syntax: XXYY where XX is hours and YY minutes). Even if there are zeroes, input four number (ex: 0030 for 30 minutes). The number shown before reserve time is weight equivalent in tons (here 1.0 tons for 30 minutes reserve).
- **5R :** Estimated minimum Fuel On Board on arrival at destination.

- **6L :** Extra fuel in tons and time (here 1.1 tons, 00 hours 33 minutes).
- Extra = block – taxi – trip – RTE – RSV – ALTN.

2.7.6 - FPLN page

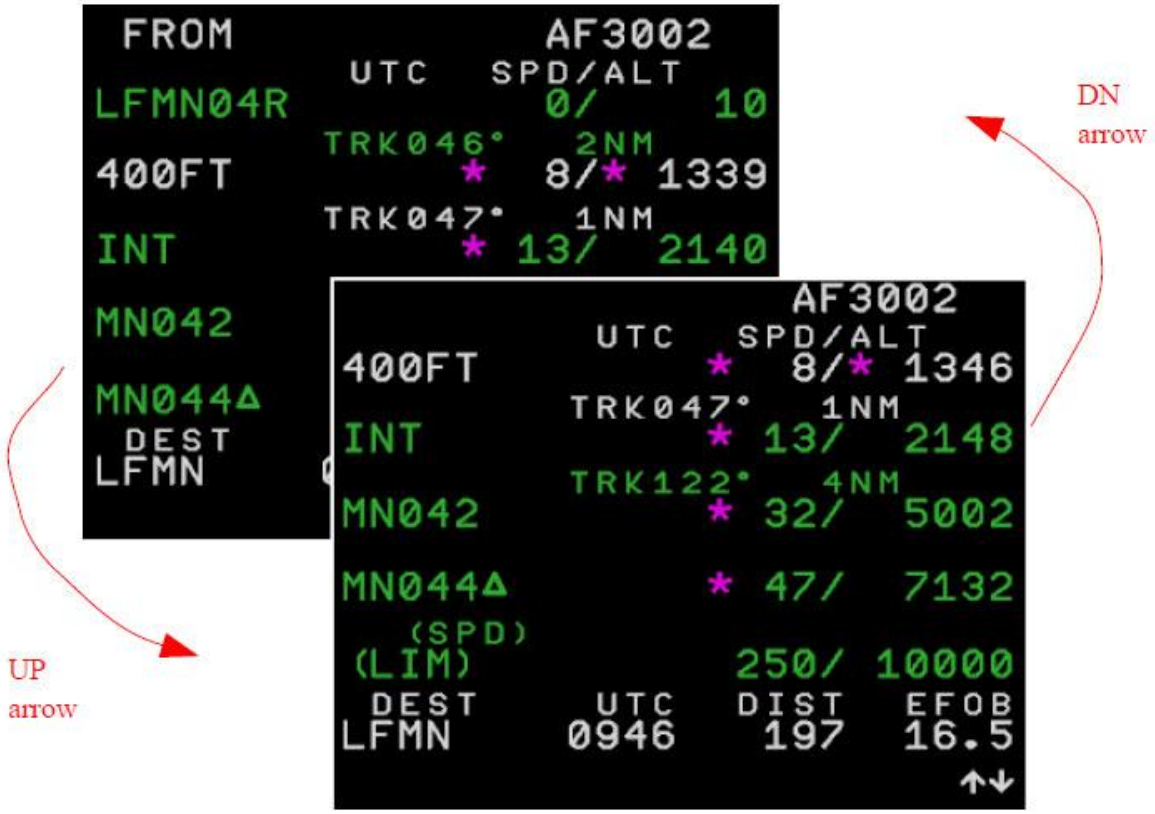


This page is where the flight plan route is entered, including SID, STAR and approach procedure. It can be accessed via **FPLN** key on MCDU.

Lignes 1 to 5 show points.

- (1) – Overfly point
- (2) – Altitude constraint (magenta if met, amber otherwise)
- (3) – Speed constraint (magenta if met, amber otherwise)
- **6L** hows destination predictions (time of arrival, distance to go and estimated fuel on board).

A normal flight plan has more than 5 points, so you can scroll through all points via the vertical arrows:



6L is reserved for destination airport.

When on the ground, and FPLN hasn't been scrolled down, **1L** shows departure airport.

To add a waypoint, enter the name of the waypoint (VOR, NDB, fix) in the scratchpad, then push the LSK adjacent to the point you want to insert the waypoint before :

If you want to insert BARSO before AMFOU point, push LSK next to AMFOU, here is what will happen:

The line labels between two points show the magnetic track and the distance in nautical miles between the two points.

The numbers on the right are the speed and altitude profiles at each point, in knots and feet. They are shown only when calculation is possible when weight and speeds data are input.

If nothing is entered in the scratchpad, pushing a LSK will prompt the **Lateral Revision** page, and a RSK will prompt the **Vertical Revision** page. If an airport is displayed on the corresponding line, RSK won't have any effect.

To delete a waypoint, push CLR button then the adjacent LSK.

You can as well add a waypoint with latitude and longitude, place/bearing/distance or place-bearing/place-bearing. Syntax is :

- *LAT/LON*, where :
  - *LAT* starts with the letter N or S (North or South) then one or two digits for degrees of arc then two digits for minutes of arc, and eventually a decimal part for minutes of arc
  - *LON* starts with the letter E or W (East or West) then one to three digits for degrees of arc then two digits for minutes of arc, and eventually a decimal part for minutes of arc.
  - **Example :** N4401.8/E00715 stands for 44°1.8' North and 007°15' East
- *Place/bearing/Distance*, where :
  - *Place* is the ID of a VOR, NDB or FIX
  - *bearing* is the magnetic bearing in degrees

- *distance* is the distance in nautical miles
- **Example :** AZR/090/5 is the point 5NM east of AZR VOR.

- *place1-bearing1/place2-bearing2* where:
  - *place1* is the ID of a VOR, NDB or fix number1
  - *bearing1* is the bearing from place1
  - *place2* is the ID of a VOR, NDB or fix number2
  - *bearing2* is the bearing from place2
  - **Example :** CGS-090/AZR-180 is the the crossing between the 090° radial from CGS and the 180° radial of AZR.

2.7.7 - DUPLICATE page

If you insert a waypoint ID (VOR, NDB or fix) which corresponds to several points worldwide, the next page is prompted:

It lists the five nearest points, in increasing distance from ACFT. To select the desired waypoint, push the adjacent LSK.

2.7.8 - Lateral Revision Page

LAT REV FROM page:

Accessed via LSK 1 to 5 in FPLN page. This page allows you to modify the lateral trajectory from the selected point.

- **3L :** Push LSK3 to add an holding circuit at the selected point.
- **3R :** enter a new waypoint in the scratchpad then push RSK3 to add that waypoint *after* the selected point.
- **4L :** activates the ALTN FPLN, starting at the active point.
- **4R :** Changes the destination airport, and deletes all points downstream from the selected one.
- **5R :** click RSK5 to enter the airways page, to follow airways to another point.
- **LSK6** to go back to FPL page.

HOLD AT page :

Accessed via preceding page. It allows you to add an holding pattern at a point with desired characteristics

- **1L :** inbound magnetic course toward holding fix.
- **2L :** direction of turns. R for right and L for left.
- **3L :** outbound track length, either in time or distance:
  - input XX.X for time in decimal minutes
  - input /YY.Y for decimal nautical miles
- Press **RSK6** to insert the holding pattern, or **LSK6** to cancel.

AIRWAYS page :

This pages is accessed via lateral revision page. It allows you to add to the flight plan several waypoints from airways easily :

- First, enter an airway which connects at the selected revision point, and push LSK1.
- Then, you can successively enter airways which connect with the preceding one, via LSK 2 to 5. The connecting point between two AWY is automatically entered in R1 to 4.
- Once you have selected all the AWYs you need, enter the last waypoint of the last AWY via the RSKs1 to 5 (according to the number of AWYs used).

In the screenshot above, AWY UM733 was entered, then UN871. Those two connect at GIPNO point. We wanted to exit UN871 at OMASI, so we entered it in R2 line.

When you are happy with the AWYs entered, push RSK6 to accept the route, or LSK6 to get back to lateral revision page.

All the points along the selected AWYs to the last point are automatically entered in the FPLN (in our example, all points between BARSO and OMASI, on UM733 then UN871):

DEPARTURE FROM :

In FPLN page, if 1L displays the departure airport, pushing LSK1 prompts this page.
Push LSK1 again to access departure RWY selection page:

The first line shows dashes if it's the first time this pages is accessed during preflight. The lines 2 to 5 show the available runways at departure APT, with length in meters, ILS frequency and course if available.

If a RWY and SID had previously been selected, the next page shows up instead with green characters in line1:

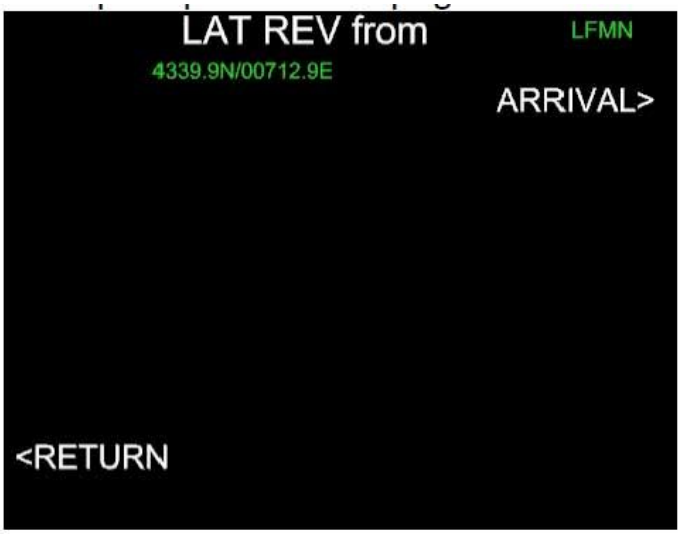
To select a RWY simply push the LSK adjacent to it. If more than 4 RWYs are available, you can scroll with vertical arrows. When selecting a runway, it prompts you automatically to the SID selection page:

In the same way, you can select the desired SID via LSK 2 to 5 and scroll with vertical arrows if more than 4 are available. When selected, the arrow before the SID name disappears (here BODRU 4E SID was selected) :

The line 1 updates, and if for that particular SID transitions are available, you can select one with the RSK1 to 5 (here none are available). Once everything is selected and verified, push RSK6 to insert the SID in the FPLN.

ARRIVAL TO page :

In FPLN page, pushing LSK6 prompts the next page:



From that page you can access the STAR and approach selection pages. Pushing RSK1 prompts the approach selection page :

Select the desired approach with LSK 3 to 5. You can scroll if more than 3 are available, using the vertical arrows keys. Each procedure is for ONE RWY only, and the length in meters, as well as ILS data (if available) are displayed. Clicking the desired LSK prompts the STAR selection page:

The available STARs are selectable with LSK 3 to 5. To connect a STAR to the approach procedure, you may need to add a “VIA”. To do so push the LSK2 :

Note :The VIAs available depend on the approach procedure selected, and in fact connect the IAF to the final segments of the approach procedure. The STARs connect the en-route phase to the IAF.

Select the VIA you need via LSK 2 to 5. Doing so will prompt you back to STARs selection page. You can chose 'NO VIA' if you don't need any VIA. Some approach procedures can come without any via.

Once you've selected your VIA (or no VIA) and your STAR, you might have to chose between STAR transitions, in the same way as SID transition, using the RSK3 to 5.

Once you're done, push RSK6 to insert the terminal procedures in the FPLN.

2.7.9 - VERTICAL REVISION page

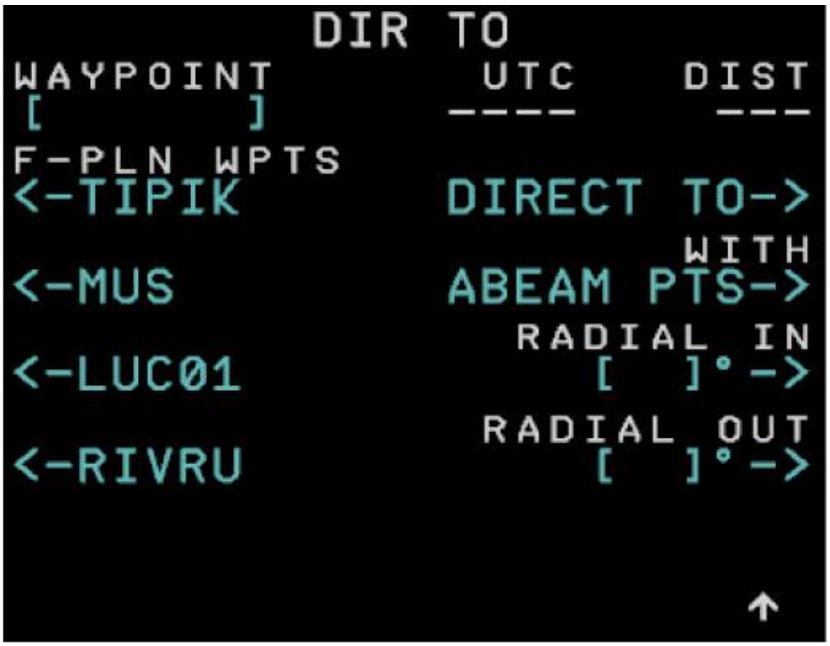
In FPLN page, pushing RSK1 to 5 prompts this page if scratchpad is empty.

- **2L :** CLB or DES Speed limitations, by default 250kts below FL100.

- **3L :** input speed constraint at point.
- **3R :** input altitude constraint at point (+/- signs for minimum/maximun altitude, no sign for exact altitude).
  - If no value is entered, blue brackets appear (like ALT CSTR above).
  - Otherwise the numeric value appears in magenta (like SPD CSTR above).

2.7.10 - DIR TO page

Push **DIR** key on MCDU to access DIR TO page. This page allows you to go directly to any point you want, either in the FPLN or not.



You can either scroll through the FPLN points in lines 2 to 5 or directly enter any point name in L1. Then you need to select a DIR TO mode with RSK 2 to 5:

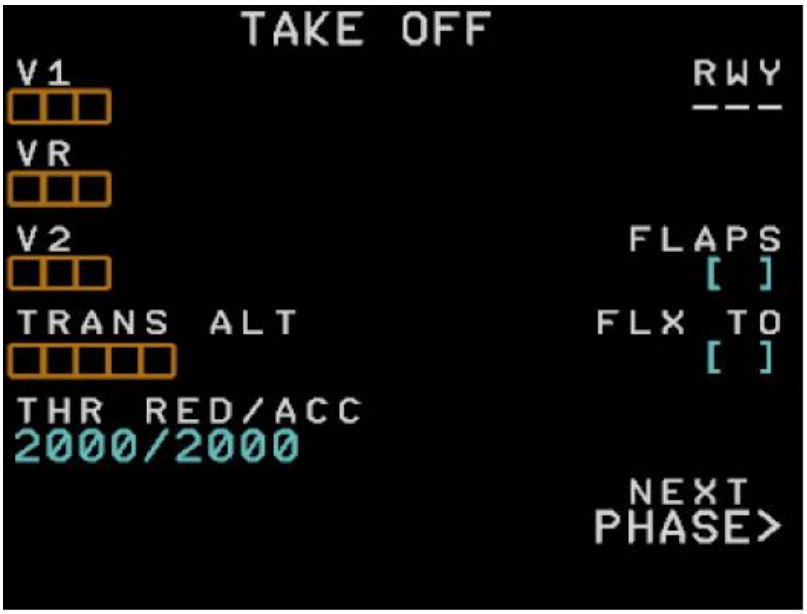
- **DIRECT TO** either deletes all points between ACFT position and selected FPLN point (if in FPLN), or insert the new point instead of current active FPLN followed by a *FPLN discontinuity* (if not a FPLN point).
- **ABEAM PTS** do the same as DIRECT TO but insert reference points on the new track, abeam the old FPLN points.
- **RADIAL IN** allows you to join the waypoint after intercepting a specified radial to it. The ACFT will fly in HDG/TRK mode until the radial is intercepted and NAV mode engaged. It's up to the pilot to select a valid heading to intercept the radial.
- **RADIAL OUT** allows you to intercept a radial outbound the specified point. The

ACFT will fly in HDG/TRK mode until the radial is intercepted and NAV mode engaged. It's up to the pilot to select a valid heading to intercept the radial.

2.7.11 - PERF pages

Those pages are accessed via the **PERF** key on the MCDU. According to the actual phase of flight, the prompted page will differ. They are still only partially modeled, especially the CLB, CRZ and DES ones.

PERF TAKE OFF page :



This page can be accessed only during preflight :

- **1L à 3L :** Reference speeds V1, Vr and V2, in knots
- **4L :** Transition altitude in feet
- **5L :** Thrust reduction altitude and acceleration altitude, syntax:
  - XXXX/YYYY where XXX and YYYY are the altitude value of respectively THR RED and ACC altitude. Ex: 1000/1000.
  - ACC altitude shouldn't be inferior to THR RED altitude.
- **1R** shows the departure runway if it has already been entered via departure lateral revision page.
- **3R** asks for take off flaps settings. V1/Vr/V2 lower limit depends on that value, and changing it for a lower value (2 to 1 for example), will resets those speed values.

- **4R :** Flexible take-off temperature (°C) if you want to use FLEX operations. Entry range is above OAT or TREF and below 68°C (TREF depends on pressure altitude).
- Pushing **RSK6** will prompt the next phase of flight PERF page, PERF CLB.

PERF CLB page :

This page is directly accessible when in CLB mode. It is no longer accessible once cruise phase is reached.

- **1L** shows the speed mode that will automatically engage after setting the thrust levers at the CLB notch on initial climb (for more details see the FMGS section).
- **2L** L2 shows the cost index that is input from INIT A page.
- **3L** is the managed speed law. The IAS value changes according to the CLB SPD LIM value (by default 250 kts below FL100, see LAT REV pages to change those values).
- **4L :** input here an indicated airspeed if you want to fly with selected speed after TO (to follow ATC clearance for example, or if expecting tight turns).

If there is an asterisk (*) before the IAS in lines 3 or 4 means that the corresponding mode is not active (in picture above, selected mode is active, and there is an asterisk at **3L**).

PERF CRZ et DES pages :

Those pages resemble PERF climb, and thus won't be detailed here.

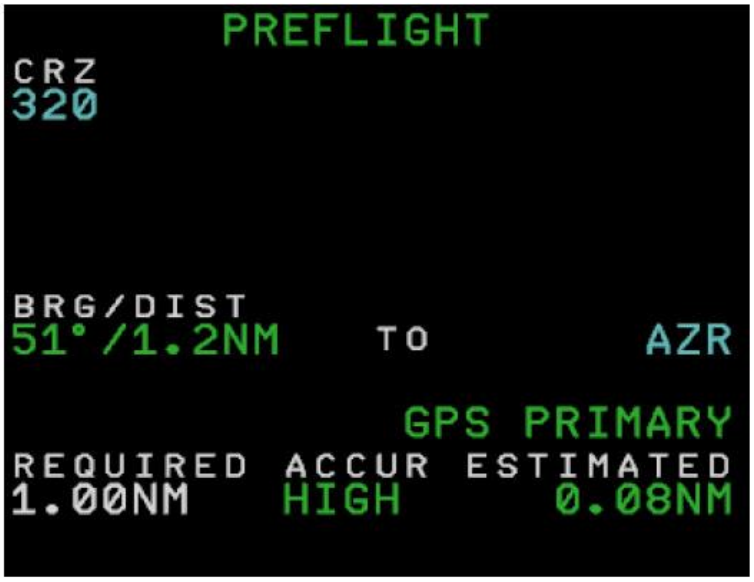
PERF APPR page :

This page allows you to input approach data.

- **1L :** Arrival airport QNH
- **2L :** Arrival airport temperature in °C
- **3L :** arrival airport surface wind. Syntax: XXX/YY where XXX is direction in degrees and YY speed in knots
- **4L :** arrival airport transition altitude in feet
- **5L :** Approach speed
- **2R :** Minimum Descent Altitude (if non precision approach selected) in feet
- **3R :** Decision Height (if precision approach selected) in feet.

2.7.12 - PROG pages

This set of pages is accessed via **PROG** key on MCDU. It is very partially modeled.



- **1L** shows the CRZ level chosen in INIT A page
- **4L** shows the bearing and distance to the point selected in R4 (VOR, NDB or fix)
- Lines 5 and Lines 6 are dummy for the moment.
- **2R :** During DES phase, displays the V/DEV numerical values :

2.7.13 - *RADIO NAV page*

This page is accessed via the **RAD NAV** key on MCDU. Use it to tune the radioelectric navaids (VORs, ILS ans NDBs). Navaids can no longer be tuned from within FS. FSUIPC controls will be added soon.

- **1L :** VOR1 ID/Frequency
- **1R :** VOR2 ID/Frequency
- **2L :** VOR1 course selector
- **2R :** VOR2 course selector
- **3L :** ILS ID/Frequency
- **4L :** ILS magnetic track
- **5L :** NDB1 ID/Frequency
- **6L :** NDB2 ID/Frequency

To tune a navaid, either input the ID or the frequency in the ID/frequency line. If you input the ID and several navaids have the same ID throughout the world, the nearest one will be tuned.

If you input a frequency or an ID, and the nearest corresponding navaid signal is not received, only the frequency will show up.

2.7.14 - *SEC FPLN pages*

The SEC FPLN key on the MCDU prompts the SEC INDEX page. It allows the pilot to

create a secondary FPLN, which is not followed by the auto pilot but can be activated any time to replace the active FPLN. When no SEC FPLN exists, the SEC INDEX page is like the picture below :

LSK1 : copies the active FPLN in the SEC FPLN. The display switches then to SEC FPLN page.

RSK1 : accesses the secondary INIT A page. (SEC INIT A has the same layout as INIT A). The display switches then to SEC FPLN page.

LSK2 : accesses the SEC FPLN page (same layout as FPLN page, but all lines are white instead of green).

Once a SEC FPLN has been created, the SEC INDEX page becomes (see next page):

The INIT prompt at R1 disappears. To create a new SEC FPLN via INIT A page, you'd

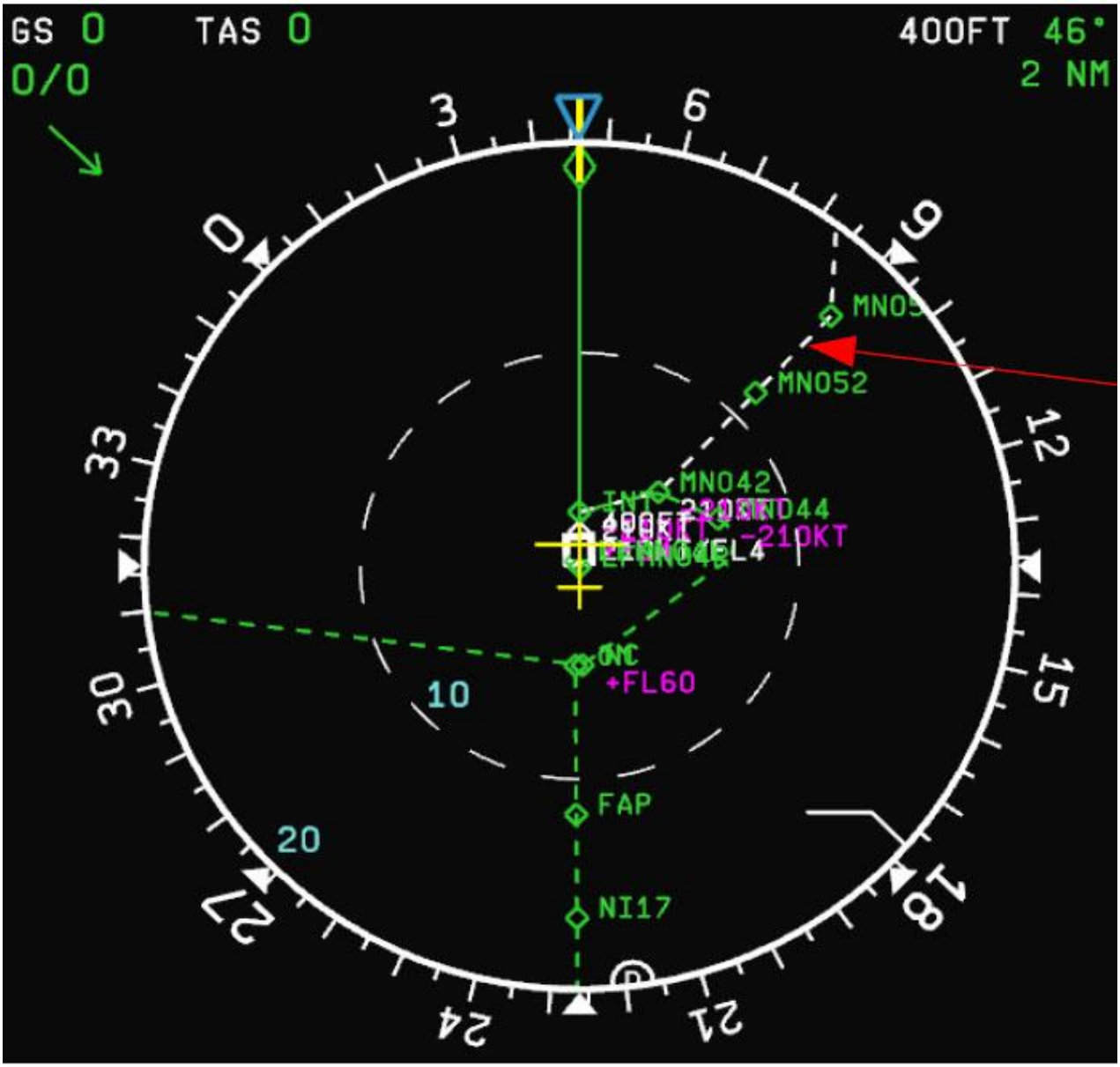
have to delete the existing one with **LSK3** “DELETE SEC”.

The **LSK4** activates the SEC FPLN. The SEC FPLN becomes FPLN and FPLN becomes SEC FPLN.

SEC FPLN page :

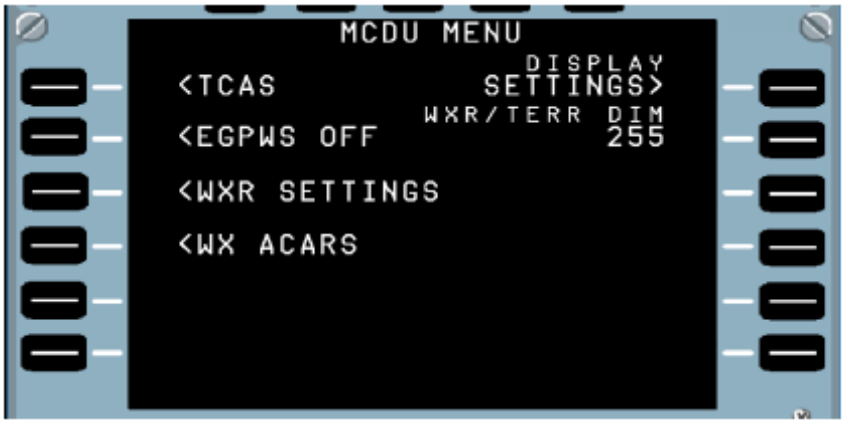
All FPLN sub-pages are available in the SEC FPLN (lateral and vertical revisions, SID, APPR, STAR selection).

When the MCDU active page is any of SEC FPLN sub-pages, and the SEC FPLN isn't empty, the ND shows the SEC FPLN track in white:



GS 0
TAS 0
0/0
400FT 46°
2 NM
MN052
MN042
+FL60
FAP
NI17
10
20

2.7.15 - MCDU MENU page



This paged is accessed via the MCDU MENU key on the MCDU. For the moment, it is not as in the real ACFT. I'm using this page to access options that are not set via the MCDU, but are quite useful.

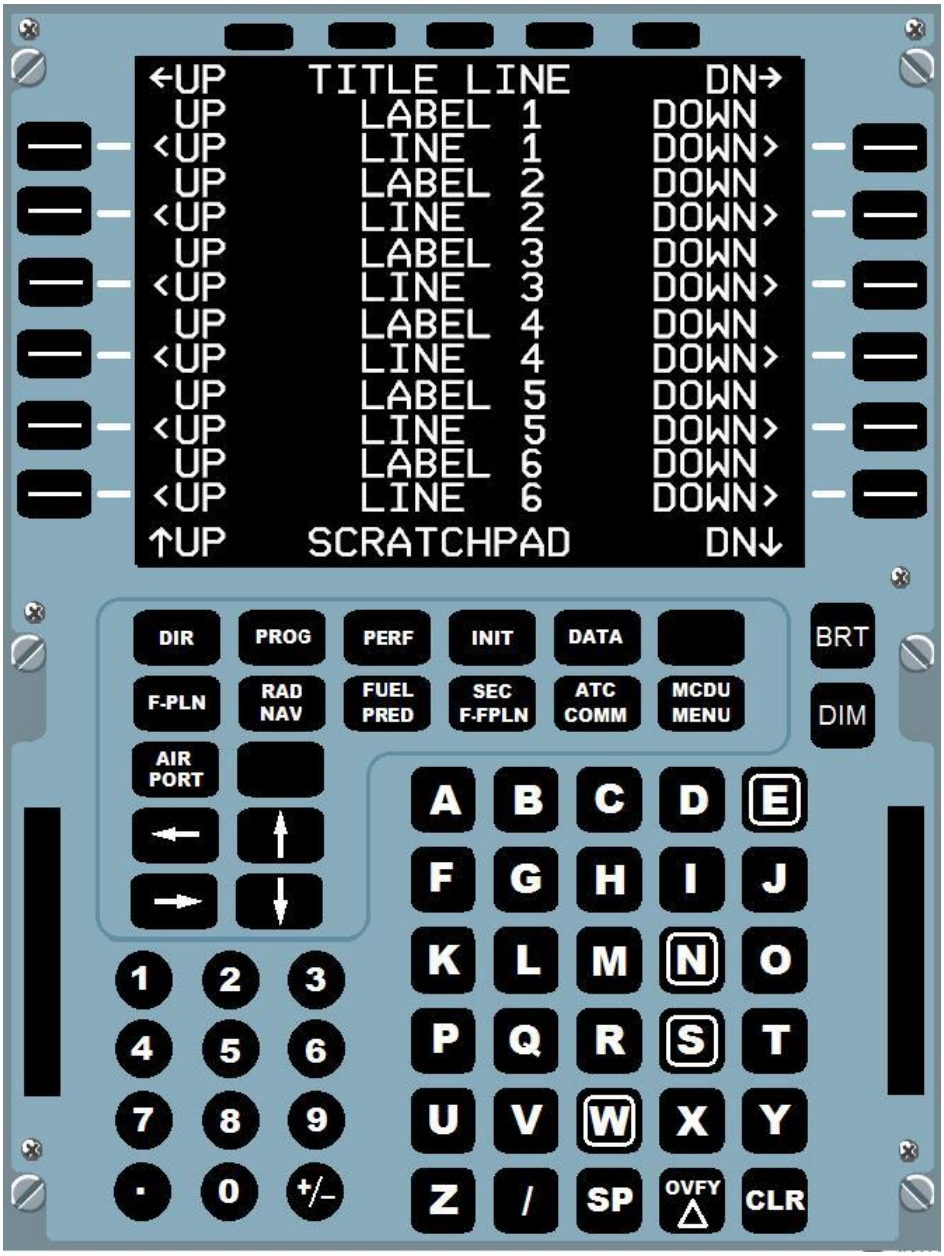
- **LSK1** will prompt the TCAS page (*please see below*).
- **LSK2** will switch on/off EGPWS “Terrain On ND” feature.
- **LSK3** will prompt the WXR RADAR page (more information at ☞ **chapter 2.7.17**)
- **LSK4** will prompt WX ACARS page, in order to get METAR datas.
- **RSK1** prompts the display settings (*please see on next page*).
- **RSK2** allows you to modify WXR / TERR DIM (from 0 to 255, using scratchpad).

LSK 1 : This page is used to set transponder and TCAS modes (more information at ☞ **chapter 2.2.7).**

RSK 1 : This page allows you to move each line to match your hardware faceplate (if you have one...).

Click on left/right arrows to move TITLE LINE, click on up/down arrows to move SCRATCHPAD line.

Click on corresponding LSK / RSK to move LINE 1 to 6.



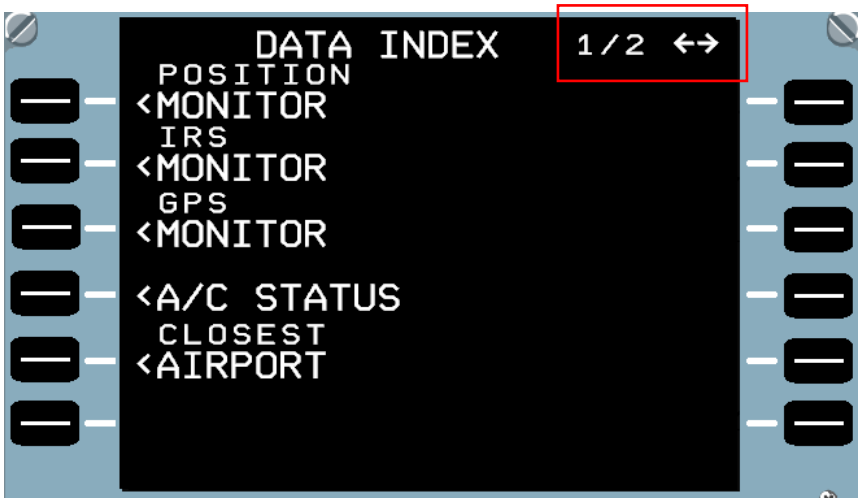
To move LABEL lines, you prior have to click on MAJ+L (on your PC keyboard), or on the empty key beyond AIRPORT and under RAD NAV keys (on the MCDU software).You will get this :

Then, click on corresponding LSK / RSK to move LABEL 1 to 6.

2.7.16 - DATA page

DATA INDEX 1 / 2 page :

You can access this page with the **DATA** key on the MCDU.



This page allows you to access various other pages :

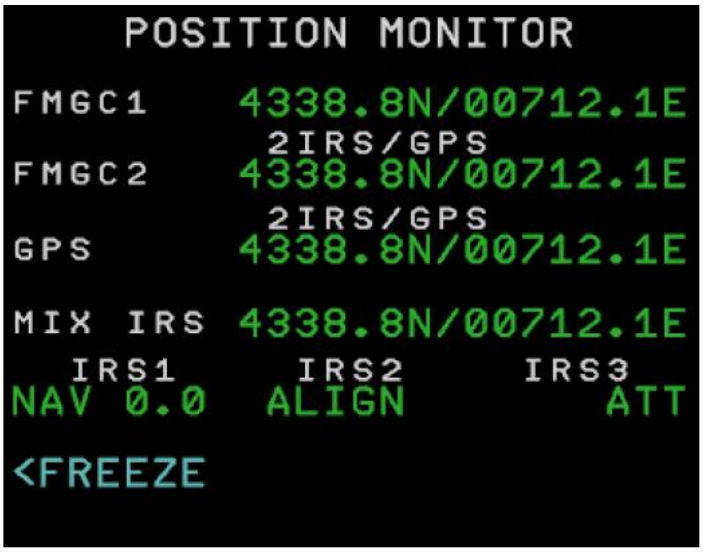
- **LSK1 :** Position Monitoring
- **LSK2 :** IRS monitoring

- **LSK3 :** GPS monitoring
- **LSK4 :** A/C Status (already described in ☞ **chapter 2.7.2**)
- **LSK5 :** Displays closest airports

For the moment, all IRS, FMGC and GPS will compute the exact value of position, HDG and track, there is no drift implemented, nor any possibility to induce a position error(in INIT A page for example).

Please note that you can now access a **DATA INDEX 2 / 2 page**, using MCDU right arrow key. For more information about this (i.e saving “Pilot Routes” function…), please check **Advanced Users Guide**

Position Monitor page :



It shows the position computed by both FMGC, the GPS and a mix from the 3 IRS. It also displays the status of the IRS (whether in ALIGN, NAV, ATT or OFF mode).

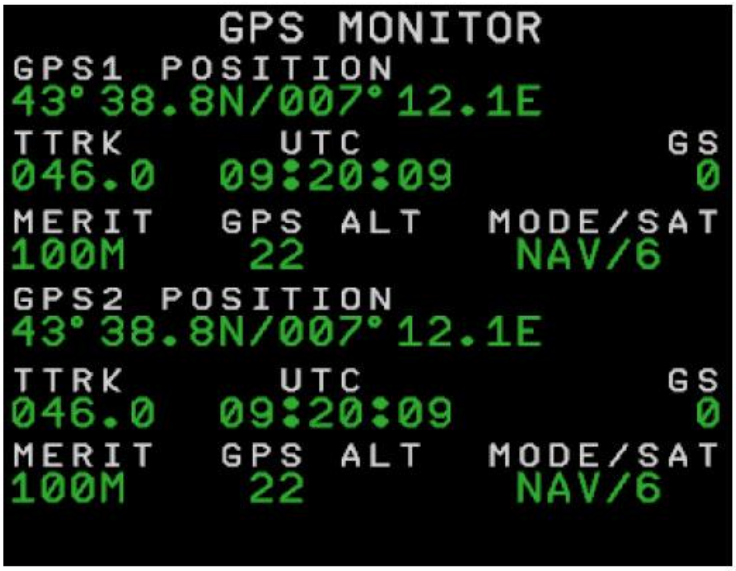
In-flight, you can press the LSK6 to freeze the display for a better readability.

IRS Monitor page :

Displays the mode of the 3 IRS and allows you to display the status of each one, by the LSK 1 to 3. If one IRS is in ATT mode and not aligned, you can enter the heading here in R5. For the moment, no matter what heading you input, the real heading will be used.

Here is the detail of the IRS 2, as in Position monitor Page, you can freeze the details (here frozen at 0918 UTC). It displays latitude, longitude, track, heading, ground speed, win. “NEXT IRS” prompt will display the next IRS (or IRS1 if you're currently in IRS3).

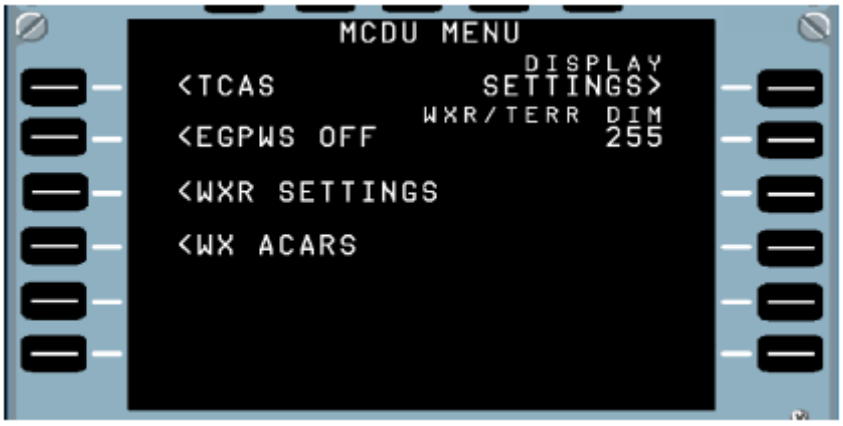
GPS Monitor page :



Displays the details of both GPS.

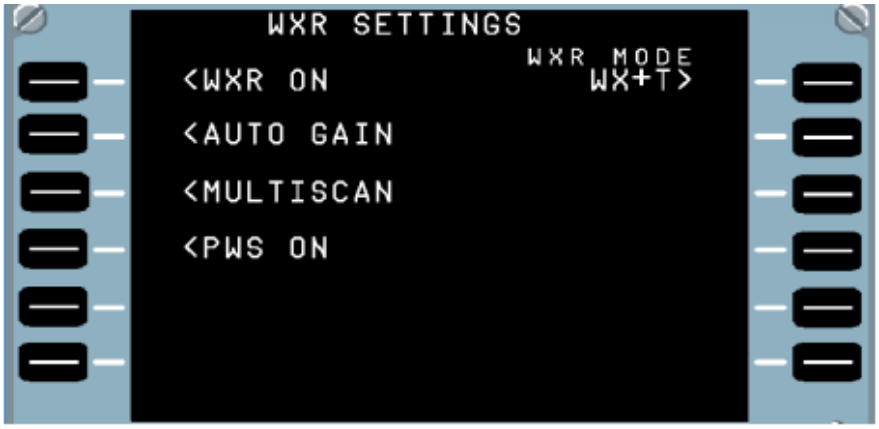
2.7.17 - WXR Radar function

To operate the WXR, you can go in the “MCDU MENU” page of each MCDU. You will then get some controls on the WXR.

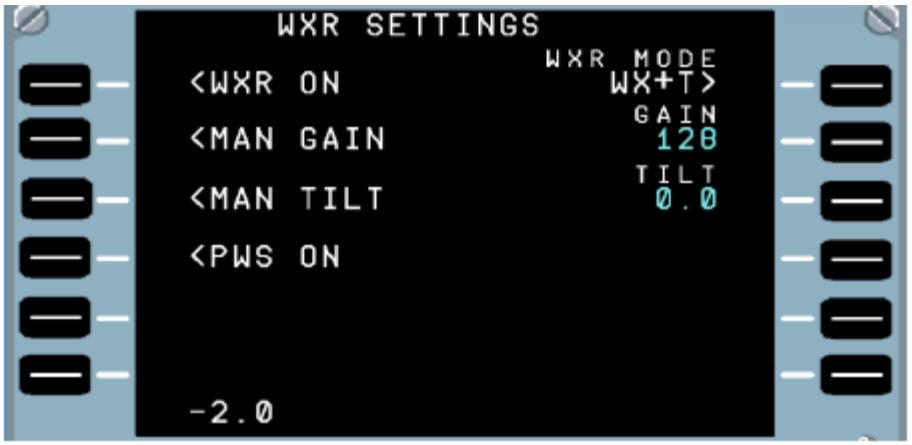


As on the picture above, pushing RSK2 on that page will help you set the WXR/EGPWS image brightness (independently of the actual ND brightness). You can enter here any value from 0 to 255.

LSK3 will get you to the specific WXR controls:



- LSK1 turns the WXR on/off. Even if ON, the WXR image will be displayed only if onside EGPWS is turned off.
- LSK2 is on AUTO by default. Setting the gain to MANUAL, you can then change the gain value in the RSK2 field. (see next picture)
- LSK3 is on MULTISCAN by default. Setting the tilt to MANUAL, you can then change the tilt value in the RSK3 field. (see next picture)
- LSK4 is used to turn PWS (predictive windshear) ON/OFF.
- RSK1 is used to cycle between 3 modes:
  - WX + T: precipitations + associated turbulences.
  - WX : only precipitations.
  - T : only turbulences.



On the real aircraft, these features are set on the WXR panel, on the pedestal. The MCDU access is only to let people use them without any hardware.

If you do not see any picture, even after all the steps described here, it can be because

simply you are not in an area with precipitations to be displayed.

To make a test, find a location with heavy thunderstorms (or set ASN/AS16 to heavy thunderstorms).

The WXR image will present a color coded image.

- Black means no precipitations
- Green is low precipitations
- Yellow is medium precipitations
- Red heavy precipitations
- Magenta means high turbulence (so heavy precipitations usually near a very active Cumulonimbus).

Clear air turbulence is NOT detected by the weather radar.

2.8 - AP/FD and A/THR logic

2.8.1 - AP/FD modes

The Auto-Pilot (AP) and the Flight Director (FD) have different modes, vertical and lateral, which depend on the phase of flight and the pilot choice through the FCU. To engage a mode:

- You must first **arm** it,
- It will then **engage** by itself when the conditions for engagement are met.

A few modes work in conjunction with the Auto Thrust (A/THR).

In the following pages, you(ll find a list of the different modes with their **arming** and **engagement** conditions.

Lateral Navigation modes

HDG or TRK modes :

these modes allow to fly along the heading or track selected by the pilot in the FCU HDG/TRK window.

You can switch between HDG or TRK with the HDG V/S – TRK FPA pushbutton on the FCU.

Engagement (one of the following is enough) :

- Pulling HDG selector knob on the FCU

- NAV mode automatically disengaged
- FINAL mode lost when in APP NAV mode
- LOC or LOC* mode lost

Disengagement conditions : engagement of any other lateral mode.

NAV mode:

This mode guides the aircraft along the lateral flight plan entered in the MCDU.

Arming conditions (one of the following is enough) :

- ACFT on the ground and no other lateral mode armed
- Pushing the HDG selector knob on the FCU

Disarming conditions (one is enough) :

- Pulling HDG selector knob on the FCU
- LAND mode engages

Engagement conditions (one is enough) :

- At 30 ft radio-altitude if armed on the ground
- With a DIR TO order.
- In-flight, when armed and near the FPLN track.

Disengagement condition: An other lateral mode is engaged.

Vertical Navigation modes

CLB mode:

this mode controls the aircraft pitch to fly at either a selected or managed speed, up to an altitude selected in the FCU altitude window. It takes into account the FPLN waypoints speed and altitude constraints, and thus require the NAV mode to be engaged.

Arming conditions (one is enough) :

- on the ground or when SRS mode is engaged, no other vertical mode is engaged and ACCEL ALT is below FCU altitude
- in-flight when FCU altitude is above current aircraft altitude.

Disarming condition (one is enough) :

- Another vertical mode is engaged
- FCU altitude lower than or equal to ACFT altitude.

Engagement conditions (**all** of the following):

- NAV mode engaged,
- FCU altitude above ACFT current altitude
- ACFT not flying an altitude constraint
- G/S mode is not active

CLB mode **manually engages** when pilot pushes the altitude selector knob on the FCU and conditions above are met.

Disengagement conditions (one is enough) :

- NAV mode disengages (vertical mode reverts to OP CLB)
- Another vertical mode engages
- Pilot selects an altitude lower than current ACFT altitude. (vertical mode reverts to V/S mode)

OP CLB mode:

open climb mode controls the aircraft pitch to maintain the target speed (managed or selected), but disregards any FPLN altitude constraint.

Engagement conditions: FCU altitude must be higher than actual ACFT altitude **AND** (one of the following) :

- Pilot pulls the altitude selector knob
- ACFT reaches ACC ALT with CLB armed and NAV not engaged
- NAV mode lost when CLB is engaged

Disengagement conditions (one is enough) :

- Any other vertical mode engaged
- FCU altitude set lower than actual ACFT altitude. (vertical mode reverts to V/S mode)

DES mode :

this mode controls the aircraft pitch to fly along a calculated vertical profile which takes into account the FPLN waypoint speed and altitude constraints, and thus require the NAV mode to be engaged. The aim of the profile is to maintain idle thrust to reduce fuel consumption. The target speed is maintained with a -20 knots error margin.

Arming conditions (all of the following) :

- FCU altitude below current altitude,
- NAV engaged.

Disarming conditions (one is enough) :

- Another vertical mode is engaged
- FCU altitude higher than or equal to ACFT altitude.

Engagement conditions (all of the following) :

- NAV mode engaged,
- FCU altitude below ACFT current altitude,
- ACFT not flying an altitude constraint,
- TO, G/S, LAND, and FINAL mode not active.

DES mode **manually engages** when pilot pushes the altitude selector knob on the FCU and conditions above are met.

Disengagement conditions (one is enough) :

- NAV mode disengages (vertical mode reverts to OPDES)
- Another vertical mode engages
- Pilot selects an altitude higher than current ACFT altitude. (vertical mode reverts to V/S mode)

OPEN DESCENT mode (OP DES) :

Open descent mode controls the aircraft pitch to maintain the target speed (managed or selected), but disregards any FPLN altitude constraint.

Engagement conditions: FCU altitude must be lower than actual ACFT altitude **AND** (one of the following) :

- Pilot pulls the altitude selector knob
- NAV mode lost when DES is engaged

Disengagement conditions (one is enough) :

- Any other vertical mode engaged
- FCU altitude set higher than actual ACFT altitude. (vertical mode reverts to V/S mode)

ALT*, ALT CSTR* modes :

Altitude and altitude constraint acquire modes.

Engagement : automatically when in CLB, OP CLB, DES, OP DES or V/S modes and the ACFT is in the altitude capture zone around the FCU altitude target or constraint altitude (in DES or CLB modes only).

Disengagement : FCU altitude is modified and ACFT is no longer in capture zone, or if ALT

or ALT CSTR engage.

ALT, ALT CSTR modes :

Altitude hold modes. They maintain either the FCU altitude of the constraint altitude if vertical profile is managed.

Arming conditions : whenever target altitude is different than actual altitude.

Engagement : automatically if altitude is within ±20ft of target altitude.

Disengagement conditions : any other vertical mode engages.

V/S – FPA modes :

These modes maintain a constant V/S or a constant flight path angle. You can switch between the two with the HDG V/S – TRK FPA pushbutton on FCU.

Engagement conditions (one is enough) :

- Pull V/S FPA selector knob or push it (for immediate level off)
- Select a higher altitude than current ACFT altitude in DES or OP DES modes.
- Select a lower altitude than current ACFT altitude in CLB or OP CLB modes.

Disengagement conditions (one is enough) :

- Pulling or pushing altitude selector knob
- Reaching FCU altitude

AP/FD common modes

During certain phases of flight, vertical and lateral modes are linked. Here are all those common modes.

Take Off modes (vertical SRS and lateral RWY) :

These modes **engage** during take off.

SRS mode maintains V2+10 knots by adjusting pitch ; it *disengages* when reaching Acceleration Altitude (ACC ALT).

ILS Approaches modes :

These are the following modes **:**

- vertical G/S or G/S*,

- lateral LOC or LOC*,
- LAND,
- FLARE,
- ROLL OUT.

Selected approach must be ILS.

LOC* **engages** when APPR has been pushed, and ACFT is in the localizer interception zone. It *disengages* when LOC engages, or ACFT loses localizer signal, or APPR pushbuton is pushed a second time to cancel approach mode.

LOC **engages** when ACFT is established on localizer beam. It then follows the localizer. It *disengages* when LAND mode engages, LOC signal is lost or APPR button pushed again.

G/S* **engages** engages when APPR has been pushed, and ACFT intercepts the glideslope signal. It *disengages* when G/S engages, or ACFT loses glidepath signal, or APPR pushbuton is pushed a second time to cancel approach mode.

G/S **engages** when ACFT is established on G/S beam. It then follows the glidepath. It *disengages* when LAND mode engages, G/S signal is lost or APPR button pushed again.

LAND **engages** when ACFT established on GP and localiser **and** RA is inferior to 400ft.

FLARE **engages** when in LAND mode and RA≤40ft.

ROLL OUT **engages** on touch down.

Non Precision Approaches (vertical FINAL & lateral APP NAV) :

Selected approach is non-ILS.

This two modes **arm** by pressing APPR pushbutton.

APP NAV **engages** with same conditions as NAV mode

FINAL **engages** if armed **and** APP NAV is engaged.

They both *disengage* if APPR pushbutton is pushed again or another vertical mode is engaged.

2.8.2 - A/THR modes

Auto Thrust (A/THR) controls the engines %N1 setting. It is used either to maintain a constant N1 setting (THRUST mode) or to adjust speed/mach (SPEED/MACH mode).

- When AP/FD is not engaged, A/THR always operates in SPEED/MACH mode.
- When AP/FD is engaged, A/THR can operate either in SPEED/MACH or THRUST mode, according to the AP/FD modes engaged.

Arming conditions of A/THR (one is enough) :

- A/THR pushbutton pushed on FCU

- Setting thrust levers to TOGA notch

Engagement conditions of A/THR (**all** of the following) :

- Thrust levers between idle and CL notches,
- A/THR is armed

A/THR operates in THRUST modes while AP/FD vertical modes is one of the following:

- SRS*, CLB, OP CLB, DES en IDLE, OP DES. It delivers a thrust between idle power and the maximum thrust setting materialized by thrust levers position (CLB, MCT, TOGA,...).

A/THR operates in SPEED/MACH modes while AP/FD vertical modes is one of the following:

- AP/FD not engaged
- ALT ; ALT CSTR ; ALT* ; ALT CSTR* ; ALT CRZ,
- DES (when in geometric path)
- V/S – FPA ; G/S* ; G/S ; FINAL.

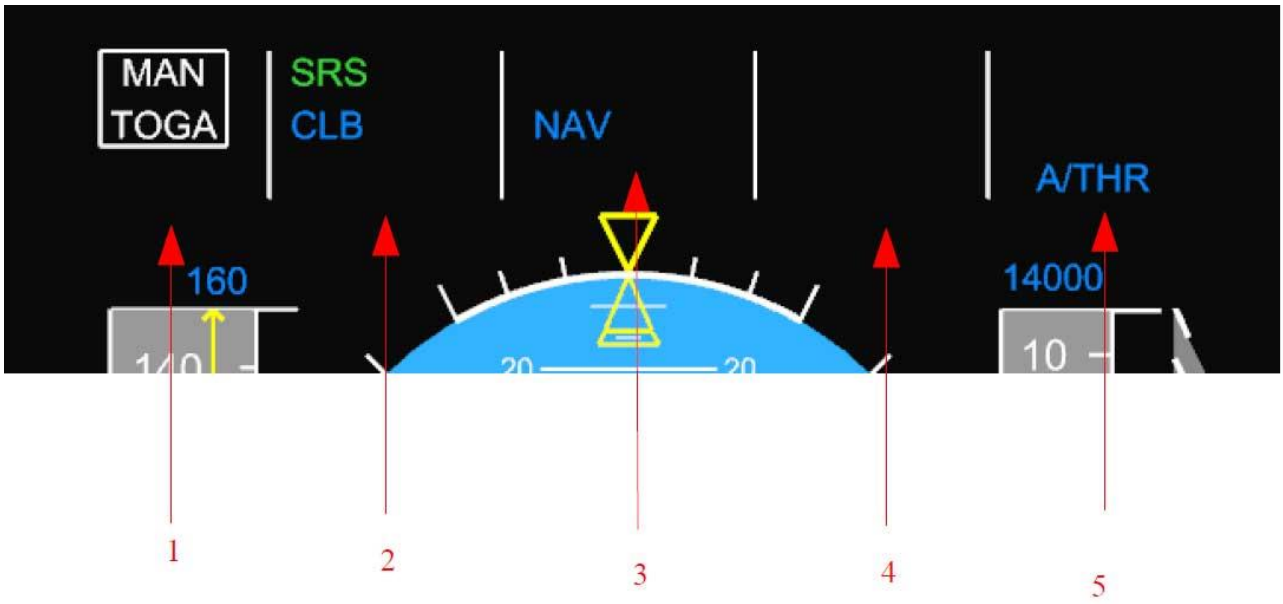
Disengagement conditions of A/THR (one is enough) :

- FCU A/THR pushbutton.
- Thrust levers at idle notch.

When disengaged, A/THR is not re-armed, you need to re-arm A/THR manually.

2.8.3 - FMA

The Flight Mode Annunciator displays the current **armed** and **engaged** AP/FD and A/THR modes:



- Columns (1), (2) and (3) (respectively **A/THR**, **vertical** mode and **lateral** mode) show in green the modes engaged and in blue the modes armed. White is used when A/THR is armed but not engaged.
- Column (4) shows Approach capabilities.
- Column (5) shows AP/FD and A/THR status: in white if engaged, in blue if armed.

On the picture above taken during take off roll, we can see that thrust levers are set at TOGA, SRS is **engaged**, CLB, NAV and A/THR are **armed**.

During the initial climb to come, THRUST, CLB et NAV will be later engaged.

2.9 - Stand-By instruments

2.9.1 - General

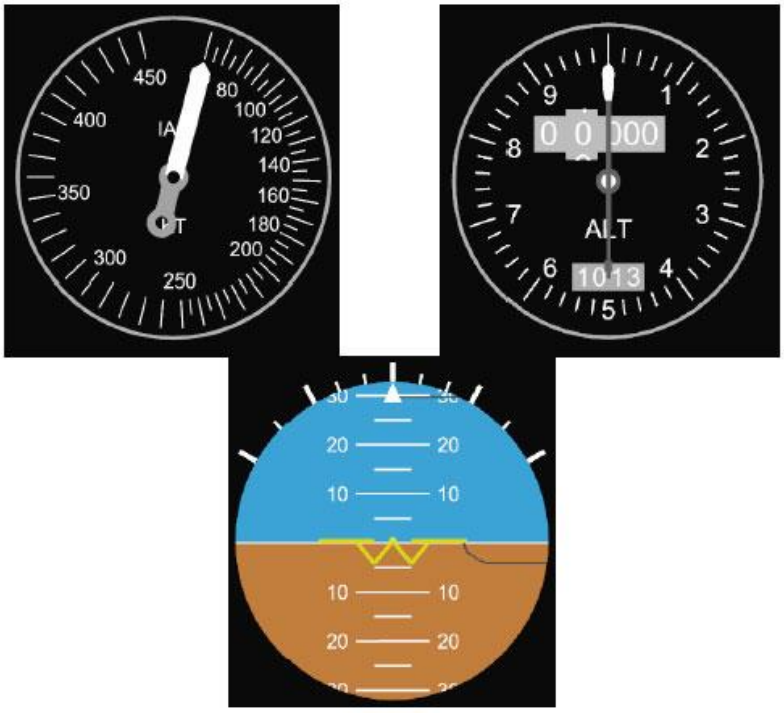
You now have the choice to install and run each specific standby instrument during installation (see **Installation Guide**, chapter 3).

The following chapter will describe briefly each of them, and list the keyboard shortcuts available. There are also FSUIPC and joysticks commands possible.

2.9.2 - Standard Mechanical Instruments

The usual mechanical stand-by instruments are included :

- Indicated Airspeed Indicator,
- Altimeter (feet or meters),
- Artificial Horizon.



Barometric settings is changed using « **O** » or « **P** » keys.

2.9.3 - DDRMI

The DDRMI (Digital Distance and Radio Magnetic Indicator) displays the DME distances (if set to VOR1/VOR2), as well as the bearing to selected navaid (VOR or ADF).

The heading rose is moving and it's top arrow shows the magnetic heading of the aircraft.

With a righ-click, you can display some options :

- Check ADF option to use either VORs or NDBs input on the DDRMI. You can switch between VOR1/ADF1 by using **F1** and **F2** keys respectively. And you can switch between VOR2/ADF2 by using **F3** and **F4** keys.
- Uncheck ADF option to only use it as a VOR receiver (as on the picture above)

2.9.4 - Clock/Chronometer

The clock is a digital version. It can show the current GMT hour, as well as the date (using Date function, « **D** » key).

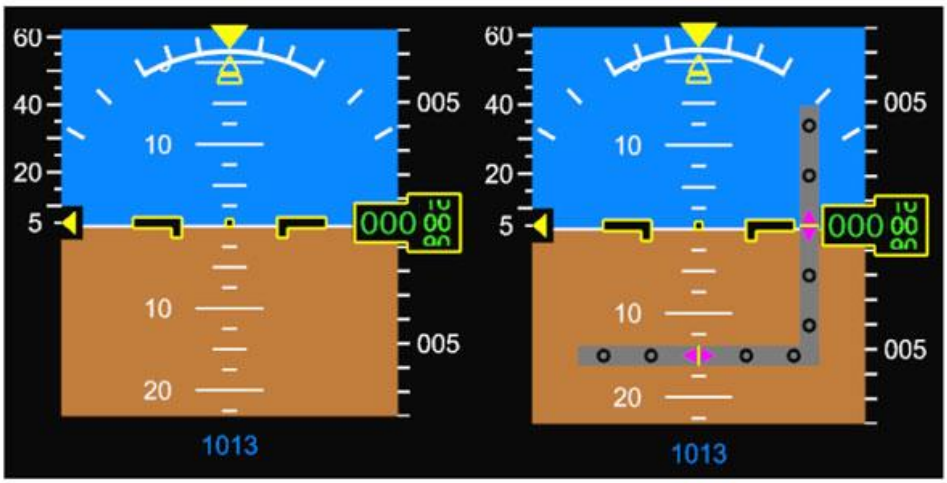
The chronometer (CHR) is started/stopped with « **C** », and reset with « **R** ». It counts a maximum of 99 minutes 59 seconds.

The elapsed time (ET) function is a timer counting up. Starts with « **S** », stops with « **T** » and resets with « **A** ». Reseting stops the timer as well. Counts up to 99 hours 59 minutes.

It is possible to move/remove the labels between the digits, if you want to place the display behind a MIP cover. The digits can be adjusted in vertical position as well. Check the *clock.cfg* file in the STBY folder.

2.9.5 - ISIS

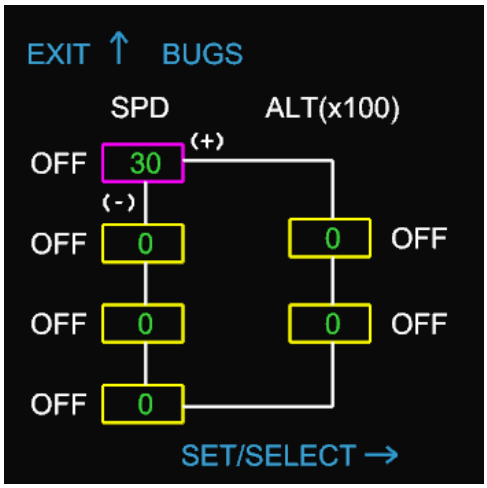
The ISIS (Integrated Standby instruments System) is a small PFD with IAS, altimeter and attitude information



You can show ILS scales (above right picture) by pressing « **L** ».

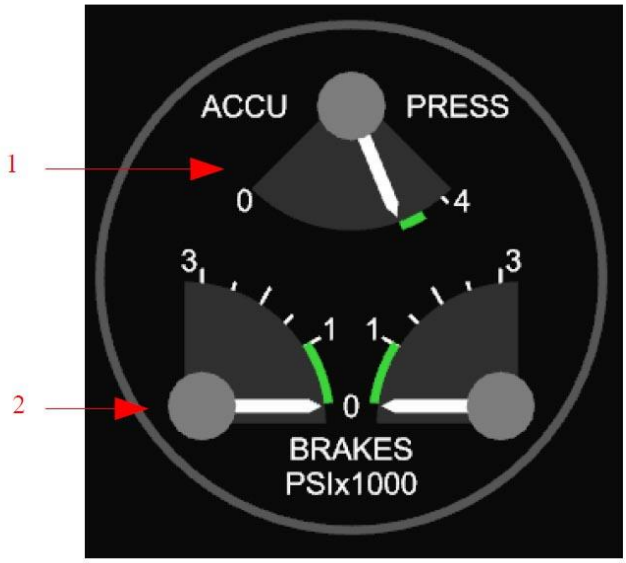
The baro-pressure is adjusted as well with « **O** » and « **P** ». You can switch back to standard 1013 hpa pressure using « **M** ».

The speed and altitude scales can show reference bugs. To do that, you need to enter the Bugs menu using « **B** »:



Then using **+** and **-** keys you can navigate through the different bug boxes. You can adjust the desired bug (the box circled in magenta) using the « **O** » and « **P** » keys (the same keys used for baro-pressure) and enable/disable it with « **M** ».

2.9.6 - Triple Brake Indicator



- (1) – Brakes Accumulator Pressure
- (2) – Brakes pressure applied. They'll show the pressure only if the brakes are powered by the yellow hydraulic circuit (in case of G failure, or ALTN braking law).

2.10 - Other Software panels

2.10.1 - General

Other panels are available as a software application, for user cases where it is preferred to have software interactions rather than hardware (limited space…).
These panels are currently the thrust levers, the Flaps and spoilers levers, the ECAM control Panel (ECP), the Audio Control Panels (ACPs) and the landing gear panel.
More panels may be added overtime.

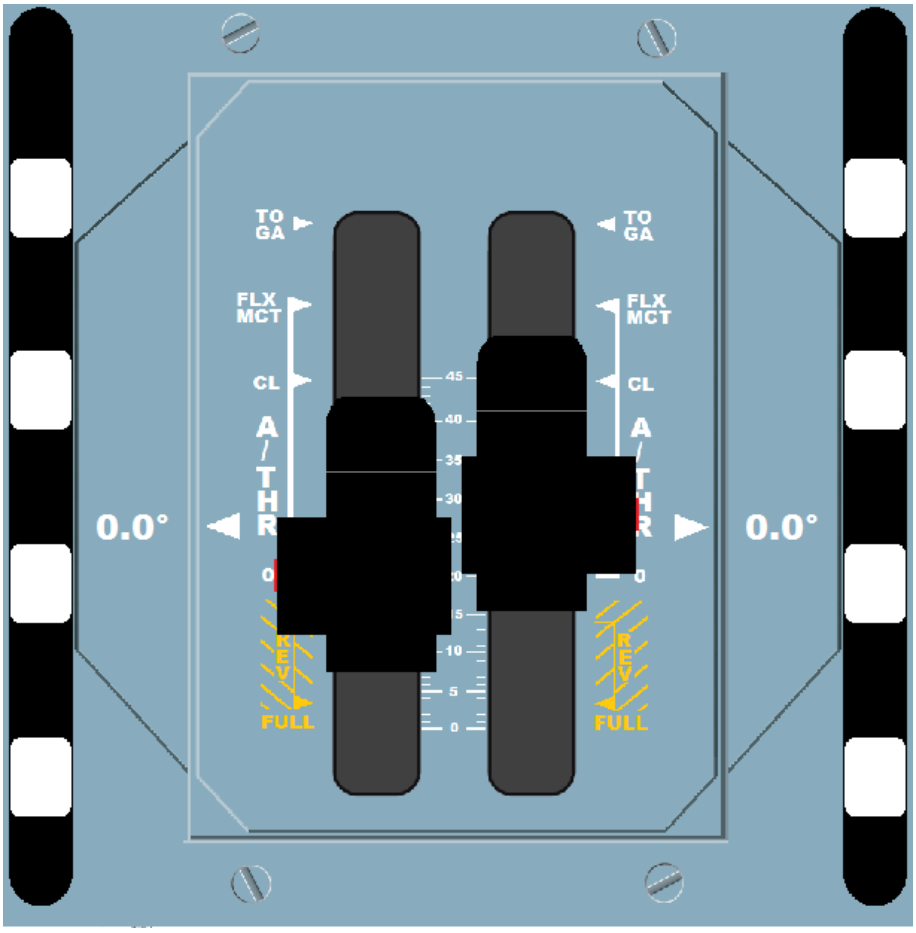
2.10.2 - Thrust levers

This panel allows control over the thrust levers and the pitch trim wheel.
There is NO need for calibration if you use this panel !

To operate the thrust levers you need to left-click on the lever directly, and drag (without

releasing the mouse button) the lever to the desired position. The detents are easily selectable.
If you click in between the two levers, you can move them simultaneously, and they will stay synchronized.
The full range from MAX REV to TOGA can be used.

The trim wheel is operated in the same way, by dragging it up or down. The reading next to the wheel will show the current wheel position, in degrees.

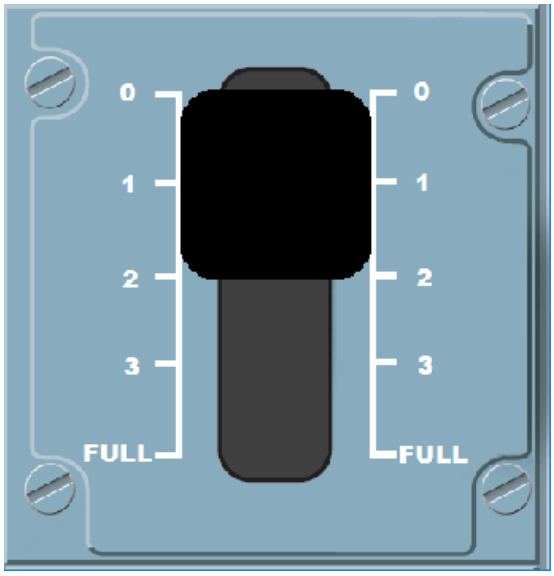


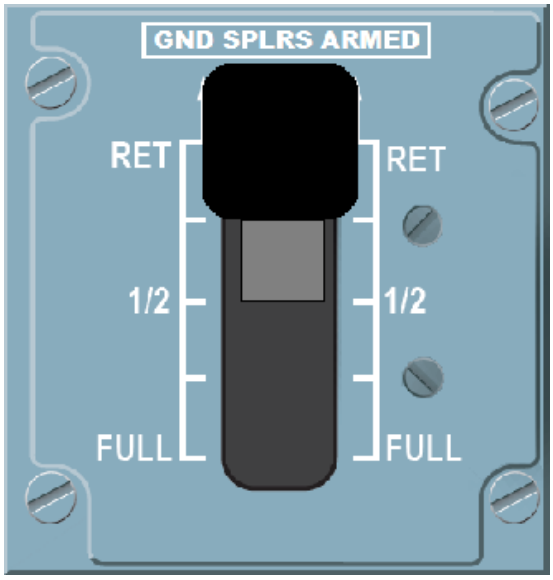
2.10.3 - Flaps and Spoilers levers

These panels allow control over the flaps and spoilers levers.
There is NO need for calibration if you use these panels!

To operate the flaps lever, you need to left-click on the lever directly, and drag (without releasing the mouse button) the lever to the desired position.
Similarly, to operate the spoilers lever, you need to left-click on the lever directly, and drag the lever to the desired position. To arm/disarm the ground spoilers, double click on the

lever.



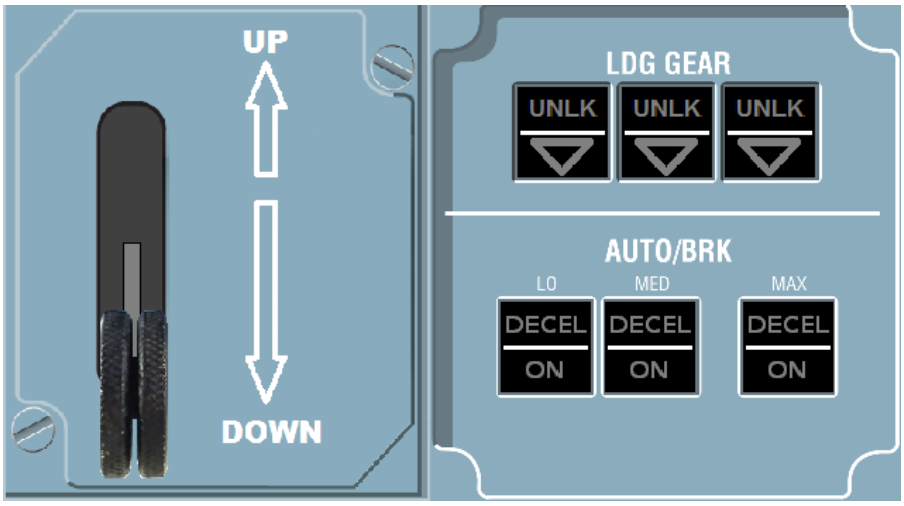


2.10.4 - Landing gear lever - A/BRK Panel

This panel allows control over the landing gear lever and on the Auto brakes.

To operate the landing gear lever, you need to left-click on the lever directly, and drag (without releasing the mouse button) the lever to the desired position.
The LDG GEAR annunciators will show the gear status.

To operate the A/BRK, a click on the desired button will arm/disarm the releant A/BRK rate.

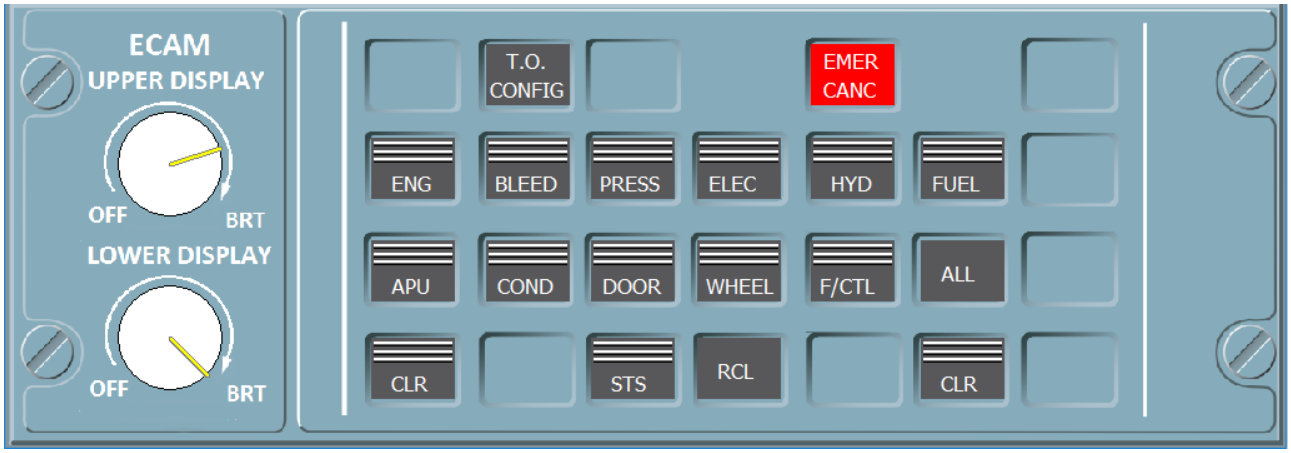


2.10.5 - ECAM Control Panel (ECP)

This panel allows control over the ECAM Control Panel.

All keys simply need to be clicked on. Most of the buttons may have effect while pushed and released, this is simulated accordingly by pushing and releasing the mouse button (for example, the ALL button scrolls through all SD pages while pushed in).

The two potentiometers are active. You can change their position using the mouse wheel, with the mouse cursor above the potentiometer.

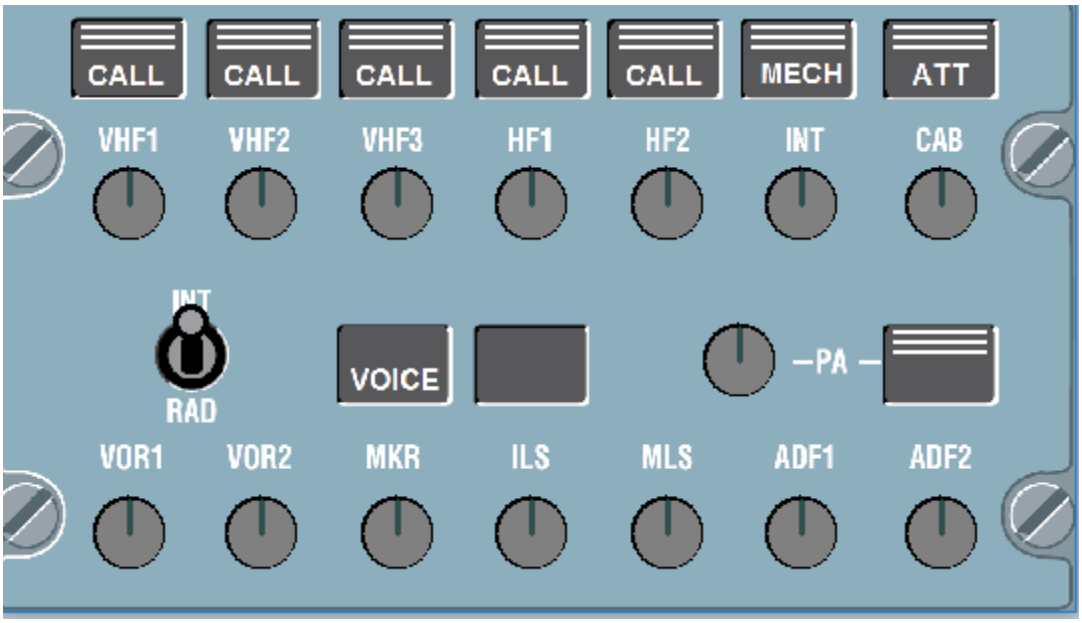


2.10.6 - Audio Control Panels (ACP)

These panel allow control over the Audio Control Panels (ACPs). The CPT, FO and jump seat ACPs are simulated, and have an effect on the Intercom module.

All keys simply need to be clicked on.

The potentiometers are active. You can change their position using the mouse wheel, with the mouse cursor above the potentiometer. Clicking on them toggles their state (ON/OFF).



A quick introduction to the operations of the ACPs and intercom functions

- All microphones and headsets/speakers in the aircraft are linked by the intercom module.
- Each crew member can hear any audio channel he wishes, by activating the relevant potentiometer. If it is lighted, it is active, and several channels may be active at the same time for reception.
- He can however emit only on one single channel, which is marked in green by the reception buttons, at the top line of the ACP.
- Emitting on a channel requires a microphone to be “live”. This is done using the Push To Talk button on the relevant microphone (hand mikes) or the sidestick trigger (headset boom mike).
- The ACP panels have a stand-by PTT, linked to the headset boom mike. It is the INT / RAD selector.
- On RAD position, it will emit on the selected (green) channel.
- On Neutral position, it is not live (unless the stick trigger is used).
- On INT position, the microphone will emit on the INT channel EVEN if it is not selected in green, and if the trigger PTT is released (remember, only one emission channel at a time).
- The lower potentiometer line is used to hear the navigation aids identification codes, which is the morse code ID of the VOR/NDB/…

2.10.7 - Radio Management Panels (RMP)

These panels are used to control the 3 RMP (CPT, F/O and jump seat).

You only have to click on the keys ; don't forget to set the panel to ON (by clicking on the small black circle inside the grey circle called "ON/OFF").

As in the real aircraft, frequency adjustment is performed using the two overlapping wheels : point your mouse over the one you want to adjust, then use the mouse wheel for adjustment while checking the display on the STBY/CRS screen. The transfer key ("double green arrow") allows you to switch the displayed values between the ACTIVE and STBY/CRS screens, and then activates the frequency you've just set.

New with B50.1 : NAV BACKUP function (guarded NAV key) and other corresponding keys (VOR, ILS, ADF, BFO) are now available. As in the real aircraft, MLS key is inoperative, and the whole NAV BACKUP function is only available on RMP 1 and 2 (CPT and F/O).

3. FMGS operations : LFBO to LFMN

3.1 - General

In this chapter, we'll be flying an imaginary flight from Toulouse-Blagnac (LFBO) to Nice Riviera (LFMN). I'll try to describe most of the FMGS functions throughout that flight.

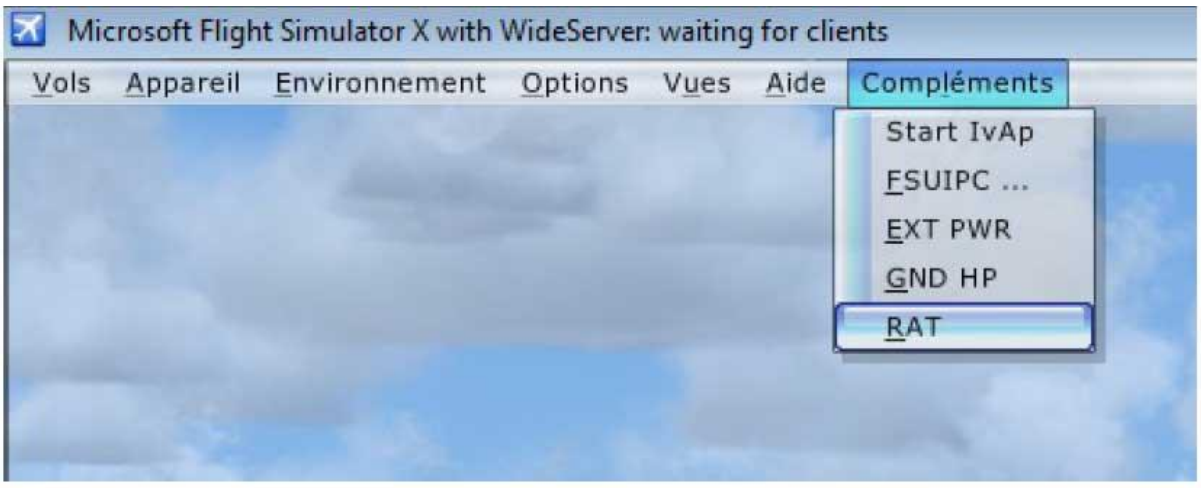
Remember that **after launching the software, the aircraft will be in a "Cold & Dark" state,** which means all systems are inoperative (Electrical, pneumatics, hydraulics, fuel, etc...). It is thus normal to get black screens only...

Of course, there is an exhaustive flight deck preparation procedure described in the aircraft manuals; if you later want to stick as close as possible to the real operations, you can find a lot of material on the web (check out ☞ **www.smartcockpit.com**).

However, please note that an added function allows you to directly run the software in the "Engine Running" status, check the **Installation Manual**, chapter 5.1.

For our discovery flight, we will first connect an external electrical power source (no, please refrain from plugin your computer USB port into the wall socket ☺ **!!**) Check ☞ **chapter 2.6.6** if necessary :

- Open FS « Add-ons » menu and chose « EXT PWR ».
- On the OVHD, a green **AVAIL** light goes on on the EXT PWR korry.
- Click on that Korry, which will turn it to **ON**.
- Now all our instruments are powering up.



Click now on all korries which have a white OFF indication lit ; you must switch all those indictions off.

Let's start the APU (see ☞ **chapter 2.6.2**). We can follow the spool up on the SD, followed by the **AVAIL** indication on the APU START korry on the OVHS ; the aircraft is now producing its own electricity.

We'll remove the EXT PWR (click on the EXPT PWR korry to switch it from **ON** to **AVAIL**, then click again on EXT PWR in the FS addon menu).

Now we have to align the IRS. Check the ☞ **chapter 2.6.11** for that, then we can move on to the MCDU initialization on next page.

3.2 - Preflight

3.2.1 - INIT A

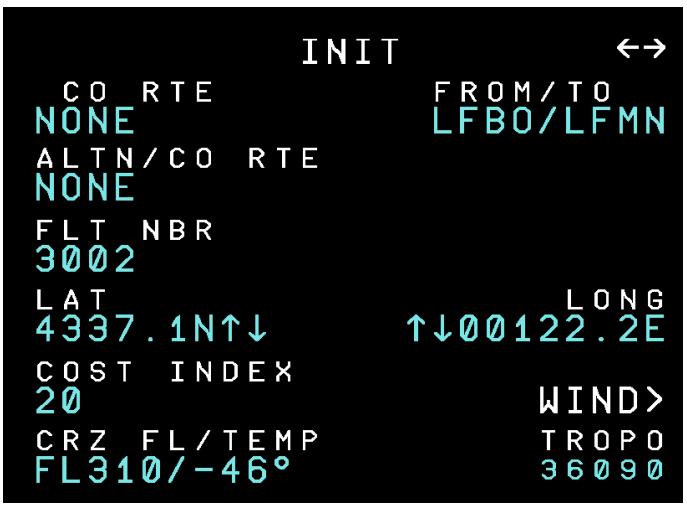
So here we are, at the gate in LFBO. The PAX are slowly boarding the aircraft, and we now have to start setting the FMGS up with today's flight.

First thing, will be to align the IRS so we can get a map on the ND and the PFD showing attitude data. To do so, go to the INIT A page in the MCDU. There, insert the departure/destination airports couple in 1R: LFBO/LFMN. Finally, push the “Align IRS” prompt on 3R. When IRS are fully aligned, the map will show up on ND.

Today flight number will be AF3002, let's write it down in 3L.

Company cost index on this flight is 20, and cruising level is FL310, which is respectively input in 5L and 6L. Today's weather is standard and wind is calm, so we won't play with 5R and 6R.

INIT A should look like:



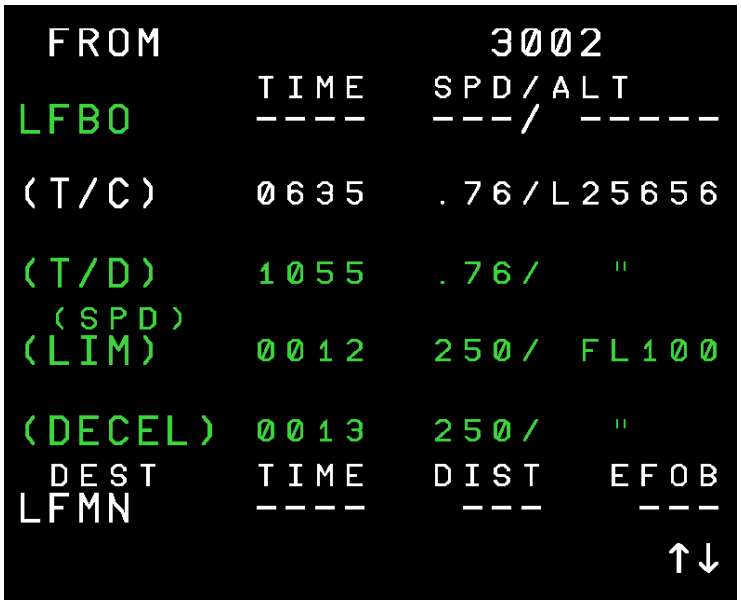
3.2.2 - FPLN

The following pages are only meant as an example ; they may evolve in the future, particularly due to new navigation data updates without any modifications done to this guide.

Our Ops gave us the routing to Nice: :

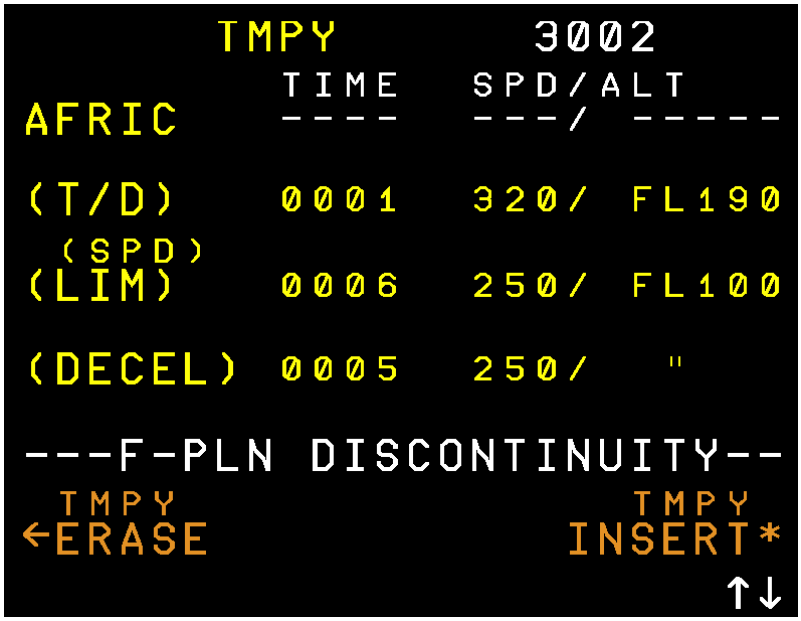
AFRIC – G39 – FJR – Y25 – MTG – G701 – MJ – Q302 – ABLAK

Let's go to the FPLN page. For the moment it looks like:



Use the up arrow (⇧) of the MCDU keyboard to scroll down the FPLN until it looks like :

Type AFRIC in the Scratchpad then insert it by clicking on **LSK3** to put it in place of « F-PLN DISCONTINUITY ». We get the following screen :

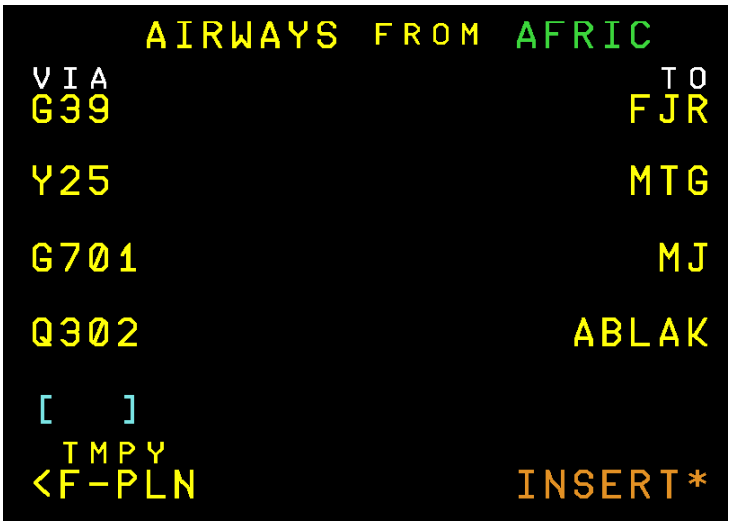


Push the **LSK** next to AFRIC to prompt the lateral revision page at AFRIC point.

- Select AIRWAYS page (**RSK5**).

- Type G39 in 1L (**LSK1**), then FJR in 1R (**RSK1**).
- From FJR, we'll follow the Y25 airway (**2L**) until MTG (**2R**).
- A DUPLICATE is called as there are several points called FJR ; we'll select the one we need (**1L**). AIRWAYS page is shown again, and MTG is written in **2R**.
- Continue with G701 in **3L**,until MJ (**3R**), which will prompt another DUPLICATE page ; do as before, then finish with Q302 (**4L**) until ABLAK (**4R**).

The MCDU should now look like that :



Click now on **RSK6** to insert this routing in the MCDU.
Scroll the FPLN using the UP arrow key (↑) until you have displayed the following :

4L says "---FPLN DISCONTINUITY---". This message appears every time the software cannot link the lateral revision with the FPLN (here between the last AWY point and

LFMN), so it happens when the last point of a new leg is different to the point after it in the FPLN sequence.

We can remove the discontinuity : CLR key ➔ **LSK4** , then « TMPY INSERT » ➔ (**RSK6**).

You now have an almost complete FPLN, only lacking departure and arrival procedures.

3.2.3 - DEPARTURE

By now, boarding is almost over, and it's time to call the delivery for our IFR clearance.

Today the RWY in use is 32L (we listened to the ATIS), and the delivery controller answers: ***"AF3002, start up to Nice is approved, squawk 4436, AFRIC 5B departure, initial FL 140, report for push back".***

Let's first enter the transponder code (via FS) then in the FCU set the altitude to 14000ft as initially cleared, and push to managed mode :

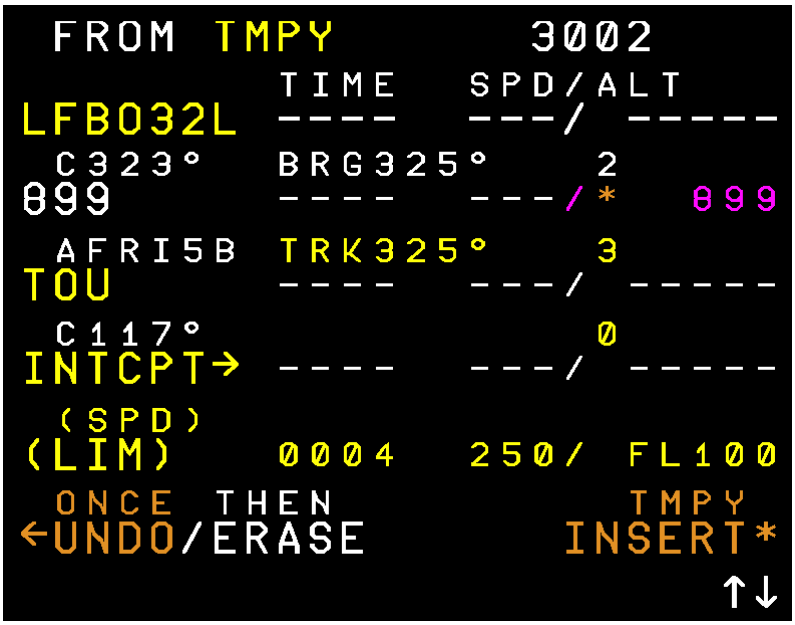
Since we'll be flying in vertical managed mode, the white dot next to the altitude window is on.

Back to the MCDU, scroll all the way up to LFBO in the FPLN page, and click the LSK1 twice to enter RWY selection page.

Chose RWY 32L then AFRIC 5B (SID). Before inserting that in the FPLN, note the first line presents your current choices.

Insert the departure procedure in the TMPY FPLN (**6L**) :

By clicking on **6R** (TMPY INSERT), we accept the temporary flight plan.



Scroll again until you get the screens above : we need to deletet the AFRIC point in **4L** (CLR then **LSK4**), then clear the DISCONTINUITY in **3L** (CLR then **LSK3**) and finally push **RSK6** to do the TMPY INSERT.

3.2.4 - ARRIVAL pages and SEC F-PLN

Our flight plan is now almost complete ; we will have to modify it for our arrival in LFMN, on the same principles as for the departure procedure.

The SEC F-PLN (Secondary Flight Plan) may be used to prepare for an emergency return to Toulouse after take off.

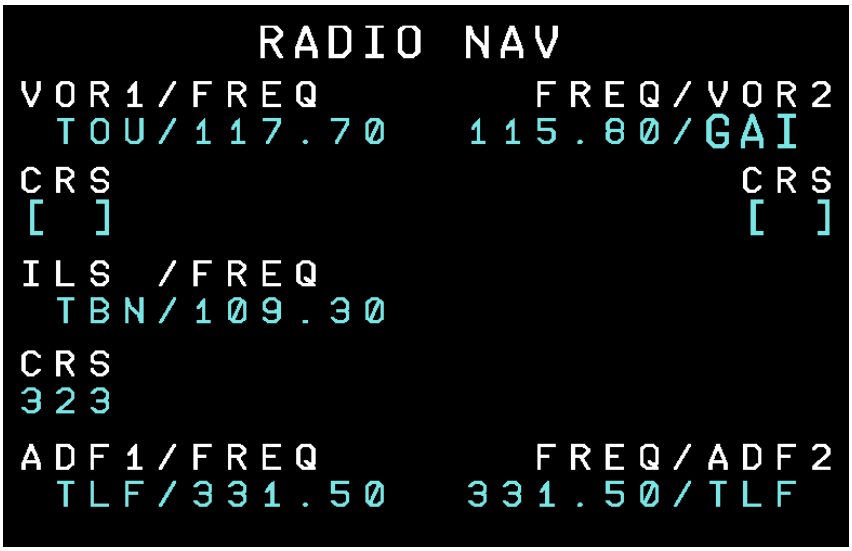
I won't go into such details as this document is meant only to be a **quick discovery** guide to JeeHellWare A320 FMGS ; your personal knowledge and research will allow you to benefit from the multiple features not presented here, and get a very realistic experience.

3.2.5 - RAD NAV page

Now, we'll tune the radio navigation aids, to be able to follow the SID even in case of IRS failure.

Go to RAD NAV page on the MCDU (picture next page) :

- We need TOU and GAI VORs, frequency respectively 117.70 and 115.80.
- We'll input TOU in VOR1 and GAI in VOR2.
- We can also manually insert the ILS of RWY32L.
- Even if the autotune is functional, it is best to manually insert the navaids to not lose the setting when needed..



3.2.6 - INIT B – Fuel Settings

Go back to INIT A page then with one of the horizontal arrows, switch to INIT B.

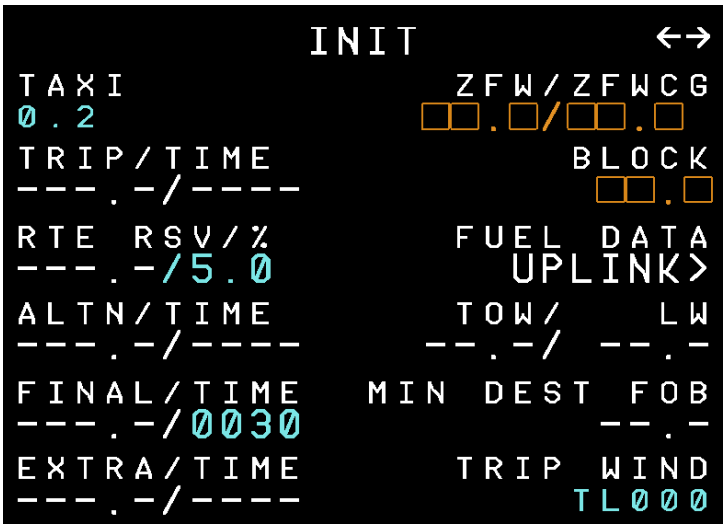
Fuel and weight inputs are complex for beginners and even for advanced users.

In real operations, the data to input depend on numerous parameters such as aircraft loaf (passengers, fret), altitude, winds at different altitudes on the FPLN, alternate route, margins (taxin time, holding before landing, …). Companies and piltos have the data... which is not easily in the reach of simmers.

Weight and balance (passengers, cargo holds) and fuel distribution in the tanks obey to strict rules and will impact the center of gravity of the aircraft, and thus its ability to fly.

FSX / P3D simulation uses default inaccurate datas (PAX and cargo loading and zoning, fuel). These data are displayed in the « Aircraft / Fuel and payload » menu).

Let's go back to INIT B page :



You will have to fill MCDU in, but it's necessary to match FMGS “forecasted” datas with “real” datas that FSX / P3D uses, too.

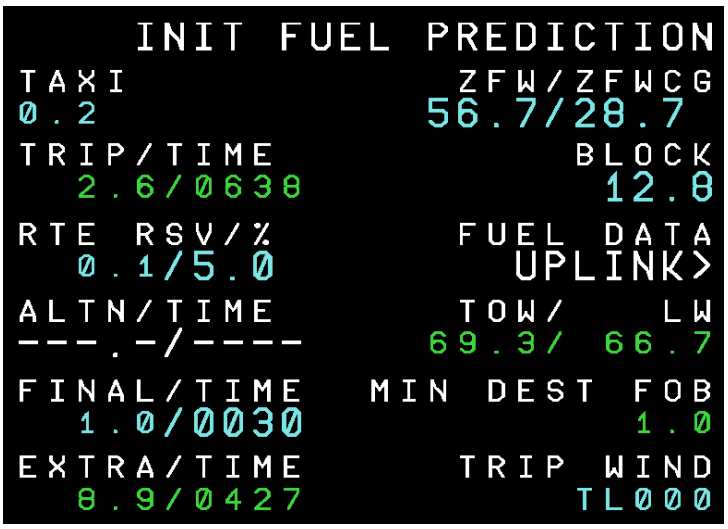
For those who want to quickly fly without doing any payload calculations, JeeHellWare A320 FMGS has a very simple solution : the software has a feature to import the fuel and payload data of the flight model directly into the MCDU.

To do so :

- Do not change the « Fuel and payload » in Flight Simulator,
- Click **RSK3** (UPLINK)and import the data in the MCDU.

Of course the data you'll get, come from default settings of FS, which could be unrealistic on most occasions (particularly on short trips).

We then get a screen as in the next picture (data may vary) :



For advanced users, there are third party add-ons which will allow you to conduct the full weight and balance calculations. You'll have to :

- Change the « fuel and payload » of Flight Simulator to make them stick to your « loadsheet »,
- Fill the INIT B page accordingly.

Note the FMGS use the **metric unit (tons),** whereas Flight Simulator can use pounds (Lbs) or gallons ; you can change FS settings to display Kgs.

However you proceed, remember what you insert in the FMGS are **predictions**, and what you insert in FS is the **"actual"** data which will be used for the simulated flight.

Note also that after engine start, INIT B is no longer available ; you'll have to prompt FUEL PRED page if necessary.

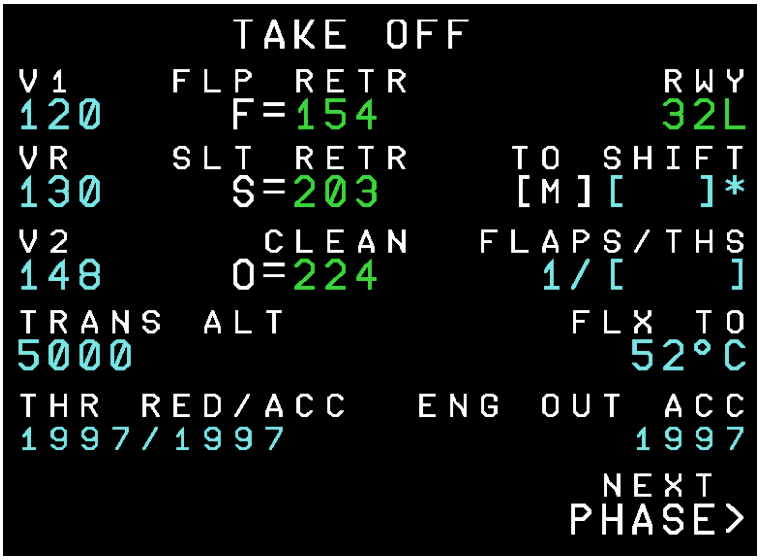
3.2.7 - PERF pages

Now on to PERF pages, the first one is **TAKE OFF page**.

Here also this data comes from complex charts and calculations. The numbers greatly depend on the weight, weather conditions, runway state, etc...

- **Reference speeds :** If you use a software such as TopCat, you can use it to determine the V1, Vr and V2 speeds, and enter them in the Take Off page. Otherwise you'll have to enter plausible values, according to the stall speed of the aircraft. Usually, V1 at **120 kts**, Vr at **130 kts**, and V2 at **148 kts** is mostly OK.

- **Transition altitude :** This depends on the departure airport. In Toulouse, it is at 5000ft.
- **Thrust Reduction and Acceleration altitudes :** The default value is 1500 / 1500 above the airport (the MCDU automatically adjusts the resulting altitude), but 1500 / 3000 is often used for noise abatement procedures.
- **FLAPS :** Enter the flaps settings you'll use for take off : this is used as trade off between runway length and climb gradient. On non limitative runways, flaps 1 is the most used setting.
- And **FLX TEMPERATURE :** This setting is related to the engine maximum power delivered with thrust levers in FLX detent. This is used to save engines life on the long term, and the concept is not the scope of this manual, check real documents, or Internet about « Flex Take Off ». A value of 52°C is usually fine.



Push now **RSK6** key to call **next page : CLB**.

If you look at our SID on the ND, you can see a 180° right turn just after departure :

- With such tight turns, it is a good idea to fly at a lower speed than the usual 250 kts below 10000 feet.
- We'll put a limitation at 210 kts, by using the pre-selected speed feature. Simply enter 210 in **4L**.
- The dashes on the speed window of the FCU should have been replaced by the V2 speed, which means we are now in selected speed mode.
- When the 180° turn is done, we'll switch back to managed speed mode.

You should have the following screen :

The following PERF pages are for later phases of flight and not useful for now.

3.2.8 - *Engine Start and Taxi*

Passengers are seated, luggage and cargo loaded, cabin and holds doors are closed : DOOR / OXY page on the SD confirms that (this page is not yet operational in the software though).

We are ready to go, we just need to ask startup, pushback and taxi clearances!

Engine start is done as described in ☞ **chapter 2.6.10**, first engine n°2 then N°1, while monitoring the SD indications.

After start-up, put the flaps lever on position 1 : EWD shows 1+F (one step of slats and one step of flaps).

Check the flight governs on the SD (move the rudder and stick in all directions).

Arm the spoilers.

Select auto-brake on MAX, so in case of RTO (rejected take off, only before V1), we get a fast braking answer.

During taxi, check everything is ready. We'll use managed later mode so push the HDG selector knob, and check you have dashes and a white dot.

On the SD and EWD all indications must be green. TO CONFIG check list item showing TEST (in blue) means we need to do the test using the TO CONFIG button on the ECP (or T button on the SD). TEST is replaced by T.O CONFIG NORMAL, in green.

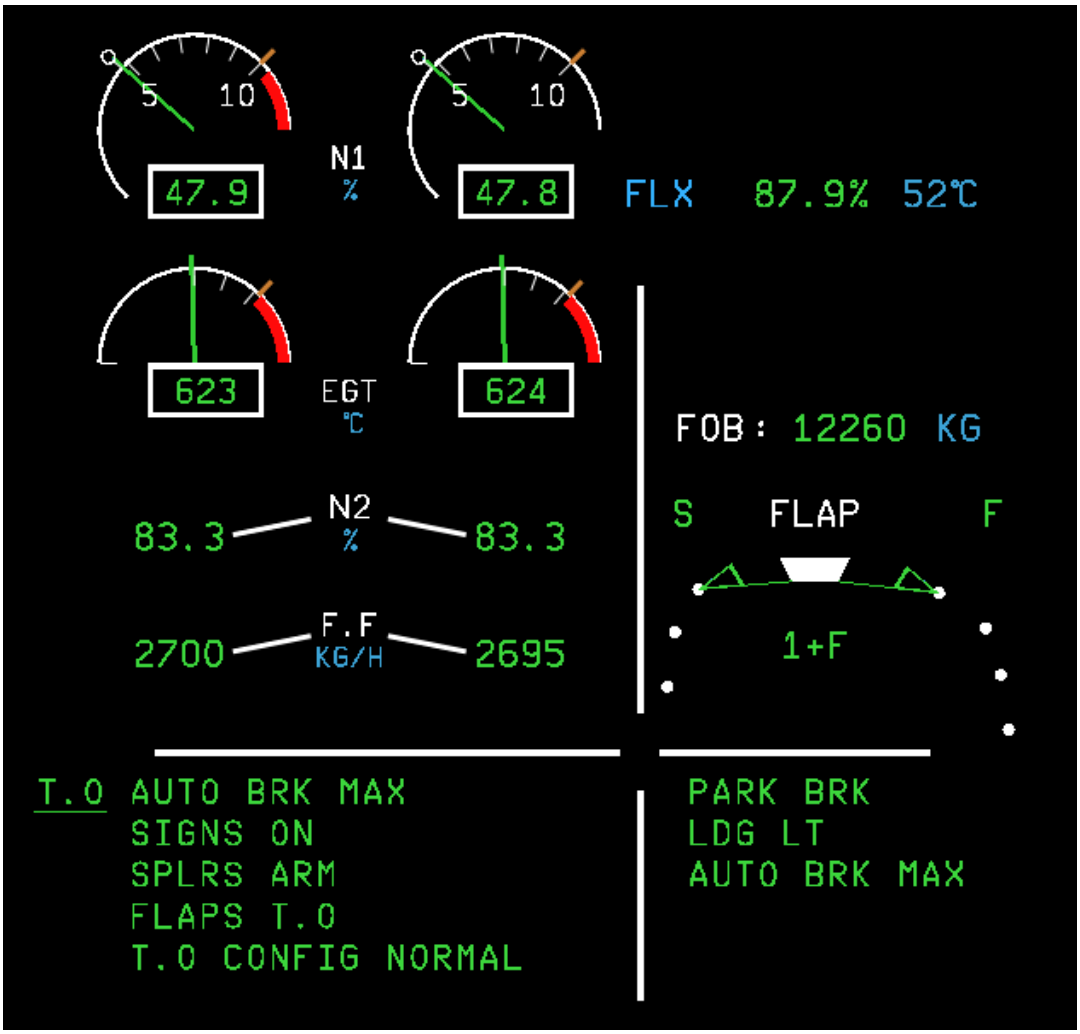
At the holding point, put the transponder in mode Charlie, and TCAS on TA/RA mode.

Align on the runway when cleared by the tower.

When cleared for take off, put nose light and Strobes ON.

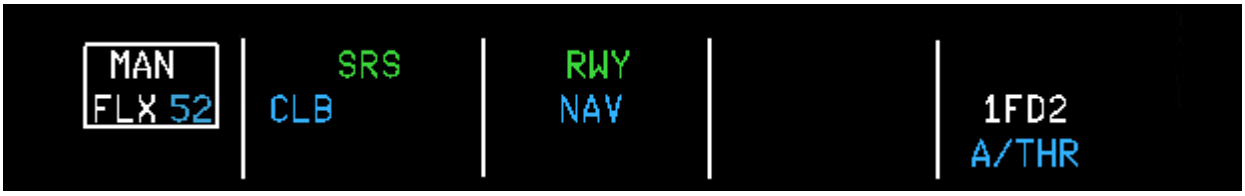
3.3 - TAKE OFF phase

Once cleared for take-off, slowly move the thrust levers to 50% of N1, and check (as on the picture below) both engines have the same N1.

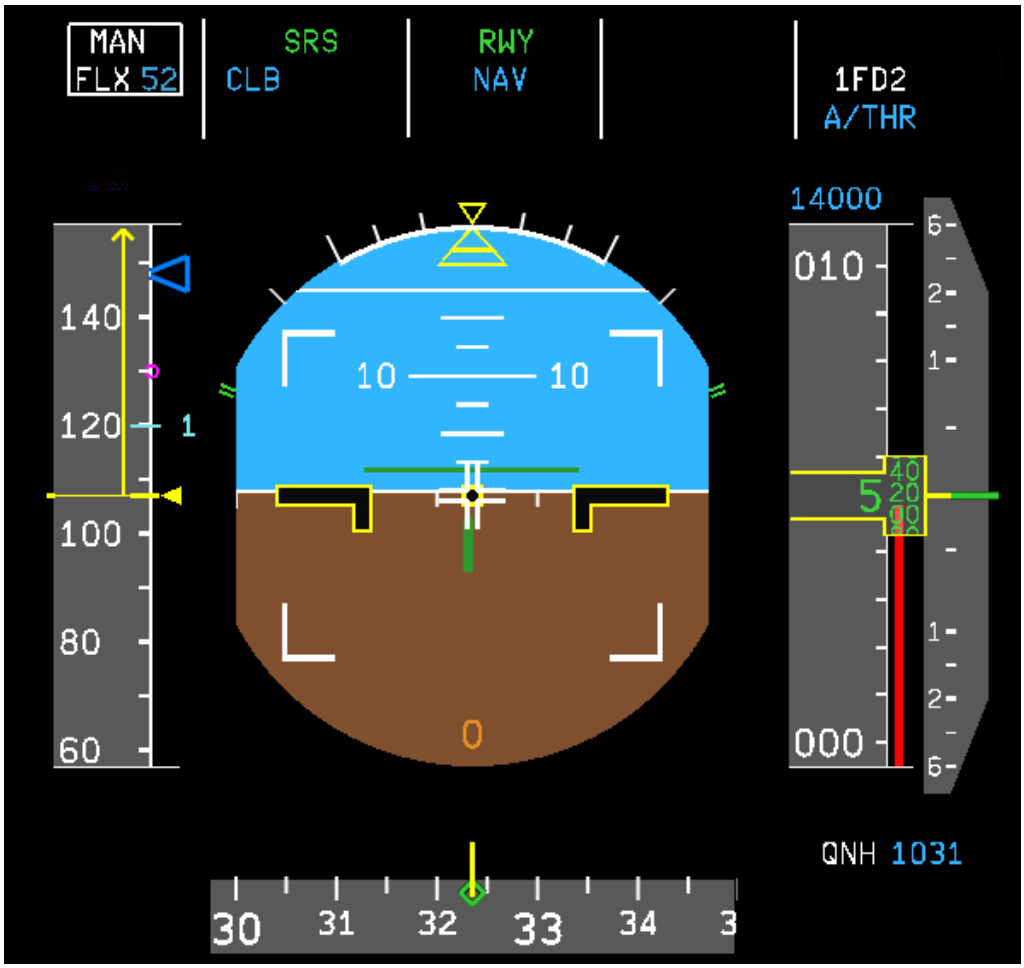


Now move the levers into the FLX / MCT detent, sicne we used a FLEX TEMP in PERF TAKE OFF page. Hadn't we entered that FLX temperature, we'd have to move the thrust levers into TOGA detent.

On the FMA, « MAN FLX 52 » must be displayed in the first column :



If you have copilot, he will call the reference speeds such as 80kts, V1 and Vr. Check on the PFD that your speed scale agrees with the callouts. SRS/RWY is engaged while CLB and NAV are armed.



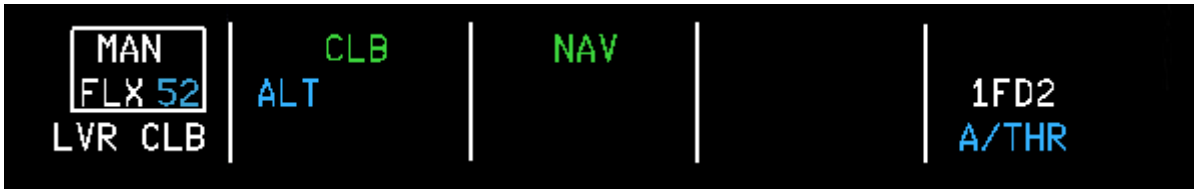
Notice the white box with the white cross on the PFD. This indication is only visible on the ground : the cross marks the stick deflection (vertically and laterally), and the box shows the deflection limits.

Reaching Vr, pull **progressively** on the stick to achieve an initial pitch of around 7° then after lift off aim towards approximately 15° pitch up.

Once V/S is positive, retract the landing gear and follow the FD orders to match the SRS guidance.

You can engage the AP when airborne for more than 5 seconds. AP will keep V2+10 knots.

Whan reaching the Thrust Reduction Altitude, LVR CLB message starts flashing on the FMA in the first column :

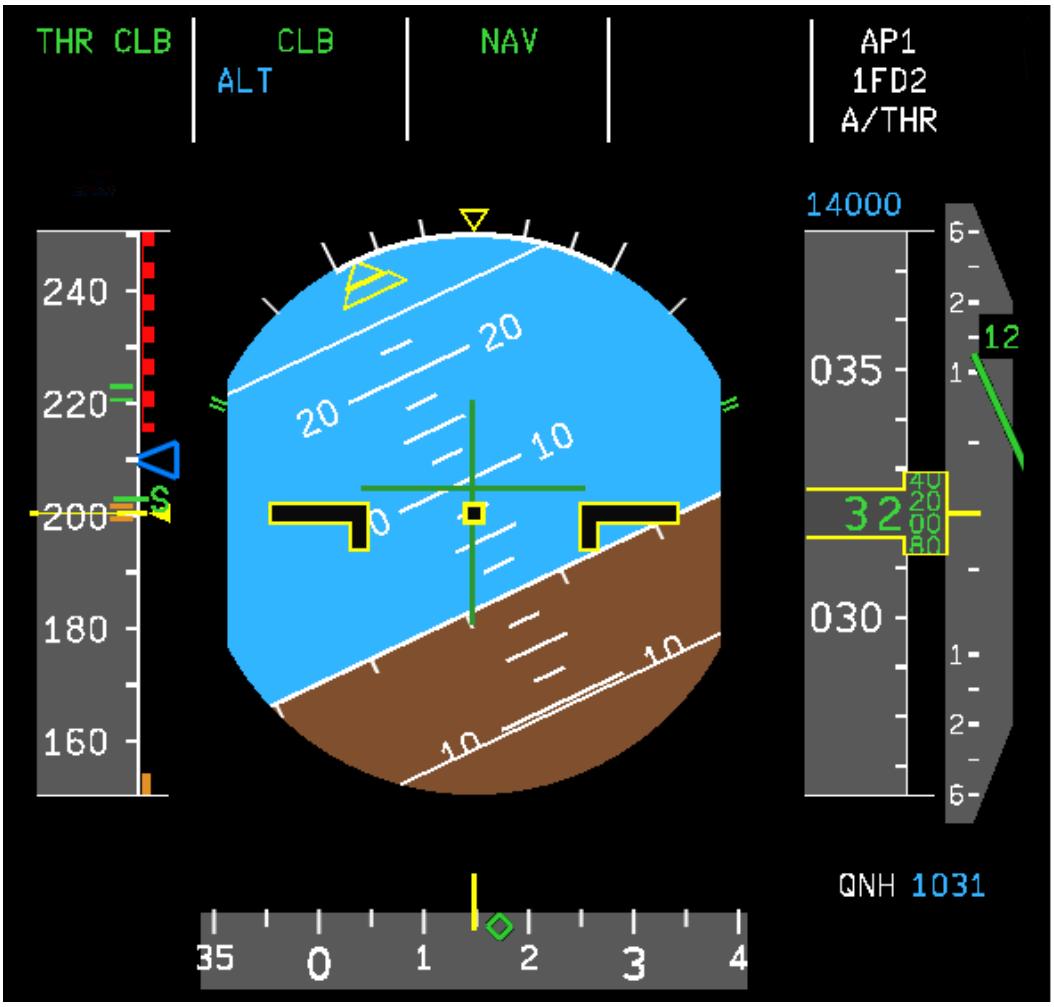


You must now put back the thrust levers into the CL detent.

A/THR will now fully engage (white on the FMA last column) and reduce the N1% to the N1 settings required for the climb phase.

AP/FD will use the pitch to maintain the desired speed. Since the ACC ALT is the same as the THR RED ALT, the aircraft will accelerate towards our selected speed.

When reaching the ACC ALT, the AP/FD commands a pitch decrease to allow the aircraft to accelerate above the -S speed. This speed marks the minimum speed at which we can retract the slats.



THR CLB, CLB and NAV are engaged on the FMA, and so are AP and A/THR.

3.4 - Climb Phase

When the tight turn is done, we go into managed speed mode by pushing the SPD knob on the FCU (which now shows a dashed speed window with a white dot). Below FL100, we'll be limited to 250 kts.

When passing 5000ft (our transition altitude), pull the QNH knob to switch the barometer setting to STD (1013 mb or 29.92 inHg).

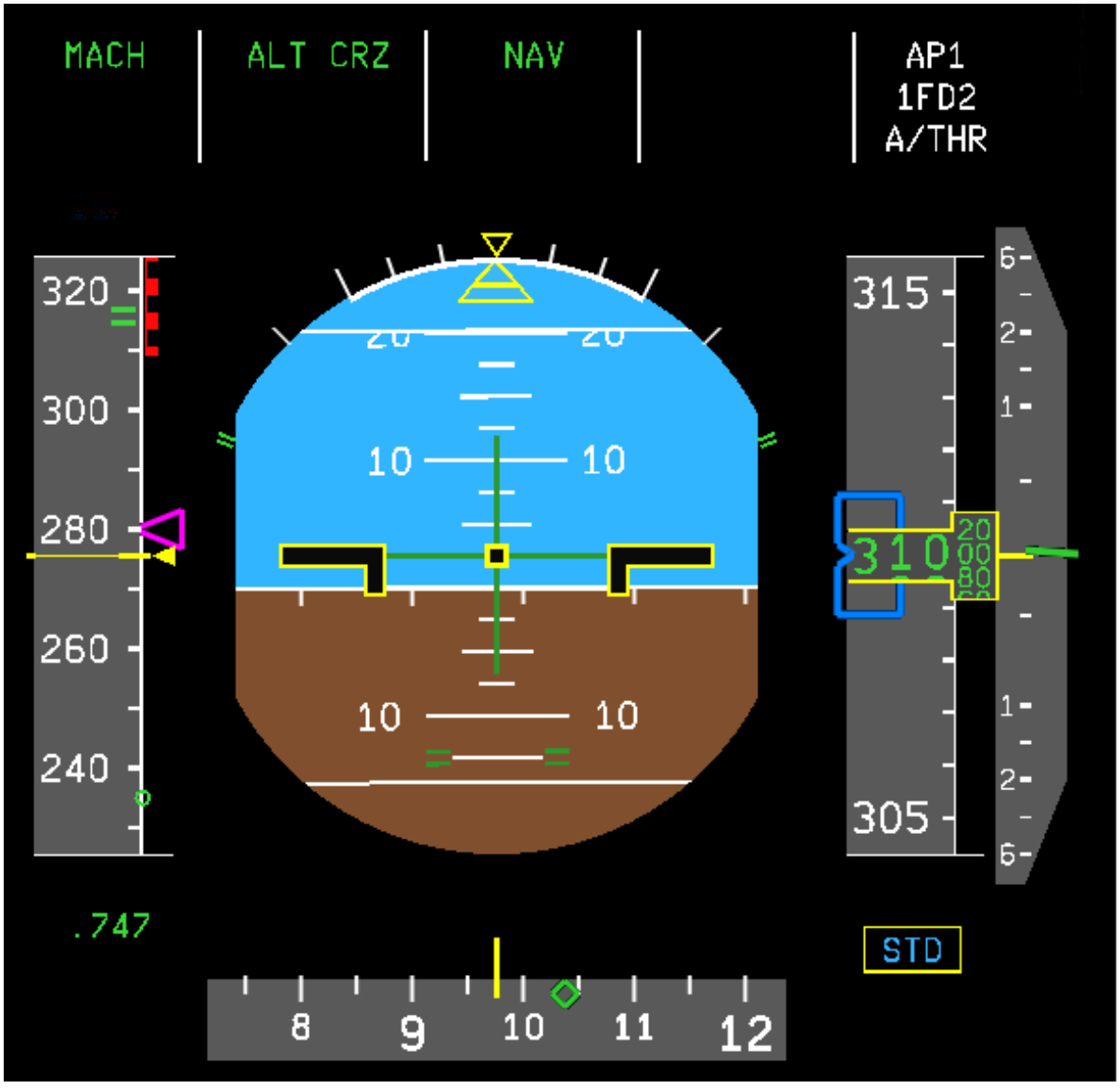
Passing FL100, will accelerate above the 250 kts limit to reach our climb speed. The pitch goes down to allow that acceleration, and so will the V/S, until it can go up again when we meet our target speed.

En-route control clears us to our cruising altitude, FL310 : select 31000 in the altitude window of the FCU (and push the ALT selector knob if you were already in ALT mode). FL310 target will be displayed on the PFD altitude scale.

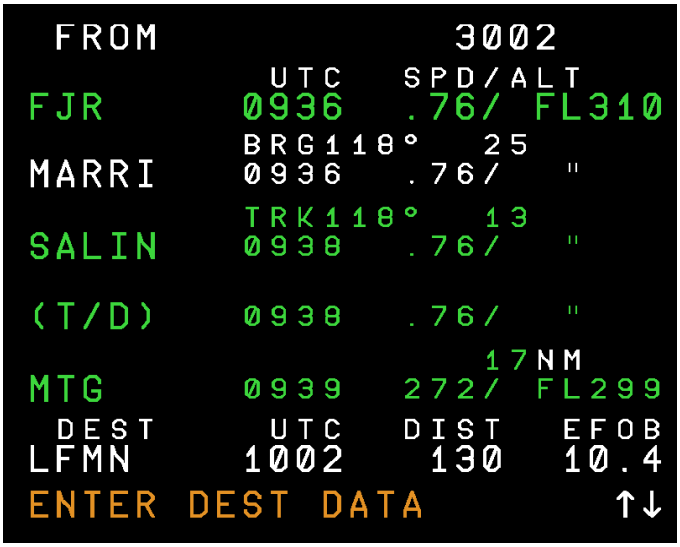
When approaching FL310, V/S will reduce to capture the altitude. FMA will now show the modes MACH, ALT CRZ and NAV engaged.

If the MDCU was previously displaying the PERF pages, CLB page is replaced by CRZ page as we are now in cruise phase.

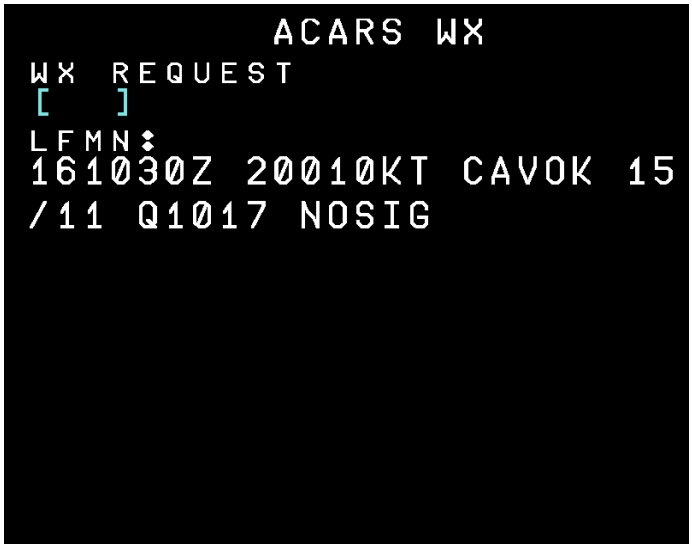
3.5 - Cruise phase



A bit later, the MCDU displays the amber message « ENTER DEST DATA » : it reminds us we haven't yet fed him with data regarding our arrival into LFMN such as weather conditions.

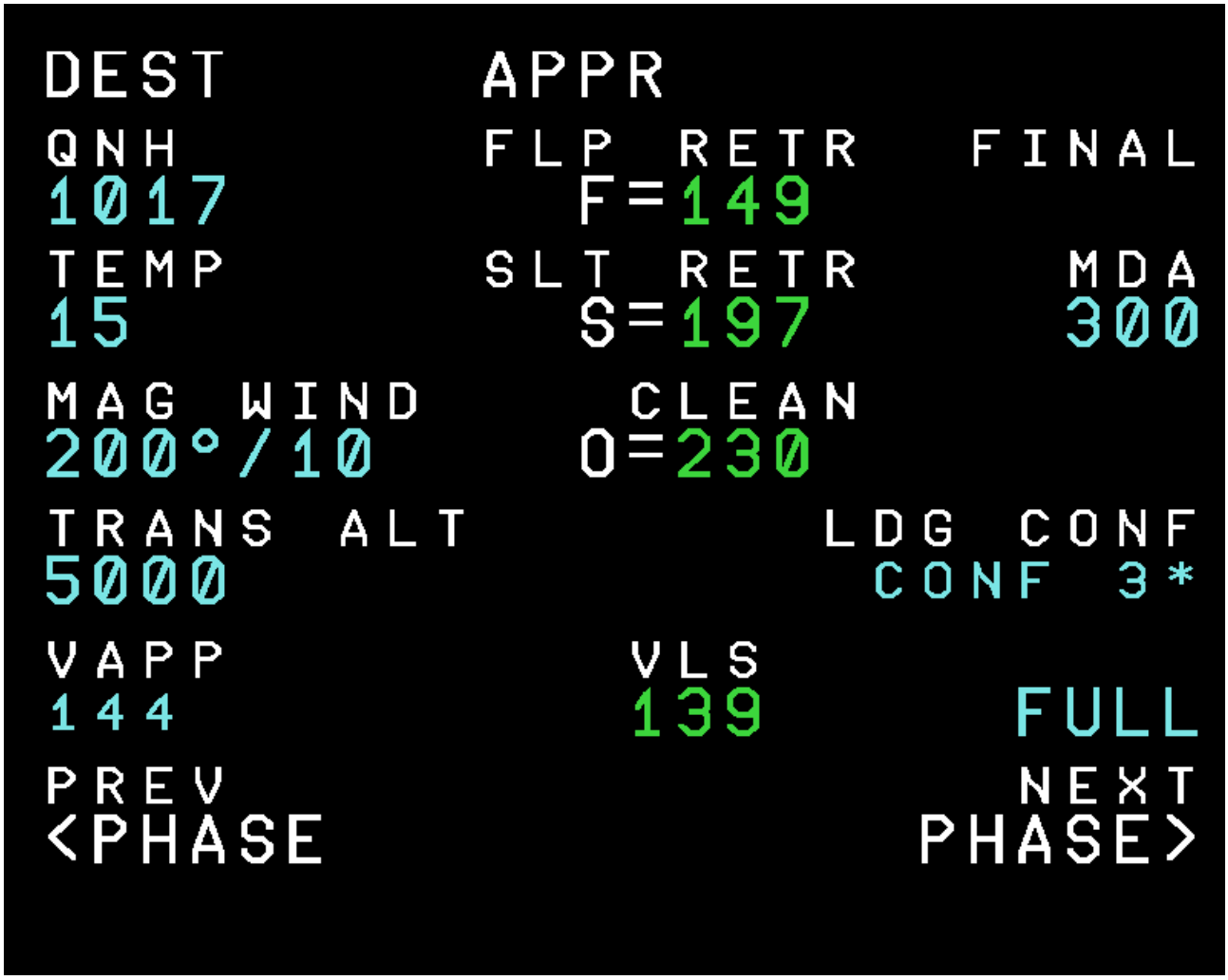


We can get the weather informations using the METAR feature simulating an ACARS link : push MCDU MENU key, then select WX ACARS. Type LFMN into the scratchpad then transfer if to **LSK1,** next to « WX REQUEST ». A moment later we get the METAR result (note this feature requires an internet access on the server computer).

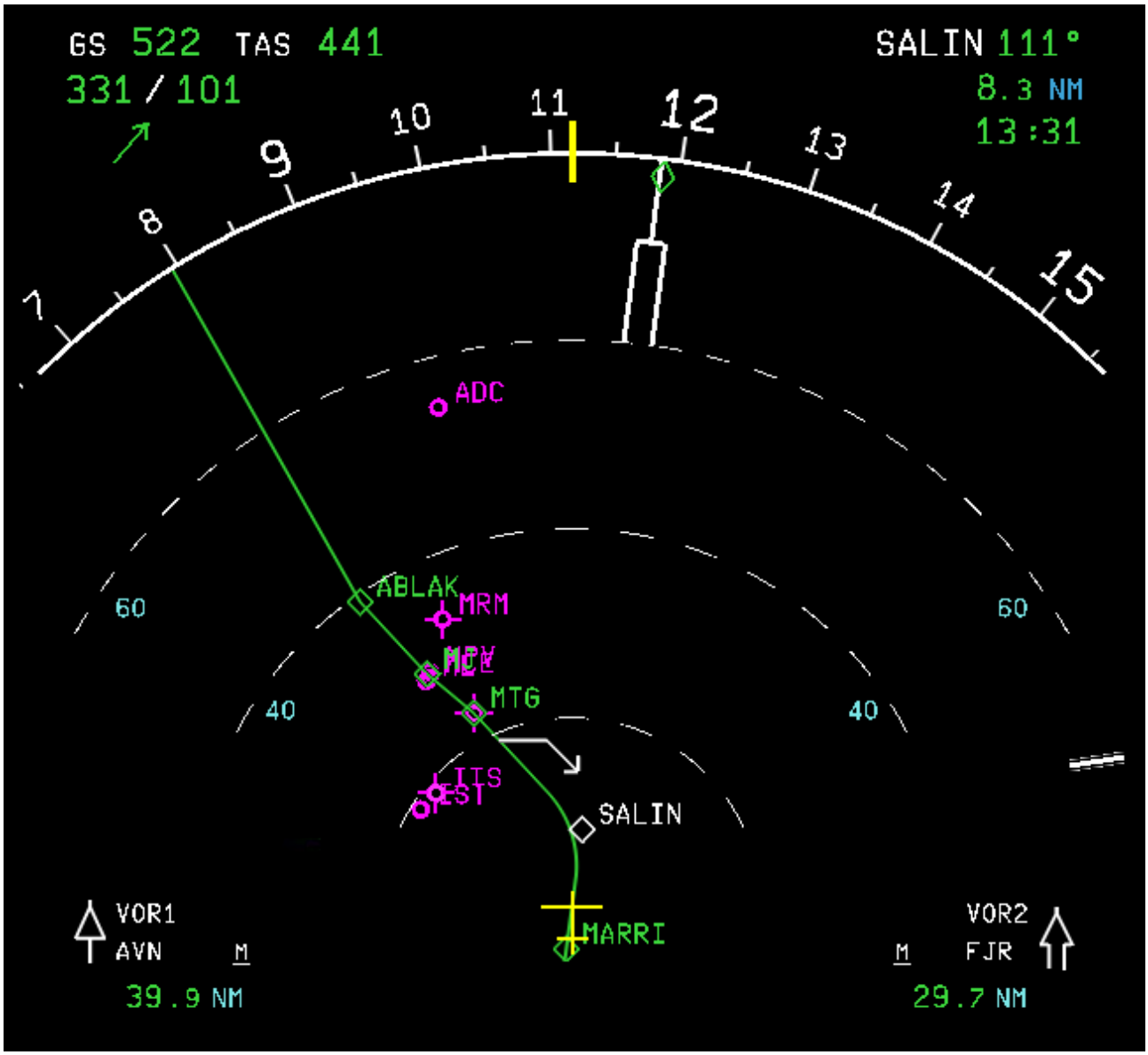


We can now fill the APPR PERF page, by pushing the PERF key, then clicking twice on **RSK6** (NEXT PHASE) : fill in the QNH (1017), temperature (15°), wind (200/10), transition

altitude (5000 ft as indicated by the apporach chart) and also the MDA (300 ft). The MCDU will look like :



Shortly after MARRI fix (see next page), ATC clears us directly to MTG.



Call DIR TO page on the MCDU, scroll if needed until you see MTG in the liste to the left, select DIRECT TO, and insert. ND will change to the following display :

At the same time, the aircraft banks left to join the new active waypoint.

Notice the arrow symbol, just before MTG : this it the « Top of descent », calculated by the FMGS. It's the point where descent phase should be started to follow the optimum flight profile.

By datalink, our company advises us the current procecure in Nice is the ILS 04L. We can finish filling in the MCDU with approach route.

Click on **LSK6** while in FPLN page, then on **RSK1** :

We'll fly the ILS04L : the first in the list, so click on **LSK3**.

Our last “en-route” waypoint is ABLAK, and the charts show we have to follow the ABLA6R STAR : click on **LSK5**, and you'll get the following screen :

The APPR VIA here is automatically filled in (if the FMGS can determine the correct VIA route). Otherwise you'd have to check the paper charts : ABLAK 5R ends at MUS, so we must put the MUS VIA to correctly join the ILS04L APPR.

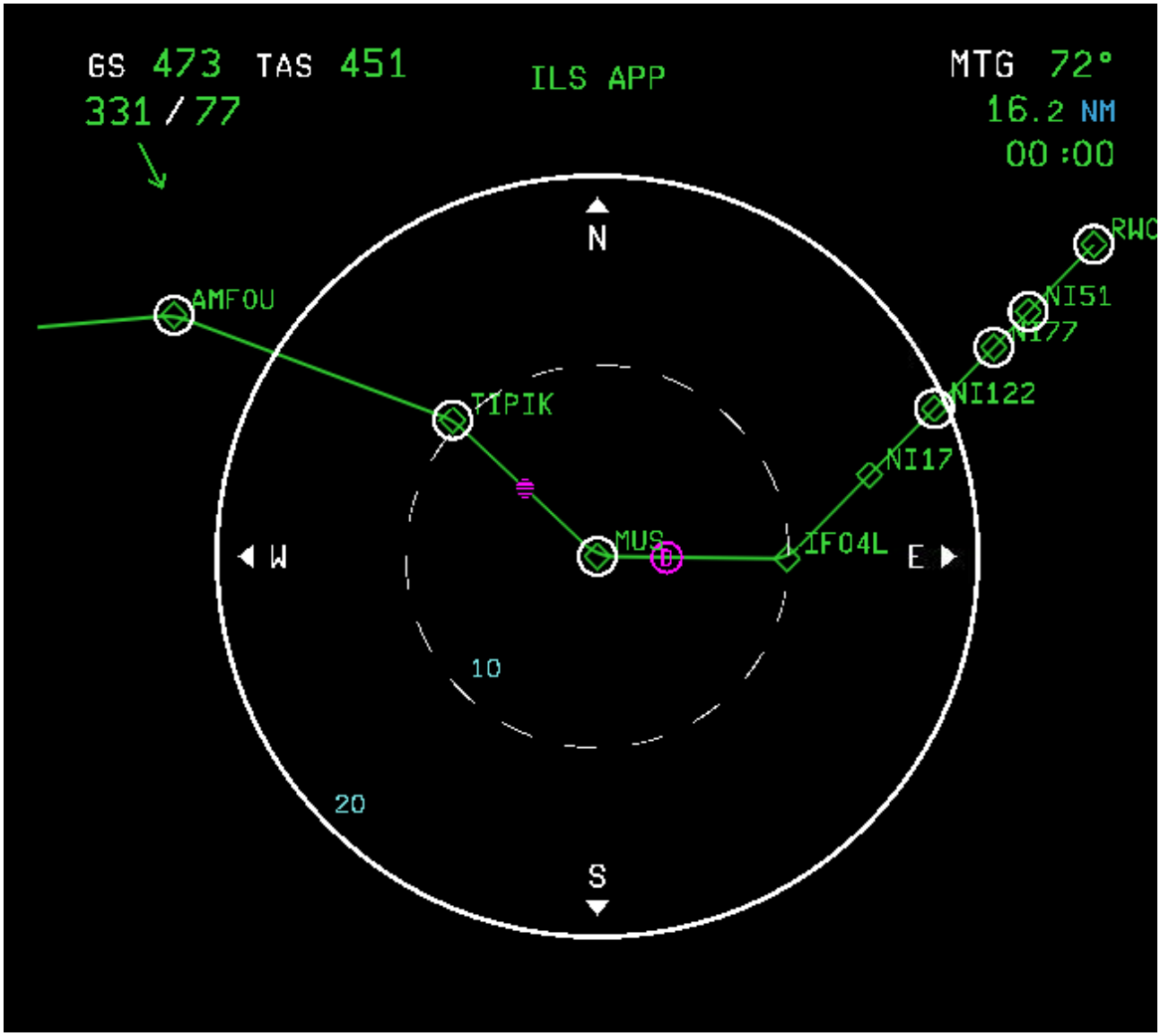
Let's insert our arrival route by clicking **LSK6**, then **RSK6**.

While in the FPLN page: don't forget to clear any F-PLN DISCONTINUITY, as we did on the departure.

We can check the complete route on the ND using the PLAN mode (mode selector on the EFIS) and scrolling the FPLN using the MCDU arrows.

Notice the FMGS has calculated the deceleration point (right after MUS), and the ND now shows the ILS APP message.

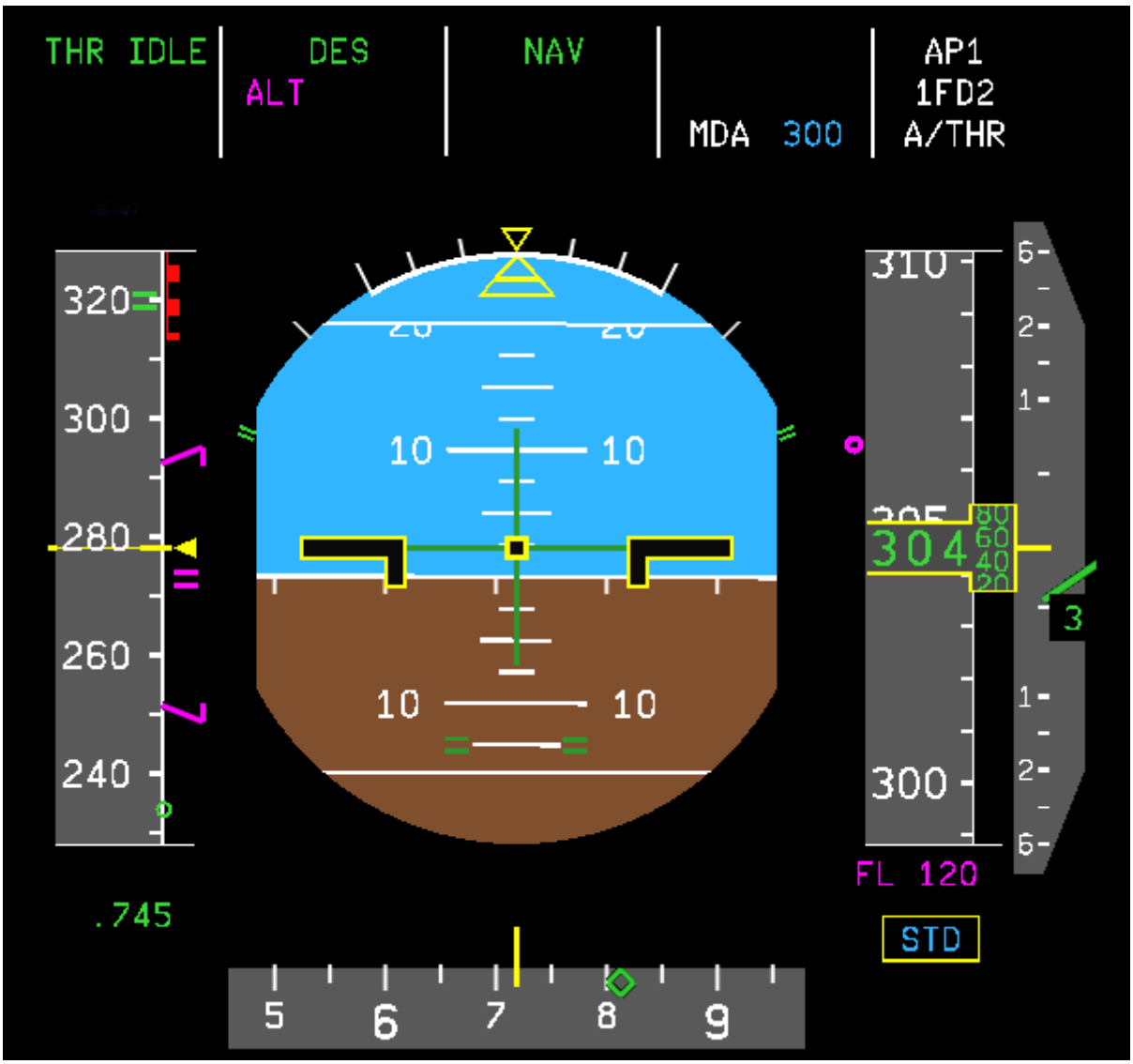
The FMGS also re-calculates the TOD. Here it moved towards us and it is soon time to ask ATC for descent.


GS 473 TAS 451
331 / 77
ILS APP
MTG 72°
16.2 NM
00:00
N
W
E
S
10
20
AMFOU
TIPIK
MUS
IF04L
NI17
NI122
NI51
RWC

3.6 - Descent Phase

We've been cleared to descend to FL120. Select 12000 on the FCU and push the ALT knob to engage managed descent.

This way, we force the descent before reaching the TOD. Note the TOD is only displayed as a reference, the aircraft will not descend by itself when overflying the TOD, we have to tell it to do so.



Managed descent speed is constantly adjusted by the FMGS to try it's best at maintaining the descent profile, symbolized by the V/DEV target. All that keeping engines at idle.

Note that an aircraft can hardly descent and slow down at the same time. This is why it will reduce its V/S to match a speed constraint such as 250 kts below FL100, or a lower speed asked by the ATC.

Speaking of constraints, notice that 12000 is displayed in magenta on the PFD. This is a constraint included in the charts which is also in the navigation database of the FMGS (Speed and altitude constraints are displayed in magenta on the ND, by selecting CSTR on the EFIS panel). This is handy, as in fact we had selected 10000 on the FCU instead of 12000. Crosschecking the instruments allows us to correct and now 12000 is displayed blue on the PFD.

Selected modes can be used when managed modes cannot follow the vertical profile, or if the ATC removes the constraint on a portion of our route. With strong rear wind, sometimes the flight profile is too steep, and so the pilot will have to do its best to get back on it. He can use the **speed brakes** (½ deflection max with autopilot on) to help increase the descent rate. This must be avoided at lower altitude/low speeds.

Check the ATIS to verify and eventually refresh the arrival conditions. QNH is still 1017, temperature rose to 16° and wind is now 200°/11 kts. Enter these modifications in the APPR PERF page ; Approach speed Vapp is now 144 knots.

The managed descent looks good so far ; at TIPIK, we are re-cleared down FL80 (managed mode will automatically reduce our speed to 250 kts below FL100). Enter 8000 on the FCU (the white dot confirms we are in managed mode).

At MUS, we are cleared at 5000 ft and asked to slow down to 230 kts. Enter 5000 ft on the ALT window, then 230 kts and pull the SPD selector to go into selected speed mode.

3.7 - Approach and landing

The approach controller in Nice clears us for the full ILS approach.

While passing the DECEL pseudo point, marked by a circled magenta D, managed speed becomes Vapp, and if we go back into managed speed mode (push on the SPD selector), the aircraft will slow down towards Vapp. Let's go in managed speed mode.

Select 4000 feet on the FCU (Glide path interception altitude) to reach that altitude (set as a constraint at NI122 point), and the FMGS will finish the job, almost by itself.

When speed is below the VFE of first flaps setting, select flaps 1.

Don't forget to set the baro setting to the QNH when passing the transition level (at 5000 ft).

At 200 kts, set flaps 2, arm the spoilers and select AUTOBRK system on MED.

Check the correct ILS frequency has been auto-tuned in RAD NAV page.

On the PFD, display the ILS deviation scales, by pushing the ILS button on the EFIS panel.

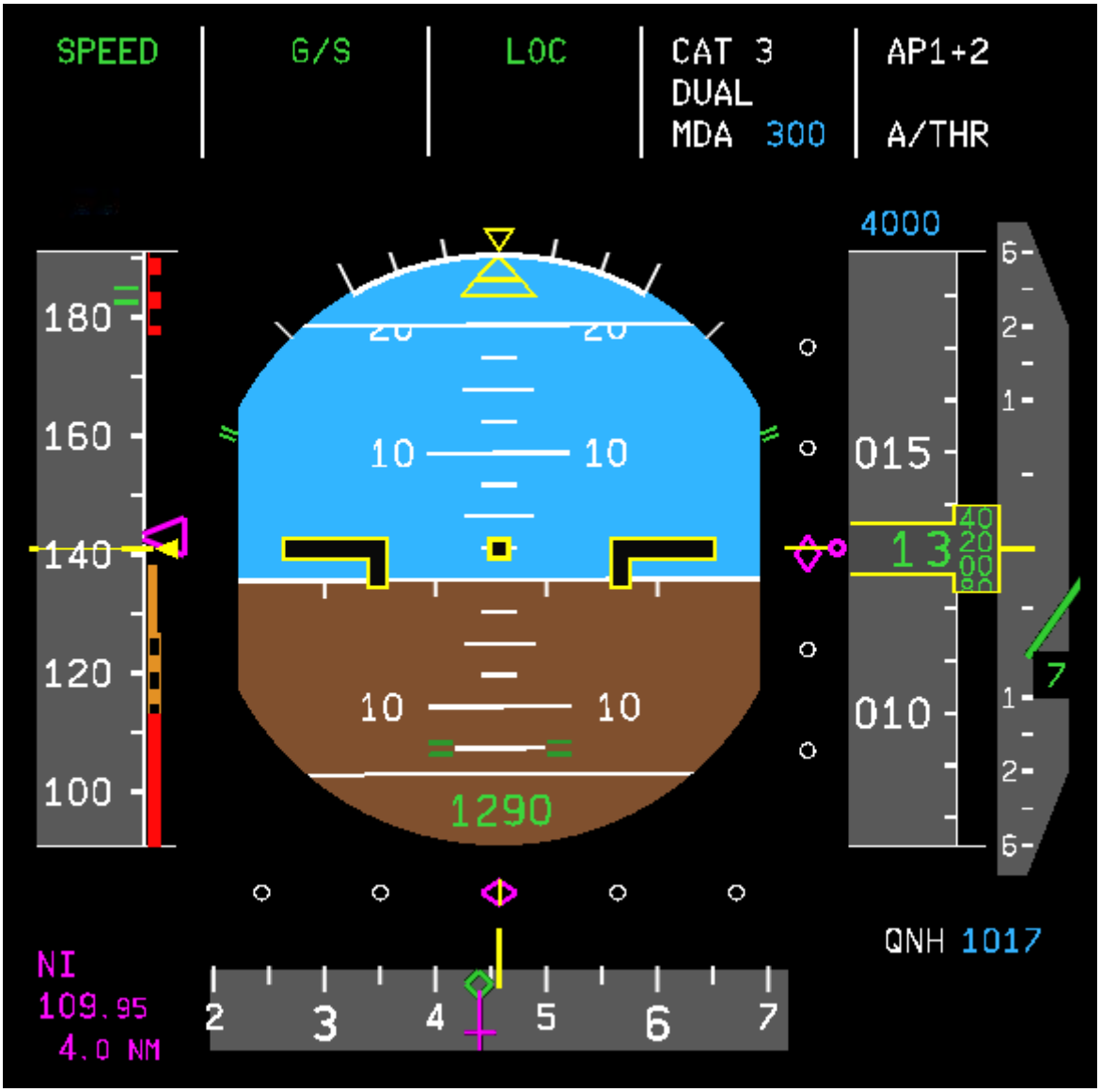
Push APPR button on the FCU and monitor LOC and GLIDE capture on the FMA and ILS scales.

Push on AP2 (if AP1 is engaged, or vice-versa) to engage the second autopilot (possible only during ILS approach, as a backup means).

At around 2000ft select flaps 3 then lower the landing gear. Finally extend flaps at FULL.

We can do an autoland, just let the AP do the rest.

AP/FD capacity is displayed in the 4th FMA column. Here we have « CAT3 DUAL ». Remember, this is different to the physical ILS capacity.



The ILS should be perfectly followed until the threshold. It may happen there is a little glide or localizer deviation. If it happens, you have to land manually.

Right before touching down, retard the thrust levers to IDLE detent.

At touch down, the spoilers will extend automatically as they were armed. Use the reverse thrust (put the thrust levers to REV MAX detent) to slow the aircraft down more efficiently.

The auto-brake will also activate automatically.

On the ground, if rollout mode is giving bad guidance, use the rudder pedals to control the aircraft.

At 70 kts, put the thrust levers back into REV IDLE, then use the differential brakes (on the pedals) to disengage the auto-brake. When speed is controlled, put the levers into IDLE detent.

You still have to vacate the runway (you may now use the tiller to taxi), disarm the spoilers, retract the flaps and follow tower instructions to get to your parking position...

«Welcome to NICE COTE D'AZUR... We have arrived at our destination...

Please keep reading this document until the aircraft doors are opened...

Note this is only a first approach at JeeHellWare A320 FMGS, voluntarily simplified.

You can learn more by yourself by researching the net, or real manuals to improve your flying experience with this software.

*Your experience can also be greatly enhanced by adding other software or hardware, compatible with the FMGS main software. These are presented in the« **Advanced User Guide** » (separate document, currently being re-written and soon available, hopefully...).*

We hope you enjoyed your flight with us... »

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