AIRBUS A320

ToLiSS

Flight Tutorial : Level 2

For X-PLANE

March, 27 2026

Introduction

The first flight tutorial allowed us to become familiar with the flight deck instruments and to create and modify a flight plan using the MCDU.

It is therefore assumed that the reader has a solid understanding of **normal Airbus A320 operations**, from flight plan initialization through landing. Routine procedures for a flight conducted without abnormal events will not be detailed in this tutorial.

This tutorial focuses on **non-standard situations** that fall outside the scope of a routine flight from departure to destination.

We will also cover:

- Multi-crew operating principles
- A more detailed description of flight deck instruments
- Weather radar operation
- Basic meteorology concepts

Standard training exercises, including **traffic pattern operations**, will also be included, along with other flight scenarios.

I would like to thank **Florent Martin**, professional Airbus A320 pilot, for his assistance with the technical flying aspects. His support made it possible to produce this tutorial, which aims to provide an **exceptionally realistic experience**, very close to real-world airline operations.

Bernard DIREIZ

Translated by Christian XERRI

Flight preparation – Nice to Toulouse
Aircraft parked at **Gate 48A, LFMN**, after our first flight of the day.

- **Primary Plan Preparation**

  Planned route: **LFMN SID TURIL UL127 FJR DCT AFRIC STAR LFBO**

  - **Alternate / Company Route:** LFML (Marseille)
  - **Cost Index:** 75
  - **Cruise Level:** FL340
  - **Transition Altitude:** 5,000 ft
  - **Departure:** SID **TURI7A**
  - **Initial Climb:** FL120
  - **Arrival:** STAR **AFRI7S**

  (The routing may vary depending on the active FMGC AIRAC database.)

  - Block Fuel: 5.5
    (Indicative value; may be adjusted as required.)
  - Takeoff Performance:
    - V1: 140
    - VR: 140
    - V2: 142

    (Enter the values provided by your ISCS.)
  - FLEX TO Temperature: 70

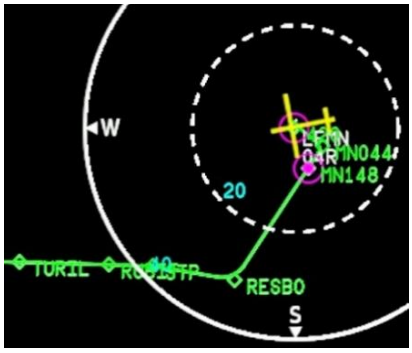
- **Secondary Flight Plan Preparation**

As seen in the previous tutorial, the **s**econdary flight plan can be used to program an alternate departure runway, or prepare an immediate return to the departure airport following a failure or any other unexpected event that prevents continuation of the flight under safe conditions
In the vast majority of cases, the secondary flight plan is used to prepare for an **immediate return**.

To access the secondary flight plan:

- Press the **SEC F-PLN** key on the MCDU
- Copy the active flight plan into the secondary flight plan

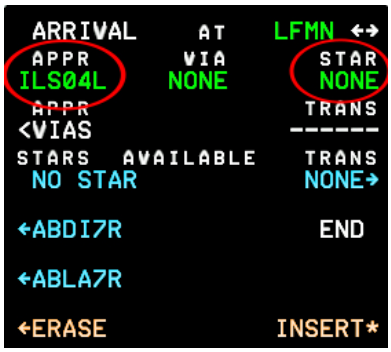
The secondary flight plan is displayed in **white** on the MCDU. On the ND, when in PLAN mode, it overlaps the primary flight plan.



We now modify the destination airport.

Select a waypoint close to the destination that will become the last waypoint of the secondary flight plan: **RESBO**.

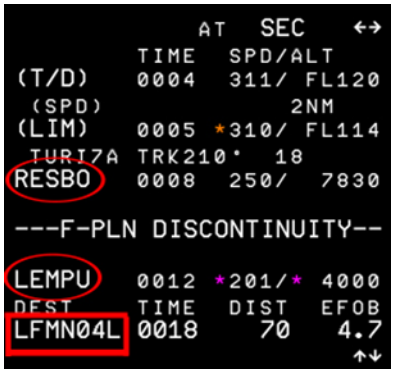
- Open the **lateral revision** page for RESBO
- Enter **LFMN** in the **NEW DEST** field



Arrival Setup for LFMN (Secondary Flight Plan)

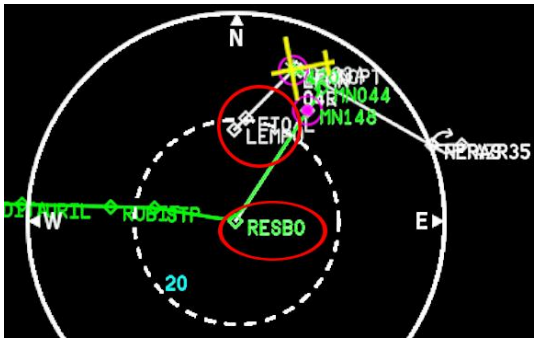
The updated flight plan now appears on the MCDU. Complete the ARRIVAL page for LFMN:

- Select **Runway 04L**
- **NO STAR**

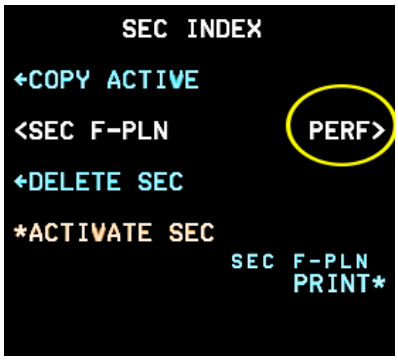


The last waypoint is RESBO

A new runway-aligned waypoint (LEMPU) has been automatically created



These flight plans are provided as examples only. Over time, AIRAC data will change. You should adapt your flight plans to the current operational situation, and you may also create different routings. The primary focus of this tutorial is abnormal and failure management, not route design.



To complete the preparation for an immediate return, access the PERF pages via the SEC INDEX page.

- Select **SEC APP**

Enter barometric minimums: **BARO 390 ft** (Nice)

- Select **SEC GO-AROUND**

Modify the default value of **ENG OUT ACC** altitude
Set **ENG OUT ACC = 1010 ft** (Nice)

Pre-Takeoff Preparation

After completing the standard procedures:
• Before Taxi Checklist
• Engine start

Configure the aircraft for takeoff:

• **FLAPS 1+F**
• **SPOILERS ARMED**
• **AUTO BRK MAX**

Line up on **Runway 04R.**

Final checks prior to takeoff:

• Press **TO CONFIG** on the ECAM

Save the situation. This saved state will be the **starting point for the remainder of the tutorial**.

L'ECAM.

Electronic Centralized Aircraft Monitor

The ECAM (Electronic Centralized Aircraft Monitor) is associated with both **aural and visual alerts**.

The ECAM consists of two primary displays:

Upper ECAM – E/WD (Engine/Warning Display); Displays:

- Engine parameters (N1, EGT, etc.)
- Warnings, cautions, and memos

Lower ECAM – SD (System Display); Displays:

- Synoptic pages for aircraft systems (FUEL, APU, ELEC, etc.)
- Associated alerts and messages

ECAM Control Panel:
Located on the pedestal, the ECAM control panel allows manual selection of system pages and clearing of ECAM actions using the **CLR** pushbuttons (details on page 6).

E/WD - Upper ECAM.
ENGINE/WARNING DISPLAY

The upper ECAM is divided into three main areas:

① **Central Area – Engine Information**

Upper right: thrust mode based on thrust lever position, thrust percentage, and FLEX temperature.
Lower section: fuel quantity and flap position

② **Engine/warning display**

Alert color indicates priority. **Green** : information ; **Amber** : caution ; **Red** : warning.

Example: a warning message indicating that the flaps are not set to the position programmed in the MCDU.

This area is also used to display takeoff and landing checklists. Items shown in blue indicate a required crew action. In this example: Spoilers must be armed and the takeoff configuration test must be performed

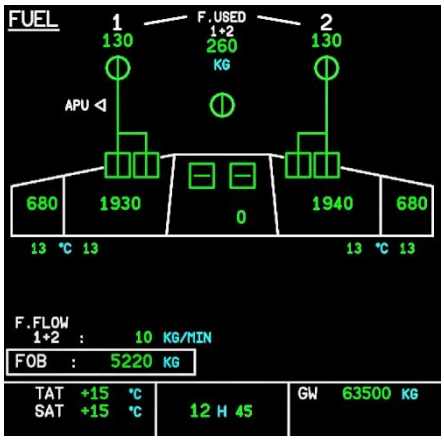
This area also displays system failures and the associated actions required to resolve them.

③ **Status message area**

The severity of status messages is also indicated by color: Green, amber, or red. An exception applies to **T.O. INHIBIT** and **LAND INHIBIT**, which are displayed in **magenta**. These messages indicate that secondary warnings are inhibited to avoid distracting the crew during takeoff and landing.

Lower ECAM - SD

SYSTEM DISPLAY



- ✓ The **upper portion** displays system synoptic pages:
- ✓ **ENG:** Engines (N1, EGT, oil, etc.)
- ✓ **BLEED:** Pneumatics and pressurization
- ✓ **ELEC:** Electrical system
- ✓ **HYD:** Hydraulic systems
- ✓ **F/CTL:** Flight controls
- ✓ **FUEL:** Fuel system *(displayed here)*
- ✓ **APU:** Auxiliary Power Unit
- ✓ **COND:** Air conditioning and cabin pressurization
- ✓ **DOOR:** Doors
- ✓ **WHEEL:** Landing gear, brakes, temperatures
- ✓ **STS:** System status

These pages are normally selected **automatically** based on aircraft phase and system logic. For example, the APU page is displayed automatically when starting the APU, provided no page has been manually selected.

The lower portion of the SD permanently displays, regardless of the selected page:

- **TAT:** Total Air Temperature
- **SAT:** Static Air Temperature
- **UTC Clock**

GW: Gross Weight, calculated by the FMGC using INIT page data. If INIT data has not been entered, **GW displays amber "XX"** instead of a valid weight.

ECAM Control Panel

Located on the pedestal between the two pilots, this panel allows interaction with both ECAM displays (E/WD and SD).

The two rotary knobs on the left adjust ECAM display brightness.

- ✓ T.O CONFIG pushbutton checks aircraft configuration prior to takeoff.
- ✓ Eleven pushbuttons allow manual display of system pages:

  ENG, BLEED, PRESS, ELEC, HYD, APU, COND, DOOR, WHEEL, F/CTL, STS

  In this example, the FUEL pushbutton light is illuminated, and the FUEL page is permanently displayed on the SD.
  Here, the automatic selection of system pages based on the situation is disabled because the FUEL page was displayed manually. To return control to the system, press the FUEL button; the light will go off, and the system will automatically display the appropriate page.
- ✓ ALL: Cycles through all system pages sequentially
- ✓ CLR (2): Clears ECAM checklist messages and advances to the next action indicated by a green arrow ↓.
- ✓ RCL: Recalls previously displayed but unacknowledged messages.
- ✓ EMER CANC: Cancels repetitive aural warnings for the remainder of the flight.

MULTI-CREW OPERATIONS

The flight crew consists of two pilots:

- Captain (CPT)
  Holds ultimate responsibility for the flight
  Responsible for safety, decisions, and regulatory compliance
  Seated in the left seat
- First Officer (FO)
  Assists the Captain
  Qualified to replace the Captain if required

Both pilots hold the same aircraft qualification and alternate roles to maintain proficiency:
Pilot Flying (PF) and **Pilot Monitoring (PM).** On each flight, one pilot is designated PF, the other PM.
Monitoring consists of observing and understanding:

- Aircraft trajectory
- Navigation
- Aircraft system operation

Pilot Flying (PF) Responsibilities.

1. **Primary task:** Fly, control, and monitor the aircraft trajectory and navigation in accordance with procedures and regulations.
2. **Secondary task:** Monitor PM actions not directly related to trajectory control.

Pilot Monitoring (PM) Responsibilities

1. **Primary task:**
   - Monitor aircraft trajectory and navigation
   - Immediately call out deviations and intervene if necessary
2. **Secondary task:** perform tasks not directly related to trajectory:
   - ATC communications
   - Checklist execution (reading and actions as required)
   - Aircraft system monitoring
   - Other operational duties

Why Two Pilots Are Essential:

1. Safety

a) Human redundancy: If one pilot becomes incapacitated (fatigue, medical issue, etc.), the other can safely assume control.

b) Mutual cross-checking: Both pilots monitor each other's actions to prevent human error (missed checklist items, navigation errors, etc.).

2. Task Sharing

Workload is shared between PF and PM, significantly reducing the risk of errors—especially during critical phases such as takeoff, approach, landing, and during abnormal or emergency situations (e.g., adverse weather).

A single pilot could not safely manage all tasks due to stress and fatigue. Two brains and four hands quickly become essential for flight safety.

3. Regulatory Compliance

Compliance with civil aviation regulations requires multi-crew operation.

ENGINE FAILURE BEFORE V1

This situation is addressed in this tutorial even though it does not require complex crew management, as it mandates a rejected takeoff.

The aircraft is lined up on Runway 04R, ready for departure.

Failure Setup (ISCS)

Open the FAULT SCENARIOS tab in the ISCS.

- Upper section: ENABLE RANDOM FAULTS: leave OFF
- Lower section:
  - ✓ Click ADD NEW FAULT
  - ✓ In the SELECT field, choose ENG1 (or ENG2)
  - ✓ Select IAS = 110 kt
  - ✓ (Any speed at least 10 kt below V1, to account for failure detection delay, ECAM alert, and aural warning.)

The failure is now programmed.

The **Pilot Flying (PF)** initiates the takeoff.

- ✓ At **100 kt**, the **PM** calls: *"One hundred knots."*
- ✓ At **120 kt**, **Engine 1 fails**
- ✓ Aural warning sounds and the **upper ECAM** displays **ENG 1 FAIL**
- ✓ The **PM** calls: *"Engine 1 fail."*
- ✓ The **PF** retards the thrust levers to **IDLE** and announces: *"STOP."* *(Rejected takeoff)*

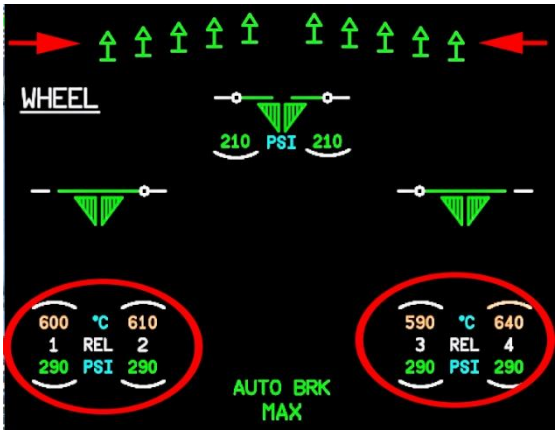
The **autobrake applies MAX braking**, and **ground spoilers deploy automatically**.

The aircraft comes to a stop. The ECAM displays the applicable message.

The ECAM checklist indicates that brake cooling is required before any subsequent takeoff.

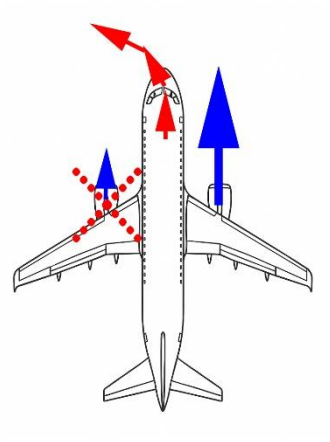
The WHEEL page on the lower ECAM shows brake temperatures of approximately 600°C or higher.

Return to the gate.



ENGINE FAILURE AFTER V1.

Primary Effects of an Engine Failure:



1. **Thrust Asymmetry**

The Airbus A320 is a twin-engine aircraft. Failure of one engine results in significant thrust asymmetry.

For example, if the left engine fails, the right engine (live engine) continues to produce thrust, creating a yawing moment toward the failed engine.

The aircraft yaws toward the failed engine.

The PF must apply rudder toward the live engine to maintain runway or flight path alignment.

2. **Performance Loss**

With the loss of one engine, aircraft performance is reduced by approximately 50% or more, considering additional drag.

Engine failure at takeoff is a mandatory training exercise for all multi-engine pilots.

Airbus Engine Failure Classification.

Airbus distinguishes between two cases:

1. **Engine failure without damage.**

   The engine may be restartable.

2. **Engine failure with damage.**

   The engine is considered lost.

In the simulator, this distinction is primarily assessed using **N1**:

- **N1 at zero or very low** indicates fan damage → restart not possible
- **Strong vibrations** also indicate internal or fan damage (e.g., blade failure)

Airbus prioritizes what is referred to as **engine securing**.

- **No damage:**
  The engine is considered secured when the **ENGINE MASTER** is set to **OFF**

- **With damage:**
  The engine is considered lost; the **fire shutoff valve** must be closed and a **fire extinguisher discharged**

In this tutorial, we will focus on the **most unfavorable scenario**: an engine failure occurring **at or just after V1**.

Engine Failure Management

Airbus defines three "golden rules": FLY – NAV – COM

1. **FLY**: The first priority is to **fly the aircraft**:

- Maintain appropriate pitch attitude
- Maintain bank
- Maintain thrust

At engine failure, the aircraft experiences a strong **yaw moment** due to thrust asymmetry.

- The pilot must **immediately counter yaw** using rudder toward the live engine
- Rudder trim and the **RESET** pushbutton are **inactive when the autopilot is engaged**
- After rotation at **VR**, yaw forces must be trimmed using **rudder trim**
- Follow **SRS guidance**, which commands the appropriate pitch attitude for one-engine-inoperative climb (approximately **12°**)

2. **NAV:** Then**,** ensure the flight path is safe and complies with terrain clearance and the intended routing.

3. **COM:** Inform ATC of the engine failure and intentions using, "PAN PAN" or "MAYDAY", as appropriate message, then inform the cabin and passengers of the immediate return.

After engine failure detection, crew actions occur rapidly, and stress management is critical.

At any phase of the simulation, it is recommended to use the PAUSE function to carefully analyze instruments and aircraft behavior.

Although PAUSE does not exist in real aircraft, the simulation environment is inherently unrealistic because:

- *Real flights always have two pilots*
- *The simulator pilot must perform both PF and PM roles*
- *Failures are pre-programmed, removing the element of surprise*

For these reasons, use of PAUSE is appropriate and encouraged.

Programming an engine failure during takeoff

Open the FAULT SCENARIOS tab in the ISCS.

- **Upper section**: ENABLE RANDOM FAULTS: OFF
- **Lower section**:
  - ✓ Click ADD NEW FAULT
  - ✓ Select ENG1
  - ✓ Select FAIL (W DAMAGE) – engine damage, engine lost
  - ✓ Select IAS
  - ✓ Set CAS to 140 kt (or higher if you prefer the failure during initial climb)

Additional options:

- RECVRBL: engine recoverable
- NO DAMAGE: engine not damaged, restart possible

Other ISCS options are available and may be explored later.

For this tutorial, select FAIL (W DAMAGE) to eliminate restart considerations.

TAKEOFF WITH ENGINE FAILURE

The aircraft is lined up on **Runway 04R**, ready for takeoff.

Crew roles are defined:

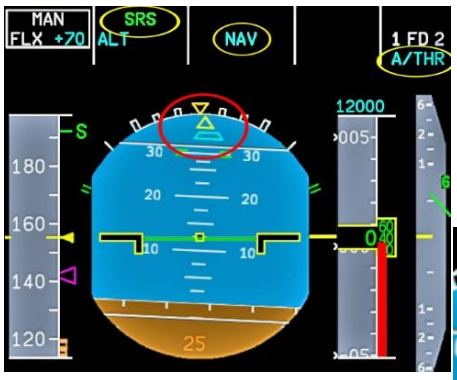
- **Pilot Flying (PF)** – you
- **Pilot Monitoring (PM)** – also you, since you are alone in the cockpit.

You will perform both roles sequentially.

Takeoff Procedure

1. The **PF** advances thrust to **50% N1**, parking brake set.
   Apply slight sidestick forward input to keep the nosewheel on the ground.
2. Once both engines stabilize at 50%, **release the brakes.**
3. Advance thrust levers to the **FLEX / MCT** detent.
   Regardless of FLEX or TO/GA takeoff, the PM starts the chronometer at brake release, as TO/GA thrust must not exceed 10 minutes to avoid engine damage.
4. The **PM** calls: *"Thrust set."* after confirming FLEX on the FMA.
5. At **100 kt**, the **PM** calls: *"One hundred knots."*
   The **PF** responds: *"Checked."*
   (Cross-check of both airspeed indications)
6. The **PM** calls: *"V1 then Rotate."*
7. The **PF** initiates rotation.

ENGINE 1 FAILURE (left engine)



The **FMA** indicates:

- **SRS** vertical mode active
- **NAV** armed
- **A/THR** armed but not active

The turn coordinator changes appearance

The **beta target** changes from yellow to blue and shifts, indicating thrust asymmetry.

ECAM explanation

- **ENG 1 FAIL** (amber) displayed in the warning area
- Engine parameters confirm the failure

The **PM** calls: *"Engine 1 fail."*

Applying the Golden Rules

Apply **FLY – NAV – COM**, in that order, with proper task sharing.

If the failure occurs between **V1 and VR**, maintain directional control on the runway and rotate at **VR**.

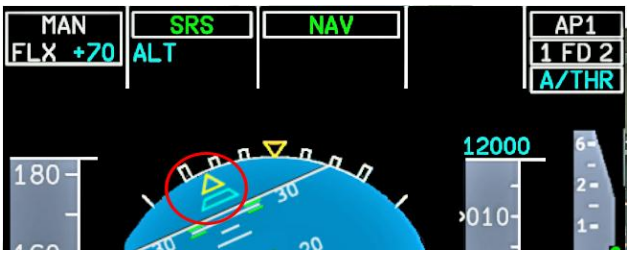
FLY – Directional Control.

1. The **PF** counters yaw using rudder toward the live engine.
   - In this case, **left engine failed → apply right rudder**
   - Objective: center the **blue beta target** on the **yellow slip indicator**
2. Apply **right rudder trim** to relieve pedal force
3. The **PM** calls: *"Positive climb."*
4. The **PF** commands: *"Gear up."*
5. The **PM** selects **GEAR UP** and calls: *"Gear up."*
   Then disarms the spoilers

Maintain pitch attitude by following the **green SRS Flight Director bar**.

<u>Once the aircraft is stabilized and correctly trimmed:</u> Engage the **autopilot**

Ensure:



1. The flight path is terrain-safe
   (Important at Nice due to terrain along runway heading)
2. **NAV** mode becomes active (green)

If required, select **HDG** mode to avoid terrain, Re-intercept the flight plan using **NAV.**

With aircraft control established, failure management can begin.

While the **PF** focused on flying, the **PM** monitored the failure and aircraft trajectory.

The **PF** initiates failure management by announcing: **"ECAM ACTION."**

The ECAM checklist provides the required actions to manage and secure the engine failure.

The **ECAM** now displays:

- **Failure title** underlined in **amber**: **ENG 1 FAIL**
- **Required actions** in **blue**

-ENG START SEL.....IGN
-THR LEVER 1.....IDLE

- **Conditional statements** in **white**

As each action is completed, the corresponding ECAM line **clears automatically**.

1.ENG START Selector – IGN

The PM selects the ENG START rotary selector to IGN, monitored by the PF.

The ECAM line ENG START SEL…IGN disappears.

2. Thrust Lever 1 – IDLE

The PF moves THR LEVER 1 to IDLE, monitored by the PM.

The ECAM line THR LEVER 1…IDLE clears.

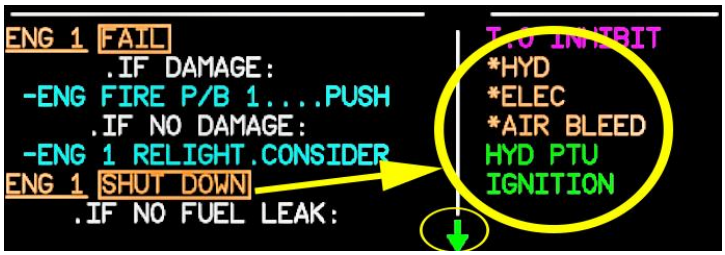
Conditional Action: IF NO RELIGHT AFTER 30S

After 30 seconds, the engine does not relight.

-ENG MASTER 1.....OFF

Engine Master 1 – OFF

The ENGINE MASTER 1 switch is set to OFF.



A new amber failure title appears on the left side of the ECAM, ENG 1 SHUT DOWN triggering several STATUS messages (five total, including three amber cautions), which will be analyzed later.

-ENG FIRE P/B 1....PUSH Since this is an engine failure with damage, the next priority action is to isolate the engine completely.

Fire Pushbutton – ENG 1
The fire pushbutton:

• Cuts off fuel

• Disconnects the engine-driven generator

⚠️ ***Important note:*** *These actions may be performed by either pilot, but always under strict cross-monitoring to avoid a catastrophic error, such as shutting down the live engine (this has occurred in real operations).*

3. ENG 1 FIRE Pushbutton Guard – OPEN

The PM opens the protective guard of the ENG 1 FIRE pushbutton, monitored by the PF.

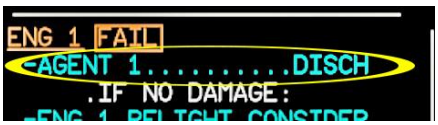
4. ENG 1 FIRE Pushbutton – PUSH (This action is irreversible)

The PM presses the ENG 1 FIRE pushbutton *monitored by the PF*.

Immediately, Engine 1 parameters disappear, they are replaced by amber XX indications

The following instructions in case of damage are:

-AGENT1 AFTER 8 S.DISCH (Wait for the 10 second countdown).



After a 10-second countdown, the ECAM displays: AGENT 1 …DISCH appears (blue color).

5. The PM presses the AGENT 1 pushbutton, monitored by the PF.

The fire extinguisher discharges into the engine.

Once discharged, the DISCH legend illuminates in yellow on the pushbutton.

The ECAM updates accordingly.

6. PM announces « ENGINE 1 SECURED ».

7. PF: announces "STOP ECAM."

ECAM actions are temporarily stopped.
With the engine secured and aircraft control assured, the priority becomes **trajectory** management.

<u>At or above acceleration altitude</u>: At Nice: 1,010 ft (refer to MCDU PERF page)

8. The PF presses PUSH TO LEVEL OFF on the FCU and calls:
"Push to level off.". The PM responds: "Checked."The PF calls: "VS zero."

The aircraft levels off and accelerates.

FMA Indications:

Column 1: MAN FLEX +70
Column 2: VS +0
Column 5: A/THR blue (armed, not active)

*When reaching **S speed or above**: the flaps must be retracted.*

PF announces: “Flaps zero.”

9. **PM: Selects flaps 0** and calls “Flaps zero.”

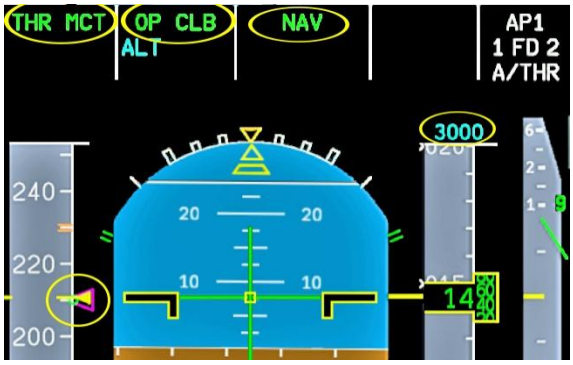
10. **PF: sets the altitude on the FCU to 3,000 and announces “3,000 ft SET”.**
    The PM replies "CHECKED".

<u>When the speed trend arrow reaches Green Dot:</u>

11. **PF pulls the FCU ALT knob and announces “open climb”.**
    PM replies "CHECKED".

When LVR MCT flashes on the FMA:

8. **PF brings the ENG 2 lever back into the CLIMB notch, then immediately pushes it back into the FLEX / MCT notch** and announces “THRUST MCT”. The PM replies “CHECKED”.



FMA Now Displays

- Thrust mode: THR MCT
- Vertical mode: OP CLB
- Lateral mode: NAV

The **upper ECAM** shows **MCT** in blue for the thrust lever position.

Column 5: A/THR changes from blue to white.

Now controlled by the FMGS, it can modulate thrust as other modes engage (SPEED, OP DES, etc.), provided the ENG 2 thrust lever remains in the FLEX/MCT detent.

Caution: The *LVR MCT* message flashes as soon as Green Dot speed is reached.
If the thrust lever is moved to the **FLEX/MCT** detent **before** pulling the **ALT** knob on the FCU, the FMA will display **SPEED** in column 1 instead of **THR MCT**.
After pulling the **ALT** knob on the FCU, the FMA will then display **THR MCT**.

- Target speed: Green Dot
- Target altitude: 3,000 ft

Note: The trapezoidal sideslip indicator displayed below the yellow bank angle symbol, which was previously blue (beta target), has returned to yellow, indicating the sideslip indicator.

The sideslip target changes from yellow to blue in the event of an engine failure during takeoff or go-around when the aircraft is not in clean configuration (flaps extended) and the operating engine thrust exceeds 80% N1.

When the blue beta target is centered, it provides optimum climb performance under asymmetric thrust conditions.

With the indicator back to yellow, the aircraft is properly yaw-trimmed. Sideslip is still present, but it is optimized for best performance.

The NAV is finished, let's move on to the COM (communication).

Inform the NICE control tower of our situation: engine failure, and of our intentions.
Inform passengers that we are returning to NICE.

9. Upon reaching the target altitude of 3000, the PF calls out "ALT STAR", then "ALT".
PM replies "CHECKED".
At level, we can continue the ECAM actions.

10. The PF announces "CONTINUE ECAM".

Both pages of our ECAM still have actions to be carried out in the left column.

Note: in the right column, LAND ASAP (As Soon As Possible): landing as soon as possible.

(This page is displayed after pressing the CLR key on the ECAM keyboard).

The right column shows urgent and non-urgent alerts that will need to be addressed after the failures.

We deal with the faults one after the other in the order in which they appear on the ECAM.

I. ENG 1 FAIL

The requested actions: ENG 1 START on IGN and THR LEVER 1 on IDLE having been executed, we can clear the first fault.

✓ The PM asks: "CLEAR ENGINE 1?".

✓ The PF responds "CLEAR ENGINE 1".

✓ The PM presses the CLR key on the ECAM keyboard.

The line ENG 1 FAIL and the next two disappeared.

II. ENG 1 SHUT DOWN

The PM reads aloud the following breakdown: "ENG 1 SHUT DOWN", then all subsequent lines as they are processed.

1) -IMBALANCE.....MONITOR

Check on the FUEL page that there is no fuel imbalance between left and right.

2) -TCAS MODE SEL.....TA

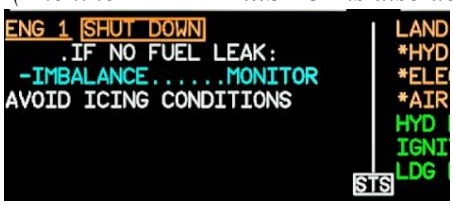
The PM turns the TCAS knob to the TA ONLY position and announces "TCAS TA".
(The TCAS MODE SEL…TA line is cleared.)

1) -X BLEED.....SHUT

In the AIR COND panel in the upper panel, turn the X BLEED rotary knob to the SHUT position. (action announced by the PM).

Notice the PACK 1 button is lit FAULT, which is normal since engine 1 is stopped.

(The line X BLEED…SHUT is also deleted).



With the actions taken, we can verify that we are not in icing conditions. AVOID ICING CONDITIONS

Note: the blue line -IMBALANCE...MONITOR is always displayed because it does not imply an action to be performed but a simple check.

The line ENG 1 SHUT DOWN *can now be erased.*

PM asks "CLEAR ENGINE 1?".

The PF responds “CLEAR ENGINE 1”.

The PM presses the CLR key on the ECAM.

The left column failures are cleared.

The breakdowns have been dealt with, now it remains to analyze the alerts present in the right column of the ECAM.

A color code of the alert characters makes it possible to quickly identify critical or informative information:

LAND ASAP

Red: Level 3 alert (warning).
Urgent situation: requires immediate action.
Here, the landing must be immediate.

LAND ASAP

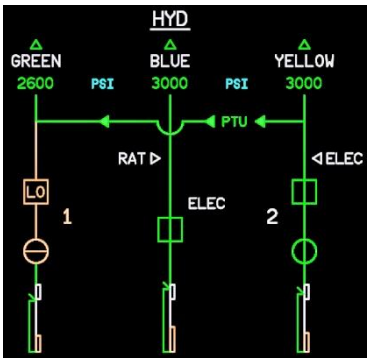
Amber: Level 2 alert (caution).
Abnormal situation: requires action, but not immediate.
Here, landing is necessary, after performing the actions required in the checklist.

IGNITION

Green: Normal status.

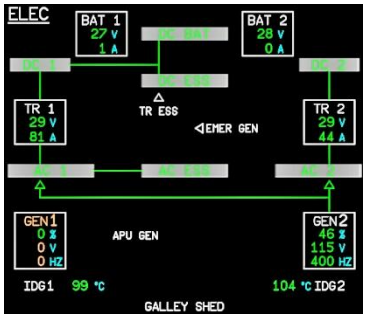
The PM reads aloud the lines of the right column of the ECAM, specifying the color.

1) PM announces “LAND ASAP amber”.



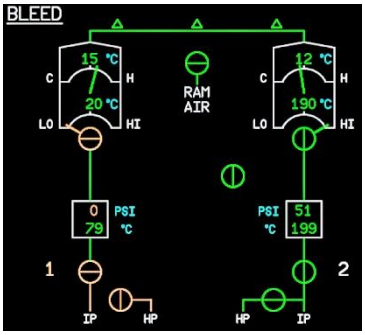
2) PM announces "HYD amber".
The HYD page is automatically displayed on the ECAM.
Check: the green circuit is supplied by engine 1, but the PTU provides pressure: Normal situation.

- ✓ PM asks “CLEAR HYD?”.
- ✓ PF responds “CLEAR HYD”.
- ✓ PM presses the CLEAR key on the ECAM: the amber HYD line is erased.



3) PM announces “ELEC amber”.
The ELEC page is displayed automatically.
Verification: GEN 1 is faulty since it is associated with ENG 1 down: Normal situation.

- ✓ PM asks “CLEAR ELEC?”.
- ✓ PF responds “CLEAR ELEC”.
- ✓ PM presses the CLEAR button on the ECAM: the amber ELEC line is erased.



4) PM announces “AIR BLEED amber”.
The BLEED page is displayed automatically.
Verification: BLEED 1 is faulty since it is associated with ENG 1 down: Normal situation.

- ✓ PM demand « CLEAR BLEED ? »
- ✓ PF respond « CLEAR BLEED »
- ✓ PM presses the CLEAR button on the ECAM: the amber BLEED line is erased.

The SUPERIOR ECAM now only displays green lines except for the LAND ASAP line.

All amber lines preceded by an * have been checked and deleted.

When the STATUS page is displayed (automatically) on the lower ECAM.

11. PM announces “STATUS”.

12. PF Responds “STOP ECAM”.

The PF wonders aloud if one of the following three questions should be considered:

a. Is it necessary to read a normal checklist?
b. Is a reset possible?
c. Can the engine be restarted?

These are the three generic questions that the crew asks themselves in all situations of failure of any kind occurring during any phase of the flight.

a. For example, a checklist may not have been read at the time of the breakdown because the crew was focused on dealing with an urgent problem.
We don't have any unread checklists.

b. After a flight instrument failure (MCDU, PFD, FD etc.), turning the instrument in question off and on again can resolve the problem and may modify the failures listed in the STATUS page. Engine failure is not affected by a reset.

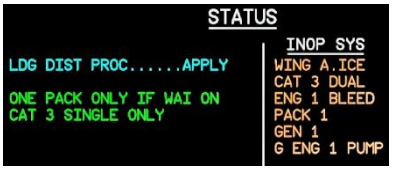
c. Can the engine be restarted?
The answer is no because we discharged one or two fire extinguishers which made the engine permanently inoperable.

This is when we think that starting the APU might be a good idea to get a larger quantity of compressed air and electricity when needed.

13. **PF asks PM to turn on the APU.**
The PM presses the MASTER SW button on the APU then START on the overhead panel.

14. **PF announces "STOP ECAM".**

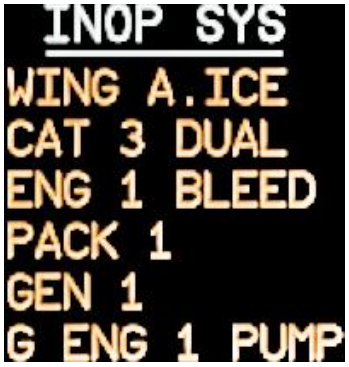
15. **PF requests "READ STATUS".**



The STATUS page of the LOWER ECAM is displayed automatically after the last page is erased (BLEED).

16. **PM reads aloud the lines of the left column, then those of the right.**

- **Left column**: Information (green) or actions to be performed (blue).
  - : LDG DIST PROC.....APPLY Landing procedure requiring the application of an increased distance.
  - : ONE PACK ONLY IF WAI ON If the wing anti-icing (WAI = Wing Anti Ice) is activated, only one air conditioning PACK must remain in operation.
  - : CAT 3 SINGLE ONLY Automatic approach capability in CAT 3 (very low visibility conditions) is limited to SINGLE mode (mono PA), instead of DUAL mode (2PA).



- **Right column**: the list of systems down for information only. (red or amber color depending on the importance).
  Systems inoperative.
- De-icing the wings.
- CAT 3 DUAL.
- Bleed air engine 1.
- Pack 1.
- Engine generator 1.
- The pressure is low on the green hydraulic pump of engine 1.

The Airbus A320 has 3 hydraulic circuits:

- Green.
- Blue.
- Yellow.

Engine 1 is the main source of the green circuit which supplies:

- The main brakes.
- The landing gear.
- The Spoilers.
- Rudder and more …

The failure of engine 1 is compensated by the PTU (Power Transfer Unit) which takes hydraulic pressure from the operational circuits (blue and yellow) to send it to the green circuit.

All lines having been commented,

17. **PM asks: “CLEAR STATUS? ».**

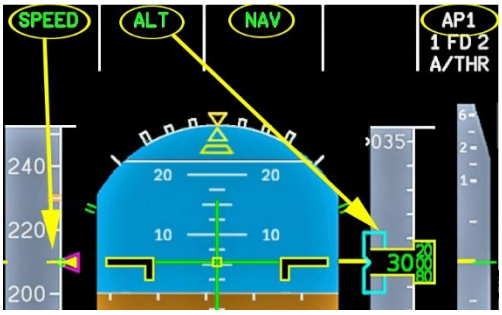
18. **PF responds: “CLEAR STATUS”.**

19. **PM presses the CLR key and announces: “CLEAR STATUS”.**
    The STATUS page is deleted.

20. **PM announces “ECAM ACTIONS COMPLETED”.**

CONTINUATION OF THE FLIGHT
Return to NICE

We are at 3,000 feet and following our flight plan path LFMN-LFBO.
The lower ECAM displays the CRUISE page.



The FMA displays:

- 1st column, speed management mode: SPEED
  The speed is stabilized on the target speed which is also the green dot (210).
- 2nd column, vertical guidance mode: ALT
  The plane is stabilized at an altitude of 3,000 feet.
- 3rd column, horizontal guidance mode: NAV
  We follow our flight plan aided by the active AP1.

The upper ECAM tells us that everything is OK except:

- Engine 1 is stopped (orange cross).
- LAND ASAP: warning message for rapid landing.

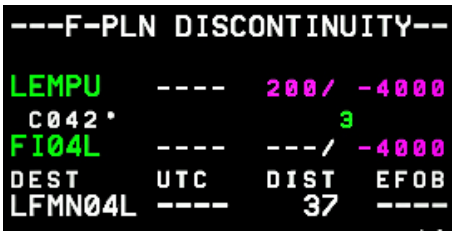
We need to prepare our return to NICE LFMN airport.

Before our departure, we created a secondary flight plan in anticipation of a hypothetical return to NICE.

1. Press the SEC F-PLAN key on the MCDU to display the SEC INDEX page.

2. Then press LSK 4L to activate the second flight plan.

The last two waypoints before LFMN are LEMPU and FI04L (after a discontinuity).



3. Press the DIR key on the MCDU to display the DIR TO page.
4. Select LEMPU by pressing the corresponding LSK L key. The temporary DIR TO page is displayed (in yellow).

5. Press LSK 6R

to validate.

Our new main flight plan is active: destination LFMN RUNWAY 04L.

Now you need to activate the APPROACH phase in the MCDU.

6. Press the PERF button on the MCDU.
   The CLB page is displayed.

7. Press

ACTIVATE APP PHASE.

8. Press

CONFIRM APP PHASE.

The EO CLR (Engine Out) message indicates that an optimized procedure to continue flight safely with a single engine is in progress.
The LSK 1R (EO CLR) key allows this procedure to be manually deleted if the engine is restarted or if the procedure is no longer necessary (false alarm).

We leave the minimum altitude before go-around in case of poor visibility at 390 BARO.

For all approaches, it is necessary to plan for a possible go-around.

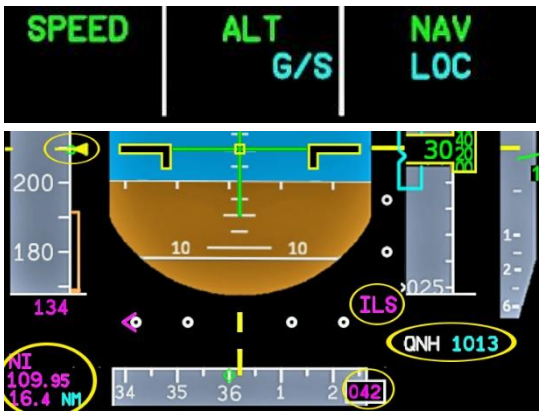
Press the NEXT PHASE button.

In the THR RED/ACC and ENG OUT ACC fields, change the default values to 3,000.

In the FCU, set the target altitude of 3,000 which is that of the NERAS holding pattern.

We arrive at LEMPU and, after a final right turn, we will capture the LOC and align ourselves with the runway axis:

The white broken arrow after FI04L on our route represents the start of the glide-guided descent.



Press the APP button on the FCU.
On the FMA G/S and LOC are armed (blue).

9. Adjust the two baro (1013, PERF page).

   The PFD gives us the essential elements:

   - Green dot speed: 250.
   - VAPP 134.
   - ILS: NI 109.95 à 16,4NM HDG 042

10. Display the ND in TERRAIN mode.

TERRAIN mode allows us to see a color representation of the relief in relation to the altitude of the aircraft.

Red: Immediate danger. The terrain is higher than our current altitude, collision is certain.
Amber: Potential danger. The safety margin is not assured.
Green: No danger.
Blue: Represents the sea.

🡐 Press the TERR ON ND button to display TERRAIN mode.

11. Extend flap 1 when capturing the LOC (or at the latest within three NM of the descent).
12. Flaps 2 when capturing the Glide (or at the latest before 2,000 feet AGL).
13. Extend the landing gear.
14. Autobrake on MED.
15. Arm the Spoilers.
16. Flaps on 3 then Full.

We will perform a go-around to 500 ft AGL (can be done at your convenience between 0 and 500 ft).

***Important**: We are in situation N-1 with the left engine inoperative.*

- *Autopilot is engaged, it has applied automatic rudder trim.*
- *The aircraft is coordinated and the rudder pedals are neutral.*

Two situations must be considered:

a) **Go-around with AP engaged.**
Simply move the engine 2 lever to the TO/GA position. The aircraft will accelerate and climb, the autopilot will manage the rudder trim and automatically compensate for the asymmetry. There is no need to manually compensate with the rudder pedal; any pedal movement could disconnect the PA.

b) **Go-around with AP disconnected.**
The asymmetry must be compensated for with the rudder pedal and the trim must be applied manually at the same time. Once correctly trimmed, the AP can be re-engaged.

Go-around

We are at about 500 ft, the AP is engaged.

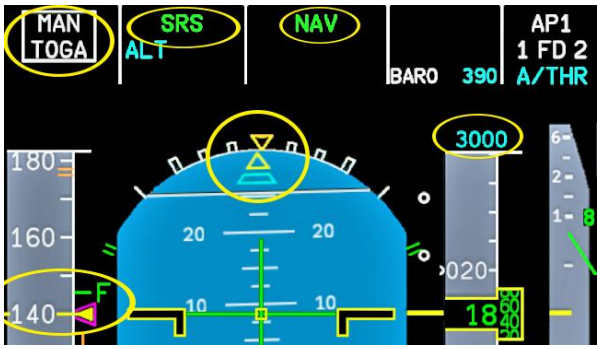
1. **Push the lever to the TO/GA position.**
2. **Flaps on 3.**

The plane accelerates and begins to climb.

The autopilot automatically applies rudder trim to compensate for the strong thrust asymmetry, allowing the rudder pedals to remain neutral.

The AP controls the go-around attitude (SRS on the FMA) as well as the trajectory (green NAV on the FMA).

3. **When the vario is positive, retract the landing gear.**



The FMA displays:

- Speed management mode: MAN TOGA.
- Vertical guidance mode: SRS.
- Lateral guidance mode: NAV active.

On the PFD the beta target is in blue (the AP is compensating the aircraft).
The target altitude is 3,000 ft.

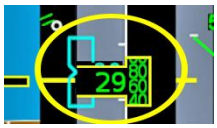
The target speed (140) will be constant until reaching the target altitude.

We are monitoring the trajectory towards the NERAS waypoint.

Approaching acceleration altitude:
(here the target altitude of 3,000 selected in the FCU is the same as the acceleration altitude defined in the GO AROUND page of PERF).

- The FMA displays ALT * (Alt star)

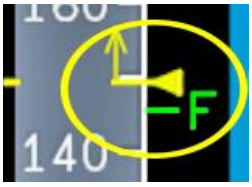
- On the PFD the altitude is framed by a blue rectangle:



- The aircraft begins to accelerate:

3. **At speed F or above:**

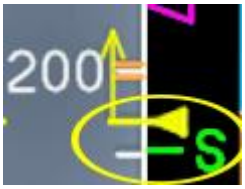
   Flaps 1 (1+F).



4. **At speed S or above:**

   Flaps 0

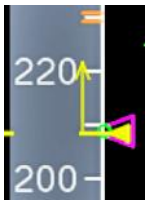
   and disarm the spoilers.



5. **When LVR MCT is flashing**

   bring the throttle back from

   engine 2 to the FLEX / MCT notch.



Note: The FLEX / CT message flashes when speed reaches green dot.

Preparing for landing.

The aircraft is stabilized at 3,000 ft. We have clearance to land on runway 04 L.
We can keep the flight plan that remained in the FMGS: landing on runway 04 L.

1. Activate the approach phase in the MCDU.

2. Display the flight plan, to verify that it is valid.

3. Press the DIR key on the MCDU to go directly to the LEMPU waypoint.

4. Prepare for landing as before.

5. Disconnect the AP at approximately 500 ft AGL
   (at the latest at the minimums in case of poor visibility: here at 360 ft AGL).

The aircraft is coordinated and trimmed because the pilot has applied automatic rudder trim.
The pedals remain neutral; the trim is not reset to zero.

6. During the flare and landing.
   Simply keep the aircraft aligned with the runway and make corrections with the rudder pedals as needed.

7. After landing and braking, maintain the trim. It will be reset before the next flight during the AFTER-START checklist.

FLIGHT CONTROLS

The Airbus A320 is equipped with fly-by-wire flight controls managed by computers.

On a conventional aircraft, the yokes are connected directly to the control surfaces (elevator and roll) by cables; they are mechanically linked and move simultaneously.

The Airbus pilot controls the plane with a side joystick connected to computers:

- Flight Augmentation Computeur (FAC)
- Spoilers and Elevators Computer (SEC)
- Elevator And Aileron Computer (ELAC)

The computers analyze the pilot's inputs on the joystick and then send the commands to the control surfaces.

These computers are controlled by switches located on the overhead panel.

This system guarantees flight envelope protection, simplifies and automates many functions.

Roll axis.

When the pilot wants to turn, he only uses the joystick, no rudder pedals because the computer automatically coordinates the yaw axis.
When the desired bank angle is reached, the joystick is returned to neutral, and the aircraft automatically maintains this bank angle.
To return to horizontal, simply move and hold the joystick in the opposite direction, then release it to neutral when the aircraft is back to horizontal.

Similarly, to climb, the pilot pulls on the stick.

Pitch axis.

If the aircraft is level and the pilot wishes to climb to a pitch attitude of 20 degrees, the pilot pulls back on the stick: the pitch will gradually increase to 5, 10, 15 then 20 degrees.
When the desired pitch attitude is reached, the pilot returns the stick to neutral, and the aircraft will maintain the 20-degree climb.

Note that the trim is automatic.

To return to level flight, push and hold the stick until pitch reaches 0 degree, then release to neutral.

On a conventional aircraft, during a turn, the plane tends to pitch down, and the pilot must compensate by pulling back on the stick.
On the Airbus, compensation is automatic.

FLIGHT PROTECTIONS.

1. NORMAL LAW

When all systems are active: security is maximum.

Roll axis.

Under normal conditions, the bank angle should never exceed 33°.
The autopilot does not exceed 25°.

In an emergency, it is possible to go beyond 33° by maintaining pressure on the stick, but by released, the aircraft automatically returns to 33°.

The maximum bank angle is 67° in clean configuration, and 45° with flaps extended.

Pitch axis.

Maximum pitch-up angle is 30° while maximum pitch-down angle is 15°.

"Alpha prot" protection. This protection prevents the aircraft from stalling at high angles of attack: if triggered, it engages the **"Alpha Floor"** mode: the aircraft pitches down and autothrust automatically applies TOGA thrust.
To exit this mode once the situation is stabilized, the pilot must manually disconnect and reconnect the autothrust.

2. ALTERNATIVE LAW.

When certain systems fail (engine, onboard instruments, etc.), the Airbus A320 leaves Normal Law and switches to a degraded mode (with loss of certain protections):
ECAM displays corresponding alerts.

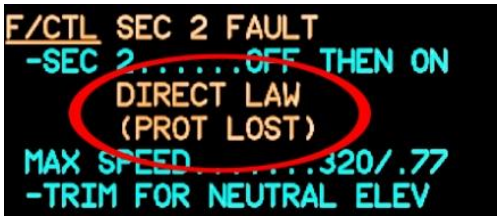
Examples:

- Pitch controls managed differently with less trim stability.
- Maximum bank angle limited manually, with no automatic return to 33°.

3. DIRECT LAW.

In the event of severe failures, the aircraft reverts to Direct Law, the most degraded Fly-By-Wire mode: the aircraft then behaves like a conventional aircraft, without protections (overspeed, stall, etc.).

Roll and pitch controls are direct: to turn, yaw must be compensated with rudder pedals. The pilot must manage trim manually.



This is the most demanding situation, requiring particular attention from the crew. A warning message appears on the ECAM to notify the pilot.

PRIMARY WEATHER HAZARDS

The Airbus A320 Onboard Weather Radar

1. **Windshear may involve:**
   - A strong downdraft forcing the aircraft toward the ground
   - A rapid wind shift (e.g., 40 kt headwind suddenly becoming 30 kt tailwind), resulting in a sudden loss of lift and potential stall risk

Windshear is frequently associated with thunderstorm activity.
It is particularly hazardous during **takeoff and landing**, where rapid airspeed or altitude loss can occur.

2. **Cumulonimbus (CB):**

The **Cumulonimbus (CB)** cloud is the most hazardous weather phenomenon for aviation.
It may generate: Severe turbulence, hail, icing, heavy precipitation and lightning
Standard avoidance guidance: Avoid laterally by at least **20 NM**, when possible.

3. **Reduced Visibility:**

Examples include: Fog, Mist, Sand and Smoke
These conditions present significant risks during approach and landing.
Thorough weather briefing before each flight is essential: Weather charts, METARs and Forecast products.

Good weather at departure does not guarantee favorable conditions *in route*. For in-flight hazard detection and avoidance, the A320 is equipped with an onboard weather radar.

A320 Onboard Wheather Radar

The weather radar is an essential detection and avoidance tool throughout all phases of flight.

Like all radar systems, it transmits electromagnetic waves. These waves return when they encounter moisture particles (rain, hail, snow). If the beam is tilted too low, ground returns may also appear.

The weather radar does not detect thunderstorms directly. It detects hydrometeors (water particles).

<u>The radar detects:</u>

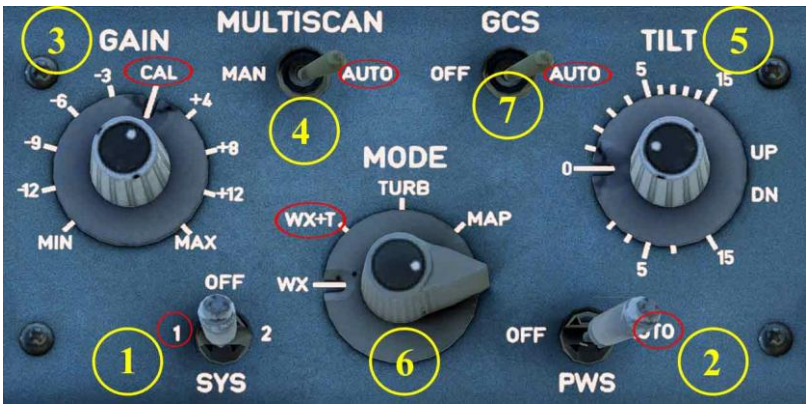
- Areas of precipitation
- Precipitation intensity, color-coded: Green (light), Yellow (moderate), Red (heavy) and Magenta (extreme)
- Hail
- Convective activity (vertical and horizontal moisture movement)

<u>The radar does not detect:</u>

- Clear air turbulence (CAT) without precipitation
- Fog
- Dry clouds
- High-altitude cirrus
- Thunderstorms: it only detects the precipitation associated with a Cumulonimbus (CB) cloud.

A 320 WEATHER RADAR CONTROL PANEL

The weather radar control panel is located on the **pedestal, left side, below the radio panel**.



① **SYS:** Activates the weather radar

Normal position: **1**

② **PWS** (Predictive Windshear System).

Normal position: **AUTO**

③ **GAIN:** Adjusts receiver signal amplification.

Normal position: **CAL**

CAL provides automatic signal calibration for optimum display.

Manual adjustment may be used to reduce image saturation or enhance weak returns.

④ **MULTISCAN:** Radar beam scanning mode.

Normal position: **AUTO**

⑤ **TILT:** Adjusts radar beam elevation

Normal position: **0°** (*Active only when MULTISCAN is set to MAN)*

⑥ **MODE Selector:**

WX+T: Normal position, Displays precipitation (green/yellow/red) and turbulence within precipitation (magenta)

WX: Displays precipitation only

TURB: Displays wet turbulence only (magenta)

MAP: Displays terrain outlines (coastlines, etc.)

Not related to the TERR ON ND function. The usefulness of this function is not universally accepted among pilots.

⑦ **GCS** (Ground Clutter Suppression)

Normal position: **AUTO**

GCS reduces ground return echoes, helping differentiate terrain from precipitation.

Typical technique: Leave GCS OFF while adjusting tilt and range and Select ON when analyzing potential weather threats.

The operational range of the Airbus weather radar is **160 NM**, however it may detect precipitation returns up to **320 NM**.
In **TURBULENCE mode**, effective range is approximately **40 NM**.

The radar operates by sweeping a beam of electromagnetic waves from left to right and right to left in a horizontal plane.

With **MULTISCAN** selected to AUTO, the radar scans both above and below the aircraft and analyzes returns at multiple tilt angles using internal algorithms to identify potential weather threats. To refine the automatic analysis, MULTISCAN may be selected to **MAN**. The crew can then manually adjust the **TILT** to scan the vertical structure of a weather cell.

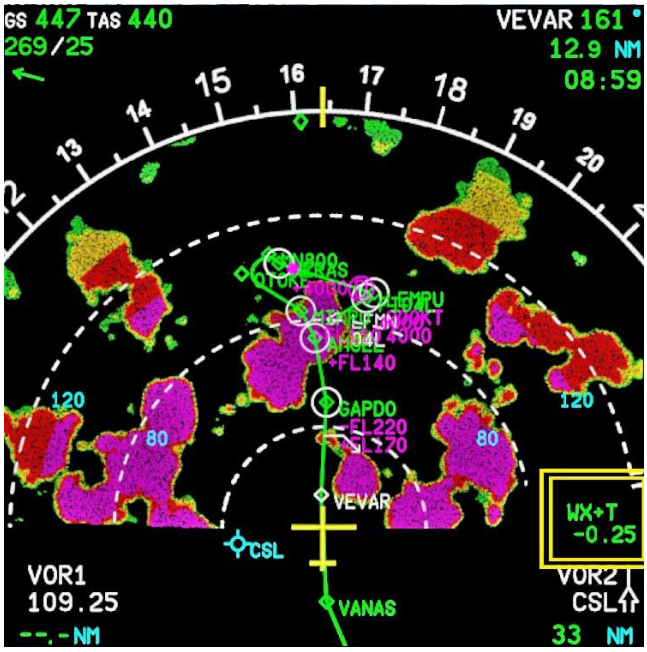
Caution

- **Tilt too high:** The beam scans above the weather. Hazardous areas may not be detected.
- **Tilt too low:** The display will show predominantly ground returns (typically red).

The objective is to:

- Scan the **base of the cell at medium range**, and
- Scan the **upper structure at longer range**.

Weather Radar Display on the Navigation Display (ND)



Weather radar display on the ND is inhibited when **TERR ON ND** is selected.
Verify that the **TERR ON ND** pushbutton (located on the lower right side of the ND) is OFF when using weather radar.

Weather returns are overlaid on the flight plan and standard ND symbology. The active radar mode is displayed in the lower right corner of the ND.

Example: **WX+T –0.25**

- Automatic TILT: –0.25° (downward)
- MULTISCAN: AUTO

Another example: **WX**

- Manual TILT: –2.00° (downward)
- MULTISCAN: MAN

Radar returns are displayed using a color code indicating precipitation intensity, regardless of whether it is liquid or solid:

✓ **Green:** Light precipitation
  - Light rain, low moisture content
  - Penetration generally acceptable

✓ **Yellow:** Moderate precipitation
  - Moderate intensity
  - Avoidance recommended
  - In a CB, this is typically where windshear and moderate turbulence begin to develop

- ✓ **Red:** heavy rainfall
  - Very active region of CB: intense rain, hail, significant convection
  - Always avoid with a lateral margin of approximately 20 NM, and a vertical margin of at least 5,000 feet above.

- ✓ **Magenta:** Turbulence area
  - Displayed in **WX+T** or **TURB** mode
  - Indicates **severe turbulence**
  - Strict avoidance required

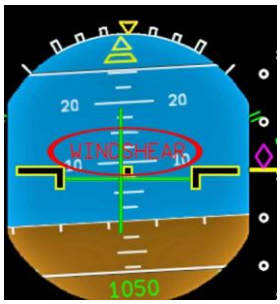
- ✓ **Black:** No radar return
  - Either no precipitation present
  - Or a phenomenon not detected by the radar (e.g., dry hail)

Important: The radar displays precipitation intensity levels, not actual meteorological severity.

GAIN adjustment significantly affects the displayed image:
- Increasing gain → more echoes displayed (risk of image saturation)
- Decreasing gain → light precipitation may disappear

Airbus recommends AUTO mode (TILT and GAIN) in normal operations.
This mode is effective but not infallible.
In practice, crews must continuously monitor, verify, and adjust TILT as required.

When operating in manual mode, do not interpret an increase in gain as an increase in weather severity. GAIN affects the image presentation, not the actual intensity of the weather cell.



If windshear is detected by the weather radar during approach:

A red WINDSHEAR alert is displayed in the center of the PFD.

An immediate **go-around is mandatory**, regardless of altitude.

The Pilot Flying calls:
"Windshear, Go Around."

- Advance the thrust levers to the TO/GA detent.
- If the autopilot is disengaged, manually maintain:
  - Go-around pitch attitude (SRS on FMA)
  - Lateral guidance (green NAV on FMA)
  - Follow the Flight Director commands.

If the autopilot remains engaged, monitor that it correctly maintains SRS pitch and the commanded lateral path.

The aircraft remains in landing configuration (gear down, flaps extended, spoilers armed) until clear of the windshear condition.

Once stabilized:
- Retract flaps on schedule
- Retract landing gear
- Disarm spoilers

Simulator Note To display real-time weather in the simulator weather window:
- *Select **"Real-World Weather."***
- *Do not select "Use Simulator Time Instead of Real Time."*

A320 SECONDARY NAVIGATION MODES

The A320 provides **two selected navigation mode** configurations: **HDG / VS, and TRK / FPA**

The HDG–TRK / VS–FPA selector pushbutton is located on the FCU, above the AP1 and AP2 pushbuttons.

Each configuration includes:

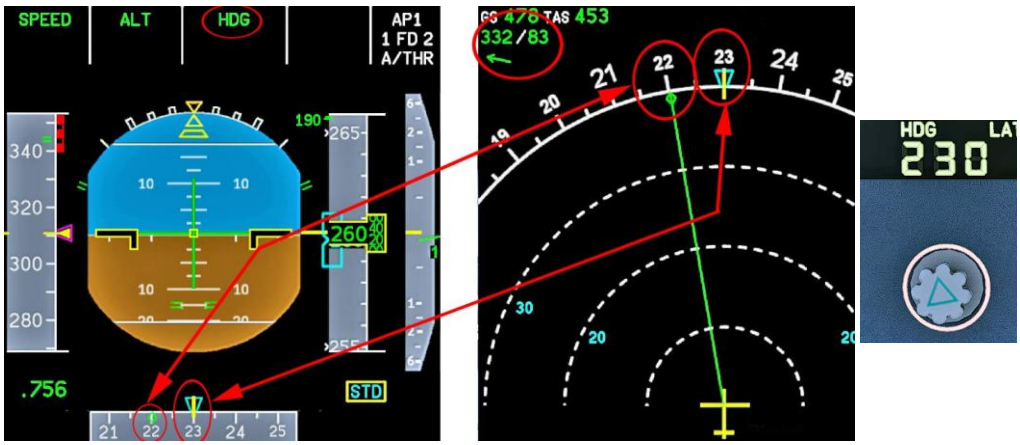
- A **lateral mode** (HDG or TRK)
- A **vertical mode** (VS or FPA)

1. **HDG / VS** (Default and most commonly used mode)

A. HDG*: Lateral Navigation*

Heading (HDG) refers to the aircraft's magnetic (or true, depending on system setting) heading.
In HDG mode, the aircraft maintains the selected heading set on the FCU.
It does **not** compensate for crosswind.

Example: FCU heading selected: 230, Crosswind present
AP1 engaged, Both Flight Directors ON



FCU heading selected 230°

PFD and ND display:

The **blue heading bug (triangle)** represents the selected heading (230°).

The **yellow aircraft symbol (lubber line)** represents the aircraft's longitudinal axis.

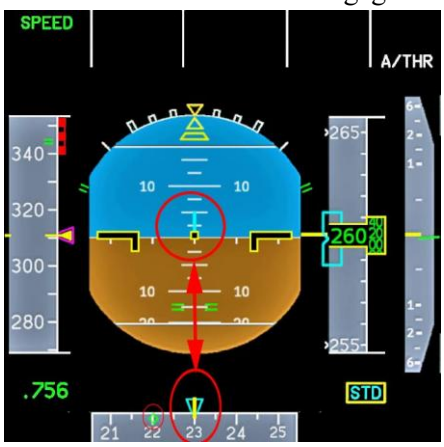
The **green diamond** on the PFD/ND represents the **ground track** (e.g., 220°).

The difference between selected heading (230°) and ground track (220°) is drift**.**

Summary:

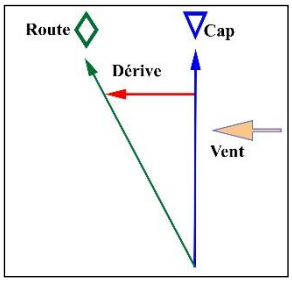
- Selected heading: 230°
- Actual ground track: 220°

If AP and both FDs are disengaged:



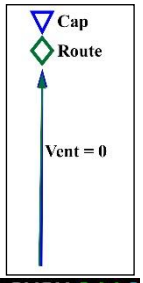
The green FD cross disappears.

A **blue vertical line** appears on the attitude indicator as a reference to the selected heading. This blue reference represents the selected heading bug set on the FCU (230°).



With no wind:

- Heading equal's track.
- Blue heading bug and green diamond are vertically aligned on both PFD and ND.



V/S*: Vertical Speed*

VS (Vertical Speed) is expressed in feet per minute.
This is a vertical mode based on a fixed climb or descent rate.

Definition:

This is a vertical mode based on a fixed rate of climb/descent.

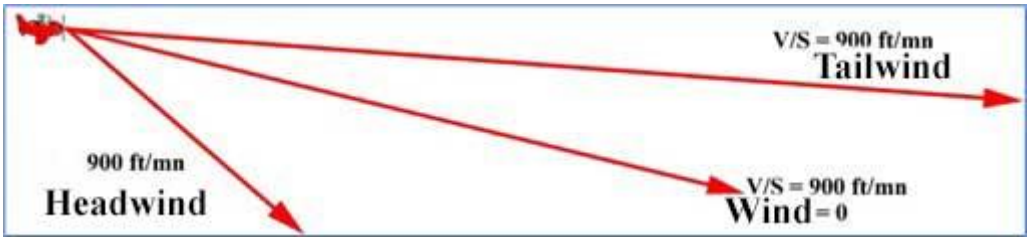
The aircraft descends (or climbs) at a given vertical speed, for example, 900 ft/min.

Characteristics:

VS has no horizontal reference.
The same ft/min rate produces different descent angles depending on ground speed.

Wind Influence:
Wind affects ground speed, therefore affecting descent angle:

Headwind → lower ground speed → steeper descent angle
Tailwind → higher ground speed → shallower descent angle



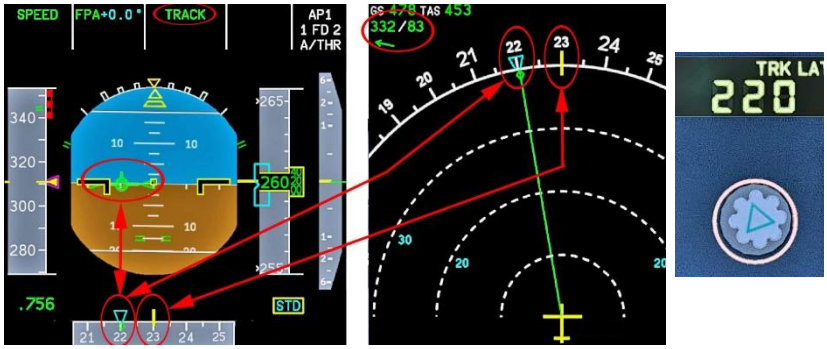
A fixed vertical speed may cause deviation from the desired geometric descent path if wind conditions change.

2. **TRK / FPA.**

A. HDG*: Lateral Navigation.*

Track (TRK) represents the actual ground path of the aircraft.
In TRK mode, the system automatically compensates for crosswind.
The pilot commands the desired ground track, not heading.

Example: FCU track selected 220,°Crosswind present.
AP1 and both FDs engaged



The ground track is 220°.

We are in the exact same situation as before:

- The ground track is 220°,
- The aircraft heading (lubber line) is 230°.
  (This difference represents the wind correction required to maintain the selected ground track).

On the displays:

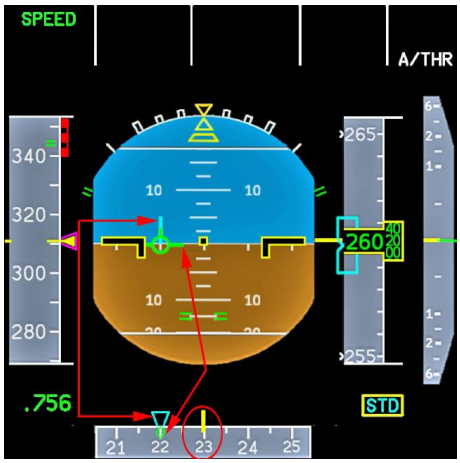
On the PFD and the ND, the index (blue triangle) represents the selected track target in the FCU (220°), with a reminder on the PFD shown as a vertical blue line at the level of the artificial horizon.

The yellow aircraft symbol shows aircraft heading.

The green diamond on the PFD heading scale and on the ND (220°) represents the ground track, materialized on the ND by the continuous green line.

In TRK mode, the blue triangle and green diamond are aligned.

With AP and FDs disengaged:

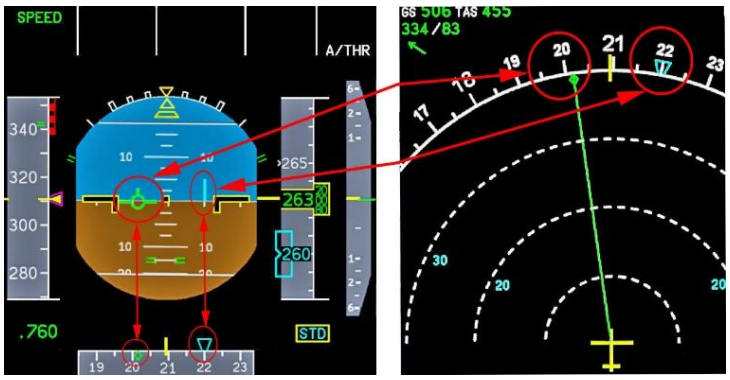


On the PFD, the flight director "bird" at the level of the artificial horizon has been replaced by a vertical blue line, which is a reminder of the selected track index in the FCU (220°). It is centered on the bird.

On the heading scale, the selected track index and the green diamond are vertically aligned: the aircraft is following the ground track selected in the FCU.

Note: *When the autopilot is disengaged, the FMA shows no active lateral or vertical guidance modes in columns 2 and 3.*

The **bird** symbol indicates operation in TRK/FPA reference mode.



We are flying **manually**, and we have deviated from our selected track of 220°.

- On the PFD:
  The bird is to the left of the blue vertical line.
  The green diamond is to the left of the blue triangle.
- On the ND:
  The green diamond is to the left of the selected track index.

To regain our track, we must turn right until the bird aligns with the blue vertical line, and the selected track index aligns with the green diamond.

B. FPA: Vertical Navigation.
FPA (Flight Path Angle).

Definition:

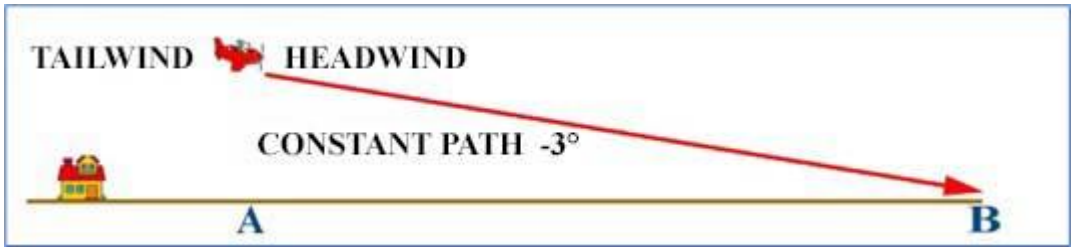
This is a vertical mode based on a fixed angle that the aircraft must follow to fly from point A to point B, most often to intercept or maintain a runway approach path.

*Example: the **3° glide slope** of an ILS.*

Characteristics

- It is a fixed geometric plane in space.
- It does not directly depend on aircraft performance.
- FPA guarantees the same descent angle regardless of wind.
- A given angle corresponds to a specific gradient:

(For 3°, this equals approximately 300 ft per NM traveled).



*The geometric path itself is independent of the wind. However, the **r**ate of descent required to maintain that angle depends on the wind, through its effect on ground speed.*

The TRACK/FPA mode is generally used during non-precision approaches (VOR-DME, ILS in selected modes), and of course for traffic patterns.

TRAFFIC PATTERN

A traffic pattern is a standardized flight path used to practice takeoff, approach, and landing procedures.
It is generally flown at an altitude of 1,500 feet AGL.

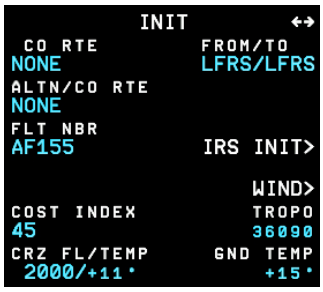
Our traffic pattern includes:

1. Initial Climb up to 1,500 ft.
2. Crosswind Leg:
   after a 90° turn, we establish on the crosswind leg.
3. Downwind Leg
   Maintain 1,500 ft AGL, Typical speed: 210 kt
   After a second 90° turn, we roll out on the downwind leg.
   Fly parallel to the runway Approximately 2.5 NM from the runway.
4. Base Turn and Final
   Descend toward 500 ft AGL, Align with the runway, descent for landing.

Flight Preparation.

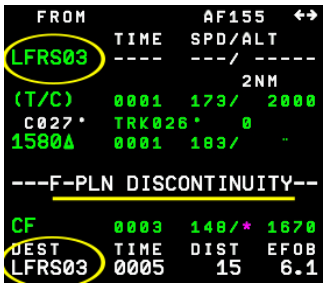
We will perform a traffic pattern departing from Runway 03 at Nantes Atlantique Airport (LFRS).

MCDU Setup



INIT Page

- FROM/TO: LFRS / LFRS
- FLT NBR: AF155
- COST INDEX: 45
- CRZ FL/TEMP: 2000 (value not relevant for this exercise)



Flight Plan Entry

1. DEPARTURE Page: RWY 03, SID NONE Transition NONE.

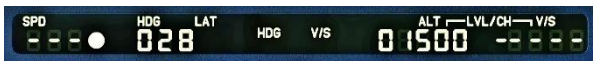
2. ARRIVAL Page:
   a) RWY 03, NO STAR.
   b) ILS 03, NO STAR

(If the runway is equipped with an ILS, it may be selected, but this is not mandatory for the traffic pattern.)

PERF Page (Takeoff Data) : Standard performance entries:

- Flaps: 1 + F
- FLEX TO TEMP: 40°

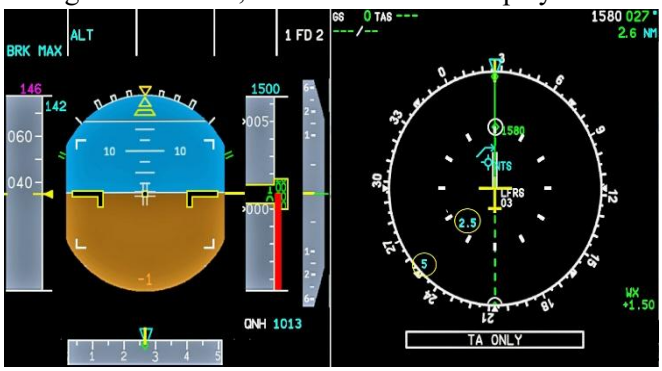
FCU



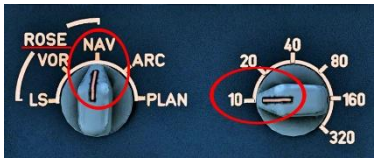
- HDG: 028°
- ALT: 1500 ft

Line-Up RWY 03

Aligned on Runway 03, after completing the aircraft configuration and performing the takeoff configuration check, the ECAM memo displays: TO CONFIG NORMAL. We are now ready for takeoff



Display Configuration:
The flight instruments are presented as follows:



- ND is displayed in ROSE NAV
- mode Range scale: 10 NM

1. Takeoff: Thrust levers set to FLEX/MCT.

Vertical guidance: SRS
A/THR armed

2. Positive Climb.
   - Landing gear UP
   - Disarm the spoilers

Engage Autopilot AP1.

3. Pull the HDG knob

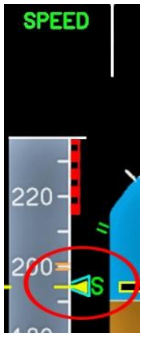
HDG selected mode engages.

4. Thrust Levers to CLB Detent.

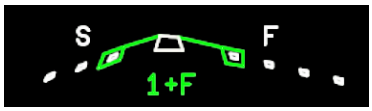
When LVR CLB flashes on the FMA, Move the thrust levers to the CLB detent.Autothrust (A/THR) becomes active.

Speed mode: SPEED
The aircraft continues to accelerate.

5. Speed Selection at S Speed



Selected speed: 194 kt.

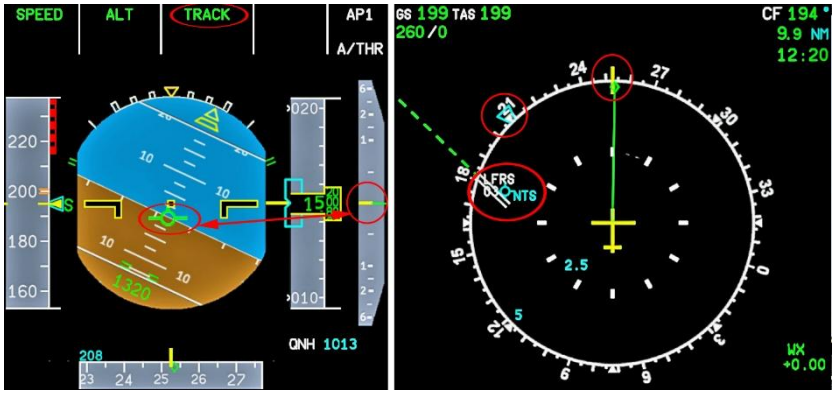


We remain in Flaps 1 + F configuration.

Note: There is no strict rule. At S speed, it is possible to select Flaps 0; the aircraft will simply continue accelerating.

6. Left Turn at 180°
   Rotate the HDG knob to the left and set the heading index to (028 + 180).
7. Perform the Approach Checklist at the end of the turn.
8. Activate approach phase (MCDU – PERF page).
9. Activate managed Speed (Press the SPD button).
10. Disconnect the two Flight Directors (OFF).
11. Select TRACK / FPA mode (press the TRACK/FPA button).
12. Disconnect Autopilot.

It is recommended, during initial training, to keep the autopilot engaged in order to become familiar with the bird behavior before flying manually.



PFD display:

Lateral mode: TRACK

The **green bird** represents the aircraft's actual flight path through space. (Here, on the attitude indicator, and horizon, the vertical speed is 0)

ND Indications
The heading index is set to 208°.

At the end of the turn, stabilized on 208°, the aircraft ground track is parallel to the runway centerline, approximately 2.5 NM away (established on downwind).

13. Abeam the Runway Threshold
    - Start the stopwatch: 45 seconds
    - Select Flaps 2

If there is a tailwind (example: GS 208 kt / TAS 199 kt):Tailwind component = 208 − 199 = 9 kt Reduce the timing accordingly: 45 − 9 = 36 seconds. (Subtract 1 second per knot of tailwind).

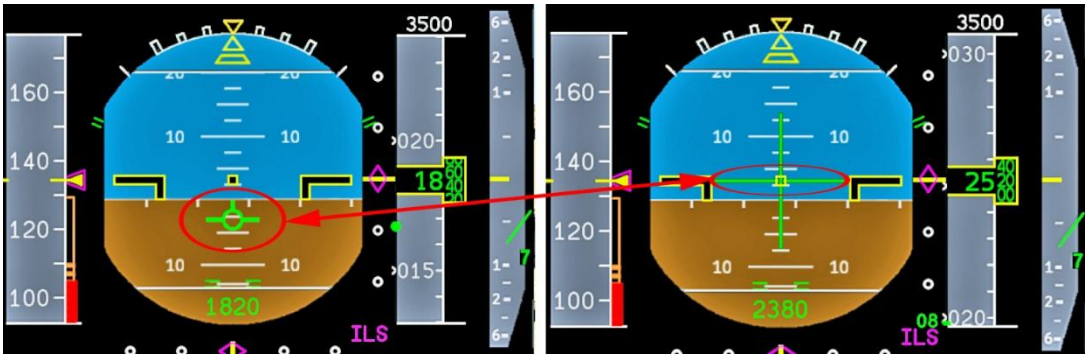
Saving the situation at this point allows you to practice continuing the flight manually, without the autopilot, and refine your control using the bird in TRACK/FPA mode.

14. If the Autopilot Is Maintained
    - Press the LS pushbutton (to display the ILS scales on the PFD).
    - Arm Approach mode on the FCU by pressing APPR.
15. Three Seconds Before the Turn, set the runway QFU on the FCU: 027.
16. At 45 Seconds left turn, vertical speed –400 ft/min.
17. Landing Gear down.
18. Flaps 3: base Leg, (track approximately 118°).
19. Turn Final visually runway. Use the ND for lateral guidance and the glide slope indication for vertical reference.
20. Flaps FULL once established on final and aligned with the runway.
21. Perform the Landing Checklist.

22. Maintain runway alignment using LOC, Glide, and PAPI (if applicable).
23. At 20 ft radio Altimeter: throttles on IDLE.
24. At 10 ft gently pull back on the sidestick to initiate the flare.
25. Touchdown: Keep the aircraft centered on the runway.

Differences Between TRACK/FPA and HDG/V/S Modes.

TRACK / FPA Mode



The bird displays the aircraft's actual flight path. A 3° descent angle is maintained regardless of wind. The reference is geometric: the aircraft follows a fixed path in space

The Flight Director (FD) displays the aircraft pitch attitude required to maintain a selected vertical speed. The resulting descent angle varies with the wind, because it depends on ground speed. The reference is not geometric.

Note: The traffic pattern is primarily a manual flying exercise. The objective is to fly manually from takeoff to landing. The autopilot is used here only as a training aid, to better understand and manage each phase of the traffic pattern before performing it entirely by hand.

HIGH-LIFTING DEVICES
Flaps and Slats

Slats

Located: on the leading edge of the wing (front).

Function:

- Increase the wing's maximum angle of attack.
- Delay the stall.
- Improve low-speed controllability.

Aerodynamic Effect:

- Increase lift with a moderate increase in drag.
- Allow flight at higher angles of attack.

Flaps

Located: on the trailing edge of the wing (rear).

Function:

- Increase lift and allow lower flight speeds.

- Reduce approach and landing speeds.
- Improve aircraft stability during approach.

Aerodynamic Effect:

- Significantly increase drag.

Summary:

- SLATS: Stall protection.
- FLAPS: Speed and descent path control.

On Airbus aircraft, the flap lever has 5 positions, while the actual slat/flap combinations total 6 configurations: 0 – 1 – 1+F – 2 – 3 – FULL

<u>Position 1 may result in two different configurations depending on airspeed.</u>

1. Moving the Lever from 0 to 1
   a) If **A**irspeed < 100 kt → 1 + F
      (Typical situation before takeoff, Flaps 1 configuration.)
   b) If Airspeed > 100 kt → 1
      (Typical situation during approach.)
2. Moving the Lever from 2 to 1
   a) If Airspeed < F speed → 1 + F
   b) If Airspeed > F speed → 1

Typical situations: Takeoff performed with Flaps 2 or Go-around.

Notes:

- The actual flap/slat position can be monitored on the E/WD.
- If the flaps are retracted from position 2 to position 1 below speed F, the configuration will be 1 + F, and will automatically change from 1 + F to 1 without moving the lever.
- Slats remain extended from position Flaps 1 through Flaps FULL.
- Speeds S and F are neither limiting nor constant speeds: they vary primarily with aircraft weight.
- S Speed = Slats only
  Minimum safe speed in clean configuration (CONF 0).
- F Speed= Flaps extended
  Minimum safe speed in Flaps 1 configuration.
- VFE NEXT: Displayed on the PFD speed scale as a double amber line (=).
  - It is the maximum speed before selecting the next flap position.
  - It indicates the correct speed at which to extend flaps safely. It prevents flap extension at excessive speed that could damage the structure.
  - This is not the maximum speed of the current configuration.

- VLS
  - It is the lower speed limit not to be crossed in normal operations.
    It is the minimum selectable speed that guarantees a safety margin above stall.
    If the pilot selects a speed below VLS, the FMGS automatically limits it to VLS.

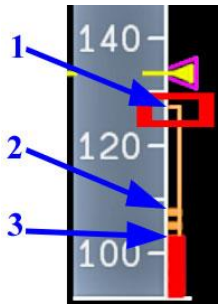
  - VLS Is Variable, continuously calculated by the FMGS according to:
    - Aircraft weight and center of gravity.
    - Flap configuration.
    - Available thrust.

  - VLS Indication on the PFD
    On the speed scale, VLS is shown as

    1) A single horizontal amber line
    2) Above an amber and black strip (Alpha Protection)
    3) Above a red strip (Alpha Max)

    Amber/black band: Alpha Protection range

    Red band**:** Maximum angle of attack (Alpha Max)



Summary: In normal flight, **"**Do not enter the amber."

Landing in FLAPS 3 Configuration: Specific Characteristics

CONF 3 is an alternative landing configuration used in certain situations.

1. *Flap or Slat Failure / Malfunction*

CONF 3 is used when CONF FULL is not available, for example in cases of:

- Flap blockage or failure
- Slat malfunction
- ECAM messages such as:
  - F/CTL FLAPS FAULT
  - SLATS FAULT
- Incomplete extension preventing flaps from reaching FULL

2. *Strong Wind or Gusty Conditions*
   CONF 3 may also be used in difficult wind conditions:
   - Very strong crosswinds
   - Significant gusts

3. Contaminated Runway (snow standing water).

Operational Consequences of CONF 3

VAPP is higher than in CONF FULL.

Landing distance is longer.

Note: *There is no universal rule: Each airline defines procedures regarding which configuration to use depending on the situation.*

CONF FULL is the normal configuration and should be used whenever possible.
CONF 3 is a contingency or special-conditions configuration.

Implementation of CONF

MCDU – APPR Page

1. Select CONF 3

The message "FLAPS…FULL" appears in blue on the EWD. This occurs because the FMGS has not yet recalculated the approach parameters, such as: VAPP, VLS etc…

2. Press the GPWS pushbutton: *LDG FLAP 3* (overhead panel). This informs the FMGS that the approach will be performed in CONF 3.

The system will then recalculate: VAPP, VLS, autothrust management

FLAPS 3 and GPWS FLAP 3 are displayed in green on the EWD.

The aircraft is now correctly configured for a Flaps 3 landing.

LOC/DME APPROACH 18 CALVI

Most modern approaches are **RNAV** or **ILS**, which greatly simplifies aircraft guidance and workload. However, some airports do not have these systems, or their terrain prevents fully automated approaches.

This is the case at Calvi–Sainte-Catherine Airport (LFKC), located in Corsica, which has runway 18/36.

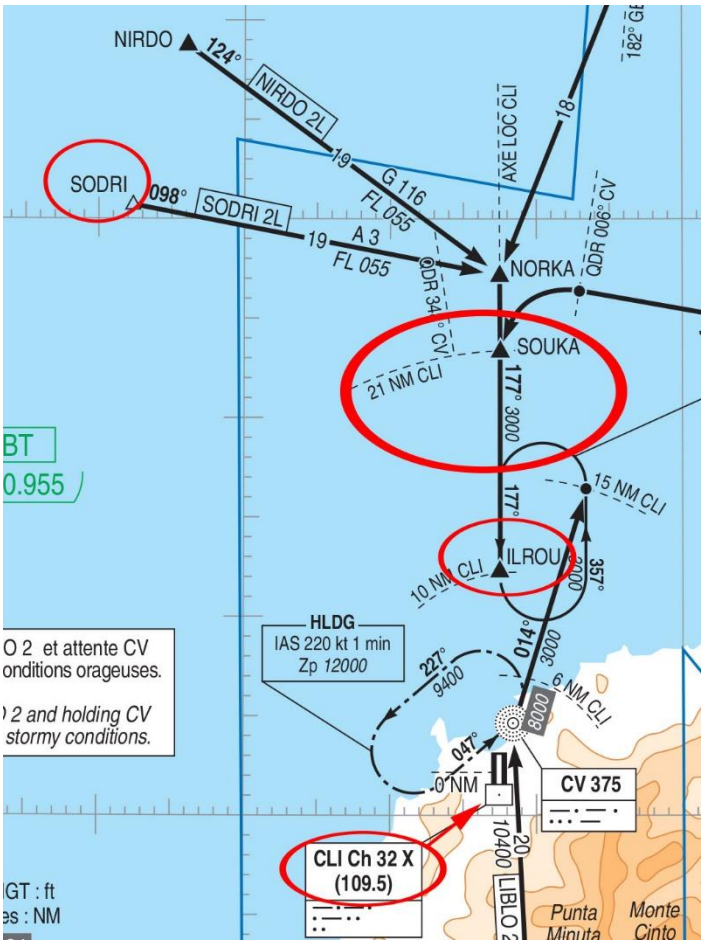
- Runway 18 is equipped with a LOC/DME approach.
- Runway 36 can only be used for visual approaches, due to the surrounding terrain.

The airport is surrounded by mountains reaching 3000 m, and the approach to runway 36 leads directly toward this terrain, making a standard instrument approach difficult to design.

We are going to operate a flight from NICE (LFMN) to CALVI (LFKC).

- Take-off from runway 04R or 22L.
- Fuel on board: about 3500 Kg
- Flight plan: LFMN SODRI LFKC.
  - SID: SODR7B
  - STAR: SODR2K
- Arrival LOC18
- Flight level: FL 150.

To simplify the tutorial, we will not create a secondary flight plan for the return to Nice, even though this would normally be done. This allows us to focus entirely on the approach.



Arrival STAR – SODRI 2L

On this chart we see the SODRI, the last waypoint of our en-route segment.

SODRI is the entry point of the STAR SODRI 2L, which ends at ILROU, passing through
NORKA and SOUKA.

STAR segments

- First segment at the altitude <u>FL 055</u>
- NORKA: right turn <u>HDG 177</u>
- SOUKA: <u>HDG 177, altitude 3000 ft</u> distance 21 NM from CLI (radio frequency: 109.5) is the LOC DME of Calvi. When LS is activated, the distance from CLI will appear on the PFD once the LOC is active.
- ILROU: <u>Distance 10 NM from CLI, altitude 3000ft Last waypoint of the STAR.</u>

Initial and Final Approach

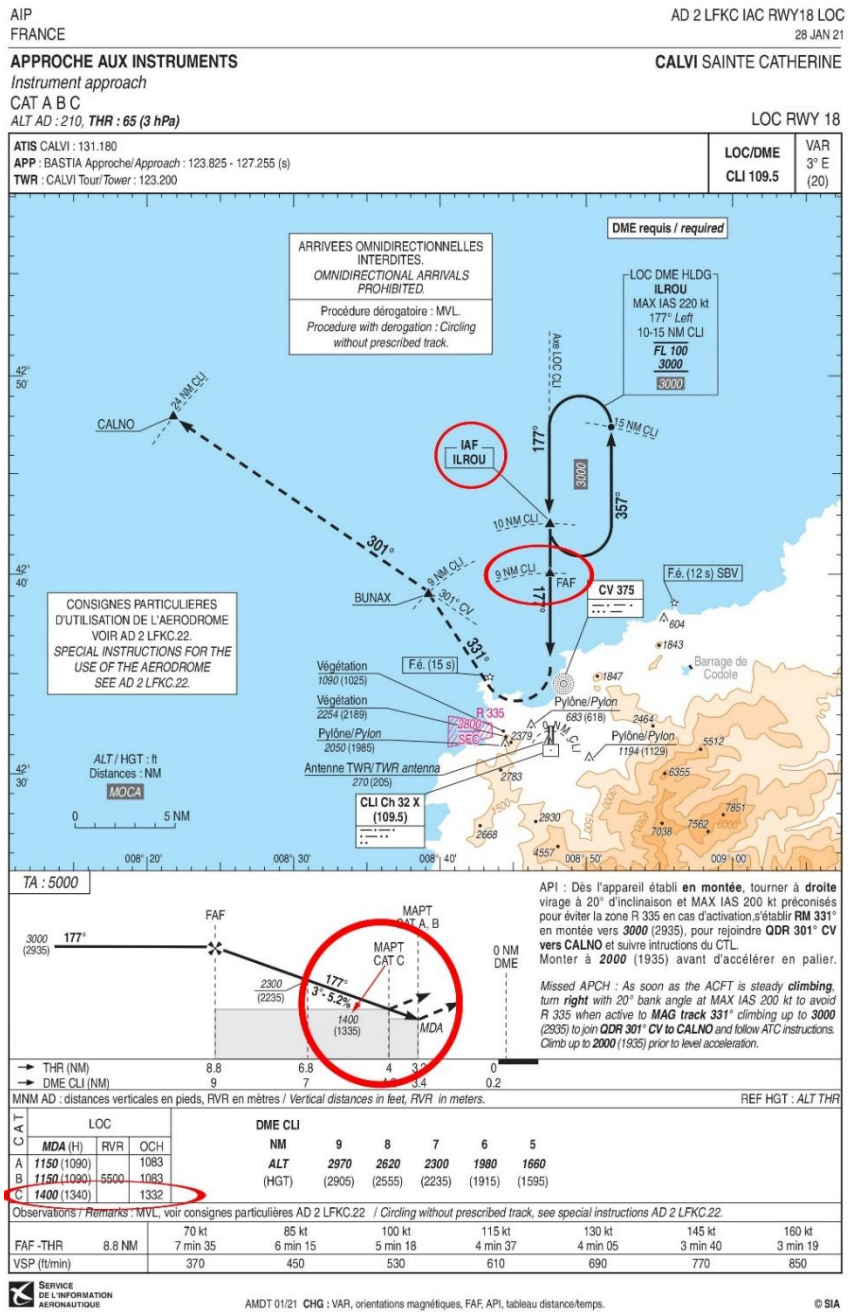
The next chart guides us from ILROU to runway 18.

IAF ILROU (Initial Approach Fix),

The Initial Approach Fix is the point where the instrument approach begins, marking the transition between the en-route phase and the instrument approach phase.
Several IAFs may exist for a single approach depending on the arrival direction.

FAF (Final Approach Fix), is located 9 NM from CLI.
It has no specific name, but *only one FAF exists for a given approach*

The **FAF** marks the beginning of the final approach segment, where the aircraft is aligned with the runway and the final descent toward landing begins.
After the FAF, the aircraft follows a specific glide slope (Glide Slope of an ILS) or a descent angle specified in the breakthrough plug (here -3 degrees).



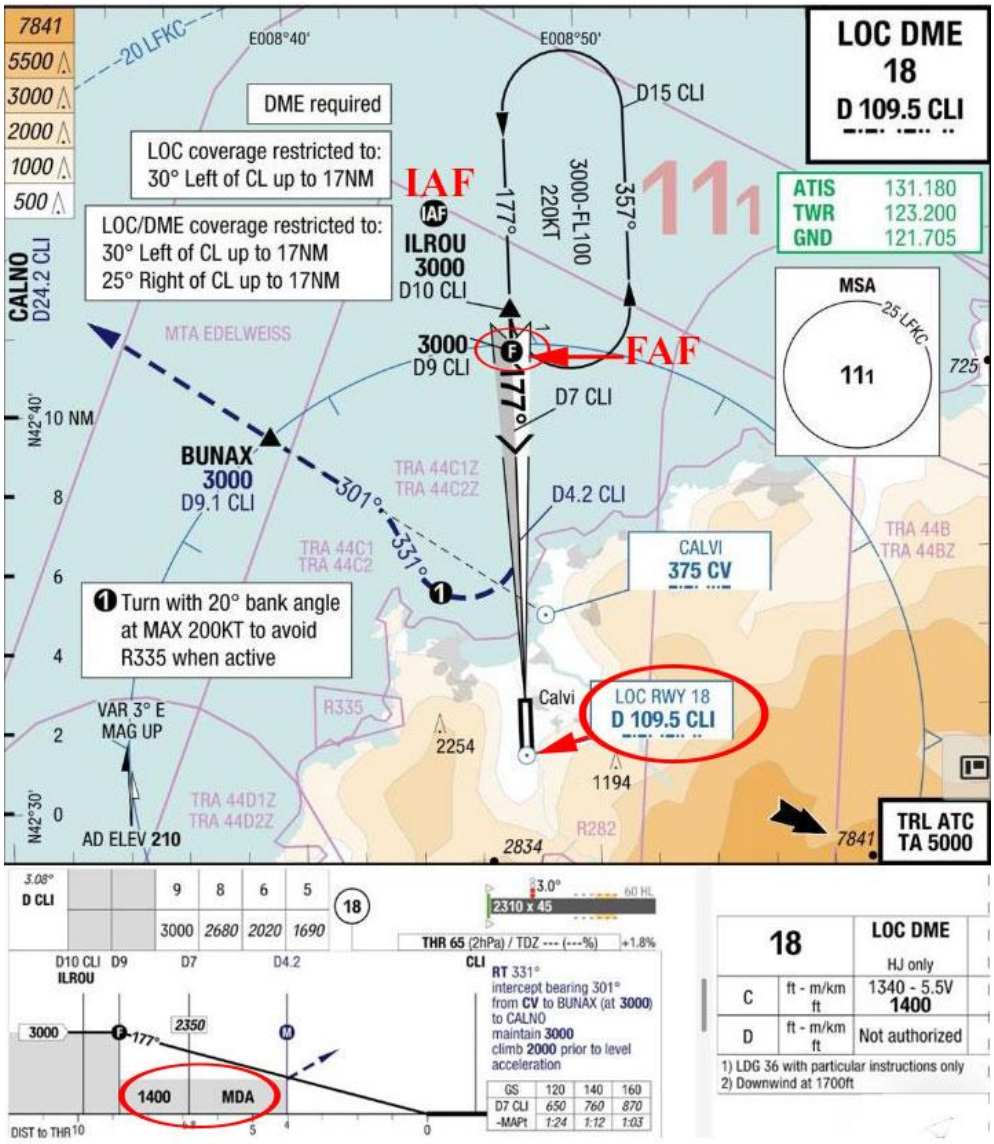
For this approach, heading: 177, descent angle: 3° (5.2%), MDA: 1400ft

MDA: **Minimum Descent Altitude**
This value must be entered in the BARO field of the MCDU APP page.

Alternative Chart Presentation

Another approach chart from a different publisher presents the same information in a different format.

ILROU is still the IAF.
The FAF marked with the letter F inside a black circle.
D10 CLI and D9 CLI indicate distances from the CLI.
The MDA is also shown.

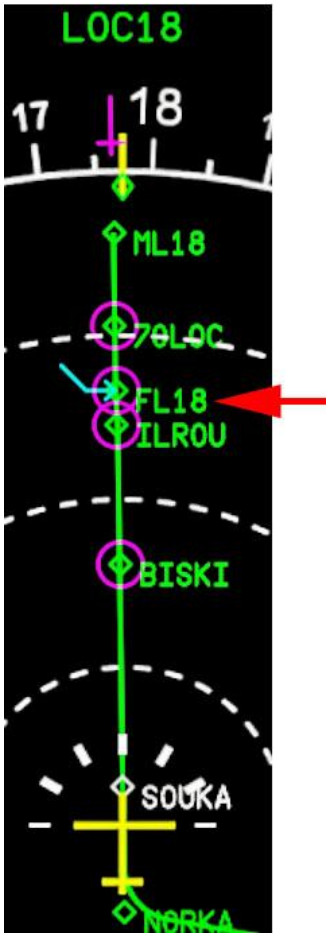


Our approach begins at the Top Of Descent (TOD).

Follow the STAR path, respecting the altitude and speed constraints shown on the charts.

Target profile: FL 055 then 3,000ft using any available means to control the aircraft at speed and altitude (flaps, speed brakes).

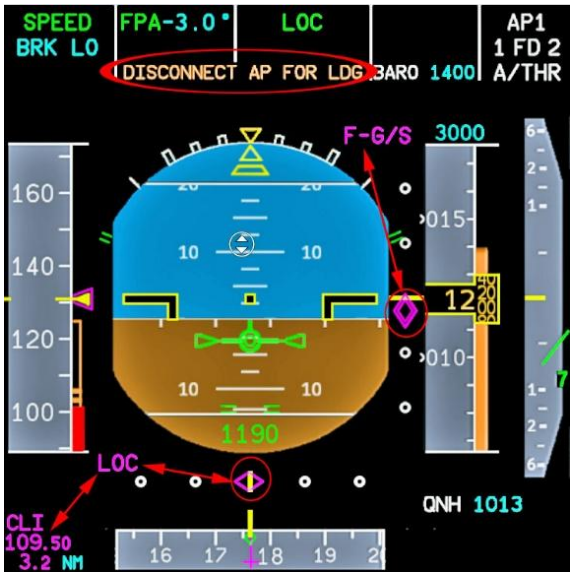
The key objective is to arrive before the IAF with 3,000 ft, FLAPS 2 and landing gear extended.



Loc/DME Approach Procedure

1) Arm the LOC.
2) Press the LS button to display the LOC lateral guidance along with the LOC identifier, radio frequency, and DME distance (in magenta on the PFD).
3) FLAPS 3.
4) Select TRACK/FPA mode and set -3° on the FCU.
5) At 9.3 NM from CLI (FAF), pull the V/S knob (or 0.3 NM before the descent point FL18 to anticipate the descent.
6) The aircraft begins the descent on the -3° path.
7) FLAPS FULL.
8) At minimums, the message DISCONNECT AP FOR LDG is displayed on the PFD.
9) Disconnect the Autopilot.
10) Manually control the lateral guidance and descent path using the PAPI.
11) When passing the runway threshold: flare and thrust levers to IDLE.

Note: For clarity, constraints are not displayed.



After minimums, the DISCONNECT AP FOR LDG *message reminds the crew to disconnect the autopilot before landing (A320 NEO only).*

The LOC lateral guidance is shown as a single magenta diamond.

A LOC/DME approach has no vertical radio guidance, because there is no glide slope transmitter, unlike an ILS.

However, the A320 can display vertical guidance computed from DME distance (Distance Measuring Equipment) or a predefined descent profile (for exemple 3°.

The magenta F-G/S (Final Glide Slope) indication (A320neo) is displayed on the PFD. Vertical guidance is represented by a magenta double-line diamond, distinguishing it from the single-line diamond used for an ILS glide slope.

This enables the crew to monitor the TRACK/FPA descent path (e.g. −3°) and manually adjust the flight path angle in the event of a high or low deviation.

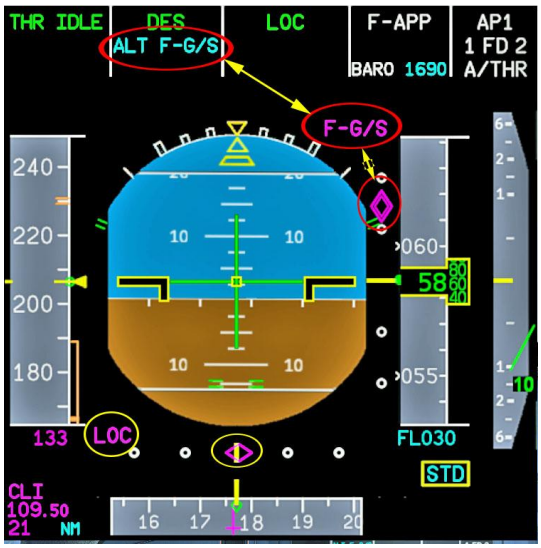
On the A320 NEO model only, Airbus added a feature designed to reduce pilot workload.

During a LOC/DME approach, i.e. without Glide Slope ILS, once the LOC is captured, the PFD may display: F-G/S (magenta)

This indicates that the FMGS has constructed a pseudo glide slope using the approach database.

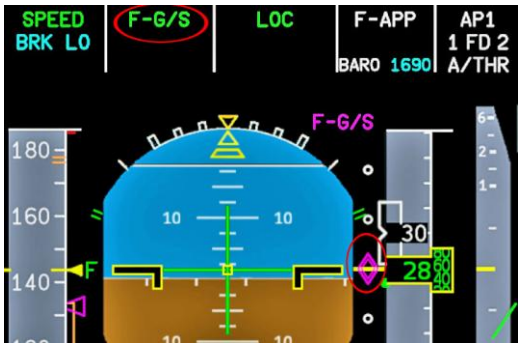
If the APPR button is armed on the FCU.

- It does not arm a real radio G/S
- It arms the F-G/S mode instead (blue on the FMA).



The airplane will automatically follow the computed descent path when:

- APPR is armed (F-G/S in blue on the FMA).
- LOC is captured.
- The aircraft reaches the Final Approach Point (FAF).

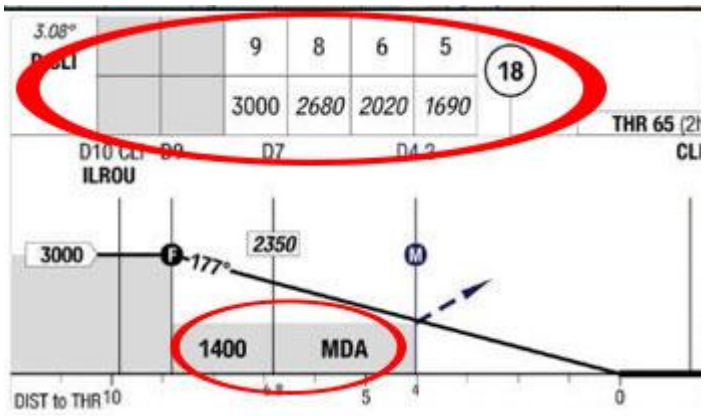


<u>This is not a precision approach like an ILS glide slope.</u>

The pilot must always:

- Check intermediate altitudes.
- Respect minimum altitudes.
- Never rely blindly on F-G/S.

If in doubt, use OP DES or V/S mode

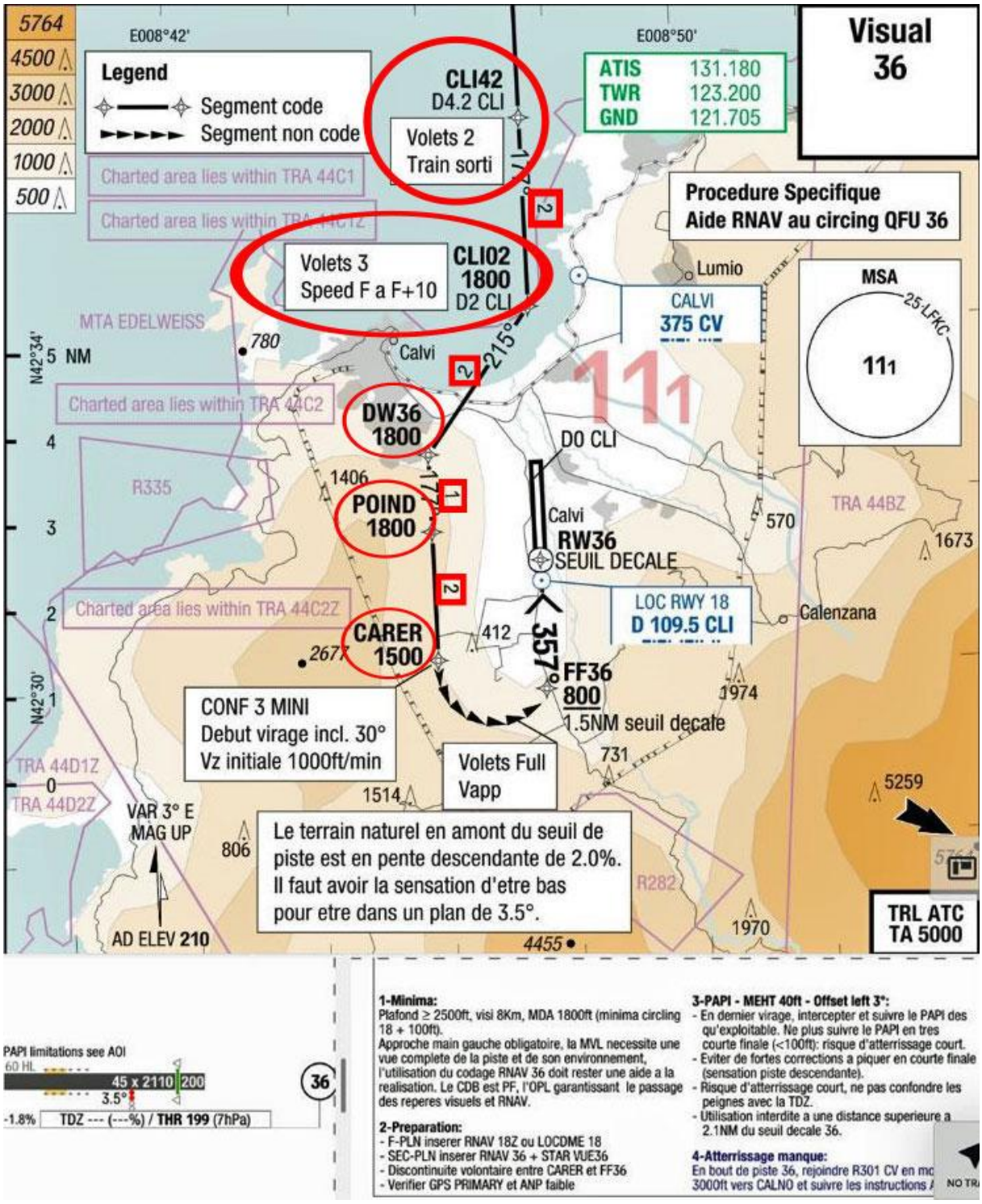


VISUAL APPROACH RUNWAY 36 (CALVI)

Landing visually on runway 36 is performed in two phases and requires specific preparation:

1. Create main Flight Plan for LOC/DME runway 18.
2. Create a secondary flight plan for runway 36. A discontinuity must remain between waypoint CARER and CF, which is located 5 NM from runway 36.

This is very important, because waypoint CF directs the aircraft toward terrain.



Creating custom waypoints.

The five waypoints used for this procedure are not stored in the FMGS database, but they can be created in the MCDU DATA page. These points extend from **CLI42 to CARER**.

1. Press DATA to open the DATA INDEX page.
2. Select page 2/2.
3. Press LSK 1R - PILOTS WAYPOINTS.
   This opens the NEW WAYPOINT page.

The first line is used to name the waypoint**.**

The remaining three lines are used to enter the waypoint coordinates, using the desired input method:

- LAT/LONG: (geographic coordinates).
- PLACE/BRG/DISTANCE: method used here.
- PLACE-BRG / PLACE-BRG: Intersection of two navaids (VOR, NDB etc...).

<u>The most important step is defining the reference point (PLACE) from which the waypoint will be created.</u>

When a runway is selected without any approach procedure, the FMGS automatically creates a Runway Reference Waypoint: CF located about 5NM from the runway threshold, at an altitude of 1500 ft QFE (height above the aerodrome).

The reference points used are the runway thresholds, identified in the database using Airport ICAO + runway number.

Runway 18 reference at Calvi: LFKC18.

Creating CLI42
Enter in PLACE/BRG/DIST: LFKC18/357/4.2. (4.2 NM is the distance shown on the chart).

Creating the other points

CLI02: LFKC18/357/2 or CLI42: CLI42/177/2.

DW36: CLI02/215/2

The same logic is applied for POIND and CARER waypoints.

Note: Custom waypoints are saved in the X-Plane/Resources/plugins/ToLissData/PilotitemsA320.dat folder.

Important Note: why not use the CLI as reference

The chart states that CLI42 is 4.2 NM from the CLI DME. However, When the aircraft reaches CLI42, the onboard radio receiver indicates 4.2 NM.
This corresponds to the distance between the aircraft and the DME antenna, which is physically located at the RWY 18 threshold.

However, the LOC antenna (lateral guidance) is installed at the opposite end of the runway, beyond the RWY 36 threshold, for practical installation reasons.

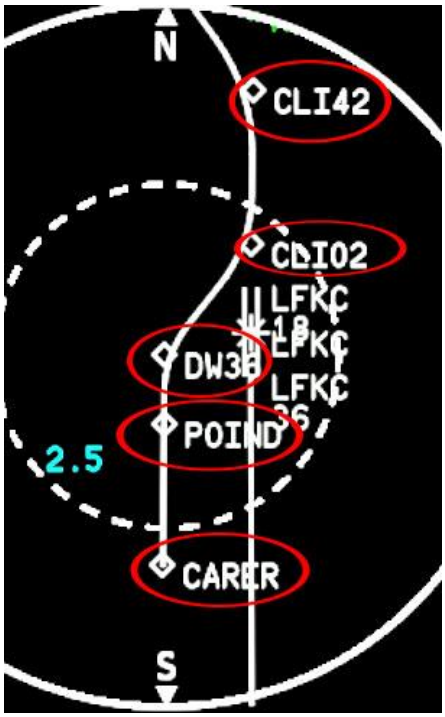
<u>In the FMGS database, the CLI navaid position correspond to the LOC antenna, not the DME antenna</u>.

Therefore, the distance between LOC and DME (~1.5 NM) must be added.
So, the correct distance from the LOC would be: 4.2 NM + 1.5 NM ≈ 5.7 NM

This makes the procedure more complex and more error-prone, which is why using LFKC18 as the reference is recommended.

Creating the Secondary Flight Plan:

For convenience, we will create the secondary flight plan before departure, although in reality it is usually entered during cruise.



1. Copy the primary flight plan to the secondary plan.
2. Change the Arrival to RW36.
3. Insert the five custom waypoints after SODRI.
4. Do not remove the discontinuity between CARER and CF.
5. Enter altitude constraints:
    - 1800 ft for CLI02, DW36 and POIND.
    - 1500 ft for CARER.

After take-off and cruise, begin the descent and approach.

1. Activate the APP phase on the MCDU.
2. Control the descent to reach 3000 ft before ILROU.
3. Arm LOC.
4. Extend FLAPS 1, FLAPS 2 and landing gear.

5. Maintain V/S mode (no fixed descent angle required).
6. Activate the secondary flight plan:
    - Pull the HDG knob.
    - Activate the secondary plan.
    - Execute DIR TO on CLI42 or CLI02.
    - Push HDG knob (return to NAV).
    - FLAPS 3
7. Set 1800 ft on the FCU and select OP DESC to level off at 1800 ft.
8. Set 1500 on the FCU.
9. At 0.3 NM before POIND, select OP DESC.
10. Landing checklist and configuration:
    - Selected Speed Mode (pull the SPD knob) *to maintain F speed (minimum speed of evolution) during the left turn in Flaps full).*
    - FLAPS FULL
11. At CARER (at 1500 ft)
    - Turn FD off
    - Disconnect autopilot.
12. Begin descent at 30° V/S 1200 ft/min then 1000 ft/min while monitoring terrain and runway.
13. Once the runway is in sight and aligned, push SPD to return to managed speed. Speed will decrease toward VAPP.
14. Landing.

Note: After CARER, it is recommended to slightly turn the view to the left in order to acquire the runway visually as early as possible. CARER corresponds to the location of a quarry on the right side, which can sometimes be recognized depending on scenery detail. The autopilot may be disconnected before CARER, provided that route and altitude are carefully monitored.
In real operations:
- *the PF (Pilot Flying) sits on the left, flying visually and monitoring terrain*
- *the PM (Pilot Monitoring) checks altitudes at each waypoint and calls the left turn at CARER*

Simulator note:

To simplify handling in the simulator:
- *the last turn may be performed in Flaps 3 with managed speed*
- *Flaps FULL can then be selected once aligned with the runway.*

In real operations however:
- *Flaps FULL + selected speed are used before the turn,*
- *then managed speed is selected once aligned with the runway,*

to avoid aircraft destabilization during the transition from Flaps 3 to Flaps FULL.

APPROACHES 02/20 AJACCIO

Flight preparation and take-off.

This airport is characterized by significant surrounding terrain, requiring a visual approach from the north to RWY 20.

We will conduct a short flight from Marseille (LFML) to Ajaccio (LFKJ):
Route: **LUC** A3 **STP** W54 **VAREK**. Cruise level: **FL170**, COST INDEX: 50.

- **Departure: RWY 13R**, SID LUC6S (or as assigned).
- **Arrival: ILS RWY 02-Z**, STAR: VARE3S VIA HORRO (or as assigned).

Aircraft loading (ISCS – LOADING PERFO page): ZFW: 64.2 t Block fuel: 6.0 t (or greater as required)

1. Primary flight plan.

   Departure will be performed from RWY 13R, which provides the shortest routing (RWY 13L unavailable).
   Due to terrain constraints and aircraft weight, a CONF 3 takeoff is selected to reduce rotation speed.

   MCDU: Enter the following data:
   - INIT B page: ZFW / ZFWCG
   - PERF page: V1 / VR / V2, Flaps / THS, FLEX TO temperature

2. Secondary flight plan.
   Prepare a secondary flight plan for an immediate return to the departure runway (see method used on page 1).

3. Aircraft Preparation and Line-Up
   - Beacon Lights
   - Engine start
   - FLAPS as required, TCAS, exterior lights, weather radar.
   - AUTOBREACK MAX, Spoilers ARMED).

4. Take-off and initial climb
   - Display constraints on the ND
   - Verify FCU settings (all managed modes)
   - TO CONFIG
     Note: If the ECAM message F/CTL PITCH TRIM/MCDU/CG DISAGREE (amber) is displayed, set the pitch trim manually to the value computed in the performance data (UP xx).
   - Thrust MAN FLX, landing gear up and spoilers disarmed.
   - Thrust reduction: THR CLB (FMA).
   - At F speed: Flaps 3 to 1 (CONF1+F)
   - At S speed: Flaps 0

5. Passing FL100

   - Landing lights off, cabin announcements as required
   - Copy the primary flight plan into the secondary. The return scenario is no longer required; the primary plan is preserved.

6. Approach data

When prompted by the MCDU, enter the approach data:

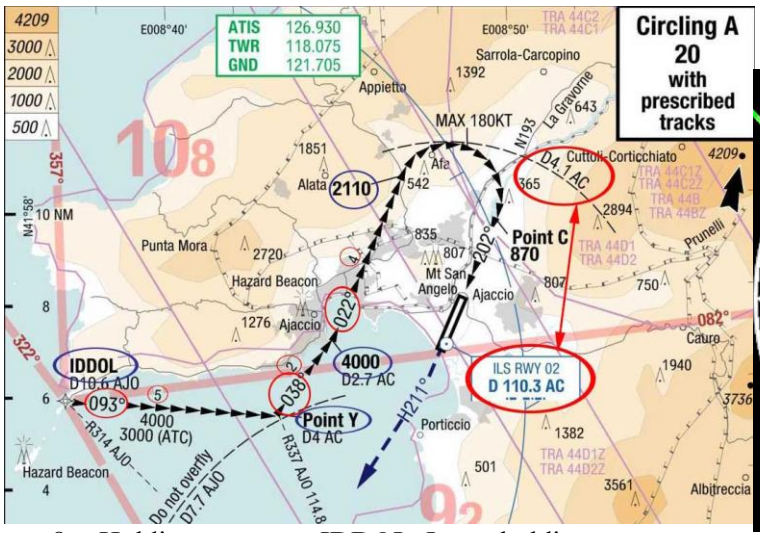
- QNH and Temperature
- Baro: 1,380 ft

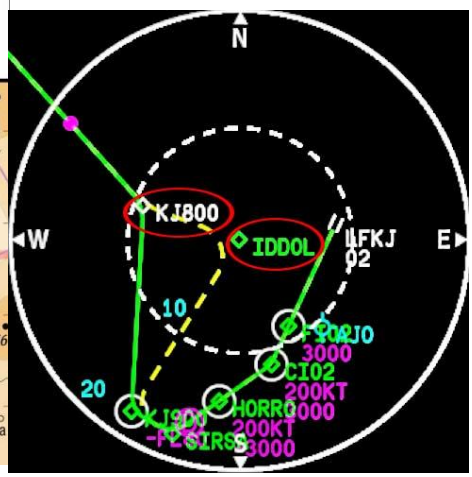
Runway 20 visual approach

Before initiating the descent, crew contacts Ajaccio Napoleon Bonaparte Airport Tower to obtain the runway in use and the current arrival conditions. Runway 20 is confirmed in use, which forecast reduced visibility.

The **entry point** for the published visual approach circuit to Runway 20 is **IDDOL**.

7. Modification of the main flight plan. Insert waypoint IDDOL after waypoint KJ800, remove the discontinuity and validate the modification.





8. Holding pattern at IDDOL. Insert holding pattern at IDDOL and update the altitude at 4,000 ft.

9. Descent preparation. Set the FCU altitude to 4,000 ft and initiate managed descent by pressing the FL100 ALT. During descent, turn on landing lights and switch passenger signs on.

10. Secondary flight plan modification.

- Open the SEC F PLN.
- Access the LAT REF page of LFKJ02, then ARRIVAL and select RWY20, then NO STAR and NO VIA. Insert the modification.
- Enter the 3 custom waypoints in the secondary flight plan. (enter POINT Y in the scratchpad and press LSK L on the CF line)
    a) Insert custom waypoint POINT Y before waypoint CFS. If point Y is not d in the FMGS database,
        - The NEW WAYPOINT page is displayed.
        - Enter IDDOL/093/5 in the PLACE/BRG/DIST field
        - Store the waypoint (LSK 6R).
    b) Insert and save the following waypoints according to the chart:
        - 4000: POINT Y/038/2
        - 2110 : 4000/022/4

11. Primary flight plan.
    - Open any waypoint LAT REV page
    - Select FIX INFO (LSK 1R)
    - On the FIX INFO page
        a) Enter POINT Y as the REF FIX (LSK 1L) line
        b) Enter a RADIUS of 1NM.
        A dashed circle will appear around POINT Y on the ND, allowing better positioning when flying the visual circuit.

12. Holding pattern configuration (4,000 ft):
    - Activate the APP phase in the MCDU.
    - Extend Flaps 1, then Flaps 2.
    - Spoilers: Armed
    - Autobrake: LO

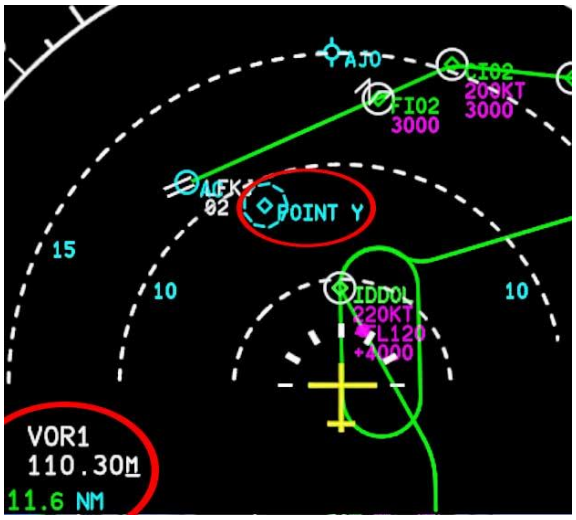
In holding pattern, two situations may arise:

1) **Runway in sight**
2) **Runway not in sight**

Note: It is advisable to make a situation backup in the holding pattern circuit.

1. **The runway is in sight: we are continuing our approach.**

- Open the RAD NAV page.
- Replace the value displayed in VOR 1 with the frequency of the Ajaccio ILS: 110.30. The DME distance will be displayed on the ND (bottom left) if enabled in the EFIS.



The ND continues to displays the main flight plan.

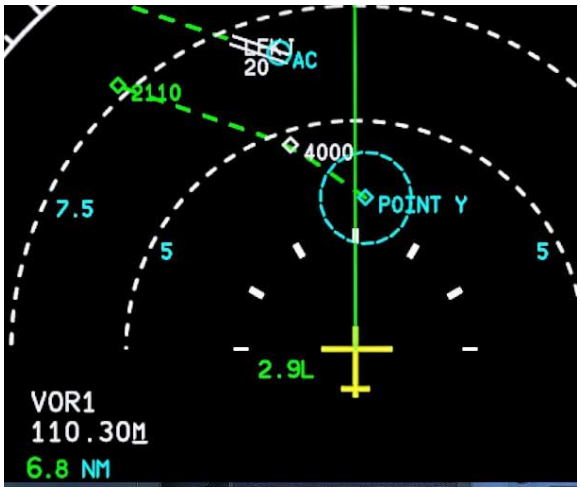
The FIX INFO circle highlights POINT Y.

To proceed toward POINT Y switch from NAV mode to HDG select mode without leaving the main flight plan.

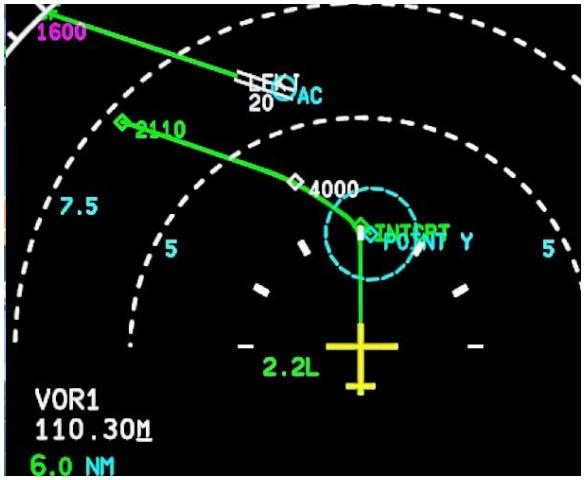
On the bottom left is displayed the DME distance of AC 110.30.

- Set HDG 093° on the FCU.

- At 1NM before IDDOL, pull the HDG knob (selected mode)



- Activate the secondary flight plan



- Push the HDG knob to re-engage NAV mode

Note: if the message NO NAV INTERCEPT appears on the MCDU, check the next waypoint on the ND. If it is 4000, turn left to intercept the track toward POINT Y.

Approach preparation:

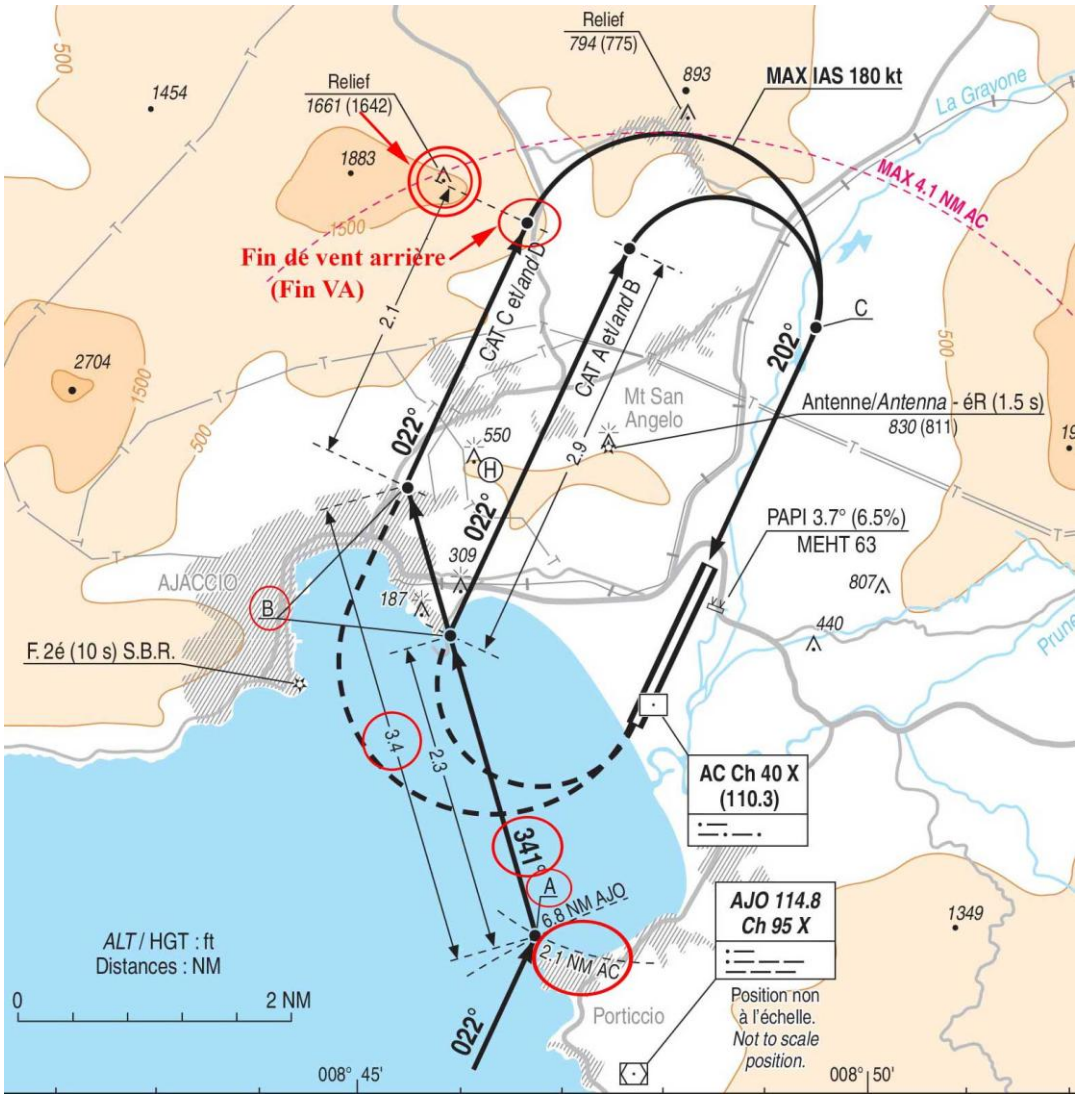
- Extend landing gear.
- At waypoint 4000, initiate descent to 2,110 ft
- Select Flaps 3
- Select SPEED mode to maintain F speed.
- Extend Flaps FULL
- Select TRACK/FPA mode.
- Turn FD OFF.
- Perform landing check-list.
- Disconnect Autopilot.

- At Approximately 3 NM from CLI (after clearing terrain on the left): Turn right and maintain the descent without exceeding 4.1 NM from AC (displayed at the bottom left of the ND).
- Perform a 180° turn at 870m altitude, using the ND for guidance.
- Align with runway center line.
- Select managed speed to decelerate toward VAPP.
- At 20 m (radio altitude), thrust levers to IDLE, perform flare and landing.

2. The runway is not in sight

Visibility is sometimes better at a lower altitude.

Continue the approach using the ILS02-Z procedure (heading 022°) stored in the main flight plan. Proceed to point A on the chart.



At point A, turn left to heading 341° toward point B (Cat C/D aircraft), turn right to 022° and then perform a 180° turn to align with the runway, and land.

We will prepare the approach as follows:
(Single-pilot operation: remain in the holding pattern to allow sufficient time for preparation.)

Creation of the secondary flight plan.

The secondary flight plan is relatively simple and contains only a limited number of custom waypoints.

At a minimum, it includes POINT B**,** and optionally a second waypoint at the end of the downwind leg, referred to as FIN VA.

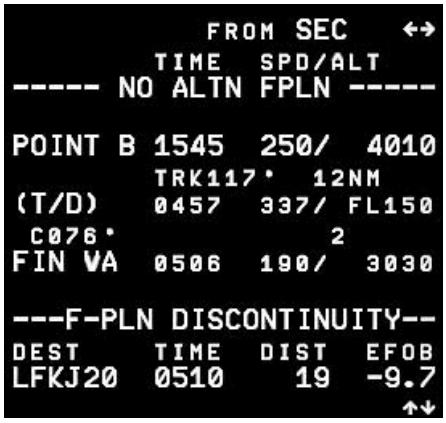
1) Creating Waypoint B
   The reference for POINT B is POINT A, which is not available in the FMGS database and must therefore be created first.

- Creation of Point A
  The approach chart indicates "2.1 NM AC", where AC represents the DME distance associated with the ILS. We know that the ILS antenna is physically located at the far end of the runway, and that the DME distance (2.1 NM) is referenced from the. runway threshold. If point A were created: PLACE/BRG/DIST with the values AC/202/2.1, this would introduce a positional error due to the offset between the LOC antenna and the runway threshold. Therefore, POINT A must be referenced to the runway threshold using the FMGS database. Name: **POINT A**, coordinates: **LFKJ02/202/2.1**.

- Creation of point B:
  POINT B is defined relative to POINT A/341/3.4.

- Creation of FIN VA. The end-of-downwind waypoint is defined as: POINT B/022/2.1.

Now that we have created the custom waypoints, we can create our secondary flight plan.



a) Open the secondary flight plan (SEC F-PLN).
b) Modify the arrival: RWY20, select NO STAR/NO VIA.
c) Enter POINT B in the scratchpad and insert it point it before CF.
d) Open the LAT REV page of POINT B and insert FIN VA.

The MCDU should now display the secondary plan.

Important: Do not delete the discontinuity after FIN VA.

Runway 20 approach

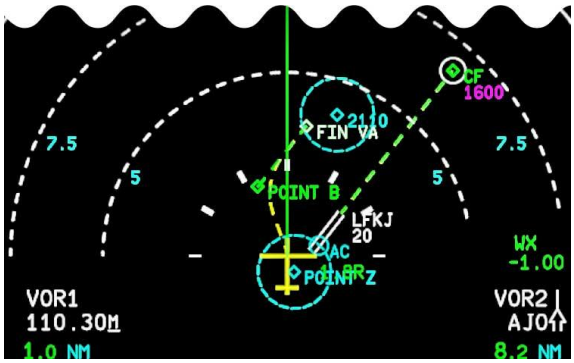
- Press LSK IMM EXIT on the main flight plan.

- On the RAD NAV page, enter 110.30 in VOR 1/FREQ).

- Press the LS pushbutton to display the LOC deviation and GLIDE information.
- Press the APPR pushbutton on the FCU.
- Extend the landing gear.
- Upon LOC capture, select Flaps 3
- Upon glide interception, the aircraft begins descent.
- **At 2,110 ft**, button PUSH TO LEVEL OFF using the FCU.

- Near 2.1 NM DME (AC 110.30), set on FCU: HDG 341°.
- At Pull the HDG knob to engage selected HDG mode.

At this point, the aircraft is established at POINT A, as defined on the chart: 2.1 NM AC and 6.8 NM LAO.
The waypoint POINT Z, depicted by a blue dashed circle, has been constructed using the coordinates AC/202/2.1.
This represents a common error and should not be used as a reference.
Due to the difference between the DME reference (runway threshold) and the LOC antenna **position**, this method introduces a positional offset.
As a result, the aircraft is actually located approximately 1 NM prior to POINT Z, which corresponds roughly to the runway length.



- Activate the secondary flight plan
- NAV mode.
- Selected speed mode (F speed): pull the SPD button
- Extend FLAPS FULL.
- Select TRACK/FPA mode displayed on the PFD.
- FD and LS: OFF.
- Perform landing Check-list.

- Disconnect the autopilot.
- At approximately 3 NM from CLI (after clearing terrain): initiate a right turn, maintain a maximum distance of 4.1 NM DME from AC (displayed at the bottom left of the ND).
- Perform a 180° turn at approximately 870 m altitude, using the ND for guidance.
- Align with the runway centerline.
- Select managed speed to decelerate toward VAPP.
- At 20 m (radio altitude), thrust levers to IDLE, perform flare and complete landing.

After leveling off at 2,110 ft, an alternative method may be used:

- Select HDG mode
- Activate SEC F-PLN
- Perform DIR TO POINT A
- Re-engage NAV mode

This allows the crew to stabilize the situation, complete the landing preparation and perform the checklist in a controlled manner.

This method is particularly suitable in single-pilot simulator operations, as it reduces workload during a high-demand phase of flight.

To be continued….

THE MCDU

Multipurpose Control and Display unit

In French: Unité de Contrôle et d'Affichage Multifunction, but in the aeronautical world, the acronym MCDU is still used even in France because it is a standardized and international technical term.

The MCDU is the main interface of the FMGS (Flight Management and Guidance System).

It allows you to:

- **Enter**
  the flight plan (airports, waypoints, altitudes, etc.)
- **Modify**
  in real time the trajectory, the flight level, etc...
- **Consult**
  the performance of the aircraft.
- **Interact with autopilot and navigation systems.**

The MCDU has 12 function keys:

DIR, PROG, PERF..... AIRPORT.

Each function key displays a dedicated page allowing access to other secondary functions.

We will describe these functions in detail and specify their practical usefulness.

➔ DIR TO

Allows you to head directly to a waypoint without following the original flight plan.

Two possibilities: this waypoint:

- Part of the flight plan
  (shortcut in a straight line)
  select in the left column by pressing the relevant line.
- Not part of the flight plan (bypassing an area).
  Enter the name of the waypoint in the scratchpad and press LSK 1L WAYPOINT.

When the waypoint is set, there are two options to achieve this:

- **DIRECT TO**:
  The flight plan is modified; all waypoints present before the selected waypoint are permanently deleted.
- **ABEAM PTS**:

Here we do a VAREK live.

The route of the aircraft is modified, but on the new route, between the position of the aircraft and the direct waypoint (here VAREK) reference points are created consisting of the perpendiculars of the deleted waypoints: TRETS, LUC and STP. They are displayed with the prefix AB for ABEAM.

Our new flight plan after confirmation (DIR TO INSERT) will display the ABTRETS CUE POINTS, ABLUC ABSSTP and then the direct waypoint VAREK.

The removed LUC and STP waypoints are VORs.

It is possible to display them on the ND by pressing the VOR D key on the EFIS, which allows us to visualize the notion of ABEAM on the ND.

For example: at the ABLUC reference point, the LUC VOR is exactly 90 degrees to the longitudinal axis of the aircraft, i.e. perpendicular to the side.
Similarly, ABSTP is also through STP's VOR.

<u>LUC and STP were part of our initial flight plan.</u>

Another function of the DIR TO page allows you to display a radial of a waypoint without changing the flight plan.

- **RADIAL IN**: close to the waypoint. Allows you to show the approach axis of a runway from the last aligned point. Example on runway 23 of LFKF Figari, select the waypoint CI23 and enter in the RADIAL line IN 047 (the heading of the runway is 227 The inbound radial is 227-180=047).

  This function is useful in radar guidance by ATC because it allows you to locate yourself in relation to the runway axis materialized by a dashed line.

- **RADIAL OUT**: radial away from the waypoint. This feature in the MCDU is much less of practical interest.

➔ Flight progress tracking.

The main PROG page is a real-time flight tracking page.

This is an information page only: It is not possible to interact with the FMGS to change the flight plan data or manage the performance of the aircraft in any way.

This page allows you to monitor the progress of the flight during its different phases.

At the top of the page, are displayed

1) Successively, the different phases: PREFLIGHT, TAKE OFF, CLIMB, CRUISE, DESCENT, APPROACH and possibly GO AROUND.
2) The company's flight number.
3) The three flight levels: CRZ, OPT and REC MAX
   a) CRZ: The current scheduled flight level in the INIT page. It is not editable in this page.
   b) OPT: optimum flight level.
   c) REC MAX: Maximum Flight Level

Note: The OPT and REC MAX levels are calculated based on the Cost Index, aircraft weight and weather, and are updated during the flight based on the weight of the aircraft decreasing with fuel consumption.

The display of this page is dynamic: some information is visible depending on the phase of the flight

VDEV: *altitude deviation* from the glide plan.

- **REPORT subpage**:
  Very useful during the flight, it is a summary of the flight. It displays:
  - The different waypoints (past, current and next) with arrival time and flight level
  - Temperature, wind (heading and speed), current fuel level.
  - Top of Descent: flight level, time and distance.
  - Destination: time of arrival, distance, estimated remaining fuel.

- **UPDATE AT**

Displays the geographical coordinates of a waypoint (here PIGOS) that can be checked on the DATA page; GPS MONITOR.

- **BRG / DIST**

Allows you to know from the position of the aircraft, the heading and the distance in a straight line of a waypoint (here LFKJ is entered on the right).

At the bottom of the main page:

Right: GPS PRIMARY (in green)
means that GPS is the main source of navigation.
The last two lines inform us in real time of the accuracy of the navigation:

REQUIRED => **RNP** (**Required N**avigation **Performance)**
This is the required accuracy expressed in NM (here 2.0 NM)

ACCUR (Accuracy)This is a quick summary of the current accuracy of navigation. It takes on different values:

- HIGHT: The most common. Optimal accuracy with PRIMARY GPS.
- MED: Medium. Correct accuracy but degraded. GPS absent or less reliable (poor reception of one or more satellites). Acceptable on the way but to be monitored.
- LOWInuffy precision: risk of significant drift. Abnormal situation.
- FAIL Situation rare: degraded or broken navigation system. Requires immediate action.

ESTIMATED => **ANP** (**Actual N**avigation **Performance)**
This is the estimate of the current forecast expressed in NM (here 0.04NM).

RNP/PDA Monitoring:

- If ANP is less than RNP => OK
- If ANP is greater than RNP => accuracy problem.

Satellite Management:

Press the <GPS key to open the PREDICTIVE GPS subpage

The PREDICTIVE GPS page allows you to know in advance if the GPS will be accurate enough in the future, and in particular for an RNAV approach.

The page displays:

- The destination (LFKJ) entered in the WPT field.
- The estimated time of arrival or passage at a waypoint,
- If GPS coverage is good (Y)

Note: in simulation, GPS coverage is always good, so it is not necessary to deselect a satellite.

➔ PERFORMANCE

Access to specific performance for each phase of flight.

The PERF page changes automatically depending on the active phase of the flight:

- **TAKE OFF**
- **CLB** (Climb)
- **CRZ** (Cruise)
- **DES** (Descent)
- **APPR** (Approach)
- **GO AROUND**

During the flight, the page of the active phase of flight is displayed, but the pages of the following phases can also be viewed in order to allow data to be entered in advance and then returned to the active phase.

PAGE TAKE OFF

Left column:

Fill in the data

- V1, VR, V2
  given by the performance calculator (ISCS)
- TRANS ALT (ATC Transition Altitude.
- THR RED/ACC thrust and acceleration reduction altitudes.
  pre-filled data that can be edited.

Middle column: The data (in green) F, S and 0 are calculated by the FMGS and are not editable.

Right column:

- RWY:
  here 24, entered in the Flight Plan page and is not editable here.(can be changed only in the "DEPARTURE" flight plan)
- TO SHIFT When the take-off is not from the runway threshold, but from a ramp, thus reducing the useful take-off length.
- FLAPS/THS
  - FLAPS: usually 1. Exceptionally 2 or 3.
  - HRT: value communicated by the performance calculator.
- FLEX TO TEMP value reported by the performance calculator
- ENG OUT ACC
  Acceleration altitude with one engine inoperative.

PAGE CLIMB

- ACT MODE (active speed mode: MANAGED or SELECTED)
- CI
  - Default:
    Cost Index populated in INIT A page
  - Can be changed at any time for each phase of flight (CLB, CRZ and APPR)
- MANAGED The FMGS-calculated climb speed applied when Speed mode is active.

- PRESEL: Pre-selected climb speed. A climb speed can be determined in advance, before take-off (here 240)When the acceleration altitude is reached, the speed will automatically be in selected mode at the chosen value (240). ACT MODE is automatically set to SELECTED. To activate the speed managed mode, press the SPEED button on the FCU.
- TIME: duration of the flight (here 01 hour 22 mins)
- EFOB: Carburizing estimated on arrival.

PAGE CRUIZE

The CRZ page is the same as the CLB page.

Here the speed is managed because the PRESEL field is empty.

PAGE DESCENT

The DESCENT page is identical to the previous two pages, except for the PRESEL field.

The descent is carried out by default in managed speed mode.

However, it is possible to descend in select mode by selecting a gear and pulling the SPEED button on the FCU.

PAGE APPROACH

Default and non-editable:

- FINAL: ILS02-YModifiable in the flight plan.
- FMGS Calculated Speeds: 0, S, F and VLS

TRANS ALT and VAPP are editable.

FULL/CONF3: The default choice is FULLCONF3 can be selected by pressing the LSK R key.

All the other fields must be filled in: QNH, TEMP, MAG/WIND and they will allow the FMGS to manage the Autothrust.

BARO or RADIO: it's one or the other.

PAGE GO AROUND

This page should not be overlooked as the possibility of a go-around is part of the flight.

THR RED/ACC and ENG OUT ACC must be defined according to the approach charts.

➔ INIT A and INIT B

By convention, the first INIT page is named INIT A, and the second INIT B.

The INIT pages allow you to prepare for the flight:

INIT A

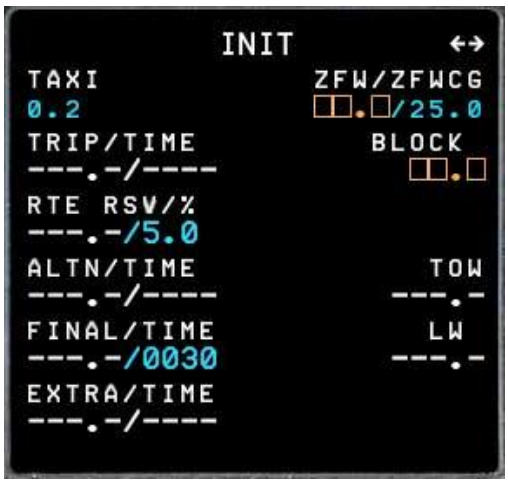
Left column

- **CO RTE**: (Compagnie Route)
  Route Saved.
- **ALTN/CO RTE**:(Alternate Compagnie route)
  Enter the alternate airport
- **FLT NBR**:Enter Flight Number
- **COST INDEX**: value from 1 to 99
- **CRZ FL/TEMP**: Enter the flight level (the temperature is displayed automatically.

Right column

- **FROM/TOSquirt the ICAO airport codes Departure / Arrival**
- **IRS INIT**
  Geographic Coordinates in IRS (from 1 to 3)
- **WIND**
  Capture or download the winds. It is possible to capture winds at different altitudes. (useless in simulation)

- **TROPO** (Tropopause)Above this altitude the temperature remains constant.
- **GND TEMP**: Ground Temperature (default value can be changed).

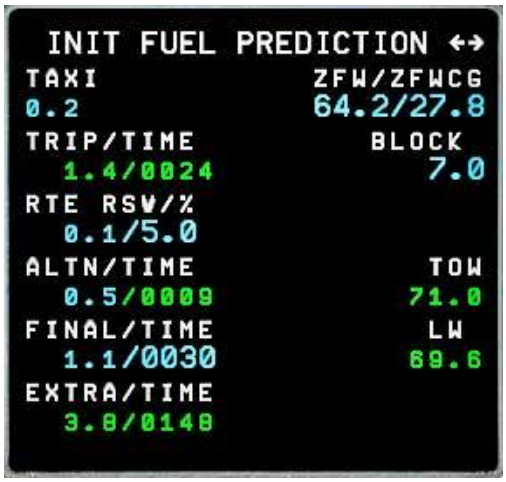


INIT B

is only accessible with engines stationary.

ZFW/ZFWCG:
Zero Fuel Weight: weight of the aircraft without fuel.
Zero Fuel Weight Center of Gravity: position of the center of gravity without fuel, expressed as a % of the average aerodynamic chord (between 20% and 35% on an Airbus).
Data calculated by the performance calculator.

BLOCK: Amount of fuel.



INIT B – INIT FUEL PREDICTION

As soon as the fuel quantity is entered into the BLOCK, the FMGS calculates the intermediate consumption predictions.

- **TRIP / TIME**:
  Weight in tons/Duration.

- **RTE RSV/%**:
  Regulatory reserve of 5%Weight/% of the consumption forecast.

- **ALT / TIME: Consummation and duration from the destination airport to the alternative airport.**

- **FINAL / TIME: Suppletion of fuel for a flight time planned for future needs, for multiple reasons (bad weather, no possibility of refueling on arrival etc...).**

- **TOW**: Take-Off Weight. (Total weight of the aircraft at the time of take-off).

- **LW**: Landing Weight. Maximum weight not to exceed structural limits: 64 to 67 tons.

➔ DATA INDEX (1 and 2)

The first page, DATA INDEX 1/2, provides access to essential information on the navigation systems and the flight plan.

- POSITION MONITOR
- IRS MONITOR
- GPS MONITOR
- A/C STATUTES
- CLOSEST AIRPORTS
- EQUITIME POINT

➢ POSITION MONITOR

Displays the position of the aircraft in real time and the systems implemented:

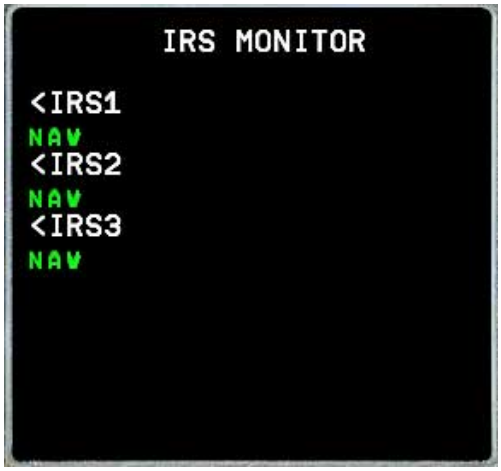
- **GCCF1 and GCFM 2**: Average of the 3 SRIs and GPS.
- **GPS**
- **MIX IRS**: Average of IRS1, IRS2, IRS3
  NAV 0.1 mention: IRS in NAV position and accuracy in NM

FREEZE allows the information to be frozen for later use.

NAVAID SALT

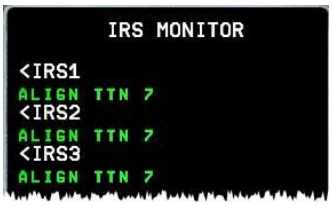
Allows you to know the radio means used automatically by the FMGC (VOR, VORDME) and then by selection, their characteristics.

➢ IRS MONITOR



Displays the status of the 3 IRSs:

- Alignment complete, ready to sail NAV.
- In the process of aligning: ALIGN + count in minutes (information also in the EWD messages).



- INVALID: IRS on OFF

For each IRS, a secondary page displays in real time:

- **POSITION**: The geographical position
- **TTRK:** (True Track)the true road
- **THDG:** (True HDG)Cape (True North)
- **WIND**: winds calculated by the FMGC (not modifiable)
- **GS:** (Ground Speed): ground speed
- **MHDG**: North Magnetic Cape

- **GPS MONITOR**

The Airbus A320 is equipped with two GPS devices (GPS1 and GPS2)

- **GPS1 POSITION**: Geographical position
- **TTRK** – **UTC** - **GS**: True Course, UTC Time and Ground Speed
- **MERIT** - **GPS ALT** – **MODE/SAT**: Horizontal Accuracy, GPS Calculated Altitude,
  NAV Mode / Number of Satellites

The same information is displayed for GPS2

- **A/C STATUTES**

A320-251N: aircraft model

- **ENG**: type of engines
- **ACTIVE NAV DATA BASE**: Date and name of the database.
- **SECOND NAV DATA BASE**: date of the secondary database.
- **IDLE / PERF**: Aircraft Aging Index (introduced by maintenance)

➢ CLOSEST AIRPORTS

The list of nearby airports is displayed by default on 4 lines in green.

For each airport, the following are displayed:

- The recovery
- The Straight Line Distance
- Estimated time of arrival

On the 5th line we will enter LFKF (Figari)

LFKF is shown in blue

The EFOB/WIND sub-page displays for each airport:

- EFOB: Estimated Fuel at Destination
- The wind

Note: the list is frozen automatically. Back on the main page, remember to unfreeze the list with UNFROZEN.

➢ EQUITIME POINT

The Equitime Point (ETP) is the point on the route where the time to arrive at the destination airport is equal to return to the departure airport.

It is not a point at equal distance but at equal time.

This time is calculated according to:

- Wind (direction and force => ground speed)
- Configuration: Engine failure, depressurization forcing to fly at low altitude etc...

- Front line (current position of the aircraft):
  - A/C TO
    <u>From the aircraft's current position to the airport of departure (LFPO)</u>
  - BRG: The Bearing (320°)
  - DIST UTC: The straight-line distance (150 NM) and arrival time UTC (13:46)

- Second line (at the FTE point):
  - TRUE WIND: Direction and strength when calculated by the FMGC.
  - **ETP TO LFPO:** the bearing (324), flight duration (2 hours 45 minutes) and ***arrival time at LFPO (14:11).***

- Third line (at the FTE point):
  - TRUE WIND: Direction and strength when calculated by the FMGC
  - **ETP TO LFKJ**
  - The bearing (150), flight duration (3 hours 40 minutes) and ***time of arrival at LFKJ (14:11).***

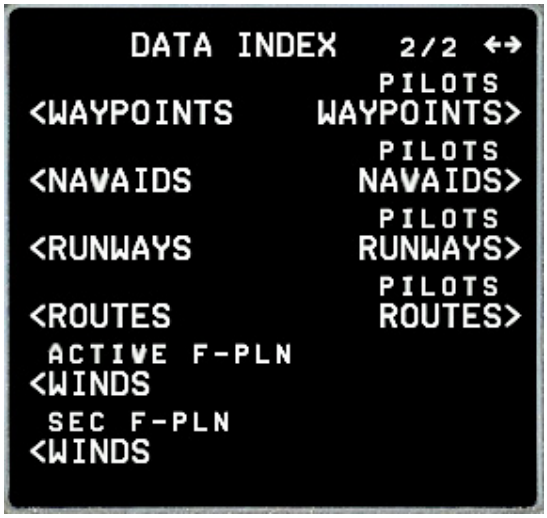
- **ETP LOCATIONPIGOS / -124.6 => the PIGOS waypoint IS 0 124.6 NM after the ETP**

- A/**C TO (ETP):**
  - Current Aircraft Position: DIST 96 NM,
  - Arrival at the ETP point at 13:39 UTC

Remember: the FTE point is important in the event of an emergency. Before this point, the flight time back to the point of departure will be shorter than the time to continue to the destination.

<u>Reminder</u>:

- *Bearing is the angle between north and the direction of a point measured from the aircraft's position.*
- *The heading is the orientation of the aircraft (or the nose of the aircraft) in motion.*
- *The track (TRK) is the direction of the aircraft's movement that is different from the heading when the crosswind deviates the trajectory. It's the information: where the plane is going).*



The second page, DATA INDEX 2/2

WAYPOINTS, NAVAIDS, RUNWAYS, ROUTES:

- Left column: General and company-specific database.
- Right column (PILOTS) :D custom data, created and saved by the driver.

WINDS: Primary and secondary flight plan information.

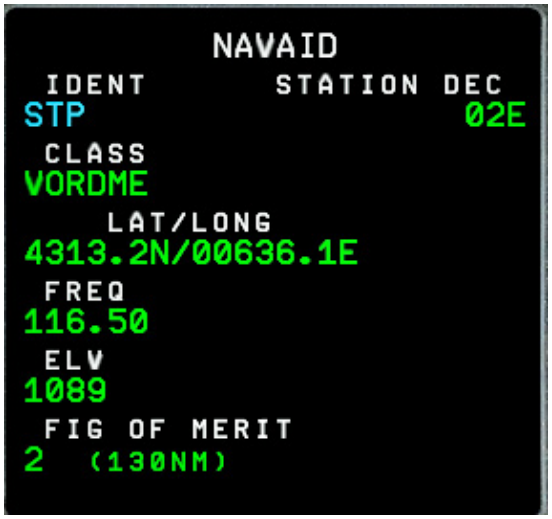
WAYPOINTS

Poster

- IDENT: The name of the waypoint
- LAT/LONG: Geographic coordinates

NAVAIDS

- IDENT: name of the navaid
- DEC STATION: magnetic declination magnetic: north is 2° east of true north.
- CLASS (tag type) :VOR, VOR DME, DME, ILS, NDB
- LAT/LONG: Geographic coordinates
- FREQ (Frequency) in MHz for VOR/ILS, in kHz for NDB
- ELV (elevation in ft)
- FIG OF MERIT (accuracy index)



RUNWAYS

- IDENT: Lead ID
- LS IDENT (ILS identifier emitted by Morse code radio)
  AC (-— —-—-)
- LAT/LONG: Geographic coordinates
- LENGTH: Length of the track in metres.
- ELV (elevation in ft)
- CRS: Runway Axis

ROADS

These are the routes specific to each company. They are uploaded each month with the personalized waypoints of each company, with the general DATA.

PILOTS WAYPOINTS

Custom waypoints are created and saved by the pilot in the PILOT database separate from the company's official database.

If custom waypoints have already been created and saved in the PILOT database, the page displays:

- The number of waypoints created (1/5)
- IDENT: Waypoint Name
- LAT/ LONG: Geographic coordinates
- PLACE/BRG/DIST(see page 47 for creating a custom waypoint with these coordinates.)

If no custom waypoint is present in the database, or if we press the NEW WAYPOINT key, the NEW WAYPOINT page is displayed. :

LAT/LONG **(**detail of the input format):

- Latitude
  2 digits degrees + 2 digit minutes
- Then a <u>decimal place</u> (1 or two digits) preceded by a period (optional, it provides better precision),
- then followed by N or S
- A slash /
- Longitude
  <u>3 digits degrees</u> + 2 digits minutes
- Then a decimal place followed by N or S

Note: seconds are converted to decimals. Example: 30 seconds ==> 0.5

Example: for 43.55**400N 6.97180E** *==>enter 4355.66N/***00697.3E**

The MCDU will display the coordinates with rounding for decimal places (a single digit)

PLACE-BRG /PLACE-BRG

The new waypoint is located at the intersection of two radials.

PLACE is any waypoint, whether or not it is part of the flight plan.

Note: This is the least used method by pilots, but it can be useful in some cases.

Note: in reality, custom waypoints are ephemeral data, they are erased at the end of the flight. Tollis, allows us to keep them for future flights. To delete a waypoint, simply press the CLR key and then select the waypoint to delete. (DELETE ALL deletes all waypoints).

NAVAIDS SPIKES and RUNWAY SPIKES

Pages for creating NAVAIDS and RUNWAYS when they are not registered in the DATA database.

These are very rare situations and we will not find them in simulation. In reality, companies pay for monthly updates but do not always need all the DATA. For example, an airline operating at LFPG and LFPO (Paris) does not need the data of Le Bourget airport (LFPB) will not request the DATA of this airport. But in the event of an emergency, the pilot will be able to create a runway in the DATA to land.

PILOTS ROAD

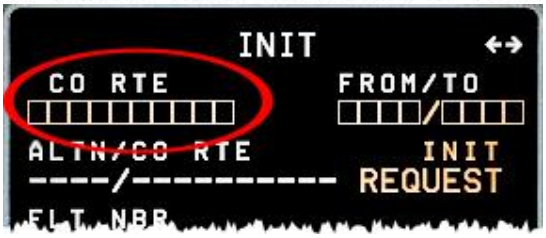
This is where all your flight plans are saved.

If routes are already saved, the page looks like this:

- ROAD PILOTS 1/3 The direction arrows allow you to view each of the 3 recorded routes.
- NEW < ROUTE ==> Create a new route
- CO RTE ==> Name the routeName of choice, no syntax.
- STORE ==> Don't forget to save the route.

PAGE INIT

- CO RTE ==> recovery of the route to be inserted in the flight plan.



ACTIVE F-PLN WINDS
and
SEC F-PLN WINDS

Allows you to enter and view the winds forecast during the flight.

First line:

- TRU: wind direction
- WIND: wind strength in kts
- ALT: Flight Level

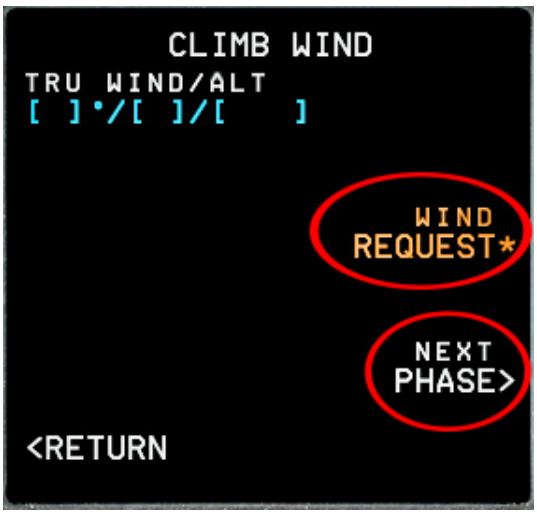
WIND REQUEST: automatic request for winds

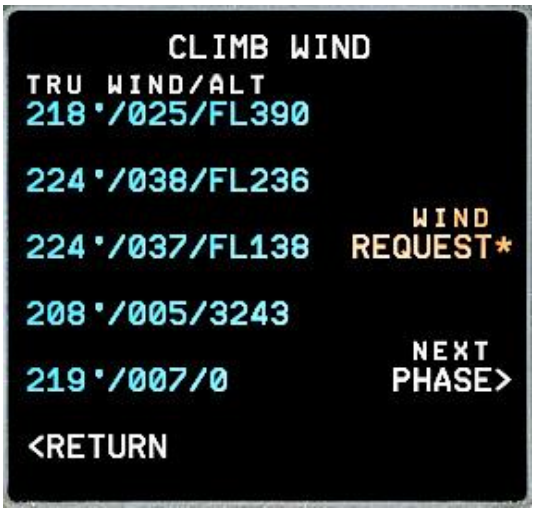
NEXT PHASE: Display the following phases of the flight.

Note: to obtain the winds, it is necessary:

- *That X-Plane is set up with the actual weather*
- *Or to be logged in to SimBrief*

This function is essential to allow the FMGS to calculate fuel and time predictions (TOD, ETA etc...)





➔ FLIGHT PLAN

When the INIT page is populated with the start and finish, the F-PLN page looks like this:

- FROM: Departure Airport (LFPO)
- EFOB: Estimated fuel on board in tonnes (7.0)
- FLT NBR: (F222 entered in INIT)
- Destination airport: LFKJ
- Estimated fuel at destination: 4.2

The F-PLN page is an interactive page for creating the complete flight plan.

LSK keys (left and right) are used to create and modify the route, enter all flight plan data

- **LSK left ==> LAT REVISION**
  - DEPARTURE / ARRIVAL: Start track, SID, transition
  - Waypoint Entrance
  - Entering a new destination
  - Airway Entrance + Waypoints
  - Create a holding circuit (HOLD)
  - Creating a transatlantic route: NAT (North Atlantic Track)
  - Create FIX INFO

Side review pages are different when they are for waypoints or start/finish for which the start and end parameters are introduced.

The departure side review pages allow you to enter information from the first waypoint of the flight plan, then the departure RUNWAY => SID => TRANSITION. :

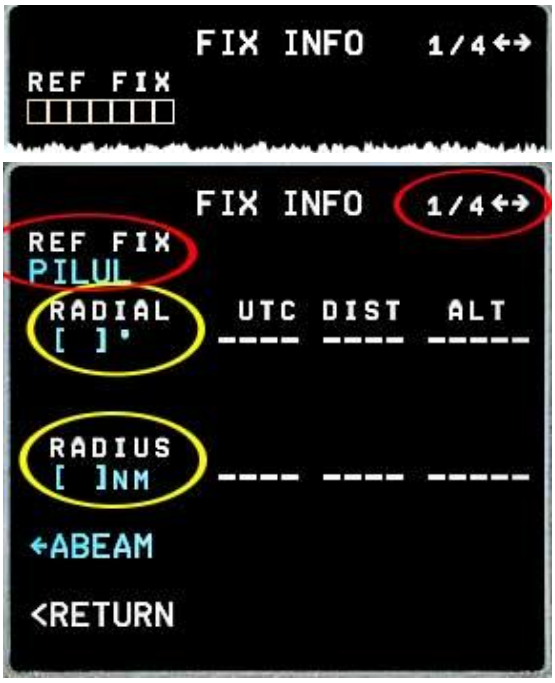
The information is stored in the temporary flight plan (yellow) and then validated by TMPY INSERT.

The Arrival Side Review page allows you to enter the track and arrival type => STAR=> TRANS and VIA.

Waypoints side review pages.

1. **FIX INFO.**

After entering the name of the point (PILUL), the FIX INFO page allows you to enter the characteristics of the FIX INFO



- RADIAL: Displays a radial from the run-up on the ND.

- RADIUS:
  On the ND, draw a circle around the point at the distance from the point entered in NM

<u>This is the only item created on this page that does not change the flight plan</u>:

it creates visual cues around a given point (beacon, waypoint, VOR, etc.).

They are limited to 4 in number
To create the next FIX INFO, press the "next page" arrow ➔ n the MCDU.

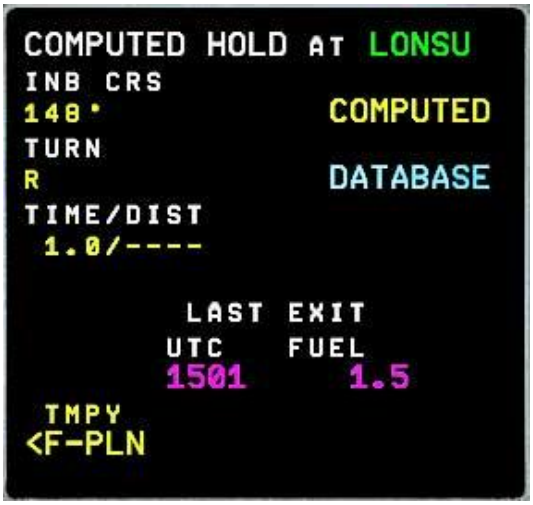
2. **NEXT WAYPOINT**
   Next Waypoint of the flight plan.

3. **NEW DESTINATION**
   In case of change of destination. All subsequent waypoints from the flight plan will be removed.

4. **AIRWAYS**
   Allows you to insert a portion of a route via an aiway and avoid entering all the waypoints between the entrance and exit of this airway.

5. **HOLD**
   Creation of a holding circuit.
   holding pattern

- COMPUTEDThe hold is calculated by the FMGS according to the current conditions (wind, speed, altitude, mass, etc.). Use when there is no hold published. INB CRS can be changed as well as the direction of rotation (l/R). The FMGS recalculates fuel consumption in real time.
- DATABASEThe hold is calculated based on the browsing data stored in the database. It is associated with a published procedure (STAR, Approach) and in principle complies with the instructions on the approach charts. INB CRS must be entered according to the value indicated on the cards.
  The direction of rotation and duration can be changed.



Creation of a parallel road.

If necessary, to avoid an area (thunderstorm, etc...) we have to modify our route temporarily. We have the option to change our route from NAV to HDG mode.

We can also create a parallel route without changing our flight plan with the OFFSET function

To access the OFFSET page, open the side review page of the last waypoint crossed (located before the active waypoint (white)

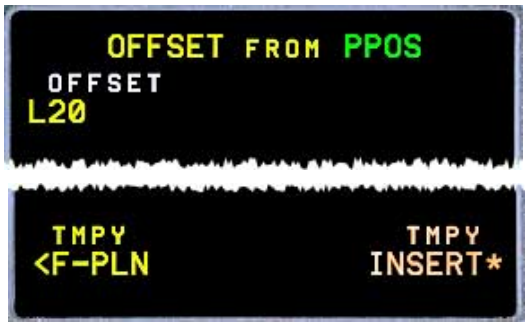
The LAT REV FROM PPOS (this POSITION) page, which is the current position and not the PIGOS waypoint as shown.

Note: We can also immediately create a waiting circuit in case of emergency.

Enter L(or R) and a distance in NM to create our OFFSET route and then validate with TMPY INSERT.

The ND shows the parallel road in solid lines and our main road in dotted lines.

To get back to our main road: clear the OFFSET value with the CLR key



- **LSK right ==> GREEN REVISION**

The GREEN REV (Vertical Review) page at a selected waypoint allows you to:

- View the speed and altitude constraints present in the FMGS database.
- Modified this data according to ATC instructions.
  The altitude constraint is
  - Or above (FL110+)
  - Or below (FL70-)

The constraints will appear in the flight plan and on the ND if constraints (CSTR) are enabled.

VERT REV AT PO300

- CLB SPD LIM:
  By default displays 250/FL100 according to current regulations.
  May be modified.
- SPD CSTR:
  Maximum speed constraint
- ALT CST:
  Altitude constraint.
  Lower limit (+), upper limit (-)
- WIND DATA:
  Access to the Winds Page
- STEP ALTS:
  Enter the constraints on multiple waypoints.

General structure of the F-PLN A page

The F-PLN page is the main flight plan management page.

It displays the complete flight plan :d departure to arrival as well as the list of waypoints.

For each sequence of the flight, it displays the associated navigation predictions.

At the top right is displayed the company flight number entered in the INIT page: FLT NBR.

The active sequence of the flight plan consists of:

- The 1st main line displays (in green):
  - The name of the last waypoint flown over (2). FROM (1)
  - UTC time (5), speed and altitude (8) at the time of the flyby.
- The 2nd line displays (in white):
  - The name of the next waypoint (4)
    It is also displayed with the distance on the ND (top right)
  - Estimated time of passage (7), expected speed and altitude (10) (sometimes two points if there is no change)
- An intermediate line (in white) between the two lines displays:
  - Additional information about the segment Name of the SID, the airway, the STAR as applicable (3)
    Here: the M622 airway
  - The BRG bearing to the next waypoint (6)
  - The remaining distance to the next waypoint (9)
    must be the same as the distance displayed on the ND.

In the next segment: HAKE => LONSU

A pseudo waypoint (11) was calculated and automatically integrated by the FMGS: (T/D).
also visible on the ND, materialized by an arrow.

Top of Descent is the point on the flight plan where the aircraft must leave cruising altitude to begin the descent. The distance between HHAKE and the T/D is 5 NM (12), then 15 NM (13) to LONSU.

After LONSU, the flight plan follows the route of the STAR LONS3S (14).

On the last line: real-time information about the arrival: LFKJ02 (runway 02),

Estimated time of arrival, distance, and remaining fuel.

Most common automatic pseudo-waypoints: displayed in parentheses.

(T/C) Top of Climb
End of the climb, transition to cruising.

(T/D) Top of descent
Start of the descent.

(LIM) Speed limit
example 250 Kt under FL100.

(DETECT) Desceleration: The point at which the approach is automatically activated. Displayed on the ND by a D surrounded by a circle.

Transitory Waypoint: **T-P**

When a DIR TO is performed (often between two waypoints), the FMGS recalculates the trajectory from the current position. It creates a transient point (T-P) calculated from the current position.

So it's not a pseudo-waypoint (not in parentheses).

Discontinuities

When the FMGS does not know how to automatically connect two segments of the flight plan, no trajectory is defined between the two waypoints. The plane will not automatically go to the next waypoint. It will take an action from the driver (removal of the waypoint, DIR TO to join the next waypoint.

The discontinuities are caused by a change in procedure

- Between SID and the route (flight plan)
- Between the road and the STAR
- The approach provides radar guidance (Radar Vectors)

General structure of the F-PLN B page

The F-PLN B page
can be accessed via the arrows

At each waypoint are displayed

- Estimated fuel
- Wind direction and strength
- Distance to the next waypoint.

The 3 notions of direction are indicated:

- C134°: Magnetic track, published on charts (does not take into account winds)
- TRK 134° ground path that the aircraft must follow.
- BRG 134°: bearing to the next waypoint .

Note: The arrows allow you to scroll the lines vertically.

All waypoints crossed during the flight are removed from the flight plan.

The AIR PORT *key displays either the start or end of the flight plan.*

In the event of a go-around, the flight plan displays the alternate waypoints in blue.

The ND also displays the go-around trajectory in blue.

➔ RADIO NAVIGATION

The RAD Nav page allows you to manually force radio aids (VOR, DME, ILS, ADF) instead of letting the FMGS select them automatically.
As soon as an element is modified, it now takes precedence over the FMGS.

The RAD NAV page includes 3 horizontal areas:

VOR 1 and VOR 2

ILS

ADF 1 and ADF 2

In normal operation, the RAD NAV page is rarely used.

When everything is working normally, the FMGS automatically manages the tuning of the radio aids (VOR, DME, ILS, ADF). It automatically selects the VOR, DME, and ADF relevant for navigation. On approach, it automatically sets the ILS frequency of the runway selected in the flight plan (ARRIVAL page). No action is required on the RADN NAV page.

Usefulness of the RAD NAV page

- On approach:
  to display precise information (distance of a navaid).
  Example: approach to runway 20 at Ajaccio (LFKJ) limit of 4.1 NM from AC 110.30, (see page 54). AC is the ILS/DME for the runway 02.Il NA or 110.30 must be entered in VOR 1 to display the distance in the ND, and not in ILS because the glide path would no longer correspond to the slope to runway 20.

- ILS data not in the FMGS.Il database must enter frequency, stroke (CRS), and SLOPE (grade grade).

- Change of track at the last moment, on a parallel track. For example, in Nice LFMN, runway 04L 109.95 is authorised.In the event of unavailability at the last moment, entering the frequency of the 04R (110.70) makes it possible to force the planned runway and to follow the LOC and the G/S of the 04R.

The RWY/LS MISMATCH message (amber color) may be displayed in the MCDU because the ILS is different from the one entered in the ARRIVAL page of the flight plan.

Note: the indicated ILS travel can be modified without consequence on the trajectory and the aircraft will follow the LOC according to the course integrated in the beacon ILS.La value of the stroke is only useful for the visual on the ND if it is displayed in PINK LS mode.

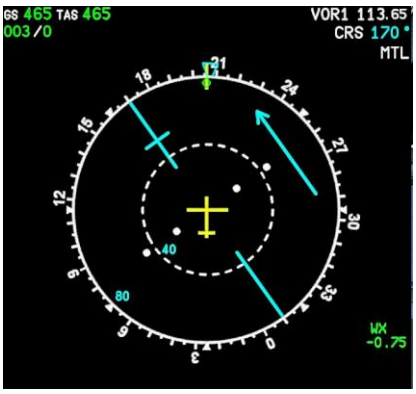
Here, the runway approach 04L: the ILS travel of 042 has been modified to 064.The aircraft continues its course at 042.

The glide is displayed on the right. It is possible to disable the glide to follow only the LOC.

Interception and tracking of a VOR.

It is possible to follow a VOR radial, but the FMGS does not manage the interception and tracking of a VOR radial: it is up to the pilot to manage in HDG mod.

The Airbus logic is not to follow a route from VOR to VOR, but to let the FMGS follow a flight plan.



==>**FUEL PRED**

PRED FUEL is an in-flight monitoring page that is primarily used to predict fuel and time to arrival.

This is a very important control page during cruises and before arrival because it allows you to regularly check the amount of fuel remaining at the destination.

The page is divided into two parts:

- Top: the destination.
- Bottom: the fuel forecast.

The destination:

1) **AT**: destination airport; **UTC**: the estimated time of arrival; **EFOB**: Estimated Fuel On Board.

2) AT alternate airport provided in the INIT A page; UTC: the estimated additional time to get there; EFOB, estimated fuel on arrival.

3) **GW /CG**: Total weight of the aircraft and center of gravity in real time.

4) **RTE RSV/%**: Regulatory route reserve equal to 5% of the estimated consumption. (in blue: editable).

5) **FINAL / TIME**: Minimum regulatory reserve on arrival: 1ton, i.e. 30 minutes of flight.

6) **EXTRA/TIME**: in tons and duration. Calculated by the FMGS (in green, not editable). *This is the fuel reserve available before consuming the clearance reserve. This reservation is at the discretion of the pilot who, during the preparation of the flight before starting the engines, decides on the quantity of fuel to be taken on board and who will modify the quantity of the Block on page B FUEL PREDITION.*

7) **FOB:** Fuel On Board. Current quantity on board in real time.

   Next to the displayed quantity (4.42 t) the indication FF + FQ
   - FF (Fuel Flow) = the fuel consumed via the engine flow meters.
   - FQ = quantity physically measured by the gauges in the tanks

   means that the FOB calculation uses both FF and FQ data.

   The FMGS compares and combines the two sources to obtain a reliable FOB:
   - Calculated FOB = Initial FOB – Fuel Consumed
   - FOB = FQ actually measured.

Note: the FUEL PRED page can be accessed either as here by pressing the Or the second INIT page (engines on).

==>SECOND FLIGHT PLAN

The index sec page is displayed when there is no secondary plan.

To create a secondary flight plan

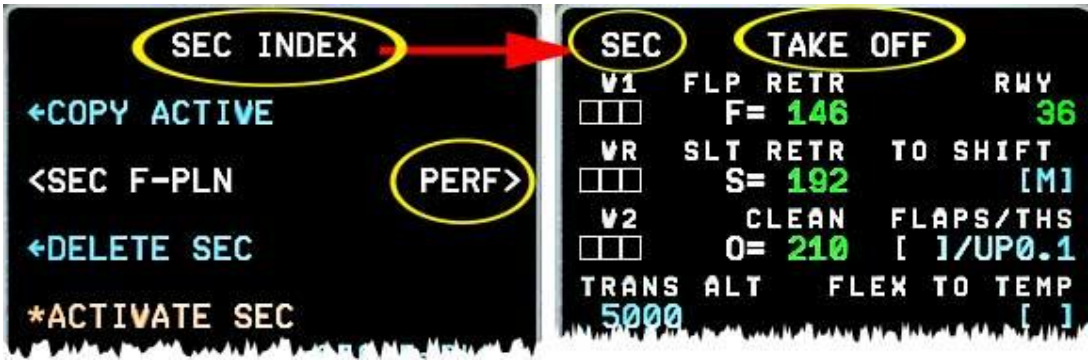
1. COPY ACTIVE
2. INIT

<SEC F-PLN: Inactive in the absence of a secondary flight plan.

1. COPY ACTIVE

Copies the entire primary flight plan in the secondary, as well as departures/arrivals.

It does not copy the PERFs that must be recalculated and entered in the SEC TAKE OFF page.



To activate the secondary flight plan:

1) FCU ==> HDG Selected Mode
2) Press the LSK *ACTIVATE SEC

Note: Creating a flight plan with INIT creates an INIT SEC page. This procedure is used mainly to download the company's flight plans and has very little interest in simulation.

Secondary flight plans are used primarily for:

- Plan for a breakdown on take-off and schedule a direct return to the departure airport.
- Plan a change of track at the finish

Note: In practice, pilots, after take-off, when there is no longer any risk of turning back, copy the main flight plan into the secondary (erasing the secondary scheduled before departure) for safety, in case the main one is modified and in order to keep a backup of the initial plan.

==> ***ATC COMM***

This button is used to access the data communication functions with air traffic control.

It allows you to:

- ✓ Send and receive ATC CPDLC
  (Controller Pilot Data Link Communications) text messages.
- ✓ Log in to a control center.
- ✓ Receive digital permissions.
- ✓ View message history
- ✓ Manage datalink communications via the ATSU (Air Traffic Services Unit).

In concrete terms, it makes it possible to

- ✓ Request an ascent or descent
- ✓ Request a direct to
- ✓ Receive an ocean clearance
- ✓ Send position rollovers
- ✓ Read ATC messages without using voice radio.

Depending on the model of the aircraft, the key may be

- ✓ Fully operational
- ✓ Limited
- ✓ Inactive on older models.

In real life, this system allows

- ✓ Fewer radio messages that can saturate the frequency
- ✓ Fewer misunderstandings
- ✓ Better traffic management
- ✓ More reliable communications over long distances

These functions are of little interest in simulation, they are not described in detail although they are well modeled on the Toliss A320.

EFB: Electronic Flight **Bag**

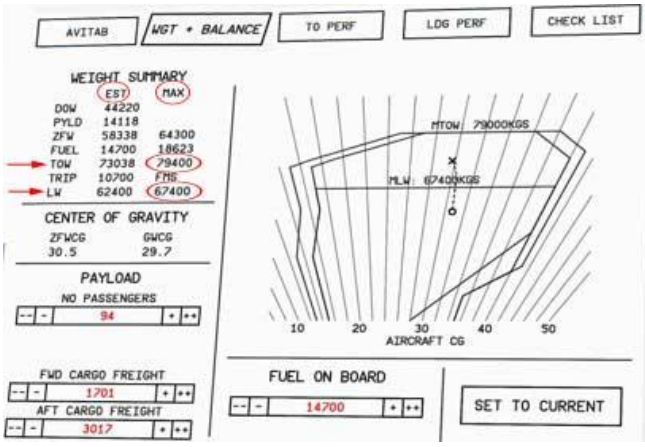
This is the shelf located in the side cockpit. It replaces a large part of paper documents and centralizes several tools:

There are 5 tabs in the EFB, simulating functions also available in the real EFBs:

- Avitab for maps, PDF reader, Navigraph Simlink integration, and more
- Weight and Scale to calculate weight and CG data for this flight
- A take-off performance computer
- A landing performance computer
- An interactive list

Note: To achieve better readability and save ink from our printer, the colors are reversed. The writing is black on a white background, but the color of the texts is also different from what you will see on your screen.

WEIGHT + BALANCE



Note: In practice, the weight of fuel required for the flight is calculated, then the two adjustment variables are adjusted: the number of passengers and the cargo (possibility of embarking only a small number of passengers and/or part of the luggage.

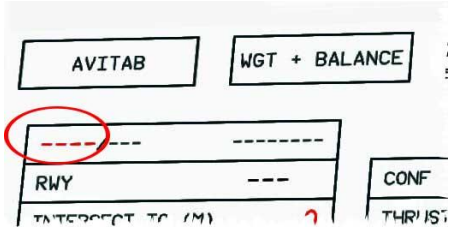
1. **Open ISCS**
   - Change the number of passengers as well as the cargo in both holds (front and rear).
   - Click APPLY THESE SETTINGS
   - Change the fuel
   - Click on QUICK DE/REFUEL
2. **Open the EFB**
3. **On the WGT + BALANCE page: click on SET TO CURRENT**
   The red numbers here are automatically updated (imported from ISCS).
   NO PASSENGERS, FWD CARGO, AFT CARGO FREIGHT, FUEL ON BOARD.
   They will not be modified for flight, but they can be modified to perform simulations.

WEIGHT SUMMARY

These data are calculated by the calculator (and not the FMGS) based on the following data entered by the pilot: They allow the development of the summary graph of the center of gravity.

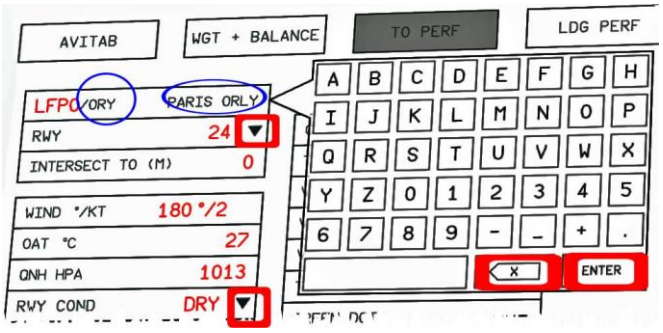
- **DOW: D**ry **O**perating **W**eight
  is the weight of the aircraft in working order with the on-board equipment empty (without fuel, without passengers or cargo/cargo).
- **PYLD**: **Payload**
  : passengers and cargo/cargo.
- **ZFW**: **Z**ero **F**uel **W**eight
  Weight of the aircraft ready to take off without the fuel.
- **FUEL**: Estimated fuel on board and total capacity of the aircraft.
- **TOW**: **T**ake **O**ff **W**eight
  Weight of the aircraft ready to take off. Do not exceed the maximum of 79.400 (overload).
- **TRIP**
  Minimum fuel weight needed for the flight, without the various reserves.
  Calculated from the FMGS flight plan.
- **LW**: **L**anding **W**eight**.**
  This is the estimated landing weight. Do not exceed the maximum of 67.400 (risk of deterioration of the aircraft's structures: to be checked before take-off).

TO PERF



When the TO PERF page is opened

Start by clicking/selecting the ICAO code of the departure airport.

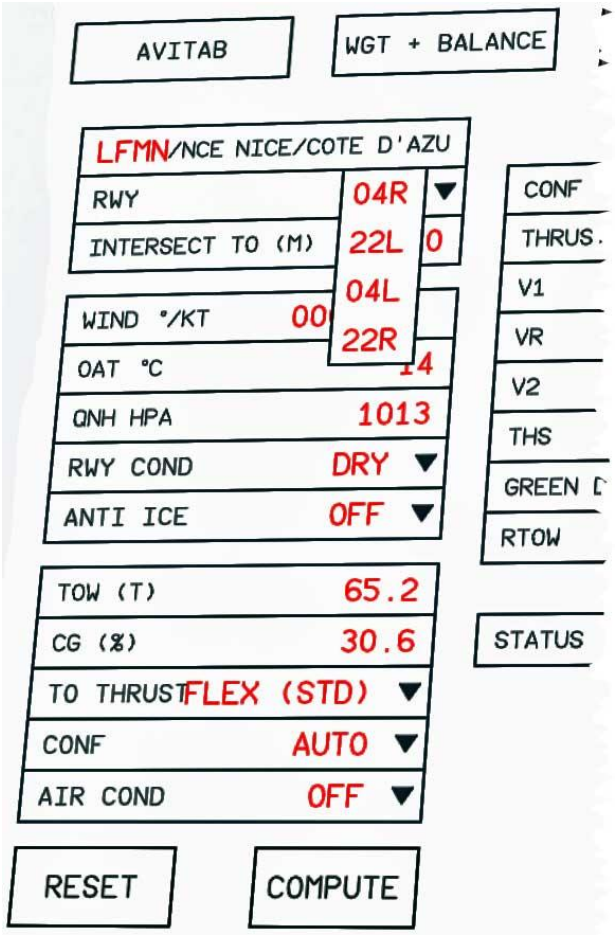


A pop-up virtual keyboard is displayed.

Enter the ICAO code and click/press the ENTER key.

The short name of the airport is automatically displayed.

Note: The small arrows in each field to be entered indicate a choice to select from a drop-down list. To modify the data entered by default, you must first delete them with the X key, then enter the new value and validate it with ENTER.



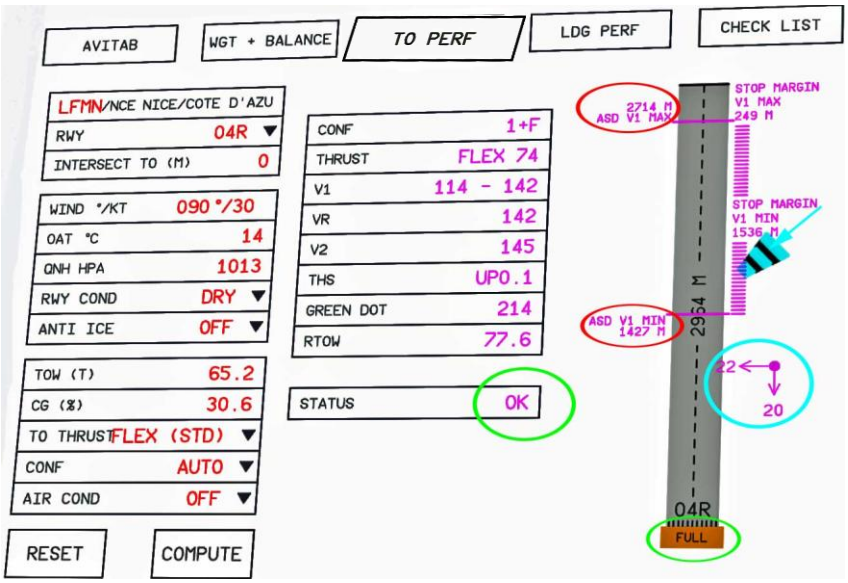
Fill in all fields:

INTERSEC TO: Take-off of a ramp. Corresponds to TO SHIFT on the PERF TO page of the MCDU.

RWY COND: Choose from the drop-down list.

TOW: take-off weight, calculated on the previous page, as well as CG.

After filling in all the fields: click/tap COMPUTE.



After calculations, the take-off performance parameters are displayed.

- **CONF 1+F**:
  We had the choice between 1+F, 2 or 3. AUTO selects the normal configuration: 1+F
- **THRUST: FLEX 74**
  To enter in the PERF TO page of the MCDU.
- **V1: 114 – 142**
  The pilot chooses a V1 speed from 114 to 142 that he will enter into the MCDU.
- **VR, V2 and THS**
  enter in the PERF TO page of the MCDU
- **GREEN DOT** for information and compare with MCDU.
- **RTOW** maximum weight in case of rejected take-off so that acceleration/stop is possible before V1.

A graphic symbolically represents the track.

FULL: indicates the take-off is made at the runway threshold otherwise replaced by the value indicated in INTERSECT TO, and the offset will be visual.

THE WIND: The direction of the wind is symbolized by the windsock The strength of the wind is broken down into two components: headwind and crosswind. (here for a wind of 090°/30 we have 20 from the front and 22 from the right side).

ACCELERATION/BRAKING DISTANCES

ASD = **A**ccelerate **S**top **D**istance**.** This is the distance needed to:

1) Accelerate to V1
2) Reject take-off
3) Brake to a complete stop

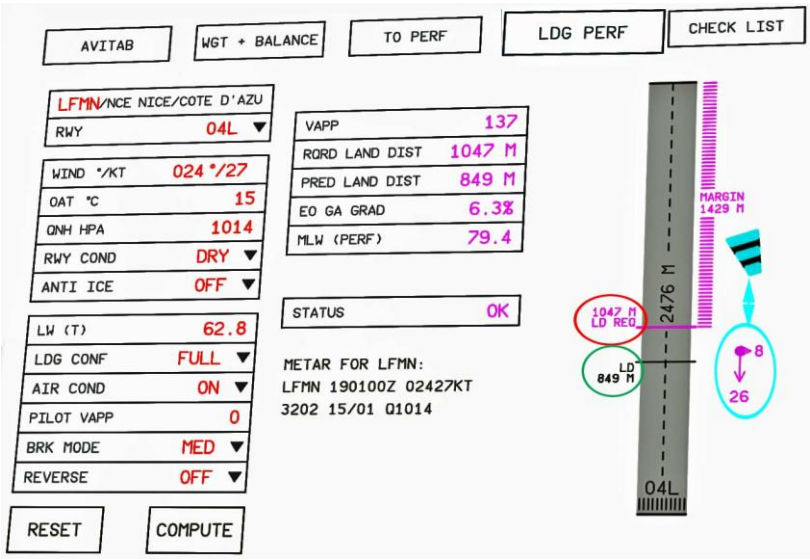
In this example:

Runway length = 2.954 m

- Minimum ASD V1 (114)
  - Distance to stop = 1.427 m
  - Distance between the aircraft and the end of the runway (safety margin) = 1.536 m

- ASD V1 Maximum (142)
  - Distance to stop = 2.714 m
  - Distance from the aircraft to the end of the runway (safety margin) = 249 m

LDG PERF



Calculation of landing performance.

- **VAPP**: final approach speed.

- **PRED LAND DIST**: **Pred**icted **Land**ing **Dis**tance.
  Expected landing distance Calculated according to the weight of the aircraft, the wind, the condition of the runway (wet/dry...), the braking selected, the reverses etc... This is the minimum distance the aircraft needs to land and come to a complete stop.

- **RQRD LAND DIST**: **Required Landing Distance.**
  Factored distance obtained by applying the regulatory safety margins to the calculated and therefore regulatory distance.

- **EO GA GRAD**: **E**ngine-**O**ut **G**o **A**round **Grad**ient.
  Rate of climb required during a go-around with an engine inoperative.

- **MLW PERF**: **M**aximum **L**anding **W**eight (Performance).
  Maximum weight allowed given the conditions at the time.
  Not to be confused with the LW line of the WGT +BALANCE page.

  - **MLW** (Maximum Landing Weight).
    <u>It has a fixed value set by the manufacturer</u>. This is the structural limit of the aircraft and is not dependent on the weather or the runway.

It is 67,400 for the A320 NEO. We must never land above this limit except in exceptional emergency situations with the risk of deterioration of the aircraft's structures.

- **MLW PERF**
  It has a variable value calculated by the EFB according to the conditions at the time:
  - ✓ Runway length
  - ✓ Runway condition (dry, wet, contaminated)
  - ✓ Airport Altitude
  - ✓ Temperature
  - ✓ Wind (strength, direction)
  - ✓ Runway Slope
  - ✓ Braking capacity required

In all cases, it is the lowest value that must be taken into account.
(MLW or MLW PRED

Note: It is possible that with a tailwind of 10, a sloping and wet runway, the MLW structural limit is higher than the MLW PERF: it is the latter that will have to be taken into account. This involves checking the weather at the destination airport before departure.

A graphic symbolically represents the runway (here length 2.476 m)

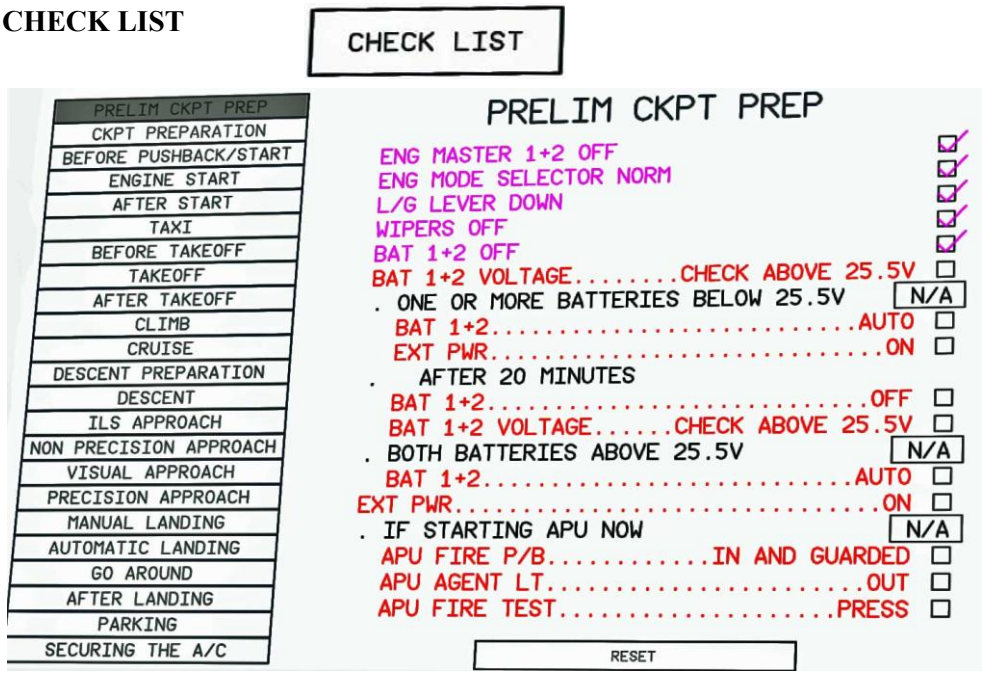
- **LD** (849 M) This is the landing distance required under the ideal calculation conditions, without additional regulatory margins, until a complete stop

- **LD REQ** (1047 M) **L**anding **D**istance **Req**uired. Regulatory distance required. The calculator applies:
  - Wide safety certification
  - Operational coefficients
  - Company-specific corrections

- **MARGIN** (1429 M) The difference between the length of the runway and the REQ LOD (safety margin).
  In our example: Runway length = 2.476 m LD REQ = 1047mmargin = 2.476 m – 1047 m = 1429 m.

Note: Under normal conditions, the length of the runway must be greater than the REQ GL.

CHECK LIST



This involves performing all the operations necessary to prepare the aircraft in the cold and dark state. These are not the pilot's checklists before take-off and during the flight.

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