TABLE OF CONTENTS

Table of Contents 1
Introduction 5
How to read this manual? 5
Setup 6
FS Setup 6
Key Assignments 6
Control Sensitivities and Null Zones 6
Throttle Setup 7
User Setup 7
Weight Unit 7
Panel Sound Volume 8
User Experience (Realism) 8
IRS Alignment Duration 9
MCDU Keyboard Input 9
Startup 9
Auto-Pause 10
Flight Reset 10
Fly-By-Wire 11
Overview 11
Usage 11
Bank Angle 11
Pitch Angle 13
Autoflight 15
Autoflight Components 15
Flight Control Unit 15
Thrust Levers 22
Flight Guidance 24
Speed Guidance 24
Lateral Guidance 27
Vertical Guidance 28
EFIS 35
Panel General Usage 35
EFIS Usage 37
PFD – Primary Flight Display 38
Attitude Indicator 39
Flight Director 40
Speed Indicator 42
Altitude Indicator 44
Vertical Speed indicator 45
Heading Indicator 45
Flight Mode Annunciator (FMA) 46
ND – Navigation Display 47

EFIS Control Panel 48
ND Modes 49
General Information 50
Navigation Information 51
Flight Plan Information 51
E/WD – Engine/Warning Display 54
General Information 54
SD – System Display 58
Systems 60
ECAM Control Panel 60
Electricity 61
Batteries 61
Auxiliary Power Unit (APU) 61
Generators 61
Ground Power Unit (GPU) 62
ELEC Page 63
Alerts & Warnings 65
Hydraulics 65
Power Transfer Unit (PTU) 65
HYD Page 66
Alerts & Warnings 67
Fuel 68
Fuel Pump Usage 68
FUEL Page 69
Alerts & Warnings 70
Air 71
COND Page 72
CAB PRESS Page 72
BLEED Page 73
Anti-Ice 74
Alerts & Warnings 74
Auxiliary Power Unit (APU) 74
APU Start & Stop 75
APU Bleed 75
APU Page 76
Alerts & Warnings 77
Power Plants 77
Engine Monitoring 77
Engine Start & Stop on Ground 79
Restarting Engine in Flight 80
Inertial Reference System (IRS) 81
IRS Alignment 81
IRS Unit 82
Alerts & Warning 83
Radio 83
Radio Management Panels (RMP) 83

Audio Management Panel (AMP) 84
Transponder & TCAS 85
Transponder Usage 85
TCAS Usage 85
Ground Proximity Warning System (GPWS) 86
Alerts & Warning 86
Flight Controls 86
Sidesticks & Rudder Pedals 86
Flight Control Computers 86
Speed Brakes & Ground Spoilers 87
Flaps 88
Trims 89
Gear, Wheels & Brakes 90
Landing Gear 90
Autobrake system 90
Brakes and Parking Brakes 91
WHEEL Page 91
Lighting & Signs 92
External Lights 92
Panel Lighting 93
Seat Belts & No Smoking 94
FMGC 95
Preamble 95
FMGC Phases & Flight Phases 95
MCDU Usage 96
Characters and Colors 99
Assistance 99
MCDU Menu Page 100
INIT A Page 100
INIT B Page 103
ROUTE SELECTION Page 105
WIND Page 106
FLIGHT PLAN Page 107
Lateral Revision Page 108
DEPARTURE Page 110
ARRIVAL Page 111
HOLD Page 111
Vertical Revision Page 113
DATA Page 114
Flight Plan Management 119
Flight Plan Creation 119
Flight Plan Modification 123
Saving a route 124
DIR Page 124
PERFORMANCE Pages 124
PERF TAKE OFF Page 125

PERF CLB Page 128
PERF CRZ Page 130
DES FORECAST Page 130
PERF DES Page 131
PERF APPR Page 133
PERF GO AROUND Page 135
FUEL PRED Page 136
PROG Page 137
RAD NAV Page 139
Page Sequencing 141
1 - Initialization 141
2 – Flight Plan 141
3 – Performance Settings 141
4 – Done… 141
Appendix A 143
Tutorial Flight 143
Flight Setup 143
Engine Start 145
Pushback 146
Taxi 146
Align and Takeoff 147
Climb 148
Descent & Approach 149
Landing 150
Appendix B 152
Advices 152
Setup 152
Autoflight 152
MCDU 153
Appendix C 155
Frequently Asked Questions 155
Flight Control Unit 155
EFIS 156
MCDU & FMGC 156
Appendix D 157
Acronyms 157

INTRODUCTION

How to read this manual?

This manual describes the A320, A330 and A340 panels and the aircraft systems. Reading this manual is very important to understand how the panels and the systems work, in order to use them efficiently.

Along the manual, you will find some notes about the usage of these aircrafts in Flight Simulator. They are written in italics. Each time you read a section in italics, remember it is something related with the implementation of a system in the Flight Simulator context.

You will also find some advices coming from real life pilots who fly real Airbus aircrafts. They are very useful to understand the usage of some systems. For example, it will help you in answering the question: "Why should I use the TRK/FPA guidance mode instead of the HDG/VS mode?" It may also let you know when a system should be used, and when it shouldn't.

SETUP

FS Setup

Key Assignments

For an optimal use of the panel, some key assignments are suggested. Some of them are not defined by default in Flight Simulator, so their definition is recommended if it has not been done already.
The key assignment is available in FSX:SE through Options > Settings > Controls…

The suggested key assignments are the following:

- Standby frequency swap:
  This commands swaps the active and standby frequencies on the Radio Management Panel (RMP). This device is described later in this documentation.
- Autopilot arming switch:
  This command is mapped to the 'Z' key by default.
  It simulates the autopilot disconnect button located on the sidestick in the real aircraft. This is why it should be assigned to one of your joystick button, if possible.
- Autothrottle arming switch:
  This command is mapped to the "Shift-R" key by default.
  It simulates the thrust lever instinctive pushbuttons located on the throttle levers in the real aircraft. For this reason, it should be assigned to a button of your throttle device, if possible.

Control Sensitivities and Null Zones

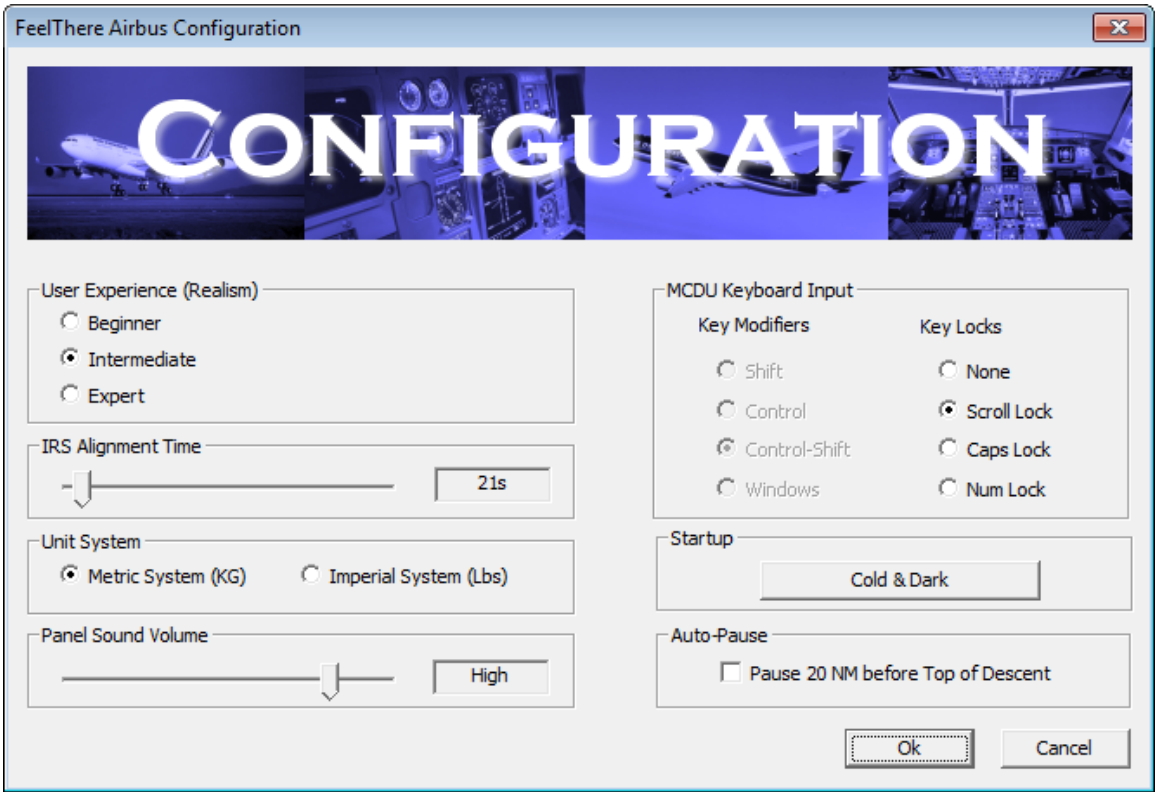
The sensitivities and null zones of the stick controller (PC joystick or yoke) must be adjusted to have the fly-by-wire working as efficiently as possible. These settings are described in details in the section dedicated to the fly-by-wire system.

Throttle Setup

In the real aircraft, the throttle levers have detents that correspond to specific throttle settings. This is detailed in the Autoflight section ("thrust levers" paragraph).
If you have a single or multiple throttle device, no specific setup is required. The throttle device is acquired to determine if the throttle lever is in a specific detent or not.
If you don't have any throttle device and use the keyboard to control the engines, everything works without needing any specific setup, but the use of a throttle device is highly recommended.

User Setup

The aircraft configuration is accessible through the Airbus configuration software:



Weight Unit

You can select the unit used to display the weights (aircraft weight, fuel weight, …) The possible choices are kilograms (KG) and pounds (LB). European pilots may prefer the metric system (KG), while US pilots may prefer the pounds.

Panel Sound Volume

The panel has its own sounds: warning sounds, GPWS altitude callouts, etc. This slider lets you adjust the panel sound volume, independently from the other FS sound settings, such as engine sound volume, cockpit sound volume, etc.

User Experience (Realism)

This aircraft can be flown in different modes, depending on the level of realism you are expecting. Three realism levels are available: beginner, intermediate and expert. To make it simple, beginner users will not have to read tons of documentation to start the engines and fly the aircraft, intermediate users will have more realism while enjoying some FS "shortcuts", and expert users will have to follow carefully all the procedures to fly this aircraft.

The following table explains in details the differences between the different levels of realism:

	Beginner	**Intermediate**	**Expert**
Engine Start	FS shortcut allowed (Ctrl-E key operative)	Full startup sequence must be executed.	Full startup sequence must be executed.
RWY Mode (runway lateral mode)	Available on any runway, as long as the aircraft is aligned.	Available only if the runway has a localizer and the departing runway has been entered in the MCDU.	Available only if the runway has a localizer and the departing runway has been entered in the MCDU.
Inertial Information (aircraft heading/track and position)	Always available.	Available only when the IRS are aligned.	Available only when the IRS are aligned.
Ref Speeds (V1, VR, V2)	Automatically computed with average values, no warning on the PFD.	Automatically computed on request. A warning appears on the PFD if they are not entered.	Not automatically computed, the pilot has to enter them in the MCDU. Otherwise, a warning appears on the PFD
Gross Weight (GW)	Automatically computed according to FS settings.	Must be entered in the MCDU to compute the F, S, and Green Dot speed (available on request)	Must be entered in the MCDU to compute the F, S, and Green Dot speed (available on request)
Default IRS Alignment duration	10 seconds	1 minute	10 minutes
Wind indication on the Navigation Display	Always visible	Not visible if speed is too low (unreliable inertial information)	Not visible if speed is too low (unreliable inertial information)
MCDU Assistance	Available	Available	Not available

In summary, if you set the realism to beginner, you will be able to start to start the engine, take off and land without reading a single page of this manual. Otherwise, you have to read the documentation to set up the aircraft properly for take off and flight.

IRS Alignment Duration

By default, the IRS alignment time depends on the level of realism, as shown in the table above.
In the real aircraft, the alignment time is around 10 minutes. For easier use, you can reduce this time and set the value you wish using the slider.
Remember that if you change the level of realism, the alignment time will be updated accordingly.

MCDU Keyboard Input

You may want to use your PC keyboard to enter data into the MCDU. You can do this by selecting a key modifier or a key locker:

- A key modifier is supposed to be used in combination with the keyboard keys. For example, if you select Shift-Control as the modifier, pressing Shift-Control-L will enter an 'L' character in the MCDU.
  Note: A key combination may be in conflict with a FS command, such as Shift-Control-L for the aircraft landing lights.
- The use of a key lock will intercept all the keys to redirect them to the MCDU. For example, if you select Scroll Lock as the key lock and press the Scroll Lock key, the scroll lock LED lights up on your keyboard and any key typed on the keyboard enters a new character into the MCDU. For example, if you press the 'L' key, an 'L' character is entered in the MCDU and the aircraft lights don't change. Pressing the Scroll Lock key again turns the keyboard back in a normal state.

  ➡ **Note 1**: Remember that when a locker key (such as Scroll Lock) is used, EVERY key is intercepted to be sent to the MCDU. Don't be amazed if the ALT key doesn't display the FS menu any more, it is just because this key is also intercepted. Press the locker key again to get normal keyboard behavior.

  ➡ **Note 2**: By default, the 'Scroll Lock' key is defined as the default locker. In FSX:SE, this key is used to display/hide the ATC window, which can also be displayed/hidden using the 'accent' key. For this reason, you should clear the 'Scroll Lock' assignment for the ATC window; which will then be accessible through the 'accent' key only.

Startup

You can press the "cold & dark" button to reset the aircraft in a cold and dark situation, with all the engines and devices turned off.
This feature is available only if the aircraft is parked on the ground.

Auto-Pause

Checking this option automatically pauses FS when the next waypoint is the computed top of descent point and the distance is less than 20 NM. This is especially useful for long flight during which you might not be in front of your computer when the aircraft is about to begin the descent.

Flight Reset

An option is available to let you reset the current flight. This operation consists in the following actions:

- The flight phase is reset (the value is set according to the current aircraft situation). Refer to the FMGC section to know more about the flight phase.
- The flight plan is reset, which means the next waypoint is the first waypoint of the flight plan.
- The recorded fuel used by each engine (displayed on the SD) is reset to 0.

Pressing Ctrl-Shift-R resets the current flight. A popup window confirms the operation.

FLY-BY-WIRE

Overview

This aircraft is equipped with a fly-by-wire system managed by the Flight Augmentation Computer (FAC) and the Elevator and Aileron Computer (ELAC). It commands the flight controls electrically from the input given by the pilot through the sidestick. In normal law, this system provides:

- Flight automation: bank angle and pitch is maintained as soon as the stick is released to the neutral position.
- Flight envelope protection: the system prevents the aircraft from entering in a dangerous situation, such as high bank angle or stall.

In direct law, the aircraft is controlled like any standard aircraft: the elevator and aileron deflections are proportional to the side stick movements.

The aircraft automatically switches to direct law when it is lower than 50 feet above the ground (100 feet if autopilot is active).
The normal law protections are active only if at least one FAC is operative.

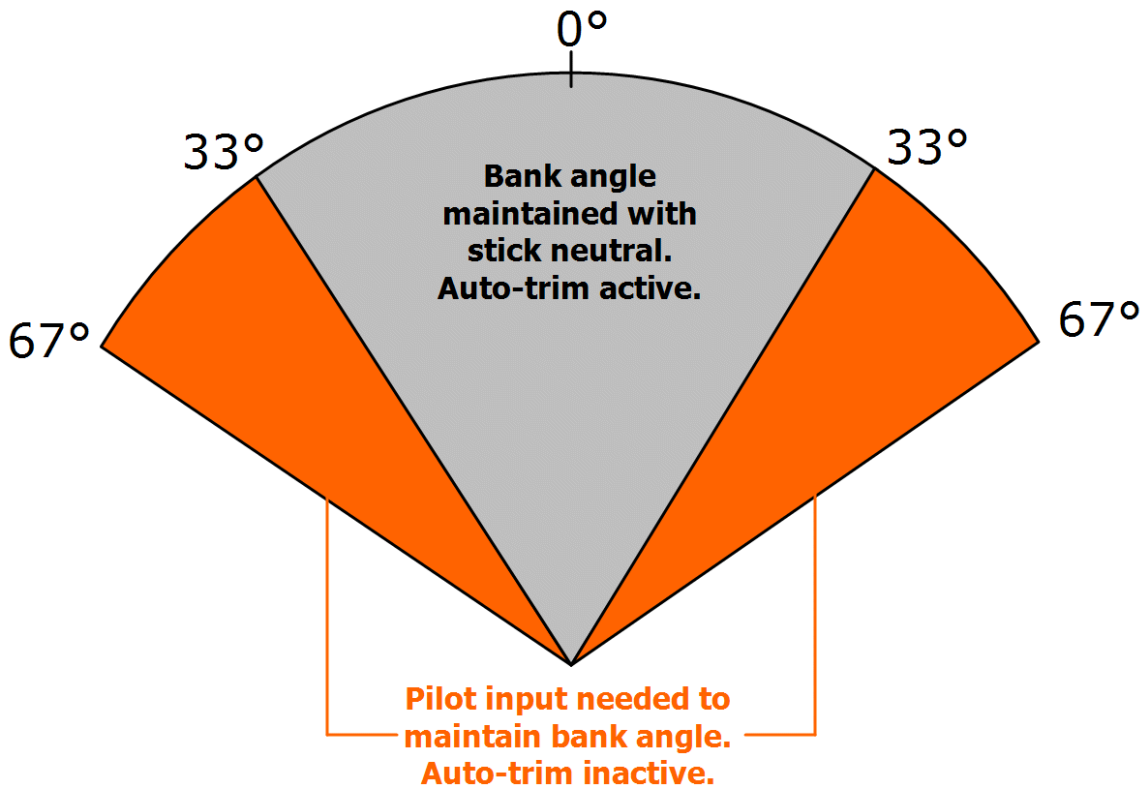
Usage

The pilot uses the sidestick to control the aircraft. The stick lateral movements command the bank angle, and the stick vertical movements command the pitch, just like on any aircraft.

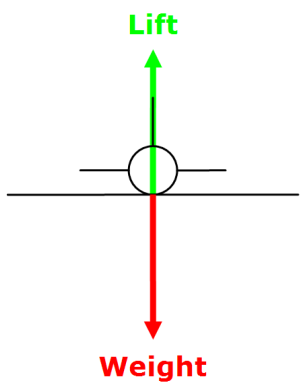
Bank Angle

When the pilot wants to make the aircraft turn, he uses the sidestick to command a bank angle. He doesn't have to use the rudder pedals as the FAC manages the auto-coordination automatically. In normal conditions, the bank angle should never exceed 33° (the autopilot always commands a bank angle less or equal to 25°). When the stick is back to neutral position, the bank angle is maintained until a new bank angle is commanded through the stick.
For any reason (emergency situation for example), if the pilot wants to exceed the 33° limit, he needs to maintain the stick input to maintain bank angle. As soon as the stick is back to the lateral neutral position, the aircraft comes back to a bank angle of 33°.
Anyway, the aircraft can not exceed a 67° bank angle in clean configuration (45° with flaps) to limit the structural acceleration of 2.5g in (2.0g with flaps).
The flight directors automatically disappear when the bank angle reaches 45°.

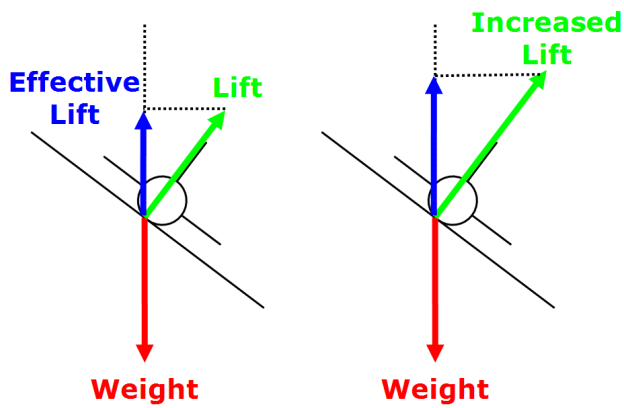
The bank angle control is illustrated by the figure below:



Why do these limits exist?
The aircraft is limited in terms of acceleration, because of structural and aerodynamic reasons. These limits are 2.5g in clean configuration and 2.0g with flaps.
If the aircraft wants to maintain a constant altitude in turn, it has to increase the lift to counter the bank angle, so it naturally increases the load factor weight.



In level flight, the lift balances the weight. The acceleration is null, load factor is 1g.



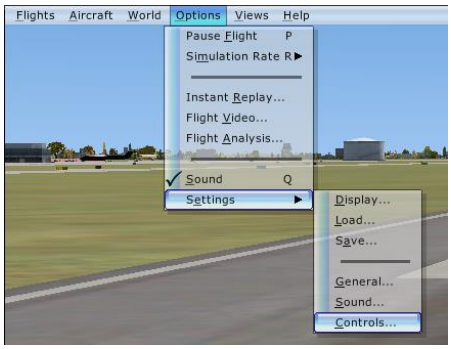
In turn flight, the vertical component of the lift (effective lift) is lower than the weight because of the bank angle. The lift must be increased to balance the weight, resulting in a load factor increase.

With the help of a little bit of mathematics, we can understand that the load factor depends on the bank angle: the more it banks, the more it has to increase lift, which means increasing the load factor. Increasing the load factor to 2.5g corresponds to a 67° bank angle, and 2.0g corresponds to 45°.
This is the explanation…

Pitch Angle

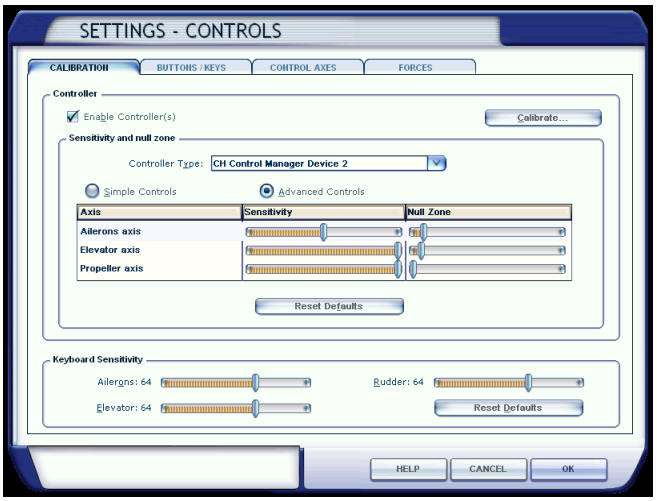
When the pilot wants to command a climb or descent, he pulls or pushes the stick. Instead of commanding an elevator position, the pilot commands a load factor change. As soon as the stick is in vertical neutral position, the current load factor is maintained in order to maintain a constant pitch angle through the auto-trim system.
The flight envelope protection limits the pitch angle to 30° in climb and 15° in descent. The flight directors automatically disappear when these limits are reached.
If the alpha protection triggers the alpha floor mode (high incidence angle protection), the alpha floor will automatically command a nose dive until the incidence angle returns to a correct value.

<u>Fly-by-Wire management in Flight Simulator:</u>
The simulation of this system does not require any additional module in Flight Simulator. It works with the standard installation of FSX:SE. Nevertheless, it only works if a joystick is used to fly the aircraft. It works with keyboard control, but it is not totally efficient, and any serious virtual pilot should not use the keyboard to fly…
The joystick sensitivities and null zones must be adjusted in order to make this system work as efficiently as possible in FSX:SE. These settings are found in the pull-down menu in FSX:SE through Options > Settings > Controls…



- *Null zone: The fly-by-wire system enters in action when the joystick is in neutral position, in order to maintain the bank/pitch angle commanded by the pilot. If you experience this feature does not work properly, it may be because the null zone defined for the aileron or elevator axis is too small. In this case, increase the null zone so that the fly-by-wire system can identify the null zone more easily.*
- *Sensitivity: The pitch control works better if the elevator sensitivity is set to the maximum. It provides a better reactivity of the system.*

The following parameters provide good results:



Real pilots suggest pushing the sensitivity to the maximum and reducing the null zone to the minimum. If your hardware is good enough to support these settings (especially regarding the accuracy), you should apply these settings.

Note:
The flight control system modeled in Flight Simulator is not designed for the usage of a fly-by-wire system. In the real aircraft, there is no direct link between the sidestick and the ailerons/elevators. The sidestick gives an order to computer, which computes an electric order for the ailerons and elevators. In FS, there is always a link between the user joystick and the simulated aircraft flight controls.
In order to get the best results from the fly-by-wire system, move the joystick gently, and remember, this aircraft is not designed for aerobatics, but for optimal passenger comfort. If you feel uncomfortable with the aircraft control, just release the stick and let the fly-by-wire control the aircraft. Then you just have to adjust the aircraft trajectory through small stick corrections.

AUTOFLIGHT

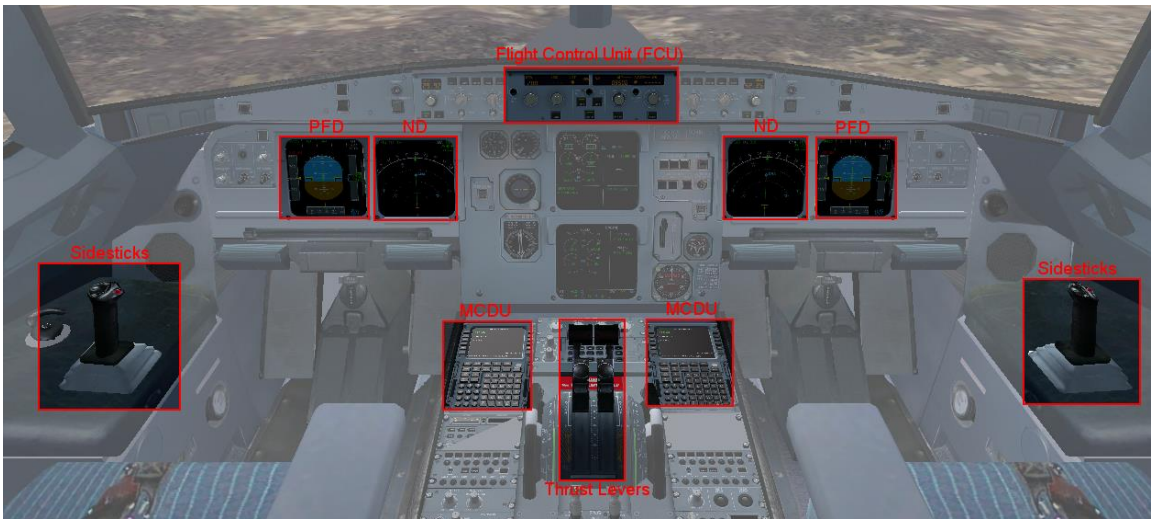
Autoflight Components

The pilot interacts with the autoflight management system through the following components:

- The Flight Control Unit (FCU) located on the glareshield
- The Multifunction Control and Display Unit (MCDU) located on the pedestal
- The thrust levers
- The sidesticks

The autoflight status can be monitored on the following components:

- The FCU
- The Primary Flight Display (PFD), especially the Flight Mode Annunciator (FMA) and the Flight Director.



Flight Control Unit

Selected and Managed functions

The Flight Control Unit (FCU) has four rotating knobs. One of the specificity of this FCU is that these knobs can be pushed or pulled.
If a knob is **pulled**, it means the pilot takes the decision of controlling the knob function. In this case, the function is **selected**.
If it is **pushed**, the pilot transfers the control of this function to the flight management system. The function is **managed**.
To remember this, think of the direction in which the knob moves:

- If you push a knob, it moves in the direction of the aircraft systems, which means you give the control to the machine.
- If you pull a knob, it moves in your direction, which means the control is given to the pilot.

<u>FCU knob usage in Flight Simulator:</u>
The actions on the FCU knobs are simulated by mouse click actions. Pushing a knob is simulated by a left mouse button click, and pulling a knob is simulated by a right mouse click.
The following table summarizes the FCU knob actions:

Real world action	***FS simulated action***	***Function***
Knob push	*Left-button mouse click*	*Managed*
Knob pull	*Right-button mouse click*	*Selected*

FCU Layout

The FCU is composed of four rotating knobs, nine pushbuttons and four display windows.

The nine pushbuttons act as follows:

- The SPD-MACH pushbutton lets the pilot choose if the airspeed is displayed in knots or in Mach.
- The HDG-V/S / TRK-FPA pushbutton selects the display mode. If HDG-VS mode is selected, the heading and the vertical speed (in feet per minute) are shown. If the TRK-FPA mode is selected, the track and the flight path angle (in degrees) are displayed.
- The METRIC ALT pushbutton triggers the display of the altitude in meters on the Primary Flight Display.
- The six engagement pushbuttons (AP1, AP2, A/THR, EXPED, LOC, APPR) will be described later in this chapter.

The four rotating knobs are the following:

- The airspeed knob controls the airspeed, in knots or in Mach depending on the mode selected with the SPD/MACH pushbutton. It can be pushed to have the speed managed by the flight management system.

- The heading knob allows the pilot to select the heading or track, depending on the mode selected with the HDG-V/S / TRK-FPA pushbutton. It can be pushed to have the lateral navigation managed by the flight management system.
- The altitude knob controls the target altitude. It can be pushed to have the vertical navigation managed by the flight management system.
- The vertical speed (V/S) knob controls the vertical speed in feet per minute or the flight path angle (FPA), depending on the mode selected with the HDG-V/S / TRK-FPA pushbutton. The vertical speed can not be managed. If the knob is pushed, it triggers a level off action.

The FCU has four windows, corresponding to the four knobs:

- The speed window displays the target speed, in knots or Mach. If the speed is managed, it is dashed and the managed speed light is on.
- The heading window displays the target heading or track. If the lateral navigation is managed, it is dashed and the managed heading light is on.
- The altitude window shows the target altitude. It is never dashed. The light is on as soon as the altitude displayed is higher than the acceleration altitude entered in the MCDU (refer to the FMGC section for more details).
- The vertical speed window shows the vertical speed in feet per minute, or the flight path angle in degrees.

Selected Functions

When airspeed, heading or vertical speed value is selected, it can be adjusted by turning the corresponding knob until the desired value is displayed in the FCU window.
In the example shown below, the speed, heading and vertical speed are selected, and their values are 290 knots, 12° heading and a 2100 feet per minutes to climb to the altitude of 25000 feet (FL250).

<u>FCU knob rotation in Flight Simulator:</u>
The knob rotation is simulated by clicking on the left/right of the knob to decrease/increase the corresponding value. For the vertical speed knob, you have to click above/below the V/S knob to increase/decrease the value.
As soon as you move the mouse in one of the sensitive area used for rotation, the hand cursor appears with a + (plus) or a – (minus) to indicate the possible variation. If you click the left mouse button, it commands a normal value change. If you click the right mouse button, it makes a big variation.

The value changes are summarized in the table below:

Function	***Button mouse click***	***Variation***
Airspeed (knots)	*Left*	*+/- 1 knot*
	Right	*+/- 10 knots*
Airspeed (MACH)	*Left*	*+/- .01*
	Right	*+/- .10*
Heading/Track	*Left*	*+/- 1°*
	Right	*+/- 10°*
Altitude	*Left*	*+/- 100 feet*
	Right	*+/- 1000 feet*
Vertical Speed	*Left*	*+/- 100 ft/min*
	Right	*+/- 1000 ft/min*

<u>Mouse wheel usage:</u>
When the mouse is moved over a knob or over a variation zone, you can use the mouse wheel to adjust the value. Turning the mouse wheel normally commands a normal variation, and turning the mouse wheel by holding one of the ***Shift*** *keys commands big variations.*

If you want to change the altitude selection, you must first turn the altitude knob to display the desired target altitude. Then you can initiate the climb or descent by one of the following actions:

- Pull the altitude knob. This will make the altitude selected, and it will result in an open climb or open descent.
- Push the altitude knob. The altitude is then managed, and it will result in a managed climb or descent.
- Pull the V/S knob, and select a vertical speed.
- Press the EXPED pushbutton, which will result in an expedited climb or descent.

Managed Functions

If a knob is pushed, the corresponding function is managed by the Flight Management System. The corresponding FCU display is then dashed and the managed guidance light turns on.
In this example, the speed, heading and vertical speeds are managed.

Notes:

- The vertical speed/flight path angle knob can not be managed. Pushing this knob results in a **level off** action.
- Even if the vertical navigation is managed, the FCU altitude window is never dashed.

➡ **Reminder**:
Before taking off, the speed, heading and vertical speed are managed by default. To make sure the FCU is correctly set for take off, remember the words "dash, ball, dash, ball, ball, dash". It means speed display is dashed and speed light (ball) is on, heading is dashed and heading light is on, altitude light is on and vertical speed is dashed (as shown on the image above).
This is especially important for the altitude light, which is on only if the selected altitude is higher than the acceleration altitude. If it is lower, the initial climb will not be correct.

Engagement Pushbuttons

Six engagement buttons are located on the FCU. They illuminate when their corresponding mode is engaged.

1 - Flight Director pushbutton: FD
This button is used to engage the flight director. This is absolutely necessary before engaging the autopilot. Remember that the flight director determines how the aircraft

should be flown, and the autopilot just executes the orders coming from the flight director (the FD is “the brain” and the AP is “the muscle”).

2 - Localizer: LOC

This button is used to engage the localizer mode. When it is engaged, it commands the lateral navigation to follow the localizer which frequency is tuned on NAV1 (ILS).
The LOC mode should be engaged before the APPR mode.

3-4 - Autopilot pushbuttons: AP1 and AP2

The pilot uses these buttons to engage the autopilots. Two autopilots are provided for redundancy. You can engage AP1 or AP2, knowing the AP1 and AP2 can be engaged simultaneously only in approach mode, to increase the safety of the autoland.
These pushbuttons should not be used to disengage the autopilots. If this is done, an alarm will occur because this is not the normal procedure. The autopilot should be disconnected using the sidestick red button.

Sidestick button simulation in Flight Simulator:

In the FS Setup section (Key Assignments), the assignment of the FS autopilot switch to a joystick button is recommended. If you can do so, it allows you to simulate the real aircraft procedure that consists in disconnecting the autopilot only through the joystick button, and not through the AP1/AP2 pushbuttons on the FCU.

5 - Autothtrust: A/THR

Pressing this button engages or disengages the autothrust system. This system can also be engaged or disengaged using the thrust levers (discussed later in this chapter).
This button illuminates when the autothrust is armed or engaged. The only way to know the exact status of the autothrust is by looking at the Flight Mode Annunciator (FMA).

6 - Expedite: EXPED

Pressing this button initiates an expedited climb or descent. An expedited climb corresponds to an open climb at green dot speed. An expedited descent is an open descent at the speed of 340 kts/M.0.80, regardless of any speed constraint.

7 - Approach: APPR

When the aircraft is on an ILS approach, press this button to engage the ILS approach mode. This will command the lateral and vertical navigation to follow the localizer and the glide slope. This mode has to be engaged for the autoland.
If the LOC mode was previously engaged, engaging the APPR mode will turn the LOC light off. Nevertheless, the APPR will guide the aircraft on the localizer and the glide slope.

Some Advices

LOC/APPR mode usage:
Real pilots say the LOC mode should ALWAYS be engaged before the APPR mode. Even if engaging the APPR mode before the LOC mode is possible, it should never be done. This is because the airport approach guides you on a lateral and vertical path that avoids the terrain. The terrain avoidance is totally reliable only if you descnd on the glide slope only when you are aligned with the runway, aligned with the localizer.

Autoland:
In case of lateral wind, the autopilot will have difficulties to follow the localizer. Real life pilots say the autoland is NEVER used in case of lateral wind. The human pilot is much better than the autopilot to make small and accurate trajectory changes in order to fly a good ILS approach. The autoland is perfect for low visibility approaches, but not for windy ones.

Autothrust usage:
Many pilots say you shouldn't use the auto-thrust when flying the aircraft manually. This is because it may amplify the trajectory correction (especially in pitch) you make to fly the aircraft along the glide slope. Other pilots think the auto-thrust is reactive enough to be used even when the aircraft is flown manually. You will make your own opinion.

In case of strong wind, you may see the auto-thrust is constantly updating the thrust. This may sound weird, but if you look carefully, this is the best way to have the aircraft speed as close as possible from the FCU required speed, selected or managed. In my opinion, the impact of the wind on the airspeed in FS is not totally realistic, it is too strong.

Flying the aircraft manually:
If you disconnect the auto-pilot to fly the aircraft manually, many pilots suggest the usage of the TRK/FPA mode instead of the HDG/V/S mode. In TRK-FPA, the green flight path vector symbol, called the "bird", shows the aircraft trajectory in a way that is easier to understand for a human pilot:

- on the lateral plan, you can see the impact of the lateral wind and you see where the aircraft is really heading,
- on the vertical plan, you see the angle of descent that allows you to easily fly an approach visually.

Sidesticks and Rudder Pedals

In the real aircraft, the sidesticks are firmly held in their center position when an autopilot is engaged. A strong manual movement of a sidestick or a rudder pedal input indicates that the pilot wants to take the control of the aircraft. It disconnects the autopilot with an aural warning. This warning indicates it is not the right way to disconnect the autopilot. It can be stopped by one of the following actions:

- re-engaging the autopilot through the FCU pushbutton,
- pressing the sidestick button to confirm the Autopilot disconnection action,

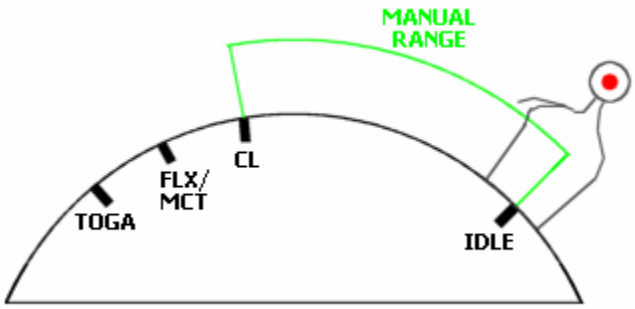
In Flight Simulator, this feature is simulated by a strong movement of the joystick or rudder pedal. If you move the joystick or rudder pedal to an extreme position, it disconnects the autopilot like in the real aircraft.

Thrust Levers

The thrust system of this aircraft has four detents in which the levers can enter. When the pilot moves the levers, he can feel "hard points" when they reach one of the detents.
The four detents correspond to four possible thrust modes:

- IDLE
- CL for Climb
- FLX/MCT for Flex/Maximum Continuous Thrust
- TOGA for Take off go-around

The thrust levers have two red buttons on the side, called instinctive buttons. They are used to disarm the autothrust system.



<u>Simulation of the lever movement in Flight Simulator:</u>
As your throttle control does not have detents, this is simulated by a sound that is played each time a lever enters or leaves a detent. When you move your throttle, pay attention to this sound because it indicates when the levers have reached a detent. You can also see the thrust mode indication on the Engine/Warning Display (E/WD).
The autothrust system works properly if you control the throttle trough the keyboard. Nevertheless, the use of a throttle device is highly recommended.

<u>Simulation of the instinctive pushbuttons in Flight Simulator:</u>
The instinctive pushbutton function is mapped on the FS auto-throttle system. You can map any key or button to the "Autothrottle arming switch" command and it will simulate the instinctive pushbuttons.

When the thrust levers are in the manual range (not in a detent), the levers command the engines like any other aircraft: the engine power is relative to the lever angle.
The levers can be moved in:

- the IDLE detent: the autothrust system is automatically disconnected and idle power is always applied, unless TOGA LOCK mode is engaged,
- the CL detent: the Full Authority Digital Engine Control (FADEC) commands climb power,

- the FLX/MCT detent: FLX (flex) is used for reduced thrust take off, and MCT (max continuous thrust) should be selected in single engine operation,
- the TOGA detent: whatever happens, full engine power is applied (for take off or go-around).

Standard Usage

The autothrust system should be used as often as possible, even if some pilots say it shouldn't be used when the aircraft is flown manually. It should be turned on just after take off and should remain on until the aircraft has landed.
The standard usage of the throttle is the following:

- The levers should be in the IDLE position when the engines are turned on.
- They can be moved in the manual range for taxi. Note that the aircraft can taxi with idle thrust, you just need a little thrust to initiate the roll.
- For take off, the pilot decides if flex or take off power should be applied. Use flex power as often as possible to save the engines. Maximum TOGA power should be used on short or wet runways or when the weather conditions are bad (especially windshears).
  As soon as take off power (FLX or TOGA) is applied, the autothrust system automatically arms: the FCU A/THR light turns on and A/THR appears in blue on the FMA (5th column).
- When airborne and the reduction altitude is reached (usually 1500 feet AGL), the pilot is requested to engage the climb mode by moving the levers into the CL detent (flashing LVR CLB message on the FMA).
  As soon as the levers are retarded into the CL detent, the autothrust system is automatically engaged: the A/THR message on the FMA appears in white.
- During the whole flight, the levers should remain in the CL detent, unless max power is needed in case of an emergency.

On this aircraft, the throttle levers don't move by themselves, even if thrust is commanded by the FADEC. They are supposed to stay in the CL detent when the autothrust system is engaged. For this reason, the pilots must be warned when idle thrust is commanded. This is shown on the Engine/Warning Display (E/WD) with an IDLE message that flashes for a few seconds.

Monitoring

The autothrust system can be monitored through several autoflight components:

- On the Engine/Warning Display (E/WD), the engine power commanded by the autothrust system is shown with a blue arc on the N1 gauges.
- On the E/WD, messages can be displayed to indicate specific autothrust status (IDLE or A.FLOOR).
- On the Flight Control Unit (FCU), the A/THR pushbutton light shows if the autothrust system is off (light off) or armed or engaged (light on).

- On the Primary Flight Display (PFD), the first column shows the current autothrust mode, and the 5th column shows the autothrust status (off, armed or engaged).

Autothrust modes

The autothrust system has two kinds of modes:

- The fixed thrust modes: a fixed thrust is commanded and the airspeed is controlled by adjusting the aircraft pitch.
- The variable thrust modes: the speed is controlled by changing the thrust engine power.

Alpha Floor - Flight envelope protection

If the alpha protection system detects high incidence angles, it engages the alpha floor mode that automatically applies full TOGA engine power (even if the autothrust system is not engaged) and decreases the aircraft pitch to reduce the incidence. A message A.FLOOR is displayed on the FMA (1st column)

When the incidence angle is correct again, the alpha floor stops and the autothrust system locks the TOGA power. The TOGA LK message is then displayed on the FMA (1st column).

To unlock the TOGA LK mode, the pilot must follow the recommendations:

1. Move the trust levers in the TOGA detent to avoid a thrust difference when the autothrust system will be disengaged.
2. Disengage the autothrust system by pressing the A/THR button on the FCU or by pressing an instinctive pushbutton.
3. Retard the levers to the CL detent.
4. Re-engage the autothrust system by pressing the A/THR button on the FCU again.

Flight Guidance

The flight guidance section covers all the automatic flight modes: speed guidance, lateral guidance and vertical guidance.

Speed Guidance

It is mainly related to the autothrust system.

Autothrust arming

If the autothrust system is off, it is armed when the throttle levers are moved to the FLX/MCT or TOGA detent during take off, or when the levers are moved in the TOGA detent while the aircraft is in flight and the flaps are extended (go around).

When the autothrust system is armed, the A/THR light illuminates on the FCU panel, and a **blue** A/THR message appears on the FMA.
Note that the A/THR button light also illuminates when the autothrust is active. This is why the pilot must look at the FMA (column 5) to determine if it is **armed** or **active**.

Typical FMA display when take off power is applied.
The first column shows FLEX power is selected,
and column 5 shows the autothrust system is armed.

When the autothrust system is armed, only the fixed thrust modes (constant thrust provided) are available:

- TOGA - Take off / Go around:
  This mode provides the maximum thrust, "MAN TOGA" is displayed on the FMA (column 1).
- FLX – Flex:
  It is used for reduced thrust take off. The provided thrust depends on the temperature that is entered in the MCDU PERF page. If the aircraft is on ground, "MAN FLX" message is displayed on the FMA (column 1) with the selected temperature in blue.
  If the flex mode is used for take off and no temperature has been entered in the MCDU, a message "FLX TEMP NOT SET" appears on the E/WD. In this case, the take off should continue in TOGA mode by pushing the throttle levers into the TOGA detent. This removes the caution message.
- MCT - Maximum continuous thrust:
  It provides a fixed thrust that is the maximum continuous thrust depending on the current conditions. This is the normal lever position of an engine fails.
- CL – Climb:
  Climb thrust is provided based on the current conditions. A message "THR CLB" is displayed on the FMA when the fixed climb thrust is provided. The aircraft speed is then controlled by the pitch (used for climb).
- IDLE:
  This mode provides fixed idle thrust. A message "THR IDLE" is displayed on the FMA when the fixed idle thrust is provided, and a flashing "IDLE" message is shown on the E/WD when the engine power is idle. The aircraft speed is then controlled by the pitch (used for open descent).

The autothrust mode is displayed on the FMA, column 1. When armed, the autothrust mode is displayed in white with a white bounding box.
The autothrust is disarmed when the A/THR button is depressed on the FCU, or when the throttle levers are moved back to the IDLE detent.

Autothrust Active

If the autothrust system is armed, it becomes active when the throttle levers are moved into the CL detent. If it is off, it can be turned active by pressing the A/THR button on the FCU.
When the autothrust system is active, the A/THR light illuminates on the FCU panel, and a **white** A/THR message appears on the FMA (column 5). The thrust mode displayed in the 1st column of the FMA appears in green.

When the autothrust is active, the fixed and variable thrust modes are available. In this mode only, the autothrust fully controls the thrust to maintain selected or managed speed in level flight or when the aircraft is following a specific vertical path (ILS approach for example).

Variable thrust modes are:

- SPEED
  This mode is available only when the autothrust system is active. A "SPEED" message is displayed in green on the FMA (column 1) when this mode is engaged.
  The autothrust automatically switches to this mode when:
  - The aircraft levels off from a climb or a descent
  - A vertical guidance mode that commands a specific vertical path (V/S or ILS mode) is engaged
  - The flight directors are turned off
- MACH
  It is the same as the SPEED mode. It is only available at high altitudes. The autothrust system automatically switches from SPEED to MACH and vice-versa at a predetermined altitude.

The autothrust system can be changed to armed mode by moving the throttle levers forward into the FLX/MCT or TOGA detent.

The autothrust is de-activated if the A/THR button is depressed on the FCU, or when the throttle levers are moved back to the IDLE detent. In this case, an "A/THR OFF" message appears on the E/WD for a few seconds and a warning sound is heard.

Thrust Limitation

During normal operations, the thrust levers should remain in the CL detent during the whole flight. If the autothrust system is engaged and the levers are moved below the CL detent (in the manual range), the thrust is limited to the thrust lever position. If the thrust lever position is limiting the autothrust system, a master caution is generated and a message is displayed on the E/WD to indicate this. Repeated chime will sound until a corrective action if taken.

Thrust Lock

When the autothrust system is armed with the levers in the CL detent, and the autothrust is disengaged by a FCU A/THR pushbutton press, the engine thrust remains constant until the levers are moved out of the CL detent. This status is shown by a flashing THR LK message on the FMA (1st column) and a message appears on the E/WD, asking the pilot to move the thrust levers. Repeated chime will sound until a corrective action if taken.

Lateral Guidance

The lateral guidance modes provide guidance along a lateral path according to the FCU settings or to the flight plan stored in the FMGC.
The pilot can control the lateral guidance through the FCU, in which case it is a selected lateral mode. Or he may let the FMGC manage it, in which case it is a managed lateral mode.

Automatic Lateral Modes

During take off (as soon as the throttle levers are in the FLEX or TOGA detent), the lateral RWY (runway) mode automatically engages. This mode is designed to help the pilot in following the runway heading. In fact, it automatically sets the ILS frequency (if it exists) and the yaw bar is displayed on the PFD to help the runway tracking. If the runway has no ILS, no yaw bar is shown.

Typical FMA display when take off power is applied.
Column 3 shows the runway mode is engaged (green RWY),
and the NAV mode is armed (blue NAV).

When the aircraft reaches the altitude of 30 feet above the ground, the NAV mode automatically engages if a flight plan is defined. If no flight plan is defined, or if the flight plan leads to a discontinuity, the RWY TRK (runway track) mode automatically engages to help the pilot in following the runway track after take off until another lateral mode is selected.

Selected Lateral Mode

The pilot can control the lateral guidance manually through the FCU by pulling the HDG (or TRK) knob on the FCU to select the heading (or track). Depending on the FCU mode, the heading or the track is selected.

Managed Lateral Mode

The crew can push the HDG knob to set the heading managed mode. The NAV mode then becomes active (shown in green on the FMA) and the aircraft follows the flight plan entered in the FMGC.

If the heading is in managed mode on the ground, the NAV mode is armed (shown in blue on the FMA). It will automatically become active shortly after take off.

Vertical Guidance

The vertical modes provide guidance along the vertical flight plan, according to the FMGC flight plan and the pilot inputs on the FCU.
The pilot can control the vertical guidance manually through the FCU (selected vertical mode) or let the FMGC manage the vertical guidance (managed vertical mode).

The vertical modes are always on the 2nd column of the FMA. The active mode is displayed in green on the first line, and the armed mode is shown on the second line in blue.

Automatic Vertical Modes

During take off (as soon as the throttle levers are in the FLEX or TOGA detent), the lateral SRS (speed reference system) mode automatically engages if some conditions are fulfilled:

- The flaps are extended
- V2 was entered in the MCDU Take off PERF page

This mode is designed to manage the initial climb, from the ground to the acceleration altitude. It will make the aircraft climb at the highest possible rate of climb, keeping V2+10 knots if all engines are running, otherwise V2. This mode is very helpful, you just have to follow the flight director after take off to make a perfect climb.

Typical FMA display when take off power is applied.
Column 2 shows the speed reference system mode is engaged (green SRS),and the managed climb mode is armed (blue CLB).

As soon as the acceleration altitude is reached, the vertical mode automatically switches to CLB mode.

Selected Vertical Modes

The pilot can control the vertical guidance manually through the FCU by doing the following actions:

- Select a new altitude on the FCU using the altitude knob
- Then select a vertical mode using the altitude knob, the V/S knob or the EXPED button. This action will determine the vertical mode that will be used to fly the aircraft: V/S, FPA, Open Climb or Open Descent.

<u>Open Climb (OP CLB)</u>
This mode is used to climb at a selected altitude without taking care of any altitude constraint. This mode is linked to the THR CLB autothrust mode (fixed thrust mode with N1 set according to the CLB thrust setting). When this mode is active, the current

selected or managed target speed is held and the pitch is adjusted consequently. This is why the V/S FCU display is dashed.
If the EXPED mode is engaged when the open climb mode is active, the aircraft will climb as quickly as possible, using the green dot speed as the target speed.

The open climb mode can be engaged only when the autopilot and autothrust systems are active, by the following actions:

1) Select an altitude that is higher than the current altitude on the FCU
2) Pull the altitude knob

Note: If the altitude change is less than 1200 feet, the vertical speed will be set automatically to 1000 feet/min and the FMA indications don't change.

In open climb, the FMA looks like this:

Open Descent (OP DES)
This mode is similar to the open climb mode, used for the descent. It allows the descent at a selected altitude without honoring any altitude constraint. It is linked to the THR IDLE autothrust mode, which means the engines power will be set to IDLE.
If the EXPED mode is engaged when the open descent mode is active, the aircraft will descend as quickly as possible, using the maximum speed of 340 kts/ Mach .80 as the target speed (potentially limited by the VMAX speed).

The open descent mode can be engaged only when the autopilot and autothrust systems are active, by the following actions:

3) Select an altitude that is lower than the current altitude on the FCU
4) Pull the altitude knob

➡ **Note: The open descent should not be used at low altitudes.**

Vertical Speed / Flight Path Angle (VS or FPA)
These modes let the pilot control the climb or descent through the vertical speed or the flight path angle (depending on the FCU mode, V/S – HDG or TRK – FPA).
Consequently, the FCU V/S or FPA display shows the selected value.
These modes are linked to the Speed/Mach autothrust mode (variable thrust mode that adjusts the engine power according to the speed target).
The FMA displays the selected mode (V/S or FPA) with the current selected value in blue.

In V/S mode, the FMA and FCU may look like this:

In FPA mode, they may look like this:

Managed Vertical Modes

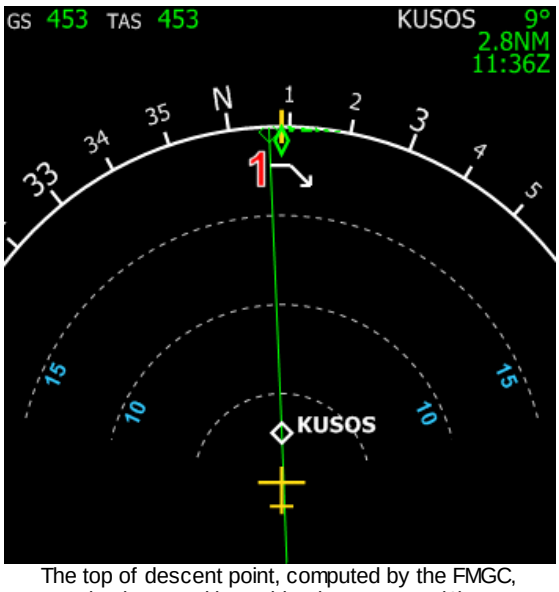
In Managed vertical mode, the FMGC determines the best climb or descent profile.
By default, the CLB mode (climb mode) is armed when the aircraft is on the ground. It is shown in blue on the FMA. It means the climb mode will be automatically activated as soon as the aircraft reaches the acceleration altitude set in the MCDU (refer to the FMGC section to know more about the acceleration altitude).

Managed Climb:
The managed climb can be set at any time by selecting a higher altitude on the FCU and pushing the ALT knob. The managed climb can be activated only if the NAV mode is active (lateral mode managed).
The managed climb is very similar to the open climb mode described earlier. The only difference is that the managed climb mode respects the altitude constraints. If there is no constraint, the open climb and managed climb modes are just the same.
If an altitude constraint is defined on the next waypoint, the managed climb mode respects it by limiting the target altitude to the altitude constraint value. In other words, the target altitude will be the altitude constraint, even if the altitude displayed on the FCU is higher. In this situation, the target altitude symbol appears in magenta on the altitude tape, and the ALT message is shown in magenta on the FMA to indicate the presence of a constraint. As soon as the constrained waypoint is passed, the target altitude becomes the FCU altitude, unless another constraint is defined.

Managed Descent:
The managed descent should be used only when the aircraft is at cruise altitude. It can be engaged only if the NAV mode is activated (managed lateral mode). To engage the managed descent, an altitude lower than the current altitude must be selected on the FCU, and the ALT knob must be pushed.

When the managed descent is initiated, the aircraft will try to descend using idle thrust as long as possible to save fuel. It will also respect the constraints, especially the speed limitation below the limitation altitude (usually, the speed limit is 250 kt below 10,000 ft). In fact, the FMGC computes a ideal descent path it will do everything possible to maintain the aircraft on this path.
As soon as you initiate the descent, the FMA looks like this:

The thrust is reduced to idle, and a magenta circle appears on the altitude tape. It represents the vertical deviation between the current altitude and the computed descent path. In managed descent mode, the FMGC will adjust the vertical speed to minimize the vertical deviation. This will be done by adjusting the descent speed by +/-20 knots around the managed descent speed. This interval is shown on the speed tape by 2 half triangles showing the minimum and maximum speed the aircraft can take to manage the descent.
The best option is to initiate the descent when you reach the Top of Descent point, displayed on the Navigation Display, unless the ATC commands you to descend at another time…

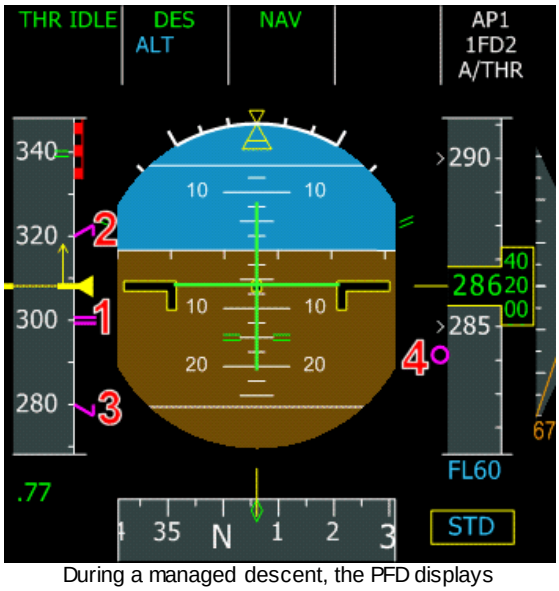


The top of descent point, computed by the FMGC, is shown with a white down arrow (1)

For any reason, you may initiate the descent before or after the computed top of descent point. In this case, the FMGC will do its best to put the aircraft back on the computed descent profile. If you descend before, the FMGC will command a slow descent (at 1000 feet per minute) until it intercepts the computed descent path. If you descent after, the FMGC will initiate a idle descent with a high rate of descent while keeping the airspeed within the possible range (+/-20 knots around the descent target speed). If the aircraft is very high above the descent profile, the FMGC may be unable to intercept the path because it would need a descent speed higher than the maximum authorized speed. If this

happens, the only solution is to extend the speed brakes so that the angle of descent increases with the same airspeed.

The example below shows a managed descent where the aircraft is above the computed descent path:



During a managed descent, the PFD displays speed and altitude information relative to the descent.

1 – The descent target speed is shown with a magenta = sign.
2 – The FMGC can adjust the speed up to the maximum managed descent speed, which is the target speed + 20 knots.
3 – If the aircraft has to slow down the aircraft, it can adjust the speed down to the minimum managed descent speed, which is the target speed - 20 knots.
4 – The descent path indicator (magenta circle) shows the vertical deviation with the computed descent profile.

On this example, the aircraft is above the descent path (the magenta circle is below the altitude yellow line), which is why the FMGC commands a speed higher than the descent target speed (300 knots) in order to increase the angle of descent while keeping idle thrust. The managed descent speed will not exceed 320 knots. If this speed is still too low to intercept the descent path, you can extend the speed brakes, but you should be aware that it will result in a VERY high descent rate.

During the managed descent, additional information is computed by the FMGC and displayed on the ND with the pseudo-waypoints. These waypoints are computed by the FMGC and added in the flight plan when all the necessary information is entered by the crew.
The pseudo-waypoints are the following:

- Speed Limit:
  It is displayed as a magenta filled circle. It shows where the

aircraft will accelerate or decelerate to reach a new target speed. On this example, this waypoint is positioned where the aircraft crosses 10,000 feet and it will accelerate from 250 to 300 knots.

- Top of Climb (1) and Top of Descent (2):
  They are shown with white arrows on the flight plan. The top of climb is placed where the aircraft is supposed to reach the cruise altitude, and the top of descent is positioned where the crew should initiate the descent to follow the computed descent path as closely as possible.

- Deceleration point:
  It is displayed with a big 'D'. It shows where the aircraft will start decelerating for the approach. If the aircraft is in managed descent and managed heading, the FMGC will automatically switch to the approach phase. It means it will automatically decelerate to green dot speed in clean configuration, then to S, F and Vapp speed according to the aircraft configuration. In addition, the ILS frequency of the arrival runway will be tuned, if it is an ILS approach.

<u>Managed Descent with the FS ATC:</u>
If you fly with the FS virtual ATC, there is a high probability that it asks you to initiate your descent before the computed top of descent point. This is not a problem, you can engage a managed descent. In this case, your aircraft will be below the computed descent path for a certain time (descent at 1000 feet per minute) and it will finally intercept the correct descent path.
In addition, the ATC will probably ask you to turn to a certain heading before you reach the deceleration point (D point). In this case, you will have to select a heading manually, and this will force you to leave the NAV mode (managed lateral mode). Consequently, the FMGC will not automatically switch to the approach phase, you will have to do it manually through the PERF page. I suggest you do this when switching to the tower frequency to get the landing clearance.

Approach & Landing

If the speed is managed when the approach phase is active, the target speed will be:

- Green dot speed if the aircraft is in clean configuration
- S speed if the slats are extended
- F speed if the flaps are extended
- Vapp if the flaps are in configuration 3 or FULL

These speeds are computed by the FMGC. The Vapp speed is continuously updated to take the current wind into account and make sure the aircraft can land in safe conditions.

When the aircraft is close from the arrival airport and the ILS signal is received, the pilot can engage the LOC and APPR mode to follow the localizer and the glide slope in case of an ILS approach. Remember that the localizer should always be captured before the APPR mode is armed for the glide slope capture.

As soon as the APPR mode is engaged, you can switch on both autopilots. This is the only time you can turn them on simultaneously in order to provide redundancy for the autoland. If both autopilots are engaged and the ILS is captured, you can just let the aircraft go and it will proceed to an automatic landing.
When the aircraft reaches 400 feet AGL, the LAND mode activates, as shown on the FMA:

As the aircraft comes closer to the ground, it will automatically engage the flare, which is also shown on the FMA:

In case of an autoland, the only action that must be done by the pilot in function is to retard the engines at 20 feet AGL when the sound "Retard, Retard" is heard.
When the aircraft touches the ground, the ROLL OUT mode engages to steer the aircraft on the ground. If the auto-brake was engaged, the aircraft automatically brakes to decelerate on the ground. This action is shown through the auto-brake pushbuttons with a "DECEL" signal:

Using the brakes manually disengages the auto-brakes.
The pilot is free to engage the reverse thrust if necessary (this action will never be triggered by the autopilot). If the pilot makes no action, the aircraft will come to a complete stop.
If the pilot wants to take the control of the aircraft, he must disengage the autopilot. It looks obvious, but pilots often forget this and don't understand why they can't control the aircraft to leave the runway…

EFIS

Panel General Usage

The panel is composed of several windows that can be popped-up using the auto-hidden icon bar or the following keys:

- Shift-3 for the pedestal
- Shift-4 for the overhead panel
- Shift-5 for the MCDU

The icon bar is located in the bottom left area of the main panel, as shown here:

The icons are invisible to avoid disturbing the panel view. They become visible when the mouse is moved over the icon bar, and the hovered icon is highlighted in red. It is composed of 6 icons:

This icon lets you show/hide the pedestal window (similar to Shift-4). When the overhead panel is visible, you can click this icon again to hide it. You can also move the mouse over the top right corner of the overhead panel: a close icon appears which lets you close the overhead window.

Show/hide the pedestal window (equivalent to Shift-3). Just like for the overhead, the pedestal also has an auto-hidden close icon that appears only when the mouse is moved over it.

Show/hide the MCDU (similar to Shift-5). The MCDU also has an auto-hidden close icon.

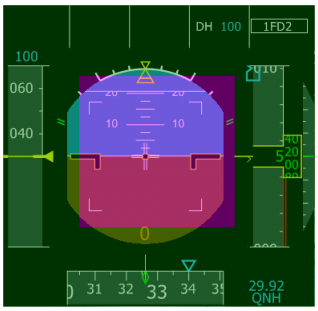
This icon shows/hides the zoomed panel view. This view displays the 3 main EFIS (PFD, ND, E/WD) in a large view that takes all the possible space and hides the standby instruments. The glareshield remains visible so that the pilot can still have access to the FCU, EFIS CP, …

Left/Right passenger views: These icons let you see your passengers see from the left/right of the aircraft. These views are very useful during replays.

EFIS Usage

All the EFIS (PFD, ND, E/WD and SD) are popable, detachable, resizable and their brightness is adjustable.

When you move the mouse in the any EFIS central zone, also called "active zone" (shown here in magenta), you can:



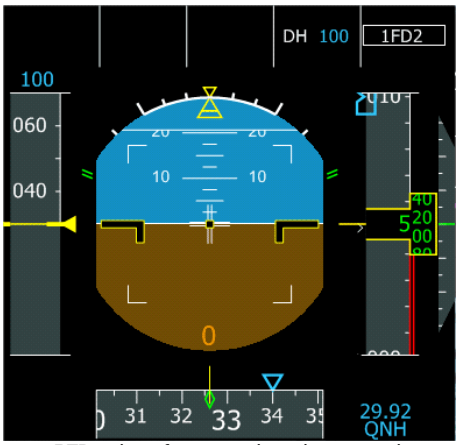
- Pop-up the EFIS by clicking with the left mouse button. When it is popped-up, you can drag it by clicking in the outer zone (shown in green) to move it around the screen or on an additional monitor if you have one. You can also resize it by dragging a border or a corner.
- Adjust the brightness by turning the mouse wheel.
- Reset the brightness by clicking the middle button (on many mice, this corresponds to clicking the wheel itself).

You can also use the number keys combined with Shift to pop-up an EFIS, which is especially useful when the EFIS is not visible on the screen (i.e. when an outside view is active):

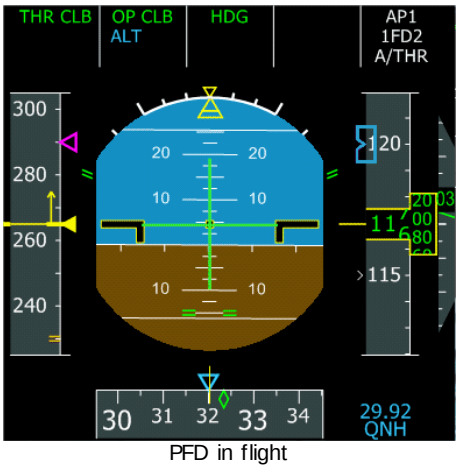
- Shift-6 for the PFD
- Shift-7 for the ND
- Shift-8 for the E/WD
- Shift-9 for the SD.

PFD – Primary Flight Display

The PFD shows all the essential information to fly the aircraft.



PFD, aircraft stopped on the ground



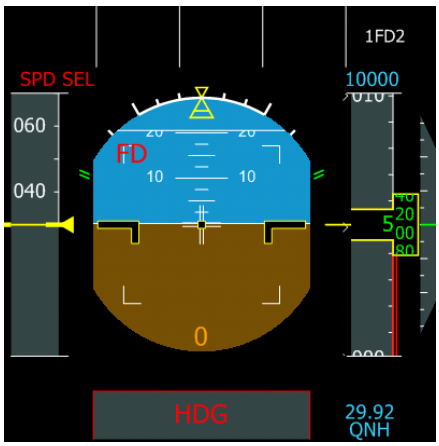
PFD in flight

It is composed of several parts:

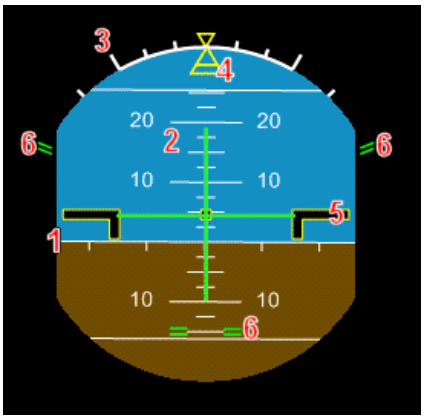
- Attitude indicator, also known as the artificial horizon (center)
- Flight director
- Speed indicator (left)
- Altitude indicator (right)
- Heading/Track indicator (bottom part)
- Flight mode annunciator (upper part)
- ILS guidance (localizer and glide slope)
- Radio-altitude

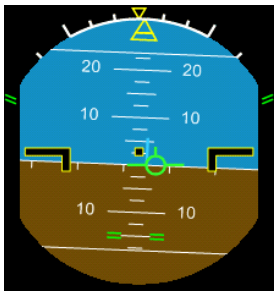
All these components will be described in this chapter.

If no IRS is aligned, some information is unavailable and can not be displayed on the PFD, which shows as following:



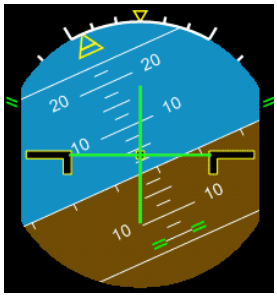
Attitude Indicator

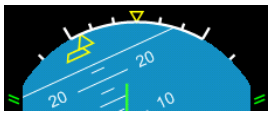




1 – Horizon line: representation of the horizon on the attitude indicator. Ticks are drawn every 10° to visualize the heading variation, especially useful during turns.
When the flight director is off, a vertical blue line on the horizon shows the heading or track selected on the FCU. This is very useful when landing manually with cross wind.

2 – Pitch indicator: the pitch indicator, also called "pitch ladder", shows the pitch angle, in degrees, with a line every 2.5 degrees. The image shows a pitch of approximately 5°.



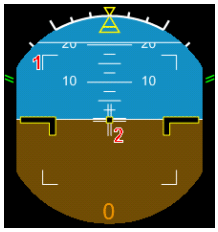


3 – Bank angle reference: on the top of the attitude indicator, ticks represent bank angles of 10, 20, 30 and 45°.
4 – Bank angle indicator: this yellow index moves as the aircraft banks. It can be moved in front of one of the tick to manage a turn with an accurate bank angle. This is especially useful to manage procedure turns when flying in manual mode.
The image shows a right turn with a maintained bank angle of 25°. The yellow bank angle indicator is also a side slip indicator. The bottom part slides on the left or right when the turn is not coordinated. This never happens in normal law because the fly-by-wire system handles the auto-coordination.

5 – Reference bars: two bars represent the aircraft wings. They are the pitch reference.
6 – Fly-by-wire limitations: the green lines show the limitations the fly-by-wire will respect. On the left and right of the attitude indicator, the green lines show the bank angle limitation (67° or 45° in normal law). On the pitch ladder, green lines show the +30°/-15° pitch angle limitation. In normal law, the fly-by-wire system will prevent the pilot from passing these limits.

The vertical and horizontal green lines are the flight director. It will be described later in this section.

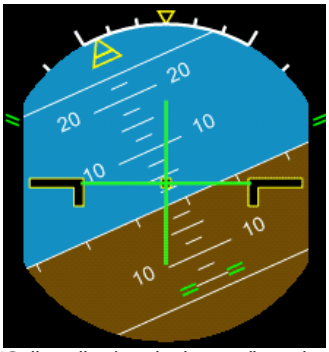
When the aircraft is on the ground with engines started, the sidestick position is shown on the attitude indicator:
1 – Maximum sidestick deviation box
2 – Sidestick position indicator



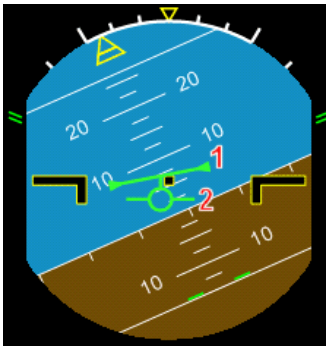
Flight Director

The flight director shows to the pilot the directions that must be taken to follow the aircraft guidance calculated by the FMGC. When the aircraft is flown manually, the pilot in command is in charge of following the flight director in order to fly the aircraft as it is supposed to be according to the FCU settings. When the autopilot is active, it will do exactly the same: it will command the aircraft to follow the flight director. If you want to fly the aircraft manually without taking the FCU settings into account, you should disconnect the flight director.
The fly-by-wire system automatically hides the flight director bars when the bank angle reaches preset limits.

The flight director has 2 different shapes, according to the guidance mode selected on the FCU:



In HDG/VS (heading/vertical speed) mode, the flight director shows a horizontal and a vertical trend bars to guide the aircraft on the vertical and lateral path.



In TRK/FPA (track/flight path angle) mode, the flight director is displayed as a line with 2 triangles (1) and the flight path vector, also called "the bird", is shown as an aircraft symbol (2). To follow the flight director in this mode, you should align the bird with the flight director symbol.

Some Advices

<u>Flight Director Usage:</u>
When the aircraft is flown by the autopilot, remember that the flight director is "the brain", and the autopilot is "the muscle". The FMGC and the flight director "think" and calculate the right flight control movements to guide the aircraft on the right trajectory, and the autopilot is in charge of moving the flight controls according to the orders given by the flight director.

This means you can replace the autopilot and fly the aircraft manually, following the directions provided by the flight director. Your actions on the sidestick will just replace the actions taken by the autopilot.

Many pilots say the flight director should be turned off when flying the aircraft manually. For example, imagine you plan to land on runway 25 at Paris Orly (LFPO). At the very last moment, you change your mind (or the ATC asks you to do so) and you have to land on runway 26 instead. In this case, no time to re-program the FMGC, you switch FD off and finish your approach on runway 26 manually, helped by the ILS.

Resetting the FCU:

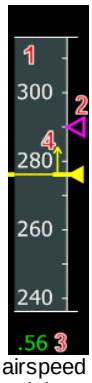
When you switch the flight director off, it clears the FCU memory. This is why many pilots switch the FD off and on at the very beginning of the flight, in order to reset the FCU and make sure no mode remains engaged because of the previous flight.

Choosing HDG/VS or TRK/FPA guidance mode:

The choice between these two modes is a matter of personal preference. Some pilots say that TRK/FPA mode should be used when flying the aircraft manually without using the flight director.

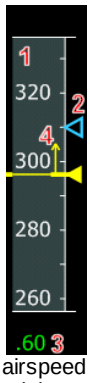
My advice is that you should make your personal experience. In my opinion, the TRK/FPA mode is very useful when you land manually with strong cross winds. You shouldn't use the auto-pilot and the autoland is such situation. Guiding the aircraft manually along its final approach trajectory is made easy by the use of the "bird" in TRK/FPA mode. First, set the TRACK value to the runway orientation. Then use the ILS indication to put the aircraft on the localizer and glide slope. When the aircraft is aligned with the ILS, you just have to keep the bird aligned with the heading vertical blue line (lateral guidance) and keep the bird on 3° on the pitch ladder(vertical guidance). Remember that the "bird" (flight path vector) shows you where the aircraft is actually going. This visual assistance helps you in following the ILS indication very easily. Try it, and you will appreciate it, even with strong cross winds.

Speed Indicator



The current airspeed is 276 knots (Mach 0.56) and the target speed is 290 knots (managed).

The current airspeed is 296 knots (Mach 0.59) and the target speed is 250 knots (selected).



The current airspeed is 298 knots (Mach 0.6) and the target speed is 310 knots (selected).

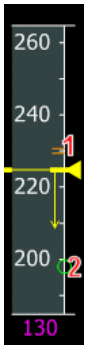
Standard Information

1 – Scrolling speed tape. The minimum airspeed shown here is 40 knots.
2 – Target speed entered on the FCU (if selected) or managed by the FMGC. The triangle index that shows the target speed is magenta if the speed is managed and blue if the speed is selected.
If the target speed value is not visible on the speed tape, it is displayed above the speed tape if higher than the highest displayed speed, and below if it is lower than the lowest displayed speed. Again, it is displayed in magenta if managed and in blue if selected.
3 – Mach speed. It is shown only when mach speed is greater or equal to 0.50.
4 – Speed trend: shows the airspeed the aircraft will have in 10 seconds.

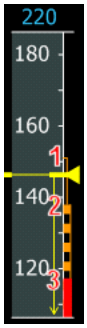
Additional Information

The speed tape also shows additional information:

- VFE NEXT (1)
  This is the VFE (maximum speed with flaps extended) that corresponds to the next flap/slat position. You should make sure the actual airspeed is below VFE NEXT before extending more flaps.
  It is shown with an amber = sign.

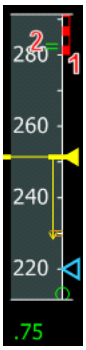


- Green dot speed (2)
  It is shown with a green circle on the speed tape. It is the best lift over drag speed. In clean configuration, it is the maneuvering speed.
  It is used as the target speed during single engine climb and during expedite climb.
- At low speeds, the minimum safe speeds are displayed
  - VLS (1)
    It is shown with an amber line next to the speed tape. It is the lowest selectable speed. If the pilot selects a speed below VLS, the autothrust system limits the speed to VLS.
  - Alpha Protection (2)
    The alpha protection system will trigger when the airspeed reaches this value. It is displayed as black and amber rectangles next to the speed tape.

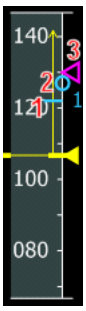


- Alpha max (3):
  This speed corresponds to the maximum angle of attack.
  It is shown as a red ribbon.

- At high speeds, the maximum speeds are displayed
  - VMAX (1)
    This is the maximum speed the aircraft can take, depending on its configuration. It is shown by a red scale on the speed tape:
    - VMO/MMO in clean configuration
    - VLE if landing gear is extended
    - VFE is flaps/slats are extended (varies with the flap configuration)
  - Max speed = VMO + 6 knots (2)
    Speed at which the fly-by-wire system will take corrective actions to reduce speed.

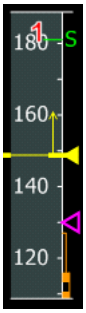


- During take off
  - V1 (1), speed at which takeoff can not be aborted
    shown with a '1' and a blue line
  - VR (2), rotation speed
    shown as a blue circle
  - V2 (3), speed at which the aircraft can climb safely
    shown as a magenta triangle (target speed)



- In flight:
  - Maneuvering speed:
    This is the normal procedure speed that depends on the aircraft configuration:
    - Green Dot speed in clean configuration
    - S speed (1) if slats are deployed (flap handle in position 1)
    - F speed if the flaps are deployed (flaps in position 2, 3 or FULL)

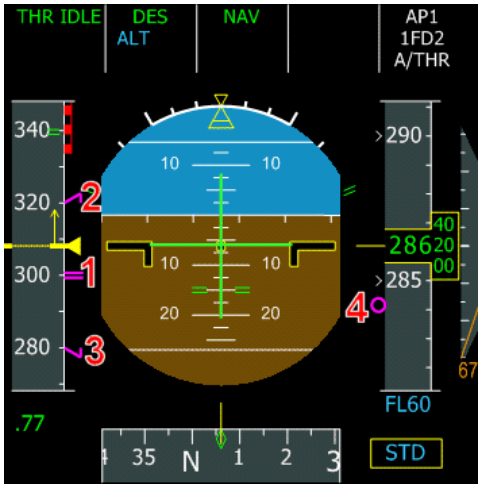
    The maneuvering speed is not a minimal speed (you can fly the aircraft below this speed), but it is the "standard" speed that should be used for procedures such as holding patterns or final approach.
    If the speed is managed during approach, the maneuvering speed will be used as the target speed.
    ➡ <u>Note</u>: If you fly the aircraft below the maneuvering speed, the autopilot bank angle will be automatically limited to 15°, instead of 25° in normal conditions.



When the autopilot and autothrust are active, the actual target speed will never be higher than the current maximum speed, and it will never be lower than VLS.
For example, if you select a speed of 250 knots on the FCU when the landing gear is extended, a target speed of 210 knots (VLE) will be taken into account by the FCU.

Managed Descent Information

In the managed descent mode, the PFD displays additional speed information. During a managed descent, the FMGC is allowed to adjust the target speed by +/-20 knots around the target speed. This is shown on the speed tape as follows:



1 – The target speed (300 knots in this example)
2,3 – The minimum and maximum speed the aircraft can take to stay on the computed descent path.
4 – Vertical path indicator (refer to the altitude tape section for more information)

Refer to the Autoflight section for more information about the managed descent.

Altitude Indicator

The altitude tape displays the altitude just like the speed tape displays the speed.

Altitude tape when the aircraft is on the ground.

Altitude tape (in flight) showing the FCU target altitude.

Altitude tape during descent.

1 – Current altitude value shown in the altitude window. The altitude is shown in green in normal conditions, in amber when the aircraft altitude is below the MDA (Minimum Descent Altitude, entered in the MCDU).
The yellow frame flashes when the aircraft is near the target altitude. It is amber when the aircraft is too high or too low according to the FCU altitude mode.
2 – Red ribbon showing the ground altitude.

3 – FCU target altitude: this symbol is shown in blue, except when the target altitude is limited by an altitude constraint on the next waypoint. In this case, it is magenta.
When the target altitude is higher than the highest altitude displayed (or lower than the lowest altitude displayed), the target altitude is displayed numerically above (or below) the altitude tape. It is displayed or in flight level, depending on the altimeter setting.
4 – During the descent, the magenta circle shows the deviation between the current altitude and the computed descent path.
5 – In this case, the target altitude is lower than the lowest displayed altitude, so it is displayed below the tape altitude. As the aircraft is above the transition altitude, the target altitude is displayed in flight level.

Vertical Speed indicator

It is located on the right of the altitude indicator. It shows the current vertical speed with a needle and a numerical value (in hundreds of feet per minute).

The vertical speed indicator turns amber when the vertical speed is too important. The maximum vertical speed depends on the aircraft configuration.

Heading Indicator

1 – Heading reference line (yellow) that shows the current aircraft heading.
2 – Track: the green diamond shows the current track, which is the direction in which the aircraft really flies. There is no difference between heading and track when the wind is null. On this example, there is a light crosswind from the right.
3 – Triangle showing the FCU target heading. It is hidden if the heading is managed.
If the target heading is out of the heading indicator range, it is displayed on the left or on the right (6).
4 – Magenta cross showing the ILS course.
5 – If the ILS course is out of the current heading range, it is displayed in magenta in a window on the left or the right of the heading tape.

Flight Mode Annunciator (FMA)

It is located on the top part of the PFD. It is the most important indicator to know in what mode the aircraft is currently flying.

It is composed of 5 columns. The first column shows the speed guidance mode. The second and third columns show the vertical and lateral guidance modes. Refer to the Autoflight section to know more about speed guidance, vertical and lateral guidance.

The fourth column shows the approach mode:

- Line 1: Category of the current ILS approach, if any. It is CAT 1 if the aircraft is flown manually or CAT 3 if the autopilot is engaged
- Line 2: SINGLE or DUAL depending on the number of autopilots engaged during an ILS approach.
- Line 3: Decision height (DH) or the minimum descent altitude (MDA) entered in the MCDU. If a value has been entered in the MCDU, it is displayed on the FMA when the aircraft is within 200 NM to the destination.

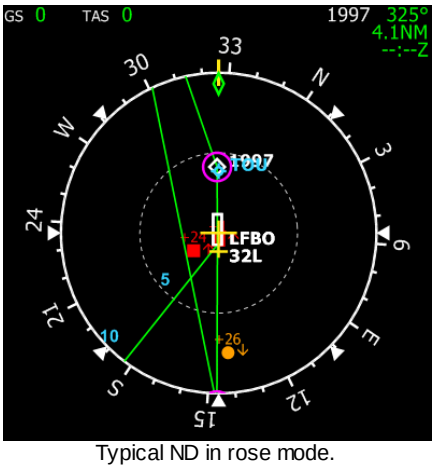
The last column shows the automatic modes:

- Line 1: Autopilot mode: AP1 for the first autopilot, AP2, for the second autopilot, AP1+2 for both.
- Line 2: Flight Directors: 1FD for the captain FD, FD2 for first officer FD, 1FD2 for both.
- Line 3: Autothrust status: A/THR is displayed in blue if autothrust is armed, in white if autothrust is engaged.

➡ The crew should <u>always</u> look at the FMA to know the autothrust status. The A/THR light on the glareshield turns on when the autothrust is armed <u>or</u> engaged. Only the FMA shows the exact autothrust status.

ND – Navigation Display

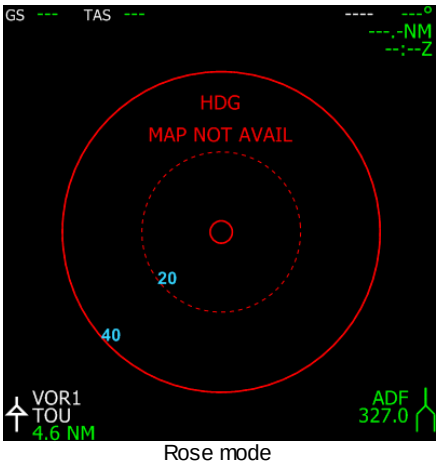
The ND is designed to show the aircraft along the programmed flight plan.



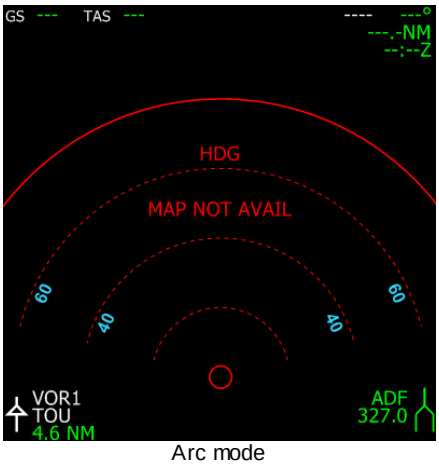
Typical ND in rose mode.

Typical ND in arc mode.

If no IRS is aligned, the ND looks like this:



Rose mode



Arc mode

EFIS Control Panel

The ND can be used in different modes, selected on the EFIS Control Panel located on the glareshield:

This control panel is composed of 5 selection pushbuttons that are used when the ND is in NAV, ARC or PLAN mode to show/hide elements in the aircraft vicinity:
1 – Constraint pushbutton (CSTR): This button is used to show/hide the waypoint constraints on the waypoints where a constraint is defined. A waypoint that has a constraint is drawn with a magenta circle, and altitude and/or speed constraints are displayed with numbers.
2 – Waypoint pushbutton (WPT): Show/hide the intersections on the ND. The intersections are represented as magenta triangles.
3 – VOR/DME pushbutton (VOR.D): Show/hide the VOR, DME or VOR-DME.
4 – NDB pushbutton: Show/hide the NDB stations (non-directional beacons), represented as magenta circles.
5 – Airport pushbutton (ARPT): Show/hide the airports, drawn with magenta stars. The departure/arrival airport is drawn as a white start, until the departure/arrival runway is defined.
Only one pushbutton can be selected. When the pilot presses one of them, the others are deselected. If he presses a selected button, it turns off.

The EFIS control panel also has 2 rotating knobs:
6 – Mode selector: ILS, VOR, NAV, ARC or PLAN. It lets the crew select the ND mode, explained later in this section.
7 – Range selector (from 10 to 320 NM): It lets you select the ND range.

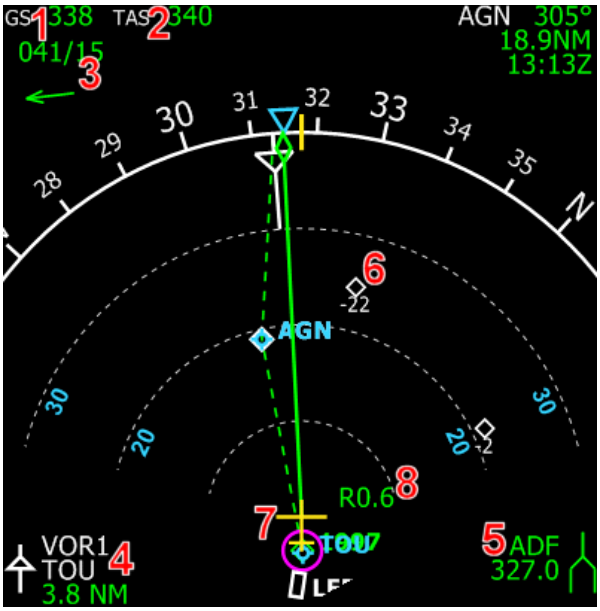
The EFIS control panel also selects the navaid information displayed on the ND:
8 – Left navaid selection: It can be ADF, VOR or nothing. The left navaid information is displayed on the ND bottom left corner.
9 – Right navaid selection: It can be ADF, VOR or nothing. The right navaid information is displayed on the ND bottom right corner.

ND Modes

		<u>ILS Mode:</u> The ILS needle is displayed in magenta with the course deviation indicator and the glideslope indicator. The ILS name, course and frequency are displayed in the top right corner. TCAS information is visible.
		<u>VOR Mode:</u> The VOR1 needle is displayed in blue with the course deviation indicator. The VOR1 name, course and frequency are displayed in the top right corner. TCAS information is visible.
		<u>NAV Mode:</u> The flight plan entered in the FMGC is displayed in ROSE mode. The next waypoint name, bearing, distance and estimated time of arrival (ETA) is displayed in the top right corner. TCAS information is visible.
		<u>ARC Mode:</u> The flight plan is displayed in ARC mode. The next waypoint is displayed in the top right corner like on NAV mode. On this example, the surrounding waypoints are also displayed (the WPT button is lit on the EFIS CP).
		<u>PLAN Mode:</u> The flight plan is displayed. The reference waypoint displayed in the center is the waypoint selected on the second line of the MCDU Flight Plan page. You can visualize all the flight plan by scrolling the waypoint on the MCDU FPLN page.

General Information

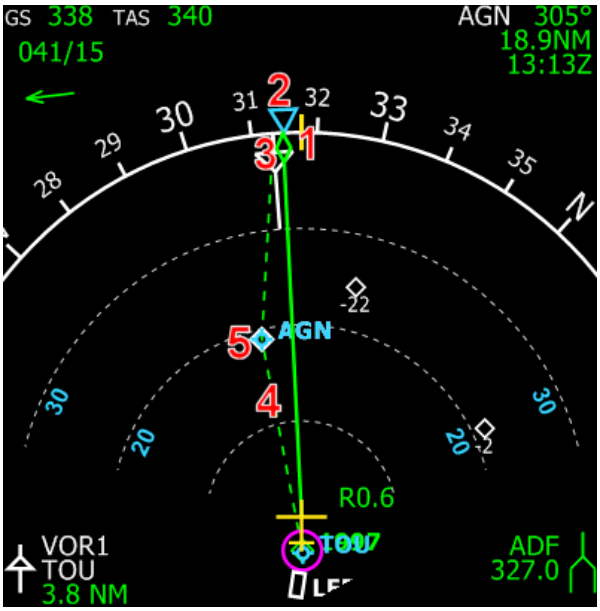
The ND also shows permanent information that appears in all modes except PLAN mode.



1 – Ground speed (GS): This is the aircraft speed relative to the ground. This information is visible only when at least one if the IRS is aligned (if you are in Beginner mode, the IRS are always aligned).
2 – True Air Speed (TAS): This is the real aircraft airspeed. It is different from the Indicated Air Speed (IAS) because the IAS varies with altitude (the air is thinner at high altitudes). If there is no wind at all, the TAS is equal to the GS. Just like for the GS, the TAS is not accessible if no IRS is aligned, unless you are in Beginner mode.
3 – Wind Speed & Direction: This indicator provides the wind speed (in knots) and the heading from which it comes. It is displayed with numbers and with a rotating arrow that represents the wind direction.
4 – Left Navaid: The left navaid symbol, type, name/frequency and distance are shown. If the navaid name is extracted from the signal received on the corresponding frequency. If a name is extracted, it is displayed on the ND, otherwise the frequency is displayed. The navaid type (VOR, ADF or nothing) is selected on the EFIS control panel.
5 – Right Navaid: Same as above for the right navaid.
6 – TCAS: The ND also shows TCAS information. Refer to the TCAS section to know more about this system.
7 – Aircraft Symbol: It represents the current position of the aircraft. It is always used as the center reference of the ND, except in PLAN mode.
8 – Lateral deviation: If the aircraft is not on the programmed route, this number shows the lateral deviation (in NM) between the aircraft and the route.

Navigation Information

The ND displays some navigation specific information.



1 – The vertical yellow line shows the current aircraft heading.
2 – Autopilot heading: The blue triangle shows the target heading selected on the FCU. If the heading is managed, this triangle does not appear.
3 – The green diamond shows the current track, which is the direction in which the aircraft is actually flying. In this example, as the wind comes from the right, the track is on the left of the heading. If there is no wind, the heading and the track are the same.
If the heading is selected, a full green line is drawn from the aircraft position to the track diamond to visualize the aircraft trajectory.
4 – The flight plan entered in the FMGC is drawn in green. If the heading is in managed mode, it is a solid green line. If the heading is selected, it is a dashed green line.
The flight plan waypoints are represented with green diamonds, except the next waypoint, which is drawn in white.
5 – Auto-tuned navaid: When the FMGC auto-tunes the VOR1 or VOR2 navaid, it is displayed in blue on the ND. In this example, AGN is the auto-tuned VOR2 and it is the next waypoint. This is why AGN is drawn both in white and in blue.

Flight Plan Information

Runways

If the crew has not defined the departure/arrival runways, the departure/arrival airports are displayed as white stars.
When the runway information is entered in the MCDU, the runways are represented on the flight plan display as a white rectangle. The rectangle length and orientation represent the actual runway length and orientation.

Waypoints

The flight plan waypoints are displayed as green diamonds. The next waypoint of the flight plan is shown in white and its information (name, distance, ETA) is shown in the top right corner.

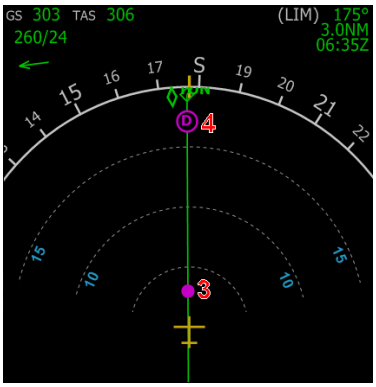
Constraints

If a waypoint has a speed or altitude constraint, it is represented with a magenta circle (1). If the crew wants to have more information about the constraints, the CSTR button of the EFIS control panel can be pressed to activate the constraint display for each constrained waypoint. The altitude and/or speed constraint is then displayed in magenta (2).

Pseudo-Waypoints

The pseudo-waypoints are displayed with specific symbols:
1,2 – A white arrow shows the computed top of climb (1) and top of descent (2).

3 – A magenta point shows a speed limit waypoint where the aircraft will have to respect a speed limit. Usually, there is a speed limit of 250 knots below 10,000 feet.
4 – A magenta circled 'D' represents the deceleration waypoint. This is the waypoint where the aircraft will decelerate to the green dot speed and the approach phase will be activated.


GS 303 TAS 306
260/24
(LIM) 175°
3.0NM
06:35Z
S
14
15
16
17
19
20
21
22
D
4
3
15
10
10
15

E/WD – Engine/Warning Display

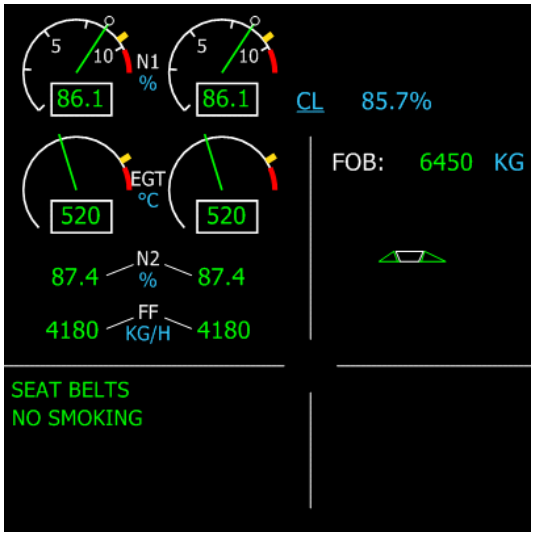
This EFIS shows the important engine information and displays warning and alert messages.

General Information

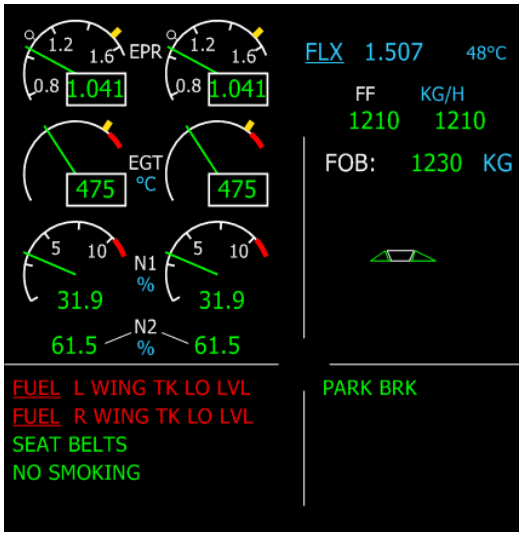
It can be presented with various layouts, depending on the panel generation and on the engine type. The following table shows the correspondence between the engine type (on all the Airbus Series aircrafts) and the E/WD logic:

Aircraft	Engine Type	E/WD logic
A318	CFM56-5	N1
	P&W 6000	EPR
A319/320/321	CFM56-5	N1
	IAE V2500	EPR
A330-200/300	GE CF6-80C2	N1
	P&W 4000	EPR
	RR Trent 700	EPR
A340-300	CFM56-5	N1
A340-500/600	RR Trent 500	EPR

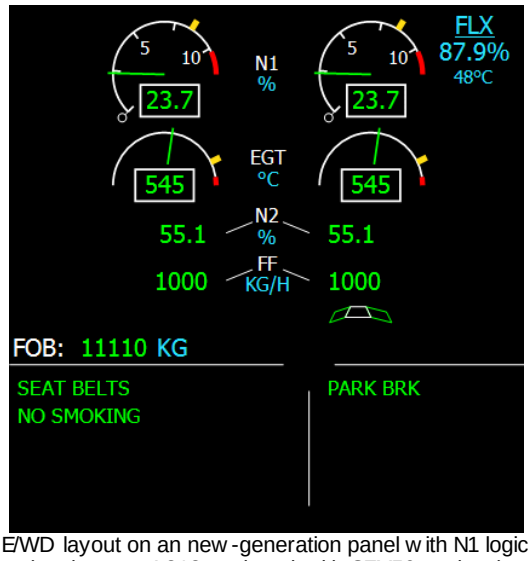
According to the E/WD logic and the panel generation, the E/WD looks like the following images:



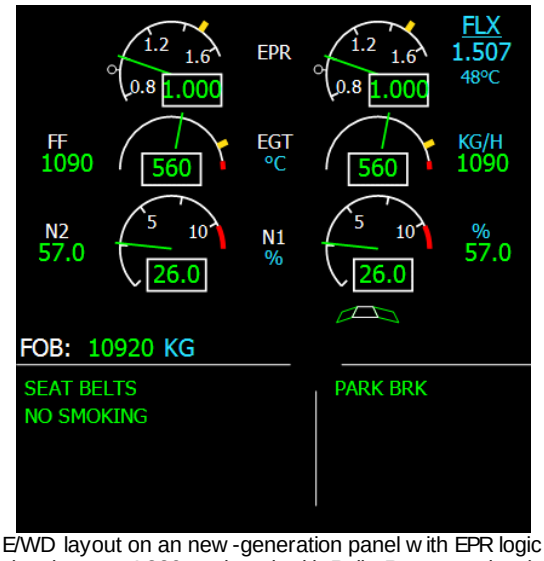
Typical E/WD layout on an old-generation panel with N1 logic (such as an A320 equipped with CFM56 engines)



E/WD layout on an old-generation panel with EPR logic (such as an A320 equipped with IAE engines)

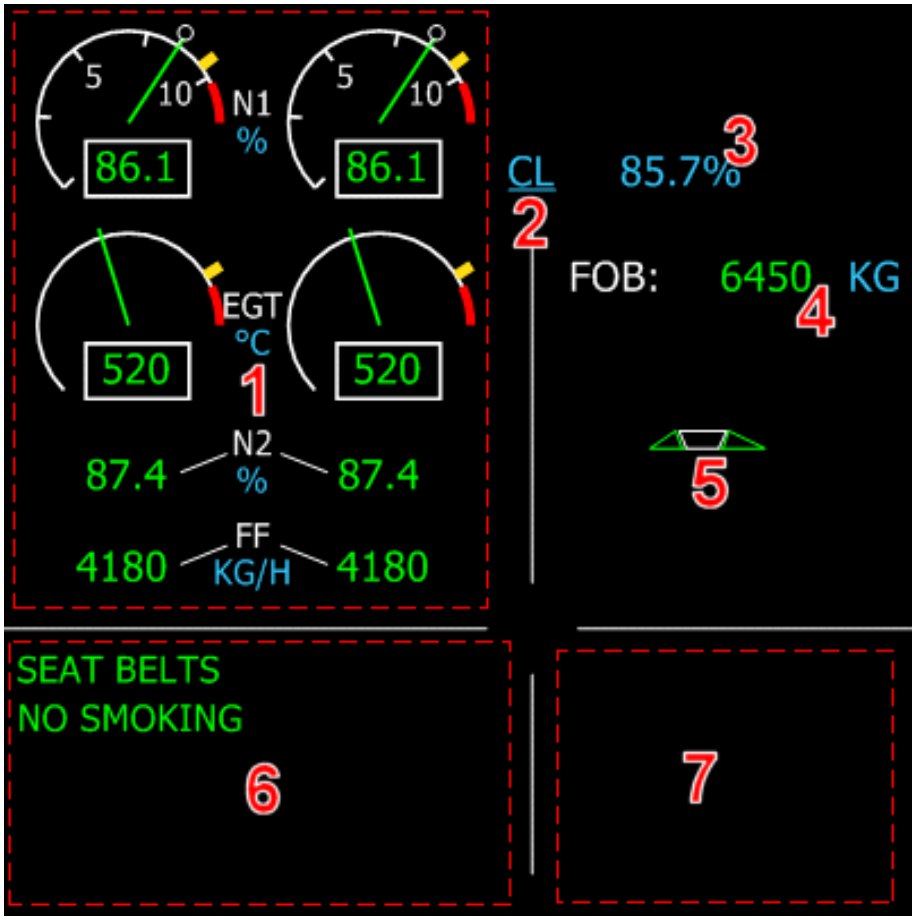


E/WD layout on an new-generation panel with N1 logic
(such as an A318 equipped with CFM56 engines)

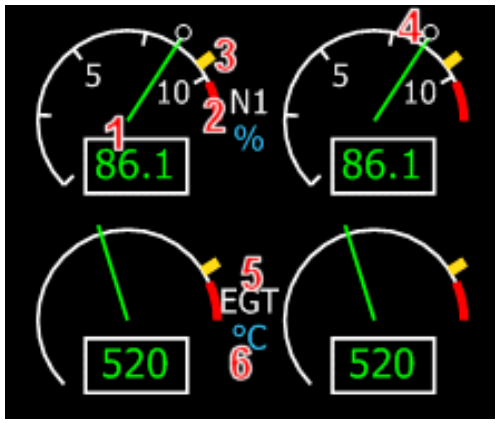


E/WD layout on an new-generation panel with EPR logic
(such as an A330 equipped with Rolls-Royce engines)

Whatever the layout, the E/WD shows the important engine information and the warning/alert messages.



1 – This area is dedicated to the engine information. It varies depending on the panel generation and the engine type. In every case, the information that is used to command the engine is displayed first. It can be N1 or EPR.



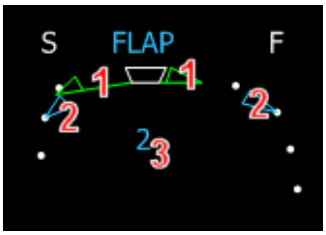
This example shows a CFM56 engine E/WD, managed by N1:
1 – For each information, the current value is shown with a needle and a numerical value. They are green if the value is normal, amber if the value is too high.
If a value is not available, amber XX are displayed.
2 – The red zone shows the maximum value that should never be reached. If by any chance the value overpasses the maximum, a red bar shows the maximum value that was reached. It can be cleared only by maintenance on the ground.
3 – The yellow bar shows the maximum value you can get if you push the thrust levers to the TOGA detent. It is computed by the FADEC (Full Authority Digital Engine Control).
4 – The white ball shows the current position of the thrust levers. When they are in the manual range, their position determines the required thrust, and the FADEC computes the corresponding N1 or EPR that corresponds to this request.
5,6 – For each information, the name is indicated in white, and the unit is in blue. On this example, N1 is displayed in % and EGT (Exhaust Gas Temperature) in °C.

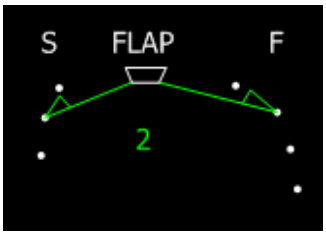
2 – The current thrust mode is shown in underlined blue. This display depends on the position of the thrust levers. If they are not in a detent, nothing is displayed here, except when you set the FLEX temperature when the aircraft is on the ground. In this case, 'FLX' is shown here to indicate that a FLEX takeoff can be executed.

3 – The thrust value that corresponds to the thrust mode is displayed here. It is a N1 value (in %) for the N1 driven engines, or an EPR value. It is regularly updated by the FADEC because it depends on the aircraft altitude and the external temperature. If the autothrust system is active, the engine thrust will be commanded to maintain this value, according to the thrust mode.

4 – The Fuel on Board (FOB) quantity is displayed here, in kg or in lbs (depending on the setup). It is the total quantity of fuel available in the aircraft. If the total quantity of fuel is not usable, an amber mark is displayed below the FOB (this can happen if a fuel pump fails).

5 – The flaps (F) and slats (S) position is displayed graphically here:



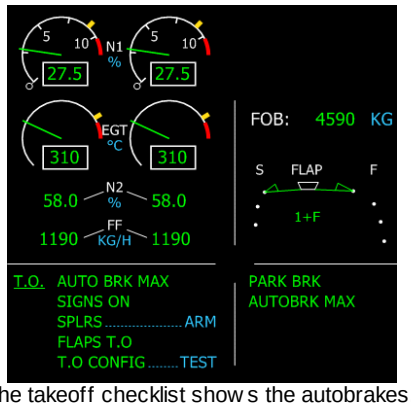


1 – The current flap and slat position is displayed in green.
2 – The target flap and slat position is shown in blue when the flaps or slats are moving. This depends on the flap handle position.
3 – The target position is displayed in blue when the flaps or slats are moving, and in green when they don't move.

6 – Warning/Alert area:

It is dedicated to warning and alert messages. Their color depends on the severity: green messages are for information, amber messages are warnings and red messages are serious alerts. Please refer to the system section for more information about the messages that can be displayed here.

This area is also used to display the take off and landing check-lists. They show a list of item that must be checked before takeoff/landing. Each item is shown in blue until the corresponding action is taken and in green if the item status is correct.



The takeoff checklist shows the autobrakes, the signs (seat belts/no smoking) and the flaps are correctly set for takeoff, but the spoilers should be armed and the takeoff config should be checked prior to takeoff.

7 – Status message area:

Like for the warning/alert messages, their color depends on the message severity. The only exceptions are the takeoff and landing inhibit messages, which are displayed in magenta. These messages indicate that low severity alerts are inhibited during takeoff and landing to avoid catching the attention of the crew during these flight phases.

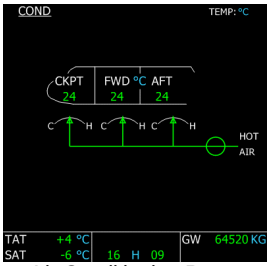
SD – System Display

The content of this EFIS depends on the ECAM Control Panel located on the pedestal. If no page is selected on the ECAM CP, the page displayed on the SD is automatically selected according to the flight phase and the possible alerts. The system automatically displays the right page at the right time.

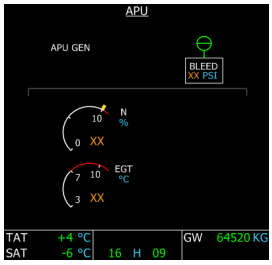
Whatever page is displayed, the SD also shows common information in the bottom part of the screen.

1 – TAT: Total Air Temperature, in °C
2 – SAT: Saturated Air Temperature, in °C
3 – Clock (UTC time)
4 – GW: Gross Weight, in kg or lbs (depending on the unit system selected on the configuration page). The gross weight is computed by the FMGC according to the data entered in the MCDU INIT pages. If no data was entered, the FMGC is unable to calculate the gross weight and amber XX is shown.

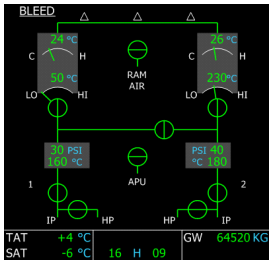
For information, all the SD pages are shown here. They are detailed in the aircraft system section.



Air Conditioning Page

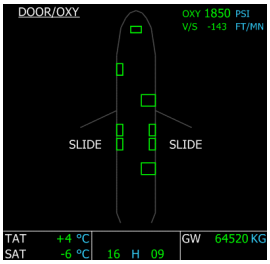


APU Page

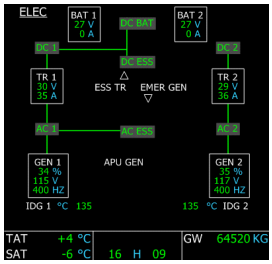


Air Bleed Page

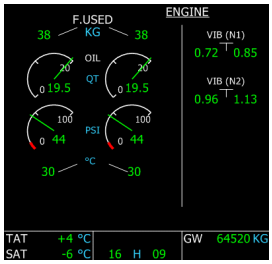
Cabin Pressure Page



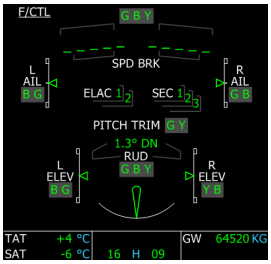
Door Page



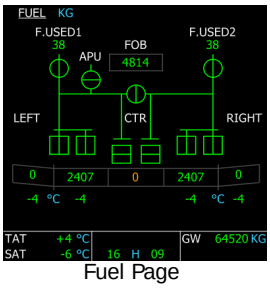
Electricity Page



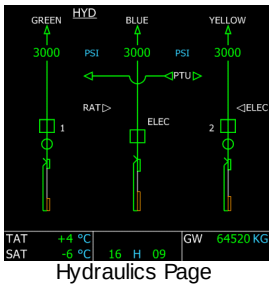
Engine Page



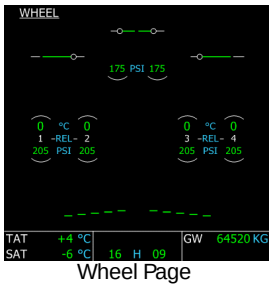
Flight Controls Page



Fuel Page



Hydraulics Page



Wheel Page

SYSTEMS

This section describes all the aircraft systems. Most of them are controlled trough the overhead panel and can be monitored on the various SD pages.
You should always keep in mind that this aircraft is based on the “dark cockpit” philosophy. It means that when no light is on, everything is all right.

ECAM Control Panel

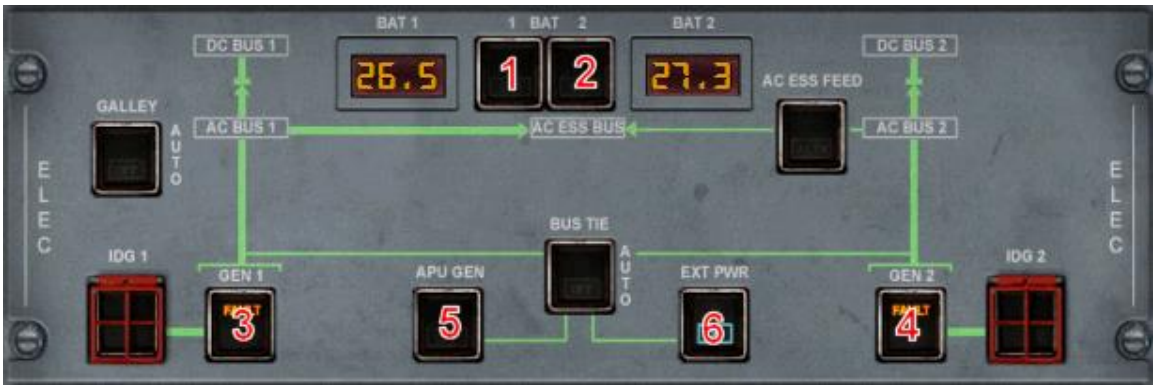
The SD EFIS is here to provide information about the aircraft systems. The SD page to display is automatically selected when needed. For example, when the crew starts the APU, the APU page is automatically displayed during the starting sequence.
If the crew wants to display a page at any time, the ECAM control panel should be used. It is located on the upper part of the pedestal. It includes one key for each page. If the pilot presses one key, the associated light turns on and the corresponding page is displayed on the SD. To give the control back to the system, the pilot can press the same key again. The light then turns off, which means the system will automatically select the appropriate page when necessary.

1 – TO CONFIG: This button is used to check the takeoff configuration prior to departure. It checks some elements of the aircraft configuration to make sure everything is OK for takeoff.
2 – ENG: The engine page displays information about the engines.
3 – BLEED: This page shows information about the air bleed system.
4 – PRESS: This page displays information the cabin pressurization system.
5 – ELEC: The electricity page shows the aircraft electric circuit.
6 – HYD: This page displays the hydraulic system.
7 – FUEL: The fuel page shows the fuel information with all the aircraft fuel tanks.
8 – APU: This page shows information about the APU.
9 – COND: Shows information about the air conditioning.
10 – DOOR: This page shows the aircraft door status.
11 – WHEEL: This page shows the wheel and brake status.
12 – F/CTL: The flight control page shows the position of all the flight controls and the flight control computer status.

13 – STS: The status page shows the current failure status.

Electricity

The electricity circuit can be controlled from the overhead ELEC section.



1,2 – Battery switches. They are dark when batteries are on (default). The battery voltage is displayed next to each switch.
3,4 – Generator switches. They are dark when in use. They are in fault when the corresponding engine is not running. An 'OFF' white light is visible if a generator is turned off.
5 – APU Generator. This switch controls the electric power that comes from the APU. It is on by default.
6 – When an external power is available, a green 'AVAIL' light turns on. The crew can then press this button to use this electricity source and 'ON' appears in blue.

Batteries

This aircraft is equipped with 2 batteries that can provide electricity for a limited time. As soon as an external source is provided, the batteries are charged if necessary.
Each battery voltage is displayed on the overhead panel. When the aircraft is cold and dark, the batteries should be turned on first, even if a ground power unit is available.

Auxiliary Power Unit (APU)

The APU is capable of providing electricity for the aircraft. A specific section is dedicated to the APU later in this chapter.
When the aircraft is cold and dark and no ground power unit is available, the APU should be turned on as soon as possible because batteries can only provide electricity for a limited time.

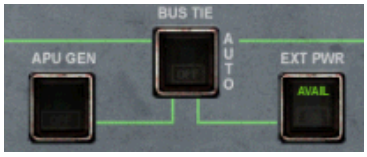
Generators

The generators provide electricity from the engine rotation. As soon as an engine is started, its generator can be used to provide electricity to the aircraft and the APU and GPU can be turned off.

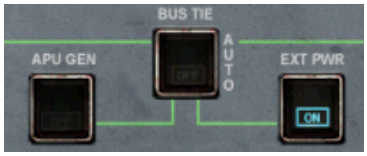
When the engines are stopped, the generators are in fault mode because no energy can be provided. When the engines start, make sure the generators are turned on.

Ground Power Unit (GPU)

When the aircraft is parked on the ground, a ground power unit can be plugged to the aircraft to provide electricity without needing to burn any fuel.
This is simulated in this aircraft. When you are parked on the ground, with parking brakes set and engines stopped, the ground power unit is available 1 minute after the engines have stopped. The external power (EXT PWR) switch then shows the GPU is available.



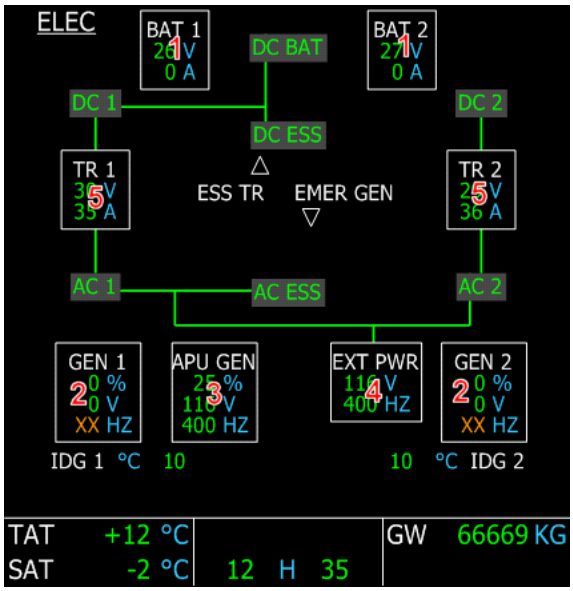
At this time, the crew can press the EXT PWR switch to use this energy source. A blue 'ON' light then turns on on the EXT PWR switch.



As soon as the aircraft moves on the ground, the external power is not available any more.

ELEC Page

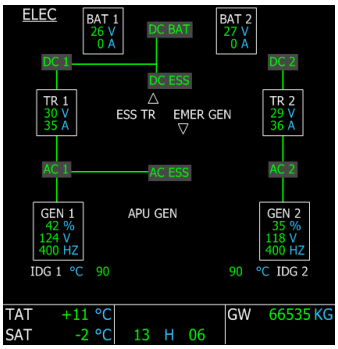
The electric circuit can be monitored through the ELEC page.



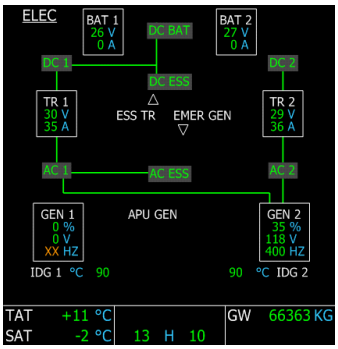
1 – The white boxes show each battery status, with voltage and current.
2 – Generators associated to engines 1 and 2. Each white box shows the generator load, the voltage and the frequency (amber XX are shown if the corresponding engine is stopped).
3 – APU GEN: This box is visible as soon as the APU is running and the APU GEN switch is on.
4 – EXT PWR: This box is visible as soon as a GPU is available and provides electricity.

Possible Electric Configurations

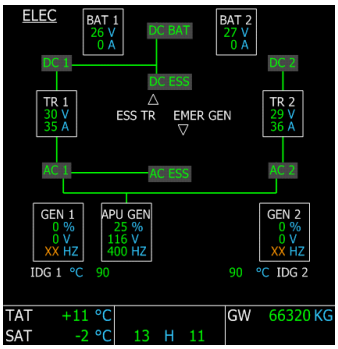
The generators provide energy with the highest priority. In flight, the standard configuration is the following, with batteries and generators on, APU and GPU off:



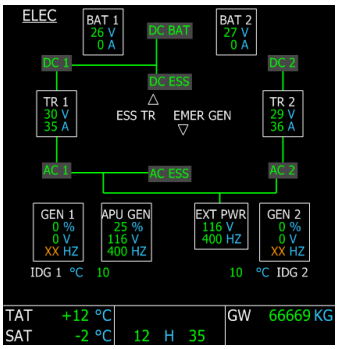
In case of an engine failure, the associated generator can not provide energy any more, so the other engine provides AC current to the whole sytem:



If the generators are off or the engines are stopped (when parked on ground for example), the external power source (GPU) has the priority. If it is not available, the APU is supposed to provide energy, as shown here:



As soon as the external power becomes available and is selected by the crew as the energy source, it takes the priority over the APU. The APU source is still available, but it is not used:



Alerts & Warnings

Message	Color	Reason
ELEC BAT 1 OFF	Amber	Battery 1 has been turned off.
ELEC BAT 2 OFF	Amber	Battery 2 has been turned off.
ELEC GEN 1 OFF	Amber	Generator 1 is off while engine 1 is running.
ELEC GEN 2 OFF	Amber	Generator 2 is off while engine 2 is running.

Hydraulics

The hydraulic system is controlled through the 'HYD' section of the overhead panel. This aircraft has 3 independent hydraulic circuits for redundancy, designated Green, Blue and Yellow. Green and Yellow circuits are associated to engines 1 and 2 and the Blue circuit is pressurized by an electric hydraulic pump.

1,2 – An hydraulic pump is associated to each engine. These switches allow the crew to switch an engine pump off. If an engine is stopped, the corresponding hydraulic pump is in fault mode.
3,4 – In addition, 2 electric pumps can be run to provide hydraulic pressure even if all engines are stopped. In standard configuration, the Blue electric pump is on and the Yellow electric pump is off.
5 – The Power Transfer Unit (PTU) can be turned off through this switch. The PTU is detailed later in this section.

When the engines are stopped, the hydraulic overhead section looks like this:

Power Transfer Unit (PTU)

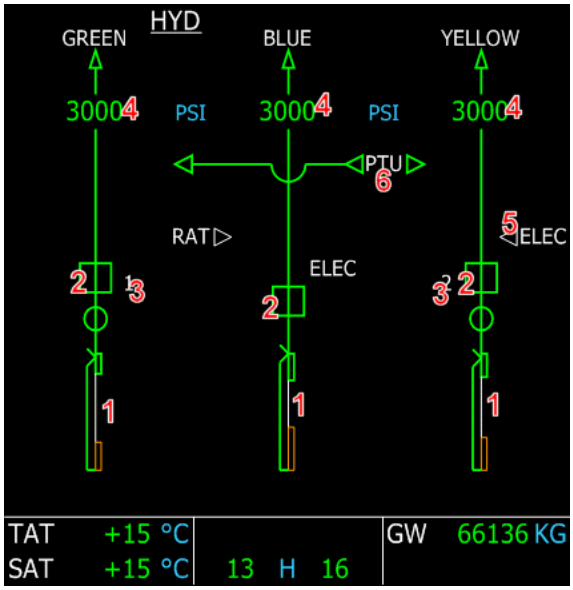
When only 1 engine is running, the remaining engine can provide hydraulic power to the whole system through the Power Transfer Unit. For example, if engine 1 is stopped, the

Green hydraulic circuit is not pressurized any more and the hydraulic pressure decreases. When it is lower than a specific threshold, the PTU enters in action to transfer hydraulic pressure from the Yellow circuit to the Green circuit, allowing all the hydraulic systems to keep working.
The PTU can easily be heard because it generates a very typical sound that the passengers can hear in the cabin.

Note: The PTU does not enter in action if the parking brakes are set. This is done to avoid having the PTU running when the engines are started one after the other.

HYD Page

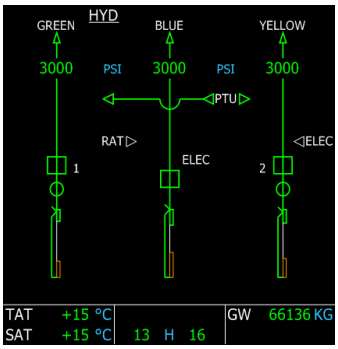
The hydraulic system can be monitored on the HYD SD page.



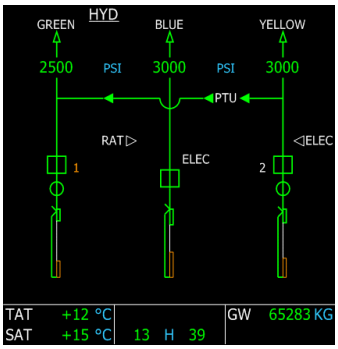
1 – The 3 hydraulic reservoirs, with an arrow showing the level.
2 – The 3 hydraulic pumps. Their status depends on the pump switches located on the overhead panel.
3 – Engine references, which show the Green circuit depends on engine 1, and Yellow depends on engine 2. They are shown in amber if the corresponding engine is off.
4 – The 3 engine pressures, displayed in pound per square inch (PSI). It turns amber if the pressure is too low.
5 – Yellow electric pump status. The white triangle appears filled amber if this pump is turned on through the overhead panel.
6 – PTU status shows how the PTU is currently used, displayed in amber if the PTU is off.

Possible Hydraulic Configurations

In standard configuration, with all engines running, it appears like this:

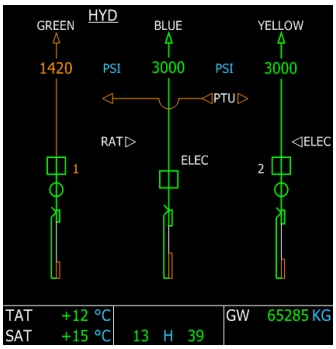


If an engine fails and the corresponding hydraulic circuit pressure drops, the PTU enters in action to provide the missing pressure. On this example, engine 1 is stopped (shown with an amber '1'):



The PTU arrows show that hydraulic pressure is transferred from the Yellow to the Green hydraulic circuit, and the typical PTU motor sound can be heard in the cabin.

If the PTU is turned off through the overhead panel switch, the PTU arrows appear amber and the Green hydraulic pressure keeps decreasing. When it reaches a low level, it is displayed in amber to indicate a potential danger:



Alerts & Warnings

A green status message 'HYD PTU' appears on the E/WD when the PTU is active.

Fuel

The fuel system can be controlled through the FUEL overhead section.
The aircraft has fuel tanks in the wings and in the center fuselage. For each tank section, 2 fuel pumps are available.
The fuel system manages the fuel automatically. Fuel is pumped in the center tank in priority, then in the wing tanks when center tank is empty.

1 – 2 switches are available for the 2 left fuel pumps.
2 – Center fuel pump switches.
3 – Right fuel pumps switches.
4 – Cross feed switch.

According to the dark cockpit philosophy, no switch light is visible when everything is OK, which is when all the fuel pumps are on.

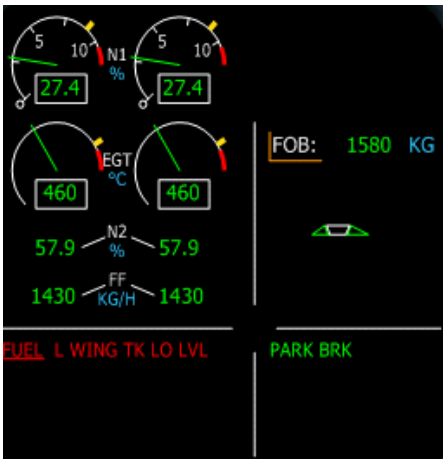
Fuel Pump Usage

The fuel pumps should always be on. If a fuel tank becomes empty, the corresponding fuel pump automatically stops, which is a normal situation.
If the crew turns center pumps off, the fuel from the center tank can not feed the engines any more. On the other hand, if the crew turns the left or right pumps off, the engines can still get fuel by gravity.

Warning:
If the engines are fed by gravity, there is a high risk of engine failure at high altitudes. If the fuel is not pumped out of the tanks, the altitude increases the risk of creating an emulsion that the engines do not like…

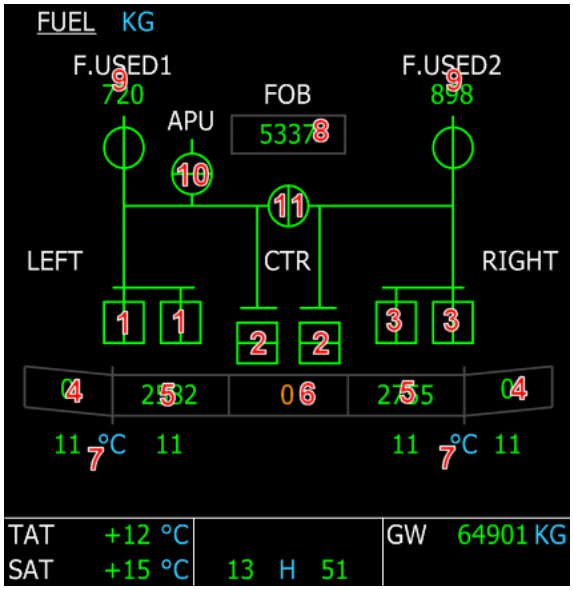
Playing with the fuel pumps may be useful to reduce a fuel imbalance. If you have much more fuel in a wing than in the other, you might want to shut the fuel pumps of the less filled wing to pump the fuel in the other wing. On this aircraft, the maximum fuel imbalance is around 400 kg.

If, for any reason, part of the fuel on board is unusable, an amber mark appears below the FOB indication on the E/WD, as shown here:



FUEL Page

The SD FUEL page shows the current fuel configuration.

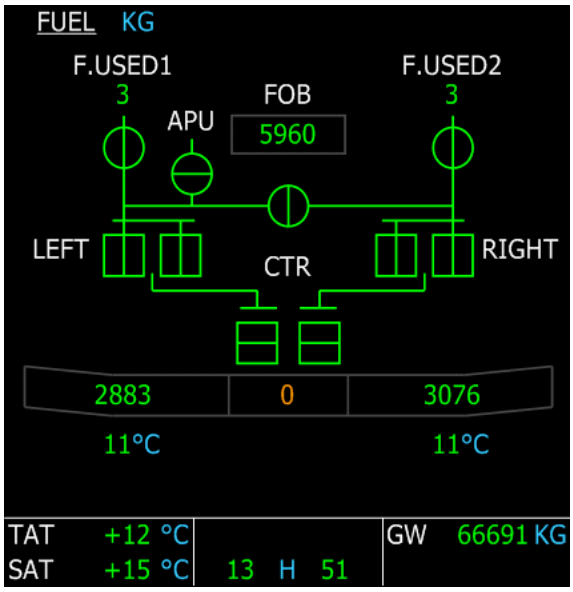


1 – Left fuel pump status.
2 – Center fuel pump status. On this example, they are closed but still green. It is because the center tank is empty, so the center pumps are off, which is a normal situation.
3 – Right fuel pump status.
4 – Wing outer tank fuel quantity.
5 – Wing inner tank fuel quantity.
6 – Center tank fuel quantity.
7 – Fuel tank temperature.
8 – Total fuel quantity on board, as displayed on the E/WD.
9 – Fuel used by each engine since it was started.

10 – APU fuel valve. It automatically opens when the APU is running to provide fuel to the APU.
11 – Cross feed fuel valve, controlled by the cross feed switch on the overhead panel.

➡ Note: The fuel used (9) is reset when the flight is reset through the 'Reset Flight' menu action.

On the A321, the FUEL page has a slightly different layout because this aircraft does not have inner and outer wing tanks, it has a single fuel tank in each wing:



Alerts & Warnings

Message	Color	Reason
FUEL L WING TK LO LVL	Red	Left wing fuel tank level is too low.
FUEL R WING TK LO LVL	Red	Right wing fuel tank level is too low.
FUEL L+R WING TK LO LVL	Red	Total wing fuel tank level is too low.
FUEL CTR TK PUMPS OFF	Amber	Center tanks pumps are off while center tank is not empty.
FUEL GRVTY FUEL FEEDING	Red	Wing fuel pumps are off so the engines are fed with gravity only.
CTR TK FEEDG	Green	Status message to indicate the fuel is pumped in the center tank only.

Air

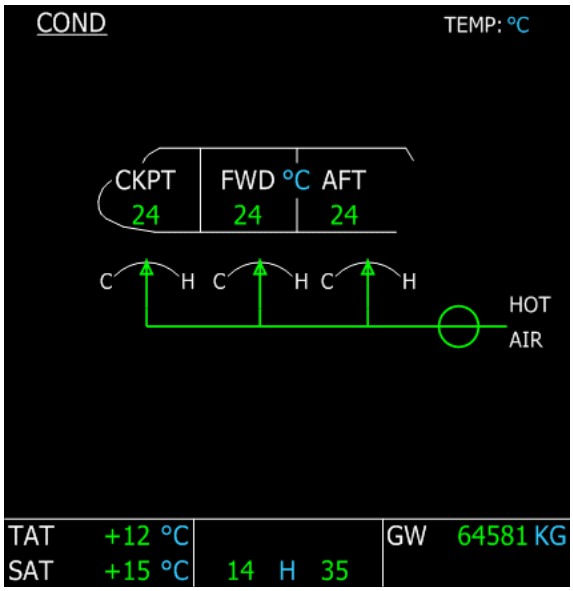
The air system is controlled through the AIR COND overhead section.

1 – Pack Flow. It lets the crew select the low, normal or high pack flow.
2, 3, 4 – Temperature knobs that let the crew adjust the temperature in the cockpit, forward cabin and aft cabin.
5 – Hot air valve can be closed using this switch.
6, 7 – Pack switches.
8 – Engine bleed switches. The engine bleed valves are opened in a standard configuration. Pressing these buttons close them.
9 – APU bleed switch. By default, it is closed. The crew must press this button to let the APU provide bleed air (necessary for initial engine start).
10 – Cross bleed (useful for restarting an engine in flight, refer to the power plant section for more information).

The status of the air system can be monitored on several SD pages.

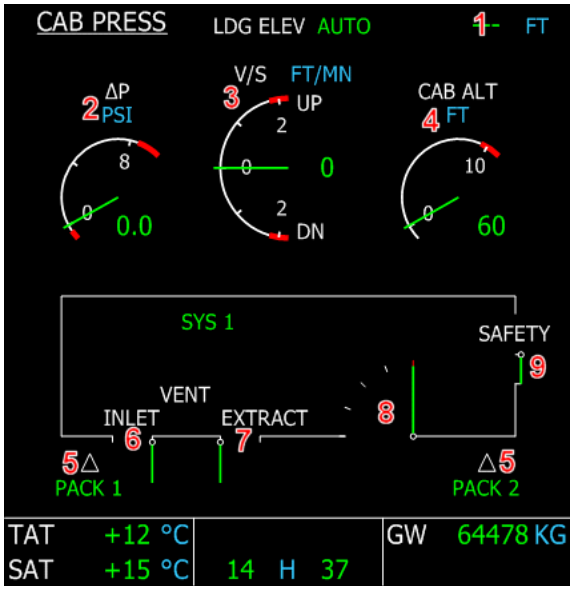
COND Page

The COND page shows the temperature in every part of the aircraft. If the hot air valve is closed, no more hot air will be provided to heat the aircraft cabin.



CAB PRESS Page

The cabin pressure page shows the status of the pressurization system.

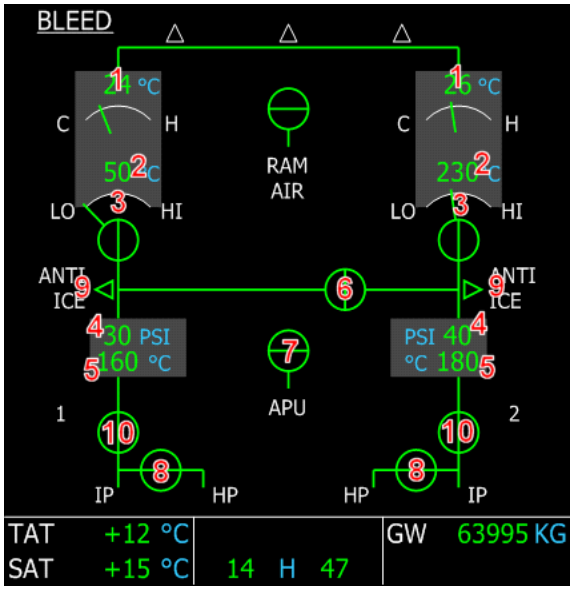


1 – LDG ELEV: This is the elevation of the arrival airport. It is dashed when the arrival airport is not defined.
2 – DeltaP: This is the pressure difference between inside and outside the aircraft.
3 – Cabin V/S: This shows the vertical speed felt by the cabin (the internal cabin pressure variation).

4 – Cabin Altitude: This is the altitude that corresponds to the current cabin pressure.
5 – Pack valves, controlled by the pack switches on the overhead panel.
6, 7, 8 – Inlet, extract and outflow valves. They are automatically controlled.
9 – Safety valve. It automatically opens if the delta P is too high, to prevent any aircraft damage.

BLEED Page

It shows the status of the air bleed system.



1 – Pack outlet temperature
2 – Pack compressor outlet temperature
3 – Pack flow pressure
4 – Precooler inlet pressure
5 – Precooler outlet temperature
6 – Cross bleed valve. If the overhead is AUTO, the cross bleed valve status is the same as the APU bleed valve. Otherwise, it is open or shut according to the XBLEED knob position.
7 – APU bleed valve.
8 – Engine high-pressure valves
9 – Wing anti-ice air bleed (visible only if wing anti-ice is turned on).
10 – Engine bleed valves, controlled by the ENG BLEED overhead switches.

Anti-Ice

The anti-ice protection system is controlled through the ANTI ICE overhead section.

1 – Wing anti-ice. Its status can be monitored on the BLEED page.
2 – Engine anti-ice.
3 – Probe and Window anti-ice. It is fully automatic. It provides low heating when the aircraft is on the ground (to avoid having ground personnel burnt if they touch the probe) and provides full heating as soon as the aircraft is airborne.
You can force it by pressing this button. An 'ON' light then appears.

Alerts & Warnings

Status messages appear on the E/WD when engine and wing anti-ice are used.

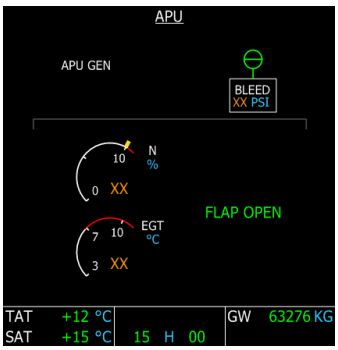
Message	Color	Reason
ENG A. ICE	Green	Engine anti-ice is on.
WING A. ICE	Green	Wing anti-ice is on.

Auxiliary Power Unit (APU)

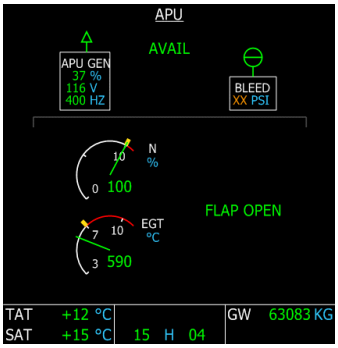
It is managed through the APU section of the overhead.

APU Start & Stop

To turn the APU on, the master switch must be pressed first. The APU system is turned on ('ON' blue light appears on the master switch) and the APU flap is opened to let the air enter into the APU ('FLAP OPEN' message displayed on the APU page). The APU page automatically appears on the SD.



If fuel is available, the START button can then be pressed, an 'ON' light appears on the button. It launches the APU start sequence. The start sequence can be monitored on the APU page displayed on the SD.
When the APU is started, a green 'AVAIL' light replace the blue 'ON' light on the START switch, an 'AVAIL' message appears on the APU page and an ECAM message displays 'APU AVAIL'. The APU is now ready to provide air and electricity.



The APU can be started at any altitude and at any airspeed.
The APU fuel consumption is around 100kg per hour.

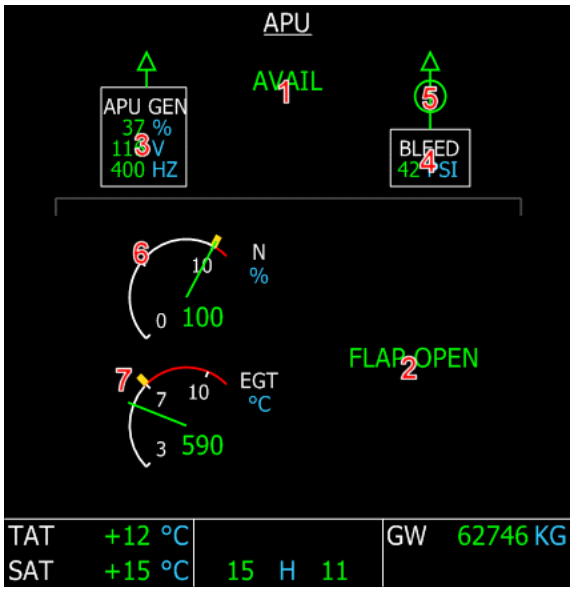
APU Bleed

As soon as the APU is running, its air can be used to start the engines. In order to do this, the crew must press the APU BLEED button in the AIR COND overhead section (see the Air section for more details).

➡ Note: If you are in Beginner mode, the APU is not necessary to start the engines.

APU Page

The APU page appears automatically on the SD during the APU start sequence. The crew can also force if by pressing the APU button on the ECAM control panel.



1 – AVAIL message appears as soon as the APU start sequence is finished and the APU is available.
2 – FLAP OPEN message is displayed as soon as the APU system is turned on and the APU flap is opened to let air in.
3 – This white box displays the APU electric information: load, voltage and frequency. The box disappears if the APU is not available. The green arrow on top of the box disappears if the APU GEN is turned off on the overhead.
4 – This box shows the APU bleed information, with the air bleed pressure. Amber XX is displayed if the air bleed is not available.
5 – Bleed air valve; controlled by the APU BLEED switch on the overhead.
6 – APU rotation speed.
7 – APU Exhaust Gas Temperature (EGT).

Alerts & Warnings

Status messages appear on the E/WD when the APU is used.

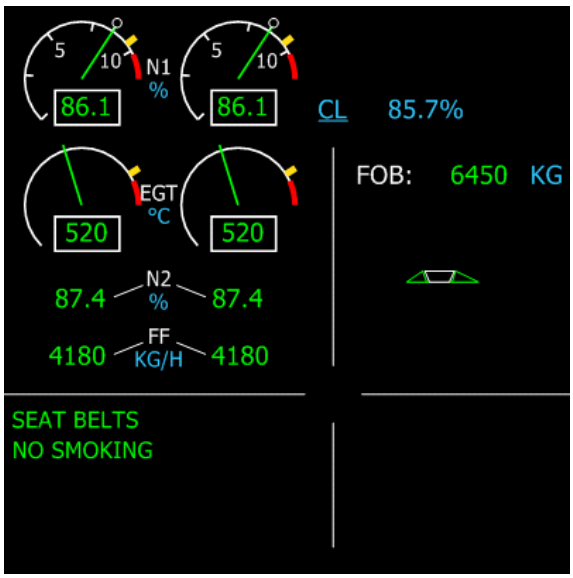
Message	Color	Reason
APU AVAIL	Green	The APU is up and running.
APU BLEED	Green	The APU is available and the bleed valve is open.

Power Plants

The engines are managed by the Full Authority Digital Engine Control (FADEC). This device controls the engine during the start sequence and during the flight to provide optimal usage.

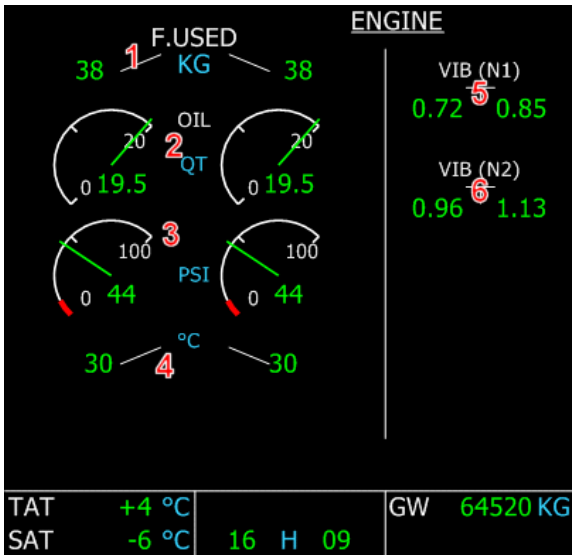
Engine Monitoring

The engine status are monitored through the Engine/Warning Display (E/WD), which displays essential engine and FADEC information, and through the Engine and Cruise page of the SD.
Depending on the engine type and EFIS generation, the E/WD can have different layouts. Refer to the EFIS section for more details. Anyway, the most important engine information is always displayed on the E/WD.



On this example, N1, EGT, N2 and Fuel Flow are displayed. In addition, FADEC information is displayed: the mode, which depends on the thrust lever detent, and the max N1 that depends on this mode.

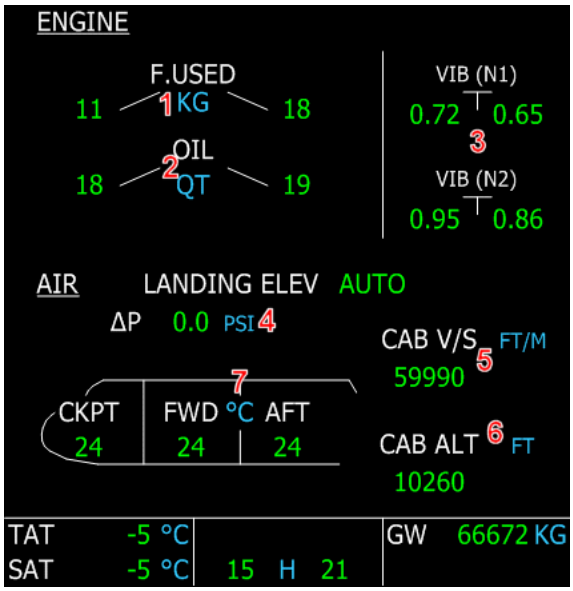
In addition, engine information is displayed on the ENG page:



1 – Fuel used by each engine since last startup.
2 – Oil quantity, in quarts
3 – Oil pressure, in Pound per Square Inch (PSI)
4 – Oil temperature
5 – Vibration on the first compressor stage
6 – Vibration on the second compressor stage

The engine page is automatically displayed during engine start sequence. It can be displayed at any time by pressing the ENG key on the ECAM control panel.

During the cruise, the CRUISE page is automatically displayed on the SD. It shows important information about the engines and the cabin pressurization and temperature, as shown on the ENG and PRESS pages:



1 – Fuel Used by each engine, as shown on the engine page
2 – Oil quantity (in quarts), as shown on the engine page
3 – Vibrations
4, 5, 6 – Cabin DeltaP, vertical speed and altitude, as shown on the PRESS page
7 – Cabin temperature, as shown on the COND page.

Note that this page can not be selected manually. It appears automatically on the SD as soon as the aircraft is above the transition altitude.

Engine Start & Stop on Ground

When the aircraft is parked on ground and engines have to be started, the APU must be started first in order to provide air bleed necessary for the engine start sequence. Refer to the APU section for more information about APU start and APU bleed.

When the APU is started and APU bleed is on, the engine start is managed through the ENG section located on the pedestal, just below the thrust levers:

1, 2 – Engine Master Switch for engine 1 and 2
3 – Engine mode switch.
In order to start the engine, the engine mode switch must be placed on the IGN/START position. This operation turns on the engine igniters and the FADEC (the E/WD engine information become active). This switch position can also be used when the engines are running in case of heavy rain. As it provides continuous ignition, it reduces the risk of having an engine stopped.

Then the engine master switches can be used to initiate the engine start sequence. The crew just has to move each engine master switch up and the FADEC does the rest to start the corresponding engine. On the twin-engine aircrafts, both engines can not be started simultaneously because the APU does not provide enough air for 2 engines. Usually, engine 2 is started first because if provides hydraulic pressure to the Yellow circuit, which is the one used by the brakes. If for any reason the pilot needs to use the brakes in emergency, having the Yellow circuit under pressure is safer.

Start engine 2 by moving up the ENG 2 master switch. You can monitor the start sequence on the E/WD and on the SD ENG page that automatically appears. As soon as the engine 2 has started, you can start engine 1 the same way by moving up the ENG 1 master switch. When engine 1 is started, you can move the engine mode switch back to the NORM position.

➡ Note: If you are in Beginner mode, you can just press Ctrl-E to start the engines, without needing to start the APU. This function is inhibited in Intermediate and Expert modes.

To stop the engines, the pilot just has to move down each engine master switch. The crew should make sure the APU is running before stopping all engines because generators will stop providing electric energy.

Engine Master Switch Usage is FS:
*To move the engine master switches down (engine off), you must use the **right** mouse button and click the lower part of the switch. This was done to prevent an unintentional engine stop with a mouse click.*

Restarting Engine in Flight

If an engine must be restarted in flight, the crew can take advantage of the air bleed from the engine that is still running. To do this, the cross bleed valve must be opened by setting the XBLEED switch on the OPEN position (overhead, AIR COND section).

Air bleed is then available, and the pilot can use the engine mode switch and engine master switch to start the engine as explained in the previous paragraph.

Inertial Reference System (IRS)

The Inertial Reference System (IRS) provides the aircraft position. The only necessary condition to have it working fine is to align the system. In fact, it measures the aircraft accelerations and updates the aircraft position, based on the original position used during alignment.

IRS Alignment

The IRS are aligned through the INIT A page of the MCDU (refer to the FMGC section for more information about this page). As soon as the FROM/TO airports are entered in the MCDU, the IRS can be aligned with the departure airport as the original destination.

The IRS can detect if the departure airport position is very different from the actual aircraft location. This can happen if the crew makes an error when entering the FROM/TO airport information. In this case, an error message is displayed on the MCDU.

The crew should remember that the IRS alignment position taken into account when aligning the IRS is the departure airport reference location stored in the database, which is different from the actual aircraft position. You don't need to adjust the IRS position accurately before aligning because this aircraft is equipped with a GPS system that will do this automatically when the takeoff thrust will be applied. It means the crew should not use the navigation display when taxiing because the IRS may not be perfectly aligned at this time.

IRS Unit

This device is located on the upper part of the overhead panel.

1 – Display selector: This switch lets the pilot select the information displayed on the LCD screen. The modes will be described later in this section.
2 – IRS selector: As this aircraft is equipped with 3 Inertial Reference Systems, this switch selects the one that is used to display information on the LCD screen.
3 – Mode selector: For each IRS, a switch lets the crew select the mode used for each IRS:

- OFF: the IRS is turned off and requires a new alignment before being used again.
- NAV: all the IRS and air data information are used for navigation.
- ATT: only the air data information is used for navigation.

Display modes

TEST: This mode is dedicated to the test of the LCD screen. It just displays characters that show the entire digits work fine.
TK/GS: This mode displays the current track and ground speed computed by the IRS.
PPOS: The current plane position is displayed on the LCD screen.
WIND: The wind direction and velocity computed by the IRS are shown.
HDG: The current true heading is displayed.
STS: This mode displays a status message of the MCD screen. It can be one of the following:

- STS-ENTER PPOS: the IRS is not aligned, so the plane position is not known and should be entered.
- STS-EXCESS MOTION: The aircraft should not move during the IRS alignment process. This message is displayed if the aircraft is currently moving while it should not.
- STS-ALIGN xxx: This message indicates the remaining time for IRS alignment.

IRS usage with Flight Simulator

1) *The IRS position entry through the IRS keyboard is not implemented. It can be done only through the MCDU.*
2) *The IRS alignment time is configurable through the aircraft configuration window (refer to the setup section for more information). In the real aircraft, a full IRS alignment takes 10 minutes.*
3) *The STS-ALIGN status message displays the remaining alignment time in real seconds, regardless the time configured by the user in the configuration window.*

Alerts & Warning

While the IRS are aligning, a green information message 'IRS IN ALIGN' appears on the E/WD, indicating the remaining time for alignment.
This message turns amber if the engines are started to indicate that the aircraft **should not move** during the IRS alignment phase.

Radio

The standard usage of the radio equipment consists in using the MCDU for the radio navigation (in fact, the crew rarely interact with the radio navigation settings because the FMGC is in charge of auto-tuning the VOR and ILS) and the radio management panels for the voice radio. Nevertheless, the Radio Management Panels can be used for radio-navigation settings in case of an FMGC failure.

Radio Management Panels (RMP)

The Radio Management Panels are located on the pedestal. One is available for the captain and one is for the first officer. The Captain's RMP can be used to set VOR1 and the FO's RMP for the VOR2.

1 – Active frequency window shows the current frequency used for the selected radio.
2 – Standby/Course window shows the standby frequency for the selected radio. In case of a VOR/ILS setting, this window is also used to set the VOR/ILS course.
3 – Swap button is used to swap active and standby frequencies.
4, 5 – Selection pushbuttons for the VHF radio channels.
6 – NAV pushbutton must be pressed if the crew wants to use the RMP for radio-navigation setting, which is not the standard procedure. If this button is depressed, the RAD NAV page of the MCDU is blocked (see the FMGC section for more information).

7, 8 – VOR and ILS selection pushbuttons. Remember that the left RMP adjusts VOR1 and right RMP adjusts VOR2.
9 – ADF selection pushbutton.
10 – ADF frequency oscillator switch.
11 – Radio master switch.
12 – Frequency/Course knob: The outside knob sets the integer part and the inner knob sets the decimal part of the standby frequency. In case of a course setting, the outer knob changes the course value by 10 degrees and the inner knob by 1 degree.

In order to use an RMP to set a VOR or ILS, the NAV pushbutton must be pressed first to activate the NAV pushbuttons (7, 8, 9, 10). As soon as this is done, the FMGC can not be used to set the radio any more.
The crew can then set the VOR/ILS standby frequency using the frequency/course knob (12). When the swap button is pressed to swap the frequencies, the standby window (2) changes and displays the VOR/ILS course, which can be changed at this time using the frequency/course knob. After a few seconds, the display turns back to standby frequency.

<u>RMP usage in Flight Simulator:</u>
Remember that the VHF1 and VHF2 buttons of the RMP correspond to the COM1 and COM2 radio channels of Flight Simulator.

Audio Management Panel (AMP)

The audio management panel lets the crew select the radio channels heard on the cockpit loud speakers.

Each pushbutton lets the crew activate/deactivate the audio for each radio channel:
1, 2 – VHF1 and VHF2 channels (called COM1 and COM2 in Flight Simulator)
3, 4 – VOR1 and VOR2 channels
5 – Marker channel (inner, middle and outer markers)
6 – ILS channel. Because of an FS limitation, ILS channel is linked to the VOR1 channel.
7 – ADF channel.

Transponder & TCAS

The transponder & TCAS device is located on the pedestal. It allows the crew to enter the transponder code required by the ATC to identify the aircraft and to configure the TCAS.

1 – Transponder Mode
2 – Transponder Channel
3 – TCAS Master Switch
4 – Keypad for the transponder code entry
5 – TCAS Mode
- THRT: Only the dangerous intruders are shown on the ND, within a +/-2700 altitude range
- ALL: Intruders located within +/-2700 ft are shown on the ND
- ABV: Intruders located within +8000/-2700 ft are shown on the ND
- BLW: Intruders located within -8000/+2700 ft are shown on the ND

6 – TCAS Advisory mode
- STDBY: The intruders are shown on the ND according to the TCAS mode, but no advisory
- TA: When an intruder is close to the aircraft with a potential collision trajectory, an aural warning 'TRAFFIC' is triggered
- TA/RA: When an intruder is very close to the aircraft with a potential collision trajectory, an aural warning and a resolution advisory is provided

Transponder Usage

To enter a transponder code, the transponder should obviously be turned on.
Then any action on the keypad clears the existing code to enter a new one. Pressing the CLR key erases the code being entered.
The code entry is validated as soon as the 4 digits have been entered.

TCAS Usage

The only important thing to think about is to change the TCAS mode according to the flight phase:

- ABV mode should be set prior to takeoff to monitor potential intruders **above** the aircraft during the takeoff and climb phases.
- BLW mode should be engaged just before the descent is initiated to monitor the potential intruders **below** the aircraft.

Ground Proximity Warning System (GPWS)

The GPWS provides aural alerts to indicate potential danger related to the ground proximity, such as excessive descent rate or bad aircraft configuration.
The GPWS is controlled through the switches located in the GPWS section of the overhead. These switches let you turn off all or some of the GPWS warnings.

1 – TERR: The terrain proximity alerts are inhibited.
2 – SYS: The whole GPWS is turned off
3 – G/S MODE: The glideslope alert is inhibited.
4 – FLAP MODE: The landing aircraft configuration warning is inhibited.
5 – LDG FLAP 3: The flap 3 landing configuration is selected, no flap alert will be generated when landing in this configuration. If you choose to land with Flap 3 configuration (refer to the PERF APPR page for more information), this switch must be pressed to avoid having a flap alert in short final.

Alerts & Warning

Message	Color	Reason
GPWS SYS MODE OFF	Green	The GPWS is totally off.
GPWS FLAP MODE OFF	Green	The flap mode is off.
GPWS G/S MODE OFF	Green	Glideslope mode is off.
GPWS FLAP 3	Green	Flap 3 configuration is selected for landing.

Flight Controls

Sidesticks & Rudder Pedals

There is not much to say about flight controls as they were described in details in the Fly-by-Wire section. The only thing to keep in mind is that a strong action on the stick or on the rudder pedals disconnects the autopilot. As this is not the standard procedure, it triggers an alarm that can be stopped by pressing the A/P disconnection button.

Flight Control Computers

Seven computers are in charge of the Fly-by-Wire system: 2 Elevator and Aileron Computers (ELAC), 2 Spoiler and Elevator Computers (SEC) and 2 Flight Augmentation Computers (FAC).
All these computers can be turned off using the switches located in the 2 FLT CTL sections of the overhead.

These switches are supposed to be used in case of failure, to reset the flight control computers by turning them off and back on. They are not designed to turn these computers off.
The FACs are in charge of the flight envelope protection, the auto-trim system and the auto-coordination. If they are turned off, amber crosses appear on the PFD to indicate there is no flight envelope protection: no bank angle limit and no pitch angle limit.

Auto-coordination in Flight Simulator:
When you load this aircraft in Flight Simulator, the FS auto-coordination is turned on according to the FAC status. When the aircraft is unloaded from FS, the previous auto-coordination status is restored.

Speed Brakes & Ground Spoilers

Speed brakes and ground spoilers are different, even if they are controlled through the same handle and use the same aircraft parts. The speed brakes can be deployed in flight, they use 4 of the 5 moving on the top of the wings and their movement is limited to approximately 50% of the maximum movement. The role of the speed brakes is to reduce the lift and increase the drag to decelerate the aircraft in flight. If they are deployed, a green message 'SPPED BRK' is displayed on the E/WD.

The ground spoilers can be deployed on the ground only. They are used to reduce the aircraft speed and to break the lift for optimal break efficiency. When they are deployed, all the 5 panels deploy at their maximum angle.
The ground spoilers can be armed to deploy automatically during takeoff in case of a rejected takeoff or during approach to deploy when the aircraft touches the ground upon landing. When they are armed, a green message 'GND SPOILERS ARMED' is displayed on the E/WD. When the ground spoilers have automatically deployed, the action of disarming them will make them retract.

The upper and lower parts of the handle can be clicked to move the handle up and down. Moving the handle higher than the RET position (retracted) arms the ground spoilers. Moving the handle down deploys the speed brakes progressively.

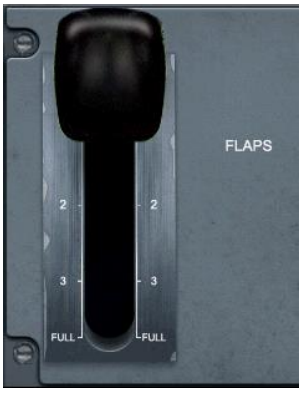
Speed Brake/Ground Spoiler control in Flight Simulator:
The standard FS keys can be used to arm/disarm the ground spoilers and extend/retract the speed brakes. By default, the '/' key is used to extend/retract the speed brakes and Shift-/ is used to arm/disarm the spoilers.

Flaps

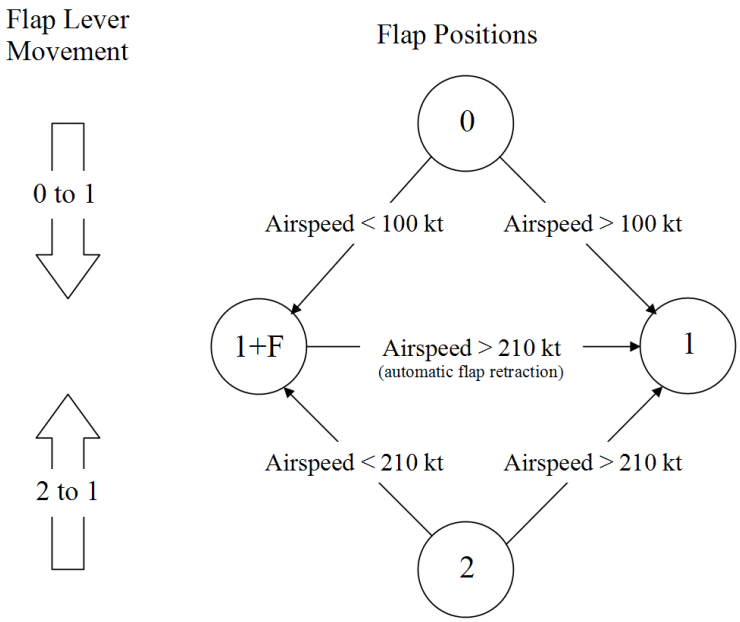
The flaps have specificity on this aircraft: the flap handle has 4 positions while the flaps and slats can have 6 positions, as shown in the following table:

Flap Handle Position	Flap/Slat Position	Flap Angle	Slat Angle	Usage	Max Speed (knots)
0	0	0°	0°	Flight	Vmo
1	1 or 1+F	0° 10°	18° 18°	Approach Takeoff/ Landing	230 215
2	2	15°	22°	Takeoff/ Landing	200
3	3	20°	22°	Takeoff/ Landing	185
FULL	FULL	35°	27°	Landing	177

The table also shows how the different flap/slat configurations are supposed to be used, and the maximum airspeed for each configuration.



The table shows 2 flap/slat positions correspond to the same handle position. If the handle is moved to the 1 position, the flap/slat position is set according to the following diagram:



The flap/slat position can be monitored on the E/WD. Refer to the EFIS section for more information.

Trims

Elevator Trim

This aircraft is equipped with an auto-trim system managed by the fly-by-wire system. It means the crew is not supposed to interact with the elevator trim wheels located on the left and right of the thrust levers, except in case of a failure.
Note that any manual action on the elevator trim disconnects the AP with an alarm.

Rudder Trim

The rudder trim is mainly used in case of an engine failure, to counteract the dissymmetric thrust.

1 – LCD screen that displays the current rudder trim position, preceded by L or R to indicate the trim direction.
2 – Reset button that triggers a rudder trim centering action.

3 – Rudder trim knob: Turning the knob to the left/right moves the rudder trim accordingly.

Gear, Wheels & Brakes

Landing Gear

The landing gear is controlled through the gear lever located on the main panel.
If the aircraft gets close to the ground during descent and the gear is still retract, a alert 'L/G Gear Not Down' appears on the E/WD with an aural warning. In addition, a red arrow lights on near the gear lever.
The landing gear status can be monitored on the SD (WHEEL page) and on the LDG GEAR section of the main panel.

The lighted symbols indicate each landing gear status:

- Green Triangle: The landing gear is down and locked
- Red 'UNLK': The landing gear is currently unlocked (in transition)
- Nothing: The landing gear is retracted.

Autobrake system

The autobrake system is dedicated to manage aircraft brakes automatically when the takeoff is rejected or when the aircraft lands.

It has 3 positions:

- LOW / MED: Low/Medium braking pressure, can be used for landing
- MAX: Maximum braking pressure, to be used for takeoff only in case of RTO (rejected takeoff).

The MAX position must be used for takeoff only. For landing, MED should be used if the runway is short or wet, otherwise LOW should be used.

When the autobrake is actually active to decelerate the aircraft, a green light 'DECEL' appears above the selected autobrake button.

If the autobrake is engaged, its status is displayed on the E/WD.

Pressing the button of the currently selected position disarms the autobrake. When autobrake is switched off, a flashing message 'AUTOBRK OFF' appears during 10 seconds on the WHEEL page.

Brakes and Parking Brakes

The brake status can be monitored on the ECAM Wheel page, detailed later in this section. The most important information is the brake temperature. If the brake temperature is too high when the takeoff check is operated, an alert 'HOT BRAKES' is triggered. The crew must be aware that heat in the brakes makes them less efficient.

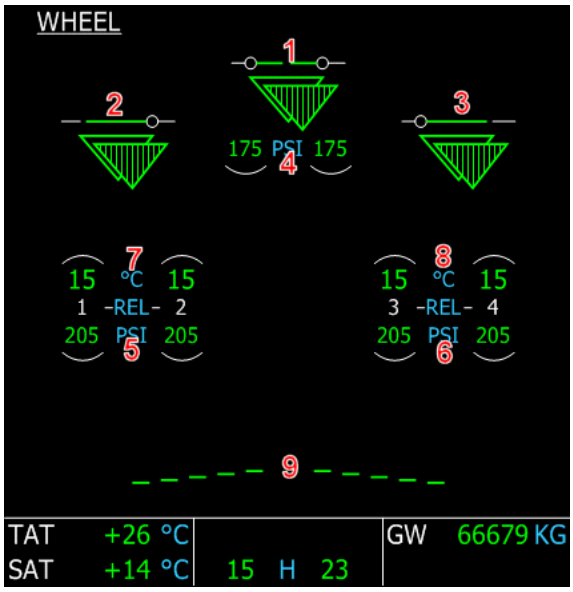
Parking brakes can be manipulated through the handle located on the pedestal or by using the FS key (Shift-. by default).

The parking brake status appears on the E/WD:

- PARK BRK appears in green when parking brake is set.
- PARK BRK turns to amber if the parking brakes are set while engine power is greater than idle.

WHEEL Page

The WHEEL page is automatically displayed on the SD when the aircraft is on the ground with engines started. It can also be selected by pressing the WHEEL key on the ECAM control panel.



1 – Nose wheel status
2 – Left main gear status
3 – Right main gear status
These 3 indicators show the gear status. The lines represent the gear doors. They are green when the gear doors are closed, amber when the doors are open or moving.
The triangles represent the landing gears. They are green if the landing gears are down and locked and red if the gears are in transition. No triangle is displayed if the gears are retracted.
4, 5, 6 – Gear tire pressure, in PSI
7, 8 – Left and right brake temperature:
The value is shown in green if the temperature is normal. In turns amber over 300°C. A green arc appears over the hottest wheel when the brake temperature is between 100°C and 300°C. An amber arc appears over the hottest wheel when its brake temperature is above 300°C.
9 – Ground spoiler status: vertical arrows appear when they are deployed.

Lighting & Signs

External Lights

The aircraft lights are controlled through the EXT LT section of the overhead panel.

1 – Strobe lights: They should be on when the aircraft is in flight. They can be turned on, off or set in AUTO mode. If set to AUTO, they automatically turn on when the aircraft is airborne, and turn off when the aircraft is on the ground.
2 – Beacon lights: Red lights located above and below the aircraft. They should be switched on as soon as the engines are running or the aircraft moves.
3 – Wing lights: These lights should be used to taxi to the gate. They can be turned off when the engines are stopped.
4 – Nav lights should be turned on as soon as the aircraft is energized.
5 – Runway turn off lights are designed to be used with the taxi lights during taxi.
6 – Landing lights: These lights are big and can be retracted into the aircraft belly. The switches have 3 positions: RETRACT to retract the lights, OFF to extend them without switching them on and ON to turn them on when the are extended. They should be turned on as soon as the aircraft is cleared to align on the runway for takeoff and can be turned off when passing 10000 feet.
7 – Nose lights (or Taxi lights) must be turned on just before the aircraft moves on the ground. This is the best way for ground personnel to see the aircraft is cleared for taxi. It

must be turned off when the landing gear is retracted, even if it is automatically turned off if the gear is up.

When the landing lights are on, a green message 'LDG LT' appears on the E/WD.
If strobe lights are off when the aircraft is airborne, a warning message 'STROBE LT OFF' appears on the E/WD.

Panel Lighting

At night, the lighting equipment provides panel lighting. The panel lighting is turned on using the standard FS key for panel lights (Shift-L by default). Turning the panel lighting on during the day has no visible effect.
At night, the panel lighting looks as shown here:

In addition, the panel lighting provides flood lighting that can be activated using the FLOOD LT MAIN PNL knob on the pedestal.

The Ctrl-Shift-F key can be used to turn flood lighting on/off.

With flood lighting, the main panel looks like this:

Keep in mind the EFIS brightness can be adjusted using the mouse wheel when the mouse is in the EFIS central zone. This is very useful at night.

Seat Belts & No Smoking

The Seat Belt & No Smoking signs are controlled with the switches located on the SIGNS section of the overhead panel.

Each switch has 3 positions: ON, OFF and AUTO.
In AUTO mode, the seat belt sign turns on when the aircraft moves and turn off when the aircraft crosses 10000 feet in climb. It turns back on when the aircraft reaches 10000 feet in descent, and turns off again when the aircraft is landed and the engines are stopped.
In AUTO mode, the "no smoking" signs always turns on because all the flight today are non-smoking flights.

The status of the seat belt and no smoking signs is displayed in green on the E/WD.

FMGC

Preamble

The Flight Management System is composed of the Flight Management and Guidance Computer (FMGC) and the Multifunction Control and Display Unit (MCDU).
The MCDU is the device used by the pilot as an interface between him and the FMGC, which computes all kind of data to fly the aircraft safely along its trajectory.

During cockpit preparation, the MCDU is used to insert a route, from departure to destination, and the FMGC computes a vertical and speed profile according to the ATC constraints and the aircraft performance. The FMGC interacts with the flight directors, the autopilots and the autothrust to guide the aircraft, or if the pilot decides to manually select any parameter (speed, V/S, heading, …)

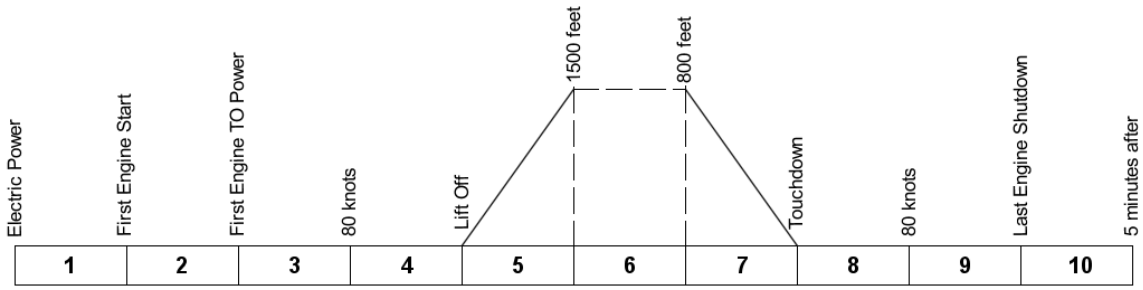
During the flight, the MCDU displays data computed by the FMGC, such as Estimated Time of Arrival (ETA), fuel predictions, constraint management, …

FMGC Phases & Flight Phases

The FMGC manages several phases during the flight. They are described in the following table:

PREFLIGHT	When the aircraft is on the ground, prior to take off power.
TAKE OFF	When take off power is applied (FLEX or TOGA) and the aircraft is below 1500 feet AGL.
CLIMB	From 1500 feet to the cruise altitude
CRUISE	All along the cruise
DESCENT	During the descent from the cruise altitude
APPROACH	Final part of the descent, close to the destination.
GO AROUND	If TOGA power is applied before landing
DONE	When the flight is finished and the aircraft is landed.

The FMGC also divides the flight into several phases, used for the system internal use and for the alert management:



MCDU Usage

The MCDU is composed of

- 12 line select keys, 6 one the left (referenced 1L to 6L) and 6 on the right (1R to 6R).
- The page keys that give direct access to some predefined pages,
- The alpha and numeric keypads to enter data into the MCDU
- The brightness control knob to modify the display brightness.

To enter any data into the MCDU, you can use the keypads. All the characters typed in are displayed on the bottom line of the screen, called the scratchpad. When the data is typed, you just have to select one of the line select key to enter it where you wish.

Some lines contain two values, separated by a '/' (slash). In this case, you can enter the 2 values by separating them with a slash. If you want to enter the first value only, enter it directly. If you want to enter the second value only, precede it with a slash.

The time information is displayed using a XXYY format, where XX are the hours and YY are the minutes. For example, 0120 means 1 hour 20 minutes. Entering time information into the MCDU must use the same convention, where XX can be omitted if null.

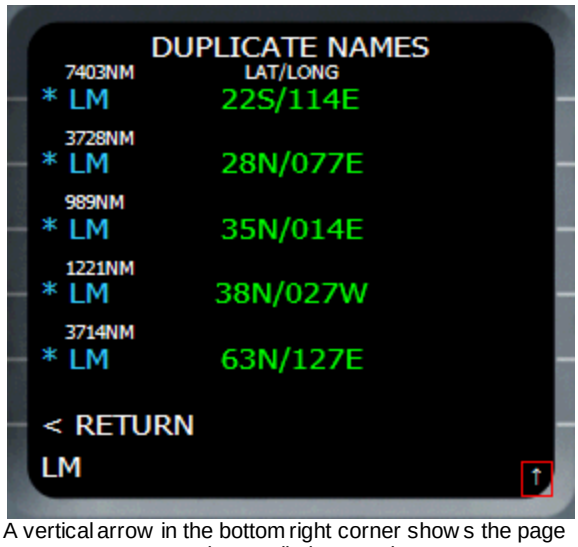
<u>Keypad simulation in FS:</u>
You can use the keypad by clicking and key of the keypad with the mouse. It may be painful if you have a lot of data to enter. This is why you can also use your PC keyboard, using the keys in combination with a modifier or a locker, to enter data in the MCDU scratchpad. Refer to the Setup section for more information about the possible keyboard configuration.
You can also use the function keys (F1 to F12) to simulate the 12 line select keys (F1 to F6 for 1L to 6L, F7 to F12 for 1R to 6R).
The Scroll Lock key is the default locker, which means that if you press this key, any key typed on your keyboard will be directed to the MCDU. Refer to the Setup section for more information.

When a locker key (such as Scroll Lock) is used to enter data in the MCDU, the following keys simulate the page keys:

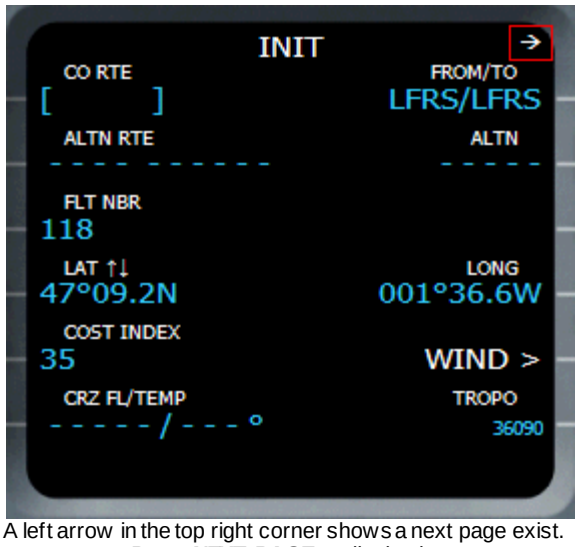
PC keyboard key	***MCDU page key***
Ctrl-D	*DIR*
Ctrl-O	*PROG*
Ctrl-P	*PERF*
Ctrl-A	*DATA*
Ctrl-N	*F-PLAN*
Ctrl-R	*RAD NAV*
Ctrl-U	*FUEL PRED*
Ctrl-M	*MCDU MENU*
Ctrl-Pg Down	*NEXT PAGE*
Ctrl-Up Arrow	*Up Arrow*
Ctrl-Down Arrow	*Down Arrow*

The MCDU displays information on pages. When a page content can not be displayed on single page, the pilot has to use specific keys to display the rest of the information:

- If the page can not display the whole information on the 6 select key lines, the pilot can scroll the page using the 2 vertical arrow keys. On the bottom right corner, vertical arrow symbols show if the page can be scrolled upward, downward, or both.
- If the information is displayed on several different pages, a horizontal arrow on the top left corner shows that another page exists. Pressing the **NEXT PAGE** key shows the next page.



A vertical arrow in the bottom right corner shows the page can be scrolled upward.



A left arrow in the top right corner shows a next page exist. Press **NEXT PAGE** to display it.

Characters and Colors

The colors and the type of characters used to display information is important as they respect a convention that helps the pilot in understanding each information type.

DATA TYPE	COLOR & CHARACTERS
Page title, comments, sratchpad	White, normal characters
Modifiable / Selectable data	Blue
Mandatory data entry	Amber boxes
Optional data entry	Blue brackets
Non modifiable data	Green
Computed data	Small characters
Constraints	Magenta
Data the impacts the flight plan	Followed by a '*'
Primary flight plan	Green
Next flight plan waypoint	White
Temporary flight plan	Yellow
Secondary flight plan	White
Features that don't exist in the real aircraft (used for simulation only)	Grey

Assistance

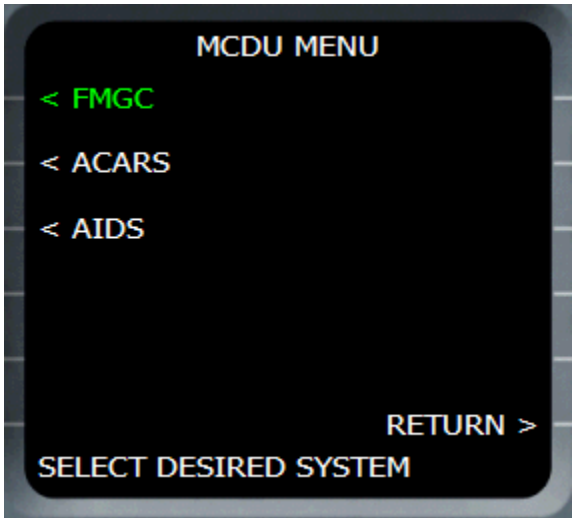
For some MCDU data, you may request assistance. If you don't know a value that should be entered in an MCDU field, you can ask FS to assist you, and if FS knows the value, it will be provided to you. To request assistance, just click on the select line with an empty scratchpad, and FS will fill the scratchpad with the value it has, if available.

For example, the pilot is supposed to enter the aircraft "Zero Fuel Weight" (ZFW) in the 1R line of the INIT B page. If you don't know this value, make sure the scratchpad is empty and click the 1R button. The scratchpad is then filled with the ZFW value provided by FS. You just have to click on the 1R button again to enter this value.

➡ Note that the assistance is never available if you are in Expert mode.

MCDU Menu Page

The MENU page is accessed by pressing the **MAIN MENU** page key. It shows the various systems the pilot can access through the MCDU.



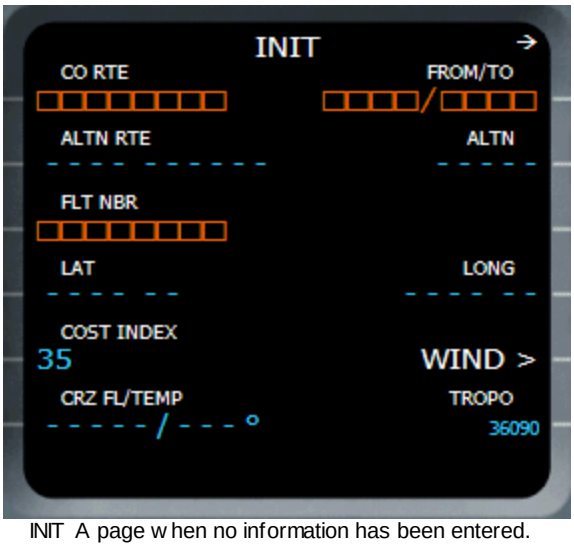
The screen shows the name of the selected system in green, all others in white.

System simulation in FS:
Only the FMGC option is valid in FS. The ACARS and AIDS are not implemented at this time.

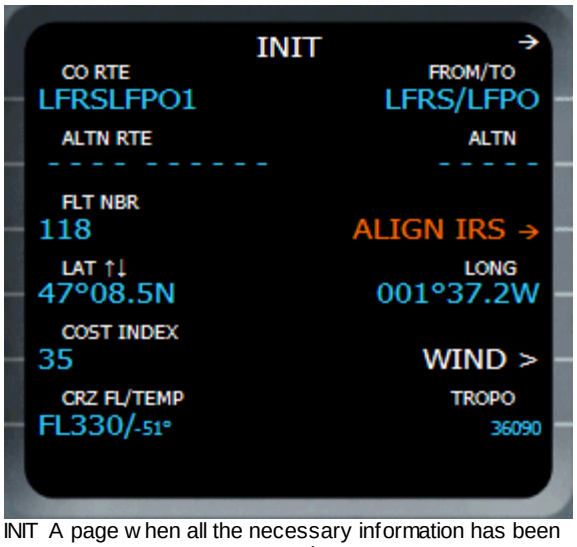
INIT A Page

This page can be accessed by pressing the INIT page key or by clicking the 1L key of the MENU page.
It is accessible only during the PREFLIGHT phase.

Note that a right arrow is visible in the top right corner because the INIT B page can be accessed from this page by pressing the 'NEXT PAGE' key of the MCDU.



INIT A page when no information has been entered.



INIT A page when all the necessary information has been entered.

CO RTE (1L)

At the MCDU initialization, this field is shown with amber boxes, which means it is mandatory. The pilot can enter a company route name in this field. If the route exists in the database, it is loaded in the FMGC.

Note that a route is composed of a departure airport, an arrival airport and waypoints. It does not define the departure and arrival runways, or the departure and arrival procedures (SID/STAR). When a route is loaded, a discontinuity is created after the departure airport and before the arrival airport.

If the pilot enters a departure and arrival airport in the FROM/TO field, the CO RTE becomes optional (shown with blue brackets), unless a company route has been selected in the route selection page.

FROM/TO (1R)

When the MCDU is initialized, the field is mandatory. If a company route is selected, this field is automatically filled with the departure/arrival airport of the route.

If you enter a departure/arrival airport in this field, the ROUTE SELECTION page automatically appears to let you select a route the goes from this departure to this arrival, if any route exists. If you select a route, it automatically fills the CO RTE field (1L). If no route exists, it just displays "NONE".

As soon as the FROM/TO field is filled, the 4L and 4R select lines (LAT and LONG) are filled with the departure airport coordinates. The 3R line (ALIGN IRS) becomes active to propose you an IRS alignment, based on these coordinates.

ALTN RTE (2L)

This field is dedicated to the alternate route. You can enter any data in this field. The alternate route is not implemented in this version.

ALTN (2R)

This field lets you enter the alternate destination, which is ignored in this version.

FLT NBR (3L)

The current flight number must be entered in this mandatory field. Assistance is available for this value.

ALIGN IRS (3R)

As soon as a Lat/Long position is defined (4L and 4R), this field appears to let the crew align the IRS (Inertial Reference System) according to this position. If no position is defined, this field is empty.

LAT and LONG (4L and 4R)

These fields show the position (in latitude/longitude), as soon as it is defined. When the crew fills the FROM/TO filed (1R), the lat/long fields are automatically filled with the departure airport position.
At this time, you can see vertical arrows (next to LAT), which means you can adjust the latitude by pressing the MCDU vertical arrow keys. You can press the 4R select key to move the arrows next to the longitude field, thus letting you adjust the longitude with the MCDU arrow keys.
When the LAT and LONG fields are defined or modified, you can press the 3R select key to align the IRS according to this position.

➡ **Note:**
When you enter the FROM/TO airports, the position is initialized with the position of the departure airport, which is not the exact position of the aircraft. You don't have to adjust the aircraft position accurately because this aircraft is equipped with a GPS that will align the IRS accurately when take off power will be applied.

COST INDEX (5L)

This value is very important for the performance and prediction calculations. It determines how you want to use the aircraft. You can decide to fly at low speed with low fuel consumption, or to fly fast and burn more fuel.
Enter a cost index value of 0 corresponds to the lowest possible fuel consumption at low speed (long range), and a higher value corresponds to higher speed, with higher fuel consumption. The cost index can vary from 0 to 999.

WIND (5R)

This will bring the WIND page that lets the crew define the winds along the flight plan. It will be described later.

CRZ FL/TEMP (6L)

The crew can define the cruise altitude in this field, and the temperature at the cruise altitude if you wish.

The altitude can be entered in feet, or in flight level. If you want to enter an alitutde in flight level, you can enter it directly or enter it by preceding it with 'FL'.

Value entered	Cruise Altitude
8000	8000 feet
FL330	FL330 (33000 feet AMSL)
350	FL350 (35000 feet AMSL)

You can also enter the cruise altitude temperature. If you enter both cruise altitude and temperature, you must use a '/' as a separator. If you don't enter the temperature, it is automatically calculated when the cruise altitude is entered (in this case, it appears in small characters).
Entering the cruise altitude is very important for the performance calculations and for the flight phase sequencing. If you forget to enter this data, some features of the FMGC may not work properly.

TROPO (6R)

The crew can define the altitude of the tropopause, which is 36090 feet by default.

INIT B Page

This page is only accessible from the INIT A page by pressing the NEXT PAGE key. It is not accessible if the engines are started. Pressing the NEXT PAGE key again brings back the INIT A page. If you start the engines while the INIT B page is displayed, it jumps to the FUEL PRED page.
Note that all the weights on this page are shown in tons or in 1000 LBS, depending on the unit system that has been selected in the configuration window (metric or imperial system).

TAXI (1L)

This field shows the fuel quantity for taxi. The default value (shown in small characters) is 200 kg.

TRIP/TIME (2L)

This field shows the trip fuel and the trip time that are calculated by the FMGC when the predictions are available. It is not modifiable by the crew (green).

RTE RSV/% (3L)

This field displays the route reserve and the corresponding percentage of the trip fuel. By default, it represents 5% of the trip fuel. The crew can modify one of the values, and the FMGC computes the other.

ALTN/TIME (4L)

This field shows the alternate trip fuel and time that are calculated when the predictions are available. It is not modifiable by the crew.

FINAL/TIME (5L)

This field shows the fuel quantity and time to fly to the alternate airport or to the destination airport if no alternate is defined. The crew can modify one of the values, and the FMGC computes the other.

➡ Note: The time is displayed and should be inserted using a XXYY format, where XX are the hours and YY are the minutes. For example, 0120 means 1 hour 20 minutes.

EXTRA/TIME (6L)

This field shows the extra fuel quantity and the available time for holding over the destination or alternate airport. It is calculated by the FMGC and is not modifiable by the crew.

ZFCG/ZFW (1R)

This field shows the Zero Fuel Center of Gravity (ZFCG) and the Zero Fuel Weight (ZFW). This entry is mandatory for the FMGC to compute the Gross Weight (GW), which is necessary to determine reference speeds.
ⓘ **Assistance** is available for this field.

BLOCK (2R)

This is the block fuel quantity (quantity of fuel available on board when initializing the FMGC). It is mandatory to compute the Gross Weight (GW) and the fuel predictions.
ⓘ **Assistance** is available for this field.

➡ Entering the ZFW and the Block Fuel is very important to let the FMGC calculate the Gross Weight (GW). The GW is very important to determine many data computed by the FMGC, including the predictions. If you forget to enter this

data, predictions are not available and some FMGC features may become inoperative.

TOW (4R)

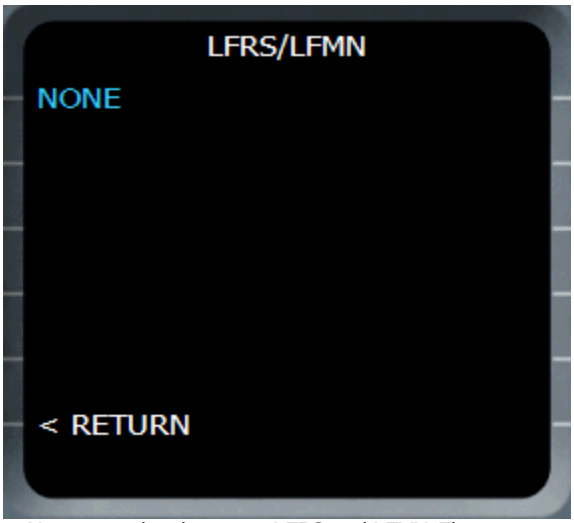
This field displays the Take Off Weight (TOW), which is calculated by the FMGC when the ZFW and Block fuel fields are filled. It is not modifiable by the crew.

LW (5R)

This is the predicted Landing Weight. It is calculated by the FMGC when predictions are available and is not modifiable by the crew.

ROUTE SELECTION Page

This page is only accessible when the FROM/TO field has been filled in the INIT A page.
The route selection page displays all the database routes that exist with the FROM/TO airports that were defined in the INIT A page. If several routes exist, you can see them by pressing the 'NEXT PAGE' key of the MCDU.
If no route exists in the database for the departure and arrival airports that were defined, "NONE" is displayed on the route selection page.



No route exists between LFRS and LFMN. The route selection page displays "NONE", and you just have to press RETURN (6L) to continue.

A route exists between LFRS and LFPO. You can use it by pressing INSERT (6R), or ignore it by pressing RETURN (6L).

If a route is defined, you can press INSERT (6R) to use it.
Note that a database route supposed to be used as a base for the flight plan, it is not a flight plan itself.
It is composed of a departure and an arrival airport, and waypoints that define the route using airways or direct. A database route **does not** contain the departure and arrival runway, and **does not** contain the departure and arrival procedures (SID and STAR).

When a route is inserted to create a flight plan, a flight plan discontinuity exists between the departure airport and the first waypoint, and another one between the last waypoint and the arrival airport. Managing these discontinuities will be explained in the flight plan section.

WIND Page

This page is accessible from the INIT A page by pressing the 5R select key. It lets the crew define the winds at different altitudes.

When it is displayed for the first time, it displays the history winds. These are the winds recorded by the FMGC during the previous flight. This is very useful if you fly the same route back and forth. For example, if you fly from Paris Orly to Nice Cote d'Azur, there is a very high probability that you have the same winds if you fly back from Nice to Paris one hour later.
As soon as you modify or enter wind information, the HISTORY WIND page becomes the WIND page.

The History Wind page shows the winds that were recorded during the previous flight (small characters). We can see that the previous flight didn't reach the FL330, which is why the wind is not defined for the cruise altitude.

The wind has been defined for the FL330 (big characters). Consequently, the page became the Wind page.

Wind Information (1L to 4L)

You can enter wind information at any altitude by entering the wind direction and the wind velocity (in knots), separated by a '/'.

INSERT (6R)

Pressing the 6R select key validates the wind information and enters it into the FMGC, which will take this information into account for the future predictions.
Note the '*' characters, which means the wind insertion may have an impact on the flight plan.

FLIGHT PLAN Page

The flight plan page is accessible by pressing the F-PLAN key on the MCDU. Basically, the flight plan page displays the flight plan stored in the FMGC memory. It also gives access to the lateral and vertical revision pages.

Example of a flight plan where the predictions have not been computed.

Example of a flight plan with predictions.

The layout of the flight plan page is explained here:

1 – The flight number is displayed in the top right corner, if it was entered in the INIT A page.

Left Column:
2 – The FROM waypoint is the waypoint from where the aircraft comes. It is the origin waypoint of the active leg.
3 – Name of the airway. In this example, the airway name is automatically generated with the course to fly from the departure airport to the initial waypoint computed by the FMGC.
4 – NEXT Waypoint: This is the waypoint to which the aircraft is currently flying. It is written with white characters.
5 – Overfly symbol: When this symbol is drawn near a waypoint, this waypoint will be overflown. If you want to have a waypoint overflown, press the OVFY key on the MCDU. A white triangle then appears on the scratchpad and you can select a waypoint to make it overfly.

Center Column:
6 – TIME: This column indicates the time to fly to each waypoint. On this example, no time is displayed because the predictions are not available yet. If a Estimated Time of Departure (ETD) is entered, the UTC time is displayed instead of the time.
7 – Bearing to fly from the FROM to the NEXT waypoint.
8 – Track to fly from the NEXT waypoint to the following waypoint.
If you scroll the flight plan, the BRG and TRK are always displayed between the first and second waypoint displayed on the page.

Right Column:
9 – Predicted speed (in knots or in Mach) or speed constraint at each waypoint. In this example, speed predictions are not available.
The speed prediction is displayed in green, the constraints are in magenta.
10 – Altitude prediction/constraint.
The altitude prediction is displayed in green, the constraints are in magenta.
11 – The distance between two consecutive waypoints is displayed here.

Bottom Line:
The bottom line shows all the information about the destination.
12 – Name of the destination airport.
13 – Total flight time, if predictions are available. It an ETD is defined, the predicted arrival time (UTC) is displayed.
14 – Distance to destination.
15 – Estimated fuel on board (EFOB) at destination.

Lateral Revision Page

It is accessible by pressing a MCDU button on the left of any waypoint displayed in the flight plan list. Depending on the type of the waypoint, the LAT REV page has different aspects.

LAT REV page at the departure airport.

LAT REV page at a normal waypoint.

LAT REV page at the arrival airport.

DEPARTURE (1L)

This is available for the departure airport only. It brings the Departure page, which allows the definition of the departing runway and SID. It is described later in this section.

ARRIVAL (1R)

This is available for the arrival airport only. It brings the Arrival page, which allows the definition of the arriving runway and STAR. It is described later in this section.

HOLD (3L)

Available for the standard waypoints only. It brings the HOLD page that lets the crew define a holding pattern at this waypoint.

VIA/GO TO (2R)

Available for the standard waypoints only. Using this key lets the pilot use an airway to add waypoints in the flight plan. Refer to the Flight Plan Management section for more information about this.

NEXT WPT (3R)

This key lets the crew add a new waypoint after the revised waypoint. The process of adding a new waypoint in the flight plan is detailed in the next section (Flight Plan Management).

NEW DEST (4R)

It allows the crew to define a new destination from the revised waypoint. An airport name must be provided here.
If you define a new destination airport, do not forget that you will have to define the arrival runway also.

DEPARTURE Page

This page is accessible from the LAT REV page of the departure airport. It is dedicated to the definition of the departure runway and SID.

All the available runways of the departure airport are listed, with their length (in meters or in feet, depending on the selected unit system), their orientation, and the ILS name/frequency, if any. You can select one of the runways by pressing the left adjacent key. As soon as a runway is selected, the SID selection page is displayed.
If a runway has already been selected, it is shown without the arrow on the left to indicate the fact that it is already selected. In addition, you can directly jump to the SID selection page by pressing the NEXT PAGE key on the MCDU.

The “ELMAA7” SID has been selected, and
no transition has been selected yet.

The SID selection page shows the Standard Instrument Departures on the left and the transitions on the right. You can select a SID by pressing its left adjacent key, and the

transition list is updated according to the SID selection. You can then select a transition by pressing its right adjacent key.
If you do not want to select a SID, you can scroll the SID list to the end. The last SID displayed is named "NO SID". If you select this one, the transition selection automatically turns to "NO TRANS", and a waypoint is automatically created in the runway alignment at 5 NM of the runway threshold.
After the SID and transition have been selected, all the corresponding changes are operated in a temporary flight plan drawn in yellow on the Navigation Display. You must press INSERT (6R) to validate it or ERASE (6L) to abort.

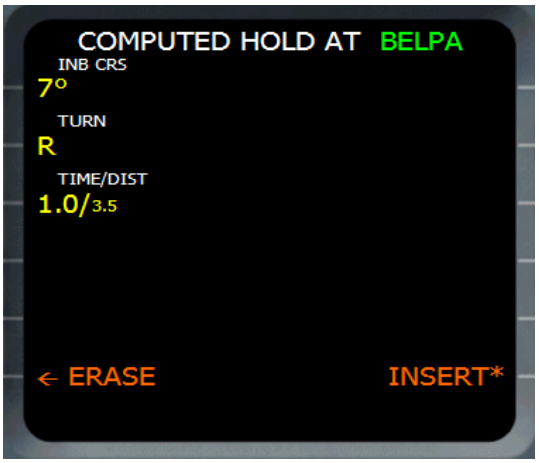
ARRIVAL Page

This page is accessible from the LAT REV page of the arrival airport. It is very similar to the departure page. It lets the crew define the arrival runway and the STAR if needed.

Just like on the departure page, the crew must first select the arrival runway. Then the STAR page is displayed, allowing the selection of the STAR and transition if needed. When the STAR selection is validated, a course fix waypoint is automatically added before the arrival runway, in the runway alignment, at 10 NM of the runway threshold for the final approach.

HOLD Page

This page is dedicated to the definition of a holding pattern at the revised waypoint, which is called the hold fix. When you select it, a default holding pattern is automatically computed and presented on the HOLD page, and it is added in the temporary flight plan (displayed in yellow on the ND).



The title of the page is "COMPUTED HOLD". The default holding pattern takes the heading to the revised waypoint as the inbound course, turns on the right and the holding duration is 1 minute below 14000 feet, 1.5 above.
You can change the holding pattern by using 1L, 2L or 3L. As soon as a change is done, the title changes to "HOLD" and the option "REVERT TO COMPUTED" appears on 3R.

INBOUND COURSE (1L)

The crew can change the heading of the holding pattern, which is the heading to the revised waypoint by default.

TURN DIR (2L)

This is the turning direction of the holding pattern. It can be L for left or R for right.

TIME/DIST (3L)

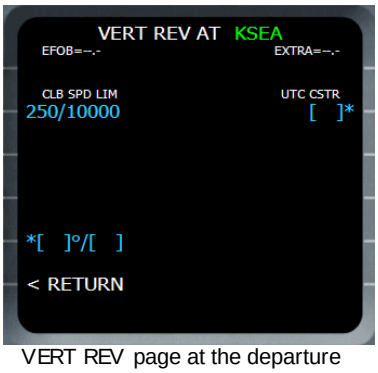
The pilot can enter the time or distance in this field. Entering one information computes the other.
If you enter the time (in minutes), the distance is computed according to the predicted speed for the holding. The predicted speed is the speed constraint at the revised waypoint if it is defined, or green dot speed.
If you want to enter the distance (in NM), it must be preceded by a '/'. The time is then computed according to the predicted speed also.

REVERT TO COMPUTED (3R)

Pressing this key brings back the default holding pattern computed by the FMGC.

Vertical Revision Page

It is accessible from the flight plan page by pressing one of the right keys adjacent to a listed waypoint. Depending on the revised waypoint type, the VERT REV page will look different.



VERT REV page at the departure airport.

VERT REV page at a standard waypoint.

VERT REV page at the arrival airport.

CLB SPD LIM or DES SPD LIM (2L)

This field defines the speed limit below an altitude. By default, it is a 250 knots speed limit below 10,000 feet. The crew can change these values. The climb speed limit is shown only on the departure airport vertical revision page.

SPD CSTR (3L)

This field appears on the standard waypoint revision page only. It lets the pilot define a speed constraint on the revised waypoint.

ALT CSTR (3R)

This field also appears only on the standard waypoint revision page. It lets the pilot define an altitude constraint on the revised waypoint. It must be preceded by a – (minus) or a + (plus) to indicate if it is a minimum or maximum altitude constraint.

WIND (5L)

This field lets the crew enter the wind forecast at the revised waypoint, with the direction (in magnetic degrees) and velocity (in knots).

UTC CSTR (2R)

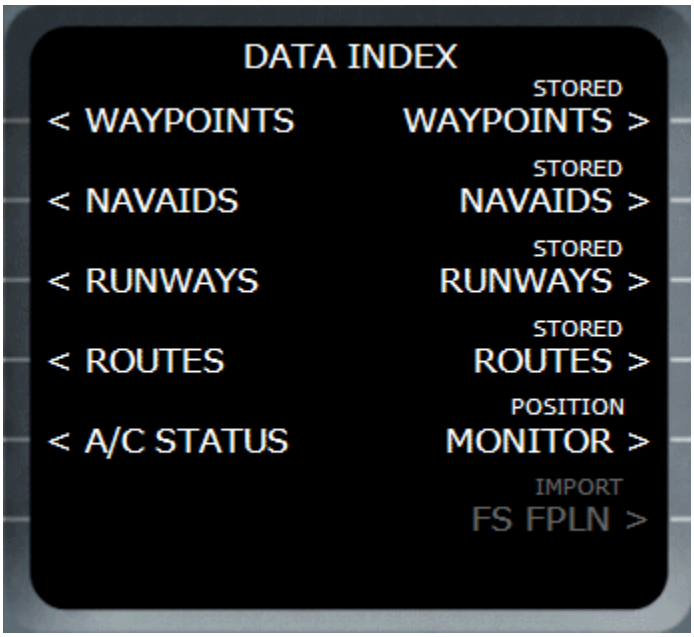
This field appears on the departure airport revision page only. It allows the pilot to define the Estimated Time of Departure (ETD). As soon as this information is entered in the FMGC, the time predictions are shown in UTC time instead of duration.
The time must be entered in UTC, using the format XXYY, where XX are the hours and YY are the minutes (i.e. 1050 for 10h50).

QNH (4R)

This field appears on the arrival airport revision page only. It lets the crew define the QNH at the arrival airport for better predictions.

DATA Page

This page gives access to the FMGC navigation database content.



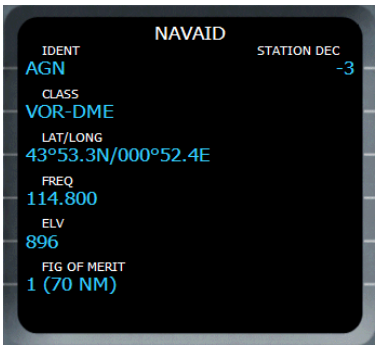
WAYPOINTS (1L)

Pressing this key gives access to the waypoints stored in the database. The pilot is asked to enter a waypoint name, and the corresponding information is displayed: identifier and lat/lon coordinates.

NAVAIDS (2L)

It works exactly like for the waypoints. All the navaid relative information is displayed on the resulting page: identifier, class, position, frequency, elevation, figure of merit (this

is fake information not supported by the current database) and the magnetic variation at the station location (station dec).



RUNWAYS (3L)

This one is a little different because the pilot is requested to enter the airport ICAO name followed by the runway name. For example, for the runway 32L at Toulouse-Blagnac, enter "LFBO32L".

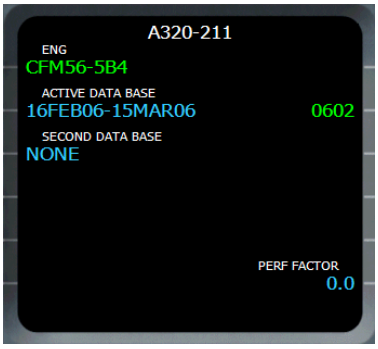
The runway identifier is displayed, followed by the coordinates, the runway length (in meters or in feet, depending on the selected unit system), the runway course and the associated ILS identifier, if any.

ROUTES (4L)

You can explore the routes stored in the database through this function. Pressing the 4L key brings a page that requests the route name (1L) or the from/to airports (1R).
If you enter a route name, the corresponding route is immediately displayed. If you enter the from/to airports, all the existing routes that correspond to these airports are displayed. The title indicates the number of routes available and you can display them by pressing the NEXT PAGE key on the MCDU.

A/C STATUS (5L)

This page shows the current aircraft status. The title is the aircraft type, and the engine type and navigation database version are shown.
Note that the number displayed on 2R is the AIRAC cycle number of the FeelThere database. It may be useful for you if you plan to update it regularly.
The performance factor shown is 6R is not used in this version.



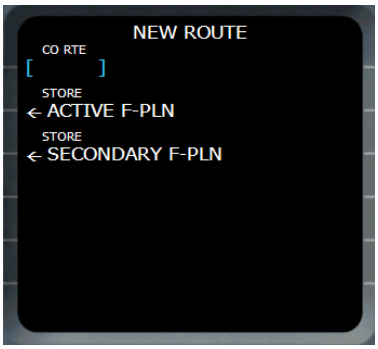
STORED WAYPOINTS, NAVAIDS, RUNWAYS (1R, 2R, 3R)

These functions are not implemented in this version. If you want to add waypoints, navaids and runways, you can do it through the FeelThere database modification tool.

STORED ROUTE (4R)

This function allows you to store the existing route in the database. Pressing 4R brings a page that shows the stored routes:

The only needed action at this stage is to press NEW ROUTE (6R) to store a new route in the database. The NEW ROUTE page appears, and you are asked to enter information about the route to save:



You can enter the name of the route in the scratchpad and press CO RTE (1L). This name will be used later to retrieve this route for a future use.
You can press STORE ACTIVE F-PLN (2L) to store the route that corresponds to the active flight plan by giving it an automatic name. In this case, the name is composed of the departure and arrival airports, followed by a number (i.e. LFBOLFPO1 for a route that goes from Toulouse-Blagnac to Paris-Orly). If a route with the same departure/arrival airports already exists, the number is automatically incremented to avoid erasing any existing route.

➡ **<u>Important Note:</u>**
When you save a route based on an existing flight plan, only the route information is saved: the departure/arrival airports and all the waypoints and airways that composed the flight plan. If you re-use a route later, you will have to define the departure/arrival runways and procedures (SID/STAR) to have a complete flight plan.

IMPORT FS FPLN (6R)
You may notice this line is written in grey. It is because it is something that does not exist in the real aircraft. It lets you create a route from the Flight Simulator flight planner. You just have to open the FS flight planner, create an FS flight plan or lad an existing one, and press this key on the MCDU to load it.

As soon as this key is pressed, a temporary flight plan is created with the loaded flight plan, and you just have to validate it. Refer to the flight plan management section for more information.

Flight Plan Management

Now that you know the meaning of all the pages involved in the flight plan creation and update (F-PLN, LAT REV, VERT REV, …), it is time to learn how to create and manage a flight plan.

Flight Plan Creation

There are several ways of creating a flight plan, they will be explained here.

Creating a flight plan from a route

When you enter the FROM/TO airports in the INIT A page, the ROUTE SELECTION page appears. If a route is available and you select it, it appears as a base for the creation of the flight plan.

Enter FROM/TO in the INIT A page.

A route exists, select it by pressing INSERT (6R).

The route waypoints are added in the flight plan with discontinuities after departure and before arrival.

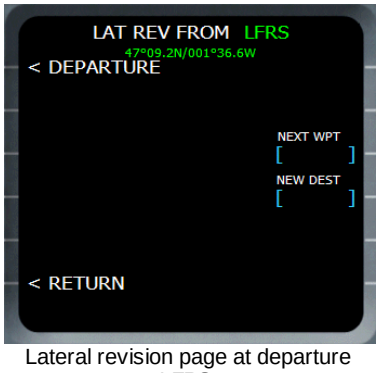
When a route is used to create a flight plan, you just have to define the departure and arrival runways, select the SID and STAR and clear the discontinuities.

Creating a flight plan from scratch

As soon as the departure and arrival airports have been defined in the FROM/TO field of the INIT A page, the flight plan page appears with the departure and arrival airports, with elevations displayed in magenta.

Pressing the 1L key brings the departure lateral revision page.

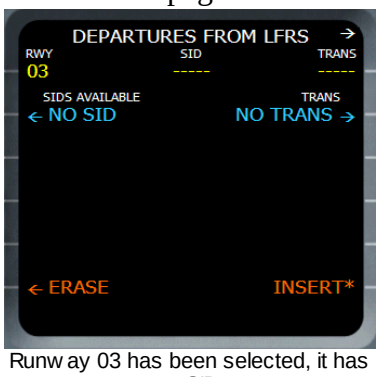
F-PLN page with only departure and arrival airports.



Lateral revision page at departure LFRS.

On the lateral revision page, pressing 1L brings the DEPARTURE page. It shows the available runways. Selecting one of the runways brings the SID selection page.

LFRS has 2 runw ays: 21 and 03 w ith ILS NT.



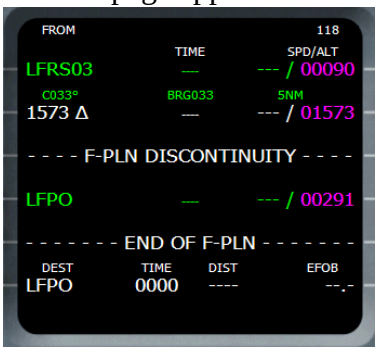
Runw ay 03 has been selected, it has no SID.

It is now necessary to select a SID by clicking one of the left buttons, and a transition (TRANS) by clicking one of the right buttons. If you select NO SID, the TRANS selection is not useful. Whatever you select, a waypoint is automatically created in the runway alignment, at 5 NM of the runway threshold with an altitude of 1500 feet above the ground, named with the altitude value. This is done to force the aircraft to follow the runway direction after takeoff when the NAV mode engages.
To validate the selection, press INSERT (6R) or press ERASE (6L) to abort.

If you validate, the flight plan page appears again, showing the waypoint created by the FMGC with the overfly triangle icon. It is the first waypoint of the flight plan.

You can proceed exactly the same way to select the runway and STAR on the arrival airport. A waypoint point (course fix) will be automatically created by the FMGC, on the arrival runway alignment, at 10 NM from the runway with a altitude constraint of 2000 feet above the ground.
It is now time to create the other waypoints of the flight plan. There are 2 ways of adding a waypoint: the immediate mode and the temporary mode.

<u>Temporary Mode:</u>
This is the standard way to add a waypoint. It is called "temporary mode" because a temporary flight plan is created.
Click the left button of the waypoint after which you want to add a waypoint. The lateral revision page appears for this waypoint.



Press 2L to add a new w aypoint after

Lateral Revision page allow s you to

the waypoint '1573'. add a new waypoint.

Enter the name of the next waypoint and press 3R (NEXT WPT) to define at as the next waypoint. A temporary flight plan is then created and displayed in yellow.

ANG is entered in the scratchpad. Pressing 3R defines it as the next waypoint.

A temporary flight plan is displayed with ANG following '1573'.

At this stage, you can:

- abort the modification by pressing ERASE (6L)
- confirm the modification and validate the temporary flight plan by pressing INSERT (6R)
- keep on modifying the temporary flight plan by adding or removing waypoints before validating it.

<u>Immediate Mode:</u>

To add a waypoint in immediate mode, enter its name in the scratchpad and click the button on the left of the waypoint before which your waypoint will be inserted. This action immediately inserts the new waypoint without needing any confirmation, but a flight plan discontinuity appears after this waypoint. If you want to fly direct, you can just clear the discontinuity.

NAMAR is entered in the scratchpad, pressing 3R inserts it in immediate mode before CHW.

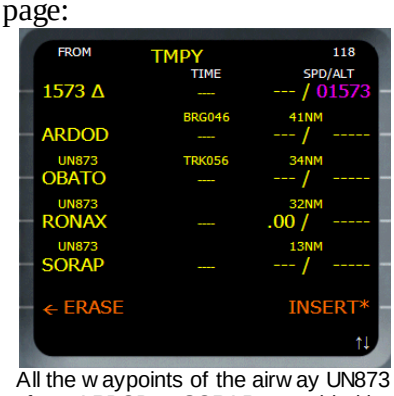
NAMAR has been added before CHW without the creation of a temporary flight plan. A discontinuity is added between NAMAR and CHW.

Using Airways

In the process of creating a flight plan, you may want to use airways to avoid entering the waypoints one by one. This can be done from the lateral revision page, by entering the

name of the airway and the name of the last waypoint you want to fly to. All the waypoints of the selected airway are then automatically added to the flight plan.
To do this, use the VIA/GO TO (2R) key on the LAT REV page:

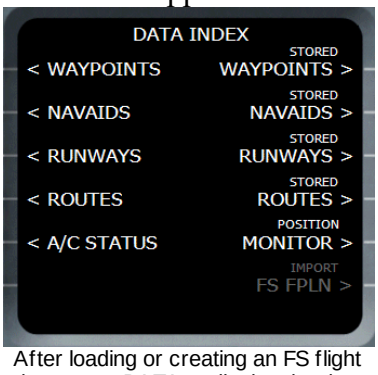
From ARDOD, you want to fly airway UN873 to SORAP. Enter UN873/SORAP in the scratchpad and press 2R.



All the waypoints of the airway UN873 from ARDOD to SORAP are added in the flight plan.

Importing a flight plan from Flight Simulator

This operation can be done from the DATA page, which will be described later in this section. It is accessible by pressing the DATA key on the MCDU.
In this page, an option that does not exist in the real aircraft has been added. This is why it is written in grey. It is the IMPORT FS FPLN (6R) function.
Pressing this button immediately imports the FS flight plan loaded or created in the flight planner. If no flight plan exists in the flight planner, an error message "NO FS FPLN LOADED" appears in the scratchpad.



After loading or creating an FS flight plan, press DATA to display the data page and press 6R.

The FS flight plan is imported in a temporary flight plan with discontinuities after departure and before arrival.

When the flight plan is imported, a temporary flight plan is created (displayed in yellow) and you can validate it (6R) or erase it (6L). The only things you need to do now are defining the departure/arrival runway and SID/STAR and clear the discontinuities.

Flight Plan Modification

Deleting a Waypoint

A waypoint can be deleted when the flight plan page is displayed, even if a temporary flight plan is displayed. You just have to press the CLR key on the MCDU keypad (or press the Backspace key on your keyboard if a locker is active) and a CLR message appears on the scratchpad.
Then you can select any waypoint displayed by pressing the button on its left and the waypoint is deleted from the flight plan.
Note that the departure, arrival waypoints can not be deleted. If you are in NAV mode, the NEXT waypoint can not be deleted either. To delete it, you first have to leave the NAV mode (by selecting the HDG mode for example), then you can delete it.

➡ **Warning**: The waypoint deletion is immediate and is not subject to any confirmation. You should be careful when using this function.

Clearing a Discontinuity

A discontinuity appears in the flight plan when the FMGC does not know how you want to fly from a waypoint to another. If you want to fly direct, you just have to clear the discontinuity in the same way as you delete a waypoint: press the CLR key, then press the button on the left of the discontinuity to clear.

Managing holding patterns

The process of creating a hold pattern is described earlier in the HOLD Page section. As soon as a hold is defined, it is integrated in the flight plan right after the hold fix (BELPA in this example) with the predicted hold speed.

If the holding pattern has to be modified, the crew can press the left key adjacent to the hold fix (2L in this example). The LAT REV page appears, and pressing HOLD (3L) brings the hold page which allows the modification of the hold settings.
To delete a holding pattern, the pilot can delete the hold fix or the holding pattern itself (2L or 3L in this example).

Saving a route

When the flight plan is created, you may want to save it for future use. You can do this through the DATA page, which allows you to save a route (refer to the DATA page section for more information). Remember that a route is not a flight plan. If you save the route, the departure/arrival airports and all the waypoints/airways used in the flight plan are saved. The departure/arrival runways, procedures (SID.STAR) and flight plan related information (cruise altitude, cost index, …) are not saved.
The saved routes are accessible when the FROM/TO airports have been entered in the INIT A page (see the ROUTE SELECTION page).

DIR Page

This page is accessible by pressing the DIR key on the MCDU. It allows the pilot to make a DIRECT. This operation consists in flying directly to a waypoint instead of going through all the waypoints of the flight plan. This operation is usually commanded by the air traffic controller if the traffic is low to let the aircraft fly its route as directly as possible. This saves time and fuel.

Pressing the DIR key brings the DIR page, which displays all the flight plan waypoints from the NEXT to the arrival airport. The crew can command a DIRECT to an existing waypoint by pressing the left key adjacent to this waypoint. Making a DIRECT to any other waypoint is also possible by entering its name in the scratchpad and pressing 1L.

PERFORMANCE Pages

The performance pages are accessible by pressing the PERF key on the MCDU. Depending on the current flight phase, different pages can be displayed, according to the following table:

Flight Phase	PERF Page
PREFLIGHT	TAKE OFF
TAKE OFF	TAKE OFF
CLIMB	CLB
CRUISE	CRZ
DESCENT	DES
APPROACH	APPR
GO AROUND	GO AROUND
DONE	APPR

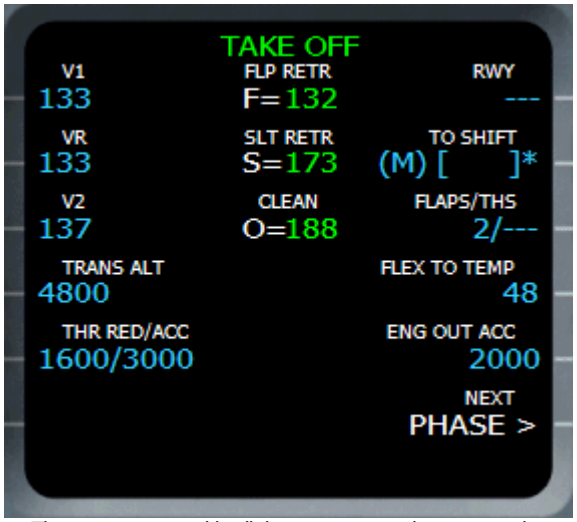
When a PERF page is displayed, you have the ability to display the page that corresponds to the next phases, but you can not access the previous phase pages.
When a PERF page is displayed, its title is displayed in green if the corresponding phase is active, otherwise in white.

When the flight is finished and the flight phase is DONE, pressing the PERF key resets the flight phase to PREFLIGHT.

PERF TAKE OFF Page

This page is displayed when the flight phase is PREFLIGHT or TAKE OFF. It lets the pilot enter all the necessary data for take off.

The page appears like this when no data has been entered. Some fields are filled with default values, others are mandatory.



The same page with all the necessary data entered.

V1, VR, V2 (1L, 2L, 3L)

The crew should enter the V1, VR and V2 speeds here. These speeds depend on the aircraft gross weight, the flap configuration, the weather (wind, rain on the runway, pressure) and the runway length. In order to enter these speeds, real pilots have sheets

that describe each airport runway and that give these numbers in all the possible conditions.
As you may not have all this information, the simulated FMGC can help you:

- If you are in Beginner mode, these fields are already filled with average speed values that *should* work in all situations. Even if they are filled, you can change the values in these fields as you wish.
- If you are in Intermediate mode, assistance is available to provide you average values if you wish.
- If you are in Expert mode, no help is available.

➡ In Beginner or Intermediate mode, the assistance is available only if you have fulfilled the line 3R to let the FMGC know which flap setting you want to use for takeoff.

TRANS ALT (4L)

This field displays the transition altitude, the altitude at which you should change from altitude in feet to flight level, thus changing the barometric setting from QNH to STD (1013 hPa or 29.92 inHg).
By default, this altitude is set to 18000 feet (written is small characters) because this is the value that is taken into account by FS. You can change it as you wish, knowing that in real life, each airport has its own transition altitude.
If you enter a value here, it appears in big characters (entered by the crew).

THR RED/ACC (5L)

This field shows the altitude for throttle reduction and acceleration. By default, these values are set 1500 feet above the departure airport altitude. You can change these values (minimum value is 400 feet AGL), but remember that acceleration altitude must be equal or greater than the reduction altitude.

The reduction altitude is the altitude at which the pilot in command should switch the throttle levers from take off power (FLEX or TOGA) to the climb power (CLB). When the aircraft reaches this altitude, a flashing 'LVR CLB' message appears on the FMA (column 1) to suggest the pilot to pull the throttle levers in the CLB detent. The climb then continues in SRS mode until the acceleration altitude is reached.

When the aircraft reaches the acceleration altitude, the aircraft begins to accelerate. The vertical mode switches to CLB (climb mode) and the autopilot manages the pitch to accelerate to the initial climb target speed, until the target altitude is reached.

➡ **Note**: The FCU target altitude should always be higher than the acceleration altitude. If it is not the case, the FCU altitude LED is off. It means you should always check this light is on prior to take off.

The FCU target altitude (2500) is lower than the acceleration altitude (3000), the LVL/CH light is off. This is a wrong situation because the aircraft will tend to descend when the acceleration altitude is reached.

The FCU altitude (5000) is higher than the acceleration altitude. This is perfect and safe. When the acceleration altitude (3000) will be reached, the aircraft will accelerate to 5000 feet.

RWY (1R)

This field displays the runway that has been selected for take off. It is dashed when the runway is not selected yet. It is not modifiable by the crew.

TO SHIFT (2R)

This field contains the Take Off Shift, in meters or in feet depending on the unit system. It is supposed to be used when the aircraft does not take off from the beginning of the runway. The FMGC takes the shift value into account to manage the take off and initial climb.
It is useless on this aircraft because the GPS provides a perfect IRS alignment as soon as the take off power is applied. Consequently, the FMGC knows exactly the aircraft position during take off without needing the TO shit.

FLAPS/THS (3R)

This field is only a reminder for the crew, it is not used by the FMGC. The pilot can enter here the flap configuration and the Trimmable Horizontal Stabilizer (THS) position chosen for take off.

In the real aircraft, this field is used as a reminder for the crew, the FMGC does not use it. If you are in Beginner or Intermediate mode, the flap setting you enter here is important because it determines the V1, VR, V2 values provided for you as an assistance.

FLEX TO TEMP (4R)

This field displays the temperature used for a FLEX take off. It consists in determining a temperature for a reduced-thrust take off, when the aircraft is below the Maximum Take Off Weight (MTOW).
In order to enter this temperature, real pilots have sheets that describe each airport runway and that give these numbers in all the possible conditions.

ENG OUT ACC (5R)

This is the altitude at which you should accelerate if an engine is out.

NEXT PHASE (6R)

Pressing 6R select key displays the climb performance page.

F, S, O Speeds

In the center of the page, the F, S and Green Dot speeds are displayed. They can be calculated only when the Gross Weight (GW) is defined (INIT B page). They can not be modified by the crew.
The F speed is the speed at which the flaps can be retracted, displayed on the PFD when the flap configuration is 2 or more.
The S speed is the speed at which the slats can be retracted, displayed when the flap configuration is 1.
The Green Dot speed is the best drag-to-lift speed, used for expedite climb or for holding patterns. It is displayed when the aircraft is in clean configuration.

PERF CLB Page

This page can be accessed by pressing the PERF key when the climb phase is active, or by pressing the 6R key in the PERF TO page.

The ECON speed/Mach computed by the FMGC will be used as a speed target during the climb phase.

The speed entered by the crew (290 kts) will be used as the speed target during the climb phase.

ACT MODE (1L)

The value in this field depends on the other fields of the page.
This field displays the speed mode that is used for the climb:

- ECON: the ECON speed/Mach combination displayed in the ECON field (3L) will be used.
- SPEED xxx: the speed entered by the crew in the SPD/MACH field (4L) will be used.

- MACH xxx: the Mach entered by the crew in the SPD/MACH field (4L) will be used.
- EXPEDITE: the expedite climb mode has been selected on the FCU. In this case, the aircraft climbs as efficiently as possible, using the green dot speed as the target speed.

CI (2L)

This is the Cost Index used for the climb phase. As explained earlier (INIT A page), the cost index determines if you want to fly slow and far (CI near 0) or fast and not far (CI near 999).
On this page, the cost index value directly impacts the ECON speed/Mach computed by the FMGC. The higher it is, the higher the speed will be, but the fuel consumption will also be higher.
This field can be modified by the crew (blue) only when the CLB phase is not active. Otherwise it is displayed in blue.

ECON (3L)

This field displays the ECON speed/Mach computed by the FMGC according to the cruise altitude and the cost index. It is not modifiable by the crew.
The aircraft will automatically switch from airspeed to Mach when the crossover altitude will be reached.
If a '*' character is displayed in this field, it means this field is selectable. The pilot can press the 3L select key to revert to the ECON speed mode.

SPD/MACH (4L)

When the climb phase is not active, the crew can enter a preselected speed, mach, or both in this field to set the speed target the FMGC will use during the climb. When a value is entered in this field, the ACT MODE automatically switches to SPEED xxx or MACH xxx.
If a '*' character is displayed in this field, the pilot can press the 4L select key to revert to the SPEED xxx or MACH xxx speed mode.
When the climb phase is active, this field is not editable. The crew may select a new speed on the FCU (by pulling the SPD/MACH knob). In this case, the FCU selected speed is displayed in this field.

PREV PHASE or ACTIVATE APPR PHASE (6L)

If the climb phase is active, the 6L select line shows 'ACTIVATE APPR PHASE'. If you press 6L, a confirmation is requested and the FMGC switches directly to the approach phase. Consequently, the PERF APPR page is immediately displayed.
If the climb phase is not active, the 6L select line lets you display the PERF TAKE OFF page.

DEST EFOB (1R)

This field displays the Estimated Fuel On Board (EFOB) at the destination. It is not modifiable by the crew.

PRED TO XXX (2R)

This field lets you define the altitude for which the predictions will be computed on lines 3R, 4R and 5R. This altitude must be lower than the cruise altitude.

Predictions (3R, 4R, 5R)

These fields show the predicted time and distance to reach the altitude entered in 2R, according respectively to the ECON speed/Mach, the preselected speed/Mach and the expedite mode.

NEXT PHASE (6R)

Pressing 6R select key displays the cruise performance page.

TIME or UTC

On the center of the page, the time or the UTC to the destination is displayed, depending on the fact that the Estimated Departure Time (ETT) has been defined or not.

PERF CRZ Page

This page can be accessed by pressing the PERF key when the cruise phase is active, or by pressing the 6R key in the PERF CLB page.

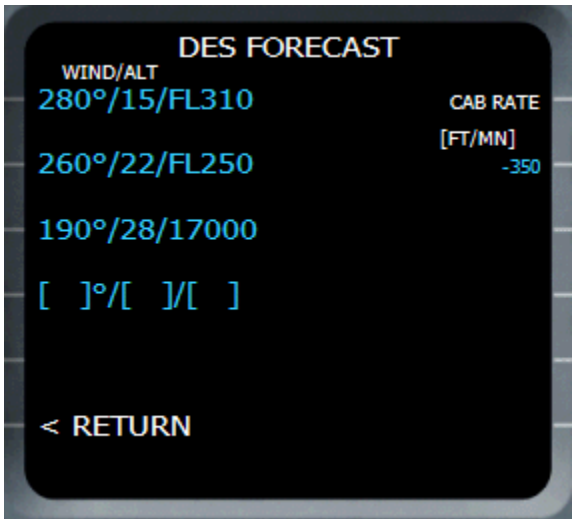
This page is very similar to the PERF CLB page. The speed management works exactly like for the climb, with select keys 1L to 4L.

DES FORECAST (2R)

Pressing the 2R select key brings the descent forecast page. This page lets the crew enter the wind information forecasted for the descent.

DES FORECAST Page

This page can only be accessed from the PERF CRZ page, by pressing the 2R select key.



WIND/ALT (1L to 4L)

The crew can enter the wind forecast for the descent. Each information line is composed of the wind direction (in degrees), the wind velocity (in knots) and the wind altitude (in feet or in flight level). Don't forget that if you enter an altitude in flight level, it should begin with 'FL'.
The wind information lines entered here are automatically sorted by altitude.

CAB RATE (2R)

This field displays the default cabin rate used for pressurization. It is modifiable by the crew. Clearing this value reverts the default value of -350 feet/minute.

PERF DES Page

This page can be accessed by pressing the PERF key when the descent phase is active, or by pressing the 6R key in the PERF CRZ page.

ACT MODE (1L)

The value in this field depends on the other fields of the page.
This field displays the speed mode that is used for the descent:

- ECON: the ECON speed/Mach combination displayed in the ECON field (3L) will be used.
- AUTO SPEED xxx: the speed entered by the crew in the speed field (3L) will be used.
- AUTO MACH xxx: the Mach entered by the crew in the speed field (3L) will be used.
- SPEED xxx: if the descent phase is active and the speed is selected on the FCU, the target speed value is displayed here.
- MACH xxx: if the descent phase is active and the Mach is selected on the FCU, the target Mach value is displayed here.
- EXPEDITE: the expedite descent mode has been selected on the FCU. In this case, the aircraft climbs as efficiently as possible, using the green dot speed as the target speed.

CI (2L)

This is the Cost Index used for the descent phase. It impacts the ECON speed/Mach computed on line 3L.

ECON / AUTO SPD / AUTO MACH (3L)

If the descent phase is not active, this field title is ECON until the crew enters a value in this field. As soon as a value is entered, the title switches to AUTO SPD xxx or to AUTO MACH xxx, and the ACT MODE (1L) is modified accordingly, as shown here.

A clearing action on this field reverts to the ECON speed/Mach and updates the ACT MODE accordingly.
If the descent phase is active, this field can not be modified.

PERF APPR Page

This page is dedicated to the approach settings. It can be accessed by pressing the PERF key when the approach phase is active, or by pressing the 6R key in the PERF DES page.

QNH (1L)

You can enter the QNH here in hector-Pascals or in inches of mercury. It is mandatory because it is used by the FMGC to perform the approach calculation.

TEMP (2L)

Enter the temperature forecasted at the arrival airport, in °C.

MAG WIND (3L)

Enter the forecasted wind (direction/velocity) at the arrival airport. This entry is optional, but if you have the information available, the FMGC will perform better predictions.

TRANS ALT (4L)

This is the transition altitude used for the approach, which can be different from the transition altitude used at departure. By default, it is set to 18000 feet because it is the default transition altitude managed by Flight Simulator (small characters).
Clearing this line brings back the default value.

VAPP (5L)

This is the approach speed. If it is drawn with small characters, the value displayed is the value computed by the FMGC, according to the aircraft gross weight and the current wind. You can enter any other value in this field. Clearing this line brings back the value computed by the FMGC.
Vapp is the speed that will be used by the FMGC if the FCU is in managed speed during the final approach, with landing flap configuration.

PREV PHASE (6L)

You can click 6L to come back to the PERF DES page, unless the approach phase is active.

FINAL (1R)

This is a reminder of the arrival runway. It is not modifiable.

MDA and DH (2R, 3R)

MDA is the minimum descent altitude, DH is the decision height. Remember that MDA is an altitude, which is measured from the seal level altitude, and DH is a height which is measured from the ground.
The MDA is the minimum altitude at which the aircraft can descend safely, and the DH is the height at which the captain decides if the aircraft lands or go around (especially important with low visibility).
The MDA and the DH can not be defined together, you must choose one or the other. As soon as one is filled, the other is erased. If DH is entered, an aural warning "minimums, minimums" is heard when the DH is reached. If MDA is entered, the digits in the PFD altitude window turn amber when the aircraft is below this altitude.

LDG CONF (4R, 5R)

The pilot can choose the flap landing configuration here. By default, FULL is selected (written in big characters) and CONF 3 is selectable (shown with a *).
This choice determines the content of the landing check-list that will display the required flap configuration when the aircraft is close to land.
Note that if you select the CONF 3, you will still have a GPWS warning "too low, flaps" when the aircraft gets close to the ground. To avoid this, press the GPWS flap button on the overhead (refer to the system section for more information about the GPWS).

NEXT PHASE (6R)

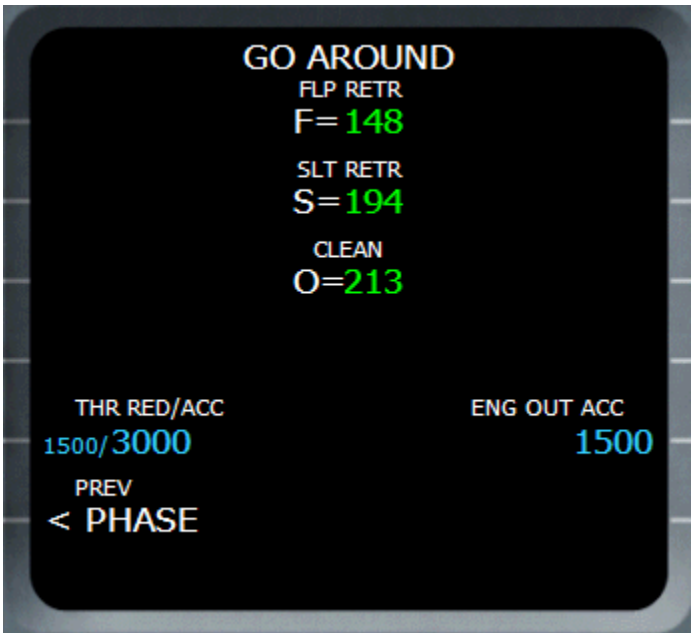
Displays the PERF GO AROUND page.

F, S, O Speeds

In the center of the page, the F, S and Green Dot speeds are displayed. They can be calculated only when the Gross Weight (GW) is defined (INIT B page). They can not be modified by the crew.

PERF GO AROUND Page

This page lets the crew set the aircraft ready for a possible go around.



THR RED/ACC (5L)

Like on the PERF TAKE OFF page, this field lets the crew select the thrust reduction altitude and the acceleration altitude in case of a go around. Remember that the acceleration altitude must be equal or greater than the thrust reduction altitude.

ENG OUT ACC (5R)

This is the altitude at which you should accelerate if an engine is out.

F, S, O Speeds

In the center of the page, the F, S and Green Dot speeds are displayed. They can be calculated only when the Gross Weight (GW) is defined (INIT B page). They can not be modified by the crew.

FUEL PRED Page

This page is accessible by pressing the FUEL PRED key on the MCDU. It allows you to enter flight information like on the INIT B page. It is especially useful if you forgot to enter data in the INIT B page and the engines are started (the INIT B page is accessible only when the engines are stopped).

AT (1L)

This is a reminder of the destination airport. It is not modifiable by the crew.

GW / CG (3L)

This field contains the Gross Weight and the center of gravity. The gross weight information is mandatory, so amber boxes appear here if this information is not available.

RTE RSV / % (4L)

This field is exactly the same as the one shown on the INIT B page.

FINAL / TIME (5L)

This field is exactly the same as the one shown on the INIT B page.

EXTRA / TIME (6L)

This field is exactly the same as the one shown on the INIT B page.
Refer to the INIT B page section for more information about these fields.

EFOB (1R)

This is the fuel prediction at destination. It is not modifiable by the crew.

FOB (3R)

This field allows the crew to enter a FOB (Fuel On Board) quantity. You should be very cautious when enter a value here because it can make the fuel predictions wrong. It can be used only when engines are stopped. As soon as engines are started, the FOB information is acquired from the fuel sensors again.
In addition, you have the ability to define how the FOB quantity is computed:

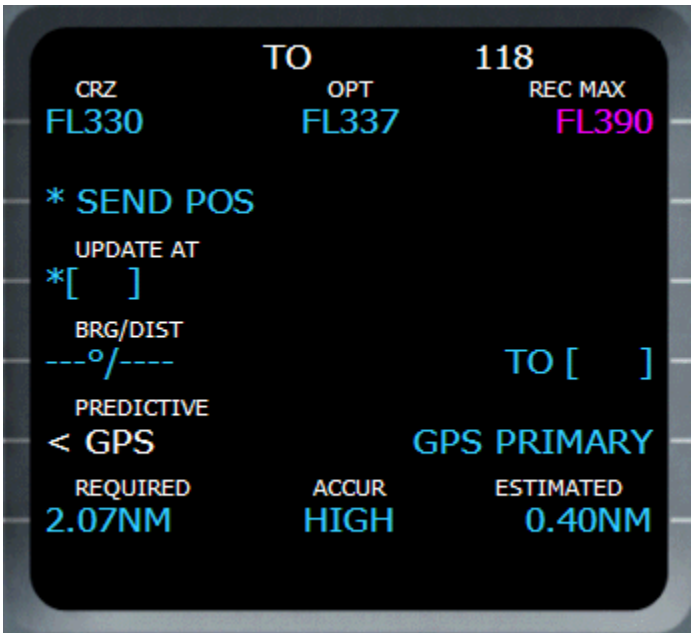
- FF + FQ: the fuel flow and the fuel quantity sensors are used
- FF: the fuel flow sensors are used only
- FQ: the fuel quantity sensors are used only

CRZ TEMP/TROPO (4R)

This field displays the temperature at the cruise altitude and the tropopause altitude. Both values can be modified by the crew.

PROG Page

The PROG page is a multifunction page.



The title is composed of the current flight phase (TO for takeoff, CLB, CRZ, DES or APPR) and the flight number.

CRZ (1L)

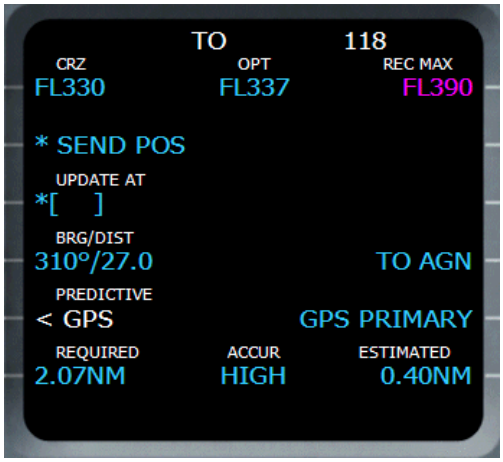
This field displays the current cruise altitude. The crew can modify this value to change the cruise altitude during the flight (it is the only way to do this as the INIT page is not accessible during the flight).
This field is empty when the aircraft is in descent or approach phase.

SEND POS (2L)

Pressing this key sends a position report.

UPDATE AT (3L)

This field allows the crew to update the IRS position with a navaid position. This function is not implemented in this aircraft because its position is updated by the GPS.
BRG/DIST (4L)
As soon as a navaid name is entered in the "TO" field (4R), the bearing and distance to this navaid is displayed and updated in real time.



OPT (1 Center)

This value shows the optimal cruise flight level computed by the FMGC, depending on the gross weight and the cost index.

REC MAX (1R)

This is the maximum flight level, displayed in magenta.

VDEV (2R)

This field is visible during the descent and approach phases only. It shows the vertical deviation between the current aircraft position and the computed flight plan. This information is also shown on the PFD altitude tape (refer to the EFIS section for more information).

TO (4R)

This field lets the pilot enter a navaid name. As soon as it is done,

DIR DIST TO DEST (5R)

This information is visible during the descent and approach phases only, if you are not in NAV mode. It shows the direct distance to the destination approach. It is very useful if the ATC makes you leave your flight plan and guides you with heading, in which case you use the HDG mode.

RAD NAV Page

This page is dedicated to the management of the radio equipment. Remember that any information written with small characters is generated by the FMGC, and big characters correspond to information entered by the crew.

VOR1/FREQ (1L) and FREQ/VOR2 (1R)

These two fields are dedicated to VOR1 and VOR2. They display the current VOR names and frequencies. If you see the identifier and the frequency both written is small characters, it means the FMGC has autotuned this VOR.
The crew can enter a VOR identifier or frequency in these fields.
If a name is entered, the VOR frequency is fetched in the database, displayed here, and set on the VOR receiver. In this case, the identifier is written in big characters, and the frequency is in small characters.
If a frequency is entered, the FMGC will fetch the closest VOR that corresponds to this frequency. The found identifier is then written is small characters (set by the FMGC) and the frequency, entered by the crew, is in big characters.
As soon as an identifier or a frequency has been entered, the VOR can not be autotuned by the FMGC until it is released. To do so, press the CLR key on the MCDU and press 1L or 1R to release the VOR1 or VOR2. As soon as the VOR is released, the FMGC will take control back on it and use it for autotune.

CRS (2L and 2R)

These fields let you enter the course for VOR1 and VOR2.

ILS/FREQ (3L)

Just like for VOR1 and VOR2, this field shows the ILS identifier and frequency. You can set the ILS identifier or frequency like for the VORs. If the ILS is released, the FMGC will automatically set the arrival runway ILS when the approach phase becomes active.

➡ Because of a limitation in Flight Simulator, the VOR1 and the ILS are linked and share the same frequency. Consequently, if you set the VOR1, the ILS setting is lost, and conversely. This is why you should make sure VOR1 is released if you want to have the ILS autotuned on approach.

CRS (4R)

This field lets you set the ILS course. If the ILS is autotuned on approach, the ILS course is automatically set by the FMGC.

ADF1/FREQ (5R)

This field lets you set the ADF in the same way as the VORs.

ADF BFO (6R)

This activates or stops the frequency oscillator. This feature is not used by Flight Simulator.

➡ The RAD NAV page is the standard way to set radio equipment manually. You can also use the left and right Radio Management Panels (RMP) located on the pedestal to do this. In this case, the RAD NAV page becomes inactive as soon as you press the NAV page on any RMP and it appears like this:

Refer to the Systems section for more information about the RMP usage.

Page Sequencing

Now that you know the FMGC and all the MCDU pages, you may be lost in their usage… There are so many pages that you may not know in which order you should use them. So here are some advices:

1 - Initialization

If the menu page appears, press FMGC (1L) to bring the INIT A page. Otherwise, press the INIT button.
Enter the FROM/TO airports. If a route exists and you select it, it brings the flight plan page with a temporary flight plan. Validate it, and come back to the INIT A page.
Align the IRS if it they are not aligned. The alignment time will be useful to set the flight plan and everything.
Enter the flight number and the cruise altitude. Edit the cost index if the default value is not good for you.

Then press NEXT PAGE to have access to the INIT B page and have the gross weight computed. If the engines are started, you can not access this page and you have to define the gross weight on the FUEL PRED page.
If INIT B is accessible, set the taxi fuel, route reserve, final, …

2 – Flight Plan

Press F-PLAN to access the flight plan page and create the flight plan if necessary (refer to the flight plan management section for more information).
Anyway, enter the DEPARTURE page through the lateral revision page of the departure airport, and define the departing runway and SID. Do the same at the arrival airport to define arrival runway and STAR.
As soon as the gross weight is defined, the flight plan is created and all the discontinuities are cleared, the predictions are computed by the FMGC and appear on the flight plan page.

3 – Performance Settings

Press the PERF button to access the performance page. The PERF TO page appears. Set the FLEX temperature, and set V1, VR and V2 for takeoff. Remember that if have entered the takeoff flap configuration and you are in Beginner or Intermediate mode, assistance is available for these values.
You can navigate to the climb, cruise, and descent performance pages to make sure the speeds and modes are correct, according to the cost index.

4 – Done…

The FMGC is now set for takeoff. Do not forget to turn the flight director on, and all the FCU modes will engage to help you during the takeoff and climb phases.
During the flight, you may have to use some MCDU pages, such as RAD NAV to manually set radio, flight plan to watch the flight along the plan and see the remaining

distance to destination, or the PROG page to monitor your descent and your distance to destination if not in NAV mode.

APPENDIX A

Tutorial Flight

This tutorial describes all the phases of a flight from Toulouse Blagnac (home of the Airbus aircrafts) to Paris Orly, from the cold & dark situation to the landing at destination.

Flight Setup

Cold & Dark

This tutorial is supposed to begin with a cold & dark aircraft. In order to be in this situation, you can place your aircraft at LFBO (Toulouse Blagnac) on a parking place, and press the "Cold & Dark" button on the configuration window.

Batteries ON

On the overhead panel and press both battery switches to turn on the batteries.

All Generators ON

Even if engines are not running yet, turn the generators on (they are in fault mode because the engines are not running).

NAV Lights ON

As soon as the aircraft is energized, NAV light should be turned on.

Radio Management Panels ON

On the pedestal, turn the Radio on by moving the RMP master switch.

External Power

Check the overhead panel. If an external power source (GPU) is available, using by pressing the EXT PWR switch.

FMGC Initialization

If the MENU page is displayed, press the FMGC key (1L) or press the INIT key on the MCDU to display the INIT A page.

- FROM/TO: Enter the departure and arrival airports in the scratchpad and press 1R
  LFBO/LFBO → 1R
- The route selection page appears. A route exists between LFBO and LFPO, named LFBOLFPO1. Let's use it by pressing INSERT (6R)
- Align the IRS by pressing 3R
- Enter the flight number in the scratchpad and press 3L
- Enter the cruise altitude in the scratchpad and press 6L
  33000 → 6L
  or
  330 → 6L
  or
  FL330 → 6L

Press NEXT PAGE to jump to the INIT B page.

- ZFWCG/ZFW: Enter the ZFWCG and ZFW in the scratchpad and press 1R
  25/59.1 → 1R
  or
  Use assistance for this (in Beginner and Intermediate modes only): press 1R with empty scratchpad, the 1R again to enter it in the FMGC.
- When ZFW is entered, the Block line appears. Enter the block fuel and press 2R (assistance is also available).

Press the F-PLAN key on the MCDU to display the F-PLN page.

- On the first line, the departure airport (LFBO) is shown. Press 1L to display the Lateral Revision page for this airport.
- On the LAT REV page, press 1L to display the DEPARTURE page.
- Select the departure runway and the SID (or NO SID).
- Press INSERT (6R) to validate, the F-PLN page appears again.
- Resolve the discontinuity.
- Scroll down to the arrival airport (LFPO) or press the AIRPORT key on the MCDU to jump directly to the arrival airport.
- Press the left button adjacent to the arrival airport to display its Lateral Revision page.
- Press 1R to display the ARRIVAL page.
- Select arrival runway and STAR (or NO STAR).
  If the arrival runway changes because of the weather (especially because of wind direction or IFR conditions), you will be able to update it during the flight.
- Press INSERT (6R) to validate, the F-PLN page appears again.
- Resolve the discontinuity.

At this time, with all the data entered in the FMGC and no discontinuity in the flight plan, the predictions are computed and displayed with the flight plan.

If you wish, you can enter the Estimated Time of Departure (ETD) by pressing the right key adjacent to the departure airport. The Vertical Revision page appears and you can enter the UTC CSTR by pressing 2R.

Now it is time to set the performance data. Press the PERF key on the MCDU and the PERF TO appears to set the takeoff performance.

- Enter the takeoff flap configuration (1, 2 or 3) and press 3R. In the real aircraft, this information is used as a reminder only for the crew. If you are in Beginner or Intermediate mode, the information is also used by the system if you request assistance for the reference speeds.
  Suggestion: Use Flap 1 confugration.
- Enter the FLEX TEMP and press 4R. This temperature will be used by the FADEC if you takeoff using FLEX thrust.
  Suggestion: A value of 50° is an average value that should work fine.

- Enter V1, VR and V2 in the 1L, 2L and 3L fields. These speeds are important for the SRS mode during takeoff. As soon as these speeds are entered, the red message 'SPD SEL' disappears from the PFD and the reference speeds appear on the speed tape.
  Remember you can use the assistance if you are not in Expert mode.
- Thrust reduction altitude and acceleration altitude can be entered. By default, both altitudes are set to 1500 feet above the departure airport altitude. You can leave this value for the thrust reduction altitude, but the acceleration should be 1500 feet higher than the thrust reduction altitude.
  To leave the thrust reduction altitude unchanged and update the acceleration altitude to 3200 feet;
  /3200 → 5L

Press NEXT PHASE to display the other PERF pages for climb, cruise, descent and approach (PERF CLB, CRZ, DES, APPR). Make sure all parameters are OK for you. You should especially check the Cost Index, which determines the speed used for climb, cruise and descent if you use managed speed.

Engine Start

APU Start

Before being able to start the engines, the APU must be started.
On the overhead, press the APU Master Switch ON.
Then press the START button.
Monitor the APU start sequence of the SD and wait for the APU to be available.

External Power

If external power was used, turn it off now by pressing the EXT PWR switch.

APU Bleed ON

Turn on the APU bleed by pressing the APU BLEED switch on the overhead.

Beacon Lights ON

As the engines will soon be started, the beacon lights must be turned on now using the switch on the overhead panel.

Strobes AUTO or ON

Strobe lights should be turned on as soon as the aircraft is moving. If you select AUTO, they will automatically turn on as soon as the aircraft is airborne.

Signs

Turn Seat Belts and No Smoking signs on, or set the auto position to have them automatically managed.

Engine Start

The APU is available and APU bleed is engaged. The engines are now ready to start.

- On the pedestal, set the ENG Mode switch on the IGN/START position.
  You can check on the E/WD that the FADEC have turned on because the amber information is replaced by active displays.
- ENG 2 Master Switch ON.
  Check the engine is correctly starting on the E/WD and SD. Wait for the engine 2 to be started completely.
- ENG 1 Master Switch ON.
  Do the same for engine 1.

- When all engines are running, set the ENG mode switch back to the NORM position.
- 2 minutes after engine start, the takeoff memo will appear on the E/WD.

APU Stop

As both engines are started, check the generators are turned on. The APU is not necessary any more.

Press the APU BLEED switch to turn air bleed off, and press the APU Master Switch to turn the APU off.

FCU

Check the "dash-ball-dash-ball-ball-dash" on the FCU to make sure all the settings are OK: speed managed, heading managed, and altitude managed with a target altitude higher than the acceleration altitude.

Check the FMA and make sure the CLB and NAV modes are armed. If not, reset the FCU by turning the FD off then on again. CLB and NAV should appear in blue on the FMA.

Pushback

Flaps

Set the flap configuration according to what you have entered in the PERF TO page.

Spoilers ARMED

Arm the ground spoilers in case of a rejected takeoff.

Autobrake MAX

The autobrake should be set to MAX in case of a rejected takeoff only (never use MAX for landing).

Parking Brake RELEASED

Release the parking brake to get ready for pushback.

Taxi Lights ON

Turn on the taxi light before taxiing.

Cleared for pushback

Ask the ATC for the pushback and press the corresponding key (Shift-P by default) to start the pushback.

Note: You can also change this sequence by starting the engines during the pushback, as it is often done on the real aircraft.

Taxi

Cleared to Taxi

When pushback is finished and the aircraft is properly positioned, you can ask the ATC for the clearance to taxi to the departure runway.

Thrust

During taxi, move the thrust lever in the manual range. Around 40% N1 should be enough to move the aircraft. Taxiing should be operated at 20 knots, with 10 knots during the turns. As soon as the aircraft moves, idle thrust should be enough to keep it going.

Flight Controls CHECKED

Move all the flight controls in all possible directions and check their movement on the F/CTL SD page, which appears automatically when a flight control moves on the ground.

Takeoff Configuration TEST

On the ECAM control panel (located on the pedestal), press the TO CONFIG key (or press Shift-Control-T on your keyboard). This action simulates takeoff thrust power and checks all the important settings for takeoff.

Landing Lights ON

Turn the landing lights on to get ready for takeoff.

Parking Brakes SET

Before entering the runway for takeoff, set the parking brakes.

Takeoff Memo GREEN

On the takeoff memo displayed on the E/WD, make sure all the items are green and no blue item remains.

Cleared for takeoff

Ask the ATC for a takeoff clearance.

Align and Takeoff

Parking Brakes RELEASED

As soon as the takeoff clearance is received, release the parking brakes to enter the runway.

Thrust

Like for taxiing, use around 40% N1 to taxi to the runway.

TCAS Mode ABV

On the pedestal, set the TCAS mode to ABV (above) to get ready for climb and watch the intruders 8000 feet above the aircraft.

Takeoff Thrust

If you are cleared for takeoff, push the thrust levers to 60-70% N1 and monitor the E/WD to make sure thrust is available. If everything is OK, you can push to the FLEX detent. You can use the TOGA detent for takeoff, but in this flight we decide to save some fuel and use FLEX thrust takeoff.

IRS

For your information, the IRS are automatically aligned with the GPS position at this time. If the IRS were not perfectly aligned before, you may see the alignment on the ND.

FMA

As soon as the thrust levers are in the FLEX detent, check that the FMA displays:

- MAN FLEX 50 in the 1st column
- SRS in green in the 2nd column, in addition to the blue CLB (armed mode) that was already displayed.
- RWY in green in addition to the NAV message already displayed in blue in the 3rd column.
- A/THR in blue in the 4th column to indicate the autothrust is armred.

Stick Position

During the takeoff roll, the stick should be pushed half way forward until the speed reaches 80 knots. This stick position can be monitored on the PFD.

Yaw Bar

As soon as the takeoff thrust is applied, and if the runway has an ILS, the yaw bar appears on the PFD to help you in guiding the aircraft along the runway centerline.

Stick Position

When the speed is over 80 knots, the stick can be released to come back to the neutral position.

Rotation

When VR is reached (indicated with a blue circle on the PFD speed tape), pull the stick for the rotation. If the FD is not perfectly stable at this time, take a 15° pitch angle.

Landing Gear UP

As soon as positive climb is checked, the landing gear can be retracted.
The autobrake will automatically turn off 10 seconds later.

Landing Light OFF

Even if the landing light is automatically turned off when the gear is retracted, it should be turned off using the overhead switch.

Ground Spoilers DISARMED

The takeoff can not be rejected so the ground spoilers can be disarmed.

Climb

Thrust Reduction Altitude

When the THR RED altitude is reached (1800 feet in this example), a flashing 'LVR CLB' message appears on the FMA (1st column). Move the thrust lever back to the CL detent.

Note: As the thrust reduces when the levers are moved back to the CL detent, the pilot should anticipate the pitch reduction caused by this thrust reduction.

Acceleration Altitude

Check the CLB mode becomes active on the FMA (2nd column).
The aircraft will now accelerate to the target speed of 250 knots.

S Speed

As the aircraft accelerates, you must retract the flaps and slats when the S speed is reached and let the aircraft accelerate to 250 knots.

10000 feet

At 10000 feet, the 250 knots speed limit disappears, so the aircraft accelerates to the target climb speed. If you did not change the default cost index of 50, the target speed is 300 knots.

Barometric Setting PULL

When the transition altitude is reached (18000 feet by default in Flight Simulator), the barometric setting flashes. Pull the barometric knob to set the STD value.

Cruise Altitude

As soon as the cruise altitude is reached, check the FMA displays 'ALT CRZ' in the 2nd column.

Descent & Approach

TCAS

Before engaging the descent, set the TCAS mode to BLW (below) to monitor potential intruders below the aircraft during the descent.

Engage Managed Descent

When the top of descent point (T/D) is reached, select a lower altitude (you can select 3000 feet) on the FCU and push the ALT knob (left mouse click).

Deceleration

As the aircraft descends, it will reach the deceleration point, shown as a big D on the ND. At this time, the approach phase automatically engages and the target speed is changed to the Vapp speed, which should be around 140 knots in this case.
Note that even if Vapp is shown as the target speed, the actual target speed will be the maneuvering speed before flaps are fully deployed in landing configuration.

If you decide to be guided by the Flight Simulator ATC, it is highly probable that your aircraft will never cross the D point. In this case, you have to manually set the approach phase by pressing the ACTIVATE APPROACH PHASE (6L) in one of the PERF page.

ILS ON

As the approach phase is engaged, the ILS is automatically tuned to the arrival runway ILS. You can press the ILS button at this time to have the ILS information displayed on the PFD.

Flaps Extension

As the aircraft descends, you can extend the flaps to help it decelerating and to keep good lift while the airspeed is decreasing.
Suggestion: Extend Flaps 1 at around 5000 feet.
As the aircraft keeps decelerating, you can extend flaps as soon as the $V_{FE\ NEXT}$ speed is reached.
Suggestion: Extend Flaps 2 and 3 as the speed decreases.

Landing Configuration

Keep following the flight plan (or the ATC instructions if you are guided by ATC). It should take you in the runway alignment.
At around 2000 feet, get ready for landing:

- Extend the landing gear
- Extend full flaps
- Set LOC mode on the FCU
- Set Autobrake MED
- Ground Spoilers ARMED

Note that the landing memo appears when the aircraft reaches 1500 feet in approach.

Glideslope capture

As soon as the localizer is captured (LOC* or LOC displayed on the FMA), you can set the approach mode (APPR) on the FCU.

If you want to make an autoland, you can engage the second autopilot at this time.

Landing Memo GREEN

Make sure all the items on the landing memo are green. If not, take the corrective actions.

Short Final

Follow the localizer and glideslope, or let the autopilot do it in autoland if you wish. As the aircraft gets closer to the ground, the LAND mode engages, then the FLARE mode. They are shown on the FMA. If you fly manually, just follow the flight director and it will be fine.

Thrust RETARD

At around 20 feet, an aural warning "Retard, Retard" is heard. Pull the thrust levers back to idle and let the aircraft gently touch the ground.

Landing

Reverse Thrust & Braking

As soon as the wheels have touched the ground, you can engage the thrust reversers if you wish.

The autobrake makes the aircraft decelerate on the ground. You can take the control at any time by using the brakes. Any action on the brakes automatically disconnects the autobrake system.

Exit Runway

Exit runway when able.

As soon as it is done, retract the flaps and disarm the ground spoilers to retract them.

Taxi to the Gate

As you taxi to the arrival gate, you may notice the FMGC resets 1 minute after the aircraft has touched the ground. Its memory is cleared to make it ready for the next flight. The FMA is also cleared.

Last Turn

Just before arriving at the gate, you should start the APU to get ready to stop the engines.

- APU Master Switch ON
- APU START

At the Gate

When the aircraft is stopped at the gate, shut it down:

- Parking Brakes SET
- ENG 1 Master Switch OFF
- ENG 2 Master Switch OFF

(Remember that the right mouse button must be used to shut down the engines)

External Power

One minute after the aircraft has stopped and the engines are shut down, the GPU becomes available. Press the EXT PWR switch on the overhead to use it.

APU Shut Down

As soon as the external power source is available, you can save fuel and turn off the APU by pressing the APU Master Switch.

APPENDIX B

Advices

This section groups all the good advices that are spread out in the documentation. Read them carefully and it will improve your flight experience.

Setup

Sidestick button simulation in Flight Simulator:
In the FS Setup section (Key Assignments), the assignment of the FS autopilot switch to one of your joystick button is **highly recommended**. If you do so, it lets you simulate the real aircraft procedure that consists in disconnecting the autopilot only through the joystick button, and not through the AP1/AP2 pushbuttons on the FCU.

Simulation of the instinctive pushbuttons in Flight Simulator:
In the same way, the assignment of the autothrottle to one of your throttle device is highly recommended. It will allow you to simulate the instinctive pushbuttons, the red pushbuttons located on the thrust levers that are used in to disconnect the auto-thrust in the real aircraft.
You can do so by associating the FS "Autothrottle arming switch" command to one of your throttle device button.

Autoflight

Mouse Wheel Usage
Remember that you can use the mouse wheel in combination with the **Shift** key on any button of the FCU. Rolling the mouse normally makes normal value changes (1 by 1), and rolling the wheel while holding down the **Shift** key makes big value changes (10 by 10). This is very convenient.

FCU setting for take off:
Remember the magic words: "dash, ball, dash, ball, ball, dash". It will make you check the FCU is properly configured before take off, with speed, heading and vertical speed managed. Forget this if you prefer to take off with selected modes.

LOC/APPR mode usage:
Real pilots say the LOC mode should ALWAYS be engaged before the APPR mode. Even if engaging the APPR mode before the LOC mode is possible, it should never be done. This is because the airport approach guides you on a lateral and vertical path that avoids the terrain. The terrain avoidance is totally reliable only if you descnd on the glide slope only when you are aligned with the runway, aligned with the localizer.

Autoland:
In case of lateral wind, the autopilot will have difficulties to follow the localizer. Real life pilots say the autoland is NEVER used in case of lateral wind. The human pilot is much better than the autopilot to make small and accurate trajectory changes in order to fly a good ILS approach. The autoland is perfect for low visibility approaches, but not for windy ones.

Autothrust usage:
Many pilots say you shouldn't use the auto-thrust when flying the aircraft manually. This is because it may amplify the trajectory correction (especially in pitch) you make to fly the aircraft along the glide slope. Other pilots think the auto-thrust is reactive enough to be used even when the aircraft is flown manually. You will make your own opinion.

In case of strong wind, you may see the auto-thrust is constantly updating the thrust. This may sound weird, but if you look carefully, this is the best way to have the aircraft speed as close as possible from the FCU required speed, selected or managed. In my opinion, the impact of the wind on the airspeed in FS is not totally realistic, it is too strong.

Flying the aircraft manually:
If you disconnect the auto-pilot to fly the aircraft manually, many pilots suggest the usage of the TRK/FPA mode instead of the HDG/V/S mode. In TRK-FPA, the green flight path vector symbol, called the "bird", shows the aircraft trajectory in a way that is easier to understand for a human pilot:

- on the lateral plan, you can see the impact of the lateral wind and you see where the aircraft is really heading,
- on the vertical plan, you see the angle of descent that allows you to easily fly an approach visually.

Remember that the flight director is "the brain", and the autopilot is "the muscle". The FMGC "thinks" and calculates the right flight control movements to guide the aircraft on its trajectory, the flight director displays it, and the autopilot is in charge of moving the flight controls according to the orders given by the flight director.
This means you can replace the autopilot and fly the aircraft manually, following the directions provided by the flight director. Your actions on the sidestick will just replace the actions taken by the autopilot.

Resetting the FCU:
When you switch the flight director off, it clears the FCU memory. This is why many pilots switch the FD off and on at the very beginning of the flight, in order to reset the FCU and make sure no mode remains engaged because of the previous flight.

MCDU

Assistance:
If you are in beginner or intermediate mode, remember that the MCDU provides assistance, when possible, for some values that need to be entered. When possible, the MCDU will get the necessary information directly from FS (zero fuel weight, gross

weight …) or from average values it has in memory (V1, Vr, V2…). To activate the MCDU assistance, click on the corresponding MCDU button without entering anything in the scratchpad, and the MCDU will fill the scratchpad with a default value that can be used.

APPENDIX C

Frequently Asked Questions

Even if you read the documentation carefully, you may still have some questions that are answered in this section.

Flight Control Unit

When I push the ALT button to engage a managed climb or descent, nothing happens.
The lateral and vertical modes are not fully independent. The managed climb/descent is accessible only when the FCU is in NAV mode. For example, if you are in heading mode ("HDG" displayed on the FMA), nothing happens when you push the ALT button. Nevertheless, you can pull the ALT button to engage an open climb/descent.

I have engaged the V/S mode to climb, and the FCU turns into Open Climb.
This is called "mode reversion". It is just because you ask the aircraft to climb very steep. In this situation, if the airspeed becomes too low, the FCU automatically turns to Open Climb (OP CLB displayed on the FMA) to prevent a low speed situation. When in Open Climb, the aircraft will adjust the pitch to maintain a correct and safe airspeed.

When the aircraft was on the ground, I have unintentionally pushed the thrust levers to the FLEX or TOGA detent, so the SRS and RWY modes have engaged. How can I clear them?
You just have to pull the thrust levers back to IDLE and reset the FCU by switching the FD off and on. Real pilots often do this operation in the beginning of a flight to make sure no mode is active.

EFIS

All the systems are turned on, but the EFIS are still black.
This is just because the EFIS brightness is set to 0 (full dark) like when they are off. You just have to move the mouse in the central zone of each EFIS and turn the mouse wheel to increase the brightness, or press the mouse middle button to reset the brightness.

MCDU & FMGC

I press the MCDU INIT button, and nothing happens.
This is because the INIT A page is accessible only when the engines are stopped. If you press the INIT button with engines started, nothing happens.

My flight plan is set up, all the associated data are entered, but the flight plan predictions are not available.
Make sure all the necessary data (cruise altitude and gross weight) have been entered in the MCDU. Also make sure the flight plan contains no discontinuity. The predictions can not be computed if any discontinuity is still in the flight plan.

I have saved my flight in FS while the aircraft was in flight. When I tried to reload it, the FMGC status was inconsistent.
This is normal. The MCDU & FMGC data is persisted in a file that is independent from the file where the FS flight is saved. Consequently, the FMGC data is retrieved correctly when the flight is reloaded in the same conditions.

APPENDIX D

Acronyms

A/C	Aircraft
AGL	Above Ground Level
AMP	Audio Management Panel
AMSL	Above Mean Sea Level
A/THR	Autothrust
AC	Air Conditioning
ADIRU	Air Data Inertial Reference Unit
APU	Auxiliary Power Unit
ATC	Air Traffic Control
CL or CLB	Climb
DES	Descent
EFIS	Electronic Flight Instrument System
ELAC	Elevator and Aileron Computer
E/WD	Engine/Warning Display
FAC	Flight Augmentation Computer
FADEC	Full Authority Digital Engine Control
FCU	Flight Control Unit
FD	Flight Director
FMA	Flight Mode Annunciator
FMGC	Flight Management and Guidance Computer
FO	First Officer
FPA	Flight Path Angle
GPU	Ground Power Unit
HDG	Heading
IRS	Inertial Reference System
LK	Lock
MCDU	Multifunction Control and Display Unit
ND	Navigation Display
PFD	Primary Flight Display
RMP	Radio Management Panel
SD	System Display
SEC	Spoiler and Elevator Computer
T/C	Top of Climb
T/D	Top of Descent
TOGA	Takeoff Go-Around
TRK	Track
V/S	Vertical Speed

AIRBUS
OFFICIALLY
LICENSED
PRODUCT

© Airbus 2017. AIRBUS, its logo and product marks are registered trademarks of Airbus. All rights reserved. Officially licensed by Airbus.