## 02-34 ATA 34 – NAVIGATION

**INTENTIONALLY LEFT BLANK**

## INTRODUCTION

This section deals with the description of:

- the navigation management (FMS) and ressources (MRC, IRS, GPS),
- the various equipment,
- a typical flight plan insertion,
- the windows and associated tabs,
- abnormal operations and back-up information.

➢ *For DME, VOR, ILS and ADF descriptions, refer to CODDE 1 / Chapter 02 / ATA 23 - RADIO-NAVIGATION.*

In addition to the above mentioned navigation sensors, the airplane is equipped with:

- one Radio Altimeter (RA) (second optional),
- one Weather Radar System (WX),
- one optional Lighting Sensor System (LSS),
- two Air Data Systems (ADS),
- one Enhance Ground Proximity Warning System (EGPWS),
- one Traffic Collision Avoidance System (TCAS).

The Guidance Panel (GP) gathers in its central part, the Automatic Flight Control System (AFCS) controls and indications.

The navigation system management is achieved through the Cursor Control Device (CCD) and the Multifunction KeyBoard (MKB).

Information is provided via:

- two Primary Display Unit (PDU),
- two Multifunction Display Unit (MDU),
- one optional Head Up Guidance System (HGS).

In normal configuration:

- PDU display:
  - ADI: primary flight data (attitude and flight path, airspeed, altitude), flight modes annunciation,
  - HSI: heading track and navigation data provided by FMS, VOR-LOC, ADF, DME,
  - ENG-CAS,
  - 1/6 configurable window: ENG-TRM-BRK, RADIOS, SENSORS, TRAFFIC,
- MDU display:
  - I-NAV (graphical flight planning),
  - WPT LIST,
  - Flight Management Window (FMW),
  - CHARTS (optional),
  - system SYNOPTICS,
  - AVIONICS,
  - CMF/AFIS (optional),
  - UPLINK WX (optional),
  - MAINT,
  - VIDEO (optional),
  - Electronic CheckList (ECL).
- HUD display:
  - Take off Display
  - Enroute Display
  - Approach Display

| STRATEGIC MISSION PLANNING<br>(LONG TERM ACTION) | IN FLIGHT MODIFICATION<br>(SHORT TERM ACTION) |
|---|---|
| FMW window provides an interface for:<br>- flight plan selection/edition<br>- performance initialisation<br>- review and performance data<br>- procedure selection and review<br>- T/O and LDG initialization and data computation<br><br>SENSORS window provides an interface for:<br>- airplane navigation sensors<br>- Weather radar (WX) / Lightning Sensor System (LSS) / Terrain Awareness and Warning System (TAWS) / Traffic Collision Avoidance System (TCAS)<br><br>AVIONICS window provides an interface for:<br>- INIT tab<br>- FMS set up data<br>- FMS speed tab<br>- Automatic Flight Control System (AFCS) tab<br>- custom DB tab | I-NAV window provides an interface for:<br>- interactive map<br>- route amendment<br>- dialog boxes<br><br>WPT LIST window provides an interface for:<br>- route amendment<br>- dialog boxes<br>- flight log data<br>- WPT list Route Type Controller (RTC)<br><br>FMW window provides an interface for:<br>- LDG data update |

**INTENTIONALLY LEFT BLANK**

## INTRODUCTION

The only navigation source is the Flight Management System (FMS).

Navigation devices are composed of:

- 2 FMS (third optional),
- 2 Modular Radio Cabinet (MRC) that include the following module:
  - 2 VOR/LOC/GS/MRK receivers,
  - 2 DME,
  - 2 ADF,
- 2 IRS, micro Inertial Reference Unit (IRU), third optional,
- 2 GPS,
- 1 stand-by compass.

## NAVIGATION FUNCTION

Navigation function is provided by the Flight Management System (FMS) which is a multi-sensors area navigation (RNAV) system.

The airplane is equipped with FMS as part of its basic equipment.
EASy FMS provides full flight navigation and performance management, as well as flight preparation.

### NAVIGATION RESSOURCES

The navigation uses three main devices:

- Modular Radio Cabinet (MRC),
- Inertial Reference System (IRS),
- Global Positioning System (GPS).

**Modular Radio Cabinet (MRC)**

The airplane contains two MRC.

Each MRC houses:

- one NAV module:
  - VOR / ILS / Data Link (VIDL),
  - ADF,
  - DME
- COM module:
  - VHF
  - ATC (XPDR)
- one Network Interface Module (NIM) modules.

Each module has a dedicated power supply within the module itself.

MRC are located:

- MRC 1 in the cabin,
- MRC 2 in the nose cone.

Raw navigation information of NAV (bearing and/or CDI), ADF and DME can be displayed on pilot request on HSI.

SENSORS window provides additional information on GPS/IRS/NAV/FMS performances, current parameters, and secondary functions.

**Inertial Reference System (IRS)**

The airplane is fitted with two micro Inertial Reference Units (IRU). A third IRU is available as an option.

The purpose of the IRS is to output pure inertial position, velocities and acceleration and IRS-GPS hybrid velocities.

The IRS operation requires system initialization (entry of latitude and longitude).

Initialization can be performed by the Flight Management System (FMS) or by GPS receiver. In addition, the IRS receives air data information (altitude, altitude rate, and true air speed) from an Air Data System (ADS) as well as GPS autonomous data.

No control device is required for normal IRS mode management. The IRS manages its modes (alignment, navigation, end of flight) without any crew action.

Three types of automatic alignment are performed on ground by the IRU already in navigation mode:

- Extended alignment auto realign,
- Pre-flight auto realign,
- Post-flight auto realign.

The extended alignment auto realign starts whether no airplane motion is detected in navigation mode after the stationary alignment (initial alignment). IRU periodically corrects position and heading, and zeroes out any velocities until motion is detected.

The pre-flight auto realign and post-flight auto realign start when the airplane becomes stationary more than 1 min. The duration of this alignment is not less than 7.5 min and not more than 15 min depending on current latitude (lower than 78° North or South). During the alignment, the IRU continues to provide valid navigation data. At the end of the alignment position and heading are corrected and the velocities are zeroed.

- **IRS sequence alignment interrupted**

  It is possible to taxi during the IRS alignment. As soon as the airplane is taxiing, the alignment is interrupted. If the airplane stops (GS = 0 kt) and remains stationary, then the system waits for one minute before starting again a new alignment sequence.

- **IRS in-flight alignment**

  After an IRS in flight shut down (e.g. transient loss of electrical power), an in-flight alignment is automatically performed without any crew action as soon as the electrical supply is recovered. The IRS attitudes are recovered within 15 sec if the airplane is maintained wings level attitude without any pitch and roll movements.

  The heading is recovered within 10 min.

  The Flight Path Symbol (FPS) and the Acceleration Chevron (AC) are recovered within 20 min.

**Global Positioning System (GPS)**

2 GPS modules are installed, one per Modular Avionics Unit (MAU).

GPS information is provided through the SENSORS window.

GPS operation is fully automatic.

The FMS use GPS valid data to compute FMS position.

## FLIGHT MANAGEMENT SYSTEM (FMS)

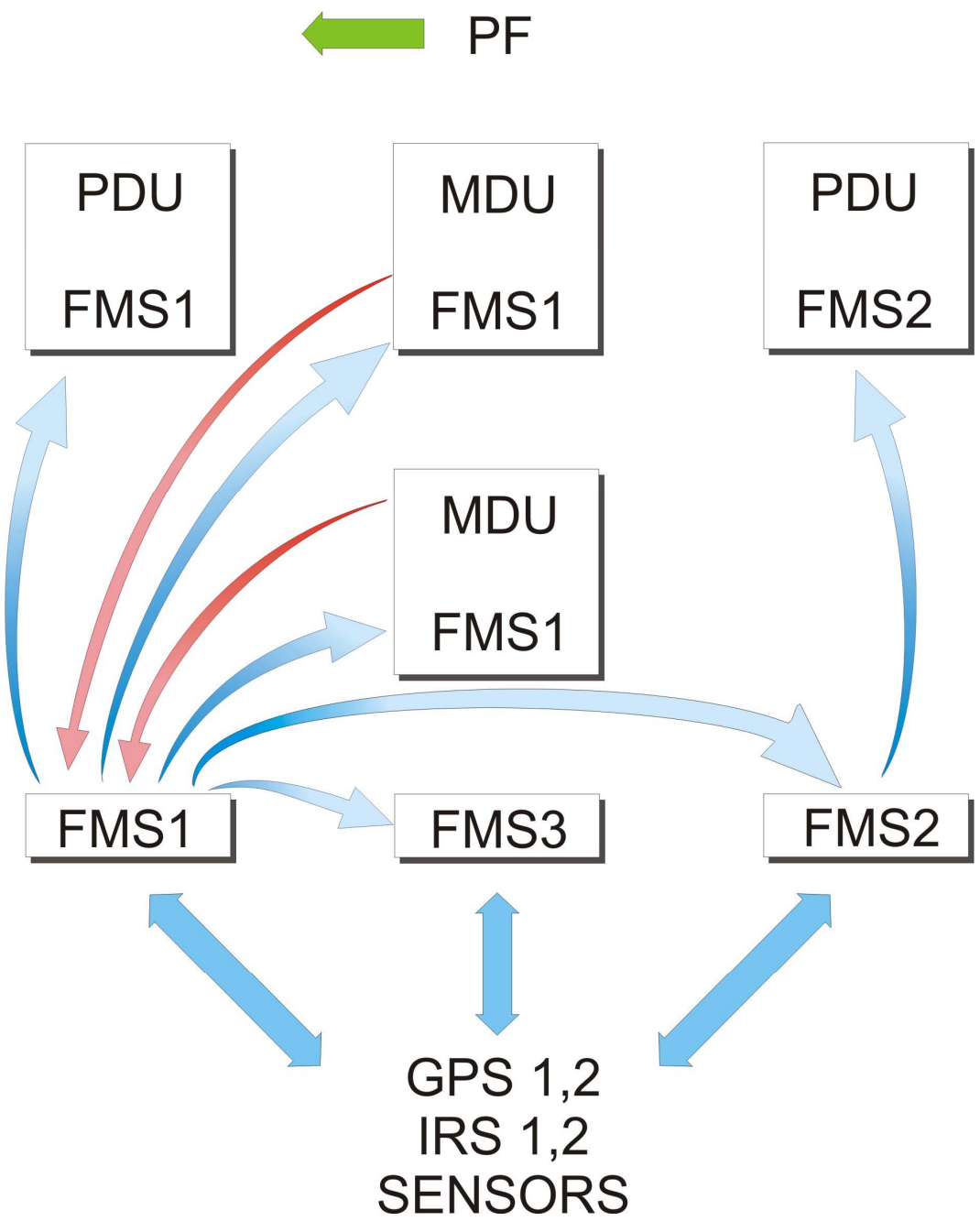



FIGURE 02-34-10-00 FMS SYSTEM ARCHITECTURE

EASy FMS system architecture can be understood as a full triplex operating system (for three FMS configured airplane).

One is the master and the other are synchronized to him.

Due to the removal of a dedicated FMS Control Display Unit, FMS system receives pilots input through the graphical interface.

In fact, internally, the graphical interface is routed to the master FMS which feeds the others FMS.

As the FMS are synchronized, the operation with flight plan A on one side of the Flight Deck and flight plan B on the other side is no longer possible.

A secondary flight plan with same functionalities as active flight plan will be available in next certification.

Reversion to the two other FMS are possible via the FMS reversion pushbuttons on the Reversion Panel (RP).

➢ *Refer to ABNORMAL OPERATION AND BACK UP INSTRUMENTATION sub-section, SENSORS REVERSION part.*

The INAV information presented on the MDU is coming from the PF FMS.

Each FMS features three types of data base:

- a navigation data base (NAV DATA BASE),
- a user data base (CUSTOM DATA BASE),
- an airplane database (plug in).

Each FMS uses the following hardware ressources:

- processor card for FMS functions,
- Advanced Graphics Modules (AGM) for interface to cockpit displays for the display and control of FMS control,
- Input/Output module to interface with external systems,
- Network interface card to interface with the Avionics Standard Communications Bus (ASCB-D), which is a high integrity airplane wide bus network,
- A data loader,
- Display units (PDU / MDU).

The FMS functions are:

- position computation,
- lateral navigation (LNAV),
- vertical navigation (VNAV),
- performances prediction and computation,
- flight plan management/edition,
- Take-Off and Landing Data (advisory TOLD).

## CREW INTERFACE

Flight planning actions are performed using either the graphical interface of the interactive map (I-NAV) or the waypoint list (WPT LIST).

Flight setting is organized into five Phases Of Flight (POF) displayed in the Flight Management Window (FMW):

- pre-flight,
- departure,
- cruise,
- arrival,
- post-flight.

Navigation ressources selection for each individual FMS is carried out in the SENSORS window (for FMS position computation function).

Flight Management setup (speed schedule…) is performed using the AVIONICS window.

FMS-related messages are displayed in a dedicated box in I-NAV.

➢ *Refer to 02-34-50.*

**NOTE**

Refer to 02-34-20 up to 02-34-38 WINDOWS AND ASSOCIATED TABS sub-sections for details.

## POSITION COMPUTATION

The FMS determines which is the best reference position update source (e.g. blended GPS position, DME-DME radio position, VOR-DME radio position or blended IRS position) to use for computing the airplane position.

The FMS uses a position and velocity filter. If no reference position source is available, the FMS uses a Dead Reckoning (DR) mode of navigation. The current FMS mode is displayed in the SENSORS window. In addition, should the FMS go to DR mode, a "NO POSITION SENSOR" FMS message is triggered and display in the FMS message box. A "MSG" label displayed in each HSI reminds the crew of the onset of a new FMS message.

## HIGH LATITUDE NAVIGATION

The high latitude area is defined as being above 72° 30' N or below 59° 30' S when entering and below 72° N or above 59° S when leaving the area.

The FMS automatically switches to true heading when entering the high latitude area (above 72° 30' N or below 59° 30' S). The HSI heading is also switched to true. At the time this switch occurs, the FMS message ACTIVE MODE IS TRUE HDG is displayed. This switch is necessary because the FMS calculates magnetic heading by using true heading and adding or substracting the magnetic variation. Magnetic variation up to 73° N or 60° S is stored in the FMS. Above the north latitude and below the south latitude, magnetic heading cannot be calculated by the FMS.

After leaving the high latitude area (below 72° N above 59° S), the FMS automatically switches back to magnetic heading, if MAG is the selected mode. The FMS message ACTIVE MODE IS MAG HDG is displayed when the switch occurs.

## POLAR NAVIGATION

**CAUTION**

**This function is not certified on the basic airplane.**

The polar area is defined as being above 85° N or below 85° S when entering and below 84° N or above 84° S when leaving the area.

## ANNUNCIATIONS

The FMS annunciates:
- the approach mode,
- the terminal mode,
- the degraded mode,
- the unable Required Navigation Performance (RNP) condition,
- the dead reckoning mode.

It annunciates if a position input differs from the FMS position by a pre-determined distance.

The FMS supports RNP operations down to RNP 0.3.

The FMS provides:
- current default RNP with a manual override capability,
- Estimated Position Uncertainty (EPU) values,
- RNP capability in terms of navigation accuracy and integrity

**NOTE**

Refer to 02-34-50 FMS messages list for details.

## OTHER EQUIPMENT

### RADIO ALTIMETER (RA)

The RA installation comprises:
- a transceiver,
- a transmit antenna,
- a receive antenna.

The airplane is equipped with one RA (a second one is available as an option for CAT III operation).

### WEATHER RADAR AND LSS

Weather radar installation comprises:
- a transmitter with its antenna,
- two dedicated controls located on each MKB and also in the SENSORS window.

**CAUTION**

**Due to radiation exposure, never operate the weather radar on ground, except during line up to check weather condition.**

In STBY mode, the radar antenna is in its maximum upward position, scanning and transmission are cut.

On ground, the weather radar automatically switches over to STBY mode, irrespective of the operating mode selected on the control units. However ,in order to use the radar at take-off, it is possible to override this protection by selecting OVRD spring loaded position more than four seconds.

### TCAS

The TCAS transceiver receives the following data:
- heading from IRS 1,
- pressure altitude and vertical speed from the Air Data System 1 (ADS 1),
- ATC data,
- Radio Altimeter height from RA.

## STAND-BY COMPASS

The stand-by compass displays magnetic heading. A correction card located next to the compass, indicates the calibration of the instrument.

During Stand-By compass operation, windshield heating PILOT and COPIL pushbuttons must be depressed OFF to avoid magnetic field disturbance.

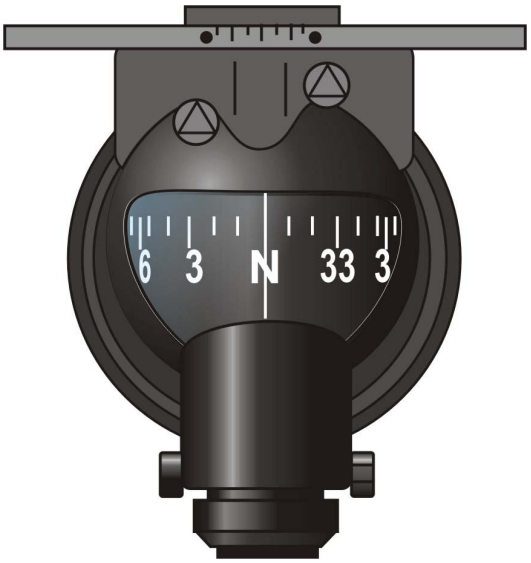



**FIGURE 02-34-10-01 STAND-BY COMPASS**

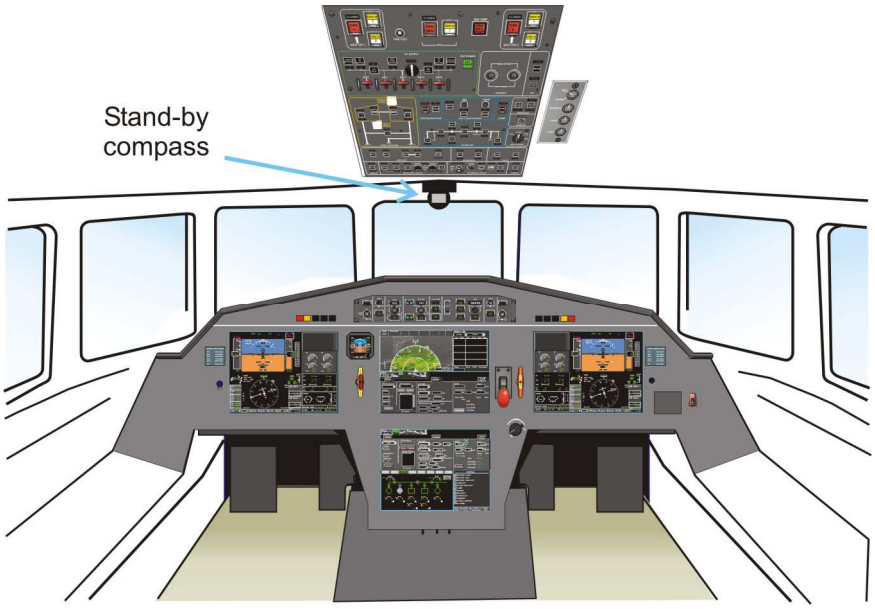



**FIGURE 02-34-10-02 STAND-BY COMPASS LOCATION**

## HEAD-UP GUIDANCE SYSTEM (HGS)

The optional HGS comprises:

- HGS Computer (HGSC) using airplane sensors inputs to generate data to be displayed on the combiner,
- OverHead Unit (OHU) receiving inputs from the HGSC to generate the picture to be displayed on the combiner,
- HGS combiner,
- a fan regulating the temperature in the HGSC,
- low-speed detector monitoring fan rotational speed.

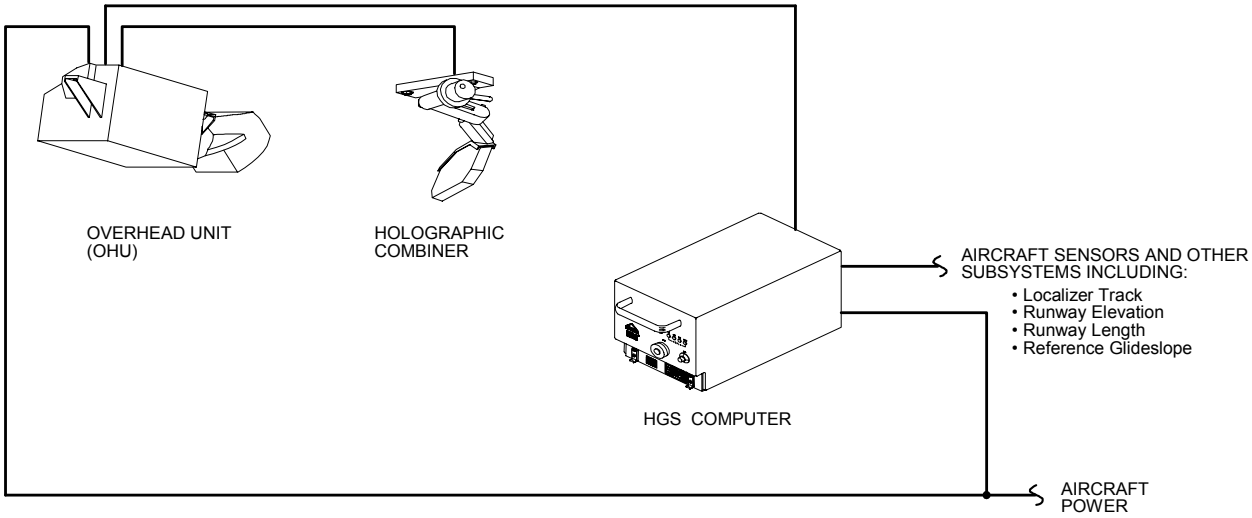



**FIGURE 02-34-10-03 HGS SYSTEM**

The use of HGS is approved for the following uses:

- visual take-off,
- with all engines operative or one engine inoperative:
  - en route (included climb and descent),
  - visual and non precision approaches,
  - manual CAT I approaches,
  - monitoring automatic CAT I approaches.

CAT II and CAT III approach and windshear escape guidance will be available for next certification.

Guidance data are displayed in the combiner positioned in the pilot field of view and in superposition with external scenery.

Following HGS parameters are set through the FLGT MGMT window:

- runway data for displaying the synthetic runway (landing elevation, localizer true track and Glide Slope reference) at takeoff or landing,
- setting of approach category and corresponding minimums.

**NOTE**

The correct setting of the localizer true track is a key element for proper operation of HGS during approach. It must be inserted in tenth of degrees for the CAT III operation. This value is supplied by local authorities to approved operators only.

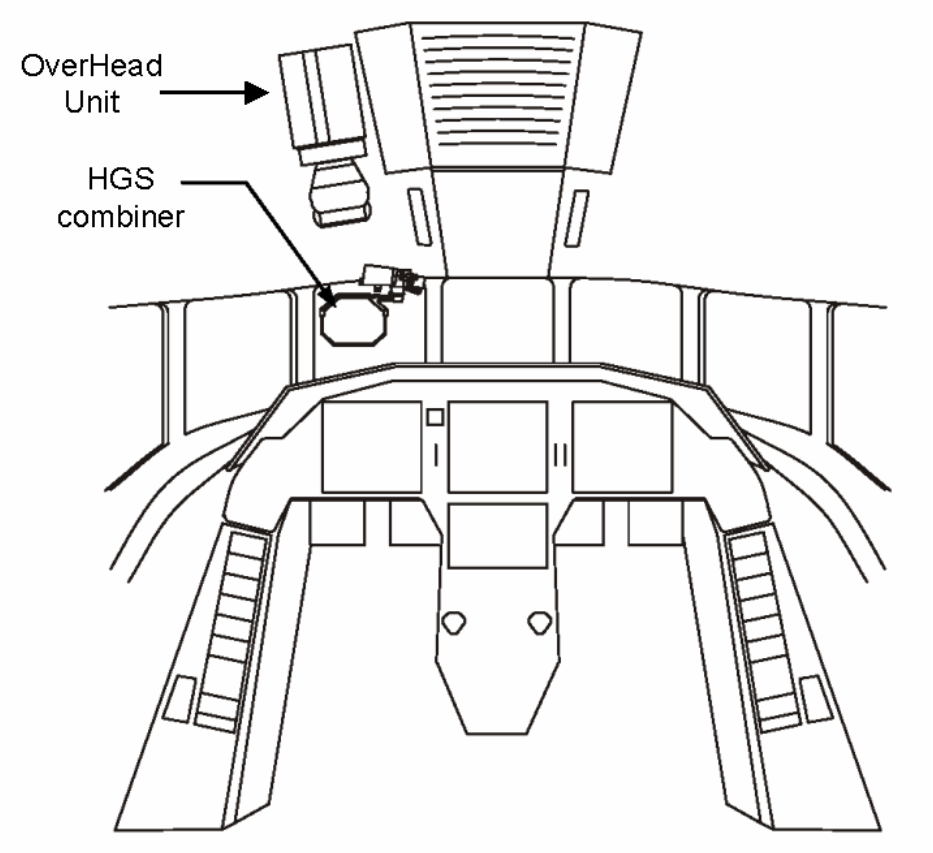



**FIGURE 02-34-10-04 HGS LOCATION**

## AIR DATA SYSTEM (ADS)

### SYSTEM OVERVIEW

The ADS uses:
- two Air Data Modules (ADM),
- two Modular Avionics Unit (MAU), each one integrates its Air Data Application (ADA),
- one dual Total Air Temperature (TAT) probe,
- two barometric corrections setting (one for PF and one for PNF) located on the Guidance Panel,
- one Air Data Unit (ADU).

The air data required for operation of the navigation systems and/or displayed in the cockpit are of four different types:
- total or pitot pressure,
- static pressure,
- total temperature,
- Angle Of Attack (AOA).

They are sensed by:
- RH and LH normal pitot pressure probes and ST-BY pitot pressure probe,
- RH and LH normal static pressure probes and LH/RH ST-BY static pressure probe,
- RH/LH AOA sensors,
- temperature probe.

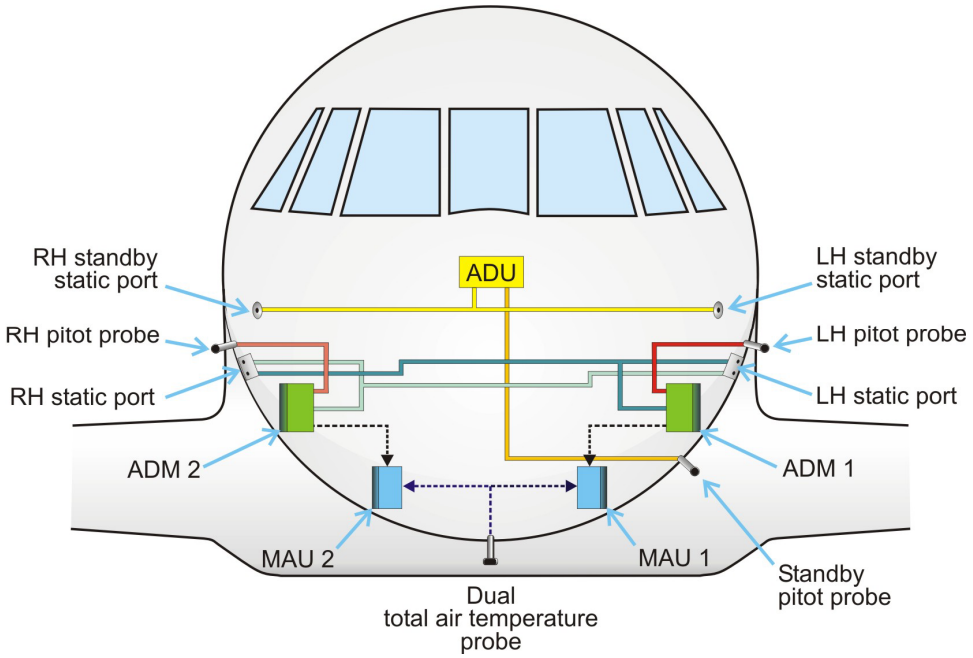



**FIGURE 02-34-10-05 ADS SYNTHESIS**

Primary flight data (altitude, airspeed) are permanently displayed in the PDU.

Airmass flight path angle is displayed in Secondary Flight Display (refer to 02-34-50).

The vertical speed displayed in the PDU is a baro inertial computed data. It could be lost in case of ADS failure.

In normal configuration parameters computed by ADA 1 are displayed on pilot PDU. Parameters computed by ADA 2 are displayed on copilot PDU.

In case of on-side parameters invalidity, parameters from cross side ADA may be displayed on each PDU using ADC pushbutton on Reversion Panel (RP).

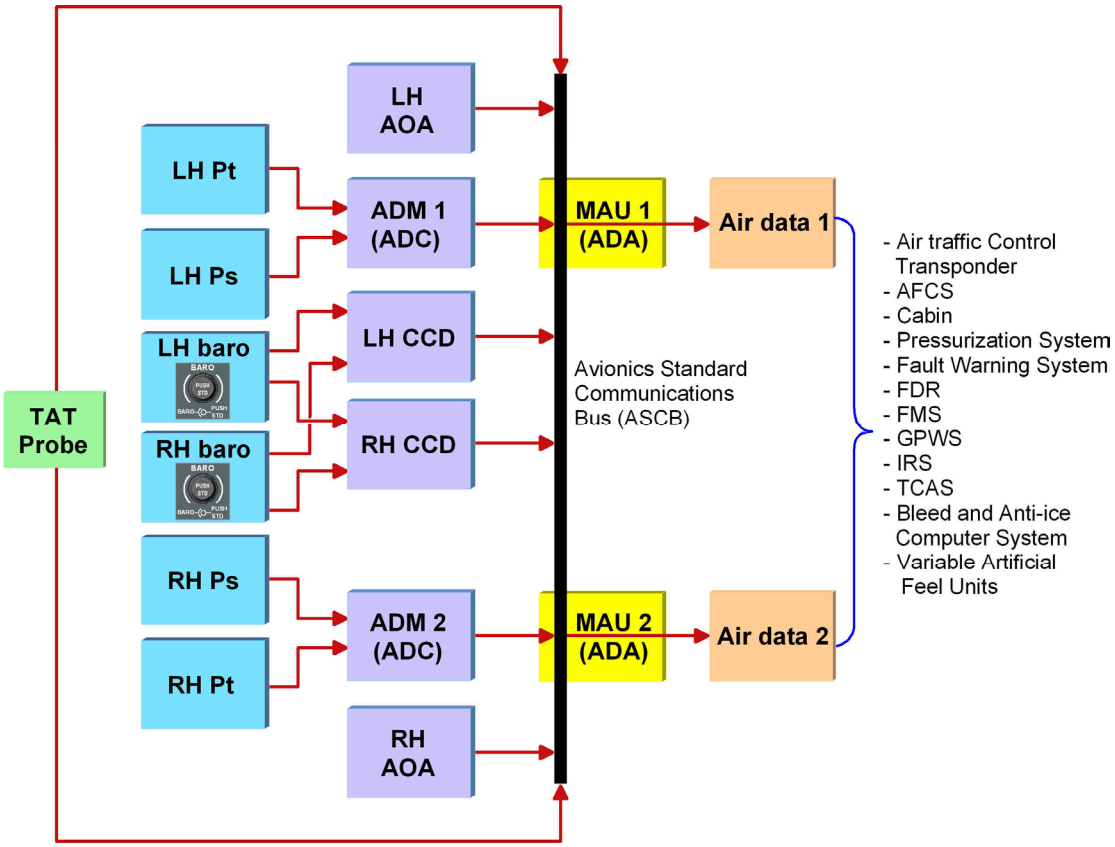



**FIGURE 02-34-10-06 GRAPHICAL REPRESENTATION OF THE ADS**

## TOTAL AND STATIC PRESSURE

The airplane is equipped with two Air Data Module (ADM) used for primary Air Data System input. The ADM is an air pressure sensing unit which measures absolute pressure. The unit contains two sensors used to measure static pressure (Ps) and total pressure (Pt). Each module senses static and total pressure from the on-side system.

## TOTAL AIR TEMPERATURE

Measurement of the total air temperature is sensed by the probe and sent to the ADA to supply static temperature.

➢ *For heating elements in the probes refer to CODDE 1 / Chapter 02 / ATA 30.*

## STAND-BY SYSTEM OVERVIEW

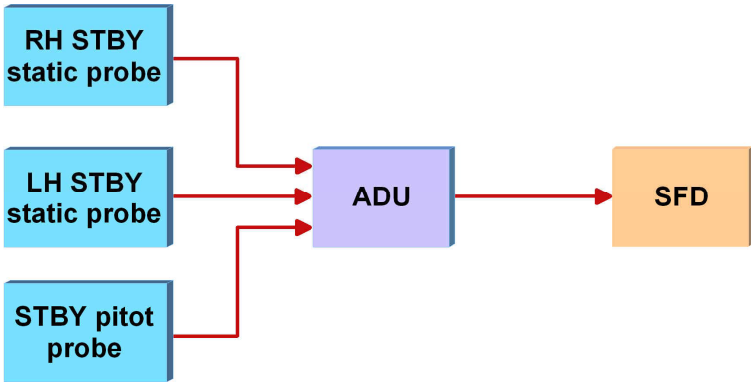



**FIGURE 02-34-10-07 GRAPHICAL REPRESENTATION OF THE STAND-BY SYSTEM**

## AIR DATA APPLICATION (ADA) OVERVIEW

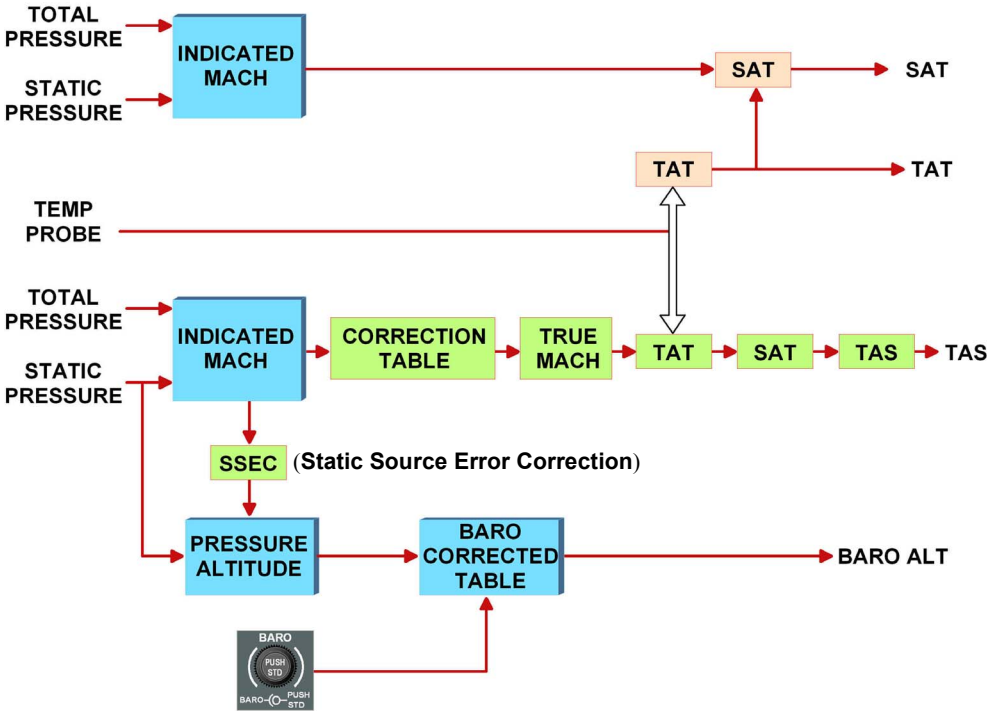



**FIGURE 02-34-10-08 ADA FLOW DIAGRAM**

## TYPICAL PDU / MDU CONFIGURATION

### INTRODUCTION

The purpose of this chapter is to focus on a typical flight preparation and to chronologically describes the steps of a flight plan insertion from airplane power on to engine start.

This description does not take into account normal procedures checklist (refer to CODDE 2 / Chapter 02).

The description is based on the assumption that:

- APU start is performed,
- a new FPLN (LFMI-LFPB) is created, this flight plan has not been strored previously,
- the alignment has been performed using GPS position,
- ATIS is known,
- en route winds known,
- the FPLN will be saved.

### AT AIRPLANE POWER UP

With the batteries on and MINI LOAD, the typical PDU / MDU configuration is:

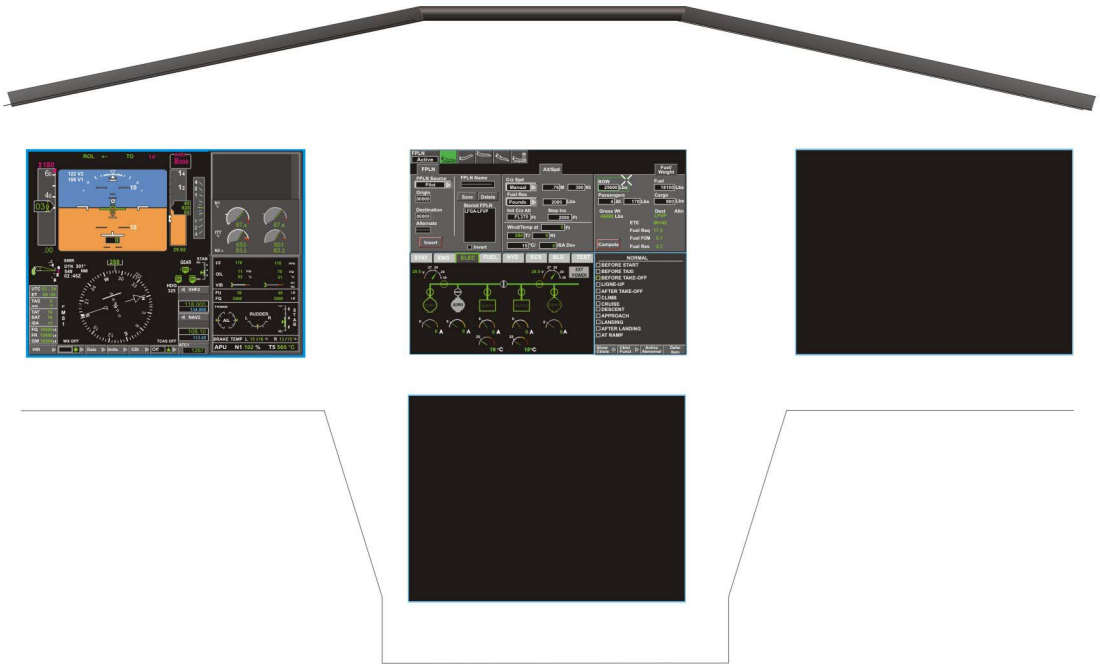


**FIGURE 02-34-15-00 TYPICAL TWO DISPLAYS CONFIGURATION**

## APU RUNNING

When APU is running and LH and RH AV MASTER has been selected, the configuration switches to four displays. Recommended windows organization is as follow:

**FIGURE 02-34-15-01 TYPICAL FOUR DISPLAYS CONFIGURATION**

At this time, follow AVIONICS window Init tab. After verification of the Init data (Time, Date…), click on Update FMS Position soft key: it pops up a dialog box.

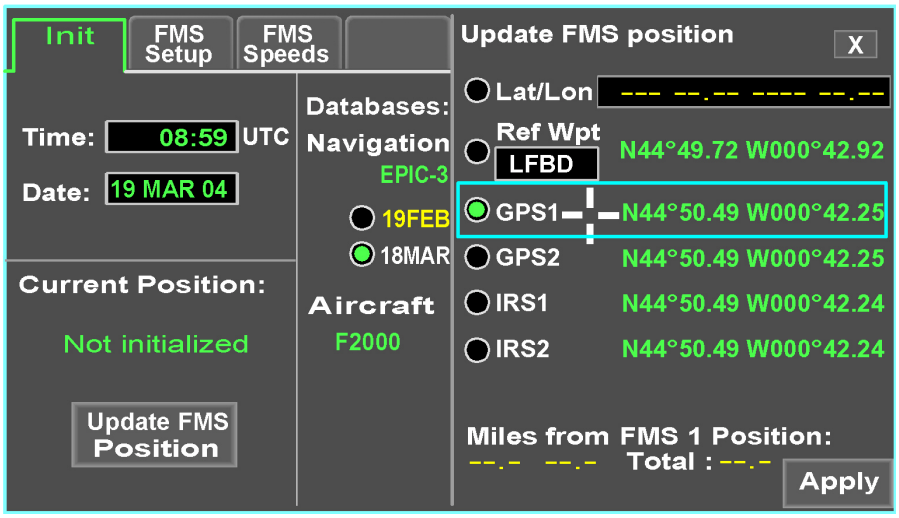



**FIGURE 02-34-15-02 UPDATE FMS POSITION DIALOG BOX**

The IRS and FMS alignment is performed on GPS position. To confirm this choice, click on **Apply** soft key. It makes the Current Position be set with GPS position.

Now click on FMS Setup tab:

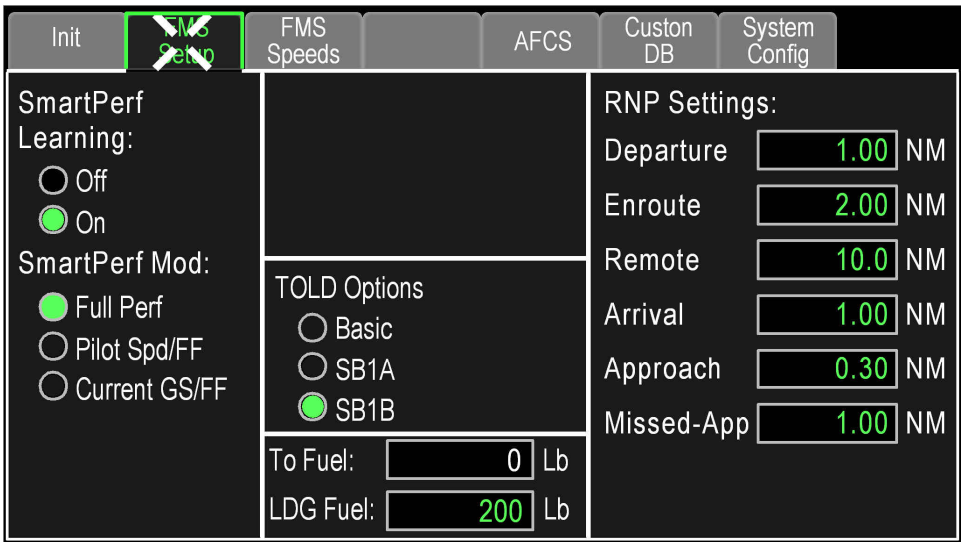



**FIGURE 02-34-15-03 FMS SETUP TAB**

**SmartPerf Learning** default value is Off, this function is usually used for a long range flight longer than 600 NM. As we are performing a short range flight, select Off.

Full Perf is the default value selection.

**SB1B** is the default **TOLD Options** selection (performance computing is independant of Basic, SB1A or SB1B selection.

**NOTE**

**TOLD Options** is inoperative will be available for later certification.

Fill in a default take-off fuel and landing fuel quantity allowance (for performance computation).

**RNP Settings** are already filled up based on certification values, usually there is nothing to change here.

**FMS Speeds** tab will be available for next certification. We can consider at this point that we are done with AVIONICS windows. Now press MENU on CCD and click on **FLIGHT MGMT**:

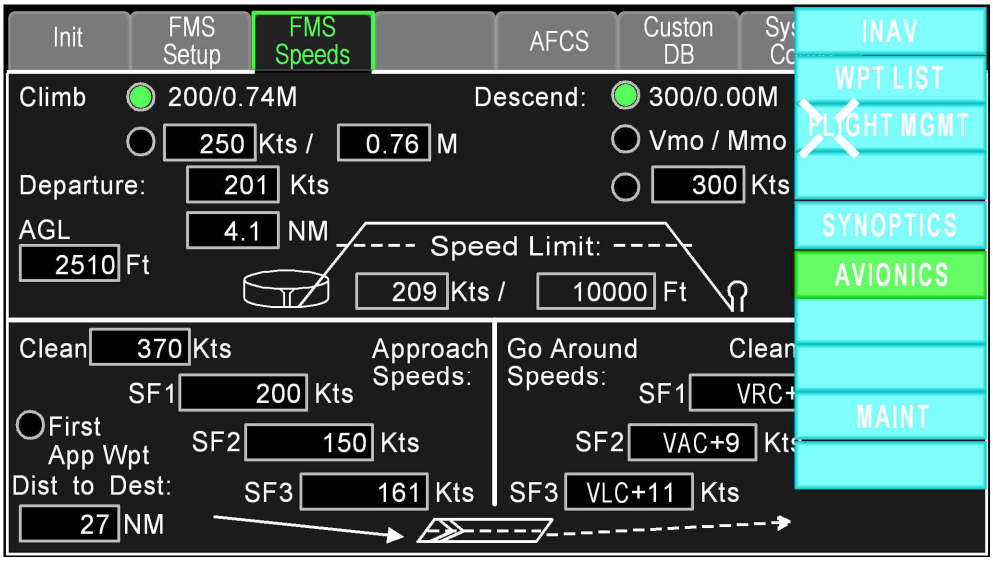



**FIGURE 02-34-15-04 FMS SPEEDS TAB WITH PULL DOWN MENU**

## TYPICAL FLIGHT PLAN INSERTION

This brings up the Flight Management Window (pre-flight Phase Of Flight tab) in place of Avionics window:

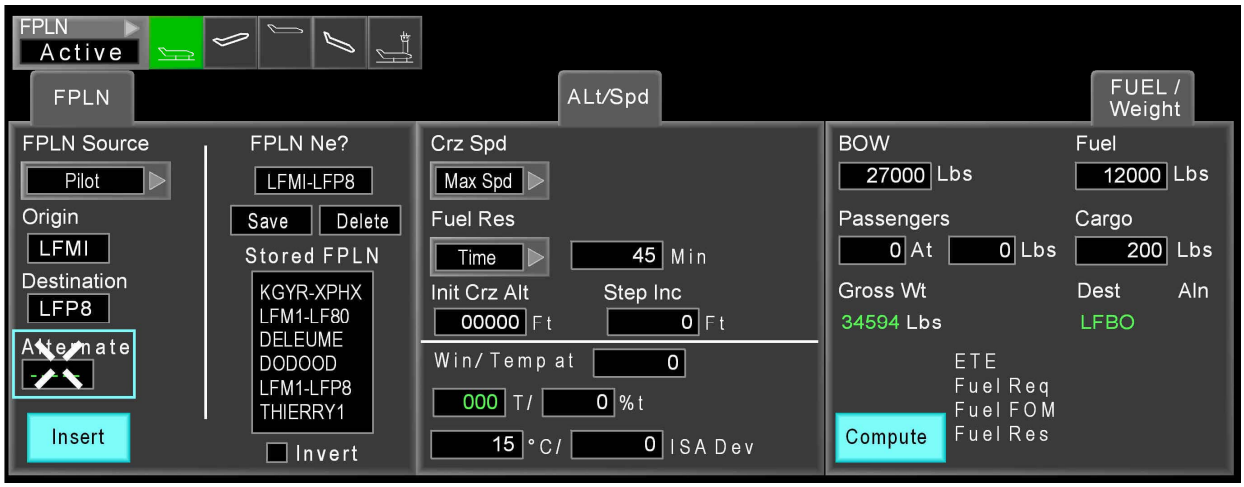



**FIGURE 02-34-15-05 FLIGHT MGMT WINDOW**

**Pilot** is the only FPLN Source available, fill in an origin, a destination and alternate to create a new flight plan (we could also use a stored flight plan but for training purpose we are going to create a new FPLN).

Once **Origin** and **Destination** are filled up, click **Insert** (we could also add an alternate). Clicking on **Insert** makes the cursor jump on the WPT LIST (UP MDU).

Fill the FPLN branches:

- select origin waypoint in WPT LIST,
- press <ENTER> on CCD and select Amend Route,
- insert next waypoints using the MKB keypad,

or:

- click on **Join**,
- select Airway,
- select the appropriate airway and select the exit waypoint,
- click **Insert** (cursor jumps on ),
- click **Activate**.

Use the same procedure for other branches making sure there are no discontinuities, then click **Activate** to confirm the FPLN.

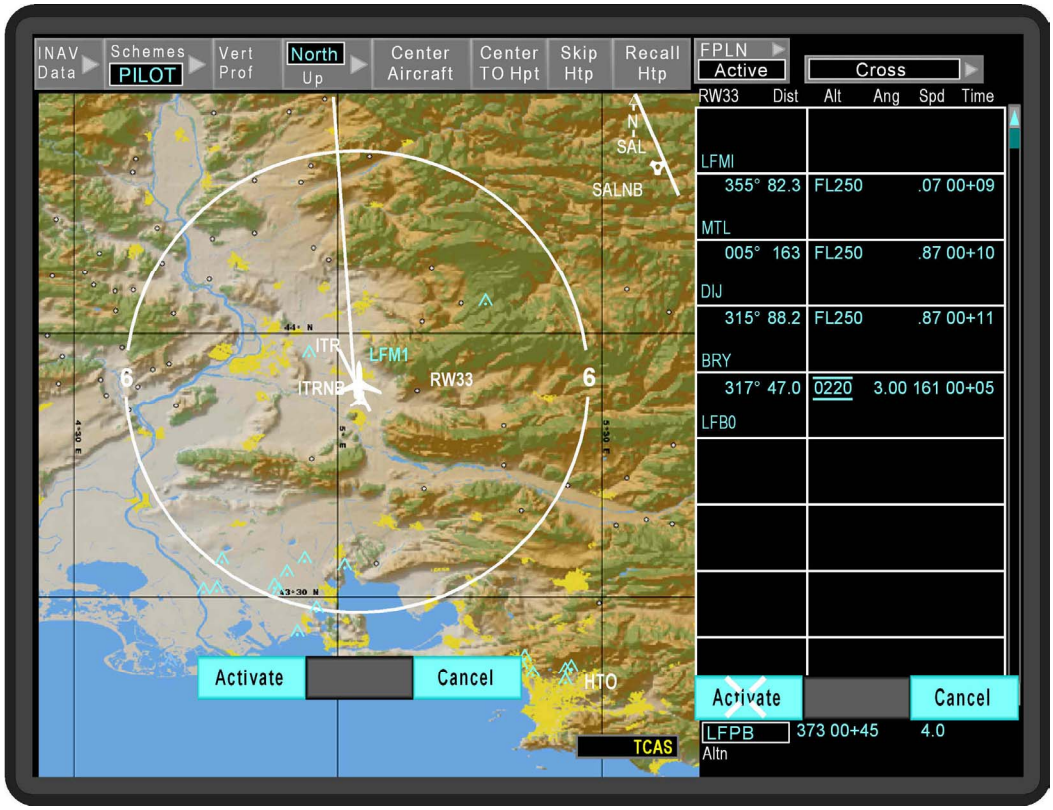



**FIGURE 02-34-15-06 I-NAV AND WPT LIST WINDOW**

Clicking on **Activate** makes the cursor jump on the **Alt/Spd** tab (LW MDU):

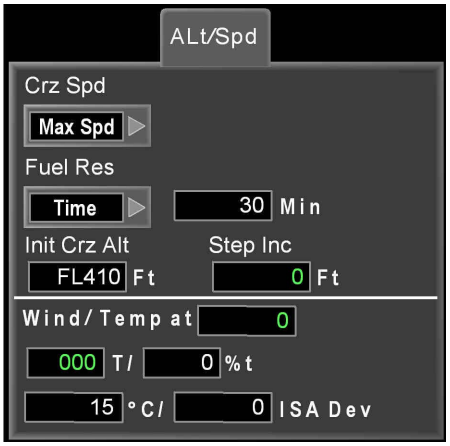



**FIGURE 02-34-15-07 ALT / SPD TAB**

In the **Alt/Spd** tab, fill in all the readouts one by one. Then click on the next tab (Fuel / Weight):

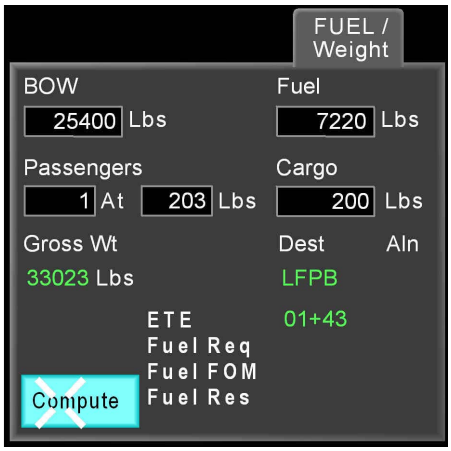



**FIGURE 02-34-15-08 FUEL / WEIGHT TAB**

In the **Fuel/Weight** tab fill in all the boxes (BOW Fuel…) and then click **Compute**. Now the system is able to compute. **Fuel Req**, **Fuel FOM** and **Fuel Res** are displayed and the data are transferred to the WPT LIST:

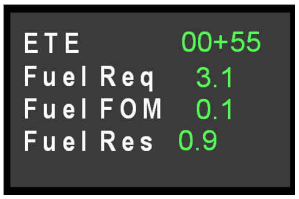



**FIGURE 02-34-15-09 FUEL / WEIGHT TAB ESTIMATION DATA**

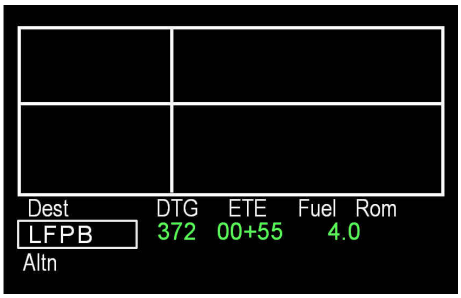



**FIGURE 02-34-15-10 WPT LIST ESTIMATION DATA**

Now select the departure POF on the FMW:

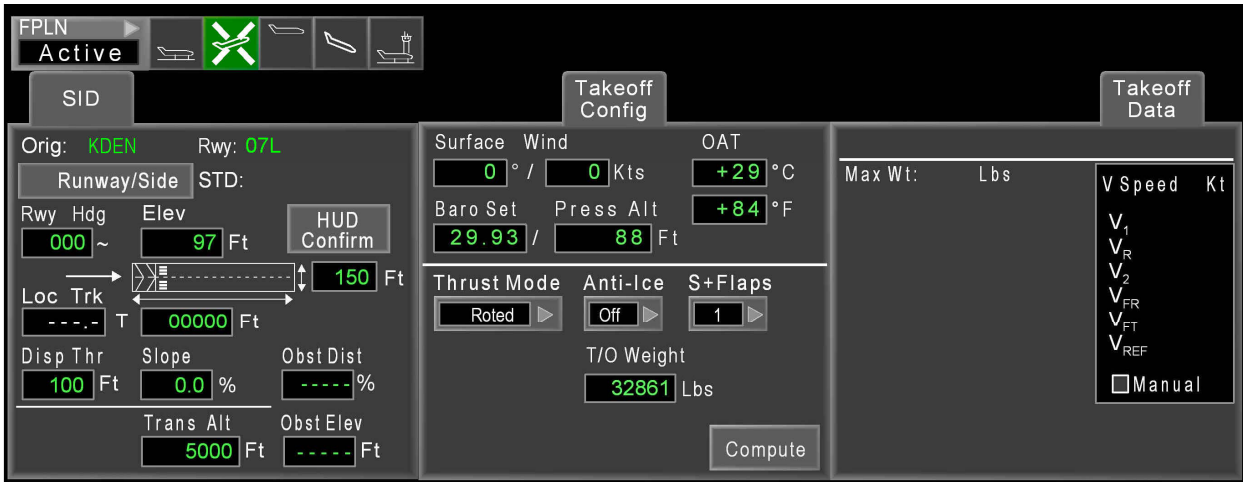



**FIGURE 02-34-15-11 DEPARTURE POF FMW**

In the **SID** tab, click on **Runway/SID** to bring up the procedure dialog box, select the Departure Runway, SID and Transition:

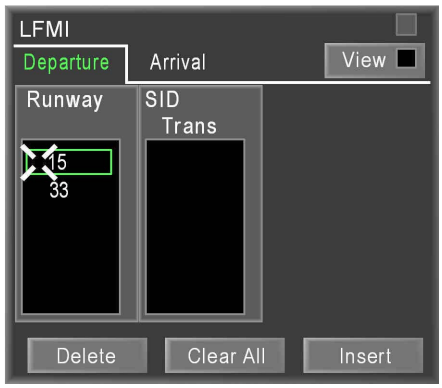



**FIGURE 02-34-15-12 SID TAB PROCEDURE DIALOG BOX**

**NOTE**

It is possible to check the departure route before insertion by selecting the **View** check box.

Then click **Insert**:

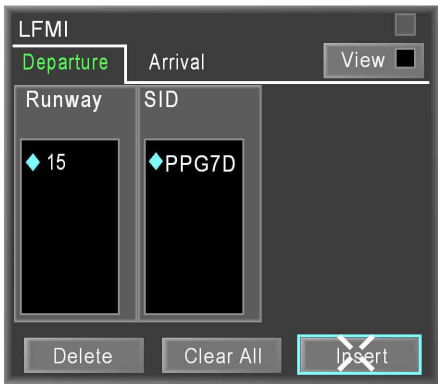



**FIGURE 02-34-15-13 SID TAB PROCEDURE DIALOG BOX INSERT**

This makes the cursor jump on the WPT LIST (UP MDU). Cancel the discontinuity if necessary (click on the Discontinuity box, it brings up a contextual menu, click delete, it removes the discontinuity) and confirm by clicking **Activate**:

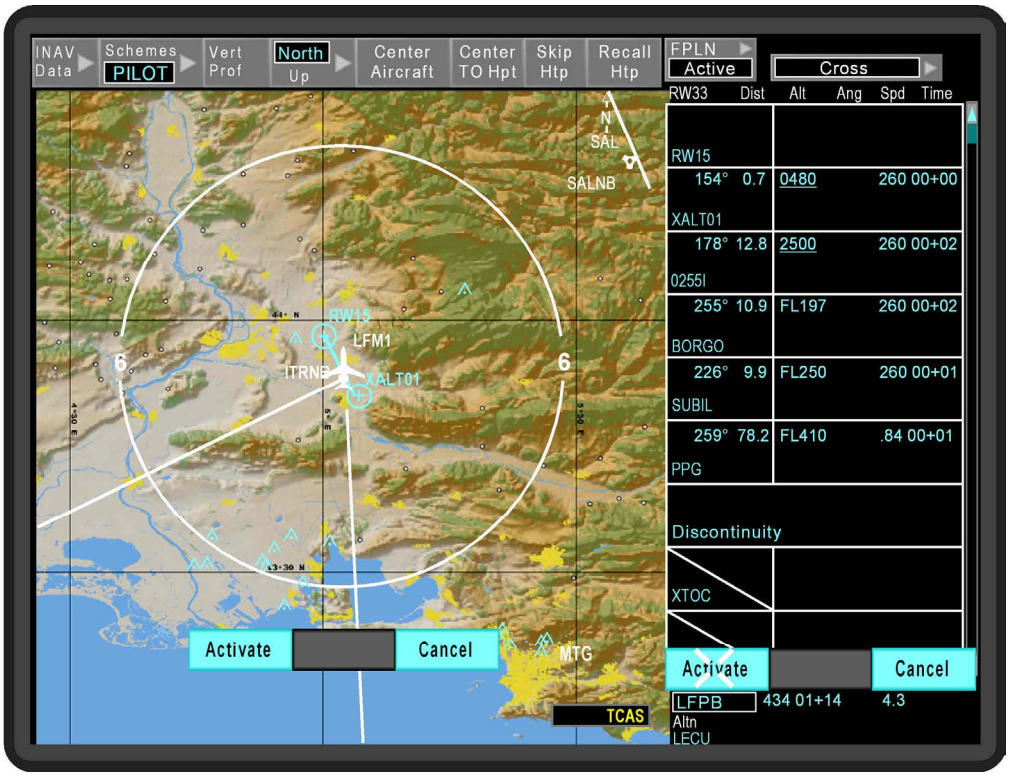



**FIGURE 02-34-15-14 I-NAV AND WAYPOINT LIST WINDOW WITH DISCONTINUITY**

Fill in the other SID tab fields excepted the **Lock Trk** field (used for HGS).

Fill in the **Takeoff Config** tab fields with ATIS parameters and take-off configuration. Confirm by clicking **Compute**:

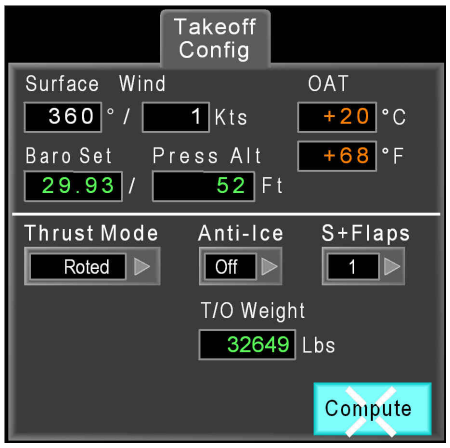



**FIGURE 02-34-15-15 TAKEOFF CONFIG TAB**

Now the system computes the data, all the data (displayed in green) shall be verified by the crew and confirm by clicking **Send**:

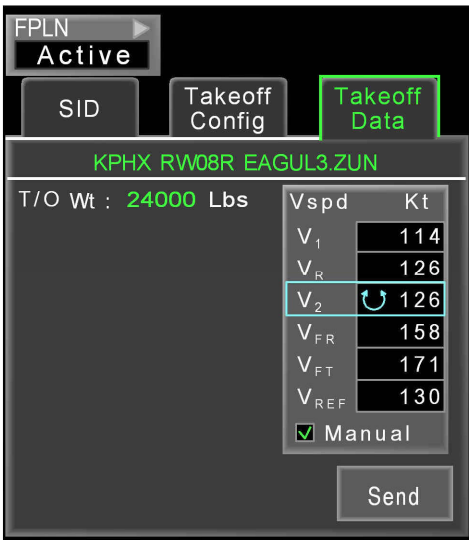



**FIGURE 02-34-15-16 TAKE-OFF DATA TAB**

Clicking **Send** makes the advisory takeoff V-speed bugs be displayed on the ADI.

When the entire flight plan is filled in, move the cursor to the FMW / pre-flight POF FPLN readout in FPLN name tab and, using the MKB, enter the FPLN name (e.g. LFMI-LFPB) and SAVE.

Flight plan insertion and flight preparation is done.

After departure briefing, configure the PDU (VOR CDI and ADF needdle in HSI and corresponding frequencies).

Place the cursor on the ENG-TRM-BRK window (PDU) and press MENU pushbutton, click RADIOS, select NAV / ADF and set frequencies:

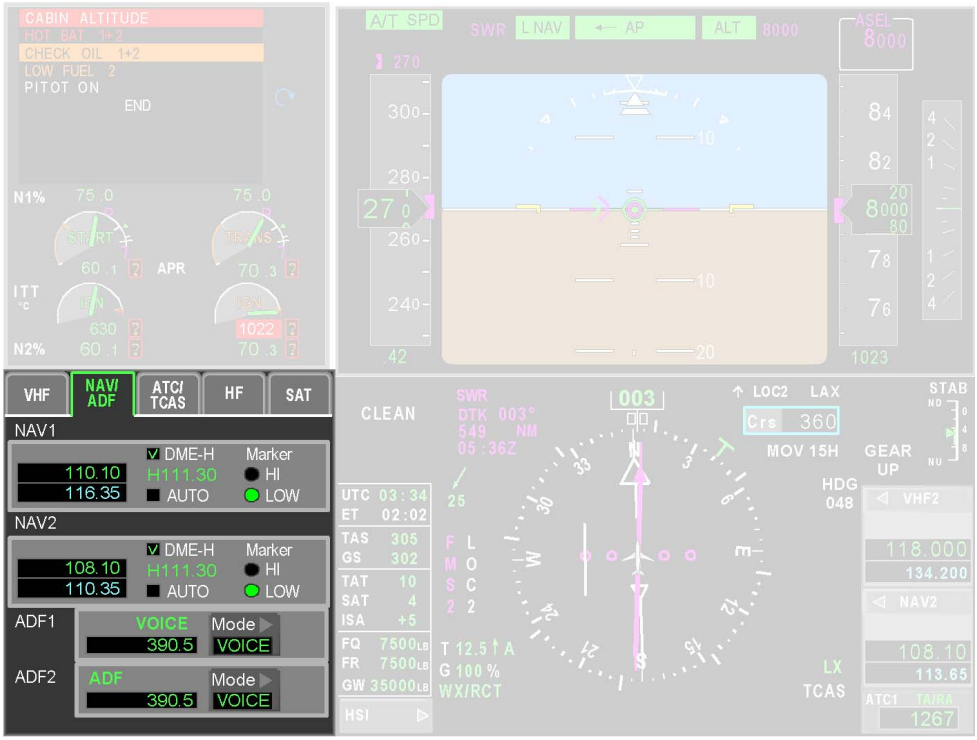



**FIGURE 02-34-15-17 RADIOS MENU NAV / ADF TAB**

**INTENTIONALLY LEFT BLANK**

## GENERAL

The Flight Management Window (FMW) provides Flight Management System (FMS) performance:

- Route Type Controller (RTC),
- Phase Of Flight selection (POF).

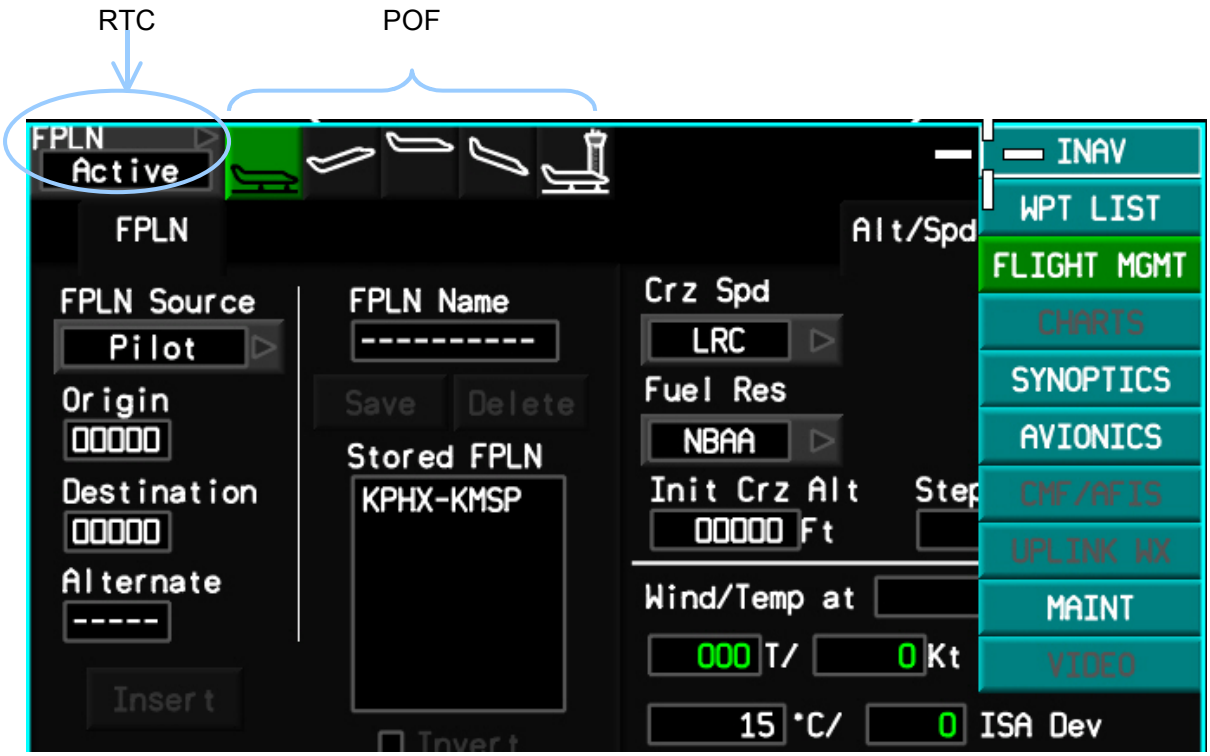



**FIGURE 02-34-20-00 FLIGHT MGMT WINDOW OVERVIEW**

The Flight Management Window FLIGHT MGMT provides an interface to the pilot for:

- FMS performance initialization,
- performance prediction and computation,
- SID, STAR and approach retrieval and review,
- advisory take-off and landing data computation.

## WINDOW LAYOUT

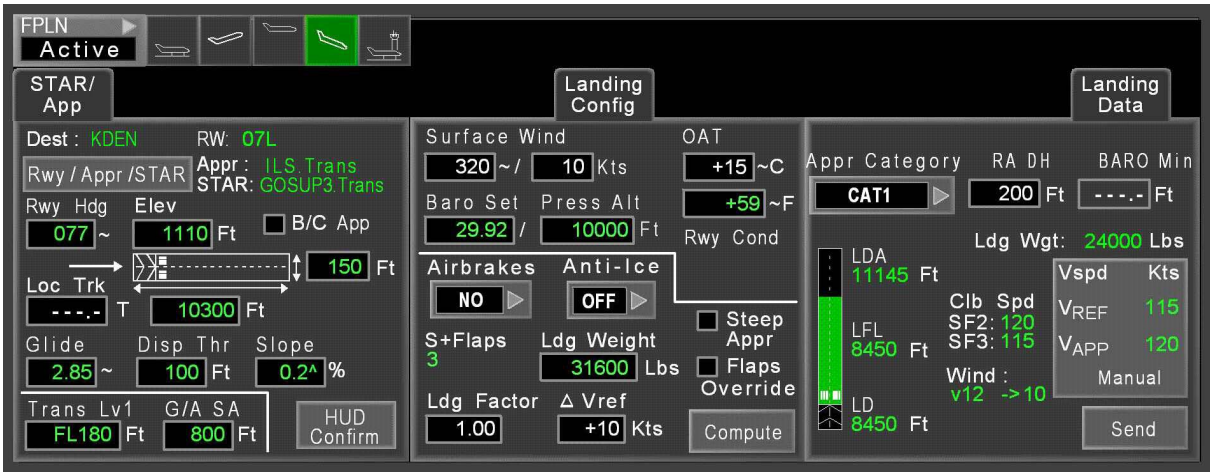



**FIGURE 02-34-20-01 WINDOW LAYOUT**

Five Phases Of Flight (POF) may be manually selected in the FMW window.

Selection tabs are located at the top of the window.

One tab with the corresponding POF pictogram is dedicated to the selection of the POF. When selected, the corresponding tab is displayed in green.

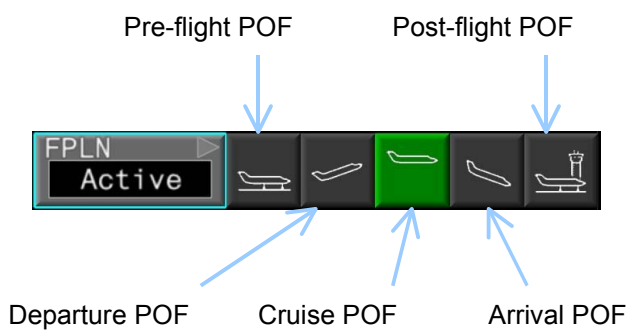



**FIGURE 02-34-20-02 PHASE OF FLIGHT SELECTION**

The FMW contains a limited number of pages.

The FMW is sequenced and organized like the crew tasks during the flight:

- flight plan creation or selection,
- departure (runway and SID) including weather data initialization and advisory take-off (TOLD) performances computation,
- cruise,
- terminal procedures (runway, approach and STAR), including weather data initialization and advisory landing (TOLD) performances computation,
- post-flight data.

The remaining part of the window displays multiple fields relative to the selected POF for the selected Route Type. After entering parameters, cursor automatically moves to the next field or tab. These features ease insertion of parameters and prompt the pilot along all remaining fields to be reviewed.

## ROUTE TYPE CONTROLLER (RTC)

As for the WPT LIST window, the FMW features a Route Type Controller (RTC) at its top left to toggle between active and secondary flight plan.

The controller is strictly identical and performs the same function as the RTC controller of the WPT LIST window. (Active is the only available function).


**FIGURE 02-34-20-03 FPLN PULL DOWN MENU**

The active flight plan is the flight plan that the FMS is actively flying. The active flight plan is defined as the primary flight plan, missed approach procedure, and the alternate flight plan. An active flight plan contains, at least, a FROM waypoint, a TO waypoint, and a destination. In some cases, the TO waypoint can also be a destination.

The FMS will provide the capability to build and review a completely independent flight plan: the secondary flight plan (will be available for next certification).

### PRE-FLIGHT PHASE OF FLIGHT (POF)

The pre-flight POF provides for system initialization, active flight plan selection, performance initialization, and performance data. The figure below illustrates pre-flight POF displayed using 1/2 window.

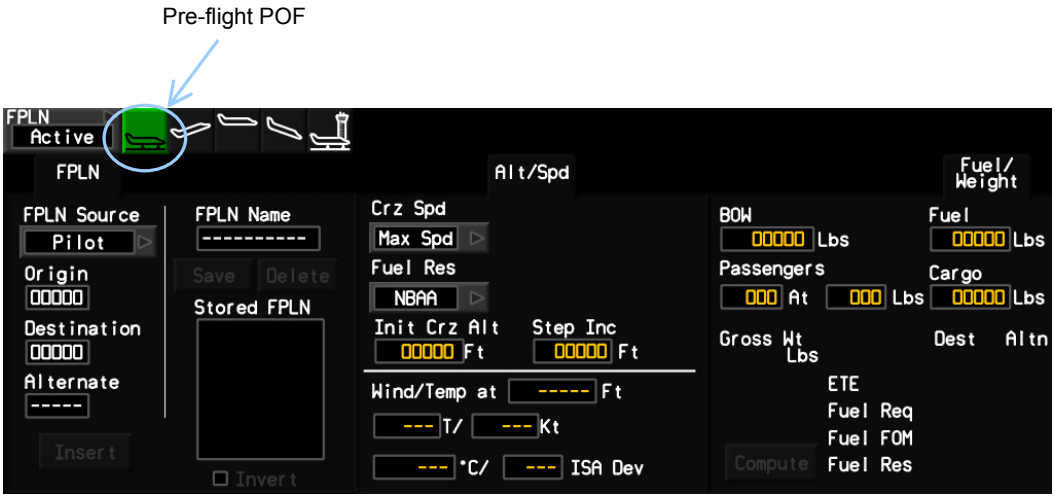



**FIGURE 02-34-20-04 PRE-FLIGHT POF TAB ½ WINDOW**

## FPLN PAGE (1ST TAB)

The Flight PLan (FPLN) tab provides the ability to create, retrieve, or save an active flight plan. An active FPLN can be entirely created by the crew or modified from a stored FPLN.

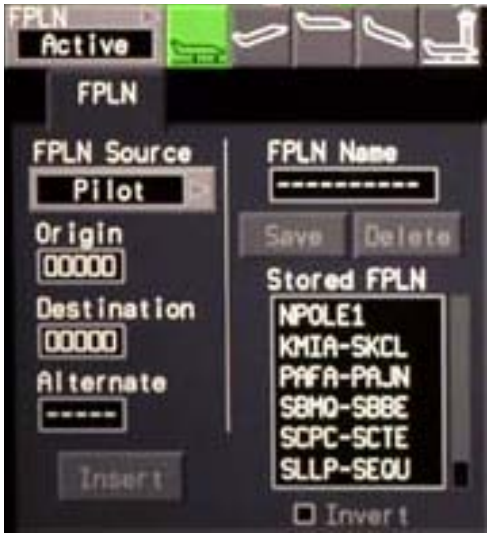



FIGURE 02-34-20-05 FPLN TAB

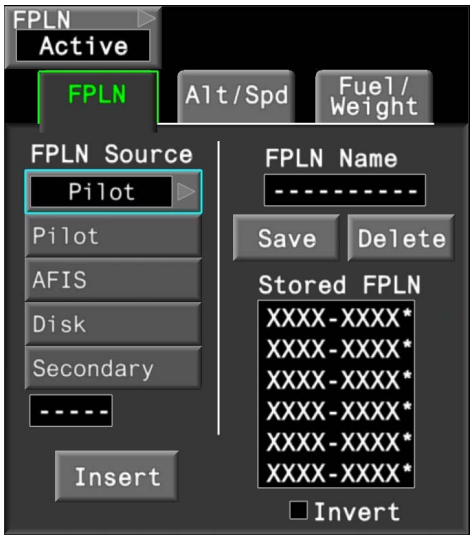



FIGURE 02-34-20-06 AVAILABLE SELECTIONS FOR THE ACTIVE FPLN

There are three ways to fill in the FPLN airport origin and destination fields:

- key in the departure and arrival airports ICAO identifier for Origin and Destination fields,
- key in a FPLN name in FPLN Name field (ICAO identifier dash separated; e.g. LFMI-LFPB). The Origin and Destination fields are automatically updated after <ENTER> activation on CCD or MKB,
- select a flight plan in the Stored FPLN field.

Delete and Save soft keys respectively allow to delete a selected flight plan from the stored list or to save the active flight plan in the stored list.

Insert soft key inserts the selected flight plan into the pending flight plan.

- **Pilot selection**

  Pilot is the default selection. This selection allows the pilot to create a flight plan inserting Origin and Destination field. The Invert check box allows to automatically reverse the Origin and Destination.

- **AFIS selection (optional)**

The Airborne Flight Information System (AFIS) selection to download a flight plan from a flight planning provider. The FMS allows the following:

- loading of AFIS flight plans,
- uploading of weather information via AFIS,
- uploading of textual messages via AFIS,
- sending messages via AFIS.

Upon initialization entry to this page, all soft keys are unselectable (Save, Transmit Request, Insert) and all field default to white dashes. Number is the default selection.

If the Number selection is made, the Transmit Request soft key remains unselectable until a number has been filled in. Once a number has been entered, Transmit Request becomes selectable. Selecting Transmit Request initiates the transmission of a flight plan request to the Global Data Center (GDC).

If the flight plan is selected by Orig, Dest, ETD or Date, the Transmit Request soft key is unselectable until all data have been entered. Once the data has been properly entered, the Transmit Request soft key becomes selectable (cyan). Selecting this soft key initiates the transmission of a flight plan request to the GDC.

If there is a Communication Management Function (CMF) failure, the Transmit Request pushbutton remains unselectable.

Once the requested flight plan is received, the FLT PLN RECEIVED I-NAV systems message is displayed and the Insert soft key becomes selectable and is highlighted in cyan (reverse video).

Selecting Insert causes the uploaded flight plan to be inserted.

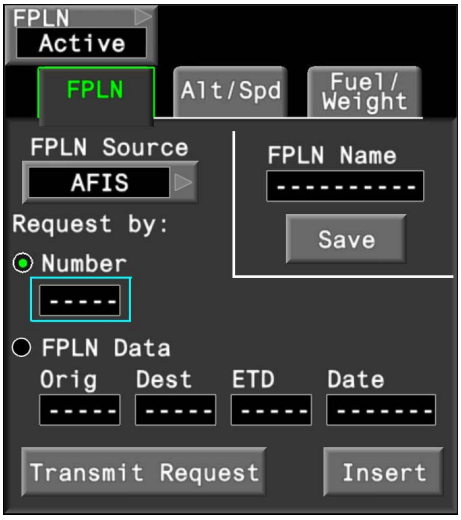



**FIGURE 02-34-20-07 FPLN TAB AFIS SELECTION**

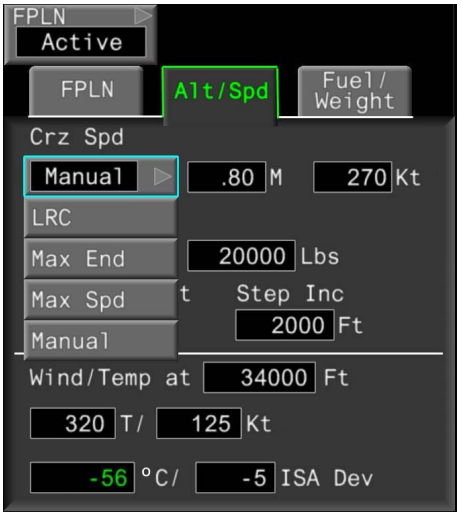
- **Disk selection (will be available for next certification)**

  The disk selection allows the selection of a flight plan from a disk inserted into a dataloader, or from a PC connected to the airplane Local Area Network (LAN).

- **Secondary selection (will be available for next certification)**

  The Secondary selection allows the current secondary flight plan to be activated into the Active Flight Plan.(will be available for next certification).

**Alt / Spd tab (2nd tab)**



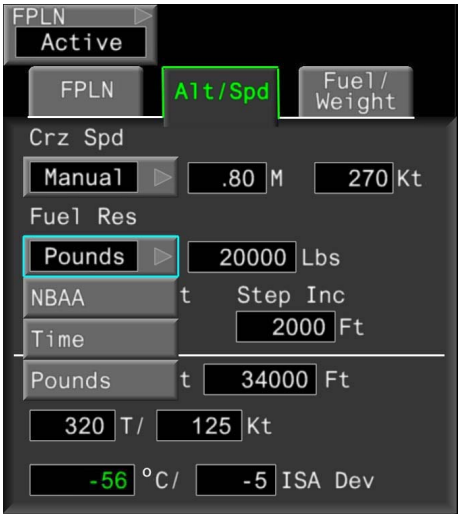




**FIGURE 02-34-20-08 ALT / SPEED TAB**

The upper part of the tab gathers mission parameters:

- Cruise speed (Crz Spd):Long Range Cruise (LRC), Maximum Endurance (Max End), Maximum Speed (Max Spd) or Manual,
- initial cruise altitude. It should be set to a flight level compatible with the FPLN length. Otherwise, it may result in the Top Of Descent (TOD) be located before theTop Of Climb (TOC),
- step increment,
- fuel reserves (pounds, NBAA or Time).

- **Crz Spd**

  - **LRC selection**

    The Long Range Cruise (LRC) is defined as a cruise mach allowing a maximum distance at a given altitude. The speed is faster than the maximum specific range speed. It is considered worthwhile because of reduced flight time.

- **Max End selection**

  The maximum endurance speed (Max End) is defined as the speed where the fuelflow is minimized.

- **Max Spd selection**

  The maximum speed (Max Spd) is defined as the maximum speed the airplane can fly.

**NOTE**

These options are only available when Full Perf is the active Performance mode. In pilot Spd / FF or current GS / FF only the Manual option is available.

- **Manual selection**

  Manual cruise speed is the performance provided for the definition of a manual cruise speed schedule. This selection requires to fill in a Mach number and a speed in knot.

- **Fuel Res**

Fuel Reserve pull down menu contains:
- NBAA,
- Time,
- Pounds.

- **NBAA selection**

  The destination reserve depends on whether an alternate destination exists. If it does not exist, a default alternate mission of 200 NM is computed, assuming no wind condition. If an alternate FPLN does exists, it is used for the reserve computation only if it is more than 200 NM. The required reserve also include 30 min of loiter at the end of the actual or default alternate mission. The alternate required reserve is only computed when an alternate destination exists. It is always 30 minutes of loiter only, regardless of the alternate FPLN length.

- **Time selection**

  This selection allows to enter a reserve with reference to a time (hours and minute).

- **Pounds selection**

  This selection allows to enter a reserve with reference to a fuel quantity in pounds.

  The entered information is then transferred to the Cruise POF page and a FMS message is sent when the fuel reaches the entered value (depending on NBAA, Time or Pounds selection)

  The lower part of the page allows to initialize expected en-route atmospheric conditions: wind and temperature (either ISA deviation or temperature) for a given altitude.

- **Init Crz Alt field**

The initial Cruise Altitude field is initially displayed with white boxes as it is a mandatory field.

- **Step Inc**

  The Step Increment field is initially displayed with white dashes as it is an optional entry. It is only displayed in the Full Perf mode. In the other perf modes, it is not possible to specify a step increment.

- **Fuel / Weight tab (3rd tab)**


**FIGURE 02-34-20-09 FUEL / WEIGHT TAB**

The Fuel/Weight tab is used to enter fuel and weight information for the active flight plan. Upon completion of data entry, Compute soft key is highlighted. Clicking on it starts the performances computations.

The Basic Operating Weight (BOW) field is initially filled with either the default value from the airplane data base, or the last value the pilot has entered.

The Fuel value is displayed with white boxes (mandatory data) if no fuel input has been received or a green default system value if the input has been received.

The Passengers field is initially displayed with white boxes.

The weight per passengers field is initially displayed with the default value from the airplane data base, or the last value the pilot has entered (from a previous flight) in white.

Cargo is initially displayed with white boxes.

The Gross Wt field is automatically filled in green once all weight data has been entered regardless of the Compute pushbutton state.

ETE, Fuel Req, Fuel FOM (destination and alternate), Fuel Res (destination) are computed by the system when Compute soft key is selected and are displayed in green. The fuel values are displayed in thousands of pounds. This information is only available in Full Perf mode.

Fuel FOM (Figure Of Merit) gives a calculation accuracy in lb. In this example, Fuel FOM 0.1 corresponds to 100 lb calculation accuracy.

## DEPARTURE POF

The Departure POF is used for:

- retrieving and activating the departure procedures using the SID tab,
- initialization of TOLD using the Takeoff Config tab,
- display of advisory take-off Data computed by the Take-Off and Landing Data (TOLD).


**FIGURE 02-34-20-10 DEPARTURE POF ½ WINDOW**

**CAUTION**

**Fill the SID tab prior to insert the Take-off Config tab to avoid the parameters to reset.**

- **SID tab (1st tab)**

The SID tab is used to retrieve the departure route from the navigation data base and insert it into the pending FPLN. It also automatically displays parameters for the departure runway. Pressing the Runway/SID soft key opens the Procedure dialog box which displays available Runways, SID and transition for the origin airport. Once the Runway and/or SID have been inserted, it is displayed at the top of the page.


**FIGURE 02-34-20-11 SID TAB IN DEPARTURE POF**

Procedure dialog box is described in the I-NAV graphical description DIALOG BOXES.

The runway parameters, stored in the data base, are automatically displayed. They are modifiable by the crew.

Obst.Dist and Obst.Elev fields allow entering an obstacle characteristics (elevation and distance). The TOLD take into account these parameters. The crew is warned when the take-off performances are not satisfied.

**CAUTION**

**This TOLD computation versus obstacle only applies up to the second segment.**

- **Take-off Config tab (2nd tab)**


**FIGURE 02-34-20-12 TAKEOFF CONFIG TAB**

The **Take-off Config** tab is used to initialize the TOLD function.

The upper part of the tab window is dedicated to the insertion of runway conditions (wind, pressure, temperature). Default entries are provided for all fields excepted surface winds.

**OAT** field: entering either a Celsius or Fahrenheit value causes the system to automatically compute and display the other parameters.

The **Baro Set** field initially defaults to the baro setting of the PF PDU.

The **Press Alt** field initially defaults to a sensed value if one is available or green boxes, until a runway is selected. Once a runway altitude is available, the pressure altitude is computed from the runway altitude and the **Baro Set**.


**FIGURE 02-34-20-13 TAKE-OFF CONFIG TAB**

Thrust Mode selections are only available when Anti-Ice selection is OFF. If Anti-Ice is selected ON, the Thrust Mode defaults to Rated and is not selectable. Anti-ice selection is only available in rated thrust mode.

S+Flaps pull down menu offers slats and flaps position 1or 2 selections, position 2 is the default selection.

The Noise A defaults to white dashes. When entering an altitude in the noise abatement field, a Speed Transition alert is generated on the PDU speed scale upon reaching that altitude (only in Manual Speed).

T/O Weight defaults to the value computed in the pre-flight POF.

Compute soft key is used to start the computation (takeoff and landing calculations). Compute soft key is only enabled when all required fields are filled and whenever a change in one of these fields is detected


**FIGURE 02-34-20-14 TAKEOFF CONFIG TAB MANUAL VSPEED**

If Manual Vspeeds is selected, the configuration items for the takeoff and landing computations are removed from the tab, and Manual Vspeed Active message is displayed.

- **Take-off Data tab (3rd tab)**

The Takeoff Data tab provides a synthesis of take-off data. It can be considered as an electronic take-off card.

The active Origin and selected runway and SID are displayed at the top of the tab as soon as they are activated.

Take-off weight is displayed in lb. take-off distance and available runway are displayed in feet. T/O pitch attitude value is the one given in the AFM for initial rotation at VR.

All this information is displayed after **Compute** has been selected on the Take-off Config tab (except for the selected airport, runway, SID, and transition which are displayed as soon as they are activated).

Non Cert Data T/O Accel field corresponds to the acceleration expressed in G at break release.

Send soft key is used to send Vspeeds on the speed tape to both PDU.

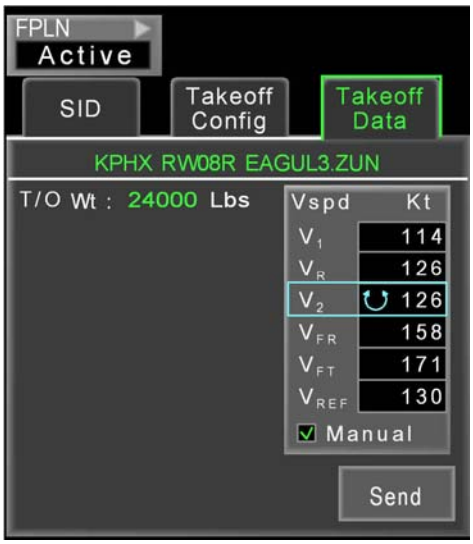



**FIGURE 02-34-20-15 TAKE-OFF DATA TAB**

## CRUISE POF

Cruise POF primary purpose is to give with synthetic bar-graphics the fuel status at destination and alternate based on current mission parameters (speed, cruise altitude, step climbs, atmospheric conditions).


**FIGURE 02-34-20-16 CRUISE POF ½ WINDOW**

The Cruise Summary POF tab is the only available.

The left white / green graphic is relative to the destination field, the right one to the alternate.

The white fuel bars at destination and alternate represent pre-planned fuel (before take-off).

The green fuel bars at destination and alternate represent current fuel estimation (during the flight).

In the event of an Engine Out condition, the tab title become Cruise Sum E.O to inform the pilot that the predictions are based on engine out data (will be available for next certification).

**NOTE**

For NBAA computed fuel reserves, the white bar does not extend to the alternate, since the alternate is included in the NBAA computations).

A white line represents fuel reserves as defined before take-off.

The destination and alternate identifiers are displayed beneath the bars along with the ETE.

This graphics presentation allows at first sight to estimate fuel status.


**FIGURE 02-34-20-17 CRUISE SUMMARY TAB NORMAL AND ENGINE OUT**

## ARRIVAL POF

The Arrival POF provides the interface for selection of the arrival and approach, landing configuration and landing data. The figure below illustrates the arrival POF displayed in a 1/2 window.

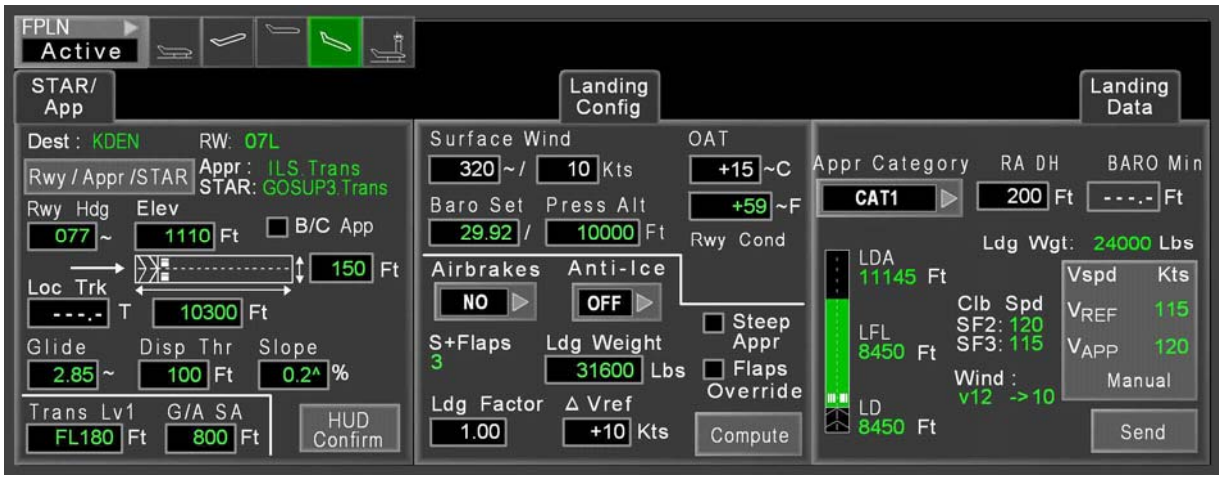



**FIGURE 02-34-20-18 ARRIVAL POF ½ WINDOW**

- **STAR/App tab (1st tab)**

The STAR/App tab is used to select and display arrival procedure (STAR and Approach) and the landing runway parameters. Pressing the Rwy/App/STAR soft key pops up the Arrival tab, which displays available Runway, Approach and STAR for the destination airport. Among this list, tick the appropriate data. **Insert** soft key sets the arrival and approach data pending in the I-NAV window and on the WPT LIST. The Arrival tab pops out back to the STAR/App page. In order to confirm those data click on ACTIVATE (available in I-NAV window or WPT list). At this step, the boxes are filled up with information except for Lock Trk.

Upon selection of a runway, all the runway information is retrieved from the data base and automatically displayed in green. The runway diagram is static and does not change based on any selected runway data.

The runway picture provides an illustrated representation of all runway data base parameters: heading, length, width, elevation, slope, displaced threshold and ILS glide slope. These parameters can be overridden by the crew whenever necessary.

B/C App check box allows to activate the back course logics when approach is selected on the GP. When App soft key is depressed, the B/C mode is displayed in the FMA.

For circle to land approaches, fill the page with the direct approach data (e.g. ILS 36) but insert the Rwy Hdg field for the runway in use (e.g. 178° for Rwy 18). In that case wind computations are related to Rwy 18.

**Disp Thr** field corresponds to displaced threshold. When a displaced threshold is entered, the system recalculates the available runway length.

**Trans Lvl** field corresponds to the transition level. The default value is the airplane data base one.

**G/A SA** field corresponds to the Go Around Safety Altitude (available in next certification). The value defaults to 800 ft above the runway elevation indicated in the **Elev** field. If no elevation is available it defaults to white dashes. Setting a value sets the bug on the altitude tape on both ADI.

**HUD Confirm** soft key allows to send loc true track, glide slope reference, landing elevation and runway length to the HUD to display the synthetic runway. It is linked to the **Lock Trk**, **Elev**, **Length** and **Glide** fields.

**NOTE**

The correct setting of the localizer true track is a key element for proper operation of HGS during approach. It must be inserted in tenth of degrees for the CAT III operation. This value is supplied by local authorities to approved operators only.


**FIGURE 02-34-20-19 STAR / APP TAB**

**NOTE 1**

Those three parameters are becoming white when modified by the crew.

**NOTE 2**

To come back to data base parameters use the **CLR DEL** pushbutton on the MKB (the color of each parameter is changing from white to green).

- **Landing Config tab ( 2nd tab)**

The Landing Config tab is used to initialize the TOLD function.

The upper part of the tab window is dedicated to enter runway condition (wind, pressure, temperature).Entering either a value in Celsius or Fahrenheit causes the system to automatically compute and display the other parameter.

Default entries are provided for all fields except surface wind. Baro Set field defaults to the baro setting of the PF PDU. Rwy Cond allows to select the dry or wet factor (15% increase of the Ldg Factor when WET is selected).

The lower part of the page is used to enter airplane configuration.

App/Ldg SF pull down menu allows the selection of approach and landing slats/flaps configuration. The default selection is 2/3.

The Ldg Weight field initially defaults to the value estimated by the FMS. The Ldg Factor field defaults to 1.00: this factor is used to compute operator Landing Field Length (LFL) based on the Landing Distance (LD) computed by the TOLD
(LFL = LD x LDG FACTOR).

△ Vref (this field defaults to 0 kt) is used to apply a correction to the Vref computation:

- to correct the wind: △ Vref = half of head wind + gust value (20 kt maximum),
- to take into account the limitation due to airplane failure (e.g, add △ Vref 5 kt to Vref in case of one engine failure).

Vref corrected of △ Vref becomes Vapp. Vapp is the landing speed used in the Landing calculations.

Steep App check box automatically considers:

- airbrakes at number 2 position,
- △ Vref field at 10 kt,
- EGPWS mode 1 to steep approach envelope.

Flaps Override is used to avoid "TOO LOW FLAPS" aural warning at 250 ft RA when not in SF3 configuration during final approach. It can be also set through the SENSORS window. It is secured by a confirmation box.

Compute soft key is highlighted when:

- all mandatory fields are filled,
- the system automatically detects a change in the TOLD,
- the horizontal trajectory is changed.


**FIGURE 02-34-20-20 LANDING CONFIG TAB**


**FIGURE 02-34-20-21 LANDING CONFIG TAB MANUAL VSPEED**

When Manual Vspeed is active, all of the configuration items used by the takeoff and landing computations are removed. The **Steep App** and **Flaps Override** remain available as they are used by the EGPWS function.

- **Landing Data tab (3rd tab)**


**FIGURE 02-34-20-22 LANDING DATA TAB**

Landing Data tab provides a synthesis of landing data.

The upper part of the page provides a summary of the selected procedures and gathers approach category and minimums selection. The new terminology used for minimums (RA DH and Baro Min) allows being compliant with new regulations and terminologies, especially concerning FMS VNAV approaches and CAT2 , CAT3 approaches:

- RA DH is used for approach minima based on radio altimeter (RA) decision. This is the case of CAT2 / HUD2 and HUD3 (if available) precision approaches,
- Baro Min is used for approach on a barometric altitude / height decision. This is the case of CAT1 and FMS approaches.

The figure below describes the pull down menu contents for the App Category selection:


**FIGURE 02-34-20-23 LANDING DATA TAB APP CATEGORY PULL DOWN MENU**

CAT1 is the default selection when an ILS approach is selected. Selecting CAT1 defaults Baro Min to be selected, with a value equal to the Touch Down Zone Elevation (TDZE), as displayed on the STAR/App tab, + 200 ft.

It is only possible to set Baro Min values above this initial value. Selection of an ILS approach also defaults this menu to CAT1.

If CAT2 / HUD2 is selected, RA DH value is automatically selected with a default value of 100 ft. The crew can only select a value between 100 ft and 199 ft.

This selection also impacts the TOLD computations by limiting the Maximum Landing Weight.

If HUD3 (if available) is selected, the RA DH value is automatically selected with a default of 50 ft. The crew can only select a value between 50 ft up to 99 ft.

If VGP approach is selected (will be available for next certification):

- Baro Min is automatically selected at runway elevation + 250 ft. The crew can only select a value above 250 ft.
- If no runway elevation is available (for next certification), the field defaults to 250 ft.

If an approach is selected other than ILS, VGP becomes the default selection. VGP selection also causes the Approach Excitement field in the FMA to display the VGP approach excitement at the appropriate time.



**FIGURE 02-34-20-24 LANDING DATA TAB MENU**

The lower part provides a synthesis of landing data. It can be considered as an electronic landing card.

The green part of the runway provides a quantitative view of runway used compared to useable runway. The runway symbol is static and does not change shape based on the active runway. The green highlight is a relative percentage based on LFL / LDA.

The Clb Spd (Climb Speed) data is based on the selected approach and landing configuration selected on the Landing Config tab. If 2/3 has been selected, the climb speeds are displayed for SF2 and SF3. If 1/3 has been selected, the climb speeds are displayed for SF1 and SF3.

Wind components are displayed as the Takeoff Data tab (arrows for wind direction and digital values for wind velocities).

Pilot may select Manual check box and modify independently each Vspeed values computed by the TOLD function. If Manual has been selected, the configuration items for the Take-off and Landing computations are removed from the page, and the Manual Vspeed Active message is displayed. Landing weight and wind components remain displayed.

Send soft key is used to send Vspeeds to both PDU.


**FIGURE 02-34-20-25 LANDING DATA TAB MANUAL VSPEED**

Check Status annunciator is displayed when an airplane failure impacts the landing performances. The crew has to check the STAT synoptic to analyze the corresponding limitations.


**FIGURE 02-34-20-26 LANDING DATA CHECK STATUS**

- **TOLD problems**

When the current airplane configuration does not match the selected configuration on Landing Config tab, the mismatch item is highlighted in amber and the Vspeed values are not displayed.

Field Length Limited, Max Weight Limited are displayed when the LFL is above the runway length. The Vspeeds and others TOLD parameters are not displayed.


**FIGURE 02-34-20-27 LANDING DATA TAB (TOLD PROBLEMS)**

## POST-FLIGHT POF

The Post-flight POF provides a flight summary. Next figure illustrates the Post-flight POF displayed in a 1/2 window.


**FIGURE 02-34-20-28 FLIGHT SUM 2 TAB**

Only the second tab is available (Flight Sum2).

**NOTE**

ERRONEOUS INDICATIONS

Some data are erroneous for the first certification.

**INTENTIONALLY LEFT BLANK**

## GENERAL

Charts function is an option, an onboard printer is a separate option. As such, electronic Jeppesen charts can not be considered as a primary mean. Original Jeppesen charts shall always be available in the airplane.

The Jeppesen CD must be inserted into the Data Module Unit (DMU) prior to first use of the charts function. The DMU loads the relevant files from the CD for the charts function. The user must verify that the CD volume label stenciled on the CD matches the CD volume label displayed on this window.

Chart are used:

- in flight: as a static image:
  - to get procedure data, for cross-check with the corresponding FMS data when available,
  - when not available in the FMS (approach minima), to get a data for manual insertion into the system after consistency check.
- on ground:
  - to be aware of a “runway ahead” and have a general survey of taxiway,
  - to get airport data.

The chart function retrieves the Jeppesen charts with no restrictions (world-wide). This function allows to select the desired chart for display as well as manipulate the charts for viewing (zoom, scroll, rotate...).

CHARTS window accessed by MDU MENU provides access to:

- Airports diagrams, SID, STAR and approaches charts ,
- Noise abatement procedure,
- NOTAM,
- Airspace charts,
- Search function,
- Revision information.

CHARTS window is always displayed on a 2/3 format on MDU. However it is available on PDU if two DU are lost.

Depending upon the phase of flight, the charts should be brought up:

- either onto the lower MDU to keep the I-NAV / WPT list in the upper MDU,
- or the upper MDU to keep the synoptics on the lower MDU.

It provides eight main tabs:

- Aprt (Airport),
- SID,
- STAR,
- App (Approach),
- Noise,
- NOTAM,
- Airsp (Airspace).

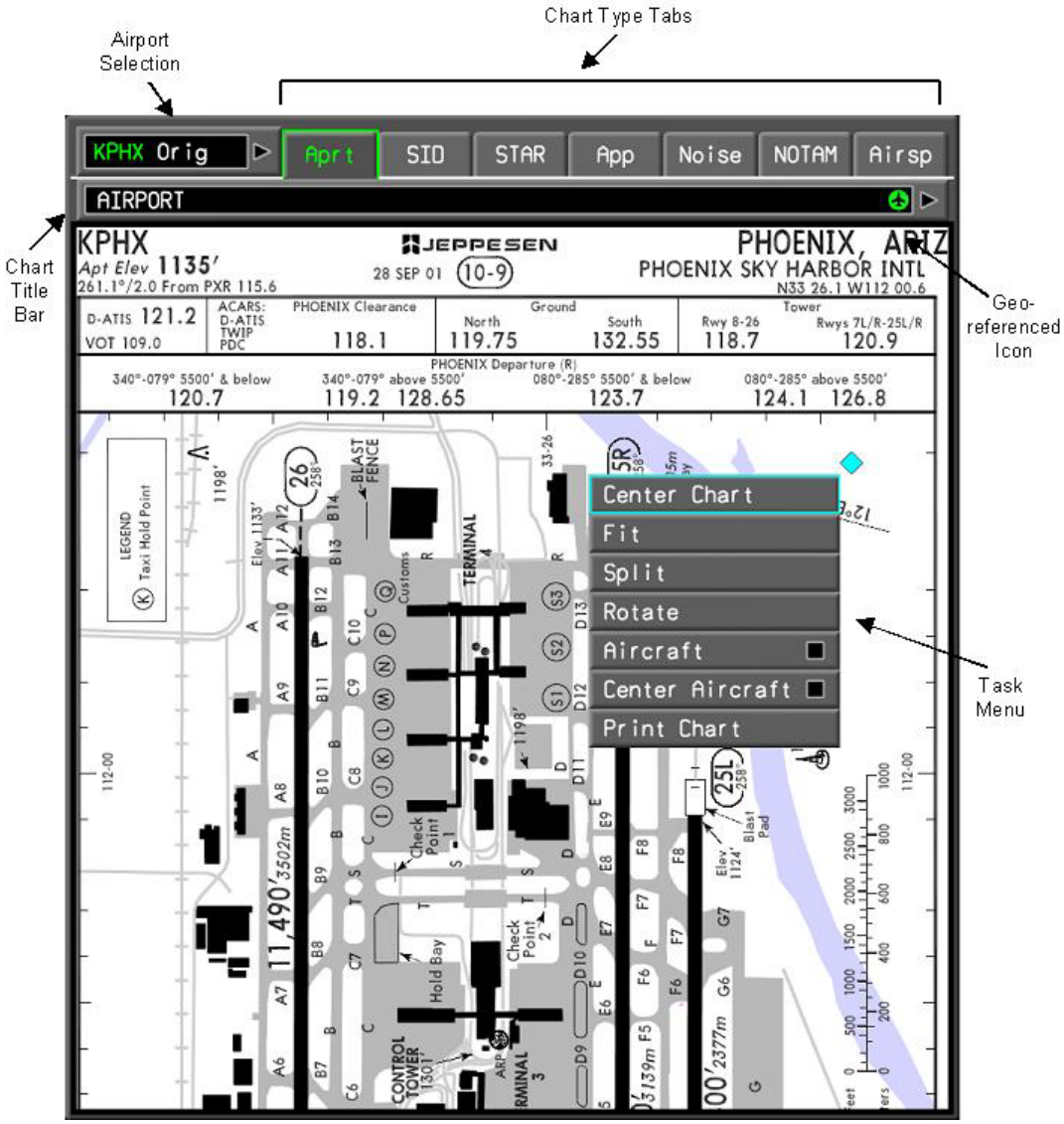



**FIGURE 02-34-22-00 GRAPHICAL USER INTERFACE FOR CHARTS**

## AIRPORT SELECTION PULL DOWN MENU

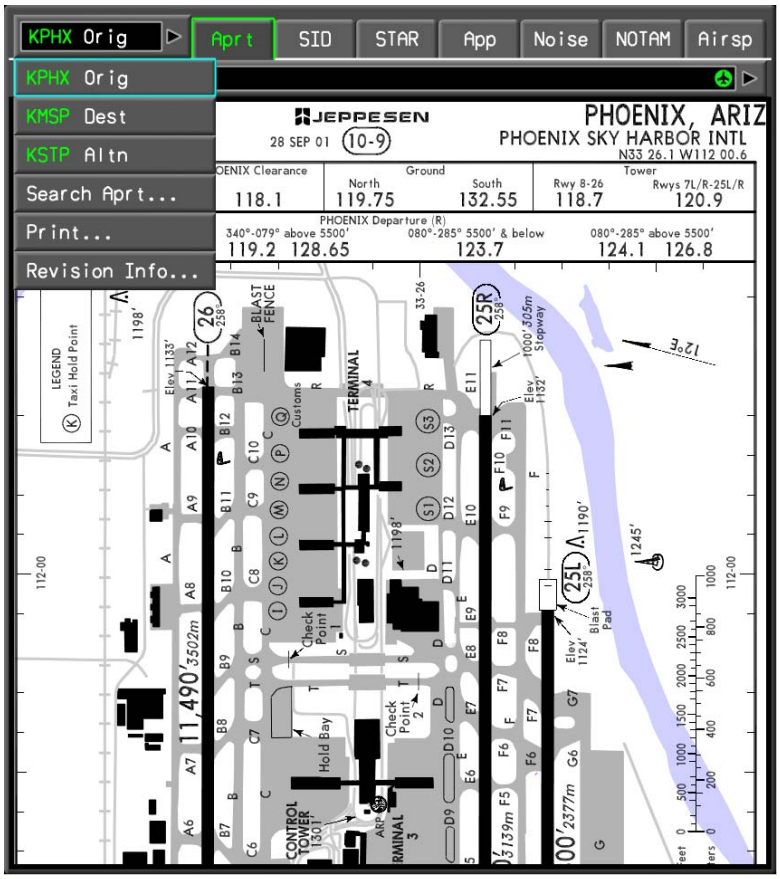



**FIGURE 02-34-22-01 AIRPORT SELECTION PULL DOWN MENU**

The pull down menu is used to select the desired airport. When an airport is selected the ICAO identifier is displayed in the menu box.

The chart function supports the ability for a maximum of four airports consisting of three fixed selections and one search selection. The fixed selections consist of the origin (Orig), destination (Dest) and alternate (Altn) from the flight plan.

In addition the pilot can display charts from any airport by selecting the Search Aprt menu item.

Use the CCD to select a radio pushbutton to perform the search based upon ICAO, Airport Name, City or Country. Only one radio pushbutton can be selected at a time.

Using the MKB allows to enter the necessary text to begin to search.

After the search string is entered, the cursor is located at the first airport in the search results window.

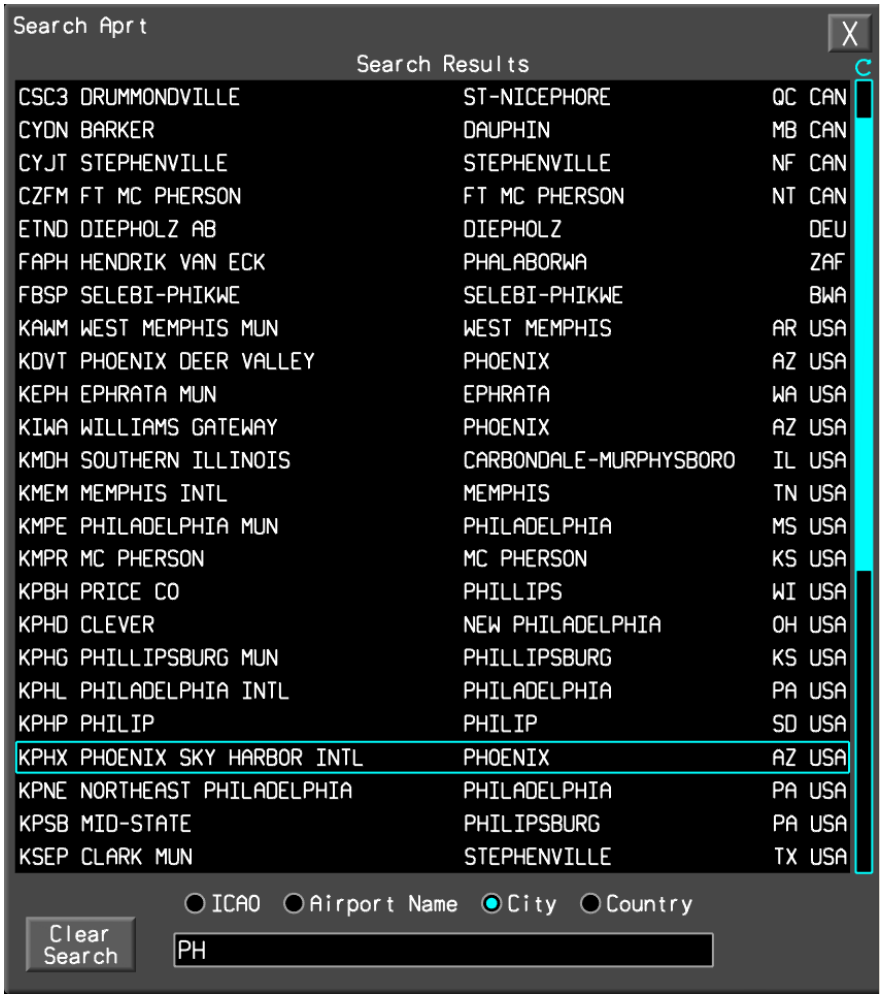



**FIGURE 02-34-22-02 SEARCH AIRPORT DIALOG BOX**

Some searches may result in a list of airports greater than what can be displayed in the window. In that case, a scroll function is displayed.

The **Clear Search** soft key allows to clear the contents of the search and scratchpad windows.

**Print** function is not available.

**Revision Info** selection allows to view chart effectivity and coverage information. This window displays the disk volume label, subscriber's serial number, a world graphic depicting coverage and messages related to reversion information.

If access codes are used they are temporarily displayed in this window as well.

Jeppesen charts are available by subscription. All subscribers receive the same data from Jeppesen regardless of the service paid for. However, Jeppesen provides serial numbers and access codes in order to control the chart data an individual subscriber can access. The serial numbers and access codes are decrypted by software and are used to determine if requested data is within the subscriber's region of chart coverage. Subscription coverage consists of geographical regions. Access codes and serial numbers are used for temporary purposes and change with each issue of the chart data. Serial numbers are used for regular subscribers using fixed chart coverage.

When the chart window is first accessed after airplane power-up, the following window is displayed:

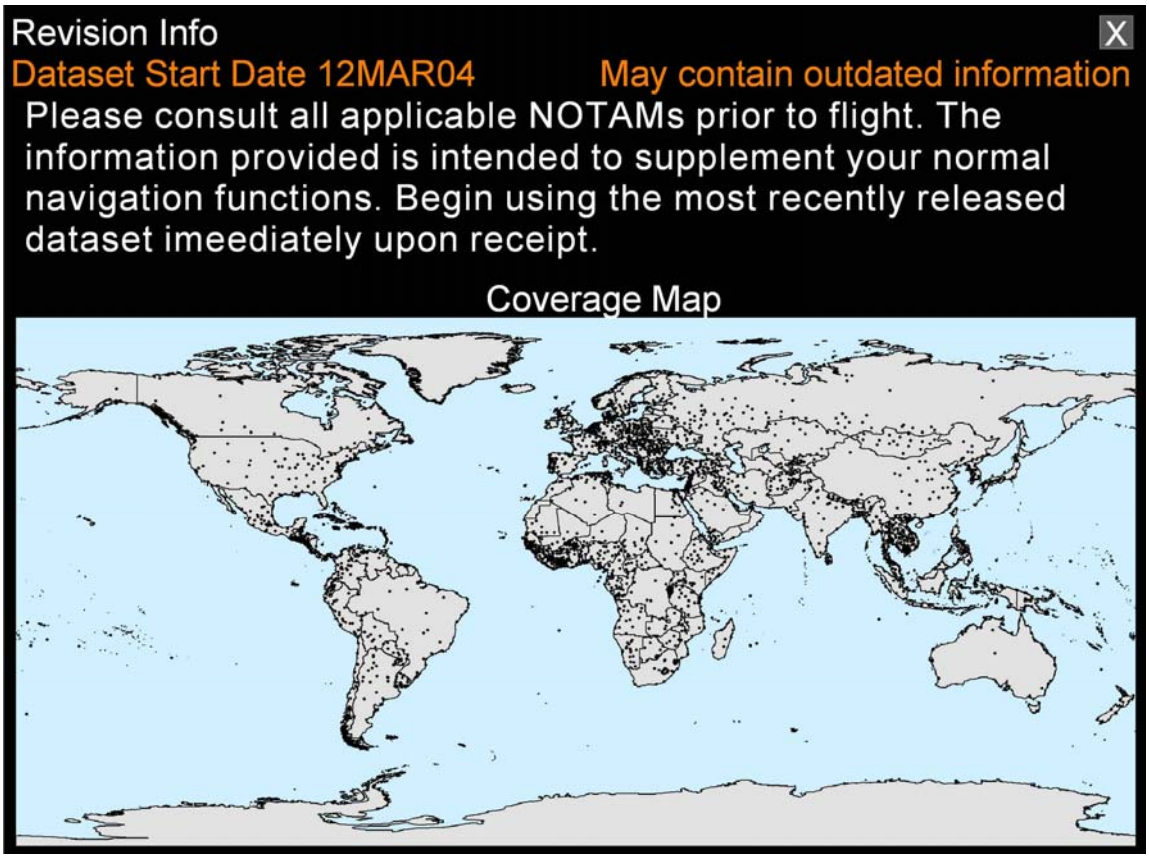



**FIGURE 02-34-22-03 REVERSION INFO WINDOW**

This allows to confirm geographical coverage and currency of the navigation charts.

Initially the fourteen digit serial number assigned to the subscriber must be inserted into the chart function. If an invalid serial number is entered, "Invalid Entry" message is displayed on the scratchpad window.

Access codes are used for two purposes:

- first time subscribers and to temporarily enlarge a current subscription coverage area. For first time subscriber, the serial number may not be stored in the database. In this case, an access code has to be used to get access to the data,
- permanent subscribers that do not have the world coverage may need to temporarily increase their coverage region.

Access code are only valid for one issue of the Jeppesen CD.

An access code is entered by placing cursor in the Valid Access Code window and by using the keyboard to insert the access code. The access code will be verified against the database and the airport locations contained in the coverage region are added and displayed as white dots. After an access code is entered and verified, it is displayed in both the "Valid Access Code" and the "Valid Access codes" windows. The Valid Access codes window is a visual aide when entering multiple access codes.

If an invalid access code is entered, an "Invalid Entry" message is displayed on the scratchpad window.

The graphic of the world map displays white dots for airport locations contained within coverage regions. This is to give an indication of the coverage areas available under the current subscription coverage and any additional subscription coverage using access codes.

The volume label is read from the CD and stored. It is displayed as part of this window. Whenever a new Jeppesen CD is loaded, as a check, the pilot need to confirm that the volume label stencil on the CD matches the displayed volume label. When the Jeppesen data is current or up to date, the volume label is displayed in green. If the Jeppesen data is used beyond its intended cycle time, the volume label is displayed in amber.

In addition, "My contain outdated information" is displayed to the right of the volume label in amber to indicate the database needs to be updated. This notification is only displayed when the chart data is outdated. If the dataset is outdated, the user is prompted to acknowledge the continued use of the dataset upon first use of the chart function after power-up.

## CHART TITLE BAR AND PULL DOWN MENU

The displayed chart title is shown beneath the airport title bar and above the chart window. In the following example, the ILS Rwy 30L CAT II chart is displayed.

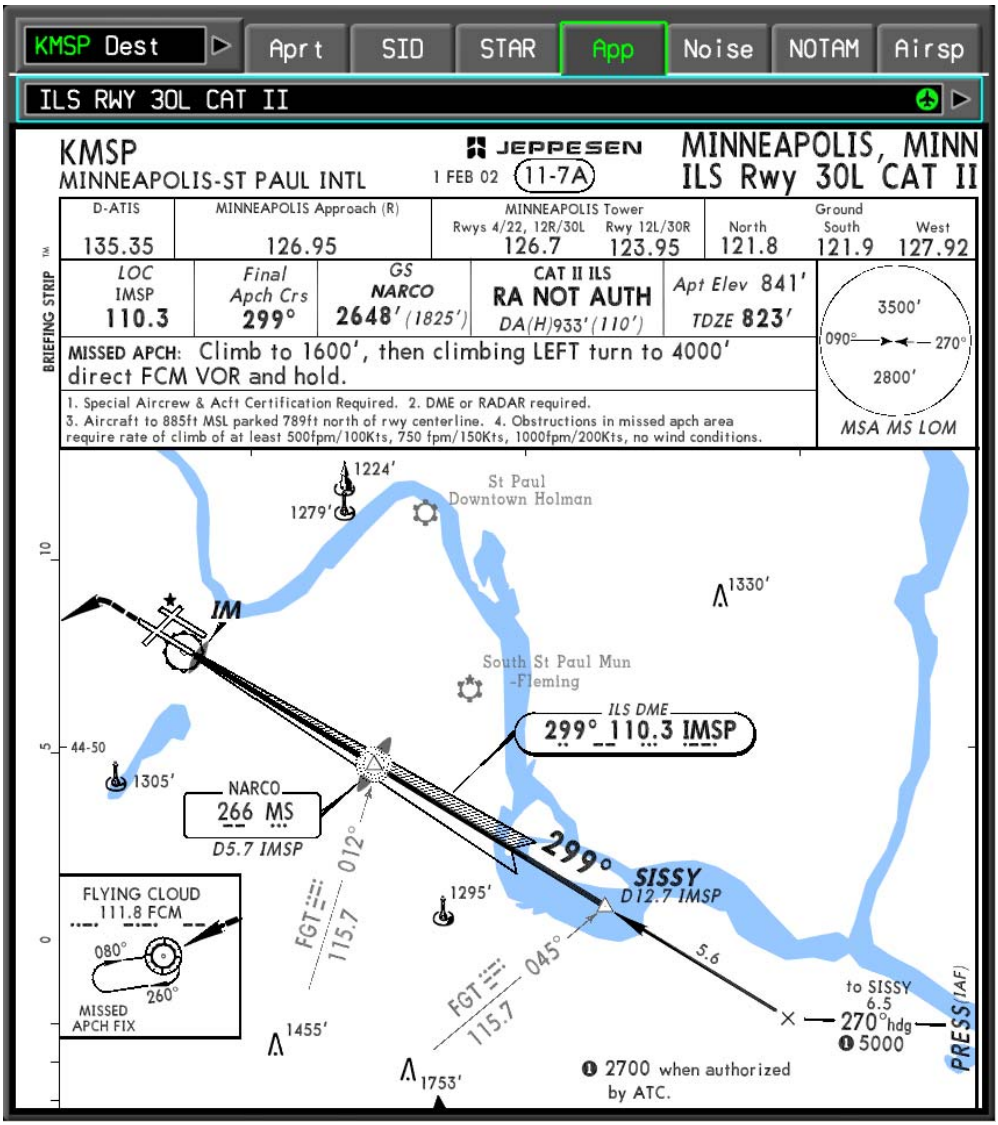
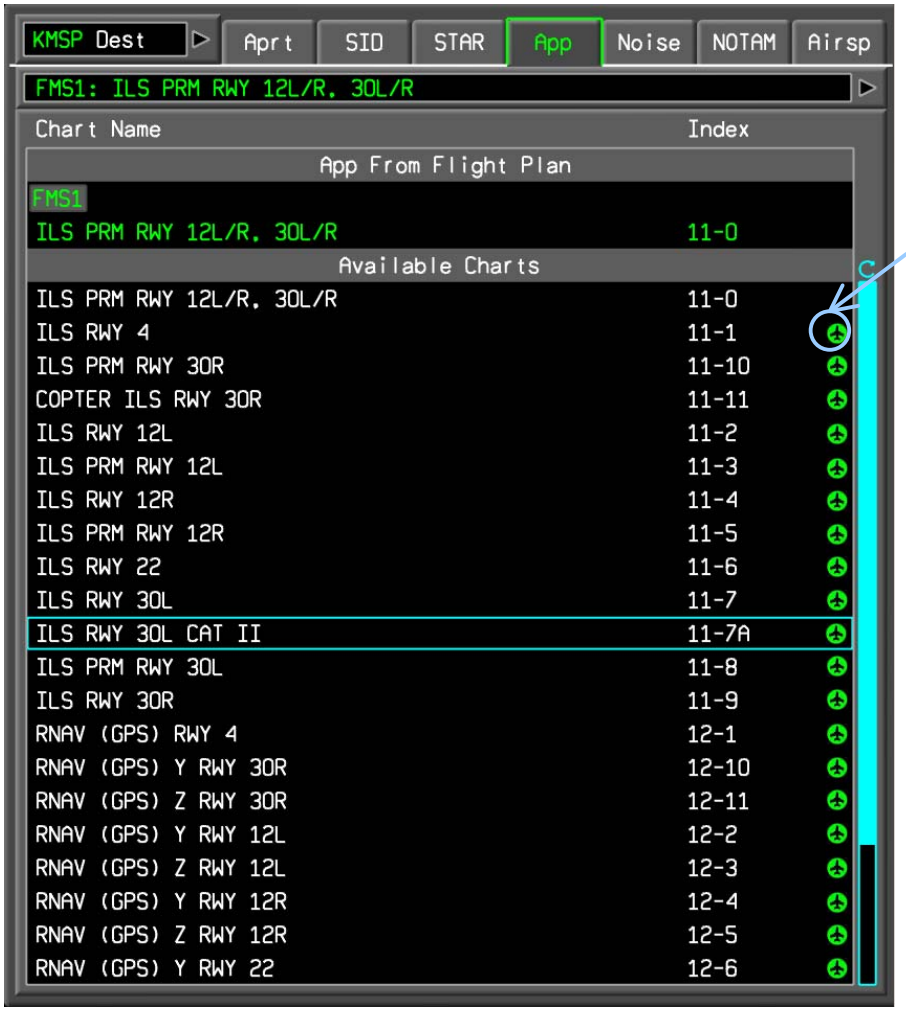



**FIGURE 02-34-22-04 CHART TITLE EXAMPLE**

The chart pull-down menu is used for chart selection. Selecting the chart title bar activates the chart pull-down menu. The pilot is able to select the desired chart from the displayed list in the menu as the following example:




The geo-reference icon indicates the chart is geo-referenced and an airplane symbol can be displayed

**FIGURE 02-34-22-05 CHART PULL-DOWN MENU**

It is possible to scroll the list if it is too long. After the chart title is in view, the cursor is moved to the chart title to highlight it.

While other chart characteristics are available (e.g. revision date, action, effective date) only the plain English chart name, chart index number and geo-referenced icon are provided in the chart title pull-down menu.

The charts are separated into two sections:

- "App From Flight Plan" not available,
- "Available Charts" lists all the available charts for the selected airports and tab.

In some cases a third section may be displayed. In this instance, two versions of a chart may exist, a "current chart" and a "future chart".

Provided the tab is selectable, the system strives to always display a chart. If no chart exist within a given tab , the tab is grayed out and cannot be selected. However, in certain cases, for a given tab, the system does not select a chart:


**FIGURE 02-34-22-06 NO CHART SELECTED**

If no origin, destination, or alternate airports have been entered, only the "Search Aprt…" and "Revision Info…" tasks can be selected from the airport selection pull-down menu. In the event that there are no charts available for a selected airport, an amber message is displayed as shown:

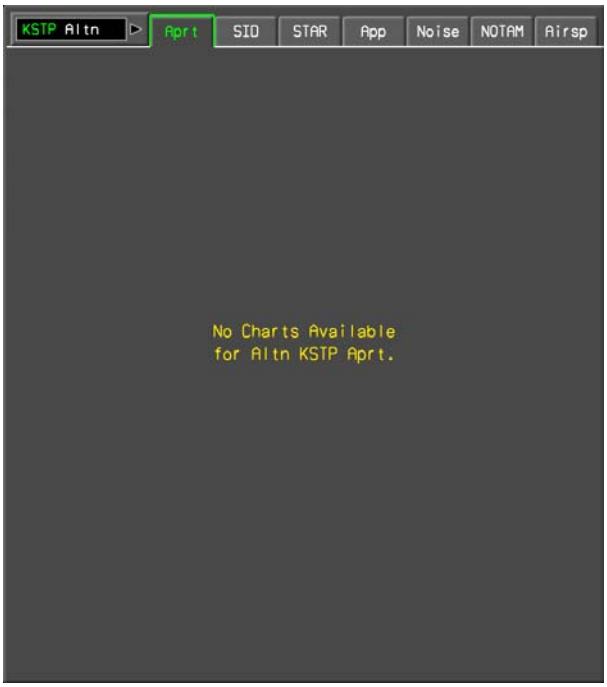



**FIGURE 02-34-22-07 NO CHARTS AVAILABLE**

## CHART TYPE TABS

### APRT TAB (AIRPORTS)

Airport diagram should be brought up onto the upper MDU.

It can be displayed for taxi to have an overview of the runways and for take-off briefing.

The pilot is not able to change the origin, destination or alternate airports within the chart function. These airports are defined from the flight plan.

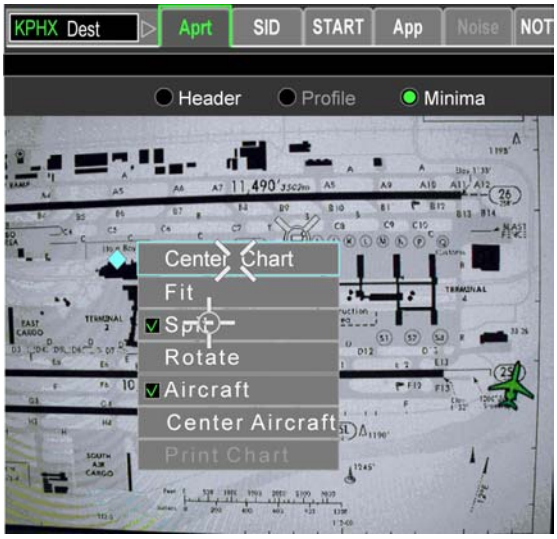



**FIGURE 02-34-22-08 APRT TAB**

"Aprt from Flight Plan" is a non available function.

"Available Charts" offers the list of Chart Name with their index, to select one chart, use the ball track to highlight it and confirm by clicking.

To see charts from an airport other that the flight plan one, use "Search Arpt".

### SID TAB

SID tab selection displays the selected airport departure chart.

### STAR TAB

STAR tab selection displays the selected airport arrival chart.

### APP TAB (APPROACH)

Approach tab selection displays the selected approach chart.

### NOISE TAB

Noise tab selection displays the noise abatement procedure if available.

## AIRSPACE

Airspace tab selection displays airspace overview.

## NOTAM TAB

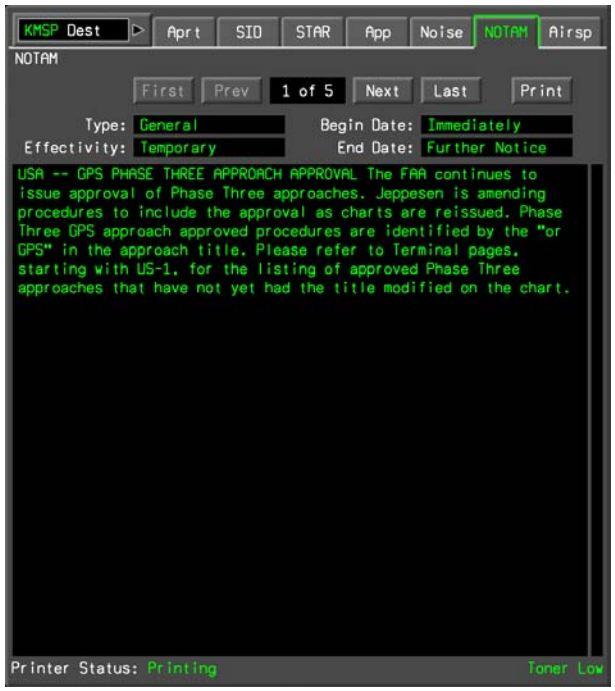



**FIGURE 02-34-22-09 NOTAM WINDOW**

NOTAM displayed in this window are always assigned or displayed using the airport as a reference. However, in the database, NOTAM are assigned either by an ICAO airport identifier or by country.

If a NOTAM is assigned to the country, it applies to all airports in that country.

Each NOTAM has four fields:

- Type: either Terminal or General, The database is populated with three entries for this field. Terminal, General and Gen Tmnl. The Terminal entry indicates that the NOTAM is associated to a specific airport and is displayed as "Terminal". The General and Gen Tmnl entries indicate the NOTAM are associated with a country and are displayed as "General".
- Effectivity : either Permanent or Temporatory. The database contains either true or false. If the database contains true, "Temporary" is displayed otherwise "Permanent" is displayed.
- Bigin Date contains two types of entries: "Immediately or an actual date displayed as "DDMMMYY".
- End Date contains three types of entrie: "No End Date", "Further Notice", or and actual date displayed as "DDMMMYY".

A scroll bar is displayed if a single NOTAM contains more text than available space in the window.

## CHART TASK MENU

The chart task menu provides an interface for the manipulation of the charts within the window. It is accessible by clicking on any location of the displayed chart:

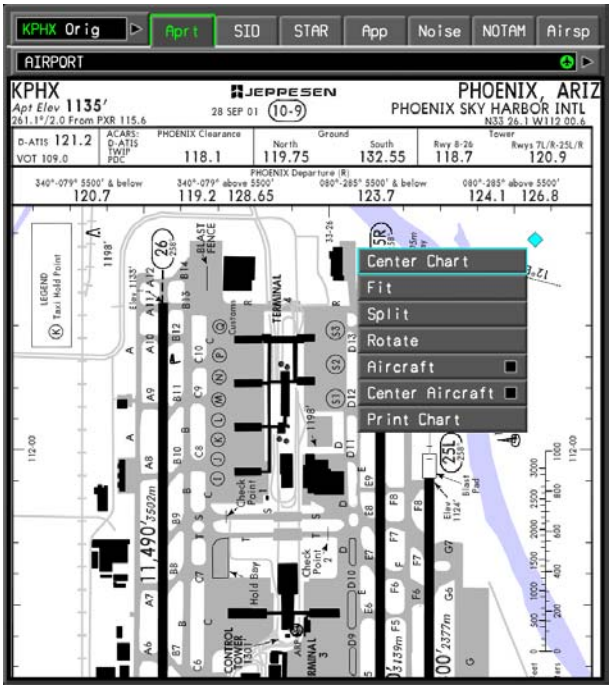



**FIGURE 02-34-22-10 CHART TASK MENU**

It provides seven available tasks:

- **Center Chart** allows to center the chart at the point of focus where the chart was clicked on. This task is used in conjunction with magnification to increase the readability of the charts,
- **Fit** provides a means to quickly view chart, the chart is scaled either horizontally or vertically so that the smallest dimension of the chart fills the window,
- **Split**. checkbox is selectable if the chart can be split into two parts. A large part shows the plan portion and a smaller part shows the header, profile or minima portion. check box is not available for all charts. The dimension for two split windows is determined by the chart software and can not be changed. No scrolling function is available. Once the chart has been split, the user shall have the ability to sequence the smaller or bottom portion between the profile, header and minimum portions. Different zoom factors are permitted between the two windows,
- **Rotate** allows to rotate the chart 90° clockwise and then 90° counter-clockwise to return to the original orientation. It is not selectable from the task menu for charts that can not be rotated,

- **Aircraft** Jeppesen terminal procedure charts support the capability of displaying an airplane symbol on some airports chart. These types of charts are referenced as "geo-referenced" by Jeppesen. The position of navigation symbols depicted on the charts have been verified by Jeppesen to be highly accurate by cross-checking the symbol plots against independent navigation data. Not all airports charts are geo-referenced. The default mode is that the chart remains fixed and the airplane moves about the chart. The following limitations are required to display the airplane symbol:
  - the chart must be geo-referenced,
  - WOW must be true,
  - the FMS must be valid with valid data (bearing and position),
  - the airplane position must be visible on the display.
- **Center Aircraft** is selectable when the **Aircraft** task is selected. It allows to display the airplane symbol in the center of the chart display. The charts move relative to the airplane, up to the point when a chart edge is reached. When the chart edge aligns with the edge of display, the airplane moves relative to the display,
- **Print Chart** is not available.

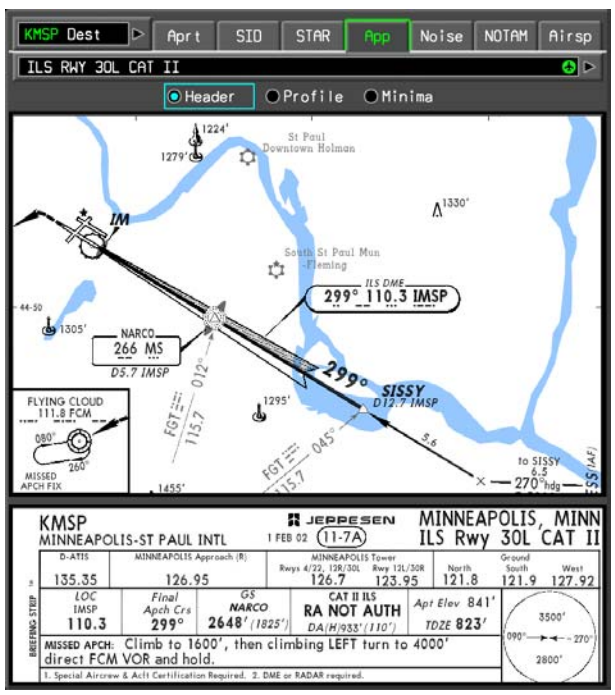



**FIGURE 02-34-22-11 SPLIT WINDOW EXAMPLE**

## SPECIAL FUNCTION

### ZOOM FUNCTION

The CCD knob controls the zoom of the chart window. The maximum zoom (most magnification) is constrained to an approximate 2× magnification of the initial chart size.

The minimum zoom of the chart (regardless if the split screen is enabled) is equivalent to the size of the chart, such as, the chart can be viewed in its entirety in an unsplit display window.

The magnification location is the center of the chart window.

### SCROLL FUNCTION

The scroll frame is enabled whenever the cursor is placed along the chart display edge in any direction. Scrolling can be performed by placing the cursor within the scroll frame on the outer edge of window.

Once the cursor is located within the frame leg of the desired scroll direction, the CCD ENTER pushbutton is used to control the scrolling.

For each CCD designation, the chart scrolls in increments in the direction of the arrows.

Scrolling is limited to the point where the edge of the chart reaches the edge of the window.

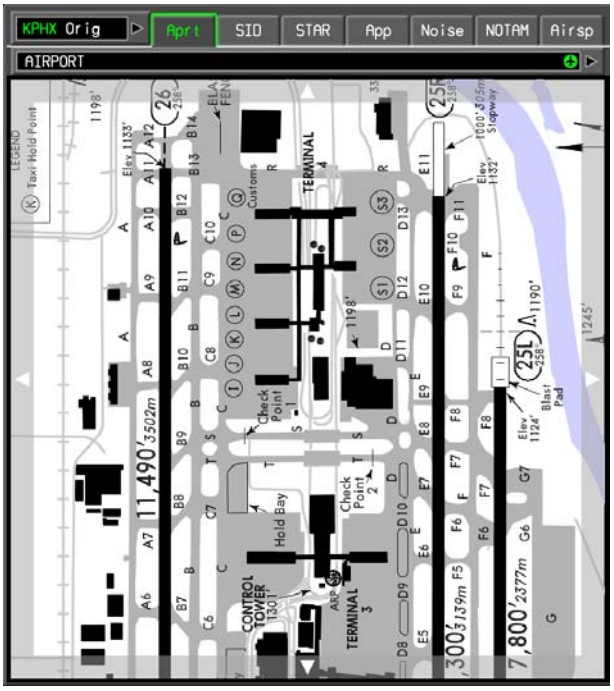



FIGURE 02-34-22-12 SCROLLING EXAMPLE

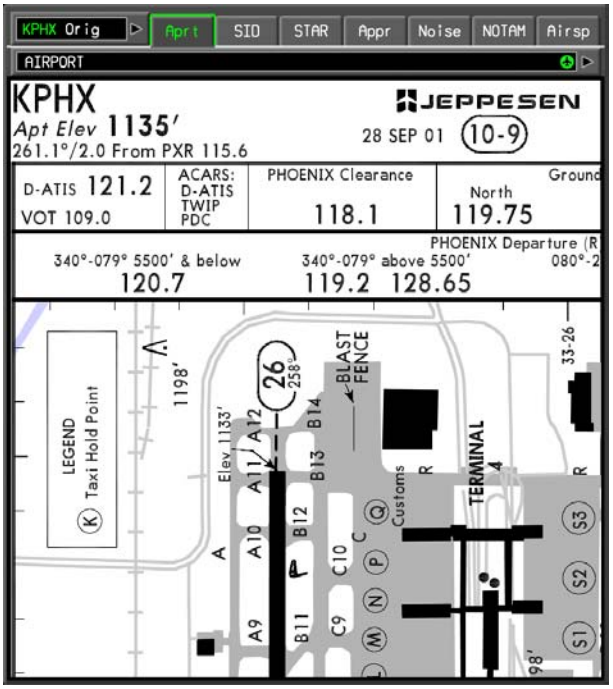



**FIGURE 02-34-22-13 SCROLLING TO CHART EDGE**

In some cases charts may need to be updated, deleted or revised in the middle of the database release cycle. To accommodate this, some charts have an action code associated with them:

- "A": chart is to be added,
- "R": chart is to be revised,
- "D": chart is to be deleted.

Based upon dates and flags included in the database some charts may have an effectively date. In that case the chart may either be effective in the future or may be passed effective,i.e., the chart is to be added to or deleted from the list of currently effective charts. Based upon the setting of the dates and flags in the database, these charts may be enable to be viewed.

Future effective charts have an affectivity date associated with them and are not used for navigation until the effective date. Similarly, past effective charts are not to be used after the effective delete date.

**INTENTIONALLY LEFT BLANK**

## GENERAL

SENSORS windows (access by PDU MENU) provides acces to:

- airplane position sensors management (IRS, VOR / DME, GPS),
- navigation function (FMS),
- environment sensors (WX, LSS and TAWS).


**FIGURE 02-34-24-00 SENSORS WINDOW SELECTION**

SENSORS window can be displayed on pilot request in the lower 1/6 of each PDU

It provides two main tabs:

- Navigation,
- WX/LSS/TAWS (Weather radar / Lightning Sensor System / Terrain Awareness and Warning System).

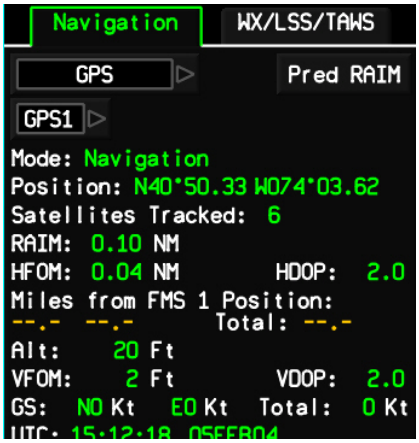



**FIGURE 02-34-24-01 SENSORS WINDOW NAVIGATION TAB**

## NAVIGATION TAB

In the Navigation tab, a menu in the top left corner allows to select different level of navigation information. The intent of these selections is to provide a hierarchical view of the navigation status to the pilots.

The highest levels contain summary information and use graphics to aid in quick understanding. The lower levels contain more specific sensor information and details, and would be used to resolve navigation issues presented on the first few selections.

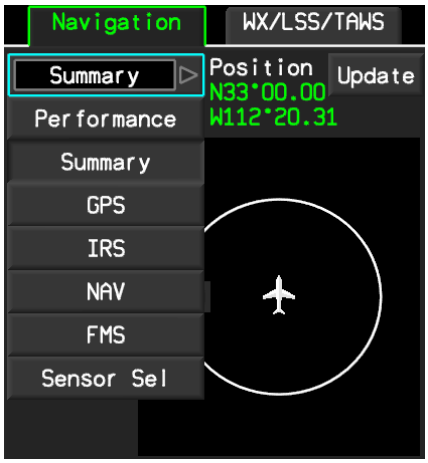



**FIGURE 02-34-24-02 NAVIGATION TAB PULL DOWN MENU**

The highest level page, called Performance, provides a summary of the navigation status:

- Estimated Position Uncertainty (EPU),
- Required Navigation Performance (RNP) for the current phase of flight.
- FMS Horizontal Navigation Mode

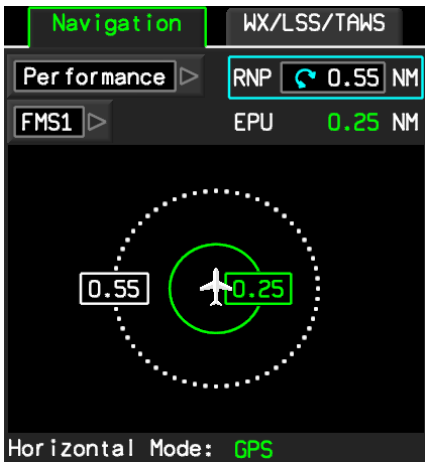



**FIGURE 02-34-24-03 PERFORMANCE SELECTION**

The graphical presentation provides the synthesis of the navigation performance of the airplane: EPU circle is green while RNP circle is white (dashed) (it corresponds to a limit).

The RNP values automatically vary according to each POF.

The RNP value is settable in the upper right corner. A defaults value comes from either the data base or the RNP setup (Avionics tab). The value is displayed in green unless for a pilot entry (white). If a pilot entry is greater than the default value, a dialog box " Confirm Entry" pops up with "Yes" or "No" selections.

The EPU value is the current value computed by the indicated FMS. It is green or amber when exceeding the RNP value. The value corresponds to the ring radius in NM.

The Horizontal Mode readout at the bottom of the window displays the current FMS navigation mode in green. Possible modes are:

- GPS,
- IRS,
- VOR/DME,
- DME/DME,
- Dead Reckoning.

If the EPU becomes greater than the RNP, the EPU circle turns in filled amber to alert pilot attention.

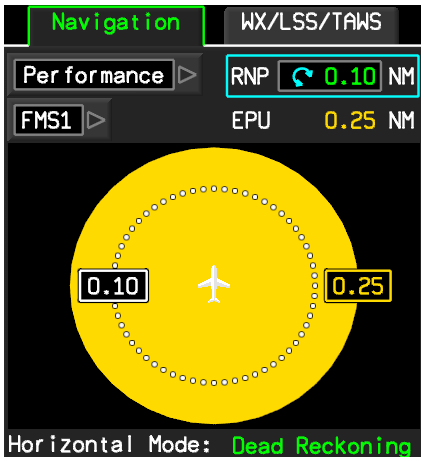



**FIGURE 02-34-24-04 RNP LOWER THAN EPU**

For example, during a FMS approach, the RNP is automatically selected at 0.3 NM. If the EPU becomes higher than RNP, the APP annunciator at the Top of the ADI becomes amber and the DGR indication is displayed at the bottom of the HSI. Also the FMS message "UNABLE RNP" would be displayed in INAV window.

In that case, the crew has to perform a go around if in IMC conditions.

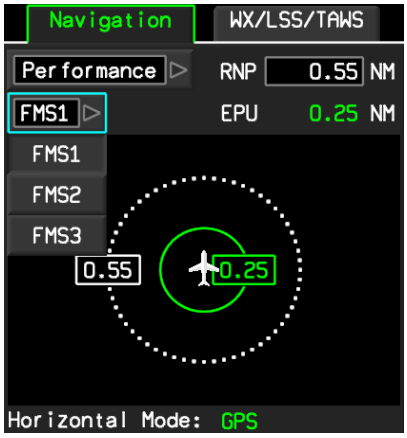



**FIGURE 02-34-24-05 PERFORMANCE PULL DOWN MENU**

The selection allows the choice of any FMS. The selected FMS then becomes the data source for the page and provides the EPU, RNP, and Horizontal Mode. In fully synchronous mode the RNP should always be the same between all FMS.

**Summary Selection**

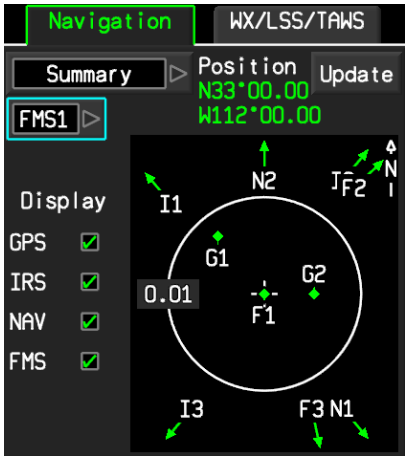



**FIGURE 02-34-24-06 NAVIGATION TAB SUMMARY SELECTION**

This page provides a graphical representation of the relative position of all position sources compared to the currently calculated airplane position.

The current airplane coordinates are displayed in the top right corner. The Update soft key allows to update the current position of the indicated FMS.

**NOTE**

The Navigation tab Update soft key has effects only on the selected FMS.

The check boxes on the left hand side allow to enable or disable the indicated position source display on the graphic.

The graphic depicts the current airplane position (as computed by the selected FMS) in the center. The white range ring is set to the current RNP value.

A digital readout displays the actual range. The position sources are displayed relative to the airplane. If a source is beyond the page limit, it is indicated with an arrow at the correct bearing. The display is always depicted North Up.

The labels for the sensors position are:

- I = IRS,
- F = FMS,
- G = GPS,
- N = Nav Radio.

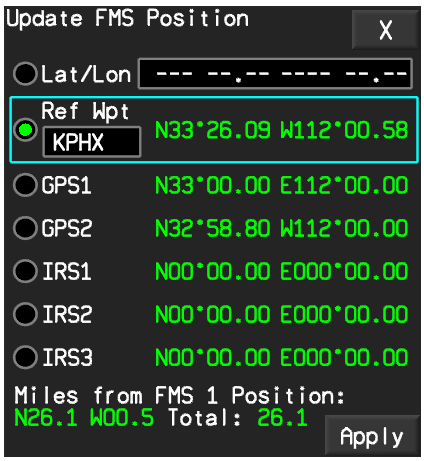



**FIGURE 02-34-24-07 UPDATE FMS POSITION SELECTED**

The dialog box allows to update the selected FMS current position:

- **Lat/Lon** selection allows a latitude and longitude manual entry,
- **Ref Wpt** selection allows a waypoint identifier manual entry. The lat/lon of that point is then determined and displayed adjacent to that field in green,
- the remaining pushbuttons allow the selection of a specific position source. Only configured sources are displayed.

Selecting **Apply** updates the indicated FMS position with the selected position.

### Gps selection

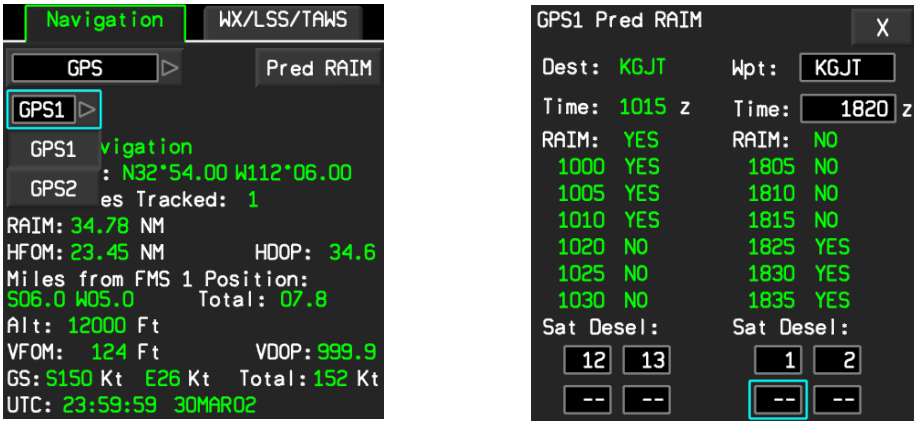



**FIGURE 02-34-24-08 NAVIGATION TAB GPS SELECTION**

All data come from the selected GPS. Data is non modifiable.

RAIM (Receiver Autonomous Integrity Monitoring) corresponds to the horizontal integrity limit of the RAIM

HFOM (Horizontal Figure Of Merit) corresponds to the accuracy of the calculated position of the GPS horizontal precision (in NM). It is equivalent to the EPU.

VFOM (Vertical Figure Of Merit) corresponds to the calculated position of the GPS vertical precision (in ft).

HDOP (Horizontal Dilution Of Precision) corresponds to the horizontal constellation quality from a geometry standpoint. HFOM is a function of the HDOP.

VDOP (Vertical Dilution Of Precision) corresponds to the vertical constellation quality from a geometry standpoint. VFOM is a function of the VDOP.

HDOP and VDOP value is based on a scale from 1 to an unlimited value.

GPS selection is made up with a Pred RAIM soft key (Predictive Receiver Autonomous Integrity Monitoring):

- The left column is automatically filled with the destination and ETA as soon as available. The first line indicates if “yes or “no” the RAIM for the indicated time (UTC time) is available. Additional information is given by ETA + 5 min steps,
- The right Wpt and Time fields allow to enter any waypoint and time (within 24 hours of current time) to compute a predictive RAIM solution at entered time. Additional information is given by 5 min steps,
- The Sat Desel fields are used to deselect satellites for either the Destination or Pilot Waypoint Predictive RAIM calculation by entering the satellite number. Deleting a pilot entry return the field to dashes. The fields are automatically cleared upon landing.

If the result of predictive RAIM computation is that RAIM conditions will not be available, UNAVAIL is displayed next to the RAIM.

### IRS selection

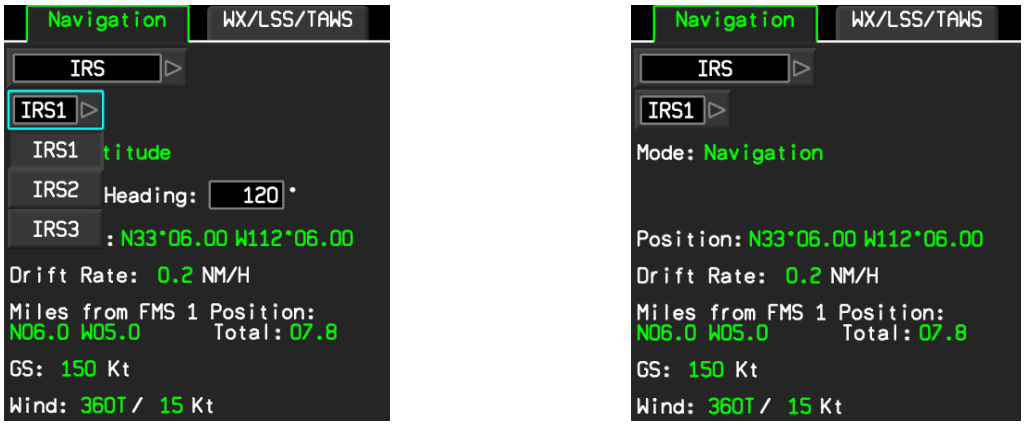



**FIGURE 02-34-24-09 IRS SELECTED**

The data come from the selected IRS except for the Miles from FMS X (corresponding to the master FMS) position, and the drift rate which are computed by the FMS.

Different modes are:

- Align is the automatic mode at power up, the Time to Nav parameter is displayed below the Mode parameter (as shown below).
- Navigation is automatically displayed when the IRS alignment is done ("Time to Nav" is then erased).
- Attitude is displayed when the position computation is lost while attitude remains available. A heading input is required, and the Set Mag Heading input line is displayed. It allows a magnetic heading manual input into the IRS (available in next certification).

On the apron, the IRS alignment position is automatically set to the FMS position. The alignment duration depends on the latitude (around 7 min at 45°).

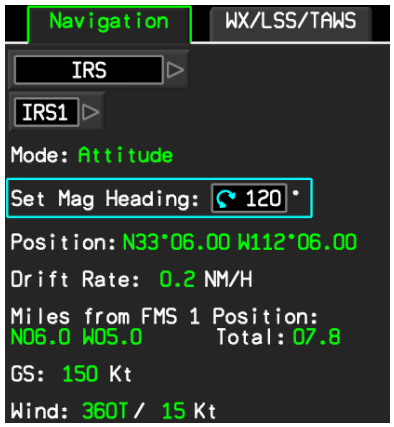



**FIGURE 02-34-24-10 IRS SELECTION MODE ALIGN AND ATTITUDE**

**Nav selection**

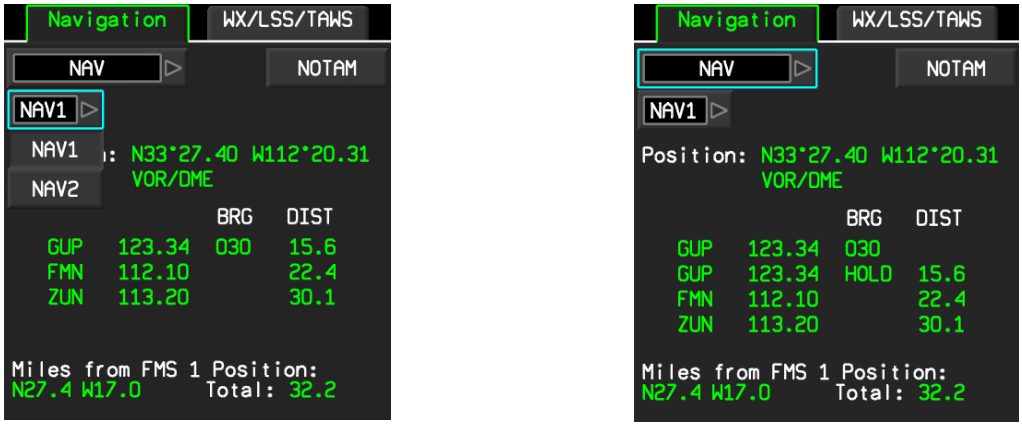



**FIGURE 02-34-24-11 NAV SELECTED**

The data come from the selected Nav Radios excepted for the Miles from FMS X (corresponding to the master FMS), actual position and position sources which are computed by the FMS. If a data parameter is not available, NCD is displayed dashed.

The IDENTS for the frequencies are displayed based on the existing FMS logic.

The NOTAM soft key allows the designation of up to six NOTAM (three permanent, and three temporary) (cleared at power off).

The default is white dashes. If the custom DB is not available due to a crossloading or uploading function, Updating DB is displayed below the NOTAM list and entry boxes are grayed.


**FIGURE 02-34-24-12 NOTAM SOFT KEY SELECTED**

**FMS selection**

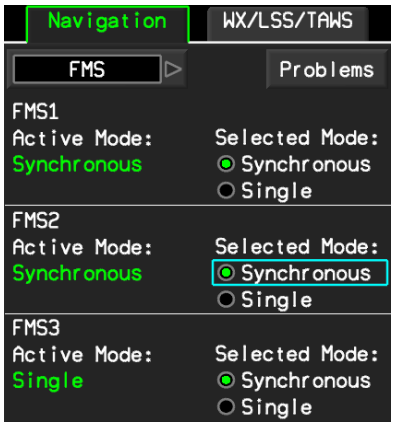



**FIGURE 02-34-24-13 FMS SELECTED**

This window allows to select between Synchronous or Single mode for each FMS.

Synchronous is the default selection.

If the active mode does not match the selected mode for any FMS, the Problems soft key becomes selectable:

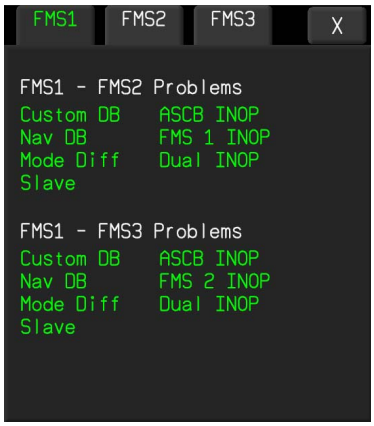



**FIGURE 02-34-24-14 PROBLEMS SOFT KEY SELECTED**

Problems that prevent the active mode from transitioning to the selected mode all listed for all FMS.

Problem messages are:

- Custom DB: the two (or three if available) FMS can not find the same Custom DB and can not synchronize. The pilot has to transfer data from the Custom DB to the FMS (it takes more or less 1 min).
- Nav DB: the FMS can not find the same Nav data base. The pilot has to transfer the data base from one FMS to another to be able to get the Synchronous mode (it takes more or less 45 min).
- Mode Diff.
- Slave: FMS are unable to synchronize.
- ASCB INOP: Avionics Standard Communications Bus (ASCB) is inoperational, information can not be transmitted between the FMS. The pilot has to select Single mode.
- FMS X INOP.
- Dual INOP.

**Sensor sel selection**

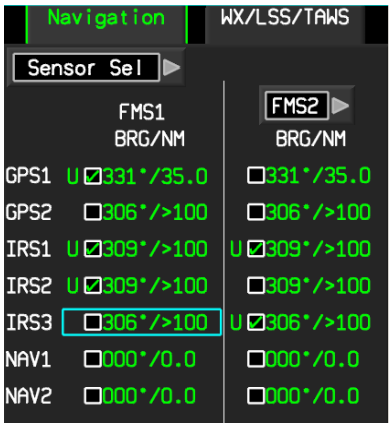



**FIGURE 02-34-24-15 SENSOR SELECTION**

This window allows to select or de-select sensors for use by the FMS in their position calculation.

The default selection is the on side FMS. The right column then defaults to the cross-side selected FMS.

The third (non displayed) FMS is still available through the pull down menu.

To select sensor, click in the corresponding check box. When the sensor is correctly being used a U is displayed.

The distance and bearing from the indicated FMS for the sensor are also displayed in green.

## WX / LSS / TAWS TAB

The WX/LSS/TAWS tab provides menu to control secondary modes / functions of the Weather Radar, the LSS and TAWS.

Primary controls of these functions are provided on the MKB.

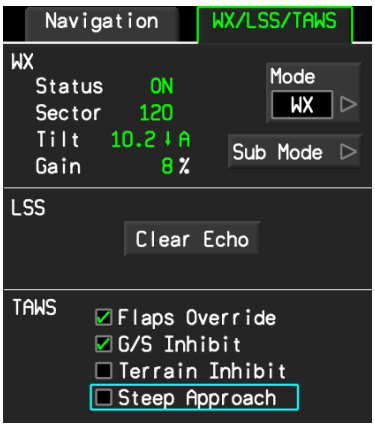



**FIGURE 02-34-24-16 WX / LSS / TAWS PAGE**

WX controls:

- -readout for WX status, sector, tilt and gain,
- -WX mode selection (WX, GMAP, …),
- -WX sub-mode selection.

Sub Mode sections are:

- REACT (Rain Echo Attenuation Compensation Technique): enable to compensate for attenuation of the radar signal at it passes through rainfall,
- TURB (Turbulence): enable the turbulence detection mode,
- TGT (TarGeT): enable and disable the radar target feature,
- STAB (Stabilization): enable in-flight attitude stabilization.

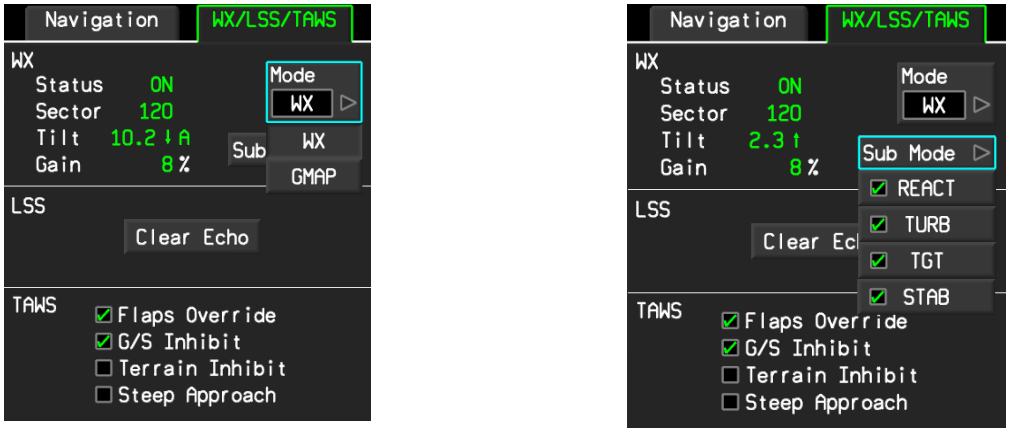



**FIGURE 02-34-24-17 WX PULL DOWN MENU**

LSS controls:

- Clear Echo soft key. It is a momentary action soft key, and is only displayed when an LSS is configured.

TAWS controls:

- -mode 4 Flaps Override selection,
- -mode 5 G/S Inhibit selection,
- -enhanced Mode Terrain Inhibit selection,
- -mode 1 Steep Approach selection.

Steep Approach and Flaps Override selections are also available on the Flight Management window. Those function can be selected in either window and the system automatically updates the other one.

G/S Inhibit and Terrain Inhibit selections are also available on the MKB.

AVIONICS window (access by MDU MENU) provides access to system initialization and setup functions, data base management function and tools functions.

## INIT TAB

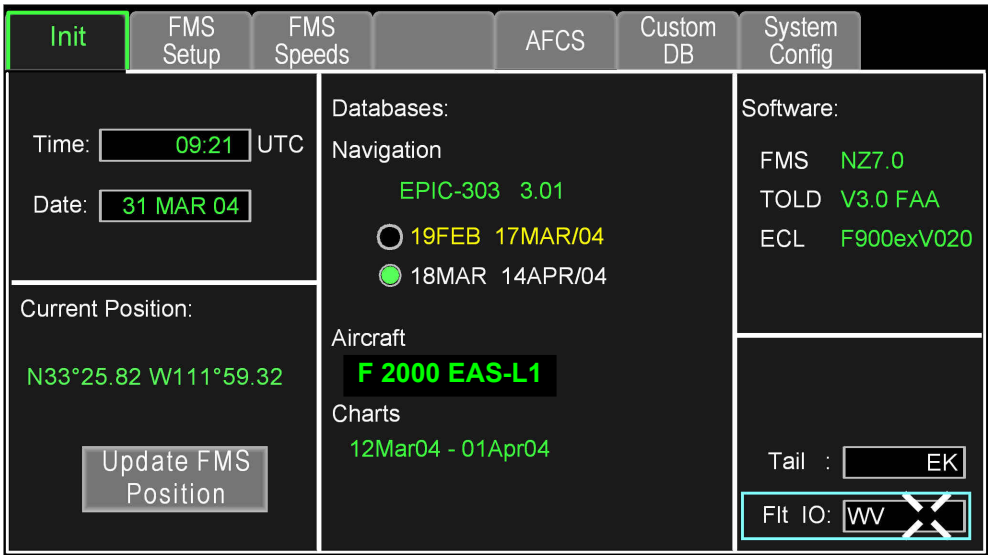



**FIGURE 02-34-28-00 AVIONICS WINDOW INIT TAB**

Avionics window provides access to the system initialization and setup functions, data base management functions and tab function through six main tabs:

- **Init**,
- **FMS Setup**,
- **FMS Speeds**,
- **AFCS**,
- **Custom DB**,
- **System Config**.

Init tab is the default tab upon power up. Init tab allows to:

- Initialize system internal time and date. Values are synchronized to GPS by default. It is not possible to set the time manually in this case. If GPS time is not available it is possible to set the time/date manually and update the internal clock (supplied by the MAU),
- display current position. The current position field contains the master FMS readout. Selecting the Update FMS Position pops up the Update FMS position dialog box,
- access Update FMS Position dialog box. Using the Update FMS Position soft key updates all available FMS and IRS:

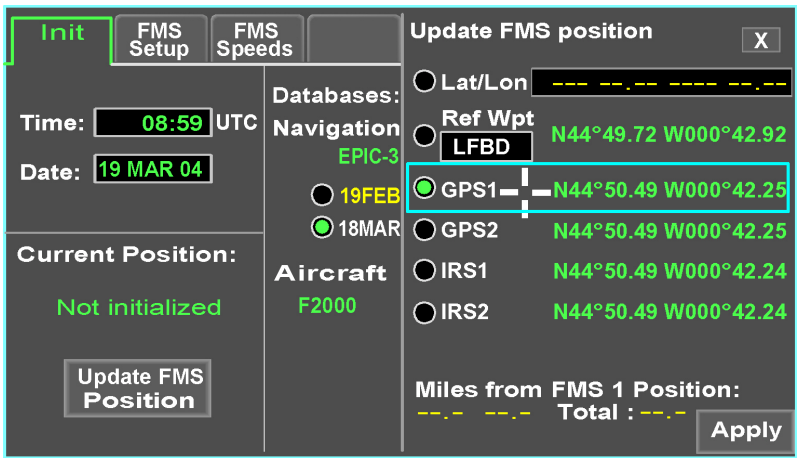



**FIGURE 02-34-28-01 UPDATE FMS POSITION DIALOG BOX**

  - Lat/Lon selection allows to enter a latitude and a longitude which becomes the reference position,
  - Ref Wpt selection allows to enter an airport OACI code or any other waypoint. Its coordinates are automatically displayed,
  - GPS or IRS selection allows to choose between the sensors the one to be the position reference,
- selecting any pushbutton makes the Apply soft key be selectable,
- display data base and software versions. The Databases field displays the current status of the various data bases loaded into the system, it needs to be checked by the crew. The airplane data bases are displayed to verify that the correct airplane type has been loaded. The charts data base version is displayed if the charts function is installed,
- select navigation data base cycle,
- enter airplane tail number.

The Software item displays the software version. It has to be cross-checked by the crew to make sure this is the correct version for the airplane.

The Tail # field displays the airplane tail number, it is modifiable and saved by the system.

The Flt ID field is used to enter a flight identification which is then used by the transponder. Once a value has been entered it is saved by the system. Deleting the value returns the field to white dashes.

## FMS SETUP TAB

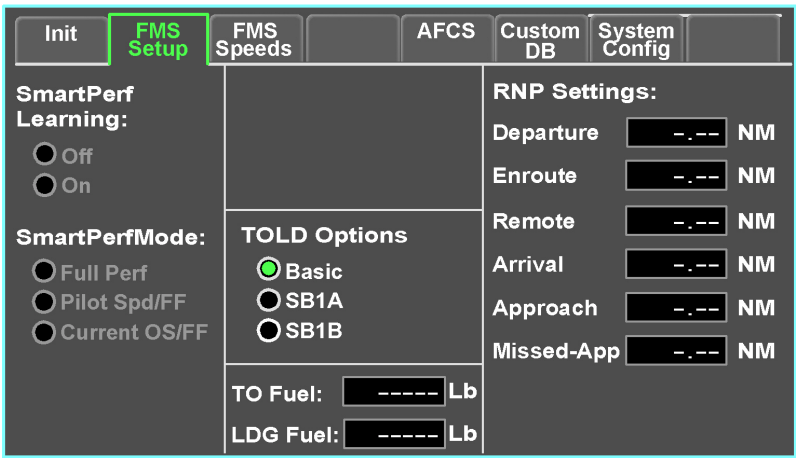



**FIGURE 02-34-28-02 FMS SETUP TAB OF AVIONICS WINDOW**

FMS Setup tab gathers all setup functions of FMS:

- SmartPerf Learning field allows the function to be enabled or disabled (default On), this function is usually used for a long range flight (greater than 600 NM),

> **NOTE**
>
> SmartPerf Learning should be set to Off.

- SmartPerf Mode selection (default Full Perf). The crew may decide to deselect Full Perf when the flight is not representative of a normal flight (training flight). The selection of the Spd/FF or of the GS/FF is only used when the Full Perf is not available,
- TOLD Options field allows the selection of the appropriate service bulletin for the airplane (default to SB1B or last selection state),

> **NOTE**
>
> The cruise performance prediction is independent of the TOLD option selections.

- TO Fuel field is used to set a default fuel quantity allowance for take-off in the performance calculations. The default comes from the last entered value or the airplane data base,
- LDG Fuel is used to set a default fuel quantity allowance for landing in the performance calculations,
- these values are estimated by the crew for the taxi, before take-off and after landing,

**RNP Settings** allows a RNP default selection for a particular phase of flight.The default values are:

- Departure: 1.0,
- Enroute: 2.0,
- Remote / Oceanic: 10.0,
- Arrival: 1.0,
- Approach: 0.3,
- Missed approach: 1.0 or the last entered value.

The order of priority for the active RNP limit is:

- manual setting on the sensors window,
- values from this schedule.

All selections are synchronized for all FMS, except for the Flight Summary Output selection which applies to the master FMS.(only one FMS prints or save the data).

## FMS SPEEDS TAB (WILL BE AVAILABLE FOR NEXT CERTIFICATION)

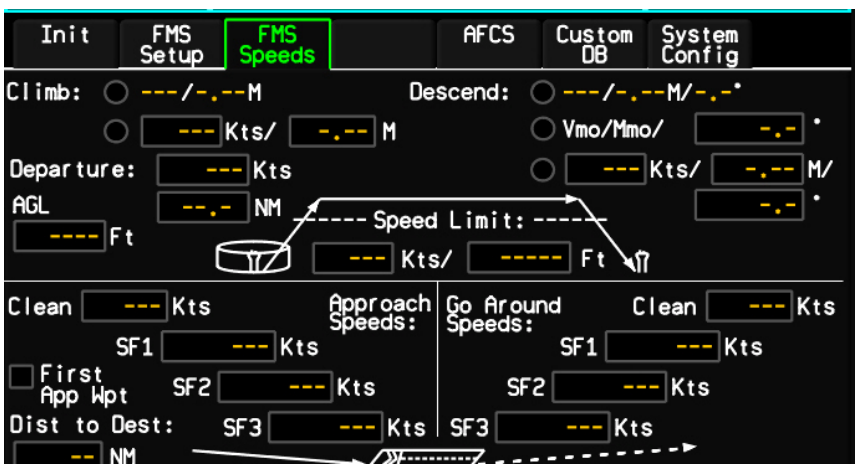



**FIGURE 02-34-28-03 FMS SPEEDS TAB OF AVIONICS WINDOW**

**FMS Speeds** tab:

- depicts indicated speed schedule used by FMS for each POF (departure, climb, descent, approach and go-around),
- allows to define envelope of Departure and Approach POF where speeds are applied. Approach and Go-around speeds can be based on TOLD computed values.

**NOTE**

FMS speeds guidance is not used in first and second certification software. Rotary switch on the Guidance Panel is inoperative (manual speed is always selected). However, performance utilizes the speed entries for predictions.

**Climb** field allows to select:

- A default value coming from the airplane data base (if the data base is not available this selection is grayed and not available),
- A manual selection. The manual field default values are the last entered values.

**Departure** field allows the entry of a single CAS speed target and the definition of the effective area for its use, altitude and range from the origin airport. The defaults are 2,500 AGL and 4 NM. The speed defaults to the airplane data base value or 200 kt or the last entered value.

**Speed Limit** fields allow a CAS entry which is used as the maximum speed below the entered altitude. The default values are 250 kt / 10,000 ft. It is possible to delete the Speed/Altitude limit (it then becomes dashed). The field retains the last entered value.

**Descent** field allows three selections:

- a default selection coming from the airplane data base,
- a Vmo/Mmo selection with a manually entered angle,
- a manual function to enter CAS / Mach / Angle.

**Approach speeds** fields allow selection of speeds for different Slats/Flaps (SF) configuration:

- **Clean** field allows CAS value entry, the default value is the airplane data base value or 200 ft,
- **SF1** field allows approach speed entry in SF 1 configuration, the default value comes from the airplane data base. Entries < minimum IAS indicate a delta from the reference speed and are displayed as “VRF+” plus the entry,
- **SF2** field is similar in operation to the SF1,
- **SF3** field allows either CAS value or V approach (VAP). There is no delta capability. VAP is the default value,
- **First App Wpt** check box indicates whether or not the approach speed should be activated at the first waypoint of the approach. The default value is checked,
- **Dist To Dest** field allows entry of a distance from the destination at which the approach speeds becomes active. The default is 15 or the last entered value.

Go Around speeds fields allow selections of speeds for different Slats/Flaps (SF) configurations:

- Clean field allows CAS value entry, the default value is the airplane data base or 200 kt,
- SF1 field allows go around speed target entry for Slats / Flaps 1 configuration. The default value comes from the airplane data base. Entry > data base placard speed results in an invalid entry. Entries < minimum IAS indicate a delta from the reference speed and are displayed as “VRF+” plus the entry,
- SF2 field is similar in operation to the SF1 field except for delta entries which are based on Approach Climb speeds and are displayed as “VAC+” plus the entry,
- SF3 field is similar except for delta entries which are based on Landing Climb speed and are displayed as “VLC+” plus the entry.

## AFCS TAB

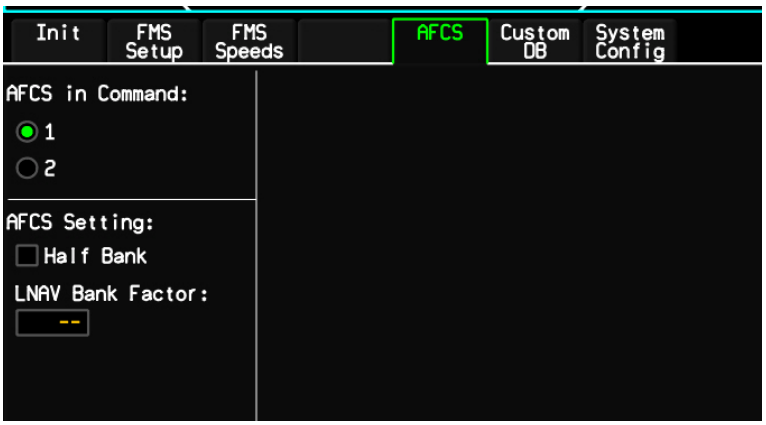



**FIGURE 02-34-28-04 AFCS TAB OF AVIONICS WINDOW**

AFCS tab gathers:

- AFCS in Command selection automatically changes at each power-up to minimize latent failure. It can be directly selected by the crew. In case of an AFCS failure, AFCS in Command is also automatically changed. The FD modes revert to basic mode,
- AFCS setting:
  - Half Bank selection (limit the bank at ½ of the normal value in HDG mode).

**NOTE**

On AVIONICS window AFCS tab, the LNAV Bank factor parameter, initialized by default at 7, can be modified. This modifiable parameter has a value between 1 and 15. This bank factor is only used in LNAV mode.

## CUSTOM DB TAB


**FIGURE 02-34-28-05 CUSTOM DB TAB OF AVIONICS WINDOW**

Custom DB tab gathers all functions to delete various sections of the custom data bases of the airplane:

- Pilot Waypoints data base,
- Flight Plan data base,
- NOTAM,
- entire Custom data bases.

The FMS pulldown menu allows to select the source of the displayed custom data base information. It is only available when there is a detected difference between any of the FMS custom data base.

Pilots waypoints: The list contains all currently defined pilot waypoints in the custom data base. A scroll bar is displayed when the list exceeds the area. (available in next certification)

Delete Pilot Wpt soft key allows to remove a waypoint from the custom data base.

Delete All Pilot Wpts soft key is always selectable. It allows to remove all pilot defined waypoints from the custom data base.

Delete All FPLNs soft key is always selectable. It allows to remove all pilot defined flightplans from the custom data base.

Delete All NOTAMs is always selectable. It allows to remove all NOTAM from the custom data base.

Delete All Custom DBs is always selectable. It allows to delete the entire custom data base (waypoints, flightplans and NOTAM).

The cross-load area is for the cross-loading of the custom data base:

- -“From” selection allows to select a single FMS as the source of custom data base,
- -“To” selection allows to select destination of the load. A one to one or a one to many transfer can be selected.

When the “From” and “To” selection have been made, the “Xload” soft key becomes active. Selecting the Xload initiates the load and causes the soft key to turn to “Abort” soft key. Selecting “Abort” cancels the cross-load. (It would causes the receiving FMS to have an empty custom data base and forces that FMS into the “Single” mode).

During the cross-load the current DB section being transferred and its percent are displayed in green.

When FMS are in single mode due to different CDB, Cross-load window allows to transfer one custom data base from one FMS to the other. In that case, FMS are automatically selected in synchronous mode.

## SYSTEM CONFIG TAB


**FIGURE 02-34-28-06 AVIONICS WINDOW SYSTEM CONFIG TAB**

System Config tab is only available on the ground. It displays configuration information for all installed software/data base and is used for return to service type operations.

Prev and Next soft key are used to cycle through the pages.

The WPT LIST window provides the waypoints and associated parameters for the active and pending FPLN.

It is available in any of the following size:1/6th, 1/3rd vertical, 1/3rd Horizontal, 2/3rd, ½ or full screen format.

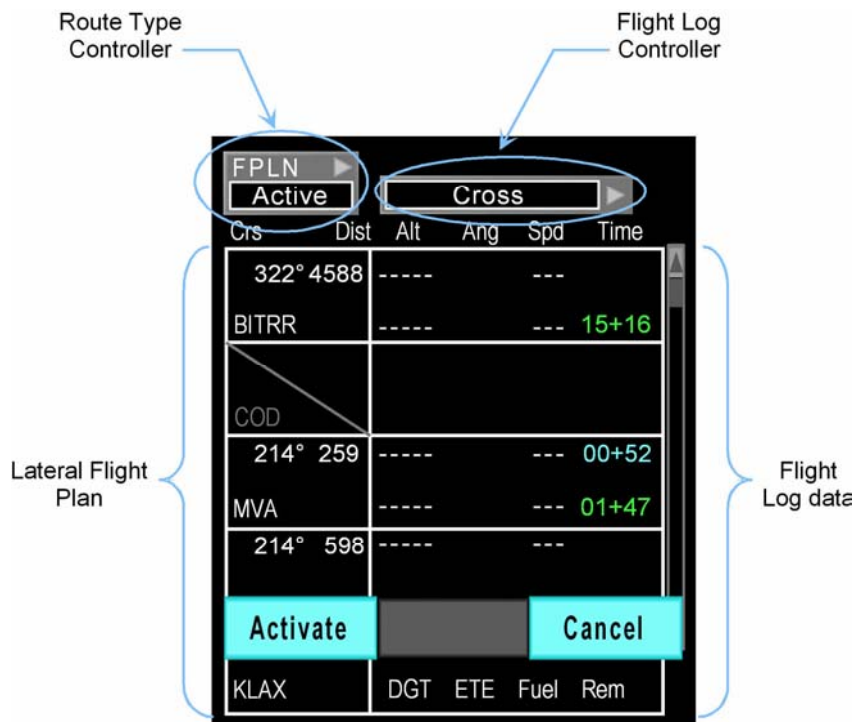



**FIGURE 02-34-30-00 WPT LIST WINDOW LAYOUT**

## WPT LIST LAYOUT

In order to accommodate all of the data for each flight plan leg, the waypoint list has been divided in two parts:

The left side of the window permanently displays lateral Flight Plan information:

- course / Distance / WPT name,
- associated functions; flyover, left turn, right turn, holding pattern,…
- Right side of the window displays for each waypoint all associated data necessary to manage a flight:
- Cross data: crossing constraints,
- Wind / Temp / ISA,
- Spd / Dist / Time,
- Fuel / Wt,
- Lat / Lon.

Bottom area of the WPT LIST provides permanent information about destination and alternate ( DTG, ETE, Fuel Rem).

Turning the CCD knob while in the WPT LIST scrolls the WPT LIST.

**COLOR CODE**

| WPT | ID CRS/Dist | Angle<br>Speed | Altitude<br>Time |
|---|---|---|---|
| From | Grey | | |
| TO | Magenta if LNAV captured<br>Amber for Waypoint Reversion*<br>Else White | Magenta if VPTH/VGP captured<br>Green if predicted,<br>Else White<br><br>Magenta if FMS Speed selected,<br>Green if predicted,<br>White if constraint | Magenta if VASEL or VALT captured,<br>Green if predicted,<br>White if Constraint,<br>Amber if Unable to meet<br>Magenta if RTA & FMS Spd selected & LNAV captured,<br>Green if ETA,<br>White if Constraint,<br>Amber if unable to meet |
| Next | Amber for Waypoint Reversion*<br>Else White | Green if predicted<br>White if Constraint<br><br>Green if predicted<br>White if constraint | Green if predicted,<br>White if constraint<br>Magenta if 1st RTA & FMS Spd selected & LNAV captured,<br>Green if ETA,<br>White if downstream RTA,<br>Amber if Unable to meet |

## WPT LIST ROUTE TYPE CONTROLLER


**FIGURE 02-34-30-01 ROUTE TYPE CONTROLLER MENU**

Route Type Controller (RTC) (FPLN) pull down menu is used to select between the Active and Secondary flight plan. The same controller is displayed in the Flight Management Window (FMW). (Secondary function will be available for next certification).

A selection made in the RTC affects all windows in the MDU where the selection was made. Therefore the I-NAV, FMW, and WPT LIST are synchronized to displaying the same flight plan within a DU.

For the same DU, when in active selection, the WPT LIST and I-NAV display Active and pending flight plan information.

For the same DU, when in secondary selection, the WPT LIST and I-NAV display active and pending flight plan information. The airplane symbol is never displayed in a DU used for secondary FPLN. It is obvious for the crew that the secondary FPLN is in progress.

At the same time; upper MDU can be configured to display Active flight plan and lower MDU configured to display the secondary FPLN.

The WPT LIST receives the data from the master FMS. This same FMS source is used for all windows in both MDU.

## WPT LIST FLIGHT LOG DATA


**FIGURE 02-34-30-02 FLIGHT LOG CONTROLLER PULL DOWN MENU**

When viewed in a 1/6th or 1/3rd vertical display, the following options are available for selection:

| | |
|---|---|
| Cross | The constraints and various operations on a specific waypoint are accessed through this function. The CROSS dialog box can be accessed by clicking on this field |
| Wind/Temp/ISA | Predicted wind, temperature, and ISA for each waypoint are shown. The Wind / Temp / ISA entry dialog box can be accessed by clicking on this field |
| Spd / Dist / Time | The predicted ground speed, distance-to-go (DTG), and ETE for each waypoint are shown. No pilot interaction is permitted |
| Fuel / Wt | The predicted fuel remaining and airplane gross weight for each waypoint is shown. No pilot interaction is permitted |
| Lat / Lon | The latitude/longitude for each waypoint in the flight plan is displayed. No pilot interaction is permitted |

The Cross display is the default selection when the WPT LIST is viewed in a 1/6th or 1/3rd vertical display.

When viewed in a 1/3rd horizontal or 2/3rd display, the following options are available:

- Wind/Temp/ISA,
- Spd/Dist/Time,
- Fuel/Weight,
- Lat/Lon.

The Cross data remains in view at any time in the second column for a 1/3rd horizontal or 2/3rd display.

The Wind / Temp / ISA display is the default selection for a 1/3rd horizontal or 2/3rd display.

## TURN DIRECTION ICONS

For large course changes, the FMS provides a turn direction indication on the WPT LIST. It consists in an inverse video L (Left) or R (Right) to indicate which direction the airplane is going to turn when the waypoint is sequenced.

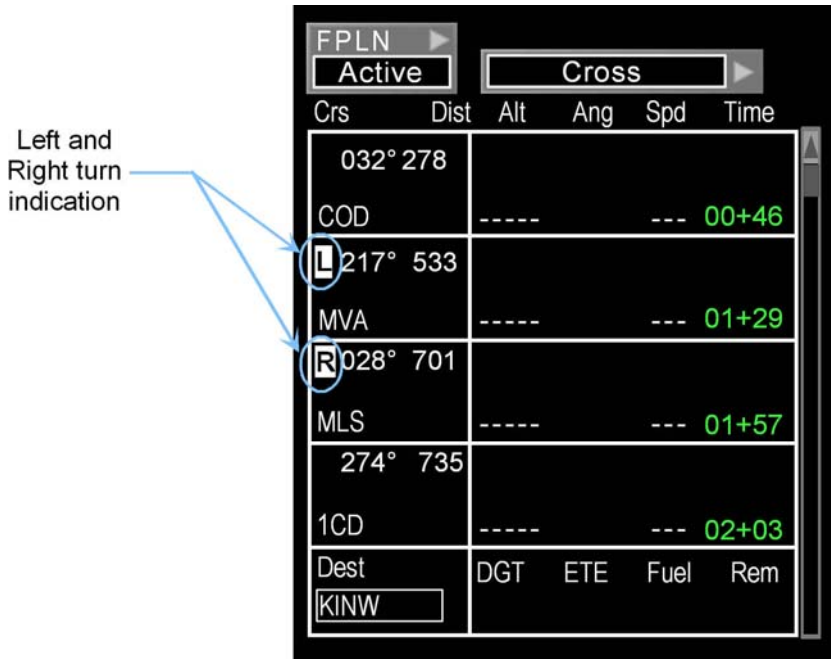



**FIGURE 02-34-30-03 L AND R TURN DIRECTION ICONS**

## WPT LIST GRAPHICAL INTERACTION

I-NAV graphical flight planning and WPT LIST modifications on active and secondary FPLN use the same menu and the same dialog boxes:

Menu and dialog boxes are not selectable for: TOC, TOD and BOSC WPT. The corresponding line on the WPT LIST is displayed with a gray background.

## COURSE

The inbound course is displayed immediately following the turn icon space, if the course is given with respect to True North, a T replaces the degrees symbol.

## DISCONTINUITY

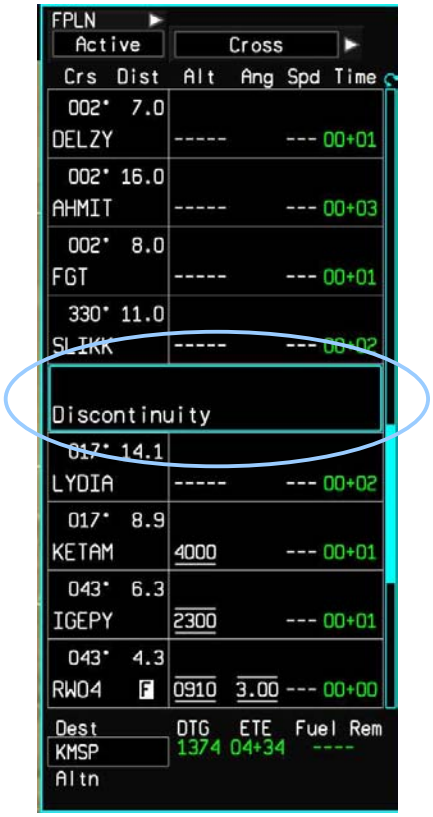



**FIGURE 02-34-30-04 WPT LIST DISCONTINUITY**

A discontinuity is a part in the flight plan where there is no lateral flight plan definition. Internally the FMS assigns the next waypoint with a leg type of Initial Fix (IF).

## NEXT LEG UNDEFINED


**FIGURE 02-34-30-05 WPT LIST NEXT LEG UNDEFINED**

Open flight plans are defined as flight plans that do not end at the destination. In that condition, the FMS does not have a lateral path defined to the destination. In that context, **Next Leg Undefined** is displayed.

## MISSED APPROACH HEADER


**FIGURE 02-34-30-06 WPT LIST MISSED APPROACH HEADER**

The missed approach header provides a visual break between the primary flight plan and the missed approach procedure.

## ALTERNATE FLIGHT PLAN HEADER


**FIGURE 02-34-30-07 WPT LIST ALTERNATE FPLN HEADER**

The Alternate FPLN header provides a visual break between the primary flight plan and the alternate flight plan.

## HOLDING

When the holding pattern is active, holding is displayed as bellow (logic for the Exit Hold, Resume… soft keys are described in the I-NAV chapter).


**FIGURE 02-34-30-08 WPT LIST HOLDING**

## EXITING HOLD

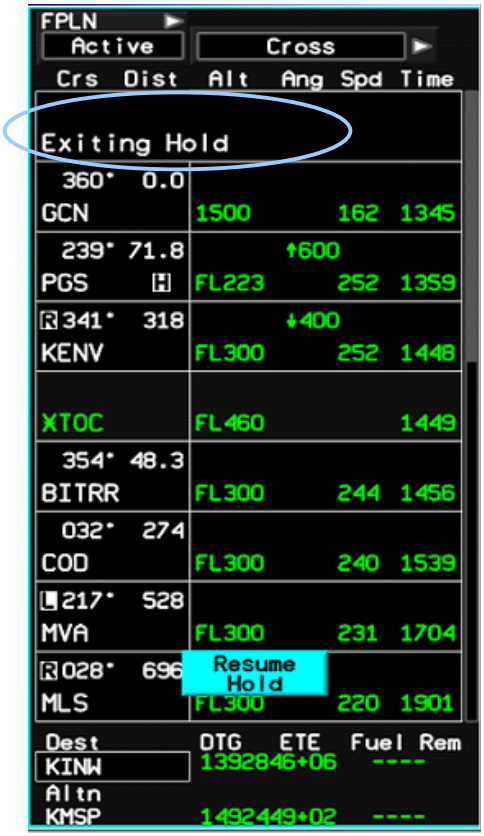



**FIGURE 02-34-30-09 WPT LIST EXITING HOLD**

When the airplane is exiting the hold, the FMS provides an **Exiting Hold** information on the waypoint list.

## ARC TURN

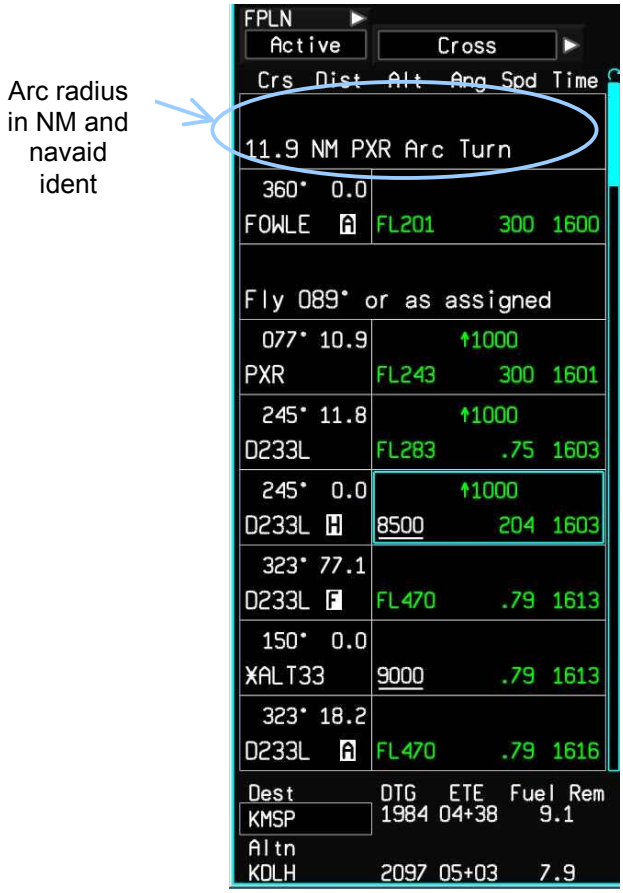



**FIGURE 02-34-30-10 WPT LIST ARC TURN**

When in a DME arc procedure, the arc radius in NM and the navaid associated with the arc are displayed as shown above.

Constant radius arc legs are similar but the navaid ident is blank since a navaid is not required for a constant radius arc leg.

## PROCEDURE TURN


**FIGURE 02-34-30-11 WPT LIST PROCEDURE TURN**

**Procedure Turn** is displayed when the procedure is active.

## PATTERN ICONS

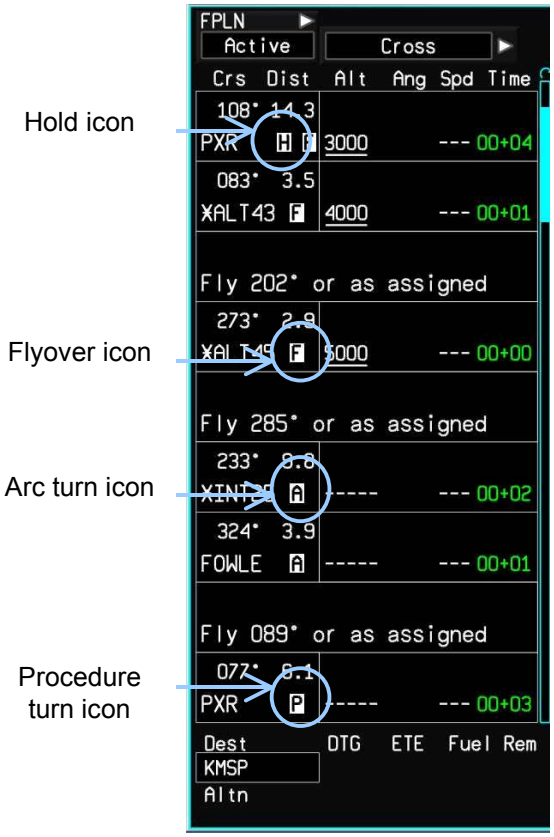



**FIGURE 02-34-30-12 WPT LIST PATTERN ICONS**

## CROSS


**FIGURE 02-34-30-13 WPT LIST CROSS 1/3RD VERTICAL DISPLAY FORMAT**

The Cross column displays vertical, speed and time crossing predictions and/or constraints for each waypoint.

The altitude fields displays either altitude constraints or predictive altitudes for each waypoint in the flight plan. Altitude constraints have higher priority over predicted altitudes. If no pending flight plan exists, the active flight plan altitude is displayed on the lower half of the row. If a pending flight plan exists, the pending flight plan altitude is displayed on the upper half of the row only if the altitudes differ by 100 ft.

The altitude can be displayed either in FL format or in feet depending on the transition altitude or transition level.

AT constraints are displayed with a small line above and below the altitude using the same color as the constraint, white, cyan, magenta or amber: e.g.


**FIGURE 02-34-30-14 AT CONSTRAINT EXAMPLE**

AT OR ABOVE constraints are displayed with a small line below the altitude using the same color than the constraint. eg:


**FIGURE 02-34-30-15 AT OR ABOVE CONSTRAINT EXAMPLE**

AT OR BELOW constraints are displayed with a small line above the altitude using the same color than the constraint. eg:


**FIGURE 02-34-30-16 AT OR BELOW CONSTRAINT EXAMPLE**

WINDOW constraints are displayed with the higher constraint displayed on the upper line with a small line above the constraint and the lower constraint displayed on the lower line with a small line below the constraint. eg:


**FIGURE 02-34-30-17 WINDOW CONSTRAINT EXAMPLE**

## ANGLE

The angle field displays either angle constraints or predicted angle for each waypoint in the flight plan. Angle constraints have priority over predicted angles.

Angles constraints are displayed with a small line above and below angle.

## SPEED

The speed field displays either speed constraints or predicted speeds for each waypoint in the flight plan. Speed constraints have priority over predicted speeds.

Speed constraints (kt or Mach) are displayed with a small line above and below the speed.

## TIME

Estimated Time of Departure (ETD) can be manually entered while on ground.

Estimated Time Enroute (ETE) is displayed when the airplane is on the ground. Once the airplane is airborne or ETD has been entered, the ETE becomes an Estimated Time Arrival (ETA).

## VERTICAL SPEED

The FMS computes a vertical speed (VS) for the climb and descent POF. The predicted VS is the rate needed to meet the altitude constraints if they exist. Otherwise they represent the estimated VS for the airplane. VS is not displayed when a pending flight plan exists due to limited space on the cross field.

The predictive VS for the waypoint is displayed in the cross tab above the angle and speed with an arrow to indicate climb or descent.

## WIND / TEMPERATURE / ISA

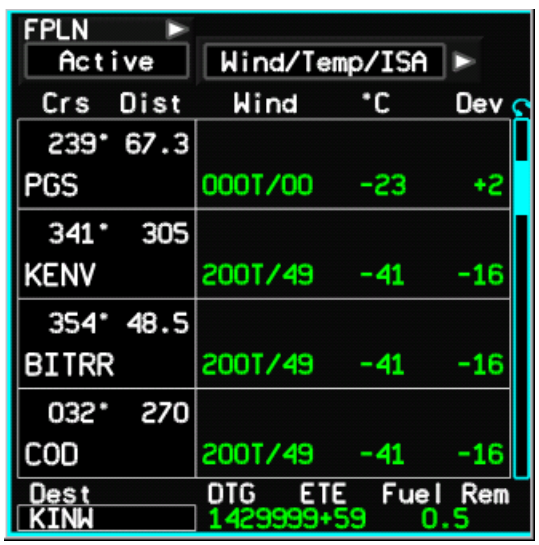



**FIGURE 02-34-30-18 WPT LIST WIND / TEMP / ISA**

This column displays wind, temperature and ISA deviation for each waypoint.

Pilot entries are available to define wind for a specific waypoint. The FMS then updates the wind model for the flight plan, including the pilot entered value for a waypoint. The pilots entries are not retained by the FMS as constraints. Thus the system always displays system computed numbers.

The FMS predicts the temperature for the predicted altitude the airplane will be at for each waypoint in the flight plan. The temperature are computed in the FMS atmosphere model.

**SPD / DIST / TIME**

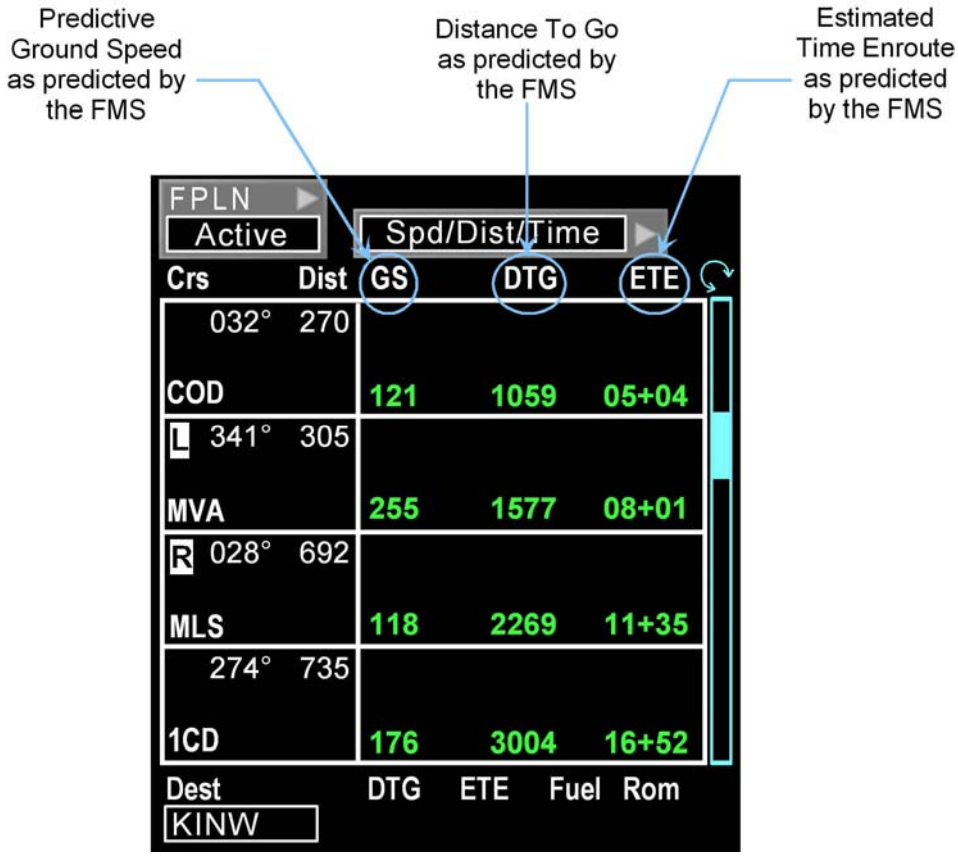



**FIGURE 02-34-30-19 WPT LIST SPD/DIST/TIME**

## FUEL / WEIGHT

Fuel remaining predicted by the FMS for each waypoint. It can be displayed either in thousands of pounds or thousands of kg (third certification)


Gross weight predicted by the FMS for each waypoint. It can be displayed either in thousands of pounds or thousands of kg (third certification)

**FIGURE 02-34-30-20 WPT LIST FUEL WEIGHT**

## LATITUDE / LONGITUDE


**FIGURE 02-34-30-21 WPT LIST LAT / LONG**

Lat / Lon Entry Format:
ANNNN.NNANNNNN.NN Latitude Longitude

Requirements:

- Latitude:
  - entry in degrees,minutes, and hundredths of minute,
  - alpha entry required to be N or S,
  - minimum numeric entry is one digit,
  - first two digits are interpreted as degrees,
  - next two digits are interpreted as minutes,
  - trailing zeros not required,
  - decimal minute not required.
- Longitude:
  - entry in degrees, minutes, and hundredths of minutes,
  - alpha entry required to be E or W,
  - minimum numeric entry is one digit,
  - first three digits are interpreted as degrees,
  - next two digits are interpreted as minutes,
  - trailing zeros not required,
  - decimal minute not required.
- Range:
  - Latitude degrees range is 0 to 90,
  - minutes range is 0 to 59,
  - tenth srange is 0 to 9,
  - hundredths range is 0 to 9,
  - longitude degrees range is 0 to 59,
  - minute range is 0 to 59,
  - tenths range is 0 to 9,
  - hundredths range is 0 to 9.

examples:

entry displays:

- N0W0 N0000.0E00000.0
- N1W1 N0100.0W00100.0
- N12W12 N1200.0W01200.0
- N123W123 N1230.0W12300.0
- N1234W1234 N1234.0W12340.0
- N1234.5W12345 N1234.5W12345.0
- N1234.5W12345.6 N1234.5W12345.6
- N1234.56W12345.67 N1234.56W12345.67

## VERTICAL WAYPOINTS


**FIGURE 02-34-30-22 WPT LIST TOC**

The figure illustrates a TOC for an example with the Cross flight plan displayed. The BOSC and the TOD have the same properties.

## PENDING FLIGHT PLAN MODIFICATIONS

In I-NAV and in the WPT LIST, all pending modifications are displayed in cyan.

When in pending modification the WPT LIST displays stroked grey waypoints when they are deleted by the crew.

**Activate** , **Cancel** and **Remove Wpt** soft keys are displayed in cyan when in pending.


ou


**FIGURE 02-34-30-23 FLIGHT PLAN MODIFICATIONS**

## SPECIFIC FUNCTIONS

When flying in an holding pattern, **Exit Hold** or **Resume Hold** soft key are displayed.


**FIGURE 02-34-30-24 SPECIFIC COMMAND PUSHBUTTON (EXIT HOLD)**

## WPT LIST DIRECT TO

When using the DIRTO short cut on MKB, the cursor automatically jumps on the Direct To field at the top of the WPT LIST (see below). Using the MKB the crew can enter the WPT. After insertion, the **Activate** and **Cancel** soft keys are displayed in the I-NAV and the WPT LIST.

Direct to using the MKB is always possible, whatever the display configuration (4, 3 and 2 DU). When the DIRTO short cut is activated, the WPT LIST is automatically displayed (if not displayed before).

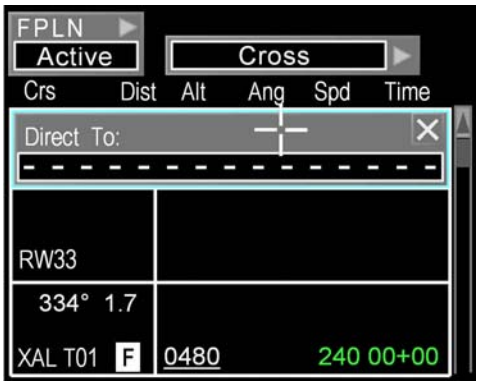



**FIGURE 02-34-30-25 DIRECT TO IN WPT LIST**

## HEADERS

One inactive line of the WPT LIST is used for missed approach and alternate headers.

## HORIZONTAL SPECIFIC PROCEDURES

All the under mentioned procedures, when selected, are displayed close to the WPT name in the WPT LIST window (H, F, R, P, A according to the list above):

- Holding pattern,
- Flyover,
- Radial,
- Procedure Turn,
- Arc Turn.

These symbols are displayed in white or cyan depending on the pending or armed (cyan), or potential target (white).

## WIND / TEMP DIALOG BOX

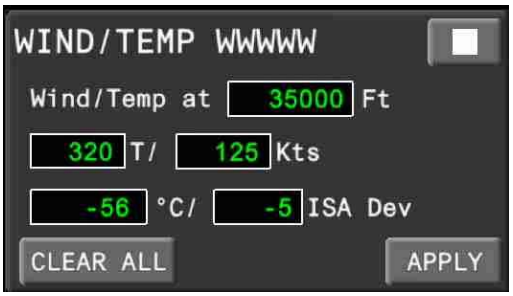



**FIGURE 02-34-30-26 WIND / TEMP DIALOG BOX**

A Wind/Temp selection, inside the WPT LIST, allows to define the wind and temperature at a given altitude for the selected waypoint.

Apply soft key inserts the new data in the flight plan. CLEAR ALL cancels all dialog box entries.

## FLY HEADING OR AS ASSIGNED

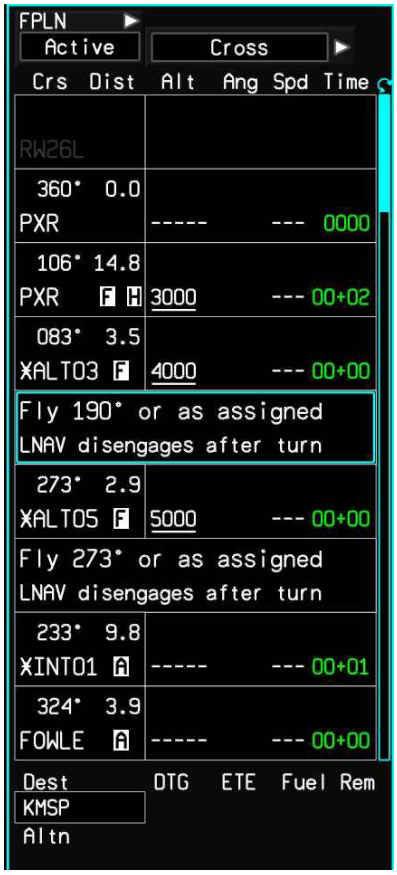



**FIGURE 02-34-30-27 FLY HEADING OR AS ASSIGNED**

This leg type only exits between two waypoints of an approach procedure.

When this leg becomes active, LNAV drops to ROL mode. Pilot should select HDG or TRK as assigned and re-arm LNAV to capture the next leg.

## FLY HDG SEL TO INTERCEPT

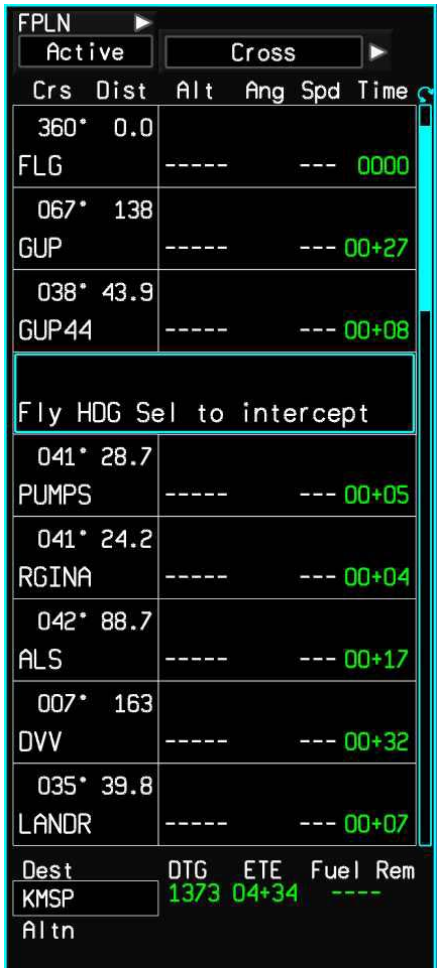



**FIGURE 02-34-30-28 WPT LIST FLY HDG SEL TO INTERCEPT**

The pilot has the ability to define a heading inbound to a waypoint.

When this leg becomes active, LNAV drops to ROL mode. Pilot should select HDG or TRK as assigned and re-arm LNAV to capture the next leg.

**INTENTIONALLY LEFT BLANK**

## I-NAV DESCRIPTION

I-NAV is the Interactive NAVigation map of the EASy Flight Deck. This interactive map is able to display various layers of data base information (terrain, airways, navaids, airports, geopolitical, airspace …) and to merge information coming from the on-board sensors (FMS flight plan and airplane position, weather, TCAS plots), to provide an intuitive and synthetic picture of the airplane situational environment in the horizontal plane.

Besides these mapping functions, I-NAV allows to modify most of the flight plan directly on the map with the CCD. All the graphical flight plan modifications are performed using the intuitive object-task method: crew clicks on an object on the map with the CCD. A task menu is displayed, it contains all the valid tasks that can be performed on the selected object.


**FIGURE 02-34-32-00 FULL I-NAV SELECTION**

### I-NAV LAYOUT

I-NAV can be displayed in a 1/3, 2/3 or full window format in each MDU. Two I-NAV can be displayed simultaneously and independently in the Flight Deck, one on each MDU, with different set of data. Whatever the format, information capacity remains the same.

## I-NAV DATA MENU

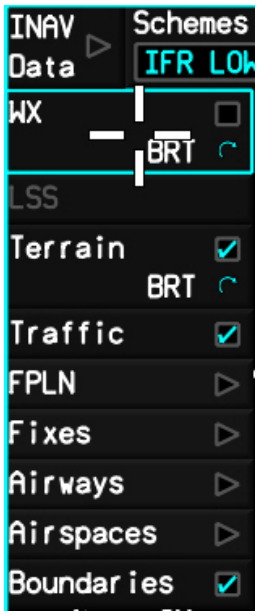



**FIGURE 02-34-32-01 I-NAV DATA MENU**

I-NAV Data Menu provides all controls to manage the layers of the I-NAV map.

I-NAV data menu is opened by clicking on the I-NAV data soft key in the I-NAV Tool bar. Each item of this menu corresponds to a layer of data (same capacity in North-up or Heading-up).

The priority of the layer is given below from top to bottom:

- WX: display of weather radar image (copy of PF PDU WX image by default, or PNF PDU if no image is available on PF PDU) and adjustment of brightness (using CCD data set knob),
- LSS (optional),
- TCAS: display of TCAS traffic plots,
- FPLN sub-menu: display of active flight plan, alternate flight plan and missed approach,
- Fixes sub-menu: display of airports, VOR, ADF, Intersections,
- Airways sub-menu: display of high altitude, low altitude airways,
- Airspaces sub-menu: display of special use, terminal airspaces,
- Boundaries: display of international boundaries, rivers,
- Terrain: display of absolute terrain information and situational awareness terrain (e.g. relative terrain) and adjustment of its brightness (using CCD data set knob).

## I-NAV MAP

The map is built to increase the situation awareness and long range flight planning. The map uses a map projection that displays great circle legs as straight lines.

### Managing the map

The map contains multiple types of data which can be selected for display through the I-NAV Data menu of the Tool bar. Symbols and text on I-NAV are range dependent, with more detail visible on smaller scales thanks to a smart de clutter feature. It is however the crew responsibility to select the appropriate layers of information depending on the flight phase. The map Schemes selection provides a quick way to recover the default set of layers.

### Centering and Orienting the map

The map may be oriented Heading Up (mag or true) or North Up (only true):

- in Heading Up mode (2/3 I-NAV), the airplane is positioned at 1/3 of the I-NAV height and the map is displayed along airplane heading. A 120° compass arc is provided,
- in North Up mode, the map is displayed with the true North pointing up. The map may or may not be centered on the airplane. It is possible to scroll the map in every geographical direction by using the scroll frame.

The scroll frame is the area just inside the edges of the map in North up format. This area is highlighted when the cursor is inside. To scroll the map Northbound, Eastbound, Westbound and Southbound, the crew has to maintain the <ENTER> pushbutton of the CCD depressed in the desired direction. The map continuously moves if the click is maintained. When the scrolling action is stopped, the airplane can move again on I-NAV. Using the scroll frame when in Heading Up automatically reverts the map in North Up.

### Adjusting map range

The range on the map can be changed whenever the cursor is in the lateral map (including scroll frame) by using CCD data set knob. Inner knob provides small range adjustment while outer knob provides higher range adjustment. Maximum half range is 750 NM, minimum is 0.5 NM.

Below 5 NM, the regular terrain is automatically removed.

## FMS MESSAGE FIELD

Messages generated by FMS system are displayed in a dedicated box located in the middle top part of the I-NAV. MSG white annunciation is displayed in the HSI when an FMS message is displayed in I-NAV.

The dialog box displays the last messages (if many messages are triggered).

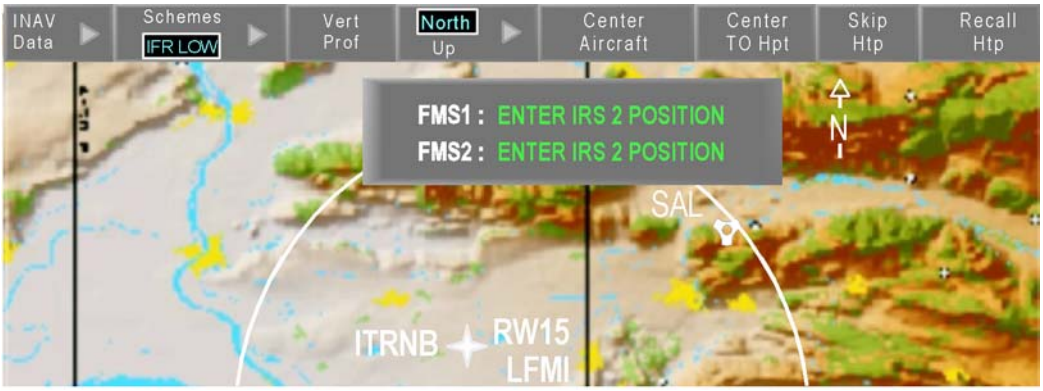



**FIGURE 02-34-32-02 FMS MESSAGES IN I-NAV**

The last messages can be acknowledged (simultaneously for all FMS) by pressing the FMS MSG white pushbutton located on the eyebrow.

**NOTE**

This pushbutton does not lit up when an FMS message is triggered. When I-NAV is not displayed only the MSG annunciation in the HSI is displayed.

In that case, the FMS MSG white pushbutton on the eyebrow has no action (no blind acknowledgement).

Basic as well as complex flight plan modifications can be performed graphically directly on I-NAV using the intuitive object-task method. Crew click on an object on the map with the CCD, a task menu is presented which contains all the valid tasks which can be performed on the selected object.

Note that all graphical flight plan modifications can also be performed on the WPT LIST window using the same object-task methods or combined between I-NAV and WPT LIST.

## LATERAL MAP DISPLAY

The lateral map primary function is to display lateral-positioning information. It is capable, but not limited to displaying the following information:

- Magnetic or True Heading,
- Graphical representation of the flight plan,
- Navigation data base,
- Weather (radar and lighting),
- TCAS,
- Wind direction and speed,
- Miscellaneous annunciators.

The lateral map has two user selectable display modes:

- North-Up,
- Heading-Up.

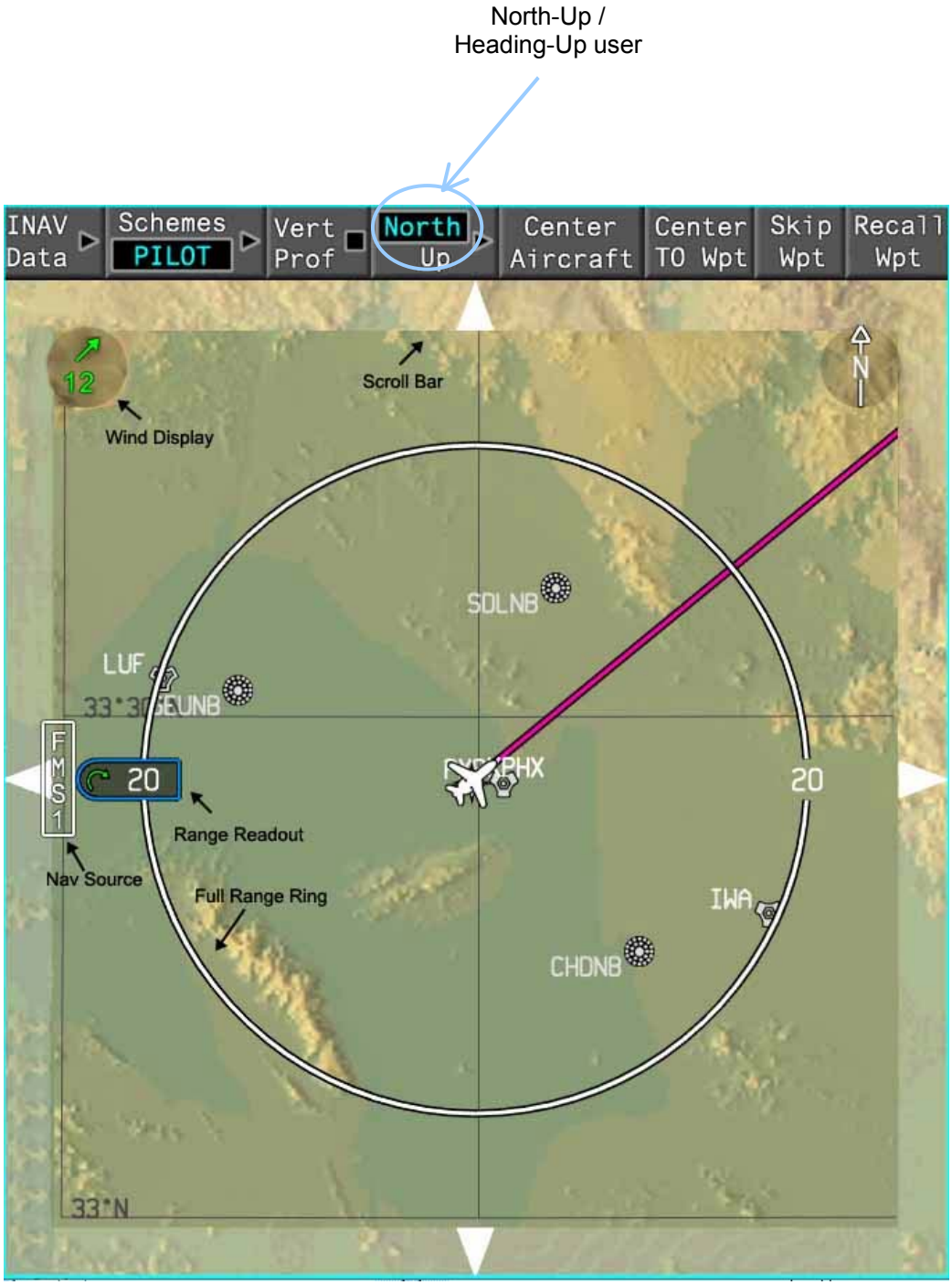



**FIGURE 02-34-34-00 NORTH-UP MODE LATERAL MAP**

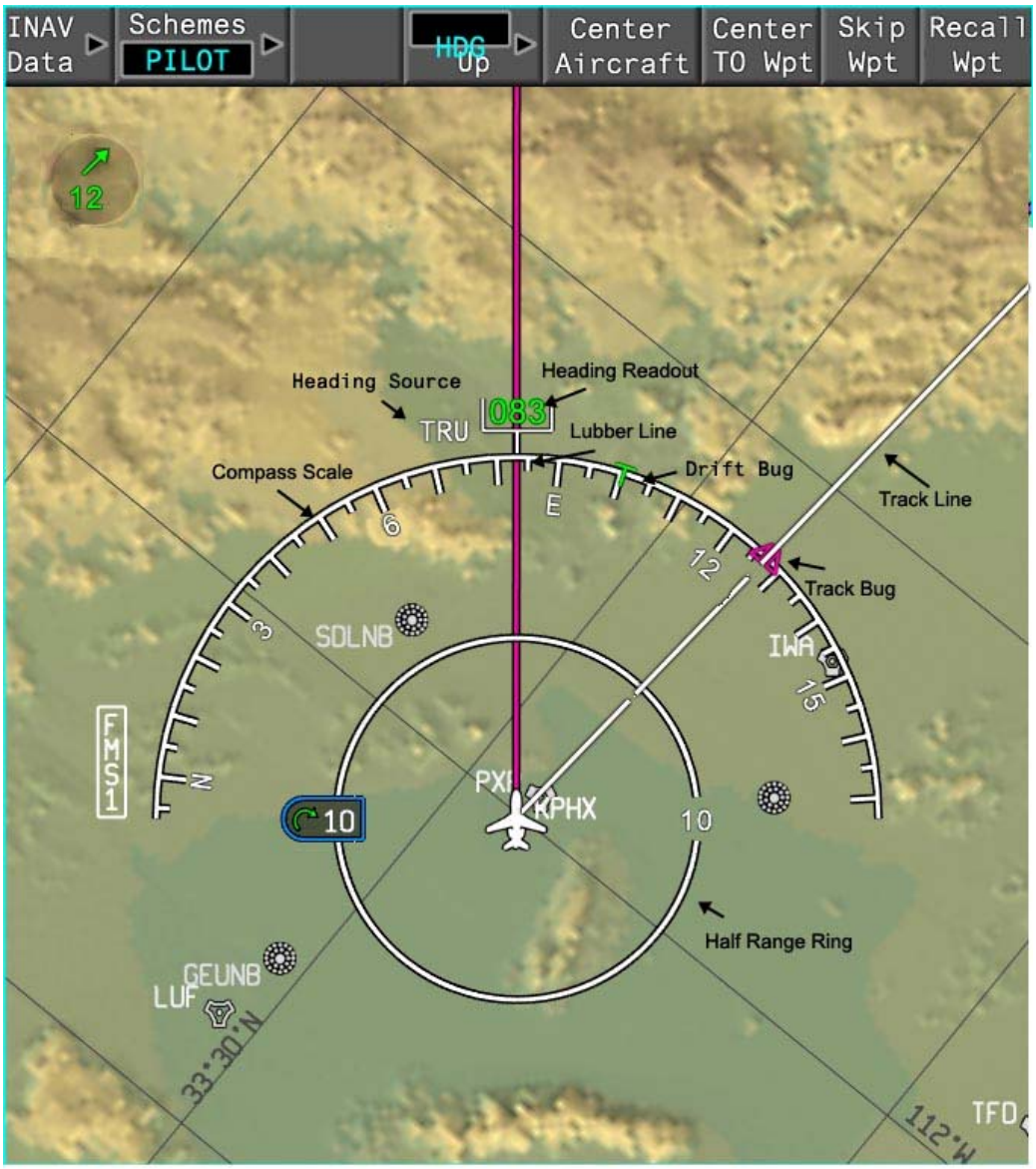



FIGURE 02-34-34-01 HEADING-UP LATERAL MAP

## LATERAL MAP MANAGEMENT

The I-NAV is capable of being displayed in:
- 2/3 window (default selection),
- full window,
- 1/3 window format.

The lateral map functionality do not change upon window format.

The power-up default selections are:
- North-Up,
- Lateral map half range set to 10 NM,
- Center Aircraft selected,
- FMS selected position, if no position is available the map centers on the lat/lon coordinates: N45° 46.579’ E000° 36.758’ without the airplane symbol displayed,
- IFR Low scheme.

## I-NAV TOOL BAR


**FIGURE 02-34-34-02 I-NAV TOOL BAR**

I-NAV tool bar provides controls of the main features of the I-NAV map and access to sub-menus to customize I-NAV contents. I-NAV tool bar is permanently displayed at the top of the I-NAV window:

**I-NAV Data pull down menu**

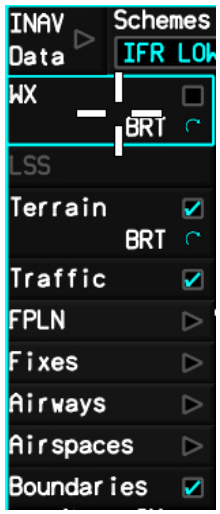



**FIGURE 02-34-34-03 I-NAV PULL DOWN MENU**

I-NAV Data pull-down menu provides all the controls to manage data layers that can be displayed on I-NAV:

- WX selection enables display of the weather radar image. This selection is available in both North-Up or Heading-Up modes. While the cursor remains positioned on the WX check box, the transparency BRT of the WX layer is capable of being increased or decreased with the CCD data set knob,
- LSS selection enables lightning sensors system display (optional),
- Terrain selection enables the terrain layer. While the cursor remains positioned on the terrain check box, the terrain layer brightness BRT is capable of being increased (full brightness) or decreased (10% brightness) by turning the data set knob,
- Traffic selection enables the Traffic Alert (TA) and Collision Avoidance System display layer. This selection is available in North-Up or Heading-Up modes,
- FPLN menu allows to select the following flight plan options:
  - missed Approach,
  - alternate,
  - constraints.

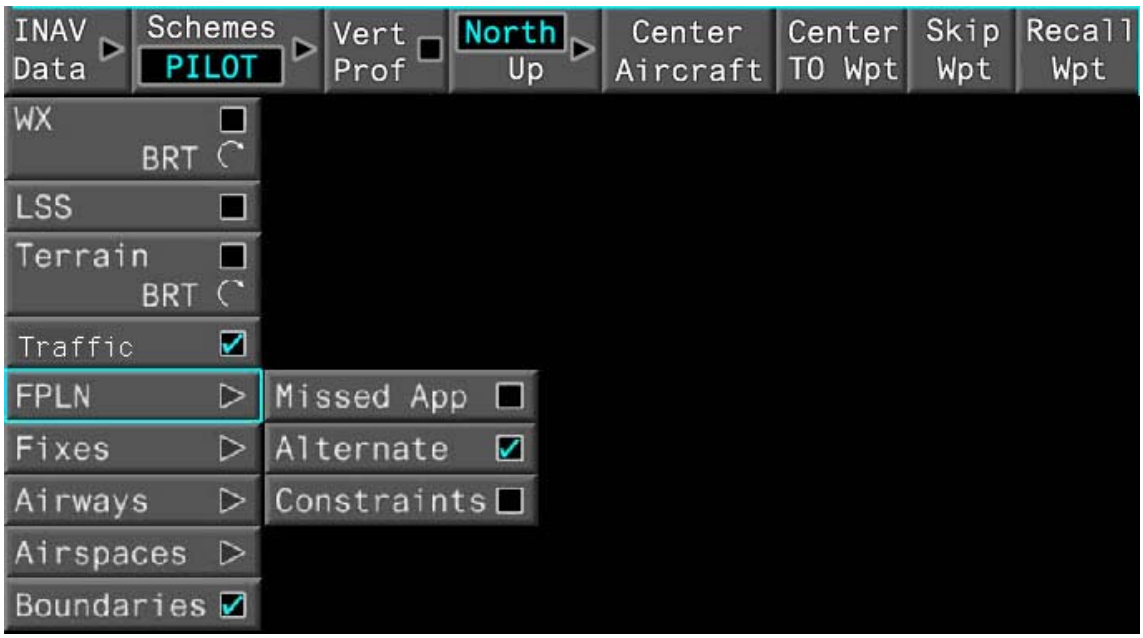



**FIGURE 02-34-34-04 I-NAV FPLN SELECTIONS**

Fixes menu allows the following selections to be displayed on I-NAV:

- Airports,
- VOR,
- NDB,
- Intersection,
- VOR course.

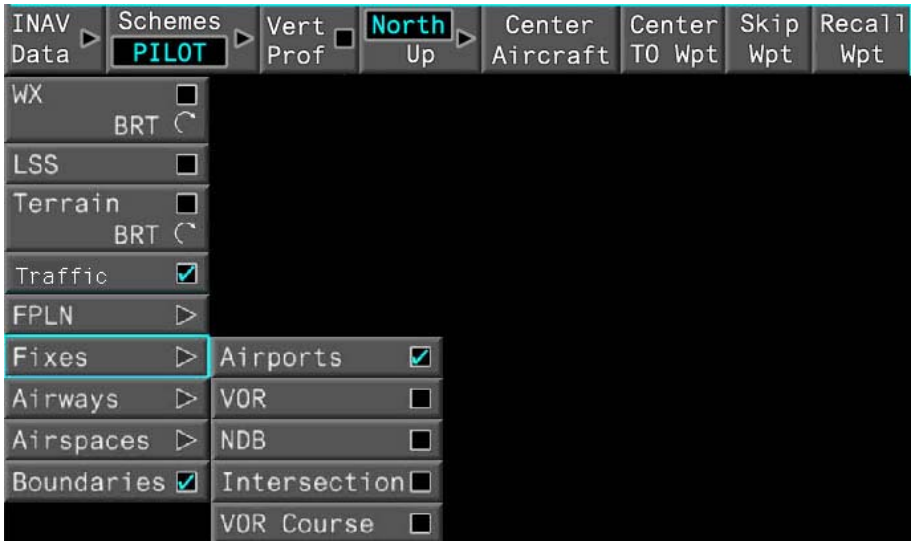



**FIGURE 02-34-34-05 I-NAV FIXES SELECTIONS**

Airways menu allows the selection of different airways to be displayed on I-NAV:

- HI ALT,
- LOW ALT.


**FIGURE 02-34-34-06 I-NAV AIRWAYS SELECTIONS**

Airspaces menu allows the following selections to be displayed on I-NAV:

- Terminal,
- Special Use Airspace (SUA).

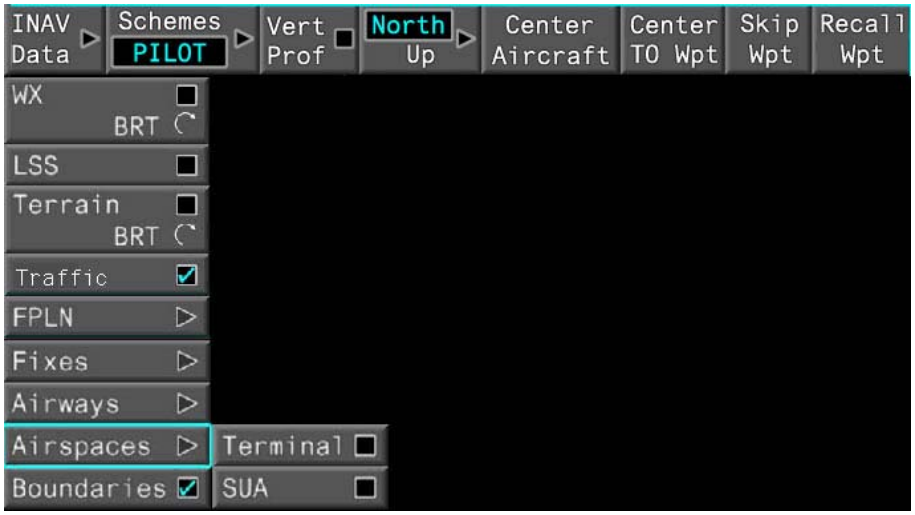



**FIGURE 02-34-34-07 I-NAV AIRSPACES SELECTIONS**

Boundaries selection turns on/off the geopolitical and Latitude/Longitude gridlines layer.

**Schemes pull down menu**

Schemes pull-down menu gives access to 3 map schemes offering a pre-defined set of data layers: IFR HIgh Alt scheme, IFR LOw Alt scheme. Any change to these standards scheme reverts the I-NAV in PILOT Defined Scheme where pilot has all the authority to select data to be displayed,


**FIGURE 02-34-34-08 SCHEMES PULL DOWN MENU**

- **Scheme configuration**

| IFR HI SCHEME | IFR LOW SCHEME |
|---|---|
| Airports = Selected | Airports = Not Selected |
| Alternate FPLN = Selected | Alternate FPLN = Not Selected |
| Boundaries = Selected | Boundaries = Selected |
| Constraints = Not Selected | Constraints = Selected |
| High Altitude Airway = Not Selected | High Altitude Airway = Not Selected |
| Intersections = Not Selected | Intersections = Not Selected |
| Low Altitude Airway = Not Selected | Low Altitude Airway = Not Selected |
| Lss = Not Selected | Lss = Not Selected |
| Missed Approach = Not Selected | Missed Approach = Selected |
| NDBs = Not Selected | NDBs = Selected |
| SUA = Not Selected | SUA = Not Selected |
| Terminal Airspace = Not Selected | Terminal Airspace = Not Selected |
| Terrain = Selected | Terrain = Selected |
| Traffic = Selected | Traffic = Selected |
| VOR Course = Not Selected | VOR Course = Not Selected |
| VORs = Not Selected | VORs = Selected |
| WX = Not Selected | WX = Not Selected |

**Vert Prof check box (will be available for next certification)**

Vertical Profile selection turns on / off the vertical profile display.

**Map mode menu**

Map mode selection allows to select between North-Up or Heading-Up graphical representation mode.


**FIGURE 02-34-34-09 MAP MODE PULL DOWN MENU**

**Center Aircraft**

The Center Aircraft soft key allows center the I-NAV on airplane.

**Center TO Wpt**

This selection is used to center the TO waypoint on the lateral map in North-Up mode.

If the I-NAV reference is Heading-Up, selecting Center To Wpt automatically changes to North-Up selection.

If there is a pending flight plan, the Center To Wpt selection follows the pending flight plan instead of the active flight plan.

**Skip Wpt**

Skip Wpt selection allows to center the next waypoint in the flight plan on the lateral map display in North-Up. If a waypoint is not currently centered, Skip defaults to the TO waypoint.

If the I-NAV reference is Heading-Up, selecting Skip Wpt automatically changes to North-Up.

When the destination waypoint has been centered on the lateral map, selecting Skip Wpt displays FROM waypoint centered on the lateral map.

If there is a pending flight plan, the Skip Wpt selection follows the pending flight plan instead of the active flight plan.

**Recall wpt**

Selecting Recall Wpt centers the previous waypoint in the flight plan on the lateral map display in North-Up. If a waypoint is not currently centered, Recall defaults to the TO waypoint.

If the I-NAV reference is Heading-Up, selecting Recall Wpt automatically changes to North-Up.

When the FROM waypoint has been centered on the lateral map, selection of the Recall Wpt displays the destination waypoint centered on the lateral map.

If there is a pending flight plan, the Recall Wpt selection follows the pending flight plan instead of the active flight plan.

**NOTE**

When I-NAV displays Secondary Flight Plan, the following options are not available (corresponding soft keys are grayed): Center Airplane, Center TO, WX layer, TCAS layer, LSS layer.

## FMS LATERAL DEVIATION

The FMS lateral deviation annunciation is displayed on the right side of the airplane symbol when in Heading-Up.

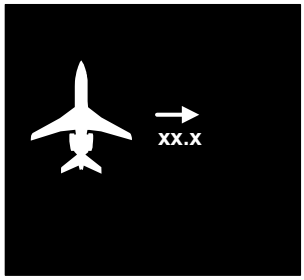



**FIGURE 02-34-34-10 CROSS TRACK ERROR ANNUNCIATION**

## DESIRED TRACK

The desired track line originates at the center of the airplane symbol, passes through the track bug and continues on the until the edge of the lateral map.

When in North-Up mode, the desired track line is displayed only when the airplane symbol is visible on the Lateral Map Display.

When in Heading-Up mode, the desired track line is drawn regardless of the heading / track bug location (e.g if the bug is behind the airplane, the line is drawn from the airplane nose to the bottom of the display).

When TRK mode is engaged, the desired track line is magenta, white otherwise.

## ANNUNCIATIONS

### Wind direction and velocity

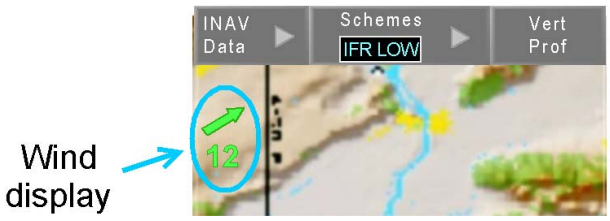



**FIGURE 02-34-34-11 WIND DISPLAY**

The wind direction and velocity is in vector format and is displayed in Heading-Up or North-Up modes. It is only displayed when the airplane is centered.

The display consists of a digital wind velocity readout and a wind direction arrow indicating the direction the wind is blowing towards.

The PF IRS is the wind data source.

**Navigation source annunciation**

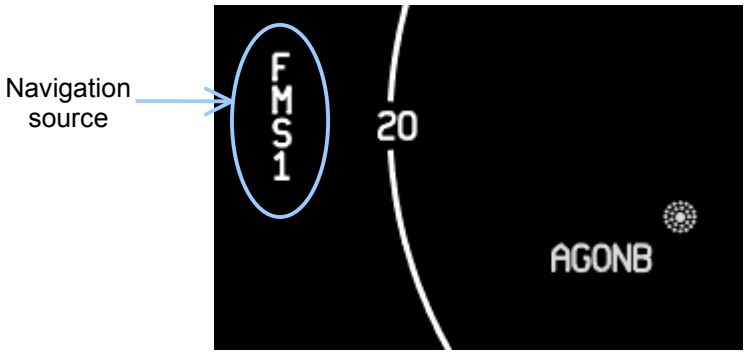



**FIGURE 02-34-34-12 NAVIGATION SOURCE ANNUNCIATION**

The annunciation color matches the HSI.

The PF selected FMS (master FMS) is the data source.

## FMS FLIGHT PLAN MAP DATA

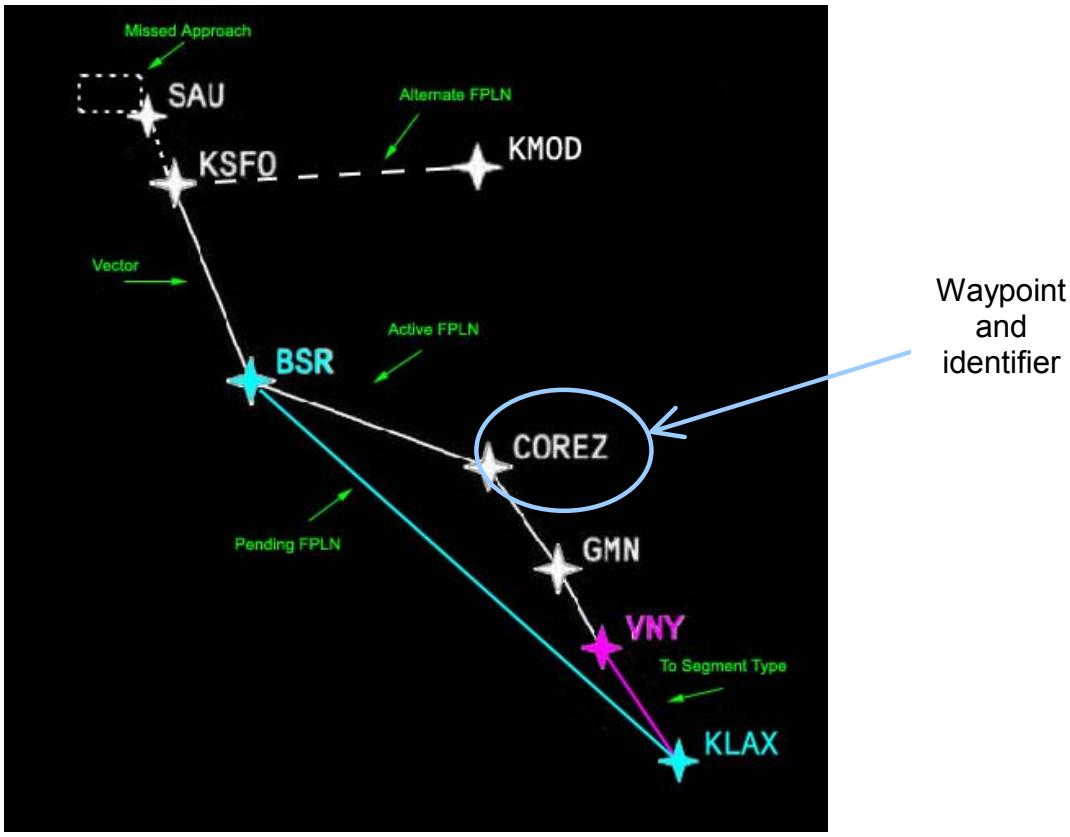



**FIGURE 02-34-34-13 FMS FLIGHT PLAN EXAMPLE**

**Flyover symbol**

**FIGURE 02-34-34-14 FLYOVER SYMBOL**

**Altitude profile point**


**FIGURE 02-34-34-15 ALTITUDE PROFILE POINT AND IDENTIFIER**

Altitude profile points consist in TOC (Top Of Climb), TOD (Top Of Descent) and BOSC (Bottom Of Step Climb).

**Arrow icon**

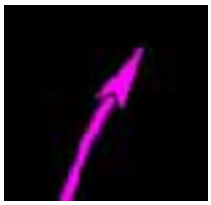


**FIGURE 02-34-34-16 TURN ARROW ICON**

The arrow icon indicates a turn direction in the flight plan.

**Constraints**

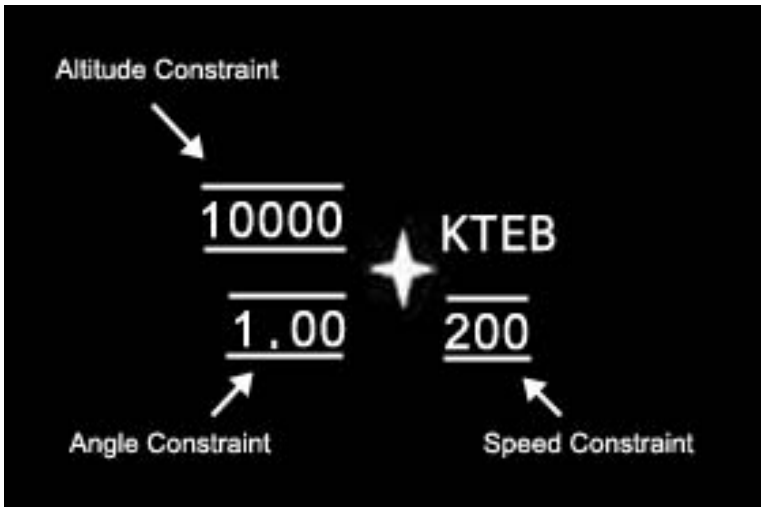



**FIGURE 02-34-34-17 CONSTRAINTS EXAMPLE**

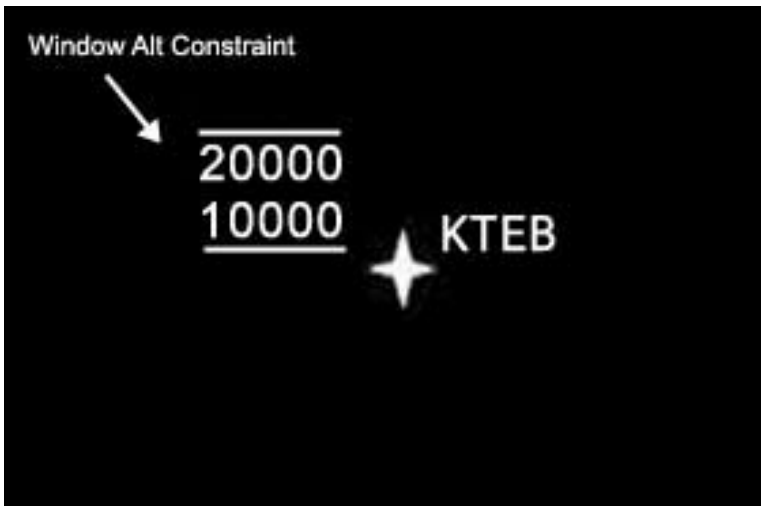



**FIGURE 02-34-34-18 ALTITUDE BLOCK CONSTRAINT EXAMPLE**

The format matches the representation on the waypoint list.

## MAP SCROLLING


**FIGURE 02-34-34-19 SCROLL BAR**

The scroll bar is displayed when the cursor is placed at the edge of the map, and disappears when the cursor is moved away from the scroll bar.

While scrolling is active the following layers are removed:

- Traffic,
- Desired track line,
- VOR course line,
- Constraints,
- Lateral deviation,
- LSS,
- WX,
- VOR,
- NDB,
- Intersections,
- Airports,
- Obstacles,
- Lat/Lon lines,
- Terrain.

## RANGE AND FMS MESSAGE DEDICATED BOX

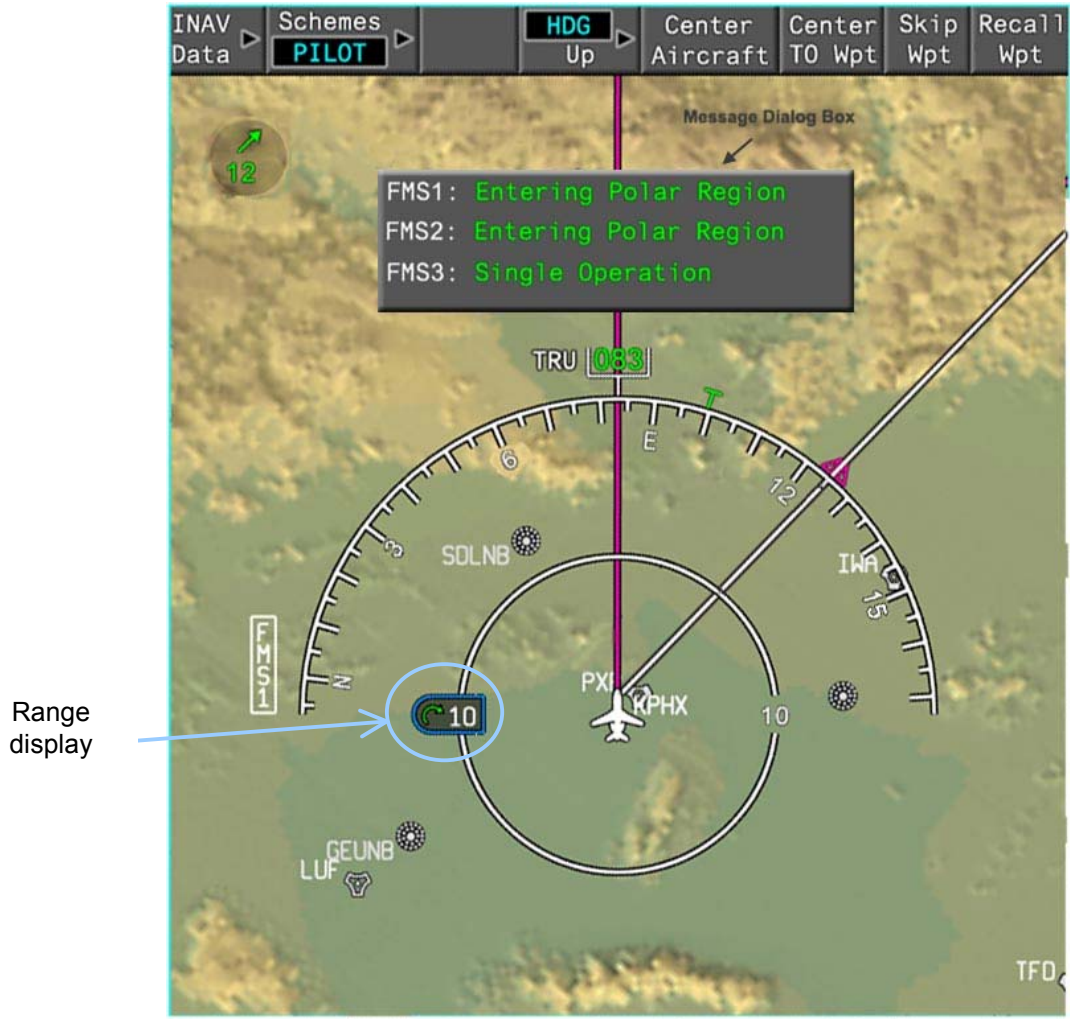



**FIGURE 02-34-34-20 FMS MESSAGE DEDICATED BOX AND RANGE EXAMPLE**

In Heading-Up mode, the range values vary between 0.5 and 375 NM.

In North-Up mode, the range values vary between 1 and 750 NM.

Message system is independent from the I-NAV control interface and is issued to alert the pilot of a situation detected by the FMS / TOLD.

The FMS MSG pushbutton, located on eyebrow, only clears one message at a time.

## AIRPORT LAYER

Airports are selectable for display from the I-NAV tool bar menu.
The airports symbols are displayed per the following tables:

| NAME | SYMBOL | DISPLAYED RANGE |
|---|---|---|
| Airport | | 0.5 ≤ Half range ≤ 5 |
| | | 0.5 ≤ Half range ≤ 5 |
| | | 0.5 ≤ Half range ≤ 5 |
| | | 5.5 ≤ Half range ≤ 150 |
| | None | 175 ≤ Half range ≤ 375 |

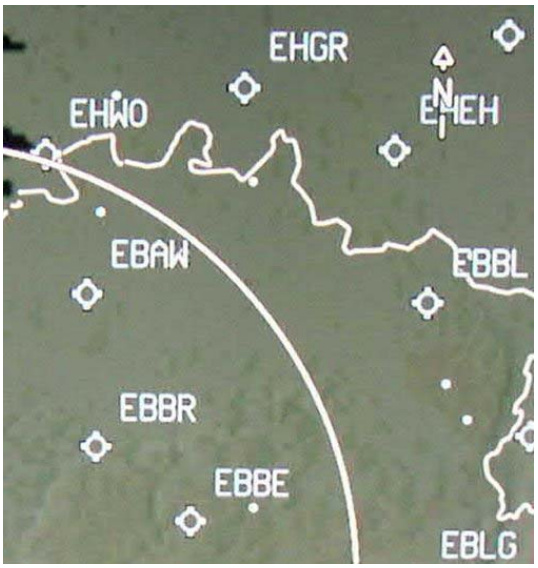



**FIGURE 02-34-34-21 AIRPORT SYMBOLS**

## VOR LAYER

| CATEGORY | NAME | SYMBOL | DISPLAYED RANGE |
|---|---|---|---|
| VOR | VOR |  | 0.5 ≤ Half range ≤ 100 |
| | | ● | 125 ≤ Half range ≤ 200 |
| | | none | 225 ≤ Half range ≤ 375 |
| | DME only |  | 0.5 ≤ Half range ≤ 100 |
| | | ● | 125 ≤ Half range ≤ 200 |
| | | none | 225 ≤ Half range ≤ 375 |
| | VOR/DME |  | 0.5 ≤ Half range ≤ 100 |
| | | ● | 125 ≤ Half range ≤ 200 |
| | | none | 225 ≤ Half range ≤ 375 |
| | TACAN |  | 0.5 ≤ Half range ≤ 100 |
| | | ● | 125 ≤ Half range ≤ 200 |
| | | none | 225 ≤ Half range ≤ 375 |
| | VORTAC |  | 0.5 ≤ Half range ≤ 100 |
| | | ● | 125 ≤ Half range ≤ 200 |
| | | none | 225 ≤ Half range ≤ 375 |

VOR are selectable for display from the I-NAV tool bar menu.

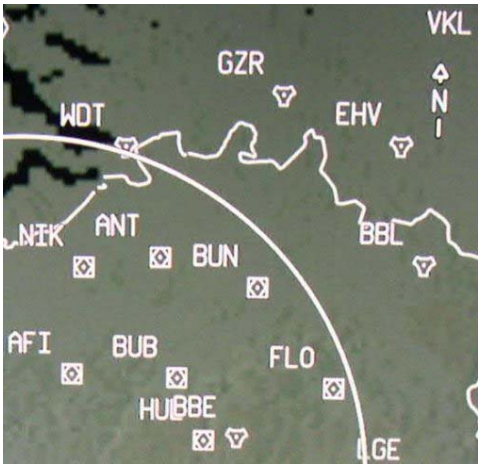



**FIGURE 02-34-34-22 VOR SYMBOLS**

**NDB LAYER**

| CATEGORY | SYMBOL | DISPLAYED RANGE |
|---|---|---|
| NDB | | 0.5 ≤ Half range ≤ 50 |
| | none | 52.5 ≤ Half range ≤ 375 |

NDB are selectable for display from the I-NAV tool bar menu.


**FIGURE 02-34-34-23 NDB SYMBOL**

## INTERSECTION

| CATEGORY | SYMBOL | DISPLAYED RANGE |
|---|---|---|
| Intersection | △ | 0.5 ≤ Half range ≤ 5 |
| | none | 5.5 ≤ Half range ≤ 375 |

Intersections are selectable for display from the I-NAV tool bar menu.

## AIRWAY

The airway layer consists in high altitude airways (jet airways in the US), low altitude airways (victor airways in the US) and others non-US airways.

Each airway category is independently selectable for display through the I-NAV tool bar.


FIGURE 02-34-34-24 EUROPE AIRWAY LAYERS

## AIRSPACE

| CATEGORY | SYMBOL | DISPLAYED RANGE |
|---|---|---|
| Terminal Airspace |  | 0.5 ≤ Half range ≤ 10 |
| | none | 10.5 ≤ Half range ≤ 375 |
| SUA |  | 0.5 ≤ Half range ≤ 50 |
| | none | 52.5 ≤ Half range ≤ 375 |

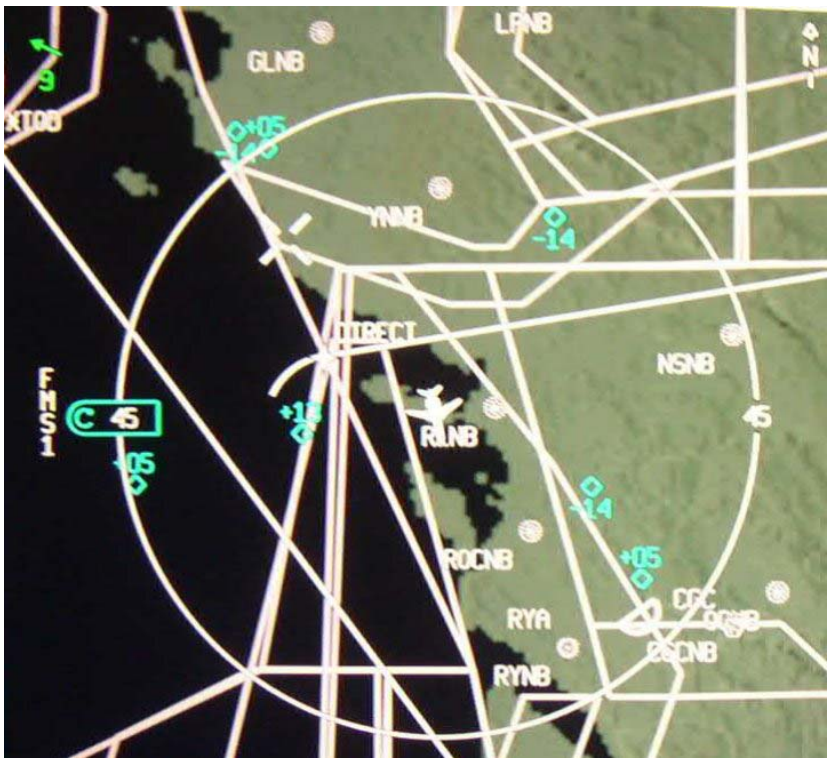



**FIGURE 02-34-34-25 AIRSPACE SYMBOLS**

## OBSTACLES

Obstacles are always displayed on the lateral map when the lateral half range is less than or equal to 10 NM.

Obstacles (defined as obstacles from 200 ft to 1,000 ft AGL), are displayed on the lateral map as follow:

**FIGURE 02-34-34-26 OBSTACLE SYMBOL**

## LARGE OBSTACLES

Large obstacles (defined as obstacles above 1,000 ft AGL), are displayed on the lateral map as follow:

**FIGURE 02-34-34-27 LARGE OBSTACLE**

## OBSTACLE INFORMATION

When the cursor is moved over an obstacle currently displayed in the field of view of the I-NAV lateral map display, the obstacle under the cursor is displayed as follow:


**FIGURE 02-34-34-28 CURSOR OVER OBSTACLE**

## GEOPOLITICAL

The geopolitical layer consists in the following geopolitical entities:

- Countries / States Boundaries consist in international country boundaries and state boundaries for Canada and US,
- Lakes and rivers,
- Coastlines.

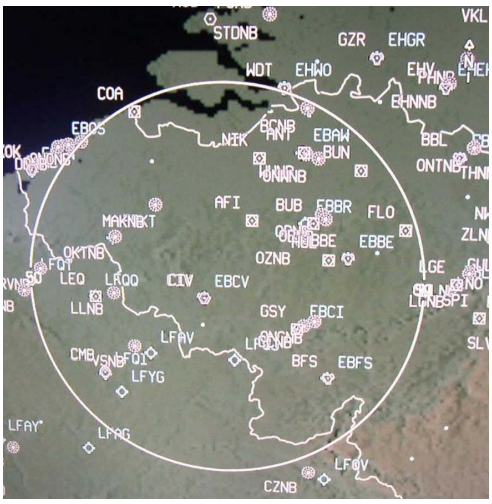



**FIGURE 02-34-34-29 BOUNDARIES AND COASTLINES**

## SECURING GRAPHICAL FLIGHT PLANNING: PENDING FLIGHT PLAN

In order to secure graphical flight planning functions and provide the capability to review any flight plan modifications before the system takes it into account, all flight plan modifications need to be activated or cancelled.

The temporary flight plan in which all the modifications are stored before activation or cancellation is called the PENDING FLIGHT PLAN. Pending Flight Plan is displayed in cyan on I-NAV and WPT LIST. Pending flight plan provides all performances parameters for the pending trajectory: this allows to compare performances between active flight plan trajectory and pending one.

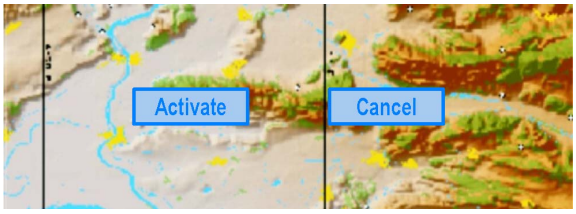



**FIGURE 02-34-34-30 PENDING FLIGHT PLAN ACTIVATION / CANCELLATION SOFT KEYS**

To activate pending flight plan, crew must click on the cyan **Activate** soft key that is displayed at the bottom of I-NAV (and WPT LIST) as soon as pending mode is entered. Similarly, pending flight plan can be cancelled by pressing on the **Cancel** soft key.

## OBJECT TASK MENU

Displaying the Task Menu associated with a graphical object is accomplished by clicking on the desired object symbol on the map. The task menu displays all the valid tasks associated with that object.

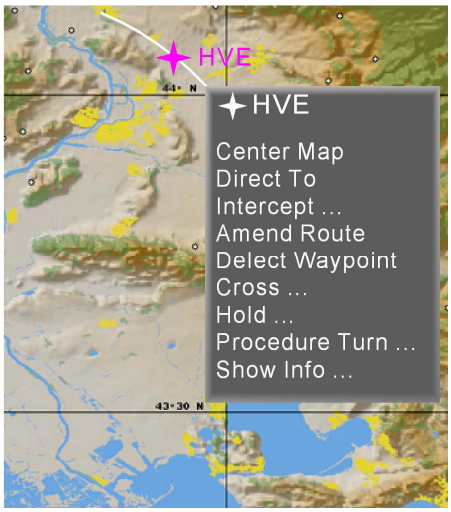



**FIGURE 02-34-34-31 TASK MENU ON HVE VOR**

A click within a task menu item selects the associated function. To exit the menu, move the cursor outside the menu.

## GRAPHICAL FLIGHT PLANNING TASKS

The following tables defines for all the interactive objects categories of the I-NAV the associated tasks (and its corresponding dialog box). Note that some objects can combine task of two of these categories: for instance, a navaid in the flight plan combines tasks from the active flight plan waypoint category and navaid category.

**Airplane symbol object** 

| ASSOCIATED TASKS | DIALOG BOX ASSOCIATED WITH TASK | WHAT FOR ? |
| --- | --- | --- |
| Center Map | | Center Map and lock it on airplane symbol |
| Lateral Offset … | LAT OFFSET | Defining a lateral flight plan offset when in LNAV (It is necessary to click the airplane symbol first in the I-NAV) |

**Active flight plan waypoint category** 


| ASSOCIATED TASKS | DIALOG BOX ASSOCIATED WITH TASK | WHAT FOR? |
|---|---|---|
| Center Map | | Center Map on this waypoint |
| Direct To | | Perform a direct to on this waypoint from present position |
| Intercept … | INTERCEPT | Intercept wpt by radial / CRS + distance or heading select |
| Amend Route | | Amend flight plan route downstream this waypoint |
| Delete Waypoint | | Delete this waypoint from flight plan |
| Cross … | CROSS | Define a crossing constraint on this waypoint : altitude (A/B), Speed (IAS, Mach), Time (at), Angle |
| Hold … | HOLD | Define a holding pattern on this waypoint |
| Procedure Turn … | P. TURN | Modify Procedure Turn of this waypoint IF EXISTING (this waypoint is part of a data base retrieved APPR) |
| Show Info … | SHOW INFO | Show any data base and FMS progress information on this waypoint |

**NOTE**

Tasks from airport or navaid categories can be added if waypoint is an airport or a navaid.

**VOR, VOR DME, TACAN, VORTAC category and ADF category** 


| ASSOCIATED TASKS | DIALOG BOX ASSOCIATED WITH TASK | WHAT FOR ? |
| --- | --- | --- |
| Center Map | | Center Map on this object |
| Direct To | | Perform a direct to on this object from present position |
| Show Info … | SHOW INFO | Show any data base and FMS progress information on this object |
| Tune NAV1 (*) | | Tune navaid active frequency on NAV1 (*) (will be available for next certification) |
| Tune NAV2 (*) | | Tune navaid active frequency on NAV2 (*) (will be available for next certification) |

(*) For ADF, NAVx is replaced by ADF.

**AIRWAY category**

| ASSOCIATED TASKS | DIALOG BOX ASSOCIATED WITH TASK | WHAT FOR ? |
| --- | --- | --- |
| Center Map | | Center Map on this airway at the row position |
| Intercept | | Intercept a named fix this airway by heading select leg |
| Show Info … | SHOW INFO | Show any data base and FMS progress information on this object |

**AIRPORT category** 


| ASSOCIATED TASKS | DIALOG BOX ASSOCIATED WITH TASK | WHAT FOR ? |
|---|---|---|
| Center Map | | Center Map on this airport |
| Direct To | | Perform a direct to on this airport from present position |
| Departure / arrival … | PROCEDURE | Select a RWY, SID, STAR or APPR for this airport |
| Change Dest | | Change destination to this airport (pending mode is entered to allow modification of new route between old destination and this new destination) |
| Show Info … | SHOW INFO | Show any data base and FMS progress information on this airport (not in first certification software) |

**Lat / Lon object category**

| ASSOCIATED TASKS | DIALOG BOX ASSOCIATED WITH TASK | WHAT FOR ? |
|---|---|---|
| Center Map | | Center Map on this object |
| Direct To | | Perform a direct to on this object from present position |

**DIRECT WPT object category**

| ASSOCIATED TASKS | DIALOG BOX ASSOCIATED WITH TASK | WHAT FOR ? |
|---|---|---|
| Center Map | | Center Map on this waypoint |
| Amend Route | | Amend flight plan route downstream this waypoint |

## INSERTING WAYPOINTS

When a pending flight plan modification is open, it is possible to insert multiple waypoints, airways or terminal procedures during the same operation (using Amend Route and Delete if necessary,…).

Multiple waypoints can be inserted in the pending FPLN using I-NAV, during the same operation. This is indicated by a cyan “rubber band” line that tracks the cursor after selecting Direct To or Amend Route tasks. Each time the CCD is clicked, a new waypoint is added to the flight plan and the cyan rubber banding continues from the new waypoint. A line is also drawn between the last stringed waypoint and the flight plan waypoint on which the FMS wants to close the modification.

If a mistake is made while stringing waypoints, the crew can delete the waypoint just entered, change the airway, exit a dialog box then continue the flight plan modifications.


**FIGURE 02-34-34-32 FLIGHT PLAN ACTIVATION IN WPT LIST**

Activate and Cancel soft keys are automatically displayed in the I-NAV and at the bottom of the WPT LIST. A click on the Activate soft key activates the FPLN. The pending FPLN becomes the active FPLN in the WPT LIST and in the I-NAV.

### Inserting WayPoinT (WPT)

In the active FPLN, it is possible to insert waypoints, airways or terminal procedures by using Amend Route on the WPT LIST.

WPT can be inserted in sequence during a single flight plan modification by entering the WPT names through the MKB. If there is only one WPT corresponding to the identifier, it is automatically inserted in the pending FPLN. If there are multiple WPT corresponding to the identifier, a list of all corresponding WPT are displayed and the crew has to choose the right one.

An airway can be inserted by using Join soft key displayed in the WPT List during Amend route procedure. All available airways are displayed. After selection of one airway, the crew has to choose the exit WPT of the airway.


**FIGURE 02-34-34-33 JOIN AIRWAY DIALOG BOX**

## DIALOG BOXES

### CROSS dialog box


**FIGURE 02-34-34-34 CROSS DIALOG BOX**

Cross dialog box can be opened for any WPT. Constraints on the WPT can be inserted:

- Past / Prior To distance crossing,
- Flyover the waypoint,
- ALT crossing (AT, At or above, At or Below),
- Speed constraint CAS/Mach (at and past waypoint),
- Time At Constraint,
- Angle Constraint,
- Climb / Descent override (used for example when the TOD is not computed if the cruise altitude inserted in the FMW FPLN page was not reached during the flight),
- vertical Direct To activation (Cleared to alt),
- Apply applies constraint in the pending flight plan,
- Delete deletes all the constraints on the WPT,
- Default reverts to default constraint from data base (ALT, SPEED, and ANGLE).

**HOLD dialog box**


**FIGURE 02-34-34-35 HOLD DIALOG BOX**

Hold dialog box can be opened for any WPT (except destination and specific WPT) A holding pattern can be inserted with the following parameters:

- RAD or CRS (in TRU and MAG ref),
- Leg Time (MIN) or Leg Distance (NM),
- Right or Left Turn,
- Speed (kt), Max Endurance option.

Real Time picture of the holding pattern (displayed using same I-NAV orientation: North Up or Heading Up) is drawn and indicates the QUAD and the type of entry (DIRECT, PARALLEL, TEAR DROP).

Apply soft keys applies constraint in the pending flight plan.

Delete soft keys deletes all the constraints on the WPT.

Default soft key.

As Published reverts to default data base parameters.

**NOTE**

The turns of the holding pattern are not displayed with the speed defined in the dialog box but with the speed (TAS) of the airplane when the holding pattern is activated.

When crossing the fix the airplane speed determines the holding pattern.

**PROC TURN dialog box (will be available for next certification)**


**FIGURE 02-34-34-36 PROC TURN DIALOG BOX**

PROC TURN dialog box can be opened on a WPT supporting an existing data base procedure turn. PROC TURN box allows modifying the following procedure turn parameters:

- Outbound time (MIN) or distance (NM),
- Angle (between outbound leg and outbound course).

Real time picture of the procedure turn (displayed using same I-NAV orientation: North Up or Heading Up) is drawn and indicates the direction of turn, boundary distance and inbound course. DELETE, AS PUBLISHED and APPLY soft keys have the same functions as in Hold dialog box.

**PROCEDURE dialog box**


**FIGURE 02-34-34-37 PROCEDURE DIALOG BOX (DEPARTURE TAB)**


**FIGURE 02-34-34-38 PROCEDURE DIALOG BOX (ARRIVAL TAB)**

PROCEDURE dialog box can be open for any airport object or when using Insert PROCEDURE menu in pending mode. It allows selecting and/or reviewing a complete terminal procedure. PROCEDURE dialog box contains two tabs: Departure and Arrival.

In Departure tab, one scrolling list is dedicated to Runway selection, one other to SID and Transition selection (transition are displayed only when a SID is selected).

In Arrival tab, scrolling lists allow respectively to select Runway, Approach, Approach Trans, STAR and STAR Trans. It is possible to directly select an approach with the corresponding runway automatically selected.

Each time a selection is made in one of the scrolling list, the other lists collapses to display only the items that connect to the selection: for instance, selecting an approach automatically selects the corresponding runway and STAR / Trans list collapses to display only the STAR matching the selected approach.

In both Departure and Arrival tabs:

- Insert soft key is used to insert the selected / Runway and/or procedure in the pending flight plan,
- Clear All soft key is used to clear all pilot selection.
- View check box is used to review the procedure. The View dialog box displays, in a WPT LIST type format, the log of the selected procedure. I-NAV and dialog box reverts to their previous format when exiting view mode.

In a waypoint list format before activating it. Transitions I-NAV and the dialog box in VIEW mode:

- In I-NAV, range and center is adapted in North Up mode to display the full selected procedure. No flight plan modification is authorized in View mode.

## LATERAL OFFSET DIALOG BOX

LATERAL Offset dialog box is opened by clicking airplane symbol on the map when in LNAV mode. It allows defining a lateral offset (0.1 to 30 NM) on authorized legs (not on procedure, pattern, terminal area and polar region). When offset is applied, it is no more possible to use PPOS Hold task.

Delete cancels the offset. An FMS message warns the crew when offset ends.

To cancel or modify an active offset, the dialog box has to be re-open by first clicking airplane symbol in I-NAV and then selecting Offset dialog box.

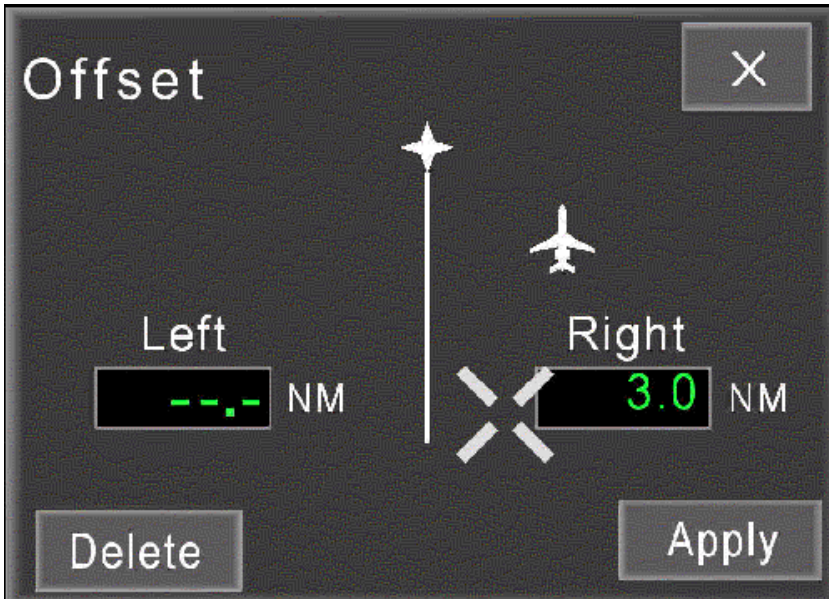



**FIGURE 02-34-34-39 LATERAL OFFSET DIALOG BOX**

## INSERT AIRWAY DIALOG BOX

Insert airway dialog box is opened using the Join soft key while in pending mode. It displays all the available airways crossing the last stringed WPT.

Airway scrolling list allows selecting the airway. Exit WPT scrolling list allows selecting the exit WPT for the selected airway. These WPT can be displayed by their full name (NAME) or by their identifier (IDENT). NAME / IDENT selection is made through the pull-down menu above the Exit WPT scrolling list.

Insert soft key inserts the selected airway segment in the pending flight plan. View check box activates I-NAV view mode: north up orientation, range and center adapted to display the selected airway segment.

## INTERCEPT DIALOG BOX

INTERCEPT dialog box is open using the Intercept task on any WPT of the active FPLN. The figure illustrates an intercept task on AVN VOR.

Intercept dialog box allows defining how to intercept the selected WPT. When the cursor is inside the dialog box, the CCD knob allows modifying the intercept course indicated by the cyan arrow. The course and the corresponding radial are displayed on the top of the dialog box.

Airways that intercept the designated object are also displayed. The format of the intercepted dialog box is always North Up.

Apply soft key inserts the intercept leg in the pending flight plan.


**FIGURE 02-34-34-40 INTERCEPT DIALOG BOX**

## GENERAL

The Attitude Direction Indicator (ADI) provides the primary information for airplane attitude, altitude, speeds and autoflight modes.

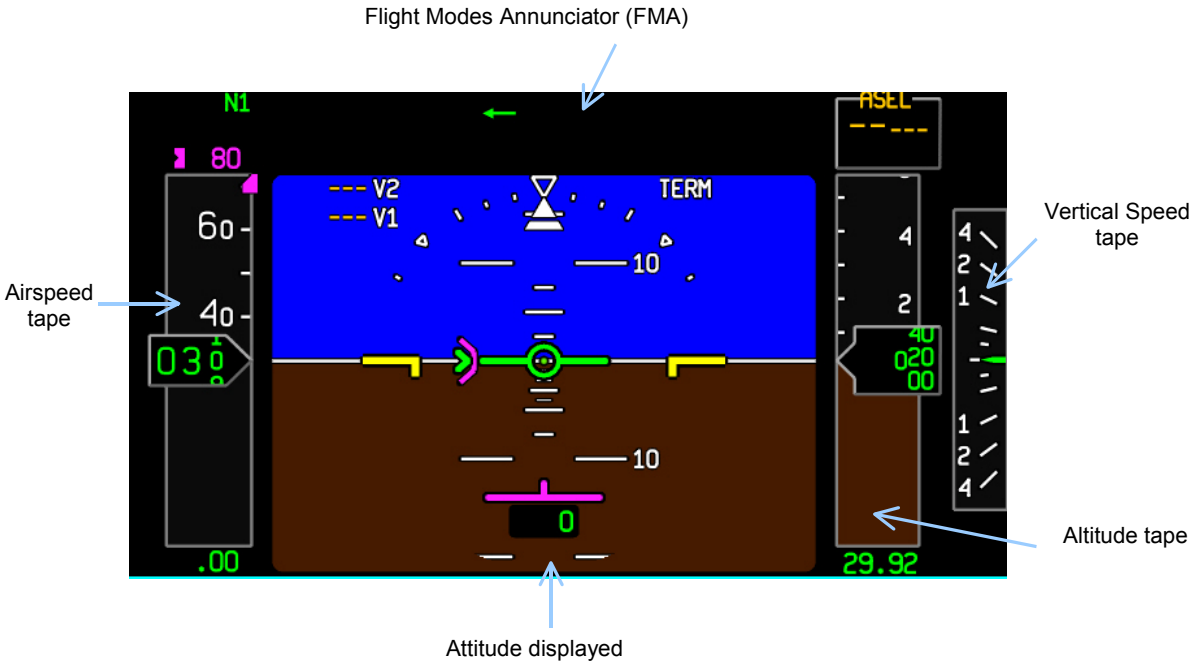



**FIGURE 02-34-36-00 ADI WINDOW**

The Flight Modes Annunciator (FMA) displays the Pilot Flying side, armed and active Flight Director mode, autopilot connection / status, auto-throttle modes and engagement status.

➢ *For more information, refer to CODDE1 / Chapter 02 / ATA 22.*

## FMA

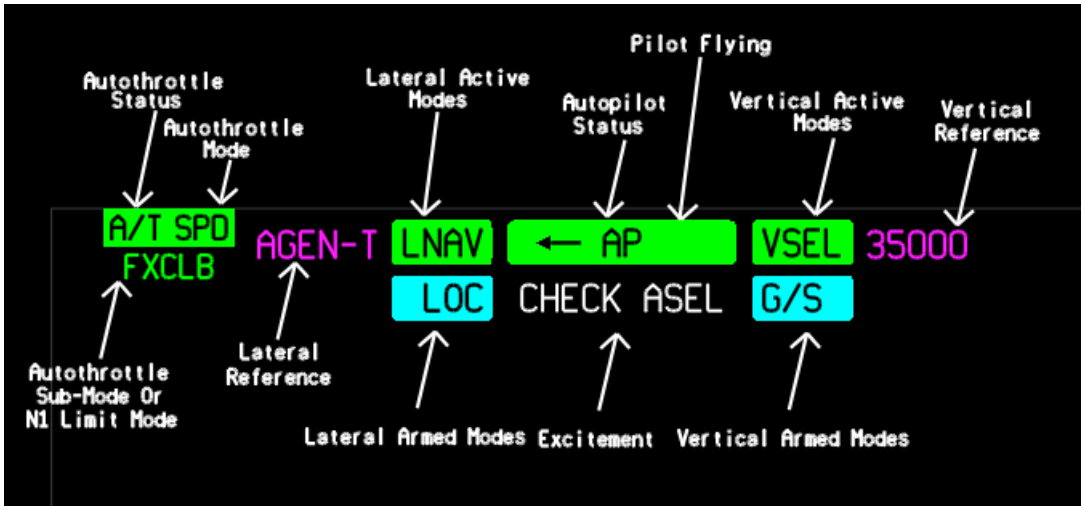



**FIGURE 02-34-36-01 FMA PANEL**

### AP status

When the AutoPilot is engaged an AP annunciation is displayed. If the Touch Control Steering pushbutton is activated, TCS replaces the AP annunciation. At AutoPilot disengagement, AP flashes until the pilot acknowledges by pressing the AP pushbutton a second time. If autopilot is not active, the field only displays the PF arrow.

### Active lateral and Vertical modes

When autopilot is engaged ROL and PATH annunciation are displayed at their activation. Upon automatic mode transitions, the mode flashes reverse video to normal video for ten seconds if autopilot is engaged. If the autopilot is not engaged, the automatic mode transition flashes normal to blank for ten seconds. The lateral and vertical reference is displayed next to the active mode in magenta.

➢ *for more information, refer to CODDE 1 / Chapter 02 / ATA 22.*

**Active lateral and vertical modes annunciations**

| ACTIVE LATERAL MODES | ACTIVE VERTICAL MODES |
| --- | --- |
| LNAV | VCLB |
| ROL | VGP |
| HDG/TRK | VASL |
| LOC | VALT |
| B/C | VPTH |
| | PATH |
| | ASEL |
| | ALT |
| | CLB |
| | VS |
| | GA |
| | T/O |
| | G/S |
| | WSHR |

**Armed lateral and vertical modes annunciations**

| ARMED LATERAL MODES | ARMED VERTICAL MODES |
| --- | --- |
| LNAV | VNAV |
| LOC | G/S |
| B/C | VGP |

## ATTITUDE DISPLAY

In the attitude display, the following information are displayed:

- altitude and speed tapes,
- AP and AT modes,
- targets linked to trajectory (speed, ASEL…),
- cautions and warnings (TCAS, EGPWS),
- failures, reversions, miscompare information, flags.

### Airplane symbol

Airplane symbol

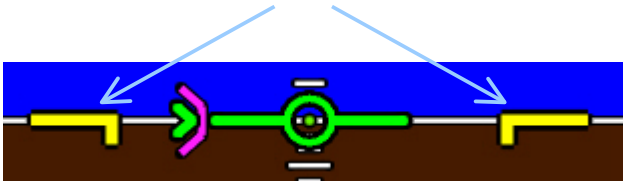


**FIGURE 02-34-36-02 AIRPLANE SYMBOL**

The attitude reference airplane symbol is a fixed object displayed in the center of the ADI sphere. The symbol is displayed in yellow and is used in conjunction with the attitude pitch tape to reflect airplane pitch.

### Flight Path Symbol (FPS)

Fligh Path Symbol

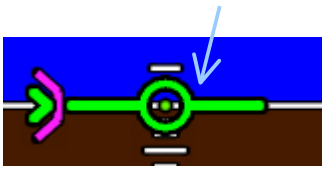


**FIGURE 02-34-36-03 FLIGHT PATH SYMBOL (FPS)**

The Flight Path Symbol (FPS) is displayed in green. It represents the airplane earth frame flight path angle.

**NOTE**

The FPS indicated on the Secondary Flight Display is an airmass flight path angle.

➢ *For more information, refer to CODDE 1 / Chapter 03 / Technical Information Pages.*

### Acceleration Chevron (AC)

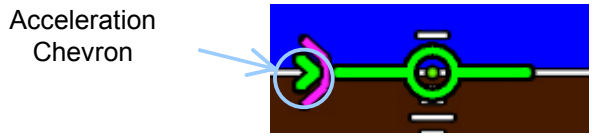



**FIGURE 02-34-36-04 ACCELERATION CHEVRON**

The flight path Acceleration Chevron (AC) is displayed green and referenced to the Flight Path Symbol (FPS). When alongside the FPS, the acceleration chevron represents a zero acceleration along flight path. When the AC is above the FPS, the airplane is accelerating. When the AC is below the FPS, the airplane is decelerating.

➢ *For more information, refer to CODDE 1 / Chapter 03 / Technical Information Pages.*

### Flight Director (FD)

The Flight Director (FD) is displayed in magenta. It is referenced to the Flight Path Symbol (FPS) and represents the path to be followed, as calculated by the AFCS.

When in HUD2 or HUD3 approach, the FD is computed by the HGS (HUD computer). In that case a HUD2 or HUD3 symbol is displayed at the top of the ADI (amber or green).

It can be removed by pressing twice the FD / TD pushbutton on the GP.

**FIGURE 02-34-36-05 FLIGHT DIRECTOR**

### Thrust Director (TD)

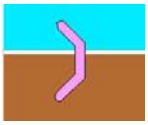


**FIGURE 02-34-36-06 THRUST DIRECTOR**

The Thrust Director (TD) provides speed guidance for speed manual holding.

TD is displayed in magenta and is referenced to the FPS. The guidance given by the TD is followed by adjusting the engines power to put the Acceleration Chevron (AC) in front of the TD. When the TD is followed the passenger comfort is the same as when the AT is engaged.

It can be removed by pressing one time the FD / TD pushbutton on the GP.

### Rotation Symbol (ROS)

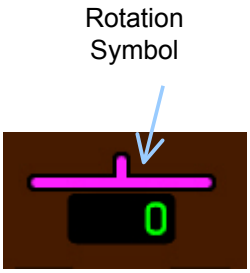



**FIGURE 02-34-36-07 ROTATION SYMBOL (ROS)**

The ROtation Symbol (ROS) is a magenta symbol displayed WOW in the lower part of the ADI. It is displayed 14° below the attitude reference (airplane symbol). At rotation, the pilot must pull up until this symbol is superimposed with the horizon bar, which means the lift off pitch attitude is correct. It is removed three seconds after lift off.

➢ *For more information, refer to CODDE 1 / Chapter 03 / Technical Information Pages.*

### AOA path limit symbol

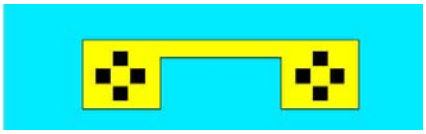


**FIGURE 02-34-36-08 AOA PATH LIMIT SYMBOL**

The position of the Angle Of Attack (AOA) path limit is linked to the FPS position. When the FPS reaches the AOA limit symbol the "STALL" aural warning is triggered.

The AOA path limit symbol is displayed when:

- airmass AOA is greater than the AOA limit (based upon flaps configuration),
- a windshear is detected.

The AOA symbol is removed when:

- FPS is not displayed,
- windshear is no longer active,
- current AOA is less than the AOA limit (based upon flaps configuration).

### Attitude pitch tape

The attitude pitch tape can display 35 degrees of field of view, and values between 0 and ± 90 degrees.

### Pitch compression

When the FPS is outside of the pitch tape field of view (e.g high AOA or windshear condition) a pitch compression is applied to the pitch scale to position the FPS at the correct value on the pitch scale while maintaining the horizon inside the field of view.

When the compression is greater than a factor of 1, the 1 degree tick marks are removed. When the compression has reached a factor of 2, the 5 degree tick marks are removed.

The maximum compression factor is 3 (field of view at 105°). Beyond this value the FPA is ghosted (dashed lines) to indicate that the FPA value is no longer on the pitch tape. When the FPA is ghosted, the compression rate is frozen at 3, the tape remains compressed. Once the FPA is no longer ghosted, the tape begins to expand back to normal. Once the FPA is ghosted it no longer indicates the correct position, however, it continues to correctly show a climbing or descending state.

The following symbols are not affected by compression:

- Flight Director (FD),
- Thrust Director (TD),
- AOA path limit symbol.

The following symbols are affected by the compression factor:

- TCAS path targets,
- Flight Path Symbol (FPS).

### Roll scale and pointer

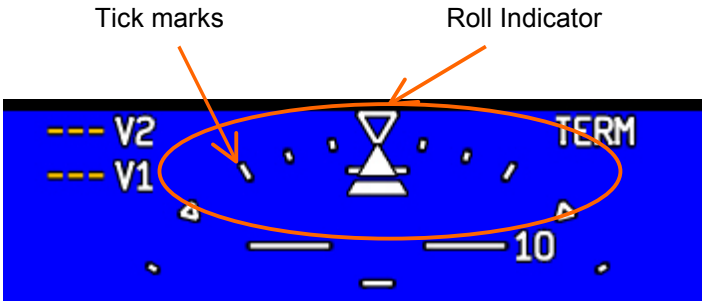



**FIGURE 02-34-36-09 ROLL SCALE AND POINTER**

The roll scale displays the roll angle of the airplane. The tick marks on the scale represent respectively ± 10, ± 20, ± 30 and ± 60 degrees; three inverted triangles represent 0 and ± 45 degrees.

### Slip / skid indicator

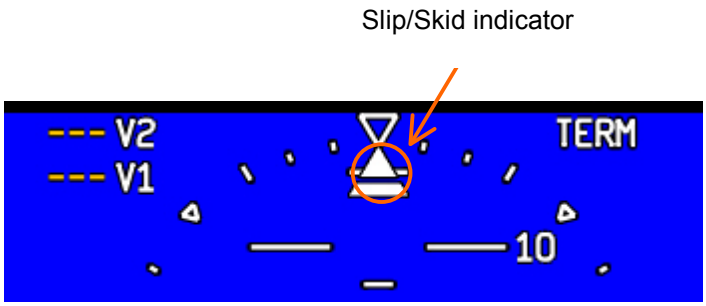



**FIGURE 02-34-36-10 SLIP / SKID INDICATOR**

The bottom half of the roll pointer indicates the slip-skid, relatively to lateral acceleration. Normally displayed in white, it turns amber when the lateral acceleration is too high.

### Radio Altitude readout

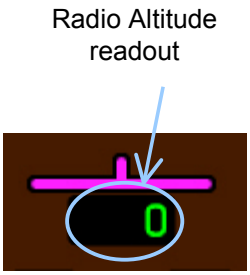



**FIGURE 02-34-36-11 RADIO ALTITUDE READOUT**

The radio altitude is displayed in green digits on a black background on the bottom of the attitude display. Below -20 ft, the display remains at -20; above 2,500 ft the indication is removed.

### BARO M or RADH readout

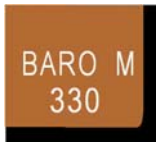



**FIGURE 02-34-36-12 BARO M READOUT**

The BAROmetric Minimum (BARO M) readout is displayed in white and is located on the lower right corner of the attitude display.

The Radio Altimeter Decision height (RA DH) radout is displayed in white at the same location than the BARO M indication.

**TCAS path target**

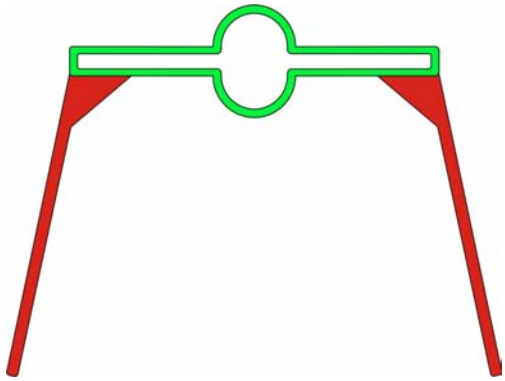


**FIGURE 02-34-36-13 RA SYMBOL**

The Resolution Advisory (RA) symbol is separated in two parts.

- Corrective area: a dynamic green “fly to” zone. To avoid the collision, the FPS must be maintained in the middle of this symbol until end of the RA.
- Peventive area: symbol is a trapezoidal shape. The FPS must be maintained out of this area.

➢ *See SURVEILLANCE subsection.*

**Marker beacons**

The marker beacon information is received from the radios. The inner, middle and outer marker beacons are displayed at the same location: upper right corner of the attitude display.

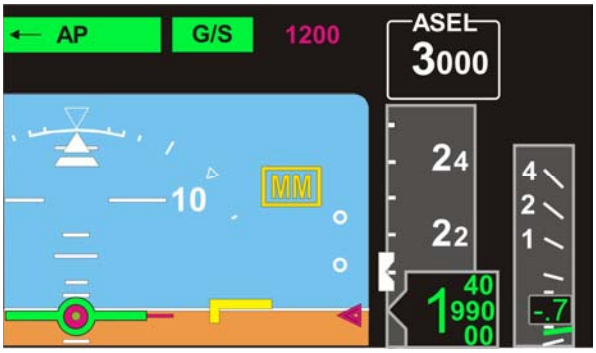



**FIGURE 02-34-36-14 IM MM OM INDICATION LOCATION**

- the Inner Marker annunciation is represented by a white IM indication framed in white,


**FIGURE 02-34-36-15 IM INDICATION**

- the Middle Marker annunciation is represented by an amber MM indication framed in amber,
- the Outer Marker annunciation is represented by a cyan OM indication framed in cyan.


**FIGURE 02-34-36-16 OM INDICATION**

When a low to high transition is seen from the appropriate marker beacon, the marker beacon flashes normal video to blank for 15 seconds then steady.

**EGPWS Annunciation**

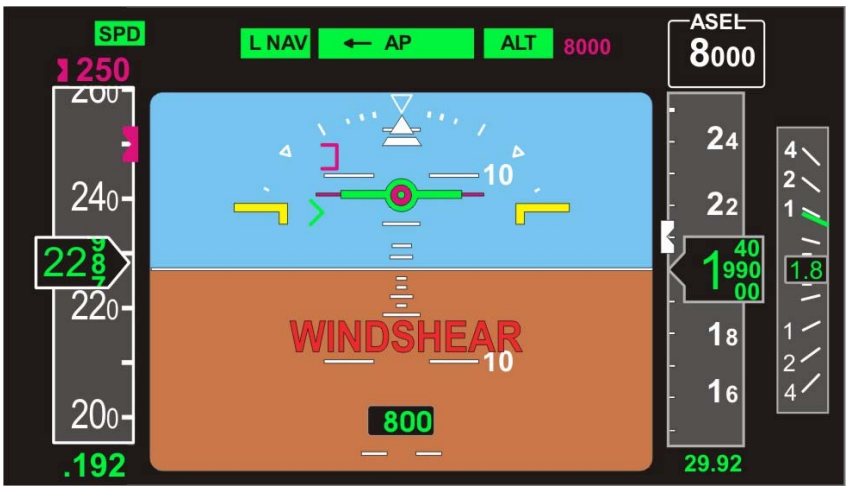



**FIGURE 02-34-36-17 WINDSHEAR INDICATION**

The EGPWS announcers (WINDSHEAR, PULL UP, AND GND PROX) is displayed at the same location in the attitude indicator. The priority of the announcers, from highest to lowest, is the following:

- WINDSHEAR,
- PULL UP indication, for a terrain warning alert or a ground proximity warning,
- GND PROX indication, for a terrain caution alert or a ground proximity caution,
- WINDSHEAR.

The STEEP annunciation, on the left of the roll pointer, indicates the EGPWS steep approach mode selected.


**FIGURE 02-34-36-18 STEEP ANNUNCIATION**

### HUD annuncers

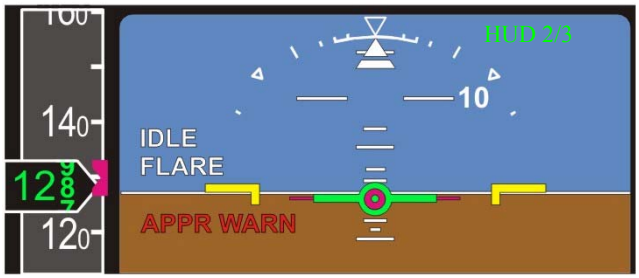



**FIGURE 02-34-36-19 IDLE, FLARE, APPR WARN ANNUNCIATIONS**

IDLE, FLARE, and APPR WARN,T/O WARN are displayed in specific conditions. IDLE and FLARE are displayed flashing for 10 sec then they are steady.

APPR WARN have priority over IDLE and FLARE.

HUD2/3 annunciation is displayed in green if the checklist passes. It is displayed in amber if the checklist is failed and radio altitude is above 200 ft. It is displayed in red if the checklist is failed and the radio altitude is below 200 ft.

### Minimums alert

The minimums descent altitude indication is the same for RA DH indication than for BARO M indication. When approaching minimums, a black window is displayed and when at minimum, MINIMUM is displayed.

### Low bank limit arc

**FIGURE 02-34-36-20 LOW BANK LIMIT ARC**

The low bank limit arc (± 15°) indication is displayed:

- automatically when in HDG/Track and crossing 32600 ft in climb,
- when low bank is selected in AFCS tab of avionics window.

### Heading scale

The heading scale appears in the ADI only in a two DU configuration and when the PNF has removed the HSI. The scale appears on the horizon line.

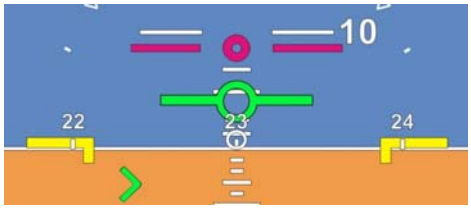



**FIGURE 02-34-36-21 TWO DU ADI CONFIGURATION**

## DEVIATION

### Vertical deviation scale

The vertical deviation scale is located on the right side of the ADI when a G/S is detected or computed by the FMS and VNAV is engaged and approaching the TOD.

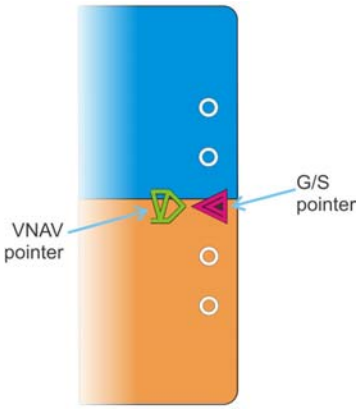



**FIGURE 02-34-36-22 VERTICAL DEVIATION SCALE VALUES**

### VNAV pointer

**FIGURE 02-34-36-23 VNAV POINTER**

If the active vertical mode is VPTH or VGP, a specific pointer is displayed on the vertical deviation scale.

### GS vertical deviation pointer

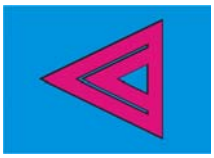


**FIGURE 02-34-36-24 GS POINTER**

If a G/S is detected a specific pointer is displayed on a vertical deviation scale.

If the pointer is at the limit of the scale only half of the scale is displayed.

### Lateral deviation scale and pointer

The expanded lateral deviation scale for Loc deviation is displayed in white at the bottom of the attitude display. The scale is two dots with a zero point.

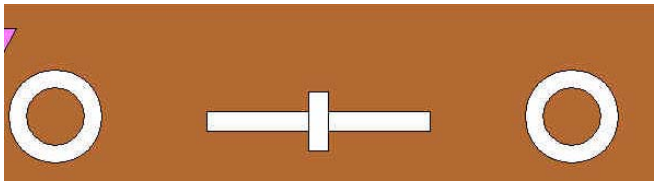


**FIGURE 02-34-36-25 LATERAL DEVIATION SCALE**

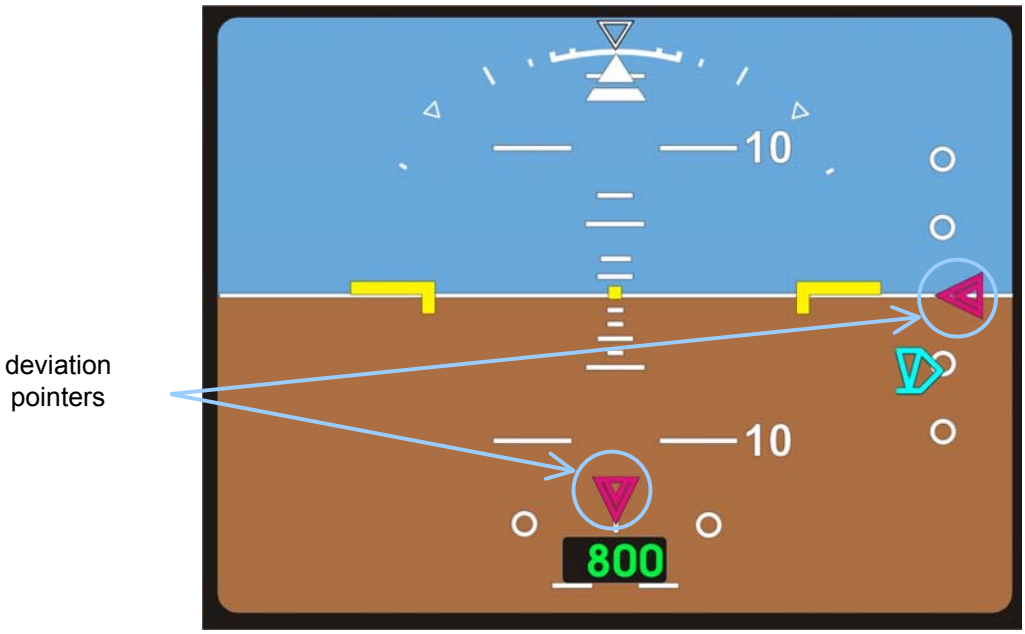



**FIGURE 02-34-36-26 LOC / GLIDE DEVIATION POINTERS**

**Lateral excessive deviation indicator**

If the navigation source is LOC and tuned to LOC, the lateral excessive deviation excessive indicator appears as two triangles.

The Loc deviation is displayed in white, cyan or magenta according to the approach mode status.

**Vertical deviation excessive indicator**

If the active navigation source is LOC and tuned to LOC, the vertical deviation excessive indication is displayed as two triangles.

In CAT2, HUD2 or HUD3 modes, if the vertical deviation is exceeding a pre-determined value, an amber (above 200 ft RA) or red (below 200 ft RA) triangle is displayed to correct an appropriate direction (the correction direction is indicated by the arrow direction). It takes between 2 and 4 seconds for the triangle to be displayed depending on the RA.

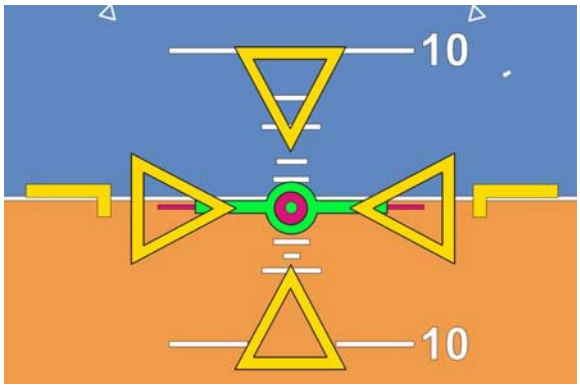



**FIGURE 02-34-36-27 EXCESSIVE DEVIATION TRIANGLES**

## AIRSPEED TAPE

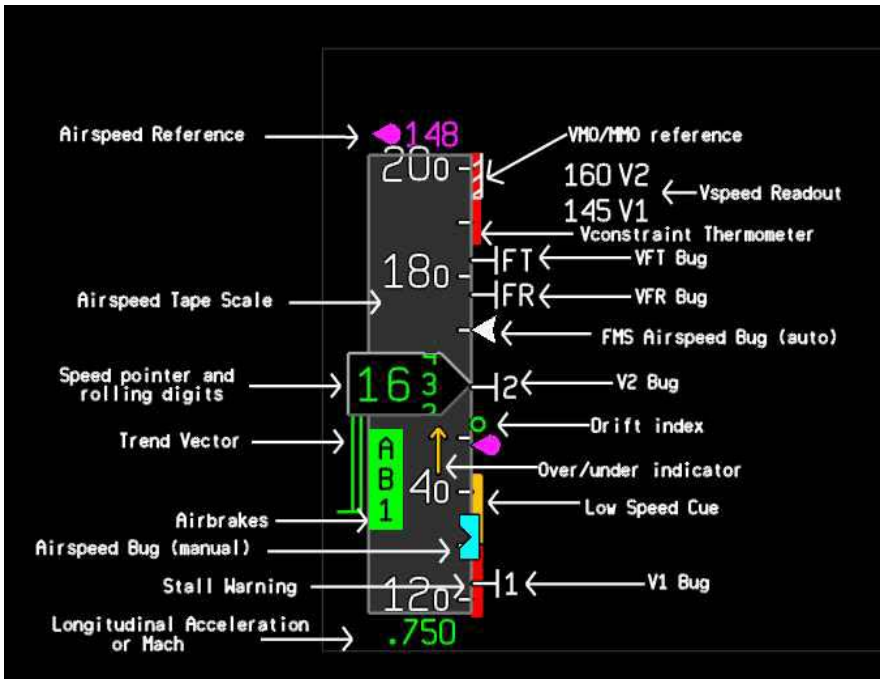



**FIGURE 02-34-36-28 AIRSPEED TAPE**

### Airspeed tape scale

The airspeed tape scale is limited from 30 to 900 kt, with white tick marks indicating every 10 kt.

When the data is deemed invalid, a **X** is displayed on the tape and all the information are removed.

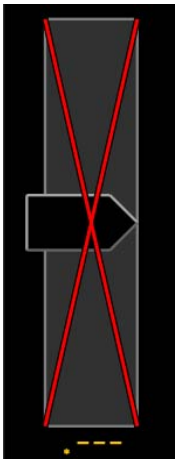



**FIGURE 02-34-36-29 AIRSPEED TAPE INVALID**

**Speed reference pointer and rolling digits**

The airspeed readout is normally displayed in green.

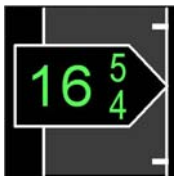



**FIGURE 02-34-36-30 AIRSPEED READOUT**

It is displayed in amber reverse video when indicated airspeed is less than or equal to the low speed cue.


**FIGURE 02-34-36-31 AMBER AIRSPEED READOUT**

It is displayed in red reverse video when:

- Indicated airspeed is less than or equal to the stall warning speed and not WOW,
- Indicated airspeed is greater than or equal to VMO,
- Indicated airspeed is greater than or equal to the Vconstraint.


**FIGURE 02-34-36-32 RED AIRSPEED READOUT**

**Manual speed bug**

The speed bug is set to the position corresponding to the IAS selected airspeed, using the SPEED knob on the Guidance Panel (GP) when in MAN position. If the selected airspeed is beyond the range of the displayed airspeed, the bug is displayed at the appropriate end of the tape with half of the bug out-of-view. The bug follows the same color code than the selected readout.

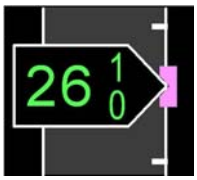



**FIGURE 02-34-36-33 MANUAL SPEED BUG**

**FMS speed bug**

The FMS peed bug is placed at the position corresponding to the FMS speed when the SPEED knob on the guidance panel is set to FMS. If the airspeed is beyond the range of the displayed airspeed, the bug is displayed at the appropriate end of the tape with half of the bug out-of-view. The bug follows the same color code than the selected readout.

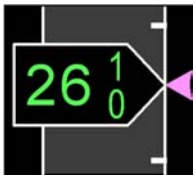



**FIGURE 02-34-36-34 FMS SPEED BUG**

**Selected airspeed reference bug (speed or mach): speed or Mach**


**FIGURE 02-34-36-35 AIRSPEED REFERENCE BUG**

Both IAS and MACH selected bugs have the same color scheme.

If the selected airspeed rotary switch on the Guidance Panel (GP) is selected to MAN position, the manual bug is displayed in magenta and FMS bug is white.

If the selected airspeed rotary switch on the GP is selected to FMS position, the FMS bug and readout is magenta and the manual bug is removed. The GP readout is dashed and the rotary knob dead (will be available for next certification).

The MAN bug is automatically set to the FMS position when the rotary switch is changed to from FMS to MAN switched from FMS to MAN position.

At power up, the default value for MAN bug is 80 kt.

The IAS selected airspeed is limited from 80 to 400 kt with the resolution of 1 kt. When the IAS is at maximum speed, the digits are replaced by the VMO characters.

The Mach selected airspeed is limited from Mach 0.40 to 0.99 with the resolution of .01 Mach. When the Mach is at maximum, the digits are replaced by the MMO characters.

When the data is invalid, the readout is amber dashed (- -).

### Longitudinal acceleration and Mach readout

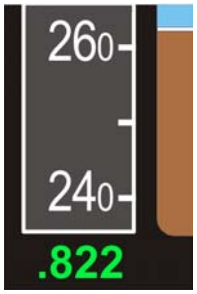



**FIGURE 02-34-36-36 LONGITUDINAL ACCELERATION AND MACH READOUT**

The longitudinal acceleration is located at the bottom of the airspeed tape when on ground. It is displayed in green and has a range of ± .99. On ground, when the data is invalid, the readout is replaced by an ACC. The ACC is removed when in flight if the data is still invalid.

The Mach readout is displayed at the bottom of the airspeed tape when in flight. It is displayed in the same colors as the airspeed digits and has a range of .400 to .998 Mach. It is displayed when MACH is greater than .450 Mach and is removed below .400 Mach.

When Mach is invalid, the readout is amber dashed (---).

**NOTE**

The displayed Mach is an indicated Mach. The true Mach shall be calculated with the correction table provided by the AFM.

### Airbrakes annunciation


**FIGURE 02-34-36-37 AIRBRAKES ANNUNCIATION**

The airbrakes annunciation AB1 or AB2 are displayed vertically on the airspeed tape in green reverse video in normal situations. These indications are in red reverse video if the NO TAKE OFF CAS message due to AB1 or AB2 is enabled, these indication are in amber reverse video if the commanded position does not match the actual position.

**V-speed readout and bugs**

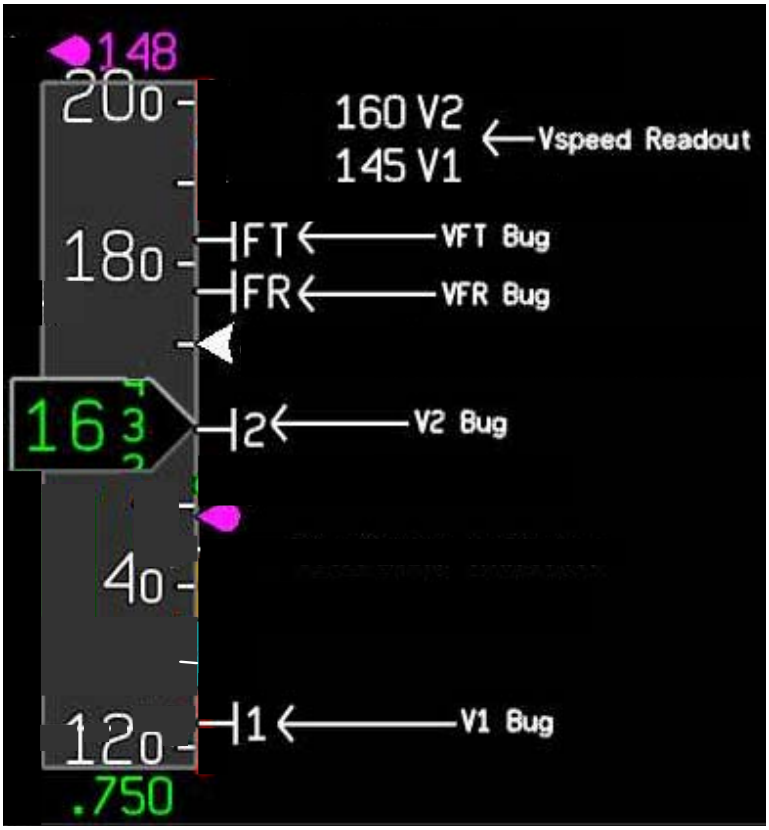



**FIGURE 02-34-36-38 V-SPEED BUG**

The V-speed digital readout is displayed in white in the upper left corner of the attitude display. The digital readouts of V1 and V2 are only displayed on-ground. If the data are sent and invalid, the digital readout is replaced by amber dashes (---V1).

Take-off V-speed bugs are V1, V2, VFR and VFT. The bugs are displayed in white alongside the airspeed tape, at the corresponding airspeed. The bug values are displayed when the **Send** soft key is depressed in the departure POF of the FMW (T/O data).

Landing V-speed bugs are VAP and VRF. The bugs are displayed in white alongside the airspeed tape, at the corresponding airspeed. The bug values are displayed when the **Send** soft key is depressed in the arrival POF of the FMW (LDG data tab).

**Airspeed limitation**

Depending on the airplane configuration, a red bar is displayed at the top of the speed scale to prevent overspeed when flaps are extended or in case of failures that might lower speed limitations (pitch feel fail, aileron feel fail, etc.). This bar may therefore correspond to speed lower than VMO / MMO.

In this case, the manual speed bug can still be positioned above the airspeed limitation bar.

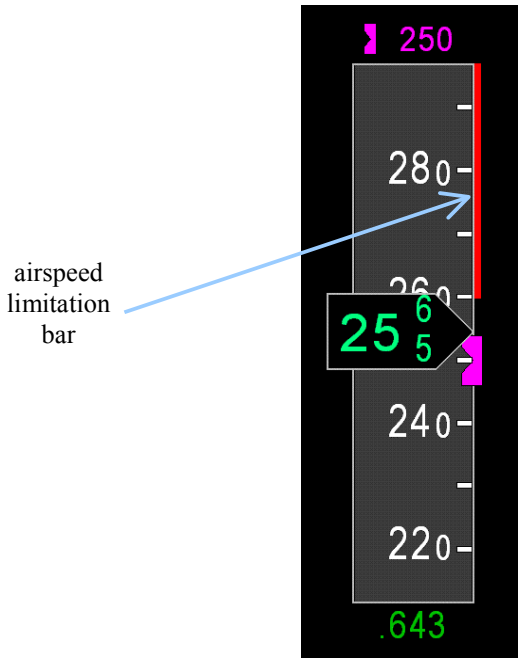



**FIGURE 02-34-36-39 AIRSPEED LIMITATION ON THE ADI SPEED SCALE**

The airspeed limitationt is displayed in red as a thermometer that extends from the top of the VMO / MMO thermometer to the Vconstraint value. It is based on the following conditions:

| CONDITION | V CONSTRAINT VALUE |
|---|---|
| CLEAN | No constrained |
| SF1 | 200 kt |
| SF2 | 190 kt |
| SF3 | 180 kt |
| CAS message **FIRE ENG ..** enabled | 250 kt |
| CAS message **FIRE REAR COMP** enabled | 250 kt |
| CAS message **TR .. : FAIL** enabled | 180 kt |
| CAS message **MT FAIL** enabled | 0.80 Mach with AP disengaged |
| CAS message **PITCH FEEL** enabled | 0.76 Mach or 260 kt |
| CAS message **AUTO SLATS** enabled | 270 kt |
| CAS message **UNWANTED SLATS** enabled | 200 kt |
| One hydraulic system (**HYDR #1 ENG 1+2PUMP** or **HYDR #2 PUMP**) is enabled | 0.76 Mach or 260 kt |
| Gear is down locked | 245 kt |
| Gear not locked (down or up) | 190 kt |

➢ *For more information, refer to CODDE1 / Chapter 02 / ATA 22.*

**Trend vector**

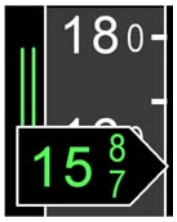



**FIGURE 02-34-36-40 TREND VECTOR**

The airspeed trend vector is displayed above or below the IAS readout according to the acceleration or deceleration of the airplane.

**Low Speed Cues (LSC)**

- **Amber LSC**

  The normal flight envelope for the airplane is above the amber LSC

  This LSC is computed using weight from the FMS (high altitude only) the pressure altitude (high altitude only) from the onside selected ADS, and taking in account the airplane configuration (CLEAN, SF1, SF2, SF3). If the weight is not computed, the low speed cue is normally displayed as long as the pressure altitude is less than 25,000 ft, else the low speed cue is removed.

- **Red LSC**

  The stall warning cue is displayed in red. It gives indication of the stall speed according to the airplane configuration.

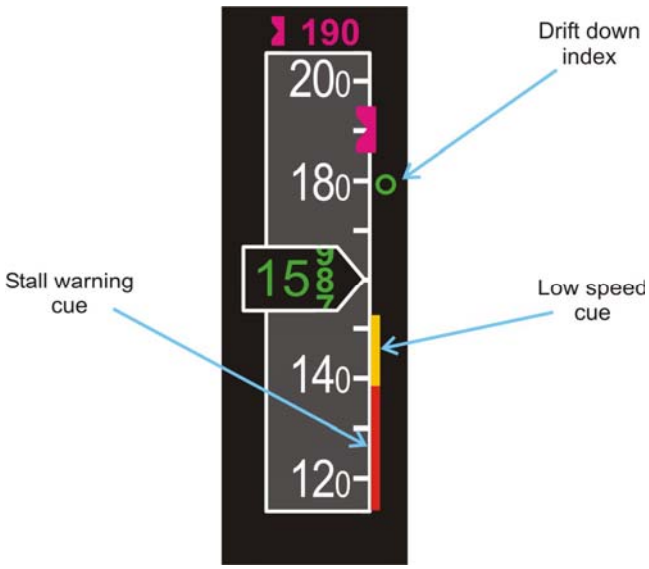



**FIGURE 02-34-36-41 LOW SPEED CUES**

➢ *For more information refer to CODDE1 / Chapter02 / ATA22.*

### VMO / MMO thermometer

The VMO / MMO thermometer is displayed as a barber pole (red with white stripes). It extends from the VMO value to the top of the airspeed tape.

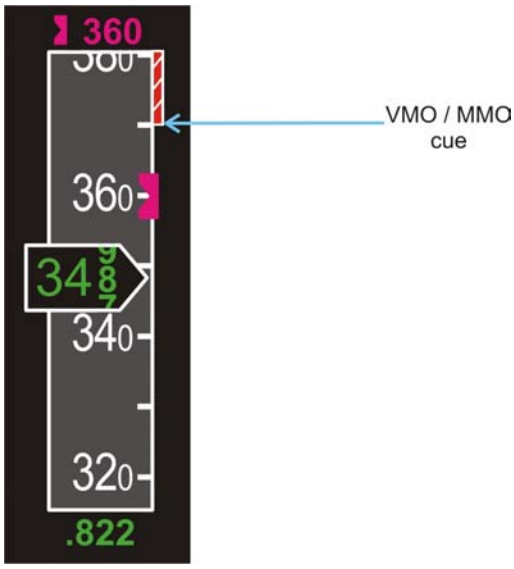



**FIGURE 02-34-36-42 VMO / MMO BARBER POLE**

### Overspeed / underspeed indication (CAT2)

When in overspeed (or underspeed) an amber arrow is displayed close to the speed scale. It is displayed if the modes CAT2, HUD2 or HUD3 are active, RA is between 15 and 1,000 feet and indicated airspeed is different from the speed bug by more than 5 kt.

When the warning is displayed, it flashes as long as the condition exists.

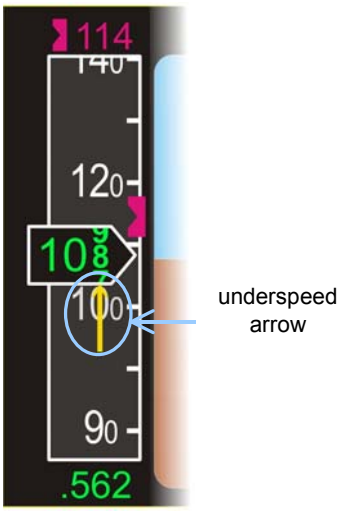



**FIGURE 02-34-36-43 UNDERSPEED ARROW**

**Drift Down Index (DDI)**

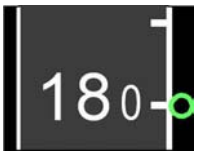



**FIGURE 02-34-36-44 DRIFT DOWN INDEX**

The Drift Down Index (DDI) symbol is a green circle moving along the airspeed tape. It is only displayed in clean configuration, and indicates the best climb/descent airspeed in clean configuration. The computation uses the weight from the FMS and the pressure altitude from the on-side selected ADS in high altitude.

If weight is not computed, the DDI is normally displayed until the pressure altitude is less than 25,000 ft; the DDI is removed when above 25,000 ft.

## ALTITUDE TAPE

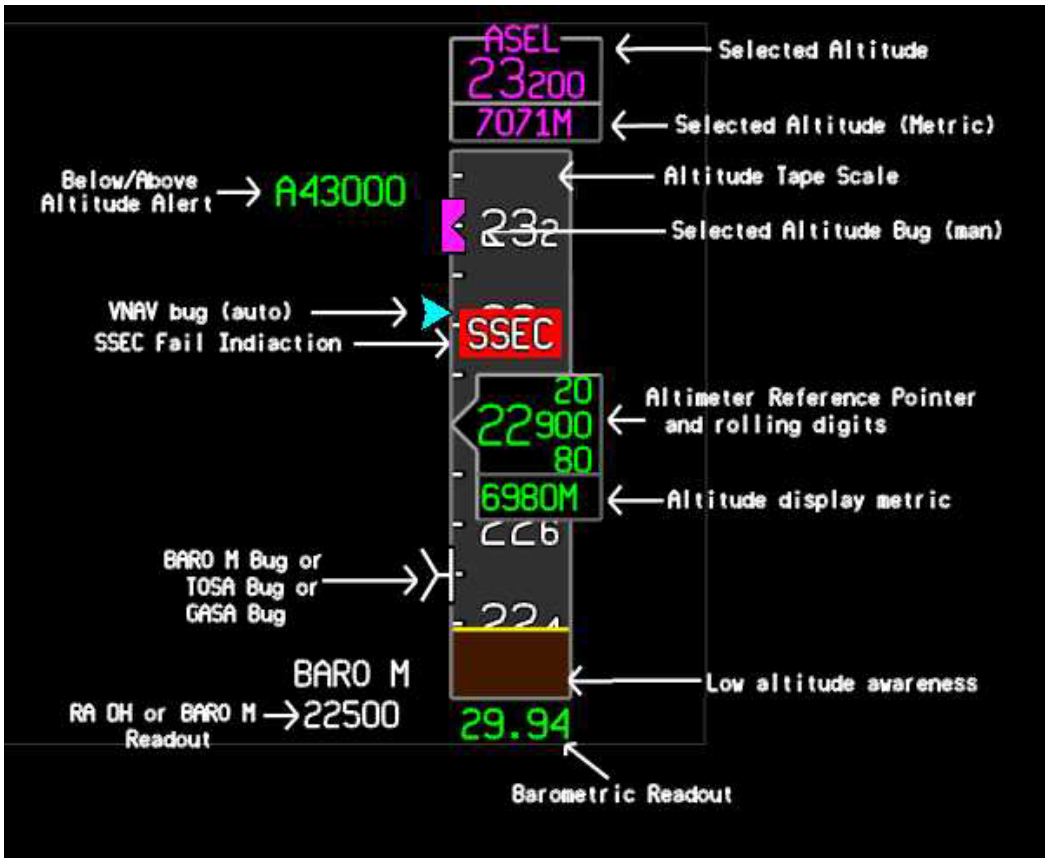



**FIGURE 02-34-36-45 ALTITUDE TAPE**

**Altitude tape scale**

The altitude tape scale goes from - 2,000 to 65,000 ft. White tick marks represent every 100 ft and enhanced tick marks correspond to 500 ft multiples.

When altitude is invalid, a X is displayed on the tape.

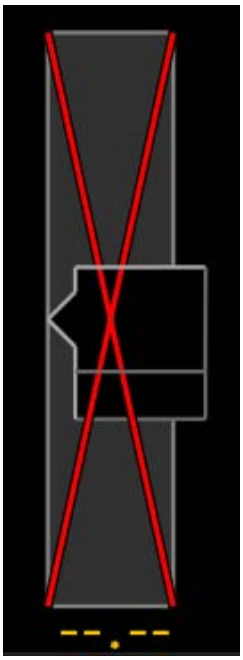


**FIGURE 02-34-36-46 ALTITUDE TAPE INVALID**

**Altimeter readout in ft**

The altimeter readout is displayed in green. If the altitude is negative, a green NEG is displayed on the left of the readout.


**FIGURE 02-34-36-47 ALTIMETER READOUT**

**Altitude readout in meters (M)**

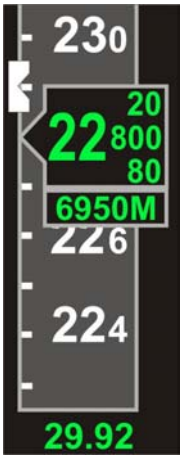



**FIGURE 02-34-36-48 ALTIMETER READOUT IN METER**

The altimeter metric readout is displayed in green. The M label is displayed following the digital readout to indicate metric units. When a value is negative, a green minus sign is displayed on the right of the readout.

**ASEL readout**


**FIGURE 02-34-36-49 ASEL INDICATION EXAMPLE**

The selected altitude readout is displayed on top of the altitude tape.

If the barosetting is selected to STD , the selected altitude displays a flight level (FL xxx). If not set to STD, the selected altitude displays 5 digits (xxxxx). At power up the ASEL is invalid (amber dashes).

The color of the readout and label is:

- magenta if the vertical active mode is VASL, ASEL,ALT or VALT,
- white if the active vertical mode is:
  - G/S, VGP,WSHR modes,
  - VPTH with ASEL below the constraint,
  - VCLB with ASEL above the constraint,
  - VALT or ALT if the altitude is not captured.
- cyan if ASEL is armed.

When ASEL is invalid, the readout displays amber dashes (---).

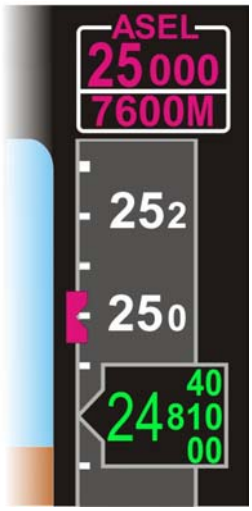



**FIGURE 02-34-36-50 ASEL READOUT IN METERS**

### ASEL bug

The ASEL bug is displayed on the altitude tape (set using the ASEL knob on the GP). If the selected altitude is beyond the range of the displayed altitude tape area, only half of the bug is visible. The bug follows the same color code than the ASEL readout.

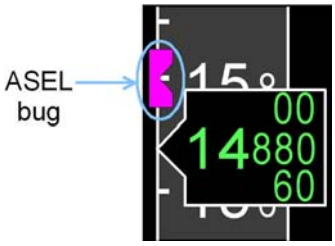



**FIGURE 02-34-36-51 ASEL BUG**

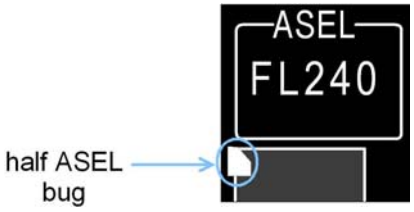



**FIGURE 02-34-36-52 HALF ASEL BUG**

**VNAV bug**

**FIGURE 02-34-36-53 VNAV BUG**

The VNAV altitude bug is displayed on the altitude tape. If the altitude is beyond the range of the displayed altitude tape, only half of the bug is visible.

The bug is colored in:

- magenta if the vertical active mode is VASEL or VALT and at the current altitude,
- cyan when in VCLB and altitude is below ASEL, or in VPTH and higher than ASEL,
- white otherwise.

If the pointer is at a limit of the scale only half of the pointer is displayed.

**RA DH and BARO M readout**

**FIGURE 02-34-36-54 BARO M TOSA OR GASA BUG**

The BAROmetric Minimum (BARO M) readout is displayed in white and is located on the lower right corner of the attitude display.

The Radio Altimeter Decision Height (RA DH) readout is displayed in white at the same location than the BARO M indication.

**Barosetting readout**


**FIGURE 02-34-36-55 BAROSETTING READOUT**

The barosetting correction is displayed in green at the bottom of the altitude scale, and is set using the BARO set knob on the GP:

- when the inches of mercury unit is selected in the Units menu of the HSI tool bar, the barometer is set in in.Hg (0.1 in.Hg increments for one click),
- when hPa is selected in the Units menu, the barosetting is set in hPa (1 hPa increments for one click).

When the PUSH STD pushbutton on the GP is depressed, a green STD indication appears at the bottom of the altitude scales and the altitude is standard.

**Low altitude awareness**

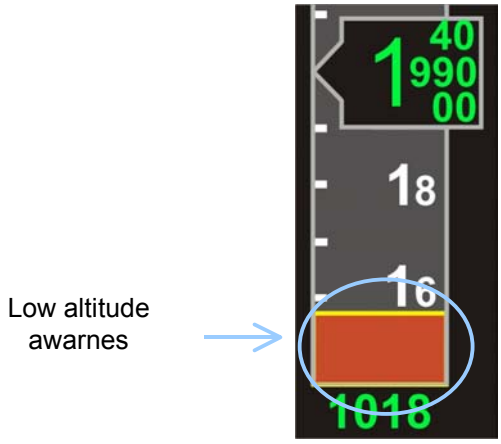



**FIGURE 02-34-36-56 LOW ALTITUDE AWARNESS**

The low altitude awareness symbol is displayed when approaching the ground. The ground is displayed brown with a yellow line at the top. The ground is displayed when the RA is lower than 550 ft.

## VERTICAL SPEED TAPE

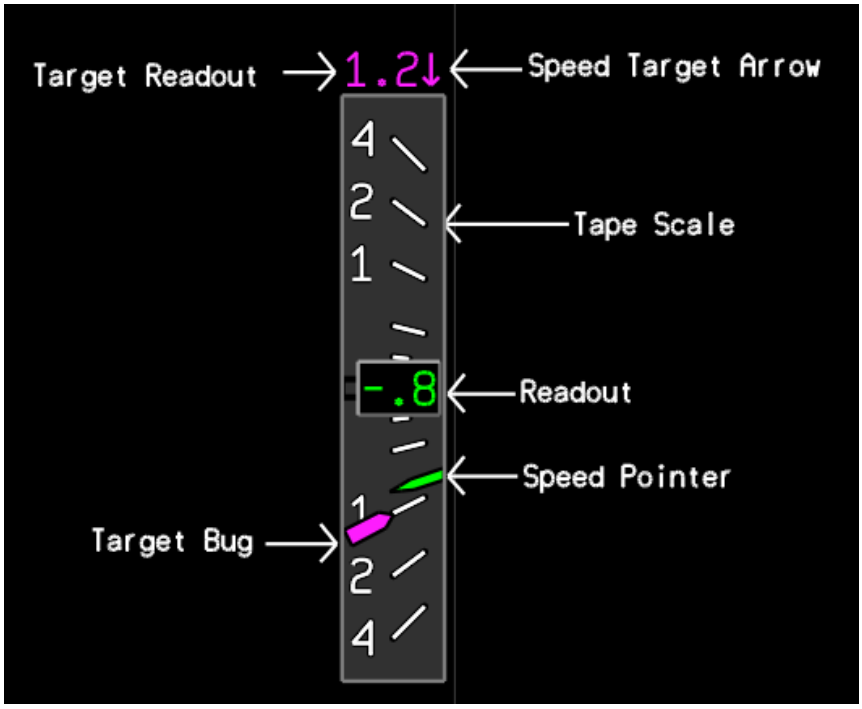



**FIGURE 02-34-36-57 VERTICAL SPEED TAPE**

**Vertical speed tape**

The vertical speed is a fixed scale with a moving speed pointer. Each tick mark on the scale represents respectively 0, ± 250 ft/min, ± 500 ft/min, ± 1,000 ft/min, ± 2,000 ft/min, and ± 4,000 ft/min.

When the VS is invalid, all the symbols are removed from the tape and a red VS flag is displayed at the top of the scale.

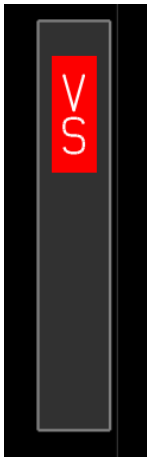



**FIGURE 02-34-36-58 VERTICAL SPEED TAPE INVALID**

**Vertical speed readout**

The vertical speed readout is displayed in green in the middle of the vertical speed scale. It indicates vertical speed in feet per minute (100 ft/min increments).

Negative values for the vertical speed are displayed with minus sign at the beginning of the readout.


**FIGURE 02-34-36-59 VERTICAL SPEED AT ZERO**

**Vertical speed pointer**

The vertical speed pointer is displayed in green. It gives an analog display of the VS.

**Vertical speed target readout and arrow**


**FIGURE 02-34-36-60 VERTICAL SPEED TARGET**

The vertical speed target is displayed above the tape in magenta when in vertical VS captured mode (100 ft/min increments). It is set using the VS / PATH wheel on the GP when in VS.

The vertical speed target bug is displayed on the tape in magenta when in VS.

The arrow displayed close to the target indicates if a positive or negative VS is set.

## MISCOMPARE ANNUNCIATION

Miscompare flags are displayed when the system senses a difference between two sensor values.

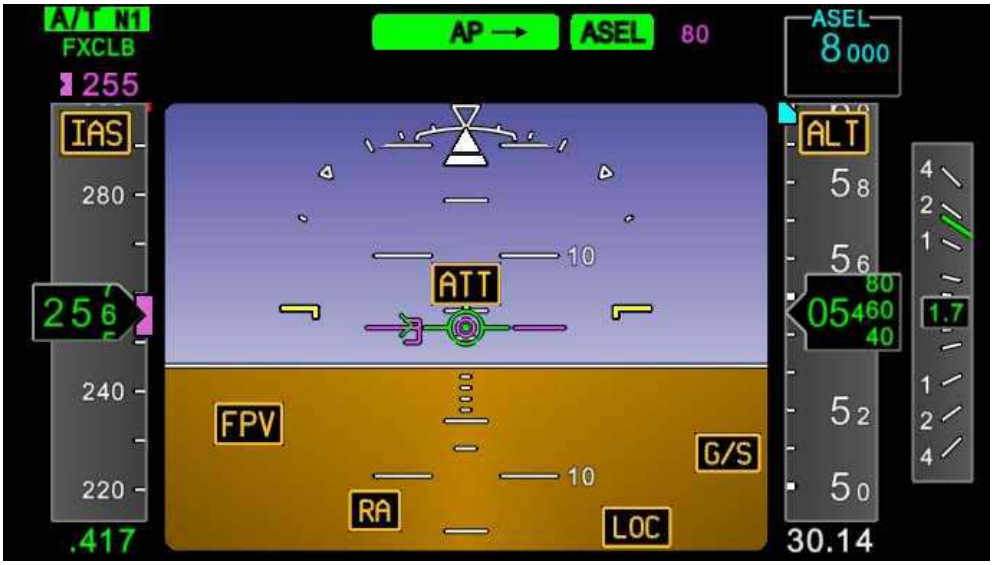



**FIGURE 02-34-36-61 LOCATION OF MISCOMPARE FLAGS ON ADI**

A miscompare indication is triggered when a difference between left and right ADI exists on certain parameters. A miscompare flag flashes for ten seconds, it is then steady till the miscompare is no longer effective.

The miscompares flags are:

- ATT,
- FPV,
- RA,
- LOC,
- G/S,
- IAS
- ALT.

The pressure altitude and baro altitude miscompare are located in the same position on the altitude tape (ALT). The pressure altitude is displayed in amber and the baro altitude is displayed in cyan. The pressure altitude has priority over baro altitude.

When a miscompare flag is displayed the crew must apply the corresponding AFM procedure.

## FAILURE INDICATIONS

In most cases, if data are invalid the corresponding indication(s) are removed. In some other cases when it is necessary for the crew to be aware of a failure, the failure indication is displayed on the ADI in white text with a red background.

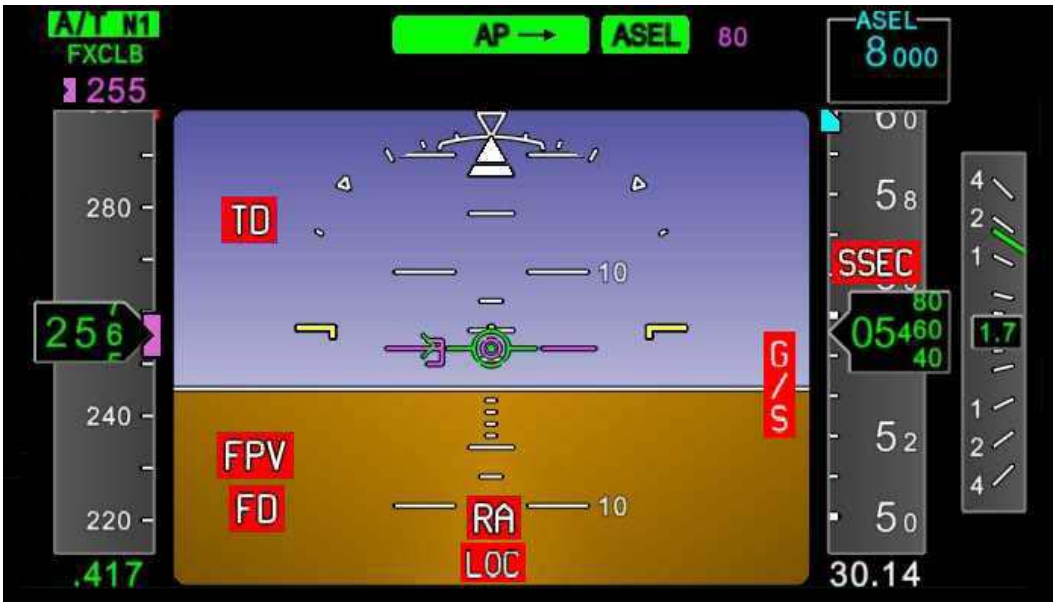



**FIGURE 02-34-36-62 FAILURE INDICATIONS ON ADI**

**G/S**

GS failure flag is displayed when the G/S receiver is failed. In that case the pointer is removed. The G/S failure flag is inhibited if the active lateral or armed mode is B/C or the active lateral or armed mode is not G/S.

**LOC**

The LOC failure flag is displayed when the Loc is failed or active or lateral mode is not locked or B/C Loc receiver is failed. In that case the pointer is removed. The LOC failure flag is inhibited or the active lateral or armed mode is not LOC or B/C.

**RA**

RA flag is displayed when the corresponding RA is failed.

**TD**

TD flag is displayed when:

- A/T is failed,
- A/T is not available (e.g DEEC failure),
- on ground when T/R is activated (will be corrected in the future).

**FPV**

FPV flag is triggered when the FPV computations are not available for the corresponding IRS. (e.g during in flight alignment phase).

**FD**

FD flag is triggered when the FD computations are not available for the corresponding AFCS.

**ATT**

ATT flag is triggered when attitude from the on-side IRS is lost.

**INTENTIONALLY LEFT BLANK**

## GENERAL

The Horizontal Situation Indicator (HSI) window provides:

- horizontal situation information,
- permanent radio information,
- airplane configuration status,
- major airplane parameters.

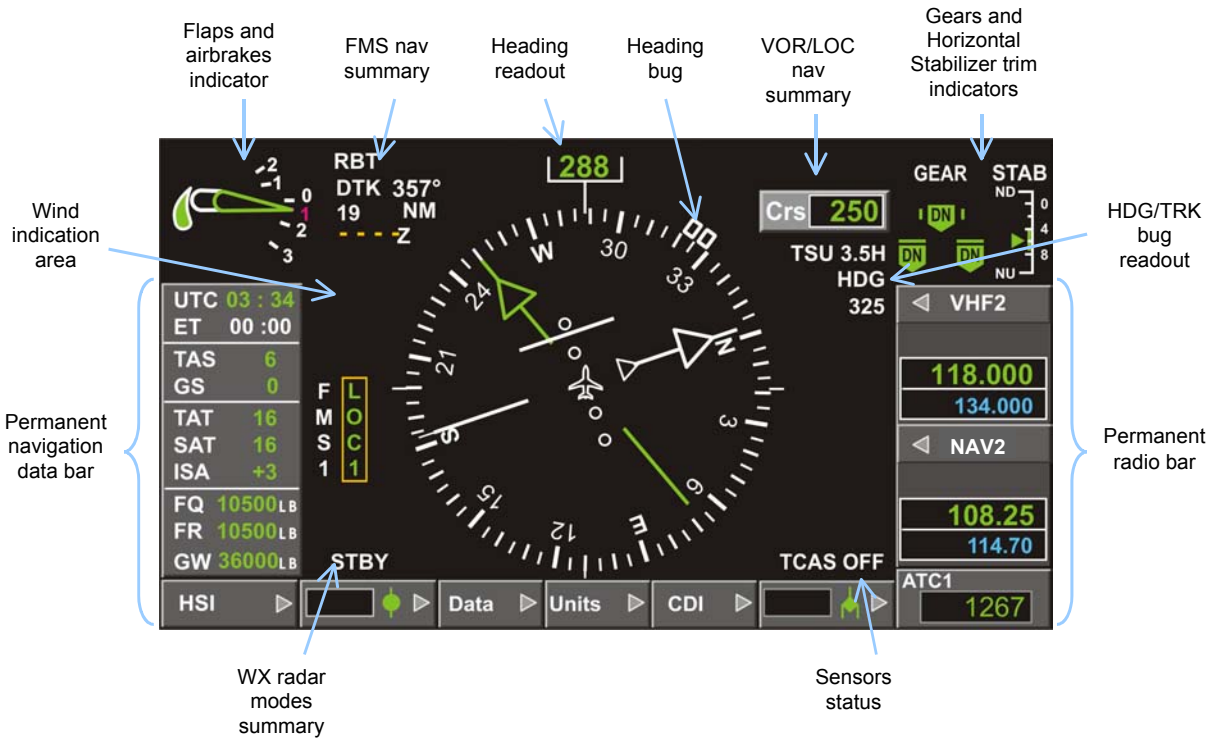



**FIGURE 02-34-38-00 HSI WINDOW LAYOUT**

## HSI FORMAT

Two formats are possible for the HSI window:
- ARC format (120° arc),
- ROSE format (360°).

MENU pushbutton gives access to format selection:


FIGURE 02-34-38-01 ROSE / ARC MENU

## HSI WINDOW

HSI window provides horizontal navigation information, airplane configuration status and permanent radio information. Reversion flags, miscompare flags and failure indication are also displayed when conditions are met.

Horizontal Navigation information is provided on a 120° arc or a 360° rose format.


FIGURE 02-34-38-02 ROSE FORMAT


FIGURE 02-34-38-03 ARC FORMAT

**Horizontal navigation information**

In two displays configuration (ARC, ROSE), on the PNF PDU, lower 1/3 may display another window than the standard HSI window. In that case a heading scale is added to the ADI on the horizon line.

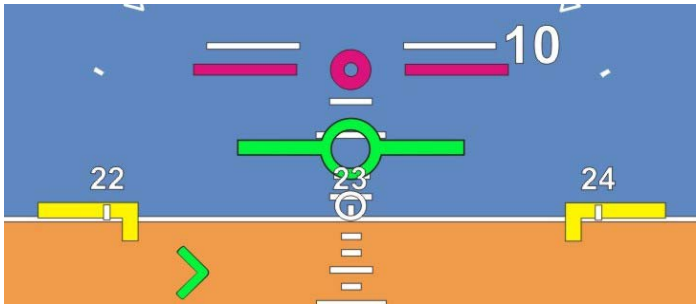



**FIGURE 02-34-38-04 ADI HEADING SCALE**

FMS CDI, VOR/ILS CDI and two bearings (circle or diamond shape) can be displayed simultaneously on the HSI:

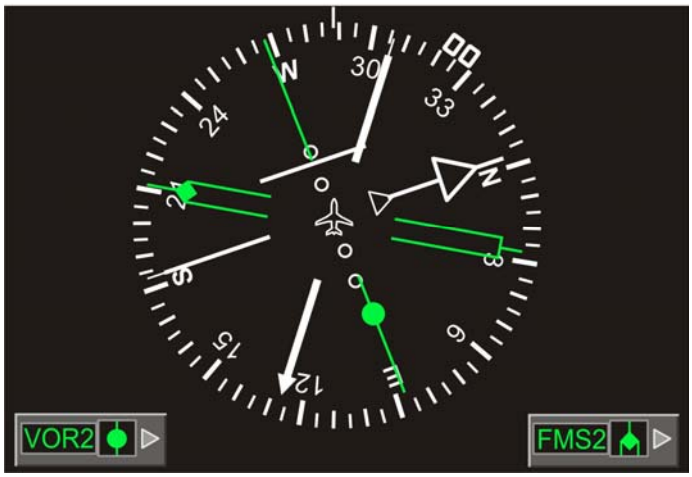



**FIGURE 02-34-38-05 FMS CDI, VOR / LOC CDI AND TWO BEARINGS**

Pilots command for selecting FMS CDI, VOR / LOC CDI and bearings are located in the HSI features menu.

ARC format has the capability to display:

- WX layer,
- Flight Plan layer (will be available for next certification),
- LSS information (optional).

**HSI features menu**

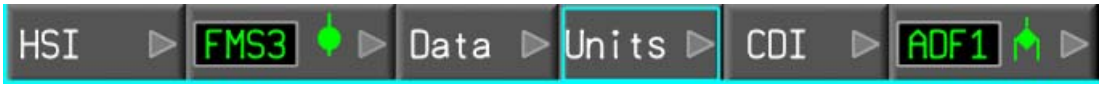



**FIGURE 02-34-38-06 HSI TOOL BAR**

HSI menu can be displayed or removed from display by clicking on the HSI tool bar the HSI bottom left corner.

HSI features menu gathers all controls to customize the HSI content. All these controls are arranged in sub-menu:

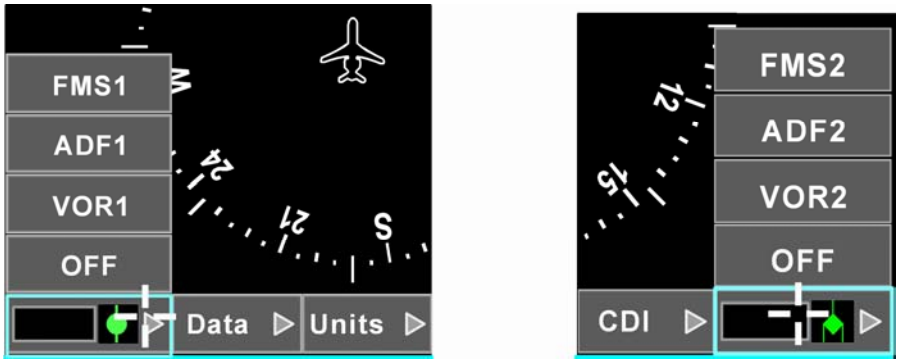



**FIGURE 02-34-38-07 BEARING MENU**

- In the left bearing menu, each crew member can choose to display in his HSI, either the FMS1, ADF1 or VOR1 bearing (primary bearing with circle shape), or to remove the bearing (OFF).

They are displayed in white in the menu, and once selected, they are displayed in green inside the pushbutton.

**FIGURE 02-34-38-08 PRIMARY BEARING**

- In the right bearing menu, each crew member can choose to display in his HSI, either the FMS2, ADF2 or VOR2 bearing (secondary bearing with diamond shape), or to remove the bearing (OFF).

**FIGURE 02-34-38-09 SECONDARY BEARING**

A VOR bearing is based on the selection in the tool bar and not Tuned–to-LOC, if the data is invalid or Tuned-to-LOC the VOR bearing pointer is removed.

The other bearing pointer, ADF and FMS, are based on the data being valid and the selection in the tool bar, if the data is invalid or selection is OFF the bearing pointer is removed.

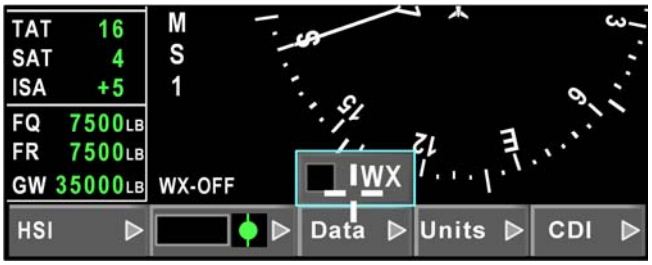



**FIGURE 02-34-38-10 DATA MENU**

Arc format offers the possibility to display the weather radar (WX) layer. Terrain layer is not available in HSI since it has its own dedicated display in the PDU lower 1/6 quadrant (TRAFFIC window). Selection of these layers are done through the Data submenu of the HSI feature menu:

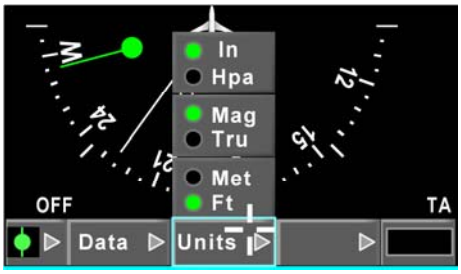



**FIGURE 02-34-38-11 UNITS MENU**

In the Units menu, each crew member can choose the units to be displayed in his PDU for altitude, heading and pressure. The default values are In, Mag and Ft.

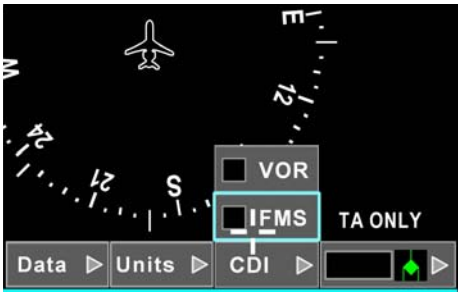



**FIGURE 02-34-38-12 CDI MENU**

In the CDI bearing menu, each crew member can choose to display the VOR and the FMS CDI. They cannot be removed when displayed in magenta since they are the active source.

**Navigation Data Bar**

This permanent data bar provides time information, navigation information and weight / fuel status:

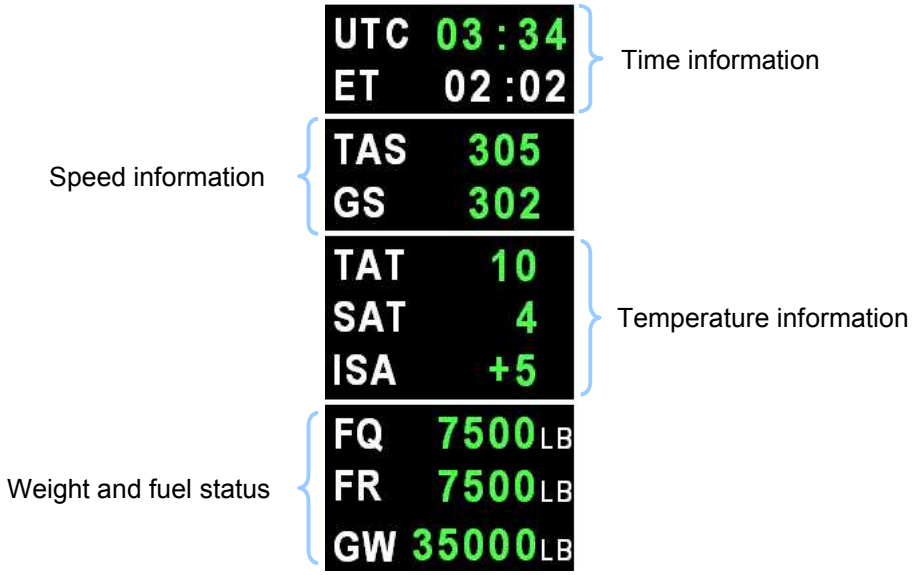



**FIGURE 02-34-38-13 NAVIGATION DATA BAR**

- Time information:
  - UTC (from GPS),
  - Elapse Time (ET) counter. Elapse Time is started using the ET pushbutton beside the each Primary Display Unit (first push: start, second push: stop, third push: reset),
- Speed information:
  - TAS (in kt),
  - GS (in kt),
- Temperature information:
  - TAT (in °C),
  - SAT (in °C),
  - ISA (difference in °C),
- Weight and fuel status:
  - FQ (total fuel gauge),
  - FR (FMS fuel remaining),
  - GW (Gross Weight).

**FMS Nav Summary**


**FIGURE 02-34-38-14 FMS NAV SUMMARY**

FMS Nav Summary gathers the primary short term FMS data in a single area at the ARC and ROSE format top left corner. The following information is displayed from top to bottom:

- Active FMS TO WPT name,
- DTK (Desired Track … to TO WPT),
- DTG (Distance To Go … to TO WPT),
- ETA (Estimated Time of Arrival … at TO WPT).

This group of data and the FMS Navigation Source Annunciator are only displayed when FMS CDI is displayed. FMS CDI is automatically displayed when LNAV mode is active or armed. If LNAV is neither active nor armed, FMS CDI and FMS Nav data can be selected for display by selecting the “FMS CDI” option in the CDI submenu of the HSI features menu.

According to the lateral active and armed mode, the color of the FMS data and Nav Source annunciator and CDI can be magenta (LNAV active), or cyan (LNAV armed) or white (LNAV not active and not armed).

**NAV (VOR / LOC) data summary**

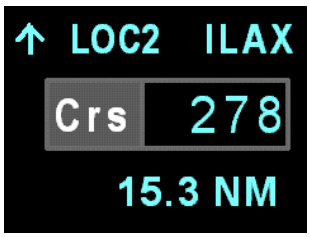



**FIGURE 02-34-38-15 VOR/LOC DATA SUMMARY**

Nav data summary gathers in a single area at the top right corner of the ROSE and ARC format the following information on the on-side selected VOR / LOC:

- VOR / LOC pointer icon and Tuned Station ident,
- Selected COURSE field,
- DME information if available.

This group of data and the LOC Navigation Source Annunciator are only displayed when VOR / LOC CDI is displayed. VOR / LOC CDI is automatically displayed when LOC mode is active or armed. If LOC is neither active nor armed, VOR / LOC CDI option in the CDI submenu of the HSI Features menu.

According to the lateral active or armed mode, the color of the VOR / LOC data and Nav Source Annunciator and CDI can be magenta (LOC actve), cyan (LOC armed) or white (VOR station tuned or ILS station tuned without LOC active or armed).

**WX and Sensors Status**


**FIGURE 02-34-38-16 SENSORS STATUS AREA**

Sensors status is summarized in the lower right corner of the HSI and lower left corner for Weather Radar. From top to bottom:

- FMS **MSG** and **DGR** annunciators,
- TAWS annunciation field: **FLAPS OVRD**, **TERR INHIB**, **G/S inhibit**, **TERR TEST** (test), **TERR** (failed),
- LSS annunciation field: **LX** (normal mode), **LX/C** (calibration), **LX/CL** (clear), **LX/T** (test), **LX** (failed),
- TCAS annunciation field:
  - TCAS limits: **AB+BW** (unrestricted), **ABV** (above), **BW** (below),
  - TCAS mode: **TCAS OFF** (off), **TCAS** (normal operation), **TA ONLY** (TA without intruder),or **TA ONLY** (TA with an intruder), **RA FAIL** (RA failure), **TCAS TEST** (test), **TCAS** (failed).

**NOTE**

**RA FAIL** is related to TCAS Resolution Advisory. It does not mean Radio Altimeter failure.

TCAS, WX, FPLN, and LSS layers are only visible in ARC format. However, they can be selected in the HSI features menu, whatever the format ROSE or ARC. FPLN layer allows to toggle between the FMS CDI layout and the Flight Plan Display + XTK readout format.

WX mode status area


**FIGURE 02-34-38-17 WX MODE STATUS**

Concerning WX annunciations:

- tilt line displays Tilt Angle readout (**T**), in automatic mode **A** or in manual,
- gain line displays Gain readout (**G**),
- WX mode is either WX OFF, WX STBY, WAIT , FSBY, WX, GMAP, TEST, WX/R/T (REACT+TURB), WX/T (TURB), OVRD, WX (failed).

### Heading scale

In ROSE mode the displayed range is limited from 1° to 360°.

In ARC mode the heading scale shows 120° in front of the airplane.

### Course Deviation Indicator (CDI)

The CDI comes from FMS or the navigation radios based on the primary NAV source.

If the NAV source is FMS, the CDI is positioned corresponding to the desired track digital readout. The FMS CDI is visually represented with a thick line.

If the NAV source is VOR or LOC, the CDI is positioned corresponding to the course select digital readout. The VOR or LOC CDI is represented with a thin line.

The two CDI can be displayed at the same time.

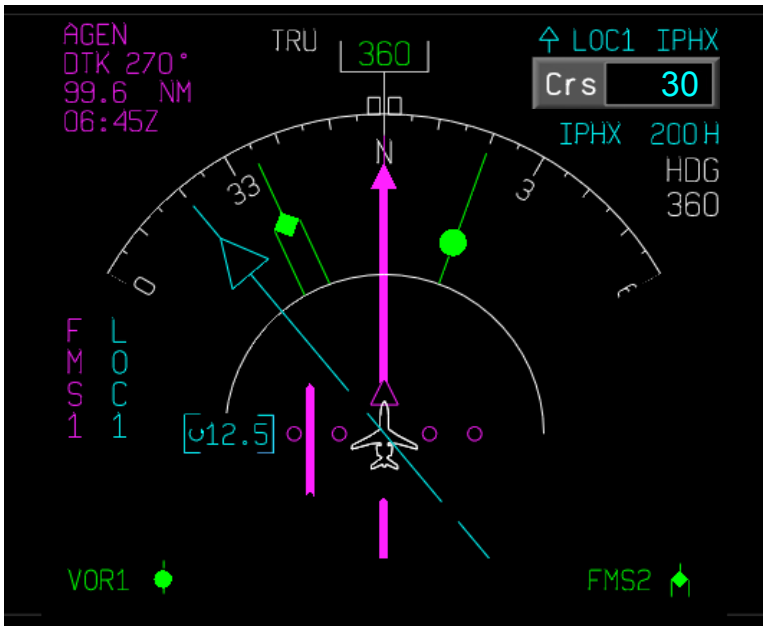



**FIGURE 02-34-38-18 FMS LOC CDI IN ARC MODE**

The FMS CDI can be selected through:

- the HSI tool bar,
- selecting a corresponding AP mode.

The VOR / LOC CDI can be selected through:

- the HSI tool bar,
- selecting a corresponding AP mode,
- selecting CRS on the MKB.

➢ *For the color code, refer to CODDE 1 / Chapter 01/ INTERFACE.*

When the CDI is magenta, it can not be removed using the HSI tool bar. During a Nav-Nav transfer, the FMS can automatically causes the LOC CDI to be displayed on both side, and set the appropriate course for the approach (as well as tune the LOC frequency). Once the approach is armed and LOC captured, the FMS CDI is automatically removed from both sides.

If in ARC mode and the pointer goes beyond the display range of the heading arc scale, a direction arrow is displayed inside of the compass indicating the shortest direction to the pointer.

If the flight plan is selected for display through the HSI tool bar, the CDI is removed and the flight plan is displayed with a digital cross track error. When deselecting the flight plan, the CDI is displayed if selected.

**Bearing pointers**

**Lateral deviation scale and pointer**

The lateral deviation scale and pointer are displayed the same color as the corresponding CDI.

For deviation values outside the limits the pointer is parked at the appropriate end of the scale. The scale and pointer rotate with the CDI

When the CDI is displayed in ARC mode, the lateral deviation is the same as in ROSE mode.

When flight plan is selected and the CDI is removed, a digital readout and arrow are displayed for the FMS lateral deviation. The digital readout has a resolution of 0.01 NM up to 0.99 NM and a resolution of 0.1 NM up to 99.9 NM inclusive. Greater than 99.9 NM, the readout has a 1 NM resolution.

The arrow is displayed to show the airplane position relative to the flight plan track. An arrow pointing right is displayed for deviation lower than 0 or left arrow for deviation greater than 0. The arrow is removed for a 0 deviation.

The lateral deviation is not displayed for LOC / VOR, if valid the lateral deviation is displayed in the lower part of the ADI.

**Heading readout**


**FIGURE 02-34-38-19 HEADING READOUT**

The digital heading readout is displayed in green and uses three digits using leading zero.

If the data is invalid, HDG is displayed.

**Selected HDG / TRK readout**

Based on the Guidance Panel selection, the readout label can be HDG or TRK and uses three digits using leading zero.

If the Guidance Panel (GP) switch indicates HDG, pressing SYNC pushbutton on the GP sets the selected heading bug to the current displayed heading. If current heading is invalid, then the pushbutton has no effect on the selected heading bug.

If the GP switch indicates TRK, pressing SYNC pushbutton on the GP sets the selected track bug to the drift bug. If the drift bug is invalid and on-ground, then pressing the SYNC pushbutton syncs the selected track to the current heading. If drift bug is invalid and not on-ground, then pressing the pushbutton has no effect on the selected track bug.

### Heading track bug


**FIGURE 02-34-38-20 HEADING TRACK BUG (SQUARE)**

Based on the GP selection, the bug can be displayed as two squares (heading) or two triangles (track). The bug is positioned according to the selected heading / track.


**FIGURE 02-34-38-21 HEADING TRACK BUG (TRIANGLES)**

If in arc format with heading/tack out of view, an arrow is displayed.

### Heading reference annunciation (True / Mag)

**TRU** is displayed when in true heading mode. When in magnetic heading mode no information is displayed.

The pilot selection is made through the tool bar (Units tab).

**HDG** is displayed when for a heading miscompare. It flashes for ten seconds then steady till the miscompare is no longer.

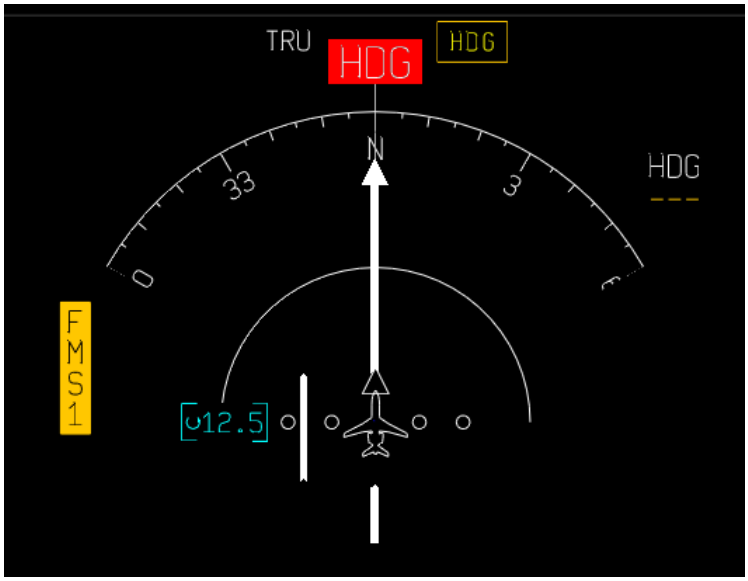



**FIGURE 02-34-38-22 HEADING INVALID INDUCING HDG MISCOMPARE**

**Drift bug**

The drift bug is displayed in green. If the value is zero, the drift bug is aligned with the lubber line.

**Identifier, Distance and Hold**

When the VOR / LOC CDI is selected for display and a DME distance is available, the DME station identifier (up to four characters) is displayed along the distance. If the DME station identifier is the same as the VOR / LOC station (collocated), the DME identifier is not displayed. DME range is 0 to 524 NM.

H is displayed for a DME hold.

Colors:

- VOR source: white,
- LOC source: CDI color.

FMS data is displayed whenever the FMS is displayed NAV source.

## GENERAL

The HGS provides attitude, speed, altitude, flight path, guidance, and other situational information to the pilot in symbolic format. Basic flight information is available during all phases of flight. The HGS also provides display functions for Flight Director guidance, HGS guided approach, visual approach, unusual attitude and takeoff guidance.

The pilot is made aware of the loss of any required displayed information for the HGS, due to unavailable aircraft sensor or equipment data, through the obvious blanking of display elements or the display of special status messages.

The HGS Combiner is removed from the pilot's forward field-of view by moving it to the stowed position. The HGS display brightness can be adjusted, from zero to full intensity through the brightness control located on the Combiner. A manual adjustment mode is available that allows a constant luminance to be set by the pilot. An automatic adjustment mode is also available that allows a constant contrast ratio to be set by the pilot (the actual luminance of the Combiner display varies with the sensed luminance of the ambient light).

The HGS records the detected faults (in aircraft equipment, aircraft sensors and HGS LRUs) and reports the system status to the aircraft Central Maintenance Computer (CMC). The HGS also records the In-Service Performance data and sends it to the CMC upon request.

The HGS Computer receives the approach / takeoff parameters, like the Localizer Track, the Runway Length, the Runway Elevation, and the Reference Glideslope from the Flight Management Windows.

## ENROUTE SYMBOLOGY

The Enroute display provides situational awareness and/or flight director information to the pilot during enroute operations. VOR and FMS information is also available. This is the default display when the aircraft is in air.

A typical representation of the symbology for the Enroute display is shown in the figure.

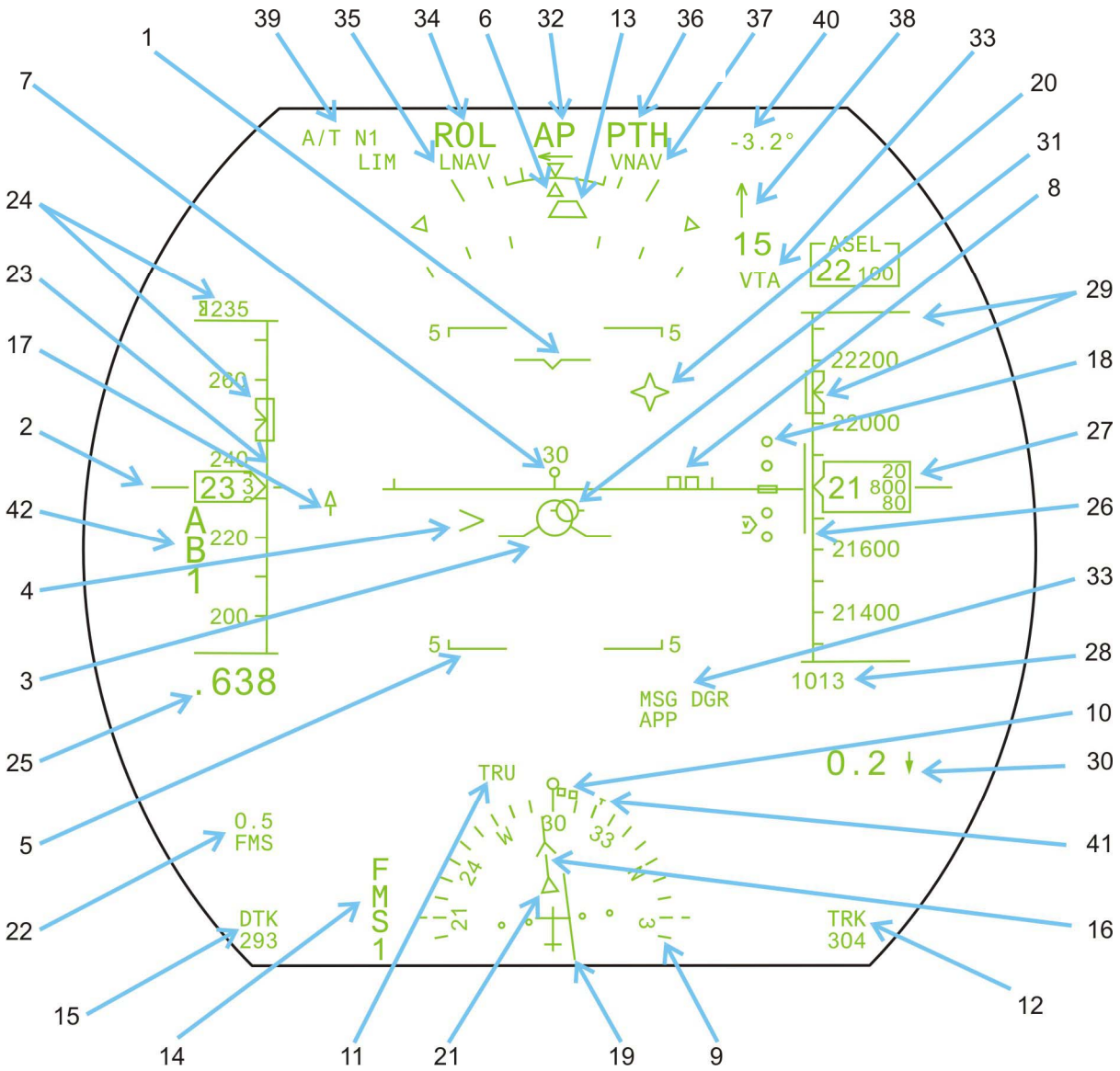



**FIGURE 02-34-40-02 ENROUTE SYMBOLOGY**

| SYMBOL | ID# |
|---|---|
| Aircraft Reference | 1 |
| Horizon Line | 2 |
| Flight Path | 3 |
| Flight Path Acceleration | 4 |
| Pitch Scale | 5 |
| Roll Scale and Pointer | 6 |
| Conformal Heading Scale and Index | 7 |
| Conformal Selected Heading Bug | 8 |
| Partial Compass Rose | 9 |
| Selected Heading Bug | 10 |
| Heading Source | 11 |
| Digital Selected Heading / Track | 12 |
| Slip / Skid Indicator | 13 |
| Navigation Source | 14 |
| Digital Selected Course / Desired Track | 15 |
| Selected Course Arrow | 16 |
| Conformal Selected Course Bug | 17 |
| VNAV Scale / VNAV Pointer | 18 |
| Lateral Deviation Indicator | 19 |
| TO Waypoint | 20 |
| To / From Indicator | 21 |

| SYMBOL | ID# |
|---|---|
| Digital Distance Data | 22 |
| Airspeed Scale | 23 |
| Selected Airspeed Bugs | 24 |
| Indicated Mach Digital Readout | 25 |
| Altitude Scale | 26 |
| Odometer / Altitude Drum | 27 |
| Baro Pressure Setting | 28 |
| Selected Altitude | 29 |
| Digital Vertical Speed | 30 |
| Flight Director Guidance Cue | 31 |
| Autopilot Status | 32 |
| FMS Annunciations | 33 |
| FD Lateral Capture Mode | 34 |
| FD Lateral Arm Mode | 35 |
| FD Vertical Capture Mode | 36 |
| FD Vertical Arm Mode | 37 |
| Wind Speed and Direction | 38 |
| Autothrottle Annunciations | 39 |
| Flight Path Command | 40 |
| Track Angle Pointer | 41 |
| Air Brake Annunciations | 42 |

## TAKE-OFF SYMBOLOGY

The Visual Takeoff display provides situational awareness to the pilot during the takeoff roll without active guidance.

This display is invoked when the aircraft is not configured for guided takeoff. A typical representation of the symbology for the Visual Takeoff display is shown in the following figure.

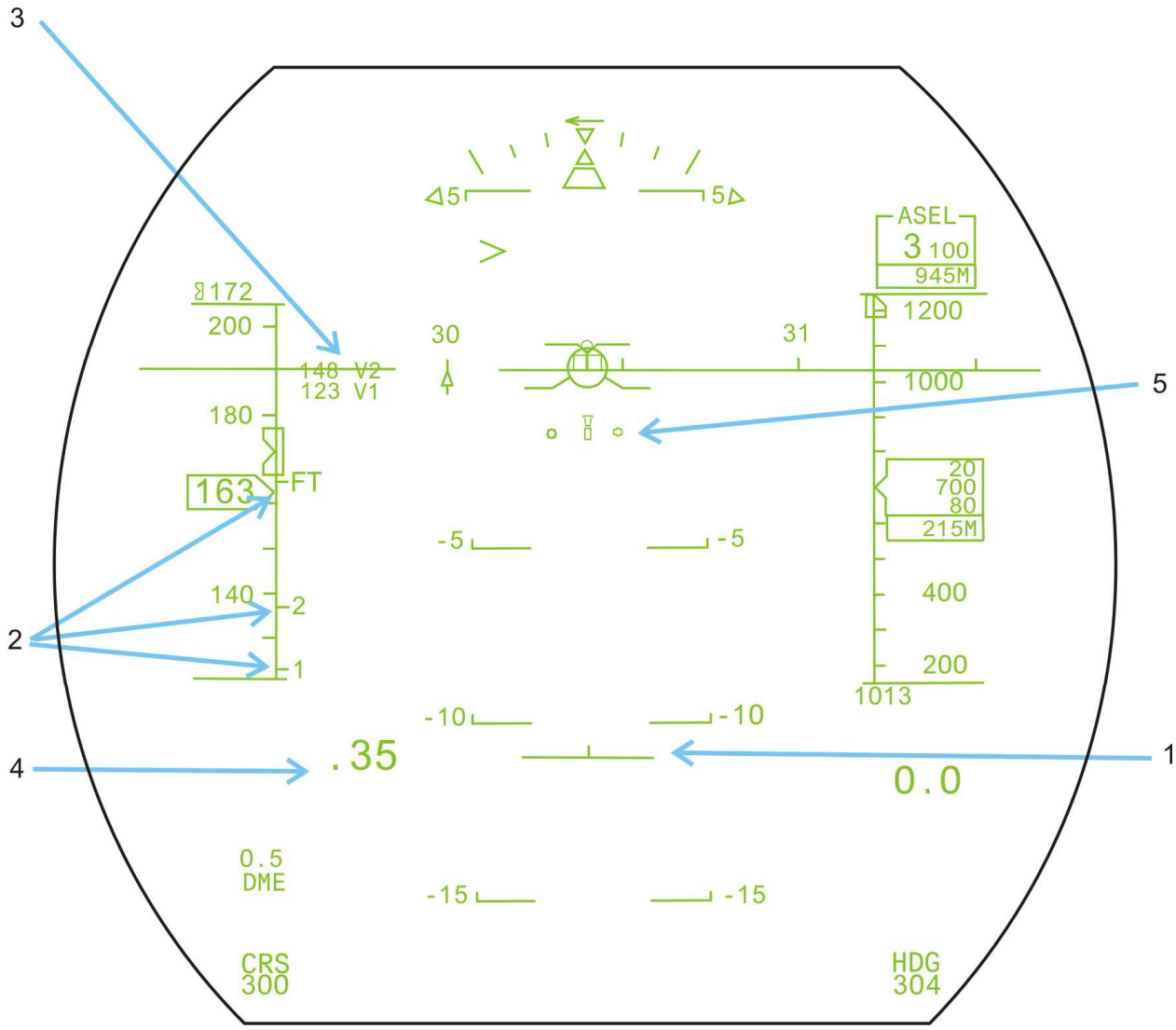



**FIGURE 02-34-40-01 VISUAL TAKE-OFF SYMBOLOGY**

| SYMBOL | ID# |
| --- | --- |
| Rotation Symbol | 1 |
| Airspeed Reference Bugs | 2 |
| Speed Reference Table | 3 |
| Longitudinal Acceleration | 4 |
| Ground Lateral Deviation Scale / Pointer | 5 |

## APPROACH SYMBOLOGY

The HGS Approach display provides precision, manual ILS approach and landing HGS guidance to the pilot for CAT III approach operations.

BothCAT II and CAT III approaches need autorisation and training.

This display is invoked when guided approach mode is active. A typical representation of the symbology for the HGS Approach display is shown in the figure.

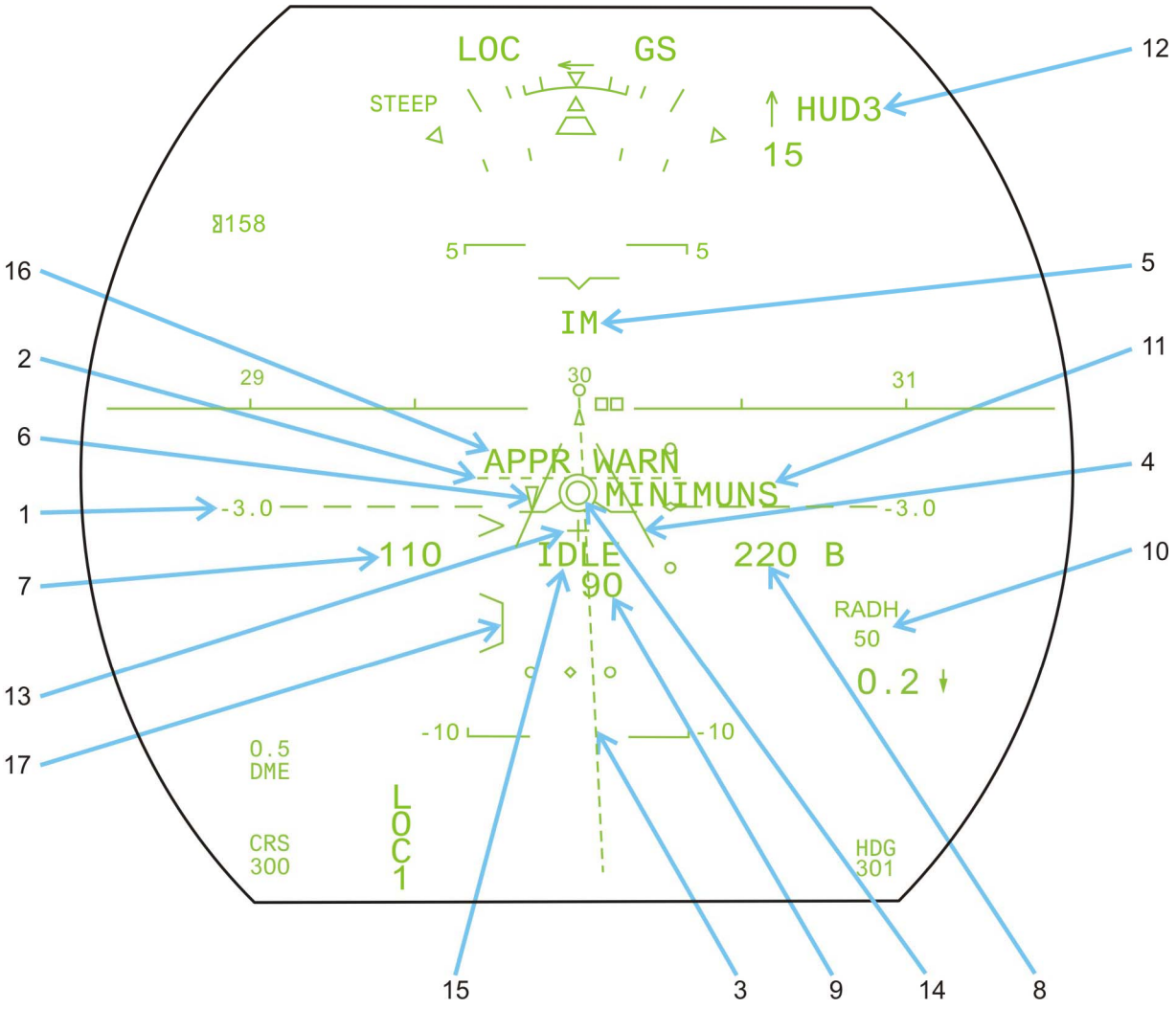



**FIGURE 02-34-40-03 APPROACH SYMBOLOGY**

| SYMBOL | ID# |
| --- | --- |
| Glideslope Reference Line | 1 |
| Glideslope Deviation Line | 2 |
| Swinging Localizer | 3 |
| Synthetic Runway | 4 |
| Marker Beacons | 5 |
| Speed Error Tape | 6 |
| Digital Airspeed | 7 |
| Digital Barometric Altitude | 8 |
| Digital Radio Altitude | 9 |
| Digital Decision Height | 10 |
| Minimum Height Alert | 11 |
| HGS Mode Annunciations | 12 |
| Flare Command | 13 |
| HGS Approach Guidance Cue | 14 |
| Idle Message | 15 |
| HGS Warning Annunciations | 16 |
| Thrust director cue | 17 |

## UNUSUAL ATTITUDE DISPLAY

During unusual attitudes (same triggering logics as the head down ADI), the HGS display will automatically switch to a format designed for recognition and recovery assistance. When the airplane attitude is restored to a stable condition, the display format is returned to the operating display format. A typical representation of the symbology for the Unusual Attitude display is shown in the figure.

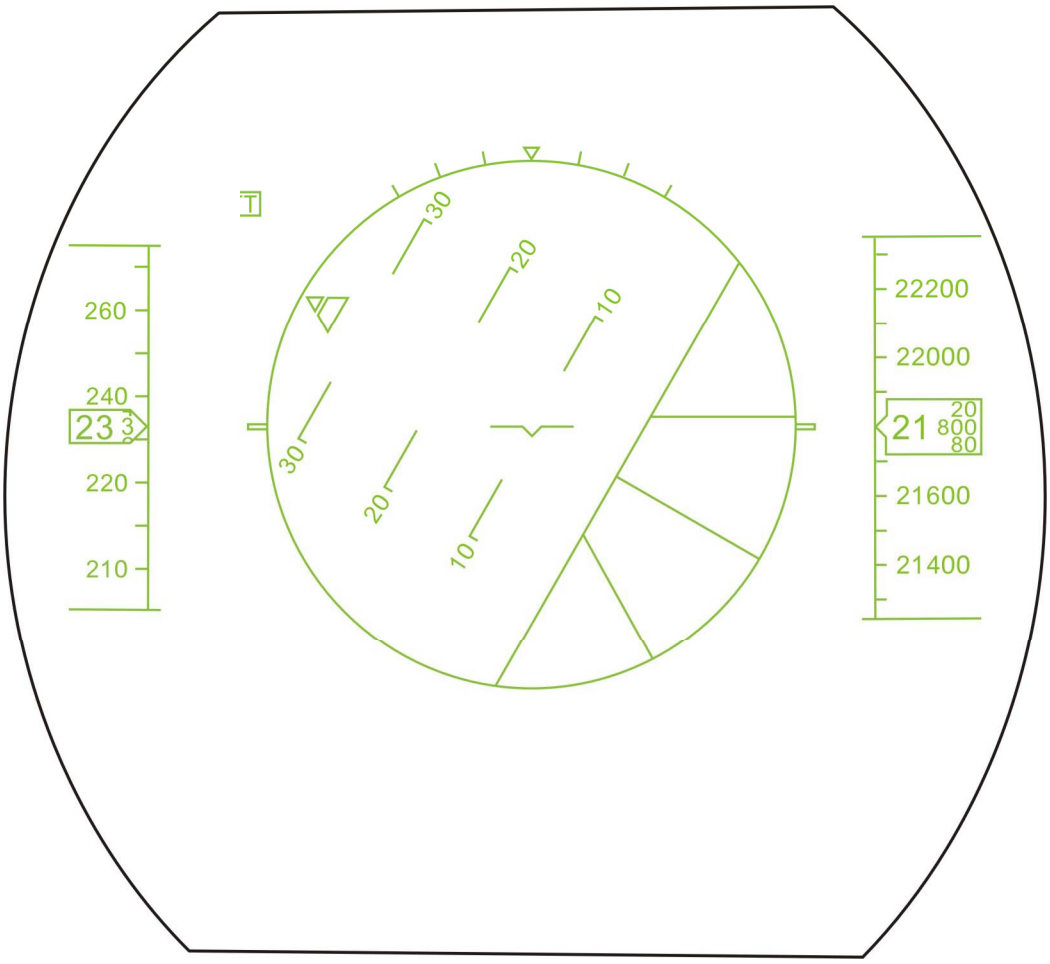



**FIGURE 02-34-40-04 UNUSUAL ATTITUDE DSIPLAY**

## FLAGS AND REVSERSION ANNUCIATION DISPLAY

A typical presentation of the Failure Flags / Comparator Flags / Reversion Annunciations is shown in the figure.

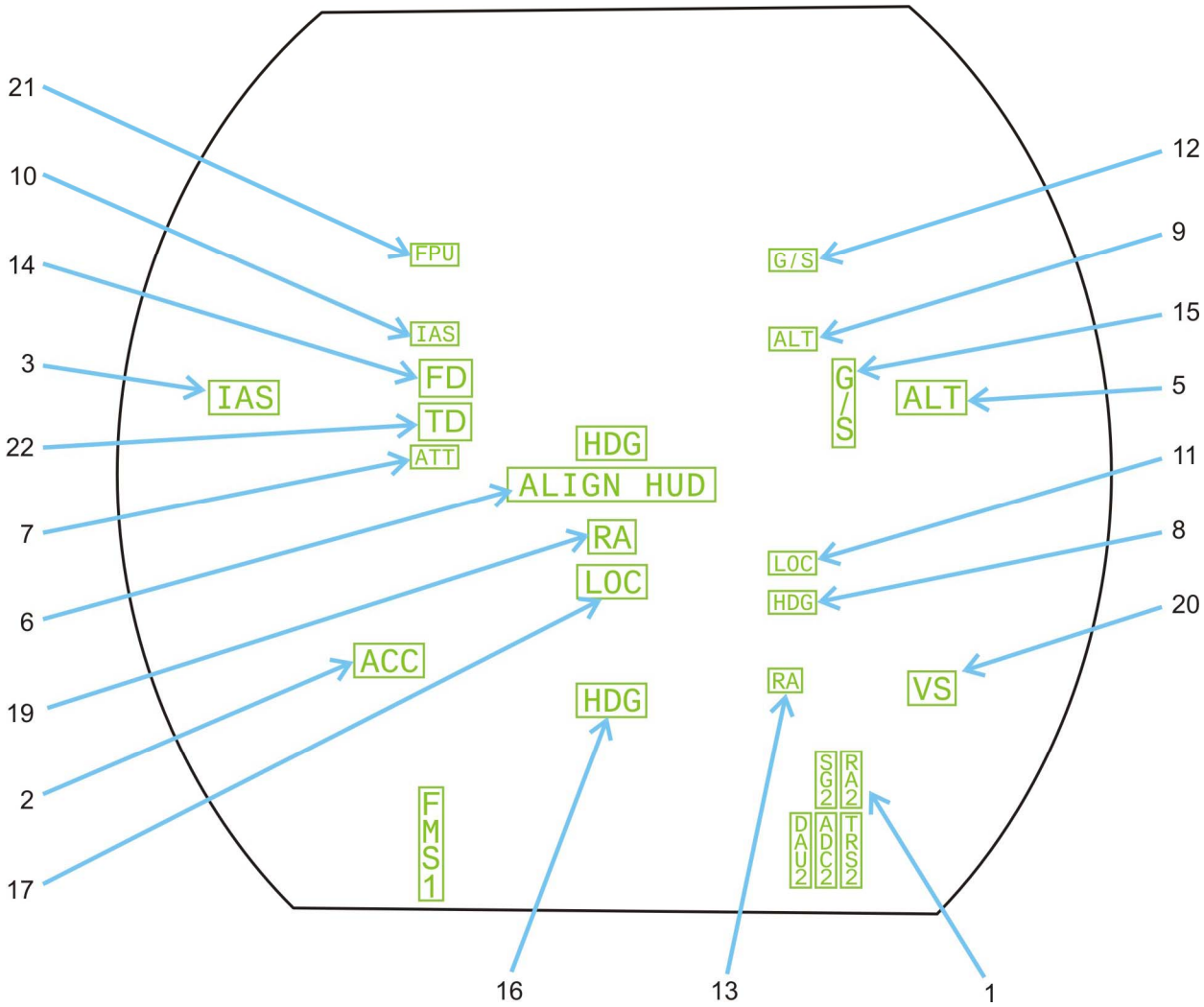



**FIGURE 02-34-40-05 FLAGS AND REVERSION ANNUCIATION**

| SYMBOL | ID# |
|---|---|
| Alternate Source Selection | 1 |
| Longitudinal Acceleration Fault | 2 |
| Airspeed Fault | 3 |
| Attitude Fault | 4 |
| Barometric Altitude Fault | 5 |
| Combiner Alignment Message | 6 |
| Attitude Comparator | 7 |
| Heading Comparator | 8 |
| Altitude Comparator | 9 |
| Airspeed Comparator | 10 |
| Localizer Comparator | 11 |
| Glideslope Comparator | 12 |
| Radio Altitude Comparator | 13 |
| Flight Director Fault | 14 |
| Glideslope Fault | 15 |
| Heading Fault | 16 |
| Localizer Fault | 17 |
| Navigation Source Fault | 18 |
| Radio Altitude Fault | 19 |
| Vertical Speed Fault | 20 |
| Flight Path Comparator | 21 |
| Thrust director fault | 22 |

## ADVISORIES AND ANNUNCIATION DISPLAY

Typical presentations of advisories and annunciations are shown in the figure.

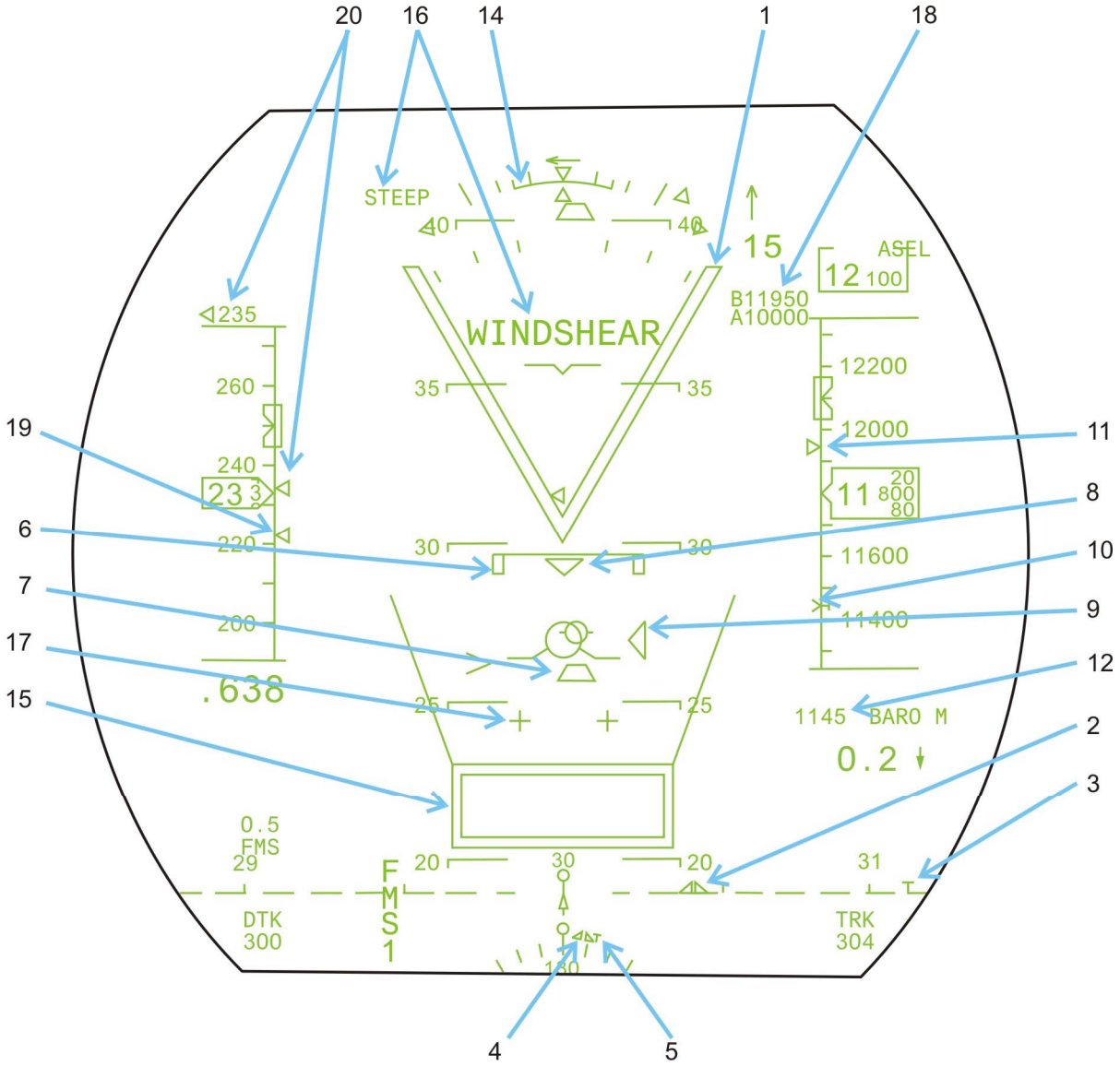



**FIGURE 02-34-40-05 ADVISORIES AND ANNUCIATION**

| SYMBOL | ID# |
|---|---|
| Pitch Chevron | 1 |
| Conformal Selected Track Bug | 2 |
| Conformal Track Angle Pointer | 3 |
| Selected Track Bug | 4 |
| Track Pointer | 5 |
| Angle of Attack Limit | 6 |
| Slip/Skid Indicator | 7 |
| Excessive Glideslope Deviation | 8 |
| Excessive Localizer Deviation | 9 |
| Minimum Descent Altitude Pointer | 10 |
| FMS VNAV Target Altitude Readout / Pointer | 11 |
| Digital Minimum Descent Altitude | 12 |
| Minimum Descent Altitude Alert | 13 |
| Low Bank Limit Arc | 14 |
| TCAS Resolution Advisory Box | 15 |
| Windshear / Ground Proximity Annunciations | 16 |
| Flare Cue | 17 |
| FMS Constraint Altitude | 18 |
| FMS Selected Airspeed | 19 |
| Speed Protection Bug / Readout | 20 |

## WEATHER RADAR

### MKB CONTROL

The primary control for the weather radar (WX) is the MKB rotary switch. The crew can directly access functions using the weather management knob, the inner knob allowing to set a value:

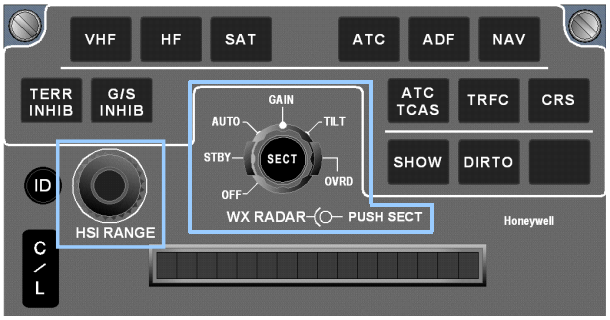



**FIGURE 02-34-45-00 WEATHER RADAR MANAGEMENT KNOB ON MKB**

- OFF:OFF is used to set the radar off,
- STBY: This position is used to power the radar (but the radar is not transmitting). It takes two minutes to warm the radar. When the rotary switch is moved to STBY **WAIT** flashing is displayed for two minutes at the bottom of the HSI, then steady STBY is displayed,
- AUTO: Using this position the tilt and the gain of the radar are automatically set by the system depending on the range of the HSI. (The rotary knob has not effect on the tilt and on the gain),
- GAIN: This position allows to modify manually the gain by using the WX radar rotary Knob (the tilt is not moving),
- TILT: This position allows to modify manually the tilt using the WX radar rotary knob (the GAIN is fixed),
- OVRD: This position allows to transmit when the airplane is on the ground. This position is spring loaded and has to be maintained during 5 sec on the right position,
- SECT: This position allows to change the swipe between ± 60 ± 30. At power up the default is ± 60.g,
- HSI RANGE: When in HSI arc format the HSI range knob changes the HSI range.

**NOTE**

When the airplane is on the ground, the weather radar automatically switches to "forced standby" mode and the status indicates "FSTBY". To get out of "FSBY" mode: go to override mode which is done by maintaining the WX rotary knob in the "OVRD" spring loaded position for more than four seconds.

## SENSORS PAGE CONTROLS (WX / LSS / TAWS)

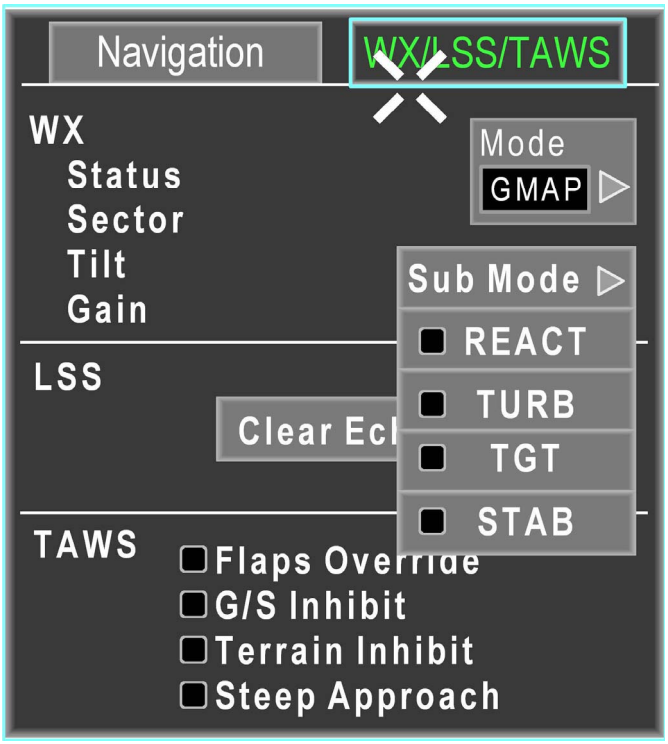



**FIGURE 02-34-45-01 WX SUB MODE**

WX mode: this position allows the radar to work or to transmit and receive in WX operation.

GMAP mode: this position allows the radar to work or to transmit and receive in GMAP operation

Sub-Mode: these sub modes allows to access specific functions of the radar.

These sub modes are:

- REACT (Rain Eco Attenuation Compensation Technique): This function allows, when passing through rainfalls, to detect potential weather ahead (by compensating for attenuation of the radar signal),
- TURB (TURBulence): This function is used to detect airmass turbulence,
- TGT (TarGeT): when selected, the system monitors for seveer weather targets beyond the selected range and within 7.5° range. “T” is displayed in a red rectangle at the top of the display when target alert is enabled,
- STAB (STABilization): When this function is selected, the radar swipe is not parallel to the ground but parallel to the wing of the airplane.The weather radar echo and status can be displayed in the HSI and in the I-NAV.

## DISPLAYS

The XW radar layer can be displayed in the HSI and in the I-NAV: WX layer in HSI

To obtain the WX layer in the HSI, the crew has to select the WX function in the Data menu of the HSI.

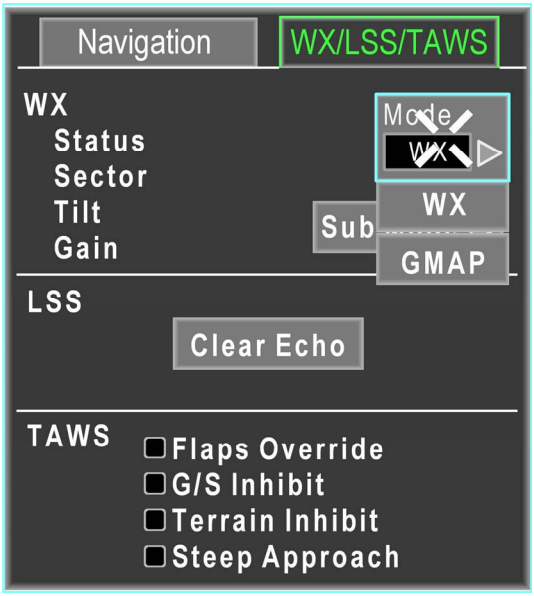



**FIGURE 02-34-45-02 WX FUNCTION**

Yet, the layer is only display when in ARC format. The weather radar status is display on the lower the HSI.


**FIGURE 02-34-45-03 WX DISPLAY ON HSI**

In the I-NAV, the WX layer is selected through the I-NAV Data menu of the I-NAV toolbar. The brightness of the layer can be adjusted using the CCD rotary knob when the cursor is on the XW position of the menu as shown below.

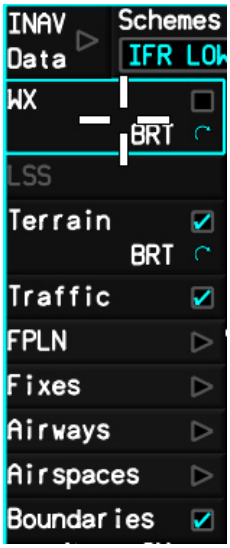



**FIGURE 02-34-45-04 BVWX DISPLAY SELECTION THROUGH I-NAV DATA MENU**

The WX display is displayed as follows:

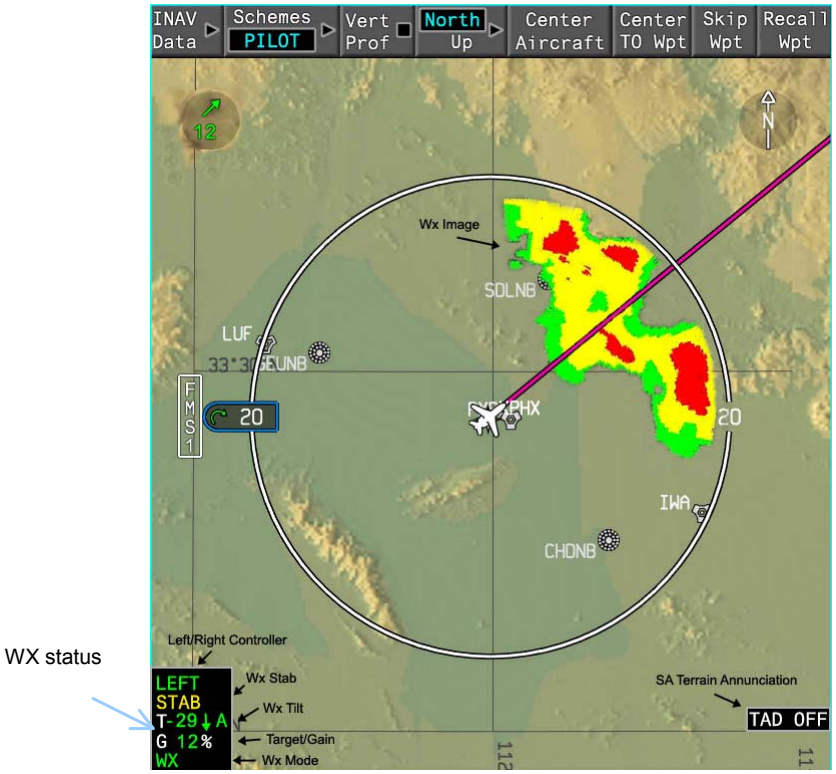



**FIGURE 02-34-45-05 WX DISPLAY IN I-NAV**

**WX tilt display**

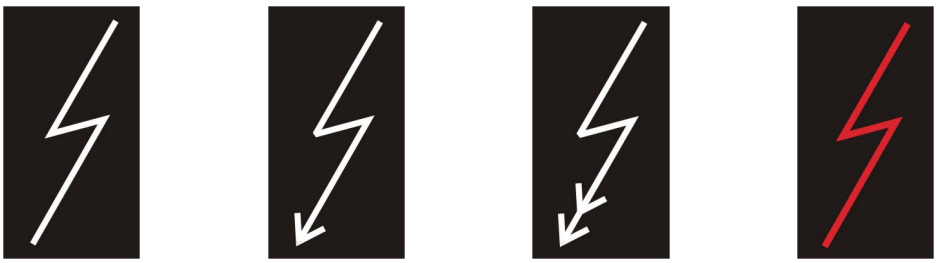
The WX tilt information is displayed as follow:

| ITEM | COLOR |
|---|---|
| WX Tilt Readout Digits | Green |
| Direction Arrow (↑ or ↓) | Green |
| T Label | White |
| A Label | Green |

**LSS (OPTIONAL)**

LSS function is available through the HSI control bar.


**FIGURE 02-34-45-06 LIGHTING DISPLAY**



Level 1 Light | Level 2 Medium | Level 3 Heavy | Alert

**FIGURE 02-34-45-07 LIGHTNING INTENSITY**

The Clear Echo soft key removes all the lightning symbols from the display.

## ATC / TCAS

In the EASy system, Air Traffic Control transponder (ATC) and Traffic Collision Advisory System (TCAS) are integrated. ATC and TCAS information are selectable using the ATC / TCAS page in the 1/6 radio window of the PDU. Some direct access to the ATC and TCAS functions are available using the MKB. TCAS information is displayed in the TRFC window (1/6 PDU) in the ADI and in I-NAV.

The default ATC selection is 1.

The setting of the ATC is done either through the Permanent Radio Bar (PDU/ Horizontal Situation Indicator) or the ATC field of the RADIOS window. When the cursor has focus on the code field, the knob icon is displayed.

The current mode is displayed above the frequency field in green. An R is displayed in front of the frequency noting when reply is active.

The altitude readout is the current altitude output from the ATC Radio. If no value is available, amber dashes are displayed.

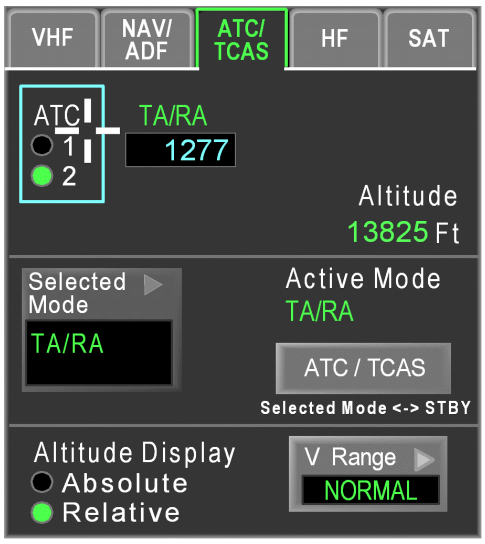



**FIGURE 02-34-45-08 TCAS TAB ON RADIOS WINDOW**

### ATC / TCAS MODES

Resolution Advisory (RA): a RA is a warning created by the TCAS system, when the airplane is conflicting with another one (the collision risk is imminent).

Airplane equipped with TCAS system has to react immediately by following the guidance computed by the TCAS system to avoid collision. RA is activated only if both airplane ATC are transmitting with ALT mode operative.

Traffic Advisory (TA): a TA is a caution created by the TCAS system, when the airplane is conflicting with another one (the colision risk is not imminent).

The system is operative only if both airplanes have operative ATC. When TA/RA mode is selected, the mode is automatically swapped to TA ONLY when RA height is below 1,000 ft in approach, or when RA height is below 1,200 ft in take-off phase.

Four different modes are available for the ATC / TCAS.These modes are displayed in the Selected Mode menu.

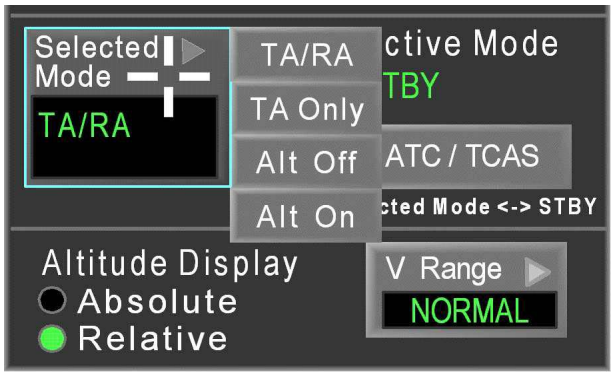



**FIGURE 02-34-45-09 ATC / TCAS MODE PULL DOWN MENU**

Even if they are not displayed in HSI and I-NAV all intruders are used to compute information (intruder position, TA,RA):

- the TA / RA mode allows the TCAS to compute traffic and resolution advisories (default selection),
- the TA Only mode provides traffic advisory only,
- the Alt Off mode allows the system to switch off the altitude transmission,
- the Alt On allows to transmit the airplane altitude (standard pressure altitude from PF side ADS).

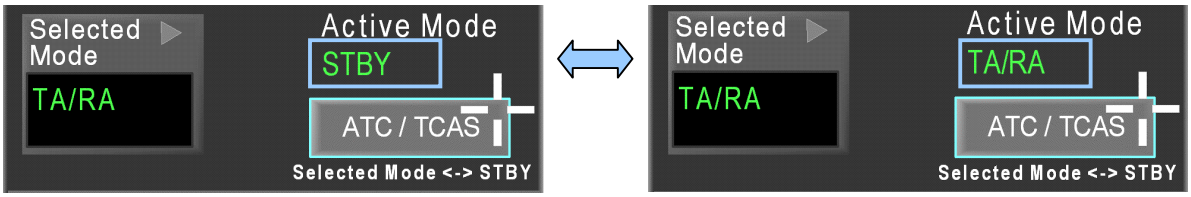



**FIGURE 02-34-45-10 ACTIVATING / DEACTIVATING THE SELECTED MODE (TA/RA FOR EXAMPLE)**

By clicking on ATC / TCAS soft key the active mode is switched from STBY to the selected mode.

It is also possible to switch between the selected mode and the stand-by mode, by pressing on the ATC TCAS short cut key on the MKB.

The result is displayed either in the ATC / TCAS page and at the bottom of the HSI.

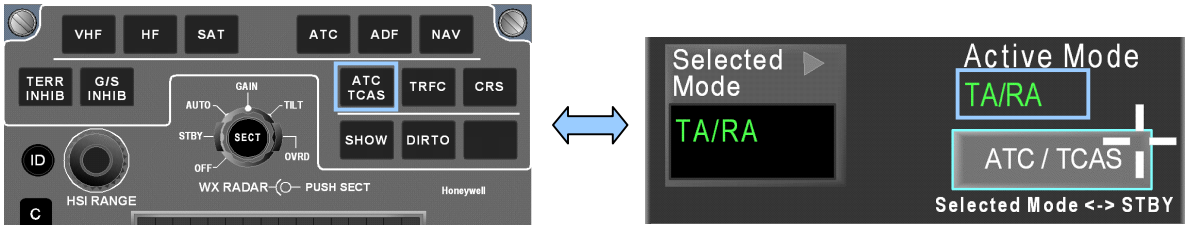



figure 02-34-45-11 SWITCHing BETWEEN THE SELECTED MODE AND THE STAND-BY MODE with ATC / TCAS short cutWhen the ATC is switched to an active mode other than Alt Off, an indication of the airplane altitude is displayed in the ATC / TCAS tab:

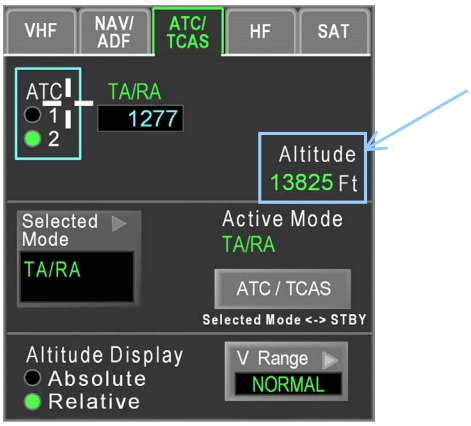



**FIGURE 02-34-45-12 ALTITUDE INDICATION ON THE ATC / TCAS TAB**

## TCAS DISPLAY OPTIONS

Altitude display

The crew can select how the TCAS plots are displayed in the traffic window (PDU) and in I-NAV .The altitude display can be absolute or relative:

- Absolute altitude corresponds to the standard altitude (1,013 hPa / 29.92 in.Hg), displayed in flight level when above FL180, in feet below. The **Absolute** mode is temporary and reverts to **Relative** mode after 30 seconds,
- Relative altitude indicates vertical separation between airplane and intruders:
  - + 10 means the intruder is 1,000 ft above,
  - - 5 means the intruder is 500 ft below.

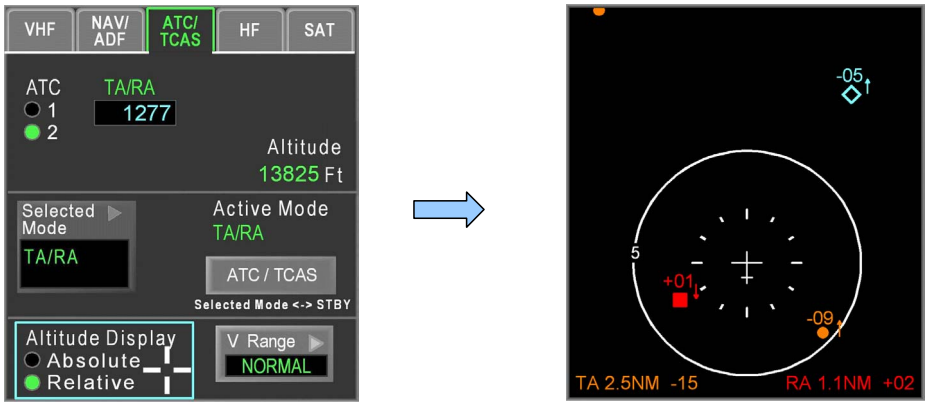



**FIGURE 02-34-45-13 RELATIVE ALTITUDE SELECTION**

## VERTICAL RANGE

The pilot can choose the vertical range of the TCAS through four modes, by selecting, Above, Below, A/B (Above/Below) or Normal, in the V Range menu:


**FIGURE 02-34-45-14 VERTICAL RANGE SETTING**

Each V Range corresponds to a display area:

- the **Normal** range shows the intruders that are flying within 2,700 ft above and below airplane (default selection),
- the **Above** range gives a higher display range above airplane of 7,000 ft and 2,700 ft below,
- the **Below** range gives a higher display range below airplane of 7,000 ft and 2,700 ft above,
- Above / Below (**A/B**) shows all the traffic in a unrestricted vertical range.

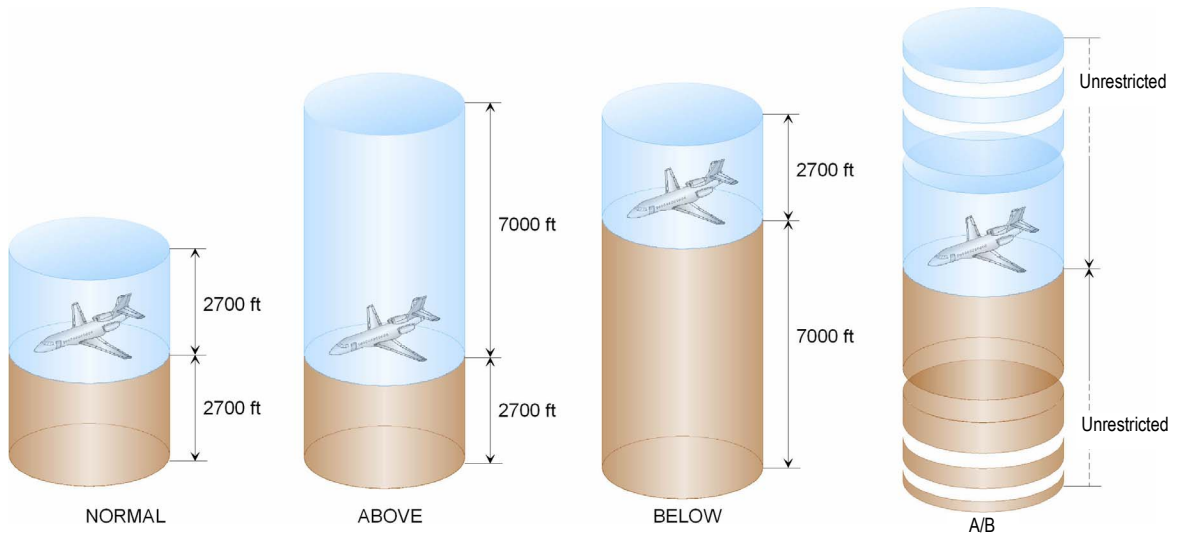



**FIGURE 02-34-45-15 TCAS VERTICAL RANGE DISPLAY**

**NOTE**

The none displayed intruder airplane is still supervised by the TCAS.

## TRAFFIC WINDOW

The traffic window is accessed through the radio window menu of each PDU. It provides a heading up format to display TCAS plots at short range (5 NM).

The TCAS plots (color and shape) are displayed with the following standard:

- red square for Resolution Advisory (RA),
- amber circle for Traffic Advisory (TA),
- solid blue diamond for Proximate Traffic (PT),
- hollow blue diamond for other traffic.

The vertical speed symbol consists in an arrow pointing in the direction of the intruder vertical speed.

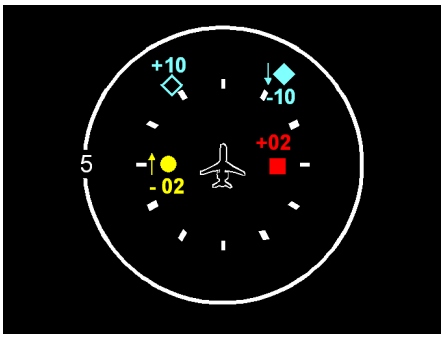



**FIGURE 02-34-45-16 TCAS PLOTS ON TRAFFIC WINDOW**

The altitude display can be either absolute or relative (refer to above Altitude display paragraph).

The traffic window is associated with the TCAS aural warnings. In case of TCAS TA, or RA caution or warning, an automatic pop-up brings the TRAFFIC window on the PF PDU.

This function provides the PF with an immediate and clear view of the traffic threat.


**FIGURE 02-34-45-17 TCAS DISPLAY ON I-NAV**

In the I-NAV window, the scale of the TCAS follows the selected scale of the display.
The **TRFC** short key on the MKB brings up the traffic window at any time.

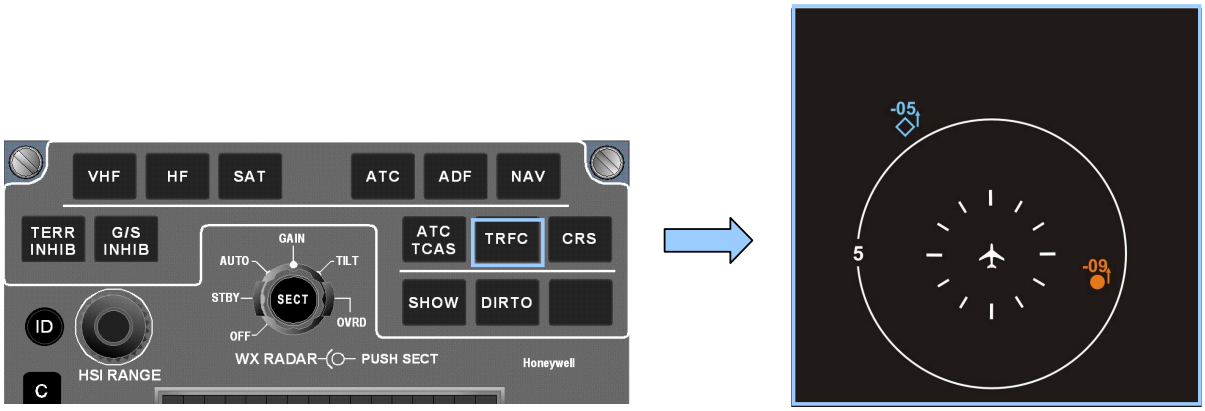



**FIGURE 02-34-45-18 TRFC WINDOW SHORT CUT ON MKB**

**Traffic advisory**


TA on I-NAV

TA on TRAFFIC window

**FIGURE 02-34-45-19 TRAFFIC ADVISORY ON I-NAV AND ON TRAFFIC WINDOW**

A traffic advisory only generates a display on the I-NAV or on the traffic window.

**Resolution Advisory**

When an RA is detected:

- the TRAFFIC window is automatically displayed on PF PDU,
- a guidance is displayed on both ADI.

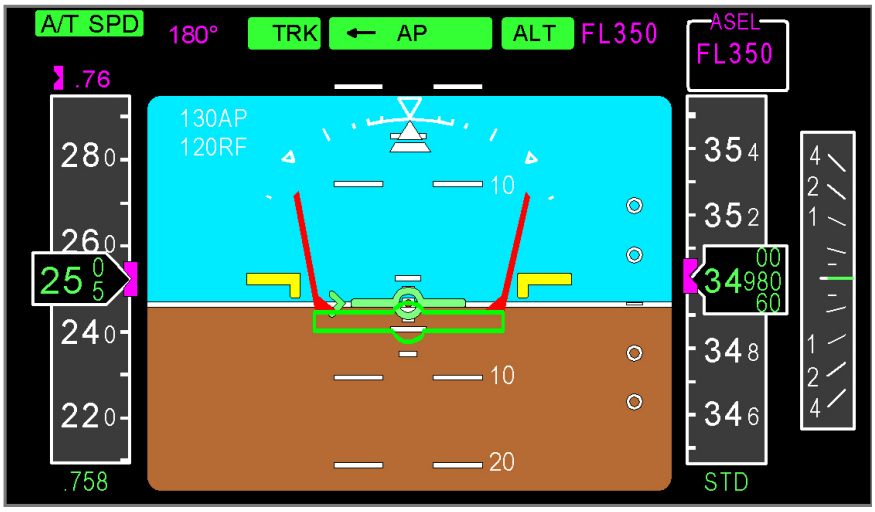



**FIGURE 02-34-45-20 RA DESCENT**

- RA climb:

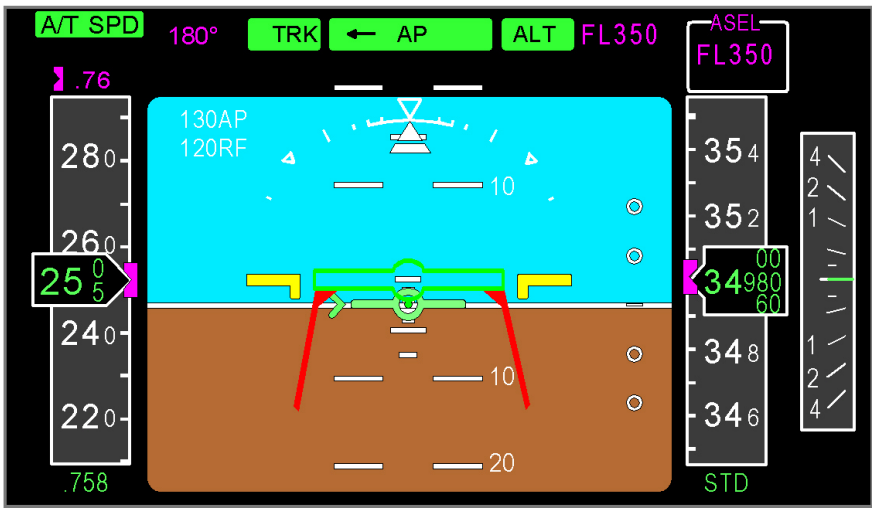



**FIGURE 02-34-45-21 RA CLIMB**

## TCAS TEST

Done when TCAS soft key is depressed and maintained in the TEST tab of the SYNOPTICS window.


**FIGURE 02-34-45-22 TCAS TEST**

During test, four TCAS plots pop-up on TRAFFIC window (this window must be already selected) and RA guidance is displayed in ADI. If passed, **TCAS TEST** is displayed in the bottom of the HSI.

## EGPWS

### GENERAL SYSTEM DESCRIPTION

The purpose of the Enhanced Ground Proximity System is to give crew information to prevent Controlled Flight Into Terrain (CFIT) or severe windshear.

The EGPWS system uses a lot of airplane parameters to provide:

- displays,
- crew aural alerts,
- visual annunciation,
- messages.

The system is designed to be fully compatible with normal operations of the airplane. The probability of unwanted alerts is close to zero during the flight if the crew follow the published IFR trajectories.

The function integrated in the EGPWS system are:

- GPWS: Basic Ground Proximity Warning System (six modes),
- EGPWS enhanced modes:
  - Windshear Detection and Alerting,
  - Excessive Bank Angle Alert,
  - Terrain Clearance Floor,
  - Terrain and Obstacles Awareness Alerting and Warning.

### GPWS MODES

The functions hereafter are part of the basic GPWS integrated in the EGPWS system. When the EGPWS enhanced modes are lost in case of failure or if the terrain function has been de-selected by the crew, these modes are always active.

### Mode 1 - Excessive rate of descent

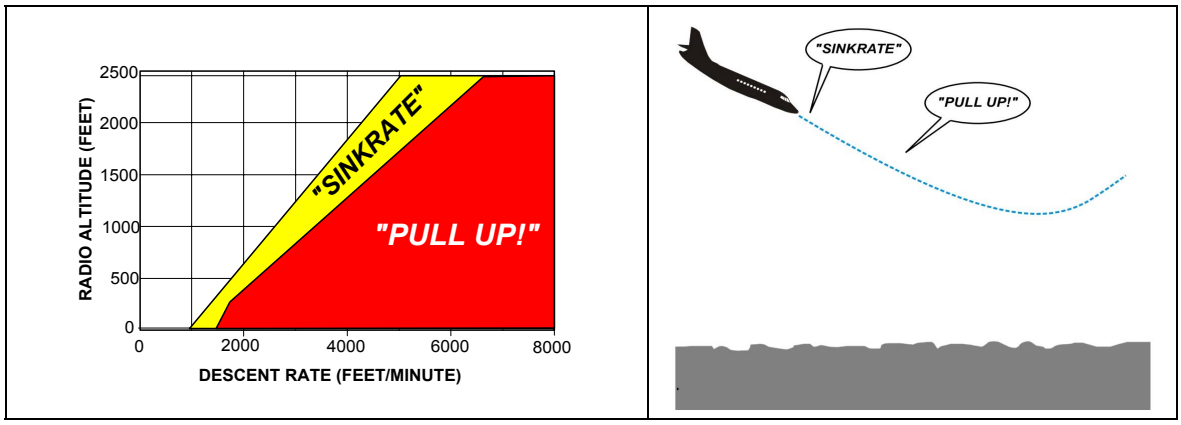



FIGURE 02-34-45-23 EXCESSIVE RATE OF DESCENT

### Mode 2 - Excessive terrain closure rate

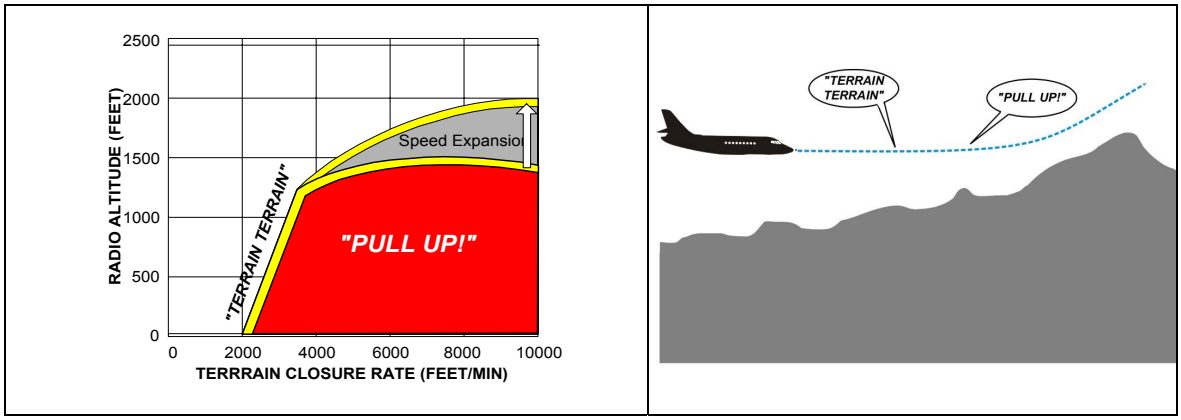



FIGURE 02-34-45-24 EXCESSIVE TERRAIN CLOSURE RATE

### Mode 3 – Altitude loss after take-off

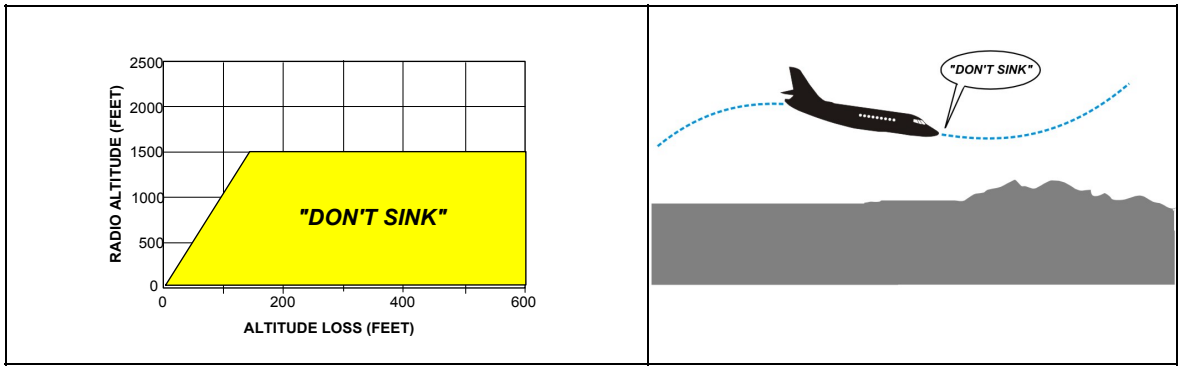



FIGURE 02-34-45-25 ALTITUDE LOSS AFTER TAKE-OFF

## Mode 4 - Unsafe Terrain Clearance

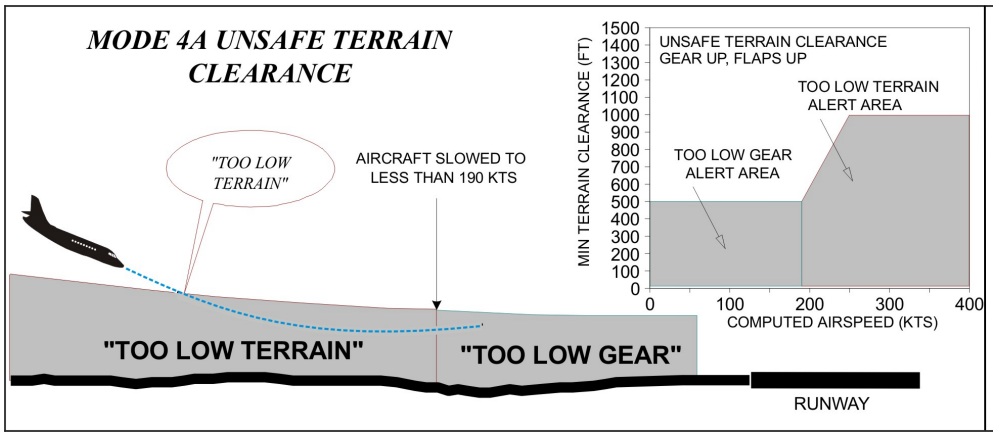



**FIGURE 02-34-45-26 UNSAFE TERRAIN CLEARANCE - MODE 4A**

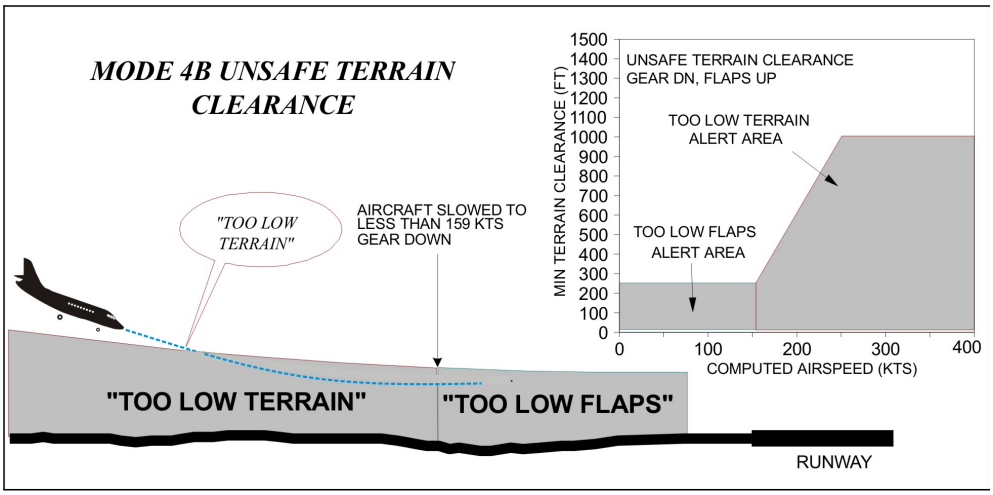



**FIGURE 02-34-45-27 UNSAFE TERRAIN CLEARANCE - MODE 4B**

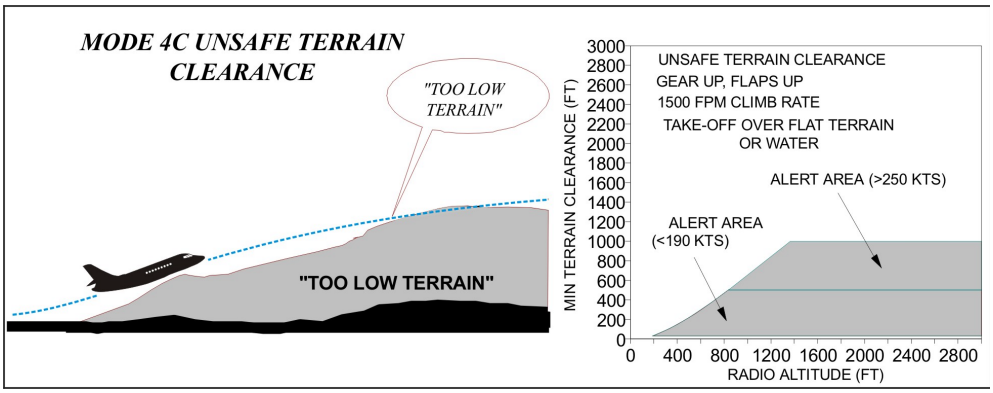



**FIGURE 02-34-45-28 UNSAFE TERRAIN CLEARANCE - MODE 4C**

### Mode 5 – Excessive glideslope deviation

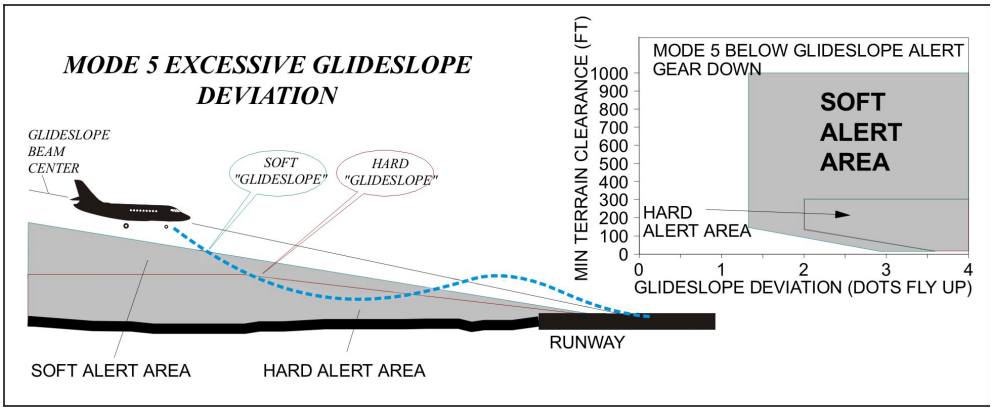



**FIGURE 02-34-45-29 EXCESSIVE GLIDESLOPE DEVIATION**

### Mode 6 – Altitude awareness call-outs

Mode 6 provides alerts and call-outs for descent below predefined altitudes, decision height (DH), minimums, approaching decision height and approaching minimums.

| MINIMUMS TYPE CALL-OUTS: | |
|---|---|
| Minimums | Provides Minimums call-out for descent below minimums setting |
| Approaching Minimums | Provides Approaching Minimums call-out for descent below minimums setting plus 80 feet |
| 1,000 | Provides One Thousand call-out for descent below 1,000 feet |
| 500 | Provides Five Hundred call-out for descent below 500 feet |

| LOW ALTITUDE CALL-OUTS | |
| --- | --- |
| 300 | Provides Three Hundred call-out for descent below 300 feet |
| 200 | Provides Two Hundred call-out for descent below 200 feet |
| 50* | Provides Fifty call-out for descent below 50 feet |
| 40* | Provides Forty call-out for descent below 40 feet |
| 30* | Provides Thirty call-out for descent below 30 feet |
| 20* | Provides Twenty call-out for descent below 20 feet |
| 10* | Provides Ten call-out for descent below 10 feet |
| 5 | Provides Five call-out for descent below 5 feet |

**NOTE**

* means that annunciations are mandatory for HUD CAT III approaches

## EGPWS - ENHANCED MODES

### Windshear detection

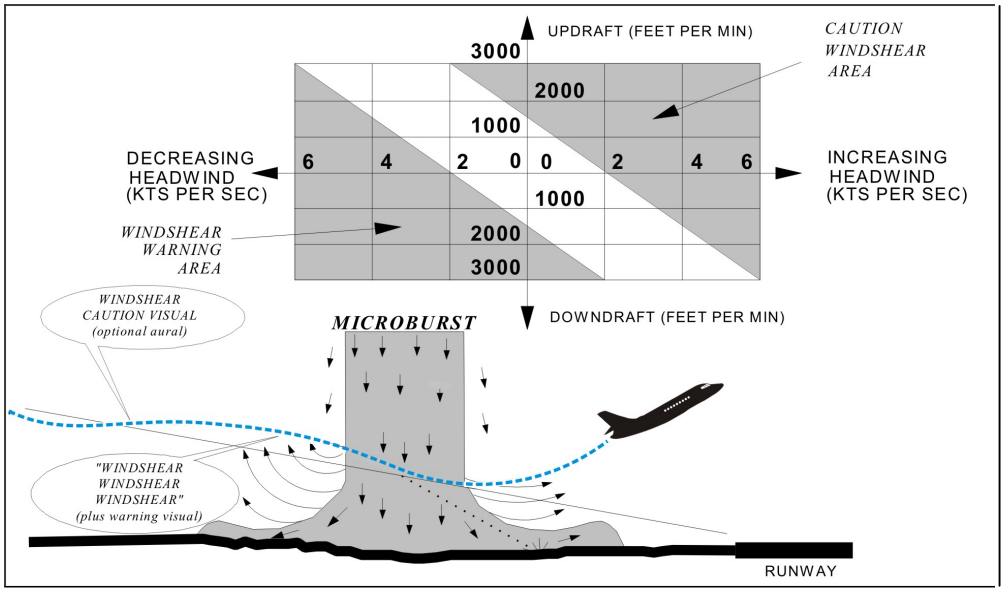



**FIGURE 02-34-45-30 WINDSHEAR DETECTION**

### Excessive Bank Angle Call-out

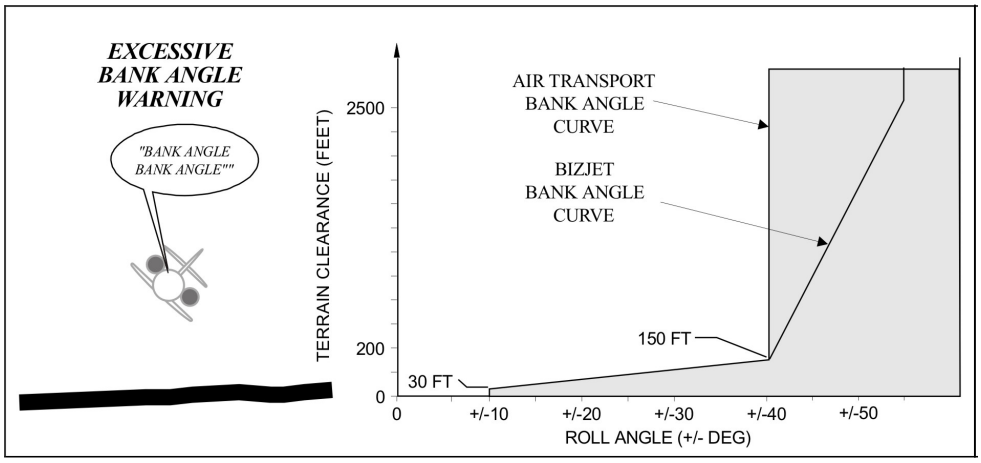
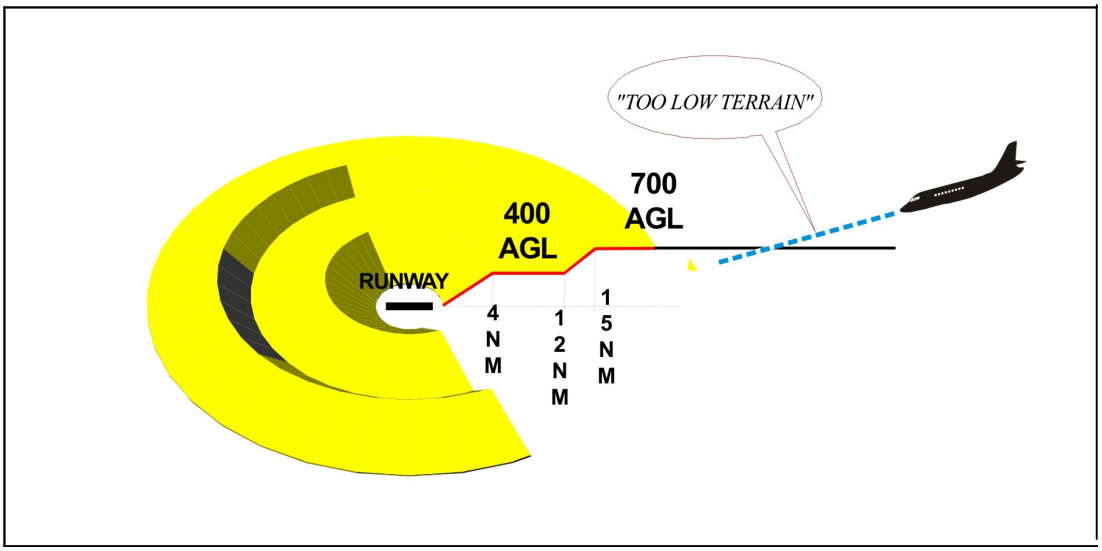



**FIGURE 02-34-45-31 EXCESSIVE BANK ANGLE CALL-OUT**

## Terrain Clearance Floor



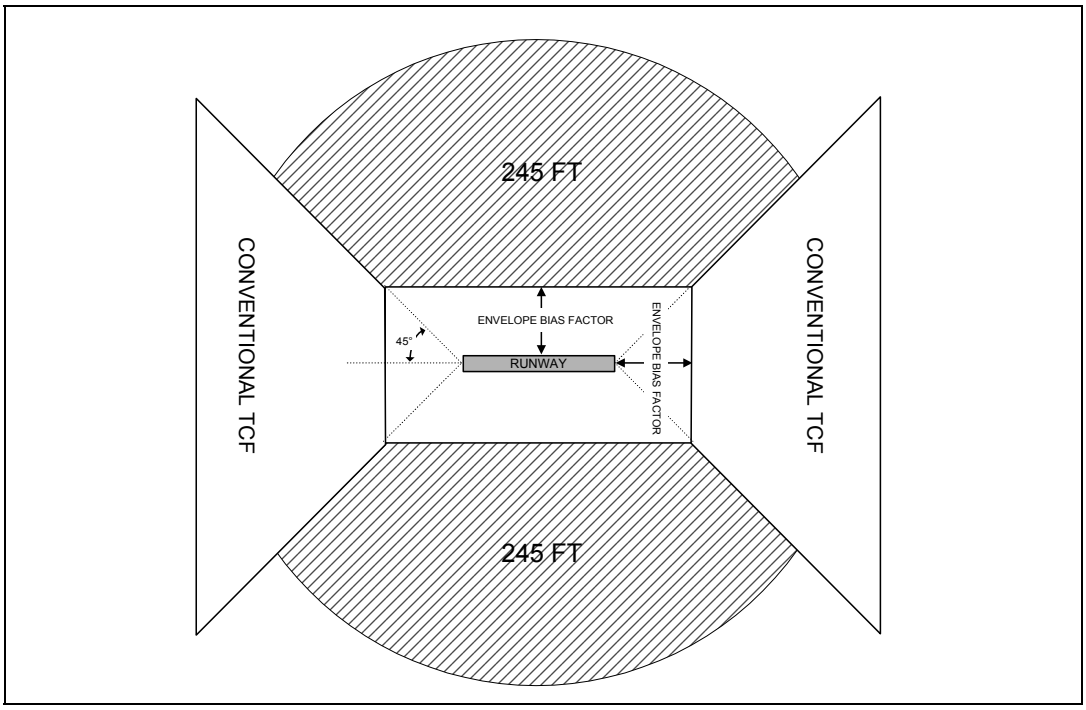
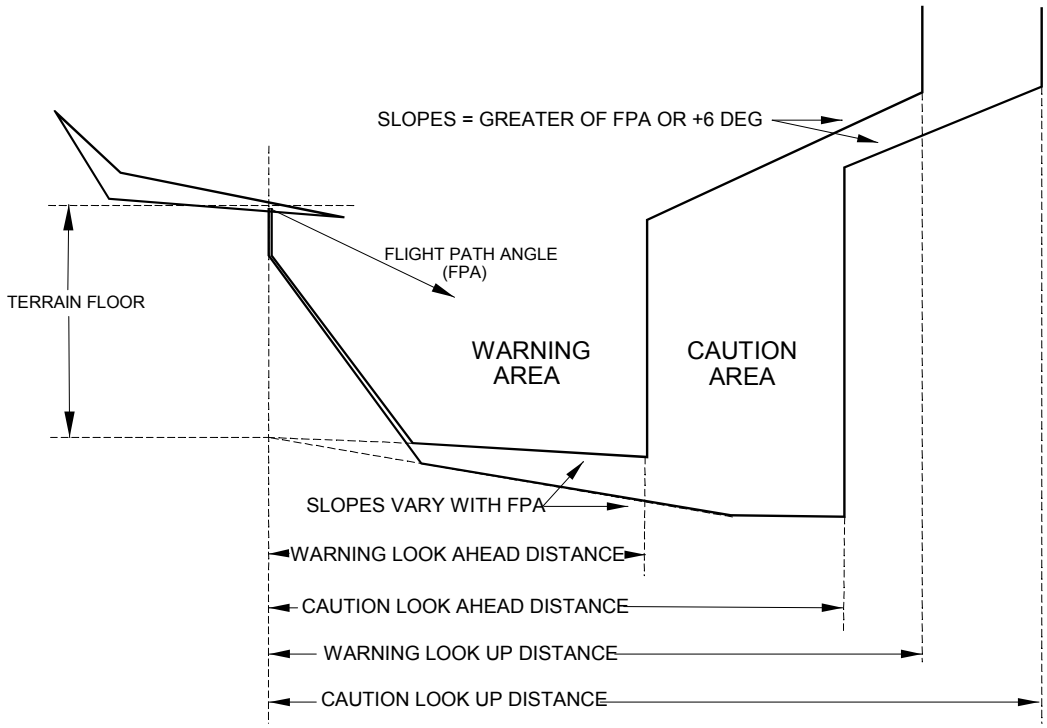




**FIGURE 02-34-45-32 TERRAIN CLEARANCE FLOOR**

## Terrain and Obstacles Alerts




LOOK AHEAD DISTANCES VARY WITH GROUND SPEED AND DISTANCE TO RUNWAY
TERRAIN FLOOR VARIES WITH DISTANCE TO RUNWAY

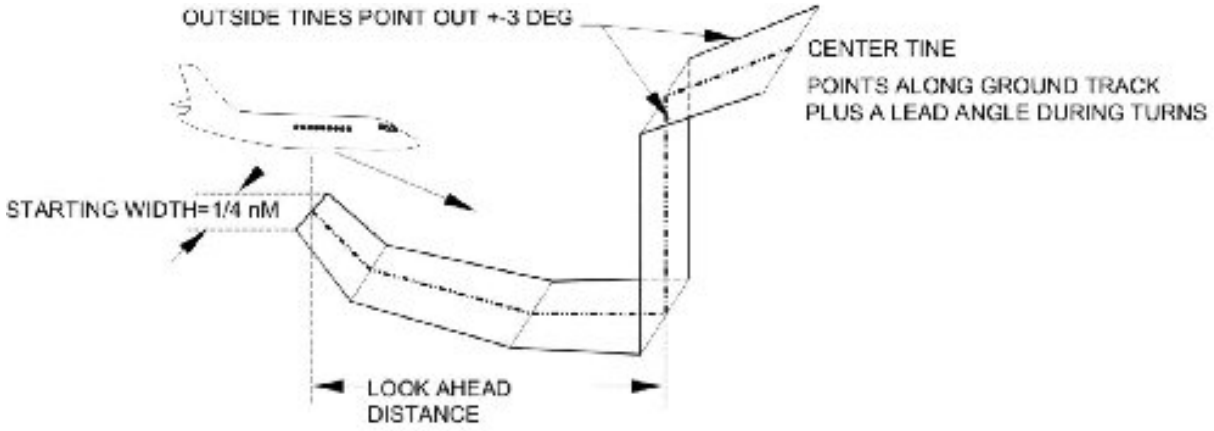



**FIGURE 02-34-45-33 CAUTION ENVELOPE - PERSPECTIVE VIEW**

## TERRAIN DISPLAY

### MDU I-NAV (if selected)

I-NAV can display all three types of terrain display: Absolute Terrain, Terrain Awarness Display (TAD) and Alerting terrain. All I-NAV informations are displayed based on the same airplane FMS position.

Absolute Terrain and TAD terrain are available on NORTH UP format. Alerting Terrain is not available in this format to avoid confusion about the terrain threat direction.

### Absolute terrain

Only displayed on I-NAV via theTerrain layer selection. This terrain can be dimmed. Terrain color code based on Absolute Height above sea level (blue, green, brown).

### Terrain Awarness Display (TAD)

Only displayed on I-NAV when Absolute Terrain is displayed. If Wx layer is also selected TAD is inhibited (annunciated by TAD OFF on the I-NAV bottom right).TAD can be dimmed in conjunction with the Absolute Terrain. The color code is based on relative height between the airplane compare to the terrain (High intensity for red, High and Low intensity for yellow, Low and very Low intensity for green). EGPWS geometric Altitude is used to determine the color of terrain (5 levels). The TAD is displayed 20 NM around the airplane FMS (Pilot Flying Side ) position.

### EGPWS Alert Display (Alerting Terrain)

If there is a terrain alert, the I-NAV is automatically forced in HDG UP format with a 10 NM range. There is no pop-up if the terrain is not displayed. The flashing yellow or green terrain cannot be dimmed.

### Sensor window pop-up in case of terrain alert

In case of CAUTION or WARNING terrain alert, there is a 1/6 PDU window POP-UP on the pilot flying side. This window only displays EGPWS alerting terrain, flashing red or yellow. The display is HDG UP oriented with a full 10 NM range (not modifiable).

**NOTE**

In case of EGPWS alert, the TCAS mode is automatically selected in TA only. - After a 1/6 window pop-up on the pilot flying side, there is no automatic return to previous selection at the end of the alert.

## CONTROLS AND STATUS DISPLAYS

### Controls

The following controls are available for the EGPWS system:

- EGPWS test: allows to test the system (TEST page),
- flaps override: allow the crew to simulate flaps in landing configuration (no alert) whatever the flaps configuration. This allows to fly without too low flaps aural alert which appears at 250 ft RA during approach if SF3 configuration is not set. This function is available in the MDU FMW Arrival page and in the PDU SENSORS TAWS,
- G/S INHIB pushbutton on the MKB: allows to inhibit "GLIDE SLOPE" aural warning. This function can be activated when in approach if the crew anticipate to fly below the glide (e.g. for visual approach),
- steep approach: allows steep landing without GPWS mode 1 nuisance alert ("SINK RATE"). This function is selectable in the MDU FMW arrival page.

### DISPLAYS

The above selections status are displayed in the lower part of the PDU; TERR TEST, TERR (failure), FLAPS OVRD, G/S INHIB, TERR INHIB.

CAS white status annunciation allows the crew to have a permanent status information of the associated EGPWS sensor selected mode :

FLAP OVRD  G/S CANCEL  TERR INHIBIT

On the upper part of the PDU, STEEP is displayed when the STEEP APPROACH mode is selected.

**AUDIO MENU**

| ALERT / WARNING CONDITION | BASIC AUDIO MENU |
| --- | --- |
| MODE 7 WINDSHEAR WARNING | WINDSHEAR WINDSHEAR WINDSHEAR |
| MODE 1 PULL UP | PULL UP |
| MODE 2 PULL UP PREFACE | TERRAIN TERRAIN |
| MODE 2 PULL UP | PULL UP |
| TERRAIN AWARENESS PREFACE | TERRAIN TERRAIN (FAA) TERRAIN AHEAD (JAA) |
| TERRAIN AWARENESS WARNING | PULL UP |
| OBSTACLE AWARENESS PREFACE | OBSTACLE OBSTACLE (FAA) OBSTACLE AHEAD (JAA) |
| OBSTACLE AWARENESS WARNING | PULL UP |
| MODE 2 TERRAIN | TERRAIN TERRAIN |
| MODE 6 MINIMUMS | SELECTED CALL-OUT |
| TERRAIN AWARENESS CAUTION | CAUTION TERRAIN (PAUSE) CAUTION TERRAIN (7 sec pause) |
| OBSTACLE AWARENESS CAUTION | CAUTION OBSTACLE (PAUSE) CAUTION OBSTACLE (7 sec pause) |
| MODE 4 TOO LOW TERRAIN | TOO LOW TERRAIN |
| TCF TOO LOW TERRAIN | TOO LOW TERRAIN |
| MODE 6 ALTITUDE CALL-OUTS | SELECTED CALL-OUTS |
| MODE 4 TOO LOW GEAR | TOO LOW GEAR |
| MODE 4 TOO LOW FLAPS | TOO LOW FLAPS |
| MODE 1 SINKRATE | SINKRATE (PAUSE) SINKRATE |
| MODE 3 DON’T SINK | DON’T SINK (PAUSE) DON’T SINK |
| MODE 5 GLIDE SLOPE | GLIDE SLOPE |
| MODE 6 APPROACHING DH | SELECTED CALL-OUT |
| MODE 6 BANK ANGLE | BANK ANGLE (PAUSE) BANK ANGLE |
| MODE 7 WINDSHEAR ALERT | (QUIET) |

## VISUAL AND AURAL ALERTING

### Visual

In case of EGPWS warning, a flashing **PULL UP** annunciation is displayed on the ADI.

In case of other EGPWS caution alerts, amber flashing GND PROX is displayed at the same location.

In case of windshear caution or warning, respectively amber or red flashing WINSHEAR is displayed at the same location.

### FAILURE INDICATION

The following failures are possible with the EGPWS system:

- EGPWS system failure: **EGPWS .. FAIL** is diplayed on CAS window,
- basic Ground Proximity Warning System failure (modes 1 to 6): **GND .. FAIL** appears on CAS window. This CAS message can be activated if one or more of the GPWS basic modes is inoperative. For any GPWS mode that remains operational, aural and visual alerts can be provided.

Windshear failure: **WINDSHEAR .. FAIL** appears on CAS window.

In addition, in case of TERRAIN failure or unavailability, an amber TERR indication is displayed in the lower part of the.PDU.

## SYSTEM LIMITATION

The performance of the EGPWS terrain protection is linked with the performance of navigation. RNP must be maintained at the good level. In case of message "UNABLE RNP", the terrain function is not available and an amber TERR indication is provided in the lower part of the HSI.

If a TERR indication is displayed in the lower part of the HSI, the basic GPWS function remains active (if all sensors required by this function are available).

## SENSORS REVERSION

The left side Reversion Panel (RP) is dedicated to the left side sensor reversion. (2 IRS, 1 RA, 2 ILS/VOR and 2 ADC sensors, as well as the 2 FMS), installed aboard the airplane ( a third FMS is optional, as well as a third IRS and a second RA).

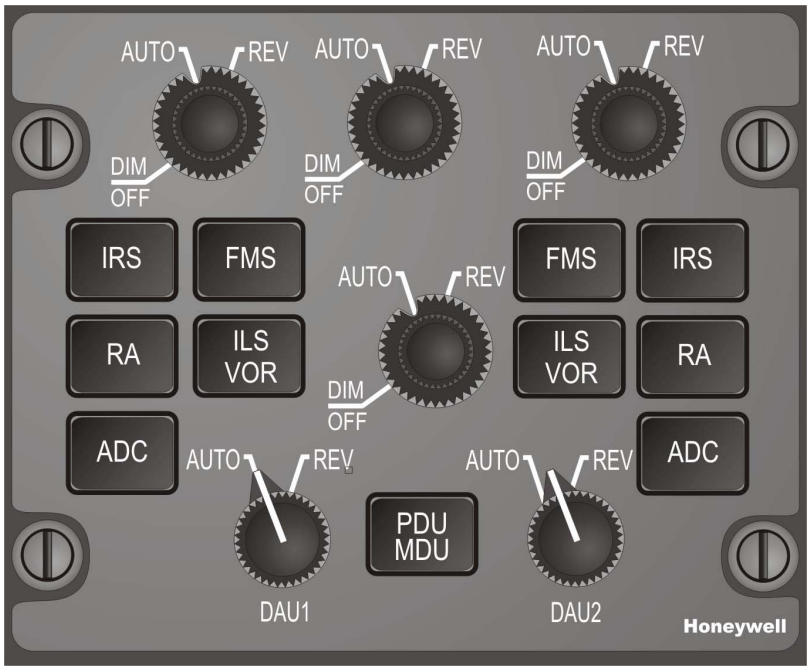



**FIGURE 02-34-50-00 REVERSION PANEL CONTROLS**

RA pushbutton is not operational when only one RA is installed (AD configuration).

Results obtained after reversions are displayed on both ADI. (only for basic configuration, airplane equipped with: 2 IRS, 2 FMS, 1 RA, 2 ILS / VOR, 2 ADC).

## ADC, RA AND IRS

On a two sensors system, the reversion is made from one to the other sensor by pressing on the corresponding pushbutton. Pressing a second time reverts to the first sensor (on-side sensor).

IRS, RA and ADC reversion captions are located in the ADI. When a reversion is done, the name of the reverted sensor appears in amber, indicating that both pilots are using the same sensor.

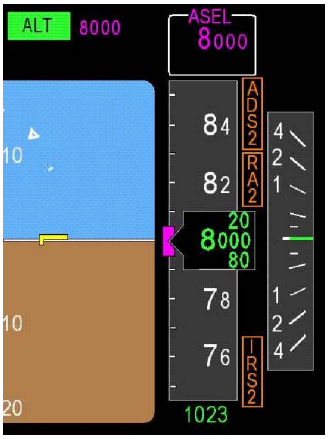



**FIGURE 02-34-50-01 ADC 2, RA 2 AND IRS 2 REVERSION**

If a double cross-side reversion is performed ( both are using different sensors but not their on-side sensors), the ADI indication is still displayed but in white, showing the sensor currently used.

When the airplane is equipped with three sensors (IRS FMS):

- the first reversion (from a nominal situation) on one side, only displays a white reversion symbol on the corresponding ADI,
- the second push reverts to the next sensor ( the one used by the other crew member). In that case the reversion symbol is displayed in amber in both ADI.
- a third push brings the on-side sensor back and lights off the reversions symbols (original situation).

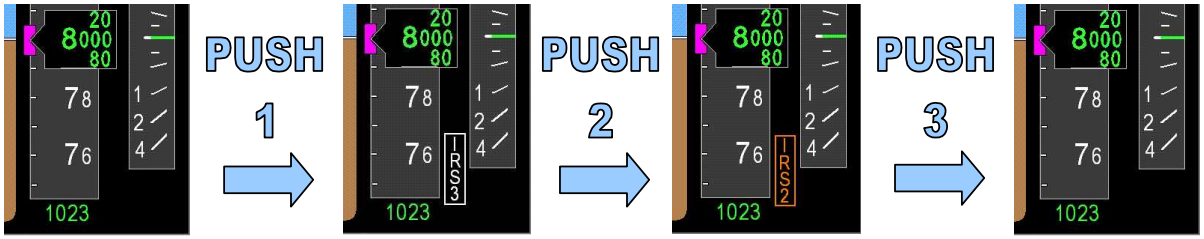



**FIGURE 02-34-50-02 IRS REVERSION FROM LH STATION**

When in abnormal operation (IRS 3 displayed on pilot slide), the annunciation is displayed in white.

When the pilot and the copilot are using the same source, the annunciation is displayed in amber.

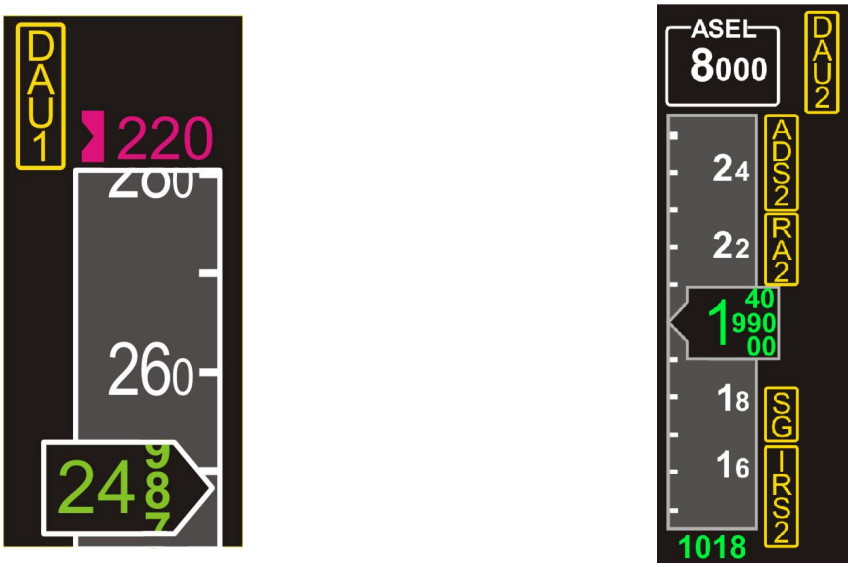



**FIGURE 02-34-50-03 ADI AMBER REVERSION INDICATION**

## ILS / VOR REVERSIONS

Depending on whether a LOC or a VOR is detected by the system, the reversion indication are different.

### LOC

The ILS source caption is only displayed in the HSI. When an ILS reversion is performed, the source symbol is framed in amber while the color corresponding to the target status remains (white, cyan or magenta).

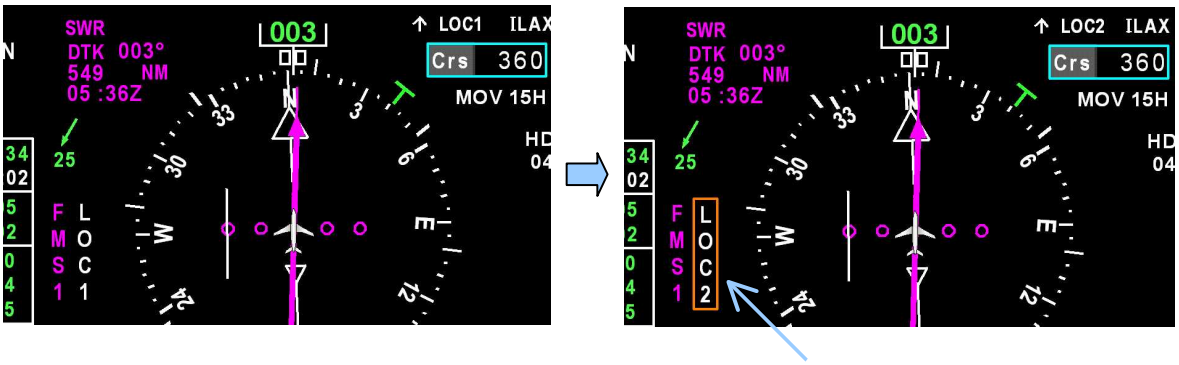



**FIGURE 02-34-50-04 LOC 2 REVERSION (LH PDU)**

### VOR station

When the VOR CDI is selected for display via the HSI control bar or by selecting APP on the GP or selecting CRS on the MKB and tuned to LOC, the source is LOC 1 / LOC 2 / BC 1 or B/C 2 (B/C is displayed insdead of LOC when the selected course is not within ± 95° of the present heading.) else the source is removed.

The priority is based on the current AP mode. The highest priority is for an active mode (magenta CDI), the second highest is for an armed mode (cyan CDI) and white in the lowest priority.

If both CDI are white, the FMS CDI is,by default, the highest priority. The source number is based on the RP selection.

For a VOR, the source is still the LOC but the ident is notified as VOR. When a reversion is done, the LOC source caption and the VOR ident caption are boxed in amber. The source remains colored according to the target status.

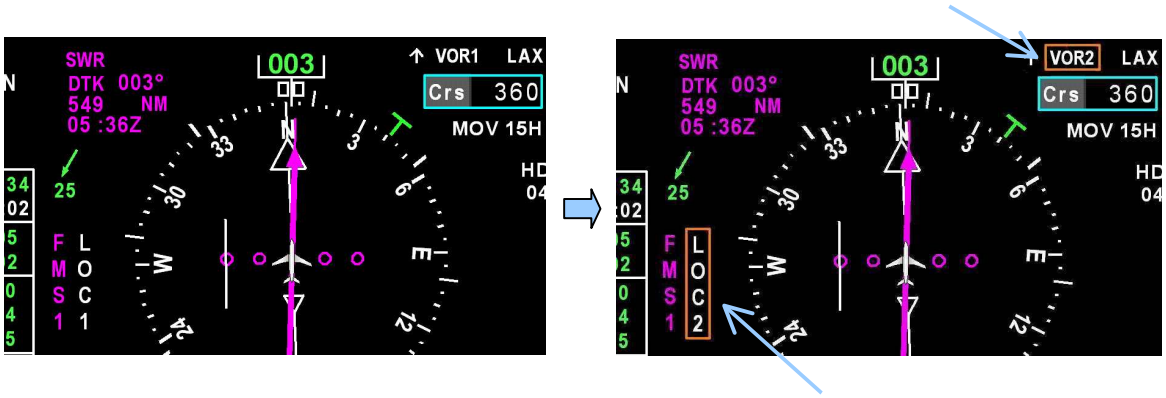



**FIGURE 02-34-50-05 VOR 2 REVERSION (LH PDU)**

### FMS reversions

In a three FMS configuration, the reversion indications are different. A third FMS is available as an option, there are two different configurations to consider when using the FMS:

- a two FMS system,
- a three FMS system.

In a two FMS configuration, after a first push on the FMS reversion pushbutton, all FMS navigation sources indications (in HSI and in I-NAV) are boxed in amber. The source and the ident keep their color, in order to continue displaying the status of the target,

In a three FMS configuration (option), the procedure slightly differs:

- at first push on the FMS reversion pushbutton, the FMS 3 indication only appears on the concerned pilot side, colored according to the status of the target,

**NOTE**

If the reversion is made on the PF side, the FMS source displayed in the I-NAV is also FMS 3 (as the I-NAV uses the same sources than the PF).

- after the second push, all FMS navigation sources indications (in both HSI and in I-NAV) are boxed in amber,
- after the third push, the system recovers a normal configuration.

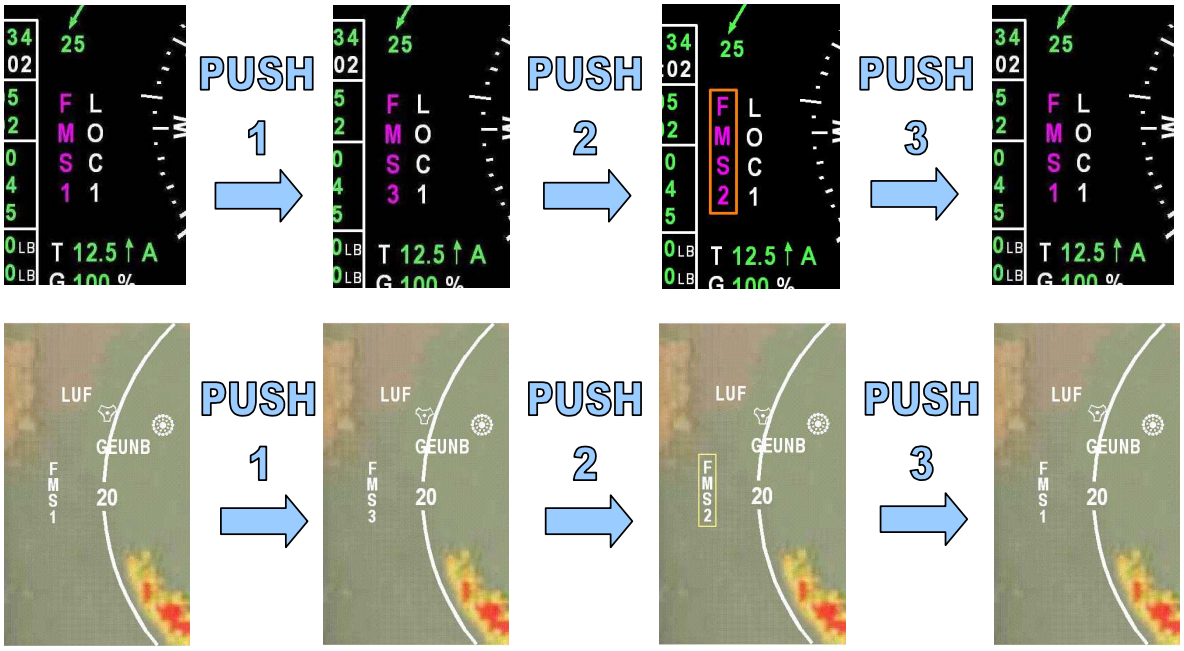



**FIGURE 02-34-50-06 FMS REVERSION FROM THE LEFT SIDE (PILOT FLYING SIDE)-HSI AND I-NAV IN A 3-FMS CONFIGURATION**

**NOTE**

As the I-NAV uses the sensor of the Pilot Flying station, a reversion on the same sensor for each pilot station implies all systems in the airplane use the same sensor.

## SECONDARY FLIGHT DISPLAY (SFD)

The SFD is an integrated solid state standby instrument, providing self-sensing of airplane attitude and display of air data from another equipment source (the Air Data Unit).


**FIGURE 02-34-50-07 SFD LOCATION**

The ADU is part of the Electronic Stand-By System (ESBS). It computes the static and pitot pressures and provides the SFD with:

- an average uncorrected static pressure,
- a dynamic pressure.

The SFD is located on the cockpit panel between LH PDU and UP MDU.

The SFD stands for both pilots in normal/abnormal/emergency operations and is dedicated to the display of :

- attitude,
- Flight Path Symbol (FPS) which represents an airmass flight path symbol (contrary to the PDU ones which is an earth frame flight path symbol),
- airspeed,
- altitude data.

SFD controls include:

- NAV pushbutton inoperative at this time,
- Inch/hPa pushbutton to toggle baro units,
- Baro setting knob.


**FIGURE 02-34-50-08 SECONDARY FLIGHT DISPLAY**

The sensors used by the SFD are fully independent from the airplane primary sensors (inertial system, anemometric sensors).

The Static Source Error Correction (SSEC) and VMO/MMO tables are integrated in the SFD.

When the SFD starts up for the first time, or under cold start conditions (power interrupted for more than two minutes) the unit aligns its inertial sensors to give accurate attitude information. The initialization display consists of a countdown timer (180 to 0 seconds).

In case of complete airplane electric power supply failure, the SFD is still powered by its dedicated stand-by battery. This battery is a Ni-Cd one with a total capacity of 4 A.h (ST-BY battery duration = 2h 40 min worst case, at end of lamp life, max brightness).

**IN ANY OPERATIONAL MODE**

The SFD features:

- a fixed airplane symbol consistent with the PDU ones is displayed in the center of the SFD. It gives the airplane attitude,

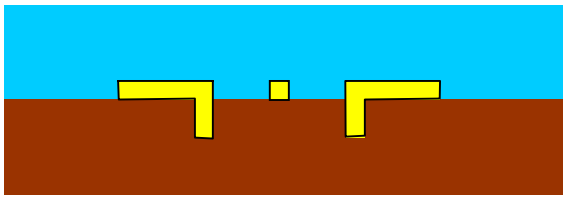


**FIGURE 02-34-50-09 AIRPLANE SYMBOL**

- a sky/ground raster (cyan/brown) rotating around the airplane symbol and moving in pitch,
- an horizon line separates the sky from the ground. Whatever the pitch value is, a minimum sky or ground representation remains in view in order to indicate the closest path to normal attitudes. In that case the horizon line is removed. When the data is deemed invalid, the shading becomes completely cyan and attitude fail indication ATT is displayed,
- a Flight Path Symbol (FPS) based on the air data parameters of the self contained attitude sensors,

**FIGURE 02-34-50-10 FLIGHT PATH SYMBOL (FPS)**

- the symbol moves only in the vertical axis centered on the SFD screen, the wings are always parallel to the lower edge of display. The symbol is displayed in foreground (on and not behind the attitude scale). This symbol is removed when the data is deemed invalid or if going out of range,
- For the calculation the normal range is:
  - roll attitude ± 65°,
  - pitch attitude + 35° / - 20°.

Out of these ranges the FPS is removed.

This symbol is comparable to the PDU one when in zero wind condition. In windy conditions, the FPS takes into account the wind gradient:

- an attitude pitch tape enable to display at least an upper bound of 15° and a lower bound of 30° of pitch as current pitch of zero degrees.

It displays values between 0 and ± 90°. The tape moves down for positive inputs and up for negative inputs. The labels and lines are white. Red pitch chevrons are displayed to enhance an excessive attitude situation (nose up or diving attitude). When the data is deemed invalid, the tape is removed:

- a roll scale having,
  - tick marks representing ± 10, ± 20, ± 30 and ± 60 degrees,
  - inverted triangles representing 0 and ± 45 degrees,
- a roll pointer enable to display ± 180° of roll moving,
  - counterclockwise for positive inputs,
  - clockwise for negative inputs.

The scale and pointer are displayed in white. When the data is deemed invalid, the pointer and scale are removed:

- an indicated airspeed tape scale (white) limited from 30 to 900 kt.

It comprises tick marks every 20 kt beginning at 30 kt and continuing to the upper limit of the scale. The white labels are represented in 20 kt increments from 40 to 900 kt. The scale moves down for increasing values and up for decreasing values. When the data is deemed invalid a X is displayed on the tape and all information is removed:

- an indicated airspeed readout consisting of a green digital airspeed representation when IAS > 30 kt (up to 30 kt no value is displayed). If the indicated airspeed is ≥ to Vmo, the indicated airspeed readout becomes white on a red background. When the data is deemed invalid, the readout is removed,
- an indicated Mach number readout (in the left upper corner).

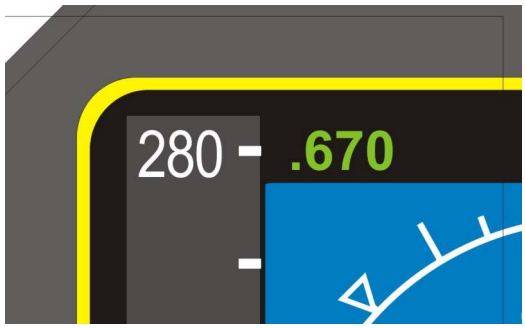



**FIGURE 02-34-50-11 MACH NUMBER READOUT**

It consists in a three digits readout (green) pre-fixed by a decimal point and displayed when the airplane reaches 0.400 Mach. When mach is deemed invalid, the readout is amber dashed.

When mach number ≥ Mmo, the mach number readout and the indicated airspeed readout become white on red background.


**FIGURE 02-34-50-12 MACH NUMBER ABOVE OR EQUAL MMO INDICATION**

- an altitude tape scale limited from - 2,000 to 65,000 ft.


**FIGURE 02-34-50-13 ALTITUDE TAPE**

It comprises white tick marks corresponding to 200 ft multiples. The scale moves down for increasing values and up for decreasing values .When the data is deemed invalid, a X is displayed on the tape and all information is removed:

- a digital barometric altitude readout displayed in green with an M following the digital readout to indicate metric units,

The data is limited from - 2,000 to 65,000 ft, converted from ft to meters. When the data is deemed invalid, the readout is removed. If the value becomes negative, a - is displayed. The metric altitude window is always displayed but this information can be removed by pin programming.

- a barometric pressure setting displayed (in green) in a four digits readout for hPa value and in a four digits (including two decimals) readout for in.Hg value.


**FIGURE 02-34-50-14 BARO PRESSURE READOUT**

Both can be displayed using a dedicated control. The adjustment of the value is possible through the rotactor which selects the value step by step (1 hPa or 0.01 inHg). A direct STD selection is possible (press the STD pushbutton) in that case STD is displayed instead of the digital value.

When the system is power supplied by the Electronic Stand-By System (ESBS) dedicated stand-by battery, a specific BAT is displayed.


**FIGURE 02-34-50-15 BAT INDICATION**

## IN APPROACH MODE

ILS Localizer indicator: LOC is displayed The data is deemed invalid because no ILS buses are connected on the SFD (option).

ILS G/S indicator: G/S is displayed. The data is deemed invalid because no ILS buses are connected on the SFD (option).

These information are shown only if NAV function is activated. ILS information are displayed on selection of the NAV pushbutton (front bezel).


FIGURE 02-34-50-16 SFD IN APPROACH MODE

## BACK COURSE (B/C) MODE

ILS Localizer indicator: B/C is displayed. When data is deemed invalid LOC is displayed. At present time, the data is deemed invalid because no ILS buses are connected on the SFD (option).


FIGURE 02-34-50-17 SFD IN B/C MODE

## FAILURE FLAGS DISPLAY


FIGURE 02-34-50-18 FAILURE FLAGS DISPLAY

## FMS MESSAGES

| FMS MESSAGES | DEFINITION |
|---|---|
| SYNCHRONOUS/FMS 1-2 | FMS are proceeding in synchronous mode |
| SINGLE/ALL | All the FMS are in single operation mode |
| COMPARE FMS POSITION | The FMS position have a difference > 5 NM. The systems continue to operate normally |
| INDEPENDENT OPERATION | Equivalent to SINGLE/ALL message |
| INVALID NAV DB | Navigation data base invalid |
| INVALID CUSTOM DB | Custom data base invalid |
| FMS POSITION DIFFERENT | The FMS positions have a difference ≥ 10 NM |
| CUSTOM DB SYNCHRONIZED | Data base have been synchronized after cross-load |
| DB TRANSFER IN PROGRESS | The data base transfer is in progress |
| DB TRANSFER COMPLETE | The data base transfer has been completed |
| DB TRANSFER ABORTED | The data base transfer has been aborted |
| INVALID AIRCRAFT DB | The airplane data base is invalid |
| ACTIVE MODE IS MAG HDG | This message is displayed when the system automatically switches from a true heading to a magnetic heading (going out of a high latitude region, latitude > 72°N or 59°S) |
| ACTIVE MODE IS TRUE HDG | This message is displayed when the system automatically switches from a magnetic heading to a true heading (entering a high latitude region, latitude < 72°30’ N or 59°30’ S) |
| CHECK IRS 1 POSITION | The position from the identified IRS sensor > 10 NM from the FMS position |
| CHECK IRS 2 POSITION | The position from the identified IRS sensor is > 10 NM from the FMS position |
| CHECK IRS 3 POSITION | The position from the identified IRS sensor > 10 NM from the FMS position |
| CHECK GPS 1 POSITION | The position from the identified GPS sensor > 10NM from the FMS position |

| FMS MESSAGES | DEFINITION |
|---|---|
| CHECK GPS 2 POSITION | The position from the identified GPS sensor > 10NM from the FMS position |
| CHECK VOR/DME 1 POSITION | The position from the identified VOR/DME > 10 NM from the FMS position |
| CHECK VOR/DME 2 POSITION | The position from the identified VOR/DME > 10 NM from the FMS position |
| END OF FLIGHT PLAN | Indicates the last defined waypoint.It is not applied to the destination waypoint |
| FLT PATH ANGLE TOO STEEP | The VNAV flight path angle exceeds the limit (6°) |
| ENTERING POLAR REGION | Indicates that the airplane is approaching a polar region, this message is displayed before the automatic heading reference change (magnetic to true) |
| EXITING POLAR REGION | Indicates that the airplane is leaving a polar region |
| LAST LEG | The active leg is the last leg on the flight plan and the TO waypoint is not the destination |
| INVALID NAV DB | The navigation data base is invalid and not useable Reload the data base |
| INVALID CUSTOM DB | The custom data base has been corrupted and has been cleared and initialized |
| CHECK ALT CONSTRAINT | The pilot must check altitude constraints for a conflict between type of constraints (CLB or DES) and current flight mode (climbing or descending) |
| CHECK SPD/ALTITUDE LIMIT | The upcoming speed and/or altitude constraint must be checked and proper action taken in order to meet the constraints |
| OFFSET CANCEL NEXT WPT | The offset is cancelled at the next waypoint. (offset is forbidden in SID/STAR/TMA…) |
| PERF-VNAV UNAVAILABLE | VNAV information is missing, the system is unable to compute PERF INIT not done. |
| FMS POSITION DIFFERENT | The FMS positions differ by 10 NM or more |
| RESET ALT SEL | The altitude selected (ASEL) is incompatible with VNAV |

| FMS MESSAGES | DEFINITION |
|---|---|
| SINGLE OPERATION | There is a problem between the two FMS that precludes full communication between the two systems |
| UNABLE NEXT ALT | The system is unable to keep constraint altitude |
| OFFSET CANCEL | The offset has been canceled |
| RAIM WILL EXCEED LIMIT | RAIM at the time requested will exceed the limit for the phase of flight |
| DB TRANSFER IN PROGRESS | The transfer of the data base is in progress |
| DB TRANSFER COMPLETE | The transfer of the data base has been completed |
| DB TRANSFER ABORTED | The transfer of the data base has been aborted |
| NO PRESENT POSITION | An action is requested that requires present position |
| NO POSITION SENSORS | The FMS lost all dead reckoning sensors. |
| HIGH HOLDING GRD SPD | The ground speed exceeds the limits for allowable size of holding pattern |
| USING CURRENT GS/FF | Indicates the current PERF mode (ground speed/fuel flow) |
| FULL PERF UNAVAIL | A numerical fault has occurred in the active predictions and the FULL PERF mode is not available |
| IRS 1 FAILED | The FMS senses the identified IRS has failed |
| IRS 2 FAILED | The FMS senses the identified IRS has failed |
| IRS 3 FAILED | The FMS senses the identified IRS has failed |
| ADC 1 FAILED | The FMS senses the identified ADC has failed |
| ADC 2 FAILED | The FMS senses the identified ADC has failed |
| GPS 1 FAILED | Indicates that inputs from the identified GPS have failed |
| GPS 2 FAILED | Indicates that inputs from the identified GPS have failed |
| DATA BASE OUT OF DATE | Data base is out of date |

| FMS MESSAGES | DEFINITION |
| --- | --- |
| CHECK SPEED CONSTRAINT | In cruise or descent in VNAV the airplane is approaching a waypoint that has a speed constraint if the FMS predicts that (based on current speed and deceleration) the constraint speed will be exceeded |
| INVALID DIRECT TO | Indicates invalid entry of the named parameter |
| VERT DIR OVER MAX ANG | The angle computed during a VERTICAL DIRECT TO exceeds the limit. In that case the angle is set to the maximum limit (6°) |
| VERT DIR UNDER MIN ANG | The angle computed during a VERTICAL DIRECT TO is under the limit. In that case the angle is set to the minimum limit (1°) and descent is started at that time |
| FLIGHT PLAN FULL | The flight plan is full and this message is displayed when the pilot attempts to enter more than 100 waypoints |
| INVALID NOTAM LIST | Indicates that the NOTAM is invalid and has been cleared |
| WEIGHT DEFAULT – LB | Indicates that the weight option has defaulted to pounds. Usually the result of the configuration module being invalid or not read |
| GPS RAIM ABOVE LIMIT | The RAIM value is above the limit for the current phase of flight |
| GPS RAIM UNAVAILABLE | RAIM is not being generated by the GPS receiver |
| HIGH PCDR TURN GRD SPD | The ground speed exceeds the limit for the defined procedure turn |
| INVALID AIRCRAFT DB | The airplane data base has been corrupted and has been cleared and initialized |
| CHECK DEST FUEL | The predictive destination fuel equals zero |
| CHECK RESERVE FUEL | The planned reserve fuel is equal to or less than the reserve fuel required |
| COMPARE FUEL QUANTITY | This message is displayed when the Fuel Remaining (FR) computed by the FMS differs with the Fuel Quantity (FQ) computed by the Fuel Quantity Management Computer (FQMC) |

| FMS MESSAGES | DEFINITION |
|---|---|
| CHECK BARO SET | The airplane has passed the transition altitude by more than 3,000 ft or is leveling and the baro set has not been adjusted to the proper value. This message is displayed during climbs and descents |
| INVALID DELETE | Indicates invalid entry of the named parameter |
| RADIALS DO NOT INTERSECT | The radials defined for the intercept function do not intercept |
| WAYPOINT NOT FOUND | The entered waypoint cannot be found. If this results when attempting to enter an airway into a flight plan, the waypoint is not part of the reference runway |
| FPL CONTAINS INVALID WPT | The stored flight plan has undefined or invalid waypoints |
| FPL STORAGE FULL | The storage area for flight plan is full |
| NO FLIGHT PLAN | There is no corresponding flight plan with the same origin or origin/destination |
| NOT AN AIRPORT | Other than an airport name has been entered |
| NOT IN DATA BASE | The pilot requested data that was not in the data base and cannot be pilot defined |
| WPT STORAGE FULL | The storage area for pilot defined waypoint is full |
| ENDING WPT NOT FOUND | The ending waypoint of an airway or a flight plan cannot be found |
| NO CROSSING POINT FOUND | No crossing point can be found |
| NOT A NAVAID | The entry made is other than a navaid |
| USED BY ACTIVE FPL | The pilot tried to delete a waypoint from storage that is used in the active flight plan |
| USED BY OFFSIDE ACT FPL | The pilot attempted to delete a waypoint from storage that is used in the offside active flight plan |
| UNABLE OFFSET | An attempt was made to insert an offset during holding a STAR or a SID |
| UNABLE HOLD CHANGE | The pilot attempted to change the holding pattern definition while in holding and not in the inbound leg |

| FMS MESSAGES | DEFINITION |
| --- | --- |
| RUNWAY NOT FOUND | The data base does not contain the entered runway at the designated airport |
| UNABLE PD PLACEMENT | The PD waypoint has been restricted from placement in the flight plan |
| BRG / CRS MUST BE IN TRUE | The bearing entry must be in true because the referenced waypoint is outside the coverage of the magnetic variation table |
| INTERSECTION NOT FOUND | PD waypoint does not intersect the active flight plan |
| CHECK PD PLACEMENT | The waypoint has not been inserted in the right box |
| FLT PLAN CHANGED | The fixed location at which a pattern is defined is different from the stored flight plan one |
| EXCEEDS MAX GROSS WEIGHT | The gross weight exceeds the maximum ramp weight in the airplane data base |
| NO CRS TO ARC INTERCEPT | No intercept to the arc can be found for the input definition |
| UNABLE PCDR TURN CHANGE | Changing the procedure turn definition is inhibited after sequencing onto the procedure turn |
| WIND EXCEEDED AT CRZ ALT | The wind entered at the altitude has caused the wind at the cruise altitude to be exceeded |
| ISA DEV EXCEEDED | The entered temperature has caused the ISA deviation to be exceeded at the cruise altitude |
| EXCEEDS CERT CEILING | This message is displayed when the entered altitude is above the airplane certified ceiling |
| EXCEEDS MAX LANDING WT | The predicted landing weight exceeds the maximum landing weight |
| DUPLICATE FLT PLAN NAME | A stored flight plan already exists with the entered flight name |
| UNABLE RNP | The current Required Navigation Performance (RNP) can not be achieved |
| UNABLE RNP NEXT WPT | The system is unable to consider the RNP for the next waypoint |
| PILOT RNP CANCEL | The system does not accept the RNP inserted by the pilot |

| FMS MESSAGES | DEFINITION |
|---|---|
| PILOT RNP CANCEL NEXT WPT | The system does not accept the RNP inserted by the pilot for the next waypoint |
| NAV DB SYNCHRONIZED | Navigation data base is synchronized |
| UNABLE – CDB XLOAD IN PROG | Custom data base cross load is unavailable |
| SET IRS 1 MAG HDG | IRS 1 navigation function is lost but the IRS 1 still supplies valid attitude.<br>The current heading needs to be input to the IRS 1 |
| SET IRS 2 MAG HDG | IRS 2 navigation function is lost but the IRS 2 still supplies valid attitude.<br>The current heading needs to be input to the IRS 2 |
| SET IRS 3 MAG HDG | IRS 3 navigation function is lost but the IRS 3 still supplies valid attitude.<br>The current heading needs to be input to the IRS 3 |
| ENTER IRS 1 POSITION | IRS are not aligned and a position is required to be entered |
| ENTER IRS 2 POSITION | IRS are not aligned and a position is required to be entered |
| ENTER IRS 3 POSITION | IRS are not aligned and a position is required to be entered |

## CAS MESSAGES

| CAS MESSAGES | DEFINITION |
| --- | --- |
| **ADF .. FAIL** | On ground, indication of ADF (1/2) receiver failure |
| **ADS .. FAIL** | Failure of Air Data System (1/2) |
| **APM 1+2+3+4 FAIL** | On ground, failure of three or more of the indicated APM modules. |
| **APM MISCOMPARE** | Indicates miscomparaison of the APM settings on ground |
| **ASCB XX PRI BUS FAIL** | On ground, primary bus failure on one (LH/RH) ASCB |
| **ASCB XX PRI BKUP FAIL** | On ground, backup bus failure on one (LH/RH) ASCB avionics bus (Dual Backup Bus Failure) |
| **CCD XX FAIL** | On ground indication of complete failure of (LH/RH) CCD |
| **CHECK DU XX** | A possible fault/error has been detected on display (LH/UP/LW/RH) |
| **CMS 1+2 FAIL** | Indication of both configuration management failure |
| **DME .. FAIL** | On ground indication of a DME (1/2) failure |
| **DU XX OVHT** | Overheating of (LH/UP/LW/RH) display unit |
| **EGPWS .. FAIL** | Failure of corresponding TAWS (1/2) system |
| **FMS .. FAIL** | On ground, failure of corresponding FMS (1/2/3) |
| **GND PROX .. FAIL** | Loss of basic GPWS modes (1/2) |
| **IRS .. ALIGNING** | On ground, IRS (1/2/3) aligning and excessive airplane motion is detected |
| **IRS .. FAIL** | Critical failure of IRS (1/2/3) |
| **IRS .. POS ENTRY** | IRS (1/2/3) has failed the alignment test due to an invalid pos init entry |
| **MAU .. FAN FAIL** | On ground, failure of two fans on the indicated MAU (1/2) |
| **MAU .X** | Failure of MAU channel (1A/1B/2A/2B) |
| **MAU .X OVHT** | Overheating of MAU channel (1A/1B/2A/2B) |
| **MKB XX FAIL** | On ground indication of failure of (LH/RH) MKB |

| CAS MESSAGES | DEFINITION |
|---|---|
| MONIT WARN .. FAIL | On ground, failure of monitor warning (1/2/3) software |
| NAV .. FAIL | Failure of NAV (1/2) receiver |
| RADALT .. FAIL | Failure of radioaltimeter (1/2) |
| SYSTEM CONFIG FAIL | System is unable to setup due to configuration mismatch |
| TCAS FAIL | Failure of TCAS system |
| TERR .. FAIL | Failure of Terrain awarness funcion (1/2) |
| VALIDATE CONFIGURATION | On ground, indicates the configuration of the MAU modules needs validated |
| WEATHER RADAR FAIL | Failure of weather radar system |
| WINDSHEAR .. FAIL | Failure of windshear protection system (1/2) |
| XPDR .. FAIL | Failure of transponder system (1/2) |
| ADF .. FAIL | In-flight, indication of ADF (1/2) receiver failure |
| AGM .. /FMS .. GFP INOP | On ground, indication of Graphical Flight Planning is not possible with the indicated AGM (1/2/3/4)/FMS (1/2/3) combination |
| AGM .. ARPT COMM ERR | On ground, Airport Comm Database in indicating AGM (1/2/3/4) is corrupt or missing. |
| AGM .. ARPT COMM OLD | On ground, Airport Comm Database is out of date. |
| AGM .. AIRWAY COMM ERR | On ground, Airway Database is corrupt or missing. |
| AGM .. AIRWAY COMM OLD | On ground, Airway Database is out of date. |
| AGM .. NDB DATA ERR | On ground, NDB Database is corrupt or missing. |
| AGM .. NDB DATA OLD | On ground, NDB Database is out of date. |
| AGM .. ARPT TEXT ERR | On ground, Airport Text Database is corrupt or missing. |
| AGM .. ARPT TEXT OLD | On ground, Airport Text Database is out of date. |
| AGM .. ENROUT COM ERR | On ground, Enroute Com Database is corrupt or missing. |
| AGM .. ENROUT COM OLD | On ground, Enroute Com Database is out of date. |

| CAS MESSAGES | DEFINITION |
|---|---|
| AGM .. GEPOLITIC ERR | On ground, Geopolitic Database is corrupt or missing. |
| AGM .. GEOPOLITIC OLD | On ground, Geopolitic Database is out of date. |
| AGM .. GRID MORA ERR | On ground, Grid MORA Database is corrupt or missing. |
| AGM .. GRID MORA OLD | On ground, Grid MORA Database is out of date. |
| AGM .. OBSTACLES ERR | On ground, Obstacles Database is corrupt or missing. |
| AGM .. GRID MORA OLD | On ground, Grid MORA Database is out of date. |
| AGM .. SUA ERR | On ground, Special Use Airspace Database is corrupt or missing. |
| AGM .. SUA OLD | On ground, Special Use Airspace Database is out of date. |
| ASCB XX PRI BUS FAIL | In-flight, primary bus failure on one (LH/RH) ASCB |
| APM .. FAIL | Failure of one or two APM |
| ASCB XX PRI BKUP FAIL | In-flight, backup bus failure on one (LH/RH) ASCB avionics bus (Dual Backup Bus Failure) |
| CCD XX FAIL | In-flight indication of complete failure of (LH/RH) CCD |
| CMS XX FAIL | Indication of one configuration management (1 or 2) failure. |
| DME .. FAIL | In-flight indication of a DME (1/2) failure |
| FLAP OVRD | Flap override has been selected |
| GPS.. FAIL | Failure of corresponding GPS (1/2/3) |
| G/S CANCEL | G/S cancel has been selected |
| HUD FAIL | HUD failure (optional) |
| IRS .. FAIL | In-flight, failure of IRS .. |
| IRS .. ALIGNING | In-flight, IRS (1/2/3) is aligning (message turns off when in NAV mode) |
| IRS .. POS ENTRY | IRS (1/2/3) alignment is complete but no valid initial position has been received |
| LSS FAIL | Failure of Lightning Sensor System (optional) |
| MAU .. FAN FAIL | Single fan failure at any time or dual fan failure for the indicated MAU (1/2)has occured in flight. |

| CAS MESSAGES | DEFINITION |
|---|---|
| MKB XX FAIL | In flight indication of failure of (LH/RH) MKB |
| NAV .. FAIL | In-flight, indication of NAV (1/2) failure |
| NIC BATTERY | At least one battery available in MAU NIC module is low. |
| TERRAIN INHIBIT | Terrain inihibt has been selected |
| XPDR .. FAIL | In-flight, indication of failure of transponder (1/2) failure |