IDU-680 EFIS

ELECTRONIC FLIGHT INSTRUMENT SYSTEM

9.0C SOFTWARE

FIXED WING PILOT GUIDE

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Pilot Operating Guide and Reference

(Fixed Wing)

EFIS Software Version 9.0C

Document 64-000099-090C

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Revision Record

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Rev	Notes/Pages changed, added, or deleted by current revision	Date	Author

Section 1 System Introduction and Overview

1.1. Introduction

The Genesys Aerosystems Electronic Flight Instrument System (EFIS) is a “pilot-centered” system. While still highly automated, it presents the pilot with information necessary to make decisions and take appropriate actions. For example, the Highway-in-the-Sky (HITS) allows for highly automated approaches, but its predictive nature provides the pilot awareness of upcoming heading and altitude changes.

1.2. EFIS/FMS Description

Figure 1-1: IDU-680 Input Identification

The integrated display unit (IDU) has 16 buttons along the vertical sides referenced as L1 through L8 starting at the top left corner of the display, moving down, and R1 through R8 from the top right corner, moving down the display from a pilot's perspective.

Four knobs at the bottom of the bezel are designated, from left to right, ❹,❸,❷, and ❶. References throughout this guide refer to which knob to push and rotate for desired outcomes but ❹ only controls the backlighting intensity.

A sensor on the face of the IDU bezel measures ambient light levels. Use ❹ to control the brightness of the panel or display lighting. To adjust panel lighting (illumination of legends, knobs, inclinometer, and buttons), push and rotate ❹ clockwise to increase or counterclockwise to decrease. Adjust display lighting (illumination of the LCD) without pushing rotate ❹ as described with panel lighting. Lighting may be controlled locally or remotely, with a default state being with the local control.

NOTE:

If entering ground maintenance mode with a bright light shining or reflecting directly into the display, shield the light sensor to avoid the IDU from going directly into the flight mode.

On the bezel between the two center knobs, a slip indicator or blank housing acts as the secure data transfer port door. Lift it before power-up to initiate the ground maintenance mode after power-up. If a limits change, software, or database update is planned, the secure data storage device must be inserted before power-up.

1.3. System Overview

The EFIS is a complete flight and navigation instrumentation system providing information via computer-generated displays. The displays include 3D, enhanced situational awareness primary flight display (PFD) and multi-function display (MFD), which may be configured to show a Moving Map, HSI, Navigation Log, WX-500 Lightning Strikes, Traffic, WX-RDR, Video, or Datalink page.

At any given time, each EFIS side has only one IDU transmit-enabled to send RS-232 and RS-422 system transmissions. By default, the PFD is transmit-enabled and, if it subsequently fails, the respective MFD becomes transmit-enabled. EFIS limits settings are possible when speed units are set accordingly.

Table 1-1: EFIS Limits Options for Speed Units

	Airspeed Units Set To	
Parameters	Knots, MPH, or Km/h	SI
Airspeed	Knots, MPH, Km/h	Km/h
Altitude	Feet	Meters

Table 1-1: EFIS Limits Options for Speed Units

	Airspeed Units Set To	
Parameters	Knots, MPH, or Km/h	SI
Distance	NM	KM
Ground Speed	Knots	Km/h
Temperature	°C or °F	°C
True Airspeed	Knots	Km/h
VSI	fpm	m/s
Wind	Knots	m/s

NOTE:

Where distances are stated in NM or KM and altitudes are stated in feet or meters, the following statement applies: “depending upon the setting of the “Speed Units” system limit.”

1.3.1. Display Options

In an IFR installation, the PFD is configured with the primary flight information (PFI) in top area and multi-function display (MFD) page in bottom area. The MFD may be configured to show a MFD page in both the top and bottom areas or as a full map page.

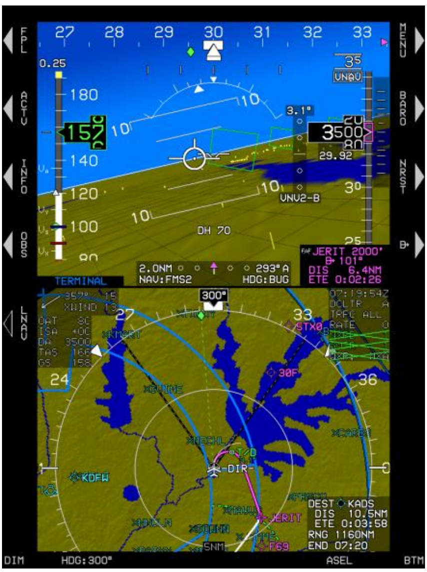
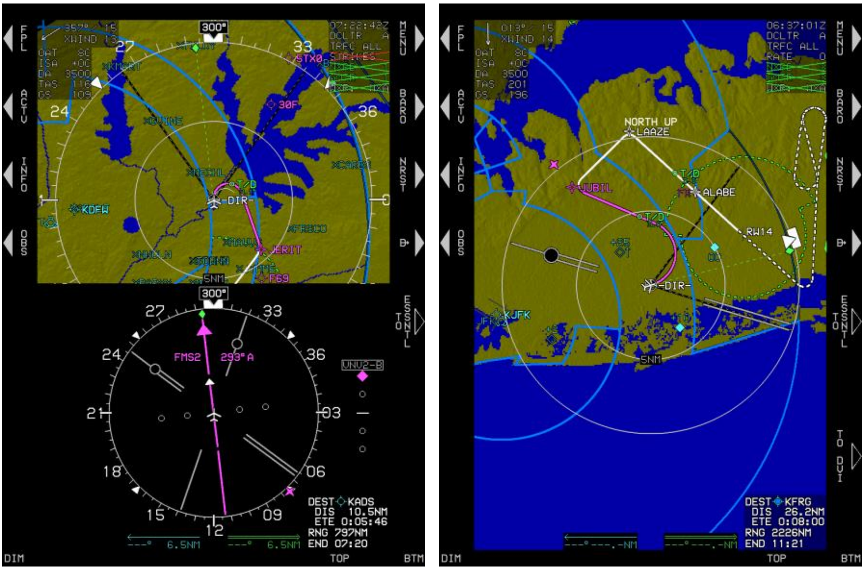


Figure 1-2: PFD



MFD

MFD with Full Map Page

Figure 1-3: MFD Display Options

1.3.2. Functional Integration and Display Redundancy

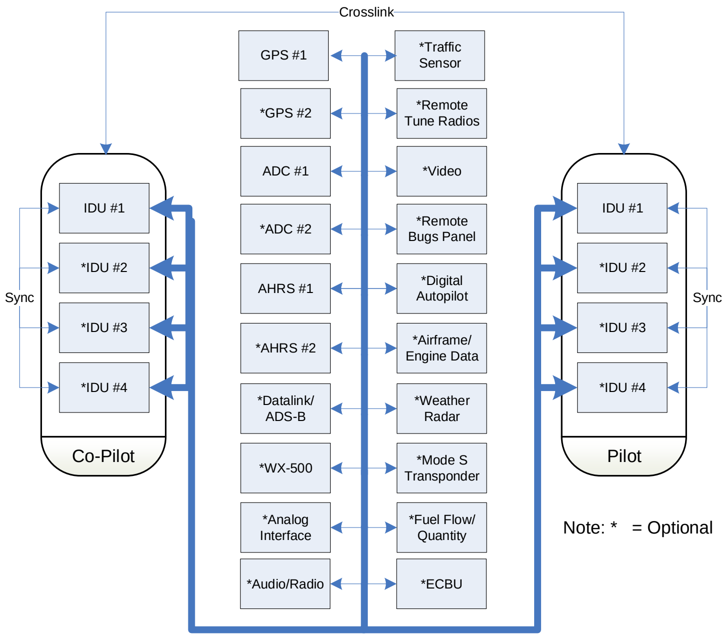


Figure 1-4: System Diagram

IDUs incorporate a high-brightness liquid crystal display screen; bezel buttons; four rotary knobs and enter switches. Because the receive ports of the IDUs are connected to the digital sensor modules in parallel, each IDU is independent from all other IDUs.

The IDUs depend upon intra-system (between IDUs on a side – "Sync") and inter-system (between IDUs on opposite sides – "Crosslink") to achieve synchronization of the integrated functions. The IDUs also depend upon intra-system communications to determine which IDU on a side takes over transmit-enabled responsibilities. The transmit-enabled IDU is the IDU providing data to external sensors and generating visual and audible alerts. Figure 1-4 is a typical system diagram.

1.3.3. Application Software Air Mode and Ground Mode

Numerous symbology elements change behavior depending upon whether the aircraft is on the ground (ground mode) or in flight (air mode). The mode is determined separately from the system initialization modes. This parameter is continuously calculated as follows:

If a Weight on Wheels/Weight on Ground sensor is installed, ground mode is determined solely from the sensor position, otherwise:

1) If airspeed is valid and AGL altitude is valid, ground mode is set when indicated airspeed is less than 40 knots, and AGL altitude is less than 75 feet.

2) If airspeed is invalid but AGL altitude is valid, ground mode is set when AGL altitude is less than 75 feet.

3) Under any other circumstance, air mode is set by default.

NOTE:

Application software for air mode or ground mode uses the following parameters: ground speed and airspeed (knots) and altitude (feet).

1.3.4. IDU Initialization

The hardware, including file system, IO, and graphics, is initialized. Immediately after graphics initialization, a screen with "TESTING" is displayed with the Genesys Aerosystems logo, software version number, and part number. The software version number delineates: (1) major revision number (i.e., "9.0") and (2) minor revision letter (i.e., "C".).

Table 1-2: IDU Number Designation

Version Number	Part Number
Rev 9.0C	25-680EFIS90C-SW-xxxx (IDU-680 CPM4)
	25-680EFIS90C-SW-xxxx (IDU-680 CPM5L)
	25-680EFIS90C-SW-xxxx (IDU-680 CPM5C)

Figure 1-5: Initialization Screen

NOTE:

Software part numbers can change after initial certification and are amended with installation manual changes or service bulletin issuance.

Aircraft limitations are initially read from flash drive storage to provide IDUs with a default configuration setup in the event of personality module failure. The personality module contains the CPU (IDU) number (Table 1-3) and side designation (pilot or co-pilot). The IDU number is identified below the part number on the CRC screen (Figure 1-7).

Table 1-3: IDU Number Designation

CPU/IDU #	Definition
0	Single IDU installation
1	IDU only shows PFD
2	First MFD in multi-display installation
3	Second MFD in a multi-display installation
4	Third MFD in a multi-display installation

Pilot IDU #1 reads aircraft configuration from its personality module. In a multi-screen installation, IDU #1 transmits this configuration to the other IDUs. The other IDUs save the transmitted configurations to flash drive storage.

Aircraft parameters (latitude, longitude, altitude), as they existed prior to the last system shutdown, are read for a good system initialization, even if system sensors are failed or not yet initialized. For future updates (i.e., updating software version 9.0C to 9.0D), all aircraft settings re-initialize to default values. Otherwise, aircraft settings, as they existed prior to the last system shutdown, are used to initialize the system except for the following default values:

1) Selected sensors are initialized to default values.
2) Active flight plan structure and associated values are cleared.
3) ADAHRS set to slaved mode, and slewing value is initialized to zero.
4) Timers are turned off.
5) Datalink and map panning modes are set to off.
6) Fuel caution and alarm thresholds are set to default values.
7) Heading bug is set to 360° (analog autopilot [AP] or Genesys/S-TEC DFCS enabled) or turned off.
8) Heading mode is turned off.
9) HSI Active navigation source is set to FMS.
10) HSI Preview navigation source is turned off. (If NAV PRV enabled)
11) Minimum altitude setting is turned off.
12) FMS OBS setting is set to automatic.
13) VOR/LOC 1 OBS setting is set to 360°.
14) VOR/LOC 2 OBS setting is set to 360°.
15) Parallel offset is set to 0 NM or KM.
16) PFD Zoom mode is set to off.
17) Manual RNP is set to off.
18) If in round dial mode, Analog AGL is set to off.
19) PFD skyway is set to on.
20) Airspeed bug is turned off.
21) Target and preselected altitude bugs are turned off.
22) True North mode is turned off.
23) V-speeds are cleared.
24) Vertical speed bug is turned off.

25) If using weather radar menu, weather radar mode is set to off, vertical profile is set to off and stabilization is set to on.

26) Weather radar scale is initialized to 80NM. When using kilometers for radar scale, initialized to 160KM.

27) Crosslink is initialized to on.

28) Map modes are set to allowed values.

29) With DVI option, DVI is set to off.

30) Essential mode is set to off.

31) G telltales are automatically reset so long as the associated G limit has not been exceeded.

32) Traffic page flight level set to off.

33) All Datalink products selected for display.

The magnetic variation coefficients database is read from the flash drive storage and CRC-32 checked.

The EFIS determines whether it is booting on the ground or in flight based on the air/ground mode parameter value from the last system shutdown. If booting on the ground, the following actions happen:

1) A logo screen with “TESTING” is displayed.

Figure 1-6: Logo Screen with “TESTING” (CPM5L)

2) CRC-32 values for application executable, limitations files, NavData files, obstruction files, sounds database, and terrain header files are checked.

   During this action, “PRESS ANY BUTTON TO QUICK START” is displayed below “TESTING.” Press any button to stop the ground booting and execute the flight booting.

3) If the built-in-test (BIT) check fails, the program exits with an error message and creates a BIT result file indicating failure.

4) If the BIT check passes, the program continues to initialize and creates a BIT result file indicating passage.

5) If “Baro Auto-Setting on Startup” is enabled in EFIS limits, the system auto-sets the altimeter based on the terrain elevation at the startup point (only applicable at surveyed airports.) In QFE mode operation, the system auto-sets the altimeter to read zero altitude.

6) A logo screen displaying:

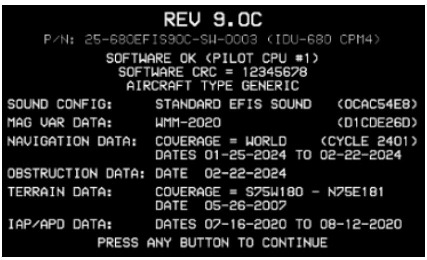
    a) Software CRC-32;

    b) Aircraft type;

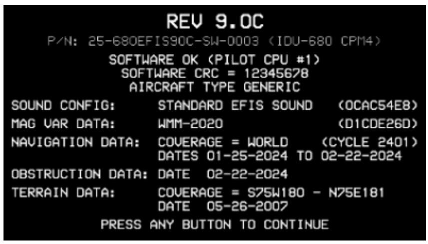
    c) Sounds database name and CRC-32;

    d) Magnetic variation coefficients version and CRC-32; and

    e) Database versions and validity dates are displayed along with “PRESS ANY BUTTON TO CONTINUE.”



With Charts



Without Charts

Figure 1-7: CRC Screen (CPM5L)

7) If all critical sensors (GPS, ADC, and AHRS) are in normal condition, the display screens are shown immediately.

8) If any critical sensor is not in normal condition, a logo screen with a two-minute countdown timer is displayed along with “PRESS ANY BUTTON TO SKIP.”

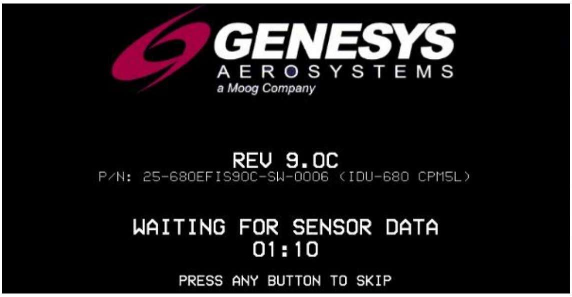


Figure 1-8: Two-Minute Countdown Screen (CPM5L)

9) The display screens initialize at the earliest of:

   a) when 2 minutes has elapsed;

   b) when the pilot presses any button to escape startup countdown; or

   c) when all critical sensors are in normal condition.

10) The display screens are shown as follows:

    a) IDU #1: PFD Normal mode with PFD on top, an MFD page (last selected MFD page on this IDU) on bottom.

    b) Other IDUs: Initialize to MFD on top and MFD on bottom.

11) On all IDUs with fuel totalizer functions enabled, the fuel set menu is activated to remind the pilot to set the fuel totalizer quantity.

12) All active alerts are automatically acknowledged for 5 seconds to reduce nuisance alerting.

If booting in the air, the following actions happen:

1) A logo screen with “QUICK START” is displayed.

Figure 1-9: QUICK START Screen (CPM5L)

2) BIT result file created during the last ground boot is checked.

a) Failure = indicates a failure, program exits with an error message.

b) Passage = program continues.

3) The display screens initialize immediately as follows:

a) IDU #1: PFD (PFD on top, MFD on bottom).

b) Other IDUs: Initialize to MFD on top and MFD on bottom.

4) The active flight plan and related parameters as they existed prior to the last system shutdown are restored.

NOTE:

If any menu is active after IDU initialization, press **EXIT (R1)** on each display and wait at least 20 seconds to allow PFDs to sync with MFDs and pilot and copilot sides to sync (as applicable). If any IDU menu is active, intra-system and inter-system synchronization messages are paused.

1.4. General Arrangement

The IDU-680 is 7.500"W x 10.250"H x 4.750"D and weighs less than 9.5 lbs. It has the capacity to accommodate integrated peripherals mechanically attached to the IDU but have electrical isolation and redundancy. These modules may include:

1) Integrated ADAHRS Sensor Module

2) Integrated GPS/SBAS Sensor Module

3) Serial Protocol Converters

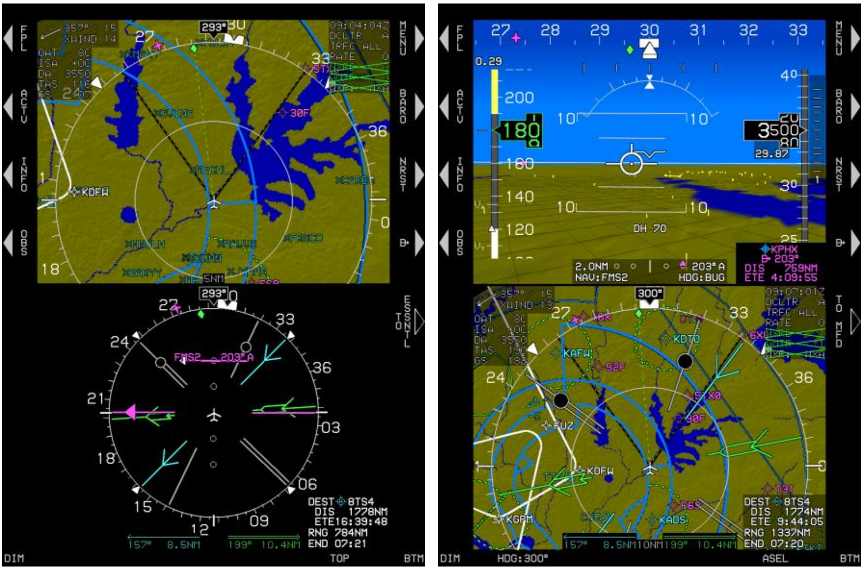
4) Video Format Converters

Data storage is sufficiently sized to hold world terrain, navigation, and obstruction databases. Because the receive ports are connected to the digital sensor modules in parallel, each IDU is independent from all others.

1.4.1. Normal and Essential Modes

IDU software has normal mode and essential modes. The PFD described in this pilot guide has only a normal mode. The PFD (IDU #1) has a PFI page in the top area and a pilot-selectable multi-function page in the bottom area. See Section 2 Display Symbology for additional information.

MFDs (IDUs configured as #2, #3 or #4) have normal and essential modes with pilot-selectable multi-function pages in both top and bottom areas. On the MFD, press **TO ESSNTL/TO MFD (R5)** to toggle Normal and Essential modes.



MFD Normal Mode MFD Essential Mode

Figure 1-10: MFD Normal and Essential Mode

TAWS popups: When an FLTA alert is generated, a popup function enables PFI SVS and activates terrain at an appropriate scale and format on the moving map page (one of the multi-function pages). This is a required function of TSO-C151b for TAWS Class A, B, and C depending on aircraft configuration, external sensors, and switches. (See Section 7 TAWS for more information.)

Traffic popups: When a traffic alert is generated, a popup function displays traffic on the PFI and moving map page and the mini traffic on the PFI (see Traffic appendix for more information).

1.4.2. Data Source Monitors

In installations with redundant sensors, IDUs continuously monitor the following sensors to detect disagreements:

1) Airspeed
2) Altitude
3) Attitude
4) Barometric setting (pilot vs. co-pilot sides)
5) GPS position, track, and ground speed
6) Heading
7) Localizer and glide slope deviations
8) Radar altitude

1.4.3. IDU Intra-System Communications

Communication between IDUs installed on the same side is referred to as intra-system communications. In a two-sided system (pilot and co-pilot) configuration, the crosslink side-to-side communications is referred to as inter-system communications. IDUs on the same side (pilot side and co-pilot side individually) monitor each other using intra-system communications and perform the following checks:

1) Intra-system communications freshness
2) Screen counter incrementing (i.e., screen not frozen)
3) Airspeed agreement
4) Altitude agreement
5) Attitude agreement
6) Barometric setting agreement
7) GPS position, track, and ground speed agreement
8) Heading agreement
9) Localizer and glide slope deviation agreement
10) Radar altitude agreement

1.5. Color Conventions

The EFIS uses a consistent set of colors to display information. Any color representation may not be identical as it appears on the IDU.

Table 1-4: Color Conventions

Color	Use(s)	Examples
White	Items set by pilot and held by the EFIS or items where device feedback is not expected; marker beacon receiver high/low sensitivity modes; scales, associated labels and figures; pilot action; or data entry. When used for an analog bar indication, light gray (low-intensity white) is used instead, as a large white area on the screen may be overwhelming.	Scales markings (airspeed, altitude, heading, VSI, pitch, map ranges, etc.) Pilot-selected values (airspeed, heading, altitude) Secondary flight data (TAS, wind, OAT, timers, etc.)
Cyan	VOR #1, TAC#1, and IFR navigation dataset items. Information received from the device that is not related to a pilot setting.	Airports with instrument approach procedures, VORs, and intersections.

Table 1-4: Color Conventions

Color	Use(s)	Examples
Magenta	Indicates calculated or derived data and certain navigation database items. Light magenta for visibility	Active waypoint related symbols. Course data (desired track, CDI). VFR airports, NDBs, VNAV altitudes,
Gray	Background for airspeed and altitude readout and for conformal runway depiction Light gray for usable portion of active runway, dark gray for other runway surfaces	
Green	VOR #2, TAC#2, and to indicate normal or valid operation (airspeed, altitude tape coloring, status indication, etc.) Light green for visibility.	Aircraft track, skyway symbology, and airspeeds in green arc.
Dark Green	Terrain indication on moving map (slope between adjacent terrain determines the shade used).	
Amber (Yellow)	Identifies conditions requiring immediate pilot awareness and possible subsequent action. Currently used for DME hold indications. Loss of GPS navigation condition in all navigation symbology, including FMS active waypoint coloring.	
Olive	In various shades shows terrain within 2000' and below aircraft altitude.	
Brown	In a variety of shades indicates earth/terrain portion of PFD or when above 100 feet less than aircraft altitude on MFD.	
Blue	In a variety of shades indicates sky portion of PFD, bodies of water on moving map.	
Red	Indicates aircraft limitations or conditions, which require immediate pilot action, or a device failure (red “X”).	

Table 1-4: Color Conventions

Color	Use(s)	Examples
Black	Field of view angle lines on moving map, figures on a gray background, and outlining borders and certain figures/elements on backgrounds with minimal contrast, e.g., airspeed, altitude, and menu tiles on the PFD/MFD.	

1.6. AHRS Fast Slave and Erect

If it is necessary to restore the heading and attitude references, the AHRS includes Heading Fast Slave and Attitude Fast Erect features, which can be performed when in approximately straight and level flight to ensure the best chance of providing valid observation for heading and attitude. See AFMS for nomenclature and location of switch or button.

1.7. Database and Software Updates

1.7.1. Navigation and Obstruction Database

The EFIS uses Jeppesen Sanderson NavData® for the navigation database and Jeppesen Sanderson obstacle data for the obstruction database.

Visit www.jeppesen.com to place the order for the correct database.

NOTE:

When ordering, review the EFIS Equipment-Database Compatibility Matrix (Document 01-000062) on the Genesys Aerosystems website. This document specifies the compatibility of Genesys Aerosystems EFIS equipment and software versions to navigation database versions.

Three available coverage areas of navigation databases may be used on this EFIS:

Americas - Major airports and navigation for Alaska, Canada, Continental U.S., Hawaii, Puerto Rico, Bahamas, Bermuda, Mexico, Central, and South America.

International - All available coverage except North and South America.

World - Major airports and navigation with the Americas.

1.7.2. Update Requirements

Scheduled updates for databases are as follows:

1) Navigation Database - Every 28 days

2) Obstruction Database - Every 28 days

3) MAGVAR Database - Every 5 years (updated as described in a Genesys Aerosystems Service Bulletin)

CAUTION:

Failure to update the EFIS with the correct NavData® causes the IDU to remain in continual reboot mode and does not allow any display page to appear.

Failure to update IAP/APD data with current data results in expired or missing NRST APD, IAP APD, or APPR plate images to appear on the MFD.

The EFIS is updated through the ground maintenance function (GMF). To gain access to the GMF, prior to applying power, slide the secure data transfer port door (slip indicator or non-slip blank cover) at the bottom-center of the IDU bezel upward to the first detent position to expose the port.

To perform an update, the following procedures must be performed separately on every IDU installed in the aircraft.

To update the databases:

1) Load the navigation database (navdata.exe) and obstruction database (obst.exe) on secure data storage device.

2) With power off, insert the secure data storage device into the port.

CAUTION:

Always install a valid secure data storage device in the IDU prior to activating any ground maintenance function. Operation of the GMF without a valid secure data storage device installed may cause erroneous failure indications or corruption of the IDU.

3) Turn on power to gain access to the GMF page.

4) Use ❶ to highlight **Update Databases** and push to enter.

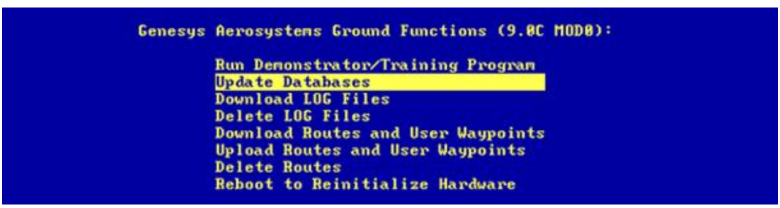


Figure 1-11: Ground Maintenance Page

5) Once each database is loaded, press any button to continue to complete the process.

6) Once both databases have been uploaded, power down the IDU, remove the secure data storage device, and lower the port door.

7) Once each IDU has been updated, power up the entire EFIS in normal flight mode and verify each IDU successfully updated with the latest database by noting the new navigation database and obstruction database cycle expiration dates before acknowledging the initialization screen (Figure 1-7). Because the obstruction database is advisory in nature, there technically is no expiration date. The listed date is the effective date of the next available obstruction database.

8) A cyclic redundancy check (CRC) self-test verifies the data at every step of the process, thereby ensuring the data installed into the system has not been corrupted at any point during the process.

9) Upon updating of the navigation database, all stored flight plans are examined to ensure the data in the flight plans are valid according to the new database.

1.7.3. Software and Terrain Database Update

Updates and terrain database updates are provided on an as-needed basis and performed as per a service bulletin.

1.8. Run Demonstrator/Training Program

The EFIS has a built-in demonstration application to fly anywhere in the world while performing any procedure (except takeoff and landing) based on the current Jeppesen® navigation database. Use this feature on the ground in ground mode as follows:

1) With power off, lift the secure data transfer port door.

2) Power on the system. If desired, after entering Update Databases or any other option, use ❶ to highlight **Run Demonstrator/Training Program** and push to enter.

Use the demonstrator to gain familiarity with the EFIS menu structure and location of button tiles for each operation or load an instrument procedure before take-off to view the expected sequence of events.

The demonstrator begins flying over Reno, Nevada, USA at an altitude of approximately 8000’ MSL. Altitude may be changed with altitude bug, VNAV profiles or navigation database procedures. Airspeed remains relatively constant but may be controlled with the airspeed IAS bug in the Bugs menu.

The simulated aircraft may be positioned anywhere in the world, by activating a flight plan stored in the memory.

All appropriate navigation signals are simulated, allowing for precision and non-precision instrument approaches found within the current navigation database. All obstructions in the latest obstruction database and all warning, caution, and advisory audible alerts and flag annunciations are presented as appropriate during simulated flights.

NOTE:

When the IDU is operating in demonstrator mode, the IDU is isolated from all sensors and other IDUs. The creation of a flight plan results in that flight plan being stored on that IDU alone. To have that new flight plan available on all other displays, the following action must be taken. While in flight mode, activate the flight plan created in demonstrator mode. With crossfill enabled (in two-sided systems) view active flight plan on any other IDU and press **SAVE (L1)** to save this flight plan on all displays.

Section 2 Display Symbology

2.1. Introduction

This section details the symbology used on the PFD and MFD in normal and essential modes. Not all combinations of possible views are represented.

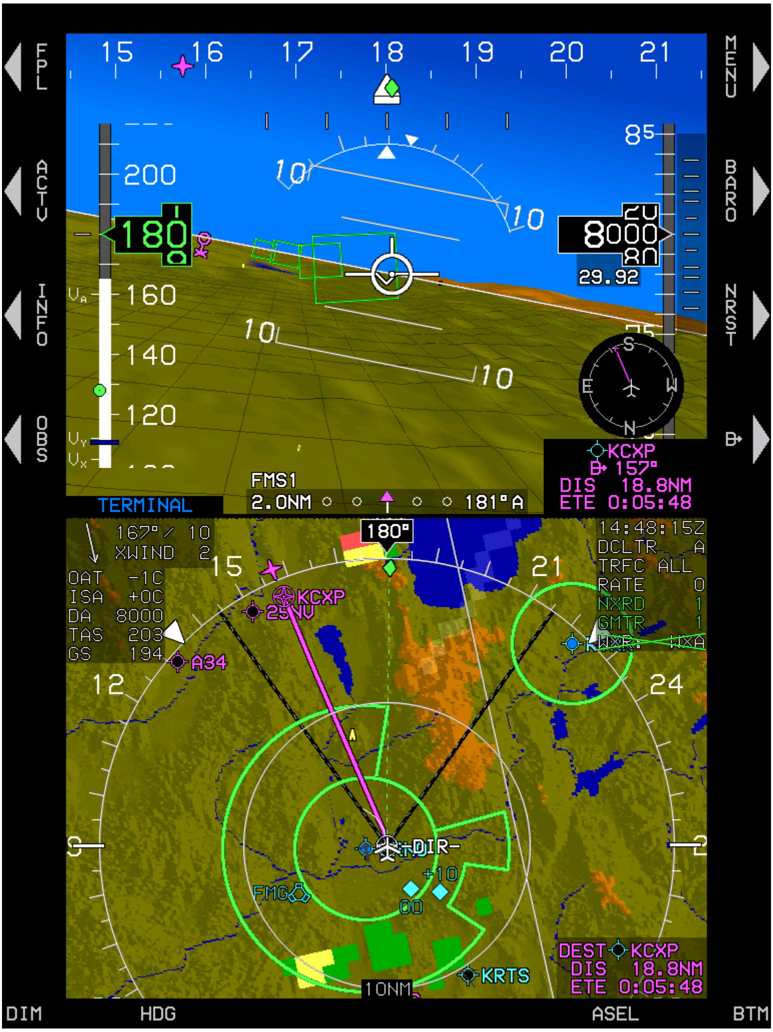


Figure 2-1: PFD SVS Mode

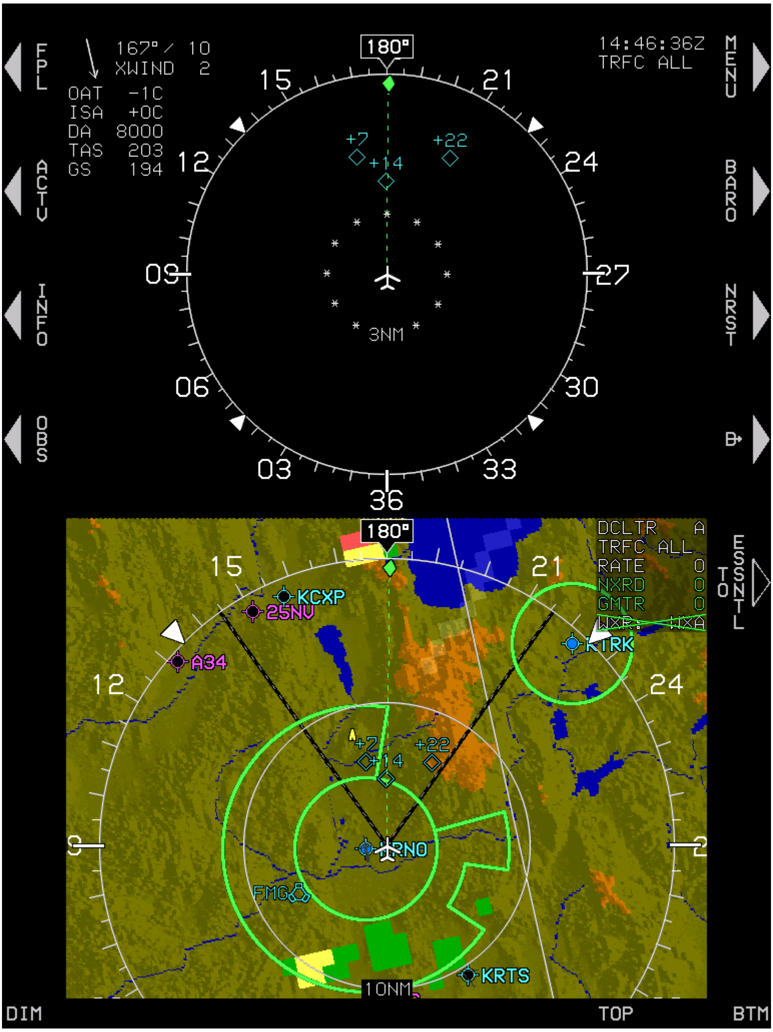


Figure 2-2: MFD Normal Mode

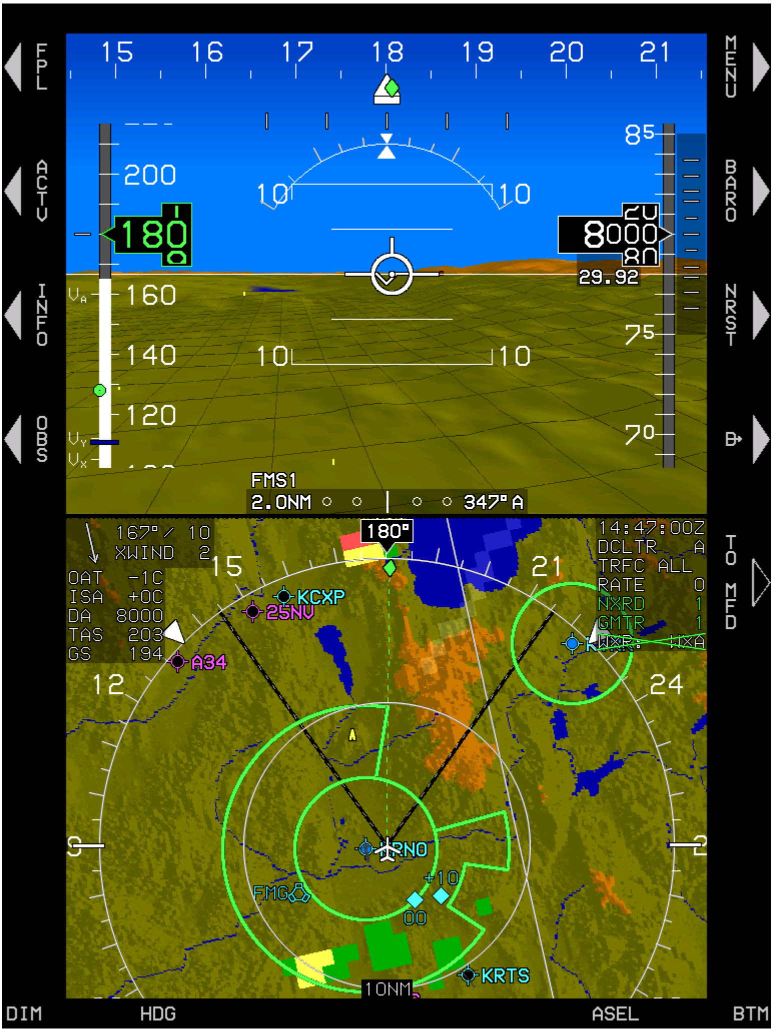
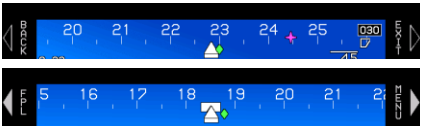


Figure 2-3: MFD Essential Mode

2.2. Menu Functions

See Section 3 Menu Functions and Step-By-Step Procedures for details.

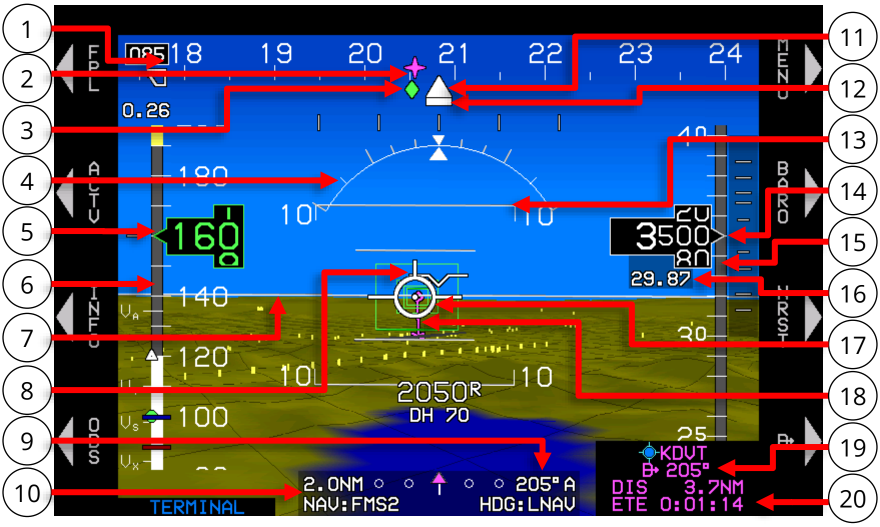
Figure 2-4: Knob Functions



When the menu system is beyond the top-level, **EXIT (R1)** escapes to the top-level. When a menu level is deeper than the first level, **BACK (L1)** returns one level through the menu system. **MENU (R1)** is displayed when the menu system is at the top level.

Figure 2-5: Menu Management

2.3. PFI Symbology



1) Directional Scale
2) Bearing to Waypoint
3) Track Pointer
4) Bank Angle Scale
5) Indicated Airspeed Readout
6) Indicated Airspeed Tape
7) Horizon Line
8) Waterline (or Large Aircraft symbol in basic or unusual attitude modes)
9) Instantaneous Desired Course to Active Waypoint
10) Course Deviation Indicator
11) Heading Pointer
12) Slip Indicator
13) Pitch Scale
14) Altitude Readout
15) Altitude Tape
16) Altimeter Setting
17) Flight Path Marker
18) Active Waypoint Symbol
19) Along-Track Course and Distance to Active Waypoint Information
20) ETE or ETA based on Along-Track Distance

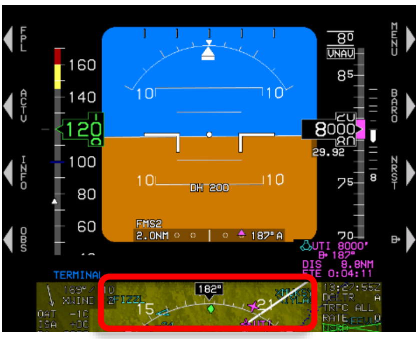
Figure 2-6: PFI Symbology

The PFI combines pitot-static information, heading, attitude, 3D navigation data, and more overlaid on a virtual background of the outside world. Other objects in the background, including terrain, obstructions, (if enabled), and runways, are presented as if seen directly in front of the aircraft while looking outside.

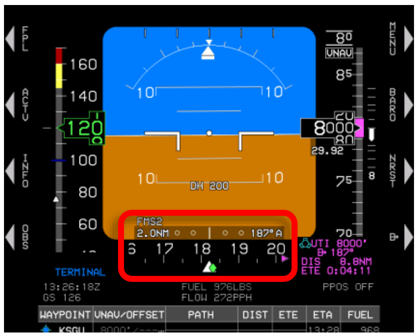
2.3.1. PFD Display (Basic Mode)

When selected, the basic mode is a traditional attitude display with airspeed, altitude, and heading scales appearing in blacked-out areas in a "Basic-T" arrangement but is disabled in unusual attitude mode. The following are no longer present in the basic mode:

1) Atmospheric perspective
2) Airspeed Trend
3) Terrain rendering
4) Obstruction rendering
5) Flight Path Marker
6) Airport runways
7) Highway in the Sky
8) Bank Scale Declutter



With Compass Rose in Bottom Area

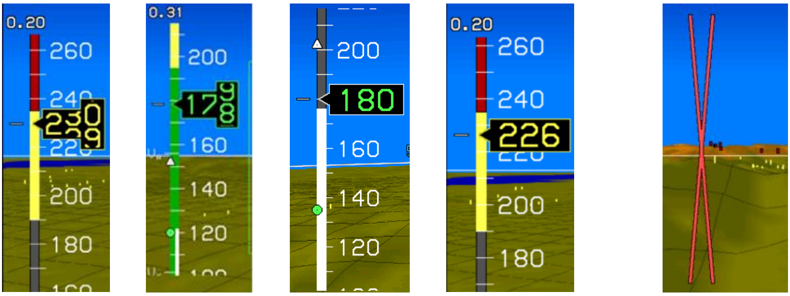


Without Compass Rose in Bottom Area

Figure 2-7: PFD in Basic Mode

2.3.2. Airspeed Display

Airspeed is digitally displayed in same color as airspeed scale in knots per hour, miles per hour, or kilometers per hour depending upon the setting of the "Speed Units" in EFIS system limits. The digital display is either pure digital or incorporates rolling digits as set in EFIS limits. The airspeed box has a pointer that interacts with the airspeed scale, which has graduations every 10 measurement units and labels every 20 measurement units. Mach number is displayed above the scale full time with resolution of 0.01 Mach (when applicable).



Knots | Km/h | Knots | Km/h | ADC Failure

Rolling Digits | Pure Digital

ADC1 FAIL
ADC2 FAIL
ADC1/2 FAIL

Figure 2-8: Airspeed Display

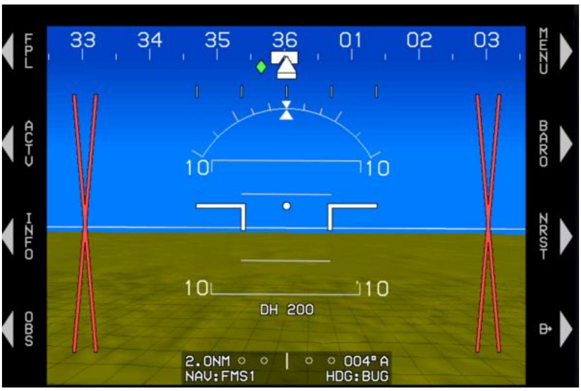
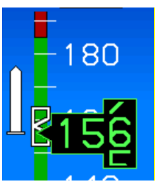
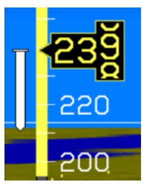


Figure 2-9: Airspeed Display Single System ADC Failure (Red X's Only)

The airspeed trend vector (calculated along the aircraft longitudinal axis) is in a "worm" format to provide analog representation of predicting speed that is achieved in 10 seconds, assuming the instantaneous longitudinal acceleration rate is maintained along the velocity vector.



Predicting speed of 178 KIAS within 10 seconds



Predicting speed of 210 Km/h within 10 seconds

Figure 2-10: Airspeed Trend Noodle

The airspeed scale background and readout for Part 23 airplanes have coloration as in Figure 2-11.

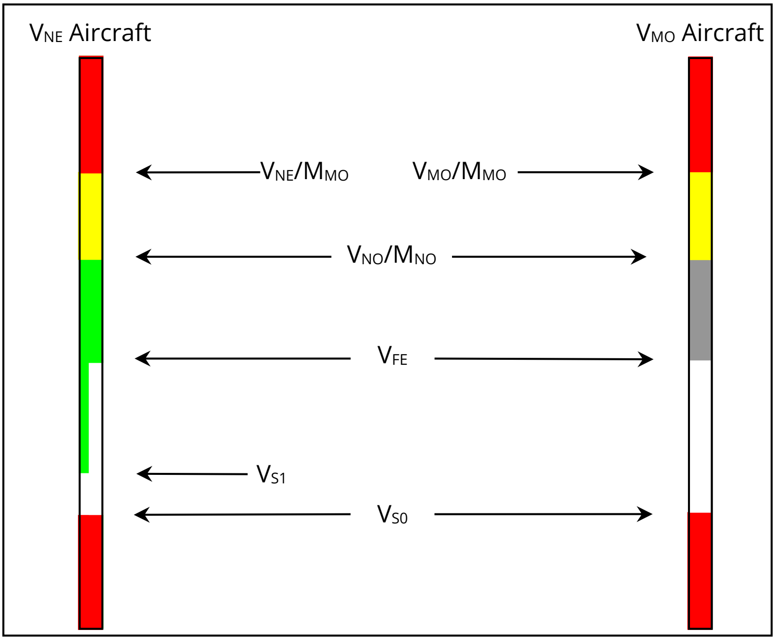


Figure 2-11: Airspeed Scale FAR Part 23

1) If in air mode, a red low-speed awareness area from the bottom of the scale to V_{S0}. The airspeed readout is red in this area.

2) If in ground mode, a gray area from the bottom of the scale to V_{S0}. The airspeed readout is gray at 0 (indicating "dead" airspeed) but otherwise white in this area.

3) If a valid V_{FE} exists, a white flap-operating area from V_{S0} to V_{FE}. The airspeed readout is white in this area.

4) For aircraft with a V_{NE}:

   a) A green safe-operating area from V_{S1} to V_{NO}. The airspeed readout is green in this area.

   b) An amber (yellow) caution area from V_{NO} to V_{NE}/M_{NO}. The airspeed readout is amber (yellow) in this area.

   c) A red high-speed awareness area from V_{NE}/M_{MO} to the top of the scale. The airspeed readout is red in this area.

5) For aircraft with V_{MO}:

a) A gray safe-operating area from V_{FE} (if it exists) or V_{S0} to V_{NO}/M_{MO}. The airspeed readout is green in this area.

b) A yellow caution area from V_{NO}/M_{NO} to V_{MO}/M_{MO}. The airspeed readout is yellow in this area.

c) A red high-speed awareness area from the lower of V_{MO}/M_{MO}. The airspeed readout is red in this area.

The airspeed scale for Part 23 (based on pounds only) airplanes has additional specific airspeed markings as follows:

6) For reciprocating multiengine-powered aircraft of 6,000 pounds or less, a red line at VMC.

7) For reciprocating multiengine-powered aircraft of 6,000 pounds or less, a blue line at VYSE.

8) A white VS marking at the aircraft's 1-G VS1 or a yellow VS marking at VS1 corrected for G-loading, whichever is higher.

9) If enabled (VGL not 0), a "green dot" best glide speed marker at VGL.

10) If enabled (VX not 0), a VX marking at VX.

11) If enabled (VY not 0), a VY marking at VY.

12) If enabled (VA not 0), a VA marking at VA.

13) If enabled (VMFE not 0), a "white triangle" maximum flap extension speed marker at VMFE.

The airspeed scale background for Part 25 airplanes (Part 25 "Airspeed Scale Type") has colored regions and readout coloration as in Figure 2-12.

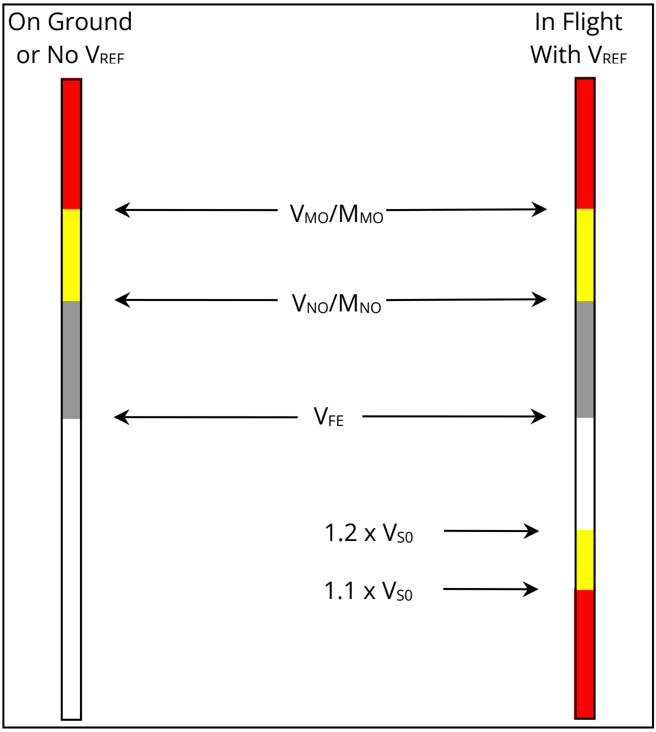


Figure 2-12: Airspeed Scale FAR Part 25

1) If in air mode with a manual-input V_{REF} value:

   a) A red low-speed awareness area from the bottom of the scale to G-compensated 1.1 x V_{S0}. V_{S0} is calculated by dividing the manual-input V_{REF} by 1.23. The airspeed readout is red in this area.

   b) An amber (yellow) low-speed awareness area from G-compensated 1.1 x V_{S0} to G-compensated 1.2 x V_{S0}. The airspeed readout is amber (yellow) in this area.

   c) If a valid V_{FE} exists, a white flap-operating area from G-compensated 1.2 x V_{S0} to V_{FE} and a gray normal-operating area from V_{FE} to the lower of V_{NO} or M_{MO}. The airspeed readout is white in the flap-operating area and green in the normal-operating area.

   d) If a valid V_{FE} does not exist, a gray normal-operating area from G-compensated 1.2 x V_{S0} to the lower of V_{NO} or M_{MO}. The airspeed readout is green in this area.

2) If in ground mode or without a manual-input V_{REF} value:

   a) If a valid V_{FE} exists, a white flap-operating area from the bottom of the scale to V_{FE} and a gray normal-operating area from V_{FE} to the lower of V_{NO} or M_{MO}. The airspeed readout is gray at 0 (indicating "dead" airspeed); otherwise, white in the flap-operating area and green in the normal-operating area.

   b) If a valid V_{FE} does not exist, a gray normal-operating area from the bottom of the scale to the lower of V_{NO} or M_{MO}. The airspeed readout is gray at 0 (indicating "dead" airspeed); otherwise, white below the minimum airspeed bug set in EFIS limits and green at or above the minimum airspeed bug in this area.

3) A yellow caution area from lower of V_{NO}/M_{NO} to lower of V_{MO}/M_{MO}. The airspeed readout is yellow in this area.

4) A red high-speed awareness area from the lower of V_{MO} or M_{MO} to the top of the scale. The airspeed readout is red in this area.

The airspeed scale for Part 25 airplanes has additional specific airspeed markings as follows:

1) If manual-input V_{REF} is valid, a white V_S marking at the aircraft's 1-G V_{S0} or amber (yellow) V_S marking at V_{S0} is corrected for G-loading, whichever is higher. V_{S0} is calculated for G-Loading, whichever is higher. V_{S0} is calculated by dividing the manual-input V_{REF} by 1.23

2) If enabled (V_{GL} not 0), a "green dot" best glide speed marker at V_{GL}.

3) If enabled (V_X not 0), a V_X marking at V_X.

4) If enabled (V_Y not 0), a V_Y marking at V_Y.

5) If enabled (V_A not 0), a V_A marking at V_A.

6) If enabled (V_{MFE} not 0), a "white triangle" maximum flap extension speed marker at V_{MFE}.

In parts 23 and 25, airplanes, V_1, V_R, V_2, V_{ENR}, $V_{REF,}$ and V_{APP} can be shown on the airspeed scale when selected. The V_1, V_R, and V_2 symbols automatically declutter when above 2,000' AGL.

2.3.2.1. Airspeed Bug

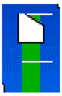
The airspeed indication can have a pilot-settable airspeed bug with a 1-unit resolution and a range from 1.2 x V_S (or configured minimum IAS bug speed, if higher) to red-line airspeed (lower of V_{MO} or M_{MO}). It is mutually exclusive with the VSI bug.

The airspeed bug setting annunciation is colored white and the airspeed bug is always filled-white in this example, which shows examples without a vertically integrated autopilot installed.

Figure 2-13: Airspeed Scale Bug Indication

NOTE:

See applicable autopilot pilot guide for airspeed bug colors when vertically integrated with autopilot.



When the airspeed bug setting differs from aircraft speed to the extent the bug is off scale, the bug appears to be parked in the direction of the difference.

Figure 2-14: Airspeed Bug Off Scale

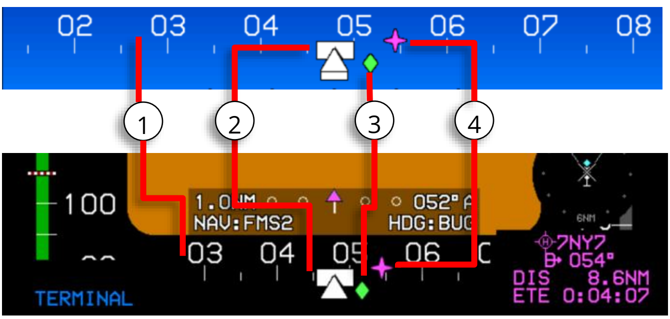
Table 2-1: Airspeed Bug Limits

Low end	High end
Higher of 1.2 x V_S or 60KIAS	Red-line (V_{NE}, V_{MO}, or M_{MO})

2.3.3. Heading Display

SVS Mode

Basic Mode



1) Heading Scale

2) Heading Pointer

3) Track Pointer

4) Active Waypoint Pointer

Figure 2-15: Heading Display

The heading scale has graduations every 5° with major graduations and heading labels every 10° at equal space so that they approximately conform to the three-dimensional background at an aircraft roll angle of zero. A pilot-settable heading bug interacts with the heading pointer.

NOTE:

The track pointer is not displayed when indicated airspeed is in the noise range (indicated airspeed or ground speed is less than 30 knots).

The integral slip indicator is responsive to lateral (Y-axis) G-force (slip indicator is the white rectangular part of the heading pointer) and is damped so it approximately matches a conventional glass vial indicator.

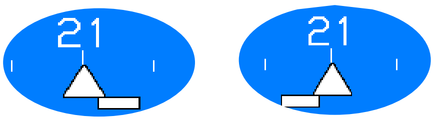


Figure 2-16: Dampened Integral Slip Indicator

Table 2-2: Heading Display

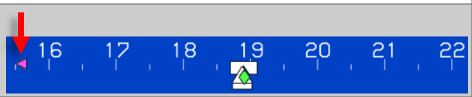
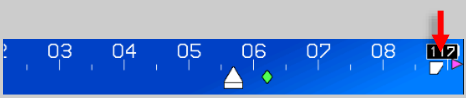
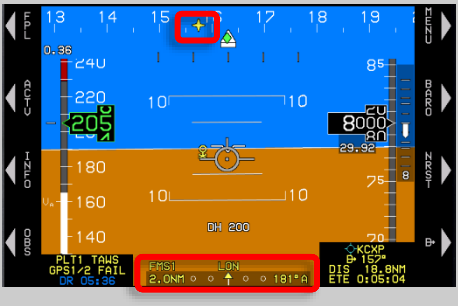
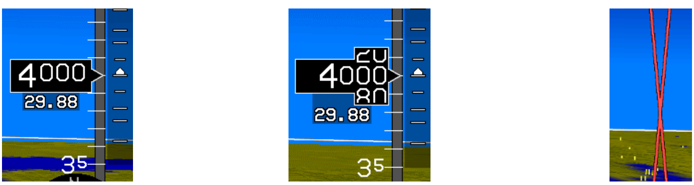
	Track pointer off scale when aircraft track is displaced from boundaries. (Extreme crosswind condition)
	When an active waypoint exists, a star-shaped bearing pointer corresponds with the active waypoint.
	Waypoint pointer is displaced from heading tape.
	When changed, the heading bug value is displayed for 5 seconds.
	When the heading bug is displaced beyond the boundaries of the heading scale, a partial heading bug is shown at the limit of the heading scale with the heading bug value above it.
	When the heading bug is hollow, feedback from the autopilot indicates HDG Bug sub-mode is in LNAV mode.

Table 2-2: Heading Display

	When the heading bug is white-filled, feedback from the autopilot indicates HDG Bug sub-mode is in HDG mode.
	When AHRS is in DG mode, "DG" appears.
	Waypoint pointer and shortest direction of turn indications turn amber (yellow) if GPS loss of integrity (LOI) or loss of navigation (LON) caution.

2.3.4. Altitude Display

The digital display of barometric altitude in feet or meters depends on the speed units system limit. Altitude is either purely digital (nearest 10 measurement units) or rolling digits (nearest 20 units) as defined in EFIS limits. The altitude box has a pointer that interacts with the altitude scale, which has graduations every 100 measurement units and labels every 500 measurement units. The altitude scale background has a gray region and a brown region where the junction between the gray and brown regions indicates ground level. When the ADC sensor fails, a red "X" is displayed in place of the altitude scale.



Pure Digital | Rolling Air Data | ADC Failure

ADC1 FAIL
ADC2 FAIL
ADC1/2 FAIL

Figure 2-17: Altitude Display

Figure 2-18: Altitude Display Single System ADC Failure (Red X's Only)

2.3.5. Altitude Display (VNAV) (Analog Autopilot Integrated)

When enabled for performing VNAV with a manually selected altitude entered, **VNAV (L6)** appears. (See applicable autopilot pilot guide.) Pressing cancels ASEL (target altitude) and enters the VNAV altitude in the active flight plan.

Figure 2-19: Altitude Display (VNAV)

When in VNAV sub-mode, the altitude scale shows the active waypoint VNAV altitude (if it exists) with a bug symbol interacting with the altitude tape. The VNAV altitude bug setting is annunciated above the altitude scale with a resolution of 100 measurement units.

When not vertically integrated with a digital autopilot, the VNAV altitude bug setting annunciation includes "VNAV" indicating VNAV altitude sub-mode and is colored white with the VNAV altitude bug always filled-magenta.

Figure 2-20: VNAV Sub-Mode (Not Vertically Integrated)

When the VNAV altitude or target altitude differs from aircraft altitude to the extent the associated bug is off-scale, the associated bug appears to be "parked" in the direction of the difference with half of the associated bug visible as seen in Figure 2-14.

2.3.6. Selected Altitude Sub-Mode (Target Altitude)

When in selected altitude sub-mode, the altitude scale has a pilot-settable target altitude bug. The target altitude bug setting annunciation includes "ASEL" indicating selected altitude sub-mode and may be used either as a visual reference or, when vertically or partially integrated with an autopilot as a control parameter for climbs and descents.

Table 2-3: Selected Altitude Sub-Mode Limits

Altitude	Range	Resolution	Indication
Feet	-1,000' to 50,000'	100 units	
Meters	-300m to 15,200m	100 units	Selected Altitude Sub-Mode Limits

When an autopilot is not installed, the selected altitude is a reference only. The target altitude bug setting is white, and the target altitude bug is always filled-white.

2.3.7. Minimum Altitude

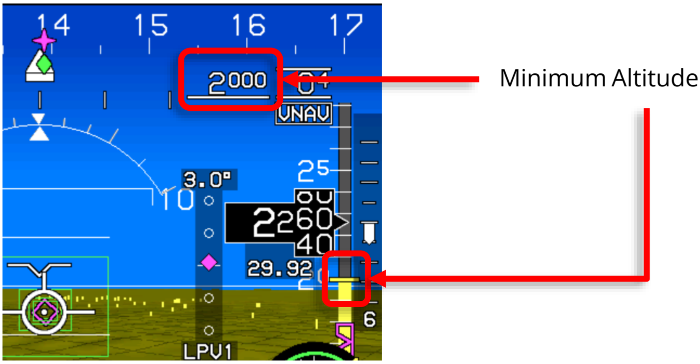


Figure 2-21: Minimum Altitude

The minimum altitude bug value is displayed in feet or meters with a resolution of 10 measurement units. The minimum altitude bug can be used in conjunction with a selected altitude or VNAV bug with no interference with each other. When a minimum altitude is set, descending from above to below causes a voice alert of "Minimums, Minimums" and the minimum altitude to turn amber (yellow) and flash.

2.3.8. Altimeter Setting

The altimeter setting is displayed digitally below the altitude readout box in inches of mercury (inHg) or millibars (mbar) according to the pilot-selected units. Press **BARO (R2)** to enter altimeter setting mode and view the altimeter setting in inHg or mbar value in the lower right corner. Rotate ❶ CW to increase or CCW to decrease QNH. Push ❶ to enter the new value and close the menu.

Figure 2-22: Altimeter Setting

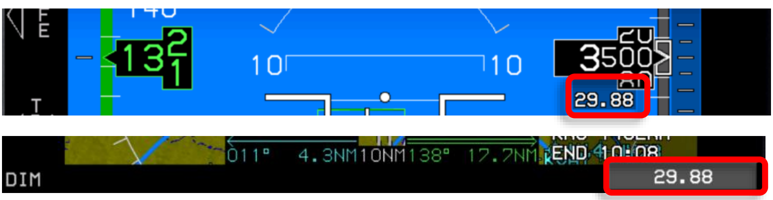


Figure 2-23: Selecting Altimeter Setting

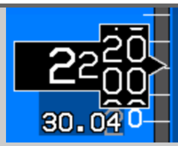
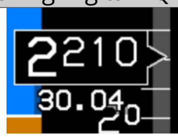
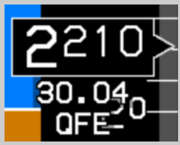
QFE: Barometric setting resulting in the altimeter displaying height above a reference elevation (i.e., airport or runway threshold). When in QFE mode on the ground, system automatically sets to read zero altitude. When QFE altimeter setting is selected, "QFE" is annunciated.

QNE: Standard barometric setting (29.92 inHg or 1013 mbar) used to display pressure altitude for flight above the transition altitude.

QNH: Barometric setting resulting in the altimeter displaying altitude above mean sea level at the reporting station. When QNH altimeter setting is selected, no mode is annunciated below the altimeter setting.

Digital display of altitude is either purely digital (nearest 10 feet) or incorporates rolling digits (nearest 20 feet) as determined by EFIS limits.

Table 2-4: Altimeter Setting

 Pure Digital - QNH	 Rolling Digital - QNH
 SVS Mode - QNH	 Basic Mode - QNH
 SVS Mode - QFE	 Basic Mode - QFE

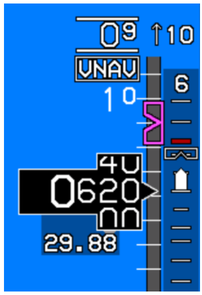
NOTE:

Altimeter setting limits are 745-1100 (mbar) or 22.00-32.00 (inHg).

2.3.9. Vertical Speed Indicator

The vertical speed indicator (VSI) is depicted in a "worm" format providing analog and digital representation of VSI in fpm or m/s depending upon the setting of the "Speed Units" system limit.

The pilot-settable VSI bug setting can be set in increments of 100 fpm or 1 m/s resolution. The vertical speed bug is used either as a visual reference, or as a control parameter for climbs or descents. It is mutually exclusive with the airspeed bug.



Altitude in Feet: 600 fpm descent

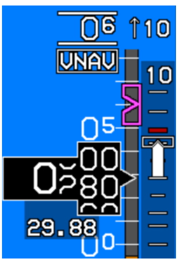
Altitude in Meters: 6 m/s climb

Figure 2-24: VSI

Table 2-5: Scale Graduations and Display

Traffic Installed	Scale Limit	Scale Graduations and Display
Rounded to 100 fpm with Resolution of 100 fpm		
With TCAS-II	±6,000 fpm	±500, ±1,000, ±2,000, ±4,000, and ±6,000 fpm Background of the VSI functions as an RA display with green and red regions to provide RA maneuver guidance.
Without TCAS-II	±3,000 fpm	±500, ±1,000, ±2,000, and ±3,000 fpm
Rounded to 1 m/s with Resolution of 1 m/s		
Without TCAS-II	±80 m/s	±5, ±10, ±20, ±50, and ±80 m/s

2.3.9.1. Vertical Speed Bug



The VSI has a pilot-settable vertical speed bug with a 100 fpm resolution and a range of ±3,000 fpm. It is mutually exclusive with the airspeed bug.

Figure 2-25: VSI Bug (fpm)

When using m/s, the scale of the VSI is ±80 m/s. The scale includes an integral scale with graduations at ±5, ±10, ±20, ±50, and ±80 m/s. Analog readouts of VSI rounded to the nearest 1 m/s appear above the VSI (climbs) or below the VSI scale (for descents).

Figure 2-26: VSI Bug (m/s)

2.3.10. Normal AGL Indication

Above ground level (AGL) altitude is displayed in two formats, above the course deviation indicator (normal) and as the (analog) AGL indicator. These are mutually exclusive of each other and driven by the AGL altitude source used for TAWS, but not displayed when source is invalid or greater than the radar altimeter maximum valid as set in EFIS limits.

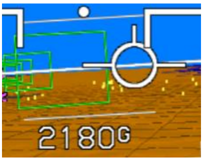
Source indication designates the source for either format as follows.

R = Radar Altitude

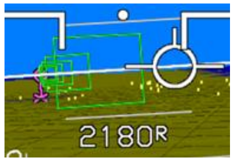
G = GPS/SBAS geodetic height less database ground elevation

B = Barometric altitude less database ground elevation

Feet or Meters



(SVS Basic) AGL Based on GPS Altitude



(SVS TAWS) AGL Based on Radar Altitude

Figure 2-27: Normal AGL Indication

AGL is not displayed when:

1) AGL altitude is greater than the radar altitude maximum valid altitude as set in EFIS limits.

2) AGL source is invalid.

3) In unusual attitude mode.

When AGL altitude source is radar altitude, AGL indication is smoothed to avoid jumpiness as defined in Table 2-6.

Table 2-6: AGL Indication

Altitude	≥100 Meters	<100 meters	≥300 Feet	≥100 Feet < 300 Feet	<100 Feet
AGL Indication resolution	5 Meters	1 Meter	10 Feet	5 Feet	1 Foot

2.3.11. Analog AGL Indication

An analog AGL indication may be selected for display on the PFI (above the waypoint identifier). Analog AGL indication is based on whatever AGL altitude source is being used for the TAWS.

Analog AGL without DH | Analog AGL with DH

Feet or Meters

GPS/SBAS Source | Radar Altimeter Source | Baro Source | Above DH | Below DH with "Decision Height" voice alert

Figure 2-28: Analog AGL Indication

If traffic is enabled and while above 500’ AGL, mini traffic overrides the analog AGL indication.

Table 2-7: Analog AGL Indicator

<table>
<tr><th colspan="3">Markings</th><th>AGL</th><th>Scaling (clock position)</th></tr>
<tr><td rowspan="5">Feet</td><td>0 to 100 Feet</td><td>100 to 1,000 Feet</td><td>0'</td><td>6:00</td></tr>
<tr><td>Linear</td><td>Logarithmic</td><td>50'</td><td>9:00</td></tr>
<tr><td colspan="2" rowspan="3">Red radial line disappears at 1,000’</td><td>100'</td><td>12:00</td></tr>
<tr><td>200'</td><td>1:30</td></tr>
<tr><td>500'</td><td>3:00</td></tr>
<tr><td rowspan="5">Meters</td><td rowspan="2">0 to 50 Meters</td><td rowspan="2">50 to 500 Meters</td><td>0m</td><td>6:00</td></tr>
<tr><td>25m</td><td>9:00</td></tr>
<tr><td>Linear</td><td>Logarithmic</td><td>50m</td><td>12:00</td></tr>
<tr><td colspan="2" rowspan="2">Red radial line disappears at 500m</td><td>100m</td><td>1:30</td></tr>
<tr><td>250m</td><td>3:00</td></tr>
</table>

Table 2-8: Analog AGL Indicator Markings

Feet	Tick Marks		Meters	Tick Marks	
	Major	Minor		Major	Minor
0’	✓		0m	✓	
10’		✓	5m		✓
20’		✓	10m		✓
30’		✓	15m		✓
40’		✓	20m		✓
50’	✓		25m	✓	
60’		✓	30m		✓
70’		✓	35m		✓
80’		✓	40m		✓
90’		✓	45m		✓

Table 2-8: Analog AGL Indicator Markings

Feet	Tick Marks		Meters	Tick Marks	
	Major	Minor		Major	Minor
100′	✓		50m	✓	
200′		✓	100m		✓
300′		✓	150m		✓
400′		✓	200m		✓
500′	✓		250m	✓	
1000′	✓		500m	✓	

The analog AGL indicator disappears in unusual attitude mode and is mutually exclusive with the mini map, analog G meter, and mini traffic. Analog AGL altitude is not displayed when it is greater than the radar altitude maximum valid value (always in feet) (2,500 feet or as set in EFIS limits), when it is invalid, or when the pilot deselects analog AGL.

2.3.12. Decision Height

A pilot-settable decision height is displayed above the CDI in feet or meters with the abbreviation DH and by a yellow radial on the analog indicator. When the aircraft descends below decision height, DH ### turns amber (yellow) and flashes and the circular tape turns amber (yellow). This is accompanied by "Decision Height" voice alert.

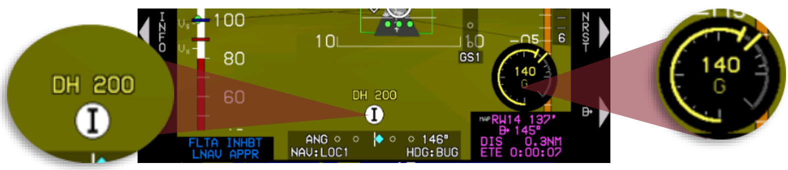
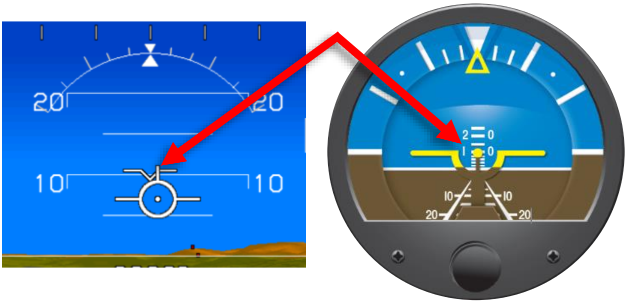


Figure 2-29: Decision Height

2.3.13. Pitch Scale

The PFI has a waterline mark fixed in the center of the display. Rotation of the background, pitch scale, and background-oriented display elements occur relative to the location of the waterline mark. The waterline is replaced with a large aircraft symbol in basic or unusual attitude mode.



10° Nose up 10° Nose up

Figure 2-30: Pitch Scale

The pitch scale has increments every 5° with major increments and pitch scale labels every 10°. Increments are equally spaced to conform approximately to the 3D background. Pointer bars at the ends of each major increment indicate the direction to the horizon and automatically declutter to present the fewest possible increments needed to display pitch attitude. The pitch scale terminates with a zenith symbol (small white circle) at +90° and a nadir symbol (small white circle with "+") at -90°.

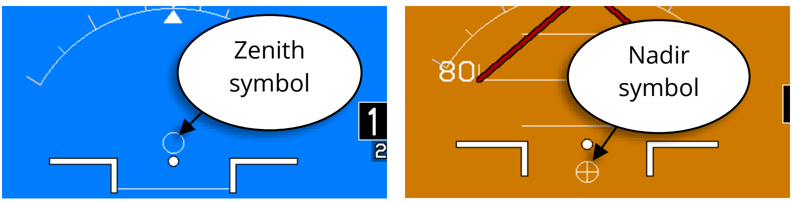


Figure 2-31: Large Aircraft Symbol with Pitch Scale Zenith and Nadir Symbol

2.3.14. Pitch Limit Indicator

The pitch limit indicator first appears above the applicable reference symbol (either the waterline or the large aircraft symbol reference marks). It converges upon the applicable reference symbol as indicated airspeed decreases. Stall speed is defined as:

FAR Part 23 airplanes: The higher of the aircraft's 1-G V_{S1} or V_{S1} corrected for G-loading; or

FAA Part 25 airplanes: if manual-input V_{REF} is valid, the higher of the aircraft's 1-G V_{SO} or V_{SO} is corrected for G-loading, where V_{SO} is calculated by dividing the manual-input V_{REF} by 1.23.

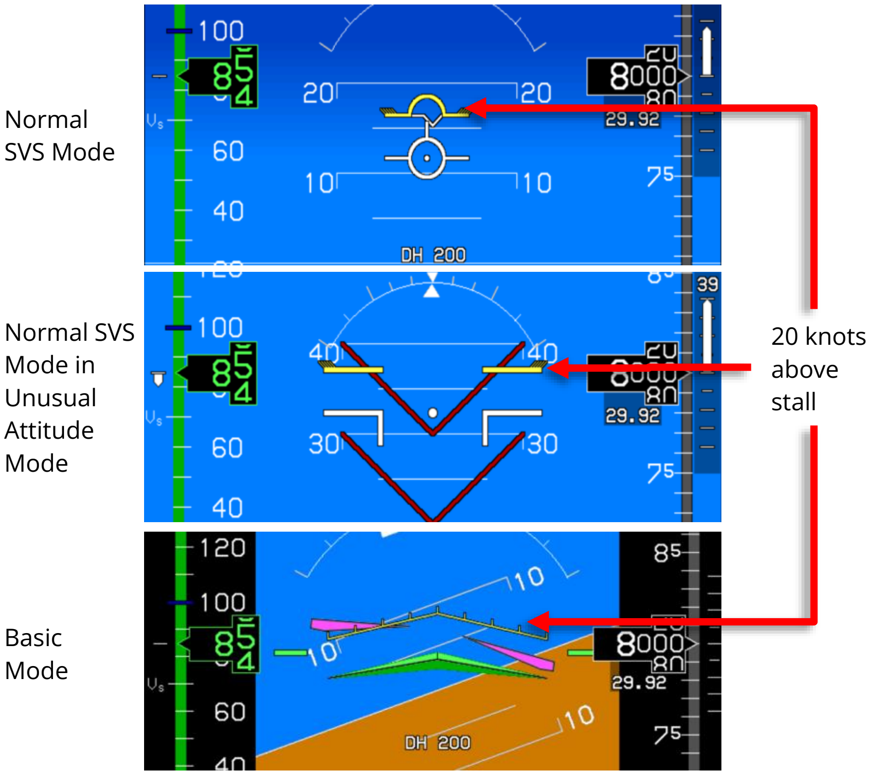


Figure 2-32: Pitch Limit Indicator (20 Knots above Stall)

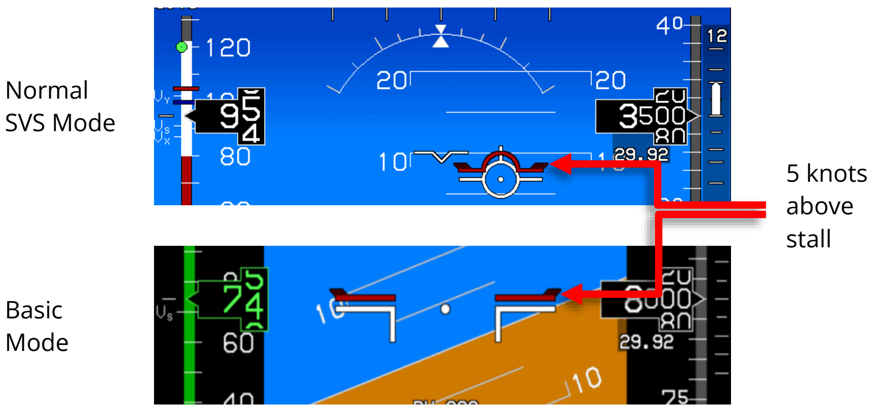
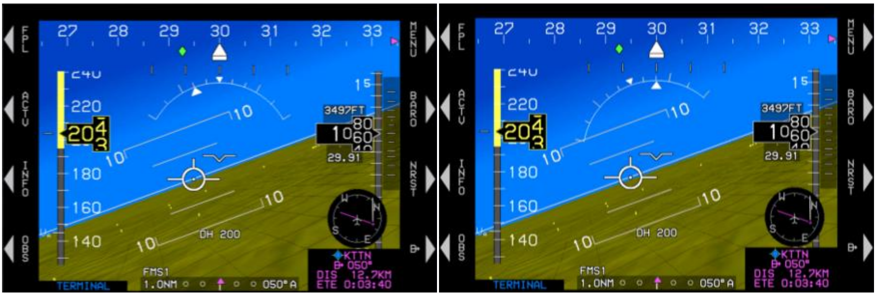


Figure 2-33: Pitch Limit Indicator (5 Knots above Stall)

2.3.15. Bank Angle Scale

The bank scale and roll pointer are centered upon the waterline (or large aircraft symbol reference marks in basic or unusual attitude mode). In Basic

Mode, with the slip indicator enabled, the roll pointer incorporates an integral slip indicator responsive to lateral (Y-axis) G-force.

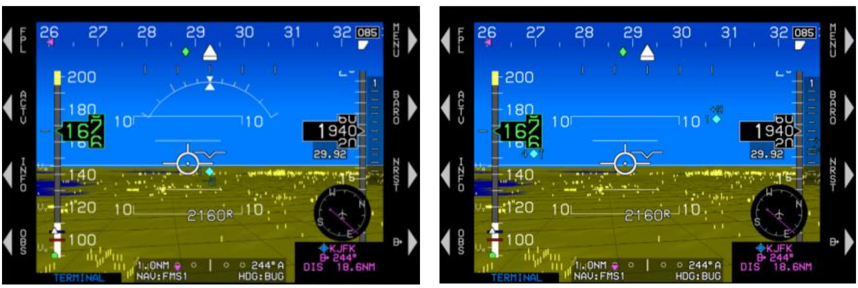


Sky Pointer Roll Pointer

Figure 2-38: Roll vs. Sky Pointer

Marks are shown at 10°, 20°, 30°, 45°, and 60° of bank. The bank angle scale and roll pointer are centered upon the waterline/large aircraft symbol reference marks. Both sky pointer and roll pointer configurations are shown in Figure 2-38, demonstrating a right turn.

When bank angle scale decluttering is selected, the appearance of the bank angle scale and roll pointer are dampened based on magnitude and time to prevent nuisance appearances. A bank angle scale and sky pointer are displayed when the magnitude of the bank angle exceeds 2.8°.



With Bank Scale Without Bank Scale

Figure 2-39: Bank Angle

2.3.16. Turn Rate Indicator

Rate of turn is available as an option in the PFD declutter menu to show a worm in the direction of turn with full-scale deflection indicating a standard rate of turn (and slightly beyond) and half-standard rate indicated at the mid-scale marking.

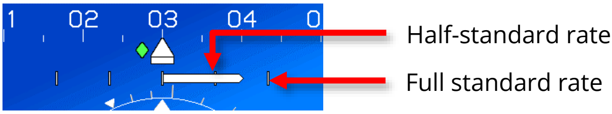


Figure 2-34: Turn Rate Indicator (Selected from Declutter Menu)

2.3.17. PFI Background

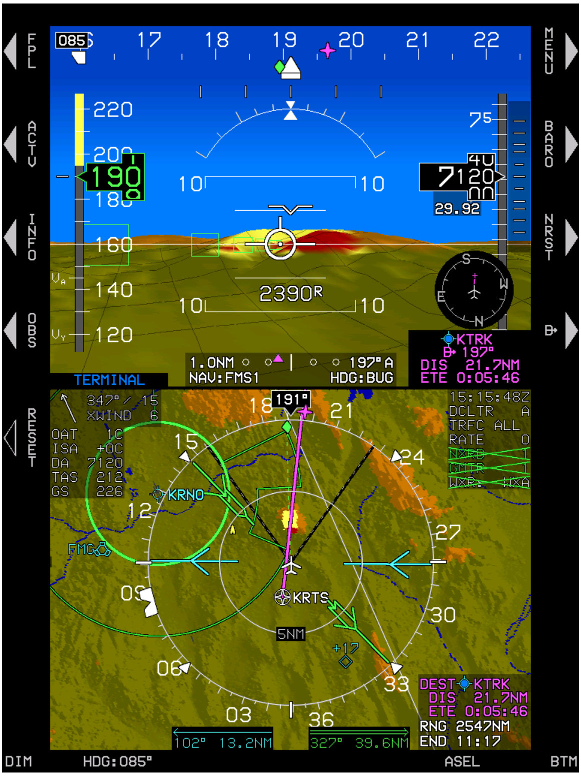


Figure 2-35: Terrain and Obstructions

The PFI has a 3D background generated from terrain elevation and obstruction elevation data stored in electronic memory. The "actual horizon" displayed on the PFI is based on the higher of terrain within 90NM or a horizon calculated using a visible horizon equation. Thus, the relative elevation of terrain and obstructions concerning aircraft altitude and performance is observed by reference to the primary flight information pitch ladder and flight path marker (FPM).

A blended-tone sky is displayed in conjunction with terrain. The sky fades from light blue at the horizon to dark blue at the top of the display to simulate atmospheric perspective and enhance the 3D presentation.

WARNING:

DO NOT USE THIS EFIS FOR TERRAIN-FOLLOWING FLIGHT. DO NOT ATTEMPT TO NAVIGATE USING TERRAIN DEPICTION. ALWAYS ADHERE TO PUBLISHED NAVIGATIONAL INSTRUMENT PROCEDURES AND NAVIGATIONAL CHARTS IN ALL FLIGHT CONDITIONS.

Terrain ahead of the aircraft is shown with the artificial horizon in the correct scale and perspective for the aircraft's current position and altitude. Worldwide terrain coverage is provided in each IDU and shown with a resolution as in Table 2-9. Terrain is displayed ahead of the aircraft using a grid and simulates atmospheric perspective (terrain lines fade into the background ground color as they recede into the distance).

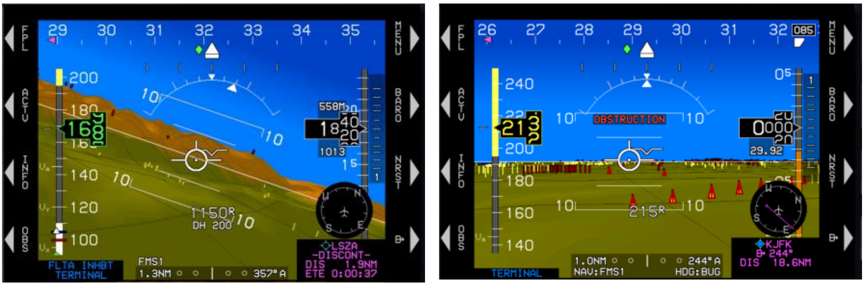
At latitudes greater than 75°, no grid lines are shown. To keep the grid spacing relatively consistent, at latitudes between 45° and 75°, the longitude spacing is increased according as in Table 2-9.

Table 2-9: LAT-LON Resolution Boundaries

Latitude Range	Longitude Grid Spacing	Heading Boundary	
		Pole	Equator
0° to 46°	24 arc-seconds		
46° to 62°	48 arc-seconds	46°	45°
62° to 70°	72 arc-seconds	62°	61°
70° to 74°	96 arc-seconds	70°	69°
74° to 75°	120 arc-seconds	74°	73°

NOTE:

There is a one-degree dead band to prevent grid flicker while flying along one of the boundary latitudes. The grid space switching changes at one degree less latitude when flying towards the Equator than when flying toward the Poles.



Obstructions without hazardous condition

Obstructions creating an OBSTRUCTION warning

Figure 2-36: PFI with Obstructions

Obstructions such as towers, antennas, buildings, and other manmade structures are shown on the PFD as vertical amber (yellow) or red lines. Obstructions are conformal in both location and size and are only shown in conjunction with terrain regardless of altitude. Obstructions representing a collision hazard are annunciated with a time-critical warning or caution alert. See Section 4 Warning Caution Advisory System for description of alerts.

WARNING:

MANY TOWERS, ANTENNAS, STRUCTURES, OBSTRUCTIONS, AND POWERLINES ARE NOT IN THE DATABASE.

NOTE:

The obstruction data is provided by Jeppesen® and must be updated every 28 days to maintain current database information.

Table 2-10: Terrain and Obstruction Rendering Levels

<table>
<tr><th>Feature</th><th>Terrain Coloring</th><th>Obstructions</th><th>Notes</th></tr>
<tr><td>SVS BASIC</td><td>Shades of brown for non-water terrain</td><td rowspan="2">Within the following ranges, depicted on PFI in SVS Basic or SVS TAWS mode:

Narrow FOV: 17NM

Wide FOV: 12NM

Tops at or below aircraft altitude: Amber

Tops are above aircraft altitude: Deep red

Obstructions causing TAWS alarms are depicted in separate symbology (See Section 7 TAWS)</td><td>Amber and red colors are not used for normal display of terrain. Obstructions are shown as yellow lines.

Deep blue for areas of water has precedence over shades of brown.</td></tr>
<tr><td>SVS TAWS</td><td>Shades of olive when at or below 100 ft. aircraft altitude

Shades of brown when above 100 ft. aircraft altitude

TAWS coloring of FLTA alert or warning cells</td><td>Amber and red colors are used for normal display of terrain and terrain areas causing FLTA alerts.

Deep blue for areas of water has precedence over other colors.</td></tr>
<tr><td>None</td><td colspan="3">No terrain nor obstructions are shown.

1) Neither SVS BASIC or SVS TAWS is selected; OR

2) The GPS/SBAS sensor is failed; OR

3) The ADC is failed; OR

4) In unusual attitude mode; OR

When the horizontal figure of merit exceeds the greater of 0.3NM or the horizontal alarm limit for the mode of flight.</td></tr>
</table>

When terrain and obstruction rendering are deselected or disabled, the PFI background is a conventional blue over brown attitude display presentation without atmospheric perspective. Additionally, terrain may be deselected on the PFI and retained on the map.

NOTE:

Independent declutter of obstructions is not possible.

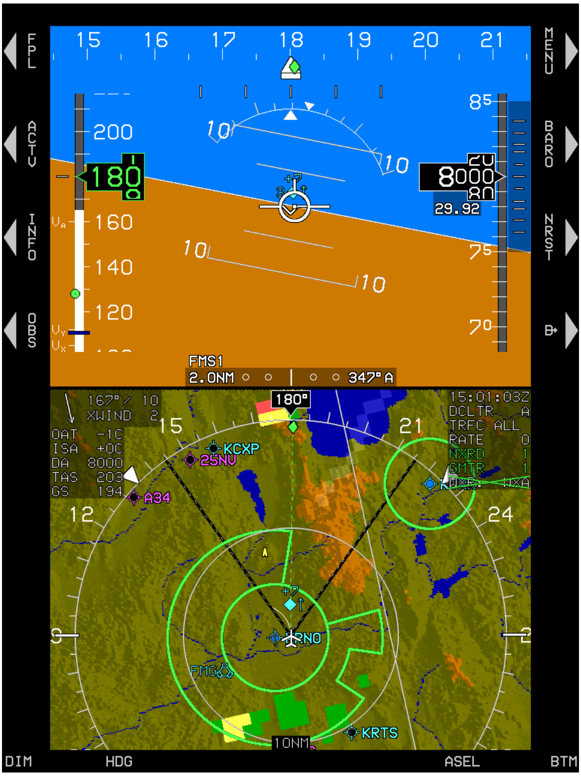


Figure 2-37: PFD with Terrain Deselected but Retained on Map

2.3.17.1. PFI Field of View (FOV)

The background has two pilot-selectable field-of-view (FOV) modes, wide FOV mode (approximately 70°) and narrow FOV mode (approximately 35°). In unusual attitude mode, wide FOV mode is automatically selected in the PFI area only. This option is normally used on final approach to emulate the synthetic vision as seen through the windscreen for a visual advantage. Unless changed back to zoom off, zoom on remains until shut down. During the next power-up the EFIS PFD initializes with zoom off. (See § 2.4.4.)

Wide Field of view (Zoom Off)

Narrow Field of view (Zoom On)

Figure 2-38: PFI Field of View

NOTE:

During a missed approach procedure requiring an immediate turn, it is recommended to select zoom off for a wide field of view to capture all obstacles and terrain.

2.3.18. Flight Director

FD1 Single Cue

FD2 Dual Cue

FD1 Single Cue (Basic Mode)

FD2 Dual Cue (Basic Mode)

Figure 2-39: Flight Director

Flight director (FD) symbology is controlled on the IDU or integrated autopilot/FD. When selected, FD symbology and valid steering commands are received from the FD. A waterline symbol (or large aircraft reference mark) is fixed in the center of the display. Rotation of the background, pitch scale, and background-oriented display elements occur relative to the location of the waterline symbol or large aircraft reference marks.

2.3.19. Flight Path Marker (Velocity Vector)

Figure 2-40: Flight Path Marker

The flight path marker (FPM) appears in the background to coincide with the aircraft's actual flight path as projected on the outside world. The FPM is laterally displaced parallel to the horizon concerning the center of the display to account for the difference between aircraft track and heading and is vertically displaced perpendicular to the horizon to accounting for aircraft climb or descent angle.

The FPM is not shown if:

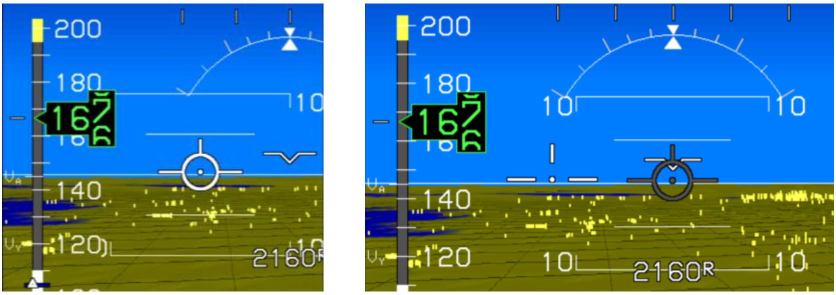
1) In Basic Mode or when the EFIS is configured for Round Dials (see Round Dials appendix).

2) In unusual attitude mode, it disappears to allow the pilot to concentrate on the large aircraft symbol reference marks for unusual attitude recovery.

3) FPM at low speed (airspeed ≤ 45 KIAS) behavior further depends on whether the aircraft is in flight or on the ground and whether a WOW/WOG is configured in EFIS limits.

4) The FPM may be inhibited with an external FPM INHBT switch if configured in EFIS limits.

Because the FPM is used in conjunction with a 3D background, the FPM utility normally associated with a HUD is achieved. When the FPM is displaced to the extent, it interferes with the heading, altitude, or airspeed indications it is removed from the display.



FPM is nearing airspeed tape due to a strong crosswind from the right.

FPM is caged in the center due to excessive crosswinds from the right. Ghost FPM appears in the proper lateral location.

Figure 2-41: Flight Path Marker Views

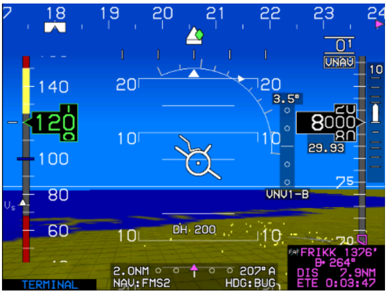
Table 2-11: Flight Path Marker Behavior

FPM	Crab Angle
Cage (Become laterally centered on display)	When exceeding 15° (wide FOV) or 7.5° (narrow FOV mode)
Uncage (Resume lateral floating)	When returning below 13° (wide FOV mode) or 6.5° (narrow FOV mode)
FPM movement is dampened by reference to aircraft pitch and heading so as not to deviate from pitch or heading at a rate greater than 1°/sec.	

FPM Ghost

Figure 2-42: Flight Path Marker Ghost

Figure 2-43: Flight Path Marker Absence

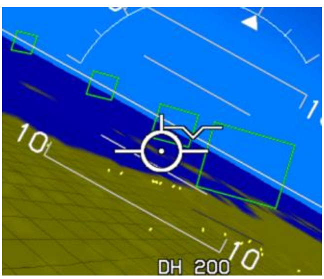


When the Eastern (Russian) ADI format is configured in the EFIS limits, the FPM rotates to indicate roll.

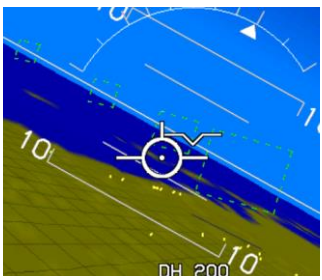
Figure 2-44: Flight Path Marker Eastern (Russian) Format

2.3.20. Highway in the Sky/Skyway

When not decluttered, the EFIS displays the active GPS/SBAS navigation route or manual FMS OBS course in 3D with a series of skyway boxes, which overly the flight plan route at the desired altitude and provide lateral and vertical guidance. See Section 6 IFR Procedures for details.



Coupled to Skyway

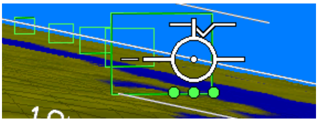


Uncoupled to Skyway

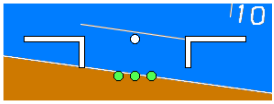
Figure 2-45: Highway in the Sky

2.3.21. Landing Gear Indication

If configured, EFIS displays landing gear position as small green "tires" below the waterline or large aircraft symbol reference mark.



Normal SVS Mode



Basic Mode

Figure 2-46: Landing Gear Indication

2.3.22. G-Force Indicator

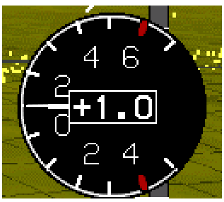
G-force indicator appears in normal mode as depicted or next to the waterline or large aircraft symbol reference mark when the difference between G-force and 1-G is greater than 0.3 Gs.

Figure 2-47: G-Force Indicator

Positive telltales appear whenever G-force exceeds 2.5G. Negative telltales appear whenever the negative G-force is less than -0.5G. Telltales appear full-time within the G-indication area.

Figure 2-48: G-Force Indicator Telltale Indications

2.3.22.1. Analog G-Force Indicator and Telltales



Analog G-force indication displayed to nearest tenth G

G-force equals or exceeds +6 or -4 limits

Figure 2-49: Analog G-Force Indicator

The analog G-force indicator is mutually exclusive with the normal G-force indication next to the FPM.

When selected from decluttering menu, an analog G-force indication is displayed to the nearest tenth G. Positive and negative telltales appear as described with the default G-force indication. The pointer turns amber (yellow) when G-force equals or exceeds settings in EFIS limits.

The telltales are unique on this analog G-force indicator. Positive G telltales appear whenever a positive G-force exceeds 2.5G, and a negative G telltale appears whenever G-force is less than 0G. Either G telltale is resettable if the associated G limits as set in EFIS limits have not been exceeded. If a G-limit has been exceeded, the associated telltale can only be cleared by a maintenance action.

The G telltales automatically reset upon EFIS initialization if the associated G limit has not been exceeded. The example reflects +6.1G and -4.1G EFIS limits.

Press **RESET G (L2)** to reset telltales to zero unless the aircraft G-limits have been exceeded. If G-limits has been exceeded, reset exceedance in GMF.

Figure 2-50: RESET G

2.3.23. Marker Beacon Symbology

Marker beacon data acquired from the navigation receiver are displayed on the PFI but are disabled when the selected NAV source is other than VLOC1 or VLOC2. Valid marker beacon signals cause circular indicators with appropriate coloring and markings. Marker beacons and flight director symbology disappear in the unusual attitude mode.

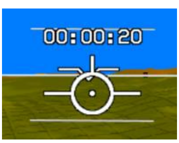
Normal SVS Mode

Basic Mode

Built-in Test

Figure 2-51: Marker Beacons

2.3.24. Timer and Time Indications



When selected, a countdown or count-up timer is displayed above the waterline or large aircraft symbol reference marks. The flight timer begins as soon as the first time the aircraft transitions from ground mode to air mode. This flight time continues until the EFIS is powered down.

Figure 2-52: Timer Indication

When the flight time display option is selected, the current elapsed time since the aircraft transitioned from ground to air mode is displayed for 10 seconds or until any button is pressed or any action on knobs ❶,❷, or ❸. If the aircraft has not yet transitioned from ground to air mode, upon selecting the flight time display, it appears as **FLT TM: 00:00:00**.

Figure 2-53: Flight Time

2.3.25. Course Deviation Indicator (CDI)

Without Autopilot

With Autopilot

Figure 2-54: Course Deviation Indicator

The order of precedence of type accuracy used by the system from highest to lowest is as follows:

1) Manual RNP: The pilot may override the automatic accuracy types by setting a manual RNP value.

2) Automatic RNP: These are based on RNP values coded in the navigation database. The EFIS looks at the leg coding on all legs other than those on the final approach segment. On the final approach segment, the EFIS looks at the "Level of Service" record for those approaches, which have RNP transition legs, and then goes to LP or LPV minima for the final approach.

3) Default TSO-C146c operation: As specified as per Table 2-12 for en route, terminal, and various approach modes according to the "Level of Service" record.

4) When FMS is the selected navigation source and not in RNP mode, the scale is the appropriate full-scale deflection value for the flight mode. When FMS is the selected navigation source and RNP mode, the scale readout is "RNP," and the RNP Advisory Alert should be referenced for scaling.

Table 2-12: CDI Behavior and Color

CDI Pointer and Condition	Color or Behavior
Full-Scale Deflection	Flash

Table 2-12: CDI Behavior and Color

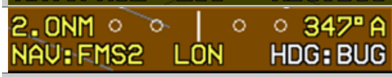
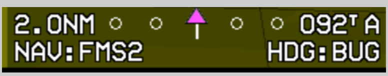
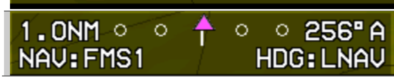
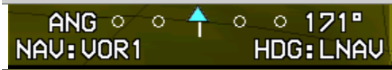
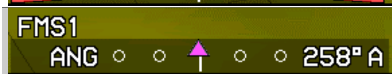
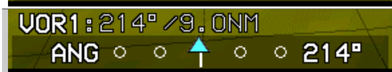
CDI Pointer and Condition	Color or Behavior
Slaved to GPS/SBAS Scale is an appropriate FSD value for the mode of flight: En route: ±2NM From En route to Terminal: Change from ±2 NM FSD to ±1 NM FSD over a distance of 1 NM; start transition when entering terminal mode. From Terminal to En route: Change from ±1 NM FSD to ±2 NM FSD over a distance of 1 NM; start transition when entering en route mode. From Terminal to Approach: If VTF, switch immediately. Otherwise, change from ±1 NM FSD to approach FSD over a distance of 2 NM; start transition at 2 NM from FAWP. From Approach to Terminal: Change to ±1 NM. From Departure to Terminal: If the initial leg is aligned with the runway, change from ±0.3 NM FSD to ±1 NM FSD at the turn initiation point of the first fix in the departure procedure.	
	Slaved to GPS/SBAS (with GPS LOI Amber (Yellow)
	Slaved to GPS/SBAS (with GPS LON Amber (Yellow)
Normal conditions	Magenta
In sources other than FMS	ANG (angular) scale annunciation
With Analog Autopilot Configured	
	RNP level of service
	True North ("T") symbol (used if the navigation source is FMS and in True North mode).
	Reverse sensing (Course error exceeds 104°)
	Red "X" displayed over CDI
	Holding the wings level
	Selected nav source FMS1

Table 2-12: CDI Behavior and Color

CDI Pointer and Condition	Color or Behavior
	Selected nav source FMS2 (Only available if a second GPS/SBAS receiver is installed).
	Selected nav source VLOC1
	Selected nav source VOR1 with "TO" indication and LNAV captured
	Selected nav source VOR2 With the "FROM" indication
With Integrated Autopilot or Without Autopilot Configured (When VOR, LOC, or BC is the NAV source, DME, when available, is displayed next to the NAV source)	
	Reverse sensing (Course error exceeds 104°)
	Red "X" displayed over CDI
	Selected nav source FMS1 (during GPS approach)
	Selected nav source VLOC1
	Selected nav source VOR1 with "TO" indication
	Selected nav source VOR2 with "FROM" indication

2.3.25.1. OBS Setting of CDI

In automatic mode, the system controls the scale and OBS. The selected navigation source is annunciated below the CDI as follows:

1) NAV: FMS1/FMS2
2) NAV: VOR1/LOC1
3) NAV: BC1/BC2 (annunciated instead of LOC1/2 when course error exceeds 104°)
4) NAV: VOR2/LOC2

2.3.25.2. Heading/Roll-Steering Sub-Mode

Heading/roll-steering sub-mode annunciation appears immediately right of the selected navigation source annunciation and displays:

1) HDG: LNAV (LNAV sub-mode guidance)

2) HDG: BUG (Heading bug sub-mode guidance)

3) HDG: --- (Failure sub-mode)

2.3.26. Vertical Deviation Indicator (VDI)

The vertical deviation indicator (VDI) on the right side displays vertical deviation for the selected vertical navigation source for displaying descent profile but disappears in unusual attitude mode.

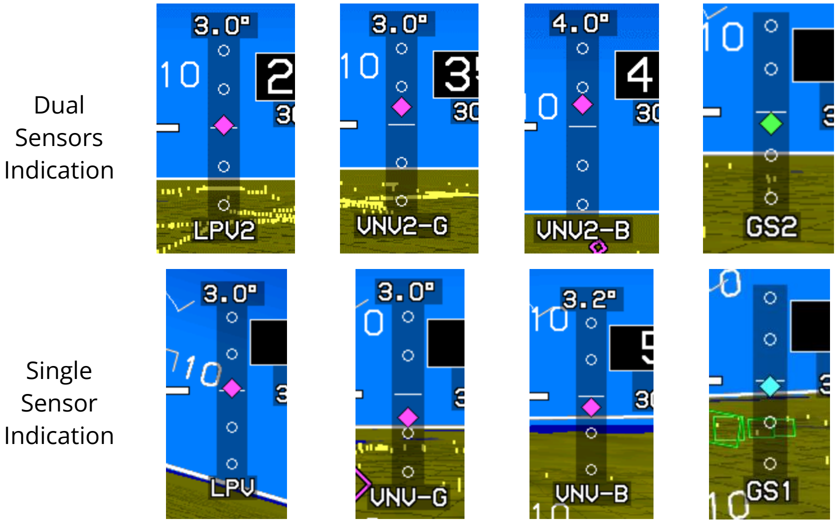


Figure 2-55: Vertical Deviation Indicator

1) LPV Mode and LPV1 or LPV2: When descending on the final approach segment in LPV mode. GPS altitude generates VDI indications; users may follow LPV minima guidance regardless of temperature.

2) LNAV Mode and VNV1-G or VNV2-G: When descending on the final approach segment in LP, LNAV/VNAV, and LNAV or RNP modes when using GPS VNAV. GPS altitude generates VDI indications; the pilot may follow guidance to LNAV minima regardless of temperature.

3) LNAV Mode and VNV1-B or VNV2-B: Default FMS barometric VNAV mode. Using barometric altitude to generate the VDI, the pilot may follow guidance to LNAV minima if the specified temperature is within limits.

4) GS1 or GS2: Glide slope receiver #1 or #2 as indicated. The pilot follows guidance to published barometric DH.

Table 2-13: Vertical Deviation Indicator Behavior

Source (Below VDI)	Behavior/Condition	Pointer Color
FMS	Conforms to the VDI display	Magenta
Glide Slope	Source must be valid when a valid glide slope is received.	Magenta (FMS) Cyan (VLOC 1) Green (VLOC 2)
LPV or VNAV mode	Source is valid if: On VNAV descent segments when approaching the Top of Descent point to provide descent anticipation if the following are true: 1) On VNAV descent segments; or 2) If the vertical deviations on VNAV level segments option are enabled, on VNAV level segments; or 3) If the vertical deviations on the VNAV level segments option are disabled when approaching the top of the descent point to provide descent anticipation; Providing: 1) Aircraft is within 2NM or twice the full-scale deflection for the mode of flight (whichever is greater) of the lateral navigation route; and 2) Aircraft is in TO operation relative to the active VNAV waypoint (i.e., considering VNAV offsets); and	Magenta

Table 2-13: Vertical Deviation Indicator Behavior

Source (Below VDI)	Behavior/Condition	Pointer Color
	3) If on the final approach segment, the aircraft is within a 35° lateral wedge of the azimuth reference point (GARP or MAWPT + 10,000 ft.).	
LPV, VNV-G	During GPS LOI/LON or GPS VLON	Pointer and Text Color Amber (Yellow)

NOTE:

The VDI remains functional during a VLON condition, providing the indication can be computed. If the pilot must revert to LNAV minimums, the VDI provides advisory guidance for stabilized profile during descent. A loss of navigation alert does not require removing navigation information from the navigation display. It is acceptable to display navigation information concurrent with the failure/status annunciation when conditions warrant.

Figure 2-56: VDI Color during GPS/SBAS LOI/LON or VLON

2.3.27. Active Waypoint and Waypoint Identifier

The active waypoint symbol is a magenta "tethered balloon" consisting of:

1) an "X" depicted at the ground location of the active waypoint;

2) a hoop or "tethered balloon" (for fly-over waypoints) or "tethered diamond" (for fly-by waypoints) depicted at the VNAV altitude or aircraft altitude (if there is no VNAV altitude), and

3) a line connecting the "X" and the hoop.

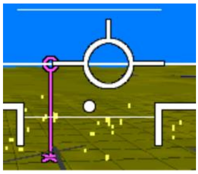
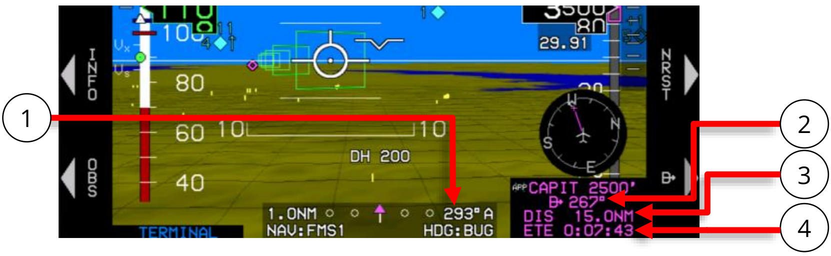


Figure 2-57: Active Waypoint Symbol

The "X" and connecting line are not shown if no ground elevation information is encoded with the NavData® waypoint information (e.g., terminal and en route fixes). The active waypoint symbol is drawn using the hidden surface removal techniques of terrain and obstruction rendering, so an active waypoint behind terrain appears to be so. The active waypoint symbol disappears in unusual attitude mode and turns amber (yellow) in the event of GPS LOI/LON caution.

The waypoint identifier and the distance and time to that waypoint (ETE or ETA) are displayed in the lower right corner of the PFI in magenta. If a target altitude is not set and the active waypoint has a VNAV altitude associated, as in Figure 2-59, the identifier includes a display of the VNAV altitude.



1) Instantaneous desired course to active waypoint

2) Course to waypoint

3) Along-track distance to active waypoint

4) ETE or ETA based on along-track distance

Figure 2-58: Active Waypoint

NOTE:

Only the active waypoint is shown on the PFD display. Subsequent waypoints in a route are displayed sequentially as the current active waypoint is passed. With terrain turned off, the active waypoint is always visible regardless of distance.

If the active waypoint is beyond the lateral limits of the screen, the magenta waypoint direction pointer (i.e., magenta triangle) on the directional scale indicates shortest direction of turn to the waypoint.

If the waypoint is only a hoop hanging in space, it is a fix and not directly associated with a NAVAID on the ground (such as a VOR, NDB, user waypoint, or airport).

If the waypoint X disappears behind terrain on the PFI, there is terrain between the aircraft present position and the waypoint.

2.3.28. Mini Map

The mini map is mutually exclusive with the analog AGL, mini traffic, and analog G-force indicator. Mini map disappears in unusual attitude mode.

Distance in NM

Distance in KM

Figure 2-59: Mini Map

Table 2-14: Mini Map Behavior (When Not Decluttered)

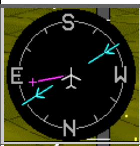
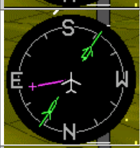
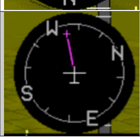
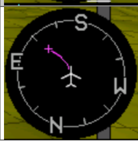
VOR Pointer, Active Leg, Ownship Symbol	Color		Condition
VOR 1		Cyan	When valid
VOR 2		Green	
Active Leg		Magenta	GPS/SBAS normal

Table 2-14: Mini Map Behavior (When Not Decluttered)

VOR Pointer, Active Leg, Ownship Symbol	Color		Condition
		Amber (Yellow)	GPS/SBAS LOI/LON condition
Ownship Symbol		Airplane FAR 23 with V_{NE}	White Always
		Airplane with V_{MO}/M_{MO}	

2.3.29. Mini Traffic

Display of the mini map, analog AGL indication, and analog G-force indicator is mutually exclusive, with the mini traffic taking precedence during a traffic warning (TA or RA). See Traffic Appendix for further details.

Distance in NM

Distance in KM

Figure 2-60: Mini Traffic

2.3.30. Runways

The EFIS displays airport runways in a 3D manner. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, runways for the airport associated with the procedure and runways associated with the three nearest airports (computed by TAWS algorithms) are displayed.

Runways are displayed so runways behind terrain appear to be so. Runways are based on characteristics in the navigation database, including elevation, position, orientation, length, and width, and are displayed as defined in Table 2-16.

Table 2-15: Runways

With SVS TAWS	
SVS Basic	
TAWS disabled	

Table 2-16: Runway Drawing Criteria

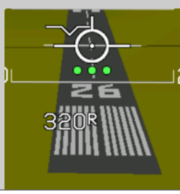
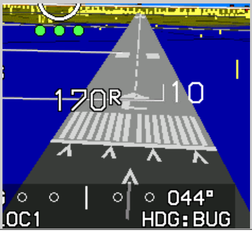
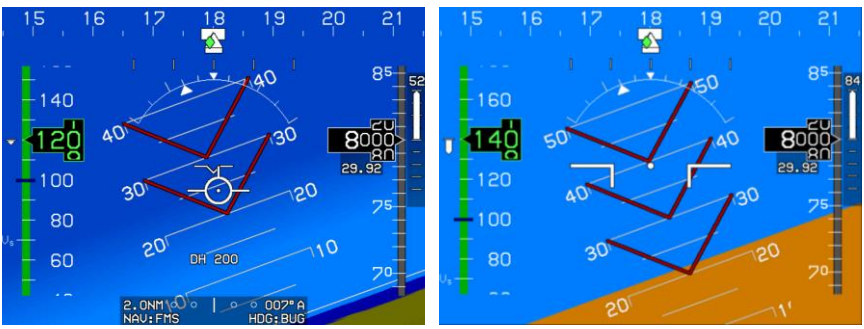
Feature	Color	Notes
Runway surface	Dark gray 	According to characteristics from the navigation database, e.g., including position, orientation, length, and width

Table 2-16: Runway Drawing Criteria

Feature	Color	Notes
Runway markings	Medium gray 	
Landing portion of the selected runway	Light gray 	Considering displaced threshold data
Runway markings for the selected runway	Contrasting lighter gray 	

2.3.31. Unusual Attitude Mode



Less than 30° pitch up and not in Unusual Attitude Mode

More than 30° pitch up and in Unusual Attitude Mode

Figure 2-61: Unusual Attitude Mode

Unusual attitude mode is enabled when pitch attitude exceeds +30° or -30° or bank angle exceeds 65° and remains engaged until pitch attitude and bank attitude return to within 10° of the horizon. The waterline symbol is replaced with a large aircraft reference mark during unusual attitude mode. Recovery chevrons appear prior to reaching ±20° of pitch to aid in unusual attitude recovery and are a normal part of the pitch scale and are not necessarily tied to unusual attitude mode. The chevrons disappear when within ± 15° of the horizon. The following are disabled in the unusual attitude mode:

1) Terrain and obstruction rendering
2) CDI
3) VDI
4) Flight path marker
5) Highway in the Sky boxes
6) Atmospheric perspective
7) Analog and digital AGL indication
8) Active waypoint symbology and active waypoint box
9) Mini map
10) Mini traffic
11) In basic mode, PFD reverts to normal mode
12) In zoom mode FOV, PFD reverts to normal FOV
13) Runways
14) Menus

2.3.32. Imperial Unit Feet and Metric Units

When EFIS limits are not set to SI units, altitude values (altitude display and pilot-selectable target [ASEL] and VNAV altitudes) may be displayed additionally in metric units with a 1-meter resolution.

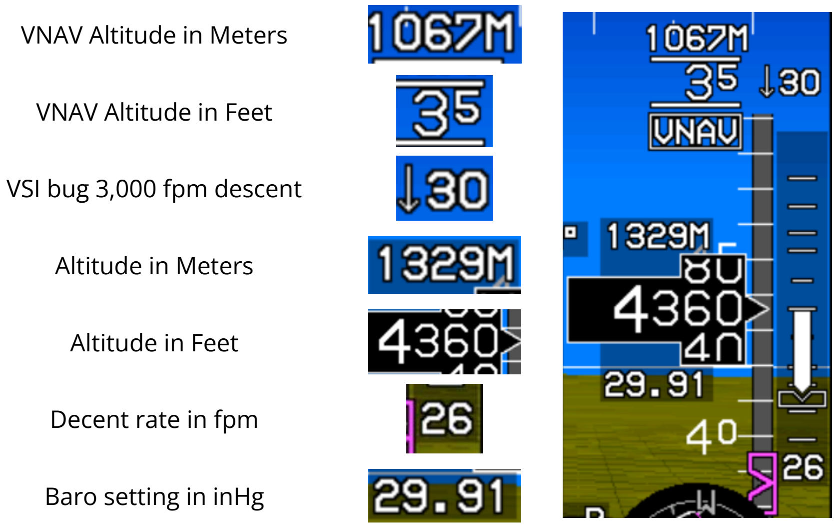


Figure 2-62: Altitude Display (Feet)

When using meters for altitude display, altitude values (altitude display and pilot-selectable target [ASEL] and VNAV altitudes) may be displayed in imperial unit feet units with a 1-foot resolution.

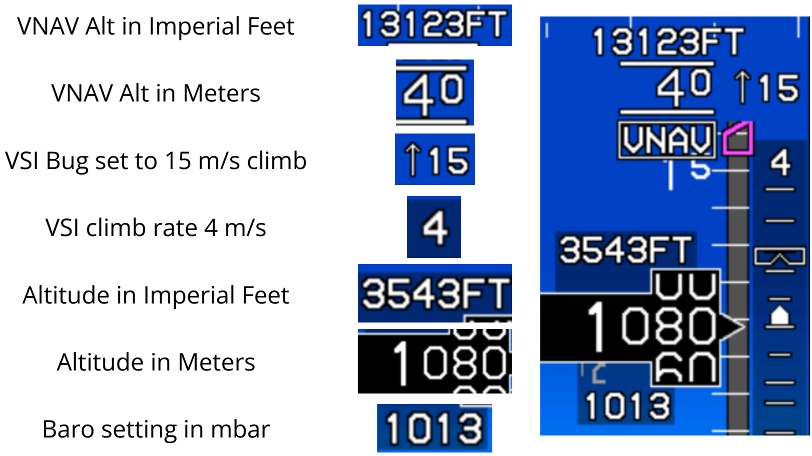


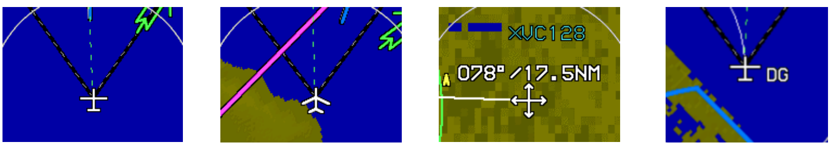
Figure 2-63: Altitude Display (Meters)

2.4. MFD Symbology

The EFIS displays a variety of MFD pages:

1) Moving Map
2) HSI
3) Navigation log
4) Strikes (see WX-500 Lightning Strikes appendix)
5) Traffic (see Traffic appendix)
6) Datalink (see Datalink appendix)
7) Video (see Video appendix)
8) Weather Radar (see WX-RDR appendix)

2.4.1. Ownship Symbology



Airplane FAR 23 with V_{NE}

Airplane with V_{MO}/M_{MO}

Pan Mode

AHRS in DG mode

Figure 2-64: Ownship Symbols

NOTE:

When not panning with the AHRS in the DG mode, “DG” appears to the right of the ownship symbol.

2.4.2. Moving Map

Table 2-17: Moving Map

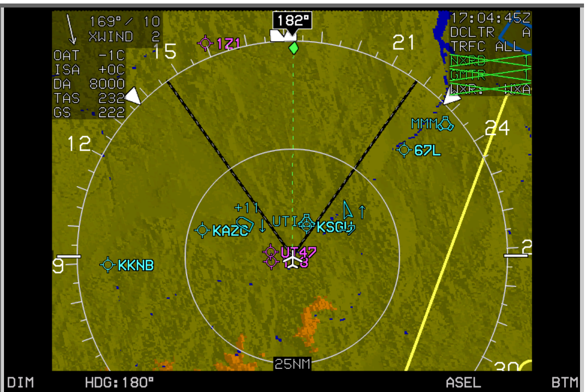
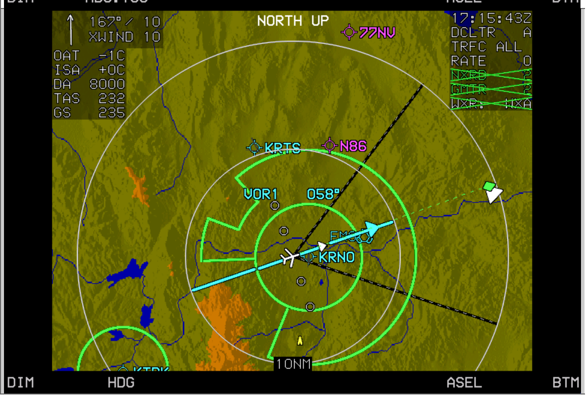
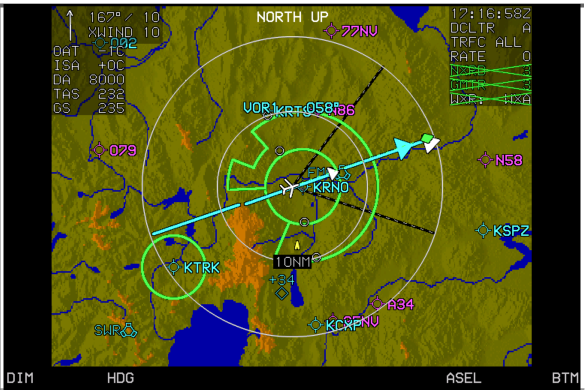
<table>
<tr><td>Basic Moving Map</td><td>
</td></tr>
<tr><td>Moving Map with Instrument Approach</td><td>
</td></tr>
<tr><td>North-Up Arc Mode with HSI Enabled and VOR1 Selected</td><td>
</td></tr>
</table>

Table 2-17: Moving Map

<table>
<tr><td>North-Up Centered Mode with HSI Enabled and VOR1 Selected</td><td>
</td></tr>
<tr><td>Heading-Up Centered Mode HSI Enabled

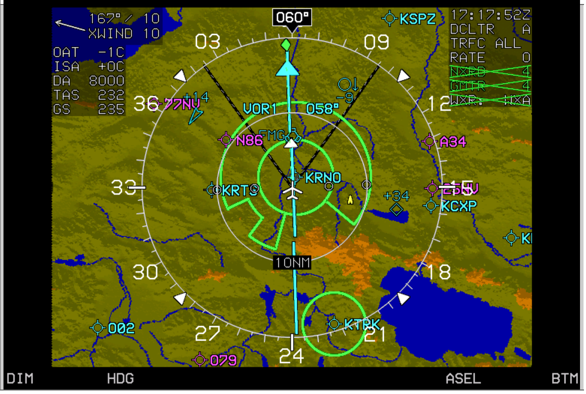
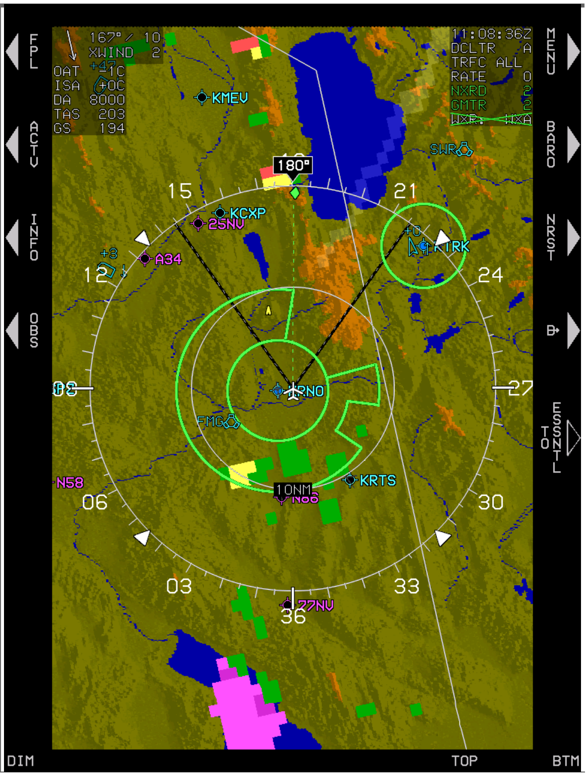
In heading up mode, the magnetic digital heading readout and pointer are aligned with the longitudinal axis of the ownship symbol.</td><td>
</td></tr>
</table>

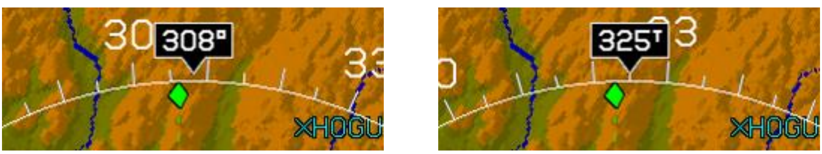
Table 2-17: Moving Map

MFD Full Map Page Heading-Up	

2.4.3. Compass Rose/Boundary Circle Symbol

When selected, a digital heading readout and pointer aligned with the longitudinal axis of the ownship symbol appears on the compass rose boundary circle. In North Up mode, a heading pointer appears on the map boundary circle (see Figure 2-66).

If referenced to magnetic north, the heading readout uses the degree (°) symbol. Otherwise, a stylized true north (ᵀ) symbol is used.



Normal Mode True North Mode

Figure 2-65: Compass Rose

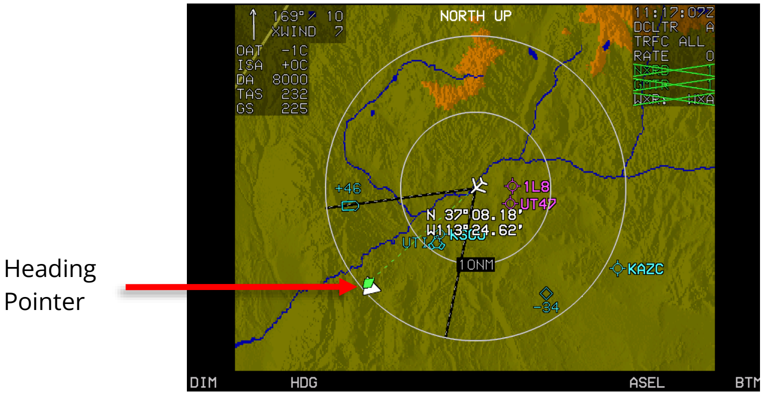
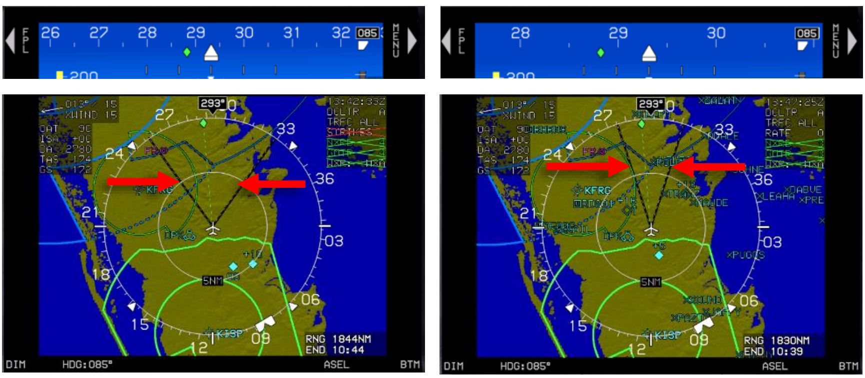


Figure 2-66: Boundary Circle

> **NOTE:**
>
> See Section 6 IFR Procedures for description of the following heading modes with the AHRS and EFIS:
>
> 1) ADAHRS Slaved—EFIS Magnetic North
> 2) ADAHRS Slaved—EFIS True North
> 3) ADAHRS Free/"DG"—EFIS Magnetic North
> 4) ADAHRS Free/"DG"—EFIS True North.

2.4.4. Field of View (FOV) Indication



Normal FOV (Zoom Off) | Narrow FOV (Zoom On)

Figure 2-67: Field of View

The Map page background indicates the FOV with a set of segmented gray lines leading out from the ownship symbol in either 35° or 70° angles depending on the zoom mode setting in the PFI area.

2.4.5. Map Range

The white inner range ring is centered on the aircraft's position to estimate distances quickly. Distance (in NM or KM) from the aircraft to the range ring is a white number on a black background overlaying the 6 o'clock position of the ring. The range ring is half the distance to the compass rose.

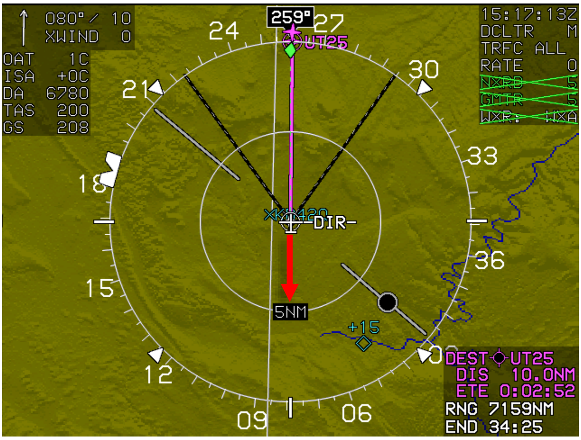


Figure 2-68: Map Range

Table 2-18: Range Scale

Distance in NM		Distance in KM	
Range Ring	Compass Rose	Range Ring	Compass Rose
0.5NM	1NM	1KM	2KM
1.0NM	2NM	2.5KM	5KM
2.5NM	5NM	5KM	10KM
5.0NM	10NM	10KM	20KM
10.0NM	20NM	25KM	50KM
25.0NM	50NM	50KM	100KM
50.0NM	100NM	100KM	200KM
100.0NM	200NM	250KM	500KM
250.0NM	500NM	500KM	1,000KM
500.0NM	1,000NM	1,000KM	2,00KM

2.4.6. Glide Range Depiction

When selected, the glide range depicts the engine out glide range as presented within a cyan border around the ownship symbol. This range symbology is calculated based on the best glide speed and the glide ratio set in the EFIS limits. The following are used to calculate the shape and size of the glide ring: aircraft altitude, speed, heading, winds, and terrain.

Glide area

Figure 2-69: Glide Range

2.4.7. Clock/Options

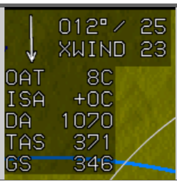
Data in Table 2-19 are displayed in the upper right corner.

Table 2-19: Clock Options

Feature	Options	Notes
07:14:44Z	Zulu Time hh:mm:ssZ	Synchronized with the GPS/SBAS constellation
13:10:50L	Local Time hh:mm:ssL	
Declutter Mode	DCLTR A DCLTR M	= Automatic declutter mode = Manual declutter mode
Terrain Status	Enabled or Disabled	Indicated by the absence or presence of terrain
		~~TERRAIN~~ — Manually turned off
		~~TERRAIN~~ — Failed
Traffic Status	See Traffic Appendix	
Strikes Status	See Strikes Appendix	
Datalink Weather Status	See Datalink Appendix	
WX-RDR Status	See WX-RDR Appendix	

2.4.8. Air Data and Ground Speed

Table 2-20: Air Data and Ground Speed

	Normal Mode		True North Mode	
				
Wind:	Knots	m/s	Knots	m/s
Alt:	Feet	Meters	Feet	Meters
Speed:	Knots	Km/h	Knots	Km/h

The following are displayed in the upper left corner:

1) Wind: Information consists of the following readouts:

   a) The direction in degrees;

   b) Speed in Knots or m/s;

   c) Crosswind in Knots or m/s; and

   d) Graphical wind vector arrow corresponding to MFD page orientation.

NOTE:

Wind information is not shown when the aircraft is in ground mode nor when the AHRS is in DG mode.

If referenced to magnetic north, direction readout uses the degree (°) symbol. Otherwise, a stylized true north (ᵀ) symbol is used.

2) Outside Air Temperature: Digitally in °C or °F (as configured in EFIS limits).

3) International Standard Atmosphere (ISA): The difference between ISA temperature and current outside air temperature is displayed digitally at °C or °F (negative value = less than standard OAT.) decluttered if the "Show ISA Temperature" is disabled in EFIS limits.

4) Density Altitude (DA): Digitally in feet or meters. Decluttered if Show Density altitude is disabled in EFIS limits.

5) True Airspeed (TAS): Digitally in knots, or Km/h. Decluttered if True Airspeed is disabled in EFIS limits.

6) Ground Speed (GS): Digitally in knots or Km/h.

2.4.9. Waypoint Distance/Fuel Totalizer Functions

GPS in normal state and current active waypoint

GPS in LOI/LON condition

GPS in normal state and not the current active waypoint

Figure 2-70: Fuel Totalizer/ Waypoint Distance Functions NM/KM

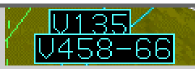
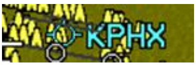
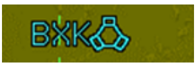
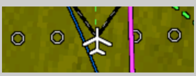
Table 2-21: Waypoint Distance/Fuel Totalizer Functions

Function	Conditions	Type/Symbols
DEST Waypoint	If there is an active flight plan, waypoint type, identifier, range, and ETE/ETA for the last waypoint ("DEST" waypoint) are shown. If the active waypoint is not the last waypoint in the active flight plan, the range and time to destination waypoint are based on the flight plan route. Otherwise, range and time are based on a direct geodetic path. Waypoint information is white but turns amber (yellow) with GPS LON caution.	ETA or ETE Degree (°) or True North (^{T}) symbol
Range	Based on instantaneous fuel flow, fuel remaining, and ground speed, the range is shown immediately below the "DEST" waypoint information for easy comparison.	
Endurance	Based on instantaneous fuel flow and remaining fuel endurance is shown.	

2.4.10. Navigation Data

Navigation symbology is shown in the correct relationship to the ownship symbol and the symbols in Table 2-22.

Table 2-22: Navigation Symbology

	High Altitude Airways H AIRWAY ✓		Low Altitude Airways L AIRWAY ✓
	IFR Airport LRG APT ✓ IFR APT ✓		VFR Airport VFR APT ✓
	VOR VORS ✓		NDB NDBS ✓
	VORTAC VORS ✓		DME only or TACAN VORS ✓
	User Waypoint USER WPTS ✓		User Waypoint in Pan Mode USER WPTS ✓
	Fix ENR FIXES ✓ TRM FIXES ✓		VFR Fix VFR FIXES ✓
	HSI overlay CDI scale HSI ✓		

The EFIS has manual and automatic decluttering of navigation data. There are six levels of automatic declutter based on the number of potential navigation data symbols drawn in the current format and range as follows:

1) Airports: Manually or automatically decluttered. In automatic declutter mode, large airports (IFR procedure and longest runway and automatically adjusted threshold needed to achieve desired symbol count) are always shown; IFR airports that are not large airports are shown in levels 1, 2, 3, and 4; and VFR airports are shown in levels 1, 2, and 3.

2) VORs: Manually or automatically decluttered. In automatic declutter mode, VORs are shown in levels 1, 2, 3, 4, and 5.

3) NDBs: Manually or automatically decluttered. In automatic declutter mode, NDBs are shown in levels 1 and 2. Both en route and terminal NDBs are shown.

4) Fixes (including user waypoints): Manually or automatically decluttered. In automatic declutter mode, en route fixes are shown in level 1, and terminal fixes are manually selected and not shown in automatic declutter mode. En route fixes, terminal fixes, and user waypoints may be manually decluttered separately from each other.

5) High Altitude Airways: Manually selected.

6) Low Altitude Airways: Manually selected.

7) Airspace: Manually selected.

NOTE:

Airspace is manually selected and does not automatically declutter. Airspace selection status is maintained in the menu during power down and appears on the Map page during the next initialization.

Table 2-23: Airspace Depiction

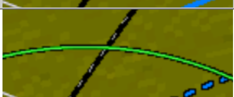
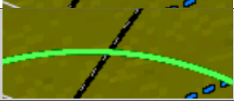
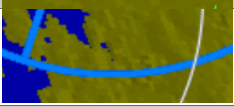
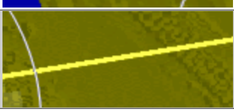
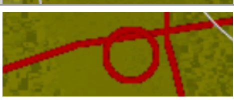
Type of ARINC 424 Airspace		Vertical Limits
	Dashed lines ARSPC CTRL ✓	More than ±500'
	Solid lines ARSPC CTRL ✓	Within ±500'
	Thick solid lines ARSPC CTRL ✓	Within airspace, vertical limits
		Airspace Color
	Class C, control area, TRSAs, Class D ARSPC CTRL ✓	Green
	Class B, TCAs (where applicable) ARSPC CTRL ✓	Blue
	Caution, danger, MOAs, training, warning, or unknown areas ARSPC SUA Y ✓	Amber (Yellow)
	Prohibited, restricted, or TFR areas (when equipped with Datalink) ARSPC SUA R ✓	Red

Figure 2-71: Navigation Data and Airspace Depiction on Map Page

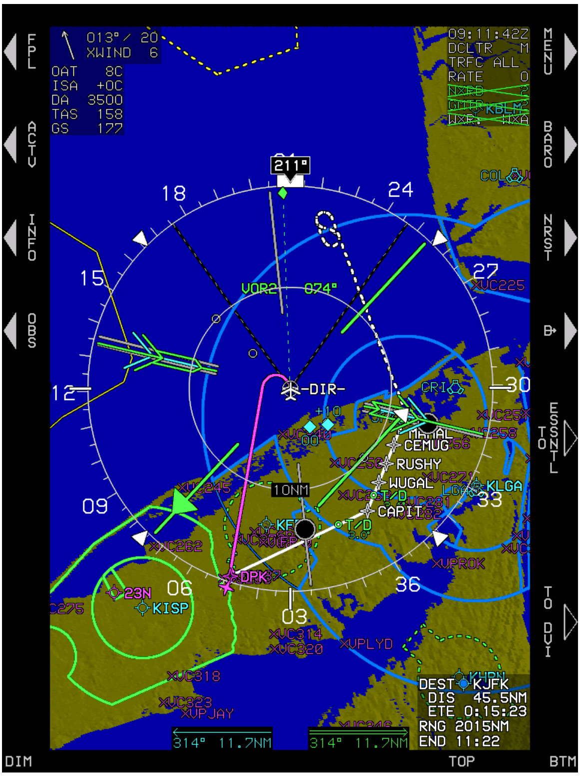


Figure 2-72: Navigation Data and Airspace Depiction on MFD Full Map Page

NOTE:

The full map page only has a centered mode.

2.4.11. Analog Navigation Symbology

When selected and valid, (VOR1 [cyan] and VOR2 [green]) navigation symbology is displayed. When VOR1 and VOR2 RMI pointers are selected for display, the bearing and distance for the selected VOR pointers appear at the bottom of the MFD page. Distance readouts match the color of the respective pointer.

If the DME channel is in hold mode, “H” is shown in the yellow distance readout. If a bearing or distance are not valid, the respective field is filled with dashes.

ADF1 is a gray single-line pointer and ADF2 is a gray double-line pointer. If the radio signal is invalid, the associated navigation pointer is not shown.

Table 2-24: HSI and RMI Pointers

VOR1/VOR2 RMI Pointers HSI OBS source VOR1	
ADF1/ADF2 RMI Pointers HSI OBS source FMS1	

2.4.12. Borders

International and U.S. state borders are drawn if selected at all map scales. They are white if the background includes terrain.

Table 2-25: Borders

With International and State Borders	
Without International and State Borders	

2.4.13. Terrain/Obstructions

Terrain and obstruction rendering are pilot-selectable to declutter the display by deselecting terrain. Furthermore, terrain and obstruction rendering are disabled when:

1) The GPS/SBAS sensor is failed; or

2) When the ADC is failed; or

3) When the horizontal figure of merit exceeds the greater of 0.3NM or the horizontal alarm limit for the mode of flight.

Terrain and obstructions are displayed in correct relationship to the ownship symbol using color to show relationship to aircraft altitude.

NOTE:

Independent declutter of obstructions is not possible.

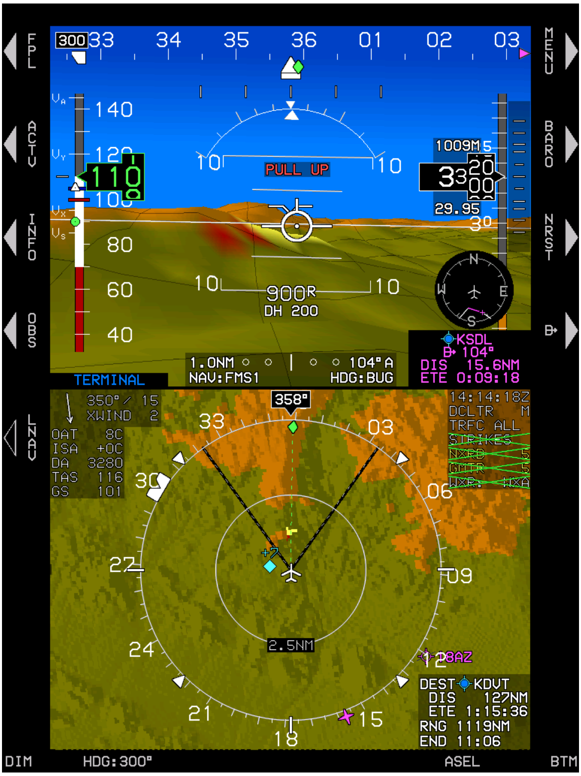


Figure 2-73: Terrain and Obstructions

Table 2-26: Terrain Color

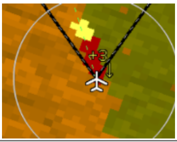
Based on Aircraft Altitude	Color	Notes
Terrain at or below 100 feet below aircraft altitude	Olive Shades 	Terrain slope determines the shade
Terrain above 100 feet less than aircraft altitude	Brown Shades 	
FLTA alerts	Amber and Red	See Section 7 TAWS

Table 2-26: Terrain Color

Based on Aircraft Altitude	Color	Notes
Water at all elevations	Deep Blue 	Takes precedence over other colors

Table 2-27: Obstructions

Lateral Distance Away	17 NM or less	PFI in Narrow FOV
	12 NM or less	PFI in Wide FOV
	Beyond the greater of 8.5 NM or current TAWS FLTA range in any cardinal direction	Not depicted
	8.5 NM or less	As described below
Vertical Criteria	More than 2,000' below aircraft	Not depicted
	Within 2,000' but more than 500' below aircraft	Depicted in amber (yellow)
	Above aircraft altitude	Depicted in deep red

NOTE:

See Section 7 Terrain Awareness Warning System for obstructions causing TAWS alarms and depiction of different symbology.

2.4.14. Pan Mode

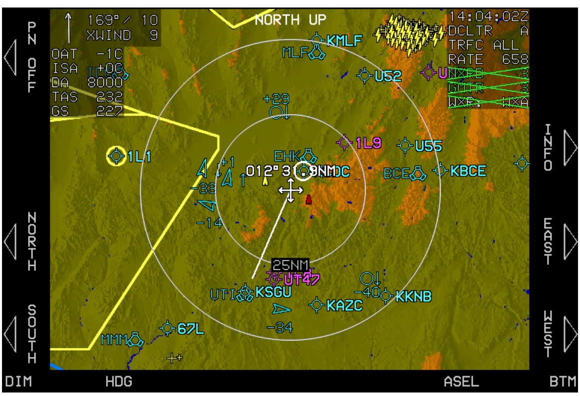


Figure 2-74: Pan Mode

Pan mode is used for changing the location of the center of the page away from current location and viewing map details along the route of flight and at the intended or alternate destination while in flight or on the ground. When pan mode is active, use labeled buttons to pan location north, south, east, and west in a North-up, centered orientation. Upon entering the pan mode, the heading pointer, track pointer, lubber line, waypoint pointer, analog navigation symbology, and field of view lines are removed.

Figure 2-74 shows the line with bearing and distance from the map center to the aircraft's current position in white when the aircraft is more than 0.5 NM away from the panning cursor. When panning, the nearest displayed airport, VOR, NDB, or fix within the inner range ring are highlighted with a flashing white circle. Buttons are labeled for viewing or hiding waypoint information. When exiting pan mode, all settings are restored as before pan mode was enabled.

2.4.15. Direct Point

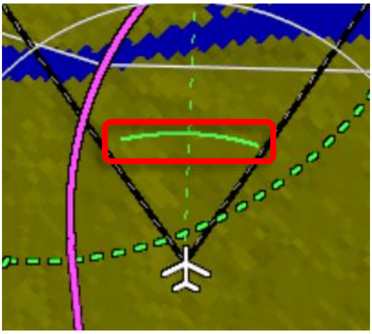
Unnamed waypoints appear depending on the procedure loaded when a direct-to command is entered. See Section 6 IFR Procedures for more information.

1) -ALT- for altitude terminations
2) -DIR- for waypoints that begin a direct-to leg
3) -DME- for distance or DME terminations
4) -INT- for intercept terminations
5) -RAD- for radial terminations

Figure 2-75: Direct Point

2.4.16. Altitude Capture Predictor/Top-of-Descent

Top of Descent



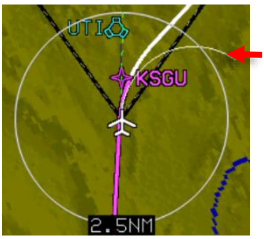
Top of Climb/Bottom of Descent

Figure 2-76: Top-of-Descent or Top-of-Climb

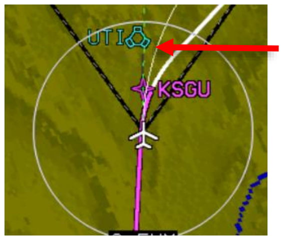
When a selected altitude or VNAV altitude is specified on the PFI, T/D marks the correct point on the flight plan path where descent must commence and contains the location on the flight plan path with an indication of the glide path angle used to calculate position. After passing the top of descent along the lubber line a green arc is shown ahead of the aircraft, marking the bottom-of-descent or top-of-climb point based upon current VSI rate.

2.4.17. Projected Path

When the aircraft is in a bank angle with a ground speed greater than 60 knots, a projected path originates from the ownship symbol. This curving path is based on aircraft bank angle and ground speed as projected one minute into the future up to a maximum of 180° of turn. The projected path or "noodle" assists in course interception and making small adjustments to the bank angle for proper rollout.



Undershooting



Overshooting

Figure 2-77: Projected Path

2.4.18. Parallel Track/Active Flight Plan Path/Manual Course

2.4.18.1. Parallel Track

Figure 2-78: Parallel Track

When there is an active flight plan and GPS/SBAS OBS setting is automatic, the flight plan path is shown in correct relationship to the ownship symbol. See Section 3 Menu Functions and Procedures for details on creating a parallel track.

2.4.18.2. Manual Course

When there is an active waypoint and the GPS/SBAS OBS setting is manual, SUSPEND appears (waypoint auto-sequencing is suspended when in manual OBS mode). The manual course through the waypoint is shown as a pointer centered on the waypoint. The pointer matches the lateral navigation guidance given on the PFI (GPS/SBAS CDI in manual OBS mode, skyway boxes, and mini map.) See Section 6 IFR Procedures for further details.

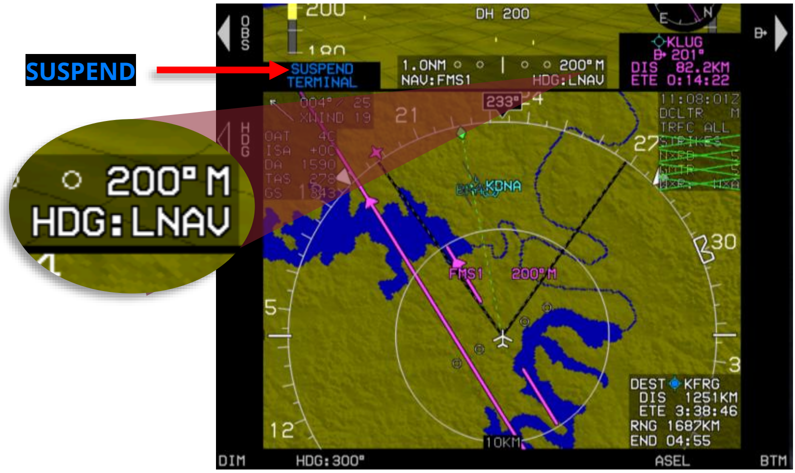


Figure 2-79: GPS/SBAS OBS Manual

2.4.18.3. Active Flight Plan Path

The active flight plan path's active leg/manual course and active waypoint are magenta but turn amber (yellow) in a GPS LOI/LON caution.

Figure 2-80: Loss of Integrity or Loss of Navigation

2.5. HSI Page

2.5.1. Conventional HSI/PTR Format

When selected, the MFD displays conventional HSI symbology, including a selected course pointer lateral deviation indicator, and "TO-FROM" indicator. The navigation source and OBS setting are displayed in the top center of the HSI in the same color as the course Pointer as follows:

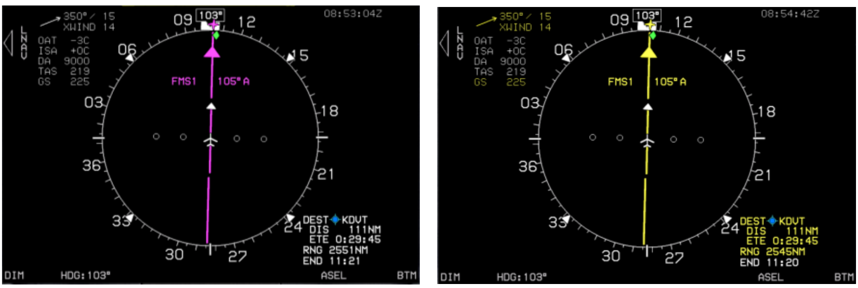
1) Magenta (if FMS is the selected navigation source);

9) Cyan (if VLOC1 is the selected navigation source);

10) Green (if VLOC2 is the selected navigation source); or

11) Amber (Yellow) when HSI is slaved to GPS/SBAS, and there is a GPS LON condition.

The ownship symbol is centered and pointing straight up on the HSI. The HSI has a compass rose aligned with either magnetic north or true north depending on the status of the true north being configured in EFIS limits. When the HSI NAV source (FMS, VOR1, or VOR2) fails, a red "X" is displayed in place of the HSI deviations. When the AHRS is in DG mode, "DG" appears to the right of the ownship symbol.



Normal Magenta Pointer

GPS LOI/LON Amber (Yellow) Pointer

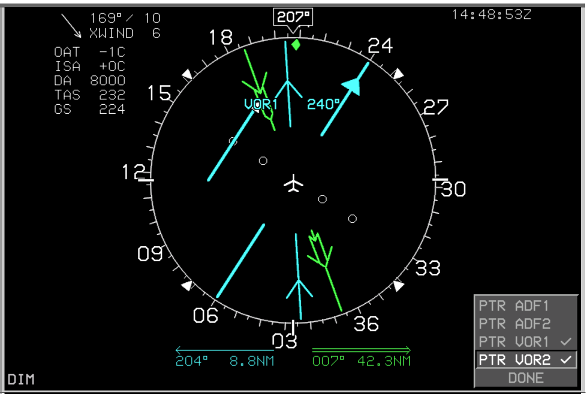
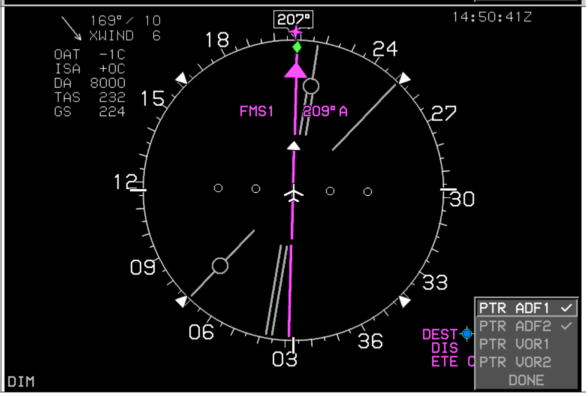
Figure 2-81: HSI Pointer Color

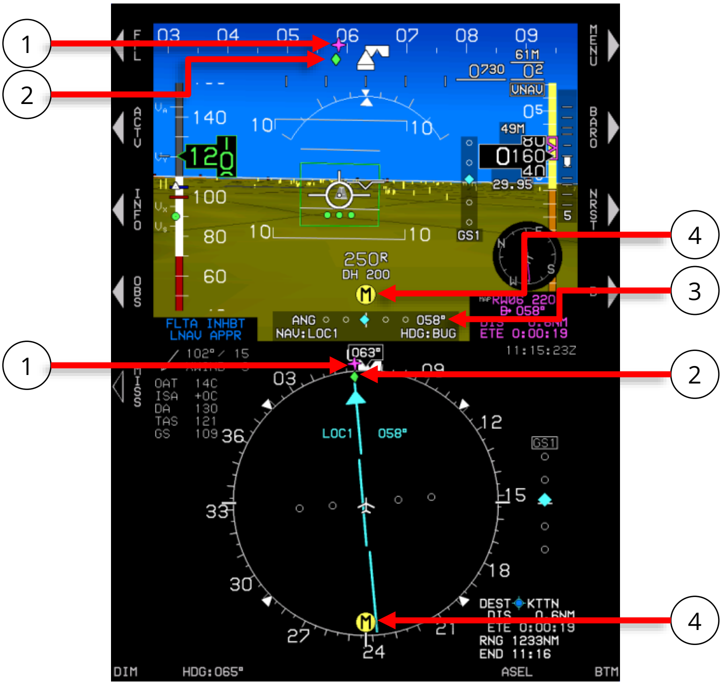
2.5.2. Analog Navigation Symbology

When selected, VOR1, VOR2, ADF1, and ADF2 navigation are displayed as defined in § 2.4.11.

Valid marker beacon symbols are displayed on the PFI and HSI page with appropriate coloring markings. Only during a built-in-test, more than one marker beacon may be active. Marker beacons are disabled when NAV source is other than VLOC1 and or VLOC2.

Table 2-28: HSI Page and RMI Pointers

VOR1/VOR2 RMI Pointers, Bearing, and Distance Readout HSI OBS source VOR1	
ADF1/ADF2 RMI Pointers HSI OBS source FMS1	



1) Magenta bearing pointer to the active waypoint

2) Green track pointer

3) Final approach course

4) Valid marker beacon

Figure 2-82: HSI with Marker Beacon Displayed

2.5.3. HSI CDI and VDI Scale

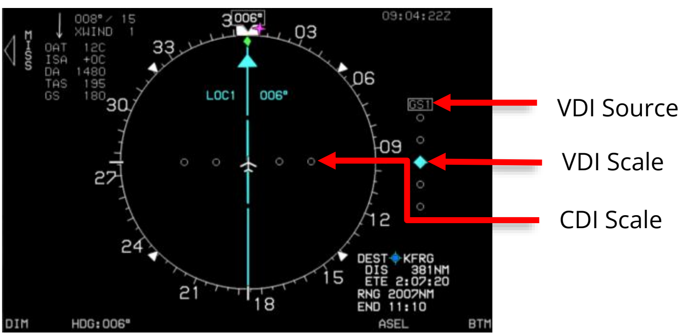


Figure 2-83: CDI Scale with VDI

A VDI appears when the VDI source is valid to display vertical deviation information for the currently selected navigation source.

1) LPV or, if a second GPS/SBAS receiver is installed, LPV1 or LPV2. Annunciation is made when descending on the final approach segment in LPV mode.

2) VNV-G or, if a second GPS/SBAS receiver is installed, VNV1-G or VNV2-G. Annunciation is made when descending on the final approach segment in LP, LNAV/VNAV, LNAV, or RNP modes when using GPS VNAV.

3) VNV1-B: Default FMS barometric VNAV mode.

4) VNV2-B: Default FMS barometric VNAV mode.

5) GS1: Glide slope #1.

6) GS2: Glide slope #2.

2.5.4. Clock

Displayed as specified in § 2.4.7.

2.5.5. Air Data and Ground Speed

Displayed as specified in § 2.4.8.

2.5.6. Fuel Totalizer/Waypoint Distance Functions

Displayed as specified in § 2.4.9.

2.6. Navigation Log (NAV LOG)

The Nav Log may be set to Waypoint to Waypoint (Wpt to Wpt) or Present Position to Waypoint (PPOS to WPT) display format as defined in Table 2-29. PPOS status is annunciated in the upper right corner.

NOTE:

Since the NAV LOG uses MAGVAR at present position for course calculations, it is a current picture-in-time based entirely on present position. The flight planner uses MAGVAR from the internal database for each waypoint along the route and never references present position. Therefore, the flight planner is the correct flight plan with corrections along the route.

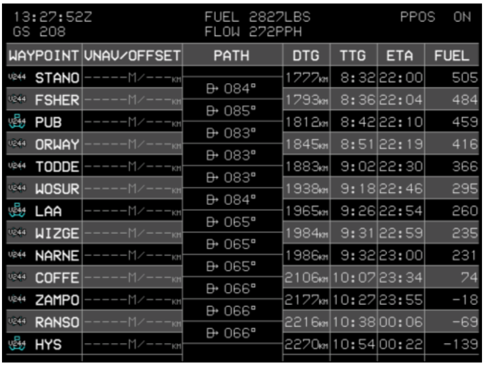
Table 2-29: Nav Log Format

Wpt to Wpt	PPOS to Wpt
Waypoint Identifier	Waypoint Identifier
VNAV and VNAV Offset	VNAV and VNAV Offset
Path	Path
Distance	Distance to Go (DTG)

Table 2-29: Nav Log Format

Wpt to Wpt	PPOS to Wpt
ETE	Time to Go (TTG)
ETA	ETA
Fuel Remaining	Fuel Remaining

In PPOS to WPT display format, PPOS status is annunciated as PPOS ON.



13:27:52Z GS 208 FUEL 2827LBS FLOW 272PPH PPOS ON

WAYPOINT	UNAV/OFFSET	PATH	DTG	TTG	ETA	FUEL
STANO	-----M/---		1777	8:32	22:00	505
FSHER	-----M/---	084°	1793	8:36	22:04	484
PUB	-----M/---	085°	1812	8:42	22:10	459
ORWAY	-----M/---	083°	1845	8:51	22:19	416
TODDE	-----M/---	083°	1883	9:02	22:30	366
WOSUR	-----M/---	083°	1938	9:18	22:46	295
LAA	-----M/---	084°	1965	9:26	22:54	260
WIZGE	-----M/---	065°	1984	9:31	22:59	235
NARNE	-----M/---	065°	1986	9:32	23:00	231
COFFE	-----M/---	065°	2106	10:07	23:34	74
ZAMPO	-----M/---	066°	2177	10:27	23:55	-18
RANSO	-----M/---	066°	2216	10:38	00:06	-69
HYS	-----M/---	066°	2270	10:54	00:22	-139

In Wpt to Wpt display format, PPOS status is annunciated as PPOS OFF.

13:24:40Z GS 208 FUEL 2841LBS FLOW 272PPH PPOS OFF

WAYPOINT	UNAV/OFFSET	PATH	DIST	ETE	ETA	FUEL
STANO	-----M/---				21:56	519
FSHER	-----M/---	084°	16.0	0:04	22:01	498
PUB	-----M/---	085°	19.1	0:05	22:06	473
ORWAY	-----M/---	083°	32.7	0:09	22:16	431
TODDE	-----M/---	083°	38.4	0:11	22:27	380
WOSUR	-----M/---	083°	54.6	0:15	22:43	309
LAA	-----M/---	084°	26.8	0:07	22:50	274
WIZGE	-----M/---	065°	19.1	0:05	22:56	249
NARNE	-----M/---	065°	2.5	0:00	22:57	246
COFFE	-----M/---	065°	120	0:34	23:31	89
ZAMPO	-----M/---	066°	71.0	0:20	23:52	-4
RANSO	-----M/---	066°	38.5	0:11	00:03	-54
HYS	-----M/---	066°	53.9	0:15	00:18	-125

Figure 2-84: Navigation Log

2.6.1. Clock and Ground Speed

The following are displayed in the upper left corner:

1) Zulu Time or Local Time: As specified in § 2.4.7.

2) Ground Speed: Displayed digitally in knots or Km/h

2.6.2. Fuel Remaining and Fuel Flow Data

The following are displayed in the upper center:

1) Fuel Remaining: If fuel level or fuel flow is available, current fuel remaining is displayed digitally in fuel units.

2) Fuel Flow: If fuel flow is available, the current total fuel flow is displayed digitally in fuel units.

2.6.3. Waypoint Identifier Column

The identifier for each waypoint of the active flight plan is displayed in the left column of the NAV Log. The active waypoint, indicated with an asterisk, is magenta. The current active waypoint color turns amber (yellow) during a GPS LON caution. Brackets indicate suppressed waypoints. Navigation data symbols are shown with the waypoint identifier to distinguish the waypoint type easily.

In the case of an airport with available datalink METAR, a graphical METAR is displayed as a colored fill within the circular part of the airport symbol, the convention as defined in Table 2-30.

Table 2-30: Datalink METAR Color Convention

Color	Meaning	
Sky Blue	Visual Flight Rules (VFR)	
Green	Marginal Visual Flight Rules	
Yellow	Instrument Flight Rules (IFR)	
Red	Low Instrument Flight Rules (LIFR)	
Magenta	Less than Category 1 Approach minimums	
Black	No Data	

When a waypoint has special attributes, the following legends are drawn on top of the navigation data symbol:

1) SAR = Waypoint is part of a SAR pattern.

2) HOLD = Waypoint is part of an en route holding pattern.

3) Airway Designation = Waypoint is part of the designated Airway.

4) FAF= Waypoint is a Final Approach Fix.

5) MAP = Waypoint is a missed approach point.

6) MA = Waypoint is part of the missed approach segment of an instrument approach procedure.

7) APP = Waypoint is part of an instrument approach procedure but not a final approach fix, missed approach point, or part of the missed approach segment.

8) VFR= Waypoint is part of a VFR Approach.

9) STAR = Waypoint is part of a standard terminal arrival procedure.

10) DP = Waypoint is part of a departure procedure.

11) PTK = Parallel Offset. In the case of a STAR or DP waypoint subject to a parallel offset, STAR/DP and PTK are shown.

2.6.4. VNAV and VNAV Offset Column

The VNAV altitude and associated VNAV Offset are displayed immediately to the right of the Waypoint Identifier column. The VNAV altitude readout is in feet or meters, and the associated VNAV offset readouts are in NM or KM.

If an approach with a final approach segment data block, the VNAV offset readout associated with the missed approach point is "GPI" to designate the distance to the glide path intercept point. VNAV altitudes and offsets from the navigation database or manually entered are shown in white. VNAV altitudes and offsets are computed automatically (shown in gray (auto-computed climb altitudes are dashed).

NOTE:

No VNAV data (dashes) is associated with a suppressed waypoint as a suppressed waypoint is not part of the active flight plan.

2.6.5. Path Column

LNAV path between waypoints is displayed immediately to the right of the VNAV and VNAV offset column. The following are displayed:

1) Suppressed waypoints (not part of the active flight plan) are shown as dashes.

2) Discontinuities (i.e., a leg where FMS cannot compute a valid path) are shown with the legend "-DISCONT-."

3) Skipped waypoints are shown with the legend "-SKIPPED-."

4) Altitude terminations are shown with the leg course followed by the altitude at which the leg terminates.

5) Manual termination legs are shown with leg course followed by "-MAN-."

6) Procedure turn legs are shown with a pictorial representation of a procedure turn (either left or right turns) and the entry and exit course for the procedure turn.

7) Holding pattern legs are shown with a pictorial representation of a holding pattern (either left or right turns) and the inbound course for the holding pattern.

8) Arc legs are shown with a pictorial representation of an arc (either left or right turns) and the arc's entry and exit radials.

9) Radius to a fix legs are shown with a pictorial representation of an arc (either left or right turns) followed by "RF."

10) SAR pattern legs are shown with a pictorial representation of the SAR pattern (Expanding Square, Rising Ladder, Orbit, Racetrack, or Sector, each with either left or right turns) followed by "SAR." (See SAR appendix.)

11) Other leg types (Direct, DME termination, radial termination, intercept, or course to a fix) are shown using the Direct-To Symbol, followed by the leg course.

The vertical position of the path column elements is offset from waypoint identifier column elements to indicate the path information applies to the leg between waypoints.

2.6.6. Distance Column

Distance between waypoints is displayed immediately to the right of the path column. The distance readouts in NM or KM are calculated considering the associated path and parallel offsets.

2.6.7. Estimated Time En Route Column

ETE between waypoints is displayed immediately to the right of the distance column and calculated considering the distance between waypoints and current ground speed.

2.6.8. Estimated Time of Arrival Column

ETA at the active waypoint and all subsequent waypoints are displayed immediately to the right of the ETE column. The time of waypoint sequencing is stored and displayed as the ETA at waypoints before the active waypoint.

The ETA at the active waypoint is calculated considering the associated time remaining on the active leg and the current time. The ETA at subsequent waypoints is calculated considering the cumulative ETEs and current time.

2.6.9. Fuel Remaining Column

The fuel remaining at each waypoint is displayed immediately to the right of the Estimated Time of Arrival column. The fuel remaining at waypoint sequencing is stored and displayed as the fuel remaining at the waypoint before the active waypoint.

The fuel remaining at the active waypoint is calculated considering the associated time remaining on the active leg, current fuel flow, and current fuel quantity. The fuel remaining at subsequent waypoints is calculated considering the cumulative ETEs, current fuel flow, and current fuel quantity.

2.6.10. Distance To Go Column (DTG)

The distance between waypoint and present position is displayed immediately to the right of the Path column. The distance readout is in NM or KM. The distance between waypoint and present position is calculated considering the associated path as well as parallel offsets.

2.6.11. Time To Go Column (TTG)

The TTG between the waypoint and present position is displayed immediately to the right of the DTG column. The TTG between the waypoint and present position is calculated considering the associated DTG and current ground speed.

NOTE:

Since a suppressed waypoint is not part of the active flight plan, dashes appear in the absence of the following VNAV data associated with a suppressed waypoint.

Where column vertical position is aligned with preceding column, elements indicate the information applies to the associated waypoint.

Where column vertical position is offset from waypoint column elements, indicates that information applies to the leg between waypoints.

The following data columns are shown as dashes if suppressed, skipped, or manual terminations:

1) Path
2) Distance
3) ETE
4) ETA Fuel remaining
5) TTG
6) DTG

Section 3 Menu Functions and Step-By-Step Procedures

3.1. Menu Functions

Navigate menu functions with the 16 peripheral buttons and three knobs (❸,❷, and ❶). ❹ is only used for adjusting screen and button brightness and cannot be used for menu functions. It is always labeled **DIM**.

Figure 3-1: IDU-680 Input Controls

3.1.1. Menu Philosophy

The menu system, and buttons with an action, are clearly labeled with tiles. When the menu system is beyond the top-level, the following buttons appear:

EXIT (R1): When the menu system is beyond the top-level, **EXIT (R1)** escapes to the top-level.

BACK (L1): When a menu level is deeper than the first level, **BACK (L1)** returns one level through the menu system.

NOTE:

Some menu options are not available if a menu has been opened. Acknowledge any changes or press **EXIT (R1)** to return to the top-level when finished with the open menu. **MENU (R1)** is displayed when the menu system is at the top level.

NOTE:

During Step-By-Step procedures, use ❶ (PFD or MFD BTM area), ❶ or ❷ (MFD) as applicable to select then push to enter.

Soft menu tiles: Used (even at the top-level) and are annunciated in a dedicated, blacked-out area in the screen margins adjacent to the appropriate IDU button or knob when appropriate.

Selection list: Menus adjacent to knobs are frequently a selection list. Within lists, a two-dot trailer **ILS..** indicates further menu levels. Lists too long to be presented in the space available provide an indication of location within the list.

Menu messages are displayed adjacent to the knobs when appropriate. Menu messages are cleared if any IDU button is pressed or knobs ❶, ❷, or ❸ are pushed or rotated.

Further menu levels

Without further menu

A filled triangle next to a menu legend means the button press leads to a further menu level. A hollow triangle next to a menu legend means the button press is a final action.

Figure 3-2: Indication of Further Menu Levels

3.1.2. Avoidance of Autonomous Behavior

The Displays are designed to be under the control of the pilot to ensure critical functions are placed at the top level (i.e., **TO ESSNTL**). Autonomous changes in function are avoided to the most extent possible. The following autonomous behaviors incorporated into the IDUs, all of which are required by regulation or guidance.

Automatic popup of flight instruments: For IFR approval in aircraft, flight instrument information essential to flight safety must remain available to the pilot without additional crewmember action after a failure. This guidance is specific to flight instruments, but it does not address powerplant or navigation instruments. This requirement is met by assigning an order of precedence of the IDUs based upon the IDU number. The PFD always shows the essential flight instruments, because the PFI page is always shown in the top area. Lower priority IDUs monitor the higher priority IDU via intra-system communications and automatically switch to Essential mode upon determining the higher priority IDU has failed.

TAWS popups: When an FLTA alert is generated, a popup function enables PFI SVS and activates terrain at an appropriate scale and format on the moving map page (one of the multi-function pages). This is a required function of TSO-C151b (Class A, B and C TAWS are described in Section 7 Terrain Awareness Warning System.)

Traffic popups: See Traffic appendix

3.2. Menu Synchronization

System settings changed by the menu system are synchronized between multiple IDUs and between top and bottom areas in MFD-MFD mode according to Table 3-1. All parameters for fixed wing aircraft are included. Each appendix for Traffic, Strikes, Datalink, WX-RDR, and Video contains specific limitations for menu synchronization for that feature.

Table 3-1: Menu Synchronization

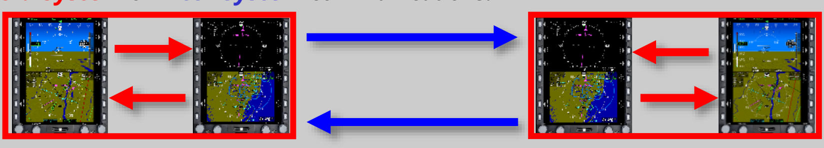
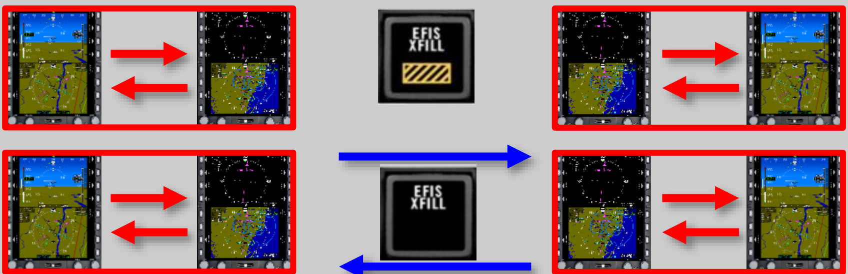
Menu Parameter	Notes
*The following menu parameters are always synchronized across all displays. These are bugs and fundamental aircraft values that should never have independence. **Intra-System** or **Inter-System** communications.* 	
AHRS 1 and 2 mode and slewing values	
Fuel Totalizer Quantity	When configured and enabled
VNAV Climb Angle	
Countdown Timer Start Time	
Countdown Timer Default Value	
Remote Tune Frequencies	When enabled
VNAV Descent Angle	
G-Force Limit Parameters	
Decision Height Setting	Dependent upon EFIS Limits “Dual DH enabled”
Emergency and Minimum Fuel Settings	When enabled

Table 3-1: Menu Synchronization

Menu Parameter	Notes
Heading Bug and Heading Sub-Mode	
Minimum Altitude Bug Value	
VLOC OBS Settings	
Roll Trim Parameter	When equipped and enabled
Airspeed Bug Setting	
Target Altitude Bug Setting	
Timer Starting Signal	When configured and enabled
True North Mode	
Settable V-Speeds	
VSI Bug Setting	
Crosslink Synchronization Status	
TCAS-II control parameters	
Transponder Selection	

The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited. ***Intra-System*** *or* ***Inter-System*** *communications.*

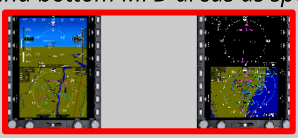
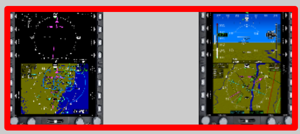


Menu Parameter	Notes
Active Flight Plan Parameters	
Runway Display Parameters	

The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference. ***Intra-System*** *communications.*

Menu Parameter	Notes
Sensor Selections	

Table 3-1: Menu Synchronization

Menu Parameter	Notes
Barometric Setting Parameters (Baro, Transition alt, Set QFE Baro)	
Intra-System Setting Parameters	When configured and enabled
Decision Height Setting	Dependent upon EFIS Limits “Dual DH not enabled”
Active Navigation Source	
Horizon Synchronization Parameters	
PFD Basic Mode	
PFD Zoom Mode	
Navigation Preview Source	When enabled
PFD Analog AGL	
PFD Full-time Bank Scale	
PFD Flight Director	
PFD Mini Map	
PFD Altitude (meters)	
PFD Skyway	
PFD Terrain	
Rate of Turn Indication	
UTC Offset (Time Zone)	
The following menu parameters are independent between displays. These are used to support non-PFI area display options to give the pilot maximum MFD operating flexibility. Note that some of these parameters are also independent between top and bottom MFD areas as specified in the notes.  	
CPU Type	To support mixed CPU type installations
MFD Show ETA	
Essential Mode Status	Support for reversion
MFD Map and HSI Page (DCLTR) Pointer Settings	Independent between top and bottom MFD areas
MFD Map Function Declutter Settings	
MFD Map NavData® Symbol Declutter Settings	
MFD Selected Page	
MFD Map Page Settings	
DVI Mode Status	Support for DVI option

3.3. Top-Level Menu

The top-level menu consists of soft menu options along with option labels for the knobs. Under certain conditions, soft menu tiles automatically appear and may be shown for a significant period, or until acknowledged.

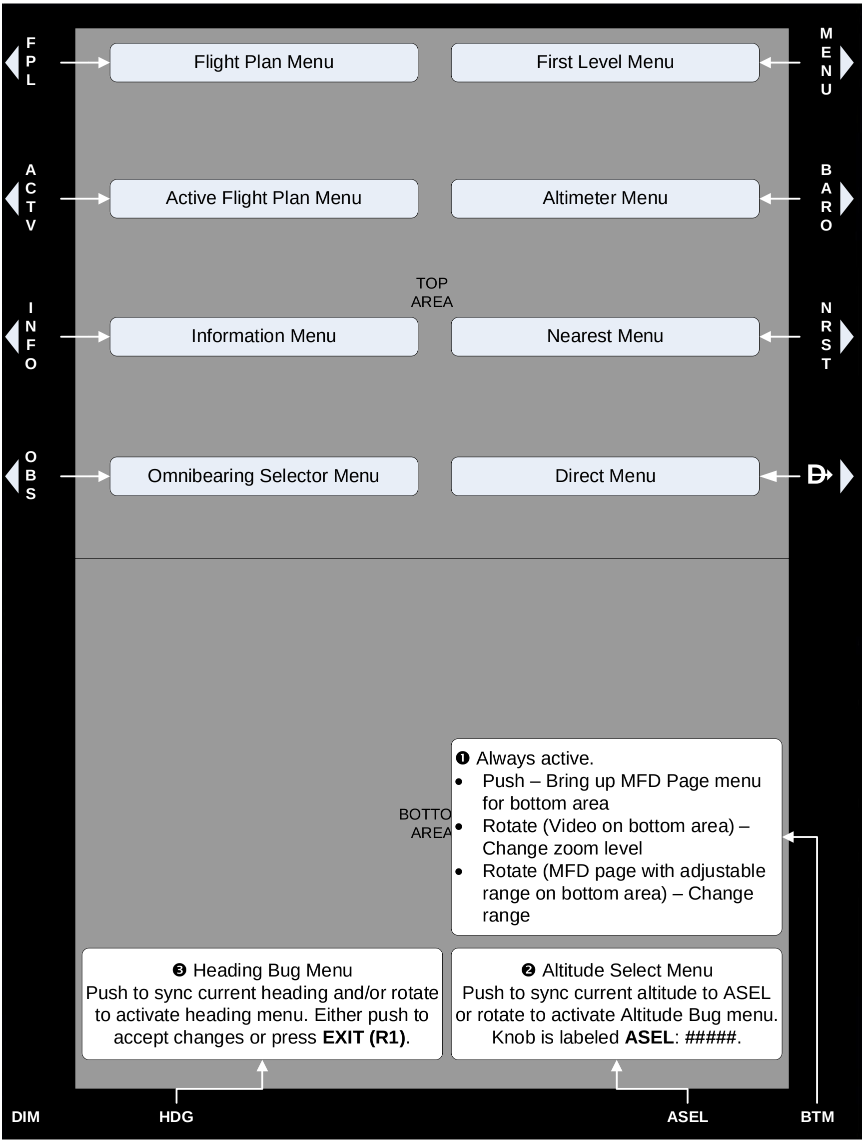


Figure 3-3: PFD Top-Level Menu

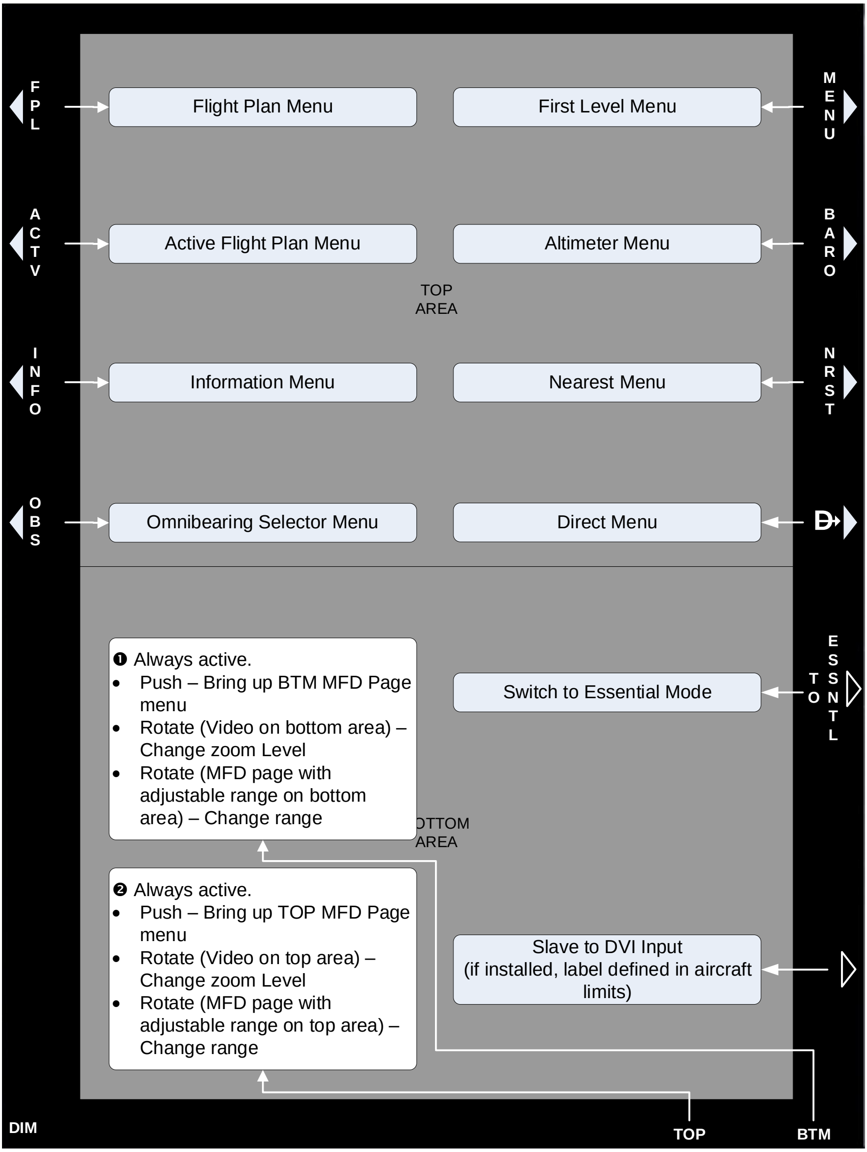


Figure 3-4: MFD Top-Level Menu (Normal Mode)

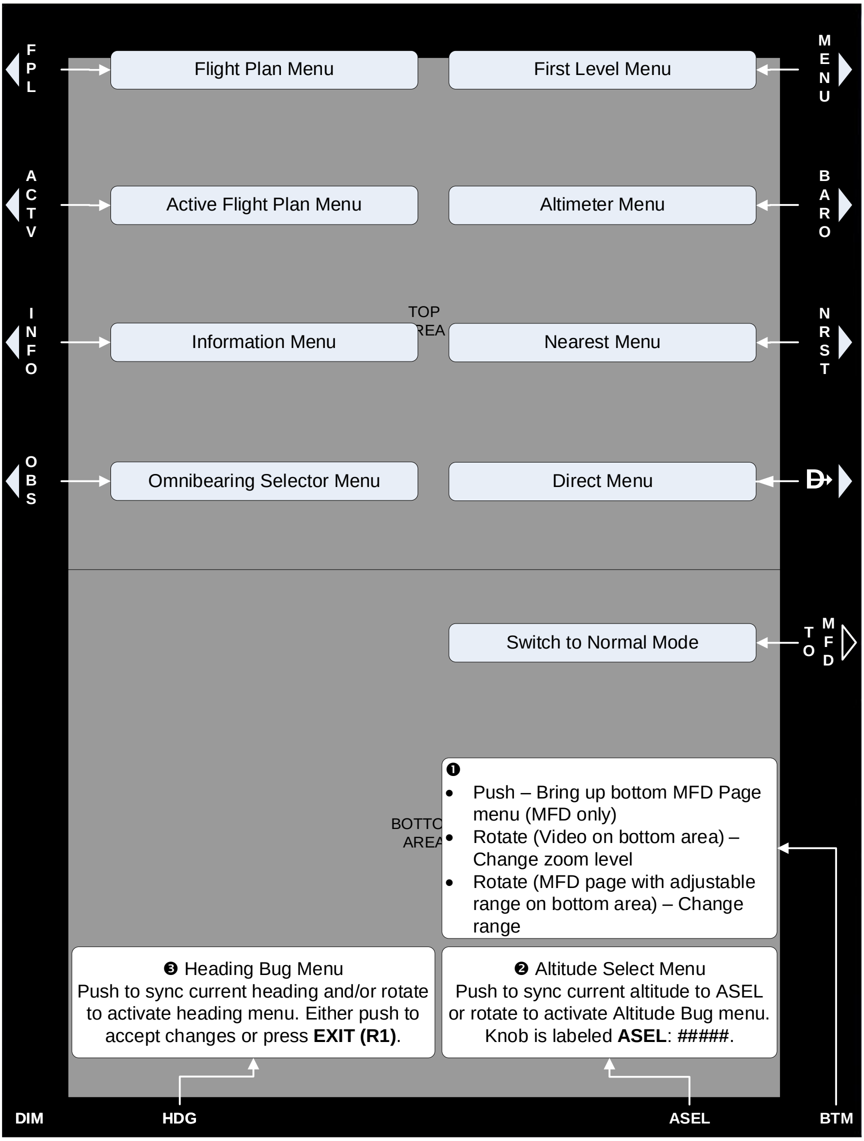


Figure 3-5: MFD Top-Level Menu (Essential Mode)

3.4. First-Level Menu

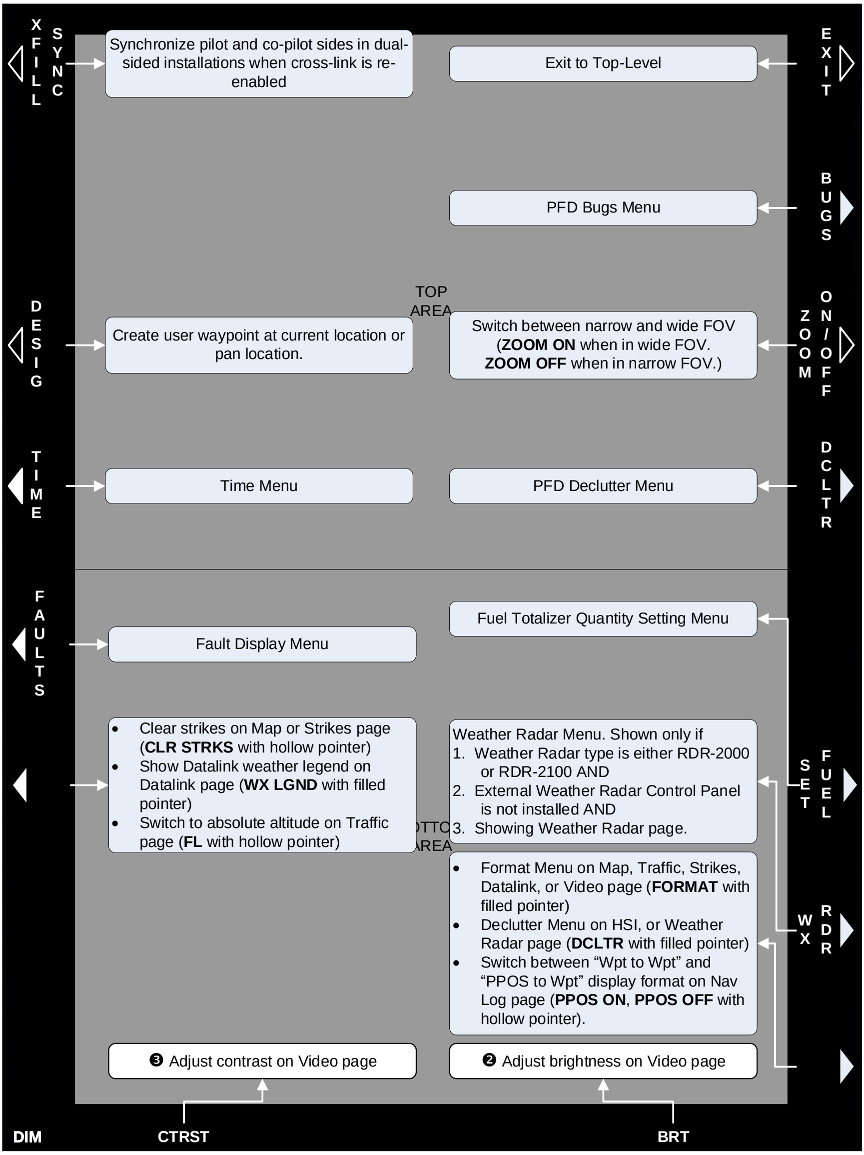


Figure 3-6: PFD First-Level

Top area of the PFD is fixed to the PFI. First-level options are shown adjacent to the top eight buttons. Options may also appear on the bottom eight buttons as appropriate to the MFD page shown in the bottom area. Crossfill status is controlled in the PFD first-level menu.

Table 3-2: Crossfill Inhibit/Arm/Sync Function

<table>
<tr><th rowspan="2">Crossfill [1]</th><th rowspan="2">Flight Plan</th><th rowspan="2">Indication (Pilot and Co-pilot)</th><th colspan="2">Action to Synchronize Flight Plans</th><th rowspan="2">Result</th></tr>
<tr><th>Pilot</th><th>Co-pilot</th></tr>
<tr><td>Enabled (Cond.1)</td><td>Synchronized</td><td>None</td><td>None</td><td>None</td><td>No action required. Pilot and co-pilot sides already synchronized</td></tr>
<tr><td rowspan="2">Enabled (Cond.2)</td><td rowspan="2">Not Synchronized [2]</td><td rowspan="2">XFILL ARM</td><td>MENU (R1) XFILL SYNC (L1)</td><td>None</td><td>Pilot's flight plan is sent to co-pilot side and both sides are synchronized going forward. XFILL ARM is removed from both sides.</td></tr>
<tr><td>None</td><td>MENU (R1) XFILL SYNC (L1)</td><td>Co-pilot's flight plan is sent to pilot side and both sides are synchronized going forward. XFILL ARM is removed from both sides.</td></tr>
<tr><td>Inhibited (Cond.3)</td><td>Not Synchronized</td><td>XFILL INHBT</td><td colspan="2">Enable crossfill [1] (proceed to Cond. 2)</td><td>XFILL INHBT is removed. XFILL ARM is displayed on both sides.</td></tr>
<tr><td>(1)</td><td colspan="5">Crossfill is inhibited with the use of a latching (ON) crossfill inhibit switch. Crossfill is enabled by releasing this switch (OFF).</td></tr>
<tr><td>(2)</td><td colspan="5">Pilot and co-pilot flight plans can become unsynchronized under the following conditions:
1) Crossfill is inhibited, and pilot and co-pilot flight plans are separately changed before crossfill is re-enabled.
2) Either the pilot or co-pilot side is restarted with an active flight plan on the other side and crossfill enabled.
3) If XFILL FAIL condition exists, and any changes are made to either side flight plans.</td></tr>
</table>

MFD page first-level options are shown adjacent to the area in which the MFD page resides.

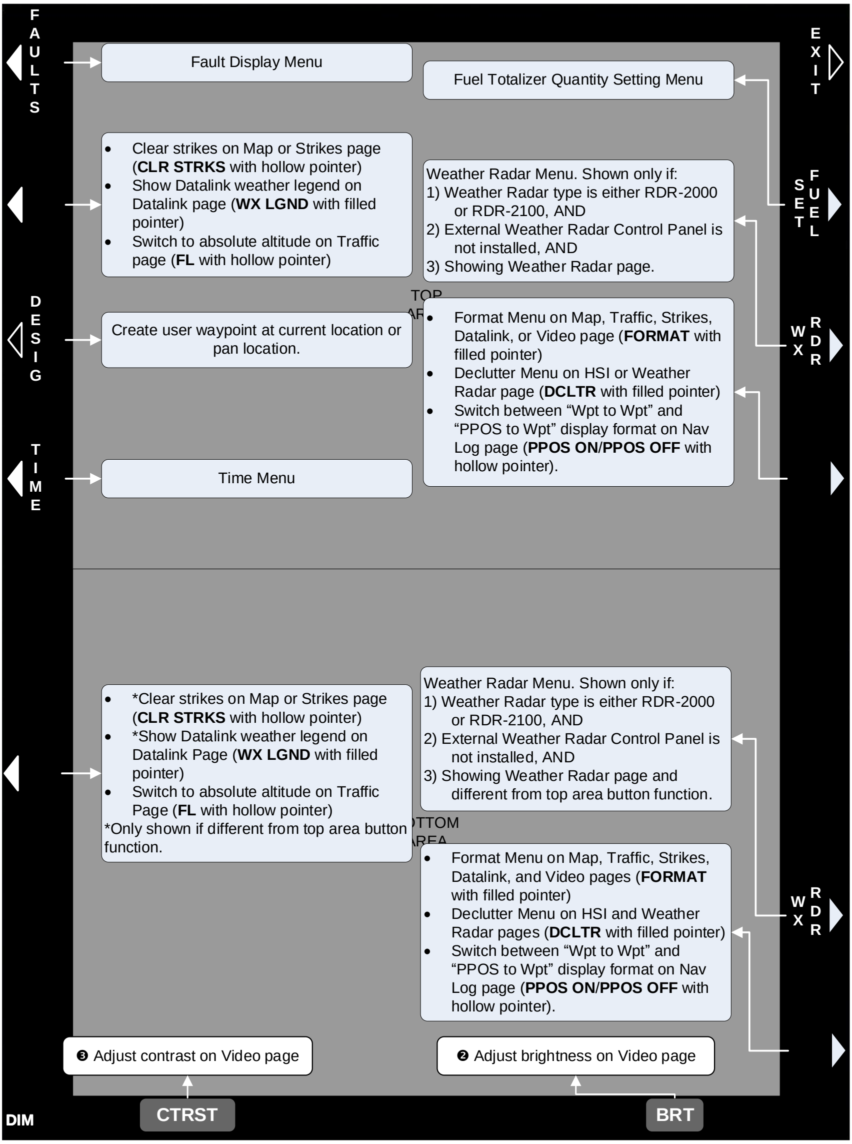


Figure 3-7: MFD First Level (Normal Mode)

3.5. Flight Plan (FPL) Menu

Upon activation of the flight plan menu, the system checks for saved flight plans. If there are no saved flight plans, only **CREATE-EDIT..** knob message appears. Otherwise, a list of saved flight plans is presented. Upon selection of a saved flight plan, the second waypoint in the flight plan is activated.

Flight Plan Limits: Flight plans are stored routes (100 maximum) for repeated use without having to re-enter the waypoints each time. A flight plan consists of at least two waypoints (a start and an end) and may have up to 100 waypoints. Flights requiring more than 100 waypoints are divided into two or more flight plans.

NOTE:

Locked flight plans (preceded by 🔒) are shown first. When selected, the locked flight plan is activated. Locked flight plans are only created, edited, deleted, or reversed with a ground-based utility and are loaded into the system using a ground maintenance function.

3.5.1. Flight Planner Page

Perform following types of functions through the flight planner page on PFD or MFD.

1) Manage stored flight plans (create, activate, edit, reverse, delete, and rename);
2) Manage user waypoints (create, edit, and delete); and
3) Perform RAIM predictions.

These operations demand pilot attention and are not a normal operating condition for the IDU. When the flight planner page is in use, it only appears on the bottom area, it takes over the IDUs controls and disables the menu operations described. Normal menu operation and IDU control function are restored upon:

1) Exiting the flight planner page; or
2) Automatic reversion of the IDU to PFD or essential mode exits the flight planner page and wipes out any changes being performed.

NOTE:

Unless otherwise noted, the following step-by-step procedures are for the PFD or MFD.

Because the flight planner page takes over the IDUs controls, limitations are placed upon access and display of the flight planner page. Selecting the stored flight plan option leads to a list of stored flight plans. Upon selection of a stored flight plan, the second waypoint in the flight plan is activated.

3.5.2. Select Flight Plan on PFD (Step-By-Step)

1) Press **FPL (L1)**.
2) Push ❶ to **SELECT..**
3) Use ❶ to highlight desired flight plan and push to enter.

3.5.3. CREATE-EDIT Menu Selections (Step-By-Step)

1) Press **FPL (L1)**.
2) Rotate ❶ to **CREATE-EDIT..** and push to enter.
3) Use ❶ to select one of the following options:

3.5.3.1. Create Flight Plan

1) Select **CREATE FLIGHT PLAN**.
2) Press **ADD (R6)** to create first waypoint.
3) Use ❶ to create first waypoint or press **NRST APT (L6)**, **NRST VOR (L7)**, **NRST NDB (L8)**, **NRST FIX (R6)**, or **NRST USR (R7)** to view applicable list.
4) If **NRST VOR (L7)** is pressed, rotate ❶ and push to enter desired VOR as the first VOR in the flight plan.
5) A VOR is added, and the highlighted line is advanced to the next position below. Press **ADD (R6)** to create the next waypoint.
6) Continue adding waypoints as described in step above and progress up to as many as 100 waypoints.
7) When a VOR is added to the flight plan, if there is an associated airway, it is available for selection. Rotate ❶ to highlight the VOR and press **INSRT (R6)** and then **AIRWAY (R8)**.
8) Use ❶ to highlight desired end point on airway and push to enter.
9) Press **SAVE (R8)** to save changes to one of the 100 maximum saved flight plans.

3.5.3.2. Activate Flight Plan PFD or MFD

1) **Select ACTIVATE FLIGHT PLAN**.
2) Use ❶ to select desired saved flight plan and push to enter. The selection for activating is accepted. Push to enter.
3) Press **EXIT (R1)** to exit menu and restore to last MFD page on the bottom.

3.5.3.3. Edit Flight Plan on PFD or MFD

1) Select **EDIT FLIGHT PLAN**.
2) Use ❶ to highlight desired flight plan requiring editing and push to enter.
3) Use ❶ to highlight waypoint where another waypoint is to be inserted above and press **INSERT (R6).**
4) Use ❶ to enter desired selection and push to enter, or press **NRST APT (L6)**, **NRST VOR (L7)**, **NRST NDB (L8)**, **NRST FIX (R6)**, or **NRST USR (R7)** to view applicable list, rotate ❶ to desired selection and push to enter.
5) When a VOR is added to the flight plan, if there is an associated airway, it is available for selection. Rotate ❶ to highlight the VOR and press **INSRT (R6)** and then **AIRWAY (R8)**.
6) Use ❶ to highlight desired end point on airway and push to enter.
7) To delete any waypoint, use ❶ to highlight desired waypoint. Press **DEL (R7)** to delete waypoint. Push ❶ to **CONFIRM DELETE WPT**.
8) If flight plan is satisfactory, press **SAVE (R8)** and then **EXIT (R1)** to exit the flight plan menu.

3.5.3.4. Reverse Flight Plan on PFD or MFD

1) Select **REVERSE FLIGHT PLAN**.
2) Use ❶ to select desired flight plan and push to enter.
3) If no other flight plan to reverse, press **EXIT (R1)**.

3.5.3.5. Delete Flight Plan

1) Select **DELETE FLIGHT PLAN**.
2) Use ❶ to highlight desired flight plan to delete and push to enter.
3) Push ❶ to **CONFIRM DELETE FPL**.
4) The next flight plan is highlighted. If no further deletions, press **EXIT (R1)**.

3.5.3.6. Rename Flight Plan

1) Select **RENAME FLIGHT PLAN**.
2) Use ❶ to highlight flight plan intended to rename and push to enter.
3) Use ❶ to create a new 12-character name for this flight plan.
4) Press **SAVE (R8)** to save changes.
5) If no further renaming is required, press **EXIT (R1)**.

3.5.3.7. Create User Waypoint

User waypoints may be created with three methods:

1) Latitude and Longitude
2) Radial and Distance
3) Overfly/Pan (See Section 6 IFR Procedures)

NOTE:

A maximum of 999 user waypoints may be created and stored.

Duplicate flight plan names or user waypoint names are not accepted.

3.5.3.8. Create User Waypoint (LAT-LON) on PFD or MFD

To create a user waypoint using latitude and longitude, use the following step-by-step procedure.

1) Select **CREATE USER WPT (LAT-LON)**.
2) To name a new user waypoint, rotate ❶ and push to enter up to five-characters and or spaces.
3) With new user waypoint name created, push and or rotate ❶ to proceed through all fields as necessary.
4) Approach bearing preloading depends on mode of flight as follows:
    a) On Ground: Preloaded with current heading
    b) In Flight: Preloaded with “OFF” value.
    c) If desired, specify the approach bearing to user waypoint in degrees 1°-360°. “OFF” disables VFR approaches to the user waypoint.
5) Once all fields are entered, press **SAVE (R7)** to save user waypoint or press D→ **(R8)** to activate/save waypoint as the active waypoint and begin navigation guidance.
6) Changes are saved and user waypoint is saved as one of the 999 user waypoints. EFIS returns to **CREATE FLIGHT PLAN**. Press **EXIT (R1)** to exit menu.

3.5.3.9. Create User Waypoint (RAD-DST) on PFD or MFD

1) Select **CREATE USER WPT (RAD-DST)**.
2) Identifier is automatically named “RD###” where ### is the next available radial distance waypoint number.

3) Use ❶ to enter for reference waypoint and push to enter.

4) If multiple search results appear, a list appears. **INFO (R6)** appears to verify each waypoint information.

5) Use❶ to highlight desired waypoint and push to enter.

6) Use ❶ to enter the radial entry and distance from desired waypoint.

NOTE:

RADIAL/DIST values, (1-360° and .1NM/KM-200NM/KM).

7) Press **SAVE (R7)** to save user waypoint or press **(R8)** to activate/save as the active waypoint and begin navigation guidance.

3.5.3.10. Edit User Waypoint on PFD or MFD

1) Select **EDIT USER WPT**.

2) **EDIT WHICH USER WAYPOINT:** Rotate ❶ to desired waypoint to be edited and then push to enter.

3) Use ❶ to edit all fields and then push to enter.

4) Either press **SAVE (R7)** to save edited user waypoint or **(R8)** to begin navigational guidance.

5) If no more waypoints to be edited, press **EXIT (R1)**.

3.5.3.11. Delete User Waypoint on PFD or MFD

1) Select **DELETE USER WPT**.

2) Use ❶ to highlight desired waypoint to be deleted and push to enter.

3) Push ❶ to **CONFIRM DEL USER WPT**.

4) If no more waypoints to delete, press **EXIT (R1)**.

NOTE:

Changes to user waypoint parameters while in flight are not automatically updated to an active flight plan containing that user waypoint.

When changes are made to a user waypoint, and those changes are desired in existing flight plans which use the waypoint, it must be deleted and replaced in the flight plans with the following steps:

1) Edit the user waypoint (see § 3.5.3.10).

2) Edit the flight plan that uses the user waypoint (see § 3.5.3.3);

3) Delete the existing user waypoint from the flight plan;

4) Insert the user waypoint again (if desired);

5) Save and exit;

6) Reload the flight plan if it was in use.

3.5.3.12. RAIM Prediction on PFD or MFD

When selected, the RAIM prediction screen is only shown if the GPS/SBAS receiver can perform a RAIM prediction (not suitable for en route predictions). This requires there be no faults along with a current almanac in memory. Check Faults menu (on PFD or MFD) to determine if the GPS/SBAS receiver can perform a RAIM prediction.

1) Select **RAIM PREDICTION**.

2) Use ❶ enter to the desired waypoint and select **INFO (R6)** to verify the waypoint.

3) Use ❶ to enter **UTC TIME:** and **UTC DATE:**.

4) Press **CALC (R6)** to check RAIM predictive status.

5) If another RAIM prediction is necessary, press **START OVER (R6)** or press **EXIT (R1)**.

NOTE:

The pilot may perform RAIM prediction at a designated waypoint. The screen has various data entry boxes as follows:

1) Designated Waypoint: Enter an identifier for the designated waypoint. If there is a single result from the search, the pilot is advanced to the UTC time entry box. If there is no result from the search, the pilot is re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers is presented and, upon selection, the pilot is advanced to the UTC time entry box. **INFO (R6)** gives information for the highlighted results.

2) UTC Time Entry: Enter the 24-Hour UTC estimated time of arrival at the designated waypoint.

3) UTC Date Entry: Enter the UTC estimated date of arrival at the designated waypoint.

4) PRN Mask Entry: Specification of the PRN number of satellites expected to be unavailable at the destination.

5) EXIT: Exit the RAIM prediction screen at any time.

6) Once a designated waypoint and UTC estimated time of arrival are entered, **CALC (R6)** appears. Press **CALC (R6)** to check the UTC estimated time of arrival and ensure it is within the current almanac (i.e., <3.5 days from current date and time). If it is, a predictive FDE request message requesting "detection availability" with a required HAL of 0.3NM is sent to the GPS/SBAS receiver. In response, the GPS/SBAS receiver replies with a sequence of predictive FDE response messages. These messages are parsed and used to fill in the RAIM prediction result area at the bottom of the screen. The RAIM prediction result area shows the RAIM prediction results as "OK" or "XX" for ETA ± in 5-minute increments. Once a prediction is complete, press **START OVER (R6)** to perform another prediction (if necessary) without exiting the RAIM prediction menu.

3.6. Active Flight Plan (ACTV) Menu

See Section 6 IFR Procedures for active flight plan description.

The following options allow various modifications for the active flight plan. Upon pressing **ACTV (L2)**, the EFIS checks for the existence of an active waypoint. If there is no active waypoint, **NO ACTIVE WPT** menu message is displayed. Otherwise, a selection list of waypoints in the active flight plan is presented. The waypoint list shows the following:

1) Each waypoint identifier and characterization (default is auto otherwise overfly ("OF") or no radius ("0R") is shown as selected);

2) A symbol designating waypoint type along with any special attributes;

3) VNAV altitudes and offsets associated with each waypoint; and

4) Information related to the flight plan path between each waypoint.

VNAV altitudes are presented in feet or meters and VNAV offsets are presented in NM or KM depending upon the setting of the "Speed Units" system limit. In case of an approach with a final approach segment data block, the VNAV offset associated with the missed approach point is the "GPI" to designate distance to the glide path intercept point.

When courses are presented as part of the path information, they are displayed referenced to either magnetic or True North depending upon the status of the

Truth North mode selection. When distances are presented as part of the path information, they are displayed in NM or KM.

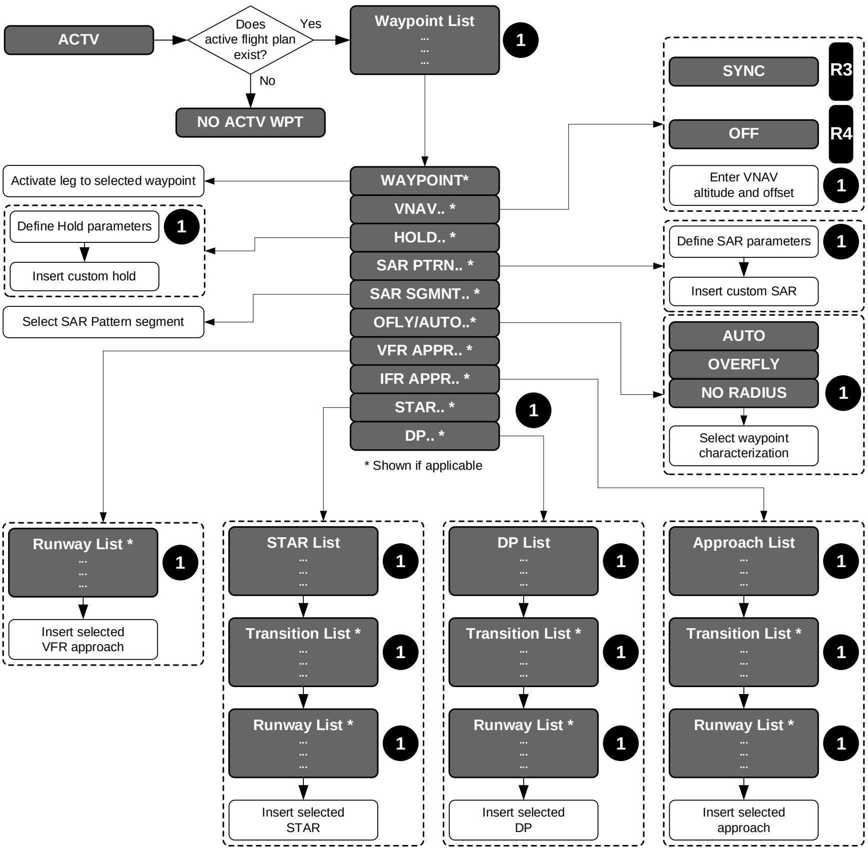


Figure 3-8: Active Flight Plan Menu

VNAV altitudes and offsets that come from the navigation database or that have been manually entered are shown in white. VNAV altitudes and offsets that are computed automatically are shown in gray. The current active waypoint is designated by an asterisk and shown in magenta. The active waypoint color turns amber (yellow) in the event of a GPS Loss of Navigation caution. Any suppressed waypoints are designated by brackets.

3.6.1. Active Flight Plan (ACTV) Menu Options

The active flight plan menu options are defined in Table 3-3. Searches are conducted for 20 items within 240 NM nearest to the waypoint prior to the insertion point or added at the end. If list is empty, (no items within 240NM), **NO RESULTS** message is displayed.

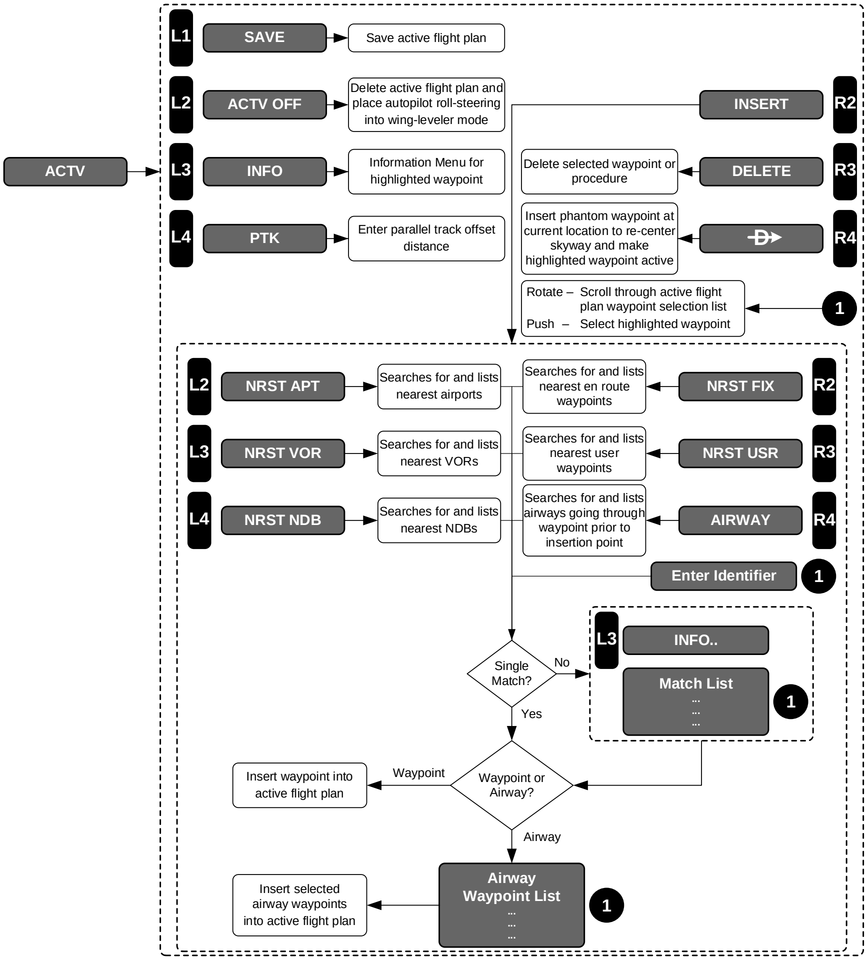


Figure 3-9: Active Flight Plan Menu Options

Table 3-3: Active Flight Plan Menu Options

Menu Options	Action for Active Flight Plan	Limitations
SAVE (L1)	Saves and is part of 100 stored flight plans	Saves without procedures or phantom waypoints. Named by first and last waypoints. For new flight plans with same start and end waypoints but with different routing, a number (1-9) is appended to the name to uniquely identify up to 10 routings with same start and end points.

Table 3-3: Active Flight Plan Menu Options

Menu Options	Action for Active Flight Plan	Limitations
ACTV OFF (L2)	Deletes	Prompted to confirm deletion.
INFO (L3)	Activates information menu for the highlighted waypoint.	With no active flight plan, activates information for nearest airport.
PTK (L4)	If active leg is eligible for offset, allows pilot to specify parallel offset distance in nautical miles or kilometers that applies to the active and contiguous legs.	Range of parallel offsets is from 20 units left or right of track in 1-unit increments. (NM or KM depending on “Speed Units” system limit. **PTK (L4)** is absent if current leg is ineligible for offsetting.
INSERT/ ADD (R2)	Insert or add a waypoint or airway. (See Note below)	**ADD**: At end of active flight plan. **INSERT**: Above highlighted waypoint. **SEARCH**: Requires minimum of two characters. **INFO**: After adding waypoint, appears to aid in selection. **AIRWAY**: Search for all airways going through highlighted waypoint. Offers option to select exit waypoint. After selection, all airway waypoints from the waypoint prior to the insertion point to the desired exit point are added to the flight plan.
NRST APT (L2)	Search for airports of runway length criteria set in EFIS limits.	**INFO**: After adding waypoint, aids in selection.
NRST FIX (R2)	Search for fixes	**INFO**: Provides information and aids in selection and includes datalinked weather information when available and enabled.

Table 3-3: Active Flight Plan Menu Options

Menu Options	Action for Active Flight Plan	Limitations
NRST NDB (L4)	Search for NDBs	**INFO**: Provides information and aids in selection.
NRST USR (R3)	Search for nearest user waypoints	**INFO**: Provides information and aids in selection.
NRST VOR (L3)	Search for nearest VORs	**INFO**: Provides information and aids in selection.
Identifier Entry Box	Area to enter identifier where knob message would normally appear.	Entry of at least two characters and then **SEARCH (R4)** appears to begin immediate search. Selection list may appear, if there are multiple results, to add to the active flight plan. Highlighted result information may include datalinked weather when enabled and available. **INFO**: Provides information and aids in selection.
DELETE (R3)	If highlighted waypoint is a non-procedure waypoint, deletes the waypoint after confirmation.	If highlighted waypoint is a parallel offset entry or exit waypoint is part of a procedure, deletes entire procedure after confirmation. Does not appear if highlighted waypoint is a non-procedure and there are only two non - procedure waypoints in active flight plan. Otherwise, deletes the waypoint. Does not appear if highlighted waypoint is suppressed or one position beyond the end.
 **(R4)**	Inserts phantom waypoint at the current aircraft position and makes the highlighted waypoint active.	Phantom waypoint is a fly-over defined entry waypoint, and leg prior to phantom waypoint is designated a discontinuity. Assures skyway is re-centered for guidance. Does not appear when highlighted waypoint is an undrawn waypoint, phantom waypoint, SAR pattern waypoint, dynamic termination waypoint, or parallel offset entry, or entry waypoint. Otherwise inserts a phantom waypoint at the current aircraft location.

NOTE:

To avoid corruption of IFR approaches, STARs, DPs holding patterns, and SAR patterns, **INSERT/ADD (R2)** does not appear when the highlighted waypoint is:

1) the second or subsequent waypoint of a procedure,

2) suppressed airport and the prior waypoint is part of an approach procedure,

3) a holding point, or

4) a SAR pattern exit waypoint.

When activated, a sub-menu is presented as follows:

For waypoints, if there is a single result, it is inserted or added to the active flight plan. If there is no result, pilot is re-prompted to enter an identifier. If there are multiple results, a list with matching identifiers is presented and, upon selection, the selected waypoint is inserted or added to the active flight plan. **INFO (L3)** aids in selection and gives access to information for the highlighted result.

For airways, this option only appears when an airway transits through the waypoint prior to the insertion point. When activated, a search is performed for all airways going through the highlighted waypoint and matching the entered identifier (i.e., for a list of all Victor airways, Q-routes and T-routes, enter an identifier string of "V", "Q," "T", etc.). If there is a single result, a list of airway waypoints is shown to select the desired pilot selected exit point. If there is no result, pilot is re-prompted to enter an identifier. If there are multiple results, a list with matching airway identifiers is presented and, upon selection, a list of airway waypoints is shown to select the desired exit point. Upon selecting the desired exit point, all airway waypoints from the previous waypoint to the desired exit point are inserted or added to the active flight plan. Each active flight plan has a limit of a maximum of 100 waypoints.

3.6.2. ACTV Menu (Step-By-Step)

1) Press **ACTV (L2)** to view active flight plan. Use ❶ to highlight desired waypoint. Push to enter.

2) Use ❶ to highlight desired option (for example, **VNAV..**), push to select, and then enter desired altitude and offset.

3) As another option, press **DELETE (R3)** to delete the highlighted waypoint.

4) Push ❶ to **CONFIRM DELETE WPT**.

3.6.3. ACTV Hold Menu (Step-By-Step)

1) With desired flight plan selected and activated, press **ACTV (L2)** to view active flight plan.

2) Use ❶ to highlight desired waypoint. Push to enter.

3) Use ❶ to highlight desired option (for example **HOLD..**) and push to enter.

4) Use ❶ to set **COURSE:**, **TURN DIR:**, **LEG DIST:**, or **LEG TIME:**, and push to enter between each entry. (**LEG DIST:** and **LEG TIME:** are mutually exclusive.)

5) The active flight plan automatically appears to show changes. Press **SAVE (L1)** to save as another stored flight plan or press **EXIT (R1)** to save changes and close menu.

3.6.4. ACTV Nearest Menu Option (Step-By-Step)

1) With active flight plan displayed, use ❶ to highlight desired waypoint where a new waypoint is to be inserted above and press **INSERT (R2).** Push ❶ to enter.

2) Press **NRST APT (L2)**, **NRST VOR (L3)**, **NRST NDB (L4)**, **NRST FIX (R2)**, or **NRST USR (R3)** to view applicable list. Rotate ❶ to desired selection and push to insert into active flight plan.

3.7. Information (INFO) Menu

The amount and type of information presented depends upon the type of waypoint as in Table 3-4.

Table 3-4: INFO Menu Information

Type	NAVAID	Airports
Waypoint Identifier Waypoint Type Waypoint elevation Long Name Bearing and distance (in NM or KM depending on speed units setting) Latitude and longitude Sunrise/Sunset times	NAVAID Type Frequency	Communication frequencies Airport runway data Airport elevations are in feet or meters depending on speed units setting

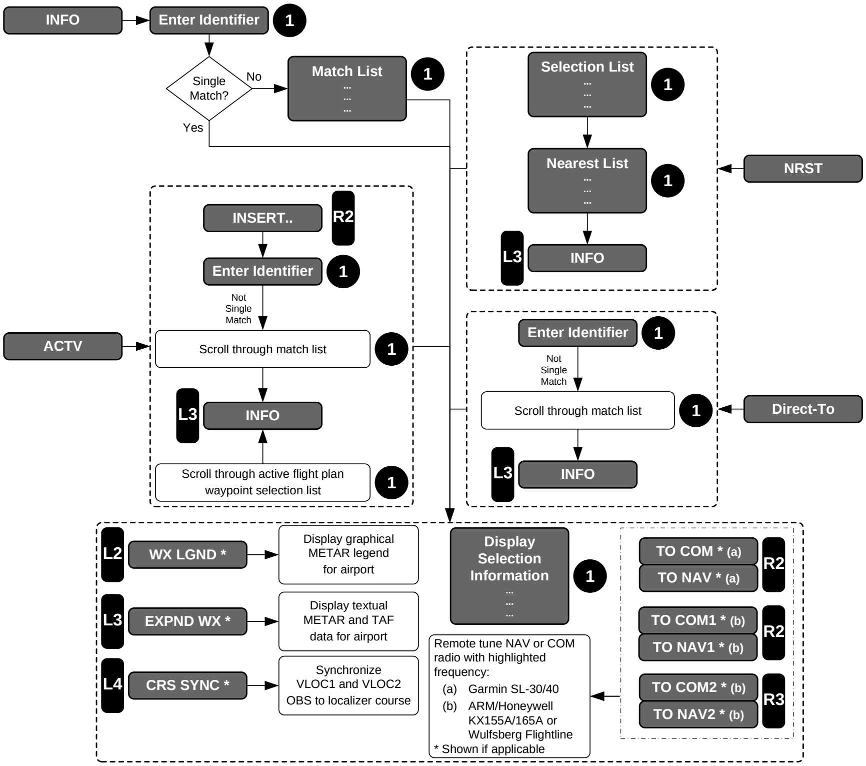
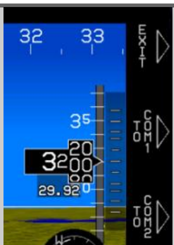


Figure 3-10: Information Menu

Table 3-5: Remote Tuning COM or NAV Radios

	For remote tuning, **TO COM1 (R2)** and/or **TO COM2 (R3)** is shown to allow transmission of the frequency to remote radios when frequencies greater than or equal to 118 MHz are highlighted in the INFO block.
	**TO NAV1 (R2)** or **TO NAV2 (R3)** is shown to allow transmission of the frequency to remote radios when frequencies less than 118 MHz are highlighted in the INFO block.

NOTE:

Frequencies are only sent to either com or nav radios in the standby position. It is up to the pilot to swap frequencies to the active position in the applicable radio.

When information presented is for an ILS or localizer waypoint and the VLOC1 or VLOC2 omnibearing selectors are not synchronized with the localizer course, **CRS SYNC (L4)** synchronizes VLOC1 and VLOC2 omnibearing selectors to the localizer course.

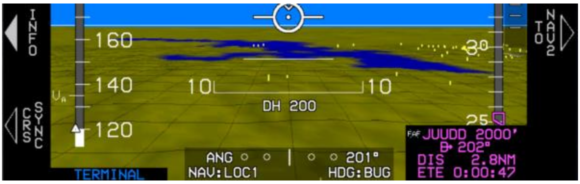


Figure 3-11: CRS SYNC

3.7.1. INFO Menu (Step-By-Step)

1) Press **INFO (L3)** to view active waypoint.

2) Push ❶ to view information.

3.8. Omnibearing Selector (OBS) Menu (without NAV Preview)

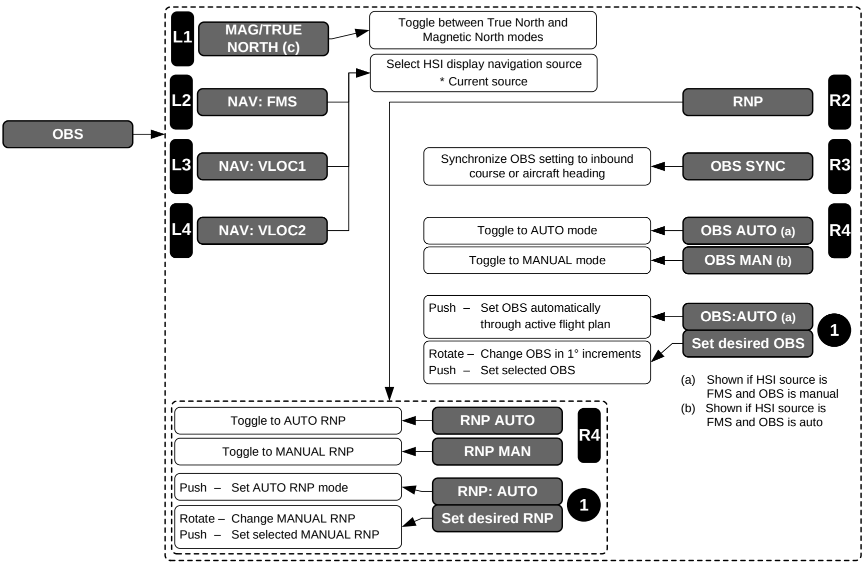


Figure 3-12: Omnibearing Selector Menu (without NAV Preview)

OBS menu allows for control of the omnibearing selector for showing course deviations. When navigation/HSI source is FMS, **OBS AUTO/OBS MAN (R4)** toggles between automatic and manual OBS settings (see Table 3-6).

Table 3-6: Omnibearing Selector (OBS) Menu Options

<table>
<tr><th>OBS (L4)</th><th>OBS SYNC (R3)</th><th>OBS MANUAL (R4)</th><th>Nav Source and CDI Indication</th></tr>
<tr><td>NAV FMS (L2)</td><td>Only available with active waypoint. Synchronizes FMS to inbound course</td><td>Only available with active waypoint. Settable in increments of 1° with ❶</td><td>GPS navigation source: FMS1 or FMS2</td></tr>
<tr><td>NAV VLOC1 (L3)</td><td>Synchronizes VLOC1 or VOR1 to the inbound course or if the inbound course cannot be determined, to aircraft heading.</td><td rowspan="2">Settable in increments of 1° with ❶</td><td>LOC1, VOR1, BC1</td></tr>
<tr><td>NAV VLOC2 (L4)</td><td>Synchronizes VLOC2 or VOR2 to the inbound course or if the inbound course cannot be determined, to aircraft heading.</td><td>LOC2, VOR2, BC2</td></tr>
<tr><td>RNP (R2)</td><td>When selected, allows for RNP(R4)

OBS AUTO (R4) or OBS MANUAL (R4)</td><td>Rotate ❶ to set desired manual RNP value</td><td>Manual RNP is selectable between 0.1NM and 15NM.

0.01 increments RNP 0.1-0.3

0.1NM increments RNP 0.3-2.0

1NM increments RNP 2.0-15

(Values always in NM)</td></tr>
<tr><td>TRUE NORTH (L1)</td><td colspan="3">Toggle TRUE NORTH/MAG NORTH (L1)

If true north mode is not configured in EFIS limits for external switching, use the OBS menu to toggle between true north and magnetic north modes.</td></tr>
</table>

3.8.1. OBS Menu (Step-By-Step)

1) Press **OBS (L4)** to view OBS source, change source selection, or change to **OBS MANUAL (R4)**. (There must be an active waypoint selected to use manual OBS.)

2) To select manual RNP, press **OBS (L4)** and then press **RNP (R2)**.

3) Press **RNP MANUAL (R4)**.

4) Use ❶ to set desired FSD and push to enter to view estimate of position uncertainty required in RNP airspace.

3.8.2. True North and Magnetic North Menu (Step-by-Step)

1) Press **OBS (L4)** to open menu for true north option selection.

2) Press **TRUE NORTH (L1)** (or activate switch if a True North switch is configured in EFIS limits) to change heading from magnetic reference to true. Reference is now true north as seen in heading indications and **TRUE NORTH** advisory flag.

3) Repeat step 1 and then press **MAG NORTH (L1)** to restore heading reference to magnetic north.

3.9. Heading Bug (HDG) Menu

Use the heading bug menu to set the heading bug in increments of 1°, synchronize to current heading, or turn off heading bug.

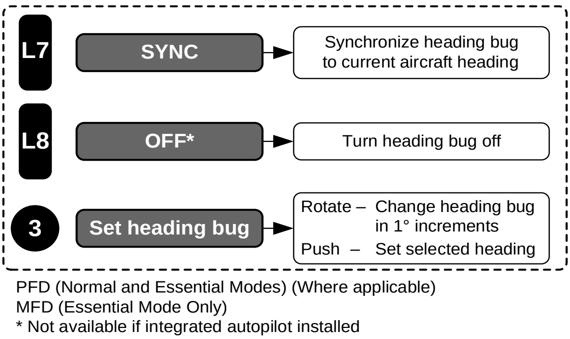


Figure 3-13: Heading Bug Menu

NOTE:

With the heading menu open, push ❸ to enter heading value and exit heading menu or press **EXIT (R1)**. Heading menu does not automatically close without being confirmed or exited.

3.9.1. HDG Menu with Analog Autopilot (Step-By-Step)

1) Use ❸ to enter heading mode and change heading bug in 1° increments.
    a) If desired press **SYNC (L7)** to synchronize to current heading.
2) Use ❸ to select set heading from previous step, or press **EXIT (R1)**, to exit the heading menu.
3) With an autopilot enabled, to change the HDG sub-mode to HDG, press **HDG (L5)** and the autopilot begins receiving left-right steering commands from the filled HDG bug.
4) HDG bug sub-mode is now HDG bug. Press **LNAV (L5)** to return to LNAV sub-mode.

3.9.2. HDG Menu without Analog Autopilot (Step-By-Step)

1) Use ❸ to enter heading mode and change heading bug in 1° increments.
    a) If desired press **SYNC (L7)** to synchronize to current heading.
2) Use ❸ to select set heading from previous step, press **EXIT (R1)**, to exit the heading menu, or press **OFF (L8)** to turn off heading bug.

3.10. Altitude Bug (ASEL) Menu

Use the altitude bug menu to either synchronize the target altitude to current altitude, turn off the target altitude, or set the target altitude increments of 100 units. ASEL bug is mutually exclusive with the VNAV bug.

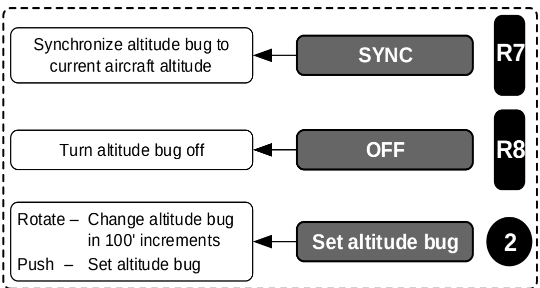


Figure 3-14: Altitude Bug (ASEL) Menu

3.10.1. Altitude Bug (ASEL) Menu (Step-By-Step)

Table 3-7: Altitude Bug (ASEL) Options

Action	Condition	Results
Push ❷	Default ASEL menu OFF ASEL	Opens ASEL menu and sets current altitude as target altitude ASEL:8000

Table 3-7: Altitude Bug (ASEL) Options

Action	Condition	Results
Rotate ❷ and push to enter	Current target altitude ASEL:7600	Sets new target altitude and displays **SYNC (R7)/OFF (R8)**
Press **SYNC (R7)**	ASEL menu open	Synchronize current altitude while climbing or descending to new target altitude
Press **OFF (R8)**	ASEL menu open	Turns off current target altitude

3.11. Nearest (NRST) Menu

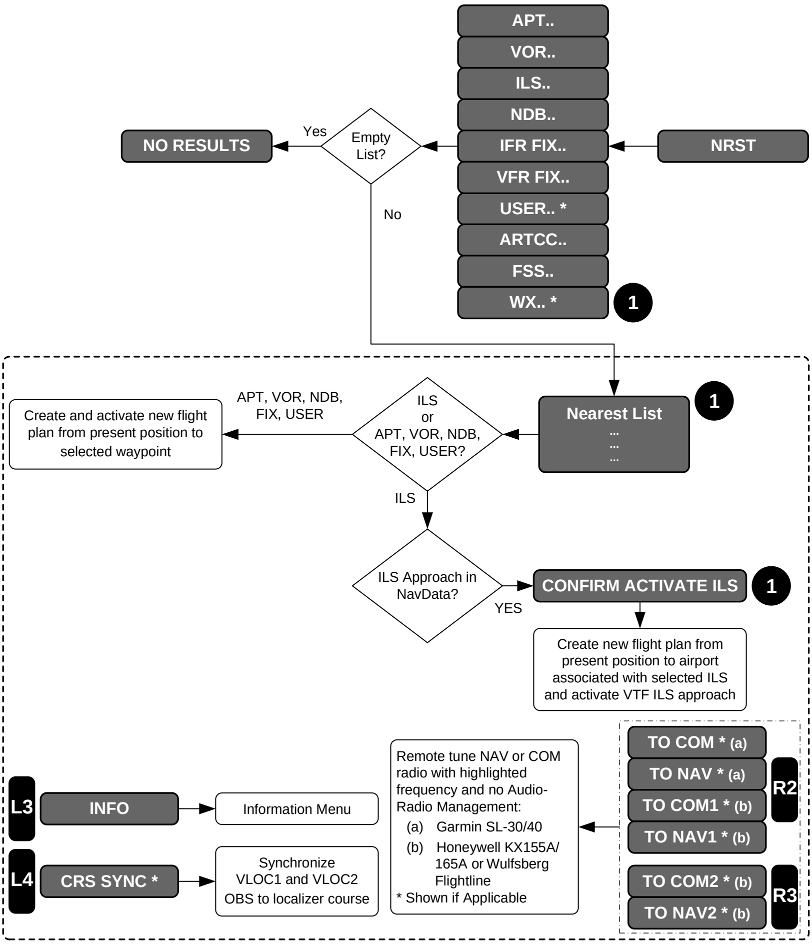


Figure 3-15: Nearest Menu

Nearest (NRST) menu options are defined in Table 3-8. Searches are conducted for 20 items within 240 NM. If list is empty, (no items within 240NM), **NO RESULTS** message is displayed. See § 3.7 for Information menu details. See Section 6 IFR Procedures for NRST Menu ILS step-by-step details. See Section 2 Display Symbology for symbology descriptions.

Table 3-8: Nearest (NRST) Menu Options

Menu Options	Limitations
APT..	Identifier, geodetic bearing/distance to airport, indication of longest runway length in feet, Sunrise/Sunset times in Zulu or local time, and CTAF frequency. List only includes airports with runway length greater than or equal to minimum runway length in EFIS limits.
VOR..	Waypoint symbol, VOR ID, distance and current radial from VOR, and receiver frequency
ILS..	ILS, airport identifier, runway, geodetic bearing to active runway threshold and distance, and localizer frequency (See Section 6 IFR Procedures for details.)
NDB..	Waypoint symbol, ID, geodetic bearing/distance to NDB, and frequency
IFR FIX..	Symbol, fix 5-digit Identifier, airport associated, and geodetic bearing and distance to fix.
VFR FIX..	Waypoint symbol, fix long name, and geodetic bearing/distance to fix
USER..	If existing. Waypoint symbol, assigned name, and geodetic bearing/distance to user waypoint
ARTCC..	RX, TX, or RXTX symbol, facility name, geodetic bearing/distance to antenna, and frequency.
FSS..	RX, TX, or RXTX symbol, facility name, geodetic bearing/distance to antenna, and frequency.
WX..	Type of airport symbol, facility name, and geodetic bearing/ distance to airport
Lengths and elevations are in feet. Distance is in either NM or KM depending upon EFIS setting limits.	

3.12. Direct Menu

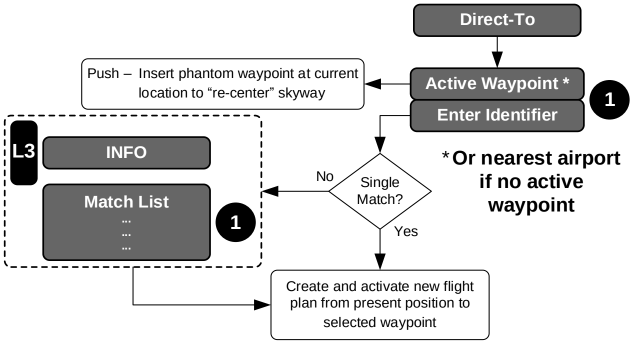


Figure 3-16: Direct Menu

Table 3-9: Direct Menu Options (Default Entry)

	Active Waypoint		Mode	Comments
	Yes	No		
Accepted		✓	Air	New active flight plan created from present position to selected waypoint *
		✓	Ground	A search is conducted for database airport within 6NM/11KM. If found, a new active flight plan is created from found airport to selected waypoint **
	✓		Air or Ground	Prompted to confirm active waypoint. HITS are re-centered with direct routing to active waypoint.
Rejected	Enters waypoint characters		Air	EFIS searches for matching characters. If there is a single result, resulting action depends on air or ground mode.*
			Ground	**
No Results	Re-prompted to enter identifier		Air	If multiple results are presented, a selection list with matching identifiers is presented. *
			Ground	**

* Results when in Air Mode for accepted entry.
** Results when in the Ground Mode for accepted entry.

3.12.1. Direct Menu (Step-By-Step)

1) Press **(R4)** to enter direct menu.

2) Active or nearest airport waypoint appears above ❶ for selection as the active waypoint in the new active flight plan.

   a) If ❶ is rotated, a field appears beginning with "A" to enter the identifier for a new waypoint, press **SEARCH (R4)** (after a minimum of 2 characters have been entered) to open a list of matching waypoints.

3) Use ❶ to enter and create a new active flight plan from the present aircraft position.

3.13. Time Menu

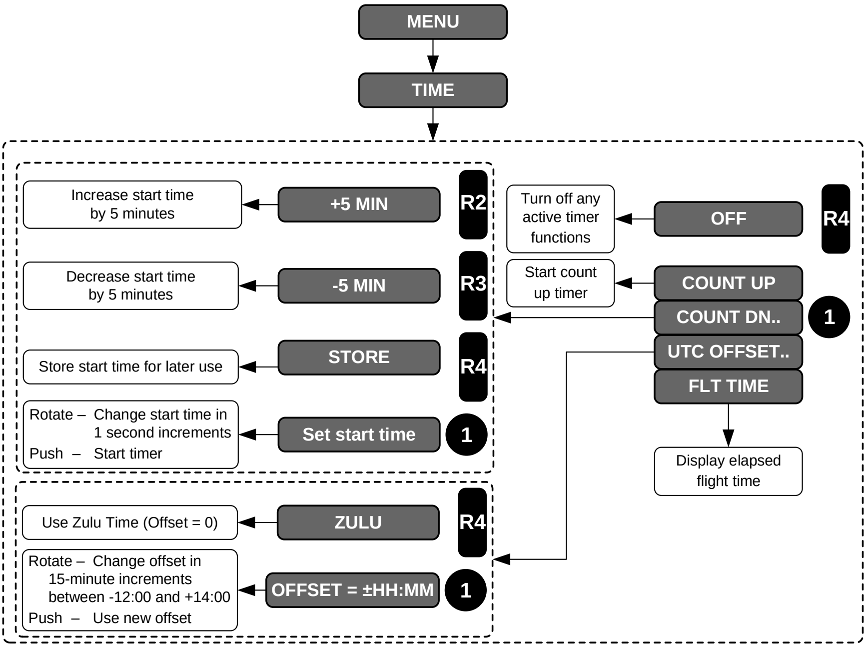


Figure 3-17: Time Menu

3.13.1. Time Menu (Step-By-Step)

1) Press **MENU (R1)** and then **TIME (L4)** to enter Time menu.

2) Use ❶ to select **COUNT UP** or rotate to and push to select and enter **COUNT DN..**, **UTC OFFSET..** (Time Zone), or **FLT TIME**.

3) If **COUNT UP** is selected, a timer appears on the PFI area below bank scale.

4) If **COUNT DN..** is selected, push ❶ to enter.

5) Use ❶ to enter the default 05:00 countdown timer. Press **+5 MIN (R2)** to increase or **-5 MIN (R3)** or decrease by 5-minute increments to set the

countdown timer. (Maximum time is 59 minutes and 59 seconds.) Press **STORE (R4)** to store start time for later.

6) To set offset for local time, rotate ❶ to **UTC OFFSET..** (time zone). Push to enter.

7) Rotate ❶ to desired offset value (time zone). Push to enter. (This is the only place both Zulu and Local time are shown.) Local time now appears. The local time appears after a power cycle and initialization.

8) If **FLT TIME** is selected, the current elapsed time since the aircraft transitioned from ground to air mode is displayed for 10 seconds or until any button is pressed or ❶, ❷, or ❸ are rotated or pushed.

9) If the aircraft has not yet transitioned from ground to air mode, flight time display indicates FLT TM: 00:00:00.

10) To turn off timer, press **MENU (R1)**, within 10 seconds. Press **TIME (L4)**, and then **OFF (R4)**.

NOTE:

When local time is created and local time is present, all ETA references in active flight plan information and Nav Log no longer refers to UTC. Use caution with ATC clearances since they are always based upon UTC. For dual-sided systems, it is possible to have different time zones on each side of the cockpit.

3.14. PFD Source Menu

Upon activating the PFD source menu, an option list of sensor sources appears to select/deselect the following items if external switches are not configured through EFIS limits configuration:

1) ADC1
2) ADC2
3) AHRS1
4) AHRS2
5) GPS1
6) GPS2
7) Radar Altimeter 1
8) Radar Altimeter 2

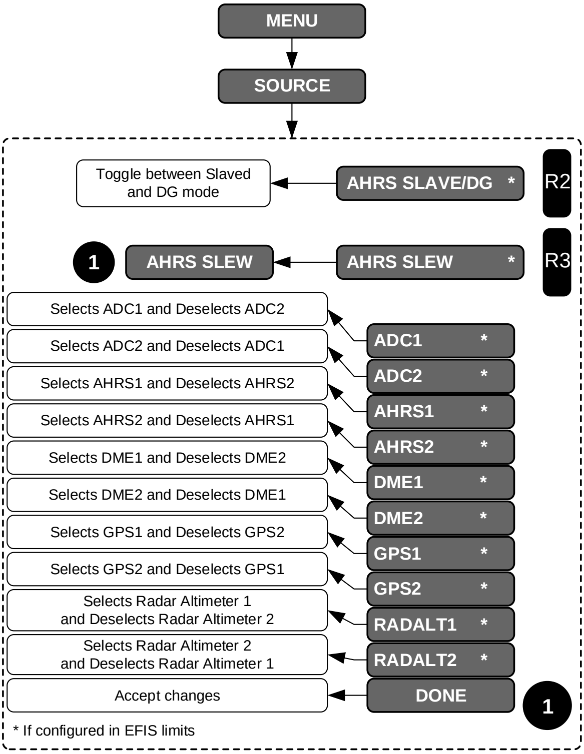


Figure 3-18: PFD Source Menu

3.14.1. Source Selection (Step-By-Step)

1) Press **MENU (R1)**, and then press **SOURCE (L2)**.

2) Use ❶ to check desired source, push to select, rotate to **DONE**, and then push to enter or press **EXIT (R1)**.

3.14.2. AHRS Slave/DG/Slew

If a Genesys ADAHRS is the selected AHRS and a DG/Slave input is not configured for that AHRS, **AHRS SLAVE**/**AHRS DG (R2)** toggles between the two AHRS modes. If in DG mode without slew inputs configured for the selected AHRS, press **AHRS SLEW (R3)** to adjust the DG mode slewing value.

3.15. PFD Bugs Menu

NOTE:

If an optional Remote Bugs Pannel (RBP) is installed refer to the RBP appendix for instructions.

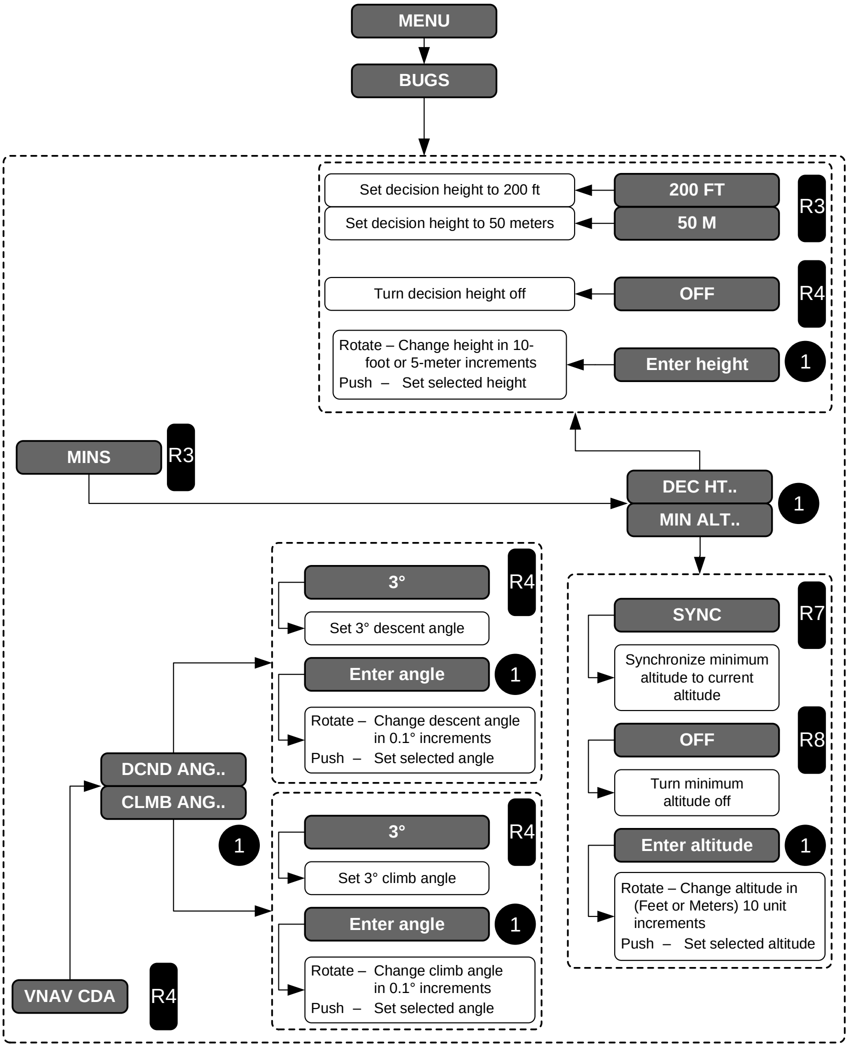


Figure 3-19: PFD Bugs Menu

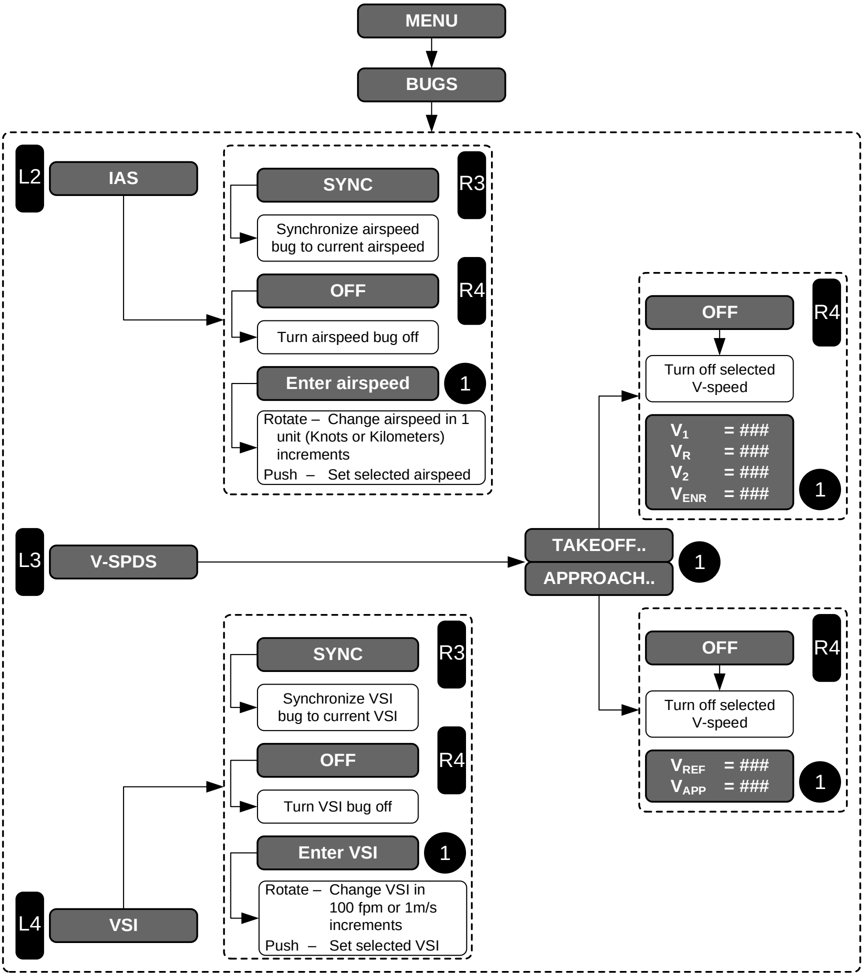


Figure 3-20: PFD Bugs Menu (Continued)

NOTE:

IAS and VSI bugs are mutually exclusive. Selecting one turns off the other.

3.15.1. PFD BUGS Menu (Step-By-Step)

Press **MENU (R1)**, within 10 seconds, press **BUGS (R2)** to enter the Bugs menu, then select one of the following options.

3.15.1.1. Minimums

1) Press either **MINS (R3)** or **VNAV CDA (R4)**.

2) If **MINS (R3)** is pressed, push ❶ to select **DEC HT..** or rotate ❶ to **MIN ALT..** and push to enter.

3) If **DEC HT..** is pushed, rotate ❶ to create new decision height in feet or meters in increments of 10 units (as set in EFIS limits) and push to enter.

4) Press **OFF (R4)** to turn off DH display.

5) If **MINS (R3)** is pressed, rotate ❶ to select **MIN ALT..** and push to enter.

6) Use ❶ to set desired barometric minimum altitude in feet or meters in increments of 10 units and push to enter.

7) Press **SYNC (R3)** to synchronize current altitude or **OFF (R4)** to turn off MIN ALT display.

3.15.1.2. VNAV Climb and Descent Angle

Selection brings up further action to select either climb angle or descent angle. Selecting either option allows the pilot to set the descent or climb angle in increments of 0.1°.

1) If **VNAV CDA (R4)** is pressed, push ❶ to select **DCND ANG..**. Rotate ❶ to create the descent angle (from -0.1° to -20.0°).

2) Use ❶ to set new descent angle and push to enter. Press **3° (R4)** to select default or press **EXIT (R1)** to save changes and return to the top menu level.

3) If **CLMB ANG..** is pushed, rotate ❶ to create the climb angle (from +0.1° to +20.0°), or press **3° (R4)** to set the default value.

3.15.1.3. Vertical Speed Bug

1) If **VSI (L4)** is pressed, press **SYNC (R3)** to synchronize VSI bug to current rate of climb or descent.

2) Press **OFF (R4)** to turn off existing VSI bug or rotate ❶ to desired VSI climb or descent rate in fpm in increments of 100 fpm. Push to enter.

3.15.1.4. Indicated Airspeed Bug

1) Press **IAS (L2)** or **V-SPDS (L3).**

2) If **IAS (L2)** is pressed, press **SYNC (R3)** to synchronize IAS bug to current IAS. Press **OFF (R4)** to turn off existing IAS bug or use ❶ to set desired IAS and then push to enter.

3.15.1.5. V-Speed Bugs

1) Below 1,500' AGL, press **V-SPDS (L3)**. Push ❶ to accept **TAKEOFF..** and then rotate and push to enter in sequence.

NOTE:

V_1, V_R, and V_2 speeds automatically declutter above 2,000' AGL.

2) To set approach bugs using knots or KPH for speed, press **V-SPDS (L3)**, rotate ❶ to **APPROACH..**, and then push to enter.

3) Use ❶ to set desired V_{REF} speed and push to enter. Press **BACK (L1)** to regress in making entries.

4) Use ❶ to set desired V_{APP} speed and push to enter.

3.16. PFD Declutter (DCLTR) Menu

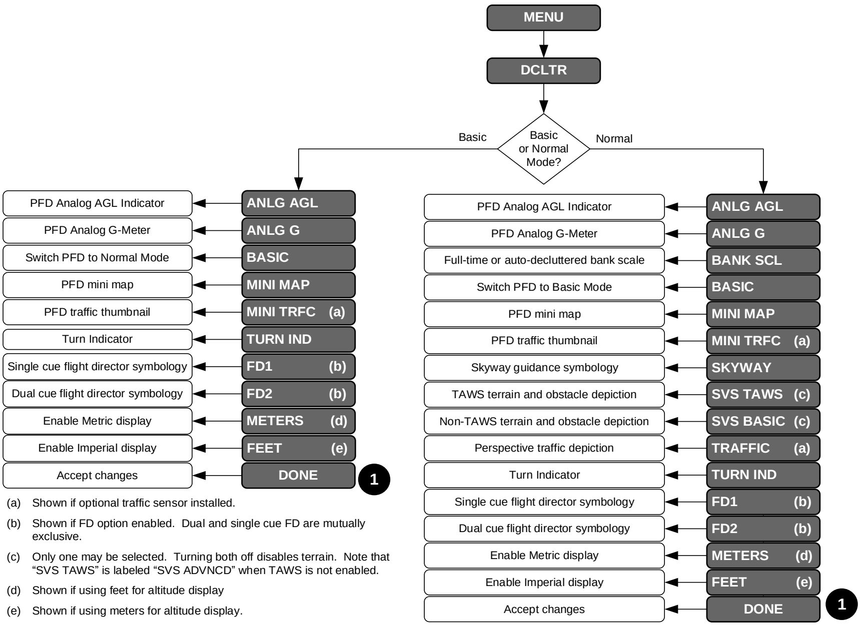


Figure 3-21: PFD Declutter Menu

Upon activation of the PFD declutter menu, an option list of declutter items are shown. If a G-force telltale that can be cleared is being shown, **RESET G (L2)** appears.

3.16.1. PFD DCLTR Menu (Step-By-Step)

1) Press **MENU (R1)** and then press **DCLTR (R4)** to enter Declutter menu.

2) Use ❶ to highlight **ANLG AGL**, **ANLG G**, **BANK SCL**, **BASIC**, **MINI MAP**, **MINI TRFC**, **SKYWAY**, **SVS TAWS**, **SVS BASIC**, **TRAFFIC**, **TURN IND**, **FD1**, **FD2**,

FEET (using meters for altitude), or **METERS** (using feet for altitude). Push to enter.

3) After ensuring desired options are checked, press **EXIT (R1)** or rotate ❶ to **DONE** and push to enter.

4) With both **SVS TAWS** and **SVS BASIC** deselected, the non-TAWS perspective terrain and obstacle depiction is displayed in the PFI area.

5) With **SVS BASIC** selected the PFI area terrain is colored in shades of brown. Slope between adjacent terrain pixels in an increasing longitude direction determines shade used.

6) With **SVS TAWS** selected, the PFI area TAWS perspective terrain and obstacle depiction are shown using color to show relationship to aircraft altitude with terrain colored in shades of olive when at or below 100’ below the aircraft. The slope between adjacent terrain pixels in an increasing longitude direction determines shade used.

7) To save changes and exit menu, rotate ❶ to **DONE** then push to enter or press **EXIT (R1)**.

3.17. Altimeter (BARO) Menu

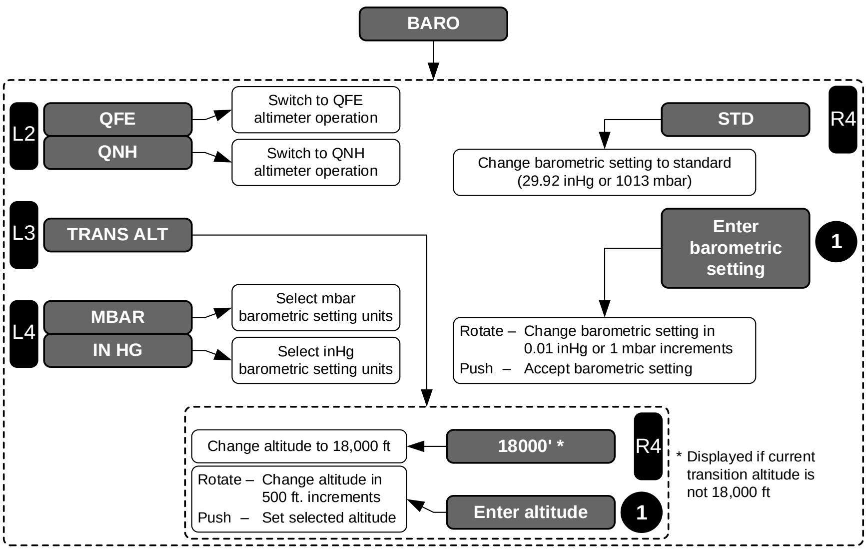


Figure 3-22: Altimeter Menu

3.17.1. BARO Menu (Step-By-Step)

1) Press **BARO (R2)** to enter Altimeter menu.

2) Use ❶ to set proper QNH and push to enter to save changes and return to the top menu level or press **EXIT (R1)**.

3) Repeat step 1. Press **TRANS ALT (L3)** to change transition altitude.

4) Use ❶ to set desired transition altitude in 500' increments and push to enter or press **EXIT (R1)** to enter and exit **BARO** menu. Transition altitude is saved during subsequent shutdown and next initialization.

5) If current transition altitude is not 18,000', **18000 (R4)** appears for quick resetting.

6) With the **BARO** menu open, press **STD (R4)** to set QNH to standard 29.92 inHg or 1013 mbar then push ❶ to accept change and return to the top menu level or press **EXIT (R1)**.

3.18. Fault Display (FAULTS) Menu

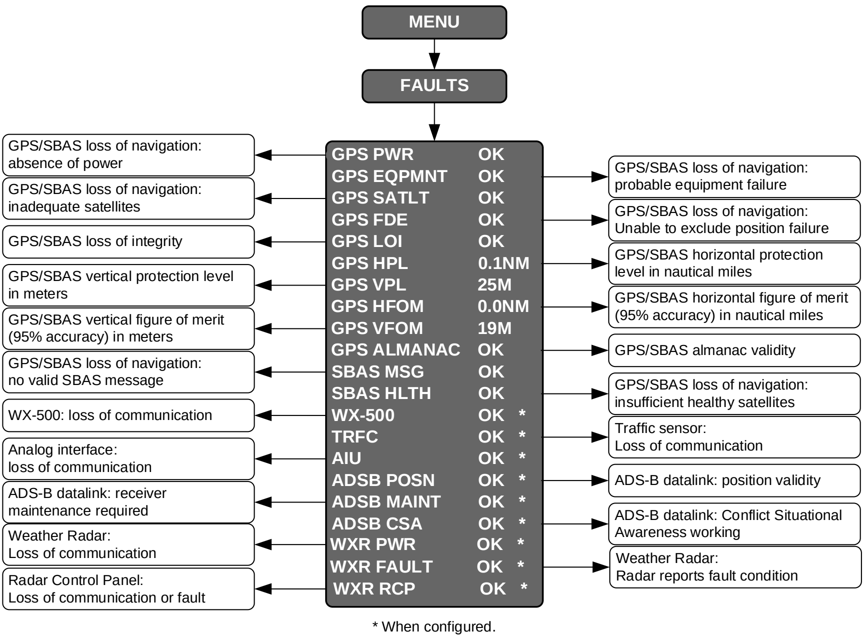


Figure 3-23: MFD Fault Display Menu

Upon selecting the MFD faults menu, status of the following system parameters are displayed.

1) GPS/SBAS loss of navigation due to absence of power (GPS PWR).

2) GPS/SBAS loss of navigation due to probable equipment failure (GPS EQPMNT).

3) GPS/SBAS loss of navigation due to inadequate satellites to compute a position solution (GPS SATLT).

4) GPS/SBAS loss of navigation due to a position failure that cannot be excluded within the time to alert (GPS FDE).

5) GPS/SBAS loss of integrity and loss of navigation due to loss of integrity (GPS LOI).

6) Readout of the current GPS/SBAS horizontal protection level (GPS HPL) in nautical miles. This value may be used as the estimate of position uncertainty required in RNP airspace.

7) Readout of the current GPS/SBAS vertical protection level (GPS VPL) in meters.

8) Readout of the current GPS/SBAS horizontal figure of merit (GPS HFOM) in nautical miles. This value is an indication of the 95% confidence horizontal position accuracy.

9) Readout of the current GPS/SBAS vertical figure of merit (GPS VFOM) in meters. This value is an indication of the 95% confidence vertical position accuracy.

10) An indication of whether the GPS/SBAS receiver has a valid almanac in memory (GPS ALMANAC).

11) GPS/SBAS loss of navigation due to no valid SBAS message received for 4 seconds or more (SBAS MSG).

12) GPS/SBAS loss of navigation due to insufficient number of SBAS HEALTHY satellites (SBAS HLTH).

13) If the WX-500 option is enabled, loss of communications with the WX-500 (WX-500).

14) If the traffic option is enabled, loss of communications with the traffic sensor (TRFC).

15) If the analog interface option is enabled, loss of communications with the analog interface (AIU).

16) If ADS-B datalink/traffic is enabled, an indication of ADS-B position validity (ADSB POSN), an indication of whether maintenance of the ADS-B receiver is required (ADSB MAINT) and an indication of whether the conflict situational awareness algorithm is working (ADSB CSA).

17) If weather radar is enabled, an indication of weather radar power/communication status (WXR PWR X or WXR PWR OK). Weather radar

power/communication status failed (WXR PWR X) reflects that any one of the following conditions are true:

a) Loss of weather radar communication not available or not accepted for more than 2 seconds.

b) Weather radar mode is OFF.

18) If weather radar is enabled, an indication of weather radar fault status (WXR FAULT -, WXR FAULT X or WXR FAULT OK). When weather radar power/communication status is failed, weather radar fault status indicates that determination of weather radar faults is not possible (WXR FAULT –). Weather radar fault status failed (WXR FAULT X) reflects that any one of the following conditions are true:

a) A Cooling Fault Condition exists. Note that for Telephonics RDR-1600, this fault condition is ignored when the commanded mode is TEST.

b) For weather radar types ARINC 708-6 or Collins 800/840, a Display or Control Bus Fault Condition exists.

c) For weather radar types ARINC 708-6, Collins 800/840 or Honeywell PRIMUS, a Calibration or Air Data Fault Condition exists.

d) An Attitude or Range Fault Condition exists. Note that for Telephonics RDR-1600, Attitude Fault condition is indicated by Range Fault condition.

e) A Control Fault Condition exists.

f) A T/R Fault Condition exists.

19) If weather radar is enabled, the weather radar type is RDR-2000, RDR-2100 or RDR-1600 and an external radar control panel is installed, an indication of radar control panel status (WXR RCP X or WXR RCP OK). External radar control panel status failed (WXR RCP X) indicates either loss of communication or a failure status using the same test as invalid data.

20) If weather radar is enabled, an indication of weather radar power/communication status (WXR PWR X or WXR PWR OK). Weather radar power/communication status failed (WXR PWR X) reflects that any one of the following conditions are true:

a) Loss of weather radar communication (not available or not accepted for more than 2 seconds).

b) Weather radar mode is OFF.

21) If weather radar is enabled, the weather radar type is RDR-2000, RDR-2100 or RDR-1600 and an external radar control panel is installed, an indication

of radar control panel status (WXR RCP X or WXR RCP OK). External radar control panel status failed (WXR RCP X) indicates either loss of communication or a failure status using the same test as invalid data.

3.18.1. Faults Menu (Step-By-Step)

Press **MENU (R1)**, within 10 seconds press **FAULTS (L5)** (PFD)/**FAULTS (L1)** (MFD) to open the Faults menu to view the status of GPS and equipment parameters.

3.19. Fuel Totalizer Quantity Setting (SET FUEL) Menu

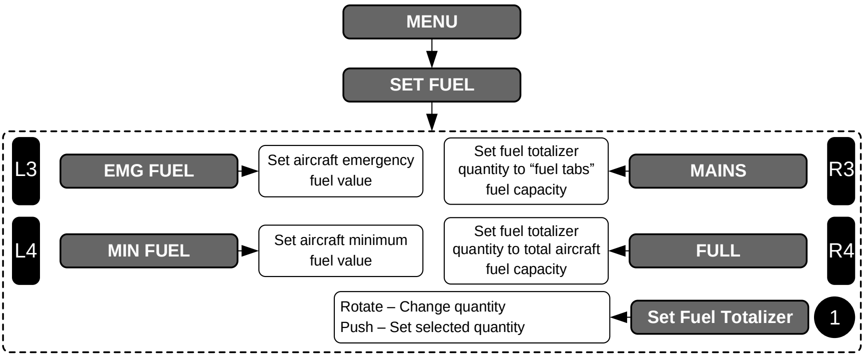


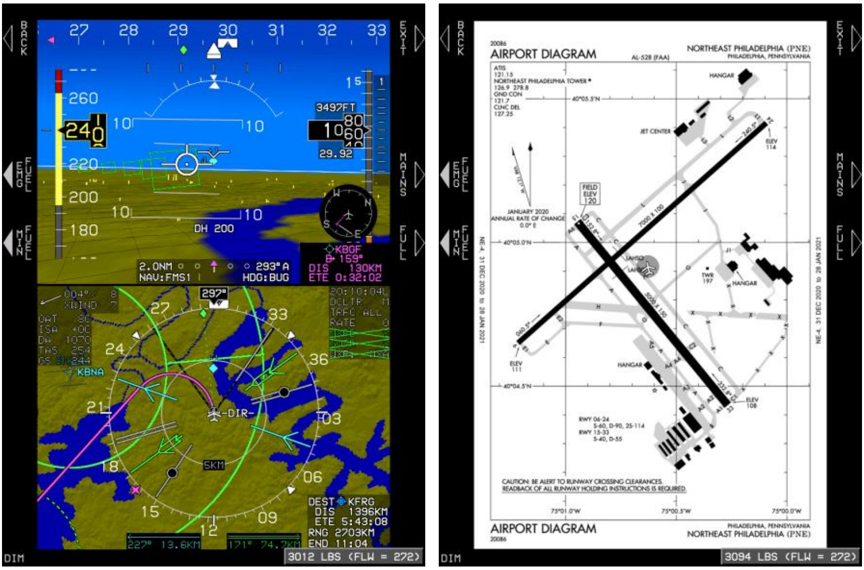
Figure 3-24: Fuel Totalizer Quantity Menu

3.19.1. SET FUEL Menu (Step-by-Step)

1) Press **MENU (R1)** and then press **SET FUEL (R6)** (PFD)/**SET FUEL (R2)** (MFD) to open Fuel Totalizer Quantity Setting menu.

2) Press **MAINS** (**R3**) to set the quantity to the "fuel tabs" fuel capacity. Press **FULL** (**R4**) to set the quantity to the total aircraft fuel capacity. Units of measure and fuel flow are shown in the quantity window when available. If fuel flow is available, current fuel flow is also shown on the Nav Log top area.

3) If an aircraft fuel caution or aircraft fuel warning is configured in the EFIS limits, set **EMG (L3)** and **MIN FUEL (L4)** fuel bugs in increments of volume units.



PFD MFD

Figure 3-25: Fuel Totalizer Quantity Setting (SET FUEL) Menu

3.20. MFD Page Menu

TOP Page Menu (2) → PAGE.. ← (1) BTM Page Menu

MAP	Map page
FULL MAP (a)	Full Map page
HSI	HSI page
NAV LOG	Nav Log page
STRIKES *	Strike page
TRAFFIC *	Traffic page
DATALINK *	Datalink page
WX-RDR *	WX-RDR page
VIDEO *	Video page
NRST APD (b)	Nearest Airport Diagram
IAP APD (b)	Airport Diagram for IAP
APPR PLATE (b) (1)	Approach Plate for IAP

* When configured.

(a) Shown other than IDU #1.

(b) CPM5 or above with chart database only. Shown as full page portrait images. Not shown on PFD nor when MFD is in Essential mode or while flight planning.

NRST APD - if an airport diagram exists for one of the nearest 3 airports.

IAP APD - if an airport diagram exists for the instrument approach procedure loaded in the active flight plan.

APPR PLATE - if an approach plate exists for the instrument approach procedure loaded in the active flight plan.

Figure 3-26: MFD Page Menu

3.20.1. MFD Page Menu (Step-By-Step)

1) Push **TOP** ❷ or **BTM** ❶ to change MFD pages.
2) Use ❶ or ❷ to highlight **MAP**, **HSI**, **NAV LOG**, **STRIKES**, **TRAFFIC**, **DATALINK**, **WX-RDR**, **VIDEO**, **NRST APD**, or **FULL MAP** and push to enter.

3.21. MFD Map Page Format Menu

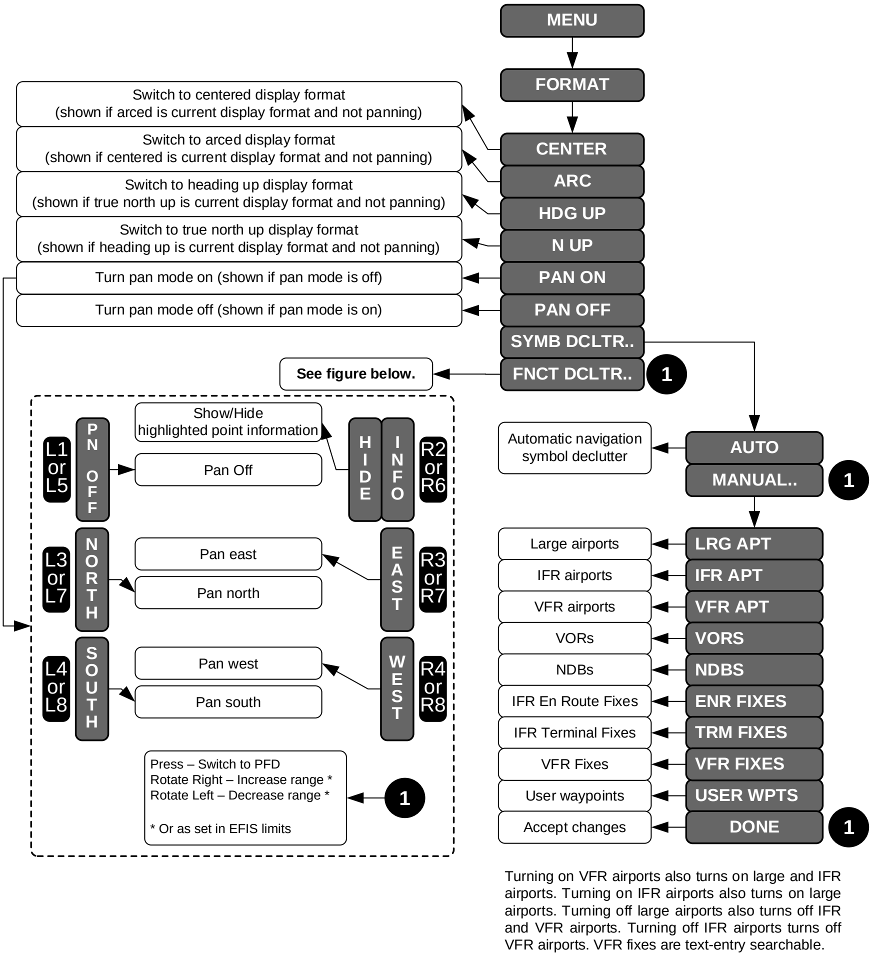


Figure 3-27: MFD Map Page Format Menu

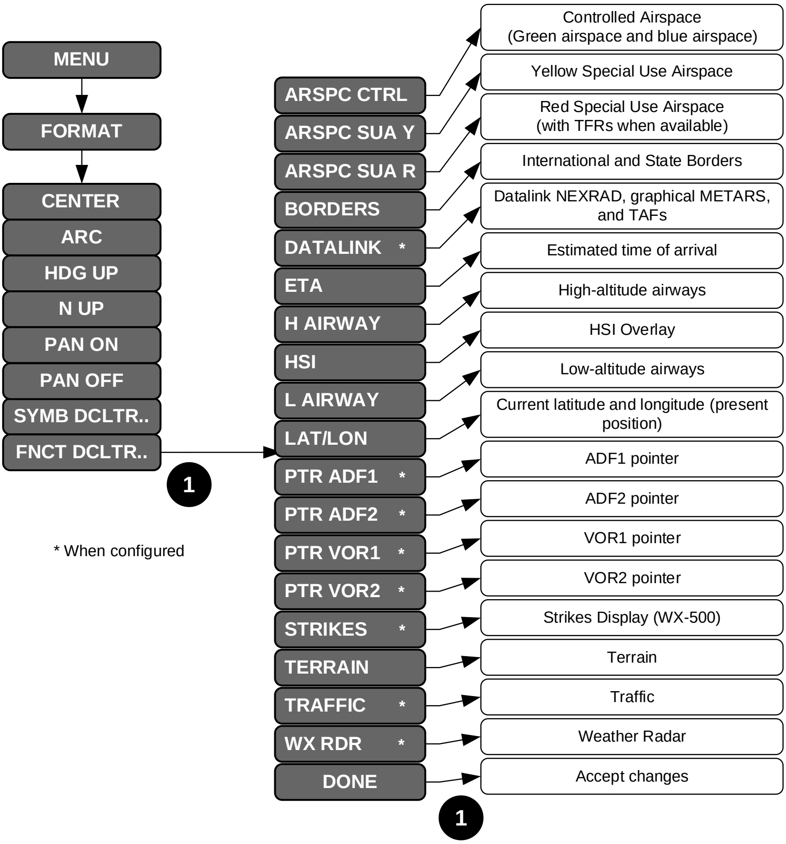


Figure 3-28: MFD Map Page Format Menu (Continued)

3.21.1. MFD Map Page Format (Step-By-Step)

3.21.1.1. Changing MFD Map Orientation (Step-By-Step) (PFD or MFD)

1) Press **MENU (R1)**. Then press **FORMAT (R4)/(R8)**.

2) If in arc mode, use ❶ to highlight **CENTER** then push to center display.

3) If in center mode, use ❶ to highlight **ARC** then push to change back to ARC mode.

4) If in HDG UP mode, use ❶ to highlight **N UP** then push to change display to North Up orientation.

5) To enter pan mode, use ❶ to highlight **PAN ON** then push to enter.

6) Use **NORTH (L3)/(L7)**, **SOUTH (L4)/(L8)**, **EAST (R3)/(R7)**, and **WEST (R4)/(R8)** to move the cursor. Bearing and distance appear when more than 0.5 NM/1.0KM away.

7) Press **INFO/HIDE (R2)**/**(R6)** to view or hide waypoint information.

8) To turn off pan mode, press **PN OFF (L5)**, or **MENU (R1)**, then **FORMAT (R4)**/**(R8)**, and then push ❶ to select **PAN OFF**.

3.21.1.2. Adding LAT/LON to MFD Map Page (Step-By-Step)

1) Press **MENU (R1)**, press **FORMAT (R4)**/**(R8)**.

2) Use ❶ to highlight **FNCT DCLTR..** and push to enter.

3) Use ❶ to highlight **LAT/LON** then push to select. Use ❶ to create **USER WPT** name and all fields including **APP BRG** if desired. Either press **SAVE (R7)** to save edited user waypoint or **(R8)** to begin navigational guidance. Press **EXIT (R1)** to exit menu.

3.21.2. MFD Full Map Page (Step-By-Step) (MFD Only)

1) Push **TOP** ❷ or **BTM** ❶ and rotate to **FULL MAP** and push to enter.

2) To format the full map, press **MENU (R1)**, within 10 seconds press **FORMAT (R4)**.

NOTE:

The MFD full Map page formatting is identical to the Map page Format menu except arc and center options are not available.

3.21.3. MFD Symbol and Function Declutter Options (Step-By-Step)

1) Press **MENU (R1)**, within 10 seconds, press **FORMAT (R4)**/**(R8)**. When on the full map page, only **FORMAT (R4)** appears.

2) Use ❶ to highlight **FNCT DCLTR..** then push to enter.

3) Use ❶ to highlight **ARSPC CTRL**, **ARSPC SUA Y**, **ARSPC SUA R**, **BORDERS**, **DATALINK**, **ETA**, **GLIDE**, **H AIRWAY**, **HSI**, **L AIRWAY**, **LAT/LON**, **PTR ADF1**, **PTR ADF2**, **PTR VOR1, PTR VOR2**, **STRIKES**, **TERRAIN**, **TRAFFIC**, or **WX RDR** then push to.

4) Use ❶ to highlight **DONE** then push to enter or press **EXIT (R1**) to save changes and exit menu.

3.21.4. MFD HSI Declutter (DCLTR) Menu

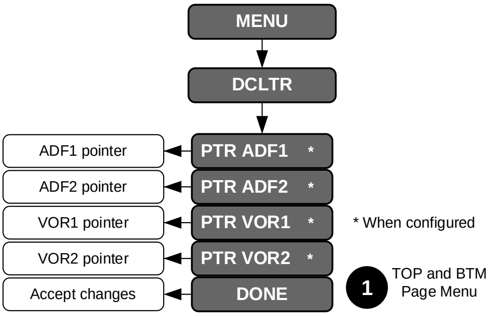


Figure 3-29: MFD HSI Declutter Menu

3.21.4.1. DCLTR Menu (Step-By-Step)

1) Press **MENU (R1),** within 10 seconds, press **DCLTR (R4)**/**(R8)** to enter Declutter menu.

2) Use ❶ to highlight **PTR ADF1**, **PTR ADF2**, **PTR VOR1**, or **PTR VOR2** and push to select. Rotate ❶ to **DONE** and then push to enter or press **EXIT (R1)** to save changes and exit menu.

3.22. NAV LOG Page (PFD or MFD)

See Section 2 Display Symbology for more information.

3.22.1. NAV LOG (Step-By-Step) (PFD or MFD)

1) Push ❶ (PFD or MFD BTM area) or ❷ (MFD TOP area) and rotate to **NAV LOG** and push to enter.

2) With NAV Log displayed, press **MENU (R1)**, within 10 seconds, press **PPOS OFF (R8)** to turn present position off.

3) Repeat step 1, press **PPOS ON (R8)** to turn on.

4) When the NAV Log is on the top area of an MFD, press **PPOS OFF/PPOS ON (R4)** to toggle.

3.23. Electronic Charts Page (MFD Only)

This option is available is certain areas with charts database loaded and a CPM-5 or above. With an instrument approach procedure loaded in the active flight plan, push **TOP** ❷ or **BTM** ❶ and then rotate ❶ to **NRST APD**, **IAP APD**, or **APPR PLATE** and then push to enter.

Section 4 Warning/Caution/Advisory System

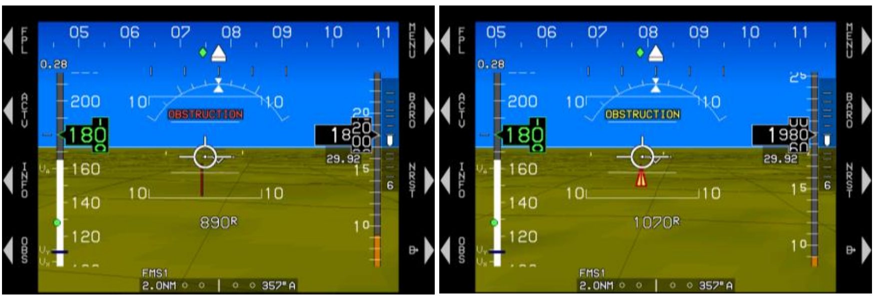
4.1. Warning/Caution/Advisory System

The IDU has an integrated audio/visual warning system, which monitors a wide variety of parameters and provides alerts for conditions that demand pilot action or awareness:

1) Warning Alerts
2) Time-Critical Warning Alerts
3) Time-Critical Caution Alerts
4) Master Visual and Audible/Voice Alerts
5) Caution Alerts
6) Advisory Alerts

All warnings, including time-critical warnings, activate the warning (red) light and master caution light. All cautions, including time-critical cautions, activate the caution (yellow) light and master caution light. Once acknowledged, the flashing behavior stops, the audio alert is interrupted, and the outputs are deactivated (as set in EFIS limits).

4.1.1. Time-Critical Warning and Caution Alerts



Time-Critical Warning

Time-Critical Caution

Figure 4-1: Time-Critical Warning and Caution Alerts

Time-critical warning and caution alerts trigger the following elements (Table 4-1) and display in the pilot's primary field of view with a shaded background (Figure 4-1). EFIS limits may have enabled the option for time-critical alerts to illuminate a master warning/master caution push button annunciator when equipped.

NOTE:

The following examples show shaded backgrounds on sky and terrain backgrounds for readability.

Table 4-1: Time-Critical Warning and Caution Alerts in Primary Field of View

Alert Type	Text Color	Flash Rate	Audio Alert at Full Volume
WARNING WARNING	Red	2 Hz	Repeated until acknowledged
CAUTION CAUTION	Amber (Yellow)	1 Hz	Plays only once

Table 4-2: Time-Critical Warning and Caution Alerts

Visual Alert	Voice Alert	Condition ** No time delay
OVERSPEED OVERSPEED	"Overspeed, Overspeed"	IAS exceeds redline (V_{NE}/V_{MO}/M_{MO}) plus instrument error. **
STALL STALL	"Stall, Stall"	Activated above 100' AGL if indicated airspeed is below the higher of V_{S1} or V_{S1} corrected for G-load + 5 KIAS.** Deactivated if stall-warning is set to 0.
PULL UP PULL UP	"Terrain, Terrain, Pull Up, Pull Up"	Terrain cell within TAWS FLTA warning envelope. Half-second time delay.
		Within GPWS 2 warning envelope. Half-second time delay.
	"Pull Up, Pull Up"	Within GPWS Mode 1 warning envelope. Half-second time delay.
GLIDESLOPE GLIDESLOPE	"Glide Slope, Glide Slope"	Within GPWS Mode 5 warning envelope. Half-second time delay.
OBSTRUCTION OBSTRUCTION	"Warning Obstruction, Warning Obstruction"	Obstruction within TAWS FLTA warning envelope. Half-second time delay.
TERRAIN TERRAIN	"Warning, Terrain, Warning Terrain"	Terrain cell within HTAWS FLTA warning envelope. Half-second time delay.
TRAFFIC TRAFFIC	"Traffic, Traffic"	Resolution advisory. Not given if own aircraft at or below 400' AGL. Not given if target is at or below 200' AGL (ground target). Audio not generated with TCAS-II system. **

Table 4-2: Time-Critical Warning and Caution Alerts

Visual Alert	Voice Alert	Condition ** No time delay
CHECK GEAR CHECK GEAR	“Check Gear, Check Gear”	Activates if aircraft is below 500’ AGL, is descending, and is below V_{FE} and any landing gear is not down. 2-second time delay.
TERRAIN TERRAIN	“Caution Terrain, Caution Terrain”	Within GPWS Mode 2 caution envelope. Half-second time delay.
		Terrain cell within TAWS FLTA caution envelope. Half-second time delay.
SINK RATE SINK RATE	“Sink Rate, Sink Rate”	Within GPWS Mode 1 caution envelope. Half-second time delay.
TOO LOW TOO LOW	“Too Low Terrain, Too Low Terrain”	Within GPWS Mode 3 envelope. Half-second time delay.
		Within GPWS Mode 4-1 “Too Low Terrain” envelope. Half-second time delay.
		Within TAWS PDA envelope. Half-second time delay.
	“Too Low Gear, Too Low Gear	Within GPWS Mode 4-2 “Too Low Gear” envelope. Half-second time delay.
	“Too Low Flaps, Too Low Flaps”	Within GPWS Mode 4-3 “Too Low Flaps” envelope. Half-second time delay.
GLIDESLOPE GLIDESLOPE	“Glide Slope, Glide Slope”	Within GPWS Mode 5 caution envelope. Half-second time delay.
OBSTRUCTION OBSTRUCTION	“Caution Obstruction, Caution Obstruction”	Obstruction within TAWS FLTA caution envelope. Half-second time delay.
TRAFFIC TRAFFIC	“Traffic, Traffic”	Not given if own aircraft below 400’ AGL nor if target is below 200’AGL (ground target). **

Time-critical warning and caution alerts are prioritized so only one alert at a time is active.

1) Stall
2) Overspeed
3) GPWS Mode 1 Warning
4) GPWS Mode 2 Warning
5) TAWS FLTA Warning
6) Obstruction Warning
7) TAWS FLTA Caution
8) Obstruction Caution

9) GPWS Mode 4-1
10) TAWS PDA.
11) GPWS Mode 4-2
12) GPWS Mode 4-3
13) GPWS Mode 1 Caution
14) GPWS Mode 2 Caution
15) GPWS Mode 3
16) GPWS Mode 5 Warning
17) GPWS Mode 5 Caution
18) Check Gear
19) Traffic Warning (Resolution Advisory)
20) Traffic Caution (Traffic Advisory)

On IDU #0 (MFD only), the following time-critical warning and caution alerts appear in the lower left corner. See Table 4-2 for conditions and voice alerts.

1) OBSTRUCTION
2) PULL UP
3) GLIDESLOPE
4) TRAFFIC
5) CHECK GEAR
6) OBSTRUCTION
7) TRAFFIC
8) TERRAIN
9) SINK RATE
10) TOO LOW
11) GLIDESLOPE

4.1.2. Warning Alerts

Figure 4-2: Warning Alerts

Table 4-3: Warning Alert Elements

Type Alert	Location	Flash Rate	Audio Alert
WARNING WARNING	PFD lower left corner of transmit-enabled IDU	2 Hz	Repeated until acknowledged
Master Visual Alert	Amber (Yellow) warning light	1 Hz	Repeated until acknowledged

Table 4-4: Warning Alerts

Visual Alert	Voice Alert	Condition ** No time delay
LOW FUEL	"Fuel Low, Fuel Low"	One of the following conditions is true: 1) A low fuel warning is active (EFIS limits) 2) One of the sensed fuel tank quantities is below its low fuel warning threshold 3) Total aircraft fuel is below the pilot-set emergency fuel threshold 1-minute time delay.

4.1.3. Caution Alerts

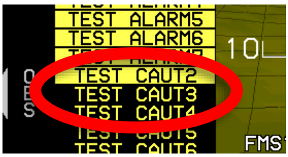


Figure 4-3: Caution Alerts

Table 4-5: Caution Alert Elements

Type Alert	Location	Flash Rate	Audio Alert
CAUTION **CAUTION**	PFD lower left corner of transmit-enabled IDU	1 Hz	Plays only once at full volume

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
** No time delay [1] Only active in dual-sensor installation with neither sensor in failure condition [2] Only active in two-sided system (pilot and co-pilot) [3] Only active when single-pilot mode configuration not asserted [4] Only active when CAUTION mode is enabled		
ADC1 FAIL **ADC2 FAIL** **ADC1/2 FAIL**	Alert Tone	Indicates no valid IAS, pressure altitude, nor VSI received from numbered ADC(s) for more than 1 second. ** [1]
ADS-B FAIL	Alert Tone	Mode-S transponder indicates bad ADS-B out status. 2-second time delay. Also, set by

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
** No time delay [1] Only active in dual-sensor installation with neither sensor in failure condition [2] Only active in two-sided system (pilot and co-pilot) [3] Only active when single-pilot mode configuration not asserted [4] Only active when CAUTION mode is enabled		
		audio/radio interface with NGT-9000R transponder. ADS-B Datalink failure is active when messages from installed ADS-B Datalink System are not received for more than 2 seconds. 5-second time delay.
ADS-B DGRD	Alert Tone	ADS-B Datalink degraded is active when the installed system indicates invalid position data or receiver maintenance required. 5-second time delay. Invalid position data is ignored during and for 10 seconds after unusual attitude mode. "ADS-B FAIL" or "XPDR FAIL" caution has priority over this message.
AHRS1 FAIL **AHRS2 FAIL** **AHRS1/2 FAIL**	Alert Tone	Indicates no valid bank, pitch, nor heading received from enumerated AHRS(s) for more than 1 second. Inhibited during and for 10 seconds after unusual attitude mode. ** [1]
AIU FAIL	Alert Tone	No valid message received from installed analog interface system for more than 2 seconds. Sensor status also displayed in Faults menu. 5-second time delay.
AUX SENSOR	"Auxiliary Sensor Failure, Auxiliary Sensor Failure"	Only active when aux sensor caution split is not asserted. AUX SENSOR is a collector message for the following: 1) AIU Failure; 2) Data Link Failure (non-ADS-B); 3) Strikefinder Failure; 4) TCAD/TAS System Failure; and 5) Weather Radar Failure. "Collector message" means that when the conditions for any of the above messages

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
** No time delay [1] Only active in dual-sensor installation with neither sensor in failure condition [2] Only active in two-sided system (pilot and co-pilot) [3] Only active when single-pilot mode configuration not asserted [4] Only active when CAUTION mode is enabled		
		are met, this message appears instead. Status of the above auxiliary sensors can be viewed in the Faults menu. 5-second time delay.
PLT1 OVRTMP **PLT2 OVRTMP** **PLT3 OVRTMP** **PLT4 OVRTMP** **CPLT1 OVRTMP** **CPLT2 OVRTMP** **CPLT3 OVRTMP** **CPLT4 OVRTMP**	Alert Tone	IDU core temperature greater than 95°C. 2-second time delay.
PLT MISCOMP **CPLT MISCOMP**	Alert Tone	Only when fresh intra-system monitor messages are received. Indicates critical parameters used by displays on the indicated side exceed miscompare thresholds using appropriate miscompare logic. Compares the following critical parameters: 1) Attitude (pitch and roll) 2) Heading 3) Pressure altitude 4) Indicated airspeed 5) Localizer (both inputs) 6) Glide slope (both inputs) 7) Radar altitude 8) Latitude 9) Longitude 10) Track

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
		11) Ground speed 3-second time delay. Inhibited during and for 10 seconds after unusual attitude mode. [2]
ALT MISCOMP	Alert Tone	Indicates pressure altitude difference between ADCs is beyond limits. 10-second time delay. Inhibit for 5 minutes after ground startup.[1]
ATT MISCOMP	Alert Tone	Indicates pitch or roll difference between AHRS is beyond limits (6°). 10-second time delay. Inhibit for 5 minutes after ground startup.[1]
CHECK TRIM↓ **CHECK TRIM↑**	"Check Pitch Trim"	Pitch mis-trimmed for more than 3 continuous seconds (trim not responding). Trim is needed in indicated direction. Only active with Genesys/S-TEC DFCS.
TRIM MOTION↓ **TRIM MOTION↑**	"Trim in Motion, Trim in Motion"	Pitch trim running for more than a preset amount of time in direction indicated by the displayed caution arrow. Only active with Genesys/S-TEC DFCS.
PLT RANGE **CPLT RANGE**	"Check Range, Check Range"	Based upon flight plan in use on the indicated side, less than 30 minutes buffer (at current ground speed) between calculated range and distance to: 1) last waypoint if it is active; or 2) airport if on a missed approach; or 3) along-route distance to destination. Not activated in climbing flight nor if below 60 kts ground speed. 5-minute time delay.
GPS1 FAIL **GPS2 FAIL** **GPS1/2 FAIL**	Alert Tone	Indicates no valid message received from numbered GPS/SBAS for more than 5 seconds. Inhibited during and for 10 seconds after unusual attitude mode. ** [1]

** No time delay
[1] Only active in dual-sensor installation with neither sensor in failure condition
[2] Only active in two-sided system (pilot and co-pilot)
[3] Only active when single-pilot mode configuration not asserted
[4] Only active when CAUTION mode is enabled

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
** No time delay [1] Only active in dual-sensor installation with neither sensor in failure condition [2] Only active in two-sided system (pilot and co-pilot) [3] Only active when single-pilot mode configuration not asserted [4] Only active when CAUTION mode is enabled		
PLT1 SCC **PLT2 SCC** **PLT3 SCC** **PLT4 SCC** **CPLT1 SCC** **CPLT2 SCC** **CPLT3 SCC** **CPLT4 SCC**	Alert Tone	Indicates personality module for designated IDU (side and IDU #) could not be read upon power-up. Internal limits are in use by the system. Only active on the ground.
PLT1 TAWS **PLT2 TAWS** **PLT3 TAWS** **PLT4 TAWS** **CPLT1 TAWS** **CPLT2 TAWS** **CPLT3 TAWS** **CPLT4 TAWS**	Alert Tone	Indicates on the designated IDU (side and IDU #), aircraft is currently beyond extent of terrain database, or a failure condition is preventing TAWS FLTA function from operating. Half-second time delay. Inhibited during and for 10 seconds after unusual attitude mode.
COOLING FAN	Alert Tone	Triggered when external cooling fan is commanded by EFIS limits, but the cooling fan status indicates the cooling fan is not rotating. 1-minute time delay.
FUEL SPLIT	Alert Tone	Compares the volume of fuel designated left wing tank fuel vs. volume of fuel designated right wing tank fuel to the fuel split caution threshold. Issued if the difference exceeds the fuel split caution threshold. Only performed if the fuel split caution threshold is not disabled and both left and right wing tank fuel is monitored and valid. 1-minute time delay.
LOW FUEL	"Fuel Low, Fuel Low"	A low fuel warning is not active and one of the following conditions is true:

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
** No time delay [1] Only active in dual-sensor installation with neither sensor in failure condition [2] Only active in two-sided system (pilot and co-pilot) [3] Only active when single-pilot mode configuration not asserted [4] Only active when CAUTION mode is enabled		
		1) One of the low fuel caution inputs (as set in EFIS limits) is active. 2) One of the sensed fuel tank quantities is below its low fuel caution threshold. 3) Total aircraft fuel is below the pilot-set minimum fuel threshold. 1-minute time delay.
GPS MISCOMP	Alert Tone	Indicates position, track, or ground speed difference between GPS/SBAS units are beyond the following limits: Position: En route Mode 4NM Terminal Mode 2NM Departure Mode .6NM IFR Approach Mode .6NM VFR Approach Mode .6NM Track: If ground speed is greater than 30 kts, miscompare if difference is more than 4°. Ground Speed: If difference between GPS#1 and GPS#2 miscompare is more than 10 kts. 10-second time delay. Inhibited during and for 10 seconds after unusual attitude mode. [1]
GS MISCOMP	Alert Tone	Indicates at least one glide slope is receiving a signal within 1 dot of center and difference between glide slope signals is beyond limits (0.25 dots). 10-second time delay. [1]
HDG FAIL **HDG1 FAIL**	Alert Tone	"HDG FAIL" applicable to single AHRS installation. "HDG# FAIL" applicable to dual

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
** No time delay [1] Only active in dual-sensor installation with neither sensor in failure condition [2] Only active in two-sided system (pilot and co-pilot) [3] Only active when single-pilot mode configuration not asserted [4] Only active when CAUTION mode is enabled		
HDG2 FAIL **HDG1/2 FAIL**		AHRS installation. Indicates heading is invalid but other AHRS data parameters are normal (i.e., attitude is not Red-X'd). Half-second time delay. [1]
HDG MISCOMP	Alert Tone	Only active with neither AHRS in failure condition nor neither AHRS in DG mode. Indicates the heading difference between the two AHRS is beyond heading miscompare threshold limit. 60-second time delay. Inhibited during and for 10 seconds after unusual attitude mode. Inhibit for 5 minutes after ground startup. [1]
IAS MISCOMP	Alert Tone	Indicates IAS difference between ADCs is beyond limits. 10-second time delay. Inhibit for 5 minutes after ground startup. [1]
LOC MISCOMP	Alert Tone	Indicates at least one localizer is receiving a signal within 1 dot of center and difference between localizer signals is beyond limits (0.25 dots). 10-second time delay. [1]
RALT MISCOMP	Alert Tone	Indicates radar altitude difference between radar altimeters is beyond limits. 10-second time delay. Limits are as follows: ≥ 500'AGL Δ14% 100 – 500'AGL Δ10% < 100'AGL Δ10' [1]
OAT FAIL **OAT1 FAIL** **OAT2 FAIL** **OAT1/2 FAIL**	Alert Tone	"OAT FAIL" applicable to single ADC installation. "OAT# FAIL" applicable to dual ADC installation. Indicates that OAT indication is invalid but other air data parameters are normal (i.e., air data is not Red-X'd). Half second delay. [1]

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
** No time delay [1] Only active in dual-sensor installation with neither sensor in failure condition [2] Only active in two-sided system (pilot and co-pilot) [3] Only active when single-pilot mode configuration not asserted [4] Only active when CAUTION mode is enabled		
RALT FAIL **RALT1 FAIL** **RALT2 FAIL** **RALT1/2 FAIL**	Alert Tone	RALT FAIL applicable to single-radar altimeter installation. RALT# FAIL applicable to dual-radar altimeter installation. For analog radar altimeter, indicates aircraft is below 2000' AGL in air mode without a valid radar altimeter reading. 2-second time delay. [1]
SAME ADC	Alert Tone	Indicates both sides are operating from same ADC source. ** [1] [4]
SAME AHRS	Alert Tone	Indicates both sides are operating from same AHRS source. ** [1] [4]
SAME DME	Alert Tone	Indicates both sides are operating from same DME source ** [1] [3] [4]
SAME GPS	Alert Tone	Indicates both sides are operating from same GPS/SBAS source.**[1][2][3] [4]
SAME NAV	Alert Tone	Indicates both sides are operating from same navigation source.**[1] [2] [3] [4]
SAME RALT	Alert Tone	Indicates both sides are operating from same radar altimeter source. ** [1] [2] [3] [4]
SSEC FAIL **SSEC1 FAIL** **SSEC2 FAIL** **SSEC1/2 FAIL**	Alert Tone	SSEC FAIL" applicable to single ADC installation. "SSEC# FAIL" applicable to dual ADC installation. Indicates that either: 1) Genesys Aerosystems ADC is not transmitting SSEC-corrected data on an airframe that requires SSEC; or 2) There is a mismatch greater than or equal to 50umHg between the SSEC calculated by the IDU and the SSEC being used by the ADC. Inhibited if the related ADC is in a failed condition. 1-minute time delay.
STRK FAIL	Alert Tone	Only active when aux sensor caution split is asserted. No valid message received from

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
		installed Strikefinder system for more than 4 seconds. Sensor status also displayed in Faults menu. 5-second time delay.
TAWS INHBT	Alert Tone	TAWS inhibited through use of external switch**
TCAS FAIL	Alert Tone	Only active with ARINC735A-1 TCAS-II, TCAS-I, or TAS system. Indicates lack of communications with system or failure indication from system.**
TRFC FAIL	Alert Tone	Only active when aux sensor caution split is asserted. No valid message received from installed RS-232 TCAD/TAS System or ADS-B TIS-B System for more than 2 seconds. Sensor status also displayed in Faults menu. 5-second time delay.
TOTALZR QTY	Alert Tone	Compares the volume of sensed fuel to the fuel totalizer calculation. Issued if the difference exceeds the totalizer mismatch caution threshold. Only performed if: 1) Totalizer mismatch caution threshold is non-zero; 2) Fuel totalizer is enabled; 3) Unmonitored fuel if not configured in EFIS limits; 4) Fuel totalizer has a valid value; and 5) Fuel levels are valid. 1-minute time delay.
WXR FAIL	Alert Tone	Only active when aux sensor caution split is asserted. Weather Radar faults received from installed weather radar. Weather radar status not received from installed weather radar for more than 2 seconds. Radar

** No time delay
[1] Only active in dual-sensor installation with neither sensor in failure condition
[2] Only active in two-sided system (pilot and co-pilot)
[3] Only active when single-pilot mode configuration not asserted
[4] Only active when CAUTION mode is enabled

Table 4-6: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition
		control panel faults received from installed weather radar for more than 2 seconds. Sensor status also displayed in Faults menu. 5-second time delay.
XFILL FAIL	Alert Tone	Only active in dual-side system (pilot and co-pilot) when single-pilot mode discrete input not asserted. Indicates lack of inter-system communications. 32-second time delay. [2][3]

** No time delay
[1] Only active in dual-sensor installation with neither sensor in failure condition
[2] Only active in two-sided system (pilot and co-pilot)
[3] Only active when single-pilot mode configuration not asserted
[4] Only active when CAUTION mode is enabled

4.1.4. Side-Specific Caution Alerts

Side-specific caution alerts are displayed on all IDUs on the side that detects the failure.

Table 4-7: Side-Specific Caution Alerts

Visual Alert	Alert Tone	Condition ** No time delay
CHECK IDU1 CHECK IDU2 CHECK IDU3 CHECK IDU4	Alert Tone	IDU status has not been received from another same-side IDU in the last second ±0.1 seconds. # indicates which IDU is failing the check. **

4.1.5. Advisory Alerts

Figure 4-4: Advisory Alerts

Table 4-8: Advisory Alert Elements

Type Alert	Location	Appearance	Audio Alert
ADVISORY	PFD lower left corner of transmit-enabled IDU	While condition persists	Single advisory chime played at 80% volume

Table 4-9: Advisory Alerts

Visual Alert	Alert Tone	Condition
** No time delay [1] Only active in dual-sensor installation with neither sensor in failure condition [2] Only active in two-sided system (pilot and co-pilot) [3] Only active when single-pilot mode is not enabled in EFIS limits [4] Only active when CAUTION mode is not enabled		
ADC INIT ADC1 INIT ADC2 INIT ADC1/2 INIT	Chime	Indicates ADC# not at full accuracy during warm-up. ** ADC1 INIT, ADC2 INIT, and ADC1/2 INIT [1]
AHRS1 DG AHRS2 DG AHRS1/2 DG	Chime	Indicates numbered AHRS in DG mode. ** [1]
PLT1 PWR PLT2 PWR PLT3 PWR PLT4 PWR CPLT1 PWR CPLT2 PWR CPLT3 PWR CPLT4 PWR	Chime	Indicates a dual redundant power supply within the designated IDU (side and IDU #) is not functioning correctly. Only active on the ground. 1-minute time delay.
FPM INHBT	Chime	Flight path marker inhibit function activated if configured in EFIS limits. **
BARO MISCOMP	Chime	Indicates mismatch of altimeter settings or altimeter modes between sides. 10-second time delay. [2] [3]
SAME ADC	Chime	Indicates both sides are operating from same ADC source. ** [1] [4]
SAME AHRS	Chime	Indicates both sides are operating from same AHRS source. [1] [4]
SAME DME	Chime	Indicates both sides are operating from same DME source ** [1] [3] [4]
SAME GPS	Chime	Indicates both sides are operating from same GPS/SBAS source. ** [1][2][3][4]
SAME NAV	Chime	Indicates both sides are operating from same navigation source. ** [1][2][3] [4]
SAME RALT	Chime	Indicates both sides are operating from same radar altimeter source. ** [1][2][3] [4]
TAS INHBT	Chime	TAS aural inhibited through activation of TCAS/TAS audio inhibit EFIS limits. **

Table 4-9: Advisory Alerts

Visual Alert	Alert Tone	Condition
** No time delay [1] Only active in dual-sensor installation with neither sensor in failure condition [2] Only active in two-sided system (pilot and co-pilot) [3] Only active when single-pilot mode is not enabled in EFIS limits [4] Only active when CAUTION mode is not enabled		
TAWS GS CNX	Chime	(Class A TAWS) TAWS glide slope cancel (GPWS Mode 5) activated with switch when enabled in EFIS limits. **
TCAS STBY	Chime	Only active with TCAS-II. Indicates system is either in standby or executing functional test in flight. **
TA ONLY	Chime	Only active with TCAS-II. Indicates system is unable to display resolution advisories. **
TCAS TEST	Chime	Only active with TCAS-II. Indicates system is in functional test on ground. **
XFILL ARM	Chime	With good inter-system communications and crossfill not inhibited, indicates sides are not synchronized and synchronized function is available. ** [2] [3]
XFILL INHBT	Chime	With good inter-system communications, indicates crossfill is inhibited if configured in EFIS limits. ** [2] [3]

4.1.6. Side-Specific Advisory Alerts

Side-specific advisory alerts have the same characteristics as advisory alerts except they always appear in the lower-left corner of the transmit-enabled IDU PFI (PFI showing) or lower-left corner of the transmit-enabled IDU bottom area (MFD in reversionary mode with PFI not showing).

These types of alerts are used where the pilot and co-pilot systems can generate different alerts, such as when the pilot and co-pilot systems are not crossfilled and are operating on different FMS flight plans.

Table 4-10: Side-Specific Advisory Alerts

Visual Alert	Alert Tone	Condition ** No time delay
CHK BARO	Chime	Ascending through transition level: Altimeter not set to 29.92 inHg or 1013 mbar.

Table 4-10: Side-Specific Advisory Alerts

Visual Alert	Alert Tone	Condition ** No time delay
		Descending through transition level: Altimeter set to 29.92 inHg or 1013 mbar. Descent warning times out in 10 seconds. Disabled during QFE operation. 2-second time delay.
ANP: 0.01 ANP: 15.0	Chime	GPS/SBAS actual navigation performance based upon current GPS/SBAS HPL. **
RNP: 0. 10A RNP: 15.0A	Chime	GPS/SBAS automatic required navigation performance as acquired from navigation database. **
RNP: 0. 10M RNP: 15.0M	Chime	GPS/SBAS manual required navigation performance as set manually if it is less than or equal to the RNP associated with the current airspace. **
DR 00:00 DR 01:23	Chime	GPS/SBAS in dead reckoning mode with valid ADC and AHRS data. Timer shows time since loss of position (mm:ss) to indicate quality of DR solution. ** Inhibited during and for 10 seconds after unusual attitude mode. Valid range is from 00:00 to 59:59.**
LNAV APPR	Chime	GPS/SBAS in LNAV approach mode.**
LNV/VNV APPR	Chime	GPS/SBAS in LNAV/VNAV approach mode. **
LP APPR	Chime	GPS/SBAS in LP approach mode. **
LPV APPR	Chime	GPS/SBAS in LPV approach mode. **
SUSPEND	Chime	Automatic waypoint sequencing is suspended under any of the following conditions: 1) Pilot has selected a manual GPS/SBAS OBS. 2) Active waypoint is the missed approach waypoint, and missed approach procedure has not been armed (ARM) nor initiated (MISS). 3) Aircraft is in a published or manually created holding pattern, and pilot has not chosen to continue (CONT) out of the holding pattern.

Table 4-10: Side-Specific Advisory Alerts

Visual Alert	Alert Tone	Condition ** No time delay
		4) Leg following active waypoint is a manual termination leg, and the pilot has not chosen to resume (RESUME) to the waypoint following the manual termination. 5) The aircraft is in a repeating SAR pattern (see SAR appendix), and the pilot has not chosen to continue out of the SAR pattern. **
TERMINAL	Chime	GPS/SBAS in terminal mode. **
VFR APPR	Chime	GPS/SBAS in VFR approach mode. **
VECTORS	Chime	GPS/SBAS in vectors to final approach mode prior to sequencing FAWP. **
PTK = L 1NM PTK = L 20KM PTK = R 1NM PTK = R 20KM PTK ENDING	Chime	GPS/SBAS parallel offset path advisory. ## is nautical miles, or kilometers, left (L) or right (R) of main path. PTK ENDING if within the parallel offset distance from a parallel offset exit waypoint. **
FLTA INHBT	Chime	Appears when FLTA function is automatically inhibited during normal operation. TAWS INHBT has priority. **
TRUE NORTH	Chime	System operating in true north mode. **
VNAV AVAIL	Chime	Only active with Genesys/S-TEC DFCS. Indicates VNAV guidance is available but not currently in use by the AP. Press “VNV” button on mode control panel to engage VNAV mode. **

4.1.7. Audio-Only Caution and Advisory Alerts

Audio-only caution alerts trigger a single audible alert that plays at full volume selected in the aircraft limits and audio-only advisory alerts play at 80% of full volume. A repeating audible alert is played until acknowledged by activating the warning/caution acknowledge button/switch (as configured).

Table 4-11: Audio-Only Caution and Advisory Alerts

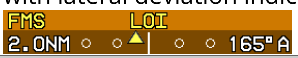
Caution or Advisory Alert	Voice Alert/ Alert Tone	Condition ** No time delay
Minimum Altitude Caution Alert	"Minimums, Minimums"	Deviation from above to below minimum altitude bug. Minimum altitude readout turns amber (yellow) and flashes. **
Selected Altitude Deviation Caution Alert	"Altitude, Altitude"	Deviation greater than 150' from selected altitude after capture (within 100' of altitude). 2-second time delay.
VNAV Altitude Deviation Caution Alert	"Altitude, Altitude"	If not on a descending VNAV profile, deviation greater than 150' from altitude of the current or prior VNAV waypoint after capture (within 100' of altitude). 2-second time delay.
Decision Height Caution Alert	"Decision Height"	Deviation from above to below decision height bug. Decision height readout turns amber (yellow) and flashes. **
GBS/SBAS Failure Caution Alert	Alert Tone	No valid position data available from selected GPS/SBAS for more than 5 seconds and dead reckoning not available. Inhibited during and for 10 seconds after unusual attitude mode. Loss of position data is obvious from symbology changes associated with reversionary modes. **
GPS/SBAS Loss of Integrity Caution Alert	Alert Tone	GPS/SBAS loss of integrity caution. Inhibited during and for 10 seconds after unusual attitude mode. LOI indication is integrated with lateral deviation indicator. ** 
GPS/SBAS Loss of Navigation Caution Alert	Alert Tone	GPS/SBAS loss of navigation caution. Inhibited during and for 10 seconds after unusual attitude mode. LON indication is integrated with lateral deviation indicator. ** 
Loss of Vertical Navigation Caution Alert	Alert Tone	Loss of vertical navigation caution. Inhibited during and for 10 seconds after unusual attitude mode. VLON indication is integrated with vertical deviation indicator. ** 

Table 4-11: Audio-Only Caution and Advisory Alerts

Caution or Advisory Alert	Voice Alert/ Alert Tone	Condition ** No time delay
Autopilot Disconnect Advisory Alert	"Autopilot Disconnect"	Sounds when autopilot servos disengage for any reason. (Genesys/S-TEC DFCS is installed)**
Autopilot Failure Advisory Alert	"Autopilot Failure"	Sounds when autopilot failure is detected. (Genesys/S-TEC DFCS is installed). **
Level-off Advisory Alert	Alert Tone	Tone given when within the greater of 1000' AGL or 50% of VSI from uncaptured selected or VNAV waypoint altitude. Inhibited in approach procedures. **
GPWS Mode 6	"Five Hundred"	Descending through 500' AGL advisory. Armed upon climbing through deadband value above 500' AGL. Half-second debounce.

4.1.8. Voice Alerts and Muting

Only the highest priority (in criticality and recency), unacknowledged voice alert is played at any given time. Any playing audio message is immediately muted by activating the warning/caution acknowledge switch.

4.1.9. Visual Alert Prioritization and Declutter

Visual alerts are visually prioritized, so warnings are displayed above cautions, which are displayed above advisories. Within categories, visual alerts are stacked in chronological order, so the most recent alert appears on top.

The maximum number of visual alerts that can be simultaneously displayed in the standard location is 11.

Only the highest priority (in criticality and recency), unacknowledged audible annunciation is played at a time. In addition, to further minimize cockpit confusion, annunciations are grouped and prioritized so only one annunciation is active.

In addition, flags are decluttered from all IDUs, which are not transmit-enabled. Flags only appear on these IDUs if they are IDU-specific (i.e., CHECK IDU #).

Section 5 Reversionary Modes

5.1. Reversionary Modes

The equipment has eight reversionary modes as follows:

Mode 0: GPS/SBAS, ADC, and AHRS normal.

Mode 1: GPS/SBAS failed; ADC and AHRS normal.

Mode 2: ADC failed; GPS/SBAS and AHRS normal.

Mode 3: AHRS failed; GPS/SBAS and ADC normal.

Mode 4: GPS/SBAS and ADC failed; and AHRS normal.

Mode 5: GPS/SBAS and AHRS failed; and ADC normal.

Mode 6: ADC and AHRS failed; and GPS/SBAS normal.

Mode 7: GPS, ADC, and AHRS failed.

Review the following tables and notes to determine what feature or function is affected by one or more of the three sensors failed conditions. Examples follow with the displays in various configurations with a table breaking down the affected functions.

Not all possible display configurations or format combinations are represented here. All eight modes of system operation are represented for description purposes.

Table 5-1: Reversionary Mode Status (PFD)

PFD Functions	Mode							
	0	1	2	3	4	5	6	7
Airspeed	OK	OK	19	OK	19	OK	19	19
Altimeter	OK	OK	19	OK	19	OK	19	19
Altimeter Set Display	OK	OK	-	OK	-	OK	-	-
Bank Scale	OK	OK	OK	-	OK	-	-	-
CDI	OK	1 + 20	OK	OK	20	20	OK	20
Runway	OK	1	25	-	-	-	-	-
Waypoint Pointer	7	1	7	7	-	-	7	-
Heading Scale	7	7	7	7	7	-	7	-
AGL Ind.	OK	2	4	OK	11	11	4	-
Flight Path Marker	OK	1 + 14	-	-	-	-	-	-
Hover Vector	OK	-	-	-	-	-	-	-
Ground Track	7	1	7	7	-	-	7	-
Heading Indicator	7	7	7	-	7	-	-	-
Horizon	OK	OK	OK	-	OK	-	-	-

Table 5-1: Reversionary Mode Status (PFD)

PFD Functions	Mode							
	0	1	2	3	4	5	6	7
Mini Map	7	1	7	7	-	-	7	-
Pitch Scale	OK	OK	OK	-	OK	-	-	-
Highway in the Sky	OK	1 + 15	-	-	-	-	-	-
Terrain/Obstructions	OK	-	25	-	-	-	-	-
Clock Functions	OK	OK	OK	OK	OK	OK	OK	OK
VSI	OK	OK	-	OK	-	OK	-	-
Waterline Symbol	22	22	5	13	5	13	13	13
Waypoint Symbol	OK	1	-	-	-	-	-	-
Waypoint Brg./Dist.	OK	1	OK	OK	-	-	OK	-
Traffic Perspective	OK	OK	OK	-	-	-	-	-
Mini Traffic	OK	OK	OK	OK	OK	OK	OK	OK
Speed Trend	OK	OK	-	-	-	-	-	-

Table 5-2: Reversionary Mode Status (PFD)

Map Functions	Mode							
	0	1	2	3	4	5	6	7
Aircraft Position	OK	1	OK	OK	-	-	OK	-
Special Use Airspace	9	1	6	9	-	-	6 + 9	-
Waypoint Pointer	9	1	9	9	-	-	9	-
Active Flight Plan Path	9	1	9	9	-	-	9	-
Ground Speed	OK	1	OK	OK	-	-	OK	-
Ground Track	9	1	9	9	-	-	9	-
Heading Indicator	9	9	9	-	9	-	-	-
Navigation Symbols	9	1	9	9	-	-	9	-
Outside Air Temp.	OK	OK	-	OK	-	OK	-	-
Projected Path	OK	1	OK	-	-	-	-	-
Traffic Perspective	OK	OK	OK	OK	OK	OK	OK	OK
Terrain/Obstructions	OK	-	25	OK	-	-	25+9	-
Clock Functions	OK	OK	OK	OK	OK	OK	OK	OK
Waypoint Brg./Dist.	OK	1	OK	OK	-	-	OK	-
Wind	21	3	-	-	-	-	-	-
WX-500 Data	OK	OK	OK	OK	OK	OK	OK	OK
Compass Rose	9	9	9	9	9	-	9	-
Fuel Totalizer Functions	23	24	23	23	12	12	12	12
True Airspeed	OK	OK	-	OK	-	OK	-	-
Density Altitude	OK	OK	-	OK	-	OK	-	-
OAT/ISA Display	OK	OK	-	OK	-	OK	-	-

Note 1: Presented using inertial dead-reckoning based on last known wind information. If unable to dead-reckon (e.g., heading is failed, or true airspeed cannot be calculated) then function is disabled.

Note 2: Only radar altitude presented when available.

Note 3: Last known wind is saved during GPS/SBAS failure.

Note 4: Either radar altitude or geodetic altitude less database elevation.

Note 5: Waterline symbol expanded to large attitude bars.

Note 6: Special use airspace boundaries are drawn with bold lines due to lack of aircraft altitude data.

Note 7: In heading-only failure mode or AHRS failure mode, heading scale aligned with aircraft track and heading indication is removed. In heading-only failure mode or AHRS failure mode combined with GPS failure, heading scale is replaced with a red-X.

Note 8: N/A

Note 9: In heading-only failure mode or AHRS failure mode, compass rose aligned with aircraft track and heading indication is removed when in heading up mode. In heading-only failure mode or AHRS failure mode combined with GPS failure, compass rose is removed.

Note 10: Presenting using last-known wind information and aligned with aircraft track in heading up mode.

Note 11: Only radar altitude presented when available.

Note 12: Assuming valid fuel flow information, endurance is presented.

Note 13: Large attitude bars presented and X'd out.

Note 14: Flight Path Marker grayed after one minute to indicate degraded operation.

Note 15: Highway in the Sky removed after one minute.

Note 16: N/A

Note 17: Defaults to AIR unless Weight on Wheel/Weight on Ground configuration in EFIS limits is active.

Note 18: Only DH function (with valid AGL altitude) in this mode.

Note 19: Red-X in place of scale.

Note 20: VLOC CDI always available if optional VOR symbology enabled.

Note 21: Function removed during heading-only failure mode.

Note 22: Full-time large attitude bars and do not show the waterline symbol.

Note 23: N/A

Note 24: Assuming valid fuel flow information, both range and endurance are presented using inertial dead-reckoning based on last known wind information. If the pilot is unable to dead-reckon due to loss of heading or true airspeed cannot be calculated, then endurance only information is presented.

Note 25: Inhibited in accordance with the conditions specified in TAWS automatic inhibit function (abnormal operation).

5.1.1. OAT Sensor Failure Mode

OAT FAIL
OAT1 FAIL
OAT2 FAIL
OAT1/2 FAIL

The EFIS has an OAT sensor failure mode. With the OAT sensor failed, wind, OAT, density altitude, and true airspeed are not displayed on MFD pages.

Figure 5-1: OAT Sensor Fail

5.1.2. Heading Failure Mode

The EFIS has a heading failure mode. With heading failed, the PFD heading scale and MFD compass rose align with track (if available) or are removed and replaced with a red-X.

The PFD heading scale includes "GPS TRK" around the track marker to clearly indicate a heading failure mode.

Figure 5-2: GPS TRK

5.1.3. PFD Auto Reversion

For IFR approval in aircraft, flight instrument information essential to safety of flight remains available to the pilot without additional action after a failure. To accommodate this, MFDs can sense when the PFD has failed and take over the PFD function automatically. Therefore, when an MFD (IDU #2) becomes the transmit-enabled IDU, the MFD automatically switches to essential mode showing PFI in the top area. To change the MFD back to normal mode after the automatic switch, press **TO MFD (R5)**.

5.1.4. GPS Failure

GPS degrades or fails resulting from loss of satellite information or GPS equipment failure. When SBAS provides the integrity, the EFIS provides a loss of integrity (LOI) caution within two seconds if the current horizontal protection level (HPL) exceeds the horizontal alert level (HAL). The LOI caution appears when there is no integrity monitoring and disappears when it is restored.

Figure 5-3: Loss of Integrity (LOI)

Further GPS degradation causes the EFIS to lose GPS updating of aircraft position, groundspeed, and ground track, and the ability to calculate the wind information.

1) 

(Loss of Integrity) displayed with no time delay.

2) HPL > HAL for the phase of flight currently in. Position is still presented based upon a GPS navigation solution.

3) 

Loss of Navigation (LON) displayed with no time delay of the onset of the following:

   a) The absence of power;

   b) Equipment malfunction or failure;

   c) The presence of a condition lasting five seconds or more where there are an inadequate number of satellites to compute position solution;

   d) Fault detects a position failure that cannot be excluded within time-to-alert when integrity is provided by FDE;

   e) HPL > HAL on the final approach segment. The EFIS does not transition to DR navigation at this stage. A GPS navigation solution is still presented; and

   f) Where HPL > HAL on the final approach segment, this position may still be satisfactory for GPS navigation. For example, an HPL of 0.31NM exists, which means as soon as a transition to terminal mode occurs, all alerts disappear. This is significantly important during a wind change if the system had been in a DR mode.

NOTE:

At any time, view HFOM on the faults menu to see the system-reported accuracy.

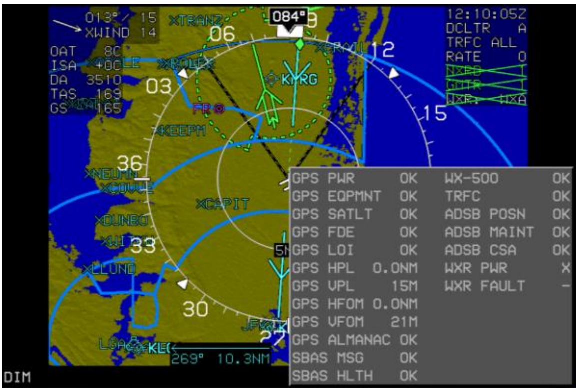
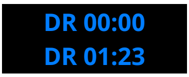


Figure 5-4: Faults Menu on MFD

1) Dead Reckoning (DR)



If a GPS position cannot be calculated, a dead reckoning solution is provided with a timer. This solution is calculated from heading and TAS derived from the AHRS and ADC.

Figure 5-5: Dead Reckoning

2) Loss of Vertical Navigation (VLON)

Figure 5-6: Loss of Vertical Navigation (VLON)

If the navigation equipment is no longer adequate to conduct or continue the LNAV/VNAV approach, "VLON" appears within one second of the onset of any of the following conditions:

a) The absence of power;

b) Equipment malfunction or failure;

c) The presence of a condition where fault detection detects a position failure that cannot be excluded;

d) There are an insufficient number of SBAS HEALTHY satellites;

e) The horizontal protection level exceeds the alert limit as follows for LNAV/VNAV approaches:

i) Prior to sequencing, the FAWP- HAL should be 556m (0.3NM) with no limit on VAL.

ii) After sequencing the FAWP- HAL 556m (0.3NM) and VAL 50m.

When in LNAV mode, the fault detection function detects positioning failures within ten seconds after the onset of the positioning failure.

5.2. PFD and MFD Failure Mode Examples

GPS failure results in the EFIS operating in dead reckoning mode. The EFIS continues to provide navigational position, ground speed, and ground track information, based upon the last known wind, current air data, and heading. The PFD and MFD are affected as in the following images.

5.2.1. Failure Mode 0

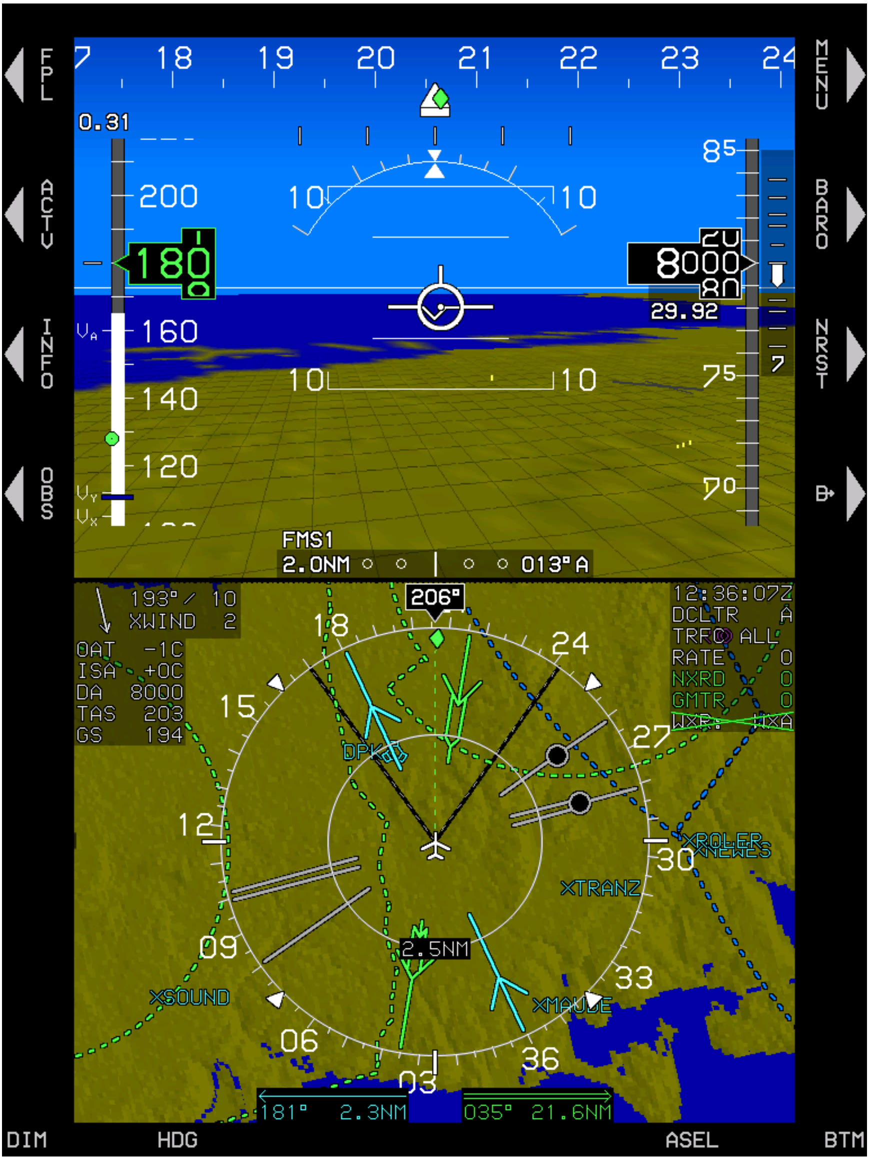
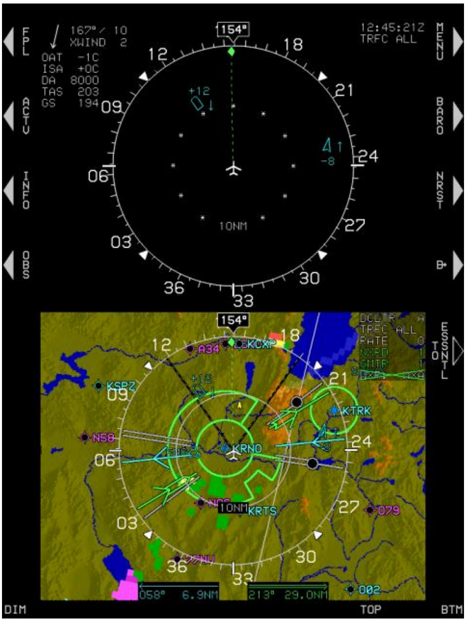
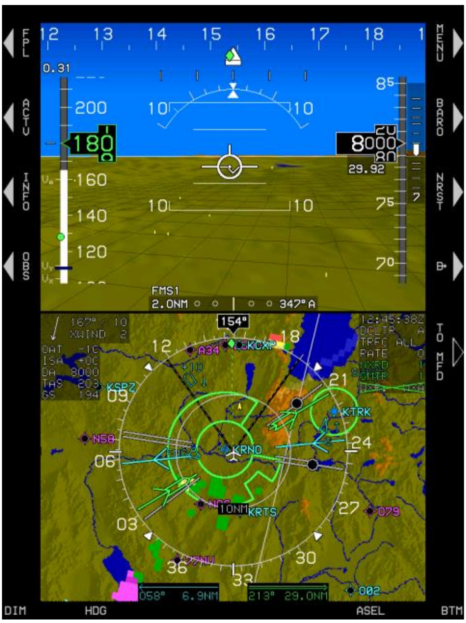


Figure 5-7: PFD Failure Mode 0
GPS, ADC and AHRS Normal



Normal Mode



Essential Mode

Figure 5-8: MFD Failure Mode 0
GPS, ADC and AHRS Normal

5.2.2. Failure Mode 1

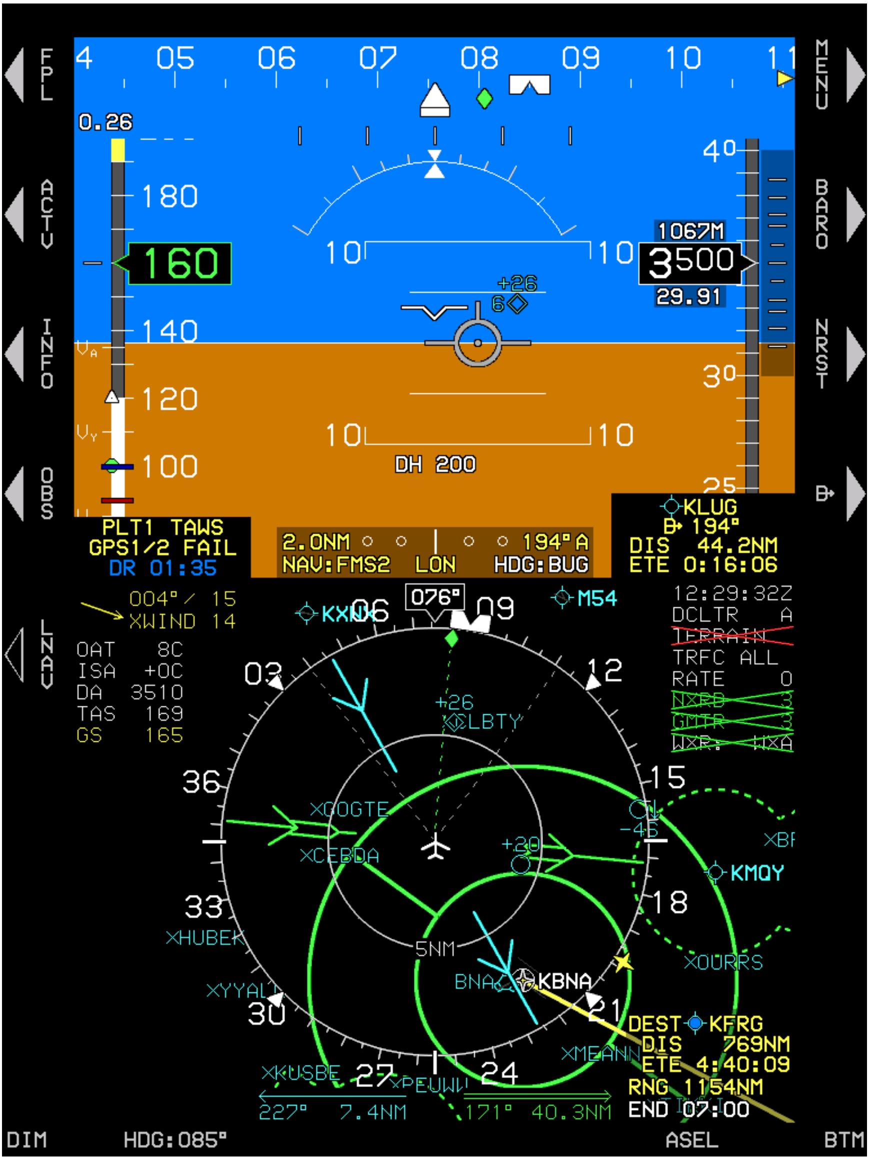
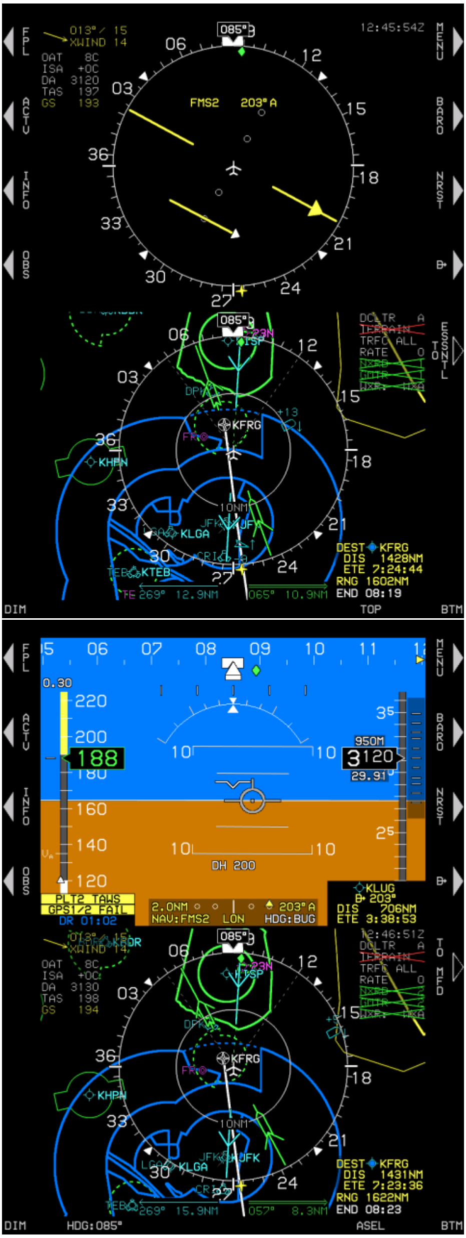


Figure 5-9: PFD Failure Mode 1
GPS/SBAS Failed, ADC and AHRS Normal



Normal Mode

Essential Mode

Figure 5-10: MFD Failure Mode 1
GPS/SBAS Failed, ADC and AHRS Normal

5.2.3. Failure Mode 2

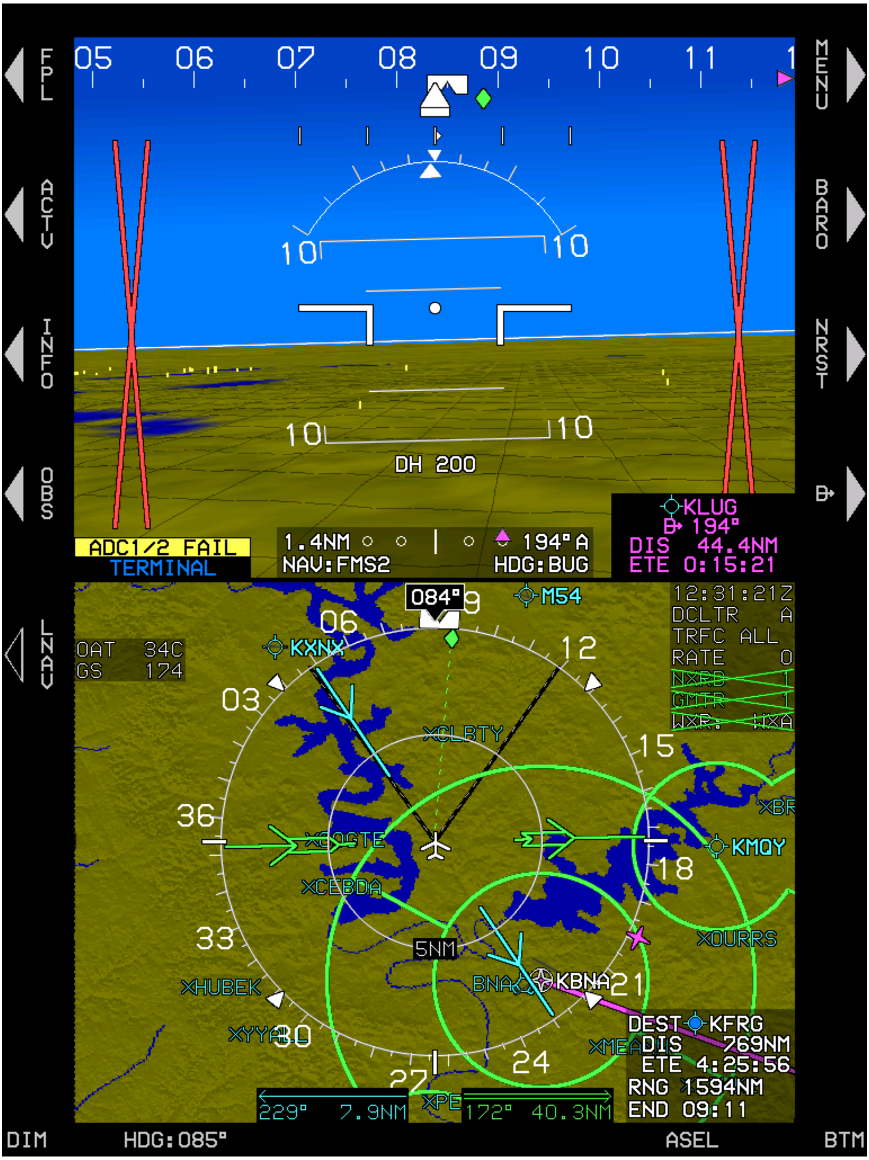


Figure 5-11: PFD Mode 2
ADC Failed, GPS/SBAS and AHRS Normal

Normal Mode

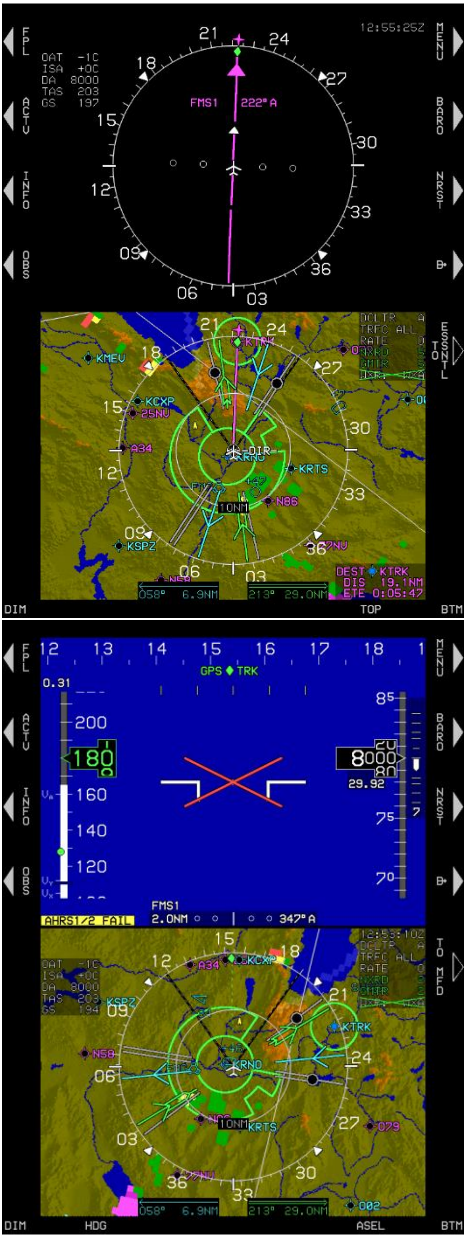
Essential Mode

Figure 5-12: MFD Failure Mode 2

ADC Failed, GPS/SBAS and AHRS Normal

5.2.4. Failure Mode 3

Figure 5-13: PFD Failure Mode 3
AHRS Failed, GPS/SBAS and ADC Normal



Normal Mode

Essential Mode

Figure 5-14: MFD Failure Mode 3
AHRS Failed, GPS/SBAS and ADC Normal

5.2.5. Failure Mode 4

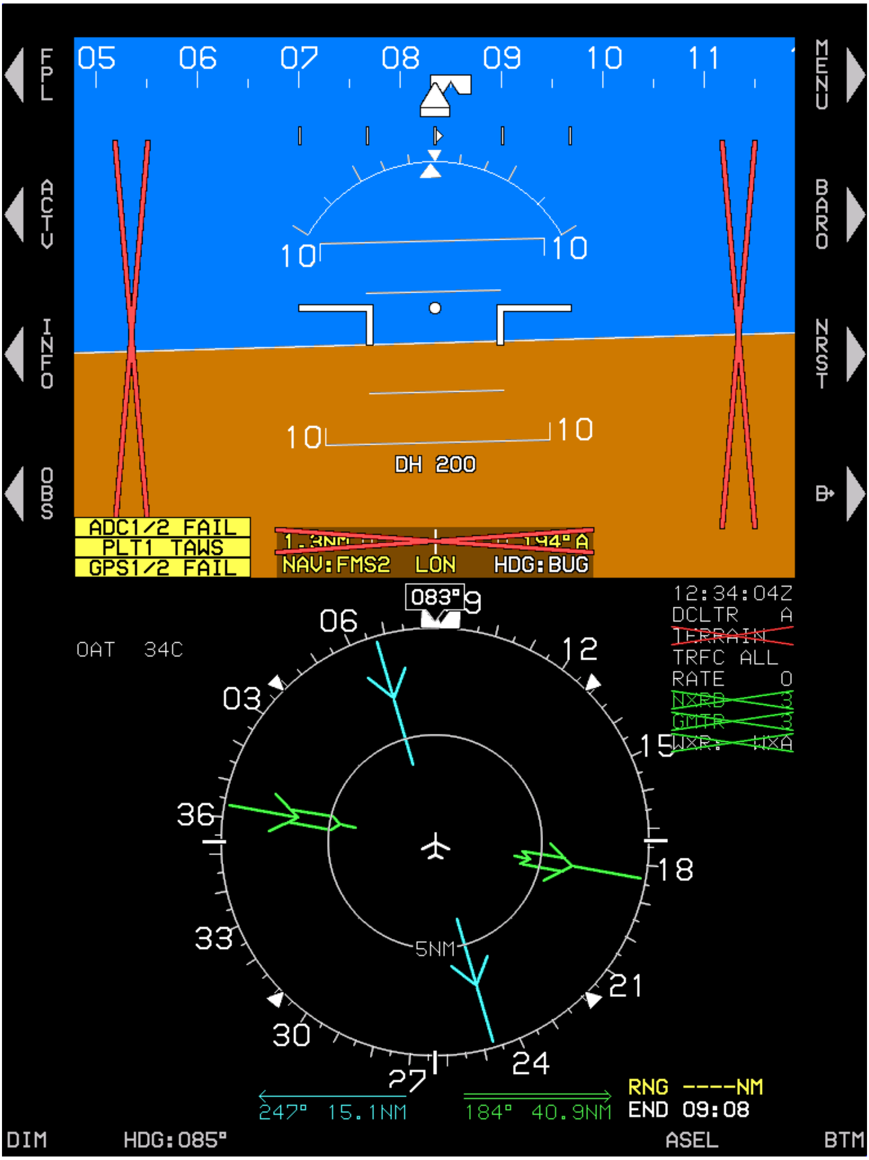
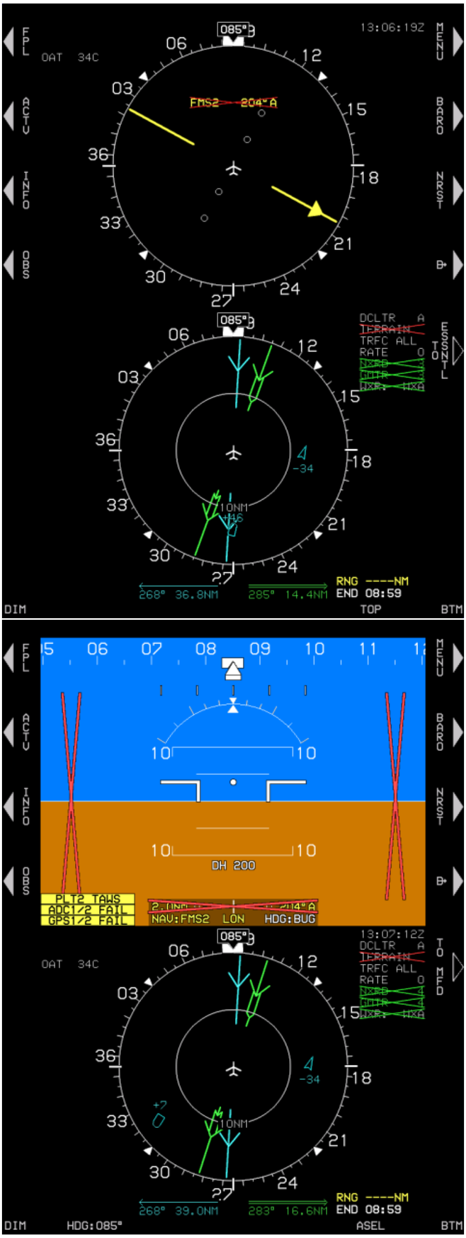


Figure 5-15: PFD Failure Mode 4
GPS/SBAS and ADC Failed, AHRS Normal



Normal Mode

Essential Mode

Figure 5-16: MFD Failure Mode 4
GPS/SBAS and ADC Failed, AHRS Normal

5.2.6. Failure Mode 5

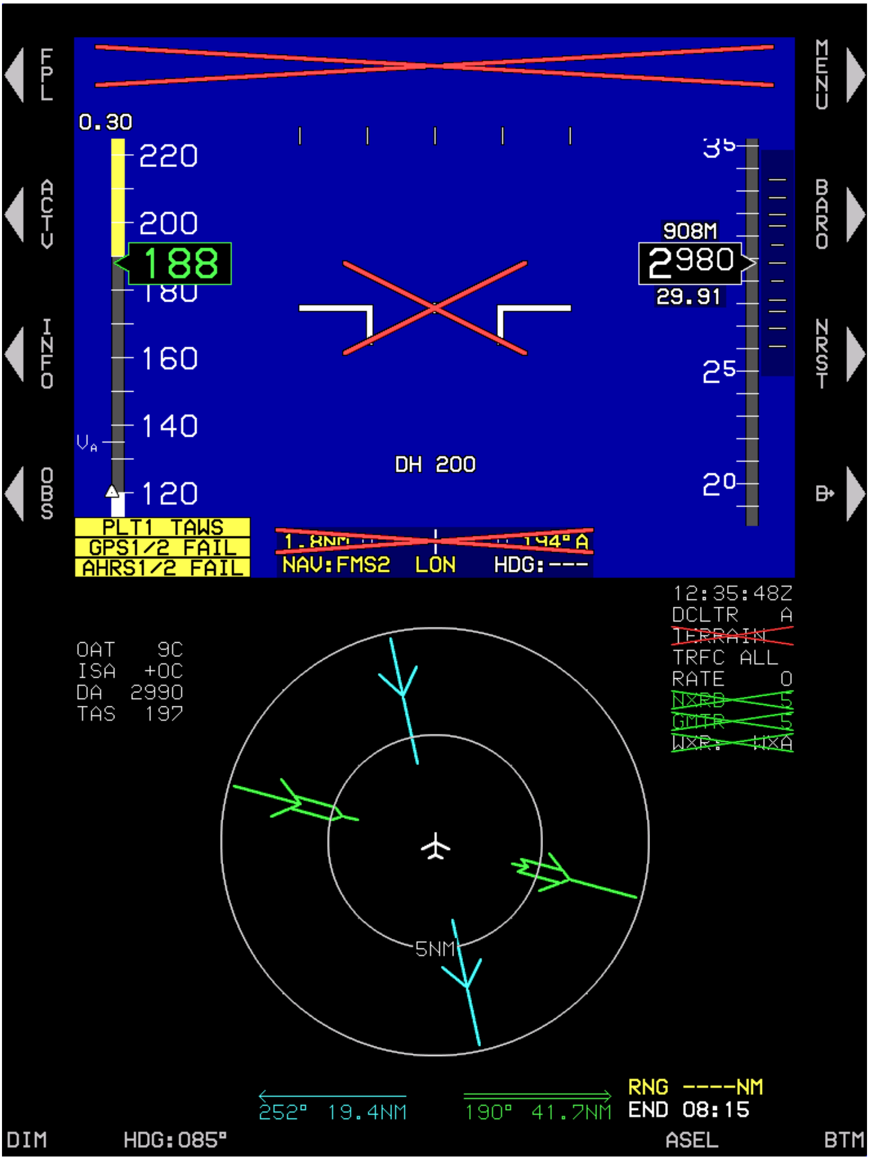
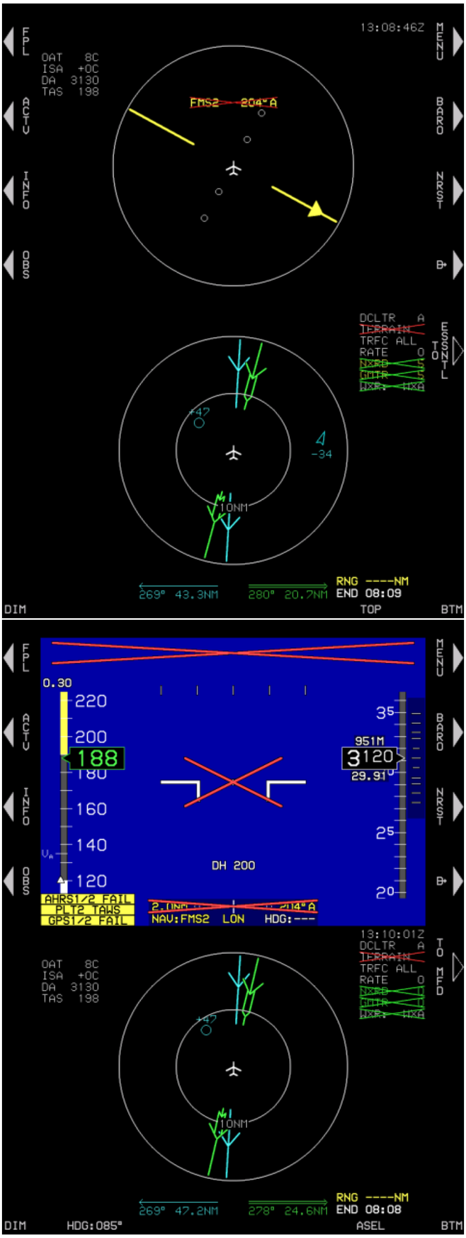


Figure 5-17: PFD Failure Mode 5
GPS/SBAS and AHRS Failed, ADC Normal



Normal Mode

Essential Mode

Figure 5-18: MFD Failure Mode 5
GPS/SBAS and AHRS Failed, ADC Normal

5.2.7. Failure Mode 6

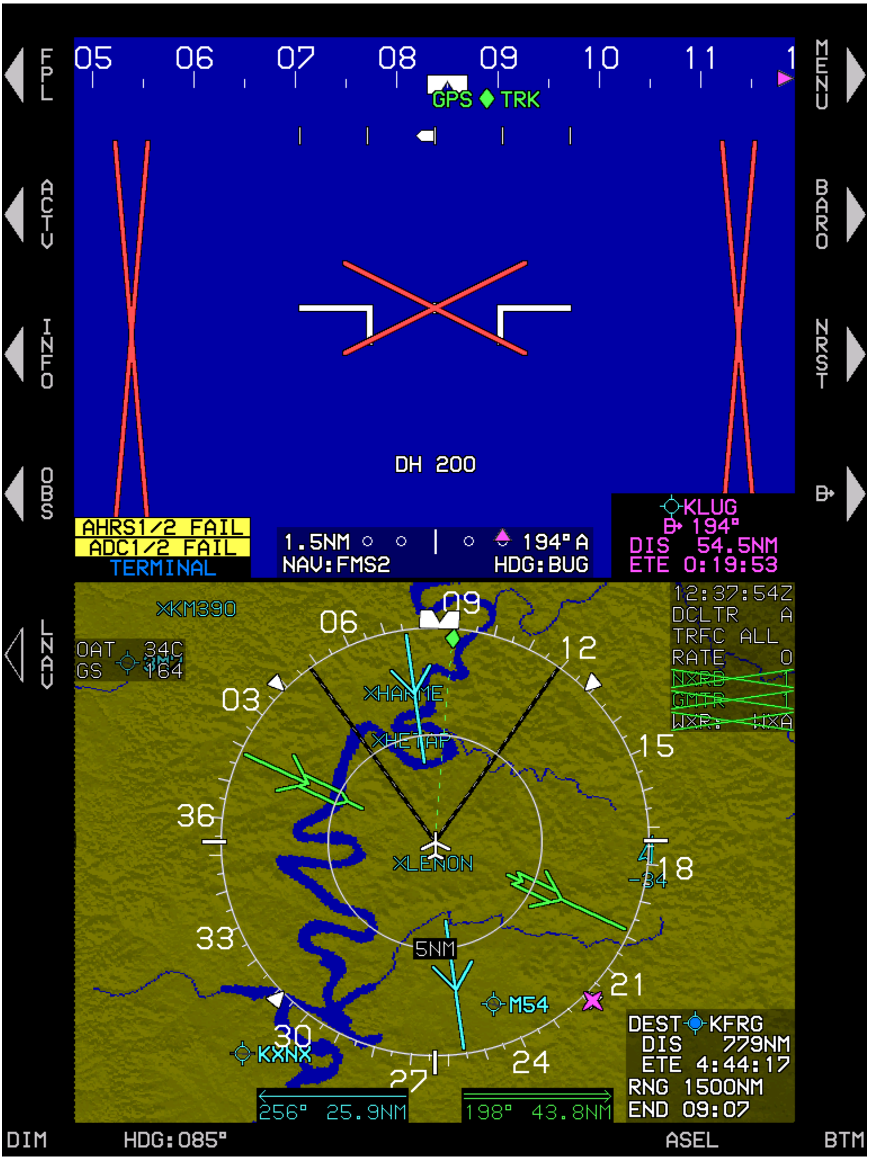
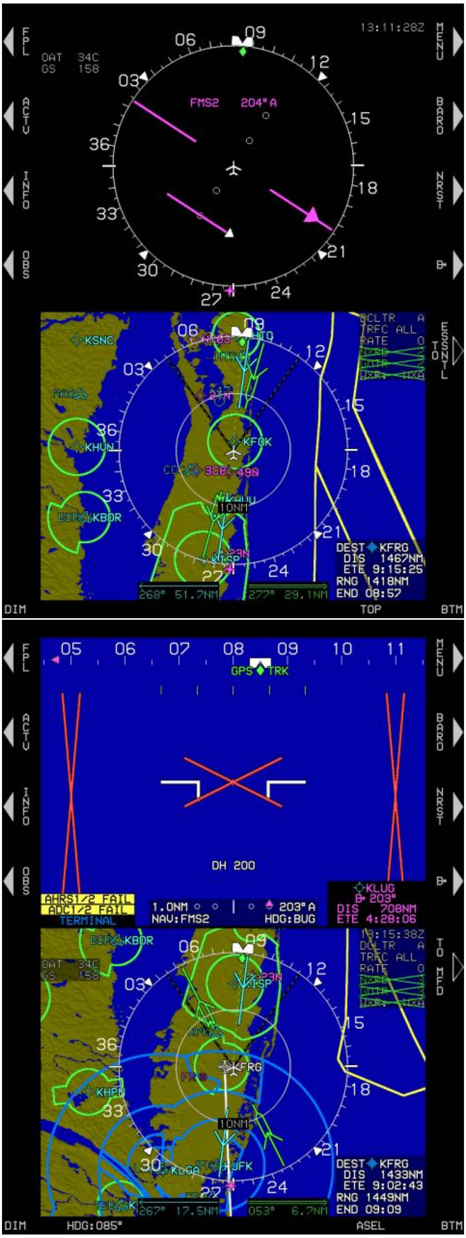


Figure 5-19: PFD Failure Mode 6
ADC and AHRS Failed, GPS/SBAS Normal



Normal Mode

Essential Mode

Figure 5-20: MFD Failure Mode 6
ADC and AHRS Failed, GPS/SBAS Normal

5.2.8. Failure Mode 7

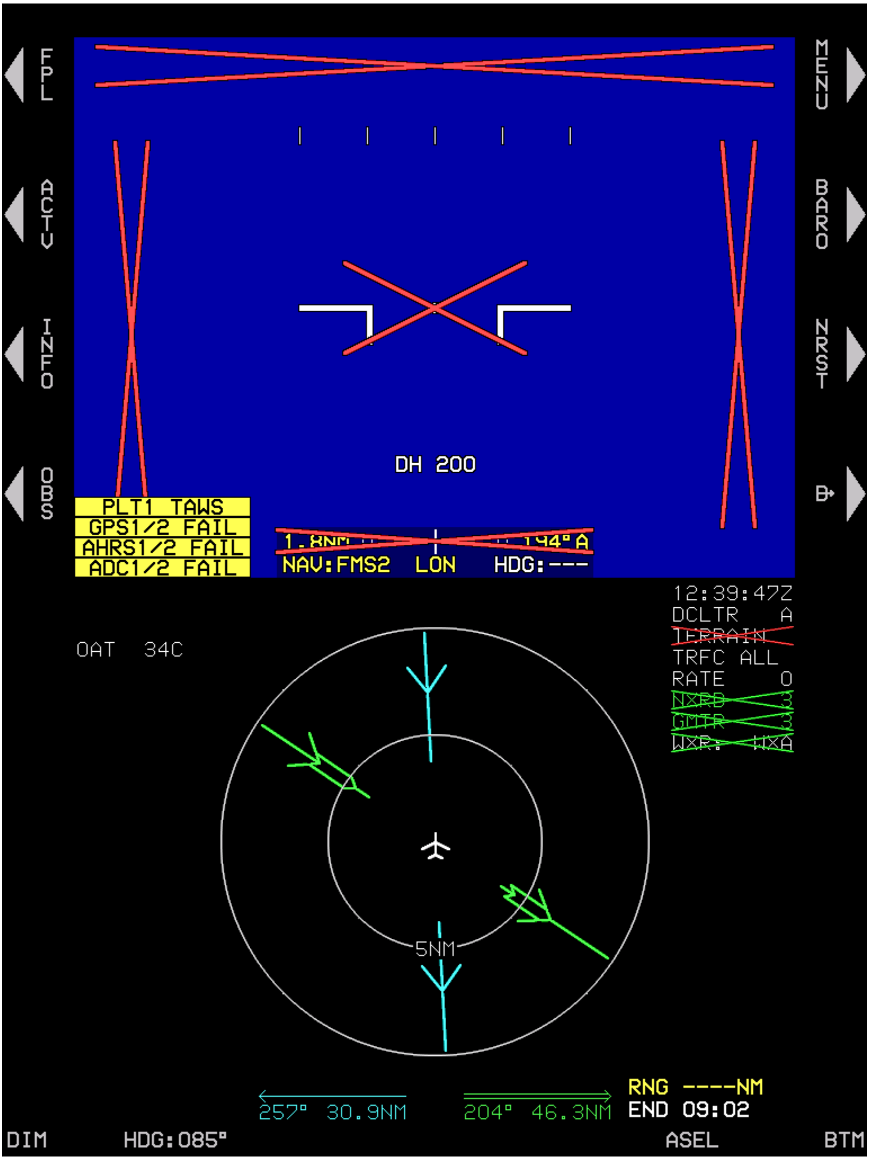
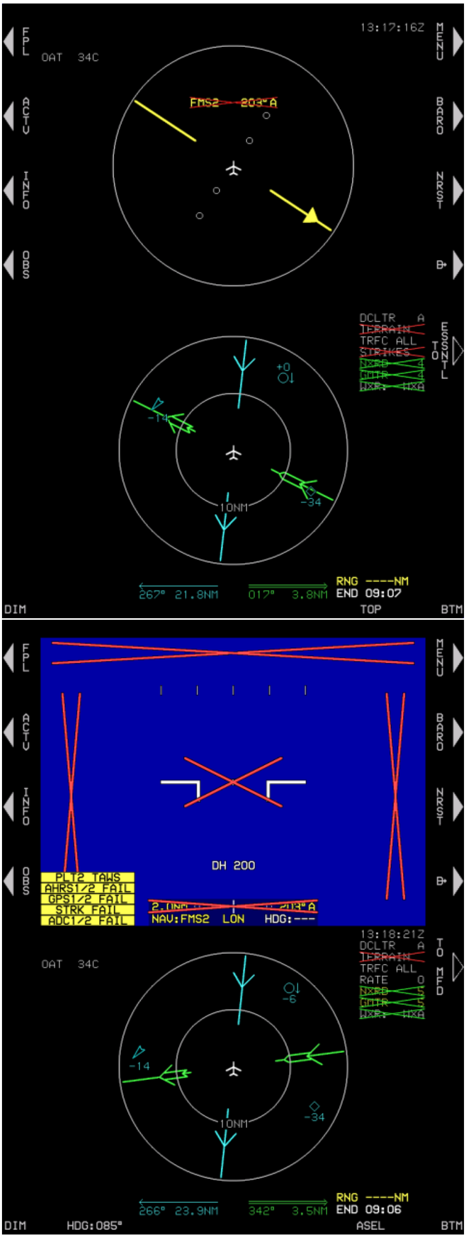


Figure 5-21: PFD Failure Mode 7
GPS/SBAS, ADC and AHRS Failed



Normal Mode

Essential Mode

Figure 5-22: MFD Failure Mode 7
GPS/SBAS, ADC and AHRS Failed

Section 6 IFR Procedures

6.1. EFIS Navigation Operational Capabilities

The installed Genesys Aerosystems EFIS, receives GPS/SBAS satellite data from the Genesys Aerosystems TSO-C145c GPS Beta 3 sensor, meets TSO-C146c Class 3, and complies with AC 20-138D for navigation using GPS and GPS/SBAS (within the coverage of a satellite-based augmentation system complying with ICAO Annex 10) for en route, terminal area, non-precision approach, and approach procedures with vertical guidance operations. Non-precision approach operations include those based on conventional navigation aids with "or GPS" in the title and those with "GPS" and "RNAV (GPS)" in the title to "LNAV" and "LP” minimums. Approach procedures with vertical guidance includes "RNAV (GPS) to "LNAV/VNAV" and "LPV" minimums.

Navigation information is referenced to the WGS-84 reference system and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

6.2. Active Flight Plan

Before using the Genesys EFIS GPS navigation system to fly any part of an instrument procedure in VMC or IMC, always compare each leg of the applicable and current published charted procedure to the flight plan displayed on an MFD page. This EFIS and FMS may not support specific navigation leg types, and all pilots must understand how each leg is depicted and navigated before conducting the procedure.

After updating the navigation database and planning to fly an instrument procedure, practice in the **RUN DEMONSTRATOR/TRAINING PROGRAM** to view how each leg is depicted.

If navigation planning includes manual sequencing of any leg in a procedure, verify what specific navigation guidance the EFIS provides. When any procedure includes ARINC-424 legs defined by headings or that terminate at a specific altitude, the pilot must understand how the EFIS behaves and how system behavior can affect coupled autopilot operations.

The application checks for an active waypoint upon opening the active flight plan menu. If there is no active waypoint, **NO ACTIVE WPT** appears. Otherwise, a nav log of waypoints in the active flight plan appears with the following (if multiple units are referenced, consider the speed units setting):

1) Waypoint identifier and characterization (default, overfly [OF], or no radius [/0R]);

2) Symbol designating waypoint type and what type of procedure (if any) the waypoint is associated with;

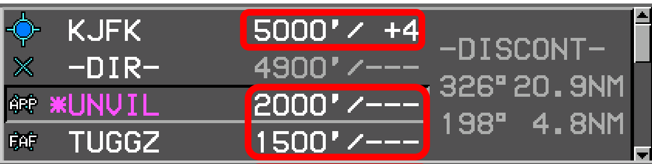
3) VNAV altitudes presented in feet or meters and offsets associated with each waypoint in nautical miles or kilometers; and

4) Information related to flight plan path between each waypoint.

In the case of an approach with a final approach segment data block, the VNAV offset readout associated with the missed approach point is "GPI" to designate distance to the glide path intercept point. When courses are presented as part of the path information, they are displayed referenced to either magnetic or true north depending on which is configured in EFIS limits. If referenced to magnetic north, the course is indicated with the degree (°) symbol. Otherwise, a stylized true north (^{T}) symbol appears.

VNAV altitudes and offsets from the navigation database or have been manually entered are white, and those computed automatically are gray. The active waypoint is designated by an asterisk and is magenta (See Section 1 System Introduction and Overview for color conventions) but turns amber (yellow) in the event of a GPS LON caution.

Table 6-1: VNAV Altitudes and Offsets

Input Source	Color
Navigation database or manually entered	
Computed automatically	
Failed FMS source	

A suppressed waypoint (designated by brackets) is an airport associated with an IFR or VFR approach procedure. After an approach procedure is activated, the associated airport is no longer part of the active flight plan for guidance purposes. However, the associated airport is still shown in the ACTV menu for it to be highlighted for information or to activate other procedures to the airport.

NOTE:

Adding a STAR procedure with no instrument approach nor SID does not suppress the airport waypoint. Adding a STAR or DP to a different airport in the active flight plan does not change the original suppressed waypoint airport.

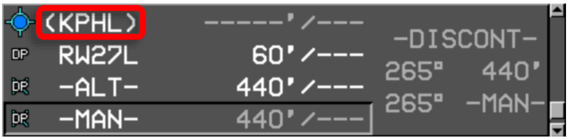


Figure 6-1: Suppressed Waypoint

It is possible to add a departure procedure to another airport within an active flight plan and have two suppressed waypoints within the same active flight plan.

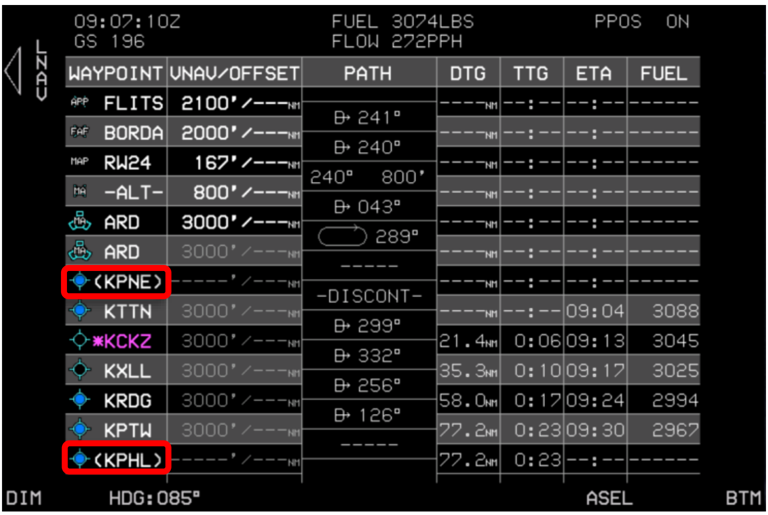


Figure 6-2: Active Flight Plan with Two Suppressed Waypoints

6.2.1. Skipped Waypoint

A skipped waypoint is a waypoint associated with a dynamic termination leg with a zero length. These are either:

1) An altitude termination leg when current aircraft altitude is above the termination altitude; or

2) System-created (i.e., not NavData® specified) intercept to a "Course to a Fix" leg where there is insufficient distance to calculate an intercept heading.

6.2.2. Waypoint

To add a waypoint to the end of the active flight plan, rotate through each waypoint of the flight plan to one position past the end.

Upon selection of a waypoint from the selection list, the EFIS checks whether the selected waypoint meets the criteria for waypoint activation, manual VNAV parameter entry, custom holding pattern entry, SAR pattern entry, SAR pattern segment selection, manual overfly characterization, VFR approach entry, IFR approach entry, STAR entry, or DP entry. If it does, a list is presented as follows:

1) **WAYPOINT**: If valid, this option allows the pilot to activate the flight plan leg to the waypoint. Option valid for any waypoint except:
   a) Suppressed waypoint;
   b) Skipped waypoint;
   c) A waypoint following a discontinuity; or
   d) The first waypoint.

2) **VNAV..**: If valid, this option allows the pilot to enter a manual VNAV altitude and offset at the selected waypoint using altitude in feet or meters and distance in NM or KM as set in the EFIS limits. Option valid for any waypoint except:
   a) Suppressed waypoint
   b) Skipped waypoint;
   c) A manual termination waypoint;
   d) A waypoint that is part of an IFR or VFR approach;
   e) A SAR pattern exit waypoint:
   f) A parallel offset entry or exit waypoint; or
   g) One of the following types of termination legs:
      i) Dynamic;
      ii) Altitude;
      iii) DME;
      iv) Radial; or
      v) Intercept

3) **HOLD..**: If valid, this option allows the pilot to enter a manual holding pattern at the selected waypoint using altitude in feet or meters and distance in NM or KM as set in the EFIS limits. Option valid for any waypoint except:
   a) Suppressed waypoint;
   b) Skipped waypoint;
   c) A manual termination waypoint;

d) The missed approach waypoint;

e) A waypoint that is part of a VFR approach;

f) A holding pattern waypoint;

g) A SAR pattern exit waypoint;

h) A waypoint that begins with a departure procedure;

i) A parallel offset entry or exit waypoint; or

j) One of the following dynamic termination waypoints:

   i) Altitude;

   ii) DME;

   iii) Radial; or

   iv) Intercept

4) **SAR PTRN..**: If SAR patterns are enabled in the EFIS limits, and valid, this option allows the pilot to create and enter a SAR pattern at the selected waypoint using altitude in feet or meters and distance in NM or KM as set in the EFIS limits (as defined in the SAR appendix). This option is valid for any waypoint except:

a) Suppressed waypoint;

b) Skipped waypoint;

c) A manual termination waypoint;

d) A waypoint that is part of an IFR or VFR approach;

e) A holding waypoint;

f) A SAR pattern exit waypoint;

g) A waypoint that begins a departure procedure;

h) A parallel offset entry or exit waypoint; or

i) One of the following dynamic termination waypoints: Altitude, DME, Radial, or Intercept.

5) **SAR SGMNT..**: This option allows the pilot to select which segment within the SAR pattern should be active for navigation guidance. If the selected waypoint is the active waypoint and is one of the following types of SAR patterns:

a) Expanding square;

b) Rising ladder; or

c) Sector search

6) **OFLY/AUTO..**: If the selected waypoint is neither suppressed, skipped, a manual termination, or a parallel offset entry or exit waypoint, change the waypoint's overfly characterization. The choices are:

a) **AUTO**: Reset automatic overfly characterization by FMS.

b) **OVERFLY**: Force the characterization to be an overfly adjust-exit waypoint and force the inbound course to go directly to the waypoint regardless of the amount of course change required.

c) **NO RADIUS**: Manually force the turn radius at the waypoint to be zero. This forces the inbound course and outbound course to go directly to and from the waypoint regardless of the amount of course change required.

NOTE:

It is not possible to track a "NO RADIUS" path perfectly, but the FMS path guidance quickly recaptures the outbound course after resuming automatic waypoint sequencing. Designating a waypoint as a "NO RADIUS" waypoint affects the turn radius used to calculate procedure turn and holding pattern leg paths.

7) **VFR APPR..**: If selected waypoint is a user waypoint with an approach bearing, a VFR approach to the user waypoint based on the approach bearing is created, then the user waypoint becomes suppressed.

If the selected waypoint is a VFR airport or an IFR airport with surveyed runways, the pilot is presented with a list of runways. After selecting a runway, a VFR approach to the runway is created, and then the airport waypoint becomes suppressed. Activating a VFR approach deletes (after pilot confirmation) any pre-existing IFR or VFR approaches. If a heading bug is not active; activating a VFR approach activates the heading bug on current aircraft heading and is used to define the course intercept angle.

8) **IFR APPR..**: If selected waypoint is an airport with an IFR approach, the pilot is presented with a list of available approaches (including, if applicable, the five-digit channel number, followed by a list of available transitions, if there are more than one) and a list of runways (if there are surveyed runways at the airport). After selection, the appropriate IFR approach is created, and the airport waypoint is suppressed. Activating an IFR approach deletes any pre-existing IFR or VFR approaches. If there is a pre-existing STAR to the airport, the IFR approach waypoints are inserted after the STAR waypoints. If a heading bug is not active and the activated transition is “Vectors to Final,” activating an IFR approach activates the heading bug on current aircraft heading for purposes of defining the course intercept angle.

9) **STAR..**: If selected waypoint is an airport with a STAR, the pilot is presented with a list of available STARs, followed by a list of available transitions (if there are more than one) and a list of runways (if there are surveyed runways at the airport). After selection, the appropriate STAR is created.

Activating a STAR automatically deletes any pre-existing STAR. If there is a pre-existing approach (IFR or VFR) to the airport, STAR waypoints are inserted prior to the approach waypoints.

10) **DP..**: If selected waypoint is an airport with a DP, the pilot is presented with a list of DPs, followed by a list of available transitions (if there are more than one) and a list of runways (if there are surveyed runways and more than one runway authorized for the DP). After selection, the appropriate DP is created, and upon activation, deletes any pre-existing DPs after pilot confirmation.

6.3. Operations Outside of a GPS/SBAS Coverage Area

When outside of a GPS/SBAS service provider's coverage area, the GPS receivers can revert to using FDE for integrity. The GPS receiver uses GPS/SBAS integrity or FDE; whichever provides the best protection level. This equipment does not have any limitations in oceanic and remote areas provided the operator obtains an FDE prediction program.

6.4. IFR Procedures

Pilots operating in a radar environment are expected to associate departure headings or an RNAV departure advisory with vectors or the flight path to the planned route or flight. The EFIS employs two types of departure procedures (DP); obstacle departure procedures (ODP), which are printed either textually or graphically, and standard instrument departure procedures (SID), which are always printed graphically. All DPs, either textual or graphic may be designed using either conventional or RNAV criteria. RNAV procedures have RNAV printed in the title.

ODPs are not found in NavData®, therefore the climb angle found in the PFD Bugs menu should be set to comply with the steeper than normal climb gradient during the departure until established on the en route structure.

Approach minima are never coded in NavData®. On some approaches, the altitude coded at the MAP for a non-precision approach coincides with an MDA (normally where the final approach course does not align with the runway), but more often the coded altitude is some height above the threshold.

6.5. Overview of Procedures and Instrument Approaches

This Genesys Aerosystems EFIS provides 3D GPS precision and non-precision instrument approach guidance using a system integral TSO C146c BETA 3 GPS receiver with GPS and augmented GPS with SBAS (Satellite Based Augmentation System) commonly referred to as WAAS (Wide Area Augmentation System). To support full integration of RNAV procedures into the National Airspace System (NAS), a charting format for instrument approach procedures (IAPs) is designed to avoid confusion and duplication of instrument approach charts.

Use of this GPS receiver provides a level of certified service supporting RNAV (GPS) approaches to LNAV, LP, LNAV/VNAV, and LPV lines of minima within system coverage. Some locations close to the edge of the coverage may have lower availability of vertical guidance.

The Genesys Aerosystems EFIS guides the pilot through every step of the approach procedure with Highway In The Sky (HITS) 3D symbology. The system defines a desired flight path based upon the active flight plan. The current position of the aircraft is determined relative to the desired path to determine deviation for display on the GPS/SBAS CDI and VDI. The EFIS auto-sequences from one waypoint to the next in accordance with the flight plan along the flight path with the following exceptions:

1) Pilot selected a manual GPS/SBAS OBS (**SUSPEND** shown).
2) Active waypoint is the missed approach waypoint, and missed approach procedure has not been armed (**ARM**) nor initiated (**MISS**) (**SUSPEND** shown).
3) Aircraft is in a published or manually created holding pattern, and pilot has not chosen to continue (**CONT**) out of the holding pattern (**SUSPEND** shown).
4) Active waypoint is the last waypoint of the active flight plan (no flag shown).
5) The active waypoint has a manual termination, and the pilot has not chosen to resume (**RESUME**) to the waypoint following the manual termination (**SUSPEND** shown).
6) The aircraft is in a repeating SAR pattern (racetrack, sector search, or orbit) and the pilot has not chosen to continue out of the SAR pattern (**SUSPEND** shown). (See SAR appendix.)

6.5.1. Waypoint Sequencing

When automatic waypoint sequencing is suspended due to reasons 1, 2, or 4 in § 6.5, the EFIS switches from "TO" to "FROM" operation when appropriate. If not suspended, automatic waypoint sequencing occurs in the following conditions:

1) Bearing to the transition point (turn bisector for fly-by waypoint, active waypoint for fly-over waypoint) is more than 90° from the current course (i.e., transition from "TO" to "FROM" operation);
2) Aircraft location is within two turn diameters (based upon current true airspeed and 15° angle of bank) of the active waypoint location; and
3) Aircraft is within 90° of the current course (i.e., generally pointed in the correct direction).

The desired flight path is created from a sequence of straight, left turning, and right turning leg segments designed to provide smooth skyway, GPS/SBAS CDI, and lateral autopilot guidance. Each leg between waypoints is composed of up to nine segments. Where a "Fixed-Radius Transition" is defined by the navigation database for a waypoint, that turn radius is used for the turning segment.

Otherwise, radius for turning segments (other than DME arc or radius to a fix segments) are calculated with the parameter speed determined as follows:

1) If the waypoint is part of a DP or STAR and within 30NM of the departure runway, speed is the pre-programmed procedure speed.
2) If the waypoint is part of an IFR or VFR approach procedure, or holding pattern, speed is the preprogrammed procedure speed.
3) If the waypoint is part of a holding pattern, speed is the pre-programmed holding speed.
4) Within a SAR pattern, speed is the lower of holding speed or procedure speed.
5) Where a fixed-radius transition (FRT) is defined by the navigation database for a waypoint, that turn radius is used for the turning segment. FRT is used in en route flight to save the number of waypoints and to provide a smoother transition. The RF leg can only be used in a SID or in a STAR. It is the flight plan leg stored in the navigation database, which is defined by constant radius turns around a given fix.
6) Otherwise, speed is the current true airspeed or procedure speed, whichever is higher.

In all cases, if a NavData® derived speed limit is associated with the waypoint, speed is the lower of the NavData® derived speed limit or the speed determined above. Radius for DME arc or radius to fix segments comes from NavData®.

6.5.2. Fly-Over Waypoints

To create the desired flight path, each waypoint is designated as a fly-by or a fly-over waypoint. Waypoints are further subdivided into waypoints with a defined entry heading and waypoints with a defined exit heading. Waypoint auto-sequencing for fly-by waypoints occurs at the bisector of the turn. Waypoint auto-sequencing for fly-over waypoints occurs over the waypoint.

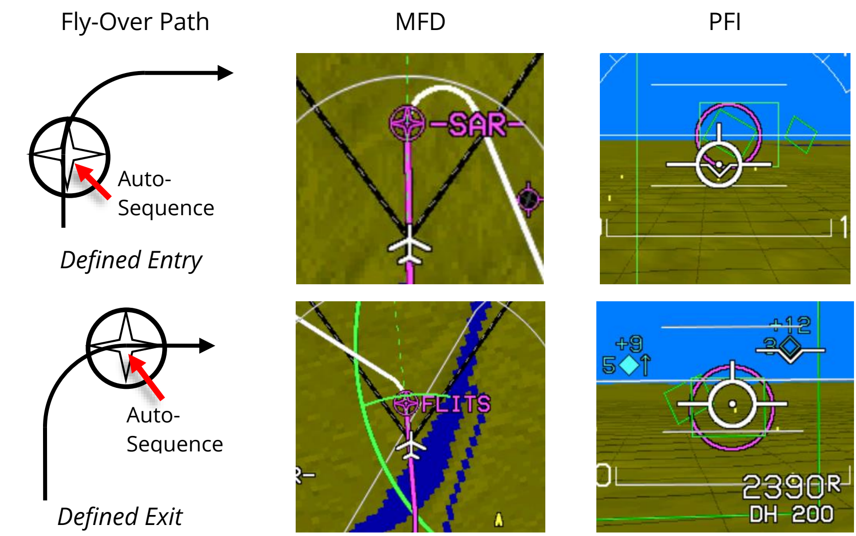


Figure 6-3: Fly-Over Waypoints

6.5.2.1. Fly-Over with Defined Entry Heading

These waypoints are type fly-over with defined entry heading:

1) Waypoint leading into discontinuity;
2) Waypoints which are marked as overfly in the navigation database or menu system;
3) Exit from holding pattern;
4) Exit from SAR pattern;
5) Exit from procedure turn;
6) Entry into holding pattern;
7) Missed approach point;
8) Phantom waypoint (created by inserting a waypoint into the active flight plan or performing Direct-To function within the active flight plan – avoids S-turns);
9) Last waypoint;
10) Reference (takeoff runway end) waypoint of a DP; and
11) Altitude, DME, or radial termination legs (ARINC-424 path types CA, FA, VA, CR, VR, CD, FD, and VD; see Table 6-2).

Table 6-2: RNAV Path Terminator Leg Type

Path	Designator		Terminator
Constant DME arc	A	A	Altitude
Course to	C	C	Distance
Direct Track	D	D	DME Distance
Course from a Fix to	F	F	Fix
Holding Pattern	H	I	Next Leg
Initial	I	M	Manual Termination
Constant Radius	R	R	Radial Termination
Track Between	T		
Heading To	V		

Examples: CF= Course to Fix, and FM= Course from a Fix to a Manual Termination, etc.

6.5.2.2. Fly-Over with Defined Exit Heading

The following waypoints are fly-over with defined exit heading:

1) Waypoint exiting a discontinuity except for phantom or DP reference waypoints;
2) Entry into procedure turn; and
3) First waypoint except for phantom or DP reference waypoints; and
4) Entry into SAR pattern.

6.5.3. Fly-By Waypoints

Course to fix legs that are not to the FAF/FAWP are fly-by with defined entry heading. All other waypoints are fly-by with defined exit heading. Leg segments for paths are constructed by the EFIS (see Figure 6-4).

NOTE:

Entry adjustments should be expected anytime a turn exceeds 120^0. Turns greater than 120^0 should not be used in conjunction with RNP routes. (RNP standards specifically exclude such turns from RNP requirements.)

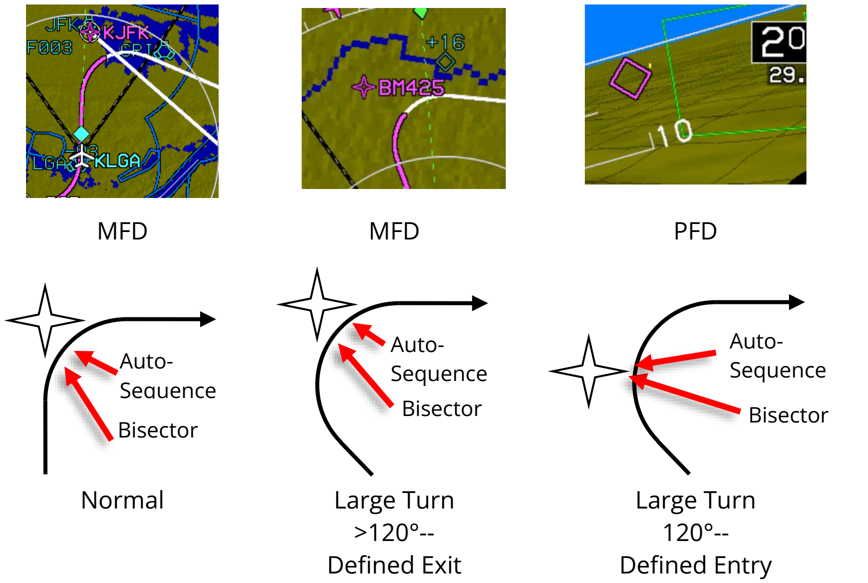


Figure 6-4: Fly-By Waypoints

Table 6-3: Leg Segments for Paths Constructed by EFIS

Path Type	Waypoint		# of Segments and Description
	Entry	Exit	
Straight Leg, DME Arc or Radius to a Fix	Fly-By	Fly-By	2nd half of fly-by turn at entry waypoint. WGS-84 geodesic or arc path from entry to exit turns. 1st half of fly-by turn at exit waypoint.
Straight Leg, DME Arc or Radius to a Fix	Fly-By	Fly-Over Defined Exit Heading	2nd half of fly-by turn at entry waypoint. WGS-84 geodesic or arc path from entry to exit turns. Turn to exit heading prior to exit waypoint.
Straight Leg, DME Arc or Radius to a Fix	Fly-By	Fly-Over Defined Entry Heading	2nd half of fly-by turn at entry waypoint. WGS-84 geodesic or arc path from entry turn to exit waypoint.

Table 6-3: Leg Segments for Paths Constructed by EFIS

Path Type	Waypoint Entry	Waypoint Exit	# of Segments and Description
Straight Leg, DME Arc or Radius to a Fix	Fly-Over Defined Exit Heading	Fly-By	WGS-84 geodesic or arc path from entry waypoint to exit turn. 1st half of fly-by turn at exit waypoint.
Straight Leg, DME Arc or Radius to a Fix	Fly-Over Defined Exit Heading	Fly-Over Defined Exit Heading	WGS-84 geodesic or arc path from entry waypoint to exit turn. Turn to exit heading prior to exit waypoint.
Straight Leg, DME Arc or Radius to a Fix	Fly-Over Defined Exit Heading	Fly-Over Defined Entry Heading	WGS-84 geodesic or arc path from entry waypoint to exit waypoint.
Straight Leg, DME Arc or Radius to a Fix	Fly-Over Defined Entry Heading	Fly-By	Turn from entry heading after entry waypoint. WGS-84 geodesic or arc path from entry to exit turns. 1st half of fly-by turn at exit waypoint.
Straight Leg, DME Arc or Radius to a Fix	Fly-Over Defined Entry Heading	Fly-Over Defined Exit Heading	Turn from entry heading after entry waypoint. WGS-84 geodesic or arc path from entry to exit turns. Turn to exit heading prior to exit waypoint.
Straight Leg, DME Arc or Radius to a Fix	Fly-Over Defined Entry Heading	Fly-Over Defined Entry Heading	Turn from entry heading after entry waypoint. WGS-84 geodesic or arc path from entry turn to exit waypoint.
Straight Leg, DME Arc or Radius to a Fix	Fly-By	Fly-By	2nd half of fly-by turn at entry waypoint. WGS-84 geodesic or arc path from entry to exit turns. 1st half of fly-by turn at exit waypoint.

Table 6-3: Leg Segments for Paths Constructed by EFIS

Path Type	Waypoint Entry	Waypoint Exit	# of Segments and Description
Procedure Turn	Fly-Over Defined Exit Heading	Fly-Over Defined Entry Heading	WGS-84 geodesic path from entry waypoint on outbound heading for 30 seconds. Turn to procedure turn heading (45°). Outbound on procedure turn heading for 72 seconds. Turn to inbound heading (135°). WGS-84 geodesic path to exit waypoint. Entry waypoint and exit waypoint are same point.
Holding Pattern	Fly-Over Defined Entry Heading	Fly-Over Defined Entry Heading	Turn to proper entry procedure heading. This heading varies. For a parallel entry, it is 180° from the holding course. For direct and teardrop entries, it is the heading required to get to entry of inbound turn. WGS-84 geodesic path to entry of inbound turn. Inbound turn. Degree of turn varies depending upon entry procedure and heading. WGS-84 geodesic path to holding fix for direct and teardrop entries. WGS-84 geodesic path to entry of turn to holding pattern heading for parallel entries. Turn to holding pattern heading for parallel entries. This leg is not used for direct and teardrop entries. Turn to holding pattern outbound leg (180°).

Table 6-3: Leg Segments for Paths Constructed by EFIS

Path Type	Waypoint		# of Segments and Description
	Entry	Exit	
			Holding pattern outbound leg (length based upon either time or distance as specified by navigation database). Turn to holding pattern inbound leg (180°). Holding pattern inbound leg (length based upon either time or distance as specified by navigation database).

6.5.4. Create a User Waypoint Overfly/Pan (Step-By-Step)

1) When flying (or in pan mode) over intended waypoint, press **MENU (R1)**, within 10 seconds press **DESIG (L3)** on PFD or MFD.
2) A user waypoint is created at the present position and automatically named "OF###" (overfly) or PN### (pan mode), where ### is the next available sequence user waypoint number.
3) Edit user waypoint to change the waypoint name or characteristics (see Section 3 Menu Functions and Step-By-Step Procedures).

NOTE:

If configured in EFIS limits, "Remote User Waypoint Designate switch" may be used to easily create a user waypoint.

6.5.5. Highway in the Sky (Skyway)

When not decluttered, the EFIS displays the active FMS navigation route or manual FMS OBS course in a 3D manner with a series of skyway boxes, which overlay the flight plan route at a desired altitude and provide lateral and vertical guidance. Skyway boxes conform to the VNAV requirements of GPS/SBAS receiver. The top and bottom of the boxes are parallel to the horizon on straight leg segments and dynamically tilt with respect to the horizon on turning leg segments based on leg segment turn radius and ground speed.

When the active route is in view, up to five boxes are shown with the dimensions being a constant 400 feet wide (±200 feet from the desired lateral path) by 320 feet tall (±160 feet from the desired vertical path) spaced horizontally 2000 feet. (Dimensions and spacing always measured in feet.)

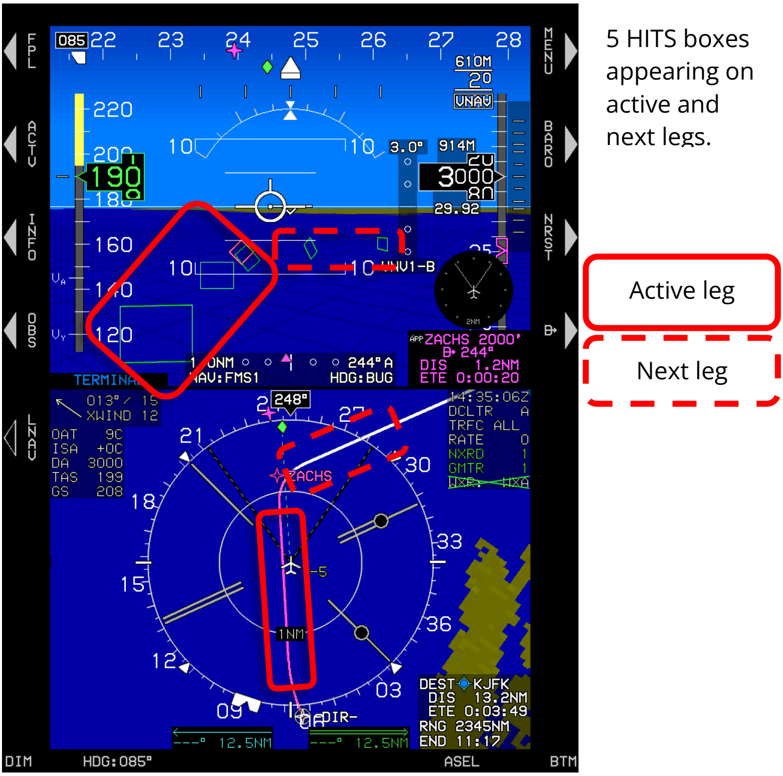


Figure 6-5: Highway in the Sky Five Boxes

Skyway boxes (when not manually deselected) are drawn using the hidden surface removal techniques of the terrain and obstruction rendering, so a skyway box behind terrain appears to be so. Skyway boxes disappear in basic mode and unusual attitude mode. In reversionary mode 1 (GPS failure), skyway boxes disappear after one minute to indicate degraded navigation performance.

Skyway box altitude is controlled by target altitude, VNAV altitude, aircraft altitude, climb performance, and climb/descent angle setting in PFD Bugs menu (outside of the FAF when an instrument approach is loaded). If no VNAV altitude is set, the skyway boxes describe the desired lateral flight path at the aircraft's current altitude.

Table 6-4: Highway in the Sky Configuration

Type HITS Lines	Fully Integrated Autopilot	Partially Integrated Analog Autopilot	Un-Integrated Autopilot or No Autopilot
Dashed	Not coupled to skyway		Always Solid
Solid	Coupled to Skyway	Coupled to skyway. Autopilot is either in HDG mode with LNAV heading/roll-steering sub-mode engaged or in NAV/APR mode with FMS1 or FMS2 as the selected navigation source.	

With a VNAV altitude set, the boxes provide both lateral and vertical guidance. Climb and descent angle settings are controlled individually with a resolution of 0.1°.

When no VNAV altitudes associated with a waypoint exist, and a target altitude is set, HITS box altitudes emanate from the current aircraft altitude and indicate a climb or descent, as appropriate, until reaching the target altitude. When a climb is shown, the HITS boxes are drawn at the higher of actual climb angle or the dynamic climb angle setting. When a descent is shown, the HITS boxes are drawn at an angle corresponding to the descent angle setting in the PFD Bugs menu.

NOTE:

This symbology emulates an altitude pre-selector and give guidance to climb or descend real-time as if being issued an assigned altitude from ATC.

When at least one VNAV altitude associated with a waypoint exists, HITS boxes are guided by VNAV waypoints determined by VNAV altitude and VNAV offsets from flight plan waypoints. The two sources for VNAV altitudes come from the navigation database or are manually input through the ACTV menu. VNAV altitudes are automatically computed by the system using "look-ahead" rules if not coming from the navigation database or manually input.

When "look-ahead" finds a further VNAV altitude constraint above the previous VNAV altitude constraint (climb commanded), then an automatic VNAV altitude is continuously calculated for the waypoint based upon an immediate climb to the altitude constraint at the dynamic climb angle.

When "look-ahead" finds a further VNAV altitude constraint below the previous VNAV altitude constraint (descent commanded), then an automatic VNAV altitude is calculated for the waypoint based upon a descent to reach the VNAV altitude constraint at the associated waypoint using the descent angle setting. If no further VNAV altitude constraints are found, then the automatic VNAV altitude is set to the last valid altitude constraint.

When a VNAV climb is desired, the HITS boxes are drawn at a vertical position that is the higher of the following:

1) The dynamic climb angle emanating from the aircraft's present position (aircraft-referenced) (Figure 6-6);

2) The dynamic climb angle emanating from the next waypoint VNAV altitude (geo-referenced forward) (Figure 6-7); or

3) The climb angle setting emanating from the previous waypoint VNAV altitude (geo-referenced backward) (Figure 6-8).

NOTE:

The geo-referenced backward calculation is only considered when the current leg is part of a procedure and is designed to provide pilot awareness if a specified climb angle gradient is not being met.

Once the HITS boxes intercept the VNAV altitude, further boxes are drawn with a zero angle to show a level-off followed by a level segment. Since five HITS boxes are shown, the level-off depiction becomes a compelling anticipatory cue for the pilot.

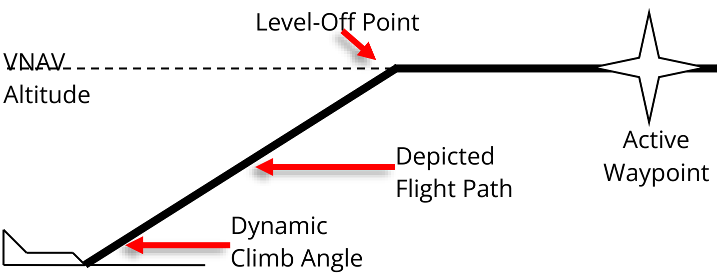


Figure 6-6: Highway in the Sky (Aircraft Referenced)

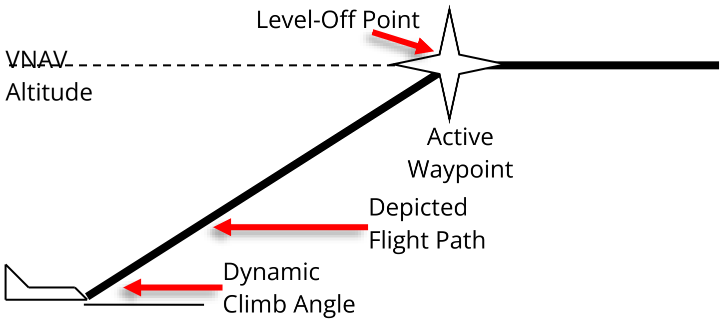


Figure 6-7: Highway in the Sky (Geo-Referenced Forward)

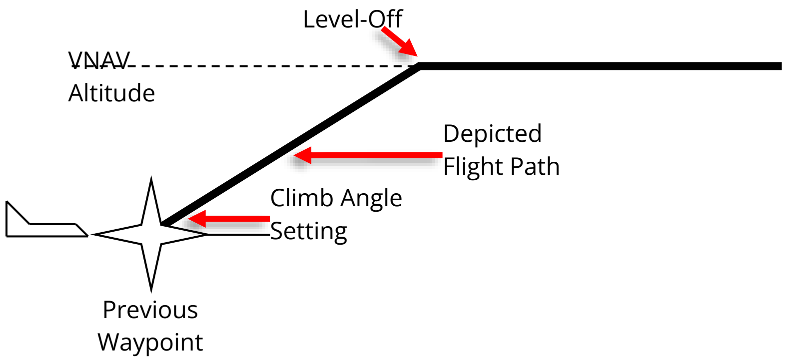


Figure 6-8: Highway in the Sky (Geo-Referenced Backward)

When a VNAV descent is desired, boxes are drawn with a zero angle until reaching a descent point. Further boxes are drawn downward at an angle corresponding to the descent angle setting. The descent point is defined by the intercept of a line emanating upward from the subsequent VNAV waypoint at the descent angle setting and a line representing level flight at the previous VNAV altitude. On the final approach segment of an IFR approach, descent angle and VNAV waypoint are defined in Table 6-5.

Table 6-5: Final Segment of IFR Approach, Descent Angle and VNAV Waypoint

Condition	VNAV Waypoint	Descent Angle
IFR approach with valid final approach segment data block containing a non-zero glide path angle	Glide Path Intercept Point (GPIP) as defined in final approach segment data block	Descent angle as defined in final approach segment data block

Table 6-5: Final Segment of IFR Approach, Descent Angle and VNAV Waypoint

Condition	VNAV Waypoint	Descent Angle
Absent or invalid final approach segment data block, or final approach segment data block glide path angle is set to 0° No intermediate waypoints exist between FAF and MAP	Missed approach point location	Straight line from FAF to MAP location and altitudes
Absent or invalid final approach segment data block, or final approach segment data block glide path angle is set to 0° Intermediate waypoints exist between FAF and MAP	Missed approach point location	Steepest descent angle based upon straight lines from FAF and subsequent intermediate waypoints to MAP location and altitudes

On the final approach segment of a VFR approach procedure, the higher of the descent angle setting or 3° is used.

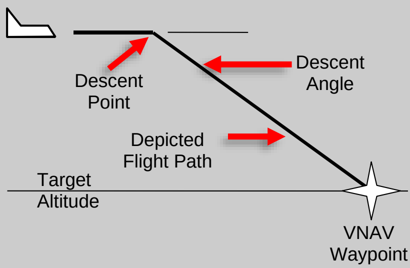
Figure 6-9: Highway in the Sky Final Approach Segment

Because five boxes are shown, the descent point depiction is an anticipatory cue. Figure 6-9 depicts descent guidance and creates an easily understood, yet safe, VNAV paradigm to meet the VNAV requirements current guidance.

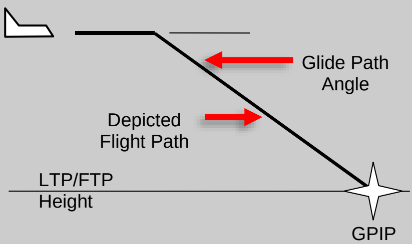
The VNAV paradigm scheme creates an easily understood, yet safe, method to meet certification requirements. Simplicity is the primary objective and this paradigm is biased towards keeping the aircraft at the highest altitude possible for the longest time. The climb paradigm automatically compensates for an aircraft's ability to climb more steeply than specified and warns of being below a desired climb gradient when the aircraft is unable to meet the specified climb angle. Furthermore, this descent paradigm encourages flying stabilized, and continuous descent profiles.

Table 6-6: VNAV Paradigm

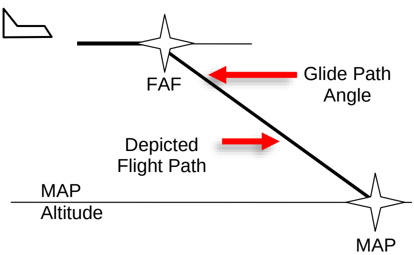
Normal Descent



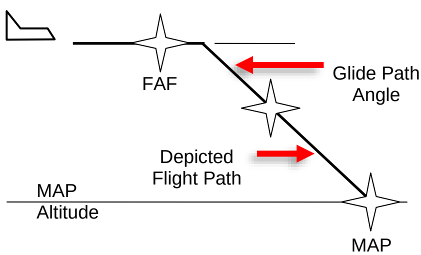
Final Approach Segment Descent w/FAS Data Block and Non-zero Glide Path Angle



Final Approach Segment Descent w/o FAS Data Block Glide Path Angle or Intermediate Waypoints



Final Approach Segment Descent w/o FAS Data Block Glide Path Angle and with Intermediate Waypoint



Further, the paradigm is biased towards keeping the aircraft at the highest altitude possible for the longest period. The climb paradigm compensates for an aircraft's ability to climb more steeply than specified and warns of being below a desired climb gradient when the aircraft is unable to meet the specified climb angle. The descent paradigm encourages flying stabilized approaches.

6.6. Direct-To

If the EFIS generates a WGS-84 geodesic path to a designated "To" fix, the aircraft captures this path without "S-turning" or undue delay. Where the selected "To" fix is in the active flight plan, the required transition is created as follows:

1) A phantom waypoint is created at the current aircraft location.

2) Leg prior to the phantom waypoint is designated a discontinuity.

3) Phantom waypoint is designated a fly-over defined entry heading waypoint where entry heading is current aircraft track.

6.6.1. Direct-To Unnamed Waypoints inside Procedures

The following identifiers are implemented for unnamed waypoints inside a published procedure and are found on the map or inside the active flight plan.

1) -ALT- for altitude terminations

2) -DIR- for waypoints that begin a Direct-To leg

3) -DME- for distance or DME terminations

4) -INT- for intercept terminations

5) -RAD- for radial terminations

6) -MAN- for manual terminations

6.7. Discontinuities

When the EFIS is unable to construct a smooth flight path, due to active flight plan waypoint spacing (i.e., spacing too close for turn radius), a discontinuity is placed between the waypoints. When a discontinuity exists, no path nor skyway is drawn between the waypoints. The pilot cannot activate the waypoint exiting the discontinuity, as it is not possible to provide path guidance to this waypoint.

Attempts to activate the waypoint exiting the discontinuity activates the next waypoint or, if there is no next waypoint (i.e., end of active flight plan), activation of the waypoint leading into the discontinuity.

6.7.1. Manual Termination Legs

Manual termination legs (ARINC-424 path types FM and VM) are a special case and are handled as follows:

1) The manual termination leg is rendered as a path on the database course/heading for 10NM beyond either:

   a) the previous waypoint (manual leg not active); or

   b) the nearest on-path point (manual leg active);

2) Rendering of the manual termination leg does not terminate with a waypoint symbol;

3) The manual termination leg is followed by a discontinuity;

4) Waypoint sequencing is suspended on the manual termination leg;

5) Once on the manual termination leg, **RESUME (L6)** appears;

6) When ready to end manual navigation and resume a path to the waypoint following the manual termination leg, press **RESUME (L6)** to create and activate a Direct-To path to the waypoint.

> **NOTE:**
>
> If the manual termination leg is not followed by another waypoint (other than a suppressed waypoint), **RESUME (L6)** does not appear, because there is no waypoint-to-waypoint sequencing to resume.

6.8. Magnetic Course

The source of magnetic variation used for paths defined using magnetic course is in accordance with the following:

1) If the leg is part of a database terminal area procedure and the magnetic variation is specified by the State for that procedure, the magnetic variation to be used is the value specified.

2) If the leg is not part of a procedure and the active fix is a VOR, the magnetic variation to be used is the published station declination for the VOR.

3) If the leg is not part of a procedure and the terminating fix is not a VOR, the magnetic variation to be used is defined by the system using an internal model.

The EFIS is capable of computing magnetic variation at any location within the region where flight operations may be conducted using magnetic north reference. The assigned magnetic variation is calculated using the NIMA GEOMAG algorithm and world magnetic model appropriate to the five-year cycle in a MAGVAR database.

6.8.1. AHRS Modes for Heading Source

AHRS Slaved—EFIS Magnetic North: Standard mode of operation. Everything displayed relative to magnetic north drift free.

AHRS Slaved—EFIS True North: Everything displayed relative to true north with drift free heading. The preferred way to operate in areas where navigation is done relative to true north. (See Section 8 Appendix for limitations on Earth's magnetic flux horizontal field.)

AHRS Free/DG—EFIS Magnetic North: Use when operating around significant magnetic disturbances in areas where navigation is done relative to magnetic north. Ensure the compass rose is slewed to a magnetic north value.

AHRS Free/DG—EFIS True North: Method of operation in high-latitude areas where navigation is accomplished relative to true north. Heading is not drift free and requires periodic correction. This mode may also be used when operating around significant magnetic disturbances in areas where navigation is done relative to true north. Ensure the compass rose is slewed to a true north value.

6.8.2. EFIS True North Mode

True north mode is selectable either through **OBS (L4)**, **TRUE NORTH (L1)**, or an external switch if configured in EFIS limits. This mode is intended to address aircraft requirements during high or low latitude operations and should be used when the AHRS has been set to free-gyro mode. See Section 2 Display Symbology for true north mode symbology examples.

6.9. Dead Reckoning

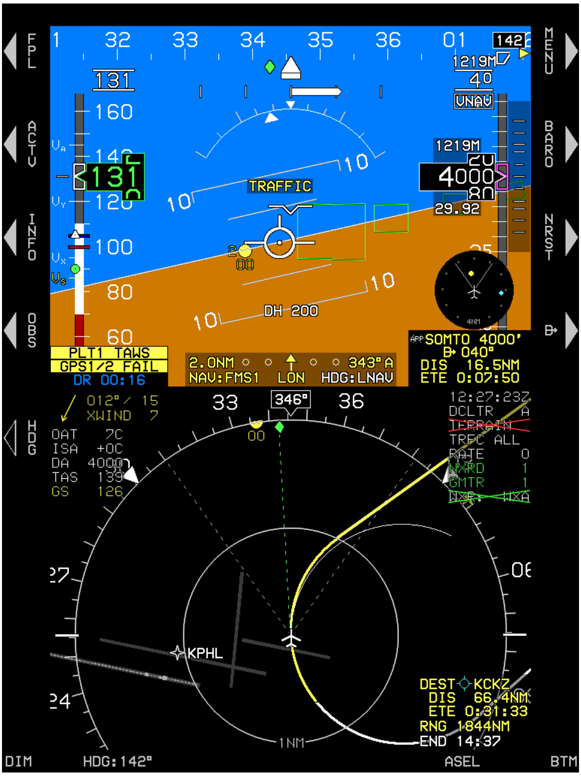


Figure 6-10: Dead Reckoning

The EFIS has dead reckoning capability and is active whenever the GPS/SBAS sensor is not sending a valid position. The EFIS projects the last known GPS/SBAS position forward using TAS and heading, corrected for last known wind as it continues to navigate using this position and the active flight plan. The system provides the capability to determine bearing to an airport, based upon the dead reckoning position.

6.10. Parallel Offsets

The parallel offset is a route parallel to, but offset from, the original active route. The basis of the offset path is the original flight plan leg(s) and one or more offset reference points as computed by the EFIS.

The computed offset reference points are located so they lie on the intersection of lines drawn parallel to the host route at the desired offset distance and the line that bisects the track change angle, except where the parallel offset ends. In this case, the offset reference point is located abeam of the original flight plan waypoint at the offset distance.

The parallel offset function is not available nor applies to:

1) Legs that are parts of approach procedures (IFR and VFR); or

2) Legs with complex geometries or that begin or end with dynamically terminations. (ARINC-424 path types other than CF, DF, or TF or any leg where the starting waypoint is not a fixed position); or

3) Legs that begin at an aircraft starting position (reference waypoint in a DP or Phantom waypoints created by the Direct-To function.

Parallel offset function does not propagate through the following:

1) Any waypoint at the beginning or end of a route discontinuity; or

2) Any waypoint at the beginning or end of a prohibited leg type; or

3) A waypoint with an unreasonable path geometry (defined as a turn greater than 120°.)

When the parallel offset function begins or ends within a flight plan due to the above constraints, parallel offset entry (PTK+) or exit (PTK-) waypoints are inserted into the flight plan. **PTK ENDING** appears in sufficient time to alert the pilot to return to the original path. Discontinuities precede parallel offset entry waypoints and follow parallel offset exit waypoints. This allows the pilot to navigate to and from the parallel offset as required.

The EFIS provides guidance to parallel tracks at a selected offset distance. When executing a parallel offset, the navigation mode and all performance requirements of the original route in the active flight plan are applicable to the offset route. The EFIS provides for entry of offset distance in NM or KM (depending upon setting of "speed Units" in EFIS limits) in increments of 1 unit left or right of course and is capable of offsets of at least 20 units. Offset mode is indicated with an advisory flag, for example, **PTK = L 20NM**/**PTK = L 20KM**. When in offset mode, the EFIS provides reference parameters (e.g., cross-track deviation, distance-to-go, time-to-go) relative to the offset path and offset reference points.

Figure 6-11: Parallel Offset PTK+/PTK ENTRY

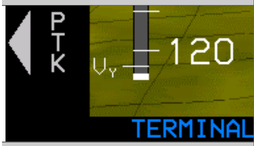
Figure 6-12: Parallel Offset PTK-/PTK ENDING

Once a parallel offset is activated, the offset remains active for all flight plan route segments until removed automatically (transitioning through a parallel track exit waypoint), until the flight crew enters a "Direct-To" routing, or activates a new flight plan route, or until (manual) cancellation.

NOTE:

If a parallel offset is entered in the active flight plan and then cancelled, that active flight plan is no longer eligible for configuring another parallel offset without deleting and reopening due to the creation of a discontinuity.

Table 6-7: Parallel Offsets Symbols and Description

Symbol	Description	
 	Distance in NM Distance in KM	Parallel offset has been created and has a designated ending waypoint.
	Designated ending waypoint of parallel offset	
PTK = R 3NM PTK = R 3KM	Distance in NM Distance in KM	Parallel track advisory indicating offset track 2 NM to the right of host route.
	**PTK (L4)** appears when active route is eligible for a parallel offset.	
PTK ENDING	Approaching end of parallel offset waypoint	
	The absence of **PTK (L4)** indicates a parallel offset is not allowed for reasons stated above.	
	Indicates each waypoint is a part of the parallel offset.	

6.11. Geodesic Path Computation Accuracy

The cross-track path deviation error between the computed path used to determine cross-track deviations and the true WGS-84 geodesic is less than 10% of the horizontal alert limit of the navigation mode applicable to the leg containing the path.

6.11.1. GPS Altitude

WGS-84 ellipsoid altitude received from the GPS/SBAS is converted to geodetic (MSL) altitude using the EGM 2008 geoidal database.

6.12. Navigation Database Requirements

The updateable navigation database contains at least the following location and path information, referenced to WGS-84, with a resolution of 0.01 minute (latitude/longitude) and 0.1° (for course information) or better at all of the following for the area(s) in which IFR operations are intended:

1) Airports.

2) VORs, DMEs (including DMEs collocated with localizers), collocated VOR/DMEs, VORTACs, and NDBs (including NDBs used as locator outer marker).

3) All named waypoints and intersections are shown on en route and terminal area charts.

4) All airways are shown on en route charts, including all waypoints, intersections, and associated RNP values (if applicable). Airways are retrievable as a group of waypoints. Select the airway by name to load the appropriate waypoints and legs between desired entry and exit points into the flight plan.

5) RNAV DPs and STARs, including all waypoints, intersections, and associated RNP values (if applicable). DPs and STARs are retrievable as a procedure. Select the procedure by name to load the appropriate waypoints and legs into the flight plan.

6) LNAV approach procedures in the area(s) in which IFR operation is intended consist of:

    a) Runway number and label (required for approach identification);

    b) Initial approach waypoint (IAWP);

    c) Intermediate approach waypoint(s) (IWP), when applicable;

    d) Final approach waypoint (FAWP);

    e) Missed approach waypoint (MAWP);

f) Additional missed approach waypoints, when applicable; and

g) Missed approach holding waypoint (MAHWP).

The EFIS also stores the data necessary to support stand-alone LNAV/VNAV approaches, such as LNAV/VNAV approaches to runway ends that do not also have approaches with a FAS data block. The LNAV/VNAV approach data consist of the height of the runway threshold, threshold crossing height, and glide path angle.

The complete sequence of waypoints and associated RNP values (if applicable), in the correct order for each approach, is retrievable as a procedure. Select the procedure by name to load the appropriate waypoints and legs into the flight plan.

7) LPV, LP, and/or LNAV/VNAV published procedures are available in the area(s) where IFR operation is intended. Select a procedure by name to load the appropriate waypoints and legs into the active flight plan.

CAUTION:

Failure to update IAP/APD data with current data results in expired NRST APD, IAP APD, or APPR plate images to appear on the MFD.

NOTE:

Waypoints used as a final approach waypoint (FAWP) and LTP/FTP/MAWP in an LNAV/VNAV procedure are uniquely identified to provide proper approach mode operation.

The LNAV/VNAV approach data consists of height of the runway threshold, threshold crossing height, and glide path angle.

NOTE:

Manual entry and or update of the navigation database is not possible. Recalling data from storage does not prevent it from being retained for later use.

6.13. Default GPS/SBAS Navigation Modes

In the default GPS/SBAS mode, the EFIS has en route, terminal, LNAV approach, LNAV/VNAV approach, LP approach, LPV approach, VFR approach, and departure navigation modes. Mode annunciation, alert limits (horizontal and vertical), and CDI FSD (horizontal and vertical) are determined by navigation mode.

Table 6-8: Default GPS/SBAS Navigation Modes

Navigation Mode	Annunciation
En route	None
Terminal	**TERMINAL**
LNAV Approach	**LNAV APPR**
LNAV/VNAV Approach	**LNAV/VNAV APPR**
LP Approach	**LP APPR**
LPV Approach	**LPV APPR**
VFR Approach	**VFR APPR**
Departure	**TERMINAL**

Table 6-9: Default Navigation Modes Based Upon Region of Operation

Default Navigation Mode	Definition of Region (All distances are always in NM units)
Departure	When an active waypoint is the first waypoint of a departure or missed approach procedure and the active leg heading is aligned (±3°) with an active runway heading. Also set when an active waypoint is MAWP, but a missed approach has been manually activated.
VTF Approach (LNAV, LNAV/VNAV, LP, or LPV)	VTF IFR approach has been selected; <u>and</u> within 30NM of the active runway; <u>and</u> on the final approach segment, the FAWP is the active waypoint or within 2NM of the FAWP; <u>and</u> bearing to FAWP is within 45° of final approach segment track (treated as a mode entry criteria); <u>and</u> aircraft track is within 90° of the final approach segment track (treated as a mode entry criteria).
Approach (LNAV, LNAV/VNAV, LP, or LPV)	IFR approach has been selected; <u>and</u> within 30NM of the active runway; <u>and</u> on the final approach segment, the FAWP is the active waypoint or within 2NM of the FAWP; <u>and</u> if the FAWP is the active waypoint or within 2NM of the FAWP:

Table 6-9: Default Navigation Modes Based Upon Region of Operation

Default Navigation Mode	Definition of Region (All distances are always in NM units)
	bearing to FAWP is within 45° of the final approach segment track (treated as a mode entry criteria); and aircraft track is within 90° of the final approach segment track (treated as a mode entry criteria); and either the segment leading into the FAWP is not a holding pattern, or the pilot has elected to continue out of holding.
VFR Approach	VFR approach has been selected; and within 30NM of the runway/user waypoint; and active runway/user waypoint is the active waypoint; and bearing to the active runway/user waypoint is within 45° of the final approach segment track (treated as a mode entry criteria); and aircraft track is within 90° of the final approach segment track (treated as a mode entry criterion).
Terminal	Not in departure mode; and not in approach mode; and active waypoint is part of a departure, or the active waypoint and the previous waypoint are parts of an arrival or approach or within 30NM of the departure airport, arrival airport, or runway.
En Route	Not in departure, approach, or terminal modes

NOTE:

During RNP 0.3 approach (manually or coded), the scale remains in RNP 0.3.

6.14. GPS/SBAS CDI Scale

NOTE:

For RNP 0.3 routes, the time to alert (TTA) is the same as for the approach. For RNP 0.3, the EFIS uses a 10-second TTA when using GPS-only and a 2-second TTA when using EGNOS.

NOTE:

The sensitivity change from ±0.3NM to ±1NM can take as long as 30 seconds to provide a smooth transition for autopilots.

Table 6-10: Summary of Changes In Cross-Track FSD

From	To En Route	To Terminal	To Approach
	Distances are always in NM units		
En Route		Change from ±2 NM FSD to ±1 NM FSD over 1 NM; start transition when entering terminal mode.	
Terminal	Change from ±1 NM FSD to ±2 NM FSD over 1 NM; start transition when entering en route mode.		If VTF, switch immediately. Otherwise, change from ±1 NM FSD to approach FSD over 2 NM; start transition at 2 NM from FAWP.
Approach		Change to ±1 NM.	
Departure		If the initial leg is aligned with the runway, change from ±0.3 NM FSD to ±1 NM FSD at the turn initiation point of the first fix in the departure procedure.	

6.14.1. OBS Setting of CDI

In automatic mode, the system controls the scale and OBS setting. The selected navigation source is annunciated below the CDI as follows:

1) NAV: FMS1/FMS2
2) NAV: VOR1/LOC1
3) NAV: BC1/BC2 (annunciated instead of LOC1/2 when course error exceeds 104°)
4) NAV: VOR2/LOC2

6.14.2. Alerting Scheme for LNAV/VNAV Procedures

During normal operation with an FMS source of navigation guidance, when an LNAV/VNAV procedure has been entered into the active flight plan, and the EFIS is in LNAV/VNAV, the vertical and lateral integrity flags are out of view, and guidance displays show the deviations from the track in vertical and lateral dimensions. The linear vertical scale limits of the VDI for LNAV/VNAV and LPV approaches are shown in Figure 6-13.

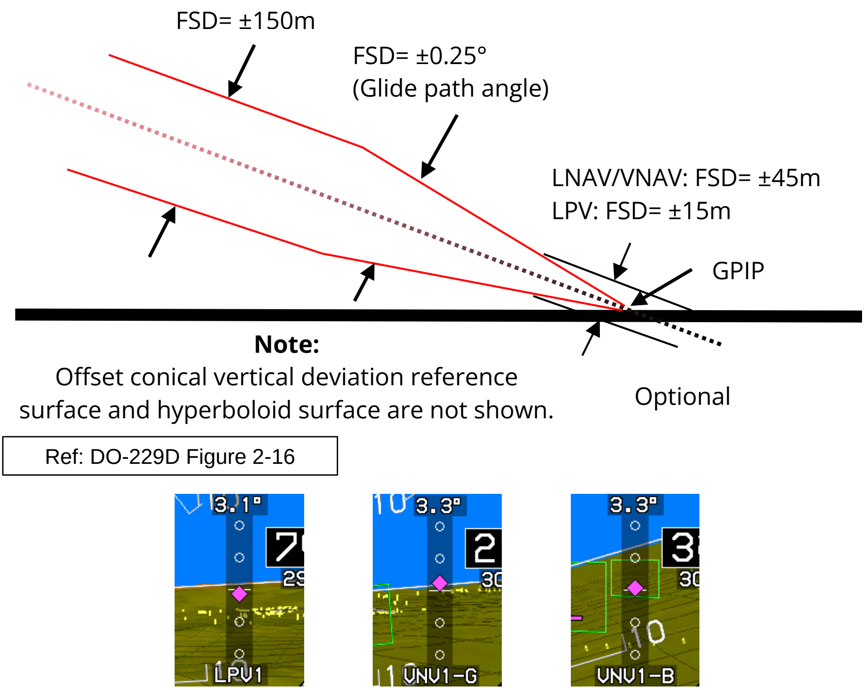


Figure 6-13: Vertical Deviation Indicator Linear Deviation

6.14.3. Alerting Scheme for LPV/LP Procedures

During normal operation with FMS source of navigation guidance, when an LPV or LP procedure has been entered into the active flight plan and the EFIS is in LPV or LP, the vertical and lateral integrity flags are out of view (only lateral integrity flag for LP). Additionally, the guidance displays show the deviations from track in vertical and lateral dimensions (only lateral for LP).

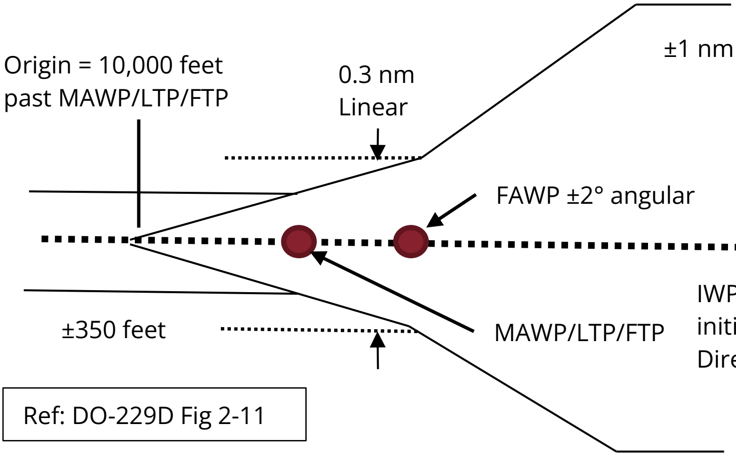


Figure 6-14: Lateral Deviation Indicator

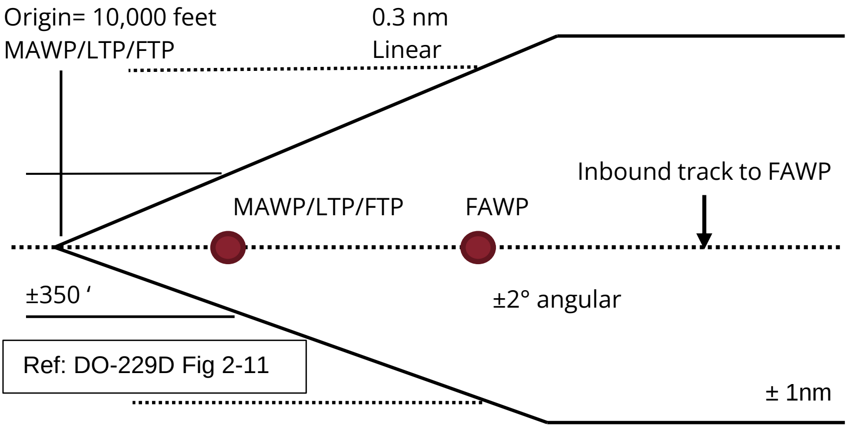


Figure 6-15: FSD Lateral Deviation Indicator Linear Deviation VTF Approach

NOTE:

Non-Numeric Cross-Track Deviation

The full-scale deflection for LNAV is either identical to LNAV/VNAV or one of the following:

Angular deviations

1) If a VTF approach has not been selected:

a) Prior to 2NM from the FAWP, the FSD is ±1NM

b) Between 2NM from the FAWP and the FAWP, the FSD is gradually changed to the FSD specified in c) below at the FAWP;

c) At and beyond the FAWP, but before initiating a missed approach, the FSD is the minimum of; a constant FSD of ±0.3 NM; or angular FSD defined by a ±2.0° wedge with the origin located 10,000 feet past the MAWP. The FSD continues to decrease or reach a minimum of ±350 feet.

2) If a VTF has been selected, the FSD is the minimum of; constant FSD of ± 1NM; or angular FSD defined by a ±2.0° wedge with an origin located 10,000 feet past the MAWP. The FSD continues to decrease or reach a minimum of ±350 feet.

6.15. Approach Type Selection

The EFIS selects the approach type (LNAV, LNAV/VNAV, LP, or LPV) when entering approach mode with the following order of precedence and prerequisites:

1) LPV:

   a) ARINC-424 "Level of Service" indicates LPV minimums are published;

   b) Valid long-term, fast, and ionospheric SBAS corrections are available and being applied to at least 4 GPS satellites;

   c) The final approach segment data block exists and passes the built-in-test; and

   d) Horizontal and vertical alert limits from the final approach segment data block are predicted to be supported.

2) LP: (Same precedence and prerequisites as LPV (except ARINC-424 "Level of Service" indicates LP minimums are published.)

3) LNAV/VNAV:

   a) ARINC-424 "Level of Service" indicates LNAV/VNAV minimums are published;

   b) If a final approach segment data block exists, it passes the built-in-test; and

   c) A horizontal alert limit of 556m (.3NM) is predicted to be supported.

NOTE:

Because the EFIS inherently supports barometric VNAV, it is not a prerequisite for the vertical alert limit to be predicted or supported, nor is it a prerequisite for valid long-term, fast, and ionospheric SBAS corrections to be available and applied to at least four GPS satellites. Rather, the vertical alert limit (50m) and SBAS correction tests are used to determine whether to present guidance based upon GPS altitude or barometric altitude.

4) LNAV: Default approach type selected when none of the above selections are made. There are no prerequisites for selecting LNAV.

The EFIS continuously displays the approach type (mode indication) after selection. The EFIS does not degrade the approach type after selection unless the approach procedure is reselected or changed.

NOTE:

These GPS/SBAS modes still appear during a ground-based approach such as an ILS approach.

Some instrument procedures include notes saying the following: "RNP 0.3 required," and are coded as an RNAV procedure. In these cases, select manual RNP to see the RNP and ANP values on the PFD.

6.15.1. Approach Path Definition (GPS Procedures)

Standard IAP path definitions are as specified in the navigation database and FAS data block procedure. Deviations are provided concerning the active leg of the approach procedure.

NOTE:

The threshold location is referred to as the LTP if it is co-located with the runway and FTP if it is displaced from the runway. The glide path angle is defined relative to the local tangent plane of the WGS-84 ellipsoid. This path definition mimics ILS glide slope characteristics, where the virtual glide path antenna location is offset from the runway by less than 500 feet.

6.15.2. VTF IFR Approach

The pilot may select a VTF IFR approach, indicating the pilot does not intend to fly the entire procedure. When a VTF IFR approach is selected, the EFIS creates an initial point (IP) waypoint on the extended final approach course to provide deviations relative to the extended final approach course. The IP is a fly-over defined exit heading waypoint, and the leg before the IP is designated a discontinuity. Until the FAWP is sequenced, the EFIS indicates a VTF IFR approach has been selected. **VECTORS** indicates guidance is not relative to a published approach path, and TERPS clearances are not assured.

6.15.3. VTF VFR Approach

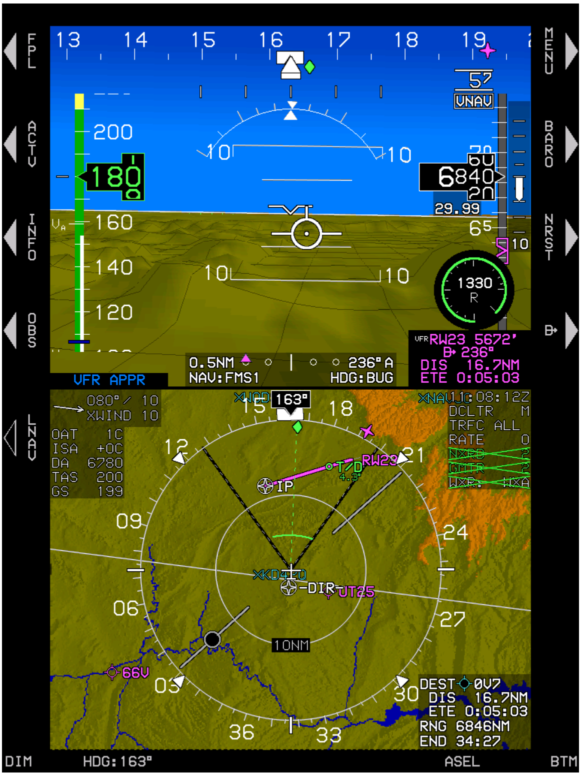


Figure 6-16: VTF VFR Approach

The pilot may select a VFR approach to a runway or user waypoint with a defined approach bearing. When a VFR approach is selected, the EFIS creates an "IP" waypoint on the extended final approach course to provide deviations relative to the extended final approach course. The IP is designated a fly-over defined exit heading waypoint, and the leg before the IP is designated a discontinuity.

As depicted in Figure 6-16, during the VTF VFR approach, the aircraft is navigated towards the IP. Since the IP is designated as a discontinuity, proceeding direct is not possible. When attempting to proceed direct to the IP, only the active leg between the IP and the selected runway is activated.

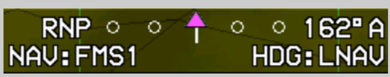
6.16. Required Navigation Performance

The EFIS supports required navigation performance by means of:

1) Manually entered RNP values; or

2) RNP values are automatically retrieved from the navigation database associated with airways or procedures (DPs, STARs, or IAPs).

Table 6-11: RNP Order of Precedence

<table>
<tr><th>Navigation Mode</th><th>Annunciations</th><th>Conditions</th></tr>
<tr><td>Manual RNP (Manually set between 0.1NM and 15NM)</td><td rowspan="2">RNP: 1.6M
ANP: 0.1</td><td>Navigation mode is RNP, and manually entered RNP is used to determine CDI FSD, LON and LOI alerting. Manual RNP overrides all other modes.</td></tr>
<tr><td>Manual RNP on Final Approach Segment</td><td>The system conforms to the mode in the associated ARINC-424 "Level of Service" navigation database record. The level of service tracks the minima lines on the published approach plate.</td></tr>
<tr><td>Automatic RNP (Retrieved from Navigation Database)</td><td rowspan="2">RNP: 0.3A
ANP: 0.1</td><td rowspan="2">When outside the approach region of operation, if a manually entered RNP value does not exist, but an automatic RNP value retrieved from the database does exist.</td></tr>
<tr><td>Automatic RNP on Final Approach Segment</td></tr>
<tr><td colspan="2">CDI shows RNP navigation mode, and automatically retrieves the RNP value to determine CDI FSD, LON alerting, and LOI alerting.</td><td></td></tr>
</table>

NOTE:

When outside the approach region of operation and neither a manually entered nor automatic RNP value exists, the system operation defaults to GPS/SBS operations.

6.16.1. Automatic RNP Mode

In automatic RNP mode, after sequencing the FAWP, the EFIS indicates when the navigation system is no longer adequate to conduct or continue the approach by displaying the LON condition inside the CDI on the transmit enabled display. The flag appears until no longer in an approach mode.

Figure 6-17: Automatic RNP Mode

6.17. Missed Approach and Departure Path Definition

Once on the final approach segment, the pilot may initiate an immediate missed approach or arm the system to execute the missed approach at the MAWP. If armed before crossing the MAWP, the EFIS arms the missed approach for automatic initiation at the MAWP. If a missed approach is not armed, nor initiated before crossing the MAWP, the EFIS switches to FROM mode at the MAWP and continues the same course.

If the pilot initiates the missed approach, the EFIS provides guidance relative to the procedure. If a missed approach is armed before crossing the MAWP, the procedure defines the desired path to and after the MAWP. If the first leg in the missed approach procedure is not a straight path aligned within 3° of the final approach course, the FSD changes to terminal mode FSD (±1 NM) when the missed approach is initiated. Otherwise, the FSD changes to ±0.3 NM when the missed approach is initiated (departure mode) and changes to terminal mode FSD (±1 NM) at the turn initiation point of the first waypoint in the missed approach procedure.

6.18. Loss of Navigation Monitoring

6.18.1. Loss of Integrity Caution Monitoring

The EFIS provides a caution, independent of any operator action when the equipment has a loss of integrity monitoring. When HPL (Horizontal Protection Level) exceeds the applicable HAL (Horizontal Alert Limit) for the longer than applicable time to alert and HPL_{SBAS} exceeds the HAL for the current navigation mode for longer than 2 seconds. The caution returns to its normal state immediately upon termination of the responsible condition. The receiver transmits only one type of HPL, either HPL_{FD} or HPL_{SBAS}, as valid at any time.

Table 6-12: Loss of Integrity Caution Monitoring

Mode of Flight	HAL	Time to Alert
RNP: 0.10M **RNP: 0.10A** *	As manually set or automatically retrieved	10 Seconds (RNP<2NM) 30 Seconds (otherwise)
En route	2 NM	30 Seconds

Table 6-12: Loss of Integrity Caution Monitoring

Mode of Flight	HAL	Time to Alert
TERMINAL	1 NM	10 Seconds
LNAV APPR *	0.3 NM	10 Seconds
LNV/VNV APPR *	0.3 NM	10 Seconds
LP APPR * LPV APPR	0.3 NM	10 Seconds
Departure	0.3 NM	10 Seconds

* Only applicable before sequencing FAWP. Meeting loss of integrity criteria after sequencing the FAWP is defined as LON.

NOTE:

The EFIS is capable of the following levels of RNP but may not be capable due to limited satellite coverage. Manual RNP is selectable between 0.10NM and 15NM as follows:

1) 0.01 NM increments between RNP 0.10 and RNP 0.3
2) 0.1 NM increments between RNP 0.3 and RNP 2
3) 1 NM increments between RNP 2 and RNP 15

6.18.2. Faults Menu

Use the faults menu to distinguish the cause of a LON caution. Table 6-13 explains conditions and caution termination for each mode of flight.

Table 6-13: Summary of Faults Menu

Mode of Flight	Conditions	Caution Termination
Manual RNP RNP: 0.10M RNP: 15.0M	LON is displayed with a 10-second time to alert if the RNP value is less than 2NM and a 30-second time to alert.	Returns to normal state immediately upon termination of a responsible condition.
Automatic RNP RNP: 0.10A RNP: 15.0A	After sequencing the FAWP, LON is displayed when the navigation system is no longer adequate to conduct or continue the approach.	Appears until equipment no longer in an approach mode.
En route and Terminal TERMINAL	LON displayed when navigation system is no longer is adequate to conduct or continue the navigation.	Returns to normal state immediately upon termination of responsible condition.

Table 6-13: Summary of Faults Menu

Mode of Flight	Conditions	Caution Termination
LNAV Approach mode LNAV APPR	Upon passing the FAWP, flag appears until EFIS is no longer in an approach mode.	Returns to normal state immediately upon termination of the responsible condition.
LNAV/VNAV Approach mode LNV/VNV APPR	LON displayed when navigation system is no longer adequate to conduct or continue the approach.	After sequencing the FAWP and LON/VERT LON flags appear until the equipment is no longer in an approach mode as defined above, with the exception that when the LNAV/VNAV approach mode is predicated upon Barometric VNAV. (See Note)
LP or LPV Approach mode LP APPR LPV APPR	LON or VERT LON is displayed when the navigation system is no longer adequate to conduct or continue the approach.	Before sequencing the FAWP, flags return to normal State immediately upon termination of the responsible condition.
Note: A supplemental test is added for lateral and vertical flagging. A supplemental test is added for vertical flagging when barometric altitude information is in a failed state.		

6.19. Manual Holding Patterns

Most waypoints within an active flight plan can have a manual holding pattern created with the following parameters:

1) Inbound course to the holding fix with 1° increment relative to magnetic or true north.
2) A left or right turn direction.
3) A leg distance, settable in either time (increments of 0.1 minutes from 0.5 minutes to 5.0 minutes) or distance (in NM or KM.) (1-unit Increments from 1 to 25 units).
4) When a time setting is used, the speed used to calculate distance is the holding speed set in EFIS limits.

6.20. Selection of an Instrument Procedure

When an instrument procedure is selected and active, the receiver notifies the pilot of the most accurate level of service supported by the combination of the GPS/SBAS signal, receiver, and selected approach using naming conventions on the minima lines of the selected approach procedure. Once the level of service has been given, the EFIS operates in this mode for the duration of the procedure unless the level of service is unavailable. The EFIS cannot change back to a more accurate level of service until the next time an approach is activated. The following are samples of step-by-step procedures.

6.20.1. Standard Instrument Departure (DP) (Step-By-Step)

When valid and the selected waypoint is an airport with a DP in the database, the pilot is presented a selection list of DPs, followed by selection list of transition(s) and runways as appropriate.

1) Press **ACTV (L2)** departure airport must be entered as a waypoint.
2) Use ❶ to highlight desired airport then push to enter.
3) Use ❶ to highlight **DP..** then push to enter.
4) Use ❶ to highlight desired DP then push to enter.
5) Use ❶ to highlight desired runway then push to enter.
6) Use ❶ to highlight desired runway then push to enter. Press **EXIT (R1)** to exit active menu.
7) If ATC issues radar vectors to assigned route as published in the DP text notes, press **ACTV (L2)**, edit active flight plan accordingly.
8) Push ❶. Rotate to highlight **NAV LOG** then push to enter. View first portion then rotate ❶ to view remainder of NAV Log, if necessary.

6.20.2. VFR Approach to User Waypoint (Step-By-Step)

To create a VFR approach procedure for any of the possible 999 user waypoints stored in the system, it is assumed that user waypoints have been uncluttered on the Map page and user waypoints are visible. In this scenario, a new user waypoint is created by panning to the desired location. Creation of user waypoints is described in Section 3 Menu Functions and Step-By-Step Procedures.

1) While maneuvering around a desired area, press **MENU (R1)**, within 10 seconds press **FORMAT (R8)**. Rotate ❶ to **PAN ON** and then push to enter.
2) Use the labeled buttons **NORTH (L7)**, **SOUTH (L8)**, **EAST (R7)**, or **WEST (R8)** to position the panning ownship symbol near the desired landing area.

3) Press **MENU (R1)**, within 10 seconds press **DESIG (L3)**, which drops a user waypoint automatically named PN###.

4) Before a VFR approach can be created to this waypoint, it must be edited with an approach bearing and saved.

5) On either MFD or PFD, press **FPL (L1)**, rotate ❶ to **CREATE-EDIT..**, and then push to enter.

6) Use ❶ to highlight **EDIT USER WPT** then push to enter.

7) Use ❶ to highlight desired waypoint then push to enter.

8) Use ❶ to sequence all five spaces to create desired name for user waypoint then push to enter through entire editing process, to include adding an approach bearing.

9) Either press **SAVE (R7)** to save the changes or press **D→** **(R8)** to save changes and begin navigation guidance to user waypoint and automatically return to EDIT WHICH USER WPT: menu.

10) If **D→** **(R8)** was pressed followed by **EXIT (R1)** to exit **EDIT WHICH USER WPT:** menu, press **ACTV (L2)** to open active flight plan.

11) Push ❶ to open list of available options for the user waypoint.

12) Use ❶ to highlight **VFR APPR..**, then push to enter.

13) Push ❶ to accept the use of the desired waypoint or press **EXIT (R1)**.

14) Use ❶ to change map scale as desired and then turn the aircraft for a downwind toward the IP. (Automatically created approximately 12NM out on the approach bearing approach bearing to the user waypoint.)

15) If desired, press **MENU (R1)**, press **BUGS (R2)**, and then press **VNAV CDA (R4)**. Push ❶ to enter **DCND ANG..**, use ❶ to set desired angle of descent, then push to enter.

16) Upon approaching top of descent (TOD), the vertical guidance provides HITS down to 50’ above surface elevation.

NOTE:

If crossfill is inhibited, operation can only be accomplished on the side with the desired waypoint in the active flight plan.

6.20.2.1. For VFR Flight Planning

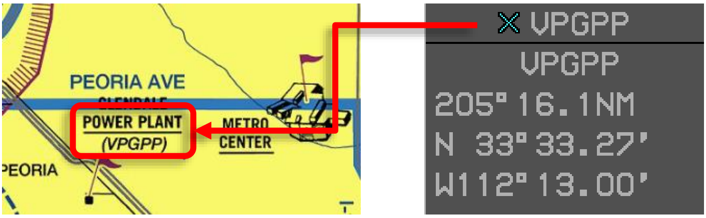


Figure 6-18: VFR Waypoint

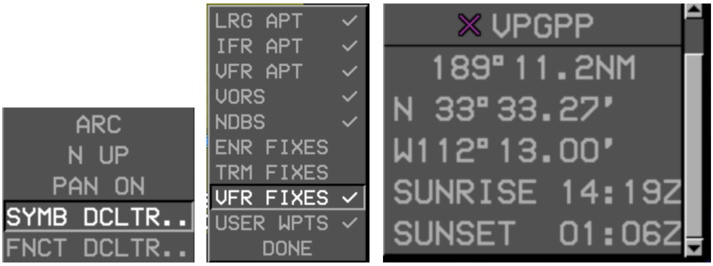


Figure 6-19: Map Format Options

6.20.3. Standard Terminal Arrival Route (STAR) (Step-By-Step)

If the selected waypoint is an airport with a published STAR, this option is available from a selection list of available STARs, transitions, and runways. After selection, the appropriate STAR is created and displayed on the MAP page. Activating a STAR deletes any pre-existing STAR and is inserted prior to any approach waypoints if previously entered.

STARS normally terminate at a fix near the airport, so a radar vector or feeder route is used for transition to the approach phase of the arrival. If an Instrument approach is activated during the STAR, the approach waypoints are inserted after the STAR.

1) Press **ACTV (L2)** and use ❶ to highlight arrival airport and then push to enter. Use ❶ to highlight **STAR..** then push to enter.

2) **PICK STAR:** Rotate ❶ to desired STAR. Push to enter.

3) **PICK TRANS:** Use ❶ to highlight desired transition (* indicates most logical transition from avenue of arrival). Push to enter.

4) **PICK RW:** Use ❶ to highlight desired runway and then push to enter. Press **EXIT (R1)** to exit active menu.

5) ATC clears direct XXX and ILS/DME RWY XXX. Press **ACTV (L2)**, rotate ❶ to **XXX**, press **D→ (R4)**, and then push ❶ to enter (see § 6.20.4).

6.20.4. ILS Instrument Approach (Step-By-Step)

1) Press **ACTV (L2)**. Rotate ❶ to desired airport then push to enter.
2) Use ❶ and highlight **IFR APPR…**. Push to enter.
3) **PICK APPR:** Use ❶ to highlight desired instrument approach then push to enter.
4) **PICK TRANS:** Use ❶ to highlight desired transition (* indicates most logical from current position). Push to enter.
5) **PICK RW:** Use ❶ to highlight assigned runway for landing then push to enter. (Colors selected runway light gray). Press **EXIT (R1)** to exit active menu.

NOTE:

HITS indicates guidance to follow GPS overlay of the localizer and glide slope. However, the localizer source for CDI and glide slope receiver VDI are the primary navigation sources for guidance on this ILS approach. Ensure the desired VLOC is selected as the OBS source. Passing the FAF, press **ARM (L6)** to arm the missed approach procedure and continue waypoint sequencing.

6.20.5. ILS Approach with Manual Termination Leg in Missed Approach Procedure (Step-By-Step)

See § 6.7.1 for details on manual termination legs.

1) Activate ILS as described in § 6.20.4. The step-by-step procedure assumes the approach was armed and the aircraft flew past the MAWP.
2) Past the MAWP, auto nav source switches to FMS (as configured). The current -ALT- (altitude termination leg) climbing to ####'.
3) After meeting the Altitude Termination leg requirements, automatic waypoint sequencing is suspended and ready for pilot action to press **RESUME (L6)**.
4) After **RESUME (L6)** is pressed, normal waypoint sequencing resumes, course to next active waypoint appears as a magenta line, and active waypoint information is updated.

6.20.6. LOC Back Course Instrument Approach (Step-By-Step)

1) Press **ACTV (L2)**. Use ❶ to highlight airport active waypoint. Push to enter.
2) Use ❶ to highlight **IFR APPR..** then push to enter.

3) **PICK APPR:** Use ❶ to highlight desired LOC Back Course procedure then push to enter.

4) **PICK TRANS:** Use ❶ to select desired transition (* indicates most logical from current position). Push to enter.

5) **PICK RW:** Use ❶ to select desired runway. Push to enter. Press **EXIT (R1)** to exit active menu.

6) Assume ATC issued clearance to proceed direct to the FAF. Press **ACTV (L2)** and use ❶ to highlight the FAF then press **(R4).** Push to enter.

7) Press **EXIT (R1)** to exit active menu; or

8) Push ❶. **WAYPOINT** appears. Push ❶ to accept the FAF as a waypoint with no further action.

NOTE:

HITS indicates guidance to follow GPS overlay of the localizer and glide slope. However, the localizer source for CDI and glide slope receiver VDI are the primary navigation sources for guidance on this ILS approach. Ensure the desired VLOC is selected as the OBS source.

9) Press **OBS (L4)**, and then press **NAV VLOC1 (L3)** or **NAV VLOC2 (L4)**, as applicable. Use ❶ to set back course bearing then push to enter. This results in proper sensing of back course CDI indications.

10) After passing the FAF, **MISS (L5)** and **ARM (L6)** appear. Press **ARM (L6)** to arm the missed approach for automatic waypoint sequencing upon passing the MAWPT.

11) Passing the MAWP, nav source automatically switches to FMS (as configured) and CDI color changes from cyan to magenta.

12) If entering the published MAWPT hold, and additional waypoints follow in active flight plan, **CONT (L6)** appears for one touch cancelation of **SUSPEND** and navigation guidance to next leg of active flight plan.

6.20.7. RNAV (GPS) Instrument Approach to LP Minima (Step-By-Step)

1) Select desired airport and desired **IFR APPR..** as described above with matching 5-digit channel number from instrument approach chart.

2) **PICK TRANS:** Use ❶ to highlight desired transition (* indicates most logical from current position). Push to enter.

3) **PICK RW:** Use ❶ to highlight desired runway. Push to enter.

4) Use ❶ to highlight desired waypoint in active flight plan, then press **(R4),** push ❶ to continue.

5) Past the FAF, press **ARM (L6)** for one touch arming of the missed approach leg.

6) This leg changes the VDI source to VNV2-G, and **LP APPR** replaces **TERMINAL** for an indication of the approach mode.

7) Missed approach is executed. Nav source remains FMS, but FSD scaling automatically switched to 0.3NM.

8) Active waypoint information describes the altitude termination leg ahead.

6.20.8. RNAV (GPS) Instrument Approach to LPV Minima (Step-By-Step)

1) Select desired airport and desired instrument approach, transition, and runway as described as described above with matching 5-digit channel number from instrument approach chart.

2) ATC issues clearance direct XXXXX and cleared for RNAV XXXXX approach. Press **ACTV (L2)**, use ❶ to highlight assigned fix, press **(R4)**, then push ❶ to accept waypoint with no changes or press **EXIT (R1)**.

3) Inside of FAF, **RNP: 0.10A**/**RNP: 15.0A** indicates the GPS mode of operation.

4) Press **MISS (L5)** for immediate missed approach or **ARM (L6)** to arm the missed approach leg.

5) Past the MAWP, NAV source remains FMS and scale automatically changes to 0.3NM FSD.

   Depending on how the procedure is coded, RNP and ANP values may appear for a particular leg with mode of service depicted in CDI area.

6) If entering the published MAWPT hold, and additional waypoints follow in active flight plan, press **CONT (L6)** to cancel **SUSPEND** and navigation guidance to next leg of active flight plan.

6.20.9. RNAV (RNP) Instrument Approach to RNP 0.3 DA (Step-By-Step)

1) Select desired airport and desired instrument approach, transition, and runway as described above.

2) ATC issues clearance direct XXXXX and cleared for RNAV XXXXX approach. Press **ACTV (L2)**, rotate ❶ to assigned fix, press **(R4)**, then push ❶ to accept waypoint with no changes or press **EXIT (R1)**.

3) Inside of FAF, **RNP: 0.10A**/**RNP: 15.0A** indicates the GPS mode of operation.

4) **MISS (L5)** and **ARM (L6)** appear. Press **MISS (L5)** for immediate missed approach or **ARM (L6)** to arm the missed approach leg.

5) Past the MAWP, NAV source remains FMS and scale automatically changes to 0.3NM FSD.

> **NOTE:**
>
> Depending on how the procedure is coded, RNP and ANP values may appear for a particular leg with mode of service depicted in CDI area.

6) If entering the published MAWPT hold, and additional waypoints follow in active flight plan, press **CONT (L6)** to cancel **SUSPEND** and navigation guidance to next leg of active flight plan.

> **NOTE:**
>
> When outside the approach region of operation, if a manually entered RNP value does not exist, and an automatic RNP value retrieved from the navigation database does exist, then the automatically retrieved RNP value is annunciated along with actual navigation performance in the PFI area. The navigation mode is RNP and the automatically retrieved RNP value is used to determine CDI, FSD, LON and LOI alerting.
>
> When outside the approach region of operation and neither a manually entered nor automatic RNP value exists, the system operation defaults to GPS/SBAS operation.

6.20.10. NRST ILS Instrument Approach (Step-By-Step)

This method does not require the airport to be in the active flight plan and uses the NRST menu with the NRST ILS method of creation.

1) Press **NRST (R3)** then rotate ❶ to **ILS..** Push to enter.

2) Use ❶ to highlight desired airport with “ILS” on the left. Push to enter.

3) Push ❶ to **CONFIRM ACTIVATE ILS**. (See Quick Reference Guide for description of NRST ILS on PFD or MFD.) Following actions occur:

    a) If present, previous active flight plan is deleted.

    b) A vectors-to-final ILS approach is activated with an IP waypoint approximately 12 NM on the extended final approach course.

    c) If the heading bug is off (no autopilot installed), it is activated to the current heading.

d) VLOC 1 and VLOC 2 OBS are set to the associated localizer course.

e) When configured in EFIS limits, ILS frequency is automatically transmitted to NAV1 and NAV2 in standby position. (Pilot must ensure correct frequency is swapped to active position and identified on both nav receivers.)

f) EFIS changes to OBS source to LOC1 or LOC2 (as configured), and VDI indicates source of glide slope GS (as applicable) when it appears.

4) FAF is the active waypoint. Press **(R4)** then push ❶ to enter a direct route with navigation guidance to FAF.

5) To set published minimums, see Section 3 Menu Functions and Step-By-Step Procedures.

6) Passing the FAF, **MISS (L5)** and **ARM (L6)** appear. Press **ARM (L6)** to arm the missed approach procedure and continue automatic waypoint sequencing.

7) HITS indicates guidance to follow GPS overlay of the localizer and glide slope. However, the localizer source for CDI and glide slope receiver VDI are the primary navigation sources for guidance on this ILS approach. Ensure the desired VLOC is selected as the OBS source.

8) Push ❶ and use to highlight **HSI** then push to enter to display the HSI page. (This must be manually changed back to the MAP page if desired during the missed approach procedure.)

9) Inside the FAF, the GPS mode automatically switches to **LNAV APPR** and replaces **TERMINAL**.

10) During the missed approach, the navigation source automatically switches to FMS with 0.3NM FSD, and terminal mode is active while within the terminal area.

NOTE:

If there is inadequate source data available for a NRST ILS search, the approach is not loaded.

6.20.11. VOR/DME Instrument Approach (Step-By-Step)

1) Select desired airport and desired instrument approach, transition, and runway as described above.

2) Press **ACTV (L2)**. Rotate ❶ to view procedure and select fix for compliance with ATC clearance. Press **(R4)**, and then push ❶ to accept waypoint with no changes or press **EXIT (R1)**.

3) Set minimum bugs, VOR pointers and DME bearing and distance symbology. See Section 3 Menu Functions and Step-By-Step Procedures for more information.

4) To set published minimums, see Section 3 Menu Functions and Step-By-Step Procedures.

5) After passing the FAF, **MISS (L5)** and **ARM (L6)** appear. Press **MISS (L5)** to immediately execute the missed approach procedure or press **ARM (L6)** to arm the missed approach procedure upon crossing the MAWPT.

6) After passing the MAWPT and the missed approach procedure automatically sequenced, aircraft begins following the dashed magenta missed approach course lines on the MAP. NAV source automatically switched to FMS and 0.3 NM FSD.

> **NOTE:**
>
> **LNAV**: The default approach type and is selected when one of the above selections are made. There are no prerequisites for selecting LNAV. Ensure the required OBS navigation source is selected as required for the approach type.

6.20.12. ILS or LOC RWY ## Instrument Approach with Missed Approach Flown to Alternate Fix (Step-By-Step)

During the instrument approach clearance, ATC advised that in the event of a missed approach, plan to fly the alternate missed approach instructions to XXXXX intersection and hold as published. The ILS or LOC RWY ## instrument approach is loaded as described in § 6.20.4.

1) Press **ACTV (L2)** and use ❶ to highlight one position past the end of the active flight plan. Press **ADD (R2)** and insert XXXXX waypoint in active flight plan. Push ❶ to enter.

2) Use ❶ to highlight **HOLD..** then push to enter.

3) Create published holding pattern at XXXXX. Use ❶ through the process then push to enter. Observe XXXXX is in correct position in active flight plan.

4) En route to the (FAF) for the ILS RWY ## observe where XXXXX is located on the MAP.

5) Upon executing the missed approach, press **ACTV (L2)**, rotate ❶ to XXXXX, press D→ **(R4)**, and then push ❶ to enter a direct routing to XXXXX, or press **EXIT (R1)**.

6) Verify active flight plan has holding pattern entered as published and is depicted correctly.

7) Established in the holding pattern at XXXXX. When cleared to continue to next waypoint on Active flight plan, press **CONT (L6)** to resume waypoint sequencing. If an approach is necessary at the destination, the approach can be loaded without losing the holding pattern at XXXXX, since it is not part of the initial approach procedure loaded into the active flight plan.

NOTE:

PFD Bugs menu VNAV descent angles are not applicable for inside the FAF during a published instrument procedure.

IFR en route, terminal, and instrument approach navigation predicted upon EFIS is prohibited unless the pilot verifies the currency of the navigation database or verifies each selected waypoint for accuracy by reference to current approved data.

Instrument approach navigation must be accomplished in accordance with the approved instrument procedures. These procedures are retrieved from the EFIS navigation database. Before conducting an instrument procedure, the procedure should be verified by reference to current approved data.

Navigation databases should be current for the duration of the flight. If the Aeronautical Information Regulation and Control (AIRAC) cycle is due to change during the flight, operators and pilots should establish procedures to ensure the accuracy of navigation data including suitability of navigation facilities used to define the routes and procedures for flight. Once acceptable means to compare aeronautical charts (new and old) to verify navigation fixes prior to departure, electronic data have traditionally been verified against paper products. If an amended chart is published for the procedure, do not use the database to conduct the operation.

There may be a slight difference between the navigation information portrayed on the chart and the primary navigation display heading. Differences of three degrees or less may result from equipment manufacturer’s application of magnetic variation and are operationally acceptable.

GPS receivers do not "fail down" to lower levels of service once the approach has been activated.

If only LPV VLON appears, use the LNAV minima if the rules under which the flight is operating allow changing the type of approach being flown after commencing the procedure. If the lateral integrity limit is exceeded on an LP approach, a missed approach is necessary, since the lateral alarm limit may not be reset while the approach is active.

Section 7 Terrain Awareness Warning System

7.1. Terrain Awareness Warning System (TAWS) Functions

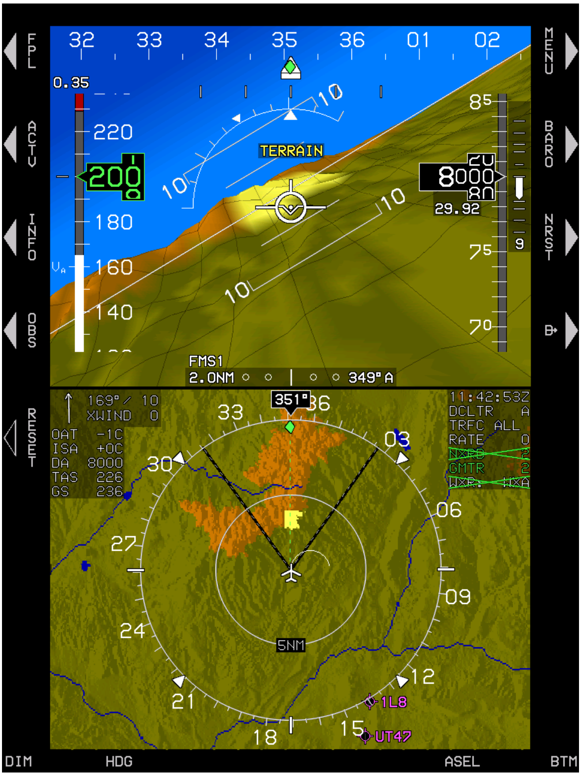


Figure 7-1: Terrain Display

The EFIS provides TSO-C151b TAWS functionality for TAWS Class A, B, and C depending on aircraft configuration and external sensors/switches. Warning functions provided by TAWS are as follows:

1) Terrain Display: Terrain and obstacles on PFI and Map page (see Sections 2 Display Symbology and 3 Menu Functions and Step-By-Step Procedures).

2) Forward Looking Terrain Awareness (FLTA): Alerts to hazardous terrain or obstructions in front of the aircraft. Terrain and obstruction symbology for FLTA alerts meet the following requirements:

   a) Terrain cells that pierce the FLTA warning volume are colored red.

   b) Terrain cells that pierce the FLTA caution volume are colored yellow.

c) Obstructions whose tops pierce the FLTA warning volume are visually distinct from the non-alerting obstructions, and flash.

d) Obstructions whose tops pierce the FLTA caution volume are visually distinct from non-alerting obstructions.

3) Premature Descent Alert (PDA): Alerts when descending well below a normal approach glide path on the final approach segment of an instrument approach procedure.

4) Excessive Rate of Descent (GPWS Mode 1): Alerts when high rate of descent above terrain (i.e., descending into terrain).

5) Excessive Closure Rate to Terrain (GPWS Mode 2): Alerts when a hazardously high rate of change over rising terrain (i.e., flying level over rising terrain).

6) Sink Rate after Takeoff or Missed Approach (GPWS Mode 3): Alerts when loss of altitude is detected immediately after takeoff or initiation of a missed approach.

7) Flight into Terrain when not in Landing Configuration (GPWS Mode 4): Alerts when descending into terrain without properly configuring the aircraft for landing.

8) Excessive Downward Deviation from an ILS Glide Slope (GPWS Mode 5): Alerts when deviating below glide slope on the ILS final approach segment.

9) 500-foot Wake-up Call: Single audible alert when descending through 500 feet AGL.

Table 7-1: TAWS Functions Provided by the EFIS

TAWS Class	A				B or C
Configuration	RG + F	RG	FG + F	FG	
Terrain Display	✓	✓	✓	✓	✓
FLTA	✓	✓	✓	✓	✓
PDA	✓	✓	✓	✓	✓
GPWS Mode 1	✓	✓	✓	✓	✓
GPWS Mode 2	✓	✓	✓	✓	
GPWS Mode 3	✓	✓	✓	✓	✓
GPWS Mode 4	✓	✓	✓		
GPWS Mode 5	✓	✓	✓	✓	
500’ Call	✓	✓	✓	✓	✓

Notes: RG + F = Retractable Gear with Defined Landing Flaps Position
RG = Retractable Gear
FG + F = Fixed Gear with Defined Landing Flaps Position
FG = Fixed Gear

NOTE:

All references to altitude are in feet, distances are in NM and rates of climb or descent are in fpm, regardless of EFIS limits settings.

7.2. Forward Looking Terrain Alert (FLTA) Function

FLTA function uses the following to alert to hazardous terrain or obstructions within a search envelope in front of the aircraft:

1) Terrain database
2) Obstruction database
3) Airport and runway database
4) Aircraft position
5) Aircraft track
6) Aircraft ground speed
7) Aircraft bank angle
8) Aircraft altitude
9) Aircraft vertical speed

7.2.1. FLTA Modes

FLTA mode is either slaved to the GPS/SBAS navigation mode or set automatically based upon default mode logic.

7.2.2. GPS/SBAS Navigation Mode Slaving

The EFIS performs TSO-C146c GPS/SBAS functions in addition to the TAWS functions. As a result, GPS/SBAS navigation mode is available as an input to the TAWS. The pilot may select an IFR procedure (approach, DP, or STAR), which automatically changes the GPS/SBAS navigation mode to en route, terminal, departure, or IFR approach as appropriate. In addition, the pilot may select a VFR approach to any runway or user waypoint with a defined approach path. Selection of a VFR approach causes automatic GPS/SBAS navigation mode changes to en route, terminal, or VFR approach as appropriate. The order of precedence is the following:

1) Departure Mode;
2) Approach Mode (IFR or VFR);
3) Terminal Mode; and
4) En Route Mode.

When slaved, the GPS/SBAS active runway threshold or user waypoint is the reference point for automatic FLTA inhibiting. The advantage is the GPS/SBAS navigation modes are a direct indication to the FLTA function of pilot intent.

7.2.3. Default FLTA Mode

If the default FLTA navigation mode is higher in precedence than the GPS/SBAS navigation mode, FLTA mode is slaved to the default FLTA navigation mode. These modes and order of precedence are:

1) Departure Mode: Enabled when in ground mode. Reference point for automatic FLTA inhibiting and mode envelope definition is the last point at which the ground definition was satisfied (near the liftoff point). Departure mode ends upon climbing through 1500 feet above or traveling more than 6NM from the reference point.

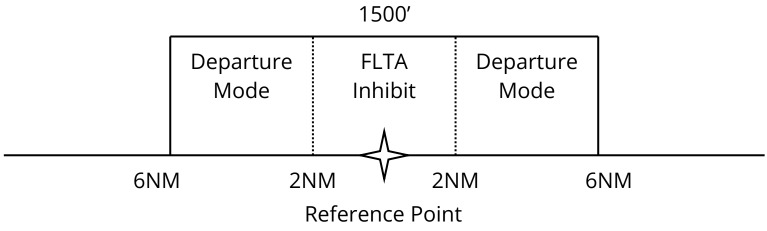


Figure 7-2: Default FLTA INHBT

2) Other Modes: For other default FLTA modes, reference point for automatic FLTA inhibiting and mode envelope is the nearest runway threshold or the nearest user waypoint with a defined approach bearing. TAWS continuously searches all runway thresholds at the nearest three airports to determine the nearest runway threshold, in addition to performing a search for the nearest user waypoints with a defined approach bearing every 3NM of distance traveled. Modes are as follows:

   a) Approach Mode: When within 1900 feet and 5NM of the reference point.

   b) Terminal Mode: From 5NM to 15NM from the reference point when below an altitude that varies from 1900 feet (at 5NM) to 3500 feet (at 15NM) above the reference point.

   c) En route Mode: When not in any other mode.

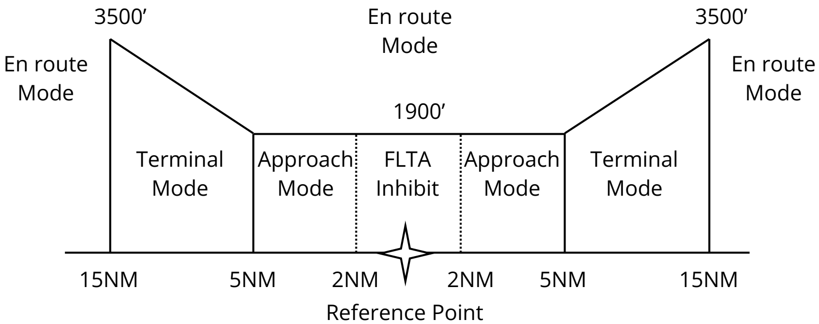


Figure 7-3: FLTA INHBT Mode Areas

7.2.4. FLTA Search Envelope

The FLTA search envelope is an area in front of and below the aircraft. If terrain or obstructions are found within the FLTA search envelope, either a caution or warning alert is given. Dimensions of the search envelope depend upon TAWS type, FLTA mode, aircraft track, ground speed, bank angle, and vertical speed. Basic envelope parameters are as follows:

1) TAWS Type: Determines the value of several parameters used to calculate the search envelope.

Table 7-2: FLTA Search Envelope

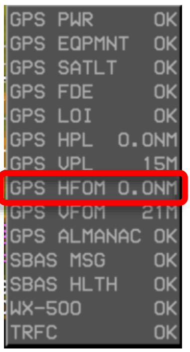
Envelope	Parameter
Range	Sixty seconds forward range search envelope. After calculations, GPS/SBAS HFOM is added to range.
En route Mode Level/Climbing Flight Required Terrain Clearance (RTC)	Class A & B: 700 feet Class C: 250 feet
Terminal Mode Level or Climbing Flight RTC	Class A & B: 350 feet Class C: 250 feet
Approach Mode Level or Climbing Flight RTC	150 feet
Departure Mode Level or Climbing Flight RTC	100 feet
En route Mode Descending RTC	Class A & B: 500 feet Class C: 200 feet
Terminal Mode Descending RTC	Class A & B: 300 feet Class C: 200 feet
Approach Mode Descending RTC	100 feet
Departure Mode Descending RTC	100 feet
Level-Off Rule	Class A & B: 20% of vertical speed Class C: 10% of vertical speed Additional value used to expand level-off leading for descending flight reduced RTC

2) Aircraft Track: Terrain search envelope is aligned with aircraft track.

3) Aircraft Ground Speed: Used in conjunction with range parameter to determine the look-ahead distance and used with FLTA mode to determine search volume width as defined in Table 7-3.

Table 7-3: Search Volume Width

Mode	Search volume width	Change in track time at aircraft ground speed	Maximum width on either side of track
En Route Mode	30° change	30 seconds	0.5NM
Terminal Mode	15° change	30 seconds	0.5NM
Approach Mode	10° change	30 seconds	0.3NM
Departure Mode	10° change	30 seconds	0.3NM



After calculating search volume width as described, the GPS/SBAS HFOM is added to search volume width. In this example, HFOM is 0.0NM, and no value is added to the search volume width.

Figure 7-4: Faults Menu HFOM Value

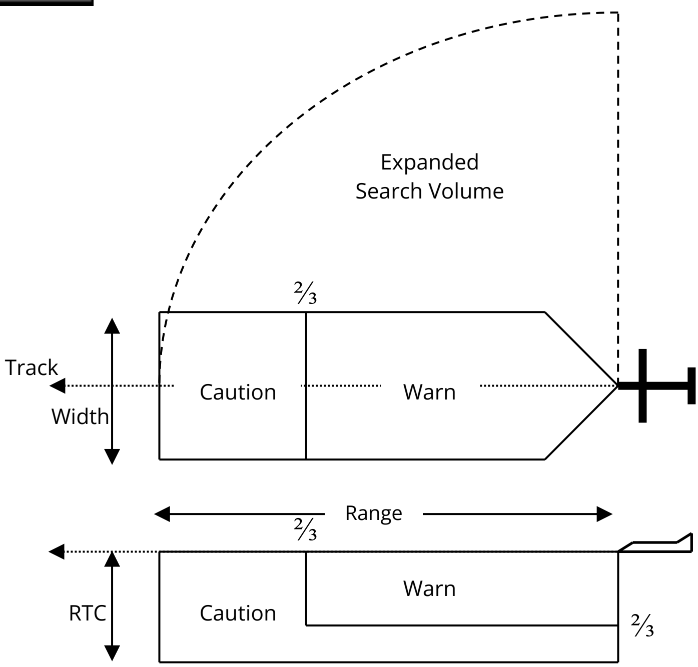


Figure 7-5: FLTA Search Volume

4) Aircraft Bank Angle: Used to expand the search volume in the direction of a turn and requires at least 10° of bank. In addition, search volume expansion is delayed, so at 10° of bank, the bank angle must be continuously held for 3.25 seconds.

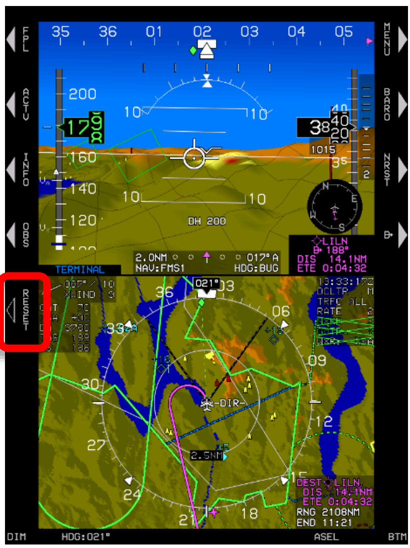
5) Aircraft Vertical Speed: Used to determine which RTC values should be used. At vertical speeds above -500fpm, level and climbing flight RTC values are used. At vertical speeds less than or equal to -500fpm, descending flight RTC values are used. In addition, vertical speed is used to increase the descending flight RTC value used by the system. The increase in descending flight RTC is based upon a three-second pilot reaction time and VSI leading according to the level-off rule parameter.

7.2.5. FLTA Alerts and Automatic Pop-up

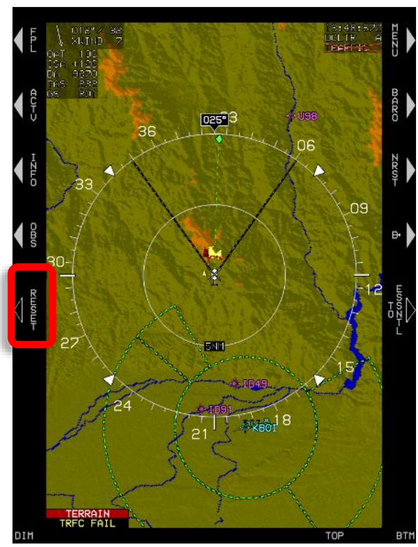
When terrain or obstructions fall within the FLTA search envelope, an FLTA alert is generated. Terrain rendering is enabled when an FLTA alert is initiated or upgraded as follows:

1) On PFD, terrain rendering is enabled;

2) On Map page, terrain rendering is enabled only if TAWS inhibit is not enabled.



PFD



Transmit-Enabled MFD in Full Map page

Figure 7-6: Pop-up Mode

In addition, when an FLTA alert is initiated or upgraded, an automatic pop-up mode is engaged and bottom area display:

1) Switches to Map page.
2) Switches to aircraft centered and heading up.
3) Panning disabled.
4) Scale (value refers to compass rose range i.e., twice range setting) set to:
    a) When using nautical mile scale:
        i) 10NM (ground speed > 200 knots);
        ii) 5 NM (ground speed ≤ 200 knots and ground speed > 100 knots); or
        iii) 2NM (ground speed ≤ 100 knots).
    b) When using the kilometers scale:
        i) 20KM (ground speed > 200 knots);
        ii) 10KM (ground speed ≤ 200 knots and ground speed > 100 knots); or
        iii) 5KM (ground speed ≤ 100 knots).

After the pop-up mode is engaged, the pilot may change any setting automatically changed by the pop-up mode. In addition, any open menus are closed and **RESET (L5)** appears for 20 seconds to reset the previous display configuration with one button press. Pop-ups only occur on the transmit-enabled IDU with all TAWS classes configured, but do not occur if TAWS is disabled or when enabled, inhibit is enabled.

7.3. Premature Descent Alert (PDA) Function

PDA function alerts when descending well below a normal approach glide path on the final approach segment of an instrument approach procedure. PDA function uses the following:

1) GPS/SBAS navigation database
2) GPS/SBAS navigation mode
3) Aircraft position
4) Aircraft altitude

PDA function is armed when on the final approach segment of an IFR approach procedure and below the FAF crossing altitude. The alerting threshold for the PDA function is 0.5° less than the lower of:

1) a straight line from the FAF to approach runway threshold; or
2) 3° emanating from the approach runway threshold.

The intent is to eliminate errors which might occur if the flight crew selects the incorrect active runway.

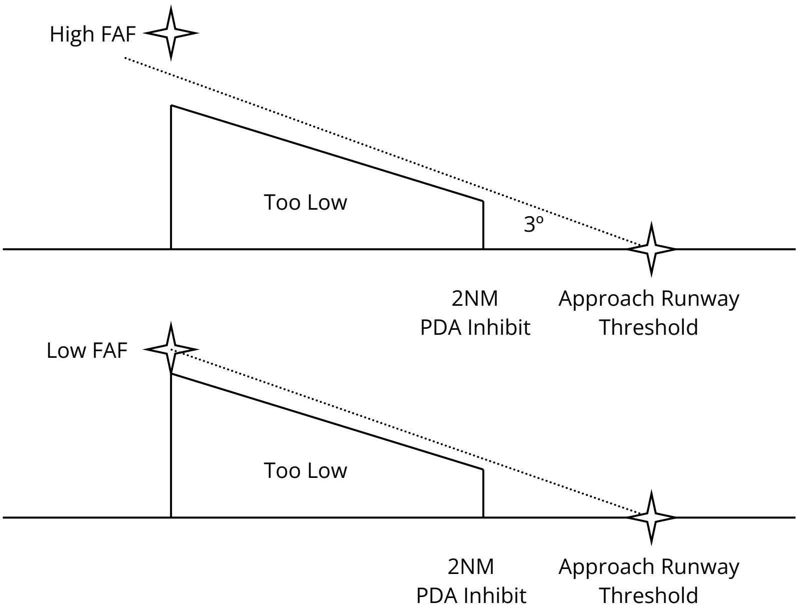


Figure 7-7: PDA Alert Threshold

When the aircraft descends below the threshold, a PDA warning is generated (Figure 7-7). The 3D location of the “approach runway threshold” is based upon the missed approach location and the active runway elevation.

7.4. Excessive Rate of Descent (GPWS Mode 1)

GPWS Mode 1 function uses aircraft vertical speed information and AGL altitude to alert when there is a hazardously high rate of descent as compared to the terrain. GPWS Mode 1 has a caution and a warning threshold. When below the thresholds, a GPWS Mode 1 caution or warning is generated.

Table 7-4: GPWS Mode 1 Alerts

Sink Rate (fpm)	AGL Altitude (ft.)	
	Caution Threshold	Warning Threshold
	SINK RATE	PULL UP
	SINK RATE	PULL UP

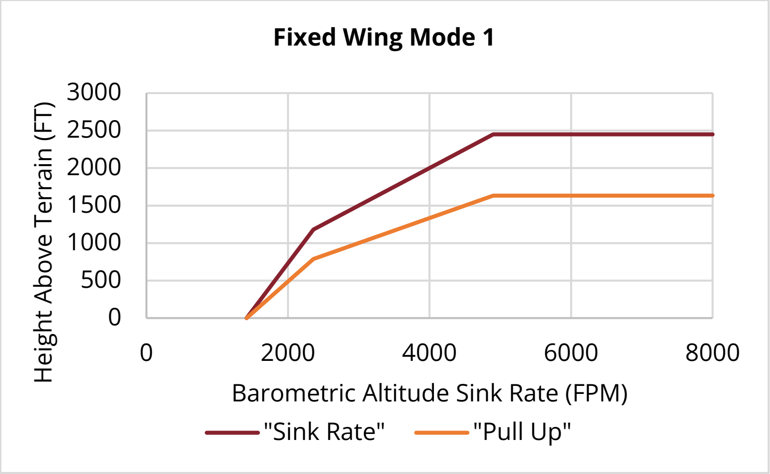


Figure 7-8: Fixed Wing GPWS Mode 1

7.5. Excessive Closure Rate to Terrain (GPWS Mode 2)

GPWS Mode 2 function is present in Class A TAWS and uses filtered AGL rate and AGL altitude to alert the pilot when the rate of change of height above terrain is hazardously high as compared to height above terrain (i.e., flying level over rising terrain). Envelope selection is based upon a 10-second sampling time.

There are two Mode 2 envelopes: Mode 2A which is active when not in landing configuration, and Mode 2B which is active when in landing configuration. Envelope selection is determined as defined in Table 7-5.

Table 7-5: GPWS Mode 2 Envelopes

Configuration	Mode 2A	Mode 2B
Retractable gear with defined landing flaps position	Flaps NOT in landing configuration	Flaps in landing configuration
Retractable gear	Landing gear UP	Landing gear DOWN
Fixed gear with defined landing flaps position	Flaps NOT in landing configuration	Flaps in landing configuration
Fixed gear	AGL Altitude > 500 ft or Airspeed > V_{FE}	AGL Altitude ≤ 500 ft or Airspeed ≤ V_{FE}

When GPWS Mode 2 envelope is pierced, a GPWS Mode 2 caution or warning is generated.

Table 7-6: GPWS Mode 2 Alerts

AGL Rate (fpm)	AGL Altitude (ft.)	
	Caution Threshold	Warning Threshold
	TERRAIN	PULL UP
	TERRAIN	PULL UP

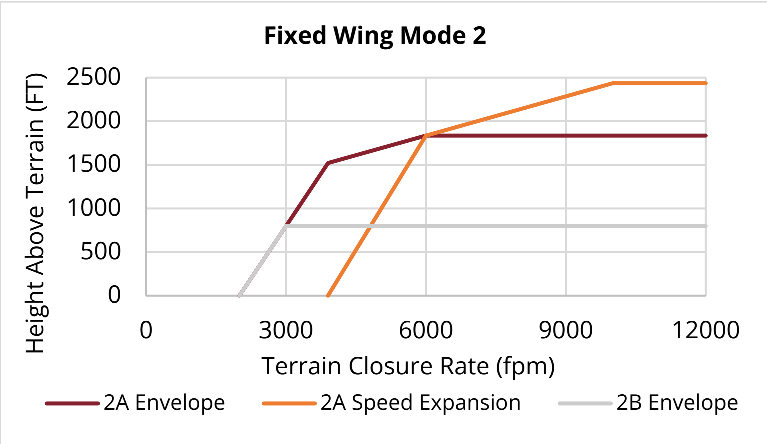


Figure 7-9: Fixed Wing GPWS Mode 2

7.6. Sink Rate after Takeoff or Missed Approach (GPWS Mode 3)

GPWS Mode 3 function uses aircraft vertical speed information and AGL altitude to alert when sink rate is detected immediately after takeoff or initiation of a missed approach. GPWS Mode 3 is armed either in ground mode or on the first leg of a missed approach procedure (as determined by the GPS/SBAS), with distance to the active runway threshold increasing.

GPWS Mode 3 is disarmed upon climbing through 700 feet AGL, traveling more than 6 NM from the last point at which the ground definition was satisfied (this is near the liftoff point), or transitioning to the second leg of a missed approach procedure.

GPWS Mode 3 has a caution threshold based upon height above terrain and vertical speed. When below the caution threshold (AGL threshold = 1.4 x sink rate), a GPWS Mode 3 caution is generated as defined: “TOO LOW”

TOO LOW TOO LOW

Figure 7-10: GPWS Mode 3 Warning (Sink Rate after Takeoff or Missed Approach)

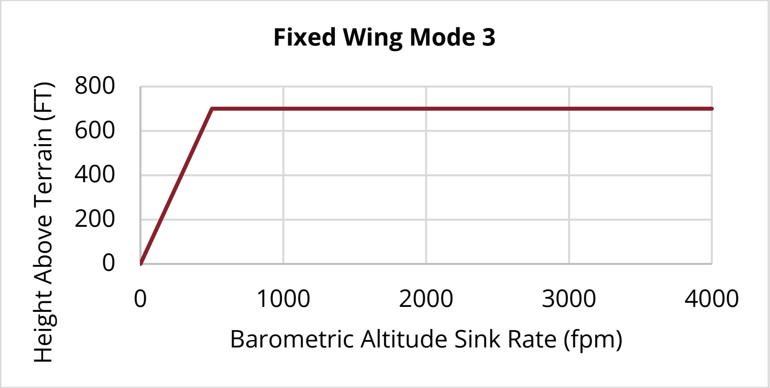


Figure 7-11: Fixed Wing GPWS Mode 3

7.7. Flight into Terrain when not in Landing Configuration (GPWS Mode 4)

GPWS Mode 4 function is present in Class A TAWS and uses aircraft speed information and AGL altitude to alert when descending into terrain without properly configuring the aircraft for landing.

There are two Mode 4 envelopes: Mode 4A which gives cautions when landing gear is in other than landing configuration, and Mode 4B which gives cautions when landing gear or flaps are in other than landing configuration. Applicability of Mode 4 envelopes to aircraft types are as defined in Table 7-7.

Table 7-7: Mode 4 Envelopes

Configuration	Mode 4A	Mode 4B
Retractable gear with defined landing flaps position	Landing Gear Up	Landing gear up or flaps not in landing configuration
Retractable gear	Landing Gear Up	Landing gear up
Fixed gear with defined landing flaps position	Not Applicable	Flaps not in landing configuration
Fixed gear	Not Applicable	Not Applicable

Mode 4 alerting criteria requires the Mode 4 envelope be entered from above, so changing aircraft configuration while within a Mode 4 envelope does not generate an alert. Mode 4 envelopes consists of low-speed and high-speed regions.

Table 7-8: GPWS Mode 4 Alerts

Mode	Region	Caution Flag	Single Audible Alert
4A	Low-Speed	TOO LOW TOO LOW	"Too Low Gear"
4A	High-Speed		"Too Low Terrain"
4B	Low-Speed		Landing gear up: "Too Low Gear" Landing gear down: "Too Low Flaps"
4B	High-Speed		"Too Low Terrain"

Table 7-9: GPWS Mode 4 Envelopes

Mode	Region	Speed (KIAS)	AGL Altitude (ft.)
4A	Low-Speed	< 182.5	500
4A	High-Speed	≥182.5	Lesser of: 800
4B	Low-Speed	< 138.75	150
4B	High-Speed	≥ 138.75	Lesser of: 800

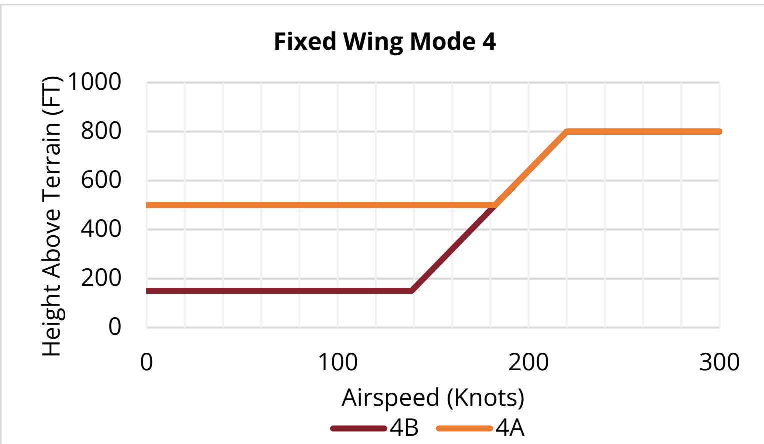


Figure 7-12: Fixed Wing GPWS Mode 4

7.8. Excessive Downward Deviation from an ILS Glide Slope (GPWS Mode 5)

GPWS Mode 5 function uses ILS glide slope deviation information and AGL altitude to alert when excessive downward glide slope deviation is detected on the final approach segment of an ILS approach. GPWS Mode 5 is armed when a valid glide slope signal is being received, and the aircraft is below 1000' AGL.

GPWS Mode 5 has a caution and a warning threshold. When below a threshold, a GPWS Mode 5 warning is generated. The curve compares glide slope deviation to AGL altitude.

Table 7-10: GPWS Mode 5 Alerts

Caution Threshold	Warning Threshold
GLIDESLOPE	GLIDESLOPE
GLIDESLOPE	GLIDESLOPE

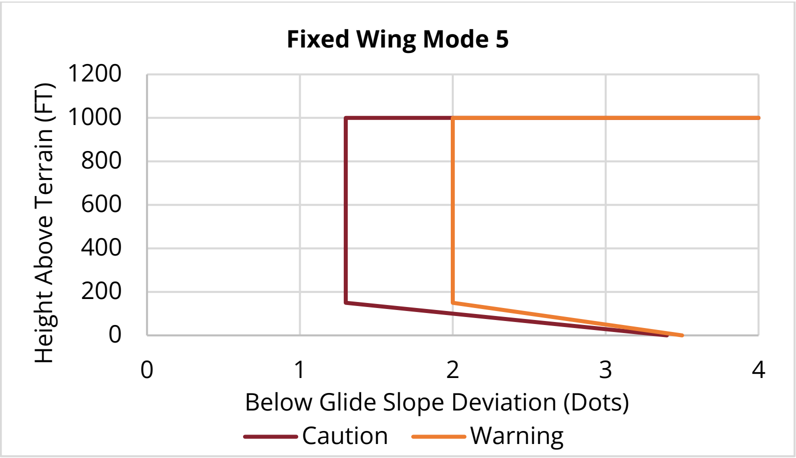


Figure 7-13: Fixed Wing GPWS Mode 5

7.9. 500-Foot Wake-Up Call

This function is present in all TAWS classes. The 500-foot function includes an arming deadband of 500 feet to prevent nuisance warnings during low altitude operations. Thus, the aircraft must climb above 1000 feet AGL to arm the 500-foot function and generate a 500-foot annunciation.

7.10. External Sensors and Switches

TAWS requires a variety of inputs from external sensors and switches to perform its functions as follows:

1) GPS/SBAS Receiver. Source of aircraft position, geodetic height, horizontal figure of merit (HFOM), vertical figure of merit (VFOM), loss of integrity (LOI), and loss of navigation (LON). Connects directly to the IDU.

2) Air Data Computer (ADC). Source of barometric altitude, outside air temperature, and vertical speed. Connects directly to the IDU.

3) ILS Receiver. Glide slope receiver is the source of glide slope deviation.

4) Radar Altimeter (RA). Source for radar altitude.

5) Gear Position Sensors. As configured in the EFIS limits, landing gear position are the source.

6) Flap Position Sensor. As configured in the EFIS limits, flap position is the source.

7) TAWS Inhibit Switch. As configured in the EFIS limits, used for manual inhibiting of TAWS alerting functions. Gives an indication of actuation (for example, toggle/rocker or button with indicator light and **TAWS INHBT**).

8) Audio Mute Switch. Momentarily activated to silence active audible alerts. It is connected directly to the IDU.

9) Glide Slope Deactivate Switch. As configured in the EFIS limits, momentarily activated to inhibit GPWS Mode 5 function.

Table 7-11: TAWS External Sensors and Switches

TAWS Class	A				B or C
Configuration	RG + F	RG	FG + F	FG	
GPS/SBAS	✓	✓	✓	✓	✓
ADC	✓	✓	✓	✓	✓
Gear Position Sensor	✓	✓			
TAWS Inhibit Switch	✓	✓	✓	✓	✓
Audio Cancel Switch	✓	✓	✓	✓	✓
ILS	✓	✓	✓	✓	
Radar Altimeter	✓	✓	✓	✓	
Flap Position Sensor	✓	✓	✓	✓	
Glide Slope Deactivate Switch	✓	✓	✓	✓	

7.11. TAWS Basic Parameter Determination

Fundamental parameters used for TAWS functions are as defined in Table 7-12.

Table 7-12: TAWS Basic Parameters Determination

Parameter	Source	Notes
Aircraft position, ground speed, and track	GPS/SBAS	HFOM must be less than or equal to the greater of 0.3 NM or the horizontal alert limit (HAL) for the mode of flight.
MSL Altitude	GPS/SBAS	Geodetic height converted to MSL with the current EGM database. VFOM must be less than or equal

Table 7-12: TAWS Basic Parameters Determination

Parameter	Source	Notes
		to 106 feet to be considered valid for use as MSL altitude. The secondary source of MSL altitude is barometric altitude from an air data computer. Barometric altitude is based upon a barometric setting in the following order of preference: 1) If either the pilot or co-pilot side is operating in QNH mode, the QNH barometric setting is used (on-side barometric setting preferred); or 2) If GPS/SBAS geodetic height has been valid within the last 30 minutes, a barometric setting is derived from the GPS/SBAS geodetic height. 3) If radar altitude has been valid within the last 30 minutes and has been valid more recently than GPS/SBAS geodetic height, a barometric setting derived from radar altitude is used. If none of the above conditions are met, MSL altitude is marked invalid. When a reporting station elevation is determined and outside air temperature is valid, a temperature correction is applied. TAWS uses the lower of barometric altitude or the temperature-corrected altitude. In the case of QNH-mode barometric setting, reporting station elevation is derived from waypoint or active

Table 7-12: TAWS Basic Parameters Determination

Parameter	Source	Notes
		runway elevations in the active flight plan using the following logic: 1) If the aircraft is in TERMINAL, DEPARTURE, IFR APPROACH, or VFR APPROACH mode and an active runway exists, reporting station elevation is the elevation of the active runway threshold. 2) Otherwise, if the aircraft is in TERMINAL mode, reporting station elevation is the elevation of the airport causing TERMINAL mode. 3) In EN ROUTE mode, no reporting station elevation is determined. In the case of GPS/SBAS geodetic height-based barometric setting, reporting station elevation is the GPS MSL altitude reported when the barometric setting was determined (see Section 2 Display Symbology).
Terrain Data	Terrain Database	To be considered valid, the following must apply: 1) The aircraft position is valid; 2) The aircraft position is within the boundaries of the terrain database; and 3) The terrain database is not corrupt, as determined by the built-in test at system initialization and during runtime.
Obstacle Data	Obstacle Database	To be considered valid, the following must apply:

Table 7-12: TAWS Basic Parameters Determination

Parameter	Source	Notes
		1) The aircraft position is valid; 2) The aircraft position is within the boundaries of the obstacle database; and 3) The obstacle database is not corrupt, as determined by the built-in test at system initialization.
AGL Altitude	Radar Altitude	A secondary source is MSL altitude less terrain altitude.
Vertical Speed	Instantaneous vertical speed	IVSI values come from barometric vertical speed from an ADC "quickened" with vertical acceleration from an AHRS. The secondary source for vertical speed is barometric vertical speed from an ADC. The tertiary source for vertical speed is GPS/SBAS vertical speed providing the VFOM is less than or equal to 106 feet.
Terrain Closure Rate	Smoothed the first derivative of AGL altitude	Due to multiple sources for altitude, there are multiple sources for terrain closure rate.
Runway/ Reference point location	EFIS navigation database	To be considered valid, the following must apply: 1) The aircraft position is valid; 2) The aircraft position is within the boundaries of the navigation database; and 3) Navigation database is not corrupt, as determined by a built-in test at system initialization.

7.12. TAWS Selections on PFD

PFD Declutter menu includes three option possibilities for TAWS:

1) SVS TAWS: With SVS TAWS selected, TAWS perspective terrain and obstacle depiction is shown using color to show relationship to aircraft altitude with terrain colored in shades of olive when at or below 100' below the aircraft.

2) SVS BASIC: With SVS BASIC selected the PFI area terrain is colored in shades of brown.

3) None: With neither SVS TAWS nor SVS BASIC selected, the PFI background is a conventional blue over brown attitude display without synthetic vision.

If SVS TAWS and SVS Basic are not selected and the aircraft pierces the TAWS FLTA terrain envelope, the EFIS automatically enables SVS TAWS for the safest possible warning alert condition. Table 7-13 shows possible scenarios where the aircraft pierces the TAWS FLTA terrain envelope and SVS TAWS is enabled. TERRAIN takes precedence over OBSTRUCTION.

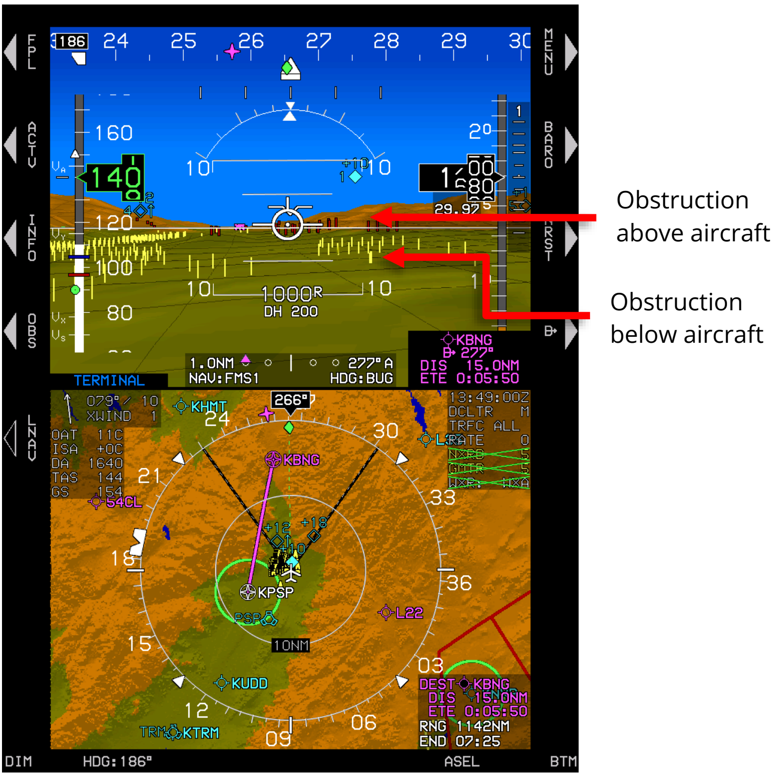


Figure 7-14: PFD SVS TAWS Option and Obstructions

Table 7-13: PFD TAWS Selections

PFI area SVS BASIC selected

PFI area neither SVS TAWS nor SVS BASIC selected

PFD SVS Basic with Terrain Caution

PFD SVS TAWS with Terrain Warning

Table 7-13: PFD TAWS Selections

	
PFD SVS TAWS with Obstruction Caution Obstruction depictions on PFD and map highlighted but do not flash	PFD SVS TAWS with Obstruction Warning Obstruction depictions on PFD and map highlighted and flash

7.13. TAWS Automatic Inhibit Functions (Normal Operation)

Figure 7-15: FLTA INHBT

The following automatic inhibit functions occur during normal TAWS operation to prevent nuisance warnings:

1) FLTA function is automatically inhibited when in terminal, departure, IFR approach, or VFR approach modes and within 2NM and 1900' of the reference point.

2) PDA function is automatically inhibited within 2NM and 1900' of the approach runway threshold.

3) GPWS Modes 1 through 4 is automatically inhibited when below 50 feet AGL (radar altimeter AGL altitude) or below 100 feet AGL (terrain database AGL altitude).

4) GPWS Mode 4 is inhibited while Mode 3 is armed.

5) GPWS Mode 5 is inhibited below 200' AGL. This form of automatic inhibit remains active until the aircraft climbs above 1000' AGL and prevents nuisance alarms on missed approach when the glide slope receiver detects glide slope sidelobes.

7.13.1. TAWS Automatic Inhibit Functions (Abnormal Operation)

Automatic inhibit functions occur during the specified abnormal operations. System sensor failures, non-installation of optional sensors, database failures, and combinations thereof affect TAWS as in Table 7-14.

Table 7-14: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terrain Display	FLTA	PDA	GPWS Mode					500' Wake-Up
					1	2	3	4	5	
		✓ = Inhibit								
GPS/SBAS (H)	AC Position	✓	✓	✓						
TD	Terrain Elev.	✓	✓							
ILS	Glide Slope Dev.								✓	
MSL	MSL Altitude	✓	✓	✓						
GPS/SBAS (H) + RADLT	AC Position, AGL Altitude	✓	✓	✓	✓	✓	✓	✓	✓	✓
GPS/SBAS (V) + ADC	MSL Altitude, VSI	✓	✓	✓	✓		✓			
TD + RADLT	Terrain Elev. AGL Altitude	✓	✓		✓	✓	✓	✓	✓	✓
MSL + RADLT	MSL Altitude, AGL Altitude	✓	✓	✓	✓	✓	✓	✓	✓	✓
GPS/SBAS (V) + ADC + RADLT	MSL Altitude, VSI, AGL ALT	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes:

1) The combinations listed give the minimum combinations with the worst consequences. Many other combinations are possible, but their effects are subsumed within the combinations listed.

2) GPS/SBAS (H) = HFOM > max (0.3NM, HAL). The indication is the loss of terrain display on PFD and MAP.

3) GPS/SBAS (V) = VFOM > 106’.

4) GPS/SBAS = GPS/SBAS (H) + GPS/SBAS (V). The indication is the loss of terrain display on PFD and MAP.

5) TD = Terrain Data invalid. This is due to being beyond the database boundaries or database corruption.

6) ADC = Air Data Computer. Indication is **ADC1 FAIL**, **ADC2 FAIL**, **ADC1/2 FAIL** flag, or red-X indicating a single ADC failure.

7) RADALT = Radar Altimeter. An indication is lack of radar altimeter source indication on the radar altimeter display.

RALT1 FAIL
RALT1 FAIL
RALT2 FAIL
RALT1/2 FAIL

8) ILS = ILS glide slope deviation. The indication is the lack of glide slope pointers.

9) MSL = MSL altitude invalid. Indication is **PLT1 TAWS**/**PLT2 TAWS** or **CPLT1 TAWS**/**CPLT 2 TAWS** in the absence of other failures. (For example, caution flags represent two displays per side.)

7.13.2. TAWS Manual Inhibit Functions

The pilot may select the following manual inhibit functions:

1) Terrain display function may be inhibited using EFIS soft menu declutter control.

2) All TAWS alerting functions (including pop-up functionality) are inhibited with the external TAWS inhibit switch, which does not affect the terrain display function, including FLTA warning (red) and caution (amber [yellow]) cells on the Map page and PFI.

3) GPWS Mode 5 is inhibited with the glide slope cancel switch when below 1000’ AGL. GPWS Mode 5 manual inhibit automatically resets by ascending above 1000’ AGL.

Section 8 Appendix

8.1. Operating Tips

This section contains a variety of useful information not found elsewhere in the document and includes operating tips, system specifications, and environmental requirements.

With the Genesys Aerosystems EFIS installed and certified in all categories of certified aircraft, numerous tips and suggestions are available for obtaining the maximum performance and benefit from this system.

8.2. Domestic or International Flight Planning

Due to the differences in every aircraft avionics suite installation, the pilot should determine what equipment code is applicable for domestic or international flight plans. The aircraft operator must determine which certifications pertain to them. Visit the FAA website, www.faa.gov, for flight plan guidance for both domestic and international filers, as well as, information and documentation regarding FAA, ICAO, and Flight Services agreements and procedures.

8.3. Altitude Miscompare Threshold

The altitude miscompare threshold is based upon allowable altitude error. There are two components to allowable altitude error, instrument error and installed system error, and allowable instrument error is based upon the values of SAE AS8002A Table 1 as in Table 8-1.

Table 8-1: Allowable Instrument Error

Altitude	Allowed Error
Sea Level	25'
1,000'	25'
2,000'	25'
3,000'	25'
4,000'	25'
5,000'	25'
8,000'	30'
11,000'	35'
14,000'	40'
17,000'	45'
20,000'	50'
30,000'	75'
40,000'	100'
50,000'	125'

Allowable installed system error is added on top of instrument error and these values are derived from the regulations as defined in Table 8-2.

Table 8-2: Regulatory Reference

Regulation	Allowed Error
14 CFR § 23.1325	At sea level, the greater of 30' or 30% of the calibrated airspeed in knots.
14 CFR § 25.1325	

An allowable altitude error is computed for each compared value and added to create the altitude miscompare threshold, accommodating the values deviating in different directions.

In an approach mode using barometric VNAV, the altitude miscompare threshold is reduced to 100 feet.

Worked example for a calibrated airspeed of 100 knots and comparing the first altitude of 3,490' with the second altitude of 3,510':

1) Calculate allowable instrument error based upon altitudes:
   Allowable Instrument Error #1 = 50’
   Allowable Instrument Error #2 = 50’

2) Calculate allowable installed system error based upon altitudes and calibrated airspeed:
   Allowable Installed System Error #1 = 30’
   Allowable Installed System Error #2 = 30’

3) Calculate altitude miscompare threshold based upon sum of above allowable errors:
   Altitude Miscompare Threshold = 160’

8.4. Airspeed Miscompare Threshold

The airspeed miscompare threshold is based upon allowable airspeed error. There are two components to allowable airspeed error, instrument error and installed system error, and allowable instrument error is based upon the values of SAE AS8002A Table 3 as in Table 8-3.

Table 8-3: Airspeed Error

Calibrated Airspeed	Allowed Error
50 knots	5 knots
80 knots	3 knots
100 knots	2 knots
120 knots	2 knots
150 knots	2 knots

Table 8-3: Airspeed Error

Calibrated Airspeed	Allowed Error
200 knots	2 knots
250 knots	2.4 knots
300 knots	2.8 knots
350 knots	3.2 knots
400 knots	3.6 knots
450 knots	4 knots

Allowable installed system error is added on top of instrument. Error and these values are derived from the regulations as defined in Table 8-4.

Table 8-4: Airspeed Regulatory Reference

Regulation	Allowed Error
14 CFR § 23.1323	Starting from (1.3 x V_{S1}): Greater of 5 knots or 3%. Do not perform a comparison if either value is below (1.3 x V_{S1}).
14 CFR § 25.1323	Starting from (1.23 x V_{SR1}): Greater than 5 knots or 3%. Do not perform a comparison if either value is below (1.23 x V_{SR1}). The system uses V_{S1} as a substitute for V_{SR1}.

An allowable airspeed error is computed for each compared value and added together to create the airspeed miscompare threshold and accommodate the values deviating in different directions.

8.5. Jeppesen Sanderson NavData® Chart Compatibility

See www.Jeppesen.com for the latest information on coding instrument procedures, naming conventions, altitudes within the database, and aeronautical information compatibility.

8.6. Data Logging and Retrieval

The EFIS logs all data associated with a flight, including all flight instrument and navigation data, which may be downloaded for review after flight. Data from the last 5 power cycles (CPM-4 units)/20 power cycles (CPM-5 units) are logged at a one-second interval.

Each time the parameters are recorded, a Zulu time stamp followed by three lines of comma delimited ASCII text data are written where the first line contains flight parameters and, the second line contains engine parameters.

With IDU powered off, open secure data transfer port door, and insert secure data storage device. Power up, and select **Download LOG Files** to create a "\log" directory on the device and copy the data logging files into the directory.

CAUTION:

Always install a valid secure data storage device in the IDU before activating any GMF to avoid erroneous failure indications or corruption of the IDU.

8.6.1. Delete Log Files

1) If there are problems updating a navigation database or application software due to an excessively large log file, select "Delete Log Files" to delete all log files in the log directory.

2) Files named "LOG##.dat" and "MSGLOG.DAT" are deleted. This does not affect operations of the EFIS, as the EFIS generates new "LOG00.DAT" and "MSGLOG.DAT" files once a power cycle begins at power on. Press any button on the IDU or push ❶ to return to the Ground Maintenance menu.

8.6.2. Logged Flags and Custom CAS Messages

Flags and custom CAS messages are logged in memory to a file named "caslog00.csv" (*.csv files may be opened in Microsoft Excel or similar spreadsheet software). In addition, data from the previous power cycles are saved in files "caslog01.csv" through "caslog04.csv." Upon system start, the existing "caslog00.csv" through "caslog03.csv" files are renamed "caslog01.csv" through "caslog04.csv," and "caslog00.csv" is opened for active logging.

The first line of the log files contains column headings related to the flag's text (for standard warning functions) or the "CAS Log File Text" parameter (for custom CAS messages). All standard warning functions are logged. Only custom CAS messages with valid "CAS Log File Text" parameters (i.e., not an empty string) are logged. Within the data fields of the log file, values are written as in Table 8-5.

Table 8-5: Log File Values

Category	Value
NORMAL	0
ADVISORY	1
NORMAL	2
WARNING	3

8.7. Routes and Waypoints

The navigation database includes VFR waypoints, which consist of five digits beginning with “VP.” These may be found on VFR charts and should be loaded in the FMS prior to flight to ensure they are available in the database, and info checked for proper location.

8.7.1. Download Routes and User Waypoints

1) Select **Download Routes and User Waypoints** from the GMF to download all routes and user waypoints stored in the IDU to the secure data storage device. This option is useful for fleet operations where multiple aircraft fly the same routes.

2) Routes are stored on secure data storage device as NAME1-NAME2.RTE where NAME1 is the 1 to 5-character designation of the origin waypoint and NAME2 is the 1 to 5-character designation of the destination waypoint. User waypoints are stored as “USER.DAT.”

8.7.2. Upload Routes and User Waypoints

Select **Upload Routes and User Waypoints** from GMF to copy all routes and user waypoints from a secure data storage device to the IDU. Use this option in conjunction with the “Download Routes and User Waypoints” option to upload the same routes and user waypoints in multiple aircraft.

8.7.3. Delete Routes and User Waypoints

When corrupted routes cause the IDU to continually reboot, select **Delete Routes** on the Ground Maintenance page to remove all routes and the user waypoint file (USER.DAT) from the IDU.

8.8. Secure Data Storage Device Limitations

When powering up the IDU with a secure data storage device inserted and "Error: No updater files found on a USB drive" displays, the secure data storage device is likely not acceptable for loading or transferring data.

1) Ensure the secure data storage device with required files is properly connected.

2) Try again after reboot.

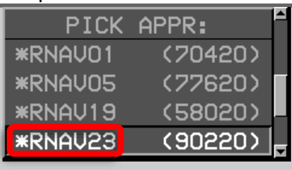
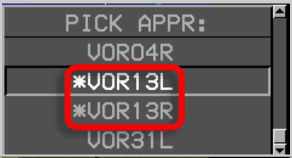
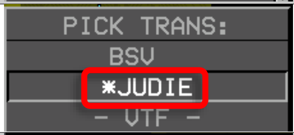
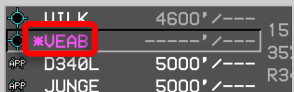
3) Press any button to continue.

4) Try a different secure data storage device.

> **NOTE:**
>
> secure data storage device must be formatted as FAT16 or FAT32.

8.9. Summary of Asterisk Symbology in Pilot Guide

Table 8-6: Summary of Asterisk Symbology Use

Examples of Asterisk Locations	Meaning of Asterisk Use
 Examples include "VOR or GPS RWY…" or "RNAV (GPS) RWY…" 	Approaches noted by an asterisk (*) before the approach procedure label may use GPS/SBAS for navigation.
	Transition most likely selected due to avenue of arrival. (Not all instrument procedures include a transition.)
 	In addition to the magenta color, asterisk designates the active leg.
	Asterisk designates the nearest end point.

8.10. Altimeter Settings

Use caution when setting the altimeter and inadvertently changing the transition level. If this is reset to a lower than published transition level, **CK BARO** may appear due to the altimeter setting not set to 29.92 inHg or 1013 mbar.

Traffic

T 1. Traffic Symbology

Traffic is drawn using the hidden surface removal techniques of the terrain and obstruction rendering so that traffic behind terrain appears to be so. Traffic is displayed using standard traffic symbols as defined in Table T-1 and Table T-2.

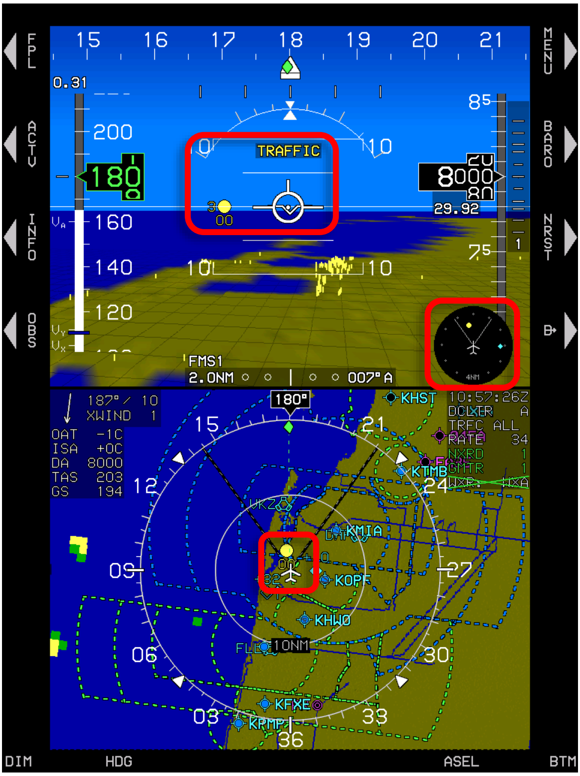


Figure T-1: Traffic Symbology (PFD)

1) Resolution Advisory (RA): Traffic with a dangerous closest point of approach and generates climb or descent commands as defined by internal TCAS-II sensor logic.

2) Traffic Advisory (TA): Traffic with a dangerous closest point of approach as defined by internal traffic sensor logic.

3) Proximate Advisory (PA): Traffic within 6NM/11KM and ±1200'/±366M from ownship that is not an RA or TA.

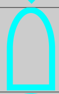
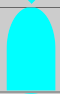
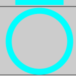
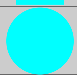
4) Other Traffic (OT): Traffic beyond 6NM/11KM or ±1200'/±366M from ownship that is not an RA or TA.

Range indication immediately to the left of the symbol is in NM or KM and relative altitude is above or below the symbol in feet or meters (in hundreds of units) depending on the “Speed Units” system limit setting.

Table T-1: Traffic Symbology

Type Traffic	Symbology			
TCAS-I, TCAS-II, and TIS-A				
	Other Traffic	Proximate Advisory	Traffic Advisory (Flashing)	Resolution Advisory (Flashing)

Table T-2: ADS-B Traffic Symbols

	Other Traffic	Proximate Advisory	Traffic Advisory (Flashing)
High-Integrity Traffic with Track Information			
High-Integrity Traffic without Track Information			
Degraded Position Traffic with Track Information			
Degraded Position Traffic without Track Information			

Rendering rules for traffic are defined in Table T-3. Distance is displayed in NM or KM, altitude displayed in feet or meters, and VSI in fpm or m/s depending on the “Speed Units” system limit setting.

Table T-3: Traffic Rendering Rules

Type Traffic	Distance	Results
TA and RA (TCAS-I/II, TAS, and TIS-A)	Off-scale	Half-symbols
TA and RA (no bearing)	N/A	Displayed with text
OT and PA (no bearing)	Off-scale	Not displayed
TCAS-I/II, TAS, and TIS-A sensor	Within 200’ of ground	Not displayed
OT and PA Traffic	Off-scale	Not displayed

When TCAS-II is enabled, the background of the VSI functions as an RA display with green and red colored regions for resolution advisory guidance. VSI display in fpm or m/s depending on “Speed Units” system limit setting.

RA PFI

RA MFD Traffic Page

Figure T-2: TCAS-II RA Indication

Traffic pop ups: When a traffic alert is generated, a pop-up function displays traffic on the PFI, moving map page, and mini traffic on the PFI.

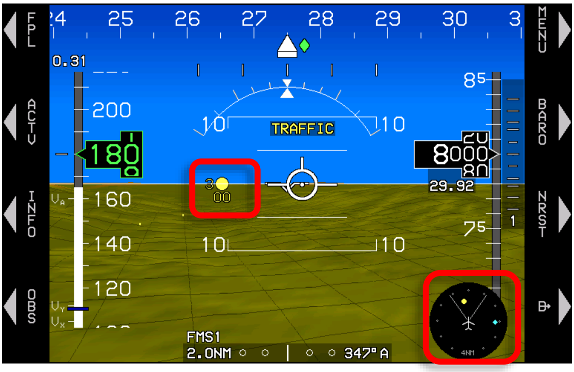
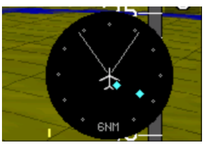


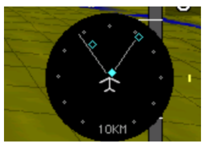
Figure T-3: Traffic Pop-Ups

T 1.1. Mini Traffic

When selected from declutter options, mini traffic is displayed in the lower right corner of the PFI area of the PFD above the active waypoint identifier and has clock face markings fixed at the 6 NM/10 KM scale.



Distance in NM



Distance in KM

Figure T-4: Mini Traffic

During traffic warning (TA or RA), and the aircraft is above 500’ AGL, the traffic mini map scale automatically adjusts in multiples of the units in Table T-4 depending on EFIS limits settings.

Table T-4: Mini Traffic Scale					
Distance in NM			Distance in KM		
2	4	6	3	6	10

The mini map, mini traffic, analog AGL indication and analog G-force indicator are mutually exclusive with the traffic mini map taking precedence during a traffic warning (TA or RA) if above 500'AGL. This feature automatically disappears in Unusual Attitude mode.

T 2. Dedicated Traffic Page

When selected, a Traffic page is available based roughly on the appearance of a TCAS display.

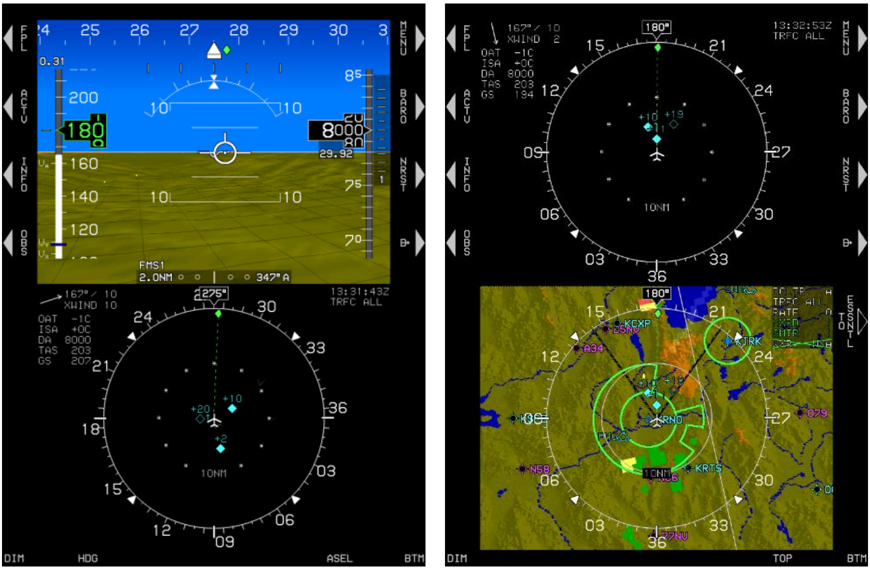
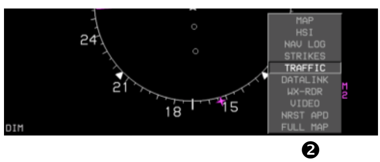


Figure T-5: PFD and MFD Traffic Page

T 2.1. MFD Page Menu

TRAFFIC: Shows the Traffic page.

PFD or MFD Bottom Traffic Page



MFD Top Traffic Page

Figure T-6: Traffic Page Access

When MFD is full map and selecting the Traffic page on the top or bottom area, the other area returns to its last configured page.

T 2.2. Traffic Display Format

The traffic display uses a centered display format with the ownship symbol centered on the traffic page with data displayed out to an equal distance in all directions. When the AHRS is in DG mode, “DG” appears to the right of the ownship symbol.

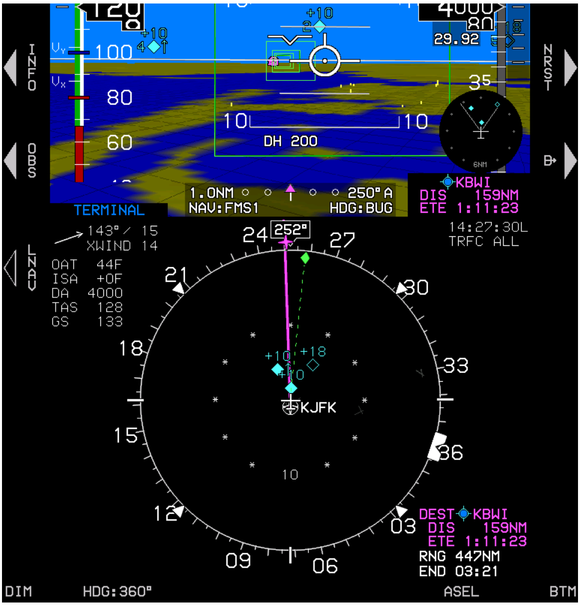


Figure T-7: Traffic Display Format

With traffic source ADS-B, traffic vectors and aircraft identification data are shown. The traffic vector is a line connecting the traffic’s current position with the traffic’s predicted position based on its current track and groundspeed. The prediction time, in minutes, is pilot-selectable.

Aircraft identification (e.g., aircraft registration number or scheduled airline flight number) is text located near the traffic symbol in the same color as the traffic symbol.

Figure T-8: Test Example of Flight Tag ID

T 2.3. Traffic Screen Range

The TCAS range ring is centered upon the ownship symbol to help the pilot judge range to displayed symbols. The distance from the ownship to the range ring is displayed on the bottom of the range ring and is half the distance of the traffic page range in most cases (3NM range ring shown on 5 and 10NM page ranges). All distances in Table T-5 represent the distance from the ownship symbol to the compass rose.

Table T-5: Traffic Screen Range

Range in NM					Range in KM				
5	10	20	50	100	10	20	50	100	200

T 2.4. PFD First-Level Menu

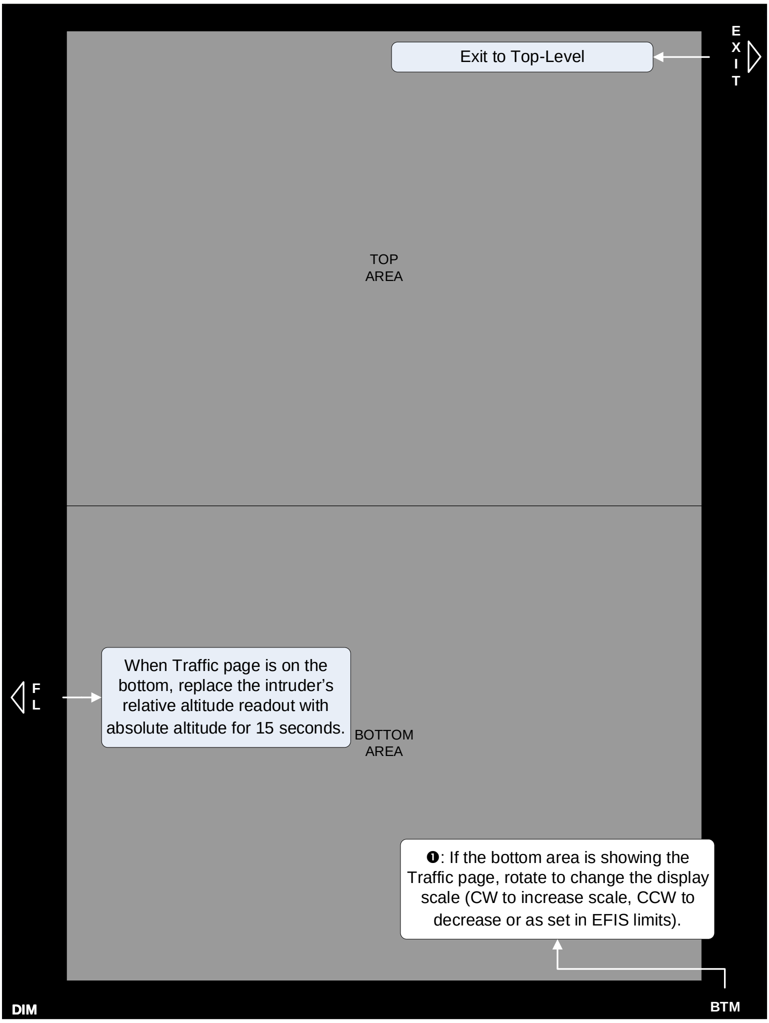


Figure T-9: PFD First-Level Menu

T 2.5. MFD First-Level Menu (Normal Mode)

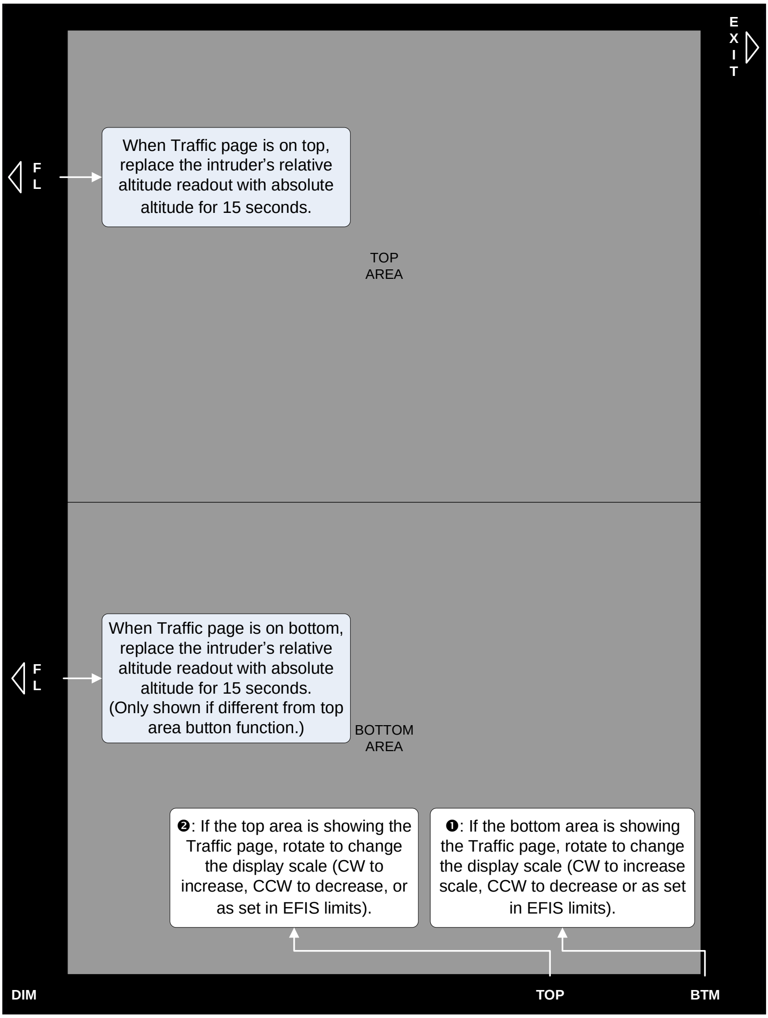


Figure T-10: MFD First-Level Menu (Normal Mode)

T 2.6. Flight Level (FL) Option

When the Traffic page is displayed, press **FL (L6)** to replace the intruder's relative altitude with absolute altitude for 15 seconds.

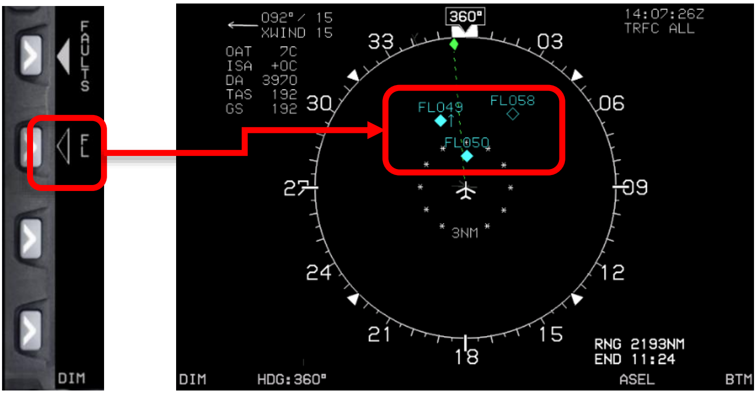


Figure T-11: Flight Level Option

T 2.7. MFD Traffic Format Menu

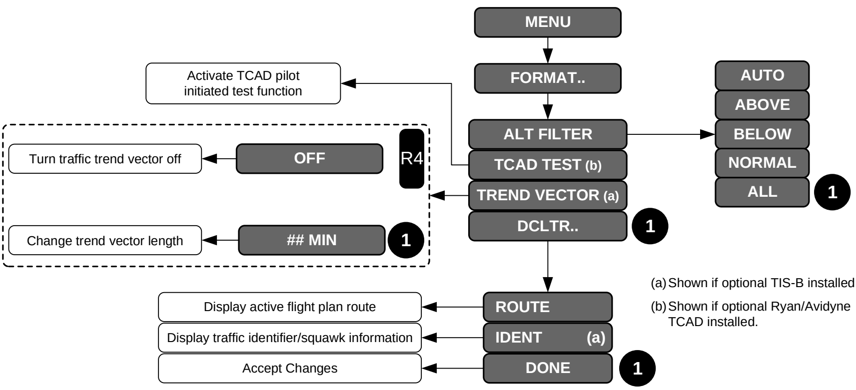


Figure T-12: MFD Traffic Format Menu

OT and PA traffic is altitude-filtered in accordance with pilot-selected filters as defined in Table T-6. All values are altitudes in feet or meters depending on "Speed Units" system limit setting, and VSI rates are in fpm.

Table T-6: Pilot Selected OT and PA Traffic Altitude-Filter

Mode	Parameter
AUTO	If aircraft VSI is less than -500fpm, traffic within +2,700 and -9,900 feet of aircraft altitude displayed. If aircraft VSI is more than +500 fpm, traffic within -2,700 and +9,900 feet of aircraft altitude displayed. Otherwise, traffic within -2,700 and +2,700 feet of aircraft altitude displayed.

Table T-6: Pilot Selected OT and PA Traffic Altitude-Filter

Mode	Parameter
ABOVE	Traffic within -2,700 and +9,900 feet of aircraft altitude displayed.
BELOW	Traffic within +2,700 and -9,900 feet of aircraft altitude displayed.
NORMAL	Traffic within -2,700 and +2,700 feet of aircraft altitude displayed.
ALL	All received traffic displayed, no altitude filtering.

NOTE:

The EFIS uses feet for internal traffic filter implementation.

T 2.7.1. Traffic Page (Step-By-Step) (PFD or MFD)

1) Use ❶ (PFD or MFD BTM area), ❶ or ❷ (MFD) as applicable to select then push to enter. highlight **TRAFFIC** then push to enter. The following example is for Traffic page on the bottom.
2) To adjust Traffic page range, use ❶ to select range (see Table T-5).
3) Press **MENU (R1)**, within 10 seconds press **FORMAT (R8)** to format the Traffic page.
4) Use ❶ to highlight **ALT FILTER..** then push **AUTO** or use ❶ to select **ABOVE**, **BELOW**, **NORMAL**, or **ALL** then push to accept altitude filtering.
5) Repeat step 3 and use ❶ to **TCAD TEST** then push to enter (TCAD/TAS [RS-232] ground operations only).
6) Repeat step 3 and use ❶ to highlight **DCLTR..** then push to enter. Use ❶ to select or deselect to show route on Traffic page.
7) Repeat step 3 and highlight **IDENT** then push to toggle IDENT on or off (ADS-B traffic only).
8) To save changes and exit menu, use ❶ to highlight **DONE** then push to enter or press **EXIT (R1)**.

T 2.8. Compass Rose Symbols

As specified in Section 2 Display Symbology.

T 2.9. Clock and Options

The following are displayed in the upper right corner of traffic page.

Table T-7: Clock and Options		
Feature	**Options**	**Notes**
Zulu or Local Time	hh:mm:ssZ hh:mm:ssL	Synchronized with the GPS/SBAS constellation.
Traffic Status	Enabled or Disabled	If traffic is disabled, overlying red “X”. When enabled, traffic altitude filtering is as follows (see Table T-2). AUTO = TRFC AUTO ABOVE = TRFC ABV BELOW = TRFC BLW NORMAL = TRFC NORM ALL = TRFC ALL

T 2.10. Air Data and Ground Speed

As defined in Section 2 Display Symbology.

T 2.11. Fuel Totalizer/Waypoint Distance Functions

As defined in Section 2 Display Symbology.

T 3. PFD Declutter (DCLTR) Menu

Figure T-13: Basic Mode Mini Traffic

Upon activating the PFD declutter menu, a list of declutter items is shown (see Table T-8). Manual decluttering is automatically overridden (PFD traffic shown) while an RA or TA is active.

Table T-8: PFD Declutter Options and Features		
Declutter Options	Configuration	
	SVN	Basic
PFD Mini Traffic	✓	✓
Perspective Traffic Depiction	✓	N/A

T 4. MFD Fault Display Menu

Loss of communications with traffic sensor (TRFC) is indicated by an "X" in place of the "OK."

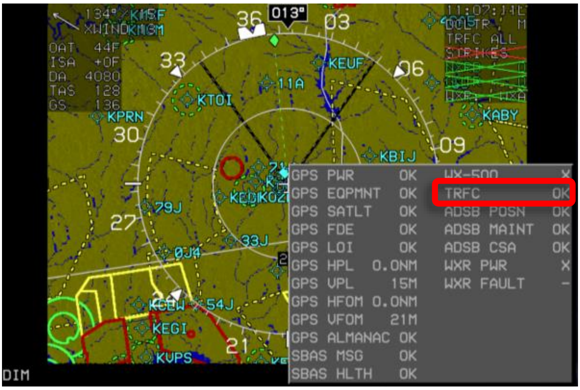


Figure T-14: Menu Faults Status

T 5. Menu Synchronization

Section 3 Menu Functions and Step-by-Step Procedures for additional information.

Table T-9: Menu Synchronization

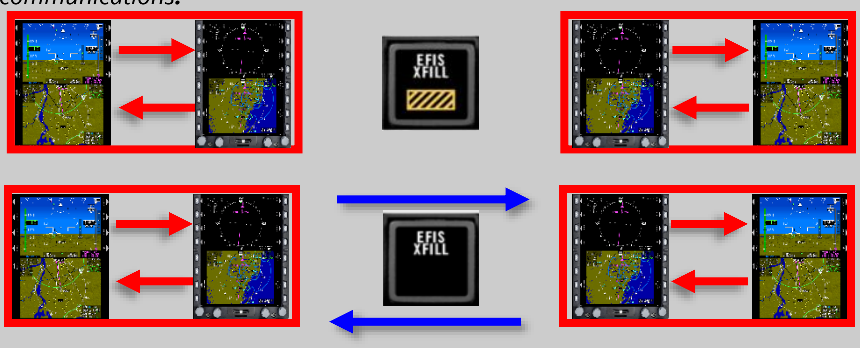
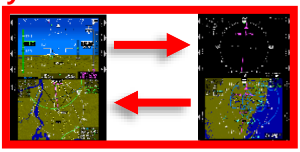
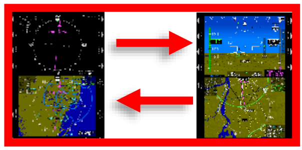
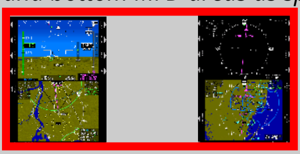
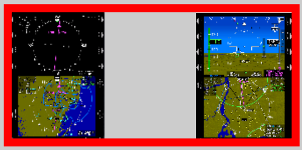
Menu Parameter	Notes
The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited. ***Intra-System*** *or* ***Inter-System*** *communications.* 	
TCAS-II control parameters	
Traffic Filter Setting	

Table T-9: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference. ***Intra-System*** *communications.*	
	
PFD Traffic Thumbnail	
PFD Traffic Perspective	
The following menu parameters are independent between displays. These are used to support non-PFI area display options to give the pilot maximum MFD operating flexibility. Note that some of these parameters are also independent between top and bottom MFD areas as specified in the notes.	
	
MFD Traffic Page Settings (show FL)	Independent between top and bottom 680 MFD areas

Remote Bugs Panel (RBP)

RBP 1. Remote Bugs Panel

The Remote Bugs Panel (RBP) provides dedicated controls for frequently used bugs and controls as defined in Table RBP-1.

The heading (HDG) and altitude (ALT) knobs behave similarly as the IDU knobs (see Section 3 Menu Functions and Step-By-Step Procedures for details).

During initialization, the RBP begins with "GENESYS RBP" on the main and option display screens. To access the internal light sensor control for brightness, press the two arrow buttons simultaneously and rotate the multifunction knob to adjust. Press the Option button to exit the brightness control program and return the RBP to normal operation.

NOTE:

The following RBP functions are available:

1) GPS Course

2) VLOC1 Course

3) VLOC2 Course

The above two groups of RBP functions are mutually exclusive as determined by the EFIS limits settings.

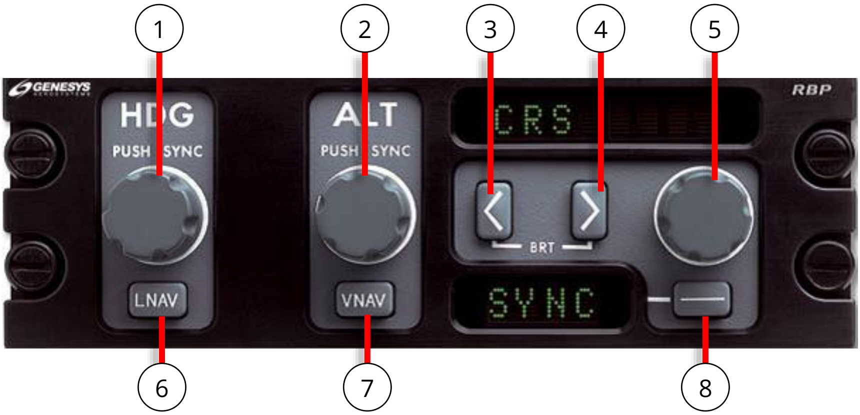


Figure RBP-1: Remote Bugs Panel

Table RBP-1: Remote Bugs Panel (RBP)

Button/Knob	Function	Rotate	Push Knob/Press Button
1 HDG Knob	Heading Bug	Increase or decrease	Synchronize to current heading
2 ALT Knob	Altitude Bug	Increase or decrease target altitude	Synchronize to current altitude
3 4 Arrow Buttons	Function Scroll	N/A	Move through "Set" options. Press both arrow buttons simultaneously to place into dimming mode.
5 Multifunction Knob (Function Active Nav Course)	GPS Course	Increase or decrease	If a manual GPS exists: (not in automatic OBS), synchronize to current bearing to active waypoint.
	VLOC1 VLOC2	Increase or decrease	Synchronize nav source course to current bearing to the station if NAV1 or NAV2 receiver is coupled to VOR; or synchronize the VLOC1 or 2 course to current aircraft heading if NAV receiver is coupled to LOC.
	ADF1 ADF2	Increase or decrease	Synchronize ADF1 or ADF2 course to the current bearing to the station
6 LNAV Button (With autopilot enabled) *	LNAV	N/A	Toggle HDG sub-mode and LNAV sub-mode. (Only active when **HDG** or **LNAV** soft tile appears on EFIS.)
7 VNAV Button (With autopilot enabled) *	VNAV	N/A	Fully integrated digital autopilot: Turn off any preselected target altitude bug. EFIS with VNAV Sub-Mode: Turn off target altitude bug to enter VNAV sub-mode. (Only active when **VNAV** appears on EFIS.)
8 Set Option "---" Button	---	N/A	Toggles function displayed in option display (also exits brightness dimming mode)

* Not applicable to installations without an autopilot or installations with a fully integrated digital autopilot (no HDG or LNAV sub-modes).

Main Message

Option Message

Figure RBP-2: Main and Option Messages

Figure RBP-3: Main and Option Messages (with Genesys/S-TEC DFCS)

Table RBP-2: Main and Option Messages - Active NAV Course Function

Selected Active Nav Source	Main Message	Option Message
GPS	NAV FMS	AUTO (If EFIS in manual OBS mode) MAN (If EFIS in automatic OBS mode)
VLOC1	NAV VOR1 * NAV LOC1 ** NAV BC1 ***	Current VLOC1 course setting (degrees)
VLOC2	NAV VOR2 * NAV LOC2 ** NAV BC2 ***	Current VLOC2 course setting (degrees)
ADF1	NAV ADF1	Current ADF1 course setting (degrees)
ADF2	NAV ADF2	Current ADF2 course setting (degrees)

* Nav receiver coupled to VOR
** Nav receiver coupled to LOC
*** Nav receiver coupled to LOC BC

Table RBP-3: Main and Option Messages - Other Functions

Function	Main Message	Option Message
GPS Course (EFIS in manual OBS mode)	CRS FMS	AUTO (If EFIS in manual OBS mode)
VLOC1 Course	CRS VOR1 * CRS LOC1 ** CRS BC1 ***	Current VLOC1 Course setting (degrees)
VLOC2 Course	CRS VOR2 * CRS LOC2 ** CRS BC2 ***	Current VLOC2 Course setting (degrees)
Airspeed Bug	SPD BUG	ON (If airspeed bug is OFF) OFF (If airspeed bug is ON)
Vertical Speed Bug	VSI BUG	ON (If vertical speed bug is OFF) OFF (If vertical speed bug is ON)
Climb Angle Setting	CLIMB ANG	Current climb angle setting (tenths of a degree)
Descent Angle Setting	DCND ANG	Current descent angle setting (tenths of a degree)
Decision Height Bug	DEC HT	ON (If decision height bug is OFF) OFF (If decision height bug is ON)
Minimum Altitude Bug	MIN ALT	Current VLOC1 Course setting (degrees)

* Nav receiver coupled to VOR
** Nav receiver coupled to LOC
*** Nav receiver coupled to LOC BC

WX-500 Lightning Strikes

S 1. WX-500 Data Symbology

When interfaced with the optional WX-500, a strike page is available based roughly on the appearance of the Goodrich WX-1000 display. When selected, the EFIS displays cell mode or strike mode lightning strikes in correct relationship to the ownship symbol with the limits defined in Table S-1.

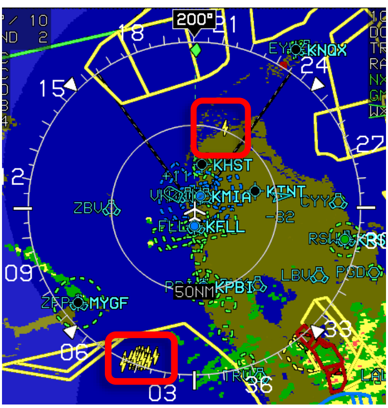
Table S-1: Lightning Strikes

Time or Distance Limit	View
Display scale less than 25 NM or 50KM	Strikes not shown
More than 3 minutes old	Strikes not shown
Strikes less than 20 seconds old	Yellow lightning symbol
Strikes between 20 seconds and 2 minutes old	Yellow large cross symbol
Strikes between 2 and 3 minutes old	Yellow small cross symbol

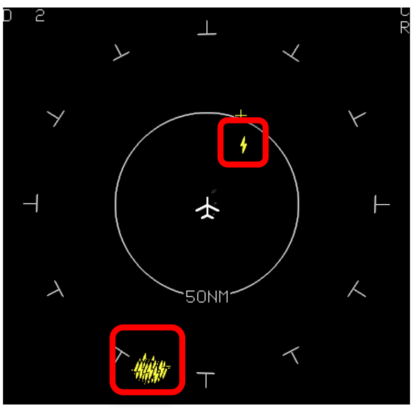
The pilot may select with Strikes overlay on map page in arc or centered mode.

Arced: Ownship displaced toward the bottom of the screen. Strike data are displayed in a larger scale while displaying all data within range ahead of the aircraft.

Centered: Ownship symbol is in the center of the page with navigation data displayed out to an equal distance in all directions.



Map Page Strikes Display Overlay



Strikes Page Display

Figure S-1: Lightning Symbols

A range ring is centered upon the ownship symbol to help judge range to displayed symbols.

Table S-2: Lightning Screen Range

From Ownship to	Range in NM				Range in KM			
Range ring (shown on range ring)	12.5	25	50	100	25	50	100	250
Strikefinder markers	25	50	100	200	50	100	200	500

Strikefinder markings are aligned with either magnetic north or true north depending on the status of the true north as configured in EFIS limits. When the AHRS is in DG mode, "DG" appears to the right of the ownship symbol.

S 2. MFD Strikes Page

Figure S-2: PFD with Strikes Page on Bottom

S 2.1.1. MFD Strikes Page (Step-By-Step)

1) Use ❶ (PFD or MFD BTM area), ❶ or ❷ (MFD), then highlight **STRIKES** and push to enter for STRIKES page to appear.

2) When the MFD is full map, use ❷ and highlight **STRIKES** to display Strikes page on top and last selected MFD page on the bottom.

S 2.2. PFD First-Level Menu

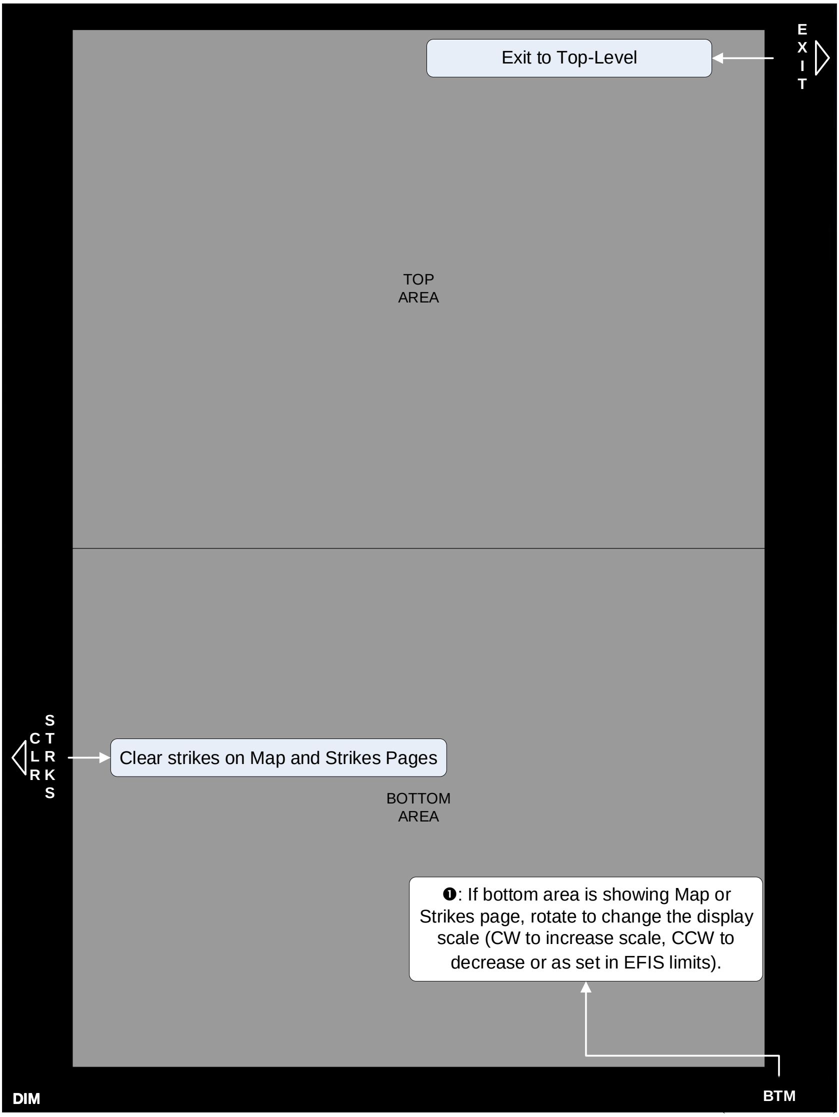


Figure S-3: PFD First-Level Menu

S 2.3. MFD First-Level Menu (Normal Mode)

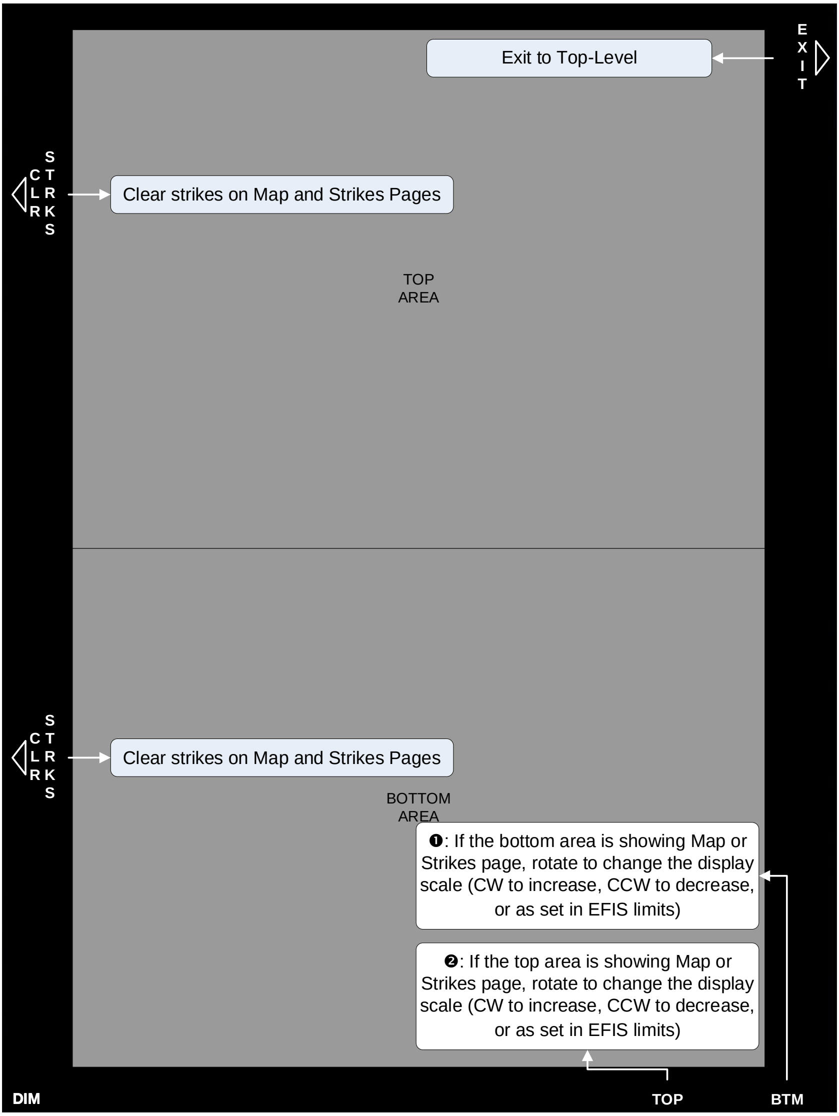


Figure S-4: MFD First-Level Menu (Normal Mode)

S 2.4. Clock and Options

The following are displayed in the upper right corner of the page:

1) Zulu Time or Local Time: As specified in Section 2 Display Symbology.

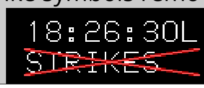
2) WX-500 Status: When selected, displays cell mode lightning strikes in correct relationship to the ownship symbol with the limits found in Table S-3.

Zulu Time

Local Time

Figure S-5: Clock and Options

Table S-3: WX-500 Status

Condition	Annunciation
System Normal, Cell Mode	CELL MODE annunciates mode RATE ### depicts strike rate
System Normal, Strike Mode	STRK MODE annunciates mode RATE ### depicts strike rate
System Failed with "Show Full Sensor Status" enabled in EFIS Limits	STRIKES overlaid with red "X" Strike symbols removed 
System in Test Mode	STRK TST shown Strike symbols removed

A new strike rate value is calculated every five seconds during normal operation, based upon strikes within the selected display range. The number of fresh strikes (less than 20 seconds old) is used to generate a strike rate representing strikes per minute. Strike rate increases are displayed immediately upon calculation, while decreases in strike rate are damped. Activating the strike clear function resets the strike rate to zero.

S 2.5. Active Flight Plan Path/Manual Course/Runways

When there is an active flight plan and the GPS/SBAS OBS setting is automatic, the flight plan path is shown on the strikes page in correct relationship to the ownship symbol.

When there is an active waypoint and the GPS/SBAS OBS setting is manual, the course through the waypoint is shown as a pointer centered on the waypoint. The pointer matches the lateral navigation guidance on the PFD (GPS/SBAS CDI in manual OBS mode, skyway boxes, and mini map).

The active flight plan path's active leg/manual course and active waypoint are magenta but turn amber (yellow) in the event of a GPS LOI/LON caution. The strikes page displays airport runways in correct relationship and scale to the ownship symbol.

Figure S-6: Active Flight Plan Path/Manual Course/Runways

S 2.6. Air Data and Ground Speed

Display as defined in Section 2 Display Symbology.

S 2.7. Fuel Totalizer/Waypoint Distance Functions

As defined in Section 2 Display Symbology.

S 2.8. Strikes Format Menu

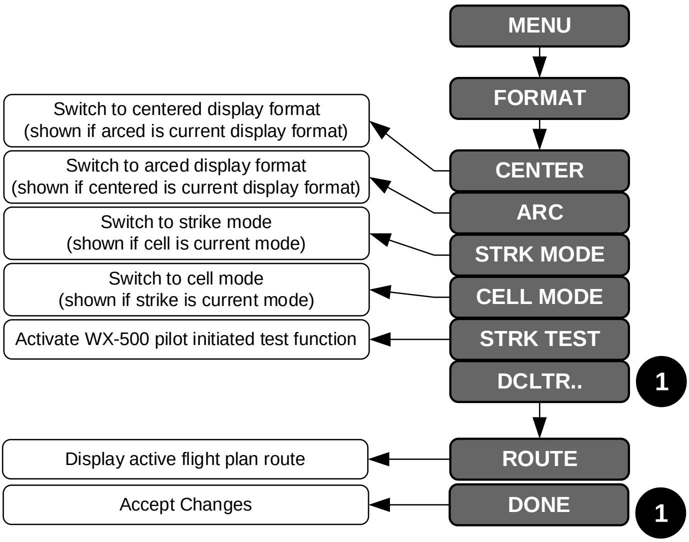


Figure S-7: Strikes Format Menu

S 3. MFD Fault Display Menu

Loss of communications with the WX-500 is indicated by an "X" replacing the "OK".

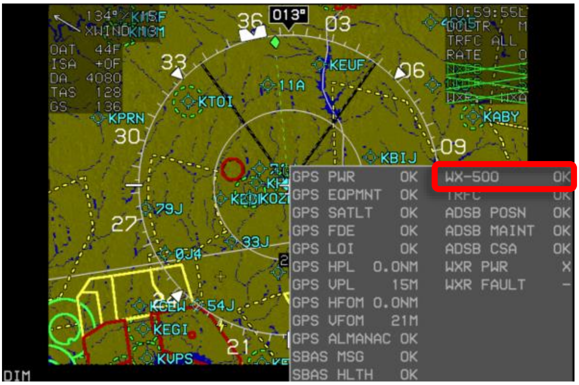
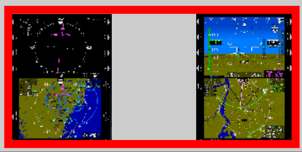


Figure S-8: MFD Fault Display Menu

S 4. Menu Synchronization

See Section 3 Menu Functions and Step-by-Step Procedures for additional information.

Table S-4: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are independent between displays. These are used to support non-PFI area display options to give the pilot maximum MFD operating flexibility. Note that some of these parameters are also independent between top and bottom MFD areas as specified in the notes.	
	
Sensor Selections	
Strike (WX-500) Page Settings	Independent between top and bottom MFD areas

Datalink

D 1. Datalink Symbology

When interfaced with an optional datalink or ADS-B receiver, a Datalink symbology is available.

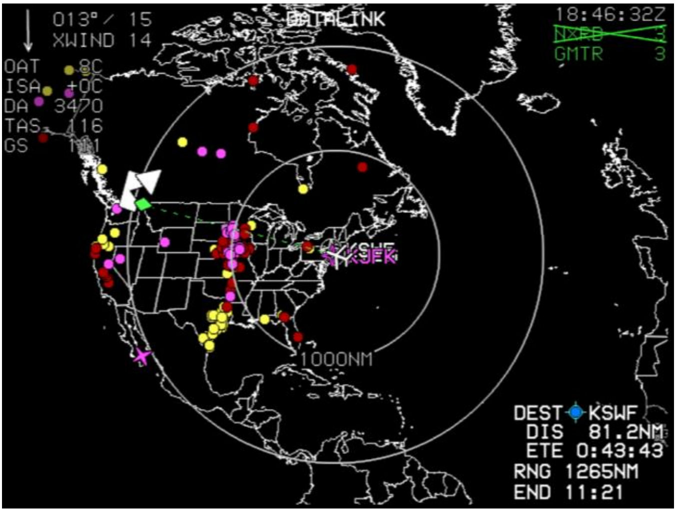


Figure D-1: Datalink Symbology with G METAR On

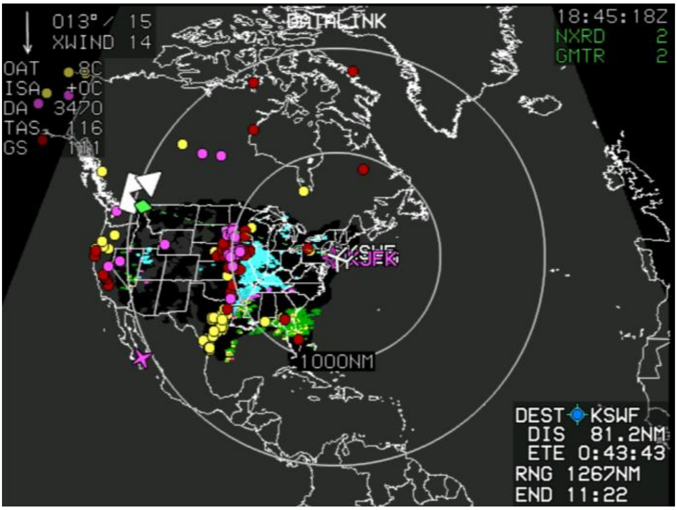


Figure D-2: Datalink Symbology with NEXRAD On

D 1.1. Borders

National and United States state borders are drawn in white in their correct relationship to the ownship symbol. The lowest scale available is 25NM or 50KM and selectable on the Map page.

D 1.2. ADS-B Data

ADS-B data products are available to be individually selected for display as defined in Table D-1.

Table D-1: ADS-B Data

NEXRAD Data	Available
Graphical METAR Data	Available. Derived from textual METAR data using EFIS algorithm.
Graphical Weather Conditions Data	
Textual METAR Data	Available
Textual TAF Data	Available

D 1.2.1. NEXRAD Data

NEXRAD data is displayed on the MFD in correct relationship as colored regions of precipitation using the coloring convention in Table D-2.

Table D-2: Datalink NEXRAD Data

Color	Meaning
Gray Shading	Areas beyond the limits of radar coverage or areas with missing data
Magenta	Rain ≥ 50dBZ
Red	Rain ≥ 45dBZ and < 50dBZ
Light Red	Rain ≥ 40dBZ and < 45dBZ
Amber (Yellow)	Rain ≥ 30dBZ and < 40dBZ
Green	Rain ≥ 20dBZ and < 30dBZ
Cyan	Snow ≥ 20dBZ
Light Cyan	Snow ≥ 5dBZ and < 20dBZ
Magenta	Mixed Precipitation ≥ 20dBZ (Area is distinguishable from rain ≥ 50dBZ by graphical context)
Light Magenta	Mixed Precipitation ≥ 5dBZ and < 20dBZ

When the EFIS is interfaced with an optional weather radar, NEXRAD automatically declutters when weather radar returns are selected for display. Display of NEXRAD data is inhibited during active FLTA alerts.

Table D-3: NEXRAD Decluttered by WX-RDR

Color	Meaning
	PFD with Map page on bottom with Datalink selected for overlay.
	PFD with Map page on bottom with Datalink and WX-RDR selected for overlay.
	MFD Full Map page with Datalink selected for overlay.

Table D-3: NEXRAD Decluttered by WX-RDR

Color	Meaning
	MFD Full Map page with Datalink and WX-RDR selected for overlay.

D 1.2.2. Graphical METARS

Graphical METARs (G METARS) are displayed in correct relationship to the ownship symbol at ranges defined in Table D-4.

Table D-4: G METARS Range

Screen Range		Display
NM	KM	
50	100	All Graphical METARs with Airport symbol and ID
100	200	All Graphical METARs with Airport symbol
200	500	All Graphical METARS
500	1,000	VFR Graphical METARS are decluttered
1,000	2,000	VFR and MFVR Graphical METARS are decluttered.
2,000	4,000	

If the airport has an available datalinked METAR, the circular part of the airport symbol is colored-fill with the coloring convention in Table D-5.

Table D-5: Graphical METAR Symbols	
Color	**Meaning**
Sky Blue	Visual Flight Rules (VFR)
Green	Marginal Visual Flight Rules (MVFR)
Amber (Yellow)	Instrument Flight Rules (IFR)
Red	Low Instrument Flight Rules (LIFR)
Magenta	Less than Category 1 Approach Minimums
Black	No Data

Graphical METARs are also displayed in the menu system "nearest airport," "nearest weather," and "info" functions.

Figure D-3: NRST Airport

Graphical weather conditions data are displayed in the menu system "info" function as large colored squares per the convention in Table D-6.

Table D-6: Datalink Graphical METAR Precipitation	
Color	**Meaning**
Sky blue	No significant precipitation
Green	Rain
White	Snow
Red	Hazardous weather
Right half gray	Obscuration to visibility
Small black square centered in large square	High wind
Black	No data

Textual METAR and TAF data are displayed when appropriate in the menu system "info" function. Time of observation and forecast are contained within the text.

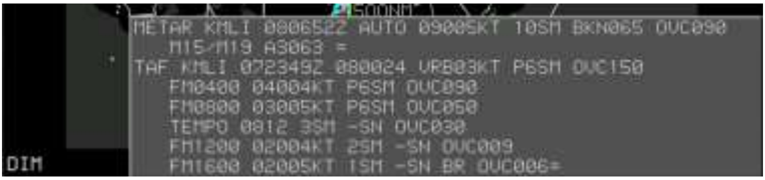


Figure D-4: METAR and TAF Report

D 2. Top-Level Menu Automatic Pop-Up Function Descriptions

See Section 3 Menu Functions and Step-by-Step Procedures for top-level menu option descriptions. Soft menu tiles appear adjacent to buttons under the specified conditions.

D 3. Dedicated Datalink Page

D 3.1. MFD Page Menu

DATALINK: Shows the Datalink page.

D 3.2. Datalink Page Orientation

Datalink is always displayed in North-Up orientation. The page has a boundary circle instead of a compass rose and "DATALINK" above the boundary circle. If not in pan mode, the ownship symbol is aligned with the aircraft heading.

North-Up orientation with active flight plan

Pan Mode

Figure D-5: Datalink Page Orientation

D 3.3. Datalink Page Locations

Table D-7: Datalink Page Locations

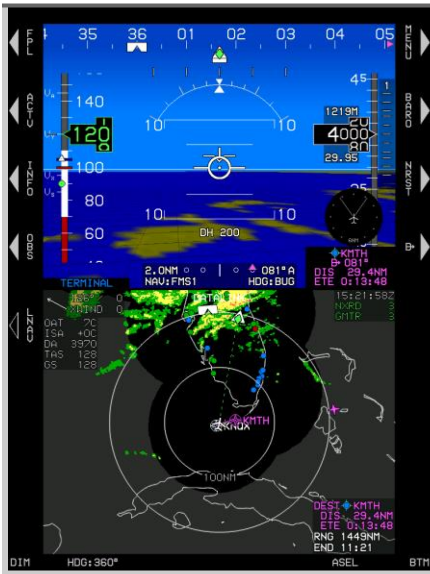
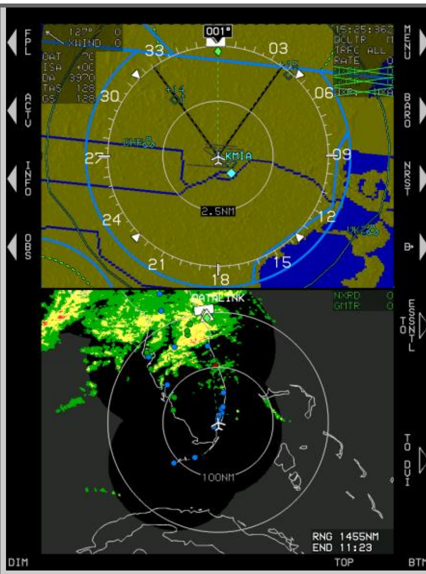
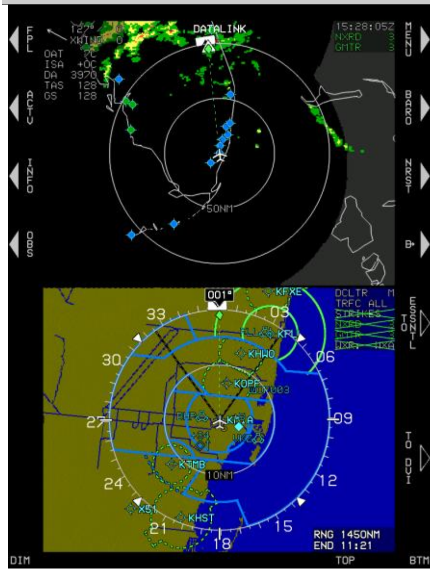
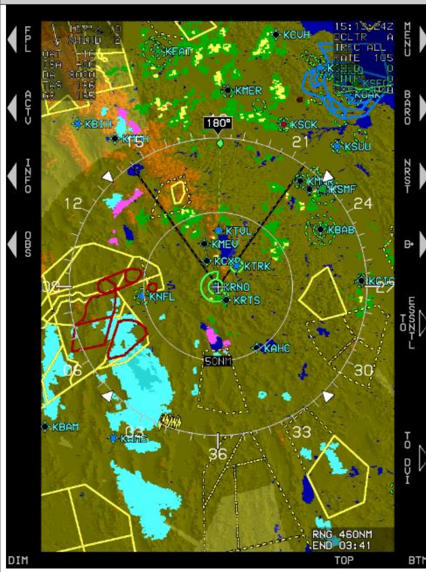
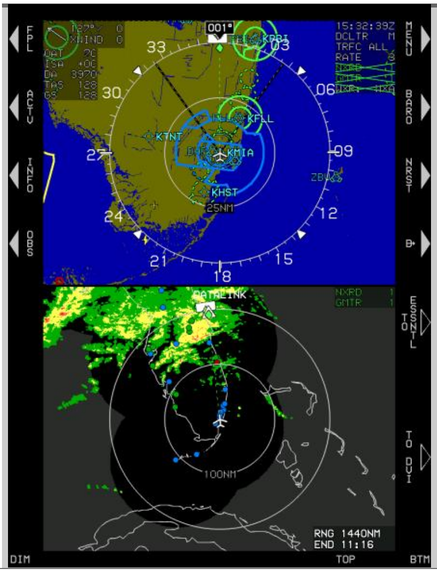
	
PFD (bottom area only)	MFD Bottom area
	
MFD top area	MFD with full map page

Table D-7: Datalink Page Locations

	When full map is showing, and Datalink is selected on the top or bottom area, the other area returns to the last selected MFD page.

D 3.4. Datalink Page Legend

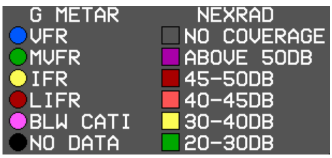


Figure D-6: ADS-B Datalink Legend

D 3.5. Air Data and Ground Speed

Air data and ground speed are displayed in the upper left corner of the Datalink page as specified in Section 2 Display Symbology.

D 3.6. Clock and Options

Zulu Time

Local Time

Figure D-7: Clock and Options

The following are displayed in the upper right corner:

1) Zulu or Local Time: As in Section 2 Display Symbology.

2) Datalink Weather Status: When status of NEXRAD, graphical METARs, displayed as in Table D-8.

Table D-8: Datalink NEXRAD Status

Condition	Status Annunciation	
	*NEXRAD	Graphical METAR
Never completely downlinked	No Annunciation	
Downlinked within last 5 minutes and selected for display (*if installed, weather radar deselected from display). "Show Full Sensor Status" enabled.	"NXRD ##" in green. ## is age in minutes. NEXRAD shown.	"GMTR ##" in green. ## is age in minutes. G METARS shown.
Downlinked within last 5 minutes and deselected from display (*if installed, weather radar selected for display). "Show Full Sensor Status" enabled.	"NXRD ##" in green. ## is age in minutes. "NXRD ##" overlaid with green "X" NEXRAD not shown.	"GMTR ##" in green. ## is age in minutes. "GMTR ##" overlaid with green "X" G METARS not shown.
Not downlinked within last 5 minutes but downlinked within last 10 minutes and selected for display (*if installed, weather radar deselected from display). "Show Full Sensor Status" enabled.	"NXRD ##" in amber (yellow). ## is age in minutes. NEXRAD shown.	"GMTR ##" in amber (yellow). ## is age in minutes. G METARS shown.
Not downlinked within last 5 minutes but downlinked within last 10 minutes and deselected from display (*if installed, weather radar selected for display). "Show Full Sensor Status" enabled.	"NXRD ##" in amber (yellow). ## is age in minutes. "NXRD ##" overlaid with green "X" NEXRAD not shown.	"GMTR ##" in amber (yellow). ## is age in minutes. "GMTR ##" overlaid with green "X" G METARS not shown.
Not downlinked within last 10 minutes but downlinked within last 75 minutes and selected for display.	"NXRD ##" in red. ## is age in minutes. NEXRAD shown.	"GMTR ##" in red. ## is age in minutes. G METARS shown.
Not downlinked within last 10 minutes but downlinked within last 75 minutes and deselected from display (*if installed, weather radar selected for	"NXRD ##" in red. ## is age in minutes. "NXRD ##" overlaid with green "X"	"GMTR ##" in red. ## is age in minutes. "GMTR ##" overlaid with green "X"

Table D-8: Datalink NEXRAD Status

Condition	Status Annunciation	
	*NEXRAD	Graphical METAR
display). "Show Full Sensor Status" enabled.	NEXRAD not shown.	G METARS not shown.
Not downlinked within last 75 minutes (timed-out). "Show Full Sensor Status" enabled.	"NXRD XX" in red "NXRD XX" overlaid with red "X" NEXRAD not shown.	"GMTR XX" in red "GMTR XX" overlaid with red "X" G METARS not shown.

D 3.7. Datalink Page Screen Range

When selected, the screen ranges in Table D-9 are available (all distances represent distance from the ownship symbol to the range ring). Radius of the range ring is presented on the inner range ring with the outer boundary circle representing double the value of the inner ring.

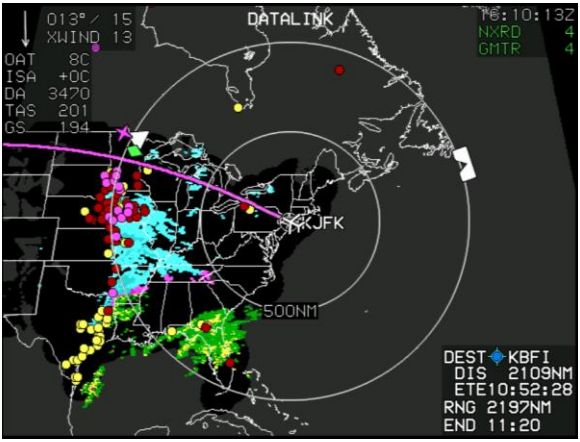


Figure D-8: Datalink Page Screen Range

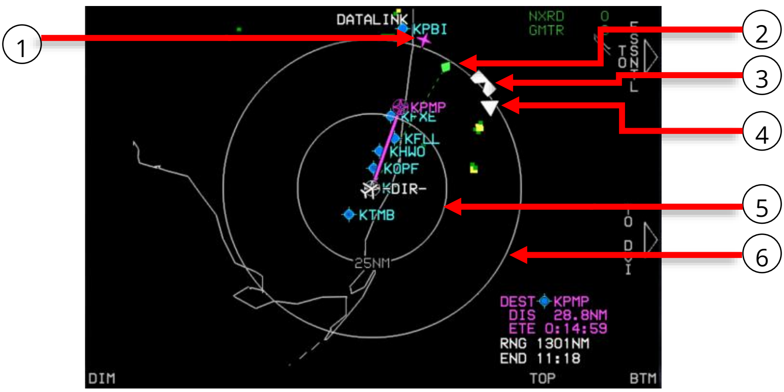
Table D-9: Datalink Page Screen Ranges

Ownship to Range Ring		Ownship to Boundary Circle	
NM	KM	NM	KM
25	50	50	100
50	100	100	200
100	250	200	500
250	500	500	1,000
500	1,000	1,000	2,000

Table D-9: Datalink Page Screen Ranges			
Ownship to Range Ring		Ownship to Boundary Circle	
NM	KM	NM	KM
1,000	2,000	2,000	4,000

D 3.8. Boundary Circle Symbols

On the boundary circle a white triangular heading pointer, aligned with the longitudinal axis of the ownship symbol, appears. A green diamond-shaped track pointer, aligned with the aircraft's track across the earth, is connected to the ownship symbol with a green dashed lubber line. A pilot-settable heading bug appears and a magenta, star-shaped waypoint pointer appears at a point which corresponds with the active waypoint.



1) Waypoint Bearing Pointer
2) Track Pointer and Lubber Line
3) Heading Bug
4) Heading Pointer
5) Range Ring
6) Boundary Circle

Figure D-9: Boundary Circle Symbol

D 3.9. Active Flight Plan Path/Manual Course/Runways

See Section 2 Display Symbology for more details.

D 4. Information (INFO) Menu

With an airport containing WX data, press **INFO (L3)** and then **WX LGND (L2)** and **EXPND WX (L3)** appears for access to the weather legend symbols and METAR or TAF text.

If **INFO** is activated from within the **ACTV**, **NRST**, or Direct menus, information on the highlighted waypoint is shown. The amount and type of information presented depends upon the type of waypoint. With Datalink enabled, current altimeter setting and wind are provided. See Section 3 Menu Functions and Step-by-Step Procedures for more information.

D 5. MFD Datalink Format Menu

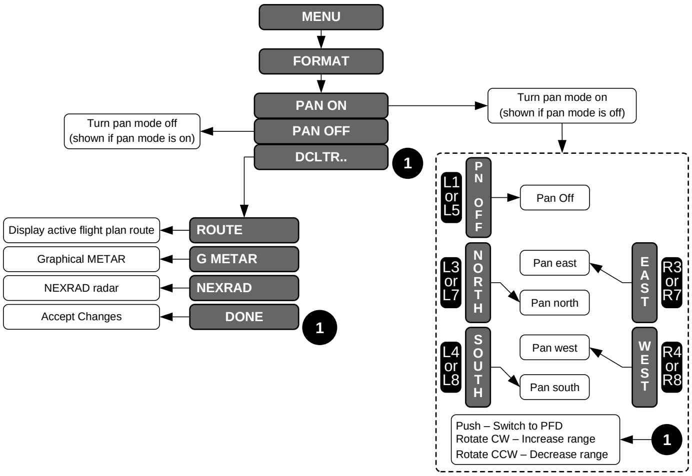


Figure D-10: MFD Datalink Format Menu

D 5.1. MFD Datalink Page Format Menu (Step-By-Step)

1) Use ❶ or ❷, then highlight **DATALINK** and push to enter for DATALINK page to appear.
2) Press **MENU (R1)**, within 10 seconds press **FORMAT (R8)** to format Datalink page.
3) Use ❶ to highlight **PAN ON** or **DCLTR..** Push to enter.
4) If **PAN ON** is selected, press **NORTH (L7)**, **SOUTH (L8)**, **EAST (R7)**, or **WEST (R8)** to pan in desired direction.
5) Use ❶ to set desired range.
6) Press **INFO (R6)** to view airport information.
7) Press **WX (L6)** to view METAR information for the selected airport.
8) When finished, press **PN OFF (L5)** or press **MENU (R1)**, within 10 seconds press **FORMAT (R8)** and then push ❶ to turn off panning and exit menu.
9) Repeat step 3. Select **DCLTR..** and then push ❶ to enter.
10) Use ❶ to select or deselect desired options from list and then push to enter.

11) If no other changes are desired, use ❶ to highlight **DONE** then push to enter, or press **EXIT (R1)** to save changes and exit menu.

D 5.2. Formatting Map Page on PFD OR MFD (Step-By-Step)

1) To overlay and display datalink information on the map, return to the Map page, press **MENU (R1)** and then, within 10 seconds, press **FORMAT (R8)**.
2) Rotate ❶ to **FNCT DCLTR..** and then push to enter.
3) Rotate ❶ to **DATALINK** and then push to enter.
4) Rotate ❶ to **DONE** and then push to enter or press **EXIT (R1)** to save changes and exit menu.

D 5.3. MFD Datalink NRST Airport Info PFD or MFD (Step-By-Step)

1) To overlay and display datalink information on the map, return to the Map page, press **MENU (R1)** and then, within 10 seconds, press **FORMAT (R8)**.
2) Use ❶ to highlight **FNCT DCLTR..** then push to enter.
3) Use ❶ to highlight **DATALINK** then push to enter.
4) Use ❶ to highlight **DONE** then push to enter or press **EXIT (R1)** to save changes and exit menu.

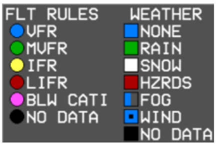


Figure D-11: NRST Airport WX LGND

D 5.3.1. MFD Full Map Page (Step-By-Step)

1) Use ❶ or ❷ and highlight **FULL MAP** then push to enter.
2) To format the Full Map page, press **MENU (R1)**, within 10 seconds, press **FORMAT (R4)**, rotate ❶ to **FNCT DCLTR..**, and then push to enter.
3) Use ❶ then select or deselect desired functions. Use ❶ to highlight **DONE** then push to enter or press **EXIT (R1)** to save changes and close menu.

NOTE:

When selecting the Datalink page while displaying the full Map page, the MFD automatically changes to a top/bottom display with Datalink displayed on the selected area.

D 6. MFD Fault Display Menu

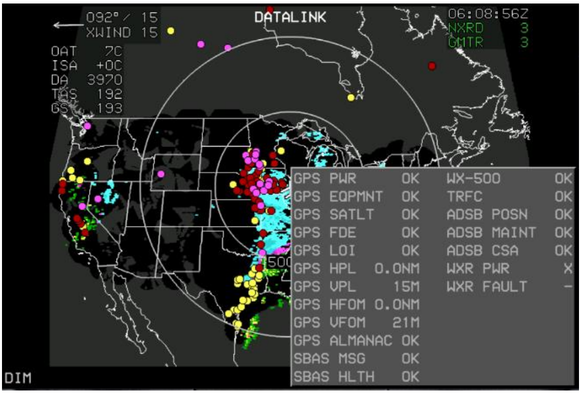


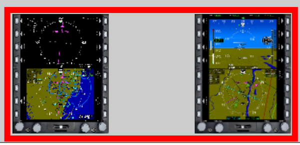
Figure D-12: Faults Menu with ADS-B Status

Press **MENU (R1)**, then within 10 seconds, **FAULTS (L1)**. Upon selecting the Faults menu with ADS-B datalink enabled, an indication of ADS-B position validity (ADSB POSN), indication of whether ADS-B receiver maintenance is required (ADSB MAINT), and indication the conflict situational awareness algorithm is working (ADSB CSA) appear.

D 7. Menu Synchronization

Section 3 Menu Functions and Step-by-Step Procedures for additional information.

Table D-10: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility. Note that some of these parameters are also independent between top and bottom MFD areas as specified in the notes.  	
MFD Datalink Page Settings	Independent between top and bottom MFD areas

Weather Radar

WX 1. Weather Radar

This Weather Radar appendix is primarily for the Honeywell RDR-2100 installed with no external control panel.

Radiation

Warning

This instrument generates microwave radiation.

DO NOT OPERATE UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED ALL SAFETY PRECAUTIONS AND INSTRUCTIONS IN THE OPERATING AND SERVICE MANUALS.

IMPROPER USE OR EXPOSURE MAY CAUSE SERIOUS BODILY INJURY.

CAUTION:

Maintain prescribed safe distance when standing in front of operating antenna (reference FAA Advisory Circular #20-68).

Never expose eyes or any part of the body to an unterminated wave guide.

WX 1.1. Weather Radar Return Data

Weather radar-specific warnings appear in a conspicuous area adjacent to weather radar return data, so they do not conflict with the weather radar return data. Only one warning appears at any given time with the following order of precedence:

1) WX ALRT: Weather alert condition is active.

2) TURB ALRT: Turbulence alert condition is active.

3) STAB LIMIT: Aircraft attitude has moved to a point where the weather radar antenna can no longer be effectively stabilized.

4) ANT FAULT: Weather radar antenna is temporarily dislodged by turbulence.

Table WX-1: Weather Radar Return Data

Color	Definition
BLACK	No Returns
GREEN	Low-Level Weather or Low-Level Ground Returns
YELLOW	Mid-Level Weather or Mid-Level Ground Returns
RED	Third-Level Weather Returns. With an RDR-1600 weather radar type, this color alternates between red and black at 1Hz when in WXA mode. For all other radar types, this color should be replaced with black when in Map mode.
MAGENTA	Fourth-Level Weather or Third-Level Ground Returns. With an RDR-2000 or RDR-2100, this color alternates between magenta and black at 1Hz when the internal sub-mode is WXA.
CYAN	Automatic range limit returns. Indicates areas of unreliable returns due to radar power absorption
LIGHT GRAY	Moderate turbulence returns
White	Severe turbulence returns

When weather radar is selected, Datalink NEXRAD is automatically deselected. Weather radar return data is inhibited in the following conditions:

1) During active FLTA alerts;

2) In panning mode;

3) When north up orientation is selected; or

4) When RDR-2000 or RDR-2100 is in vertical profile mode.

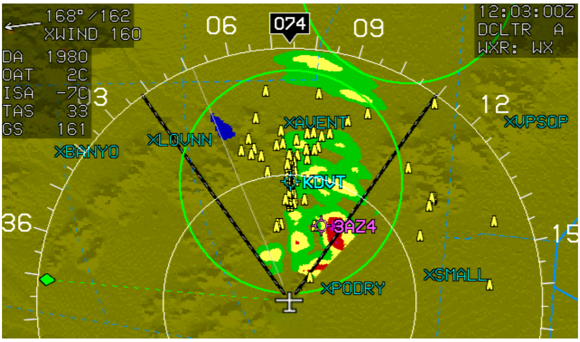


Figure WX-1: Weather Radar Overlay on Map

Weather radar automatically declutters when weather radar returns (see Table WX-1) are selected for display on the Map page in correct relationship to the ownship symbol (see Section 2 Display Symbology) unless inhibited during active FLTA alerts.

WX 2. Weather Radar Page

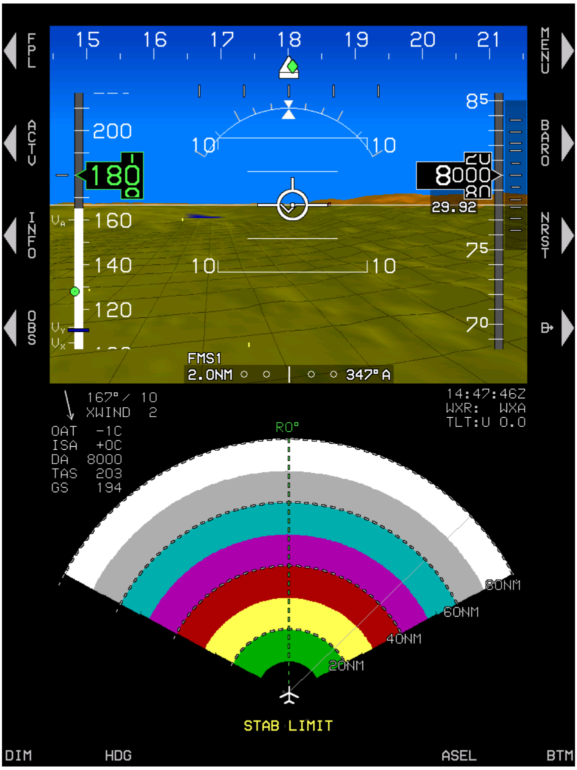
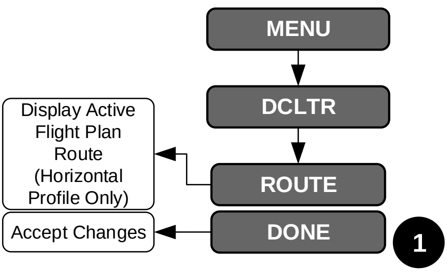


Figure WX-2: PFD Weather Radar Page on Bottom

WX 2.1. First-Level Menu Descriptions

If a Weather Radar page is displayed, **WX RDR (R3)/(R7)** activates the Weather Radar menu for controlling Honeywell RDR-2000/2100. An external control panel is required for the Telephonics RDR-1600.

If a Weather Radar page is displayed rotate ❶ (bottom area) or ❷ (top area) to change the display range. If the WX-RDR page is open in both the top and bottom areas, any knob action affects all WX-RDR pages per side.



DCLTR (R8): On the Weather Radar page in horizontal profile mode, activates Weather Radar Declutter menu option.

Figure WX-3: WX RDR Declutter (DCLTR) Menu

WX 2.2. Weather Radar Page Menu

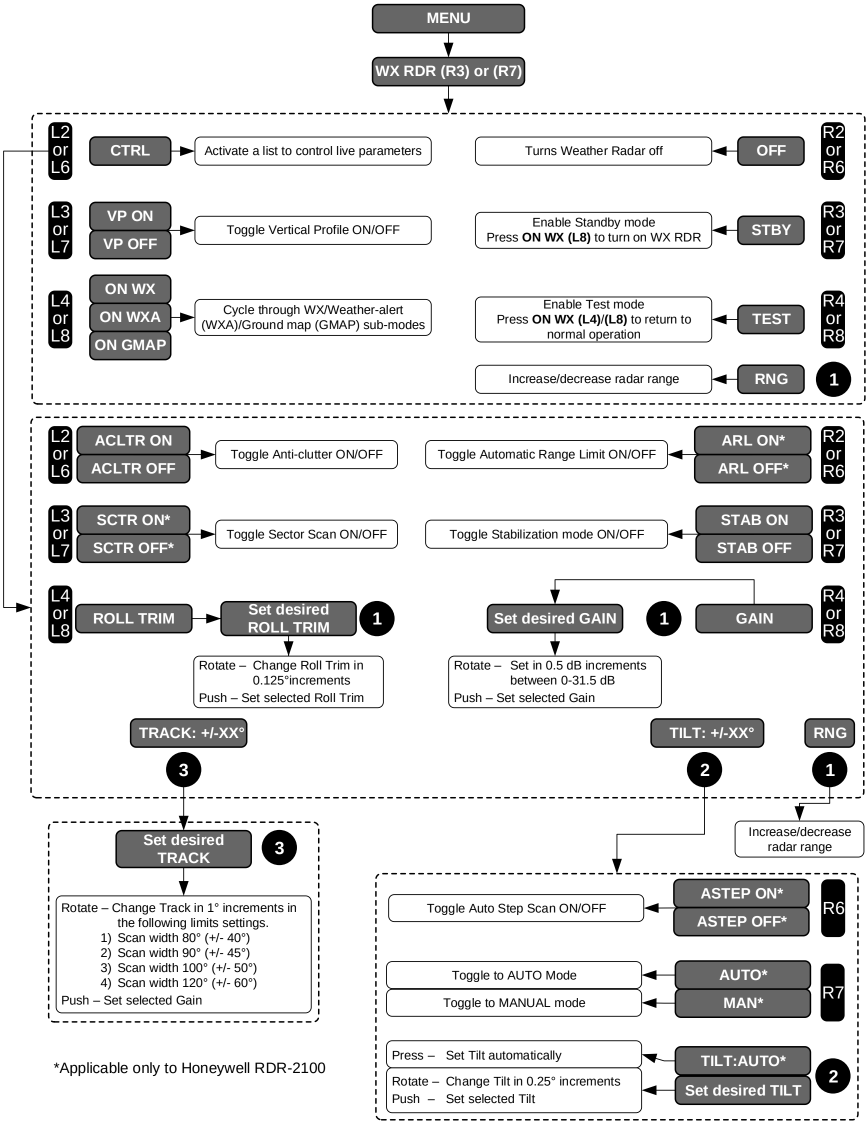


Figure WX-4: Weather Radar Page Menu

Since there is only one weather radar installed in the aircraft, when the WX-RDR page is opened in both top and bottom areas, only the top area displays the WX-RDR menus. Any menu action affects all WX-RDR pages per side.

NOTE:

Weather radar modes are mutually exclusive and therefore selecting one turns off the other modes with the exception of vertical profile, which appears in the selection box only when the selected weather radar mode is not OFF or STBY.

WX 2.2.1. Managing RDR-2100 Weather Radar Menu (Step-By-Step) (PFD or MFD)

Use ❶ (PFD or MFD BTM area), ❶ or ❷ (MFD) as applicable to highlight **WX-RDR** then push to enter. Press **MENU (R1)**, within 10 seconds, then press **WX RDR (R3)**/**(R7)** and choose the desired menu below. The following examples are describing a WX-RDR page shown on bottom area of a PFD or MFD:

NOTE:

Press **BACK (L1)** return to WX RDR menu or **EXIT (R1)** to save changes and exit a menu.

1) Press **CTRL (L6)** to enter radar control menu (see § WX 2.2.2)
2) Current mode status is displayed in upper right corner of radar page. Press **VP ON/OFF (L7)** to toggle between horizontal and vertical modes.

NOTE:

VP mode is automatically turned off if not showing any WX-RDR page on the onside IDUs.

3) While in STBY mode, press **ON WX (L8)** to return radar to ON mode.
4) Press **ON WXA (L8)** to enable Weather-alert sub-mode.
5) Press **ON GMAP (L8)** to enable ground map sub-mode. Annunciated in upper right corner.)
6) Press **ON WX (L8)** to resume normal weather radar mode of operation.
7) Use ❶ to alter range of weather radar from 5.00 NM to 320.00 NM. Rotation direction dependent upon EFIS limits setting. (Annunciated on the right side of the arc in NM or KM.)

NOTE:

Radar range limited to 160NM/240 KM when using RDR-2000 or RDR-1600.

8) Press **STBY (R7)** to enable standby mode. (Not shown in standby mode.)

9) Press **TEST (R8)** to enable test mode. (Not shown in test mode.)

WX 2.2.2. Managing RDR-2100 Weather Radar Control Menu (Step-By-Step)

1) Press **CTRL (L6)** to enter radar control menu.

2) Press **ACLTR ON/OFF (L6)** to toggle anti-clutter on and off.

3) Press **SCTR ON/OFF (L7)** to toggle sector scan on and off.

4) Press **ROLL TRIM (L8)** then use ❶ to set desired roll trim angle (increments of 0.125°) and push to enter.

5) Press **ARL ON/OFF (R6)** to toggle automatic range limit option off and on.

6) Press **STAB ON/OFF (R7)** to toggle Stabilization mode.

7) Press **GAIN (R8)** to open gain menu and rotate ❶ to change gain in 0.5 dB increments between +0.0 dB to -31.5 dB. Push to set selected gain value.

WX 2.2.3. Managing RDR-2100 Weather Radar Tilt (Step-By-Step)

1) Repeat step 2 in § WX 2.2.1. Press **CTRL (L6)** to enter radar control menu.

2) Use ❷ to open tilt menu. Press **MAN/AUTO (R7)** to toggle between **TILT:AUTO** and **TILT:##.##°**. Use ❷ to set tilt angle in 0.25° increments. Set angle is annunciated above ❷ and in upper right corner with "D" (for down °) and "U" (for up°) values.

3) Press **ASTEP ON/OFF (R6)** to toggle antenna tilt to sequentially step in 4° increments. (Auto step scan is entered initially by adjusting the tilt to ±15°.)

WX 2.2.4. Managing RDR-2100 Weather Radar Track Angle Menu (Step-By-Step)

1) Track angle annunciation is above ❸ at the end of the green track line (or top right corner in profile depiction).

2) Use ❸ to set new track angle in 1° increments between limits set in EFIS limits. Push to enter.

WX 2.2.5. Managing RDR-2000 Weather Radar Menu (Step-By-Step)

The Weather Radar menu for the RDR-2000 MFD is the same as for the RDR-2100 (see § WX 2.2.1) with fewer control menu options (see WX 2.2.6).

WX 2.2.6. Managing RDR-2000 Weather Radar Menus Control Menu (Step-By-Step)

1) Press **ACLTR ON/OFF (L6)** to toggle anti-clutter on and off.

2) Press **ROLL TRIM (L8)** then use ❶ to set desired roll trim angle (increments of 0.125°) then push to enter.

3) Press **STAB ON/OFF (R7)** to toggle Stabilization mode between on and off.

4) Press **SCTR ON/OFF (L7)** to toggle sector scan option between on and off.

5) Press **ARL ON/OFF (R6)** to toggle automatic range limit option between on and off.

6) Press **GAIN (R8)** then use ❶ to set desired GAIN between +0.0 DB and -31.5 DB (increments of 0.5 DB) then push to enter.

WX 2.3. Weather Page Screen Range

Weather page screen range is pilot-selectable with either ❷ (top area) or ❶ (bottom area) for RDR-2000 or RDR-2100 weather radar types, or a control panel directly attached to the weather radar receiver-transmitter.

Weather page screen range is displayed NM of KM distances (depending upon EFIS limits settings) as a series of equidistant dashed arcs centered upon the ownship symbol to help judge range to the displayed weather radar returns. For most screen ranges, there are four equidistant dashed arcs. When in 2.5NM or 5KM range, there are five equidistant dashed arcs.

Each arc is labeled with distance in units at the right (horizontal depiction) or bottom (profile depiction). In the profile depiction mode, there are also three horizontal altitude lines drawn relative to the aircraft's altitude to help the pilot judge the vertical distance to the displayed weather radar returns. The center line is level with the ownship symbol to represent the aircraft's altitude. The other two lines are equally spaced above and below the center line to represent altitude differences above and below the aircraft. The number of feet or meters above and below the aircraft vary with the selected range to compensate for the radar scan width at the different ranges.

With the exception of the RDR-2000, RDR-2100 or RDR-1600 weather radar types, available screen ranges are controlled by the weather radar and the IDU formats the dashed arcs as commanded by the range parameter settings.

In the case of RDR-2000, RDR-2100 or RDR-1600 weather radar type, screen range is an internally controlled parameter and the following weather screen ranges are available (all distances represent the distance from the ownship symbol to the outer dashed arc.)

Table WX-2: Weather Radar Page Range

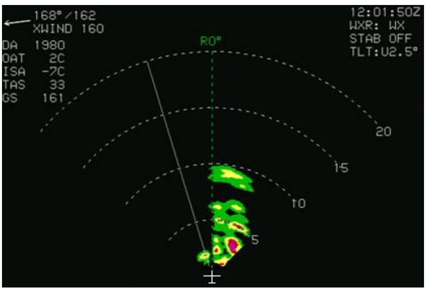
Range (NM)	Range (KM)	RDR-2000	RDR-2100	RDR-1600
0.5	1			✓
1	2			✓

Range (NM)	Range (KM)	RDR-2000	RDR-2100	RDR-1600
2	4			✓
5	10	✓	✓	✓
10	20	✓	✓	✓
20	40	✓	✓	✓
40	80	✓	✓	✓
80	160	✓	✓	✓
160	320	✓	✓	✓
240	480	✓	✓	✓
320	640		✓	

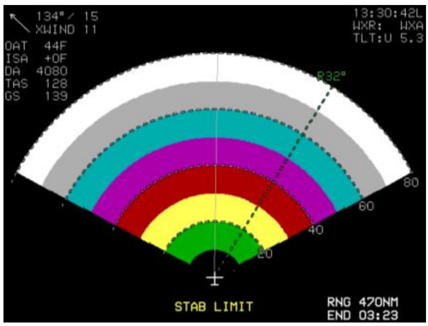
Table WX-2: Weather Radar Page Range

WX 2.4. Horizontal/Vertical Profile Depiction

In a horizontal depiction, the weather page uses an arced format with the ownship symbol centered in the bottom of the display with the weather area depicted as an arc ahead of the ownship symbol.



Radar Image in Arc Format



Radar Image in Arc Format (STAB LIMIT)

Figure WX-5: Horizontal Depiction

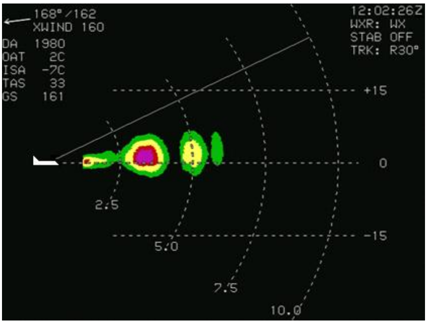
To select vertical profile depiction, use the weather radar menu (see § WX 2.2). Profile depiction is only available on the weather radar page, as the map page only depicts the horizontal view depiction, if selected from the declutter menu.

In vertical profile depiction, the weather page uses an arced format with the ownship symbol centered on the left side of the display and the weather area depicted as an arc to the right of the ownship symbol.

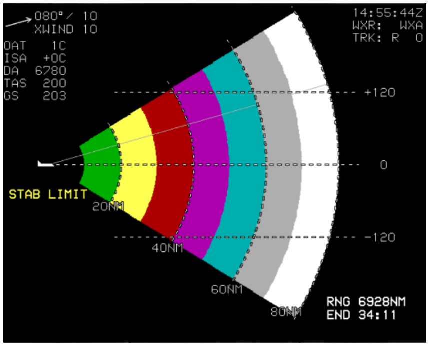
Distance in NM	VP Altitude	Distance in KM	VP Altitude
5NM	±7.5 X 1,000′	10KM	±2.5 X 1,000M
10NM	±15 X 1,000′	20KM	±5 X 1,000M

Table WX-3: Weather Radar Vertical Profile Altitude References

Table WX-3: Weather Radar Vertical Profile Altitude References			
Distance in NM	VP Altitude	Distance in KM	VP Altitude
20NM	±30 X 1,000’	40KM	±10 X 1,000M
40NM	±60 X 1,000’	80KM	±20 X 1,000M
80NM	±120 X 1,000’	160KM	±40 X 1,000M
160NM	±240 X 1,000’	320KM	±80 X 1,000M
240NM	±360 X 1,000’	480KM	±120 X 1,000M
320NM	±480 X 1,000’	640KM	±160 X 1,000M



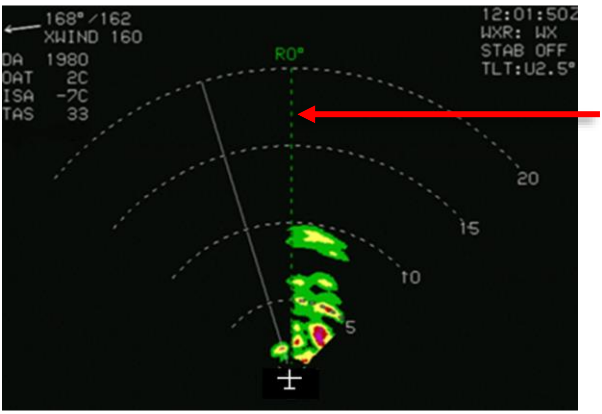
Radar Image in Profile Depiction



Radar Image in Profile Depiction (STAB LIMIT)

Figure WX-6: Vertical Profile

WX 2.5. Track Line



Track Line

Figure WX-7: Radar Track Line

When the weather radar type is RDR-2100 and in horizontal depiction, a dashed track line emanates from the ownship symbol to the outer dashed arc. The value of the track line in whole degrees left or right of aircraft heading is displayed adjacent to the outer end of the track line.

WX 2.6. Active Flight Plan Path/Manual Course/Runways

When the Weather Radar page is in horizontal depiction, the active flight plan path (when selected), waypoints, manual course, and runways appear.

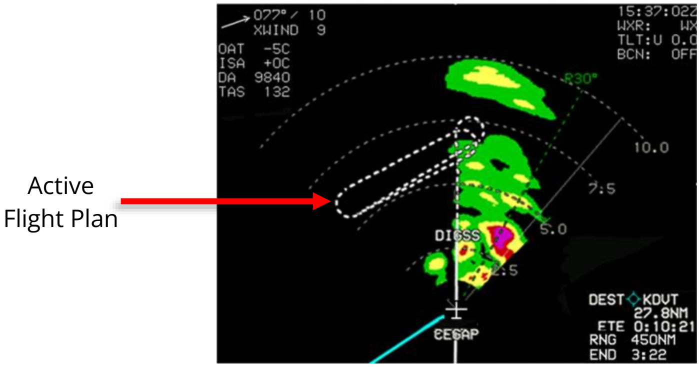


Figure WX-8: Radar Active Flight Plan

WX 2.7. Clock/Options

The following are displayed in the upper right corner.

Zulu Time

Local Time

Figure WX-9: Radar Clock/Options

1) Zulu or Local Time: As in Section 2 Display Symbology

2) Weather Radar Mode Annunciation: As in Table WX-4 and Table WX-5.

Table WX-4: Weather Radar Mode Annunciation

Mode	Annunciation
Off	WXR:OFF
Standby	WXR:STBY
Weather only	WXR:WX
Weather alert	WXR:WXA
Ground map	WXR:GMAP
Test	WXR:TEST
Not defined	WXR:----

Table WX-5: Weather Radar Mode Annunciation Conditions

Annunciation	Conditions
Overlaid with Red X	Weather radar mode is off or not defined. Cooling fault condition exists. Attitude or range fault condition exists. Transmit/receive (T/R) fault condition exists. For Honeywell RDR-2000 and 2100, or Telephonics RDR-1600, the external radar control panel is failed.
Overlaid with Green X	For Honeywell RDR-2000 and 2100, or Telephonics RDR-1600, when RCP is not failed and the commanded RCP mode is OFF.
STAB OFF (Stabilization)	Mode annunciation not overlaid with a red or green “X”; Mode not standby or forced standby; and Weather radar indicates stabilization is OFF
TGT ALERT (Target Alert)	Mode annunciation not overlaid with a red or green “X”; Mode not standby or forced standby; Weather radar presenting horizontal depiction. The weather radar type is Honeywell PRIMUS, Honeywell RDR-2000 or Honeywell RDR-2100.
REACT	Honeywell PRIMUS only. Annunciation is provided when all of the following conditions are true: Weather radar mode annunciation is not overlaid with a red “X”. Weather radar mode is not standby or forced standby.
“TLT:U##.#” or “TLT:AUTO” (TILT)	U = up or down (either U or D, but not both, may appear – use “U” for 0°); “TLT:U##.#” or “TLT:AUTO” ##.# represents absolute value of the tilt angle in degrees truncated to the nearest tenth; “TLT:AUTO” used where weather radar reports a value of -16°, representing automatic tilt. Weather radar tilt annunciation only appears when all following conditions are true: 1) Mode annunciation not overlaid with a red or green “X”.

Table WX-5: Weather Radar Mode Annunciation Conditions

Annunciation	Conditions
	2) Mode not standby or forced standby; and 3) Radar not in vertical profile depiction.
TRK:L## (TRACK)	(RDR-2000/2100 only). Weather radar track annunciation indicates the track of the profile depiction relative to the aircraft's heading. The weather radar track annunciation only appears when all of the following conditions are true: L = left or right (either L or R, but not both, may appear – use "R" for 0°); and ## represents absolute value of the track angle in degrees. Weather radar track annunciation only appears when all following conditions are true: Mode annunciation not overlaid with a red or green "X". Mode not standby or forced standby; and Radar in vertical profile sub-mode (Profile depiction).
"GN:S##DB," "GN:CAL," or "GN:MAX" (GAIN)	A weather radar gain annunciation indicates the manual gain setting of the weather radar where: S = Sign (either "+" or "-," but not both, may appear – use "+" for 0°); and ## represents the manual gain setting in decibels. (Used for ARINC 708-6, Collins 800/840 and Honeywell PRIMUS weather radar types). ##.# represents the manual gain setting with one decimal point in decibels. (Used for RDR-2000, RDR-2100 and RDR-1600 weather radar types.) "GN:CAL" represents the calibrated condition "GN:MAX" represents maximum manual gain Weather radar manual gain annunciation only appears when all following weather radar mode conditions are true: Mode annunciation not overlaid with a red or green "X". Mode not standby or forced standby; and

Table WX-5: Weather Radar Mode Annunciation Conditions

Annunciation	Conditions
	In RDR-2000/2100 installation, weather radar mode is Ground Map. In RDR-1600 installation, weather radar mode is any search modes.

WX 2.8. Air Data and Ground Speed

As defined in Section 2 Display Symbology.

WX 2.9. Fuel Totalizer/Waypoint Distance Functions

As defined in Section 2 Display Symbology.

WX 2.10. Waypoint Distance

Displayed as specified in Section 2 Display Symbology.

WX 3. MFD Fault Display Menu

Upon selecting the MFD faults menu, the status of the following system parameters are displayed if weather radar is enabled:

1) Indicates weather radar power/communication status (WXR PWR X or WXR PWR OK). Status failed (WXR PWR X) reflects any one of the following conditions is true:

    a) Loss of weather radar communication.

    b) Weather radar mode is OFF.

2) Indicates weather radar fault status (WXR FAULT –, WXR FAULT X, or WXR FAULT OK). Status failed (WXR FAULT –) indicates it is not possible to determine weather radar faults. Status failed (WXR FAULT X) reflects any of the following conditions is true:

    a) A cooling fault condition exists.

    b) An attitude or range fault condition exists.

    c) A control fault condition exists.

    d) A T/R fault condition exists.

3) If weather radar type is RDR-2000 or RDR-2100, indicates radar control panel status (WXR RCP X or WXR RCP OK). Status failed (WXR RCP X) indicates loss of communication.

> **NOTE:**
>
> Manufacturer's Fault Annunciations
>
> Fault annunciations are a method of alerting the pilot that the radar system is not performing to established standards. Built-in test equipment automatically and constantly tests the radar system. If a fault occurs, the fault annunciation is presented on the display configured for WX-RDR.
>
> See appropriate weather radar pilot guide for failure descriptions.

WX 4. Menu Synchronization

See Section 3 Menu Functions and Step-By-Step Procedures for more information.

Table WX-6: Menu Synchronization

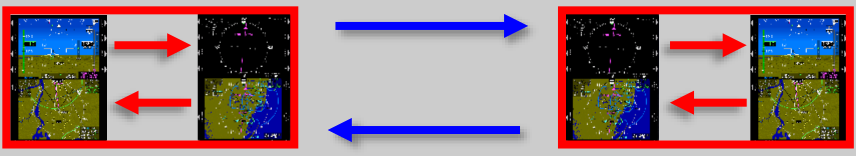
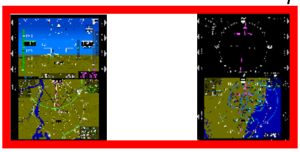
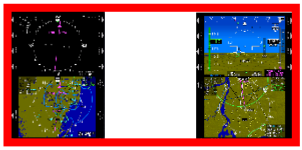
<table>
<tr><th>Menu Parameter</th><th>Notes</th></tr>
<tr><td colspan="2">The following menu parameters are always synchronized across all displays. These are bugs and fundamental aircraft values that should never have independence. Intra-System or Inter-System communications.
</td></tr>
<tr><td>WX RDR Control Menu parameters</td><td>Used to synchronize certain RDR-2XXX modes. See note below.</td></tr>
<tr><td colspan="2">The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference. Intra-System communications.
</td></tr>
<tr><td>WX RDR Control Menu parameters</td><td>Synchronized onside when Honeywell RDR-2XXX is installed.</td></tr>
<tr><td>Weather Radar Scale</td><td>Onside because range is controlled by the weather radar.</td></tr>
</table>

Table WX-6: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are independent between displays. These are used to support non-PFI area display options to give the pilot maximum MFD operating flexibility. Note that some of these parameters are also independent between top and bottom MFD areas as specified in the notes.	
	
MFD Selected Page	This parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Map scale is transmitted onside to support weather radar range selection.

NOTE:

When using EFIS menu system for RDR-2XXX control, the weather radar mode received from the offside system is used to update onside weather radar mode as follows. This is to ensure weather radar power on/off is synchronized between both sides.

When offside mode is commanded to STBY, TEST, or ON and if onside mode is OFF, then the onside mode is set to STBY.

When offside mode is commanded to OFF, then the onside mode is also set to OFF.

NOTE:

The WRM 429 output on each side (pilot and co-pilot PFDs and MFDs) can be wired to a separate control input on the RDR-2XXX. This allows each side to request separate modes from the RDR-2XXX. The radar time-slices the radar sweeps between the 2 controllers. Thus, if the pilot requests a horizontal profile and the co-pilot requests a vertical profile, one sweep provides the requested return to the pilot, the dish repositions, and the next sweep provides the requested return to the co-pilot.

Video

V 1. Video Page

PAGE Menu ❶: **VIDEO** – opens Video page.

The video input page is an image of 640 by 480 pixels and accepts video input signals in the RS-170 composite format. The system is configurable to the NTSC, PAL (including the PAL-m and PAL-nc variants), or SECAM versions of RS-170 separately for each video input. In addition, an auto-detection mode, which programs the video input chip to process most standard RS-170 formats, is configurable for each video input.

When no video signal is detected, the video input page is black and NO VIDEO IMAGE AVAILABLE is displayed in white on the center of the page. To aid in diagnosing problems with undetected video signals, the following annunciations may also be displayed:

1) NO INTERLACED SIGNAL: No interlaced signal detected.

2) NO HORIZ OR VERT SYNC: No horizontal or vertical synchronization detected.

3) NO COLOR SIGNAL: No video chroma signal detected.

4) LOAD ERROR DETECTED: Video chip reports a load error.

5) TRIGGER ERROR DETECTED: Video chip reports a trigger error.

6) PROGRAMMING ERROR DETECTED: Video chip reports a programming error.

V 1.1. Top-Level Menu Option Descriptions

1) ❶: On a PFD or MFD operating in Normal mode, if the bottom area is showing a video page, and Zoom is enabled in EFIS limits, rotate the knob to change the zoom level (CW to increase, CCW to decrease) or as set in EFIS limits.

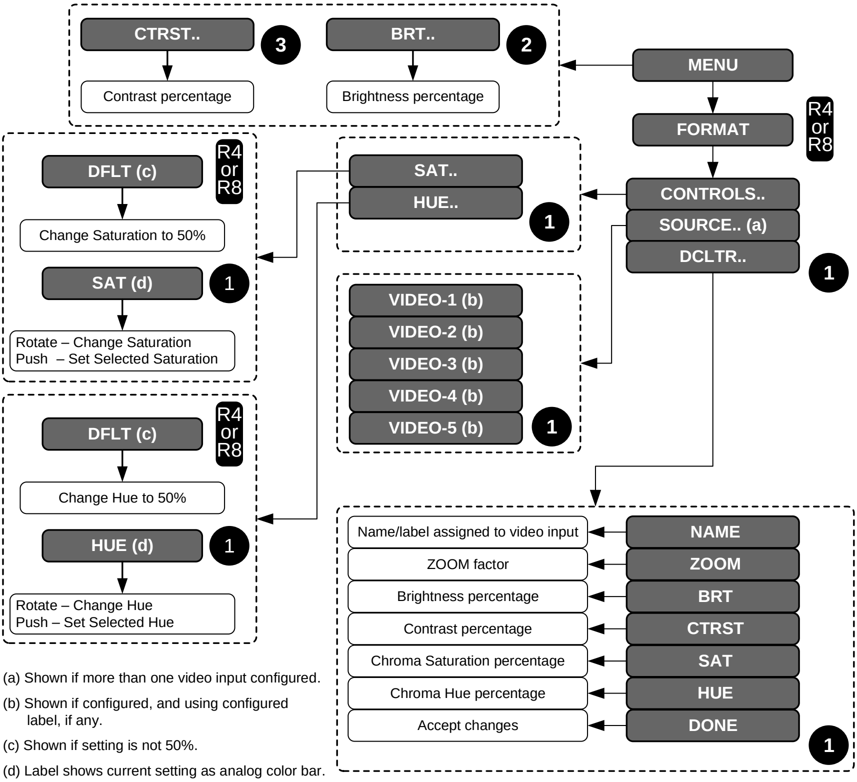
2) ❷: On an MFD (IDUs other than #1) operating in Normal mode, if the top area is showing a video page, and zoom is enabled in EFIS limits, rotate the knob to change the zoom level (CW to increase, CCW to decrease) or as set in EFIS limits.

V 1.2. Video Page First-Level Option Descriptions

CTRST ❸: Adjusts contrast setting for the current video input.

BRT ❷: Adjusts brightness setting for the current video input.

V 1.3. Video Page Format Menu



(a) Shown if more than one video input configured.

(b) Shown if configured, and using configured label, if any.

(c) Shown if setting is not 50%.

(d) Label shows current setting as analog color bar.

Figure V-1: Video Page Format Menu

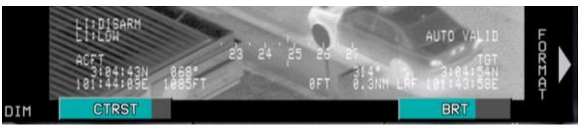
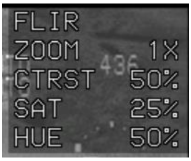


Figure V-2: Video Page Contrast and Brightness Setting

Figure V-3: Video Page Saturation and Hue Setting

Figure V-4: Video Page Sources

Source: Mission



Source: FLIR

Figure V-5: Video Status

V 1.4. Pan Mode

Figure V-6: Video Pan View

When enabled in EFIS limits, and the zoom level is greater than 1, the Video page has a pan mode for selecting the portion of the video image displayed by replicating pixels. When pan mode is active, controls are present to allow moving the portion displayed up, down, left, and right.

A mini map of the displayed image's position in the full video image is displayed for 10 seconds after:

1) Entering pan mode;
2) Changing the zoom level to a value greater than 1;
3) Panning the zoomed image.

Exiting pan mode removes pan mode controls and mini map, if any.

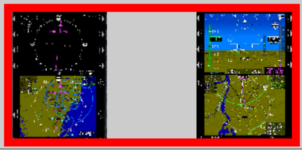
Table V-1: Pan Mode Function Descriptions

Top Area	Bottom Area	Tile Legend	Action
L2	L6	**UP**	Press to move the section of video image displayed in specified direction.
L3	L7	**DOWN**	
R2	R6	**LEFT**	
R3	R7	**RIGHT**	

V 2. Menu Synchronization

See Section 3 Menu Functions and Step-By-Step Procedures for more information.

Table V-2: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility.	
	
MFD Video Page Settings	Independent between top and bottom MFD areas with exception of the following video hardware settings: 1) Selected Input 2) Brightness 3) Contrast 4) Saturation 5) Hue

Round Dials

RD 1. PFD Primary Flight Instrumentation

The following details round dial display symbology used on the PFD and MFD IDU-680 in normal and essential modes. The round dials option is only available with pure digital ADC configured. Not all combinations of views are represented. See Section 2 Display Symbology for further information.

RD 1.1. Pitch Scale

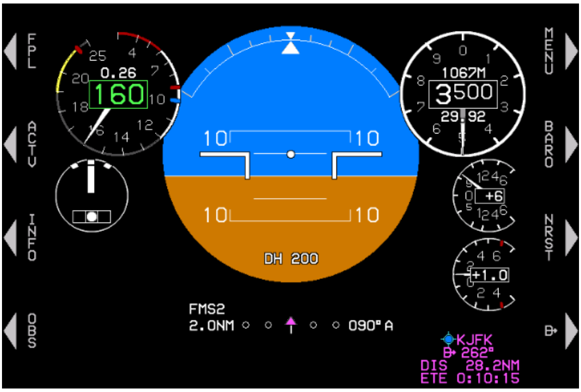
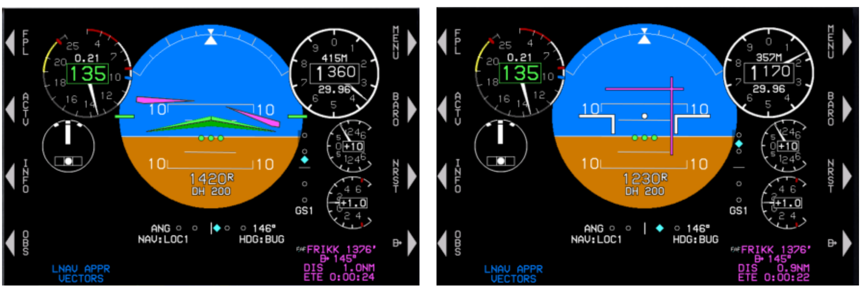


Figure RD-1: Pitch Scale

The white pitch scale and horizon rotates about the large aircraft symbol reference marks according to the aircraft's roll angle. The pitch scale has 5° with major increments and pitch scale labels every 10°. Pointer bars at the ends of each major increment indicate the direction to the horizon. Pitch scale increments automatically declutter to present the fewest possible increments needed.

RD 1.2. Flight Director Symbology



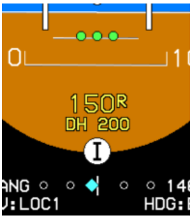
FD-1 Single Cue FD-2 Dual Cue

Figure RD-2: Flight Director

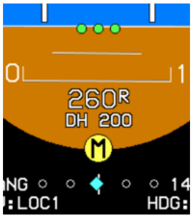
A pilot-selectable flight director is available through the menu system or integrated autopilot/flight director avionics. When selected, one of the symbology examples in Figure RD-2 appear when valid steering commands are received.

RD 1.3. Marker Beacon Indicators

When enabled and valid marker beacon indicators with appropriate coloring and markings are displayed in the lower central portion of the PFD. During a built-in-test, more than one marker beacon can be active. Marker beacons are acquired from NAV VLOC1 or VLOC2. Marker beacons are disabled when the NAV source is FMS.



Inner Marker



Middle Marker

Outer Marker

Figure RD-3: Marker Beacon Indicators

RD 1.4. Unusual Attitude Mode

Unusual attitude mode is enabled when the pitch attitude exceeds +30° or -30° or bank angle exceeds 65° left or right. Once enabled, unusual attitude mode remains engaged until pitch attitude returns to within 5° of the horizon and bank attitude returns to within 10° of the horizon. Recovery chevrons appear prior to reaching ±20° of pitch to aid in situational awareness and are a normal part of the pitch scale and are not necessarily tied to unusual attitude mode. The chevrons disappear when within ± 15° of the horizon.

Pitch up 25° Recovery Chevrons Only

Pitch up 30° Unusual Attitude Mode

Figure RD-4: Unusual Attitude Modes

RD 1.5. Bank Angle Scale

The bank angle scale and roll pointer are centered upon the waterline. During EFIS limits configuration, either a roll pointer or sky pointer can be selected.

Roll Pointer

Sky Pointer

Figure RD-5: Bank Angle Scale Type

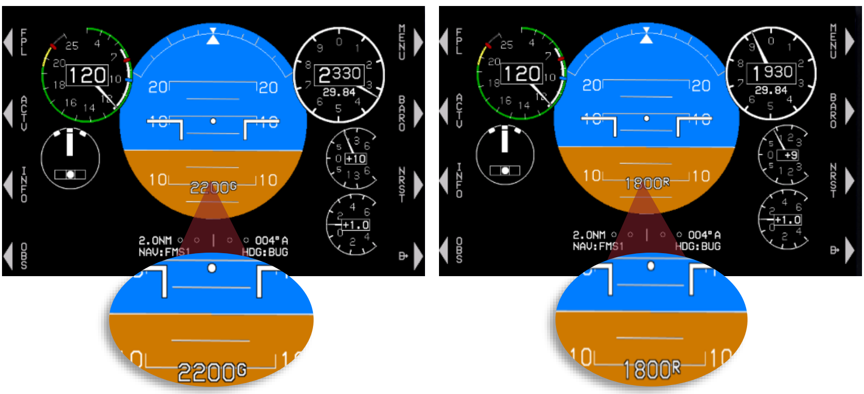
RD 1.6. AGL Indication

AGL altitude is displayed as shown in Figure RD-6 at the bottom of the display or above the CDI. The source for AGL indication is the source used for TAWS, which is designated as follows:

R = Radar Altitude

G = GPS/SBAS geodetic height less database found elevation.

B = Barometric altitude less database ground elevation.



GPS/SBAS

Radar Altitude

Figure RD-6: AGL Indicator

AGL altitude is not displayed when it is greater than the radar altimeter maximum valid altitude and is not displayed when it is invalid. This area also includes a decision height set with the PFD bugs menu.

RD 1.7. Airspeed Display

The airspeed display is scaled to show the entire operating range of the aircraft. CW movement corresponds to increasing speed. When an ADC sensor fails, the display appears as shown in Figure RD-12.

Knots per hour

Kilometers per hour

Figure RD-7: Airspeed Display

NOTE:

For airspeed bug use with integrated autopilot, see applicable autopilot pilot guide.

Table RD-1: Airspeed Bugs

Airspeed Bug	Limits	Notes
	The higher of 1.2 x V_s or 60KIAS at the low end, and red-line airspeed (V_{NE}, V_{MO}, or M_{MO}) at the high end	Can be used as a visual reference. Mutually exclusive with VSI bug.

Table RD-2: Airspeed Display Limits and Bugs

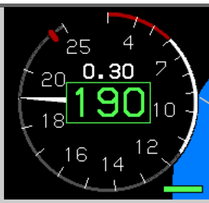
Airspeed in Knots (with Autopilot)	 Without airspeed bugs	 IAS bug set to 170 and indicating 170 KIAS	 IAS bug set to 170 and indicating 150 KIAS

Table RD-2: Airspeed Display Limits and Bugs

Airspeed in Km/h (without Autopilot)	 Without airspeed bugs	 IAS bug set to 215 Km/h and indicating 215 Km/h	 IAS bug set to 180 Km/h and indicating 150 Km/h

RD 1.7.1 Airspeed Readout

When enabled, the Mach indicator is displayed above the airspeed readout with a resolution of .01 Mach.

Figure RD-8: Airspeed Readout with Mach Number

RD 1.7.2 Takeoff and Landing Speed Bugs

In airplanes Part 23 or 25 airspeed scale, V_1, V_R, V_2, V_{ENR}, V_{REF}, and V_{APP} can also be shown on the airspeed dial when set. The V_1, V_R, and V_2 symbols automatically declutter when above 2000 feet AGL.

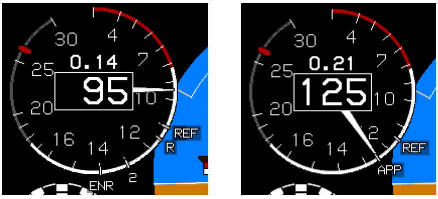


Figure RD-9: Takeoff and Landing Speed Bugs

RD 1.8. Altimeter

The altimeter setting digitally displays the altimeter setting in either inches of mercury (inHg) or millibars/Hectopascal (mbar/hPa) according to the pilot-selected units. The mode is annunciated during QFE operations; otherwise, no mode is annunciated.

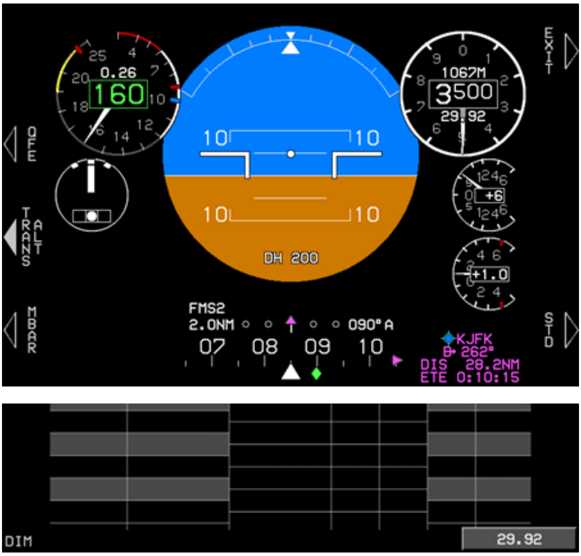


Figure RD-10: Altimeter Setting

QNH QFE

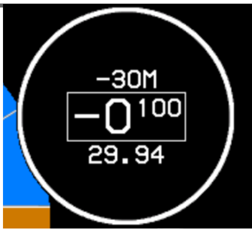
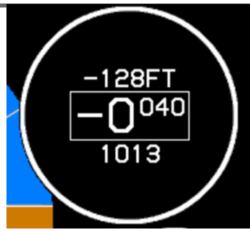
Figure RD-11: Altimeter

RD 1.9. Altitude Display

Table RD-3: Altitude Display

Altitude in Feet	Altitude in Meters
	

Table RD-3: Altitude Display

Altitude in Feet	Altitude in Meters
	
-30 meters or 100 feet below sea level	-40 meters or -128 imperial feet below sea level

The altitude readout digitally displays barometric altitude to the nearest ten measurement units as adjusted by an altimeter setting and shows a 1000-unit range with labels and graduations every 100units. Clockwise rotation of the pointer corresponds to increasing altitude. All graduations are removed when below sea level. When an ADC sensor fails, the display appears as shown in Figure RD-12.

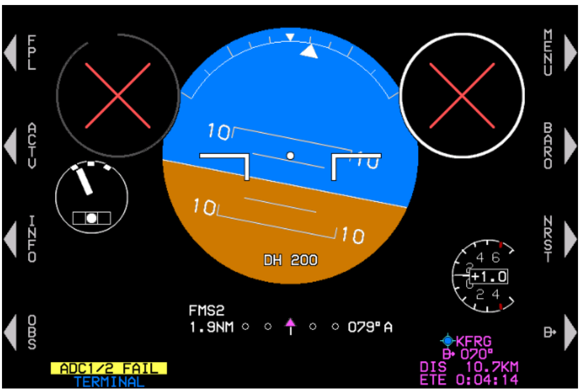
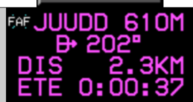
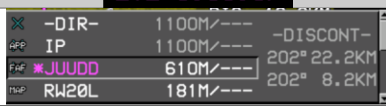


Figure RD-12: Airspeed and Altitude with Loss of ADC

When using feet for altitude display, metric altitude values may be selected from within the declutter menu with a resolution of 1 meter. The metric display of barometric altitude appears above the normal value (feet) and is colored white followed by a white "M."

When using meters for altitude display, altitude values may be selected from within the declutter menu with a resolution of 1 foot. The imperial display of barometric altitude is presented in imperial feet with a resolution of 1 foot. The imperial display of barometric altitude appears above the normal value (meters) colored white and followed by a white "FT."

Table RD-4: PFD Declutter Options

	
Altitude in feet 	Altitude in meters 
Altitude in Meters 	Altitude in Imperial feet 
	
	
	

RD 1.9.1 Altitude Sub-Mode

Altitude sub-mode pilot-settable triangular target altitude bug. The bug is removed when more than 500 measurement units away from current altitude. When using feet for altitude display, the target altitude bug is limited to -1,000' at the low end and 50,000' at the high end.

Altitude in feet

Altitude in meters

Figure RD-13: Target Altitude Bug

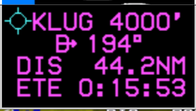
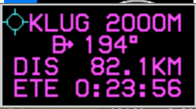
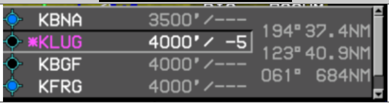
When using meters for altitude display, the target altitude bug setting is limited to the corresponding values in meters (shown in Figure RD-13 at 1,600 imperial feet). Bug is limited to -1,000' up to 50,000' at the high end.

NOTE:

For target altitude bug use with integrated autopilot, see applicable autopilot pilot guide.

When in VNAV sub-mode, the VNAV altitude bug appears when within 500' from the current altitude.

Table RD-5: VNAV Sub-Mode

<table>
<tr><th>Altitude in Feet</th><th>Altitude in Meters</th></tr>
<tr><td>Arrive at 4,000' 5 NM before crossing KLUG</td><td>Arrive at 2,000M 5 KM before crossing KLUG</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>

NOTE:

For VNAV bug use with integrated autopilot, see applicable autopilot pilot guide.

RD 1.10. Vertical Speed Indicator

A vertical speed indicator is located below the altitude display with a readout, dial, and pointer. The readout is displayed in fpm or m/s depending upon the "Speed Units" system limit.

When using feet or meters for altitude the VSI uses clockwise (upward) rotation of the pointer to correspond with increasing vertical speed.

	
Altitude in feet for 2100 fpm descent	Altitude in meters 7 m/s descent

Figure RD-14: VSI Bug

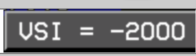
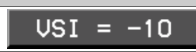
RD 1.10.1 Vertical Speed Indicator Bug

The VSI includes a pilot-settable triangular vertical speed bug. The VSI bug is mutually exclusive with the airspeed bug.

When using fpm, the vertical speed bug setting is limited to ±3,000 fpm.

When using m/s, the vertical speed bug setting is limited corresponding values in m/s.

Table RD-6: Vertical Speed Indicator Bug

Altitude in Feet	Altitude in Meters
	
	
Descending at -1200 fpm with VSI bug set to -2000 fpm	Descending at -7 m/s with VSI bug set to -10 m/s

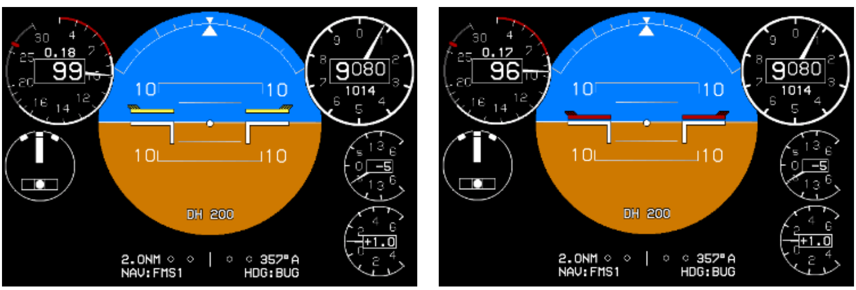
> **NOTE:**
>
> For vertical speed bug use with integrated autopilot, see applicable autopilot pilot guide.

When TCAS-II is enabled, the background of the VSI functions as an RA display with green and red colored regions to provide RA maneuver guidance.

Figure RD-15: Vertical Speed Indicator RA Display

RD 1.11. Pitch Limit Indicator

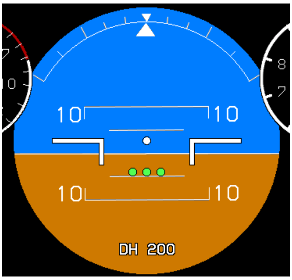
For part 23 and Part 25 airplanes, the yellow feathered pitch limit indicator appears 20 knots indicated airspeed above the stall speed. The pitch limit indicator merges with the large aircraft reference symbol at stall speed and continues moving downward as indicated airspeed further decreases.



20 Knots above Stall | Stall Speed

Figure RD-16: Pitch Limit Indicator

RD 1.12. Landing Gear Indication



If configured, PFD displays landing gear position as small green "tires" below large aircraft symbol reference marks.

Figure RD-17: Landing Gear Indication

RD 1.13. Heading Display

The heading display appears in a blacked-out area on the bottom to emulate a “Basic-T.” The heading display automatically declutters when a compass rose is in the bottom area.

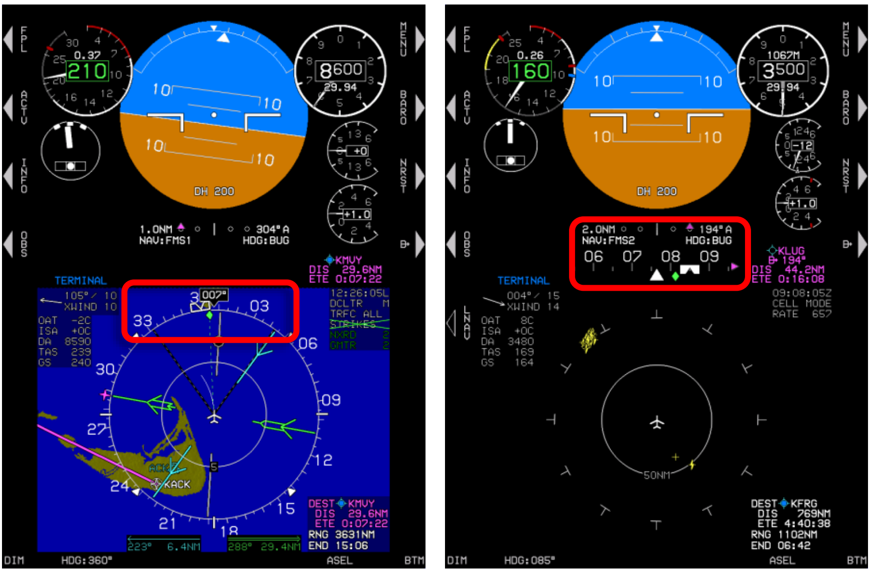


Figure RD-18: Heading Display

Table RD-7: Heading Indicator and Heading Bug

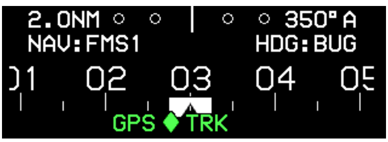
	When AHRS is in DG mode, heading indicator appears. Heading scale includes a green diamond-shaped ground track pointer aligned with the aircraft’s track across the earth.

Table RD-7: Heading Indicator and Heading Bug

	When the aircraft's track is displaced from aircraft heading beyond the boundaries of the PFI, the track pointer is drawn at the limit of the heading scale in the direction of the displacement and track value appears in a solid green box above the track pointer.
	Pilot-settable heading bug interacts with the heading pointer.
	When heading bug is modified, a white bordered black box above the heading bug appears for five seconds.
	When heading bug is displaced from aircraft heading beyond the boundaries, the heading bug symbol is drawn halved at the limit of the heading scale.
Track pointer is not displayed when ground speed is less than 30 knots.	

RD 1.13.1 Heading Failure Mode

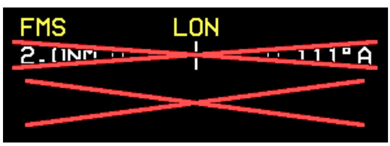
With heading failed, the PFI heading scale and MFD compass rose align with track (if available) or are removed and replaced with a red-X.



In this failure mode, the PFI heading scale includes "GPS TRK" around the track marker to clearly delineate the failure mode.

Figure RD-19: GPS TRK

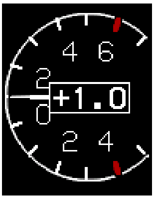
Good GPS



GPS Failure

Figure RD-20: Heading Indicator Heading Failure

RD 1.14. G-Force Indicator



The G-force indicator located below the VSI has a readout dial and pointer. The scale accommodates any G-force limits with a minimum of +6/-4G. The dial is centered on 1G including labeled indices at even values (i.e., -2G, 0G, +2G, etc.) and displays G-force to the nearest tenth G.

Figure RD-21: G-Force Indicator

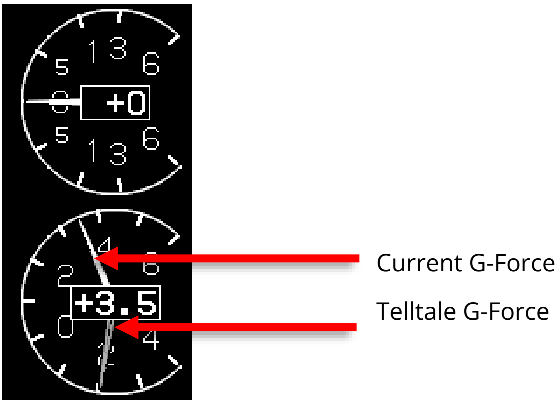
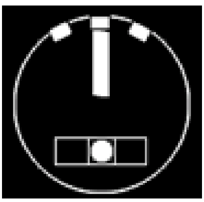


Figure RD-22: G-Force Telltale Indication

RD 1.15. Turn Rate Indicator



The turn rate indicator is displayed below the airspeed display. This standard "turn needle" displays marks representing a standard rate turn. The full scale for the turn needle is beyond the standard rate turn mark. This allows the pilot to fly a standard rate turn. The "balance ball" is driven from accelerometers within the AHRS. When the input turn rate or "balance ball" input is invalid, a red "X" is shown instead of the respective indicator.

Figure RD-23: Turn Rate Indicator

RD 1.16. Vertical Deviation Indicator

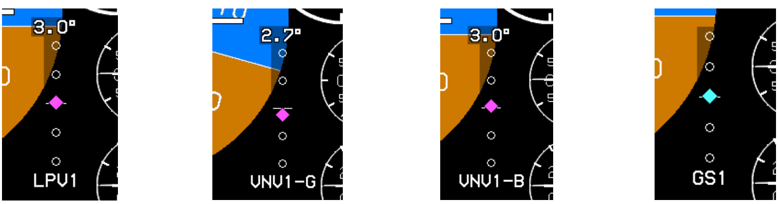


Figure RD-24: VDI

The vertical deviation indicator (VDI) on the right side displays vertical deviation for the selected vertical navigation source for displaying descent profile but disappears in unusual attitude mode.

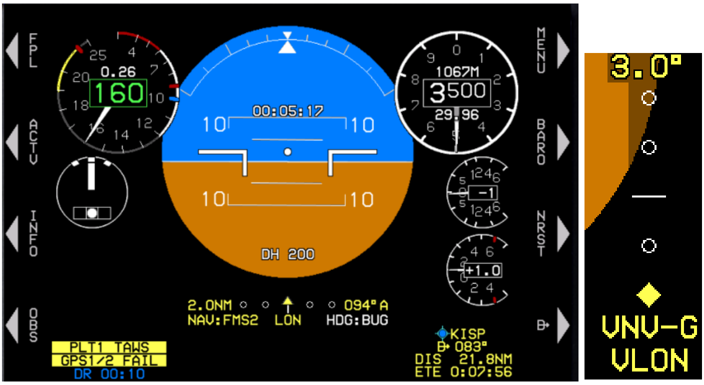
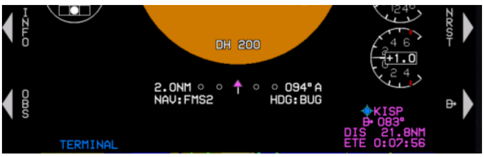


Figure RD-25: VDI Color during GPS/SBAS LOI/LON or VLON

RD 1.17. Course Deviation Indicator



Display NAV Source FMS2 (Normal GPS/SBAS)

NAV Source FMS2 (GPS/SBAS failed LOI/LON condition)

Figure RD-26: Course Deviation Indicator

Table RD-8 defines en route, terminal, and various approach modes according to the Level of Service record.

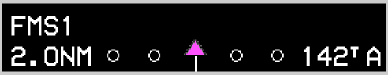
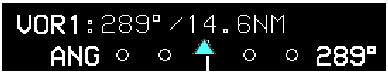
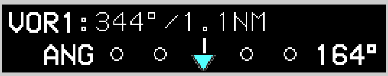
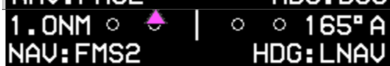
NOTE:

For CDI use with integrated autopilot, see applicable autopilot pilot guide.

Table RD-8: CDI Behavior and Color

CDI Pointer and Condition	Color or Behavior
Full Scale Deflection	Flash
Slaved to GPS/SBAS	Scale is appropriate FSD value for mode of flight: En Route: ±2NM From En Route to Terminal: Change from ±2 NM FSD to ±1 NM FSD over distance of 1 NM; start transition when entering terminal mode. From Terminal to En Route: Change from ±1 NM FSD to ±2 NM FSD over distance of 1 NM; start transition when entering en route mode. From Terminal to Approach: If VTF, switch immediately. Otherwise, change from ±1 NM FSD to approach FSD over distance of 2 NM; start transition at 2 NM from FAWP. From Approach to Terminal: Change to ±1 NM. From Departure to Terminal: If initial leg is aligned with runway, change from ±0.3 NM FSD to ±1 NM FSD at the turn initiation point of the first fix in the departure procedure.
CDI images below represent installations with Genesys/S-TEC DFCS integrated autopilot or without an autopilot enabled.	
	Nav source FMS1 GPS/SBAS (with GPS LON) amber (yellow) OBS manual mode with a “FROM” indication.
	Nav source FMS1 GPS/SBAS (with GPS LON) amber (yellow) OBS automatic mode with a “TO” indication.
Normal conditions	Magenta
In FMS LP/LPV mode or VOR/VLOC approach mode	Angular scale annunciation
	Nav source is localizer (course error exceeds 105°). Reverse sensing with distance to approach threshold.

Table RD-8: CDI Behavior and Color

CDI Pointer and Condition	Color or Behavior
Lateral deviations in failed state	Red “X” displayed over CDI
	Nav source FMS1 in auto waypoint sequencing mode.
	Nav source FMS1 in manual OBS mode with a “TO” indication. Waypoint sequencing is suspended.
	Nav source FMS 1 in manual OBS mode with a “FROM” indication. Waypoint sequencing is suspended.
	Nav source FMS1 in automatic OBS mode with true north mode. Only applicable for CDI in this GPS/SBAS navigation source.
	Nav source VLOC1
	Nav source VLOC2
	Nav source VOR1 with “TO” indication. Currently on a bearing 289°/14.6NM to the VOR.
	Nav source VOR1 with a “FROM” indication on a bearing of 344°/1.1NM from the VOR.
	Nav source VOR2 with “TO” indication on a bearing of 145°/46.3NM to the VOR.
	Heading bug sub-mode guidance
	LNAV sub-mode guidance
	Failure Sub-Mode

* Installations with an analog autopilot enabled.

RD 1.18. Timer Indication

A countdown or count-up timer can be displayed above the large aircraft reference marks when selected through the Time menu.

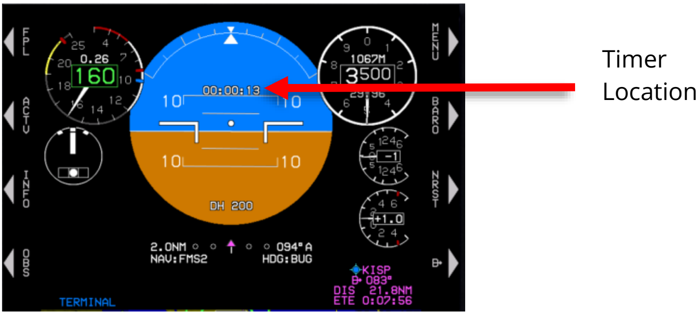


Figure RD-27: Timer Indication

Search and Rescue (SAR) Patterns

SAR 1. Search and Rescue (SAR) Patterns

When enabled by EFIS system limits, the pilot can create one SAR pattern at an eligible flight plan waypoint and only one waypoint within the active flight plan. The current position of the aircraft is determined relative to the desired path for lateral deviation for display on the GPS/SBAS CDI. In most cases, the IDU auto-sequences from one waypoint to the next similar to all other flight plan sequencing along the flight path.

The SAR option is available for any waypoint except the following:

1) Suppressed waypoint
2) Skipped waypoint
3) Manual termination waypoint
4) Waypoint that is part of an IFR or VFR approach
5) Holding pattern waypoint
6) SAR pattern exit waypoint
7) Waypoint that begins a departure procedure
8) Parallel offset entry or exit waypoint
9) Dynamic termination waypoint (altitude termination, DME termination, radial termination or intercept termination)

NOTE:

Flight plans can be saved with a SAR between waypoints or at the end of the flight plan. When a saved flight plan includes a SAR pattern it is shown in the flight plan name.

SAR patterns can be created in the **RUN DEMONSTRATOR/TRAINING PROGRAM** Ground Maintenance Page or the EFIS Training Tool. After the SAR pattern is created and saved, that flight plan can be uploaded to any IDU or all IDUs in an aircraft for later use.

The desired flight path is created from a sequence of straight, left, and right turning leg segments to provide smooth skyway, GPS/SBAS CDI, and lateral autopilot guidance. SAR patterns are drawn at the lowest of holding or procedure speed.

SAR 1.1. SAR Pattern Step-by-Step Procedures

To select a SAR pattern, follow these step-by-step procedures. Refer to subsequent sections for additional details and examples for the individual patterns.

1) Press **ACTV (L2)** and use ❶ to highlight desired eligible waypoint to begin SAR pattern creation process then push to enter.

2) Use ❶ to highlight **SAR PTRN..** then push to enter.

3) Use ❶ to highlight one of the five SAR pattern options then push to enter.

    a) **EXP SQUARE..***

    b) **LADDER..***

    c) **ORBIT..**

    d) **RACE TRACK..**

    e) **SECTOR..***

    *Pattern includes the option to select individual legs within the SAR pattern for navigation guidance.

4) Use ❶ through each step, create the desired parameters (e.g., direction, track, leg length, leg spacing, and number of legs), then push to enter. See following sub-sections for more details for parameters of each pattern.

5) After SAR pattern is created, it appears on the map, mini map, and active flight plan. The active waypoint, becomes the SAR pattern entry point, followed by the SAR pattern exit waypoint.

6) To select a SAR pattern individual leg, use ❶ to highlight SAR pattern exit waypoint as it appears in white then push to enter, to make this the active waypoint, and then:

    a) Use ❶ to highlight **SAR SGMNT..** then push to enter for **SELECT SAR PATTERN SEGMENT** to appear.

    b) Use ❶ CW or CCW to advance forward or backward through all legs to begin leg selection process. When desired leg is magenta, then push ❶ to select and exit menu.

7) Control the aircraft to new magenta line for maneuvering to begin following navigation guidance. See following sub-sections for examples of selected segments.

8) To delete existing SAR pattern, press **ACTV (L2)**. Use ❶ to highlight SAR pattern then press **DELETE (R3)**. Push ❶ to confirm.

SAR 2. Expanding Square Pattern

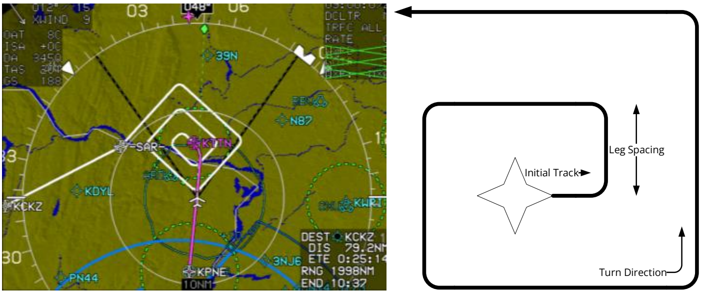


Figure SAR-1: Expanding Square Pattern

Distance in NM

Distance in KM

Figure SAR-2: Expanding Square Pattern Parameters

Table SAR-1: Expanding Square Pattern Parameters

Parameters	Increments (Range)/Direction	Notes
Initial Turn	Left or Right	
Initial Track	Outbound from previous waypoint in 1° increments	Magnetic or True
Leg Spacing	NM or KM 0.25 unit increments between 0.25 unit and 10 units	
Number of Legs	1 to 50	

SAR 3. Rising Ladder Pattern

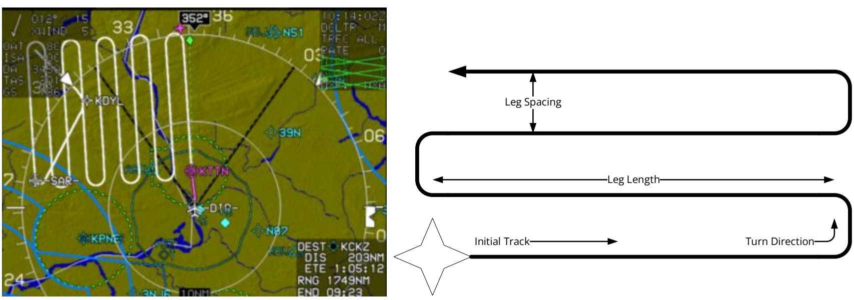
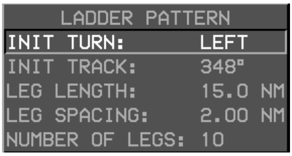
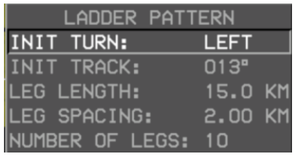


Figure SAR-3: Rising Ladder Pattern



Distance in NM



Distance in KM

Figure SAR-4: Rising Ladder Pattern Parameters

Table SAR-2: Rising Ladder Pattern Parameters

Parameters	Increments (Range)/Direction	Notes
Initial Turn	Left or Right	
Initial Track	Outbound from previous waypoint in 1° increments	Magnetic or True
Leg Length	NM or KM 0.5-unit increments between 1 and 100 units	
Leg Spacing	NM or KM 0.10-unit increments between 0.10 and 10 units	
Number of Legs	1 to 50	

Figure SAR-5: Rising Ladder Pattern-Individual Leg Selected

SAR 4. Orbit Pattern

The SAR exit waypoint is a duplicate of the previous waypoint. This SAR pattern is unique in that the navigation path never goes through the waypoint. The path is a circle around the waypoint intercepted along tangents. With no other menus displayed on the PFD and a waypoint following the active waypoint, **CONT (L6)** appears to allow for continuing out of the orbit and normal sequencing in the active flight plan.

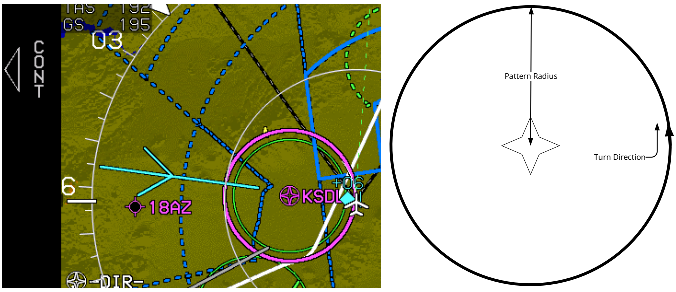


Figure SAR-6: Orbit Pattern

Distance in NM

Distance in KM

Figure SAR-7: Orbit Pattern Parameters

Table SAR-3: Orbit Pattern Parameters

Parameters	Increments (Range)/Direction
Turn Direction	Left or Right
Radius	NM or KM 0.25 unit increments between 0.25 unit and 10 units

SAR 5. Racetrack Pattern

With no other menus displayed and a waypoint following in the flight plan, **CONT (L6)** appears for continuing out of the racetrack and normal sequencing in the active flight plan. SAR exit waypoint is a duplicate of the previous waypoint.

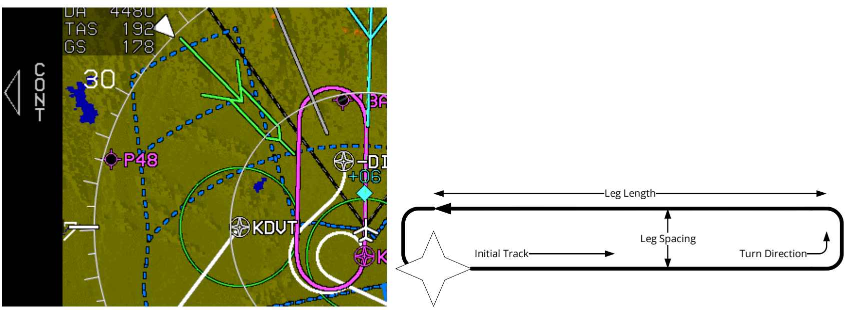
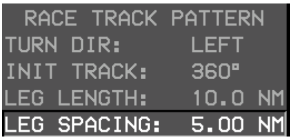
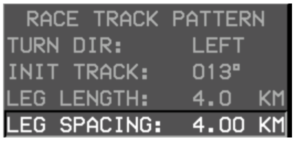


Figure SAR-8: Racetrack Pattern



Distance in NM



Distance in KM

Figure SAR-9: Racetrack Pattern Parameters

Table SAR-4: Racetrack Pattern Parameters

Parameters	Increments (Range)/Direction	Notes
Initial Turn	Left or Right	
Initial Track	Outbound from previous waypoint in 1° increments	Magnetic or True
Leg Length	NM or KM 0.5 unit increments between 1 unit and 100 units	
Leg Spacing	NM or KM 0.25 unit and 10 units	

SAR 6. Sector Search Pattern

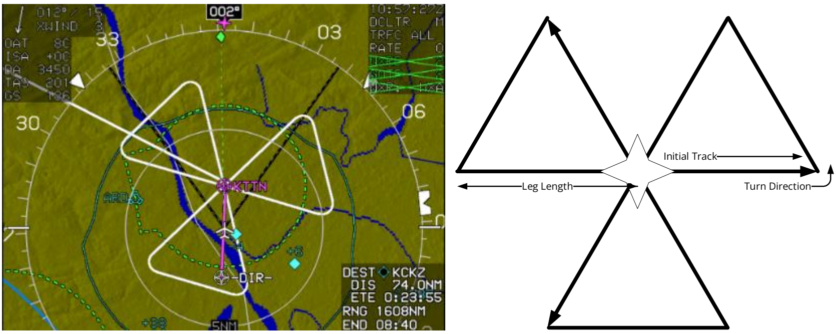
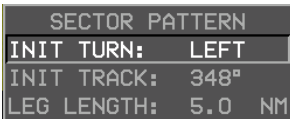


Figure SAR-10: Sector Search Pattern



Distance in NM

Distance in KM

Figure SAR-11: Sector Search Pattern Parameters

Table SAR-5: Sector Search Pattern Parameters

Parameters	Increments (Range)/Direction	Notes
Initial Turn	Left or Right	

Table SAR-5: Sector Search Pattern Parameters

Parameters	Increments (Range)/Direction	Notes
Initial Track	Outbound from previous waypoint in 1° increments	Magnetic or True
Leg Length	NM or KM in 0.5 unit increments between 1 unit and 100 units	
Exit waypoint is a duplicate of the previous waypoint.		

Figure SAR-12: Sector Search Pattern-Individual Leg Selected

Abbreviations and Acronyms

μmHg	Micrometer of Mercury
0R	No Radius
3D	Three-Dimensional
ACTV	Active
ADAHRS	Air Data Attitude Heading Reference System
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADS-B	Automatic Dependent Surveillance-Broadcast
AFCS	Automatic Flight Control System
AFM	Aircraft Flight Manual
AFMS	Aircraft Flight Manual Supplement
AGL	Above Ground Level
AHRS	Attitude Heading Reference System
AIRAC	Aeronautical Information Regulation and Control
AIRMET	Airmen's Meteorological Information
ALT	Pressure Altitude
AMLCD	Active Matrix Liquid Crystal Display
ANP	Actual Navigation Performance
ANT	Antenna
AP	Autopilot
APP	Waypoint is part of an Instrument Approach Procedure
APPR	Approach
APT	Airport
APV	Approach with Vertical Guidance
ARINC	Aeronautical Radio, Inc.
ARL	Auto Range Limiting (RDR-2100)
ARTCC	Air Route Traffic Control Center
ASEL	Aircraft Selected Altitude
ATC	Air Traffic Control
ATT	Attitude
Baro	Barometric setting
Baro-VNAV	Barometric Vertical Navigation
BC	Backcourse navigation
BIT	Built-in-test
B-RNAV	European Basic RNAV
BRT	Brightness
BTM	Bottom
C	Celsius
CA	Course to Altitude (ARINC-424 Leg)
CALC	Calculate RAIM Prediction
CF	Course to Fix (ARINC-424 Leg)
CI	Course to Intercept (ARINC-424 Leg)

CAS	Crew Alerting System
CCW	Counterclockwise
CDA	Continuous Descent Approach
CDI	Course Deviation Indicator
CLR	Clear
CNX	Cancel
COM	Communication
CONT	Continue
CPLT	Co-Pilot
CPM	Computer Processor Module
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CRS	Course
CSA	Conflict Situation Awareness (ADS-B)
CTRST	Contrast
CW	Clockwise
DA	Decision Altitude
dB	Decibel
dBZ	Decibel (dB) relative to radar reflectivity (Z)
DCLTR	Declutter
DCND	Descend
DEC HT	Decision Height Bug
DEL	Delete
DESIG	Designate
DFCS	Digital Flight Control System
DFLT	Default
DG	Directional Gyro
DH	Decision Height
DH	Decision Height
DLNK	Datalink
DME	Distance Measuring Equipment
DO	RTCA Document
DP	Departure Procedure
DR	Dead Reckoning
DTG	Distance to Go
EFIS	Electronic Flight Instrument System
EGM	Earth Gravity Model
EGNOS	European Geostationary Navigation Overlay Service
EQPMNT	Equipment
ESSNTL	Essential
ETA	Estimated Time of Arrival
ETE	Estimated Time En route
ETT	EFIS Training Tool

EXCD	Exceedance
EXPND	Expand (also EXP)
F	Fahrenheit
FA	Course from a Fix to Altitude (ARINC-424 Leg)
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FAR	Federal Aviation Regulation
FAS	Final Approach Segment (DO-229D and AC20-129 reference)
FAWP	Final Approach Waypoint (same as FAF)
FD	Flight Director
FDE	Fault Detection and Exclusion
FG	Fixed Gear
FIS	Flight Information Service
FIS-B	Flight Information Service-Broadcast
FG + F	Fixed Gear with Defined Landing Flaps Position
FL	Flight Level
FLTA	Forward Looking Terrain Awareness
FMS	Flight Management System
FOV	Field of View
FPL	Flight Plan
fpm	Feet per minute
FPM	Flight Path Marker
FPNM	Feet Per Nautical Mile
FRT	Fixed-Radius Transition
FSD	Full Scale Deflection
FT	Feet
FTE	Flight Technical Error
FTP	Fictitious Threshold Point
FNCT	Function
GAGAN	India’s GPS and GEO-Augmented Navigation System
GARP	Global Navigation Satellite System Azimuth Reference Point
GBAS	Australia’s Ground Based Augmentation System
GLS	GNSS Landing System
GMAP	Ground Map mode (RDR-2100)
GMETAR	Graphical METAR (also GMTR)
GMF	Ground Maintenance Function
GN	Gain
GND	Ground
GPI	Glide Path Intercept
GPIP	Glide Path Intercept Point
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GS	Glide Slope; Ground Speed

H	Hold
HA	Terminates at an altitude (ARINC-424 Leg)
HF	Holding, Pattern to Fix (ARINC-424 Leg)
HM	Altitude or Manual Termination (ARINC-424 Leg)
HAL	Horizontal Alert Limit
HDG	Heading
HFOM	Horizontal Figure of Merit
hh:mm:ss	Hours: Minutes: Seconds
HITS	Highway in the Sky
HLTH	Health
HORIZ	Horizontal
hPa	Hectopascal
HPL	Horizontal Protection Level
HPL_{FD}	Horizontal Protection Limit Fault Detection
HPL_{SBAS}	Horizontal Protection Limit based on SBAS
HSI	Horizontal Situation Indicator
HUD	Head Up Display
IAP	Instrument Approach Procedure; Initial Approach Point
IAS	Indicated Airspeed
IAWP	Initial Approach Waypoint (same as IAP)
ICAO	International Civil Aviation Organization
ID	Identity or Identification
IDU	Integrated Display Unit
IF	Initial Fix leg
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Inner Marker
INFO	Information
INHBT	Inhibit
inHg	Inches of Mercury
INIT	Initialize
IO	Input/Output
IP	Initial Point
IPV	Instrument Procedure with Vertical Guidance
ISA	International Standard Atmosphere
IVSI	Instantaneous Vertical Speed Indicator
IWP	Intermediate Approach Waypoint
K	Kilo=1000
KB	Kilobyte
kHz	Kilohertz
KIAS	Knots Indicated Airspeed
Km	Kilometers
Km/h	Kilometers per Hour

KT	Knot
LAT	Latitude
lbs	Pounds
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LGND	Legend
LIFR	Low IFR conditions (Ceiling < 100’ or visibility < 1 mile)
LNAV	Lateral Navigation
LOC	Localizer
LOI	Loss of Integrity
LON	Loss of Navigation; Longitude
LP	Localizer Performance
LPV	Localizer Performance with Vertical Guidance
LTP	Landing Threshold Point
LVL	Level
MA	Waypoint is part of the missed approach segment of an instrument approach procedure
MAGVAR	Magnetic Declination (Variation)
MAHP	Missed Approach Holding Point
MAHWP	Missed Approach Holding Waypoint
MAN	Manual
MAP	Missed Approach Point; Missed Approach Procedure
MAWP	Missed Approach Waypoint (also MAWPT)
mbar	Millibars
MDA	Minimum Descent Altitude
MESO	Mesocyclonic
METAR	Routine hourly weather report
MFD	Multifunction Display
MIN	Minimum
MM	Middle Marker
M_{MO}	Maximum Operating Mach Number
M_{NO}	Maximum Structural Cruising Mach Number
MOA	Military Operations Area
m/s	Meters per second
MSAS	Japan’s MTSAT-based Satellite Augmentation System
MSG	Message
MSL	Mean Sea Level
MVFR	Marginal Visual Flight Rules
NAS	U.S. National Airspace System
NAV	Navigation
NAVAID	Device or system providing navigational assistance
ND	Navigation Display
NDB	Nondirectional Beacon

NEXRAD	(Next-Generation Radar) network of weather radars operated by the National Weather Service (NWS) (also NXRD)
NIMA	National Imagery and Mapping Agency
NM	Nautical Mile
NRST	Nearest
NWS	National Weather Service
OAT	Outside Air Temperature
OBS	Omnibearing Selector
ODP	Obstacle Departure Procedure
OF	Over-fly
OM	Outer Marker
OT	Other Traffic (Traffic Function)
PA	Proximate Advisory (Traffic Function)
PDA	Premature Descent Alert
PFD	Primary Flight Display (also refers to the primary IDU with software that only shows primary flight instrumentation)
PFI	Primary Flight Information
PLT	Pilot
PM	Personality Module
PN	Part Number, Pan
PPOS	Present Position
PROC	Procedure
PRN	Pseudo-Random-Noise (Satellite communications)
PRS	Press
PRV	Previous
PTK	Parallel offset (Parallel Track)
PWR	Power
QFE	Altimeter setting provides height above reference point
QNE	Altimeter setting provides pressure altitude readout
QNH	Altimeter setting provides MSL altitude at a reporting point
RA	Resolution Advisory (Traffic Function)
RADALT	Radar Altimeter (also RALT)
RAD-DST	Radial and Distance
RAIM	Receiver Autonomous Integrity Monitoring
RBP	Remote Bug Panel
RCP	Radar Control Panel
RDR	Radar
RF	Precision Arc to Fix (ARINC-424 Leg)
RG	Retractable Gear
RG + F	Retractable Gear with Defined Landing Flaps Position
RHT	Radar Height
RMI	Radio Magnetic Indicator
RNAV	Area Navigation

RNP	Required Navigation Performance
RNP APCH	Required Navigation Performance Approach
RNP AR-APCH	RNP approach procedure that requires special aircraft and aircrew authorization.
RTC	Required Terrain clearance
RTCA	Radio Technical Commission for Aeronautics
RW	Runway
SAE	Society of Automotive Engineers
SAR	Search and Rescue
SAT	Saturation
SATLT	Satellite
SBAS	Satellite-Based Augmentation System
SECAM	Analog color television system used in France
SI	International System of Units
SIC	Side-in-Command
SID	Standard Instrument Departure (DP)
SIGMET	Significant Meteorological Advisory
SSM	Sign Status Matrix
STAB	Stability
STAR	Standard Terminal Arrival Routes
STBY	Stand-by
STD	Standard
STRKS	Strikes (Lightning detection)
SVN	Synthetic Vision
SVS	Synthetic Vision System
SYMB	Symbol
SYNC	Synchronize
SYRD	System Requirements Document
TA	Traffic Advisory (Traffic Function)
TACAN	Ultra-High Frequency Tactical Air Navigational Aid
TAFs	Terminal Aerodrome Forecasts
TAS	Traffic Advisory System; True Airspeed
TAWS	Terrain Awareness and Warning System
TCA	Terminal Control Areas
TCAD	Traffic Collision Alert Device
TCAS	Traffic Collision Alert System
TD	Terrain Data
T/D	Top of Descent
TERPS	Terminal Instrument Procedures
TFR	Temporary Flight Restriction
TGT	Target
TIS	Traffic Information Service
TIS-B	Traffic information Service-Broadcast

TOAC	Time Of Arrival Control
TLT	Tilt
T/R	Transmit/Receive
TRANS	Transition
TRK	Track
TRNDO	Tornadic
TSO	Technical Standard Order
TTA	Time to Alert
TTG	Time to Go
TURB	Turbulence
TX	Radio Transmit
USB	Universal Serial Bus flash drive data storage device
USR	User Waypoint
UTC	Universal Time Coordinated
VA	Heading to Altitude (ARINC-424 Leg)
V_A	Design Maneuvering Speed
VAL	Vertical Alert Limit
V_{APP}	Target approach airspeed
VDI	Vertical Deviation Indicator
VERT	Vertical
V_{FE}	Maximum flap extended speed
VFOM	Vertical Figure of Merit
VFR	Visual Flight Rules
VHF	Very High Frequency
V_{HOLD}	Aircraft's normal speed (in airspeed units configured in EFIS limits) for flying holding patterns. Value is used for calculating the turn radius of holding patterns.
VI	Heading to Intercept (ARINC-424 Leg)
VLOC	VOR/Localizer
VLON	Vertical Loss of Navigation
VM	Heading to Manual Termination (ARINC-424 Leg)
V_{MO}	Maximum operating limit speed
VNAV	Vertical Navigation (also VNV)
V_{NE}	Never exceed speed
V_{NO}	Maximum structural cruising speed or maximum speed for normal operations
VOR	VHF Omnidirectional Radio
VORTAC	Collocated VOR and TACAN
VP	VFR waypoints (five digits beginning with "VP")
VPL	Vertical Protection Level
V_{PROC}	Procedure Speed
V_R	Rotation speed
V_{REF}	Landing reference speed or threshold crossing speed

VS	Vertical Speed
VSI	Vertical Speed Indicator
VTF	Vectors to Final
V_{YSE}	Best rate of climb speed with a single operating engine a light twin-engine aircraft
WAAS	Wide Area Augmentation System
WOG	Weight on Ground
WOW	Weight on Wheels
WPT	Waypoint
WX	Weather
WXA	Weather-alert (RDR-2100)
XFILL	Crossfill

Definitions

ADF – Display of single and or dual ADF bearing information in the form of an RMI pointer (when enabled in EFIS limits).

AGL Indication (Rad Alt, GPS Alt, Baro Alt) – Display of altitude above the ground, with designation of the altitude source as R (radio altitude), G (GPS SBAS/WAAS geodetic altitude less local ground elevation), or B (barometric altitude less local ground elevation in Feet or Meters as configured in EFIS limits.

Air Data and Ground Speed – Display of outside air temperature (°C or °F), ISA temperature deviation (°C or °F), density altitude (feet or meters), true airspeed (knots, MPH, or Km/h), and ground speed (knots, or, Km/h) as configured in EFIS limits.

Airspeed Information – Display of airspeed is the indicated airspeed tape and airspeed readout with associated data. The airspeed function includes color-coded caution bands for minimum and maximum speeds based on airspeed units (knots, MPH, or Km/h) as configured in EFIS limits.

Altitude Information – Display of altitude information is the altitude tape and altitude readout in feet or meters as configured in EFIS limits.

Approach Mode Signal Output – Conventional autopilot approach mode signals are course error output, the left/right deviation signal (localizer output) and the up/down deviation signal (glide slope output). Signals are based on the selected navigation source.

Attitude Information – Display of attitude information includes pitch and roll.

Autoset – Automatically selects features or settings.

Azimuth – Angle between the north vector and perpendicular projection of the star down onto the horizon. Usually measured in degrees (°).

Barometric Altimetry – Measurement of altitude based on the atmosphere (pressure and temperature).

Barometric Correction – Display and altitude correction for local barometric pressure.

Bezel – Faceplate of the IDU comprised of buttons along the sides and knobs along the bottom.

Chroma – Colorfulness relative to the brightness.

Clock, Timers – Display of Zulu time (based on GPS data) or Local time (based on UTC Offset) and pilot-selected timers.

Conformal – Angle-preserving, as seen viewing the outside world. Example: traffic, terrain, and obstructions appear conformally on the PFI area.

Course Deviation Indicator – Display of course deviation from selected course, including a To-From indicator, and source of information.

Critical Flight Phase – Phase(s) of flight where the failure mode would result in a hazard condition using flight phases. For example, failure of ILS would only be a hazard condition during approach and landing.

Crossfill – Transfer of data and information between IDUs in a two-sided system with two PFDs configured.

Cross-linked – Synchronized across both pilot and co-pilot sides.

Datalinked – Display of received data such as weather or traffic from peripheral systems such as ADS-B.

dBZ – Decibel relative to radar reflectivity (Z). Composite reflectivity shows the highest dBZ (strongest reflected energy) at all elevations. Unlike base reflectivity, which only shows reflected energy at a single elevation scan of the radar, composite reflectivity displays the highest reflectivity of all elevations scans. If there is heavier precipitation in the atmosphere over an area of lighter precipitation (i.e., rain has yet to reach the ground), the composite reflectivity displays the stronger dBZ level.

Deadband – Neutral zone where no action or changes are made.

Directional Scale (Compass Rose or Arc) and Ownship Symbol – Display of general directional information. MFD pages include a form of the compass rose with current heading pointer and aircraft "ownship" symbol.

Dot – (CDI scale referenced) represents an additional 2° for VOR and 1.25° for Localizer.

EFIS-Coupled – EFIS is coupled to an autopilot and controls the lateral and or vertical modes of the autopilot.

Failure Condition Hazard Description – A description of the failure mode to be analyzed.

Flight Director (Selectable Function) – Display of flight director in a single or dual cue format when selected for display on the PFD or MFD in Essential mode.

Flight Path Marker (Velocity Vector) – Display of aircraft's actual flight path, showing where the aircraft is going as opposed to where the aircraft is pointed.

Flight Plan and Navigation Display – Display of the active GPS SBAS/ WAAS-based flight plan, including course line, waypoints, ground track, glide range (NM or KM), projected path, altitude capture predictor, approach procedure, missed approach procedure, and the aircraft present position on the active leg.

Geodesic – A generalization of the notion of a straight line to curved spaces. The shortest route between two points on the Earth's surface.

Geodetic – Set of reference points used to locate places on the earth.

Geoid – Global mean sea level.

G-Force – Indications to show the G-force and tell-tales on the aircraft.

Glide Slope – Display of glide slope 1 or glide slope 2 in the form of vertical deviation dots and deviation on PFD VDI or MFD HSI page VDI.

Glide Slope Sidelobes – False glide slope signals.

GPS SBAS Course Deviation Indicator (CDI) – Display of CDI relative to selected course, either automatic based on active flight plan or manual based on pilot-selected OBS when in OBS manual mode. When following an FMS path, the bearing indication is the instantaneous desired course to follow the magenta line.

GPS SBAS Functions – The EFIS meets the GPS SBAS/WAAS navigation and flight planning/management requirements of TSO-C146c (RTCA/DO-229D) for Class Gamma 3 equipment. These functions include navigation, flight planning (function select, flight plan generation and editing, selected waypoints, user waypoints, etc.), path definition including approach and departure paths, GPS altitude, dead reckoning, navigation modes with automatic mode switching, loss of navigation monitoring, loss of integrity monitoring, etc. The database used with the GPS SBAS/WAAS functions meets the integrity requirements of RTCA/DO-200A.

Ground-Based Utility –The compatible program used for the creation, deletion, editing, or reversing of locked flight plans, routes, and user waypoints for later uploading into the IDU.

Heading Bug – Display and control of selected heading using a bug. May be used to drive heading bug output to autopilot for HSI-based heading mode or visual reference.

Heading Display – Display of heading with directional scale is provided at the top of the PFD in SVS mode and as defined in Section 2 Display Symbology.

Heading Mode Signal Output – Conventional autopilot heading mode signal is a heading error output based on the difference between the EFIS desired heading and the actual aircraft heading. The EFIS desired heading is either the pilot-selected heading bug or a heading designed to achieve and maintain the active GPS-based flight plan.

Hectopascal (hPa) – International System of Units (SI) unit measure of pressure, equals one millibar (mbar).

Horizontal Situation Indicator (Selectable Function) – Display of GPS, VOR or localizer and glide slope deviation when selected for display on the MFD top or bottom areas as map overlay or HSI page.

Inches of Mercury (inHg) – Unit of atmospheric pressure used in the United States. Named for the use of mercurial barometers which equate height of a column of mercury with air pressure.

Inhibit – Prevention of activity or occurrence e.g., **XFILL INHBT**, **TAWS INHBT**, **FPM INHBT**, **FLTA INHBT**, and **TAS INHBT**.

Integrated Peripherals – Internal devices of the essential unit.

International Standard Atmosphere (ISA) – Standard model of the change of pressure, temperature, density, and viscosity over a wide range of altitudes or elevations. (°C or °F configured in EFIS limits.)

Ionosphere – Region of the atmosphere between the stratosphere and exosphere, 50 to 600 miles (80 to 1,000 km) above the surface of the earth.

Landing Gear Indication – When enabled on retractable landing gear aircraft, PFD (PFI area), and MFD PFI area (when in Essential mode) shows indication of landing gear extended.

Level of Service – Standard Positioning Service (SPS) for general civil use. With Selective Availability (SA), SPS provides predictable accuracies of 100m in the horizontal plane and 146m in the vertical plan 95% of the time. Without (SA) SPS, accuracy would be approximately 25m in the horizontal plane and 43m in the vertical plane 95% of the time. ARINC-424 “Level of Service” indicates a particular type of approach minimum is approved, e.g., **LP APPR**, **LPV APPR**, **RNP: 0. 10A**.

Lightning Cell Information – Display of lightning information from a WX-500 system and shown in the form of lightning cells. The pilot may show individual lightning strike data by selecting the dedicated WX-500 page when enabled in EFIS limits.

Localizer – Display of VLOC1 or VLOC2 in the form of horizontal deviation dots and deviation.

Lubber Line – Green-dashed line connecting the center of the ownship symbol and the track pointer.

Mach Display – Display of Mach number when the aircraft is traveling at or above 0.35 Mach. This function may be deselected by a setting in the EFIS limits.

Magnetic Declination (MAGVAR) – Angle between magnetic north and true north. Sometimes called magnetic variation.

Map Data – Display of map data, including airspace, VFR/IFR airports, VHF navaids such as VOR/NDB/DME, H Airway, and L Airway, IFR/VFR fixes, ARSPC CTRL, ARSPC SUA Y, ARSPC R, and display range rings.

Marker Beacon – Display of outer, middle, and inner marker beacons in the form of a color-coded circle with the corresponding letter.

Menu Functions – The EFIS includes menus to access functions on both the PFD and the MFD.

Mesocyclonic – Contains a vortex of air within a convective; air rises and rotates around a vertical axis, often in the same direction as low- pressure systems.

Millibar (mbar) – Metric (not SI) unit of pressure, one thousandth of a bar, which is about equal to the atmospheric pressure on Earth at sea level - 1013 millibars.

Miscompare – Disparity of data or information, for example **ALT MISCOMP**, **ATT MISCOMP**, **GPS MISCOMP**, **GS MISCOMP**, **HDG MISCOMP**, **LOC MISCOMP**, **IAS MISCOMP**, and **BARO MISCOMP**.

Nanoteslas (nT) – A unit of measurement of the strength of the magnetic field. Earth's strongest magnetic field is located at the poles, and the weakest field is near the equator.

NavData® – Jeppesen's aeronautical database to navigate the global airspace system.

Navigation Display – Display of active waypoint, bearing to waypoint, and ground track based on active flight plan. The pilot may also select flight plan information as a MINI MAP, these functions are analyzed as part of the GPS SBAS/WAAS functions not the PFD functions.

Navigation Log – Display of navigation information based on active flight plan, including next waypoint, destination, estimated time remaining, and fuel totalizer-based range and endurance. This function may be deselected by a setting in the IDU configuration (limits) file. These functions are analyzed as part of the GPS SBAS/WAAS functions not the MFD functions. (As configured for Wpt to Wpt or PPOS to Wpt.)

Navigation Mode Signal Output – Conventional autopilot Navigation mode signals are the course error output and the left-right deviation signals. Course error output is based on the difference between the EFIS selected course (OBS) and the actual aircraft heading. These signals are based on the selected navigation signal (VOR, LOC, TAC, ADF or GPS).

Nondirectional – Functions in all directions.

Obstructions Display – Display of obstructions identified in the embedded obstruction database.

Offset – When referring to parallel track of an active flight plan, "offset" implies the distance paralleling the original track. When referring to VNAV altitudes, "offset" refers to the distance before or after the waypoint the VNAV altitude must be reached in NM or KM units.

Omnibearing – Magnetic bearing of an omni-range station.

Ownship – Principal eye-point; referring to icon of aircraft represented on PFD or MFD (MAP), HSI, Traffic, WXR-RDR, WX-500 Lightning, or Datalink pages.

Pitch Limit Indicator – The pitch limit indicator first appears above the applicable reference symbol (either the FPM or the large aircraft symbol reference marks) and converges upon the applicable reference symbol as indicated airspeed decreases. Pitch Limit Indicator Appearance Limits: 1-G V_{S1} or V_{S1} corrected for G-loading.

Projected Path (Noodle) – Projected curving path from the ownship symbol, based upon the aircraft bank angle and ground speed, used effectively to assist in course interception and making small adjustments to bank angle for proper roll out.

QFE – Barometric setting that results in the altimeter displaying height above a reference elevation (e.g., airport or runway threshold).

QNE – Standard barometric setting (29.92 inHg or 1013 mbar) used to display pressure attitude for flight above the transition attitude.

QNH – Barometric setting that results in the altimeter displaying altitude above mean sea level at the reporting station.

Q-Routes – Published RNAV routes, including Q-Routes and T-Routes, can be flight planned for use by the Genesys EFIS, subject to any limitations or requirements noted on en route charts, in applicable advisory circulars, or by NOTAM. RNAV routes are depicted in blue on aeronautical charts and are identified by the letter "Q" or "T" followed by the airway number, e.g., Q35, T-205. Published RNAV routes are RNAV-2 except when specifically charted as RNAV-1.

Recency – State of occurrence, appearance, or origin.

Selection and Display of Selected Course – Omni-Bearing Select (OBS) function for the pilot to select the course for navigation. Selected course is displayed for reference.

Settable V-Speeds, Targets – The pilot may set certain V-speeds for reference during flight found in two categories, takeoff and approach. Takeoff speeds are V_1, V_R, V_2, and V_{ENR} (as applicable). Approach speeds are V_{REF} and V_{APP}.

SI Units – International Speed Units according to the following:

Speed: Knots (Nautical), MPH (Statue), Kilometers per hour (Km/h)

Altitude: Feet, Meters

Rate: fpm, m/s

Side in Command – Side of aircraft control responsible for its operation. This display of steady green arrow in the center of the PFD mode annunciation area is displayed on two-sided systems only to show which side is commanding the autopilot.

Skipped Waypoint – A skipped waypoint is a waypoint associated with a dynamic termination leg with a zero length. These are either:

1) An altitude termination leg when current aircraft altitude is above the termination altitude; or

2) System-created (i.e., not NavData® specified) intercept to a "Course to a Fix" leg where there is insufficient distance to calculate an intercept heading.

Skyway VNAV/LNAV Guidance (Synthetic Vision) – Display of GPS-based active navigation route, flight plan, procedure, or FMS-OBS course in a three-dimensional series of skyway boxes. Also known as Highway in the Sky (HITS).

Slip Indicator – Display of aircraft lateral accelerations via an integral slip/skid indicator function. The slip indicator is a rectangle just below the heading pointer that moves left and right to indicate the lateral acceleration sensed by the AHRS in the same manner as the ball in a mechanical slip indicator.

Strikefinder – Lightning detector system (WX-500) connected to EFIS and enabled through factory program settings.

Suppressed Waypoint – A suppressed waypoint (designated by brackets) is an airport associated with an IFR or VFR approach procedure.

Symbology – Use of symbols.

Terrain Display (PFD Artificial Horizon) – Conformal display of surrounding terrain presented with the artificial horizon, shown in the correct scale and perspective for the aircraft's current position and altitude. Includes conformal display of known runway locations, direction, scale, and perspective based on aircraft's current position and altitude.

Time Indication – Pilot-selected function for count-up or countdown timers, flight time, local time, and Sunrise/Sunset.

Time Zone – Derived from Time Menu when setting UTC Offset for purposes of displaying the local time. On two-sided systems, it is possible to have different time zones on each side.

Traffic – When integrated with an appropriate traffic system, traffic is shown using standard TCAS symbology showing relative position, altitude, climb/decent, and color via traffic symbols on the PFI area, Map page, and Traffic page. The pop-up mini traffic display shows traffic position in a full 360° format. Distance displayed in NM or KM as configured in EFIS limits.

Transmit-Enabled – IDU providing data to external sensors, generating aural alerts, and displaying warning, caution, and advisory flags. IDUs depend upon intra-system communications to determine which IDU on a side takes over transmit-enabled responsibilities. There is only one transmit-enabled per side and a master PFD when considering aircraft limits. Any IDU may become transmit-enabled through auto reversionary means in the event of the PFD failing.

T-Routes – T-Routes are available for use by GPS or GPS/SBAS equipped aircraft from 1,200 feet above the surface (or in some instances higher) up to but not including 18,000 feet MSL. T-Routes are depicted on en route low altitude charts and considered to include the same attributes of Low altitude airways in the Genesys Aerosystems EFIS declutter menus. (Altitudes always in feet.)

Vertical Speed Display – Display of altitude rate of change (vertical speed or climb rate). (FPM or m/s as configured in EFIS limits.)

VOR RMI – Display of VOR1 and VOR2 bearing in the form of RMI pointers.

V_{PROC} (Procedure Speed) – The aircraft's normal speed (in airspeed units as configured in EFIS limits) for flying published instrument procedures (DPs, IAPs, STARs). This value is used for calculating the turn radius used for instrument procedure legs. This speed is not seen on the airspeed tape and only found in the aircraft speed settings units inside the limits.

Warning, Caution, and Advisory Flags – Time-Critical Warning and Caution Alerts in the primary Field of View remain present until acknowledged by pressing master caution switch. Display of, warning, caution, and advisory indications accompanied by aural indications. The flags are stacked in the lower left corner of the PFD. Warnings are always shown at the top of the flag stack, followed by cautions and then advisories. These flags remain in view for as long as the situation exists.

Waterline – Indication of the aircraft's longitudinal axis or waterline (attitude).

Wide Area Augmentation System (WAAS) – Developed by Federal Aviation Administration to provide accurate positioning part of the Satellite Based Augmentation System (SBAS). Other countries have similar systems: Europe: European Geostationary Overlay System (EGNOS); Japan: MTSAT Satellite-based Augmentation System (MSAS); India: GPS Aided GEO Augmented Navigation system (GAGAN).

Wind Information – Display of wind direction, wind speed (knots or m/s), and cross wind component (knots or m/s as configured in EFIS limits.)

Zulu – Display of Zulu time (based on GPS data).

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